

# Retrofit Rotterdam



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 Urbanism

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# Vision

Imagine being amidst of a bustling city, the energy is palpable. People rushing to their destinations, cars honking, and the constant hum of activity. It's a place to meet, conduct business, and participate in a wide range of activities.

What if we could balance the bustle of urban life with the peace and quiet experienced on a rooftop: a place away from noise, bathing in sun (or sometimes rain) and enjoying the views of the city. And what if we can combine this with green roofs, solar panels and gardens to make our habitats sustainable and more affordable in the process.

This is the potential that rooftops offer: a diffuse network of domesticable space waiting to be reclaimed. Places where inhabitants, investors and wildlife can thrive on their own terms, in their own habitat. Places that improve our cities however we see fit.

But on this path, many obstacles await. Because however you might see this improvement, your neighbour, your landlord or your municipality might have different ideas. And that is the origin of my project: overcoming these obstacles; the discord between those who have an equal claim on the rooftop.

My job would be to find not how these conflicts can be resolved, but to reveal where the conflicting interests have overlap. To provide a tool that brings forward where a liveable city, a climate-adaptive city and a prosperous city can meet on their roofscape.

Now image the city again as seen from the sky. Not with a black and grey roofscape made from gravel and bitumen, but composed of a rich life for people and nature. One that offers an enclave of peace in the bustle of the city.

This is a roofscape I envision.





# Abstract

Cities worldwide are grappling with spatial constraints, particularly in rapidly growing urban areas. Rotterdam, as an aspiring sustainable city, faces similar challenges in balancing sustainability goals with limited space. This predicament extends to the underutilized rooftop spaces across the city. While initiatives like the “multifunction rooftop” program and “Rotterdam Rooftop Days” have made inroads, the issue of unused rooftops persists. The primary obstacle often cited is cost, but cost is a relative factor, dependent on the unique values held by different stakeholders, buildings, and neighbourhoods. Several approaches to activate these rooftops have emerged but often lack consideration for the perspectives of rooftop stakeholders.

This report introduces a novel strategy aimed at bridging the gap between municipal sustainability goals and the interests of rooftop stakeholders. The strategy leverages pattern language principles, providing a flexible framework for tailoring rooftop solutions to diverse scenarios. It not only assists stakeholders in conceptualizing rooftop designs but also aligns them with their values. To illustrate the strategy’s effectiveness, it is applied to a neighbourhood case study, wherein various rooftop types are designed in alignment with the proposed principles.

# Preface

I am Thomas Bollen, a student of the MSc Urbanism at the Technical University Delft and this is my Master Thesis. It is a year long project in which I have dived into the theme of Retrofitting Rooftops and formulated a strategy.

The project was made in the studio Metropolitan Ecologies of Place, in which the goal is to analyse a metabolism in a spatial domain, find a leverage point and use it to solve a problem or challenge. In my project, I looked at the metabolism surrounding rooftops. This means I analysed the what things are involved in rooftops, both on a spatial and a human level. I looked at stakeholders in buildings, researched what needs they might have and compared it against the different possibilities rooftops may offer.

This means I had to cover a wide variety of topic, ranging from human behaviour, to the impact of climate in the city, to the technical aspects of building a rooftop.

Throughout this year, I was guided by my two mentors. My first mentor, Ulf Hackauf, has specialised in Environmental Technology and Design, integrating elements of Circular Economy into the spatial domain. My second mentor, Machiel van Dorst, is a professor in Environmental Behaviour and Design, specialised in the relation human behaviour and space.

This combination of expertises, as well as my own background, has guided my project into what it has become.



# Introduction

My project takes place in Rotterdam (Figure 1), the second largest city of the Netherlands, located in the Randstad. After I moved here for my MSc Urbanism from a village outside of Tilburg, I missed a garden, a place to interact and connect with nature. But I figured this was part of urban life in the big city. This was until I visited the Rotterdam Rooftop Days in 2022, which opened up a new world for me and showed how these nature and this outdoor living space could be introduced into the cities through rooftop. This has inspired me to start on this project, in which I try to find a solution for the empty roofscape that makes up the city.



Figure 1. Province Zuid-Holland, Rotterdam, City Centre

## REPORT STRUCTURE

I have seen projects before that create an elaborate roofscape design in a city, integrating it with the public domain, but never felt compelled to these plans myself. And as this empathic component is important in my way of designing, I started to look for other solutions.

This resulted in a project leading towards a strategy for bottom-up design, one in which the inhabitants of a building are in charge of what happens on their rooftop.



In this report, you, the reader, will be guided through my project in a narrative that unfolds the importance of rooftops, why they still remain empty and eventually, how it came to a strategy to tackle this.

### Chapter 1: Why Rooftops Matter

The first chapter will dive into the current situation and analyse why rooftops in a **roofscape** could be an important element in the transition towards a sustainable city.

### Chapter 2: The Unscathed Surface

The second chapter will look a bit deeper into *why* so many **individual rooftops** are still empty and explore the theoretical underpinning behind these reasons.

### Manifesto

The manifesto is a 1 page statement that take the research and offer a bold, personal statement on this. It highlights the problem and proposes a solution to it.

### Chapter 3: Sparking Incentive

The third chapter offers a strategy derived from the research, it shows which leverage points have been identified and how they can be used to change the status quo.

### Chapter 4: Collaboration & Conflict

The fourth chapter will look back on the individual rooftop and show how the strategy works with it. It will illustrate how these findings have been processed in different iterations that have lead to the strategy.

### Chapter 5: Designing with Patterns

The fifth chapter looks back on the roofscape and illustrates how the strategy and the bottom-up approach can lead to an integral 'design'.

### Chapter 6: Conclusion & Reflection

The last chapter will reflect on the process of the entire project, the findings, the methods used and its relevance both academically and in the field.

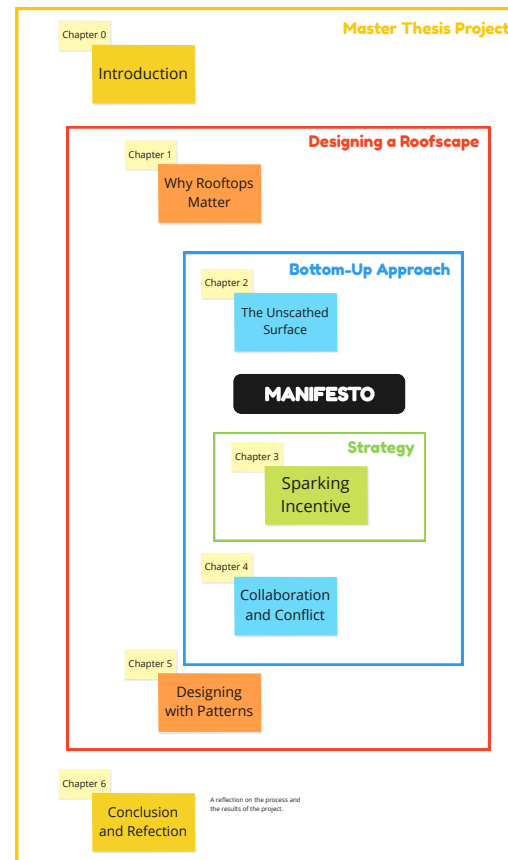


Figure 2. Report Structure

# Chapter 1

## Why Rooftops Matter





Aerial image Kop van Zuid and Katendrecht (Swart, 2021)



# Spatial Pressure in the Growing City

As cities are growing, the space within and around cities is becoming more precious. Everything ranging from amenities and housing, to parks and parking lots needs this space. This concept is called: Spatial Pressure. Especially in the Netherlands, where almost every square meter in- and outside of cities have an allocated function, space is always contested.

In this part, we will go through the history of how Dutch cities have dealt with growth and how they will in the future.

## THE CONTEST FOR SPACE

First of all, it would be sensible to lay out a clear definition of spatial pressure, as it has can be unclear at times. If we consider an piece of land in a more rural area, spatial pressure could indicate the battle between different functions that want to use this land. This piece of land that is for example currently used for agriculture, might have properties that are interesting for other functions. Think of a highway connecting two big cities, a neighbourhood to provide housing or a solar field to generate renewable energy. These functions are all competing to use this space (Figure 3). In planning, we often deal with this problem by combining functions and finding synergies between them. For example, we can combine the sound barrier of the highway with housing, and put solar panels on top (Figure 4). Or we add wind turbines to a field of cattle.

### Oplossing voor woningnood in het groen: moet natuur wijken voor 4.500 nieuwe woningen?

25 september 2021, 20.00 uur - Aangepast 28 september 2021, 12.00 uur - Door Redactie

Figure 3. Translation: Solution for housing crisis, does nature need to go for 4.500 new houses? (NH Nieuws, 2021)



Figure 4. Boschkens: an example of combining housing and a sound barrier. (Buro Lubbers, 2009)

But of course, there are limits to what extent we can do this. In an urbanised area, we sometimes see this phenomenon occur when trying to build new housing or offices. To put it in a simplified manner: imagine a



big open space like a park, but we want to build more houses in that area. We could just build in the park, but it offers some good qualities we want to keep. We could also build where the adjacent road is, but we need that infrastructure as well. It is not always possible to combine the needed functions on the same location.

An approach that is often used is densification, which means to build more houses or amenities within or on top of the existing building block, by adding layers or building towers. Since this space is already allocated for buildings, we technically do not raise the spatial pressure.

But in these densified areas, there is also a different kind of spatial pressure, which is space per capita. Using our example: as

we are increasing the amount of houses around the park, more people are 'using' it, essentially decreasing the amount of available space per person. A recent study has shown that in the cases of Amsterdam and Brussels, the available green space per capita has plummeted by 15,7% and 26,5% respectively (Balikçi et al., 2021). Although there generally are good methods and policies to deal with spatial pressure regarding expansion, the paper argues that there are no "...integrative policy measures to overcome this conflict between densification and greening of cities." In other words, we do not really know how to deal with space per capita yet.

## DEALING WITH GROWTH

---

In cities, spatial pressure is most often associated with growth. When looking at growth in the built environment in the Netherlands, there is an issue that can not be left unaddressed: the housing shortage. As a result of multiple factors, including urbanisation, population growth, immigration and the lagging of housing development, there is a general shortage of housing. Especially in cities in the Randstad\*, the shortage has become a big problem, driving up housing prices and putting more pressure on the real estate market. The solution (so far) has been to

build more houses where we need them: in the cities. This causes the cities to grow either outward, by expanding, or inward, by densifying.

### Expansion

Throughout history, these cities have all experienced some form of expansion as a result of an increasing need for houses in urban environments. A common example of this, are the VINEX neighbourhoods (Figure 5). These neighbourhoods were developed as agglomerations outside of medium-large cities to alleviate the real estate market (Jokovi, Boon & Filius, 2006). Yet,

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\* The Randstad is a collection of cities and villages in the west of the Netherlands, including Amsterdam, The Hague, Rotterdam and Utrecht.

expansion of cities could reach its limits, as the negative impact of urban sprawl is becoming more and more pressing (EEA, 2006). Moreover, as the cities are growing towards each other, they reach the boundaries of critical areas, such as the Green Heart between the cities of Utrecht, The Hague and Rotterdam. This means the pressure on space is raising even more. The limits of expansion are within sight, so cities reach out to other strategies to grow.

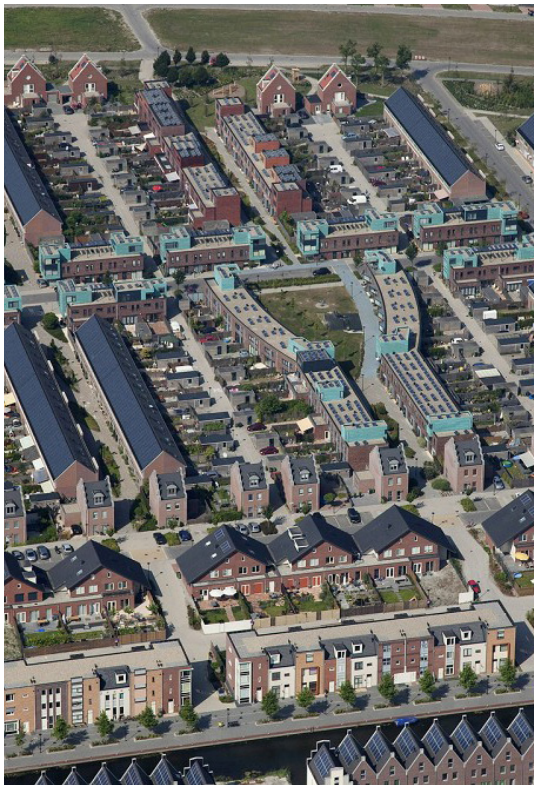


Figure 5. Aerial view of a typical VINEX neighbourhood (Tangram Architekten, 2017)

## Densification

A strategy most of these cities are adopting now is densification. This essentially means that more houses are built within the existing urban tissue, increasing the amount of houses per area, or density. A commonly referred to concept when talking about densification is that of the “compact city”, as proposed by Thomas L. Saaty and George Dantzig in 1973. There are a couple of benefits associated with densification. To start, an increase in density could mean more households live within a closer proximity of amenities, reducing travel times and effectively promoting more sustainable transport options like walking and cycling (Newman & Kenworthy, 2006). Moreover, densely built residential blocks can be more sustainable and lower in cost, as they can be more efficient in the use of materials for building, infrastructure and utilities (Holden & Norland, 2005). Finally, by increasing the density of the existing urban tissue, the surrounding open space can be preserved, reducing the pressure on this space.

However, by increasing the density in the existing urban tissue, it might become (over)crowded, as the area simply doesn’t have the capacity to deal with these extra citizens. A clear, more technical example of this are congestions in traffic and other infrastructure, like power lines or the sewage system, where the results of overcrowding can be easily observed (Neuman, 2005). But the limits of the city’s capacity also extend to the less visible aspects.

## Crowded Spaces and Control

In an area with increased density, the ratio between open space and inhabitants shifts. Effectively, the available space per capita shrinks, which has some consequences on the qualities of this public space associated with liveability.

Liveability here can be defined as “The quality of the match between people and their living environment...” (van Dorst, 2012). Key components that play a part in the correlation between liveability and crowding are related to control:

- 1) Control over the physical environment: having the authority to alter the surroundings to one’s liking
- 2) Control over the social interactions: having the authority to engage in social interaction or enforce privacy.

Both help to establish a sense of “... (perceived) freedom, individualisation, tolerance and identity” (van Dorst, 2012), contributing to the liveability.

An example of these forms of control from my personal experience, could be found in Copenhagen, where people gathering placed flags and other items in parks to “mark” their space (Figure 6). This phenomenon is in line with the theory as these objects form clear borders that contribute to the physical conditions which assert control over the physical environment and social interactions. Essentially, it is a form of domesticated public space. The items mark the space, temporarily claiming it and providing the authority to control it.



Figure 6. Marking out a territory with flags, blankets and bikes in Copenhagen, Denmark (Williams, 2014)

Yet, these two forms of control are jeopardised under spatial pressure. In crowded public spaces, it is more difficult to establish these borders, as they become less “defensible”. This results in a loss of control, leading to a decline in liveability.

## SPATIAL PRESSURE IN ROTTERDAM

With the preceding findings of how growth can, and has been dealt with, it is not possible to further analyse the location of this project, Rotterdam.

According to the Centraal Bureau voor de Statistiek [CBS] (2022), the population of the Netherlands will likely grow with about 3 million (about 18%) in the coming 40 years (Figure 7). For Rotterdam, the expected growth is slightly lower than the other main cities in the Netherlands (Plan Bureau Leefomgeving, 2022), but still very significant. Along with the housing shortage, this means the city will have to build more houses, approximately 50.000 more until 2050 (Gemeente Rotterdam, 2019a).

(Gemeente Rotterdam, 2019b). Moreover, they speak of “Good and Smart Growth”, by incorporating climate-adaptive building techniques to help with climate change mitigation.

An often debated example mentioned within following this vision is the plan for “Feyenoord City”, a new, massive project that has mixed functions like housing, a football arena\* and tidal parks (Figure 8). The ambition is to work with high densities to reduce costs for the high quality open spaces (Feyenoord City, n.d.)

### Groei en krimp bevolking tot 2050

2021 - 2035 2035 - 2050

#### Rotterdam

Toename van 12% tussen 2021 en 2035

Krimp  
0 - 5 %  
5 - 10 %  
10 - 15 %  
Meer dan 15 %

Groei  
0 - 5 %  
5 - 10 %  
10 - 15 %  
Meer dan 15 %

Absolute groei  
Aantal inwoners  
toename  
in jaren  
2021-2035

Procentuele  
groei of  
krimp  
in jaren  
2021-2035

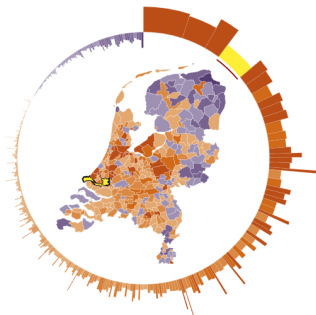


Figure 7. Expected growth per city, Rotterdam in yellow (Centraal Bureau voor de Statistiek, 2022)

The municipality envisions this growth to be achieved for a big part by densification, as is mentioned in their housing vision

\* The implementation of the arena of the football club Feyenoord has been surrounded by controversy. The most recent plans do not include the stadium, despite the name “Feyenoord City” (Groenendijk, 2022).





Figure 8. Latest plans for Feyenoord City (Effekt et al., 2023)

### Early Ideals of Densification

But densification is not something completely new for the city. In fact, the iconic Erasmus bridge, opened in 1996, was part of a big urban project to rejuvenate the area south of the city centre, Kop van Zuid (Stadsarchief Rotterdam, n.d.), a former port area that was almost completely abandoned in the 1990's. By connecting the two sides with the new bridge, the area that previously was part of the port, now became part of the inner city. As it was mostly undeveloped, it proved to be an interesting site for brand new, dense developments. The initial plans show that the peninsula was to be filled with modern high-rise buildings that would fit the image of Rotterdam. Later, other iconic developments such as De Rotterdam and

Nieuwe Luxor have been built here. Along with the Erasmus bridge, they have become a part of the modern identity of Rotterdam.

But even though these projects make were fitting the modern standards of a modern Rotterdam, the amount of available open (or public) space per capita is still relatively low. When walking through the area it becomes apparent that the vision of the time was clearly not to put urban life on the streets, but inside of the buildings. In fact, the building "De Rotterdam" has even been described by their designers OMA (1997) as a vertical city, housing all the functions of a city within a single building.

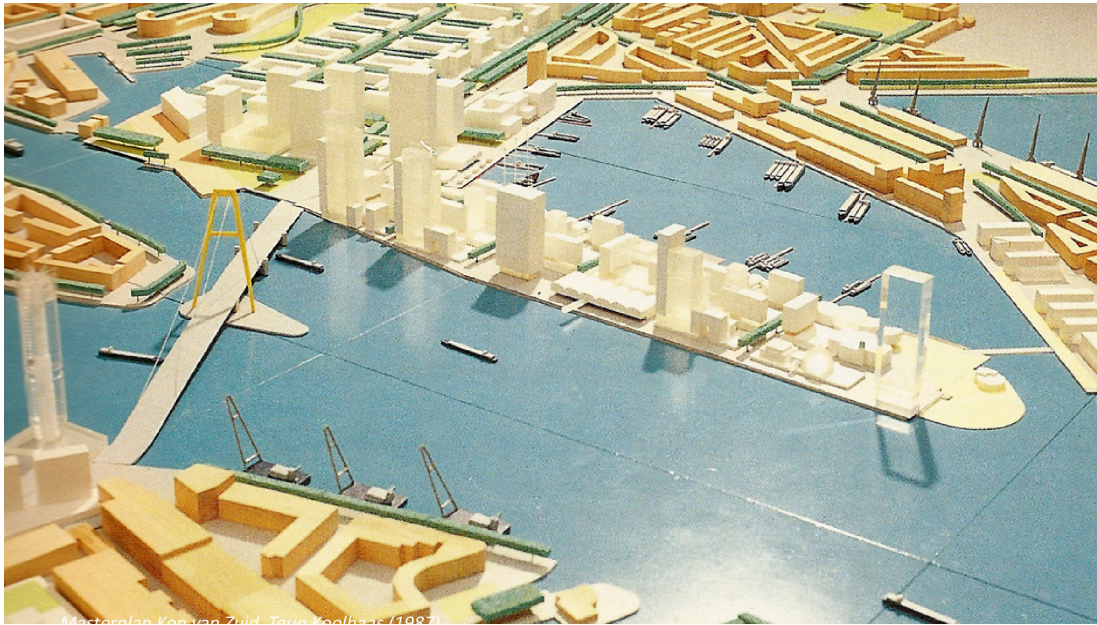


Figure 9. Model of the Kop van Zuid Masterplan (Koolhaas, 1987)



Figure 11. Image of "De Rotterdam" (Arquitectura Viva, 2018)



Figure 10. De Rotterdam: Building Programme (OMA, 1997)

### **Nature-Inclusive: Open Space Matters**

However, there has been a shift in ideals in the past years. Whereas in the case of Kop van Zuid, the ideal was to have a high quality of public services, recent ideals, as demonstrated in the vision of “Good and Smart Growth demonstrate the desire to build “Nature-Inclusive” (Gemeente Rotterdam, 2019b). This includes not only lending public space to urban facilities, but also to nature. This is also why, supplementary to the developments in Kop van Zuid, plans have been made to build a tidal park in the Rijnhaven, next to Kop van Zuid. This is one of 8 big, nature-inclusive plans in the city, aimed at a more sustainable development, increasing biodiversity and offering a place for peace and quiet for the inhabitants (Cleypool, 2022; Gemeente Rotterdam, 2019b).

Besides increasing the amount of available public space per capita and offering a variety of situations and potential social interactions, these new green developments also reinforce contact with the natural environment, which is a key quality associated with liveability (van Dorst, 2012).

Interesting to point out is that most of them are located in and around (yet to become) dense areas. Moreover, three of the proposed big plans are located on or close to water. Since there is a lack of available space in these area, the space currently used up by the water is essentially intensified.

Which brings us back to the topic of spatial pressure, or space per capita. Although these plans include a bigger amount of open (green) space available, there is a limit to how much they actually contribute to creating open (green) space per capita, especially when they are paired with densification around them. A low amount of available green space per capita can result in a decrease of health and wellbeing (Russo & Cirella, 2018), so preventing overcrowding and maintaining a healthy ratio is an important aspect of the qualitative assessment of these new developments. This makes it questionable to what extend these new developments actually contribute to the aforementioned qualities associated with liveability.

For example: the new park suggested in the Rijnhaven promotes the ideals of nature and peace in a bustling city, but can these promises be fulfilled when the park is crowded? And can a connection with nature be established when the songs of birds are drowned out by the voices of people.





### 1. Rijnhavenpark

A tidal park located next to the busy Kop van Zuid. This new park will offer space for outdoor activities and meeting spots.

*image: Barcode Architects, 2022*

### 5. Hofbogenpark

This former railway bridge is being transformed into a long, elevated park. This offers a new pedestrian route through a green area.

*image: De Urbanisten, 2020*



### 2. Prins Alexanderplein

Close to an important infrastructural node, this new square should transform the space to a place of staying.

*image: Bureau Hosper, 2022*

### 6. Schouwburgplein

Plans are made to make this square more lively and bustling. More green shall be added to make it into a more pleasant experience.

*image: Gemeente Rotterdam, 2022b*



### 3. Hofplein

A square currently dominated by motor traffic, this plan offers a solution to make it more pedestrian friendly and nature-inclusive.

*image: Juurlink en Geluk, 2022*

### 7. Nelson Mandela Park

This former port area will be transformed into a big park to host events and activities. It shall also compensate for the lack of greenspaces around it.

*image: SWA/Balsey, 2022*



### 4. Westblaak

This busy car-oriented street in the city centre is to become more oriented towards pedestrians. Moreover, stormwater retention capacity is added.

*image: Gemeente Rotterdam, 2022a*

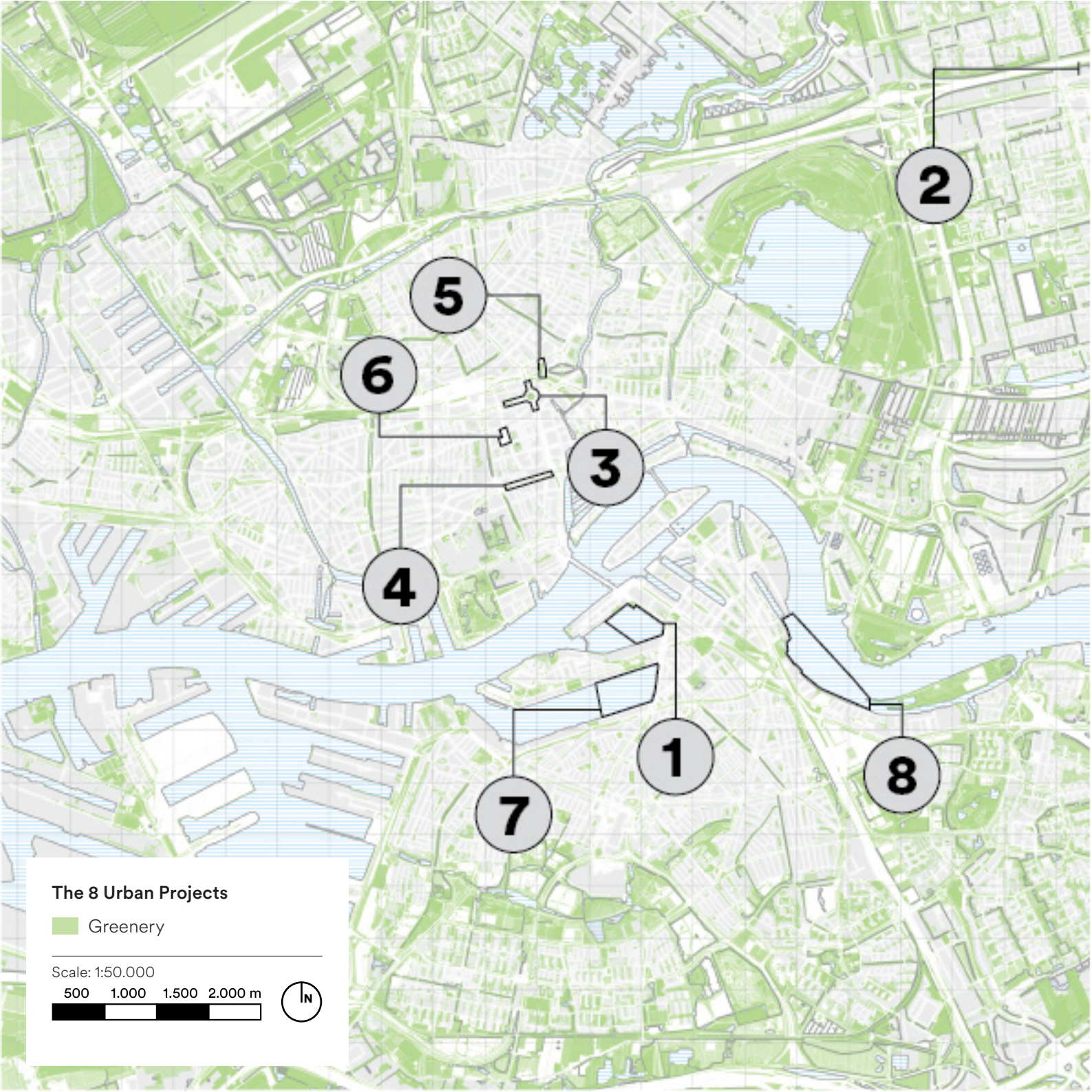
### 8. Tidal Park Feyenoord

On the quay of the Maas, this new tidal is planned to facilitate nature into the new, dense area of Feyenoord City.

*image: Feyenoord City, 2022*







### The 8 Urban Projects

 Greenery

Scale: 1:50,000

500 1,000 1,500 2,000 m





## Areas under Pressure

Most of the 8 big projects are located in areas that seem dense and lack open space. But in order to understand how much spatial pressure there actually is on these locations, there are a many things we could look at. One very simple way to visualise this, is by using the Open Space Ratio: the amount of available open space divided by the total floor space. This gives an indication of spatial pressure, as it shows areas that have relatively little of open space per built up area (high spatial pressure) next to areas that have a lot of open space per built up area (low spatial pressure) ("OSR in Rotterdam City Centre", p.25).

Using this information, we see that the city is mainly suffering from spatial pressure in the city centre, the area Kop van Zuid and along some major traffic arteries in the South. This is also where the majority of these new developments are planned.

But besides big projects launched by the municipality, it has become almost canon that citizens of Rotterdam have been taking their own measures to create space (Figure 12, Figure 13). When skimming across the roofscape of Rotterdam, it is very common to see an occasional rooftop terrace. Sometimes done in a very professional manner, but also sometimes very much like do-it-yourself project. In these cases the roof is used for more than the ceiling of the top layer. In these cases, we speak of an **intensive-use rooftop**, as the roof is used more intensively.

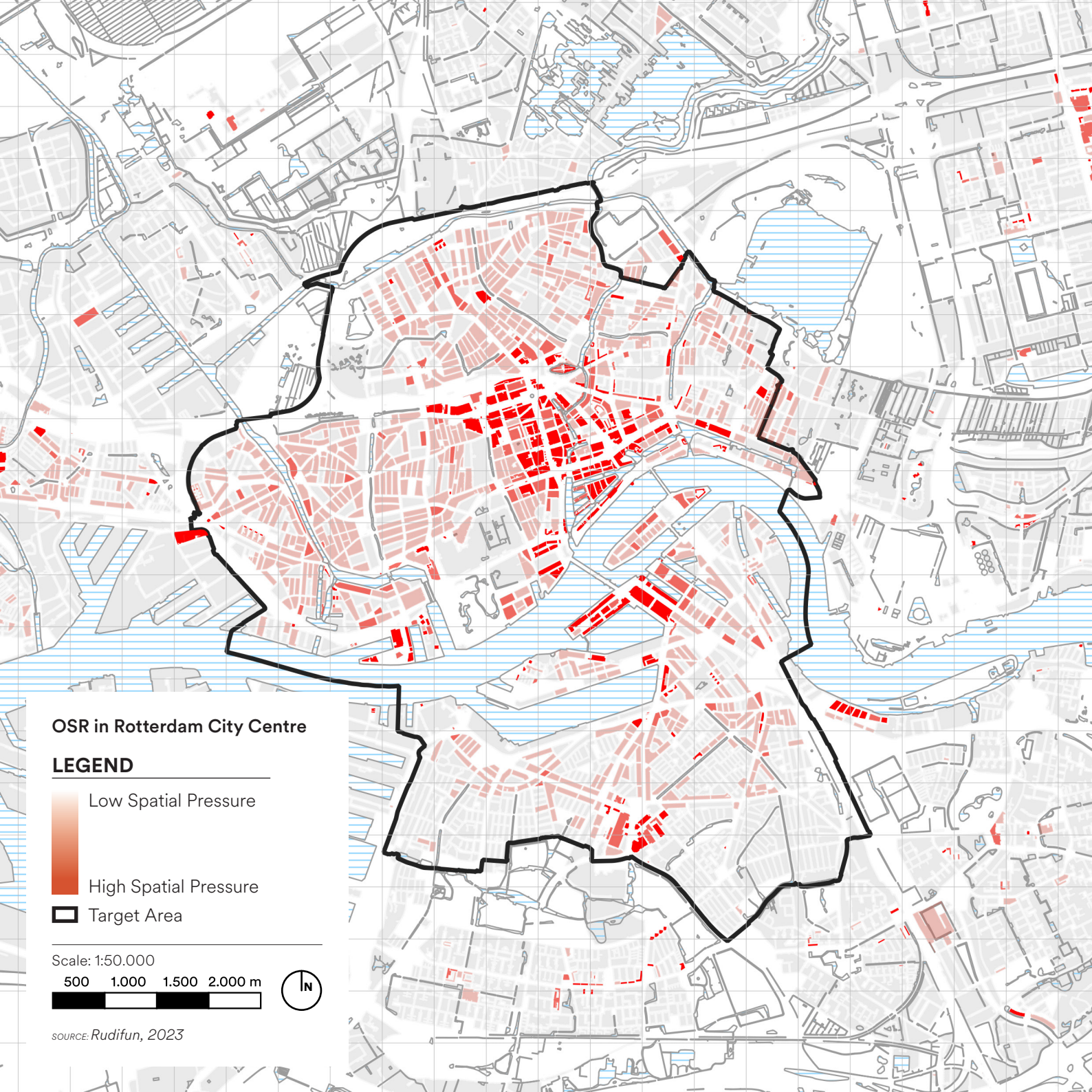


Figure 12. Rooftop terrace Mathenesserlaan (Funda, 2018)

By utilising their rooftop, citizens have create their own space for leisure that was lacking on ground level. This efficient use of space, although sometimes very primitive, is an excellent example of the "smart and good growth" the municipality refers to.



Figure 13. Example of a slick rooftop terrace (Renoparts, n.d.)



**OSR in Rotterdam City Centre**

**LEGEND**

- Low Spatial Pressure
- High Spatial Pressure
- Target Area

Scale: 1:50.000  
500 1.000 1.500 2.000 m



SOURCE: Rudifun, 2023



### **Rooftops that accommodate space**

Little Coolhaven (or Little C), a new development located in the western part of the city centre, is a good example “good and smart growth”. The design of this building block is made to support high densities, while also using the space in between and on top as efficiently as possible. Not only does the block offer a variety of mixed activities on the plinth and residential types, there are also multiple uses for the rooftops. Some roofs use their surface for solar panels that generate renewable energy, others are utilised as either private or (semi-)public terraces (Figure 15).

However, Little C could definitely not function as a typology we could copy-paste all over Rotterdam. If we look at the block in its context, we can see that it can easily support this low level of open space, because it is situated in close proximity to a large (open) park on one side, and a large waterbody on the other side, giving it some breathing air and surrounding space (Figure 14).

Nevertheless, it does provide us with an interesting case study of how higher densities can be supported by using rooftops more intensively.



Figure 14. Aerial image of Little Coolhaven (Google Earth)



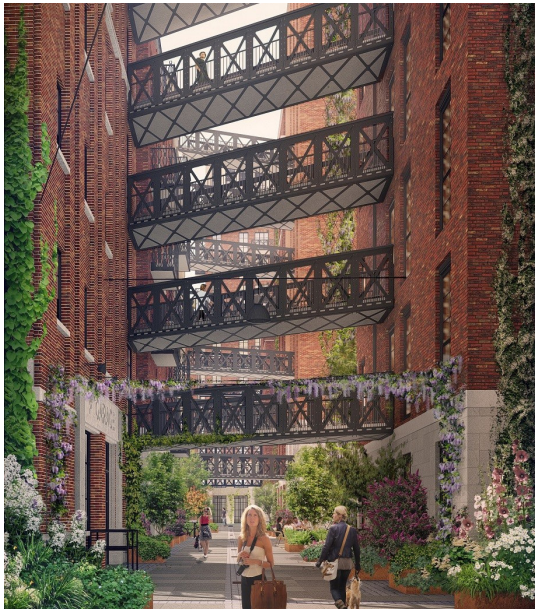


Figure 15. Little C, Rotterdam; an example of “Good and Smart Growth” (Rotterdam Architectuurprijs, 2021; INBO, 2020)

# The Fifth Facade

So now we know that there is a need for space in the city, not just for parks and public functions, but also for the more mundane things in life like infrastructure and utilities. And we also see that in Rotterdam, rooftops can provide us with a large surface within the city to facilitate this space. The next step would be to understand what the possibilities these new surfaces could offer and how we can make use of them.

## A BRIEF HISTORY OF THE FIFTH FACADE

Before we start, I must disclaim: the use of rooftops is not something completely new. In fact, one of the first records we have of rooftop usage is that of the Ziggurats of ancient Mesopotamia that date back to almost 5000 BCE (Mark, 2022). The most well-known example of this is probably the Hanging Gardens of Babylon (Figure 16).

But history is quite littered with examples of rooftop usage, which shows that being efficient in terms of urban space and use of materials is not a concept of only the 21st century.



Figure 16. Painting of the Hanging Gardens of Babylon (Gordon, 1930)

Back in the more relatable time period of the 20th century, Le Corbusier & Pierre Jeanneret introduced the term “Fifth Facade” to refer to the rooftop as an integral part of the building design (1927). It was meant to serve the city as a “(...) recovery of all the built-up area”. Moreover, Le Corbusier used the inherent qualities of rooftops, such as their semi-private nature



and vistas over the surrounding area, as a part of the design itself (Figure 18). In the Unité d'habitation in Marseilles, the rooftop was designed to supplement the large open space around the high-density building (Figure 17, Figure 19).



Figure 17. Children playing on the rooftop of Le Corbusier's Unité d'habitation (Burri, 1956)

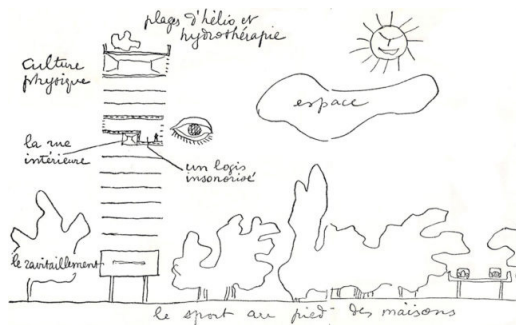


Figure 18. Sketch of the relation between the building and the open space (Le Corbusier, 1947)



Figure 19. Aerial photograph of Unité d'habitation (Esakov, 2018)

Le Corbusier's plans for the Unité, accompanied by those of the Cité Radieuse, are (in-)famously known for the incorporation of large open spaces. But as we have established before, in the current situation, we do not have the open space anymore, which means that the relation between rooftop and ground level that Le Corbusier suggested, does not work in most cases of the 21st century.

### The Fifth Facade in the 21st Century

The term "Fifth Facade" was later repurposed by Diana Balmori, a landscape architect and urban designer. She describes it as the a usable surface in the urban environment, rather than a by-product of buildings. In a keynote during the Greenroofs & Walls of the World Virtual Summit in 2015, Balmori discusses an experiment on Long Island (Greenroofs.

com, 2016). In this experiment, a series of green roofs spanning a large area were placed close to a major motor traffic artery (Figure 20). The results showed that the green roofs had a positive, city-wide effect on stormwater retention and the urban heat island effect.



Figure 20. Silvercup Studio Rooftop in Long Island (Balmori Associates, 2005)

Now, the term “Fifth Facade” represents the potential that rooftops can have to positively impact an urban environment, not only in terms of climate and biodiversity, but also in liveability and human well-being (Cook et al., 2015).

These benefits are showcased in the design of Government City in Sejong in South Korea by Balmori Associates (Figure 21). They used a variety of rooftops in a huge-scale masterplan the form a series of connected rooftops, stretching about 4 km with different types of green. A pathway over the rooftops offers a nice walk through a green environment as an interruption to the busy life within the building.



Figure 21. Design for the new government city in Sejong, Korea (Balmori Associates, 2007)

This design ideology describes an almost utopian green view of how natural elements that previously succumbed under the spatial pressure of the city, can be re-introduced on top of the buildings.



## THE ROOFTOP TYPOLOGY OF ROTTERDAM

Rotterdam itself also has a turbulent historical relationship with its roofscape. Starting in the late 19th century, Rotterdam architects begun experimenting with new typologies and building and materials, such as concrete and steel. These new buildings often had flat rooftops as a result of the new-found building techniques. Buildings like “het Witte Huis” (Figure 22) or the “Hofpleinviaduct” (now sometimes referred to as the longest roof of the Netherlands) had flat rooftops (Wienese, 2017).



Figure 22. Construction of the White House in 1897  
(Stadsarchief Rotterdam, 1897)

### Bombing and Reconstruction

An important moment in the history of the city, that marked and changed the urban fabric, is the bombing of the Rotterdam during the second world war on the 14th of May, 1940. After this, most of the inner city was left destroyed or heavily damaged. After the debris was cleared, only a small part of the buildings that once made up the tightly nit urban fabric of the city remained intact (Figure 23).



Figure 23. Rotterdam after bombardment (Brandgrens.nl, n.d.-a)

The area marked by the so-called “brandgrens”, shows which part of the city was bombed (Figure 24).



Figure 24. Brandgrens: the area that was bombed in 1940 (*Stichting Voorouder, n.d.*)

From the ashes of this aftermath, the city was reconstructed. Now, new ideals and beliefs, as well as an urgency to facilitate housing for those who lost it changed the way the city was constructed. New technologies and conventions in the architecture caused many buildings to make use of flat roofs, which subsequently became iconic for the post-war typology we still see a lot in the city today (Figure 25).



Figure 25. New post-war typology (*Brandgrens.nl, n.d.-b*)

### Surface in Quantities

With this information in mind, the next step would be to find out what the spatial impact of incorporating rooftop would be. In other words: how much square meters of (usable) flat roofs are out there? With openly available GIS data, this estimation can be made.

As has been previously identified, the area where rooftops will have the biggest impact is in the city centre, where the open space ratio is the lowest. The area marked with a black outline shows the neighbourhoods that typically had a low OSR. The, by using the same GIS data, we can calculate how much of the surface area is actually used by it's components. The calculations were made for water, buildings, and parks & plazas. The remaining space consists of

infrastructure, private property and other public spaces not classified as parks & plazas (Figure 26, Figure 27).

After that, a calculation was made on how much rooftop surface could be used, using the flat roof index (RIVM, 2023; "Usability of Rooftop Surface", p.34).

Comparing these against each other shows that more than half of the built-up area (54.3%) could be used with an intensive-use rooftop.

Although the calculation does not incorporate factors like the structural capacity of the buildings or inaccuracies of the provided data, it does give a general indication of how much potential these rooftops have in there mere surface area.

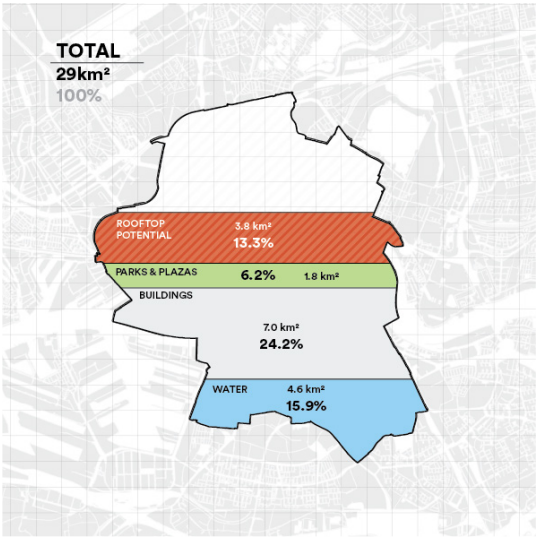


Figure 26. Diagram of city centre with land use in percentages

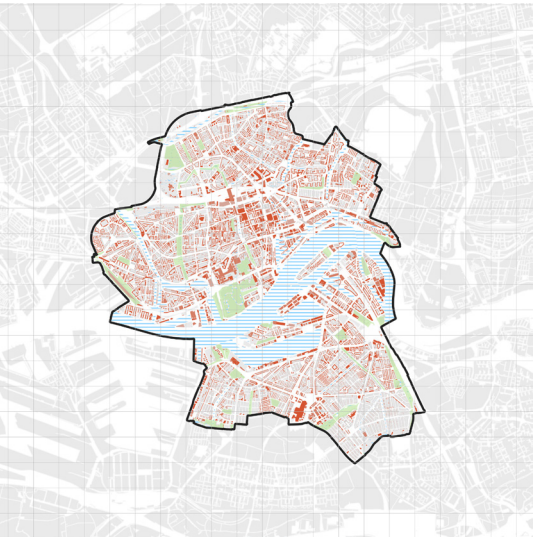
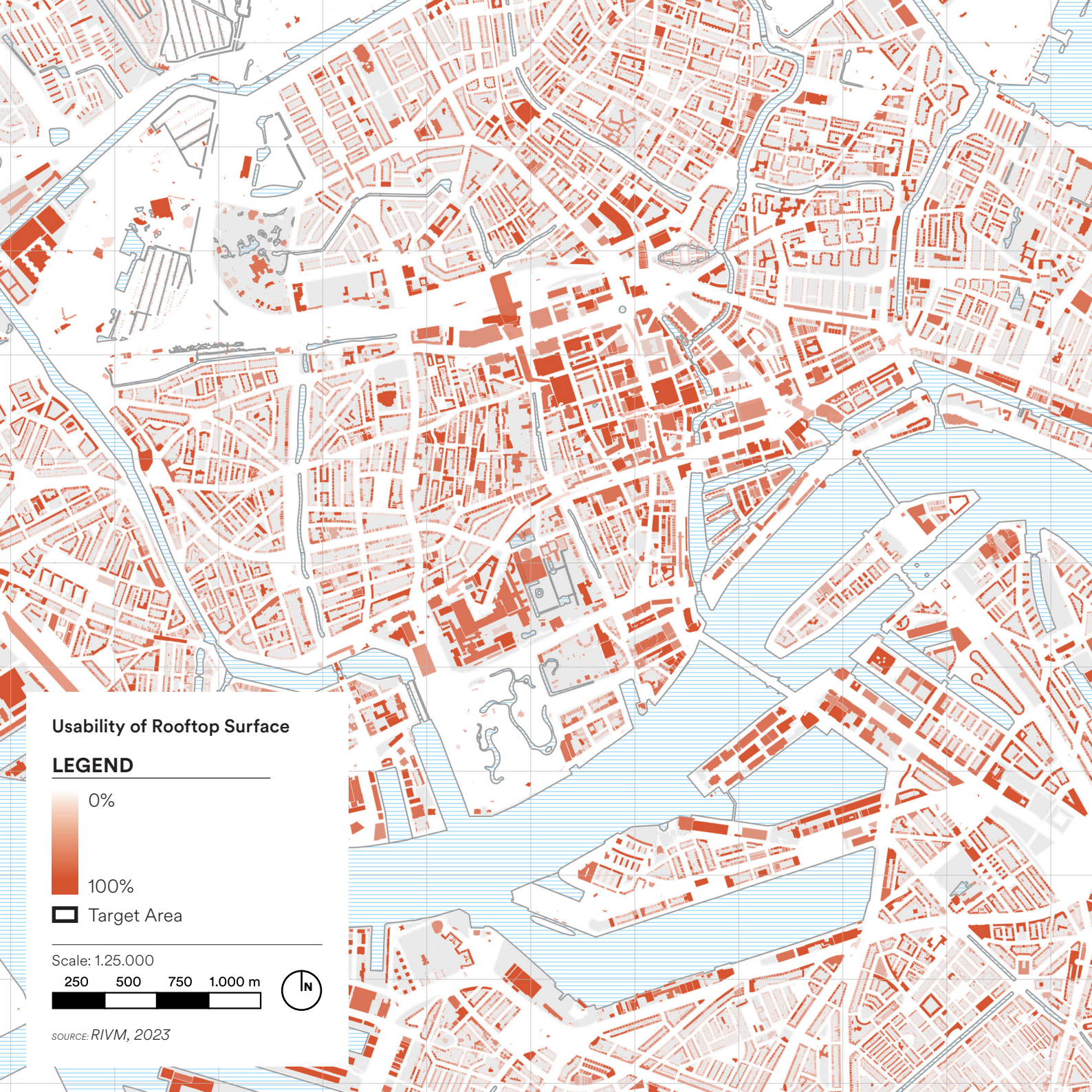


Figure 27. Overview of city centre with land use.





Usability of Rooftop Surface

LEGEND

0%

100%

Target Area

Scale: 1:25.000

250 500 750 1.000 m



SOURCE: RIVM, 2023

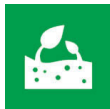


# A New Urban Surface

The flat roofs of Rotterdam cumulate to vast surface area that could be used for a variety of functions, which can contribute to a sustainable city. In this part, the different functions of rooftops as proposed by the municipality of Rotterdam will be elaborated upon. Moreover, the impact of this new-found roofscape on the sustainable city will be analysed.

## MULTIFUNCTIONAL ROOFTOPS

There are various options when it comes down to rooftops, it can range from incorporating green or applying solar panels, to rooftop terraces and options for densification. The municipality of Rotterdam made 7 distinct categories identified by colours, in their “multifunctional rooftops” programme. These colours are typically used to address these different functions (Gemeente Rotterdam, 2018).



### Green Roof

Placing vegetation to decrease heat stress and improve biodiversity.



### Blue Roof

Capturing and retaining water during (heavy) rain and providing a source of water during dry periods.



### Yellow Roof

Generating renewable energy from the sun or wind, contributing to the energy transition.



### Red Roof

Facilitating recreational and social functions such as sports, bars or meeting places.



### Orange Roof

Providing space for mobility and infrastructure. Currently, bridges and pedestrian connections are used, but in the future, these could house aerial mobility hubs.

These three categories are used quite widely. Parties that are more concerned about rooftops in an environmental context, like Rooftop Revolution, often use the terms green and blue. Although yellow is often simple referred to as “solar panels”, the idea of an energy generating roof remains.

The “red roof” insinuates a social, publicly available rooftop, although we see in practise that these are mostly used in relation to private or shared roof terraces.



### Purple Roof

Densifying by adding new layers of housing. These could be new floors added, or 'tiny house' rooftop villages.

These categories are very specific and not used so much outside of the municipality. Although densification is a relevant topic in urban design, retrofitting a new building layer on an existing roof is not very common.



### Grey Roof

An unattractive, but necessary type of rooftops, offering space for utilities like chimneys, antennas and air treatment units.

Finally, "grey roofs" are the ones that have been the industry standard for decades. Reserved mostly for practical and cost efficient solutions like installations, the roofs in this category are often the ones covered with gravel or bitumen.

### Intensive-use Rooftops

These categories together make up the "multifunctional rooftops" programme, whose name is derived from the practise of combine multiple of these categories together. Solar panels can be placed on a roof garden to make a green-yellow combination or a park can be added to a densification project. The municipality calls these "golden roofs".

However, this term may imply that the rooftop needs to serve multiple functions, whereas in some cases, simply using it for one function like solar panels or water storage can be already make a significant change. Moreover, the goal itself of using this empty roofscape would not be to apply a lot of different functions to it, but rather to make use of space more intensively.

To address this limitation, the term "**intensive-use rooftops**" is proposed to describe rooftops that are designed as an integral part of the urban space, whether that involves one, or multiple functions. The key difference between multifunctional rooftops and intensive-use rooftops is that the former focuses on incorporating multiple functions onto a single rooftop, while the latter emphasizes optimizing the use of the rooftop space for a particular function or set of functions.

The concept of intensive-use rooftops has a broader implication for urban sustainability, as it is focussed not on the impact of the different functionalities, but rather on the premise of utilising space more efficiently.

***"Intensive-use Rooftop is a type of rooftop which forms an integral part of the urban space."***

## SUSTAINABLE ROOFTOPS

Sustainability is the concept of meeting the needs of the present without compromising the ability of future generations to meet their own needs. In other words: creating a scenario that can be sustained.

### Sustainable Development Goals

And since this definition is rather vague, the United Nations (UN) have defined several handholds to assess the sustainability of scenarios in the form of their Sustainable Development Goals (SDG's). These goals serve as a universal framework for action that can guide policy and decision-making towards a sustainability scenario, fit for the future (United Nations, 2015). They cover a broad range of global urgencies, including poverty, health, education, responsible consumption and production and climate action.

In the Rooftop Catalogue, commissioned by the municipality of Rotterdam and created by MVRDV et al. (2021), and analysis of the impact on sustainability of the aforementioned multifunctional roof functions in regards to the SDG's is provided (p. 40). Typically 7 goals stand out that rooftops can actively contribute to.



### Good Health and Well-being

Space for additional greenery, quiet places in a busy city, and spaces for playing and sports.



### Clean Water and Sanitation

Delayed drainage of rainwater and water collection for irrigation or re-use.



### Affordable and Clean Energy

Reducing energy consumption through insulation and providing space for generating renewable energy.



### Sustainable Cities and Communities

Creating spaces for social community functions, making neighbourhoods more inclusive through programming and increasing the amount of public space.



### Responsible Consumption and Production

Producing food through urban farming and allotment gardens and using sustainable construction methods like circular construction and sustainable materialisation.



### Climate Action

Contributing to climate adaptation and climate mitigation, and increasing the sustainability value of the building stock.



## Life on Land

Creating green, ecological habitats for animals such as birds and insects, increasing the biodiversity, and offering space for native species.

## Triple Bottom Line

Another popularised method to measure sustainability is the “triple bottom line”, more often referred to as the 3P’s: People, Planet, Profit. The term developed by John Elkington in 1994, has since been widely adopted by businesses, governments, and non-governmental organizations as a way to measure and promote sustainability. It was originally developed to expand the focus of a healthy business beyond just the financial performance, while including social and environmental impacts (Elkington, 1998). It was even adopted by the UN for a long time, but was often subject to subtle changes in the used terminology. The word “profit” changed to “prosperity” to indicate a broader sense of economic sustainability, indicating economic equality as a key factor. Later, the terms “peace” and “partnership” were added as well (Brown & Rasmussen, 2019).

Nonetheless, the foundations of the triple bottom line still underpin many sustainability frameworks used today and are comprised of three main pillars

**People** refers to the social dimension of sustainability, including the well-being and quality of life of individuals, communities, and societies. In urban design,

incorporating the People dimension often includes designing cities for walkability, creating public spaces that encourage social interaction, and ensuring access to basic services such as healthcare and education. Generally, it could be seen as a reflection of urban liveability.

**Planet** refers to the environmental dimension of sustainability, including natural resource management, pollution reduction, and climate change mitigation and adaptation. In urban design, incorporating the People dimension often includes using renewable energy sources, designing green infrastructure such as parks and green roofs, and implementing sustainable transportation systems.

**Profit**, also known as Prosperity, refers to the economic dimension of sustainability, including financial viability, job creation, and economic growth. The applications of the Profit dimension in urban design can include incorporating energy-efficient buildings and infrastructure, which can reduce operational costs and generate cost savings in the long run. Moreover, by integrating businesses and economic practices as an integral part of the urban fabric, such as through mixed-use neighbourhoods, the economic pillar can be healthily integrated into society.



## ENVIRONMENTAL DIMENSION

As discussed before, different functional rooftops can have an impact on the environmental dimension of a sustainable future. As climate change is becoming a bigger threat every day, it is of vital importance that we take measures to reduce the negative impact the built environment can have on our cities, commonly known as climate adaptation, as well as decreasing the rate in which the climate changes, commonly known as climate mitigation. Cities are increasingly suffering from flooding, low biodiversity, heat stress and many other problems as a result of climate change. One approach to reduce the negative impact the built environment has on climate change is to build in a “climate adaptive” matter.

### Climate Change Adaptation

This means that we have build and adapt our buildings in order to cope with the effects of climate change. The built environment should accommodate life in a new scenario, facilitating cold spots during heat waves, ecological habitats to improve a declining urban biodiversity and store rainwater to deal with more droughts and pluvial floodings.

A reliable handhold for assessing and designing for climate adaptivity, is the “**Leidraad Klimaatadaptief Bouwen 2.0**” (Guidelines Climate Adaptive Building 2.0), which was released in 2022 (van den Dool & Valkenburg). The guidebook describes the goals regarding the 6 most pressing topics for climate adaptation: *pluvial*

*flooding, drought, heat stress, subsidence, biodiversity and coastal/river flooding.* Moreover, it gives an overview of how these phenomenons can be combated through design interventions.

### PLUVIAL FLOODING

As periods of rainfall are increasing in intensity as a result of climate change, pluvial (rainwater) flooding is becoming more of a problem in urban environments. This can cause damage to buildings and infrastructure (Figure 28).

The effects of pluvial flooding can be reduced by creating water buffers and improving soil infiltration.



Figure 28. Heavy flooding in Rotterdam 2021 (Algemeen Dagblad, 2021)

### **DROUGHT**

Paired with periods of heavy rainfall, are periods of long drought. Resulting in a low groundwater level, this can cause damage to wooden foundations, vegetation and decrease water quality (Figure 29).

Common strategies to deal with this are creating reducing water consumption and improving soil infiltration.



Figure 29. Dried grass in Vondelpark (Mol, 2018)

### **HEAT STRESS**

Longer heat waves and high temperatures are a result of climate change. Especially in cities, temperatures are even higher due to the Urban Heat Island effect, causing discomfort and often even an increase in deaths (Lamper, 2022).

In order to cool the city, some measures can be taken. First, increasing the amount of vegetation provides cool spots throughout the city (through evapotranspiration). Moreover, using fountains and water

elements creates cool spots and adding publicly available drinking water taps prevents dehydration (Figure 30).



Figure 30. Drinking water tap in the centre of Rotterdam (Rutting, 2018)

### **SUBSIDENCE**

Due to dry soil and a low ground water level, buildings can (partially) 'sink' into the ground (Figure 31). This is called subsidence. It can cause a lot of damage to the building and usually is very costly to repair.

Although rooftops can contribute little to mitigating these effects, some things can be done on ground level.

By increasing soil infiltration and supplementing the ground water supply, the effects of subsidence can be reduced.



Figure 31. The “Dancing Houses” in Amsterdam, the result of subsidence (Gemeente Amsterdam, 2020)

### **BIODIVERSITY**

Biodiversity is an essential element of a healthy and resilient ecosystem. The Leidraad recommends designing buildings and public spaces that can promote biodiversity, for example, by using green roofs, green façades and green walls, and by creating habitats for animals and plants (Figure 32). The guideline also recommends using locally sourced materials to reduce the ecological footprint of buildings.



Figure 32. Peregrine falcon nest in the Hague (Jacobus, 2018)

### **RIVER & COASTAL FLOODING**

Finally, coastal and river flooding is a significant problem in the Netherlands, which has a large part of its land below sea level (Figure 33). The Leidraad recommends designing buildings and public spaces that can cope with flooding, for example by using flood-resistant constructions and by creating green infrastructure that can absorb and store water. The guideline also recommends working closely with local water management authorities to ensure that buildings and public spaces are designed in a way that reduces the risk of flooding.



Figure 33. Flooding of the river Geul in Valkenburg (ANP, 2022)

### **Climate Change Mitigation**

Besides adapting cities to deal with climate change, there are also means to decelerate it. The goal of mitigation is to avoid significant human interference with Earth’s climate, “stabilize greenhouse gas levels in a timeframe sufficient to allow ecosystems to adapt naturally to climate change, ensure



*that food production is not threatened, and to enable economic development to proceed in a sustainable manner” (IPCC, 2014). Common methods to approach this are “...reducing the flow of heat-trapping greenhouse gases into the atmosphere (for example, the burning of fossil fuels for electricity, heat, or transport) or enhancing the ‘sinks’ that accumulate and store these gases (such as the oceans, forests, and soil)” (NASA, 2019).*

From a more practical perspective, this often means pushing the development of renewable energy sources while reducing energy demand. Moreover, the ongoing transition to a new type of mobility that utilises renewable, non-polluting energy sources like hydrogen and electricity, rather than energy sourced from fossil fuels, forms an important part of the mitigation process. All in all, there is a growing need to generate, store and transport renewable energy that can be produced from solar panels, wind turbines, nuclear energy, etc. This requires a new type of infrastructure, especially considering that most of these solutions are focussed towards electricity, and the distribution network for electricity is experiencing limitations (Neuman, 2005). Besides that, many sources of renewable energy are subjected to fluctuations in their production as a result of changes in the weather or the season. Therefore, it is important that the produced energy can also be stored for usage when the weather conditions affect production efficiency

These changes in the energy landscape, commonly referred to as the “*energy transition*”, mark a new era in which energy and its required infrastructure, forms an integral part of sustainable design (Figure 34).



Figure 34. Windmill park on the North Sea (ANP, 2021)

### **The Role of Rooftops**

Rooftops can play an important role in climate adaptation in urbanised areas. Especially in locations where open space is scarce.

By implementing green and blue roofs, rooftops can absorb and retain stormwater, reducing the amount of stormwater runoff that overwhelms urban drainage systems during heavy rainfall events. Essentially, these types of roofs function as a water buffer. When properly treated, the buffers can also be used as a rainwater harvesting system, which is suitable for flushing toilets or water vegetation. This can offer a well-needed source of usable water in times of drought.



Moreover, the green and blue roofs can help to reduce heat stress, as the evaporating water in a blue roof, or the evapotranspiration of the vegetation of a green roof cools the area. They also create an layer of insulation on the roofs, making it easier to regulate indoor temperatures, thus increasing thermal comfort.

Depending on the type of green roof, the vegetation can offer an ecological habitat for plants and wildlife, contributing to biodiversity (Figure 35). However, this claim must be approached with a healthy caution, since many roofs described as “green roof”, like Sedum or other extensive green roofs often offer a very monocultural habitat with limited possibilities for subsoil life, which in term can lead to a significantly lower contribution to biodiversity than advertised (Grant, 2006).



Figure 35. Biodiversity can be promoted through some applications of green roofs (Lockett, n.d.)

Different from the large parks the municipality has planned (p.22), roofs offer a very diffuse network of small patches of space. This can actually improve biodiversity, by contributing to the intricate ecological network of the city. Moreover, they allow pluvial flooding to be tackled in areas where spatial scarcity is highest. In other words: the diffuse properties of roofs allow interventions to be placed on locations that typically do not have an abundance of space.

While rooftops can contribute to mitigating the effects of pluvial flooding, drought, and heat stress, they are not very effective in addressing subsidence and river & coastal flooding. Subsidence is primarily caused by soil compression and the extraction of groundwater, which are not directly related to rooftop activities. Similarly, river and coastal flooding require large-scale interventions such as dykes, flood barriers, and river widening projects. While green roofs and other types of vegetated roofs can help to reduce the impact of small-scale local floods, they are not effective for large-scale flooding events.

In terms of climate change mitigation, solar panels on rooftops have already proven to be a popular means of generating renewable energy on space that otherwise would have been underused. Whereas some cases provide an alternative for combining them with other functionalities, like a green roof or a terrace, solar panels can often be found as a standalone feature (Figure 36). Moreover, other means of

generating renewable energy, like wind turbines or solar water heaters can be found as well. They harness the environmental qualities of the roof, like high solar exposure and increased wind speeds. Products like the Pownest (Ibis Power, n.d.; Figure 37) even harness both sun and wind for a higher efficiency.



Figure 36. Rooftop of Rotterdam Centraal, filled with solar panels (Info Steel, n.d.)



Figure 37. Pownest on the Lloydpier, Rotterdam (Stebru, n.d.)

## SOCIAL DIMENSION

Another aspect that rooftops can have a significant impact in is the social dimension. Although this is a broad topic to begin with, there are theoretical handholds that can help to identify qualities within this dimension. In the triple bottom line, this social dimension is represented by “People”, which refers to human capital and social equity. This means the value that is behind the human component of a business, such as their knowledge, personality and the role in the social structure. Key factors is this valuation

include the well-being of and cooperation with these people (Elkington, 1998). In other words: it assess humans not as a financial asset of labour, but as something more. A common example of human capital as a business value can be seen in fairtrade companies, where fair labour is seen as more than an economic asset.

In the adaptation of the triple bottom line by the UN, re-purposed as a framework for sustainability, “People” has translated itself to a synonym for global well-being, health,

emancipation, equality, and as a movement to counter poverty (European Commission, 2002; United Nations, 2002).

### **Liveability**

However, in modern urban design, this social dimension is often limited to the relationship between people and their physical environment, encompassed by the term “Liveability”. According to van Dorst (2012), the basic components of liveability are “Health and Security, Material Prosperity, Social Relationship, Control and Contact with the natural environment. Although not all these factors are determined by the physical environment, it can have a significant influence on the liveability.

### **Connection to Nature**

An element that highly determined by the physical environment is that of “contact with the natural environment. “The presence of green in a neighbourhood seems to reduce stress and seems to be positively related to the physical well-being of occupants and aesthetic quality.” (van Dorst, 2012)

Although it would not be within the scope of the project to dissect this element, it should be pointed out that this forms a strong connection between the social and the environmental dimension.

### **Domestication**

One specific component that should be highlighted is that of control, which van Dorst describes as both control over the physical environment, and control over social interactions.

Control over the physical environment indicates a sense of flexibility in the organisation and functionality of a space, which in term can be changed as a result of human behaviour. This is a phenomenon that is sometimes also referred to as “domestication”. Hartevelde (2020) describes the process of domestication, especially during the events of COVID-19, as a (re)discovering of the direct living environment. “Corona forces many to look closer to home, and then it becomes more apparent what is missing there.” (Van Noort 2020). The result is a shift in our evaluation of public space close-to-home, or as Hartevelde puts it nicely: “the city is our common house”.

Moreover, domestication in the urban domain is means to shape it to the needs and wants of its community. In her book “DIY Detroit”, Kinder (2016) explores the concept of DIY Urbanism\* in of Detroit, a city that is lacking services and amenities. Kinder describes how citizens of Detroit take measures in their own hands to change the physical environment. With initiative like cleaning the streets, organising potluck

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\* Do it yourself” (DIY) urbanism, sometimes also called “tactical urbanism” or “guerilla urbanism”, describes a group of related spatial cultural practices, generally aimed at making informal physical alterations to the urban built environment (Douglas, 2019)

dinners or public vegetable gardens, citizens provided for themselves when the city would not provide for them.

This form of exerting control over the physical environment can also be seen in Barcelona, where citizens are encouraged to transform the car-oriented inner streets of its well known “superblocks” into pedestrian area using temporary interventions (Figure 38).



Figure 38. DIY Urbanism in Barcelona (Blanchar, 2020)

### Regulating Privacy

The second aspect of control, that over social interactions, indicates to what extent inhabitants have power over the amount of social interactions, or more specifically, the regulation of privacy. Although different people have different needs in regards to privacy, “...the need of control is universal” (van Dorst, 2012). On one side of the spectrum there is loneliness, which is the absence of social interaction. On the other

side is crowding, which is the absence of privacy. A good balance between the two is important.

This also goes hand in hand with why domestication during COVID-19 was so prominent. During a period where bars and shops were closed, the only social interactions that could be found were in public space. However, many public spaces lack the qualities of a home-like space, which resulted in domestication.

But the relation between domesticated space and control over social interactions extends beyond the (exceptional) situations found during COVID-19. Perhaps the strongest symbol to represent this is the garden fence. A clear, physical border that marks the line between privately and publicly controlled space, or a ‘privacy zone’. In this case, the front garden functions as an intermediary space between the public street and the private building, easing the transition between the two and enabling control in the process. In fact, the street itself functions as a hybrid space between the domesticated areas of the community and the city. These nested elements of public-private hybrid spaces closely resemble the qualities of ‘the open city’ model (Sennett, 2006; Appendix B, p.276), which describes a scenario in which the harsh line between private and public functions in cities fades. Arguably, this could lead to an enhanced (perception of) control over social interactions, as well as the physical environment.



### **The Role of Rooftops**

Rooftops can offer a great contribution to liveability. They easily fit into the profile of a public-private hybrid space, given their shared and exposed properties on the one side and their private, inaccessible properties on the other side. As they are part of the building and thus, controlled by its owners, the roof offers an opportunity to exert control over the physical environment. Additionally, this form of privately owned space creates an environment that can be altered and tweaked safely, but within the restraints that permits and the municipal aesthetics committee have set out.

Finally, similar to how rooftops may contribute in forming a diffuse network of ecological habitats, the diffuse properties also increase the proximity of the functions placed on the roof. These amenities are now close-to-home, which fits nicely in the widely adapted model of the “15-minute city”, which describes urban planning practises in which urban services are within a 15 minute walk (Pozoukidou & Angelidou, 2022). This is a quality that the planned big parks in Rotterdam (p.22) can not match.

## **ECONOMIC DIMENSION**

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The last dimension is the economic dimension, indicated in the triple bottom line as “Profit” (altered to “Prosperity” by the European Commission in 2002). Although the most modern definition is rather vague, the triple bottom line clearly states the components of the economic dimension. It describes to just the financial results a company has booked, but also the its relation to the social capital and environmental capital indicated by the other two dimensions (Taylor, 2020). For example, if a business has booked economic growth over the backs of farmers (unlike fair trade practises), or has caused pollution, this is ought to be seen as a loss of human and environmental capital.

The triple bottom line considers not just the generated revenue, the costs and added capital, but also incorporates abstract forms of capital.

### **The Role of Rooftops**

Rooftop are interesting from an economic perspective. They do not just offer an exploitable surface in locations where space is scarce, they are already part of an economic asset: real estate. And so, intensive-use rooftops has seen a surge of popularity among real estate development. The most obvious one being solar panels, which utilise the empty surface and sun exposure to generate energy, which in term brings down the upkeep costs (energy bills), or generate revenue. But more recent cases have shown how increased human and environmental capital can

lead to an increase in economic value. This phenomenon goes hand in hand with gentrification: as a building becomes more attractive (due to a higher liveability or environmental impact), prices may go up. Although social housing and regulations are put in place to prevent this, it can not always be avoided.

One of the most well-known examples of gentrification is that of the High Line in New York, an elevated linear park on a former railway in the district Manhattan (Figure 39). Research has indicated that after the implementation of the High Line, adjacent houses became 35% more valuable (Jo Black & Richards, 2020). Moreover, the research indicates that adding to existing green spaces instead contributed to gentrification significantly less.



Figure 39. High Line, New York (Dansnguyen, 2021)

However, the High Line formed a large, green, and central structure in the district. This might not be the case for renovated intensive-use rooftops that incorporate

green. Although property values of the building itself may rise, the effects on the neighbourhood could be less, as it is not necessarily accessible to the community and is of a more moderate proportion. Moreover, the diffuse properties of the roofscape may also help to further temper gentrification, as developments are likely to be more distributed, or in neighbourhood that already have an increased housing value.



# Chapter 2

## The Unscathed Surface





Visie Hoogkwartier (Rooftop Revolution, n.d.)





# The Status Quo

Rooftops have the potential to contribute to our cities in terms of climate adaptation, the energy transition, liveability and much more. Yet, when looking at Rotterdam, the applications of these types of roofs seems to be lagging behind. It only takes a quick glance of the current roofscape of the city to draw this conclusion, as the flat surfaces, dripping with potential, remain mostly covered with gravel or bitumen\* (Figure 40).

In this part, the current state of rooftop in the city will be addressed. It will explore what is being, and what is not being done with rooftops, which programs are in place and where rooftops have already been developed.



Figure 40. Empty rooftops of Hoogkwartier, Rotterdam (Stadslab Hoogkwartier, n.d.)

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\* Bitumen is a commonly used, sticky black material that can be applied on rooftops to form a waterproof membrane. This protects the building from water damage and extends the life of the roof, but can get really hot when exposed to sun.

## TOWARDS INTENSIVE-USE ROOFSCAPES

The roofscape of Rotterdam is slowly becoming a theme in its urban planning. The flat rooftops cumulate to a vast surface of untapped potential that can contribute to a sustainable city. Hence, it has posed itself as a new tool in the toolbox of the city's planners. As the work of Le Corbusier, the experiments of Balmori and the general term of "the Fifth Facade" suggest, these surface could be utilised for vital functions in the urban ecosystem.

### Rotterdam Rooftop Days

And this has not slipped the attention of the Rotterdam, as it is actively promoting the use of rooftops to its citizens. One commemorable example of this are the Rotterdam Rooftop Days, a week long event in the city where various cases of intensive-use rooftops are presented to the public. 2022's highlighted feature was a large temporary orange bridge, constructed over one of the crowded streets in the city, the Coolsingel.

The goal of this event is to "showcase how the usage of rooftops can contribute to a healthy, lively, inclusive, attractive and future-proof city" (Rotterdamse Daken Dagen, n.d.). Moreover, it functions as a public event to connect different actors in the making of rooftops.

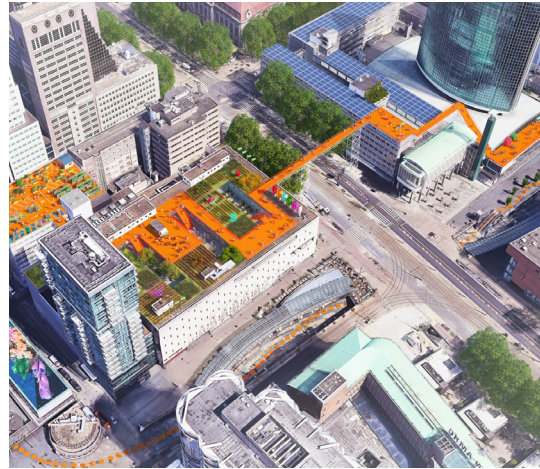


Figure 41. Aerial image of the bridge over the Coolsingel (Rotterdam Rooftop Days, 2022)



Figure 42. Visualisation of "Het Podium" on top the the Architecture Centre (MVRDV, 2022)



Rooftop Catalogue

For the Rooftop Days of 2022, the municipality cooperated with MVRDV to launch the ‘Rooftop Catalogue’ (Figure 43), an overview of many different types of rooftops that could be placed throughout the city. The options show how their interpretation of ‘multifunctional roofs’ can manifest themselves onto a building, resulting in very modest, to very extravagant options (Figure 44).

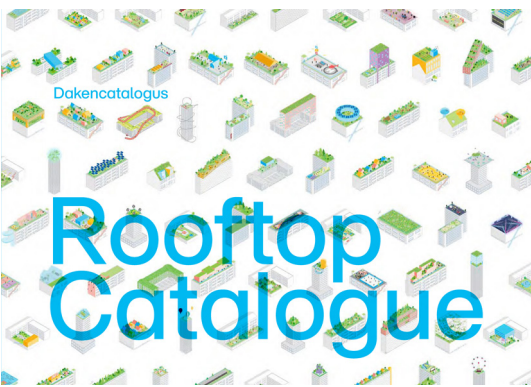
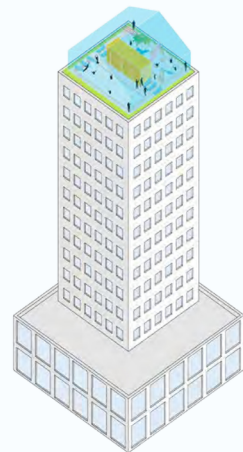


Figure 43. Cover of Rooftop Catalogue (MVRDV, 2021)

Swimming pool

A rooftop swimming pool would allow you to swim with the city skyline in the background. Of course, the weight of the water must be taken into account. The pool could also play a role in cooling down the building.

**Zwembad** In zwembad op het dak kan je zwemmen met de skyline van de stad op de achtergrond. Er moet uiteraard rekening gehouden worden met het gewicht van het dak. Het zwembad kan ook een rol spelen in de koeling van het gebouw.



Types of rooftops  
Type dak

Building typologies  
Gebouwtypologieën

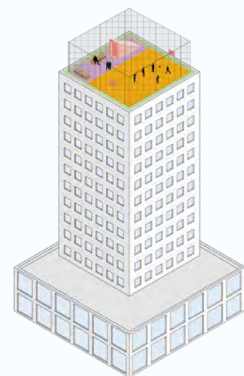
UN Sustainable  
Development Goals

Urban challenges  
Stedelijke opgave

Sports cage

All kinds of sports cages could be placed on rooftops, either specific to one sport or in a more multifunctional way. These can be publicly accessible or only accessible to the users of the building below.

**Sportkooi** Op de daken kunnen allerlei soorten sportkooien geplaatst worden. Specifiek voor één sport of multifunctioneel. Deze kunnen publiek toegankelijk zijn of enkel toegankelijk voor de gebruikers van het ondergelegen pand.



Types of rooftops  
Type dak

Building typologies  
Gebouwtypologieën

UN Sustainable  
Development Goals

Urban challenges  
Stedelijke opgave

Figure 44. Example Page of Rooftop Catalogue (MVRDV, 2021)

### **Amsterdam Rainproof**

Another organisation that is actively promoting intensive-use rooftops is Amsterdam Rainproof. They are advertising different bottom-up interventions to inhabitants that prevent pluvial flooding and harvest rainwater.

Amsterdam as a municipality is working hard to decrease the amount of pluvial floodings to a minimum. On May 11 2023, a policy was introduced that obligates new buildings in the city to retain stormwater during rainfall (Amsterdam Rainproof, 2023). As the space for water retention can be very scarce in the city, a blue roof (often combined with green) has become interesting for investors (D. de Leeuw, personal communication, March 6, 2023).

### **Digital Rooftops**

Behind the screens, the municipality and companies are working together on “Digital Rooftops”. I went to a symposium organised by the municipality of Rotterdam about this topic on the 15th of February 2023. The symposium was organised to inform parties active in rooftop development, such as other municipalities, companies and governmental organisation, about the potential of data and digitalisation in policymaking and applications for rooftops. They were also asked to give their feedback on this process, regarding the organisation, used data, financing, and policies and planning (see Appendix C, p.282).

The first speaker on the symposium was Deborah Nas, professor of Strategic Design for Technology-based innovation at the TU Delft. In her keynote, Nas spoke about the implementation of new technologies and the role of human behaviour (Nas, 2023). The keynotes showed how people react to new ideas and technologies, sometimes by resisting the change, sometimes by accepting it gracefully. It offered an introduction to the transition of utilising rooftops in the city and how human behaviour plays an important component in it.

After that, speakers from several companies presented how they are using data to design and consult users regarding their rooftop. This included methods like satellite image processing and creating building profiles from GIS data.

### **Why data**

The symposium showed how data could be a useful tool in designing with rooftops, as they do not only influence the environment, but also have a number of aspects that need to be taken into consideration. Since working with rooftops automatically mean working with stakeholders like inhabitants, companies and landlords, the economic aspect is often something to take into consideration. Using data to get a better understanding of the opportunities and limitations of a rooftop can help to reduce these costs upfront, which normally would require elaborate analysis.

## MVRDV & SUPERWORLD: ROOFSCAPE

“Roofscape” is a data driven design tool that uses openly available GIS data to apply functions to the existing roofscape of a city (MVRDV Next et al., 2022). These functions are in line with the “multifunctional rooftops” programme by the municipality. The end result is a 3D overview of the roofscape and a suggested mosaic (customisable with sliders) of colours, resembling rooftop functions.

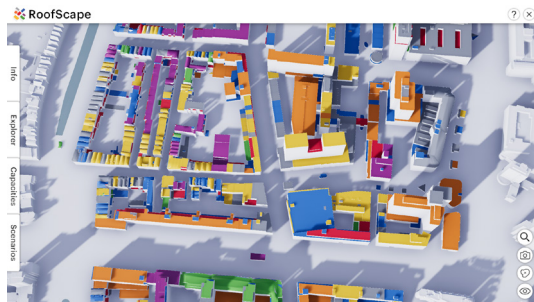


Figure 45. Visualisation of Roofscape (MVRDV Next & Superworld, 2022)

## Data & Assessment

Essentially, it is an algorithm that goes through a neighbourhood and makes a parametric analysis of the buildings and the context. For the context, information such as *flood risk*, *view quality*, *green corridors* and *access to public space*, referred to as “urban preferences” were taken into consideration (p. 134-135). These were compared to the building parameters, such as *rooftop area*, *solar irradiance*, *existing functions* and *construction year*, referred to as “rooftop requirements” (p.96-97).

Based on this information, the buildings are given a “preference score” for each function (colour), which is then translated into a single colour for visualisation purposes.



Figure 46. Visualisation of Roofscape (MVRDV Next & Superworld, 2022)

## Take-aways and critical notes

The general idea of using data to support decisions regarding programming and functions in urban design is of course not new. However, the combination of contextual data and building data, used to explore physical limitations and opportunities of the rooftops, is something I have personally not seen before. It offers a very promising tool for urban design in regards to considering the roofscape as an integral part of it. The idea of automating this with a data model reinforces how this data can be processed in an urban design.



However, an important property of the buildings has not been taken into consideration as much as I think it should be: the stakeholders.

Most the buildings in the design are (at least partially) property of one or many stakeholders. This divergent palette of stakeholders might have a divergent palette of motives and values that are likely not perfectly aligned with the values an urban planner or the municipality might have. So an urban planner might approve of a “green & blue” rooftop, the stakeholders might think differently. Moreover, the abstract visualisation of the outcomes: colours placed onto white blocks, does not exactly create an inspiring image for one owners of the building this colour is placed upon.

Moreover, we have already established that an important aspect of liveability is control. By not involving the stakeholders actively in the process, the perceived control will be jeopardised.

All in all, the software is a great start and shows how designers and municipalities, who are primarily approaching the roofscape from a top-down perspective, can make informed decisions about its design. But it is clearly missing input from the involved stakeholders, and offers only a very narrow output for them: a rigid programme represented by a colour that is placed on their property. It is missing the bottom-up perspective that is an integral part of rooftop design.

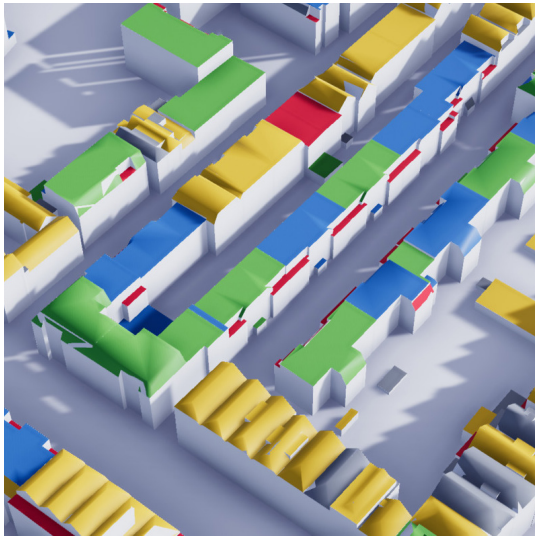


Figure 47. Lost in translation. Left: a rooftop interpretation from *Roofscape* (MVRDV Next & Superworld, 2022). Right: a rooftop design by de Dakdokters (Dakdokters, 2022).

## ROOFTOP PROJECTS

The possibilities for rooftops extend beyond the basic coloured functions that are defined. Looking around, we can see all sort of projects with a very different context and executions. In this next part, a small collection of case studies will be shown.

### Dakakker (2012)

The first, and perhaps most well-known example of an intensive-use rooftop in Rotterdam is Dakakker, an urban farm retrofitted to a large mixed-use building block (Figure 48). The building was squatted by small companies and inhabitants when the municipality announced a desire to renovate the area and demolish the building (de Bruijn, 2014). Eventually, due to their protests, the plans to renovate the building and build one of the first, big retrofitted rooftops were integrated in the municipality's plans of the "Luchtsingel", a yellow wooden pedestrian bridge connecting two parts of the city divided by the train track.

The project was largely funded by the municipality, and is now being maintained by volunteers, the income from tours and the cafe on top, and with sponsorships.

It primarily functions as a space for experiments and education about rooftops and urban farming. Its performance as a project has been ranked by "bouwadaptief", the company behind "Leidraad Klimaatadaptief Bouwen 2.0" (Figure 49).



Figure 48. Farm on the Schieblock (Dakakker, n.d.)



Figure 49. Assessment of rooftop (Bouwadaptief, n.d.)

### Dakpark (2013)

The second case study in Rotterdam is the Dakpark. This is a large rooftop park built on top of a linear commercial block with an integrated car parking (Figure 50). Various functions can be found in the park, including a rooftop cafe, allotment garden, playground and a fountain (Figure 51).

The park started out as an initiative of neighbours who desperately wanted a park in their area. When a railway yard became vacant, the inhabitants negotiated with the municipality to use it as a park. Eventually, it was decided to place it on top of the shops (VVA Larenstein, 2015). The park was built with subsidies from the European Union and the municipality.



Figure 50. Dakpark from above (Buro Sant en Co, 2014)



Figure 51. Fountain in the park (Buro Sant en Co, 2014)

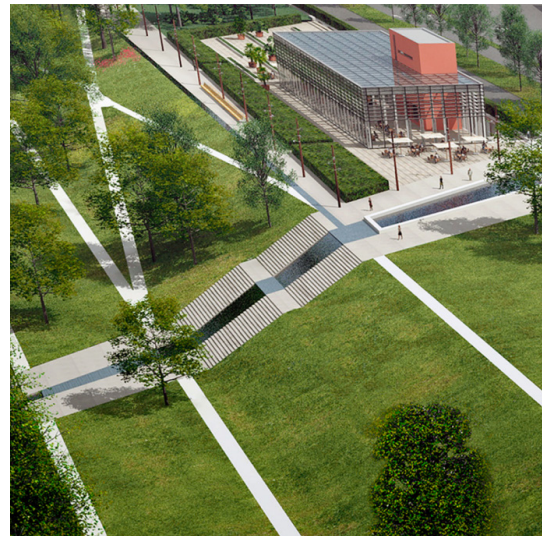


Figure 52. Cafe and Fountain from above (Buro Sant en Co, 2014)



## Didden Village (2006)

One case that catches the eye is the “Didden Village” in Rotterdam. It is not so much the scale of functionality that makes this one stand out, but the design itself. The project is an extravagant home extension retrofitted on an existing building and outfitted in a bright, blue colour (Figure 53, Figure 54).



Figure 53. Didden Village from street level (MVRDV, 2006)



Figure 54. Didden Village (MVRDV, 2006)

## De Dakdokters

One company that has specialised itself into rooftops is “de Dakdokters”, who are located in Amsterdam. They are designing and constructing rooftop projects, both new developments and retrofitting. In the designs, landscape features often determine the looks and functions of the roof, while incorporating other functionalities like terraces, water storage or solar panels. In order to give an indication of what types of rooftops they have been working on, a couple of projects are highlighted (Figure 55 - Figure 59).



Figure 55. Groenmarkt (De Dakdokters, 2021)



Figure 56. Groenmarkt (De Dakdokters, 2021)

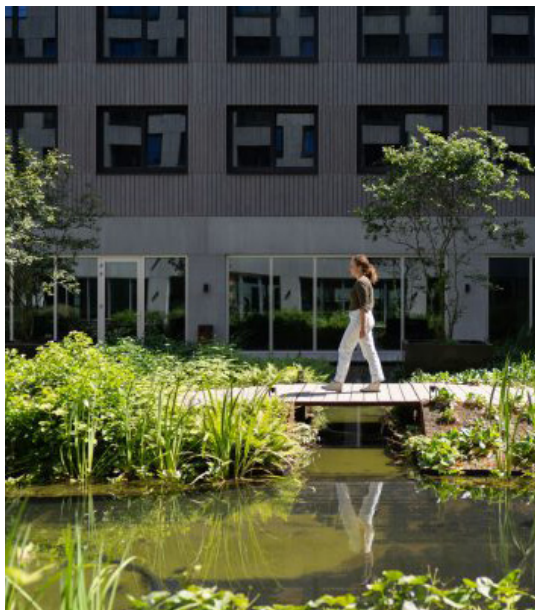


Figure 57. The Student Experience (De Dakdokters, 2022)



Figure 58. The Student Experience (De Dakdokters, 2022)



Figure 59. Jordaen (De Dakdokters, 2020)



Figure 60. Jordaen (De Dakdokters, 2020)



## THE ROOFSCAPE OF ROTTERDAM

The projects give a good indication of what type of rooftop developments can be found in the Netherlands, but they are showing mostly the big and colourful projects.

A way to get a more accurate representation of Rotterdam would be to map out the different rooftops. However, this has proven to be quite a task. Although rooftop terraces typically require a permit, applications like sedum (non-accessible green roofs) or solar panels often do not require a permit (Omgevingsloket, 2021). Beside that, the municipality has not actively mapped out existing used rooftops as parts of their digital rooftops program. This means that there is no complete database regarding rooftop uses yet.

However, one option that can be used is processing satellite images manually. To give an indication of what type of rooftops can be found in the city and how much

of the roofscape is saturated a couple of neighbourhoods are analysed using the satellite images. The area taken here is Rotterdam West (Figure 61), close to the city centre.



Figure 61. Point of view location for aerial image



Figure 62. Aerial Image of Rotterdam West (Google Earth, n.d.)



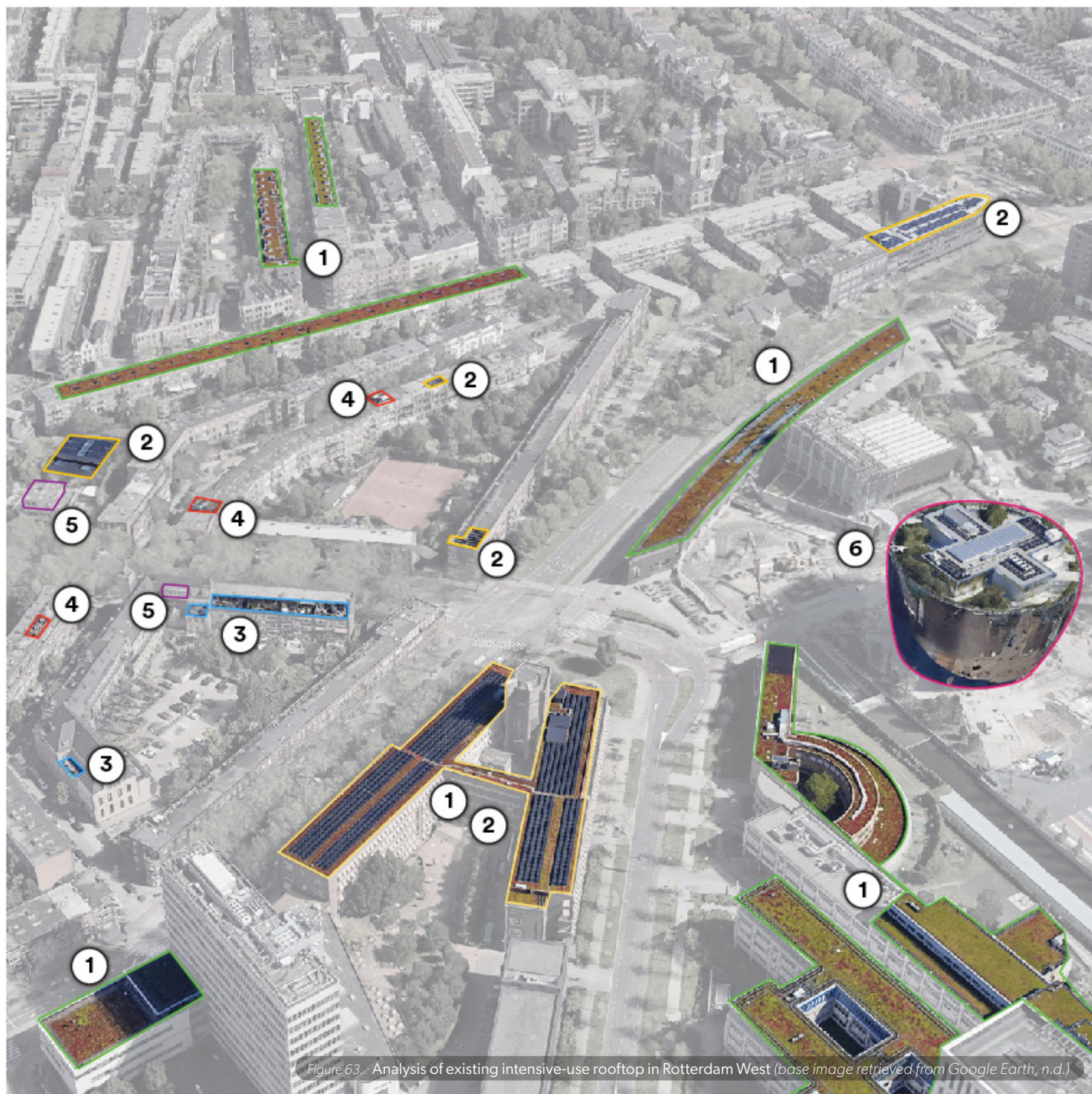


Figure 63. Analysis of existing intensive-use rooftop in Rotterdam West (base image retrieved from Google Earth, n.d.)



## Rooftop Typology

The analysis of the aerial image on p.63 shows multiple types of intensive-use rooftops.

### 1. EXTENSIVE GREEN ROOF

The first and most common type found is that of an extensive green roof, mostly using *sedum*, as seen in Figure 64. This is a type of green roof that is lightweight and can quite easily be retrofitted to most roofs.

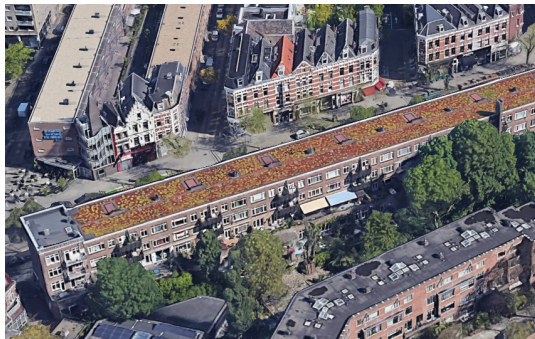


Figure 64. Sedum on one of the roofs (Google Earth, n.d.)

### 2. SOLAR PANELS

Another lightweight options that is applied on multiple locations are solar panels (Figure 65). These are becoming increasingly popular in the Netherlands (Eshuis, 2023). This is especially a popular options for larger buildings like offices and schools and can be combined quite well with green roofs, as seen in.



Figure 65. Office building fit with solar panels (Google Earth, n.d.)



Figure 66. Combination of sedum and solar panels (Google Earth, n.d.)

### 3. INTEGRATED TERRACES

One distinct type of intensive-use roof for this area is the terrace integrated in the building design (Figure 67). Functioning like a blown-up balcony, it offers an outdoor terrace on the top layer for the building.



Figure 67. Integrated Terraces (Google Earth, n.d.)

#### 4. ROOFTOP TERRACES

Whereas the previous type was integrated in the building, this type is placed on top of the old roof (Figure 68). It is applied on the buildings that do not have an integrated terrace. These types of applications can get quite expensive, as in some situations, a structural renovation is required.



Figure 68. Rooftop Terraces (Google Earth, n.d.)

#### 5. EXTENSION

Some buildings have utilised their rooftop as a vertical extension of the building, which is a form of densification promoted by the municipality. This new building layer could be used as an expansion of the top layer or

as a new, leasable building layer (Figure 69). An option that can be used with sloped roofs is that of a dormer (Figure 70).



Figure 69. Vertical Expansion (Google Earth, n.d.)



Figure 70. Dormer Expansion (Google Earth, n.d.)

#### 6. DEPOT: ROOFTOP RESTAURANT AND GARDEN

The last type is an uncommon one. A restaurant and a garden are placed on the roof of the Depot, which is a museum (Figure 71). It has been constructed new and opened in 2021. The restaurant and garden were part of the design of the building. This is the only building in this case study that has been constructed newly with an integrated intensive-use rooftop.





Figure 71. Rooftop of the Depot (Google Earth, n.d.)

### A Critical Note on Sedum

Sedum is often classified as a green roof and attributed its accompanying benefits such as stormwater retention capacity, and a contribution to biodiversity a microclimate. However, the contribution of sedum-based extensive green roofs to biodiversity and the resilience of the microclimate is questionable (Cook-Patton, 2015). This is mostly because sedum offers a monocultural deck of vegetation compared to other extensive green roof types that incorporate herbs, mosses and grasses.

Secondly, the performance of sedum (and extensive green roofs in general) in regards to stormwater retention capacity is mostly dependent on the depth of the substrate. In the case of lightweight, thin extensive green roofs, usually applied on rooftops with limited structural capacity, this means stormwater capacity is very limited.

If its contributions to biodiversity and stormwater retention are limited, a sedum-based extensive green roof effectively functions as a green, external type of insulation, in which the sedum (through evapotranspiration) slightly cools the roof as well (Eksi et al., 2017).

Nevertheless, sedum offers a good, lightweight alternative to insulation that can easily be retrofitted onto most rooftops. It definitely has its benefits, but should be attributed for the qualities a green roof offers.

## OBSERVATIONS

In the analysis of the existing roofscape, a couple of things stand out that explain how and why the transformation of the the roofscape is progressing.

### Rooftop Usage is Limited

The first and perhaps most pressing observation is that of the limited use of rooftops in the current situation. This is most evident on the analysis of the aerial images on p.63. It shows how only a

limited amount of rooftops actually fulfil a functional purpose. Moreover, the use of the sedum roofs, which questionably fits into the category of intensive-use, takes up most of the used rooftop surface in that study.

And this is not a very unusually barren roofscape. In fact, the area was chosen because I knew personally that there were a number of used rooftops with a variety

of functions. In fact, compared to other parts of the inner city, such as Kop van Zuid or Hoogkwartier, the use of rooftops is relatively high.

### **Retrofitting vs New Developments**

A second observation is the difference in usage and function between *new developments*, such as Little C (p.26), the Depot (Figure 71) and The Student Experience (Figure 57), versus *retrofitted rooftops* (placed onto an existing building). Not only are intensive-use rooftops less common for retrofitted situations, they are also quite often limited in their functionality. Rooftop terraces, large water storages or ecological habitats are more common in new developments. Retrofitted rooftops are often equipped with simpler, lightweight constructions such as sedum and solar panels, which make a considerably less contribution to their surroundings.

### **Askew Incentive**

Finally, it is clear that society, represented by municipalities and NGO's, are showing great incentive to transform the barren roofscape into a lush, multifunctional extension of the urban fabric. Yet, it also becomes evident that this transformation is only in its infancy, as the roofscape to

this day is still relatively barren. Moreover, this transformation comes with its growing pains. Human factors are not always taken into consideration in planning, sedum roofs still make up for most of the "intensive-use" rooftops, despite their limited usefulness and actual multifunctional combinations are rarely seen.

This raises the question whether the incentive under the stakeholders (inhabitants, landlords, homeowners, etc.) is great enough to support this transition.

In fact, according to D. de Leeuw (personal communication, March 6, 2023), de Dakdokters stopped with actively recruiting clientele for retrofitted rooftops, as the progress with the clients and the owner associations was often not fruitful enough to support their business.

This is in line with the theory provided by Nas during the Digital Rooftop symposium (2023). This states that the adoption of ideas and new technologies (being intensive-use rooftops) happens gradually over time, not instantly, and that it is expected to come across scepticism or resistance along the way. However, this does raise a new question:

## **Why are intensive-use rooftops not always retrofitted on existing buildings?**

# Costs and Policy

The first answer we might have to the question “*Why are intensive-use rooftops not always retrofitted on existing buildings?*” is that it may have something to do with the renovation costs of the building and the lack of policies that encourage retrofitting intensive-use rooftop. In this part, the costs and policies that influence this transition are explained.

## RENOVATION AND STRUCTURE

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A big disincentive for stakeholders might be the costs that come with an intensive-use green roof. Since a big part of these costs are attributed to the structural renovation or adaptation on the roofs, mapping this out could help to give insights in why retrofitting intensive-use rooftops is not always done. To get a better understanding, I had a personal communication with Bart Bollen, who works as a construction planner for Remmers Bouwgroep (2023).

### Typical Structures

First of all, it is important to understand the structural type of a building and its roof. As could be seen in the integrated terraces (Figure 66) and on new developments such as the Depot (Figure 71), in some cases, the rooftop is part of the design of the building. In these cases, the structure can be adapted to fit the requirements of the function on top.

However, in most situations, this is not this case. Typically, rooftops are built to hold rainwater and accumulated snow, And although they always have some

overcapacity for safety and maintenance, they are mostly unfit for heavy, intensive-use purposes.

This is also why options like solar panels and sedum are quite popular. They are lightweight and can be retrofitted to most roofs, especially those who already have a heavy cover, like gravel (which can be removed when sedum is applied).

Moreover, the structural capacity of a roof near its load bearing walls is often a lot higher than in the middle, making it possible to fit heavier constructions like a water tower on these nodes.

### Categorisation

All in all, the exact capacity consists of many different factors and requires expertise to assess. This is also why the initial costs of an intensive-use rooftop are quite high, since a structural assessment is required before the process can start. These upfront costs form a first, harsh barrier that can easily disincentive stakeholders. This makes it all the more difficult to sell the premise of an intensive-use rooftop.



And it also goes to show that there might be a need to get an understanding of the possibilities (and potential renovation costs) before this assessment is started. Which is why I think it would be relevant to identify a **simplified** set of structural categories that can help to understand what type of interventions can be placed on the roof and what structural renovations are required. In the communication with Bollen, 3 categories for empty, flat roofs came out. Of course, these are simplified interpretations, real life buildings do not always fit neatly into 1 category. Hence, an expert should be consulted before actual developments.

#### **LIGHTWEIGHT: WOODEN**

The first type of construction is that of a wooden one. These are typically found on residential buildings and have a limited capacity of around  $75\text{kg/m}^2$ . This is mainly due to the fact that the rooftops are required to have a minimal raised edge of 8cm, which can accumulate up to  $80\text{kg/m}^2$  of rainwater.

With a few, affordable adaptations, the roof can be used for lightweight constructions.

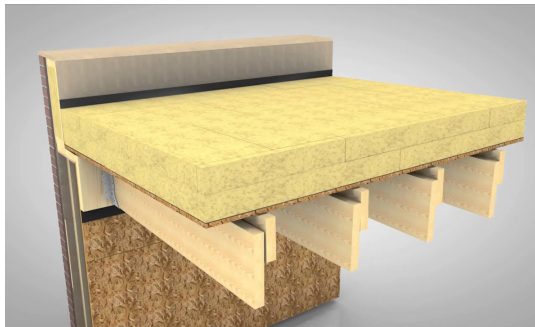


Figure 72. Example of Wooden Construction (Odisee, 2015)

#### **MEDIUM-WEIGHT: STEEL**

The second type of construction is that of a steel one. In a typical steel construction, there is an overcapacity between  $75\text{kg/m}^2$  and  $150\text{kg/m}^2$ . With a few adaptations, the steel construction can be used for a lot of different functions, including a rooftop terrace.



Figure 73. Example of Steel Construction (BouwTotaal, 2019)

#### **HEAVYWEIGHT: CONCRETE**

Finally, the heaviest type is that of a concrete construction. These generally have a higher overcapacity around  $150\text{kg/m}^2$ , which would suit the requirements for a rooftop terrace. This is partly due to that in many manufacturing processes, the top floor (roof) has the same properties as the floors in-between, which have a high structural capacity as they experience high live loads.

However, higher capacities are required for many types of intensive green roofs. Moreover, renovation costs of a concrete roof are often a lot higher than that of the wooden and steel roofs.



Figure 74. Example of a concrete structure (Holcon, n.d.)

### Structural Renovations

In order to increase the capacity of the rooftop, different renovations could be used, depending on the purpose and weight of the intended functions.

First of all, there is always the option to completely renew the rooftop. This is of course the most expensive option, but it allows for a new construction that fits the needs of many functions. In practice, this is only really done in situations where the existing roof is in poor conditions due to wood rot (Figure 75), fatigue or other types of damage.



Figure 75. Wood Rot (Dak Discounter, n.d.)

The second option is to build a floating construction, typically used to place roof terraces (Figure 76). This option can easily be retrofitted, but can get costly. A floating construction can cost around €1000/m<sup>2</sup> (de Lepper, 2021). It utilises the capacity of the load bearing walls to extend the structure and make a 'second' rooftop floating above the existing one.



Figure 76. Floating Construction (Topdakterras, n.d.)

The third option is to reinforce the existing construction of the rooftop. This is also the cheapest of the three. This can be done by increasing the amount of girders or adding steel reinforcements to wooden beams (Figure 77). For concrete structures, this is very difficult (Corradi et al., 2019).



Figure 77. Reinforcement of a timber beam (Corradi et al., 2019)

## POLICIES AND SUBSIDIES

All in all, the costs of renovation and structure can be an obstacle of retrofitting intensive-use rooftops. However, since the roofs could also serve a purpose for neighbourhood and the city, subsidies could be applied. These help to compensate for a part of the cost and promote the rooftops and contribute to the city.

Moreover, policies could be set in place to either coerce parties into developing an intensive-use rooftop or make it financially more attractive.

In order to stimulate people to adopt an intensive-use rooftop (for which they use their term: 'multifunctional rooftops'), the municipality developed a strategy (Gemeente Rotterdam, 2018). The primary target of the strategy is to gradually introduce intensive-use rooftops and target cases where a building is newly developed or renovated (Figure 78).

### Subsidies

As for green and blue roofs, subsidies have been put in place before, especially on the topic of pluvial flooding which costs the municipality a lot of money. In Rotterdam, there are subsidies for green and blue roofs (Gemeente Rotterdam, 2023).

- Up to €10/m<sup>2</sup> of 'green surface'
- Up to €500 for each m<sup>3</sup> of water storage
- Up to €5 for each m<sup>2</sup> that is disconnected from the sewage system
- Extra subsidies for added native plants, although this is relatively small

The underlying idea is to use subsidies to boost the rate of adaptation of intensive-use rooftops. In a later phase, subsidies gradually become less. The strategy regarding the subsidies can be seen in Figure 78 (Gemeente Rotterdam, 2018).

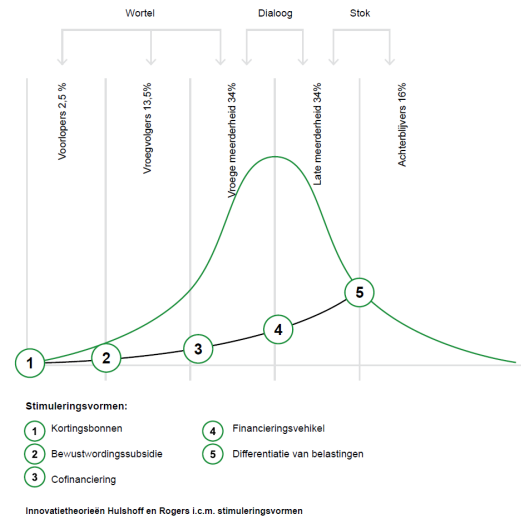


Figure 78. Subsidies Strategy (Gemeente Rotterdam, 2018)

### Policies

The strategy shows how subsidies can be used as an incentivisor in the early stages of this transition, stimulating early adopters financially and attractive those that are in doubt. In a later stage, policies can be put in place to coerce cases that are lagging behind. However, in Amsterdam, they have decided to introduce policies earlier. With the obligation of retaining rainwater on rooftops (Amsterdam Rainproof, 2023) But for this, some resistance can be expected.



# Convention and Resistance

It has become evident that in the transition towards an intensive-use roofscape, some resistance is to be expected. Not only are intensive-use rooftops often associated with a high price tag due to their structural and renovation costs, but also is the adoption of the new ideas and paradigms (especially when stimulated by higher authorities) historically something that takes time and needs to happen gradually.

In this next part, the theoretical background behind the adoption of new paradigms, is explored. Moreover, an inventory is made of what elements in these changes typically incentivise and disincentive stakeholders in the progress.

## THE ADOPTION OF A ROOFSCAPE

One theory that helps to frame the adoption of this new convention is “Rogers’ Innovation Diffusion Theory” (Rogers, 1962/2003) This model argues that when it comes to new ideas or technologies, they are not adopted instantly, but instead they are adopted gradually over time.

Similar to how a mobile phone, electric vehicles or microwaves gradually became convention over time (some faster than others), the idea of intensive-use rooftops needs to grow. Rather than making a big masterplan and expecting everyone to participate, we must accept that this process is gradual and will need to be adopted over a longer time period.

This theoretical approach is much alike the approach the municipality has taken to introduce new policies and subsidies (as indicated in Figure 78, p.71).

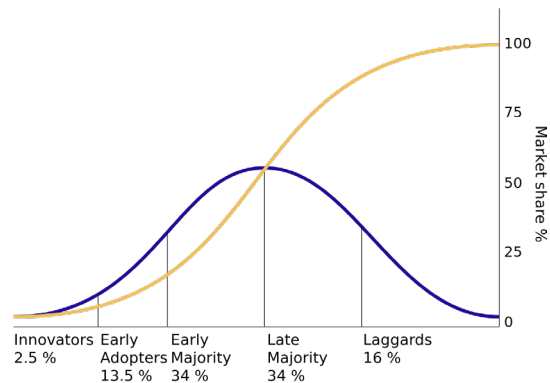


Figure 79. Technology Adoption Curve (Rogers, 1962/2003)

## Rates of Adoption

A key to this process is understanding the difference between the adopters and their rate of adoption. Rogers describes 5 groups or 'phases' of adopters starting out with a small group of eager adopters called "innovators", all the way to those most resistant called "laggards".

These same groups can be found when looking at the diffusion of retrofitted rooftops in Rotterdam. Cases like Dakakker, where an enthusiastic group of individuals (innovators) worked together to build to rooftop were quite rare at the time it was being built. But from there on, the idea of intensive-use rooftop has started to take off and more small-scale developments popped up. This points us to the phase we currently are in, one where the idea of rooftops is becoming more popular, but is not yet convention. Most of the developments are still driven from a bottom-up perspective (Figure 80).

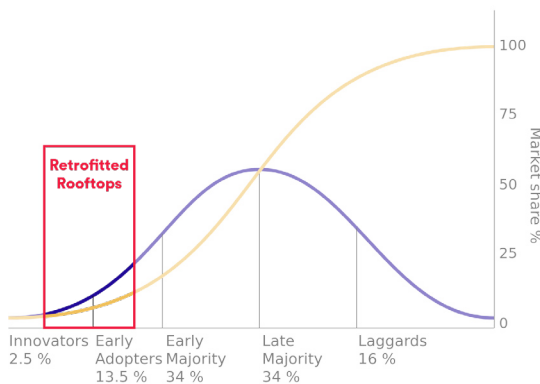


Figure 80. The estimated current position of intensive-use rooftops on the curve (Rogers, 1962/2003)

## Tipping Point

Knowing the phase we currently are in, we can start looking towards the future. An important point in the adoption rate is where an idea transforms from a new technology to a growing convention that is adopted widely enough to be self-sustainable. This is called the "tipping point" or the point of "critical mass" (James & Schirtzinger, 1989).

An important aspect of this tipping point is that it changes the market dynamics. Rooftop development businesses and contractors can change their marketing strategy from a more push-oriented strategy, which refers to actively promoting the product and acquiring clients, to a more pull-oriented strategy, a scenario where clients are drawn to the product themselves (Brocato, 2010). This change helps to build a competitive and healthy market where innovation is very important. In turn, that helps to further push the movement of intensive-use rooftops.

In short, this means that if the adoption of intensive-use rooftops continues to grow from their bottom-up approach of development, there will be a point where it becomes normal enough to actually make the rooftop masterplan.

## Gaining Momentum

To conclude, we can see that retrofitted rooftops are currently in an early stage of adoption. Knowing their important to creating an urban roofscape, we want them to be widely adopted throughout the city. Yet, we also know that forcing

this movement, for example by making a masterplan of all the roofs in the city, could lead to a lot of resistance.

But by compelling those who are interested but not fully convinced yet, we can gain momentum and accelerate the adoption. In

other words, by inspiring the early adopters and early majorities to develop intensive-use rooftops, the tipping point will be reached quicker. A strategy like this requires a bottom-up approach.

## DESIGN STRATEGIES

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Generally, when it comes to accelerating the adoption of intensive-use rooftops, there are two important foundations to keep in mind: strengthening benefits and mitigating resistance. Nas (2021) describes these pillars as the core of every product design, but the theory applies to a much broader context than products alone. Especially in the case of the rooftops, where they are both a consumer product and a paradigm shift in the urban fabric.

### Strengthening Benefits

One of first things companies point out when they are selling their product, is how good it works for “this and that”. They are pointing out the benefits in a *relatable* manner. The products that have been adopted most successfully are those that do an excellent job in strengthening what they are good at, especially in the way this message reaches the consumer. These benefits manifest themselves as values: things that are important and good.

In the case of rooftops, these values are very clear. Green roofs add to biodiversity, blue roofs prevent pluvial flooding, and the list goes on. However, these values might

not be important to everyone. Whereas the municipality promotes them as key components of intensive-use rooftops, an inhabitant or investor might make a completely different assessment. The simplicity that work so well for the values of the municipality, can create the perception for someone else that the roof does not contribute to them at all.

### Mitigating Resistance

As we have seen before, new products and innovations often come with resistance, disguised as risks. These can include things like physical risks, which can cause harm to our health or possessions, or economic risks, in which the product offers low value for money. By understanding what holds people back from the product, it becomes possible to develop products that trigger less resistance. It is about decreasing the worries a consumer might have regarding the product.

Clarity and transparency play an important role in mitigating the resistance (or worries). Often, worries are amplified by obscurity, which means that the perceived risk of something that is not mapped out clearly is



greater than the actual risk itself. Where the municipality is clear in what programmes they suggest (indicated by the colours p.35), and its simplicity helps into addressing its benefits, this simplicity might form a worry for others that have different values.

### **Incompatibilities**

Especially the case of “value for money” is applicable for rooftops. We have established that rooftops can come with quite a price tag, but also with great benefits for the city. However, when stakeholders assess these values differently, the relation between value and money changes. Where the municipality might see a great deal on improving biodiversity on a roof, an owner-occupier might see a missed opportunity for solar panels.

This incompatibility of assessments can cause a greater resistance. Therefore, it is important to understand what the stakeholder are and what their values might be. This also goes for the stakeholders of the rooftop and the municipality. Understanding exactly what the other wants helps to find solutions and make a better assessment of values. Relatability can help to achieve this. Moreover, it is important to know who the stakeholders are and what they (might) find important.

# Stakeholders in Undeveloped Roofs

It is important to understand which stakeholders are involved in the process of developing intensive-use rooftops. This can increase the knowledge about their stance and help to map out their values, in term contributing to the adoption of a rooftop. However, which stakeholder are located where, what their role is and what their values are is something that can not easily be generalised. However, by making case studies and comparing their results, it might be possible to get a better understanding of the different types of stakeholders. These can in term help to set up a strategy to deal with the incompatibilities. In the part, three distinct case studies are conducted on buildings with a currently undeveloped rooftop.

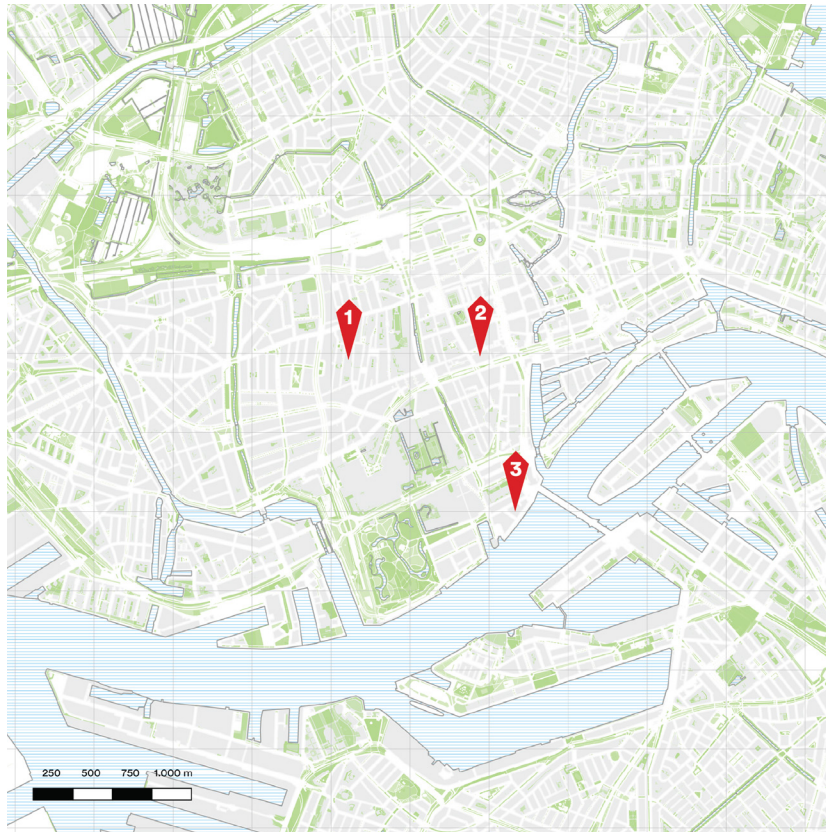


Figure 81. Map of case locations in Rotterdam

## CASE 1: SCHOOL

The first case that will be analysed is a school building in the west of the city centre. The building has quite a large flat roof that has the potential to be used, but currently is not. Schools form an important part of the social structure of a city, so it would be logical to see them as frontrunners when it comes to contributing to the social fabric by using the rooftop for public functions. Yet, just as many other school buildings, these rooftops remain unused.



Figure 82. Aerial image of case location in Het Oude Westen [edited] (van Duivenbode, 2019)

If we dive a little bit deeper into the case of the school and the stakeholders involved, we can already see some difficulties.

### Complex stakeholder relations

Typically, school buildings (primary and high school) have either one of 4 ownership structures (VGN, n.d.):

- A board within the school that oversees everything related to the building.
- The municipality, represented by a delegate member within the school board.
- A third party that owns the building and leases it to the school.
- In some older schools, the building is owned by the school itself.

Moreover, decisions made regarding the building often involve a variety of stakeholders to account for, ranging from those directly involved in the school like students and teachers, to more indirect parties like to educational quality control and people that live around the school (Verus, 2018). This complexity of stakeholders and their different individual values, might be a hurdle when trying to develop anything related to building itself, including a rooftop.



Figure 83. Overview of stakeholder types (Verus, 2018)

In an interview with Eva Valk, head of Education and Quality control at Techniek College Rotterdam (2023), it became clear that quite often, this complexity created



difficulties for the communication between parties. This has often led to a relatively one-sided, asymmetric approach when it comes to the school building, rather than an integral approach regarding the wants and needs of stakeholders with less decision-making authority. Moreover, when it comes to developments of any kind, including that of intensive-use rooftops, justifying the costs of the developments to these stakeholders is difficult, as they are seen as non-essential for educational purposes.

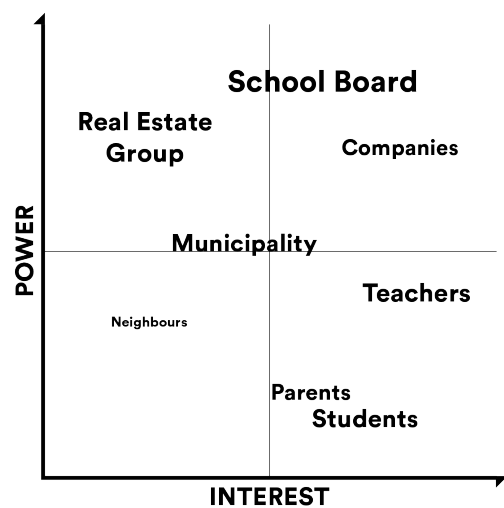


Figure 84. Stakeholders on the power-interest matrix

## CASE 2: SHOPS

A very different type of building can be found in the heart of the city centre: large blocks with various shops and businesses. Although this is only a small share of the buildings in the city centre, it gives us an interesting case regarding the stakeholders and context.

### Financially Oriented

These building blocks are typically used by shops and offices, which they rent from a real estate group. These shops include a big electronics store, a fast food chain, a dollar store and a supermarket. Besides from the employees and visitors, these stakeholders all have a financial motive.

### Targeted Audience

In a similar example close by, the Bijenkorf, a luxurious warehouse, has plans to intensify the use of their rooftop by placing a garden and a café on top. But their situation is slightly different. For starters, they are the only tenants of the building. They also provide a very different experience compared to the case study. The planned rooftop accompanies the luxurious shopping experience, which gives the warehouse a good financial reason to do something with it.



Figure 85. Aerial image of case location in the city centre [edited] (Google Earth, 2023a)



Figure 86. Stakeholders on the power-interest matrix

## CASE 3: APARTMENTS

Finally, we will look at a case that is very common in Rotterdam: the apartment building (Figure 87). This specific typology is very common in the city, especially for the rooftops that need to be retrofitted.



Figure 87. Aerial image of the case location in Scheepsvaartkwartier [edited] (Google Earth, 2023b)

### Users and owners

These type of buildings sometimes have a mixed use, where the plinth could be rented out to businesses and offices. The floors above are residential and can have a mix between owner-occupiers and tenants (Figure 88). Since decisions regarding the building are usually made by the association of owners (Vereniging van Eigenaren or VvE in Dutch), other building users like tenants and the businesses are often excluded from the decision making process. Moreover, it

is not uncommon for one of the landlords or real estate groups to own a majority of addresses, giving them more power in this process.



Figure 88. A clear division of functions between the ground floor and top floors

### Administration and power

In an interview with one of the owner-occupiers, it became clear attempts to utilise the rooftop have already been made. This person wanted to place solar panels on the rooftop, but the VvE disagreed with the plans. Then, the owner-occupier tried to see if it was possible to rent or buy the rights to use the rooftop, but it proved to be too complicated in the administration. As a result, the rooftop remained unused.



This person was kind enough to take me up to the rooftop, so I could see the untapped potential for myself (Figure 89).



Figure 89. The flat, unused rooftop of the building

### Available options and potential

When I told this person about the other possibilities besides solar panels, and how they could synergise with each other (like a solar canopy or sedum/solar combinations), it became clear they weren't aware of the possibilities.

These combinations could be very beneficial for this neighbourhood, as it is densifying quite a lot, with the recently added Zalmhaventoren (the highest in the city) next to it (Figure 90).

Combined with the potential the rooftop has, it would provide an excellent location to retrofit, but yet it remains unused.



Figure 90. Zalmhaventoren, as seen from the apartments

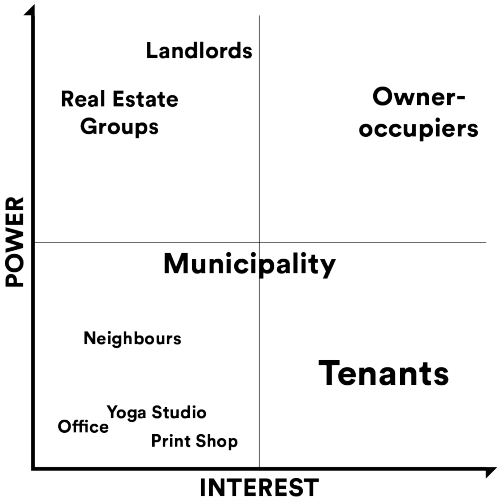


Figure 91. Stakeholders on the power-interest matrix

# Observations

To conclude this chapter: we have seen the current state of the roofscape, which despite its vast potential, remains under used. This has especially been the case for retrofitted intensive-use rooftops. Whereas new developments like Little C, Dakpark and the Depot are making use of their rooftops effectively, existing building now remain mostly empty, or use simpler, more lightweight types such as solar panels or sedum.

Moreover, we have seen some of the potential reasons the transformation to an intensive-use roofscape are lagging. In this part, the observations of the chapter will be elaborated upon and recommendations for a strategy will be given.

## The Market Gap

The first thing that I personally observe in this chapter is the gap between what common retrofitted roofs are equipped with, and what programmes (such as the Rotterdam Rooftop Days) are promoting. Whereas a lot of roofs are equipped with extremely simple and lightweight options like sedum and solar panels, big events and exemplary projects are on the opposite side of the spectrum. They show luscious intensive green roofs with parks, playgrounds (even a roller coaster at some point). This discrepancy between the ambition of a vast roofscape and the reality of applied rooftops may cause a mismatch in their relatability (as seen in

Figure 92). In other words: the ideas and visions of rooftop stakeholders versus the municipality do not align, which makes it difficult for both to understand the others angle and values.

As we have pointed out, relatability can help to make a more accurate assessment of values, which is important for weighing out the risks against the values.

A suggestion to tackle this would be to find a method not to fill, but to bridge this gap between ambition and reality. The projects from de Dakdokters are already in this gap, showing a vast number of functions and values (ambition), but also a practical means of applying it (reality).

### Roller coaster

This drawing speaks for itself. The roller coaster starts on the rooftop, plunges down, circles the building and ends back on top of the roof.

**Rollercoaster** Deze tekening spreekt voor zich. De rollercoaster start op het dak, start naar beneden, draait om het gebouw heen en eindigt weer op het dak.

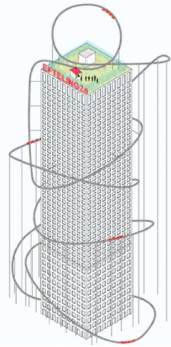


Figure 92. Discrepancy between ambition and reality.

Left: a rooftop interpretation from the Rooftop Catalogue (MVRDV, 2021).

Right: a rooftop in Rotterdam West (Google Earth, n.d.).

### Owners Associations and Conflicts

Another observation is that within the stakeholders of a building, there might already be a different idea of the values. Even within the exact same context, each of the stakeholders might have their own role and personal opinions. An inhabitant, a landlord and an owner-occupier might all have their own ideas and assess its value accordingly.

This is something also de Leeuw explained in our conversation (2023). He mentioned that they stopped doing most of the retrofitting projects and now focus on new developments, as in the mix of stakeholders in these cases are typically limited to the investor or developer, and the municipality: stakeholders that are willing to develop an intensive-use rooftop.

In retrofitting, they too often were multiple iterations in a project before conflicts started to arise and stakeholders lost interest, which has made it difficult to continue these kind of projects and remain profitable.

This could also explain why most of the retrofitted intensive-use rooftops nowadays from de Dakdokters (Figure 93), are private projects. In this case, the objective and added value of the roof is clear and undisputed for the stakeholders.

In the case of a public or shared building, like in Figure 94, going for a low-cost lightweight option like sedum or solar panels is easier to evaluate, as they have a direct financial value (savings on energy as costs).





Figure 93. Private Rooftop (De Dakdokters, 2021)



Figure 94. Shared Rooftop (Google Earth, n.d.).

Although this is not a problem that design can solve, it is a property that should be taken into consideration. Being clear about

how a specific rooftop design might be valuable and to whom can make this conflict a lot easier to solve.

### Clarity as a Catalyst

Another constant throughout this chapter has proven to be 'clarity'.

One thing the Roofscape software does really well is explain why a certain rooftop function (or colour) can be placed on a specific location, using data. By showing the environmental properties and urgencies around a building next to the physical properties of the building, it makes sense to fit a certain programme there. A rooftop with a high structural capacity in an area with flooding risk will logically result in a blue roof. This is a form of clarity that explains why the proposed function is valuable for the designated location, which could help the stakeholders to assess and evaluate the option.

Despite the intricate nuances of the information used, such as structural capacity, Roofscape makes educated assumptions that clarify a list of potential outcomes. This does not only make assessment easier, but also encourage stakeholders to look beyond the standard lightweight solutions .

### It Takes Time

Finally, the transition towards an intensive-use roofscape is something that does not happen overnight. We can set an ambition to design all the roofs in the city as one, consecutive extension of the urban space, but this will likely not happen in the

coming decades. It takes time for projects to develop and it takes time for this new paradigm to sink in and become accepted.

Therefore, the scope of the project should not be to work with an entire neighbourhood of rooftops, but rather to focus on making 1 change at a time. Nevertheless, understanding the impact of that change in a future scenario with an integrated roofscape is important as well.

For the time being, the focus should be on stakeholders that are already in the spectrum of 'early adopters', rather than those who will resist until they have no choice. However, this is not a group that is easily targeted, as these early adopters are simple people distributed throughout the population. Therefore, it is important to reach a broad audience.

# Manifesto

We as a society are craving for a new, sustainable form of urban living. One where neighbourhoods are pleasant and comforting, where nature blooms, and where businesses are more than economic institutes. These dimensions: liveability, climate and prosperity, can in their collaboration make up for a this new form of living.

The repercussions for this are seen in cities. Around me, I see projects that incorporate nature into old infrastructure, pedestrianise streets and revitalise industrial heritage. As the public domain becomes increasingly important to achieve this new form of living, space becomes more valuable and monofunctionality is being replaced with synergies between human, nature, culture, business. All carefully designed to work together like clockwork.

But for our rooftops, this new form of life is just a dot on the horizon. The roofscape of today is still mostly barren, a by-product of our lifestyle. Although their combined value exceeds that of the public domain, as individual cases, creating these synergies has proven to be cumbersome.

This report proposes a difference. It shows a strategy that empowers **you** to explore those synergies yourself. It encourages you to work together with your neighbours and take matters into your own hands. It reveals the potential of rooftops in this new way of life, one that is suited to you.

One step at a time, a roofscape develops as an extension of our homes and our cities. One that promotes liveability, a thriving climate and prosperity.

This is the new paradigm.





# Chapter 3

## Sparking Incentive

Key Values:

native ecology urban nature  
stormwater retention

### Chicken Coop

Urban Farming

f.01



Key Values:

food production outdoor

### Rainbarrel

Water Systems

d.05



rain harvesting stormwater retention

### Sedum Moss

Materials

p.11

### Solar Panel

Energy

d.12



clean energy

### Polder Roof

Water Systems

p.03



Key Values:

stormwater retention cooling

### Picnic Table

Living Rooftop

d.09



living space outdoor

### Pond

Natural Habitats

f.20



Key Values:

urban nature cooling attractivity

### Rainwater Tank

Water Systems

f.04



Key Values:

rain harvesting stormwater retention

### Living Module

Expansion & Densification

f.15



Tip: Combine multiple units to create a rooftop village!

Key Values:

home extension living space

### Vegetable Farm

Urban Farming

p.01



Key Values:

outdoor urban nature food production  
co-responsibility

### Beehive

Urban Farming

d.02



native ecology food production

### Solar Panel

Energy

d.12



clean energy

Key Values:

outdoor urban nature food production

### Billboard

Living Space

f.23



Key Values:

urban nature

### Rainbarrel

Water Systems

d.05



# Strategy

The observations of the previous chapters convey a clear message: retrofitting an intensive-use rooftop and finding synergies between its values is difficult.

Not only does it require a solid cooperation with the involved stakeholders, they are also often not well-informed about its projected qualities and associated risks, as well as how they can synergise. This can cause stakeholders within a project to formulate a different assessment throughout the process, increasing friction and, in some cases, halting the project. This does not only make it less attractive for businesses to engage in the ‘retrofitting business’, it may also discourage those who are incentivised themselves, but feel lost.

In order to accommodate the transition towards an intensive-use roofscape, new methods are required that both propose the ambition of the roofscape, while empathising with various needs and values that stakeholders in a building uphold. In this, finding synergies is key. Hence, the main question that guides this new strategy is:

***How can we strengthen incentive to initiate the development of retrofitting intensive-use rooftops?***

## STRATEGIC COMPONENTS

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The answer to this question has taken the form of a strategy. With the knowledge gained from the research, we have the handholds to start developing it.

Based on the findings of the previous chapter, the strategy accommodates several goals:

- The strategy should **educate** stakeholders about **possibilities** of an intensive-use rooftop.
- The strategy should **clarify** the **consequences** of the implemented possibilities, both positive and negative, in a **transparent** way.

- The strategy should assist in finding **synergies** between the values of the stakeholders.
- The strategy should offer an **interpretable** solution that offers the stakeholders a possibility to adjust it to their own values and ideas.

These goals are translated to three main components that form the conceptual guideline of the strategy.

Finally, the desired end result is to create an intensive-use rooftop that is useful for the stakeholders, which does not mean all rooftop have to be lush gardens. Solar

panels and sedum combinations are still a very viable solution for some situations. The strategy is put in place to show how, with some minor additions, more values could be represented.

### **Contextualise**

This component is set up to get an understanding of the building and its context. This means looking at the **physical and environmental properties** of the building to identify what is possible and what is desirable. This closely resembles the strategy of *Roofscape* (the software developed by MVRDV and Superworld, p.56), which uses GIS to do map out environmental urgencies and project them onto the most suitable buildings. But rather than using it as a guideline for programming, the contextual information should be used to give handholds to the limitations and opportunities of the rooftop.

Using **GIS data** to determine this, allows for a systematic approach that can **clarify** suitable types of rooftop interventions for a given context. This helps to **educate** the stakeholders about the possibilities (beyond sedum), without requiring the financial commitment and risks of the assessment of an expert, such as a structural engineer, beforehand.

### **Communicate**

This component represents the gap between ambition and reality that should be **bridged**. The possibilities for rooftops are endless and there are a lot of cost-efficient solutions that represent more

values than sedum. This component focusses on communicating that idea to the stakeholders. By clearly showing the different options available, as well as in which configuration they can be used, stakeholders are opened up to new types of rooftops they have not considered themselves.

The core of this component is to **educate** the stakeholders about what is available, what is possible and what **consequences** (both in impact and risks) are linked to it. This should aid in clarifying the potential their rooftop may have for themselves, as well as their environment.

Clear communication can help to show stakeholders the mutual benefits of an intensive-use roofscape and shed light on the potential worries they might have.

### **Cooperate**

This component is designed to bring the stakeholders together and align their values. Whereas it may seem like the differences between a landlord and a tenant may be big, a lot of rooftops can actually contribute to what they both find important. By showing **transparently** what a rooftop does and in what way it can be valuable, the assessment is much easier and the stakeholders can **cooperate** to make a design they all feel represented by. The goal is to find **synergies** between their values in the combinations of different rooftop options.

For this component it is important to think beyond the values the municipality has set up. Although they should be incorporated, most stakeholders probably have their own ideas and values. Rather than defining strict roles and values, an open **interpretation** is needed to adapt to different circumstances and stakeholders. Making sure that everyone can feel represented by the

values a rooftop has to offer is key in this component, as it reinforces their feeling of control.

The term cooperate was carefully chosen over the more popular term co-create, as the goal of the strategy is not to *create* a new rooftop, but to *spark incentive* to do so.

## STRATEGIC FRAMEWORK

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With these three components in mind, a strategic framework was set up. It consists of a number of steps that are based on the theory and findings from the previous chapters (Figure 95).

The strategy is a result of many iterations, tests, successes and most importantly, failures. The steps and the process that has lead towards this strategy are documented in Chapter 4, p.122 - p.156.

The elaboration on the elements, such as the pattern language, the values and the data can be found further in this chapter.

The following texts will give a short explanation of each of the elements seen in the strategic framework.

### Values

The strategic framework starts out from the values. These represent the qualities a rooftop option may offer to the stakeholders. The values and their argumentation can be found on p.107. They are based on the assessment of multiple case studies and are organised

into three main categories inspired from the triple bottom line: Liveability, Climate and Economic Prosperity. However, most values have a cross-reference to another category.

The goal of the values is to emphasise the benefits of the rooftop options and assist the stakeholders in finding the qualities that represent their vision.

### Pattern Language

In order to establish a strong communication, a pattern language is used. It forms a catalogue of rooftop options that are put in a comparable format. It forms the spine of the strategy.

The patterns are based on a series of case studies and underlying values that originate from the research. The methods and formatting of design are elaborated upon on p.95. The goal of the patterns are:

- Aligning the values of the stakeholders by presenting them with options to synergise.
- Educating the stakeholders about the possibilities of rooftops by communicating the various options.



- Informing the stakeholders about the qualities and technical requirement of the options in order to emphasise its strengths and mitigate worries.

## Data

The data sets represent the contextualisation. By analysing and understanding the environment and the properties of the building, a suggestion for the design can be made. This could be done in the form of a filtered set of patterns. Rather than providing the full set of patterns to the stakeholders, the data can help to reduce the set of patterns to something that is more suitable for the building and its surroundings, while still offering the stakeholders plenty to choose from. This is a more open approach than *Roofscape* offers, as there are still opportunities to change the programme of the rooftop to something they feel represented by.

The possible implementations of the pattern language in a *roofscape* in comparison to the outcomes of the *Roofscape* software are explored through a design in Chapter 5, p.156.

On a critical note, the concept of filtering the provided patterns has not been tested and implemented. Hence, other types of implementations of the data, such as giving a data-generated report on the context or assigning certain types of programmes, have not been further explored.

## Discussion and Design

The information the patterns present should be processed in a cooperative discussion. This is an opportunity for the stakeholders to insert their own motivations, personal biases, and perception of needs in the environment into the selection process. The comparability of the patterns offers the platform to initiate this discussion.

The outcome of this discussion can be one (or multiple) configurations of patterns that fit the need of the stakeholders. The design of the patterns takes into consideration that they should be combined together, rather than function as standalone solutions. This is done to encourage finding combinations, or synergies, that represent the values of multiple stakeholders.

## Iterations

Finally, the strategy consists of some recursive functions that result in iterations. These iterations have changed the strategy and its content throughout the process and are documented in Chapter 4, p.122. The chapter describes the methods used to devise the strategy such as co-creation workshops, empirical research and literary research, along with the mishaps and observations in this process.

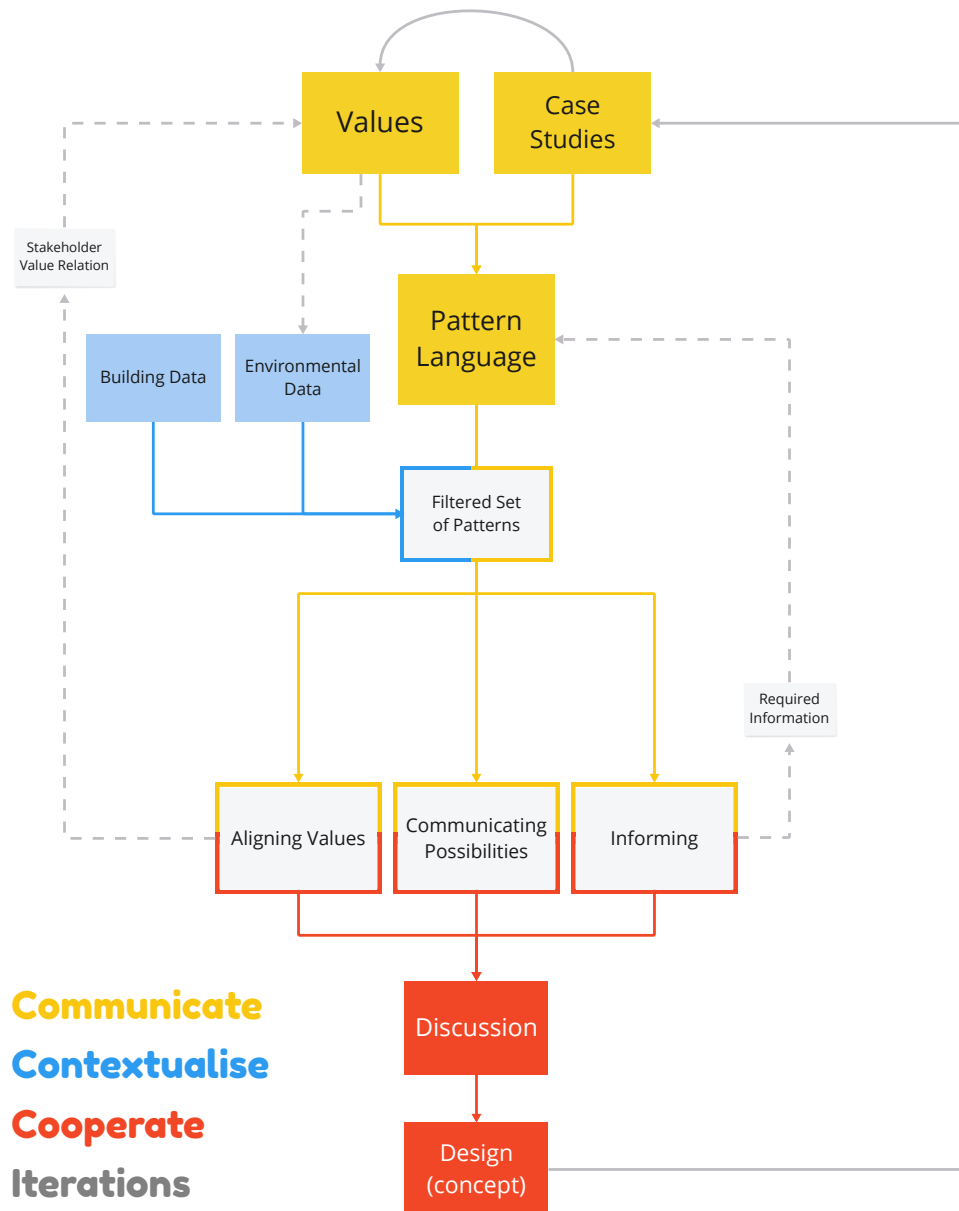


Figure 95. Strategic Framework (\*\*this will be updated for P5)

# Patterns

Rather than starting from the top of the strategy, the dissection starts from its core: the Pattern Language. In this sub-chapter, the patterns will be explained, starting out from the explanation and applications of pattern language itself. After that, the patterns will be shown and dissected. A full overview of all the patterns in their format and the applied strategy can be found in the Pattern Booklet (Appendix A, p.274). This booklet is intended to be used as a guidebook for the users (the stakeholders), and explains step by step what the patterns language is and how it should be used.

## OVERVIEW OF PATTERNS

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Before diving into the details, an overview of all the patterns is provided (Figure 96, p.96 & Figure 97, p.97). This shows all the patterns that have been made organised by their hierarchy and the overlapping themes. In total, there are 74 patterns that each offer a rooftop solution. A full, detailed overview can found on Figure 243, p.333.

### Hierarchy

Each pattern is assigned to one of three hierarchies: 'Programme', 'Feature' and 'Detail'. These represent the 'impact' a pattern has on the programme and available synergies of the rooftop, similar to how the colours from the 'multifunctional rooftops' determines which function can be put on a roof. Patterns in a lower hierarchy can be applied more liberally. This will be elaborated upon on p.106.

### Themes

The patterns are connected to each other with overlapping themes. There are 12 themes that each describe a 'function' associated with a set of values.

The goal of the themes is to give the users an idea of which patterns can go together quite well and what values these combinations represent.



<div>PROGRAMME</div> <div>16</div>	<div>FEATURE</div> <div>30</div>	<div>DETAIL</div> <div>28</div>	<div>Theme</div>
<div>Vegetable Farm</div> <div>Allotment Garden</div>	<div>Greenhouse</div> <div>Chicken Coop</div>	<div>Composter</div> <div>Beehive</div> <div>Vegetable Planter</div> <div>Edible Herbs</div>	<div>Urban Farming</div>
<div>Polderdak</div>	<div>Helophite Filter</div> <div>Rainwater Tank</div>	<div>Rainbarrel</div>	<div>Water Systems</div>
<div>Rooftop Bar</div> <div>Outdoor Cinema</div> <div>Neighbourhood Park</div>	<div>Lookout Point</div>		<div>Urban Bustle</div>
<div>Garden</div>	<div>Pergola</div> <div>Canopy</div> <div>Shared Terrace</div> <div>Private Terrace</div> <div>Shed</div> <div>Trellis</div>	<div>Seating</div> <div>BBQ Spot</div> <div>Lounge Area</div> <div>Picnic Table</div> <div>Laundry Rack</div>	<div>Living Rooftop</div>
<div>Playground</div> <div>Fountain</div> <div>Maze</div> <div>Football Field</div>	<div>Swimming Pool</div>	<div>Fitness Equipment</div>	<div>Sports and Playing</div>
<div>Powernest</div>	<div>Energy Storage</div> <div>Wind Turbine</div>	<div>Solar Panels</div> <div>Solar Tree</div>	<div>Energy</div>

Figure 96. Overview Of Patterns 1/2

PROGRAMME 16	FEATURE 30	DETAIL 28	Theme
<div>Housing Expansion</div> <div>Added Building Layer</div>	<div>Living Module</div> <div>Dormer Expansion</div>		Expansion & Densification
<div>Forest</div> <div>Nature Preserve</div>	<div>Flower Field</div> <div>Pond</div> <div>Dunes</div> <div>Herbs and Grasses</div> <div>Shrubs</div>	<div>Insect Hotel</div> <div>Nest Boxes</div> <div>Nesting Zones</div> <div>Trees</div> <div>Climbing Ivy</div>	Natural Habitats
	<div>Lawn</div>	<div>Fruit Tree</div> <div>Sculpture</div> <div>Planters</div> <div>Hedges</div> <div>Sunbeds</div>	Outdoor Leisure
<div>Parking</div>	<div>Billboard</div> <div>Data Centre</div>		Leasing Space
	<div>White Painted Roof</div> <div>Mural</div> <div>Sedum Moss</div>	<div>Tiles</div> <div>Stepping Stones</div> <div>Gravel Paths</div> <div>Wooden Decking</div>	Materials
	<div>Elevator</div> <div>Stairwell</div> <div>External Staircase</div>	<div>Ladder</div> <div>Rooftop Hatch</div>	Accessibility

Figure 97. Overview Of Patterns 2/2

## PATTERN LANGUAGE

The strategy heavily uses the qualities Pattern Language provides. This part will explain what a pattern language is, what common cases of pattern language can be found and what criticism there is. "Pattern Language" is a method used by Alexander et al. (1977). The methodology consists of a set of design principles, or "patterns," that can be combined to create solutions to specific design problems. Each pattern is a solution to a recurring problem in a specific context and is described in a concise, understandable manner (Figure 98). It is a flexible methodology that can be adapted to a wide range of contexts, from small-scale residential design to large-scale urban planning. This makes it highly suitable for rooftops, as it is a very context-sensitive topic that can have impact on big and small scales.

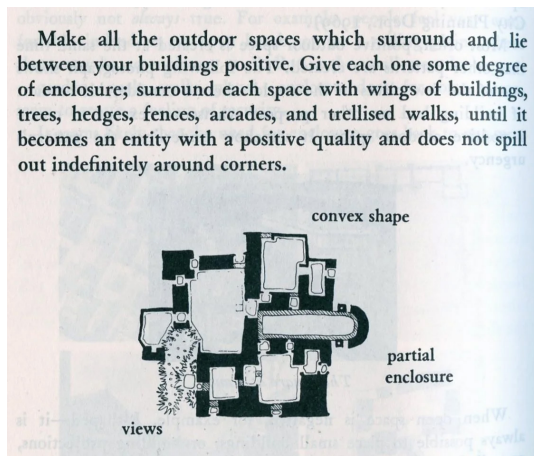


Figure 98. Example of a "Pattern" from the book "A Pattern Language" (Alexander et al., 1977)

### Patterns as a Communication Tool

Pattern languages are typically used in situations where multiple complex concepts need to be compared and combined. Since there are many different types of rooftops out there, all with their own complex structural requirements and represented values, a pattern language can be a strong method of communicating this to the stakeholders. It does not only help to identify the intricate details of a concept, but also helps to communicate this to those without prior knowledge in the field. This makes it a valuable tool to communicate the options to a stakeholders with a different profile and level of expertise, while maintaining a more in-depth explanation for stakeholders with a specific goal in mind.

The next part will highlight a couple of other uses for pattern language.

### ...as a Learning Tool

Since the use of patterns by Alexander et al. in 1977, the definition and application of patterns has changed. Whereas the initial concept of patterns was to form a concise overview of a concept, patterns now are considered to have a much broader use.

Rooij and van Dorst (2020) describe pattern language as a valuable tool in education that "...catalyzes (comparative) learning in planning for young professionals." as it helps to organise complexity. Thus, it functions as tool for education. And this is a purpose that fits the goal of a retrofitted intensive-use roofscape on a higher



level. Part of the municipality's strategy to transition to this new situation has been to educate and inform (Gemeente Rotterdam, 2018), which has manifested itself into events like the Rotterdam Rooftop Days and educative experiences on the Dakakker. A pattern language that explores the different possibilities on rooftops and their impact can assist in this vision, as it can function as an educative tool beyond its use in the actual development and design of intensive-use rooftops.

### ...as a Design Convention

Another widely popular use of pattern language in the modern day is in the field of software design. Buschmann et al. (2007) describe a pattern in software design as something that "...documents a recurring problem-solution pairing within a given context". Although the use of it compared to urban design is different, the concept remains exactly the same.

Similarly, in Human Computer Interaction (HCI), patterns are described as a means to convey information to a user regarding the function and potential interactions with the 'computer' (Dearden & Finlay, 2006). It is something that bridges the gap between front-end (what the user sees) and back-end (what is happening behind the screens). For example, a button indicates the user that there is the computer will execute an action: click it and something happens. It forms a design convention that maps out not exactly how something should look, but what message it should convey (Figure 99).

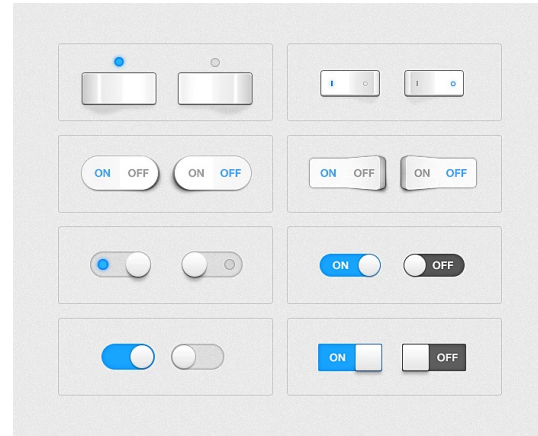


Figure 99. Different type of "toggle" buttons (agente, n.d.)

### ...as an Analysis Tool

As patterns represent recurring situations associated with a problem or context, pattern language can be used as a tool to analyse an existing or new situation. By identifying patterns in a set context, its related properties can be flagged. In a paper by Sousa et al. (2020), patterns were suggested as a means to identify the role of traffic nodes in a network analysis and insert it in an analytic software tool. Patterns were chosen because they are very suitable for describing in a context, as well as the relation between them.

By using patterns as a tool to analyse existing situations, the occurring events and their relations can be visualised.

### **...as a Form of Prototyping**

Patterns can also be a valuable tool for prototyping, a quick and dirty method for creating designs and testing them. By utilising a pattern language, different configurations can be made, tested and assessed. This can be especially valuable when using scenarios, a technique commonly used in urbanism to simulate specific events (often expressed as extremes) and their consequences (Abou Jaoude et al., 2022). Patterns can supplement to this technique, as they can be used to quickly compose different configurations that fit a scenario.

### **...as a Collaboration Tool**

Finally, pattern language could be used as a collaboration tool. It can provide the information and considerations regarding a topic as a framework for discussion. In other words: it can reveal elements that evoke reactions, starting a discussion.

This can be a valuable tool to guide a discussion towards certain topics. In the case of rooftops, these include the consideration between the benefits versus the risks: does the rooftop offer enough value for the projected costs and risks?

This principle formulates a guideline used in the creation of the pattern language.

## **EXAMPLES OF PATTERN LANGUAGE**

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To further increase our understanding of the different application and functions of pattern language, some examples from practise are analysed.

### **Textile Landscape (2022)**

This project the Master Thesis project of Duijghuisen (2022), in which the transition towards a sustainable textile industry in Noord-Brabant, the Netherlands was researched. The pattern language is used as a design tool to that organises and emphasises the relation between different design interventions. In this process, the hierarchy between patterns plays an important roles, as they "...value the relationship between the different patterns." (Duijghuisen 2022)

The pattern language manifests itself as a card-game-like set of options that propose a conceptual design principle (Figure 100). This is a format that is commonly used on our faculty of Urbanism at the TU Delft. It gives the reader a digestible interface to comprehend the complex interventions proposed. Moreover, it catalogues the research and associated design solutions in a comparable manner.

### T.12 Landscape guides Farming Strategy

**Significance**

The diagram illustrates the spatial arrangement of different land uses and how they influence farming strategies. Key features include:

- Grassland:** Located in the upper left, it is associated with 'Pasture' and 'Set-aside'.
- Woodland:** Located in the upper right, it is associated with 'Set-aside' and 'Arable'.
- Water:** Located in the middle left, it is associated with 'Arable' and 'Pasture'.
- Set-aside:** Located in the middle right, it is associated with 'Arable' and 'Pasture'.
- Arable:** Located in the bottom left, it is associated with 'Pasture' and 'Set-aside'.
- Pasture:** Located in the bottom right, it is associated with 'Arable' and 'Set-aside'.

**Interpret:** T12, T13, T14, T15, T16, T17, T18, T19

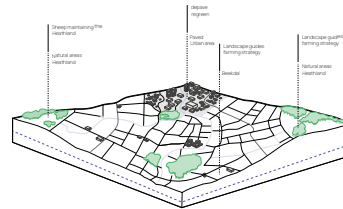
### T.13 Shaping maintaining the landscape

**Significance**

The diagram illustrates the spatial arrangement of different land uses and how they influence farming strategies. Key features include:

- Grassland:** Located in the upper left, it is associated with 'Pasture' and 'Set-aside'.
- Woodland:** Located in the upper right, it is associated with 'Set-aside' and 'Arable'.
- Water:** Located in the middle left, it is associated with 'Arable' and 'Pasture'.
- Set-aside:** Located in the middle right, it is associated with 'Arable' and 'Pasture'.
- Arable:** Located in the bottom left, it is associated with 'Pasture' and 'Set-aside'.
- Pasture:** Located in the bottom right, it is associated with 'Arable' and 'Set-aside'.

**Interpret:** T12, T13, T14, T15, T16, T17, T18, T19



To restore the cultural historical landscape sheep farming has to connect to the local landscape

38171

Textile landscape  
Spatial framework Noord-Brabant

Figure 100. Application of Pattern Language as a design tool (Duijghuisen 2022)

origin, the book more closely resembles a bible than a pragmatic handbook for hands-on developers.

This project is the result of a cooperation between various actors which “... explores the future of urban based manufacturing in European cities in terms of technology, resources, place and application.” (Hill et al., 2020)

The project uses patterns as a means to communicate the analysis of urban manufacturing, starting out from the contexts and eventually arguing possible solutions. The projects aims to speak to a wide audience, ranging from politicians to community groups and business sector organisations (p.27). This influences the format the patterns are presented in.

The patterns are represented by a category indicating their scale (R for Regional, N for Neighbourhood etc.), as well as a 'pathway': "... reflecting on different disciplines or ways of approaching manufacturing in cities." (p.67) However, with 260 pages, to cover 50 patterns, their explanation and their

## N.10 MAKING ALONG HIGH STREETS

170



Concentrations of mixed use activities along high streets can take advantage of the best regional accessibility and the highest amount of pedestrian flows, enhancing visibility.

Connected to:  
R.3/R.4/C.2/C.3/C.4/C.7/N.1/N.3/N.5/N.8/N.11/P.5/P.6/P.7/P.8

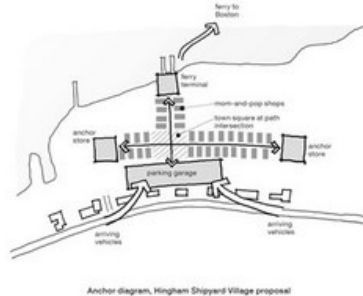
Figure 101. Pattern from Cities of Making (Hill et al., 2020)

## 101 Things I Learned...

The final example of a pattern language is one that I personally adore. It is the series of the “101 Things I learned...” by Matthew Frederick. Especially 101 Things I Learned in Urban Design School (Frederick & Mehta, 2018).

This book is a collection of lessons and concepts that are commonly taught in Urban Design. Things like “Urban is *how* people live, not simply *where* they live.” (p.98) may

lack a solid theoretical background, but for me, link back to the lectures and cases where this was explained to me (Figure 102). They do not act like explanations, but rather as mnemonics to the knowledge I have gained in the past. And this is one of it’s greatest powers. Whereas the small, 100 page book of 17x12cm pages fails to accurately underpin the concepts, it gives me *personally* a direct link to the knowledge I have endured in my education.



### Activate, activate, activate.

A suburban shopping mall is made active by the placement of anchors—large department stores—at each end. An anchor inherently attracts a lot of shoppers, many of whom walk to another anchor. As they do so, they enliven the mall's common space and may patronize the smaller stores located along the way.

anchors can be used to activate many urban spaces. For example, an office building and garage located on the same site will produce a single locus of activity. But if they are sited a block or two apart, pedestrian activity will occur between them at least twice each weekday. This will drive demand for dry cleaners, coffee shops, restaurants, drugstores, and banks, bringing benefit to buildings, businesses, and people beyond those invested in the primary project.

Almost any two large, related uses can be deployed as anchors: a housing project and supermarket, a hotel and shopping area, an event arena and transit stop. Anchors have limited gravitational pull, however. If they are placed too far apart, the space between them will not be sufficiently activated.

34

Figure 102. Example of a 'lesson' (Frederick & Mehta, 2018)

## CRITICISM ON PATTERN LANGUAGE

Although Alexander laid the foundation of pattern language, which is widely adopted in many different fields, there is a voice of criticism to his theory as well. This part proposes several elements of criticism as proposed by Dawes & Ostwald (2017) that are relevant to the application of pattern language for the strategy. These criticism will be analysed and applied to the use

of pattern language as a strategy in this project. Finally, a design suggestion will be made based on the criticism.



## Universal Values

First of all, in his book *The Timeless Way of Building* (Alexander, 1979), Alexander proposes certain values that are ought to be present in every individual. However, "...the very idea that all humanity shares an innate and common value system is deeply problematic. Values and attitudes are developed and learnt through a combination of human sensory engagement, education, and enculturation." (Dawes & Ostwald, 2017)

This is also the case when pattern languages are applied to rooftops. As has been discussed before, there are several stakeholders involved with different backgrounds, role-based motives and personal biases. Attributing a set of 'universal values' to the patterns may inadvertently lead to a mismatch between these proposed qualities and the perceived qualities by the stakeholders. However, within a certain framework, like sustainable growth, there are core conventions that **do** describe a 'conventional' value which, as opposed to a universal value, can be carefully labelled as a constant. Defining a convention and its associated values is, in a responsibility upheld by the political system in a democratic society. In the case of rooftops, the municipality set up a convention system in the form of their 'multifunctional rooftops' programme.

The role of myself as a designer and strategist within the scope of this project, is not to defy this convention, but to

supplement it to form the bridge between the ambitions of the municipality and the reality stakeholders need to deal with.

To conclude: there is no such thing as a universal value. However, the municipality has defined a convention of values in their 'multifunctional rooftops' programme. The projects will take these values and supplement it with values that represent the stakeholders and stimulate the finding of a middle ground.

The finding of this middle ground is also more in line with common criticism Dawes and Ostwald propose in regards to the romanticised world view. This criticism argues that Alexander's interpretation of pattern language disregards lifestyles that do not fit within the vision of the author.

## Provocations and Visions

A second point of criticism argued by Dawes and Ostwald is the presentation of truths and scientific proof in the documentation of Alexander's patterns, as seen in Figure 98, p.98. Although this point of criticism is more specifically directed to the patterns made by Alexander and not to pattern language as a method in general, it provides insight in how patterns should and should not be documented.

The criticism boils down to a very simple argument: the explanatory texts Alexander uses to argument the foundations of his patterns are providing an unbalanced, non-objective vision that is dismissive of the insights and solutions of others, which alienates fellow architects and planners.

Whether one agrees with this or not, the accusation of Alexander's misuse of 'empirical' as an evident validation of his theories, stands. "Alexander's supporting evidence has been criticised for being superficial, pseudo-scientific and little more than personal preference..." (Dawes & Ostwald, 2017).

However, this does not necessarily have any implications for the use of pattern language as a method. There have been many good examples that have a more nuanced interpretation or combine empirical research with a solid theoretical background. Cities of Making provides an excellent example of how patterns can steer the reader while offering them more than the observations and personal preferences of the authors.

## **PATTERN FORMAT**

---

The format of the pattern is designed to show the essential information, such as the values, the implementation of the patterns and possible synergies. The following part will elaborate on the format (Figure 103) and show which elements the patterns consist of.

### **1. Title**

Each pattern can be identified by their distinct title. It serves as a quick explanation for the pattern and should be relatable

### **2. Numbering**

The numbers are a way to refer to the patterns. They also indicate the hierarchy of the pattern with a 'p', 'f' or 'd'.

### **3. Theme**

Each pattern is associated with a theme. There are a number of themes that categorise the patterns based on their function on its associated values.

### **4. Image**

The image shows an example of the pattern applied on a real-life case. This helps to formulate how the pattern could look like and be used on an actual rooftop. In contrast to an icon or simplified visualisation, an image speaks more directly to the practical implication of the pattern rather than its concept.

### **5. Values and Tips**

This box can in some patterns suggest a usage in the form of a tip, but is generally reserved for the values. These values are shown in a coloured textbox which indicates a category. This is further elaborated on in the next sub-chapter (p.107).

### **6. Short Description**

On the back of the pattern, a short description can be found. The goal of the text is to emphasise the qualities the pattern may offer, but not to oversell it.

7. Technical Aspects Table

The table shows a concise overview of the technical properties and requirements. Most patterns are outfitted with an indication of the structural requirement, which in terms is important to understand the costs, but it can also show other quantified information.

In many cases, it is difficult to give an exact number to the costs, structural requirements or maintenance. This is why a simple score system is used. It gives an indication of these elements without providing information that could be different depending on the implementation or context.

8. Technical Aspects Annotation

For some patterns, the technical aspects are annotated with a small text highlighting an important factor, or offering an explanation to the rating. These are placed in this box.

9. Proposed Synergies

Some pattern have direct synergetic relationships with other patterns within, or between the themes. These are indicated here to give the user an indication how the patterns could be combined together.

10. Sources

Finally, the sources of the image and of, for some cases, of the provided information are given here.

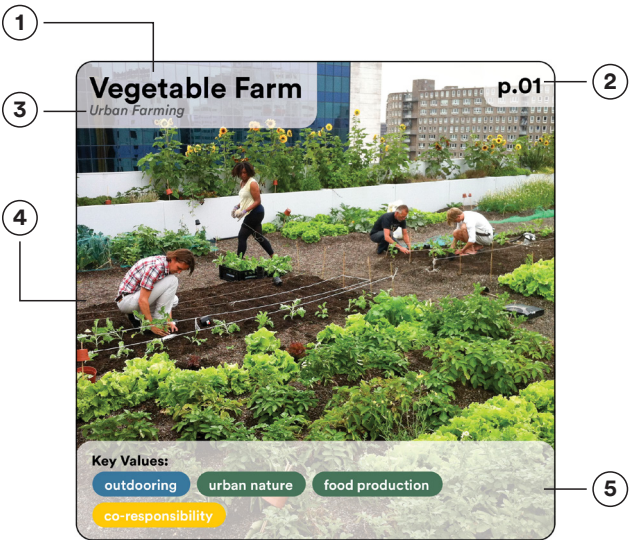
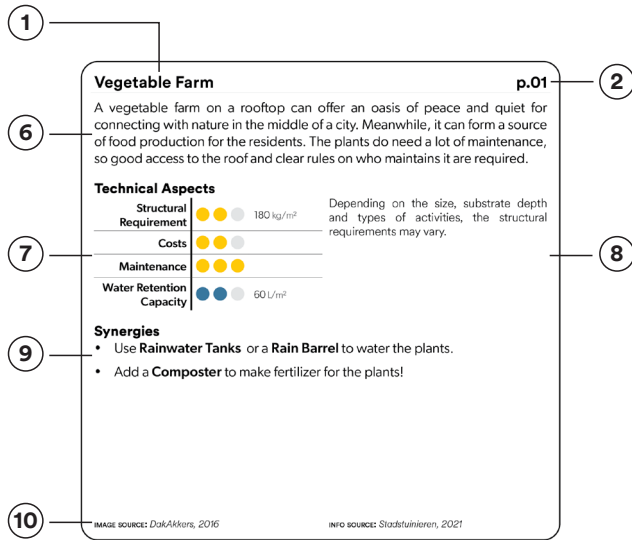


Figure 103. Example of a pattern with numbering



## HIERARCHY AND SYNERGIES

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An important element of the patterns is their associated hierarchy, labelled as 'Programme', 'Feature' and 'Detail'. The hierarchy is designed to help the users find synergies between the patterns. They give an indication of how much a pattern determines its function and what elements could be added along it. Although the 'programme' may have the biggest impact on its main function, lower hierarchy patterns (features and details) can be added.

The combination of all patterns shows a package of options and represented values. This means the values are not fully determined by the programmes assigned, but can be flexible by adding other features or details.

As an example, a roof that has '**p.12 - Polder Roof**' as its main programme is not limited to 'water retention' and 'cooling', but can be combined with multiple '**d.12 - Solar Panel**'s to generate clean energy, with a '**d.14 Insect Hotel**' as a habitat for pollinators or with a '**f.08 Shared Terrace**' to create an outdoor domesticated space.

### Programmes

Programmes are the patterns that have the highest impact on the function of the rooftop. They often also play a big role in the structural requirements of the rooftop and occupy more space.

The patterns ranked as 'Programmes' also have a bigger size (16x16cm) to indicate their impact.

### Features

Features are patterns that can do not determine the function of the rooftop, but can add to it. They represent a smaller variety of qualities and are limited in their size. However, features are mostly the things that make a rooftop multifunctional.

The patterns ranked as 'Feature' have a medium size (12x12cm) to indicate that they have an impact on the composition and functionality of the roof, but are more flexible and can be mixed and matched easier.

### Detail

The final hierarchical category is 'Detail', which indicates patterns that can be applied to almost any situation. These include small objects, materials and types of vegetation. Although they are considered to impact the function of the rooftop less than the other two, they can have a great impact on the qualities the roof represents. A '**p.06 - Neighbourhood Park**' with a '**f.22 - Lawn**' and many '**d.09 - Picnic Table**'s and '**d.23 - Sunbeds**' has a very different feel and quality than one with '**d.03 - Vegetable Planter**'s and '**d.11 - Fitness Equipment**'.

The patterns ranked as 'Detail' have a small size (8x8cm) to indicate that they are small and flexible, making it easy to place them around other patterns.



# Values

The values make up an important part of the strategy, as they are associated with transparently strengthening the benefits of various rooftop options. In this sub-chapter, the different values will be shown and dissected. Their categorisation and origin from theory, as well as their formulation, will be explained.

## TRANSLATION TO VALUES

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The values are divided into three categories that are derived from the triple bottom line (p.38) and translated to a practical implementation for rooftops. These are Liveability, which represents the social dimension; Climate, representing the environmental dimension; and Economic Prosperity, which represents the economic dimension.

The values are organised in a scheme (Figure 104, p.113) and related to these categories via a *Pathway*, which has a theoretical foundation.

### Values

The values are indicators of qualities a pattern may represent. They are designed to be malleable, meaning that different stakeholders can assign their own interpretation to it. This can help to initiate a conversation about the perceived values of the stakeholders and start a conversation that explores the underlying motivation for a stakeholder to incorporate these qualities into the roof.

### Validation

Whether a value fits with a pattern or not is not always that easy to assess. First of all, to avoid an overwhelming list of information, the values on a pattern are in many cases limited to the core message they convey. As such, a pattern like '**p.01 - Vegetable Garden**' does not have the value "insulation", even though the pattern typically comes with a layer of substrate that insulated the building.

Moreover, whether the values apply to the pattern often depends on the exact implementation of the rooftop option. For example, whether a Sedum roof significantly contributes to water retention depends on the substrate depth, which can vary for different implementations.

All in all, whether a value is associated with a pattern often comes down to an interpretation of the pattern, in combination with the preceding knowledge of the theoretical background of the value.

## LIVEABILITY

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The category of liveability finds its origins in the social dimension. Although the social dimension encompasses a broad spectrum of aspects, liveability forms the most direct and practical translation that is relevant to stakeholders in the context of Dutch rooftops.

In order to clearly map out the relationship between the values and Liveability, three subjects derived from the theory by van Dorst (2012) are chosen to represent it:

- Control over the Physical Environment
- Control over Social Interactions
- Mental and Physical Health

### cooling

Cooling indicates patterns that actively cool the rooftop and the area during warm days. This can be done with water elements or dense vegetation.

### exercise

Some patterns allow for exercise and play outdoors, promoting a healthy lifestyle with lots of activity. These patterns have the value exercise.

### living space

This value marks the patterns that consider the rooftop as an extension of the living room. They offer options for outdoor dining, relaxing or social gatherings.

### outdooring

For those who are looking enjoy outdoors, the outdooring value is there. It is put on patterns that provoke the interaction between people and nature, like sunbathing, listening to birds or getting some fresh air.

### shelter

Looking for a space more secluded, safe from the elements and prying eyes? Shelter describes the patterns that do just that. They keep you safe from strong sun, heavy winds or rain and allow for a more intimate space.

### social space

Social space is put on patterns where social interactions are promoted. These are patterns that encourage interaction between neighbours, or strangers passing by. Most of these are (semi-)public options.

## CLIMATE

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Climate is derived from the environmental dimension of sustainability. Both climate adaptation and climate mitigation form important parts of this. However, within these subjects, not everything is applicable to rooftops.

The subjects that are chosen to represent this category are:

- Water, indicating stormwater retention, as well as stormwater re-use to combat drought.
- Climate change mitigation, focussing on reducing consumption of energy, water and good, while incorporating new sources of energy.
- Healthy Ecosystems, which promote a resilient and biodiversity ecosystem that can naturally sustain in the native environment.

Urgencies such as subsidence and drought are closely related to soil and subsoil activities, which do not directly apply to rooftops. Similarly, river and coastal floodings is hard to prevent and adapt to using only the rooftops. And finally, heat stress is taken into consideration, but not as an overarching subject. It is considered an effect of climate change that influences health and biodiversity.

### clean energy

Clean energy is linked to patterns that help in the energy transition. They either produce or store energy from renewable sources and help to bring down the electrical bill.

### food production

Some options are designed for urban farming, helping the production of your own food. Not only are fresh vegetables very healthy, they also bring down the costs for groceries.

### native ecology

Patterns marked with this value actively support ecosystems that are indigenous to your area. They support native plant- and wildlife, and typically require less maintenance.

### rain harvesting

Rain harvesting offers options to re-use rainwater that falls on the roof for irrigation or sometimes even flushing the toilet. It saves a lot of water and can reduce the bills.

### stormwater retention

During heavy rainfalls, streets could flood. Some roofs are designed to hold the stormwater during the rain and release it later, preventing floods and water damage. This is called stormwater retention.

### urban nature

Urban nature is a value attributed to patterns that promote biodiversity and greenery. This helps to clean the air of pollutants, offer thermal comfort and contribute to a good mental health of those in contact with it.

## ECONOMIC PROSPERITY

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The last category is related to the economic dimension of sustainability. It represents the integration of the economic concerns in the discussion, as it has proven to be very impactful. The subjects in this category are:

- Revenue & Expenses, which represents the incoming assets versus the upkeep costs and other expenses. These form the economic model of any business.
- Value, which represents the economic value of the property and the rooftop, or the capital. But it also relates to the human and environmental capital. This means that increasing the value of liveability and climate can, for some stakeholders form a value comparable to the economic value itself.
- Investment represents the costs of the building and the rooftop. These increase with more expensive options but can decrease with subsidies or by distributing the costs between multiple investors.

The economic dimension is perhaps one of the most important ones in the decision-making process. The consideration between value, investment and revenue & expenses often forms a recurring theme in rooftop discussion and can be interpreted differently by stakeholders. A rooftop that is cheap but costs a lot of maintenance perhaps is more desirable for a stakeholder than one that is expensive but pays off in the long term. Moreover, the valuation of other aspects such as green and rooftop terraces can differ between stakeholders.

### attractivity

Attractivity indicates patterns that make the roof more appealing for the eye. Not just for the ones using the roof, but also for those who live around it and see it from their windows.

### co-responsibility

Sharing ownership and responsibility of the roof be a great way to distribute the costs of maintenance and upfront investments. Moreover, sharing it with neighbours can help to build a strong sense of community.

### home extension

Patterns that use the rooftop surface to extent the houses of the top floors are marked with this value. It can be a great addition to those homes, while freeing up new funds to invest in other shared amenities.

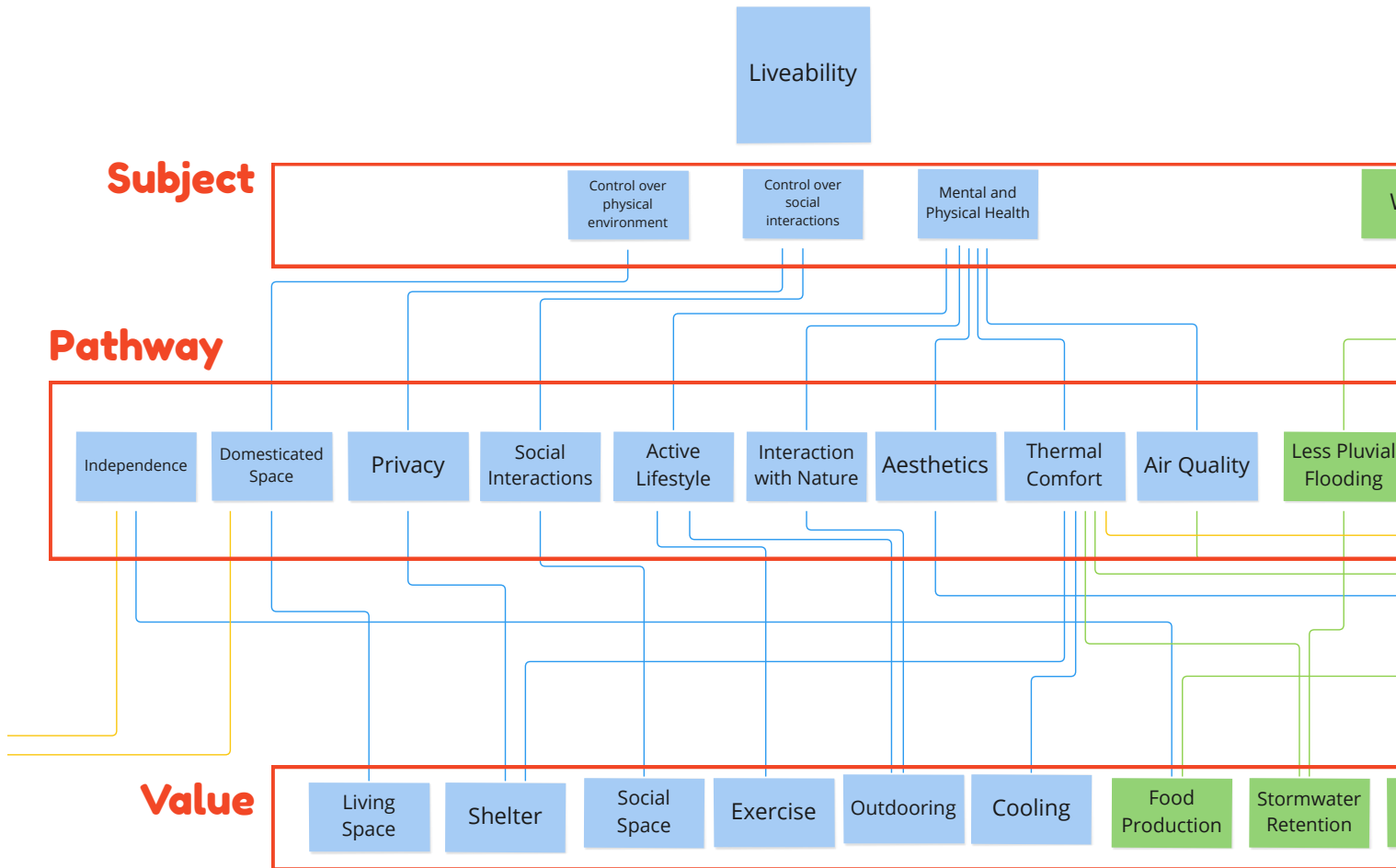
### insulation

Some patterns are designed specifically to improve the insulation of the building, increasing thermal comfort during very cold and very warm periods. However, most options offer some sort of insulation.



### profitable space

The rooftop surface can also be used as a space that can be leased out, which helps to free up funds for other types of development or simply increase the revenue of the building.



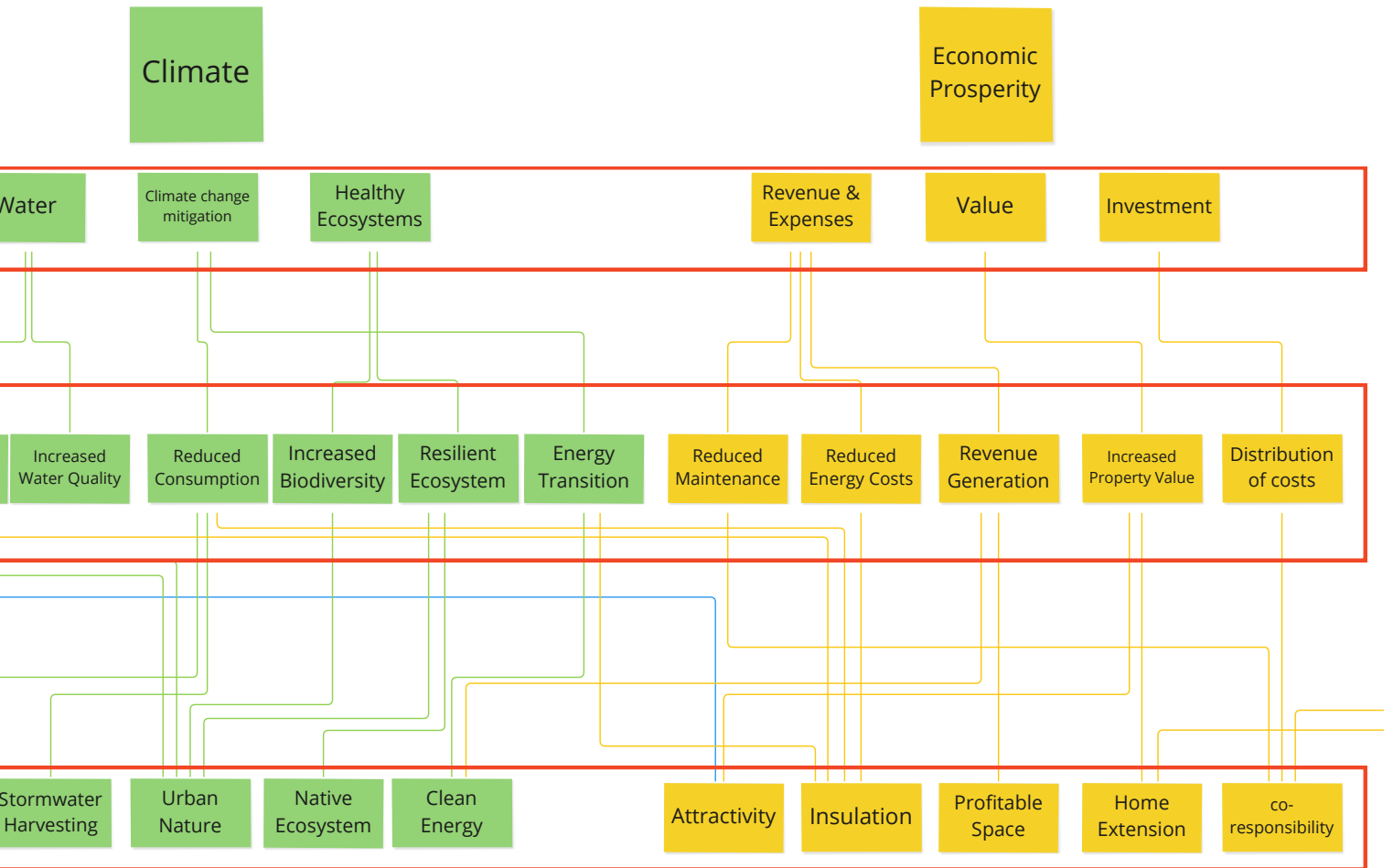


Figure 104. Value Relation Scheme (this will be updated at p5)

## CRITICAL REFLECTION ON THE VALUES

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The process of creating the values has been turbulent for good reason. The selection of the values and their naming convention could have been done in a multitude of other ways. In this part, several points of criticism are presented.

### Relatable Terminology

The values are argued to represent the various stakeholders and help them in communicating their innate values, but are also designed to accommodate an open interpretation. This is seemingly a self-contradictory statement. How can a value be both clear and precise, as well as relatable and malleable? The result is this overview of values that is flawed, but pragmatic. They show not the exact, correct, theoretically underpinned qualities of a value, but are designed to initiate discussion.

A weakness of this is that it becomes more difficult to identify the direct relation to the supporting theory. As an example, where the pattern '[d.14 - Insect Hotel](#)' is associated with the value 'urban nature', it is arguable to which extent buzzing insects actively contribute to the positive impact of interaction with nature.

### Value Pathways

Some cases, such as "Heat Stress" and "Interaction with Nature", are core of the theoretical background of the category, but are not represented as important subjects. This has two reasons.

Firstly, it has to do with my own interpretations of the theory and its translation to the values. Although van Dorst (2012) describes "Contact with the natural environment" as a basic need for Liveability, the explanation clearly states a direct relation to mental- and physical health, which *are* included as core subjects. This is how I defined the pathways: as a theoretical backup for the reason why a value is related to a core subject. In a similar fashion, heat stress is often not addressed as an urgency itself, but as a property of climate change that has severe effects on health and the ecosystem.

Secondly, it has to do with the limitations rooftops may have on contributing to several subjects mentioned in the literature. Similar to how rooftops can hardly be of a significant contribution to subsidence, some values and subjects are excluded from the scheme.

### Densification & Mobility

The municipality clearly defines both densification and mobility as part of their 'values', as they each form one of the colours in their multifunctional rooftops programme (p.35). However, the decision was made to exclude them from the list of values provided to the stakeholders. This has two reasons:

First of all, densification and mobility are elements that are important for the municipality and are widely represented in different projects, renovations and policies



they are already applying in the public domain. As a designer, I believe existing rooftops are not the place to organise these interventions specifically. Especially regarding mobility, I think there is an innate value in the difference between the public and private domain. I believe that when public functions like mobility and infrastructure are introduced to a existing roofscape that is not designed with this purpose in mind, it may lead to a loss of control, which can effects the liveability of the rooftop.

Secondly, densification is market-driven and organised. Developers are often eager to work on a densification programme in cooperation with the municipality, as the newly acquired space in a space-scarce environment has a lot of economic value. This economic value *is* represented in the value scheme and can form an incentive for context with many economically driven stakeholder to apply rooftop options associated with densification. Hence, densification is not excluded, but left as an option that could speak to stakeholders in some contexts. In fact, densification (& expansion) are formulated as a theme in the patterns.

### **Categorisation**

The categories, represented by the three dimensions of sustainability, that the values are placed can cause some confusion. Whereas they might help to assist stakeholders in identifying their values and initiating the discussion, they might also lead to conflicting situations and prevent

synergies from being formed. Stakeholder may favour a certain category and ignore the effects values in other categories may have on them.

Moreover, whether a value is placed in one or another category is sometimes very clear, as they share a theoretical background, but other times can be rather trivial. For example, 'Clean Energy' is labelled as a value in 'Climate', but in practical applications is often chosen for the economic benefits they come with.

# Discussion and Outcome

The final part of the strategy is the discussion and the design concept as an outcome. This is where the participants are asked to cooperate and find a collection of patterns that represent their collective requirements and evaluation. This chapter will highlight how the patterns could be combined and what consequences they might have.

## ELEMENTS TO CONSIDER

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### Structure and Renovation Costs

One important element to consider in the discussion is that of the costs, which are mostly caused by structural adaptations and renovations. As these exact costs are very dependent on the building, the context and the state it is in, as well as the design of the rooftop, it is difficult to quantify this.

To give an indication, the patterns make use of the three structural categories as mentioned in "Costs and Policy" on p.68. These include:

#### LIGHTWEIGHT

These are the lightest variant of patterns. They can be placed on most roofs, sometimes with minor adaptations. These include options that weigh up to 75kg/m<sup>2</sup>. Only some patterns, like solar panels, are suitable for these type of rooftops.

#### MEDIUMWEIGHT

These types of patterns are mediumweight and in some cases require a structural renovation of the roof. These typically weigh

between 75kg/m<sup>2</sup> and 150kg/m<sup>2</sup>. Rooftop terraces, small intensive green roofs and the polder roof fall into this category.

#### HEAVYWEIGHT

This is the heaviest type of structural requirement. Patterns that fall into this category often require a full structural renovation or adaptation of the current rooftop, which leads to higher costs. Big intensive green roofs like the forest or roofs that are publicly accessible for a large amount of people fall into this category.

### Subsidies

As the financial part of the discussion can determine which patterns will and will not be chosen, it can help to take the potential subsidies that come with a certain pattern into consideration. However, these subsidies are variable depending on the municipality, the rooftop it is applied to and the exact implementation of the pattern. For example, in Rotterdam, subsidies are given out to rooftop developments where water is stored per m<sup>3</sup> (p.71), but how much a water a pattern can exactly store is highly dependent on how it is

implemented and what other patterns are used in combination with it. Accounting for the different municipalities and their own policies regarding this, it is very difficult to give even a indication of what subsidies may be relevant. Hence, these are excluded from the pattern.

### **Role of a Designer**

As the patterns do not suggest an elaborate design plan of a rooftop, but rather a conceptual design brief with its associated qualities, the role of the designer is very important. This is the person that needs to translate these concepts and qualities into an engineered solution. Moreover, the designer needs to consider the costs and implementations of the structural renovations.

## **EXAMPLES OF OUTCOMES**

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To illustrate how the patterns could be combined into a design concept that synergises multiple values, three examples are made (p.118 - p.120). These show outcomes that can occur in different contexts in practise.

**Example 1: Garden**

The first example shows a cooling , natural neighbourhood park with water elements like a fountain and a pond. The helophyte filter cleans the water for the pond and offers a nesting place for some birds. There is a path of stepping stones leading to a lookout point.

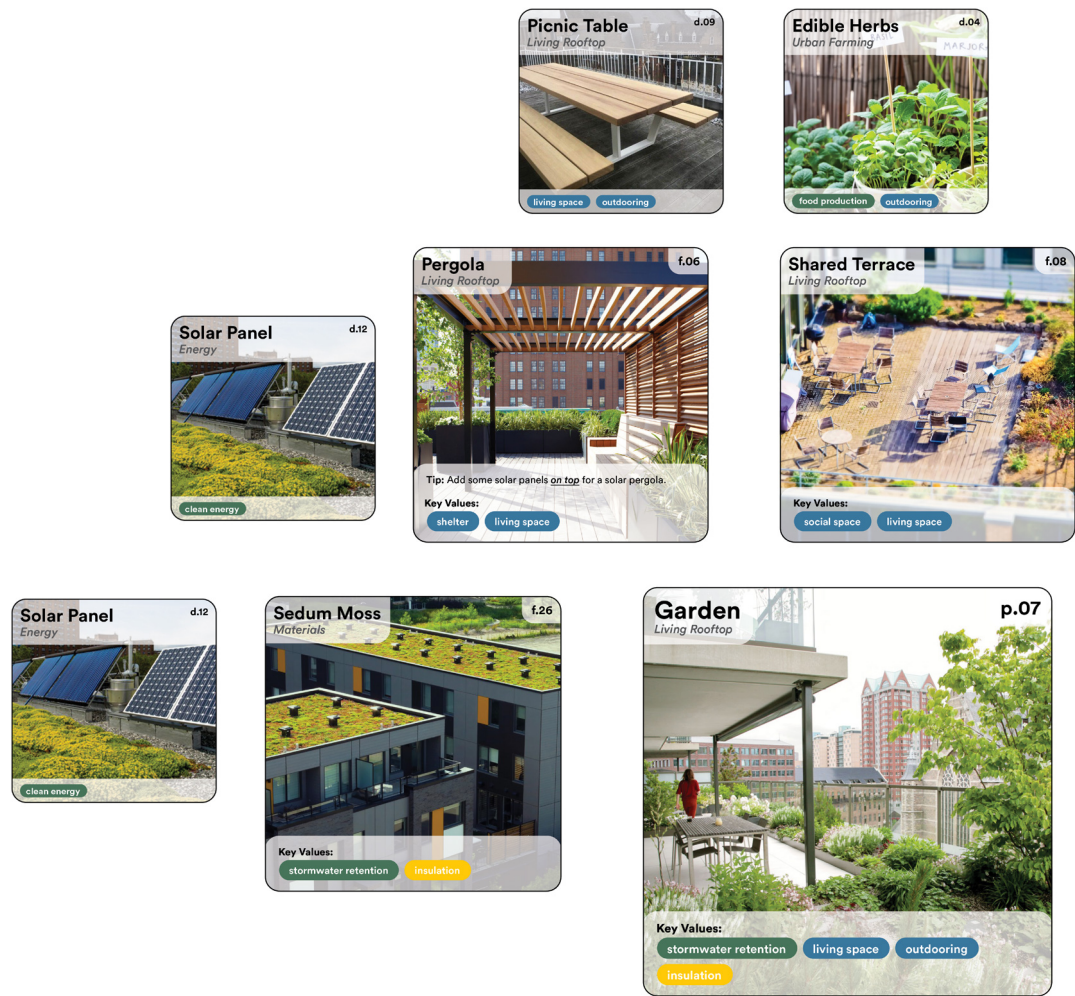


Figure 105. Example of Pattern Configuration - Garden



**Example 2: Park**

The second example shows a private rooftop garden with a terrace, on which a solar pergola provides a shaded spot for the picnic table. A part of the roof is covered with sedum and solar panels, and there are some edible herbs planted around.

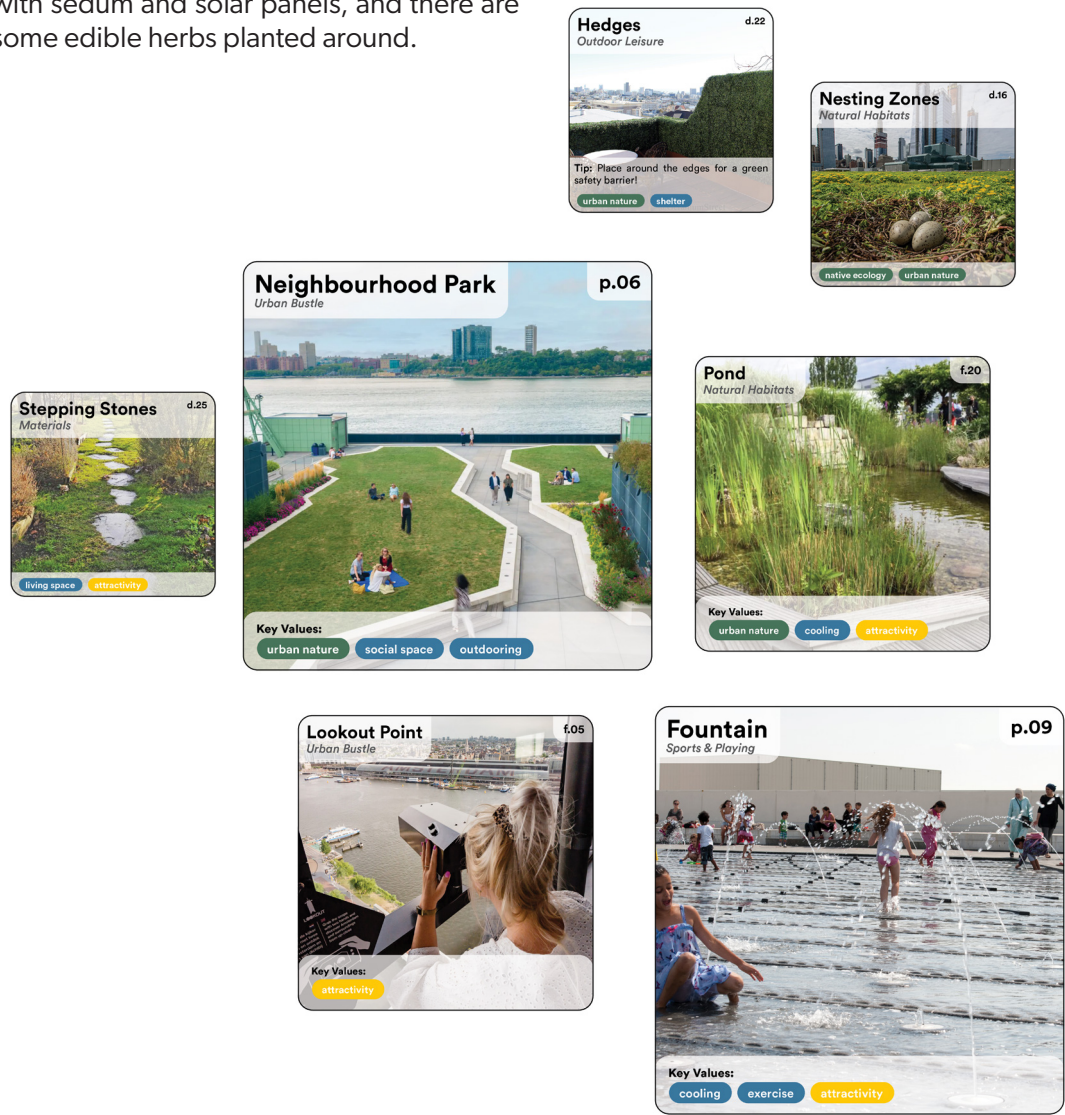


Figure 106. Example of Pattern Configuration - Park

**Example 3: Solar Panels**

The third example is made to illustrate an outcomes that is more like the sedum/solar combination seen in so many cases already. As has been said before, the point of the strategy is not only to create lush, green rooftop gardens or parks, but to represent the values of the stakeholders, this means that a roof dominated by solar panels can still be a viable option.

This example specifically was taken from the results of workshop 3 (p.158), in which the participant made a plan for the rooftop of a

ground floor home extension. Personally, it is my favourite example, as it shows how the pattern language can be used flexibly to bridge the gap between the ambitious green roofs and the pragmatic solar panels.

The example shows solar panels placed on a white painted roof and a small flower field for some extra cooling. The flower field can be used to provide nesting for birds. Moreover, edible herbs are placed on the side of the building that can be picked with a ladder or some steps.

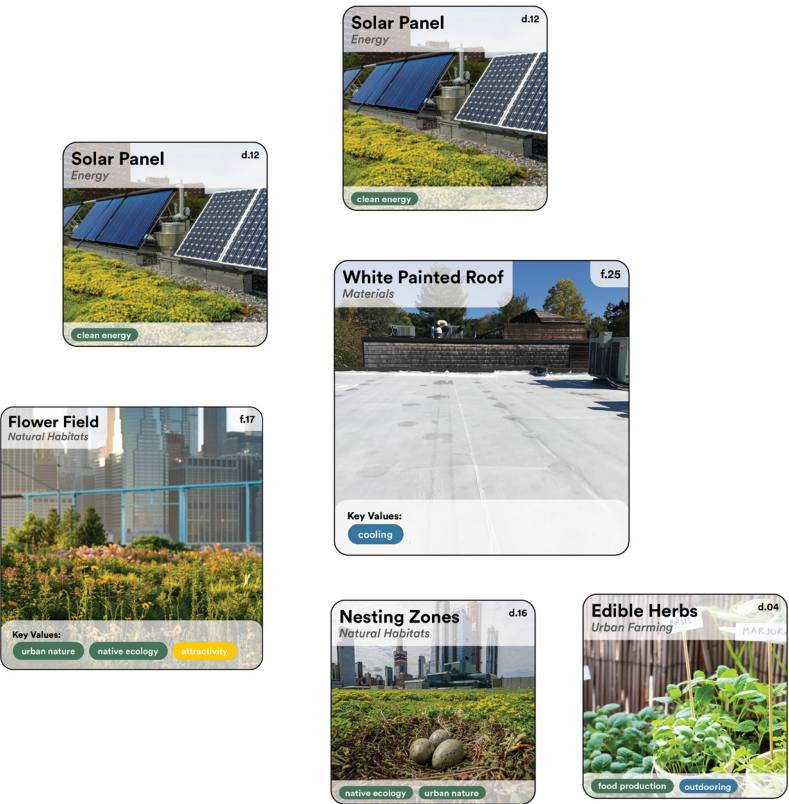


Figure 107. Example of Pattern Configuration - Solar Panels

## DISTRIBUTION OF THE STRATEGY

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The tool is designed to be used flexibly and in different context. Moreover, as the research has pointed out, it can help to target a broad audience. Although my personal expertise in marketing is limited, I would like to point out a couple of solutions that may work. In the next part, these options will be explored. The eventual distribution method can be a combination of these options.

### Online Tool

The first option is to distribute the strategy via an online platform. This can be hosted by the municipality or an NGO like Rooftop Revolution. By making the pattern language available online, the strategy can reach a broad audience, including users outside of the municipality. However, there are a couple of disadvantages to this method.

Firstly, the discussion is not actively imitated by an organisation that understands the strategy and the responsibility is left to the individual users, or owner associations. Especially for larger buildings, this will form a threshold to engage with the strategy.

Secondly, although an online tool is very accessible, the threshold of interacting with it as opposed to a physical version is a lot higher. An alternative for this would be to distribute a physical, paper version of the strategy, but this could become quite costly.

### Via Owner Associations

A second method could be to promote the strategy to owner associations, for example through “Vereniging Eigen Huis” or to housing associations. These associations are already overseeing and managing multiple buildings, which provides an organised approach to reach a broad audience.

A downside of this is that these associations are often stakeholders themselves who have an interest in the building. Putting them into control of the organisation could prove ineffective in regards to the cooperative element.

### Present at Events

A good way to get attention for the strategy is to show it in related events, such as the Rotterdam Rooftop Days. By showing and presenting the strategy to a larger audience of potential users and companies, the use of the strategy could be highlighted. Similar to how the municipality launched the Rooftop Catalogue (MVRDV, 2021) during the Rooftop Days in 2022, the strategy could be released as well. However, this method does not offer a way to actively use the strategy in practise.

### Exemplary Projects

Another way to promote the strategy is through the use of exemplary, guided projects. By cooperating with housing corporations and applying the strategy, it forms a series of exemplary projects that can help in its marketing.

# Chapter 4

## Collaboration & Conflict





# Stakeholder Driven Strategy

The first iteration of the strategy was designed to address the stakeholders directly, as opposed to the value driven strategy. In this approach, three groups of stakeholders (User, Society and Enterprise) were chosen. Each of these groups had a set of fixed values and is flexible. This means sometimes, stakeholders can fit in multiple groups.

## STRATEGY

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The strategy was set up around several goals.

### USING A SYSTEMATIC APPROACH

First of all, we can't afford to analyse and work out each case individually. This will in practice drive up costs and make it less attractive to develop a rooftop. Therefore, the strategy needs to work systematically and be capable of dealing a variety of cases.

### EMPOWERING STAKEHOLDERS

In order to make sure all stakeholders are heard, we must give them a platform on which they can express their values. By doing this, their motives and values become clear and can be taken into consideration more effortlessly.

Beside involving stakeholders with less decision making authority, the same platform could apply for the collective values, like biodiversity and climate adaptivity, that are not represented by stakeholders.

### CONSTRUCTIVE SYNERGIES

Another way to make sure all stakeholders have a say, is by showing available synergies between their values. Exposing how two

different means can be achieved by one intervention will help to make decisions that are beneficial for all stakeholders. It can also help to steer the discussion into a constructive dialogue

### CLEAR INTERVENTIONS

Another hurdle in the development process is the lack of knowledge and clarity in the available interventions.

By placing possible interventions in a simple, unified format, communication about different types of rooftop usage and the intervention that come with it can become more clear. This makes it easier to compare them and make decisions.

### INITIATING THE CONVERSATION

As we have seen from initiatives like the Rotterdam Rooftop Days, putting the development of rooftops on the table can in some cases be just the nudge for some people need to start the process. Therefore, the strategy should be an accessible open invitation to do something with a rooftop. It should be relatable and understandable. Moreover, the strategy should carry out a



sense of empathy towards the stakeholders and provide a platform to project their own ideals on.

#### **STIMULATE BOTTOM-UP DEVELOPMENT**

Rather than trying to create a strategy for 10.000 roofs in 30 years, we should focus on creating 1 rooftop, yesterday. In other words, focus on the easier development of a few rooftops, as this helps to push the movement for the entire roofscape.

With this in mind, it is a good idea to develop a strategy not to convince *everyone*, but cases where there already is some incentive. For these cases, a bottom approach could work best, which requires the strategy to facilitate a level of freedom and space for own personal interpretation.

### **THREE C'S**

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Similar to the current strategy, the stakeholder driven approach consisted of three concepts. These concepts and the goals resulted in the strategic framework (Figure 108, p.127).

#### **Contextualise**

First of all, we must understand the situation, specifically that within the building. This means we need to get a grip on the different stakeholders involved and their relationship. Moreover, we need to know what parts they may find important and can interest them into developing the rooftop.

To do that, the stakeholders are systematically divided into three categories: User, Society and Enterprise. Users represent the stakeholders that use the building, Society represents the stakeholders that are concerned with the common good and Enterprise represents stakeholders that are financially invested in

the building. It could also be possible for some stakeholders, like owner-occupiers, to fit in more than one category.

By doing this, the stakeholders involved and their interests are formatted in a way we can process and analyse more easily. It allows us to identify stakeholder groups that might need to be empowered and helps to make an estimation of which of their values could be important. For example, in a situation where there is little green and a lot of nuisance, the Society may want to add ecological habitats on the roofs, whereas User may want to see interventions that reduce noise pollution. As you can see, a systematic approach like this can help to identify possible problems and find solutions that synergise.

## **Convince**

Which brings us to the next part. In order to make sure all stakeholders are convinced, we need to make sure their values are represented in the design of the rooftop. Using publicly available information, we can analyse which values could be more important in the described context and find which solutions that offer synergies to address these values.

By exposing which interventions facilitate these synergies, the discussion can become more constructive and address the concerns of every stakeholder.

## **Communicate**

Having a general idea of which interventions could be put in place, the next step would be to communicate this to the stakeholders. But rather than simply sending them a list of things they could do, the suggested interventions are put in a unified format that informs the reader about the intervention and its implications. Using elements from pattern language, we can compose a format that doesn't just tell them what to do, but instead shows a concept or an idea of what is possible on the rooftop as well as other ideas it could be combined with.



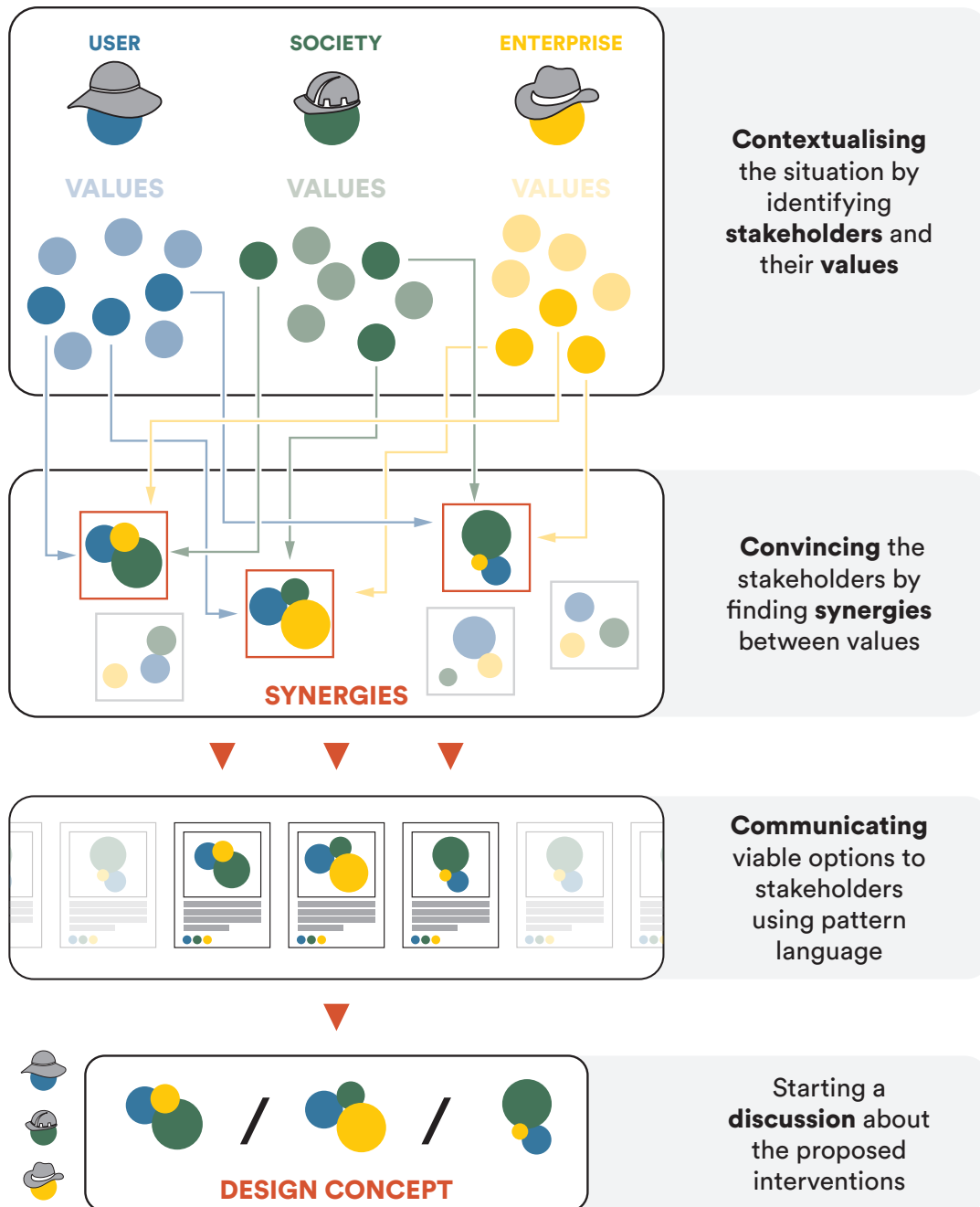


Figure 108. Grouped power-interest matrices of case 1, 2 and 3 from left to right

## USER, SOCIETY AND ENTERPRISE

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The three stakeholders groups are set up as a derivative of the triple bottom line, translated to a relatable role. These three roles are:

### User

Users are those who live in or make use of the building. These include tenants, workers, owner-occupiers, visitors, etc. They are concerned about the impact a roof may have on their interaction with it. Things that make their lives in, or visits to the building more pleasant.

The users consider the building and its rooftop as an object of use.

### Society

Society represents the organised values of people. These include municipalities, social entrepreneurs, neighbourhoods, etc. They are concerned about the impact the rooftop will have on the surrounding environment. This also means that typically, they have not a lot of interest in the individual building and its rooftop, but consider it part of a bigger structure.

For society, the building and its rooftop is an object in an environment.

### Enterprise

For *Enterprise*, the building is an object of financial value. These include investors, owner-occupiers, landlords, housing corporations, etc. They represent the stakeholders that are financially invested in the building and usually seek for methods

and interventions that generate revenue or cut costs. They typically have high power, and medium interest.

Enterprises consider the building and its rooftop as an object of economic value.

### Power-Interest Matrix

Based on the power-interest matrices and stakeholder analyses from “Stakeholders in Undeveloped Roofs” on p.76, these roles could be filled in. In most cases, there were high-power stakeholders who would fit in the Enterprise role, low-power low-interest stakeholders who could fit in the society role, and low-power high-interest stakeholders that fit in the user role. (Figure 108, Figure 109)

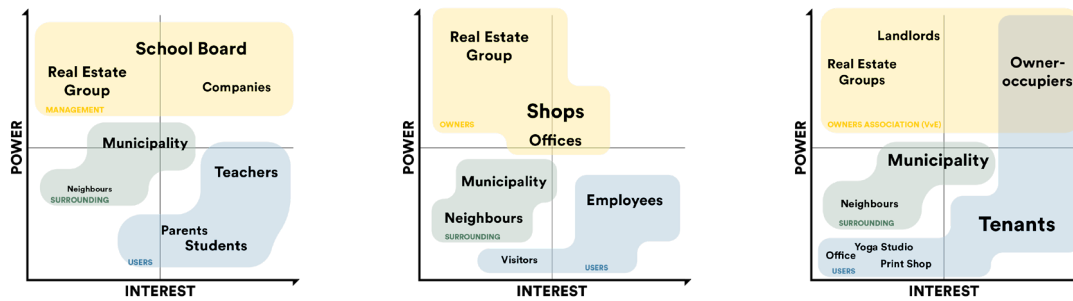


Figure 109. Grouped power-interest matrices of case 1, 2 and 3 from left to right

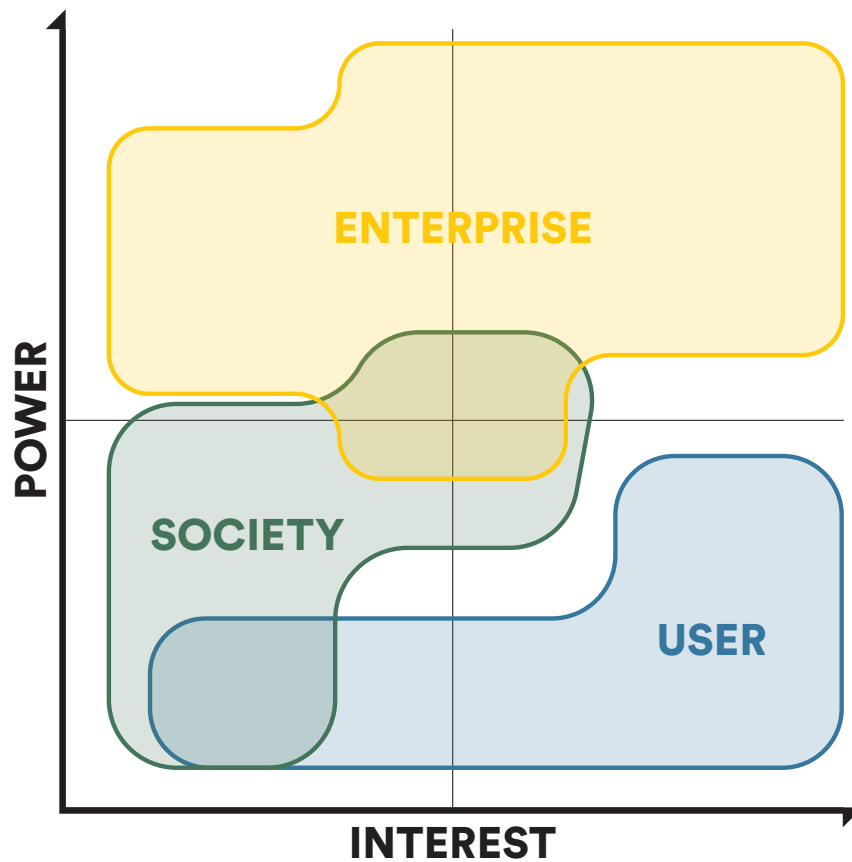


Figure 110. USE Framework on the power-interest matrix

# PATTERN LANGUAGE

Using this strategy, a pattern language was built. The idea is test the strategy, so the pattern language (Figure 112) was kept relatively simple.

## Levels of Implementation Difficulty

Each pattern was fitted into of of three levels of implementation difficulty. The highest ones often require a full renovation, whereas the lowest ones could usually be placed on any rooftop.

## Associated Values

Based on the stakeholder groups and the literature, a list of values per group was created (Figure 111). The goal of the list is to form an overview of what qualities a stakeholder desires to see on a rooftop.

Each of the patterns are associated with one or multiple of these values.

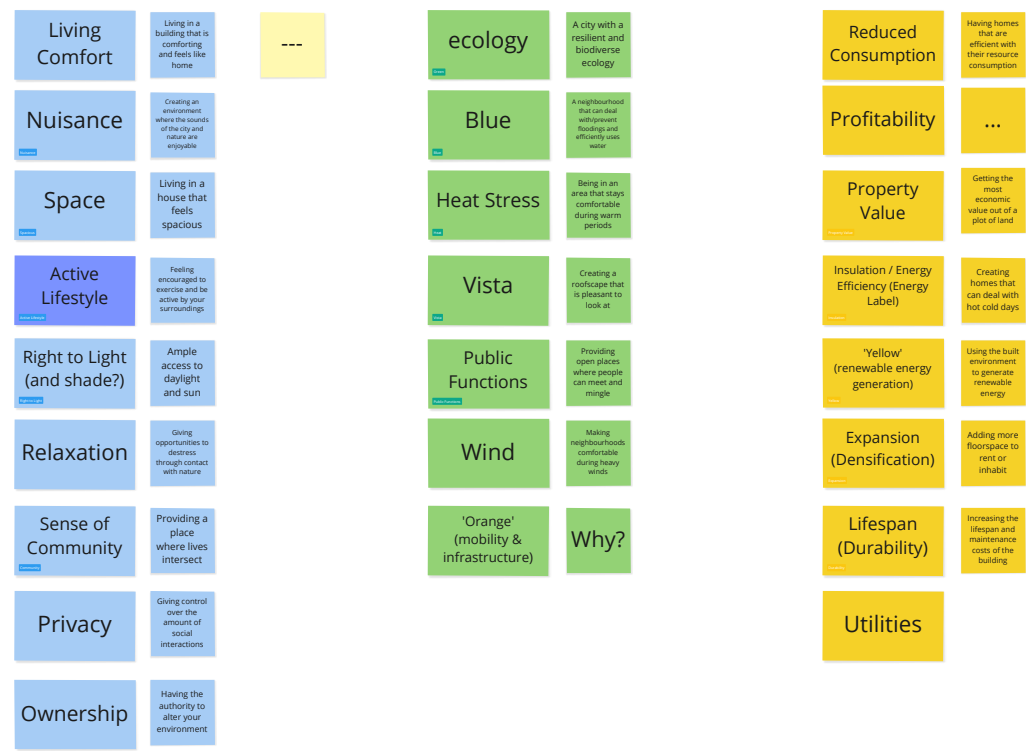
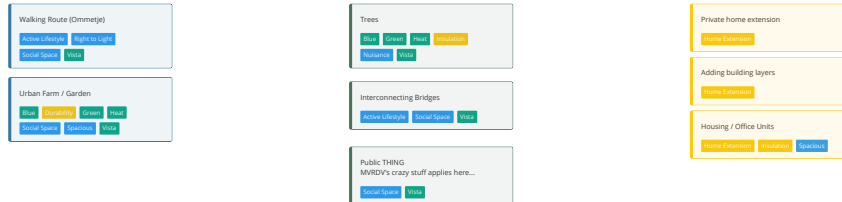


Figure 111. USE Framework on the power-interest matrix

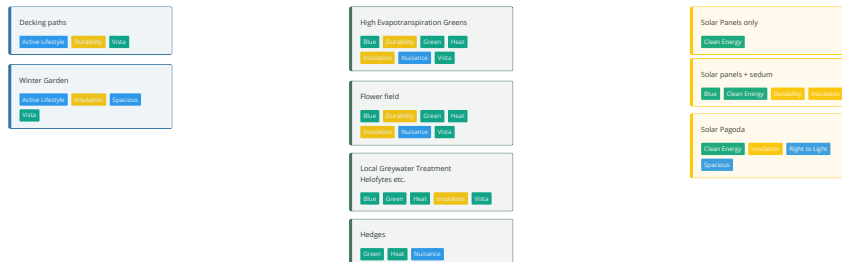




## BIG, COSTLY SOLUTIONS - renovation



## EASY ENOUGH TO RETROFIT



## DIY-able

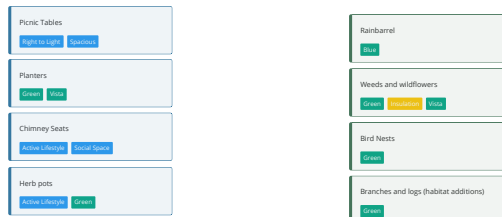


Figure 112. The used patterns in this iteration sorted by their relation to a stakeholder role and implementation difficulty

# PATTERN WORKSHOP 1

According to the strategy, each stakeholder should fit in one or multiple roles that represent their values. In order to test whether the patterns offered a palette of options that would fit the needs of each stakeholder group, a test setup was created.

Besides testing whether the patterns would fit stakeholder values, the test setup could also assist in determining whether the patterns (all with different scales and intentions) offered solutions that could be combined and compel the stakeholders.

Finally, the patterns have a vast list of different values and parameters that could be assigned to them. One of the intended goals of the strategy is to understand which parameters guide the participants in their discussion. In this workshop, three technical parameters: Structural Capacity, Accessibility and Safety were given to each pattern. These were not given strict rules on how they are categorised, but were an interpretation of myself including the technical knowledge I have gained throughout this project.

In order to test the relation between stakeholders and patterns, the workshop intentionally did not specify a location or context, apart from the building having a residential function.

The results of the workshop are collected and processed through observations, and discussed with the participants in a reflection after the workshop.

## Goals

The following goals were set:

- Get an impression of which patterns are generally liked and why.
- Find out whether the stakeholders ideas and beliefs are represented by the palette of patterns and the values.
- Find out what information about the patterns is required to make a well-informed decision.

This relates back to the latest strategy of Chapter 3, as the workshop was oriented on using and the pattern language and the associated values to better understand how they can contribute to making a design concept (Figure 113).

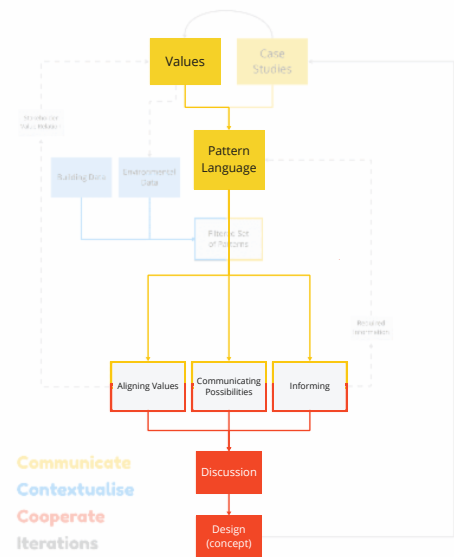


Figure 113. Goal of workshop 1 projected onto the strategic framework

### Stakeholder Roles

For the sake of making a quick start, 6 participants with different backgrounds were asked to take on the role of either one of 6 stakeholders that typically could be found in a building. This helps to speed up the process and make organising the workshop easier.

The 6 stakeholder roles were:

- Inhabitant
- Owner-occupier
- Landlord
- Real Estate Group
- Municipality
- Urban Ecologist

### Structure

The workshop consisted of 3 rounds, starting with the participants introducing themselves and their role to the other participants.

In the second round, the participants went around the room to look at the patterns and place a green sticker on the patterns they found appealing and a red sticker on those they did not find appealing. Each participant was also provided one big green and one big red sticker to mark the patterns that were very (un)appealing.

In the third round, the patterns were discussed. The participants explained why they liked or disliked the pattern and worked together to make a selection of 5 patterns that they all agreed on.

### Adding Layers



**Description**  
By adding layers on top of existing buildings, more houses can be built in the city. This provides a solution for investors to generate **revenue** while addressing the housing shortage in urban areas.

Building Structure

Safety

Accessibility

Technical Details

The structure of the building needs to be strong enough to support extra floors. No additional safety measures are required as the new layers should be safe enough themselves. However, the layers need to be very accessible, as new inhabitants need to get there easily.

Participant Rating

Inhabitant

Owner-occupier

Landlord

Real Estate Group

Biodiversity

Municipality

Comments

Figure 114. Example of a pattern from Workshop 1

### Observations

The results of the workshop were rather surprising. Where I expected some clashes between stakeholders about patterns that were targeted at specific values, it went slightly different.

#### MISSING PART OF THE BALANCE

During the discussion, it became clear that rather than weighing out the values of the stakeholders against each other, the values were weighed against the risks and worries that came with the pattern.

The discussion was more oriented to argue whether a pattern was worth the risks, than what values were preferred over others.

#### **UNCLARITY IS PERCEIVED AS A RISK**

In the weighing, unclarity regarding the costs, safety or possibility of implementing the roof was perceived as a risk. If it was not clear whether a pattern was suitable or whether it actually has a significant contribution to a value, the pattern was put away. For example, if the participants were not convinced that a pattern really contributed to biodiversity, this was seen as a risk.

#### **CONTEXT SPECIFIC PREFERENCES**

Some patterns that suggested a more public solutions (like the lookout tower or the rooftop bar) were almost unanimously disliked as they did not fit the context of a residential building. This could indicate that a pre-selection based on the context could be made using context-sensitive data.

#### **ROLES DO NOT DETERMINE VALUE**

Perhaps the most significant observation is that the roles of the participants do not necessarily determine their values as strictly as though. Some roles were targeted towards society, but also took many values from user into account, or roles from enterprise were much engaged with the values of society.

This could indicate that, rather than a stakeholder-driven approach, a value-driven approach that lets stakeholders more freely decide what they want to see could work better.

#### **SYNERGIES ARE ENCOURAGED**

I was, as a moderator, often asked if the patterns could be combined. The participants actively searched for patterns that could be combined with each other and patterns that reflected their values very well were often swapped out for a pattern that was less fitting, but could easier be combined with other patterns.

Clarifying how and which patterns could be combined could help to come to conclusions.

#### **HIERARCHY**

An important finding was that the participants distinguished a clear hierarchy between the patterns. Some patterns (like the outdoor cinema) had much more impact than others (like the planters). This also meant it was hard to compare these patterns and make a decision between them. The participants suggested making a distinction between them and providing a method to work with this hierarchy.

#### **PRACTICAL IMPLICATIONS**

Practical aspects of the patterns were often very important in the discussion. Things like ownership, responsibility and maintenance in some cases determined whether a pattern was liked or disliked. For example, with solar panels, it was about who would get the energy and with the urban farm it was about who would have to tend to the plants and who would have right to the harvested crops.



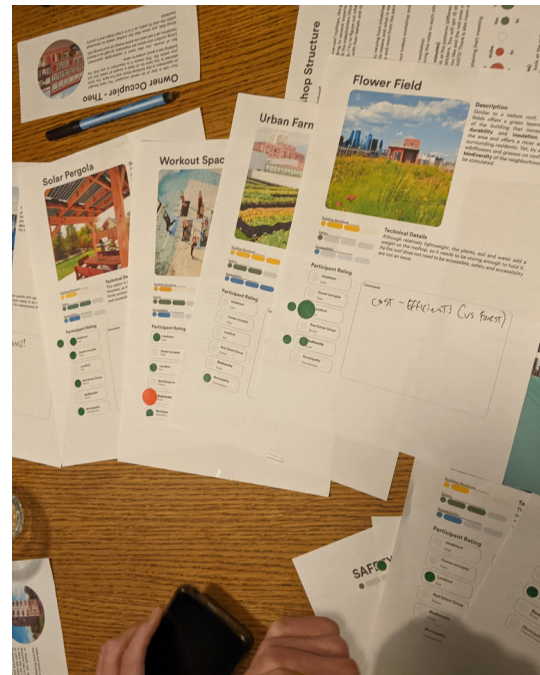


Figure 115. Photos of workshop 1

## Outcomes

The observations have are related to the goals in the following way:

*Get an impression of which patterns are generally liked and why.* These mostly included patterns that would fit the context of a residential rooftop. Other than that, no clear recurring observations could be linked to this.

*Find out whether the stakeholders ideas and beliefs are represented by the palette of patterns and the values.* The participants were open for many options and actively sought after combinations. This could be an indication that their ideas and beliefs were represented quite well by the provided set of patterns.

*Find out what information about the patterns is required to make a well-informed decision.* The implementation of the patterns, or at least suggestions for it, should be incorporated in them. Moreover, the patterns should indicate how they can be combined with each other. The suggestion was to create a hierarchy that supports different levels of patterns that can interact. As opposed to direct links between patterns, this hierarchy allows for a more different interactions.

## Critical Note

### PERSONAL ORIENTATIONS

One elements that should be highlighted is the similarities between the personal orientations of the participants. As they all had a slightly similar situation, age and background, the discussion started out with

a much more uniform vision. This could have influenced the discussion and might not give an accurate representation of reality.

### WILLINGNESS AND COSTS

As this was only a mock-up workshop and not organised with actual stakeholders of a building on a tight budget, the participants were very willing to do something with their rooftop and were progressively looking for solutions. This might not be the case in most situations.

### OBSERVATION AND VALIDATION

The use of observations as part of this exploratory workshop is very effective to quickly engage in a conversation regarding the patterns and explore new, interesting directions on the go. In the reflection with the participants, more new questions than answers to the set goals arose. Generally, it has helped me as a researcher to decompress from my project and talk it through with others, which has given me new insights and directions.

However, the use of observations and discussion as a method makes it hard to reproduce the workshop and its results. Although notes were taken, they do not convey the full message. This makes it difficult to validate whether the results relate back to a form of (theoretical) underpinning, and whether I as both the researcher and the observer was not biased myself in how these observations were interpreted.

## REFLECTION ON STAKEHOLDER DRIVEN APPROACH

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In the development of the strategy, the assumption was that conflicts between stakeholders are driven by conflicts in their innate values. However, the workshop pointed out that this might not be the case.

### Values vs Risk

In the workshop, participants were actively weighing out options against each other in which the overarching theme was Value versus Risk. The concept that Risk, often in the form of costs and worries, are an equally important part of the weighing process was not taken into consideration in the initial strategy.

This is also in line with the theory Nas (2021) provides, which states that in complementation to 'Strengthening the Benefits', 'Mitigating Resistance' forms an important aspect. By showing the value next to the projected risks, participants are enabled to make a valuation of the patterns. The difference between the stakeholders is not necessarily how they rank the values, but whether they outweigh the accompanied risks.

### Towards Value Driven

Secondly, the stakeholder driven approach is designed to also incorporate stakeholders who fit in multiple groups. Yet, even stakeholders that accurately fit in one group may have other values due to their personal beliefs and biases. For example, a landlord with a pure economic role in the process can value green and nature in the city higher than expected. A stakeholder-driven

strategy does not account for differences in values like these, which are disconnected from the role of the stakeholder.

Therefore, a value-driven approach would work much better. This could still encapsulate the motives generally found in the stakeholder roles, like economic or climate related, but also allows for a higher level of flexibility.

# Reflection on the Symposium

One of the main pivot points in the development of the strategy was the Digital Rooftops Symposium on the 15th of February 2023. The result and observation of this symposium changed the scope of the strategy. In this sub-chapter, the observations and changes will be discussed.

## OBSERVATIONS

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The symposium offer clear insights into the exact developments regarding the multifunctional rooftops programme. From this, there are three significant observations (Figure 116) that changed the scope of my project from a data-driven and stakeholder-oriented strategy, to a more user-friendly strategy.

### Retrofitting is Lagging

The symposium showed what already is being done with rooftops, but also where it is lagging. In fact, there was a clear communication that, when it comes to retrofitting, rooftops are far behind of the “curve” of Rogers’ Innovation Diffusion Theory” (1962/2003) in comparison to new projects and developments.

### Data Competency

The symposium showed different parties, ranging from governmental organisations, non-governmental organisations and businesses, who are already working with data in regards to rooftops. The message was that the expertise on data-driven rooftops and willingness was there, but an integral approach was missing. Moreover, it

showcased various sources of data, ranging from satellite image analysis to openly available GIS data.

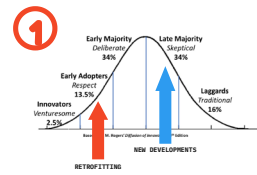
### Implementation

Despite the vast knowledge and applications of data, the implementation of it on a large scale rooftop programme was missing. This is also a field that no parties currently are specialised in (Figure 117). The next step should be to implement the data in a strategy that communicates, or ‘sells’ it to the stakeholders.



# Conclusions

Digital Rooftops Consultation  
15 Feb



We are indeed 'behind' the curve when it comes to retrofitting.

Marketing and 'mindset' (awareness/willingness) are important in this stage!

Retrofitting rooftops can be a step in the transition, but NOT THE END GOAL



Figure 116. Overview of observations

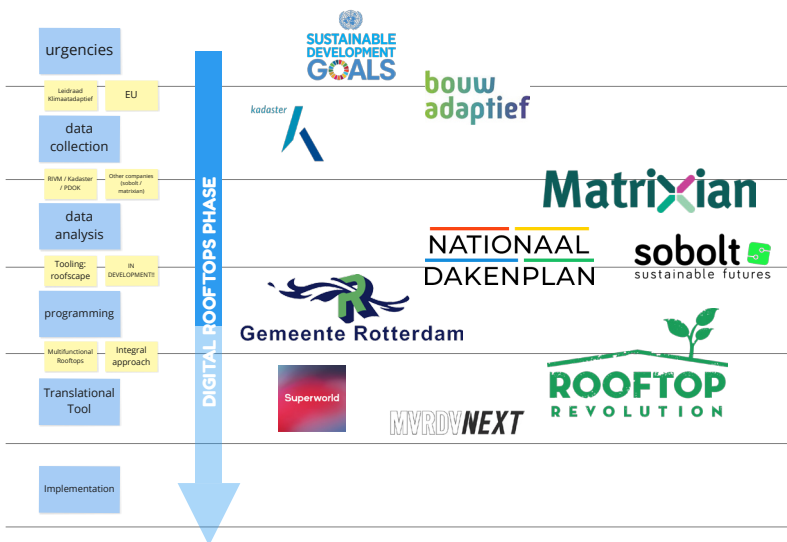


Figure 117. The role of different parties in 'Digital Rooftops'

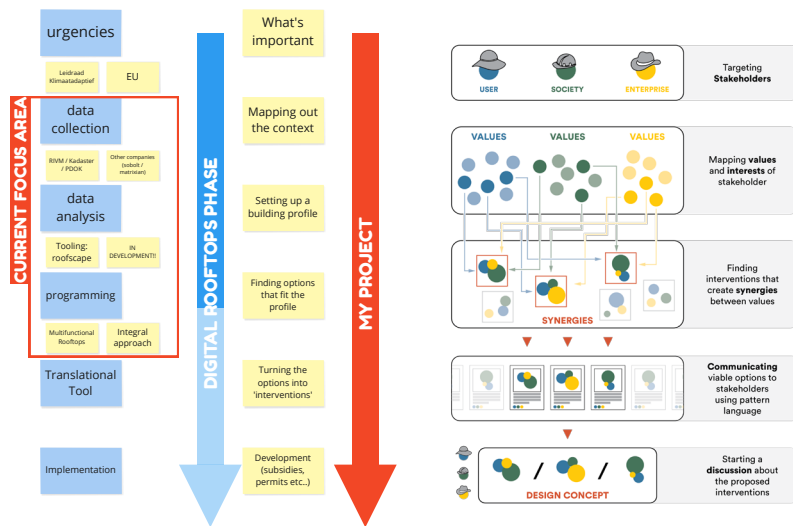


Figure 118. 'Digital Rooftops' in comparison to the stakeholder-driven strategy

## STRATEGIC SUGGESTIONS

From the observations made during the symposium, a series of suggestion on the strategy were made analyses. These three suggestions were the following:

### Repeat and Validate

The first approach is to look at the work that already has been done and try to repeat and validate their steps. This would be a critical reflection on existing work, including rethinking the multifunctional rooftops programme. The strategic focus would be on the contextualisation and finding synergies within this context (Figure 119). The goal would be to lay down a new foundation of the 'multifunctional rooftops' programme that is more suitable to be implemented.

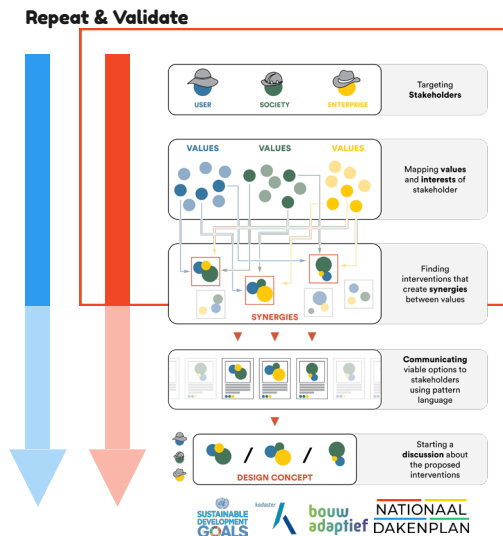


Figure 119. Strategic focus of Repeat and Validate

### R&D Reproduction

The second approach is to retrace and reproduce the steps taken and come to an alternative strategy that incorporates its implementation. The goal would be to provide an alternative solution that can be compared to the existing programme. This would require the project to go through the process as a quick iteration and reflect on it in comparison to the 'multifunctional rooftops' programme.

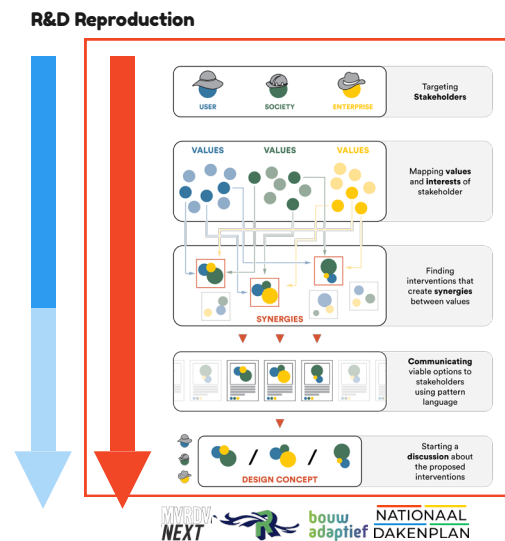


Figure 120. Strategic focus of R&D Reproduction

### Exploratory Implementation

The last approach is to further understand the current place the 'multifunctional rooftops' is in and work on a solution to implement it in practise. Although the implementation would be the focus of the

project, it would likely require a reflection on the multifunctional rooftops programme and probably revisions on their use.

### Exploratory Implementation

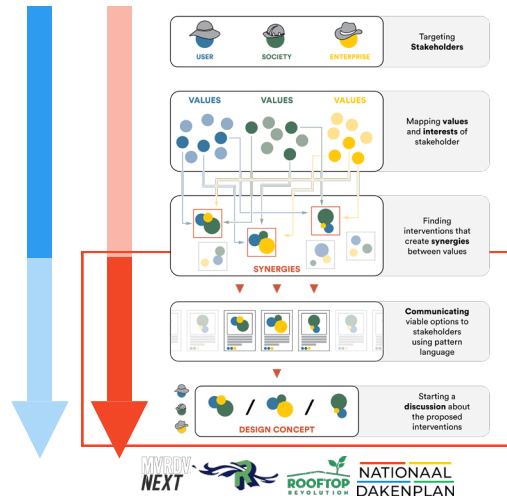


Figure 121. Strategic focus of Exploratory Implementation

### Chosen Strategy

Eventually, the suggestion “Exploratory Implementation” was chosen, as it offered the most promising contribution to the existing programme, as well as the best fit with my profile and background as a designer. However, a revision of the multifunctional rooftops was made nevertheless. This revision was made in order to create a foundation of the implementation strategy that would fit a communication strategy better. The multifunctional rooftops and associated colours held a level of abstraction that I, as a designer, did not see fit to function as the base of a communication strategy.



# Information Workshop

From the workshop in the stakeholder-driven approach, it became clear that an important part of assessing the patterns is the weighing of the value versus the risk. In order to test which information could be needed to make this assessment, a second workshop was organised. This was a smaller and quicker workshop.

## Setup

Similar to the first workshop (p.132), the participants were provided with a stack of patterns and asked to work together to make a selection. As the goal was to find out which information is required, the patterns were slightly changed compared to workshop 1. The patterns now only showed an image and a description, without the technical information.

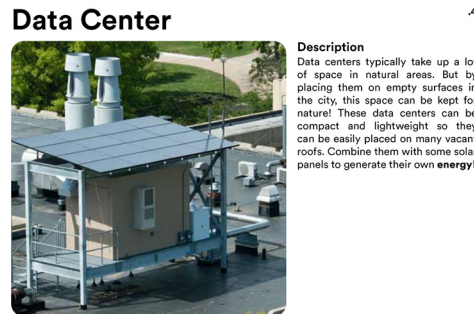


Figure 122. Example of a pattern from Workshop 2

Learning from our mistakes in workshop 1, an online questionnaire was prepared that the participants were asked to fill in after the workshop.

The 4 participants were all fellow urbanism students. As they all have (had) to work with multiple stakeholders, they can be expected to understand the motivation and beliefs of these stakeholders.

The participants were given 2 randomly assigned cards that show a value associated with one of the four categories from the stakeholder-driven approach. Another category in red was added to indicate potential risks. This was done to emphasise the risks that could come with a pattern and trigger the participants to request information about it.

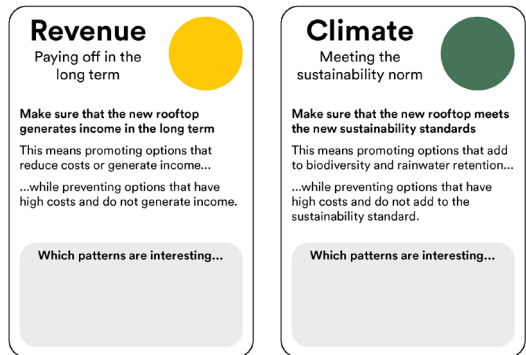


Figure 123. Examples of a value card from Workshop 2

## Structure

Similar to workshop 1, the workshop consisted of some rounds. This time, the process was more streamlined. In the first round, the participants were given two value cards and were introduced to the workshop.

In the second round, the participants were asked to quickly go through the patterns and put them on 1 of 4 piles:

- Yes: indicating patterns they would like to see.
- Maybe: indicating patterns that have some qualities, but might not be a good fit.
- Not on my roof: indicating the patterns that were good, but not good fitted for the participants
- No: indicating patterns that were not attractive at all.

In the third round, participants were asked to combine patterns and make a conceptual design, keeping the values from their card in mind. This time, the patterns could be discussed more elaborately.

After these rounds, the participants filled in the online questionnaire. These results can be found in Appendix F, p.368

## Goal

The goal of the workshop is to test which information is required to make an assessment of value versus risk.

This relates back to the latest strategy of Chapter 3. The workshop was oriented on figuring out how to align the values of the

stakeholders and which information was required to solve conflicts. The participants were presented with the patterns, but not with the associated values. Moreover, the discussion and result in the form of a design concept remain (Figure 113).

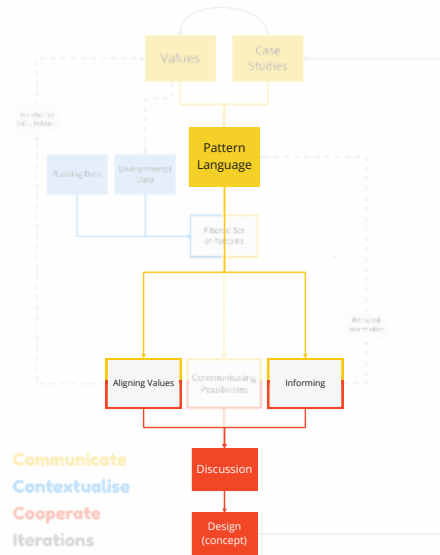


Figure 124. Goal of workshop 2 projected onto the strategic framework

## Observations

### COMBINATIONS CAN MAKE PATTERNS ATTRACTIVE

Some pattern were initially put on the 'no' pile, but were brought back in the discussion. The "Adding Layers" pattern was one of these. The pattern was brought back because it could be used to meet the economic value of the participants, while offering new space (and funds) for other options, such as the "Flower Field".

It shows how some patterns can become attractive because they work together well or free up the resources for other patterns.

### COSTS AS A THEME

Costs were playing an ongoing theme in the discussion. These include long term costs like maintenance, as well as short term costs, like investment and renovation. Especially the latter was a point of discussion as it was not always clear whether a renovation was necessary.

### CONTEXT

Multiple participants pointed out that it is difficult to design without the context of an actual roof. A context may provide better insights to the importance of some values and the projected costs of a pattern.

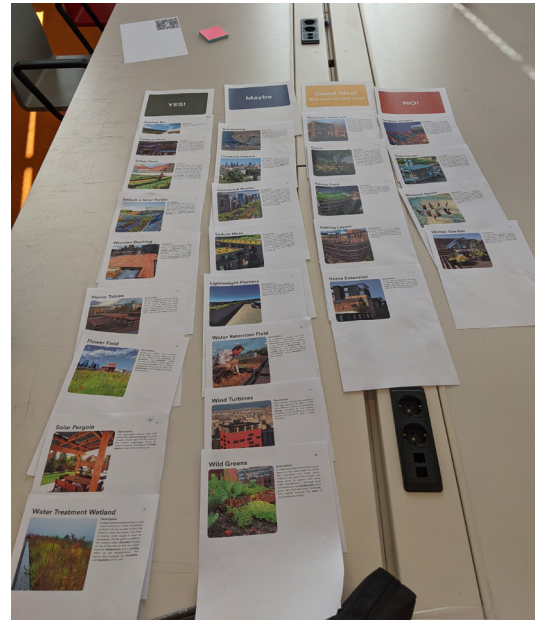


Figure 125. Pattern Preferences of Workshop 2

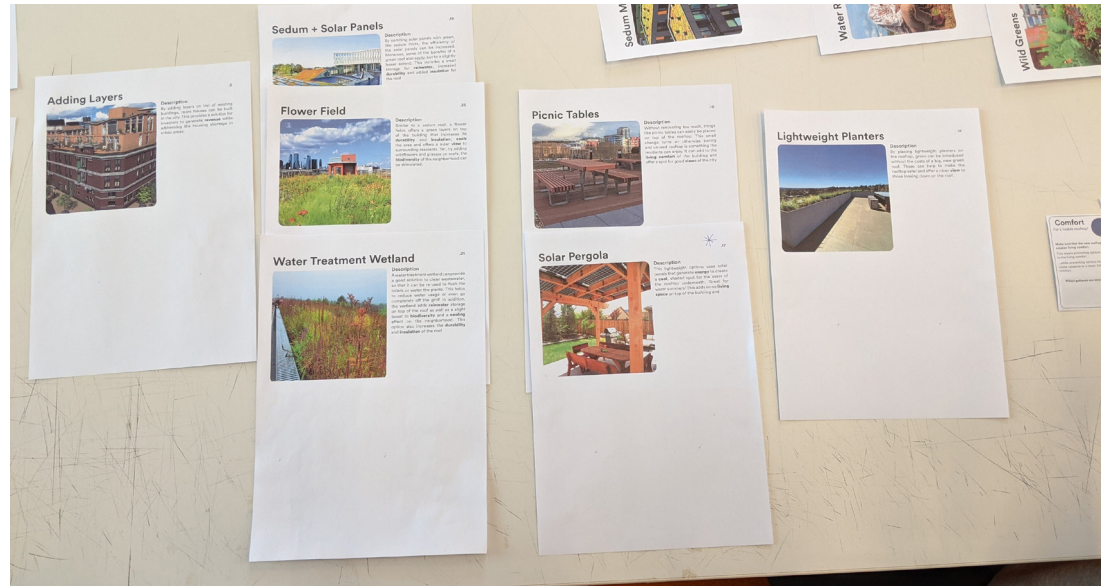


Figure 126. Design Concept of Workshop 2

## Critical Notes

### EXPERTISE

The observations say nothing about missing values and qualities on the patterns. The participants were all studying urbanism, which means they are all acquainted with certain interventions in cities and their consequences. This could be a reason why the discussion was a nuanced conversation about the underlying values (biodiversity, social interactions, etc.), despite this not being mentioned on the patterns themselves. This could explain why there was no need for the values to be shown.

### SPATIAL BIAS

The expertise of the participants in the spatial domain may have led to an increase in focus on the spatial conflicts at the expense of the conflicts in the underlying value. In other words, to test what information is required to mediate conflicts between values, a workshop with a different set of participants might be needed.

### LEAVING OUT CAN WORK COUNTERACTIVE

The workshop was set up to understand what information is missing to start a discussion, as opposed to what information is used. Although this is a time-saving method, it could have resulted in observations that were not accurately mapping out the required information. The term "ignorance is bliss" applies here: if the participants are not made aware of the underlying information and parameters, they might not miss this information as well.



# Pattern Creation

The patterns of the final strategy are created with a using several case studies. As the pattern language addresses not entire rooftop designs, but rather components that together create a design, the patterns are dissected components of the case studies. Throughout this process, the values associated with a rooftop were also identified. The following sub-chapter will explain the methods used and the results. The full document can be found in Appendix D, p.288.

## CASE ANALYSIS

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The case studies were analysed by looking at which components could be found. In some cases, this is very clear, but sometimes the components needs to be interpreted as design concepts, regardless of their difference in execution.

### Case Projects

The first 12 cases are taken from real-life projects. These include various projects by De Dakdokters. The cases were curated based on their multi-functionality and variety. This means cases that have multiple functions and elements were favoured over those who only had 1 or 2 functions, as they provided more different patterns. By curating a wide variety of contexts and implementations, a wider variety of patterns could be expected as well.

### Rooftop Catalogue

Beside the case projects, 28 designs from the Rooftop Catalogue (MVRDV, 2021) were chosen as well. These do not include all options, as they are filtered out based on a couple of points. The following filters were applied:

1. Expensive or too Futuristic  
(For example: Vertical park, p53; Sky car parking space, p.117)
2. Monofunctional and case specific  
(For example: Climbing Wall, p80; City stage/ event plaza p.99; Emergency rooftop, p.116)
3. Only relevant within a larger urban context  
(For example: Stadium, p85; Hyperloop station, p.118)
4. Very similar (conceptually) to other options  
(For example: Added layers on p.64; BMX & MTB track, p.82 & p.84)

5. The “WTF” category: options that are weird, treacherous or far-fetched.

(For example: Roller coaster, p.96; Super Hammock, p.97; Zeppelin Station, p.115)

### **Naming Convention**

Since many options offer a slight variation of how they are implemented, it was important not to end up with a list of 300 options with slightly different patterns. Therefore, the naming and labelling of these patterns was done with a naming convention. This was an iterative process that continuously cycled through the identified patterns and adjusted their names or split/merged them. This tedious process allowed for a more coherent set of patterns, but often needed to be interpreted.

For example, the “Palm House” (MVRDV, 2021, p.55) was interpreted as “Park” combined with a “Greenhouse”, although it has a different function than most of the greenhouses identified in the book.

A similar naming convention and method was applied to the values associated with the case studies.

## Dakpark

Rotterdam (2014)



### Found Patterns

- Park  
Programme
- Rooftop Bar  
Programme
- Allotment Garden  
Programme
- Playground  
Programme
- Grass Field  
Feature
- Fountain  
Feature
- Lookout Point  
Feature
- Herbs and Bushes  
Feature
- Picnic Table  
Detail
- BBQ Spot  
Detail

### Open Values

- Connection to Nature
- Ecological Habitats
- Outdoor Activity
- Public Function
- Profitable Space
- Cooling

### Technical Restrictions

- High Accessibility & Safety
- High Structural Capacity

Figure 127. Example of Case Study

## Programme Patterns

Pattern	Associated Values	in Cases	in Catalogue
Rooftop Bar	Public Function, Profitable Space	2	0
Allotment Garden	Food Production, Outdoor Activity, Connection to Nature	1	0
Playground	Outdoor Activity, Public Function	2	2
Urban Farm	Food Production, Outdoor Activity, Connection to Nature	1	5
Polderdak	Water Retention, Cooling	1	0
Rooftop Terrace	Domestic Space Expansion	2	3
Shared Garden	Public Function, Domestic Space Expansion, Connection to Nature	1	7
Added Building Layer	Profitable Space	1	9
Private Terrace	Domestic Space Expansion	1	0
Powernest	Renewable Energy Generation	1	1
Park	Public Function, Outdoor Activity, Connection to Nature	2	9
Private Garden	Domestic Space Expansion, Connection to Nature	1	6
Dunescape	Connection to Nature, Ecological Habitat, Native Ecosystem	1	0
Forest	Ecological Habitat, Cooling	0	4
Maze	Public Function, Water Retention	0	1
Grass Field	Cooling, Green Views	1	1
Livestock Pasture	Food Production, Connection to Nature	0	1
Housing Expansion	Domestic Space Expansion, Profitable Space	0	1
Outdoor Cinema	Public Function, Profitable Space	0	1
Parking	Profitable Space	0	2

Figure 128. Overview of found Programmes



## Feature Patterns

Pattern	Associated Values	in Cases	in Catalogue
Grass	Outdoor Activity, Cooling	1	0
Fountain	Outdoor Activity, Cooling	1	0
Lookout Point	Aesthetic Views, Public Function	1	2
Herbs and Bushes	Ecological Habitat, Native Ecosystem	5	3
Lounge Area	Domestic Space Expansion	3	0
Canopy	Cooling	2	1
Sedum Moss	Cooling, Insulation	2	0
Terrace	Domestic Space Expansion	2	0
Greenhouse	Cooling, Insulation	1	3
Pond	Cooling, Water Retention, Ecological Habitat	1	5
Pergola	Cooling	1	1
Wire & Ivy Pergola	Cooling, Connection to Nature	1	0
Swimming Pool	Cooling, Outdoor Activity	1	0
Shed		1	1
Flower Field	Ecological Habitat, Native Ecosystem	0	5
Helophite Filter	Water Treatment, Cooling, Water Retention	0	1
Aviary	Outdoor Activity	0	1
Dormer Expansion	Domestic Space Expansion	0	2
Domestic Unit	Domestic Space Expansion	0	5
Fitness Equipment	Outdoor Activity	0	1
Mural	Aesthetic Views	0	1
Billboard	Profitable Space	0	1
Wind Turbine	Renewable Energy Generation	0	1
Data Centre	Profitable Space Expansion	0	1
Energy Storage	Renewable Energy Storage	0	1

Figure 129. Overview of found Features

## Detail Patterns

Pattern	Associated Values	in Cases	in Catalogue
Beehive	Ecological Habitat	1	1
Picnic Tables	Domestic Space Expansion	2	3
BBQ Spot	Domestic Space Expansion	1	1
Planters	Connection to Nature	2	0
Sunbeds	Outdoor Activity	3	0
Potted Trees	Ecological Habitat, Cooling	2	0
Hedges		1	1
Solar Panel	Renewable Energy Generation	2	0
Tiled Terrace	Domestic Space Expansion	2	0
Insect Habitat	Ecological Habitats	1	0
Tiled Paths		1	0
Stepping Stones		1	0
Composter	Outdoor Activity, Food Production	1	0
Vegetable Planter	Outdoor Activity, Food Production	2	2
Trees	Ecological Habitat, Cooling	0	1
Solar Tree	Renewable Energy Generation, Cooling	0	1
Bird Nesting	Ecological Habitat	0	3
Wooden Decking		0	2
Climbing Ivy		0	1
Gravel Paths		0	2
Seating	Domestic Space Expansion	0	1
Falcon Nest	Ecological Habitat	0	1
Art Installation	Art & Culture	0	1
Laundry Rack	Domestic Space Expansion	0	1

Figure 130. Overview of found Details

## RESULTS AND OBSERVATIONS

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Apart from offering a large set of patterns from which the pattern language can be derived, there are two interesting observations. These consider the relation between the patterns.

### **New Hierarchy**

One observation is that a hierarchy between the patterns can be distinguished. This is in line with the observations of the workshop, where the participants noted a distinction between “big” and “small” patterns should be made to indicate potential synergies.

From the found patterns in these case studies a “can be applied to” style could be identified. So some patterns a standalone thing that you can put on a rooftop. They determine what kind of rooftop with what kind of functionality will be there. This type of pattern is named a “Programme”.

But other patterns identify something than can be applied to it. For example: you can place a pergola on a terrace or you can add a helophite filter to a meadow. This type of pattern is named a “Feature”.

Finally, a set of even “smaller” pattern is identified. These are the things that do not make a big impact on the function or programme of the roof, but rather on its feel and implementation. It can be a material application or an object that can be placed on the roof. This type of pattern is named a “Detail”.

### **Similarities and Themes**

Many patterns share similarities with each other. This is both within and between the different hierarchical divisions. For example: a beehive, a falcon nest and a flower field are essentially the same thing; an ecological habitat. Although they differ in size, application type and preferred circumstances (like how a falcon nest should be placed on high towers), their underlying values and reasoning is the same: contribute to an healthy, biodiverse ecosystem by offering a habitat for indigenous species.

This leads me to believe the patterns can be organised in a category matrix, with on one axis the different hierarchies that were identified (programme, feature and detail), and on the other axis the overlapping themes (like habitats, densification and sports).

These themes help not only to generate more coherent patterns, they can also assist the end user in revealing compatible patterns and their synergies.

## NEW PATTERNS

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From the case studies and the observations, a new pattern language is made. For the final patterns, a few adaptations are made. These changes make make the pattern more user-friendly or simplify terms. The full changelog is documented in Appendix D, p.288. The most important changes are:

- Limiting the amount of values a “Detail” and “Feature” pattern can have to two and three respectively. This was done to emphasise its main qualities and avoid overwhelming lists.
- Added the category “Accessibility”, to evoke a discussion regarding the public/private nature of the roof, as well as the practical implementation of accessibility.
- Simplified the names of values like “Domestic Space Expansion” to “Living Space”, which should help to formulate a more relatable quality and avoid complex terminology.





# Chapter 5

## Designing with Patterns



# Designing for Contextual Impact

The preceding chapters have demonstrated how patterns can be utilized to design intensive-use rooftops. Yet, the impact of these designs on the broader urban context remains unexplored. In this chapter, an area in Rotterdam is chosen as a case study on how to design various rooftops in a context, and what implications these designs have on its surroundings.

## Working Through the Scales

As the project progresses from addressing urban-scale challenges like climate adaptation to designing individual rooftops and stakeholder interactions, we arrive at a critical juncture – evaluating the effectiveness of these designs within a specific urban context

As visualised in Figure 131, this final step of design brings the research back to its largest scale: that of the urban context. The project started from the urgencies that arise on this urban context scale, such as climate adaptation, and worked its way to a smaller, human scale of individual rooftops and stakeholder compositions.

The next step is to find out whether the proposed rooftop strategy using the patterns is effective in dealing with these large-scale urgencies, by applying them to a hypothetical roofscape design. Or to rephrase this in a research question:

*Does the **translation** of the **rooftop strategy** to a **roofscape design** address the **urgencies** of the city in an effective manner?*

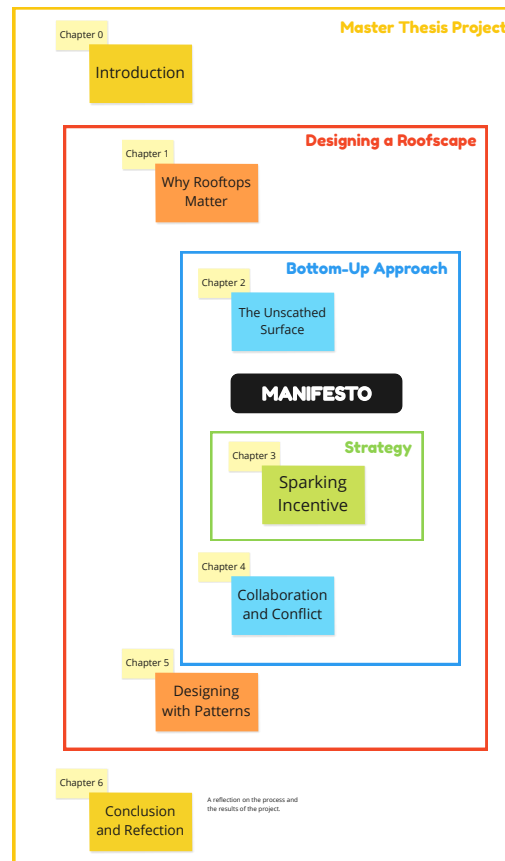
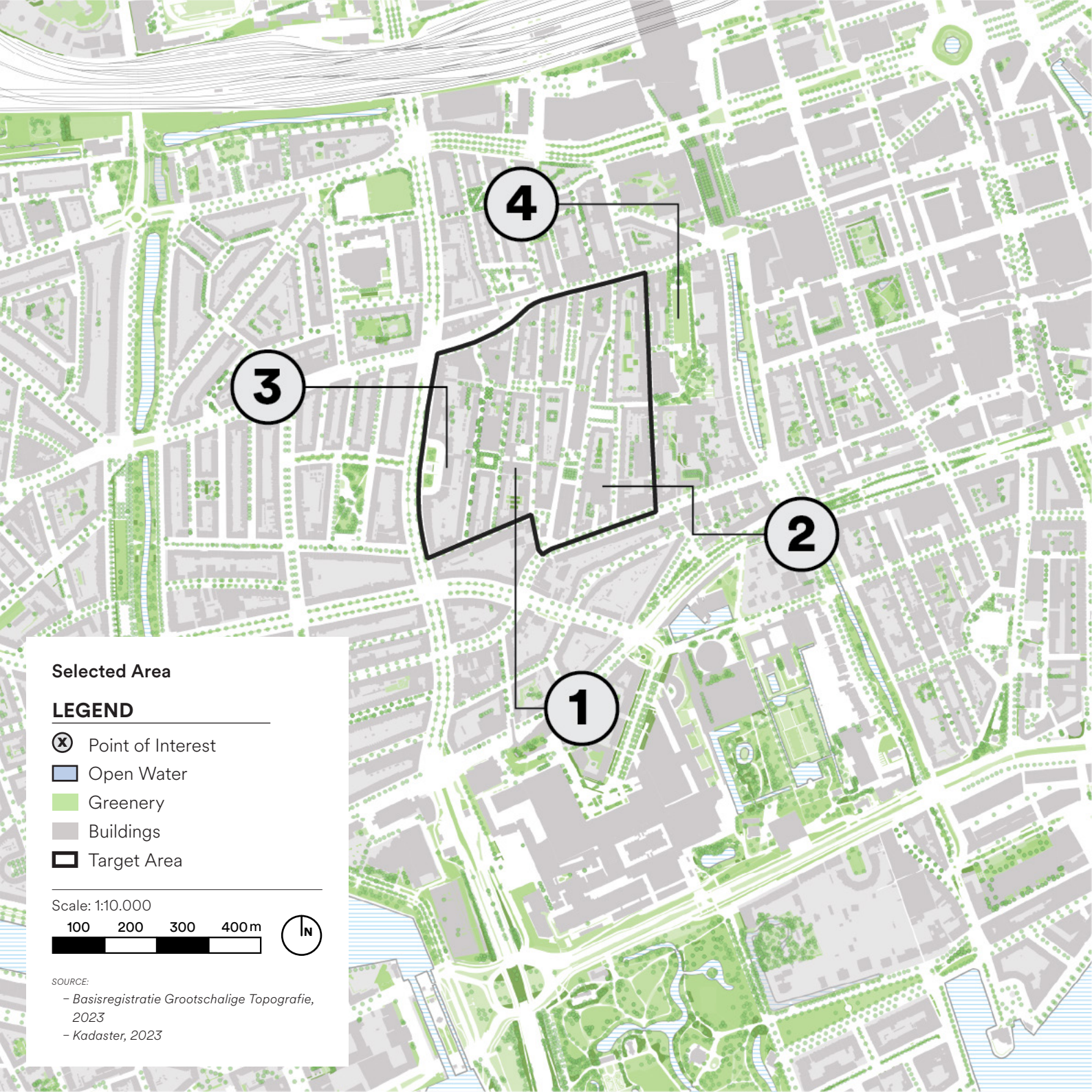


Figure 131. Stages of the report in terms of scale



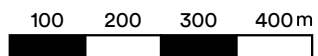


## Selected Area

### LEGEND

- ⊗ Point of Interest
- Open Water
- Greenery
- Buildings
- Target Area

Scale: 1:10.000



SOURCE:

- Basisregistratie Grootchalige Topografie, 2023
- Kadaster, 2023



## HET NIEUWE WESTEN

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The selected area is part of the neighbourhood 'het Nieuwe Westen', which lies west of the city centre. The neighbourhood has mostly residential functions and is flanked by a number of busy main streets that form an important axis in the urban structure (Figure 142). Although it is situated in this urban buzz, the area itself feels more quiet.

A reason to pick this area is partly due to the high concentration of flat-roofed buildings with similar typologies and heights, as can be seen clearly in the aerial image.

There are several squares and green spaces, but they are relatively small and lack dense patches of greenery. The area, much like the rest of the city, is mostly car oriented, but is very walkable.

Finally, the area is a cultural melting pot, where people from different backgrounds intersect and interact.



Figure 132. Aerial Image of Het Nieuwe Westen (Google Maps, 2023)

## Points of Interest

Looking at the area, several Points of Interest arise. These are locations that typify the neighbourhood and function as important locations in the social fabric.

### 1. SCHOOL

In the middle of the selected area is a primary school called KC Het Oude Westen. It is one of many primary schools in the area and was chosen in the report as a case study on ownership structures (Subchapter "Stakeholders in Undeveloped Roofs" on p.76).



Figure 133. KC Het Oude Westen

### 2. CINEMA KINO

KINO is a cultural hub in which cinema, theatre and musical performances come together. It is situated in a historical building and the venue is quite well known throughout the city.



Figure 134. KINO

### 3. NEW GROUNDS

New Grounds is a music and cultural venue located in a former school building, which is a historical landmark in Rotterdam. Several musical genres like Jazz, Techno and Hip Hop can be heard playing here.



Figure 135. Old school building that houses New Grounds



#### 4. COMMUNITY PARK

The community park called 'Wijkpark het Oude Westen', is a green area that was realised in 1987 as a neighbourhood initiative. It offers a quiet green space with many birds and urban nature in the heart of the city. In recent years, the park has garnered attention due to an increase in issues related to crime. There has been a notable presence of individuals struggling with substance abuse and exhibiting behaviours that indicate distress and instability. In fact, the park has been closed due to a violent incident involving a volunteer (Klapmuts, 2023).



Figure 136. Wijkpark Het Oude Westen (Open Rotterdam, 2023)

#### **Place in the city**

For a more comprehensive understanding of the area and its role within the city, the focus should be placed on the significant streets that encircle it. These major urban arteries are utilized as crucial conduits for

a range of city functions, encompassing shopping, nightlife, and essential infrastructure.

#### 'S-GRAVENDIJKWAL

's-Gravendijkwal is a notable infrastructural artery for motor traffic located in Rotterdam, Netherlands. It is lined with a variety of architectural styles, including well-preserved buildings that reflect the city's heritage. Additionally, 's-Gravendijkwal connects to other key routes, contributing to the overall transportation network of Rotterdam.



Figure 137. 's-Gravendijkwal (Rotterdam Wonen, n.d.)

#### 1E MIDDELANDSTRAAT / WEST-KRUISKADE

West-kruiskade and 1e Middelandstraat are a series of streets that form an important historical and cultural axis in the inner city. Due to the large amount of foreign shops and services (especially Asian), the area is often referred to as the Chinatown of Rotterdam.



At the eastern end of West-Kruiskade, Kruisplein can be found. This is a large square in front of the central train station, Rotterdam Centraal.



Figure 138. West-Kruiskade (van den Akker, n.d.)



Figure 139. Kruisplein with a view on Rotterdam Centraal (Flatspot Magazine, n.d.)

#### WESTERSINGEL

The Westersingel is a tradition singel, a historical water infrastructure with soft borders, that runs through the inner city.

It is flanked by trees and green space, and serves as a recreational space during warm days.

In the modern city, it forms a cultural axis, with several art installations on the long walking route along the water.



Figure 140. Westersingel (Tak, 2017)

#### NIEUWE BINNENWEG

Nieuwe Binnenweg, situated in the heart of Rotterdam, is a prominent street known for its diverse range of establishments. This bustling avenue features a wide array of shops, eateries, and cultural venues. Architecturally, it presents a mix of historic and contemporary buildings, offering a visual contrast along its length. Nieuwe Binnenweg is a popular destination for both locals and tourists, offering opportunities for shopping, dining, and cultural exploration.

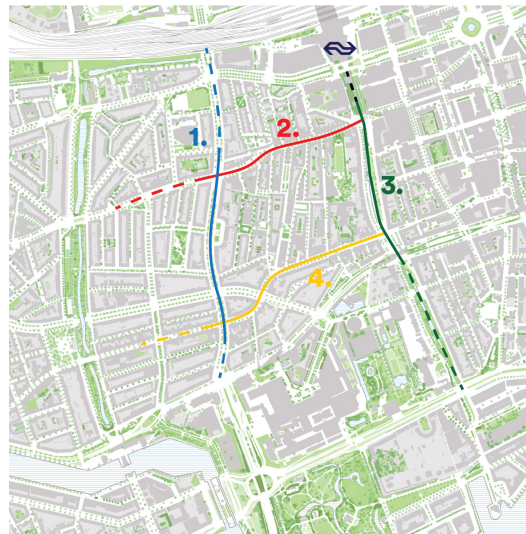


Figure 141. Nieuwe Binnenweg (Blankestijn, n.d.)

Figure 142. **Important Structural Lines**

### LEGEND

1. 's-Gravendijkwal
2. 1e Middelandsstraat / West-Kruiskade
3. Westersingel
4. Nieuwe Binnenweg
- 🚉 Train Station



# Neighbourhood Analysis

Before designing the roofscape of the selected area, a strong understanding of the neighbourhood, as well as the people within should be established. Therefore, the design process is kicked off by an analysis of the context, considering the demographics, climate and liveability.

For these analyses, several methods are used. Firstly, maps generated with GIS data are taken to address the facets of the analysis that are both factual and spatial. Secondly, demographic data is collected and interpreted to establish an understanding of the social composition of the neighbourhood.\* Finally, empirical research is utilised for elements that are harder to measure, such as quality of urban spaces and everyday social interactions.

Rather than using the values described in the patterns (as detailed in subchapter “Values” on p.107), the conclusions of the analysis are drawn independently, without these values in mind. This approach serves as a valuable method for validating the relevance of the values within the context of the neighbourhood analysis. By comparing the analysis findings with the predefined values, we can determine the extent to which these values align with the actual characteristics and needs of the neighbourhood.

## CLIMATE

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In the context of the neighbourhood analysis, climate considerations encompass both adaptation and mitigation strategies. Understanding the neighbourhood’s vulnerability to climate change impacts and opportunities to combat this is essential to create a design that fits the vision of sustainability.

### Heat Stress and Cooling

One large climate-related issue in most Dutch cities is the Urban Heat Island Effect (UHI Effect). Especially in areas with little to no green areas and vegetation, temperatures can rise and the thermal masses of the cities building materials absorb and hold the heat of the day.

Typically, green areas like parks and open water can create cooler spots in the city and mitigate the UHI effect locally, but their

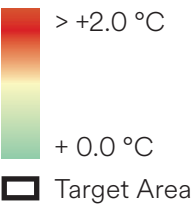
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\* Due to the availability of data on different levels, in some cases the area ‘Rotterdam Centrum’, instead of ‘Het Nieuwe Westen’ is chosen. This is the larger district in which the chosen area lies.

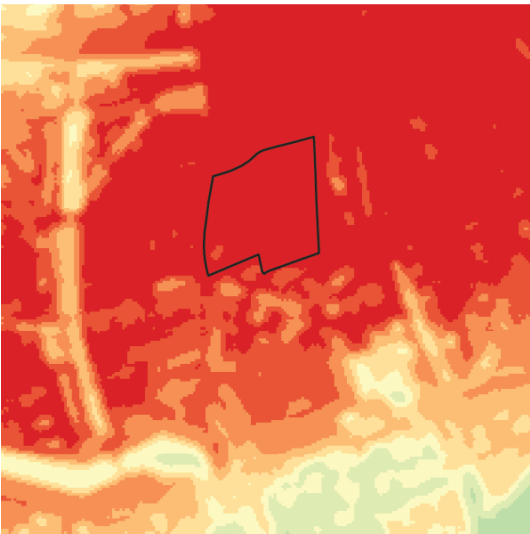
effects on a larger scale are limited. The map in Figure 145 shows the UHI Effect in Rotterdam around the selected area.

Figure 143. **Urban Heat Island Effect**

**LEGEND**



SOURCE: *Atlas Natuurlijk Kapitaal*, 2017



Although some cooling can be seen in the south, near the park and the river, the UHI effect causes a rise in temperature throughout the rest of the city. The small parks and singels in the city offer some cooler spots to escape the heat, but their effects are limited.

Within the borders of the selected area, there are several cool, shaded places with trees and vegetation to provide shelter from the warmth, but they are small and offer only a very local cooling effect.



Figure 144. Shaded park on a hot day



Figure 145. Shaded Areas and Cooling

### LEGEND

 Cool areas



### Flooding and Infiltration

The second point that should be evaluated in regards to climate adaptation is Pluvial Flooding. As a result of heavy rainfall, parts of the city may flood, causing damage to buildings and infrastructure. There are several days to deal with excess stormwater:

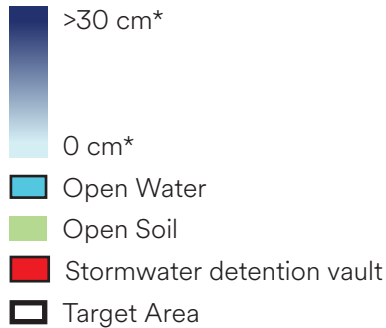
- Draining through the sewage system. This is effective method, but can cause congestion during heavy rainfall.
- (Soil) infiltration, in which the water trickles into the soil and is stored in the groundwater. Plants can later access this water through their roots. However, the soil can become saturated.
- Water detention, which are natural or artificial buffer systems that can hold a lot of water and release it later into the soil or sewage system.

Hence, to understand the effects and combat strategies of pluvial flooding, factors should be looked at. First of all, the locations where water accumulates most, often being low-lying locations or without proper sewage/infiltration. Second, location with open soil or water, where the water can infiltrate and be retained. Third, places that can detain and release water, such as stormwater detention vaults.

The map shows that the area, much like the rest of the city, suffers a lot from pluvial flooding. However, the target area does not have a lot of open-soil, or water, nor detention vaults in its proximity. The park to the east of the area has some open soil, but suffers a lot from pluvial flooding itself.

Figure 146. **Pluvial Flooding**

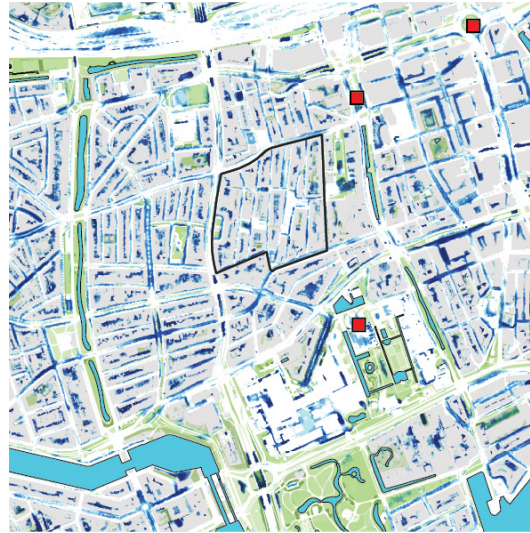
### LEGEND



\*Water depth after 2 hours of 70mm rain

SOURCE:

- Deltares & ROR, 2018
- Basisregistratie Grootschalige Topografie, 2023



### Green and Biodiversity

Observations regarding green spaces and biodiversity in the neighbourhood reveal some interesting insights. Within the neighbourhood itself, there are numerous small green patches, providing residents with pleasant areas to relax. However, most of these patches lack a high diversity and density of plants and will thus not function as effective natural habitats. This suggests that while there are green spaces for leisure, they may not be contributing significantly to local biodiversity.

Additionally, these patches are not interconnected, limiting opportunities for wildlife movement and plant propagation. The majority of open spaces within the neighbourhood are covered with tiles,

often surrounding trees. While these spaces may offer aesthetic value, they contribute minimally to supporting diverse flora and fauna. Furthermore, there is a noticeable absence of nests and bird activity, although this observation might be somewhat subjective.



Figure 147. Lush green pocket park

In contrast, the surrounding areas of the neighbourhood display a more robust presence of greenery and biodiversity. Notably, the park to the east of the neighbourhood stands out for its lush green cover, providing a significant habitat for various species. Furthermore, the presence of a green-blue corridor along the Westersingel brings an assortment of bird species like herons, geese, and coots,

further enhancing the biodiversity in the vicinity. These observations suggest that while the area may have some green spaces for relaxation, the neighbourhood benefits from the more substantial green areas and corridors in its surrounding environment, contributing positively to biodiversity and the overall ecological balance.

Figure 148. **Green Areas and Natural Habitats**

**LEGEND**

- Green-Blue Corridors
- Green Corridors
- Natural Habitats
- Suggested Interventions

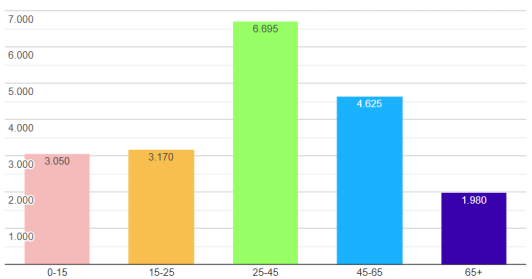
SOURCE: *Basisregistratie Grootschalige Topografie, 2023*



# DEMOGRAPHIC PROFILE

When looking at the demographic profile of the area, it becomes evident that there is a fairly average distribution of ages, migration backgrounds, education- and income levels (Allecijfers, 2023; Onderzoek010, 2023). People from all different layers of society can be found in the area, making it an interesting mix of cultures and personalities.

## Inwoners naar leeftijd in de buurt Nieuwe Westen



Bevolking, leeftijdsgroepen: aantal inwoners op 1 januari 2022 per leeftijdsgroep.

Figure 149. Age Distribution (Allecijfers, 2023)

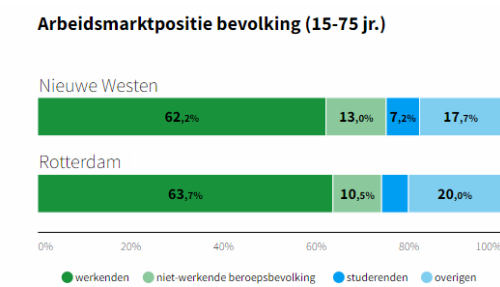


Figure 150. Distribution of Employment compared with Rotterdam (Onderzoek010, 2023)

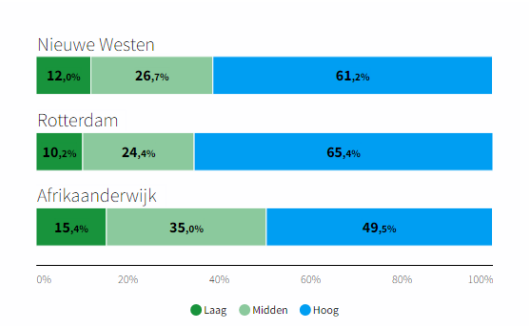


Figure 151. Distribution of Income Levels compared with Rotterdam and Afrikaanderwijk (Onderzoek010, 2023)

## Family structures

In the area, most households are single-person, and the amount of families (single-parent or dual-parent) are limited. They do however reflect the distribution found throughout the city.

### Huishoudens naar samenstelling

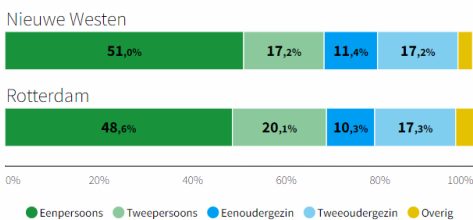


Figure 152. Distribution of Household Types compared with Rotterdam (Onderzoek010, 2023)

In addition, most of these households are renting from social housing corporations, and a smaller part rents from a private investor or landlord. Only a small portion (24,5%) is owner-occupier.



Woningvoorraad naar bezit

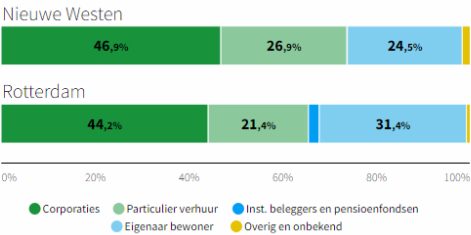


Figure 153. Distribution of Home Ownership compared with Rotterdam (Onderzoek010, 2023)

Ethnicities

Zooming in on the ethnicities found in the area, it becomes clear that there is a wide range of ethnic backgrounds in the area. Moreover, the share of the non-Dutch ethnicities is fairly equal, especially compared to neighbourhoods like Afrikaanderwijk, in which Turkish background are the dominant non-Dutch ethnicity.

Something to keep in mind with this observation is that neighbourhoods with a high demographic diversity can have a positive impact on social cohesion, if they have positive interactions between them. However, this also means that the environment should facilitate these positive interactions to achieve the desired results (McKenna et al., 2018). In fact, according to Wessel et al. (2018), lack of social interaction between ethnicities might even lead to segregation.

Health and Well-being

Looking at the numbers, it becomes clear that the majority of people in the area are in good health, but there is also a significant part that experiences some form of disability due to health related issues. Moreover, over 50% of the people meet the guidelines for sports and activity, and exercise weekly.

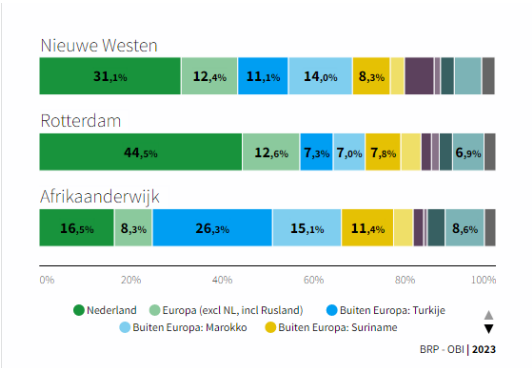


Figure 154. Distribution of Ethnicities compared with Rotterdam and Afrikaanderwijk (Onderzoek010, 2023)

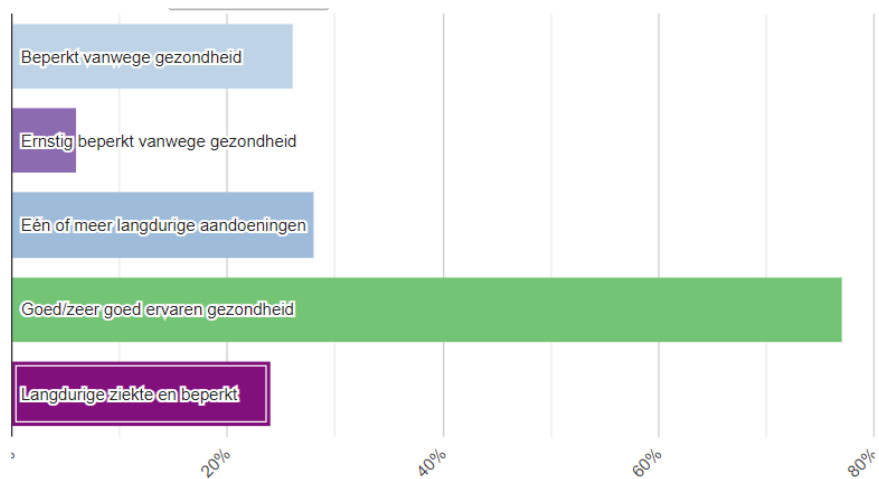


Figure 155. Physical Health (Allecijfers, 2023)

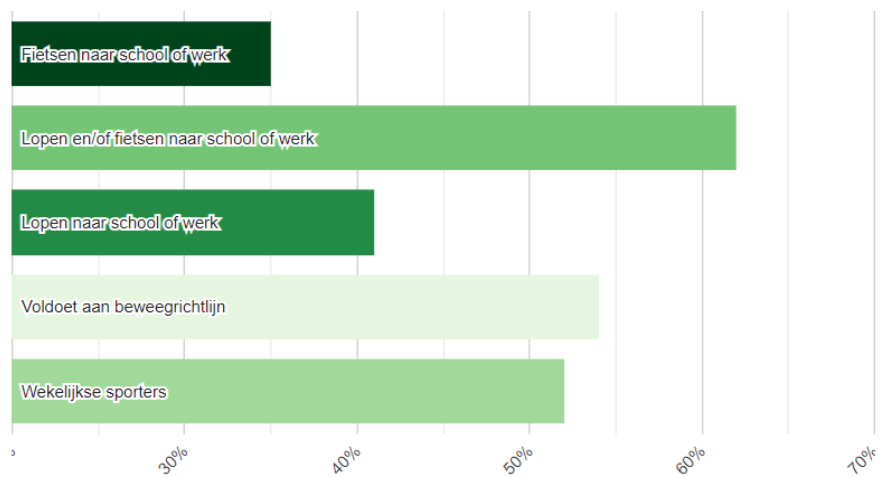


Figure 156. Physical Health (Allecijfers, 2023)

Furthermore, the risk for anxieties and depressions are significantly higher compared to the rest of the Netherlands, and residents experience higher levels of loneliness in this area (Allecijfers, 2023).

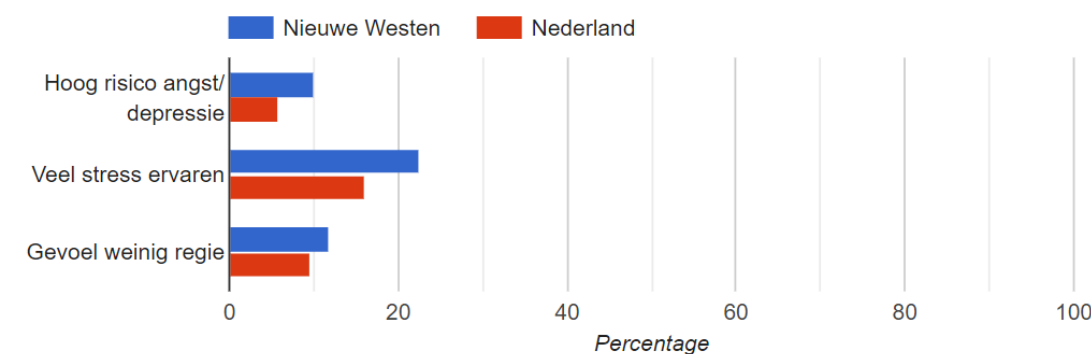


Figure 157. Mental Wellbeing (Allecijfers, 2023)

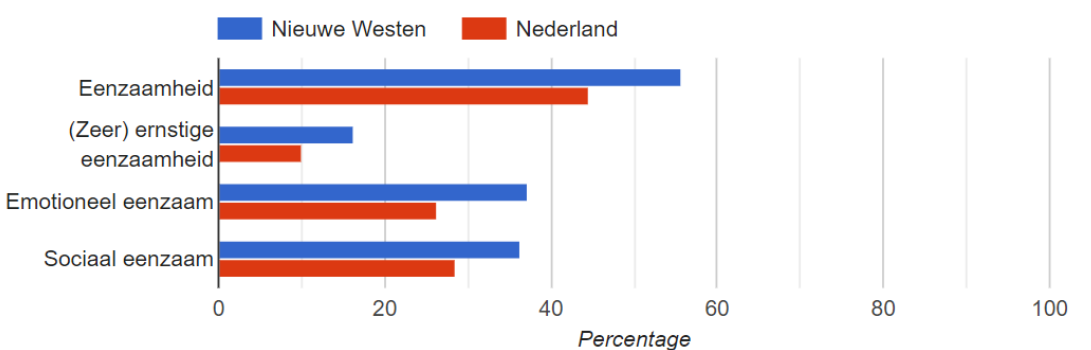


Figure 158. Loneliness (Allecijfers, 2023)

## LIVEABILITY

In order to get an understanding of the liveability of the neighbourhood, two distinct methods are chosen. The first method focusses on the interpretation of the available data to get a basic understanding of the existing, measurable qualities in the area. But the more subjective qualities of the urban spaces and their role in the liveability of the neighbourhood depends on factors that are not that measurable and thus, hard to identify using maps and data. Therefore, empirical research is chosen as the second method, as it enables a more accurate, yet subjective interpretation of these qualities. The conditions however, are important.

### Conditions and Route

The empirical research was conducted in the form of a field trip on a warm Tuesday afternoon (22 - 30 °C), between 11:00 and 13:30. The weather conditions of the field trip offered the perfect circumstances to observe outdoor life. Moreover, the chosen day was a regular schoolday and the school breaks were in this period.



Figure 159. Route taken during the research

### Domesticated Area

The report describes 'domesticated areas' as an important factor of liveable urban environments. This means as much as how well the urban spaces can be included and used in the everyday life of the neighbours. In the field trip, signs of domestication were investigated.

One observation is that there are many small squares that are used in different ways. Some were designed for children to play, whereas others had a higher density of greenery or were used by elderly to meet outside.

The variety of squares and (potential) activities surprised me. Each urban space has its own identity and can serve different



purposes. Moreover, the spaces were used quite well, although observations may be influenced by the weather.



Figure 160. Sports field used by children



Figure 161. Elderly meeting in a shaded spot



Figure 162. Two workers having lunch in the shade



Figure 163. Tiled urban square with some trees, which was very warm

### Hybrid Spaces for Social Interaction

In addition to the open spaces in the area, there are other private and semi-private spaces that form the identity of the neighbourhood and create hybrid spaces for social interaction. Many building blocks encompass a closed or partially closed (semi-)private courtyard, often with gardens, greenery and playgrounds.



Figure 164. Semi-private courtyard

However, the connection of these spaces and buildings to the public space is limited. Most blocks are closed off or gated, including the elevated streets that are found in some areas.



Figure 165. Private entry to elevated street

Moreover, there are only a small amount of spaces that create a transition between public and private, such as front gardens and woonerf streets. In addition, the transitions between building and street is sometimes very harsh, lacking intermediate spaces like broad sidewalks with a line of trees or shrubs.





Figure 166. Narrow front garden with strong identity



Figure 168. Broad sidewalk with trees as a hybrid zone



Figure 167. Harsh transition between building and street

## Amenities

Different amenities can be found in and around the area. First and foremost, Nieuwe Binnenweg and West-Kruiskade/1e Middelandsstraat (as seen in Figure 142 on p.164) are big streets for shopping and nightlife. These also include many different shops for groceries. They attract a lot of people in the evenings, which can cause some nuisance.



Figure 169. Café on Nieuwe Binnenweg

Moreover, there is a large amount of healthcare facilities in the neighbourhood, reducing travel times as well as three primary schools.

Knowing that the area has people from all ages and walks of life, it offers a wide variety of amenities that support these various demographic groups.

Figure 170. **Urban Functions in Buildings**

### LEGEND

- Shops & Nightlife
- Schools
- Healthcare Facilities





## **Schools, Children and Playing**

The presence of three schools within the neighbourhood breathes life into the community, especially during the daytime when many children engage in outdoor activities. These schools play a significant role in connecting the neighbourhood with the local community. Publicly accessible play areas that intersect with squares and streets provide opportunities for positive interactions between residents and schoolchildren. For instance, it's not uncommon to witness spontaneous acts of kindness, like a passerby returning a stray ball to a group of kids. However, it's important to note that the the high energy

levels of children at play can sometimes lead to noise, which may cause occasional disturbances.

In addition to the schools, the neighbourhood boasts numerous child-friendly features, including several playgrounds and play areas. While there is some vehicular traffic in the area, it is not excessive, and the relatively low speeds make it a safe environment for children. These factors collectively contribute to an environment where children can thrive and residents can enjoy the benefits of a close-knit, family-friendly neighbourhood.



Figure 171. Children playing in one of the squares

## Placemaking and Atmosphere

The area stands out for its significant presence of street art and poetry, contributing to its distinctive character. These artistic expressions, including murals, printed plates, and sidewalk paintings, add to the visual diversity of the area.

It also incorporates placemaking through shared spaces and community hubs. For instance, you'll find shared garden planters outside residential blocks, encouraging communal engagement. Furthermore, the area hosts various cultural and community centres, such as KINO, New Grounds, a community centre, a mosque, a public reading room/library, and several art galleries.

Overall, the area offers a pleasant atmosphere with residents often seen outdoors, engaging in various activities. This, combined with the presence of art and community spaces, contributes to a lively and appealing environment, despite variations in architectural aesthetics.



Figure 172. Neighbourhood garden planters



Figure 173. Contemporary street art made by the community

Figure 174. **Signs of Placemaking**

### LEGEND

- Cultural/Community Hubs
- Street Art

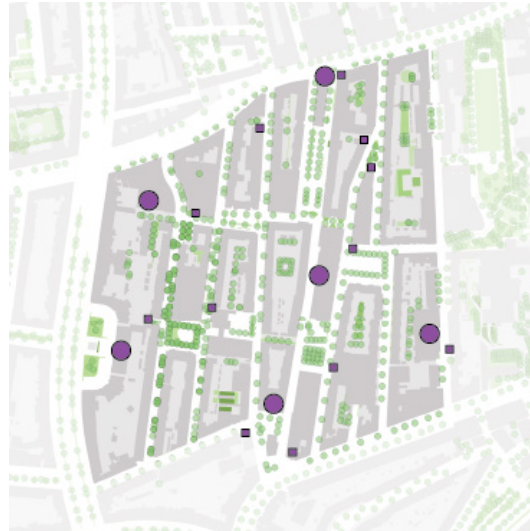


Figure 175. Street poetry on Nieuwe Binnenweg





Figure 176. Collage of Street Art in Het Nieuwe Westen



# CONCLUSIONS

The comprehensive analysis of the selected neighbourhood provides valuable insights into its characteristics, needs, and potential rooftop developments. The findings expose several strengths and weaknesses of the neighbourhood in its current state. These are then related to the values of the pattern strategy as described in the subchapter “Values” on p.107.

## Weaknesses

Firstly, the weaknesses should be discussed. These target some of the urgencies that are found in the area.

### HEAT STRESS

Much like the rest of the city, the area suffers from a high level of heat stress, mostly due to the lack of open soil, water and vegetation.

*Associated values:*

cooling shelter

### PLUVIAL FLOODING

Similarly to heat stress, a major concern in the department of climate adaptation is pluvial flooding. Several areas in the neighbourhood suffer a lot from flooding and parks or singels (open soil and water) close by seem unable to handle the excess rainwater.

*Associated values:*

rain harvesting stormwater retention

### LIMITED GREEN HABITATS

While there are some small green patches in the neighbourhood, they often lack diversity and density of plants and do not effectively support local biodiversity. The lack of interconnected green spaces limits wildlife movement and propagation.

*Associated values:*

outdooring native ecology urban nature

### LONELINESS AND ANXIETY

The data reveals a significant prevalence of loneliness and anxiety-related issues within the area. While the root causes for this phenomenon can be multifaceted, it's evident that there exists a correlation between mental well-being and factors like social interactions and access to urban green spaces. The scarcity of these interactions and green areas may contribute to this observation.

*Associated values:*

outdooring social space urban nature

### HYBRID ZONES

The connection between private and public spaces is limited, with most blocks being closed off or gated. The transitions between buildings and streets can be harsh, lacking intermediate spaces for community engagement. Moreover,

these barriers cause some streets to lack attractive qualities and function merely as infrastructural space.

*Associated values:*

social space

attractivity

#### NUISANCE

The coexistence of vibrant nightlife and motor traffic along the area's edges presents a complex urban challenge. The allure of urban energy must be balanced with the need for peaceful residential spaces. Similarly, the sounds of children playing highlight a family-friendly atmosphere but can occasionally disrupt the tranquillity.

*Associated values:*

living space

shelter

attractivity

#### **Strengths**

Secondly, the strengths found in the analysis should be highlighted. These are qualities in the area that should be reinforced, and can be used to combat some of the urgencies.

#### DIVERSITY

The neighbourhood boasts a fairly diverse population in terms of ages, migration backgrounds, education, and income levels. This diversity can contribute to the overall social cohesion and integration of cultures, *if* the area facilitates positive social interactions.

*Associated values:*

social space

co-responsibility

#### AMENITIES AND SERVICES

The area has a large variety of available amenities and services, including schools, shops, nightlife and healthcare. These amenities cater to the needs of residents of all ages and backgrounds, while providing a healthy economic environment. Moreover, there is a strong connection between these amenities and the social fabric of the area.

*Associated values:*

social space

attractivity

profitable space

#### CHILD-FRIENDLY

With the presence of three schools and numerous child-friendly features like playgrounds, the neighbourhood is conducive to the well-being of children. There are opportunities for positive interactions between residents and schoolchildren. Moreover, the various playground offer a space for children to play and exercise.

*Associated values:*

exercise

social space

#### CULTURAL VIBRANCY

The area stands out for its significant presence of street art, poetry, and cultural community hubs. This artistic vibrancy adds to the character of the neighbourhood.

*Associated values:*

outdooring

social space

attractivity

# Building Analysis

In addition to the analysis of the neighbourhood and its context, the building within the neighbourhood are taken into consideration as well. Two distinct approaches are chosen for this. To start, the physical building properties, such as the available rooftop surface and the typology are analysed. This is done to sketch a clear image of what type of building are in the area, in what state the buildings are, and what sort of rooftops they could have.

After this, the configuration of the building is analysed. The goal of this approach is to understand not only what could be physically possible on a rooftop, but also what type of stakeholders are involved in the different buildings what type rooftop functions would suit their ideas and needs.

Finally, the building types are categorised into 'types' that represent their properties and design opportunities. In the remainder of this chapter, one design for each of these types is made.

## BUILDING PROPERTIES

---

The analysis turns to the physical attributes of the neighbourhood, including building typologies, age, foundation types, and rooftop possibilities. These elements are pivotal in understanding the neighbourhood's architectural composition and its potential for rooftop development.

### Architectural Landscape

The neighbourhood presents a diverse architectural landscape that encapsulates various periods of urban development. One noticeable feature is the mixture of building ages and typologies. Most of the structures in this area were constructed before the year 2000, reflecting the historical evolution of the neighbourhood. The buildings flanking the main streets, particularly those predating 1940, hold

significant historical value and contribute to the city's architectural heritage. These older buildings not only serve as historical landmarks but also enrich the urban character.

Interestingly, there is a difference in building size and plot dimensions between older and newer structures. The older buildings tend to be narrower and are often associated with a more varying, historical urban fabric. In contrast, the more recent constructions, predominantly found on larger blocks and plots, introduce a modern and spacious architectural typology to the neighbourhood. However, it's noteworthy that there's a noticeable gap in the architectural timeline between 1940 and

1970, reflecting the post-war reconstruction period in Rotterdam. Despite this temporal gap, the newer buildings in the area appear to conform to a common typology prevalent across various parts of the city, contributing to the overall uniformity of Rotterdam's architectural landscape.

The buildings constructed between 1970 and 2000, primarily to address the 1980s housing shortage for affordable, inner-city rental apartments, often exhibit architectural and urban quality concerns.

These structures, driven by economic constraints and rapid development needs, tend to prioritize functionality over nuanced design. As a result, they can lack the architectural finesse and human-scale considerations that contribute to a harmonious urban environment. Their imposing, monolithic presence can sometimes disrupt the local urban fabric and lack hybrid or transition zones between private buildings and public open spaces.

Figure 177. Buildings by Age

**LEGEND**

- After 2000
- 1970 - 2000
- 1940 - 1970\*
- Before 1940
- No Data Available

*\*No remaining buildings in this area are built between 1940 and 1970*

SOURCE: Kadaster, 2023



**Rooftop properties**

The dominant type of building in the area is characterised by a number of properties, including its flat rooftop. This makes the area an interesting case study for the roofscape design. Some exceptions to

this phenomenon can be found in the older buildings situated along the borders of the area, where sloped roofs can be found. Although this has implications for the design of the roofs, there are plenty of options available for this type.



Figure 178. **Rooftop Flatness**

### LEGEND

- Mostly Flat
- Slightly Sloped
- Sharp Slope
- No Data Available

SOURCE: RIVM, 2018



The flatness of most roofs make them interesting spaces for extended functionality, or intensive-use rooftops. Hence, it is not surprising to see some rooftops already are used intensively.

However, upon further inspection of the roofscape, it becomes clear that only a very small portion of these roofs are used intensively. There are only a handful of instances that have a rooftop terrace, some more with solar panels and two small blocks with extensive green roofs. Only in 5 of the rooftops found, terraces or solar panels are combined with green.

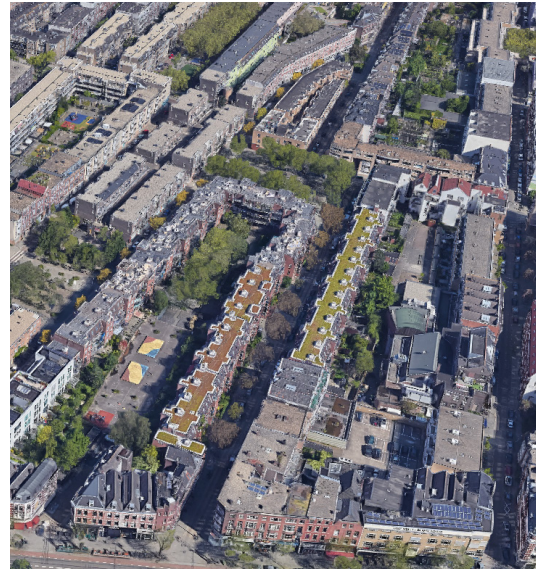
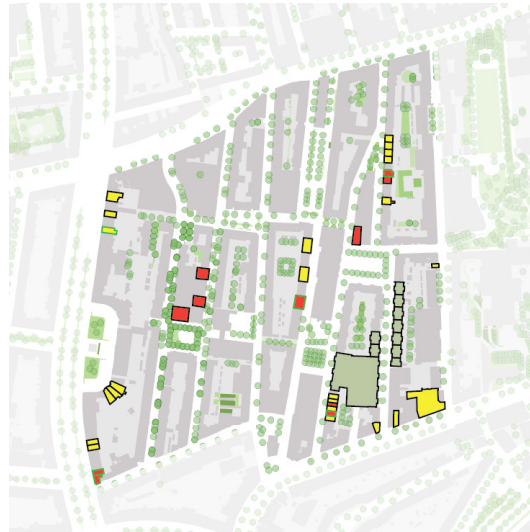


Figure 179. Blocks with extensive green roofs as seen in the aerial image (Google Maps, 2023)

Figure 180. **Current Rooftop Use**

### LEGEND

- Solar Panels
- Roof Terrace
- with green
- Extensive Green Roof



### Renovation State

The current state of the building in terms of energy label and foundation can determine whether the building or the rooftop or the building itself might need to be renovated in the near future.

The current energy label can already offer an incentive for renovation. As of 2030, housing corporations and landlords are obliged to provide an energy label of D or higher to all rental lots (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2022; NOS Nieuws, 2022). Moreover, better energy labels typically save up on energy bills, making it an interesting investment for owner-occupiers as well.

Especially rooftop insulation is a relatively affordable option to increase the energy label.

Additionally, many buildings in Rotterdam are built on wooden poles that after many years may start to rot and form a risk for the structural integrity of the building. As a result, these buildings often need to be renovated quite extensively, a procedure that costs a lot of time and money.

A renovation can increase the incentive to create an intensive-use rooftop in the process. Firstly because insulating the building could be done by implementing an intensive-use rooftop. Secondly because large renovation projects (for example foundational), offer a window of opportunity for other improvements as well.

In order to get a better understanding of what type of renovations are needed, and what sort of window of opportunity arises with it, the buildings are put into different categories.

#### HERITAGE

Heritage buildings form a special category. As they do of course need to be renovated every once in a while, the window of opportunity is different. Heritage buildings often have special requirements for renovations and are limited in what options can be implemented in terms of intensive-use rooftops. In short, each heritage building would require its own approach and design when it comes to a rooftop, making it hard to include it in any of the categories.

#### (TYPE 1) LARGE RENOVATION

Buildings marked with Type 1 include those that are very inclined to undergo a large renovation in the near future, in which the entire building and structure is targeted. This includes three sorts of buildings:

- Buildings that do not have a pole foundation.
- Buildings with a structural liability (like older wooden foundations) and energy label of C or lower.
- Buildings with a regular wooden foundation and energy label of E or F

#### (TYPE 2) SMALL RENOVATION

The buildings marked as Type 2 include those that will likely require a small renovation in terms of foundation or energy label, but unlike Type 1, do not need to be renovated entirely.

This includes 3 types of buildings:

- Buildings with energy label of C or D
- Buildings that have energy label B or higher, but also have a structural liability.
- Buildings with a wooden foundation and an unknown energy label, as these are typically low.

#### (TYPE 3) NO INCLINATION

The last type of renovation opportunity includes buildings that do not have a structural liability (like concrete foundations) *and* have energy label B or higher. These will likely not need to be renovated and thus, do not have the added incentive of renovation to implement an intensive-use rooftop.

#### HIGH CAPACITY

Finally, buildings that have a concrete foundation and structure typically have a higher structural capacity. This opens up opportunities for interventions that are heavier (like intensive green roofs), which normally would require structural renovations.

Figure 181. Renovation Opportunity Types

## LEGEND

- Heritage
- Type 1
- Type 2
- Type 3
- High Capacity

### SOURCE:

- Funderingsloket Rotterdam, 2023
- Atlas Leefomgeving and Rijksdienst voor Ondernemend Nederland, 2022



## BUILDING CONFIGURATION

Besides looking at the physical properties of the building, it is equally important to consider the building as an object in the socio-economic fabric. In this part, the ownership, function and role in everyday life will be considered.

### Ownership

In order to understand what sort of configurations are found in the buildings, one point that should be considered is the ownership types found. Whether a building is owned entirely by a housing corporation, made up of various private rental lots or only owned by owner-occupiers makes a big difference in the financial possibilities, willingness to transform the rooftop and

upheld values in this process. The map in Figure 178 shows an indication of the ownership types that could be found within the building. The buildings are classified as a majority when over 85% of the ownership is within one category, otherwise it is classified as mixed. The 'other' category is reserved for buildings where the ownership structure is labelled as 'other' for more than 60%.

The map shows that the majority of buildings in the area are owned by Social Housing corporations, typically clustered together in blocks. Moreover, there are several blocks that have a mixed type and some individual lots that are mostly owner-occupied or private rental.



Figure 182. Ownership Structures

### LEGEND

- Social Housing
- Private Rental
- Owner Occupied
- Mixed
- Other

SOURCE: Nationale EnergieAtlas, 2023



### Building Functions

Within the area, different functions on the plinths of the buildings can be found. These vary from the many schools in the area, to the shops and cafés on the Nieuwe Binnenweg and 1e Middelandstraat, to the different garages and workplaces.

An interesting observation however, is that in almost every building in this area, a mixed functionality can be found. This is often an open or economic function in the plinth, with floors of residential on top. The amount of mono-functional buildings is very limited, making it an interesting mix of work, tourism and everyday life.



Figure 183. Residential floors with active plinth

Figure 184. **Building Functions**

### LEGEND

-  Residential
-  Education, Health & Governmental
-  Social and Gathering
-  Workplaces
-  Shops

SOURCE: Kadaster, 2023



## BUILDING TYPES

With the observations of the physical building properties, as well as the configurations in mind, the buildings are grouped into different types. This is done to create a sort of 'standard' in which each building finds some form of representation in the design phase. Important to note is that the groups are based on their consequences for the rooftop designs.

### TRADITIONAL SLOPED

Along the main streets around the selected area, many buildings from before 1940 can be found. Many of these have a sloped roof and fit in the typical image of a historical Dutch city. Most of these buildings have a non-residential function in the plinth and have a renovation type of 1 or 2. The footprint of the individual lots is usually small.

Since the buildings are part of the historical image of the city, the sloped roofs and general appearance should be preserved after renovations, meaning that large or radical adjustments to the rooftops that change this image are not recommended.



Figure 185. Traditional Sloped Type on the map



Figure 186. Example of Traditional Sloped Type



### TRADITIONAL FLAT

Complementary to the traditional sloped buildings, there are remnants of the old city with flat roofs. These usually include buildings with larger lot footprints and a more unified style.

Although renovation types are mixed, most buildings are built on wooden pile foundations, limiting the potential structural capacity of the rooftop.



Figure 187. Traditional Flat Type on the map



Figure 188. Example of Traditional Flat Type



Figure 189. Example of Traditional Flat Type Street



### **CONCRETE SOCIAL BLOCK**

This cluster type makes up the majority of the buildings in the area. These are social housing complexes built between 1970 and 2000. They have a fairly flat rooftop surface, lined with gravel and are made with a high capacity concrete structure and renovation type 2 or 3.

Most of the buildings are built along a courtyard, which in some occasions is elevated with parking or other functions underneath. In most cases, the plinth has a residential function.



Figure 190. Concrete Social Block Type on the map



Figure 191. Example of Concrete Social Block Type



Figure 192. Concrete Underpass allows access to the courtyard

### WOODEN SOCIAL

The main difference between the Concrete Social and the Wooden Social is the form and the renovation type of the building. First of all, where Concrete Social blocks are typically large, rectangular and flat, the Wooden Social type has more variation in depth, height and materials. Second, the Wooden Social type is characterised by the wooden structure and foundation, often not in greatest shape. Hence, the renovation types of these buildings are 1 or 2, and the buildings do not have a high structural capacity.



Figure 193. Wooden Social Type on the map



Figure 194. Example of Wooden Social Type



Figure 195. Wooden Social Type above a School



### CLOSED BLOCK

In the selected area, three large blocks with a similar typology can be found. These blocks consist of two rows of buildings, separated by a narrow street that forms a back-entrance to some of the lots. In some blocks, this street is elevated.

The blocks are owned by a mix of social housing corporations and owner-occupiers and have some non-residential functions in the plinth, including the community centre, healthcare facilities and shops.

The renovation types are 2 or 3, and the buildings itself are made with a concrete structure.



Figure 196. Closed Block Type on the map



Figure 197. Example of Closed Block Type



Figure 198. Elevated Street as seen from the side

### MIXED RESIDENTIAL

In addition to the social housing blocks, several blocks with a more mixed type of ownership can be found as well. These buildings typically have a good energy label and concrete foundation, which causes most of these to fit into renovation type 3.

In contrast to the concrete social blocks, these buildings have a higher variety in their form and materialisation.



Figure 199. Mixed Residential Type on the map



Figure 200. Parking Underneath Courtyard



Figure 201. Example of Mixed Residential Type



## UNIQUE

Some of the buildings do not exactly fit in either of the type categories, for which the type 'Unique' has been made. This includes buildings like KC Het Oude Westen (the large primary school building), KINO and a row of modern apartment blocks.



Figure 202. Unique Type on the map



Figure 203. KC Het Oude Westen



Figure 204. Modern Apartment Blocks

## HERITAGE

Finally, some buildings have a protected heritage status, which limits the amount of options for rooftop designs. In fact, each of these heritage buildings requires a custom fit solution that works together with the historical aesthetic they represent.

These specific building are both old schools that are currently used for other purposes.



Figure 205. Heritage Type on the map



Figure 206. Old Secondary School as a Heritage Type Building



Figure 207. Old St. Augustinus Primary School

# Rooftop Designs

The analyses have shown various insights in the neighbourhood and its buildings. In this next part, the findings of the analyses will be taken into consideration for the design of the rooftops. For each discovered building type, a selection of patterns and a subsequent design will be made to illustrate how these various buildings can host an intensive-use rooftop that contributes to its surroundings. This relates back to the question asked in the beginning of the chapter:

*Does the **translation** of the **rooftop strategy** to a **roofscape design** address the **urgencies** of the city in an effective manner?*

By creating a design, the effects of the bottom-up strategy on top-down urgencies can be analysed.

## DESIGN PRINCIPLES

---

explain a method is needed to structurally tackle each design

### Design Goals

*--remove black bitumen!*

### Values and Perspective

The preceding analyses have given an insight in the urgencies of the urban domain and their relation to the values of the pattern strategy, as has been illustrated on "Conclusions" on p.183. These values shall be considered in the design- and selection process of the rooftops.

However, the report has elaborately discussed various perspectives on rooftops that do not necessarily focus on tackling these problems alone and offer different interpretations of values and qualities. For example: investors, residents and neighbours can have different ideas and

values that do not include aspects like heat stress or biodiversity. Therefore, it is important to understand potential perspectives of the stakeholders that can be found within the building types.



## Building Types

### LEGEND

-  Selected Buildings
-  Concrete Social\*
-  Closed Block\*
-  Unique\*
-  Mixed Residential
-  Traditional Sloped
-  Traditional Flat
-  Wooden Social
-  Heritage

*\*These selected types are supported with a more elaborate design*





## CONCRETE SOCIAL

For the design of the concrete social type, a large block in the southern part of the area is chosen. The block is large, so for the design itself, only part of the block is considered.

The first thing that stands out is that there is a large available rooftop surface that spans over multiple lots. Moreover, these lots are mostly owned by a social housing corporation. Although this means that it becomes easier to make a plan connecting multiple roofs, funds are probable also limited. The structure however, is likely made out of concrete and is expected to have a higher structural capacity.

The block itself has a nice semi-private courtyard with green, but lacks hybrid zones on the street-side of the building. Moreover, the plinth is not very active, apart from the reading hall / library in the southern part, and it is fair to say the buildings lack some aesthetic qualities on the street side.



Figure 208. Aerial Image of Concrete Social Type (Google Earth, 2023)



Figure 209. Plinth of the selected building



Figure 210. Reading Hall / Library

### Design Goals

The large gravel-covered rooftop seems like a perfect place for more green that supports the local micro-climate. Making the green visible by placing higher plants on the edges also makes the building more attractive. A crucial point is to reduce

the total costs of the roof, keeping the renovation (and therefore the houses) affordable.

*Associated Values*

cooling

native ecology

urban nature

attractivity

Additionally, in terms of climate change mitigation, the building can be insulated further through its green roof and solar panels can be added as an effective solution to generate both clean energy and revenue. This is especially useful considering that the amount of owners is limited and the building is managed by a single instance, making it easier to share and distribute the energy among households.

*Associated Values*

clean energy

insulation

Finally, the social structures in the building can be reinforced by adding a small communal space on the roof, combined with outdoor activities such as a small allotment garden. Some seating can be added in the greenery for residents to immerse themselves in the natural area.

*Associated Values*

social space

outdooring

co-responsibility

**Selected Patterns**

p.07 Garden

p.16 Nature Preserve

f.07 Canopy

f.10 Tool Shed

f.17 Flower Field

f.19 Shrubs

d.03 Vegetable Planter

d.06 Seating

d.12 Solar Panels

d.18 Climbing Ivy

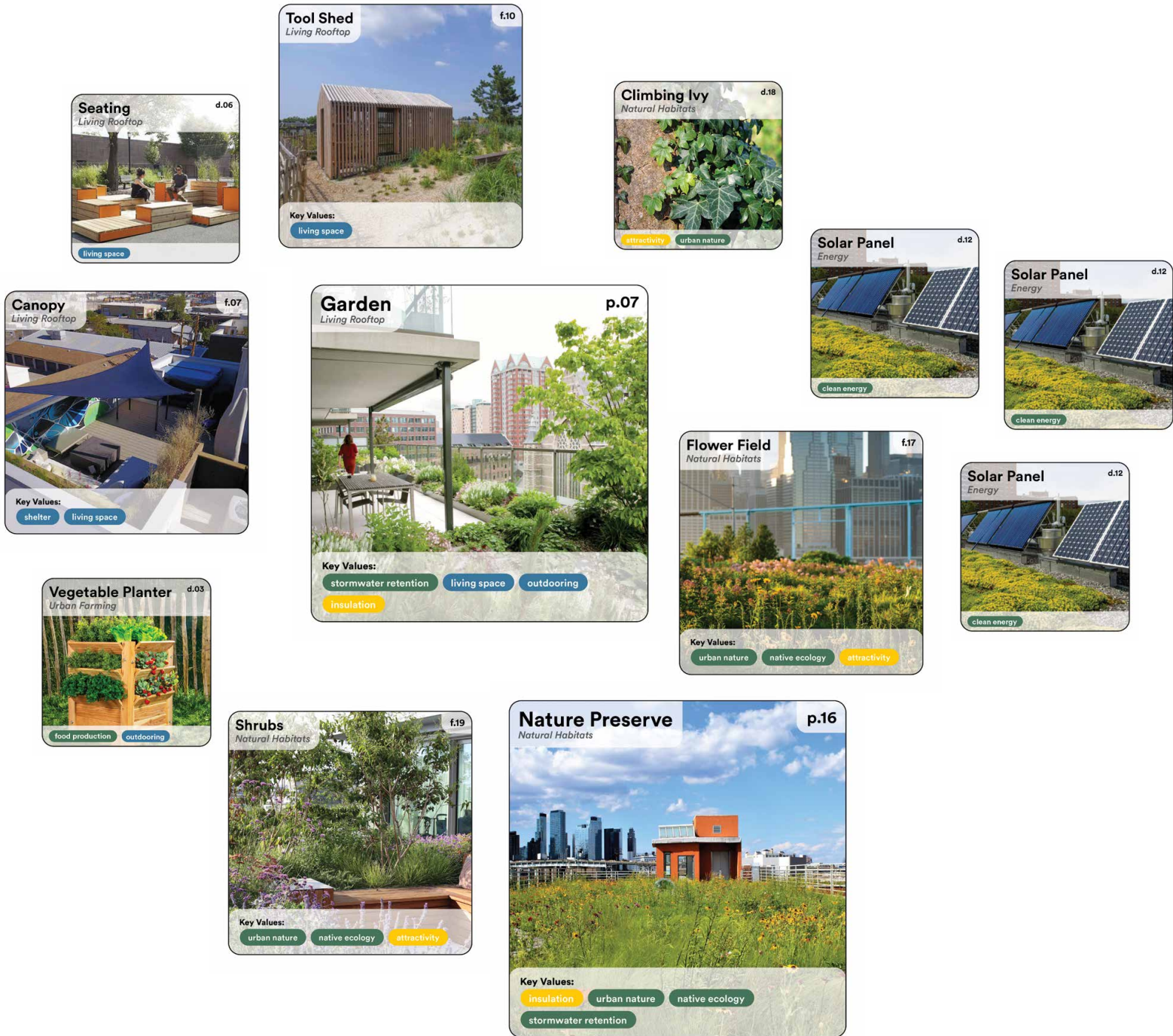


Figure 211. Pattern Selection of Concrete Social Type





Figure 212. Floor Plan of Concrete Social Type Design





Figure 213. Collage of Concrete Social Type Design

## CLOSED BLOCK

The closed block is a distinct type of building, mostly due to its peculiar building shape. It consists of two narrow blocks that enclose an elevated street, under which other functions like parking can be found. This elevated street functions as a hybrid community space for the residents, but is inaccessible for public use.



Figure 214. Aerial Image of Closed Block Type (Google Earth, 2023)

There is mostly 1 (type of) owner; social housing corporations, which has both advantages and disadvantages. On the one hand, a single owner makes it easier to manage and design for the entire block, rather than individual rooftops. On the other hand, the missing mix of stakeholders and their respective interests can lead to a more monofunctional type of rooftop.

Finally, the state of the building and owner suggest that the funds for a rooftop development are limited. However, the

research indicates that the building has a high structural capacity, especially in the elevated street area.



Figure 215. Private Entrance to the Elevated Street

### Design Goals

In order to make better use of the elevated street, accessibility should be increased. This is done by adding a larger entrance that can be open for more people. Moreover, this new street can leverage its high structural capacity to host large planters with greenery and some lawn. This helps to cool down the area and retain stormwater if necessary.

#### Associated Values

cooling

social space

stormwater retention

attractivity

Since the block has no nearby courtyard or green area to release the water to during heavy rainfall, additional water retention areas can be added on the higher, inaccessible rooftop. Since the structural capacity is high, the transformation can be affordable. This also helps to insulate the house, and provides a natural habitat for insects and birds.

#### *Associated Values*

native ecology

stormwater retention

insulation

### **Selected Patterns**

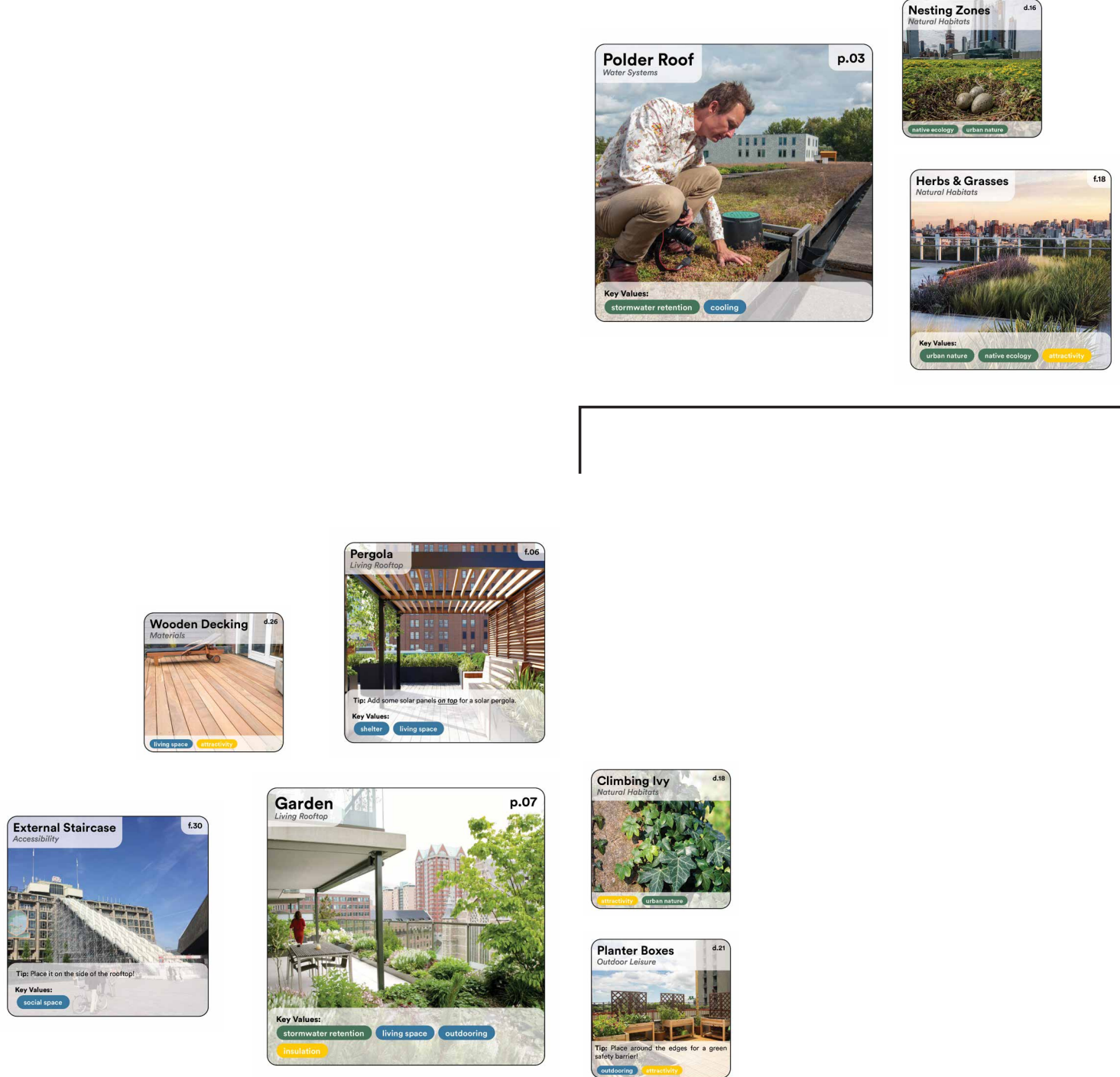
#### **ELEVATED STREET**

- p.07** Garden
- f.06** Pergola
- f.30** External Staircase
- d.18** Climbing Ivy
- d.21** Planters
- d.26** Wooden Decking

#### **HIGHER ROOFTOP**

- p.03** Polder roof
- f.18** Herbs and Grasses
- d.16** Nesting Zones





210 Figure 216. Pattern Selection of Closed Block Type





Figure 217. Floor Plan of Closed Block Type Design

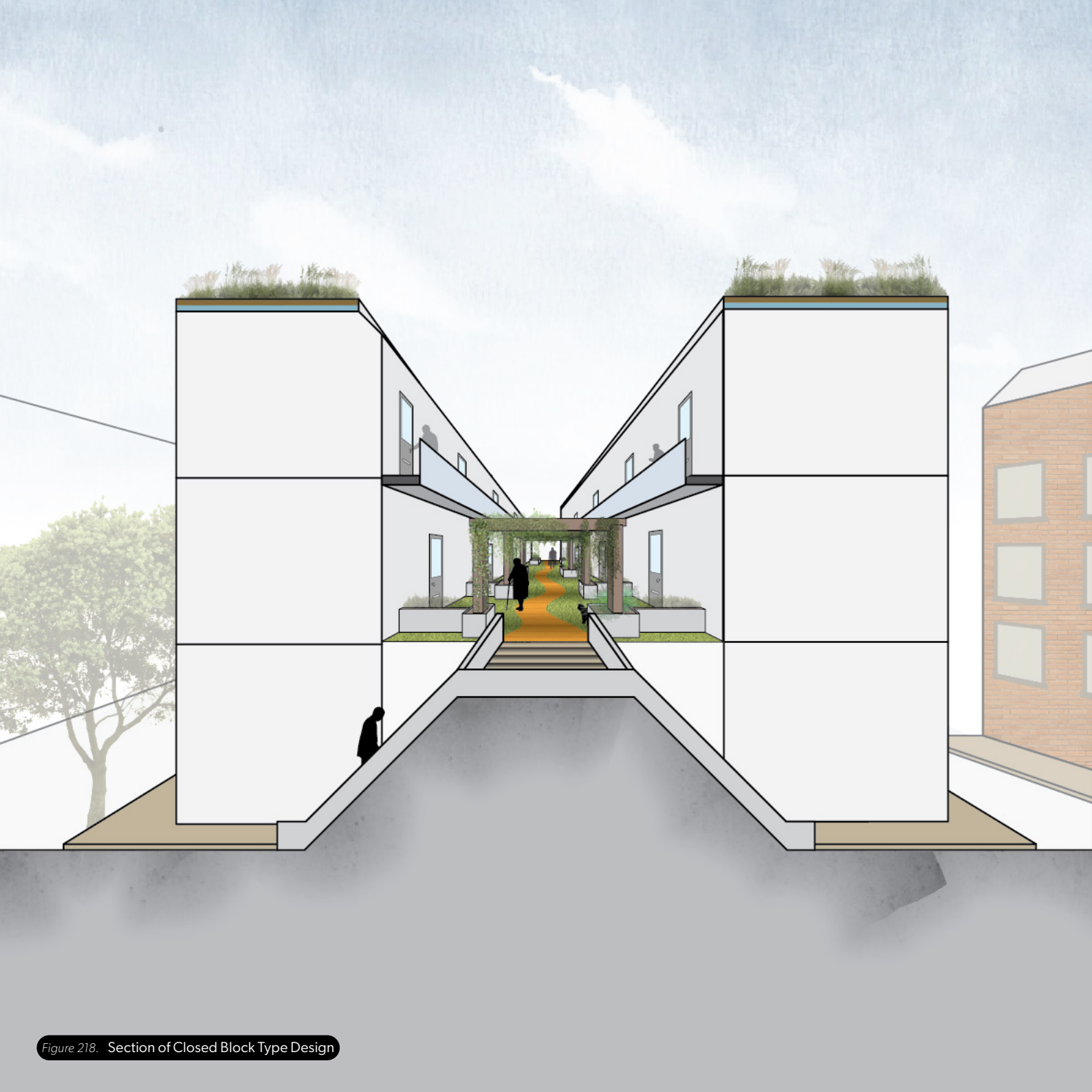


Figure 218. Section of Closed Block Type Design

## UNIQUE (KC HET NIEUWE WESTEN)

For the unique type, the large primary school (KC Het Nieuwe Westen) is chosen. The building lies in the heart of the area and already has a strong social function in the neighbourhood that could be reinforced in its rooftop use.

Other than most buildings, has a couple of low-lying rooftops that could be made accessible. Especially in combination with the concrete structure, there are some interesting opportunities.



Figure 219. Aerial Image of KC Het Nieuwe Westen (Google Earth, 2023)

The available flat surface is large, but as can be seen in Figure 219, there is a large variety of small rooftops with slight height differences.

Finally, in the case of schools, there are many different ways the building, its maintenance and possible renovations are managed, but an overlap that can be found is the

limitations in budget and costs, as well as a large variety in stakeholders and values. Therefore, multiple options, including those that make the rooftop financially attractive, should be considered.



Figure 220. The lower rooftops of the School Building can be seen from other buildings across the street

### Design Goals

Firstly, it would be interesting to use one of the lower rooftops as a fenced off playground. Although the interaction between the neighbours and the playing children is a desirable side-effect of the open playground, a more private and manageable area could come in useful for smaller children or outdoor events. This also creates more space for the children to play in their own ways.

### Associated Values

outdooring

exercise

social space

In order to decrease the carbon footprint of the building, it is important to make sure energy can be generated locally and the energy efficiency is high. This can be done by placing solar panels or wind turbines on a layer of insulating greenery like sedum. Especially for a building with such a public function, like a school, it is important to set a good example for the rest of the area. Moreover, the school can contribute to the energy network of the neighbourhood by hosting space for a neighbourhood battery.

*Associated Values*

clean energy   attractiveness   insulation  
profitable space

To further increase the economic benefits of an intensive-use rooftop, a small-scale data centre can be hosted. This will help to generate revenues and reduce the overall (maintenance) costs of the rooftop. In addition, an extra classroom can be placed next to the playground to make more use of the available space.

*Associated Values*

home extension   profitable space

Finally, there is an option to make the low-lying roofs that are not used for sedum or the heavier and expensive playground more attractive as well. By painting a mural on the now black bitumen, the empty roof becomes a lot less of an eyesore. Moreover, it helps to reduce the amount of heat absorption during sunny days.

*Associated Values*

attractivity   insulation

**Selected Patterns**

PLAYGROUND AREA

- p.08   Playground
- p.13   Private Extension
- f.27   Mural
- f.30   Exterior Staircase

SEDUM GREEN

- f.26   Sedum Moss
- d.12   Solar Panels

ECONOMIC PURPOSES

- f.24   Data Centre
- f.13   Energy Storage



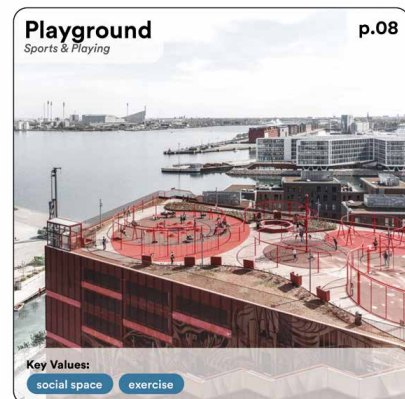
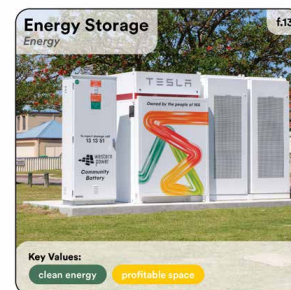
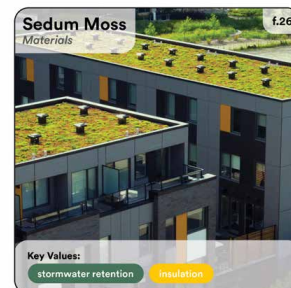
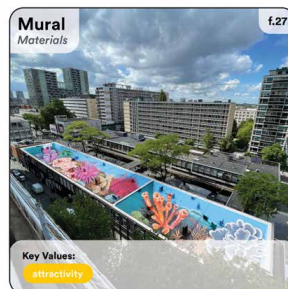
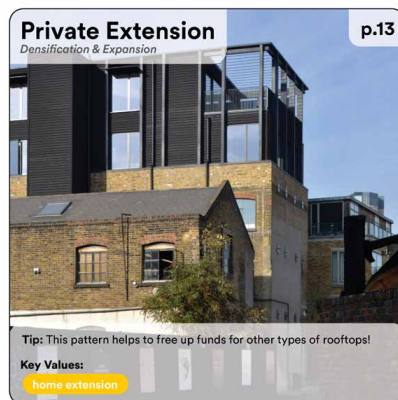
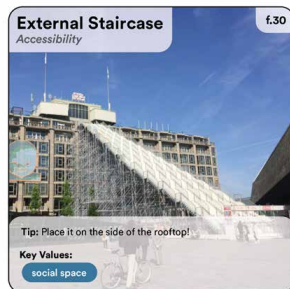


Figure 221. Pattern Selection of Unique Type

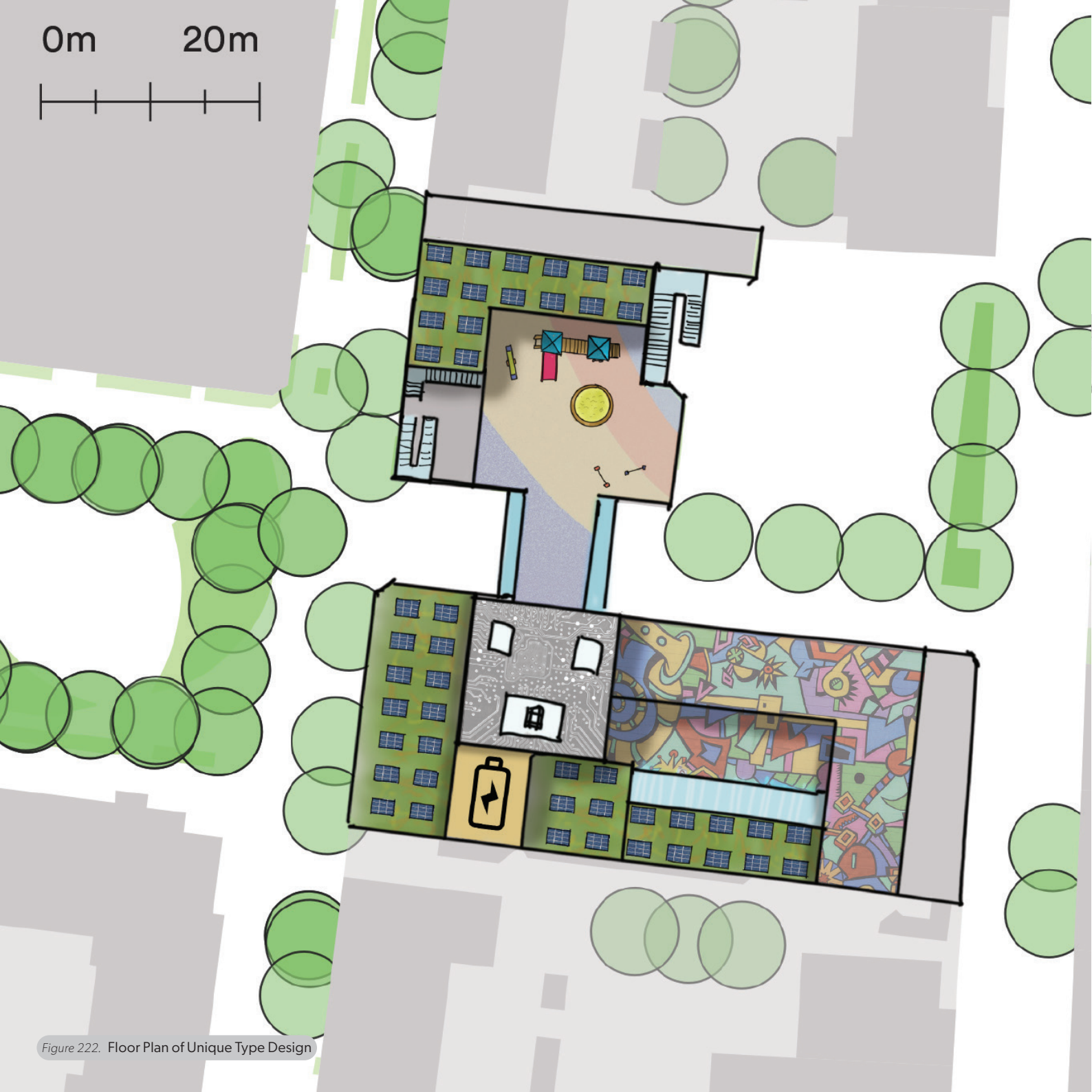


Figure 222. Floor Plan of Unique Type Design





Figure 223. Floor Plan of Unique Type Design

## MIXED RESIDENTIAL

The Mixed Residential type is a bit of an outlier in the area. Although they are characterised by their mix in ownership, they also have more elaborate hybrid space in street level, such as front gardens. In combination with the trees and vegetation, these streets are quite attractive.

In addition, these buildings are typically in a good state, having a solid concrete structure and a good energy label. Some even come with an incorporated sedum roof. This indicates a higher willingness to work with an intensive-use rooftop, potentially leading to more available funds.

Most buildings have access to a (semi-) private courtyard and a garden on ground level. Although these gardens are likely only accessible to the residents on the ground floor.

The mix of users has a positive and negative side when it comes to the assessment of values and the rooftop design. On the one hand, a larger variety of perspectives and ideas can lead to a more progressive process where various ideas are considered. On the other hand, it may lead to conflicts between the evaluation of qualities versus costs. This means as a designer of the roof, it is essential to consider a range of options that align with the diverse interests of stakeholders. Especially when a larger design overarching multiple rooftops is considered, it is important to make sure all stakeholders are represented.



Figure 224. Aerial Image of Mixed Residential Type (Google Earth, 2023)

### Design Goals

To address the point last mentioned, multiple plans that reflect the diverse value packages should be considered, which makes it very hard to come up with a single plan. To avoid conflicts between owners associations, the plans for the roofs are divided into their individual plots, rather than a large, multi-rooftop plan (as is the case with the previous designs).

### NOTHING PLAN

The first plan speaks to the stakeholder configurations that, much like can be seen in the current state, have no intention of renovating their rooftop. Therefore, the



plan remains simple and affordable: paint the bitumen into a lighter colour to reduce heat absorption.

*Associated Values*

insulation

GARDEN PLAN

Secondly, a rooftop can be designed to provide the residents on the top floor with a garden, offering direct access to an outdoor recreation spot. By placing some higher greens that protect from the sun and wind, a cool spot is created that makes the hot days more bearable.

*Associated Values*

cooling

outdooring

shelter

urban nature

attractivity

insulation

ADDED LAYERS

The next plan is a more economically driven one. By adding new floors with apartments on top of the rooftop, more profitable space is created. Moreover, it follows the examples of densification that the municipality sets in their vision of “Good and Smart Growth”. The subsequent rooftop can then be utilised for water retaining green, such as a polder roof.

*Associated Values*

stormwater retention

insulation

profitable space

Another plan could be to add functionality to the already existing sedum roofs, by placing solar panels on them. The green helps to increase their efficiency, while

maintaining their insulation and cooling effect. This makes the building even more energy efficient and forms a simple, affordable step towards a sustainable urban landscape.

*Associated Values*

clean energy

insulation

**Selected Patterns**

GARDENER TYPE

p.07 Garden

f.02 Greenhouse

f.19 Shrubs

d.03 Vegetable Planter

d.04 Edible Herbs

d.05 Rainbarrel

d.14 Insect Hotel

ADDED LAYERS

p.03 Polder Roof

p.14 Adding Layers

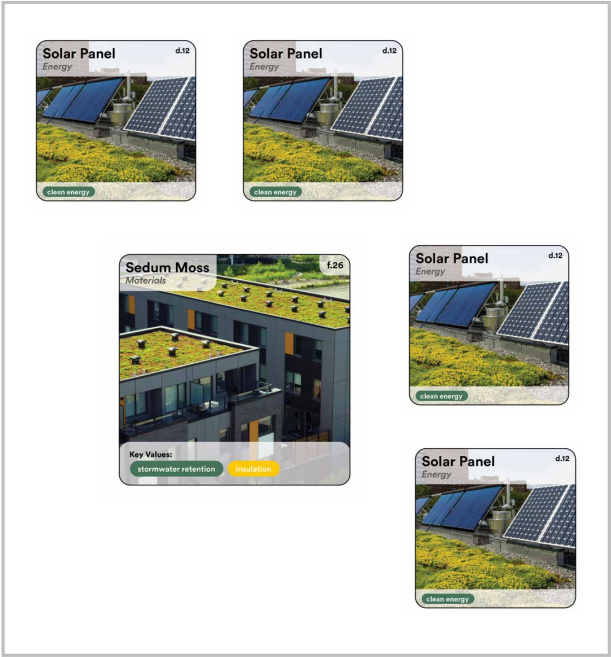
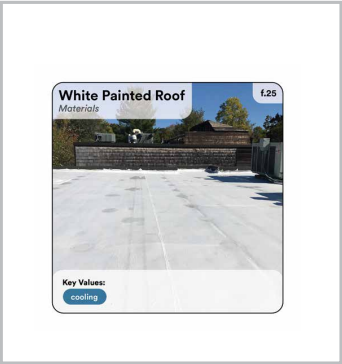
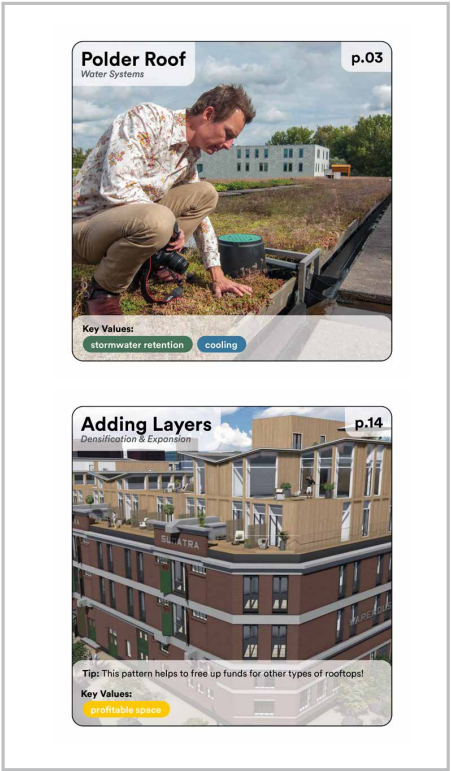
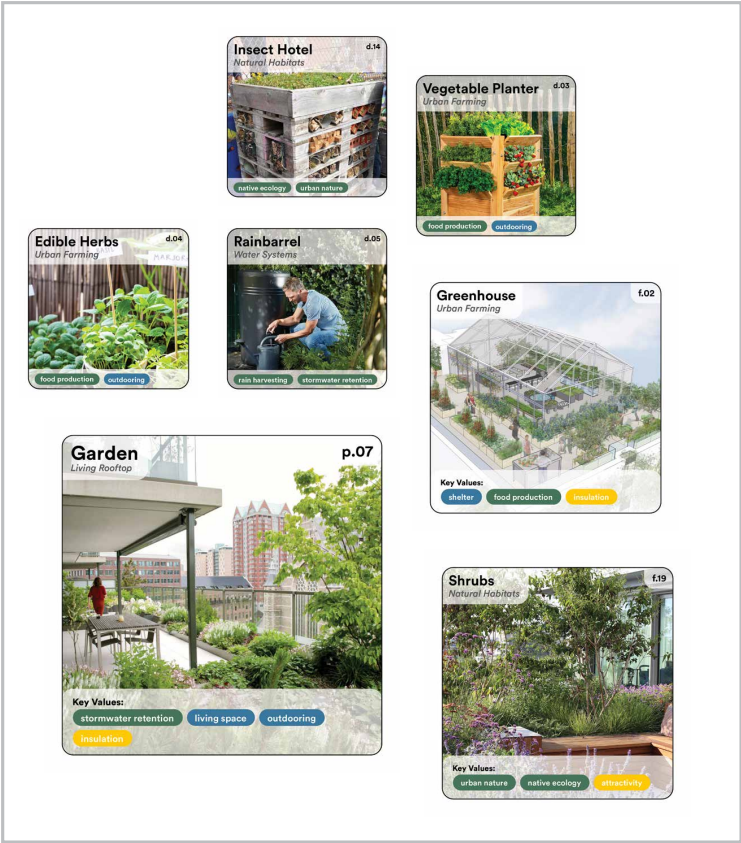
SEDUM IMPROVEMENTS

f.26 Sedum Moss

d.12 Solar Panels

NOTHING TYPE

f.25 White Painted Roof





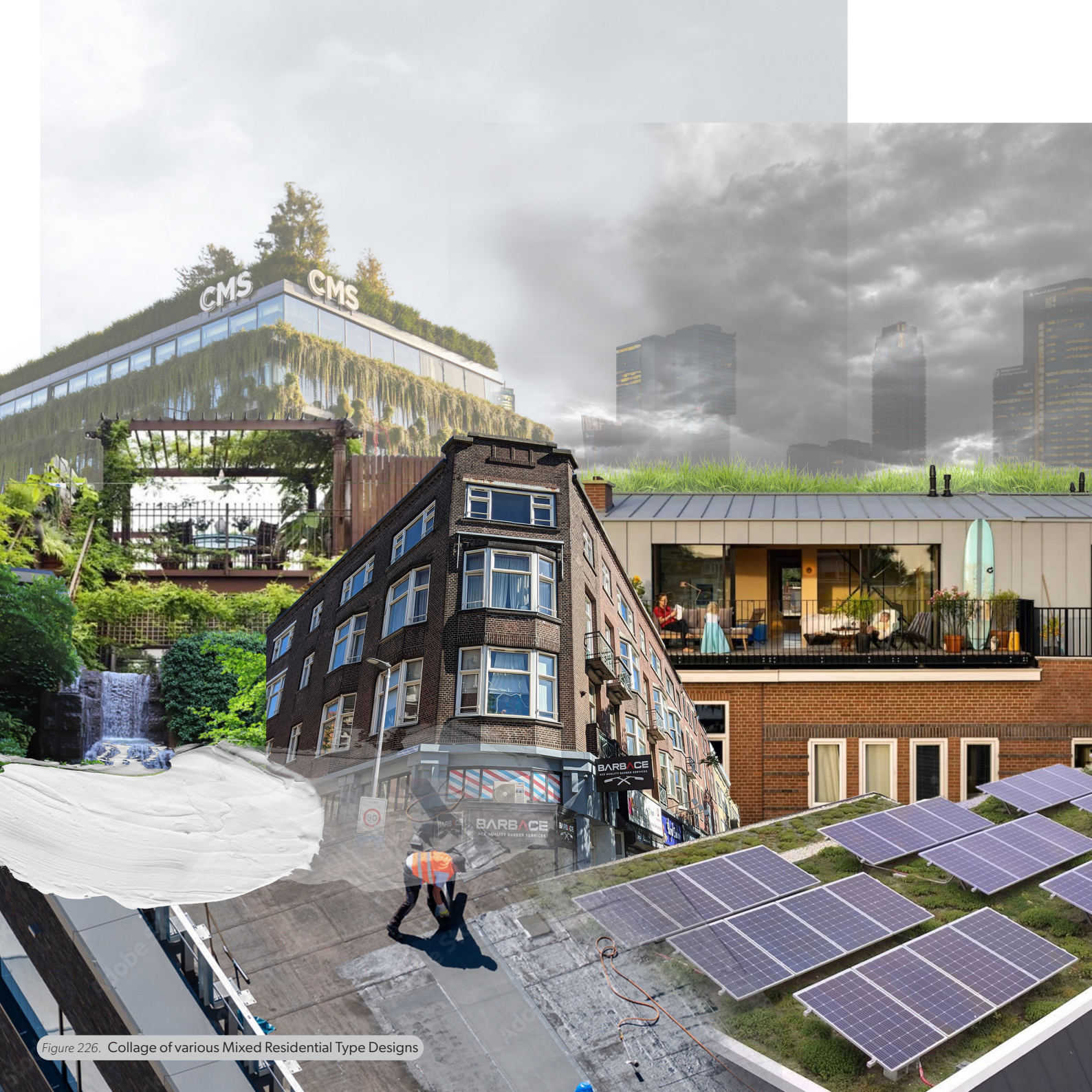


Figure 226. Collage of various Mixed Residential Type Designs



## TRADITIONAL SLOPED

The buildings from the traditional sloped type are mostly situated along the busy roads around the area, where there is limited access to greenery. It may also cause some nuisance. However, for those looking to be immersed in the busy urban life, these building offer a direct connection to the bustling city, often combined with an active plinth.

The buildings are part of the more historical aesthetic image of the city, that with old, narrow buildings, sloped roofs and beautiful façades. The sloped roof however, limits the amount of available rooftop options. Moreover, the protected historical image limits radical changes.

The narrow plots with a variety of ownership structures makes the amount of stakeholders that decide on the rooftops a lot smaller, but also restrict plans that could cover a larger roofscape.

Finally, the buildings often have a low energy label and are in need of renovation. Insulating the rooftop could be a financially attractive option.



Figure 227. Aerial Image of Traditional Sloped Type (Google Earth, 2023)

### Design Goals

The sloped roof limits the amount of available options, but there is still a lot that can be done. First of all, some extensive green roofs can still be placed under an angle. These help to make the building more attractive and insulate it, which is a priority. On top of (or instead of) this green roof, solar panels could be placed, helping to generate clean energy for the households.

### Associated Values

clean energy

insulation





Figure 228. Example of a sloped Green Roof (*Waterproof Magazine*, 2011)

A simple and unobtrusive way to expand the living space is by adding a dormer on the sloped roofs. This allows the narrow attics of the buildings to become more spacious, which can be just enough to support a larger household or create a work-from-home space.

#### Associated Values

living space

home extension

Lastly, a simple way to support biodiversity is to create nesting zones or boxes for local birds. There are several options that work well with sloped roofs or façades.

#### Associated Values

native ecology



Figure 229. Nesting Box integrated in the facade (*Bird Brick Houses*, 2018)

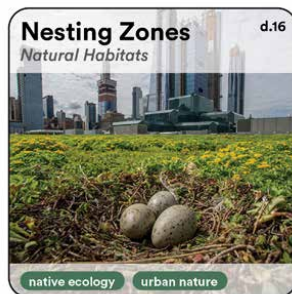
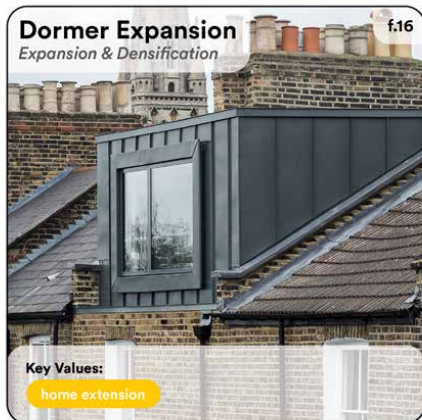
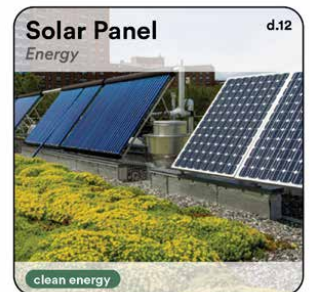
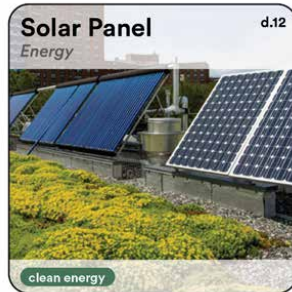
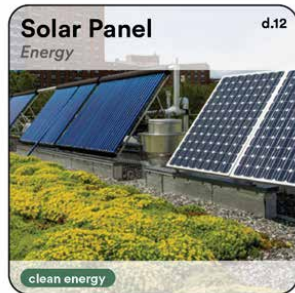
#### Selected Patterns

**f.16** Dormer Expansion

**f.26** Sedum Moss

**d.12** Solar Panel

**d.16** Nesting Zones



# TRADITIONAL FLAT

Similar to the traditional sloped type, these older type of buildings form part of the historical image of the city. The building are mostly situated in the core of the neighbourhood, rather than along the main streets. They are very attractive and sometimes have commercial activities in the plinth.

Most of the streets have some form of hybrid zone that creates a transition between the public space of the street and the private space within the building. Moreover, they almost all have a (semi-)private courtyard.

In contrast to the social type buildings, the plots are more narrow and have a mixed ownership configuration.

Finally, the building often have a decent energy label, but are built on wooden foundation, limiting the structural capacity of the rooftop. Therefore, the most common material found on the roofs is bitumen.



Figure 231. Aerial Image of Traditional Flat Type (Google Earth, 2023)

## Design Goals

The low structural capacity limits how much options there are for the rooftop. Therefore, sedum, a lightweight solution that insulates the roofs is chosen as the new material. A cheaper alternative is to paint the existing bitumen white.

### Associated Values

insulation

In order to enrich the contribution of the rooftop to the biodiversity of the area, herbs and grasses are placed distributed among the sedum. Especially those that have limited root depth and therefore need less heavy soil are preferred.

### Associated Values

native ecology

Finally, on some parts of the sedum, solar panels can be placed to generate energy for the households in the building. The sedum cools the underside of the panels and increases their efficiency.

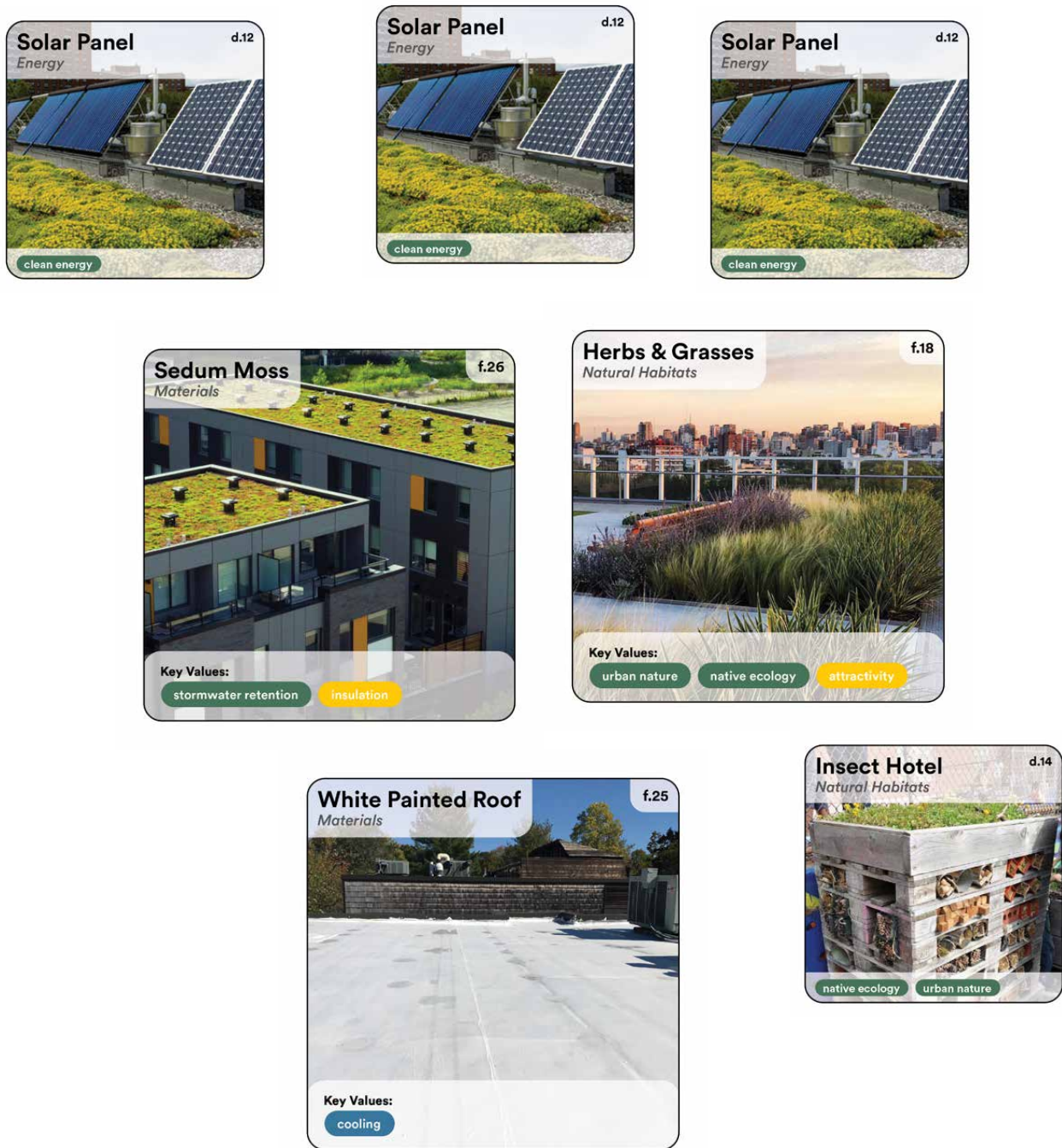
### Associated Values

clean energy

## Selected Patterns

- f.18 Herbs and Grasses
- f.25 White Painted Roof
- f.26 Sedum Moss
- d.12 Solar Panel
- d.14 Insect Hotel







## WOODEN SOCIAL

Similar to the concrete social type, the wooden social type consists of large plots, mostly owned by social housing corporations. These buildings are relatively low-cost and only a little budget for rooftop projects can be expected.

The main difference with the concrete social type, is the low structural capacity of the building and the energy label.

Most buildings have direct access to green, either in the street or in a (semi-)private courtyard.

Finally, the rooftop is lined with bitumen, which can absorb a lot of heat from sunlight.



Figure 233. Aerial Image of Wooden Social Type (Google Earth, 2023)

### Design Goals

In order to accommodate the small budget of the building, a regular insulation is placed in favour of the sedum. However, the bitumen on top of it will be painted white or enriched with a mural, reducing the amount of heat it can absorb.

#### Associated Values

attractivity

insulation

Furthermore, a data centre and a neighbourhood battery can be placed along a field of solar panels, making the entire venture more attractive for investors and reducing the financial dependency on the low-cost houses in the block.

#### Associated Values

clean energy

profitable space

### Selected Patterns

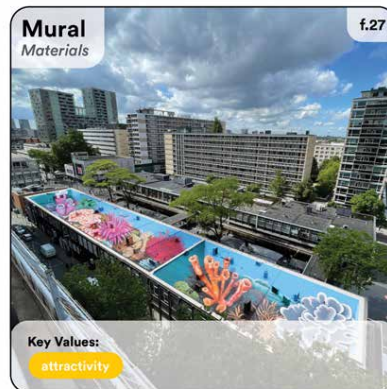
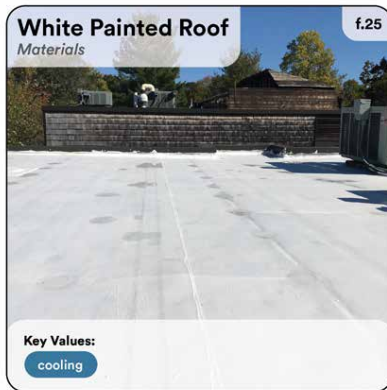
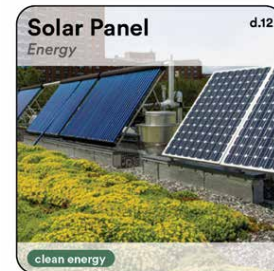
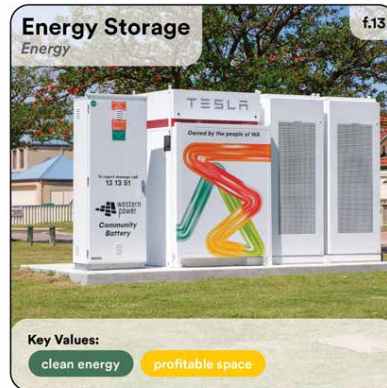
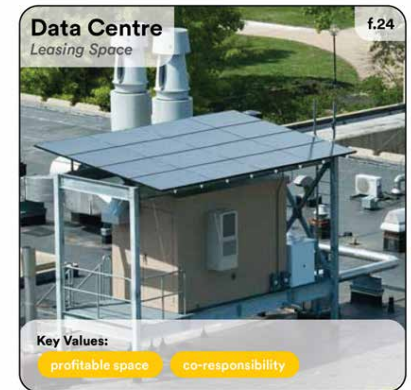
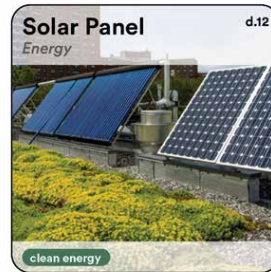
f.24 Data Centre

f.13 Energy Storage

f.25 White Painted Roof

f.27 Mural

d.12 Solar Panel



# Design Evaluation

The goal of the designs has been to assess whether the bottom-up approach of the proposed rooftop strategy (as explained in Chapter 6), manages to address the urgencies of its surroundings. Moreover, it forms a testing ground in which the pattern language can be applied to a context and reviewed. In this sub-chapter, the design outcomes will be evaluated.

## RESEARCH QUESTION

---

In the first part of this chapter, a research question was set.

*Does the **translation** of the **rooftop strategy** to a **roofscape design** address the **urgencies** of the city in an effective manner?*

In order to answer this question properly, there are several elements within the question that should be addressed. These are divided into three sub-questions.

### Bridging the Gap

First of all, it is vital that the strategy lends itself to the design of the individual rooftop, which represents the needs and values of the stakeholders. Simultaneously it should be able to form a tool to “push” the urgencies of the urban domain, such as climate adaptation and liveability, into these designs. It should bridge this gap.

*Does the strategy offer a means to address the **values** of the **neighbourhood**, as well as the **stakeholders**?*

### Changing Perspectives

Secondly, the designs offer a use case to test the contribution of a roofscape to the neighbourhood and its values. Moreover, it can help to understand how a design with a top-down perspective varies from a design with a bottom-up perspective.

*Does the **roofscape** made using the strategy contribute to the **neighbourhood** and how is this different from a **top-down** style design?*

### As a Design Tool

Thirdly, the strategy as a method can be analysed. It should offer a comfortable tool for stakeholders to make a selection of elements (patterns) that represent their needs and values. The patterns should be usable, flexible and still create a clear notion of which elements and values the eventual design should reflect. At the same time, a designer should be able to easily translate these patterns into a spatial design.

*Does the strategy offer a useful **tool** for both **designers** and **stakeholders** in designing roofscapes?*

## BRIDGING THE GAP

---

*Does the strategy offer a means to address the **values** of the **neighbourhood**, as well as the **stakeholders**?*

In order to answer this question, there are several aspects that should be addressed.

### **Representation of Stakeholders**

First, do the design outcomes actually represent the values of the chosen stakeholders? Unfortunately, there is no short answer to this. On the one hand, the chosen patterns follow a set of assumed values that place in the stakeholder groups in a certain box. Moreover, conflicts between stakeholders groups, which the strategy is specifically designed for and tested on, are not taken into consideration. On the other hand, there are distinct differences between the designs based on their building properties and ownership types. The social housing blocks have a selection of more economically beneficial patterns, while the school offers a selection of specific interventions for that type and ownership.

It has proven difficult to make an assumption of the available funds and values without a more direct, personal input from the stakeholders. However, the strategy is designed to create a platform for this input as well, which could mean a designer could have more direct access to this information.

All in all, it is safe to say that the designs offer a variety of pattern collections that could represent a similar variety of values. Multiple contexts and stakeholder configurations are

taken into consideration, which could offer a form of representability for many different scenarios.

### **Representation of Neighbourhood**

Secondly, one could ask whether the selected patterns represent the values of the neighbourhood. To this question, I believe there *is* a simple answer: yes. The patterns are chosen to actively combat urgencies on a larger scale (like biodiversity and pluvial flooding), wherever possible and probable. However, as both the designer and pattern selector of the rooftops, as well as a promoter of intensive-use rooftops, I am inherently biased towards synergetic solutions. A concern that pops up is whether the selection of climate adaptive patterns is still in line with the vision and portfolio of the stakeholders, especially when there is little stimulation from the municipality. Yet, we can make a strong case as to how this might change.

### **Pushing Climate Adaptive Projects**

The analyses highlight significant challenges in climate adaptation within the area, which are representative for the densest parts of the city. Efforts to relieve these urgencies are made in the form of spatial transformations: water is turned into a tidal park and infrastructural arteries gain more nature inclusive functions. Projects like these, as can be seen in “The 8 Urban Projects” on p.23, form the backbone of the city’s vision of “Good and Smart Growth”.



However, realizing large-scale municipal projects has proven to be a complex endeavour. As of the report’s publication, every single one of the major projects proposed by the municipality is yet to be completed. Recent attempts to restore infrastructural arteries, like the Goudsesingel, to their former, more nature-inclusive singels faced considerable opposition from local communities and politicians, leading to even more delays (Liukku, 2023).

Given these circumstances, it might be expected that the municipality would actively promote and incentivise projects that are more manageable and could face less resistance, such as intensive-use rooftops. It would not be out of place to see the municipality offering financial- and informative support, which would increase the incentive for climate-adaptive rooftops. Hence, the associated values, such as **cooling**, **native ecology** and **stormwater retention** could be more common in the collection of values upheld by the buildings stakeholders. This is one way the gap between stakeholder values and neighbourhood values can be closed.

**Is the Gap Bridged?**

Finally, can we say that the gap between the stakeholders and neighbourhood can be bridged with the strategy? The designs point out that it is possible to integrate values of the area *and* the stakeholders in one single, synergetic design. So **yes**, the gap can be bridged with the strategy.

However, synergies can only be found on condition that both parties are somewhat willing to cooperate. The report calls out the strategy for “sparking incentive”, indicating that at the very least, both the municipality and the stakeholders need to be willing to work towards a roofscape that serves both of them. A municipality that only wants public social functions, diverse green and energy generation for the entire neighbourhood will not help in working towards an intensive-use roofscape. Likewise, a stakeholder that is not at all interested in natural green or water retention is not going to be beneficial either. The synergies between parties can only be reinforced.

Nevertheless, the tool to create solutions that connect the values of the stakeholders and the municipality (which are not necessarily aligned) is there in the form of this strategy. A design this can clearly be seen is on the Closed Block Type (p.208). Here, values from different perspectives come together into a design.



Figure 235. Overview of all associated Design Goal values in Closed Block Type Design

## CHANGING PERSPECTIVE

*Does the **roofscape** made using the strategy contribute to the **neighbourhood** and how is this different from a **top-down** style design?*

To understand the implications of the applied strategy on a neighbourhood scale, there are several things that should be taken into consideration.

### **Single Cases versus Big Scale**

The point of the designs has been to contextualise the strategy in an applied case. Since the strategy focusses on individual rooftops in the wider context of a roofscape, similar to how islands form part of a bigger archipelago, the cases need to be translated to a larger scale before we can make conclusions. But this translation depends on many other factors. The report pointed out that likely, not all rooftops will be developed into intensive-use rooftops, making it hard to assess when and where the transformations might happen. Moreover, it is very probable the designs and their selected patterns will not repeat themselves on every building of the same type. Variations of pattern and value collections are likely to occur and are in fact encouraged by the strategy. This makes it difficult to say something sensible about the impact of a roofscape designed by this strategy on the entire neighbourhood or even the entire city. To remain in the metaphor, understanding an island does not immediately help to understand the archipelago.

### **Distribution versus Concentration**

One thing all designs have in common is form which perspective they are designed. The designs revolve around finding synergies that fit well with the rooftop and in addition, complement the strengths and weaknesses of the neighbourhood. However, this does not take designs that only work in a large scale into consideration. Rather than building options that are part of a diffused approach like various small ecological habitats, domesticable areas or patches of solar panels, the area could benefit from more concentrated options as well. Small habitats can be complemented by a large green rooftop reserve, squares could create a public domesticable space and even windmill hubs, such as the '[p.12 - powernest](#)' could be placed to make an impact on the bigger scale.

These more concentrated options are not considered in the designs of the types, or the roofscape as a whole, despite their high potential. The analysis of the area and the buildings however, do provide an interesting knowledge base that could support this exploration. Further research and design experiments should be conducted to analyse whether the existing roofscape, as well as the pattern language support these types of rooftops.

## **Environmental Impact**

Yet, there is something to say about the impact the individual rooftops have on their environment. The research has pointed out the need for domesticated space, biodiversity and other qualities of a liveable, as well as a climate adaptive city. Even though the single rooftops may have a almost negligible impact on their environment, their can form part of a bigger whole. Even if only 20% of all rooftops turns into an intensive-use rooftop, they make up a vast landscape of functions that together, **do** have a significant impact on their environment. Although this makes clear and accurate measurements difficult, promoting solutions for these city-wide urgencies on rooftops, as has been done in the designs, can have major implications for the climate adaptive and liveable city.

Moreover, the perspective of individual users is likely not in line with the homogeneous image of the city. A single rooftop terrace or lush garden may not impact liveability or climate adaptation on a large scale, but most definitely changes their respective perception of individual who interact with these spaces regularly.

## **Differences with Top-Down Planning**

One significant difference when comparing an application of the rooftop strategy with top-down plans is that realisation plays a more important part when using the strategy. Rather than defining from a

map and contextual analysis where green corridors and places for social interaction are desirable, the strategy focusses on where they are probable.

To illustrate this, we can take a look at two approaches for designing a green structure in the selected area. The logical planning approach would be to connect green patches with an east to west green corridor. But this is different considering the direction of the buildings, as well as their owners (as seen in Figure 182: "Ownership Structures" on page 198). This shows that several blocks possess a concentrated group of owners in the north-to-south direction. This insight could simplify the process of realising and realising a new green corridor in this direction.

Although these corridors might be less effective on the larger scale, they offer less obstacles and potential conflicts with stakeholders. The top-down approach is more prone to 'gaps' in the structure on places where owners do not wish to commit to the plans of the municipality.

The rooftop strategy offers an approach that is more compliant with the stakeholders in the buildings, which has proven to be one of the largest obstacles in designing rooftops and roofscapes. This can help to realise rooftop plans within a short timespan and stimulate the transition towards the new standard.



Figure 236. Green Structure: Interventions from a top-down approach (left) versus a bottom-up approach (right)

## AS A DESIGN TOOL

*Does the strategy offer a useful **tool** for both **designers** and **stakeholders** in designing rooftapes?*

As the creator of the pattern strategy and the designer of the rooftaps, I am not in the position to declare whether the strategy is easy to use. Nevertheless, some critical observations can be made.

### Designing for Different Scenarios

The various design solutions made in this chapter show how the pattern language provides solutions for different contexts, values and configurations. Whether a rooftop needs to be primarily green, fit for water retention or made for clean energy generation, there are patterns

for everything. However, the amount of patterns available for each situations varies a lot. Green roofs, especially recreational green roofs, have a lot of different patterns to choose from, whereas for clean energy, there is only a handful. Though solar panels are more of a monotonous design variant, it could help to be more specific in the type of solar panels and the considerations one could make. Moreover, patterns for non-accessible rooftaps are very limited and only offer a small variety of solutions.

On the other hand, the collection of patterns forms a large library of green types that can be applied, making it relatively simple to construct a lush rooftape.





it shows how functions on rooftops are distributed over the entire roofscape, which is mostly publicly accessible.



Figure 239. Roofscape Impression Hoogkwartier (Rooftop Revolution, n.d.)

A key difference between the proposed strategy and the impressions seen, is that with the pattern strategy, much more roofs are expected to function as isolated islands within a context, rather than part of a large structure. Functions are mostly kept (semi-) private and related to the building (or block) itself, not the surroundings. The amount of public functions is limited and the resulting rooftops will likely be less green, and more solar panels. However, their contribution to the larger scale will still be as effective as that of the other plans. Green will still contribute to biodiversity, social spaces are still created to enhance liveability and water retention zones can hold water just as easily. To refer again to the metaphor of the archipelago: the islands are individual states, but they do share their ocean.

## Creativity and Exploration

One element the designs from this chapter are lacking in when comparing them to the impressions and designs, is the extravagance and creative exploration. The designs from the types are kept simple and easy to execute, but do not necessarily spark the imagination of a wild roofscape that fits with a vision for the future. Even though something like the Rollercoaster rooftop of the Rooftop Catalogue seems something that will never be realised, it is something that sparks the imaginations and makes us think about what a rooftop *could* be.

### Roller coaster

This drawing speaks for itself. The roller coaster starts on the rooftop, plunges down, circles the building and ends back on top of the roof.

**Rollercoaster** Deze tekening spreekt voor zich. De rollercoaster start op het dak, stort naar beneden, draait om het gebouw heen en eindigt weer op het dak.

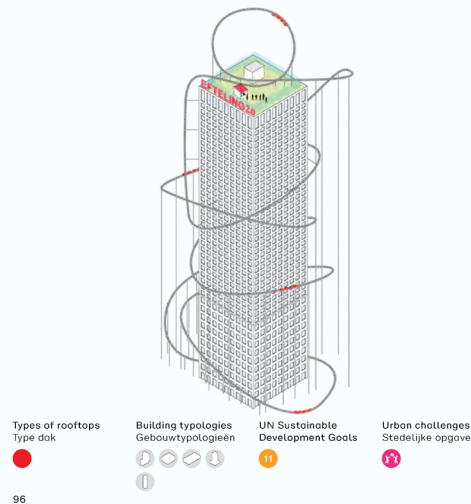


Figure 240. Rollercoaster Design (MVRDV et al., 2021)

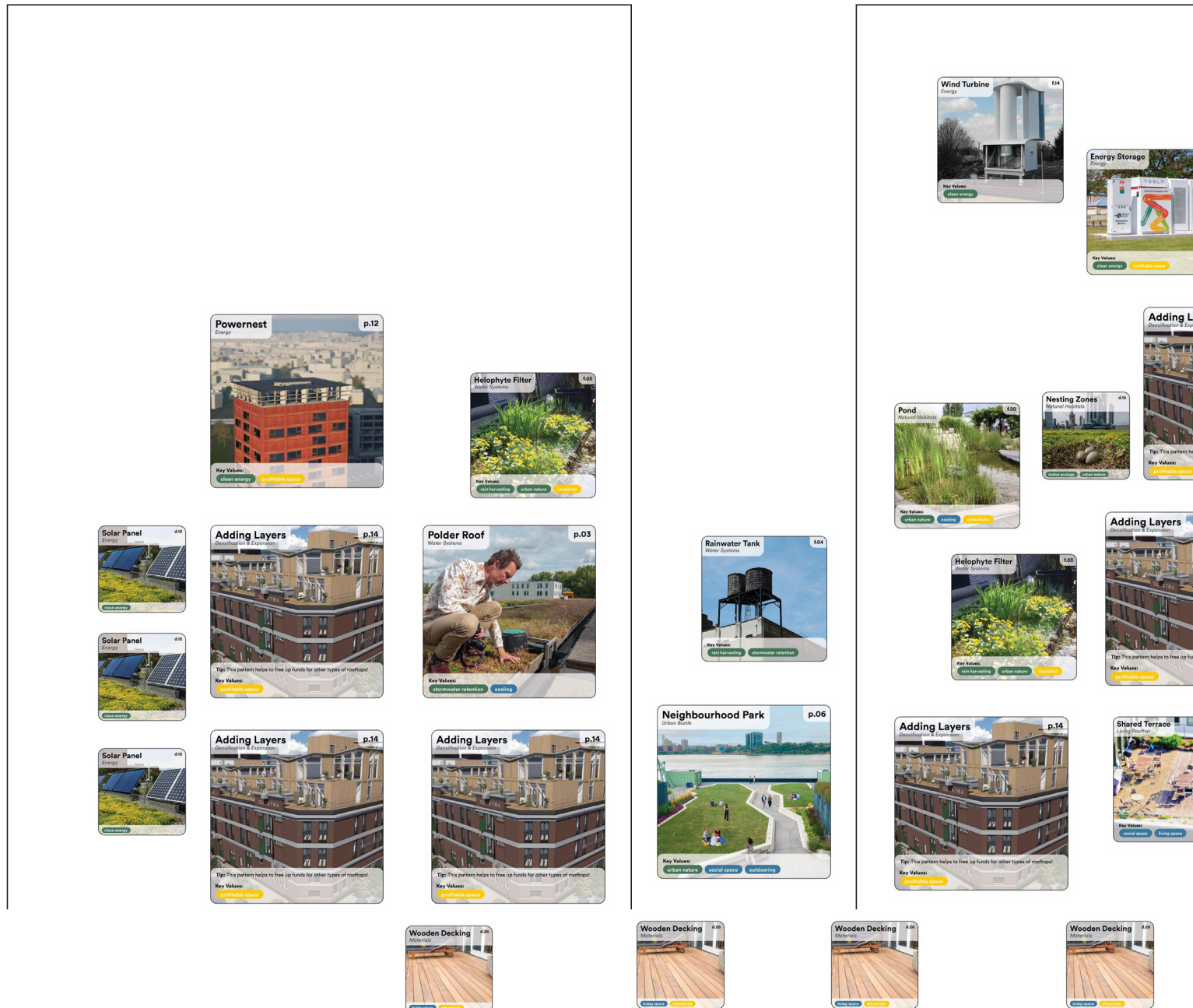
Moreover, it provides us with an idea that we, as stakeholders, designers or interested observers, can agree or disagree with. It helps to evaluate what we want to see, or do not want to see, in our future roofscape and what value this has to us. Especially these out-of-the-box ideas offer something to think about, not whether we want to realise it, but **why** we want or do not want to realise it.

### **Complementary Design**

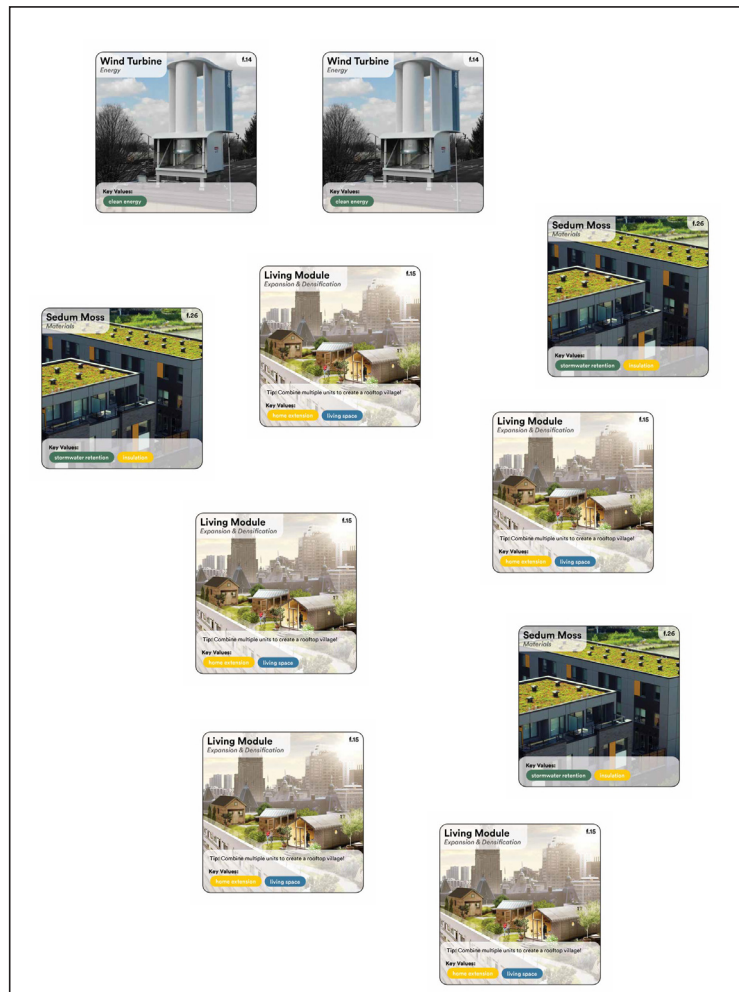
To complement the somewhat unimaginative designs of this chapter, an elaboration of a densification design has been made using the strategy. The goal is to gain an understanding whether the strategy is capable of creating out-of-the-box ideas and facilitates creative exploration.

The design on p.238-p.240 shows a simple densification plan of a building block in which offices and residences are created on top of the existing block. The restrictive properties of the building are for this purpose left out of consideration.

To evaluate, the design highlights that it is possible to work with larger ideas and bigger scales. Making the patterns selection and configuration in fact was an interesting experience, especially when the restrictions of the building were not holding back which patterns to select. The final design however, still is relatively inside-the-box. Recreating the extravagant ideas of the pattern catalogue for example is still very difficult. However, this is not something the strategy was designed for.







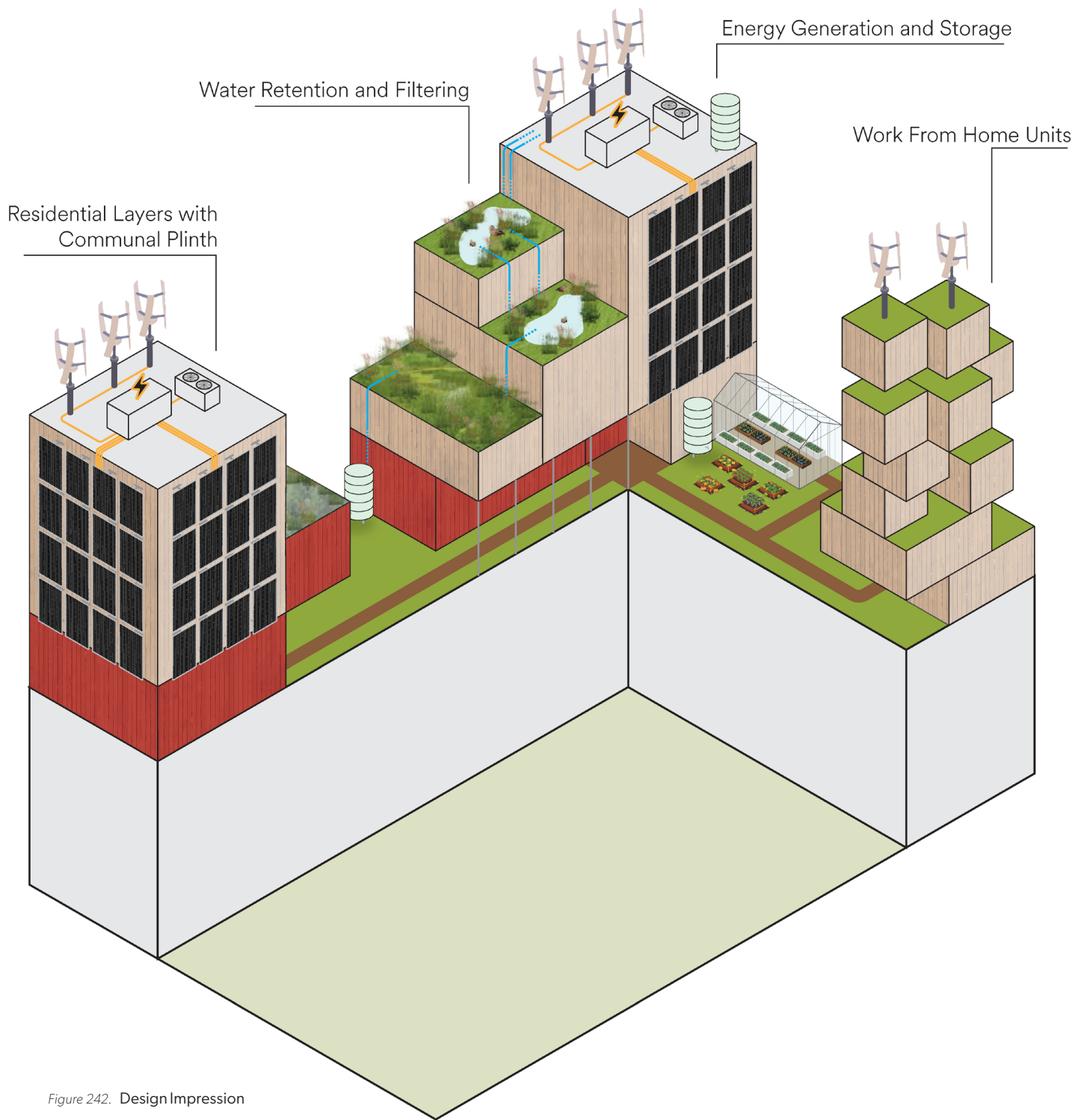


Figure 242. Design Impression

## CONCLUSION

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*Does the **translation of the rooftop strategy to a roofscape design** address the **urgencies** of the city in an effective manner?*

Yes it does so quite well, on condition that both the stakeholders as well as the municipality are showing willingness to find synergies between their values and idea. The pattern strategy creates a tool that allows these synergies to be identified and translated into a design. This could address not only the urgencies (or values) of the neighbourhood, but also of the stakeholders. Although some adaptations and additional testing are required to refine the strategy for more flexibility, the current patterns offer a variety wide enough to represent a range of possible needs and ideas.

The values work, as designed, to identify qualities that could speak to certain stakeholders and indicate in what practical solution they can be manifested. Moreover, they provide handholds for the rooftop designer to understand the input of the stakeholders better and conceptualise their wants and needs more accurately.

Nevertheless, the strategy could benefit from a wider variety of patterns and exemplary configurations that support out-of-the-box ideas. These can help to drive a discussion towards more conceptual ideas and showcase the design capability of the strategy as a whole.

## Manifesto

The manifesto on p.86 calls for a sustainable urban living model where neighbourhoods prioritize liveability, climate resilience, and prosperity as integral parts of its urban existence. It emphasizes the transformation of urban spaces into multifunctional, nature-friendly, and culturally vibrant areas that intertwine with everyday life of its occupants. The pattern strategy is a proposed answer to this vision.

With the findings of the design, I am confident in saying that the strategy indeed works towards this vision effectively.

# Chapter 6

## Conclusion & Reflection





Roofscape Impression (MVRDV et al., 2021)

# Relevance

This part will cover the relevance of the project in relation to the academic field, society, and practise. The following question will be answered in the narrative of this sub-chapter and summarised at the end.

- What is the relation between your graduation project topic, your master track (Urbanism), and your master programme (MSc AUBS)?
- How did your research influence your design/recommendations and how did the design/recommendations influence your research?
- How do you assess the value of your way of working (your approach, your used methods, used methodology)?
- How do you assess the academic and societal value, scope and implication of your graduation project, including ethical aspects?
- How do you assess the value of the transferability of your project results?

## Academic relevance

To summarise the academic component of the project: it combines a large base of varied knowledge into a tool that leverages overlap between them.

The width, or variety, of the theoretical background questionably influences its depth, or quality. One may argue that by incorporating knowledge from many disciplines, the applied knowledge on

each of these disciplines could be limited. This resembles the principle of “Jack of all trades, master of none”. And I believe my project, to some extent, fits this principle. The analysis on building structures or implementation of data for example, lacks the required depth to formulate accurate conclusions, and therefore, a significant contribution to the academic field.

However, it is to my understanding that the translation and combination of multiple fields of knowledge offers a different kind of contribution. The project is not a dissection of the spatial properties of rooftop, or its structural capacities and solutions, or the implementation of data in roofscape design. The project proposes a means to combine these fields into a strategic approach that effectively tackles a problem. I think the principle that should apply here is “ $1 + 1 = 3$ ”.

To conclude, the project is of very little academic relevance regarding each of the individually treated fields of knowledge. However, the combination of these fields and translation into an applicable tool offer an approach that bridges the gap between academics and practice. It shows its relations and offers handholds for both sides: an introduction to the academic theories for practitioners, a method for translation for academics. Especially in the

field of Urbanism, the translational bridge between academics and practice is a recurring theme.

### **Societal Relevance**

The project proposes a strategy that offers handholds for stakeholders to make educated decisions regarding the design and implementation of a rooftop in a roofscape. I believe this is a form of empowerment. It gives stakeholders in a roof the knowledge to understand the consequences of a rooftop in a city, and authority to act upon according to their own beliefs and ideas. Especially in the case of rooftops, where often the financial component steers the discussion, revealing the other possibilities and their associated values could help to address other, non-financial components in this discussion. Ideally, the strategy creates a platform that stimulates cooperation between stakeholders.

### **Ethical Considerations**

The strategy offers a platform for stakeholders that are not in the owner associations, such as tenants, to engage in a discussion regarding the rooftop. As has been said before, this could be seen as a form of empowerment. However, this might work counteractively. It might also offer economically driven stakeholders a platform to actively disregard tenants, as they hold no decisive authority when it comes to the rooftop. The result of this might be a situation where the discussion is initiated, but tenants are denied influence.

The second point considers gentrification as a threat the strategy comes with. The project aims at developing intensive-use rooftops that increase the efficiency of the space and add functionality. As the strategy incorporates economically driven values, an increase of property value and revenue are an integral part of the discussion. However, these economic factors may result in gentrification, as the property becomes more valuable and expensive. Similar to the case study of the High Line, the introduction of new green spaces (on rooftops) can further accelerate this process (Sacco et al., 2018). The strategy does not take these factors into account, and considers an increase of property value as a motivator for economically concerned stakeholders, which often inevitably form an important faction of the discussion.

### **Relation to Urbanism & MEP**

In the studio Metropolitan Ecologies of Place (MEP), an important element is the metabolism of the city, which involves the interaction between systems (both natural and human) in the urban environment. The studio proposes a methodology that analyses the metabolism of a set context, which in my project is the roofscape, and find leverage points to introduce systemic changes.

In my project, I am working with the metabolic system that surrounds rooftops. In this metabolism, the stakeholders and their values form the base of all transformations. These different streams of stakeholders and values intersect on



the various levels, including rooftops. The project analyses the different components, such as the stakeholder, the building and the context, and leverages synergies between their associated values to come to a conceptual rooftop design. Similar to how other students in this project leverage overlap between natural components in the spatial domain, like agriculture and salination, my strategy allows stakeholders to find overlap in what they find important.

The relation to Urbanism as a MSc track is less obvious, but very relevant. First of all, the proposed strategy and underpinning research extends its scope beyond the spatial domain. Whereas the rooftop is associated with many spatial properties, the projects look to those who interact with this space, rather than the space itself. It is a very human-centred approach to a spatial design. Although this is not a very typical approach to an Urbanism project, it still is more related to Urbanism than to any other field. Especially in the analysis of metabolisms, the resulting qualities and properties of the design often outweigh the design itself, but still meet in the spatial domain. For my project, this is no different. Although the developed strategy is human-centred and value-driven, each of the analysed components have a direct relation to the space it works with: a rooftop. This understanding of interacting values in space is a competency not many disciplines outside of Urbanism possess.

## **Transferability**

The strategy of the project is designed to be a systematic approach that can be transferred to various contexts. This is reflected in the palette of patterns in the pattern language. However, the workshops and testing mechanisms have been oriented towards residential settings. This means that the implementation of the patterns has not been validated in these different contexts. Some test and adaptations might be required to transfer the strategy to other context, including a revision of the values and the technical requirements.

On another level, the project itself has transferrable aspects as well. The combination of the multiple fields of knowledge, the respective translation of this knowledge into a strategy and the iterative nature of its development show a methodology for tackling urgencies in the urban domain that heavily rely on stakeholder engagement. The project establishes itself as an example of how this translation of knowledge into a stakeholder-, or user-friendly tool can be made. Moreover, the circumstances are created that allow new knowledge and perspectives to be inserted into the project as iterations. These can build further onto the current implementation on rooftop design, or can extend itself to other subjects in the urban domain, such as facades, streets and public space designs.



## METHODOLOGY

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### Literature Review

The literature review refers to the theoretical underpinnings of the concepts used in the project. Specifically, the impact and importance of rooftops in modern-day sustainable urban planning (as presented in chapter 1), as well as the elaboration on incentive and motivation in stakeholders (as presented in chapter 2) have been the result of other works of literature. These have formulated the core concepts and paved the way for the strategy to be developed.

### Consulting Experts

Besides the knowledge gained from literature, a lot of knowledge is gained from experts. The symposium, and talk with Daan de Leeuw are examples of this. These helped me to identify difficulties and obstacles regarding rooftop design, which I could later elaborate on and validate using the theory from the literature review.

### Case Studies

The case studies that were used in this project were often aimed at increasing the understanding of the status quo. These include analyses of satellite images, and well-documented cases, such as Dakakker. Besides revealing the current state of roofscapes, they also offered a palette of different (spatial) qualities, which have laid the foundation of the value-driven strategy and the patterns.

### Workshops

Throughout the iterations, the testing of the strategy was partly done by workshops. These were organised events in which specific elements of the strategy could be tested and validated. In this workshop, a variety of methods were used, including empirical (observational) research and surveys. The workshops offered a quick and effective tool to test the strategy while gaining direct, qualitative feedback from the participants. However, the qualitative feedback and observations were quite difficult to accurately record.

### Research through Design

The final method that should be highlighted is research through design. This was applied to the design of the patterns and their values, to research what information and values represented the stakeholders. This has proven to be an effective and time-efficient method that, in combination with the workshops, offer a hand-on approach that complements the theoretical knowledge.

### Iterations

The strategy was developed using an iterative process. It started out as a very simple stakeholder-driven strategy in the first weeks of the project, which through testing and research grew into the strategy it is now. This means that, as opposed to the linear presentation of the theoretical research in Chapter 1 and 2, the knowledge base grew over time and in relation to

the findings of the strategy. For example, the researcher regarding “Strengthening Benefits” and “Mitigating Resistance” was a result of the findings of the first workshop, which indicated that there was a resistive component in the assessment of the patterns.

All in all, this iterative process allowed the research to be guided naturally into the current strategy, utilising the interaction between research and design (of the strategy). However, a downside to this approach is that the interpretation of the

results heavily influenced the direction of the research and therefore, the project. Other interpretations of the results could have led to a very different outcome, supported by a very different knowledge base. This makes it difficult to validate whether the resulting strategy of the project is a natural outcome of the problem statement, or whether the problem statement is a natural response to the imposed strategy. In other words: does the solution fit the problem, or does the problem adapt to the solution?

## QUESTIONS

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Q. *What is the relation between your graduation project topic, your master track (Urbanism), and your master programme (MSc AUBS)?*

A. Within the studio MEP, the role of the Urbanist can be defined as a central collector of information, who processes it into the spatial domain. The project analyses the various components in the metabolism of rooftops and leverages synergies between them. It does so within the spatial domain defined by the rooftop.

Q. *How did your research influence your design/recommendations and how did the design/recommendations influence your research?*

A. The design followed an iterative process, in which a resulting strategy was tested and reflected upon, leading to a new field of research. In this iterative process, design and research continuously influenced each other. However, this could also indicate that the research was biased works that propose an explanation or solution to the findings.

Q. ***How do you assess the value of your way of working (your approach, your used methods, used methodology)?***

A. The methods used offer a wide variety of information types that fit within the iterative process. This means that there is always a suitable method available for the problems found in the iteration. This methodology is a good fit for my professional personality, as it offers an intuitive logic behind the next steps. Moreover, the variety of outcomes and methods feeds well into the comprehension of the conceptual whole. However, this might not be suitable for other designers with a different preference.

Q. ***How do you assess the academic and societal value, scope and implication of your graduation project, including ethical aspects?***

A. The project addresses two gaps: the gap between the academic field and practise, and the gap between planning ambitions by the municipality and practical implementations organised by stakeholders. The result of the project offers a bridge between these gaps which offers handholds for all sides of the. It is both a combination of academic knowledge into a practical tool, as well as a translation of the vision of the municipality into an applicable set of interventions.

Q. ***How do you assess the value of the transferability of your project results?***

A. The result of the project: the pattern language and the strategy, are designed for transferability. Although they might require adaptations or extensions to fit other contexts. As for the project in a broader context, it is on a very conceptual level the development of a tool that allows for interaction between users (stakeholders) and the spatial domain. The methods used, as well as the tool itself, can offer a solid foundation for new co-creation or participatory design practices.

## FUTURE RESEARCH

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### Technical Aspects

The technical aspects presented on the patterns are based on the research and discussions with experts. However, their simplification remains an interpretation of this knowledge by me as the designer. Lacking the expertise and vast knowledge of these technical aspects myself, there will likely be inconsistencies in its simplification and translation. Future research should be conducted to improve how this simplification could communicate the technical aspects more accurately.

### Effects of the Strategy on a Roofscape

The implementation of the strategy as a tool to design an entire roofscape has not been researched elaborately. Although a roofscape design has been made to show potential uses, ideally, the strategy should be tested by a broader, representative audience, and projected onto a roofscape. This could show how the bottom-up approach may result in a roofscape, which in term can be analysed for its contextual qualities. It can validate whether the bottom-up approach needs to be supervised by a coordinator that takes the neighbourhood into consideration, or whether it suffices the needs of the neighbourhood as is.

### Putting it to Practise

A final iteration on the project would be to apply it to an actual rooftop, including real stakeholders, contexts and technical challenges. This could give a batter insight as to how the pattern language is successful or lacking.



# Personal Reflection

I believe that every positive quality also has a negative drawback. These are the things that have directed my project into what it has become. In this part, I will reflect on how my personal qualities and weaknesses have manifested themselves in this process.

## **Wicked Problems and Overthinking**

One of my strengths that I have been able to use in this project is that processing and conceptualisation of complex information. As the project included many facets that were taken into consideration, this quality helped to combine the knowledge into the strategy. Complementary, the preference of information width over depth fits better with my profile. I am much stronger in collecting many sources of information and combining that than diving very deeply into a couple of facets.

For this quality, the drawback manifested itself as a form over overthinking. Especially when organising the workshops, it was hard to make quick decisions and not over-prepare. Moreover, the wicked problems I prefer to unravel are at the cost of the quick visualisation and descriptions which are needed to get feedback from my mentors. This often made it difficult to communicate my findings to my mentors and work together on a solution.

Throughout the year, I have adapted to this and became better at making quick visualisations and schemes for the sake of communication.

## **The Octopus Paradox**

Another strength is that I thrive in collaborative processes with specialists. I gladly take the role upon me to work as the multidisciplinary “head of the octopus”, processing and working with the information and feedback the “arms of the octopus”, or the specialists, provide. This immediately forms a big problem, as the project is a one year long individual process. The need for a sparring partner who offers new insights and aspects to consider has significantly influenced my performance, creativity, and motivation throughout the year.

Nevertheless, this property has shaped the way I have interpreted my project. I have become more active in supplying myself with the specialised information I can work with, by consulting experts, organising the workshop and literature review. These formed sources of information from which I could develop the strategy and schemes.

But this might have led to a below-average quality of research. I understand and acknowledge that the research lacks depth. However, I do believe that the translation of the research to the strategy is of high quality. What distinguishes me as a designer

is the ability to comprehend complex and empathic information and translate it something understandable. My strength as the “head of the octopus” has shown itself in this translation.

### **Documenting Progress**

One of my weaknesses is that I am not good at documenting the findings I have made. I am able to work intuitively and respond to new findings, but this is at the cost of documenting and organising it. For example, the conversation with Daan de Leeuw was one that really helped me to understanding why retrofitting was difficult and focus on research regarding those points. However, the conversation itself was not documented very well. My intentions were to get an understanding of the current circumstances, which I got. But I have not been able to process this information concretely into the report due to a lack of documented material.

In the last phase of the thesis, I have documented my methodology and findings more enthusiastically, and I have learned how to do this much better. Nevertheless, a lot of work done before could not be used as much as I would have like to.

### **What is a Designer?**

The overarching question to this entire project has been: What is an urban designer, and does this reflect me? The focus on a design method rather than a design has plagued the project until the very end. It took a retake and several months delay to

understand the role of- and apply design in this process, which eventually has gained its own meaning for me personally.

For me, to be an urban designer is to understand qualities of space and translate these into something that can be made. The pattern strategy does just that. However, it took me to realise that an important step in this is to figure out what this realisation means, and whether the process reflects the outcomes. This is why the last chapter “Designing with Patterns” on p.156, was the result of my retake assignment. I was missing the key ingredient of understanding the spatial consequences of my method, and evaluating whether the process reflects the outcome.







# Chapter 7

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