

# DESIGN IN PINK

SPATIAL STRATEGIES FOR **INCLUSIVE** AND **SAFE** URBAN **MICRO MOBILITY**

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### **Spatial Strategies for inclusive, affordable and safe urban micromobility**

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# COLOPHON

The vision of Design in Pink focuses on a city where everyone can contribute to the energy transition by prioritising shared and public transportation over private cars. By implementing diverse, safe, and accessible mobility options, we aim to reduce emissions, enhance urban safety and create a more sustainable and inclusive future. This project was created by Quazi Anika Afrin, Sterre Keukens, Kika van der Schans and Kate Schuitemaker during the first year of the master track urbanism.

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## THE ABSTRACT

This report is made to show how urban planning and spatial design can help to create a more inclusive and gender equal mobility system that supports the travel needs of low-income women living in peripheral areas of Rotterdam. The research topic for this report is a result of the energy transition that the Netherlands is going through, which mainly influences the lives of women. Some policies that are set for the energy transition, like the implementation of the low emission zones and the ban of fossil fueled cars, mainly affect inhabitants in peripheral areas, since those areas are more car dependent and economically vulnerable. The neighbourhoods Charlois and Hilleegersberg-Schiebroek are used as case studies to highlight the socio-economic differences within Rotterdam.

The travel behaviour of women often exists of more trip chaining: for work, caregiving and housekeeping duties than men, on whom the current mobility system is focused. Besides the mobility system, there's also personal safety issues that women encounter more often. These issues are caused by poorly lit streets, isolated transit stops and harassment, influencing their mobility and autonomy. Even though we live in the twenty-first century, design aspects that make transportation safer and more comfortable for women are often overlooked.

To reduce this mobility gap, the research for this project combines literature reviews, with street interviews and spatial analysis, to develop a strategic spatial plan that integrates both interventions on street-level and on regional level. The focus of the plan is the implementation of shared micromobility to make last-mile transport possible.

The result of the research is a spatial plan for Rotterdam, which makes the city more inclusive and accessible through an upgraded mobility network that focuses on the needs of its most vulnerable residents, so that nobody is left behind during the energy transition.

Keywords: *women, micromobility, sustainable transportation, inclusivity, accessibility*

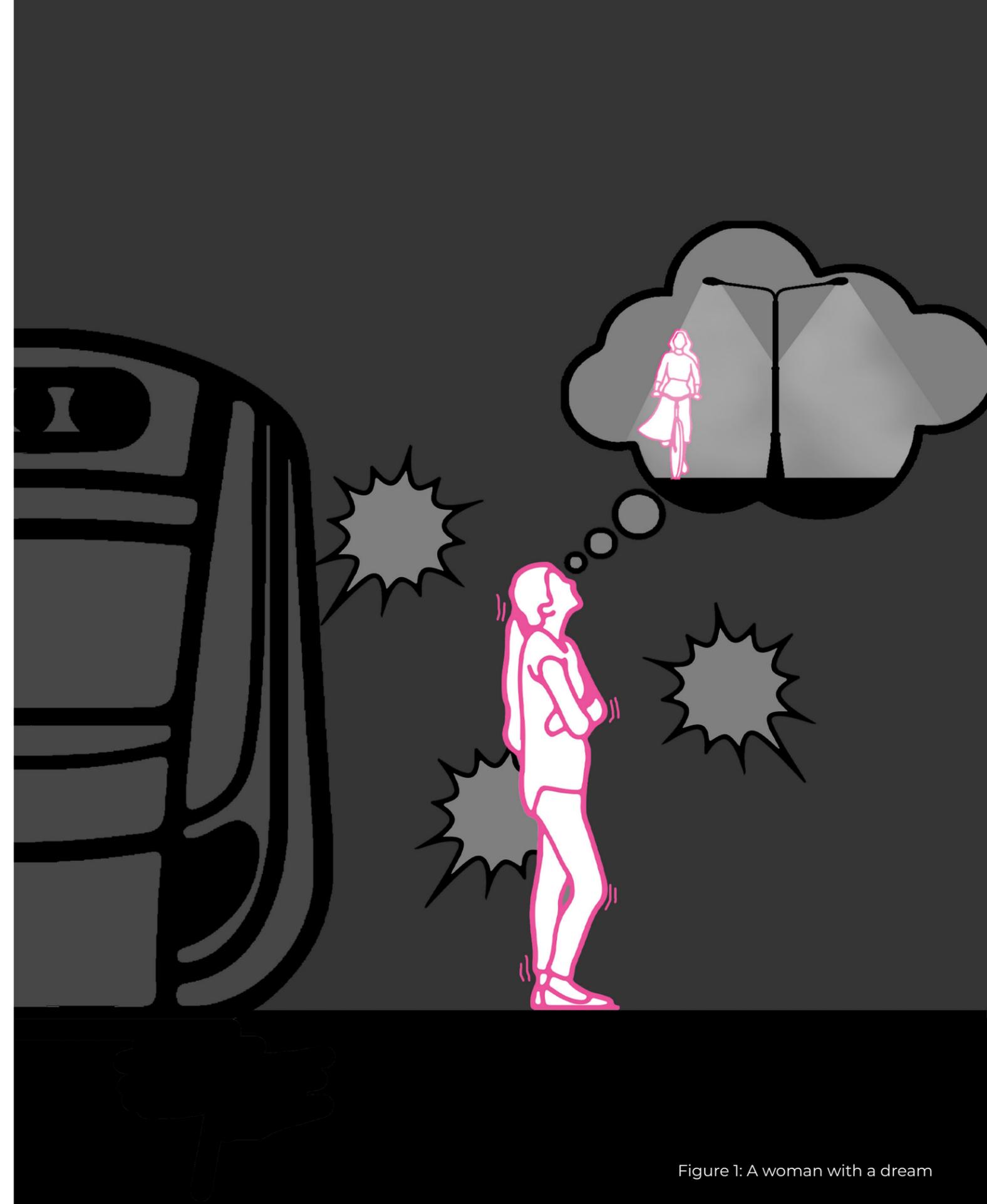


Figure 1: A woman with a dream

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# INTRODUCTION

# ENERGY POVERTY

In 2021 a strong increase in energy prices drew public and political attention to the issue of energy poverty in the Netherlands (Mulder et al., 2022).

**Energy poverty** refers to the situation where households struggle to afford sufficient energy for basic needs. It results from a combination of low income, high energy bills, and poorly insulated or energy-inefficient houses.

Around **7%** of Dutch households are affected by energy poverty (Mulder et al., 2022). These households spend a large share of their income on energy. As a result, they may reduce their use of heating, experience discomfort or fall into debt. In addition **48%** of Dutch households are unable to participate in the energy transition related to the built environment (Mulder et al., 2022). They live in a poorly or moderately insulated house that they cannot upgrade. This because they are either tenants or owners without the financial means to invest in energy-efficient renovations.

Energy poverty is not evenly spread across the country. It is more common in peripheral regions.

In urban areas, energy poverty often occurs in low-income neighbourhoods. Cities such as Rotterdam and The Hague have several districts where energy poverty is concentrated. These areas are characterized by high population density and socio-economic disadvantages. The spatial pattern of energy poverty in the Netherlands is shown on the map in Figure 4.

Energy poverty percentage of the Netherlands

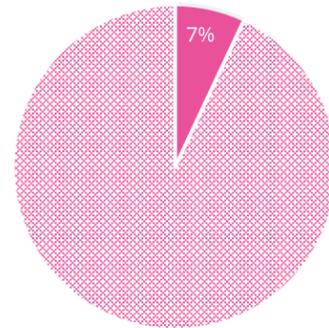


Figure 2: Energy poverty percentage of the Netherlands (Mulder et. al, 2022)

Percentage of the Netherlands unable to participate in energy transition

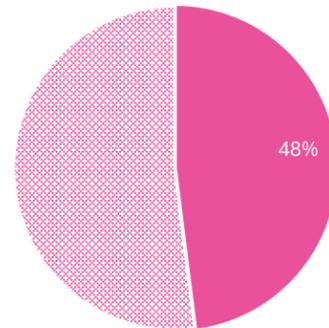


Figure 3: Percentage of the Netherlands unable to participate in energy transition (Mulder et. al., 2020)

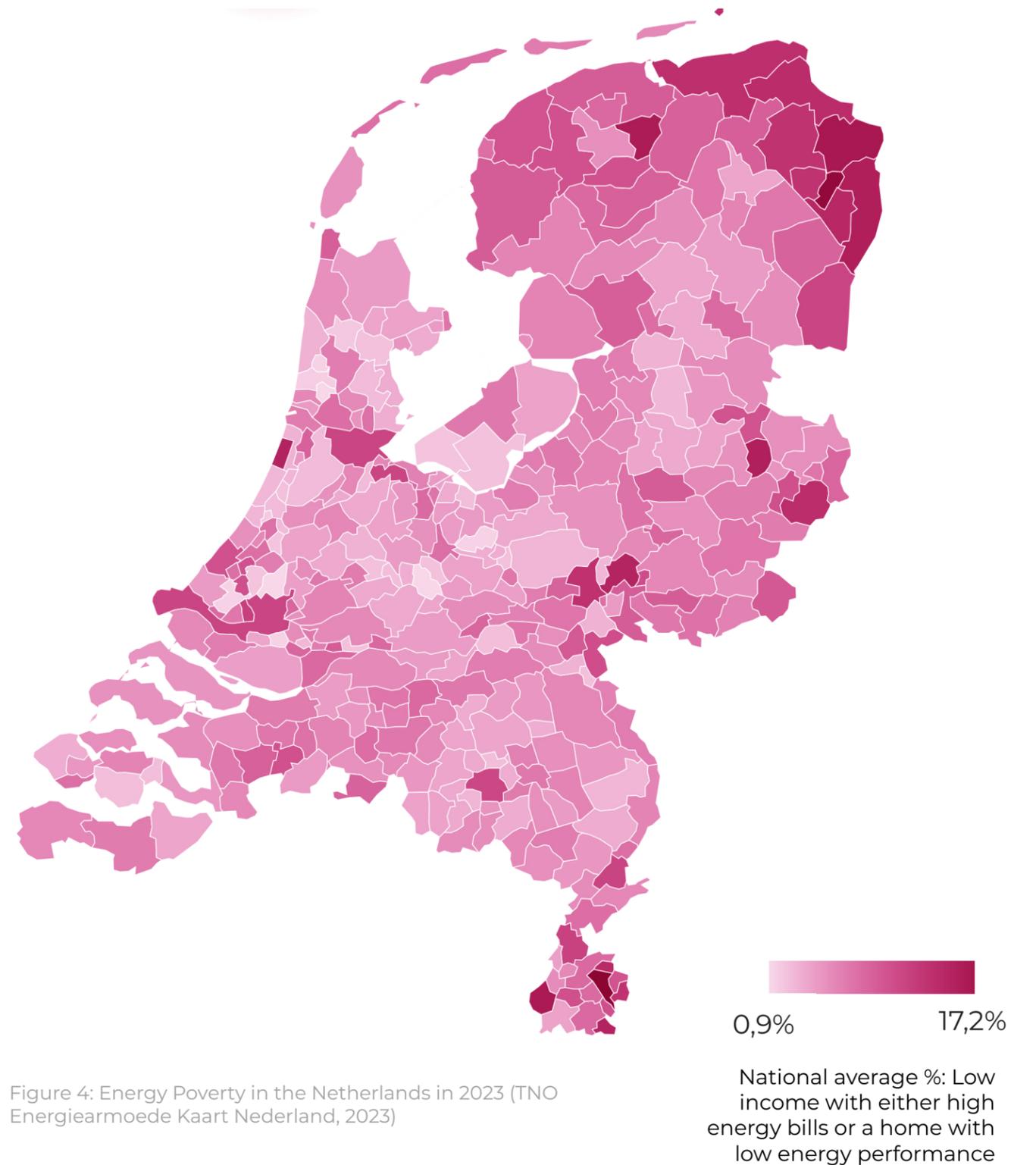


Figure 4: Energy Poverty in the Netherlands in 2023 (TNO Energiearmoede Kaart Nederland, 2023)



# POLICIES RELATED TO MOBILITY POVERTY

The Dutch Climate Agreement states that from 2030 onwards only electric vehicles (battery-electric, hydrogen, or solar-powered) will be allowed for first-hand sales. This is despite the fact that these cars are relatively expensive. In a study conducted by CBS, the most commonly cited reason for not switching to an electric vehicle was the high purchase price. Residents of peripheral areas that are dependent on their cars and don't have the means to invest will be affected by this regulation.

On top of this, CO<sub>2</sub>-emissions need to be reduced, particularly in major emission hotspots such as the city of Rotterdam. Rotterdam aims to reduce CO<sub>2</sub>-emissions by 49% by 2030. Achieving this requires significant efforts to lower emissions from road traffic through new vehicle technologies, behavioral changes, economic shifts, and adjustments to public space.

In 2025 they have started with the first implementation of zero-emission zones (Gemeente Rotterdam, z.d.). Eventually they want to shift from mainly motorised transportation to electric- or human-powered, as you can see in on the visualisation of their vision Figure 7.

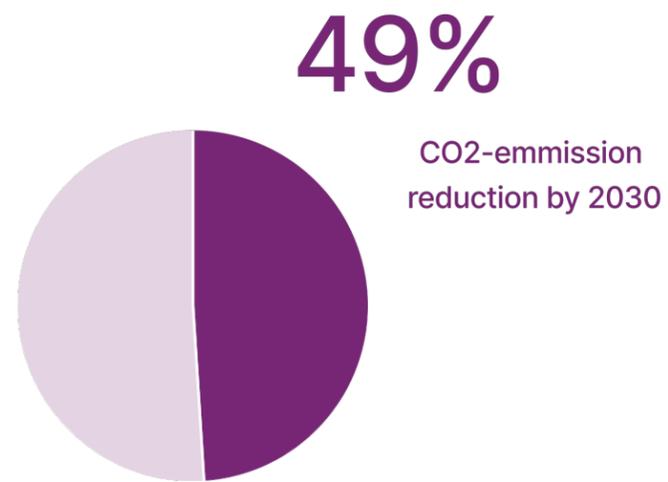


Figure 6: Percentage Rotterdam for CO<sub>2</sub>-emission reduction by 2030 (Rotterdam Climate Agreement, 2019)

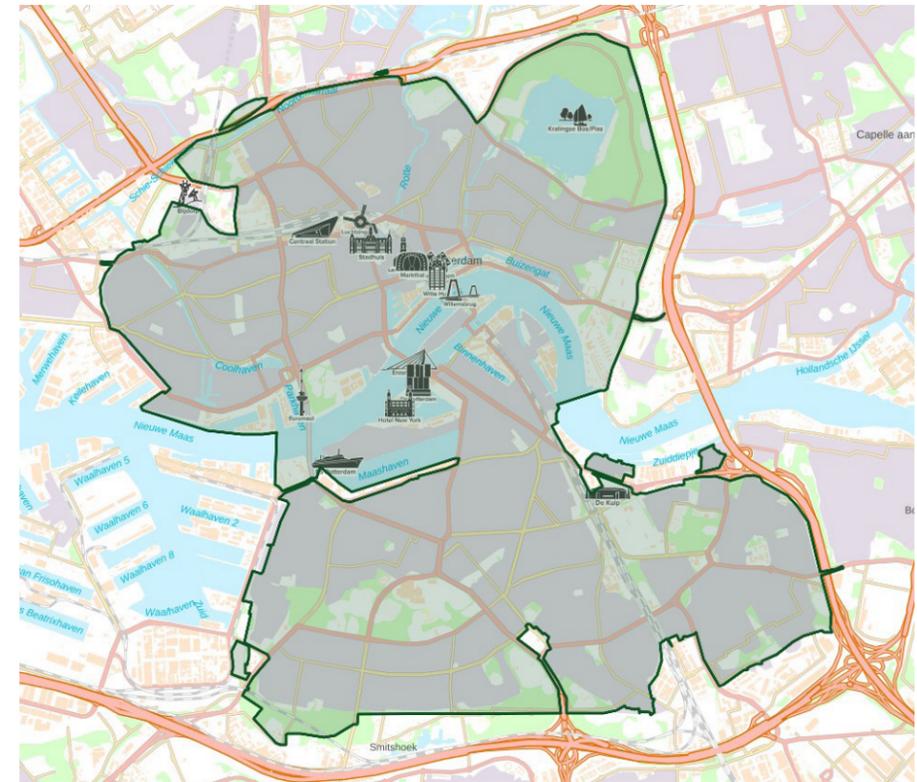


Figure 8: Zero emission zone Rotterdam by 2025 (Gemeente Rotterdam Milieuzone, z.d.)

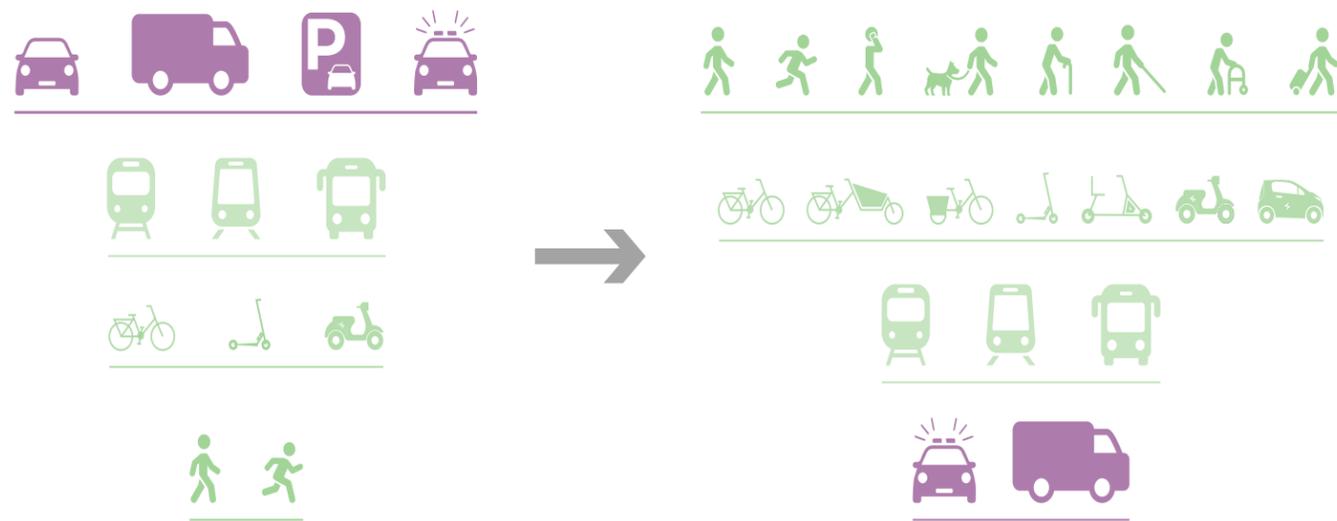


Figure 7: Vision on mobility Rotterdam (Gemeente Rotterdam, 2020)

From the first of January 2025 they started with implementing these zero-emission zones in Rotterdam, The Hague and Delft for city logistics. The map in Figure 8 shows this zone for Rotterdam. Eventually this will be implemented for all reasons of transportation.

By then residents would need to have zero-emission mobility to access these areas. This policy further intensifies the financial barriers faced by low-income communities in peripheral areas around the city centre. They don't always have the access to or can afford other sustainable transport options.

**Accessible** transport options mean that they are within walking distance, passed by regularly, don't include major detours and are easy to use.

**Affordable** transport options mean that they don't require a high investment and the variable costs are reasonable considering people's purchasing power.

# PERIPHERAL AREAS

## METROPOLITAN REGION ROTTERDAM - THE HAGUE

### Rotterdam

A mobility analysis on the Metropolitan Region Rotterdam-The Hague done by Deloitte (Deloitte, 2019) highlights the dominance of car use in Rotterdam, as you can see in Figure 9. Rotterdam is a sprawling city (Figure 10), bisected by a river and has the largest port of Europe. This report will focus on Rotterdam to gain a deeper understanding of the community's challenges and travel patterns. To achieve this, case studies will be used for further analysis.

### Charlois and Hillegersberg-Schiebroek

The community that is researched in the report lives in peripheral areas. This is why the report will use two case-studies which are located around the same distance from the city centre. These areas are Charlois and Hillegersberg-Schiebroek. The property value of Charlois is the lowest of Rotterdam and due to a large amount of apartment buildings, the population density is relatively high (AlleCijfers.nl, 2025).

On the other hand, the property value of Hillegersberg-Schiebroek is relatively high and the population density much lower than in Charlois (AlleCijfers.nl, 2025). This contrast defines the diversity of Rotterdam itself. Rotterdam has the greatest wealth inequality of the Netherlands (Gemeente Rotterdam, 2020).

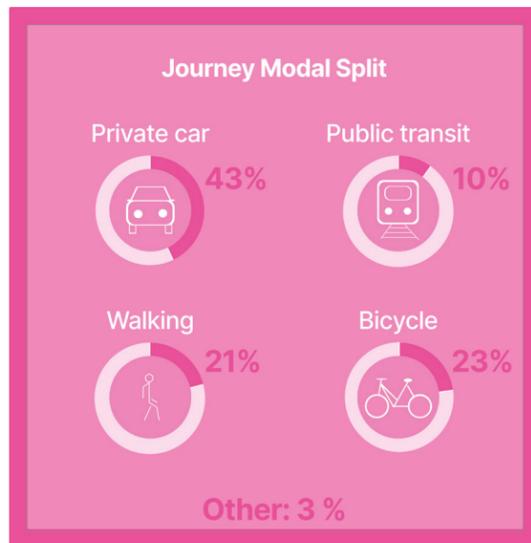


Figure 9: Journey Modal Split of Rotterdam and The Hague (Deloitte, 2019)



Figure 10: Case study areas Charlois and Hillegersberg-Schiebroek

## WOMEN IN ENERGY TRANSITION

The shift towards sustainable mobility in urban areas, driven by energy transition policies, has already posed significant challenges for residents, particularly in terms of affordability and accessibility. However, **Women** are even more affected, not only due to their weaker economic position, which makes rising energy costs more burdensome, but also because of systemic mobility barriers in urban areas (Feenstra, M., Creusen, A. 2021). As 'Invisible Women' by Caroline Criado Perez highlights, urban planning is predominantly designed around traditional male commuting patterns, namely linear home-to-work travel. In contrast, women engage in trip chaining, making multiple short trips throughout the day for caregiving, shopping, and household-related tasks. Despite shifting household structures, they continue to bear the majority of unpaid care work and rely more on public transport and walking. However, cities often fail to accommodate this mobility pattern, leading to inefficiencies and longer journey times.

Beyond accessibility, safety concerns further restrict women's mobility. Poorly lit streets, isolated transit stops, and a lack of social surveillance make public spaces unsafe, increasing the risk of harassment and violence. In a survey done by the Pointer in collaboration with the AD, with 7400 female respondents, 91 percent of the women addressed that they felt unsafe at (train-, metro-, bus-)stations and 82 percent in public transport (Pointer and AD, 2024).

The lack of gender-sensitive urban planning also extends to public infrastructure, with insufficient access to restrooms and strategically located childcare facilities making it harder for women to balance work and caregiving duties.

Addressing these systemic mobility inequities requires a fundamental rethinking of urban design to accommodate the realities of

women's everyday movement patterns, ensuring that transport systems are not only sustainable but also inclusive.

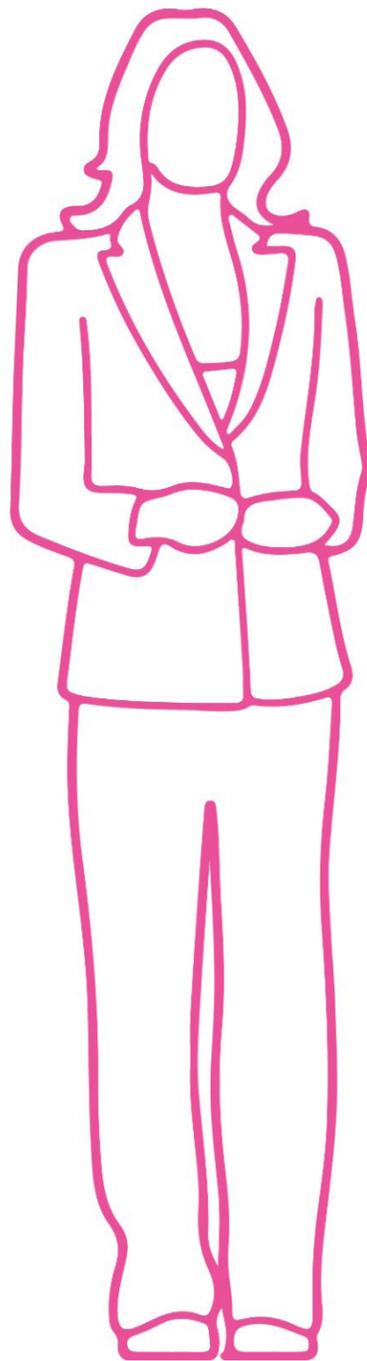


Figure 11: Woman in suit

'91% of the women feel **unsafe** at (train-, metro-, tram-) stations' ~ The Pointer & AD (Pointer and AD, 2024)

'82 % of the women feel **unsafe** in public transport' ~ The Pointer & AD (Pointer and AD, 2024)



Figure 12: Woman carrying burdens while taking the public transport

'84% of women between the ages of 18 and 45 have experienced **street harassment**, and 90% have adjusted their behaviour because of it. ~ Erasmus university, commissioned by the Municipality of Rotterdam Rotterdam (Fischer, T. Vanderveen, G. 2021)

"Can I milk you?"

"If you weren't that young, I would tear that ass up"

"Hi Baby, nice ass, let me get a bite out of that"

"Hey beautiful lady, give us a little smile, will you?"

Figure 13: Quotes from harassed women in Rotterdam (Robert van de Griend, 2021)

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# METHODOLOGY

## PROBLEM STATEMENT

The energy transition is reshaping urban mobility, but low-income communities in peripheral areas are especially vulnerable. In the Metropolitan Region Rotterdam-The Hague, policies like the 2025 zero-emission zones and the national 2030 ban on fossil-fuel car sales will impact car-dependent communities in peripheral neighbourhoods. This report examines communities in peripheral areas through two case studies, Charlois and Hillegersberg-Schiebroek, which are similarly distanced from the city center but differ significantly in property value and population density, highlighting Rotterdam's socio-economic diversity and wealth inequality.

Women in these communities face even greater difficulties. Due to their weaker economic position, rising energy and transport costs hit them harder. Additionally, they navigate urban spaces differently than the typical home-to-work commute patterns. Women frequently engage in trip chaining: multiple short trips following each other with multiple purposes, such as working, caregiving, shopping, and household tasks. This is often overlooked in urban planning, leading to longer travel times and inefficiencies.

Furthermore, personal safety concerns, due to street harassment, poorly lit streets, isolated transit stops and a lack of social surveillance, further restrict women's ability to move freely and securely through urban spaces.

As the energy transition progresses, it's crucial that the low-income communities, particularly the women in these communities, are not left behind. Understanding the link between mobility, gender, and socio-economic disadvantage is essential for creating an inclusive, affordable, accessible and safe spatial urban plan.



Figure 14: Woman with stroller

## DESIGN QUESTION

'How can spatial planning and design contribute to an inclusive and gender-sensitive urban mobility system that supports the complex travel needs of low-income women in peripheral neighborhoods in the Netherlands during the energy transition?'



Figure 15: General impression on Charlois and Hillegersberg-Schiebroek during field trip

# MATRIX

## SUB QUESTIONS & RESEARCH METHODS

Question number	Question number2	Method
<b>1 What are the mobility profiles of women living in peripheral area's of cities in the Netherlands?</b>		
1.1	What are the socio-demographics of these area?	Critical mapping
1.2	What are the current transport modes of this community?	Case-study containing media-analysis, two field trips, a survey and street interviews
1.3	What transportation-related challenges does this community face?	Case-study containing media-analysis, two field trips, a survey and street interviews
1.4	What factors influence their choice of transportation mode?	Case-study containing media-analysis, two field trips, a survey and street interviews
1.5	How do women perceive urban areas, particularly around public transport stations/stops?	Case-study containing media-analysis, two field trips, a survey and street interviews
1.6	What prevents them from switching to more sustainable transport options	Case-study containing media-analysis, two field trips, a survey and street interviews
<b>2 How can micromobility systems be adapted to better support the diverse travel patterns and needs of women to promote sustainable and inclusive transportation?</b>		
2.1	What is the current state of micro-mobility systems (infrastructure, technology and vehicle types)?	Field trip & online research
2.2	What infrastructure and spatial design changes are needed for effective micro-mobility implementation?	Designing with the literature
2.3	Where would the most effective locations for micro-mobility hubs be?	Spatial analysis
2.4	How should the number and types of micro-mobility vehicles in a hub be determined?	Critical mapping & literature research
2.5	How can micro-mobility be improved to better support trip-chaining and the transportation of burdens, such as goods and dependents?	Designing with the literature
<b>3 How can public transport stations/stops and transfer to last-mile mobility be adapted to better accommodate the diverse travel patterns and needs of women to promote sustainable and inclusive transportation?</b>		
3.1	How do current public transport stations score in terms of amenities, safety, accessibility, and supporting facilities?	Designing with the literature Framework defining spatial quality of the high quality transportation station (Book Verena)
<b>4 What policies are needed to accomodate the vision?</b>		
4.1	Who are the key stakeholders involved, and what are their interests?	Stakeholder analysis
4.2	What are the current policies related to the subject?	Literature review
4.3	What is the timeline for implementing these policies?	Literature review

Table 1: Methodology Table

### Methodology Overview

Looking at table 1, the sub-research questions are divided in four sub-categories

1. Defining the community  
The first part of the research focuses on uncovering the mobility profiles of women living in in peripheral areas of Rotterdam. This is done through a case study approach on Charlois and Hillegersberg-Schiebroek. The community will be visualised with four profiles based on online research on the areas, two fieldtrips to the areas, several street interviews and a survey to gather insights. Sub-questions explore socio-demographic characteristics, current transport modes, challenges faced, and factors influencing transport decisions. Particular attention is paid to perceptions of public transport areas and the barriers that prevent women from switching to more sustainable transport options.

2. Adapting Micromobility for Inclusion and implementation in urban areas  
The second cluster of questions investigates how micromobility can be designed to

better serve women's needs. Field trips and online research are used to understand current systems, while spatial analysis helps identify effective hub locations. Design proposals from the book *What if Women Designed the City?* (chapter: Literature review) focus on infrastructure improvements and hub composition. These designs address trip chaining and the need to transport goods or dependents., factors that are critical to many women's mobility experiences.

3. Inclusive Public Transport Integration  
The third sub-question group focuses on the connection between public transport and last-mile mobility. Using a framework from the book *Ruimte en Lijn* (chapter: Literature review) , current stations will be assessed for safety, amount of amenities, and accessibility. Design interventions from the book *What if Women Designed the City?* (chapter: Literature review) will be applied to propose more inclusive transit nodes that support flexible travel behaviour.

4. Policy and Stakeholder Analysis  
This stage addresses the policies required

to bring the vision into reality. Through stakeholder analysis and policy reviews, the research identifies key actors, their interests, and the institutional changes needed to support equitable mobility planning. Literature is also used to outline a policy implementation timeline that will feed into the strategic visioning process.

Answering the design question:

Building on the community analysis, spatial analysis, community analysis, problem analysis and the stakeholder analysis, this final part of the project articulates a vision for an inclusive mobility system that centres women's experiences. This vision will be visualised through maps and a framework to show the interconnectivity of the city. The vision will be explained more detailed with a strategy. The strategy contains an implementation plan, different hub typologies with a formula to calculate the ratio of micromobility, a design of the different types of micromobility interventions, spatial design implementations and a overall map to show the vision for Rotterdam and for the Metropol.

### Data Collection and Tools

- Spatial Analysis in QGIS using data from OpenStreetMap and Open Dataportaal Zuid-Holland.
- Literature Review based on academic articles from Elsevier and policy documents.
- Case Study Research including field visits to Charlois and Hillegersberg-Schiebroek.
- Media and Survey Analysis using articles from NRC, AD, and de Volkskrant and surveys conducted in the field.
- Critical Mapping to explore socio-demographic inequality and travel behavior
- Design Research to visualize micromobility strategies and propose inclusive transport infrastructure.
- AI-tools are used to check our grammar.

# LITERATURE

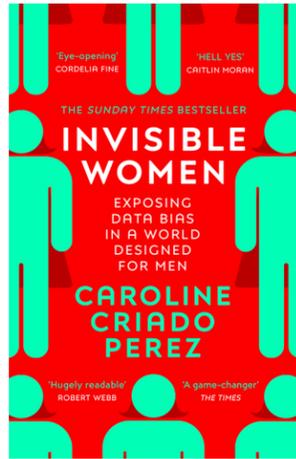


Figure 16: Invisible Women Book (Invisible Women | Caroline Criado Perez, n.d.)

This book reveals how many everyday systems, ranging from urban design to public policy, are based on data that largely ignores women's lives, needs, and experiences. The book shows how this gender data gap leads to unequal outcomes, especially in areas like transportation, health, and access to public space.

This theme directly connects to this report, which examines how women in peripheral urban neighborhoods experience mobility differently. Their travel patterns are often more complex, involving multi-purpose trips that are not well supported by traditional transport systems. Despite this, transport planning still largely relies on data centered around male commuting behavior (home-to-work).

Both the book and this report point to the same underlying issue: a persistent lack of gender-sensitive data in the design of mobility systems. Invisible Women exposes the broader knowledge gap in public policy, while this report focuses on how that gap plays out in urban mobility with the energy transition. Addressing this disconnection is essential for creating more inclusive and effective sustainable transportation strategies.

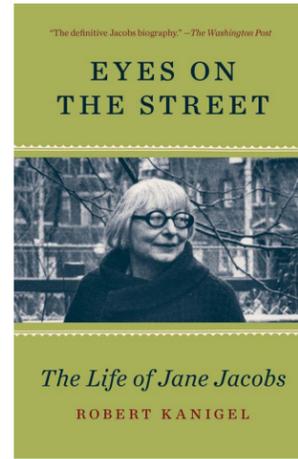


Figure 17: Eyes on the Street (Robert Kanigel - EYES ON THE STREET: The Life of Jane Jacobs, n.d.)

This book is a biography of urban thinker Jane Jacobs, whose ideas revolutionised how we understand cities. The book explores Jacobs' belief in bottom-up urbanism, human-scale design, and the importance of diverse, walkable neighborhoods. Central to her thinking is the concept of "eyes on the street": the idea that vibrant and active public spaces create safety, community, and social cohesion.

This idea is relevant to this report, which looks at how the design of mobility infrastructure can support safer, more inclusive and accessible urban environments. Just like Jacobs, this research emphasizes the importance of local context and everyday users, especially women, whose presence and movement through space are often overlooked in planning processes.

Eyes on the Street highlights a long-standing knowledge gap: the lack of attention to lived experience, informal networks, and social safety in urban design. This report builds on this by focusing on how women's specific mobility patterns in peripheral areas are not reflected in current transport systems. Both works call for urban planning that centers real people and creates places that are truly responsive to those who use them every day.

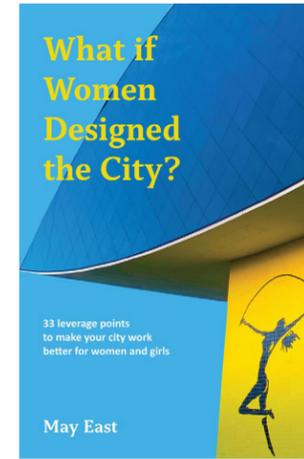


Figure 18: What if Women Designed the City? (What if Women Designed the City — May East, n.d.)

What if Women Designed the City? by May East is an exploration of how urban environments might look, feel, and function if shaped through the lens of women.

Through experience in development, sustainability development and spatial justice, the writer investigates how the city was designed through the lens of a man. The book is a blend of storytelling, systematically thinking and case studies to challenge the male-dominated urban designs. By bringing together diverse voices from over the world, East creates an inclusive framework for urban design. The book contains valuable insights on how urban design affects everything from mobility and accessibility to community resilience and well-being. Through 33 leverage points, the writer designs an inclusive framework to reimagine cities as equitable, accessible and adaptable ecosystems. The vision of this project is built on the leverage points that focus on inclusive and sustainable urban design.



Figure 19: Ruimte en Lijn (Verstedelijkt deelvan de provincie Zuid-Holland | Grafisch lokaal, n.d.)

This book explores the relationship between station environments and their potential development opportunities by combining spatial and network characteristics in ways typical of urban rail-linked areas.

We have used the technique from this book to analyse the train stations in the region of Rotterdam, a total of eight train stations and important stops have been assessed based on their location, connectivity with other public transport, wait times, living population, concentration of amenities in the area and the supporting facilities. Like the book, we have used the analysis to reveal the existing problems based on spatial and network conditions, while also identifying the changes that will be needed to improve the connectivity of the stations.

# CONCEPTUAL FRAMEWORK

## INTEGRATIVE RELATIONAL AND REALIST ONTOLOGY

### Identifying Key Concepts:

**Mobility Efficiency:** Allowing everyone to be able to make point to point movement with ease and energy efficiently.

**Equity:** Not everyone has access to the same mobility options. This is because not everyone can afford it, use it, or has access to the same options.

**Collective Sustainable Responsibility:** Governance decisions influence the energy transition and determine to what extent everyone can participate in this transition. Stakeholder engagement is essential for designing the urban environment in a way that meets the needs of the people living in the area. Reusing resources for new energy and changing spatial planning through combined efforts can make this possible.

**Inclusivity:** A key aspect of the energy transition is enabling people to adopt a more energy-friendly lifestyle. To support this, spatial planning must be adapted to create an environment that facilitates and encourages sustainable lifestyle changes.

**Women in Energy Transition:** The transition community is more vulnerable to the energy transition and it is important to ensure that the future transition can cater to their needs.

**Connectivity:** The last mile transport and the point to point movement is often not provided by public consumption. It is thus very important that the connections between spaces are easily accessible by all.

### Framework's Philosophy:

This perspective is appropriate for our research because it allows us to analyse both the structural realities of mobility inequality and energy poverty (realist ontology) and the social relationships, governance decisions, and stakeholder collaborations that shape access to mobility and resource distribution (relational ontology). By integrating both views, we can develop a spatial strategy that addresses tangible barriers while considering the dynamic interactions that influence the energy transition.

### Reflection and Justification:

This framework is established to help guide us through the research process in a way in which we can perceive what is important and how the concepts are interconnected. It is essentially a step by step guide of how we would like to connect the various research methods and participatory exercises to establish our goals. For our concepts we choose, we found three methods or research concepts we would like to explore and achieve to feel like we have made progress with the core concept. To elaborate, for Women in Energy Transition, we want to understand the lives of the Urban Women and their perspectives, while also connecting their voices to the municipalities so that we can all come together and collaborate to make urban space also catered to women and learn from the women what they seek from public spaces. All these factors would come together for us to feel that we have successfully achieved Collective Sustainable Responsibility. Similarly, we want to have strong governance structures that allow for redistribution of resources to achieve mobility equity and efficiency for all and we strongly believe that through inclusive and well connected initiatives and practices, we can start to work towards all the aspects we set out to achieve.

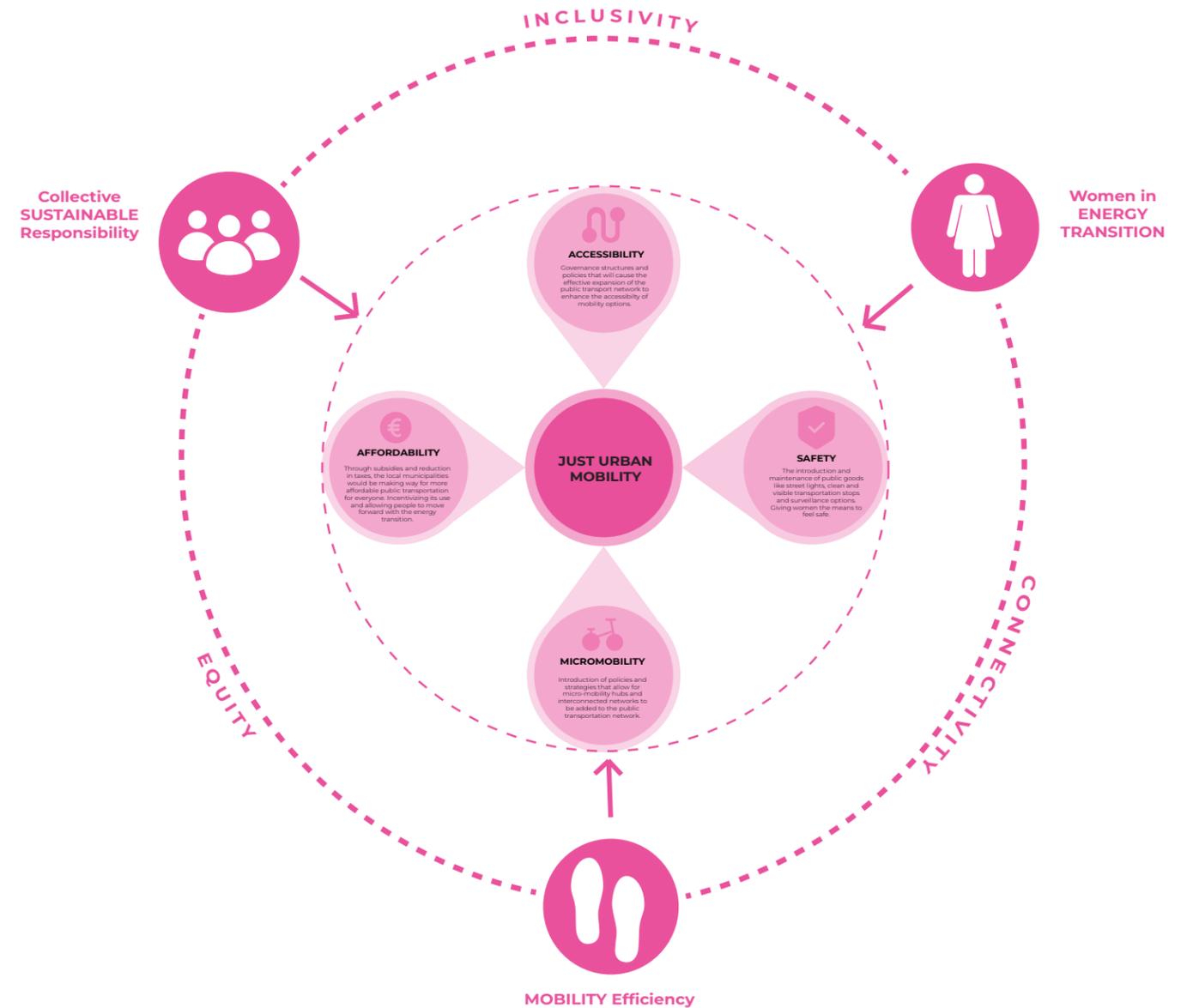


Figure 20: Conceptual Framework

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3.5 INTRODUCING MICROMOBILITY

# ANALYSIS

# REGIONAL ANALYSIS

## PUBLIC TRANSPORT IN RELATION TO URBAN AREAS

The Netherlands has a population of 18.045.532 residents. The region of Rotterdam and The Hague has 3.840.460 residents (CBS,2024). The top 3 municipalities with the most residents are:

1. Rotterdam with 569.412 residents
2. The Hague with 477.114 residents
3. Leiden with 114.814 residents

And they are also expected to grow in the upcoming years.

The region is connected through a very expanded public transport network:

### Train

The train connects the main stations of Rotterdam and The Hague to the big cities outside of the region. The company that operates most of the trains in the Netherlands is the NS (Nederlandse Spoorwegen).

### Metro

That mainly connect in Rotterdam to other areas and with one line even going to the Hague. The metro within Rotterdam is operated by RET.

### Tram

The tram operates within the city center. In Rotterdam the tram is operated by RET and in The Hague it is operated by HTM.

### Bus

There are several bus lines within the region. The bus is mainly for the connection between urban areas and peripheral areas.

- Train
- Metro
- Tram
- Bus
- High urban areas

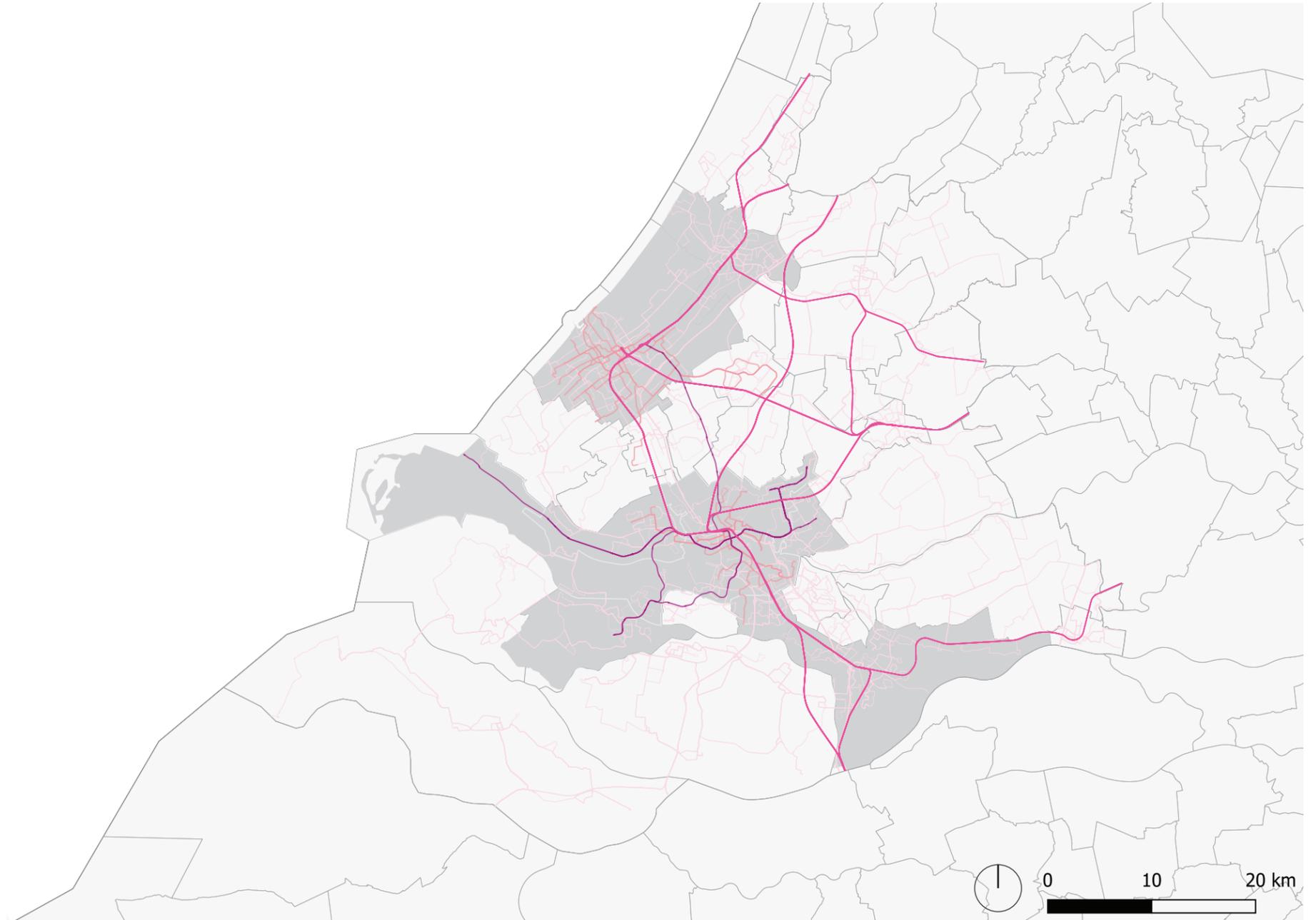


Figure 21: Map of public transport in relation to urban areas

# REGIONAL ANALYSIS

## REGIONAL BIKE NETWORK IN RELATION TO NATIONAL ROADS

The region focuses on a utilitarian cycle network for functional connections between important urban areas. The cycle network is catered to a “home-to-work” connections. The network also focuses on better accessibility to points of interests like education or shopping areas. The secondary cycle network is the recreational network which focuses on connecting green destinations with each other such as swimming lakes and nature areas (Open-dataportaal Zuid-Holland, n.d.).

The biggest connection within the region is also the national roads. Within the region you have the A44, A12, A20, A16, A15 and A29 (Komende Jaren Nieuwe Wegen En Werkzaamheden in Zuid-Holland | Evofenedex, n.d.).

- Utilitarian bike roads
- Recreational bike roads
- High urban areas

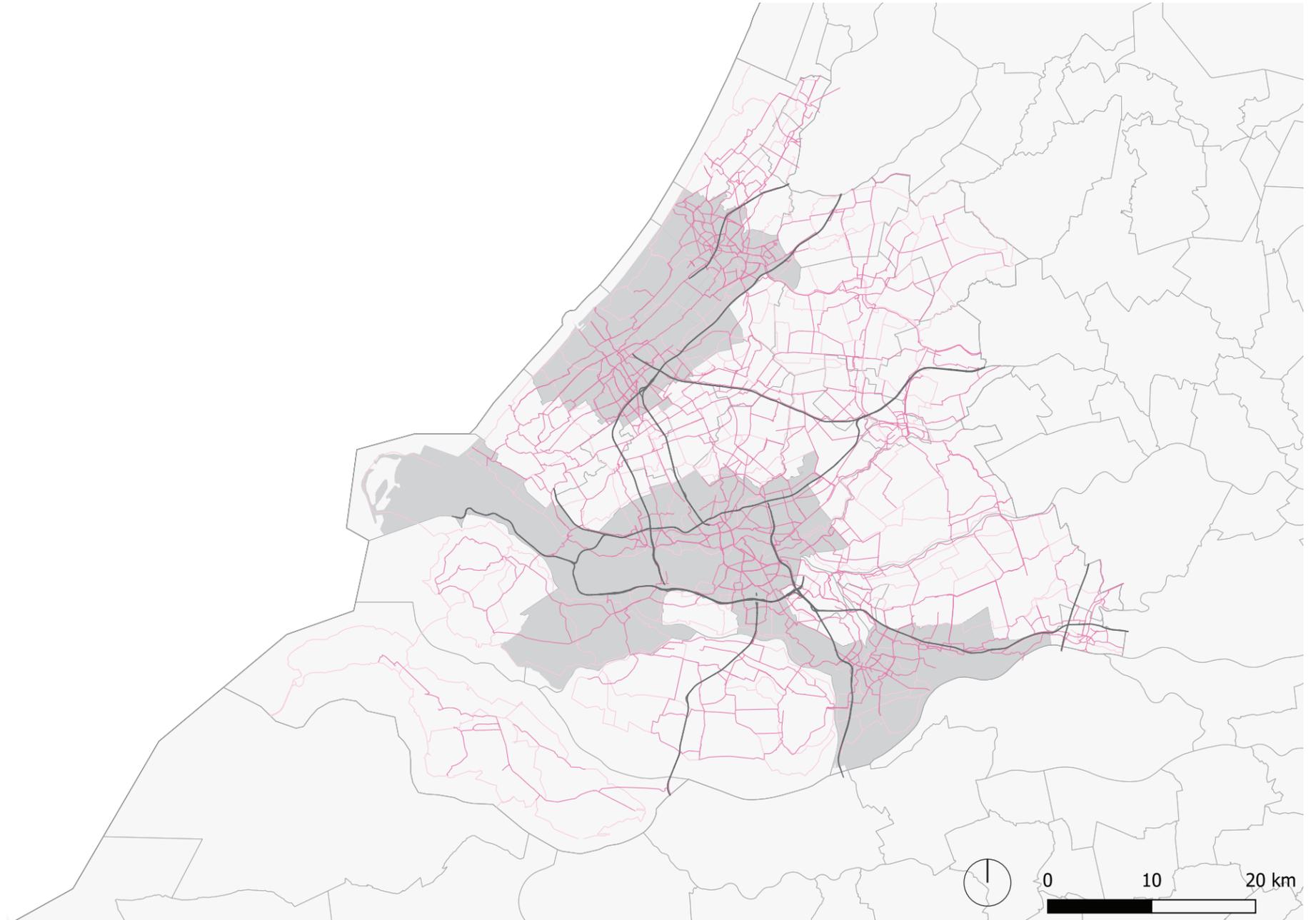


Figure 22: Map of cycle network in relation to the national roads

# REGIONAL ANALYSIS

## ZERO-EMISSION ZONES

At the moment there are 4 cities that have an environmental zone for passenger cars and vans that run on diesel. These are: Amsterdam, Arnhem, The Hague and Utrecht.

Nine Dutch municipalities have an environmental zone for fossil fuelled vehicles that are for leisure and transportation. These are: Amsterdam, Arnhem, Breda, Delft, Haarlem, Maastricht, Maasvlakte Rotterdam, Rijswijk and 's-Hertogenbosch.

For the municipalities of The Hague, Eindhoven, Leiden, Rotterdam, Tilburg and Utrecht, the environmental zone for fossil fuelled vehicles has been abolished with the introduction of the zero-emission zones as of 1 January 2025 (Locaties Milieuzones | Milieuzones in Nederland, n.d.).

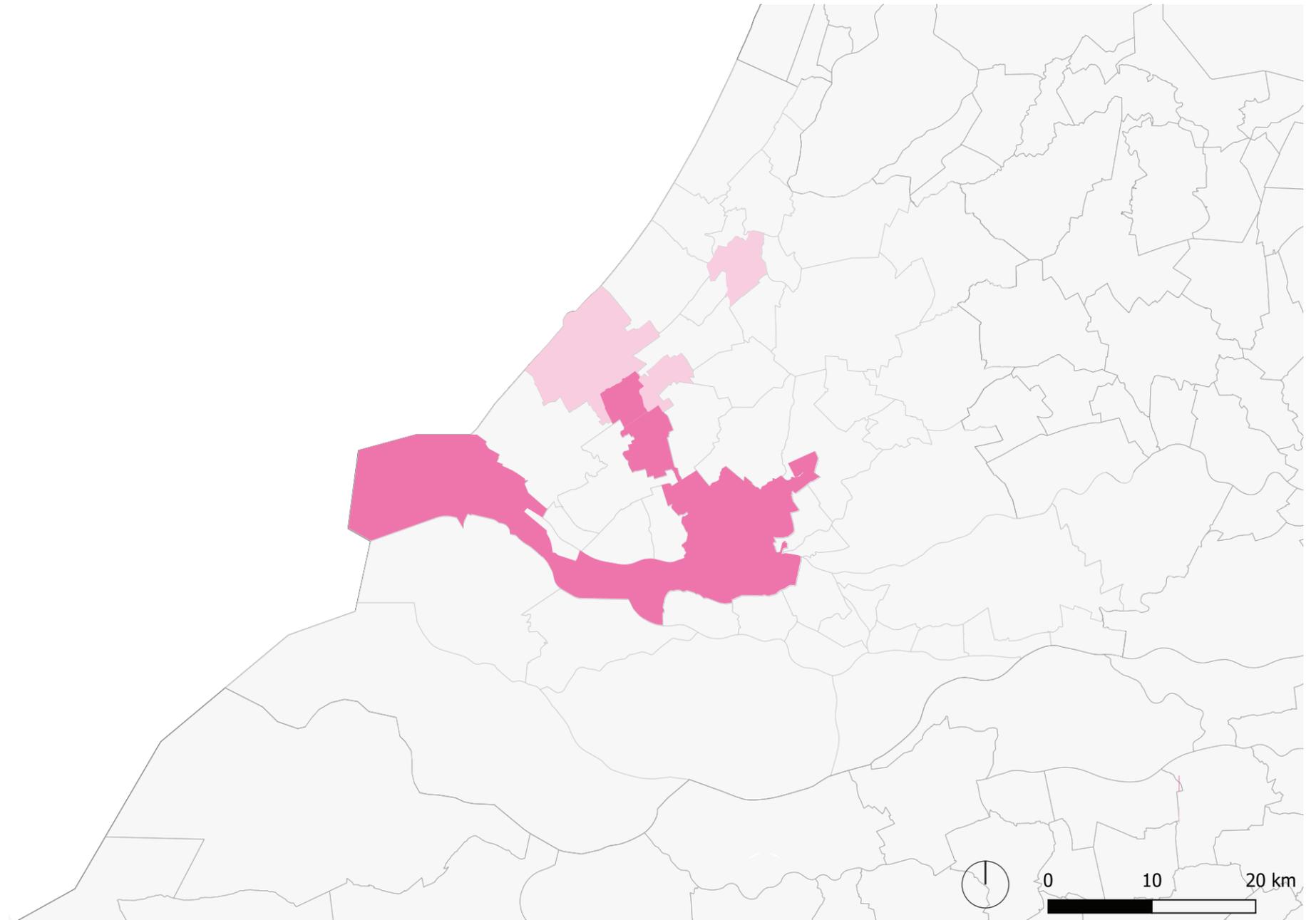


Figure 23: Map of emission zones

# PROPERTY VALUE ANALYSIS

## ROTTERDAM SCALE

The average value of a residential property (gemiddelde WOZ waarde) in the Netherlands is €379.000, while it is €402.620 in the region of Rotterdam and the Hague (CBS, 2024). The residential properties have a higher value in this area, because high urban areas have more amenities, which make these cities more attractive for residents and businesses, leading to higher house prices (Koomen et al., 2015). In Rotterdam the average value is €334.000 (based on numbers from 2024), with the highest value in the district Hillegersberg-Schiebroek (€472.000) and the lowest in Charlois (€217.000).

Sources used: AlleCijfers, OpenStreetMap & PDOK

Hillegersberg-Schiebroek



Acreage = 1326 acres  
Inhabitants = 44.855  
WOZ = €489.000

Charlois



Acreage = 1190 acres  
Inhabitants = 80.525  
WOZ = €230.000

1. Botlek Europoort Maasvlakte - x
2. Charlois – €230.000
3. Delfshaven – €316.000
4. Feijenoord – €302.000
5. Hillegersberg-Schiebroek – €489.000
6. Hoek van Holland – €311.000
7. Hoogvliet – €289.000
8. IJsselmonde – €261.000
9. Kralingen-Crooswijk – €381.000
10. Nieuw Mathenesse – €232.000
11. Noord – €356.000
12. Overschie – €395.000
13. Pernis – €289.000
14. Prins Alexander – €357.000
15. Rotterdam Centrum – €412.000
16. Rotterdam Noord-West – x
17. Rozenburg – €282.000
18. Spaanse Polder – €480.000
19. Vondelingenplaat – €14.300
20. Waalhaven-Eemhaven – €348.000

-  Business Park
-  ≤ €200.000
-  €200.000 - €300.000
-  €300.000 - €400.000
-  ≥ €400.000
-  Water

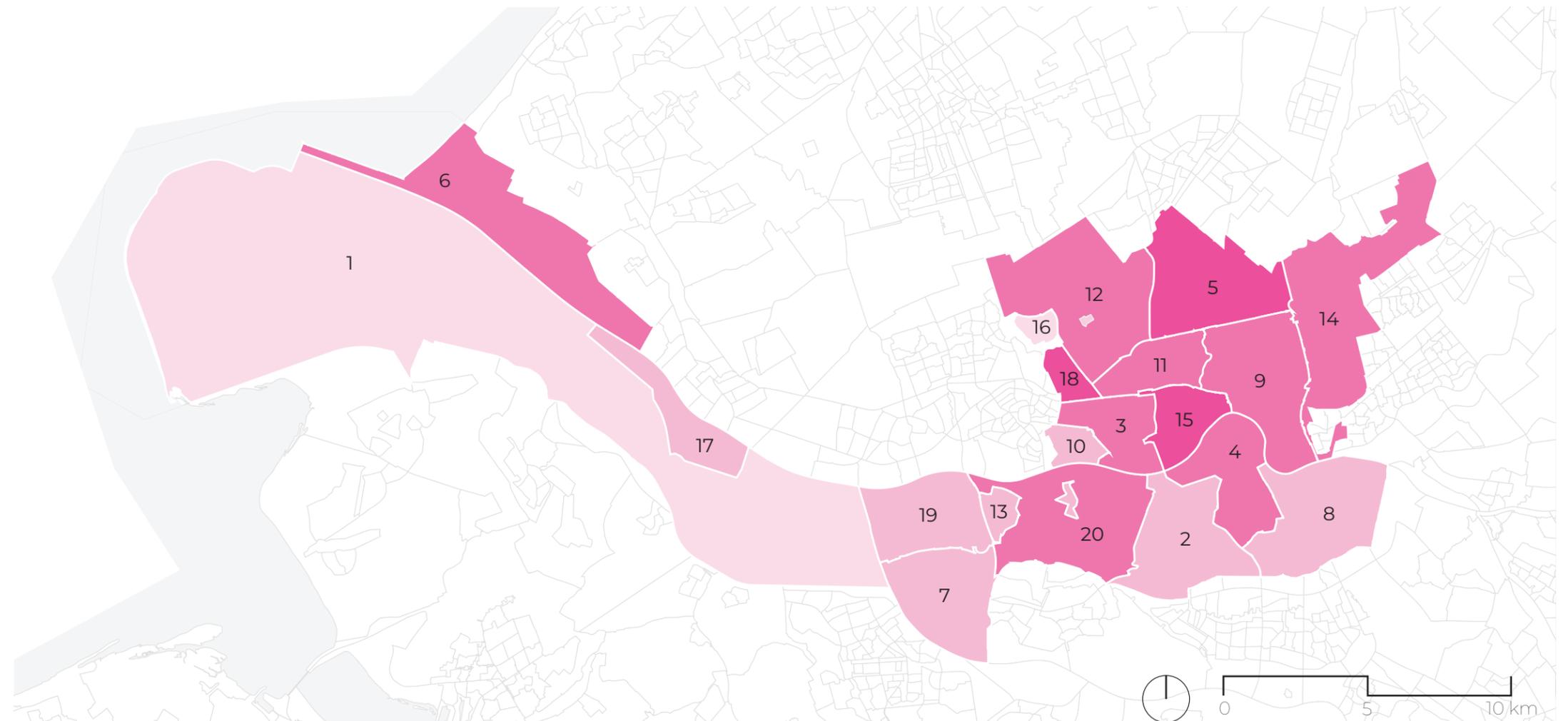


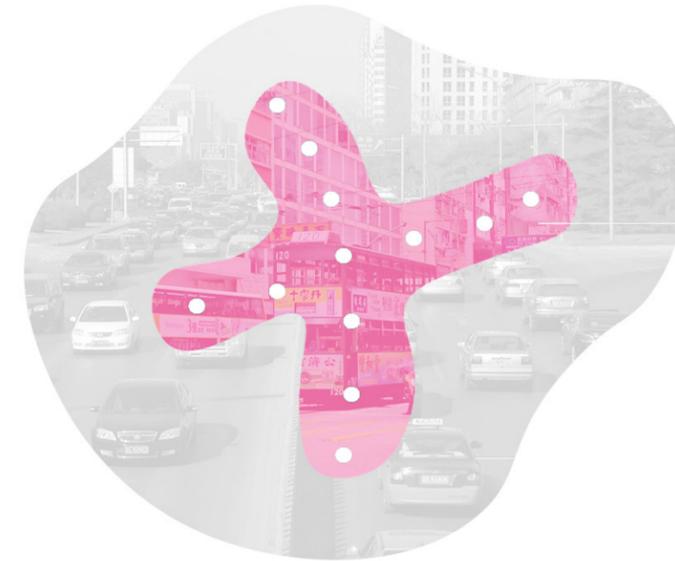
Figure 24: A spatial map of the average property value per neighborhood in Rotterdam.

# CAR OWNERSHIP ANALYSIS

## THE RELATION BETWEEN PUBLIC TRANSPORT AND CAR OWNERSHIP

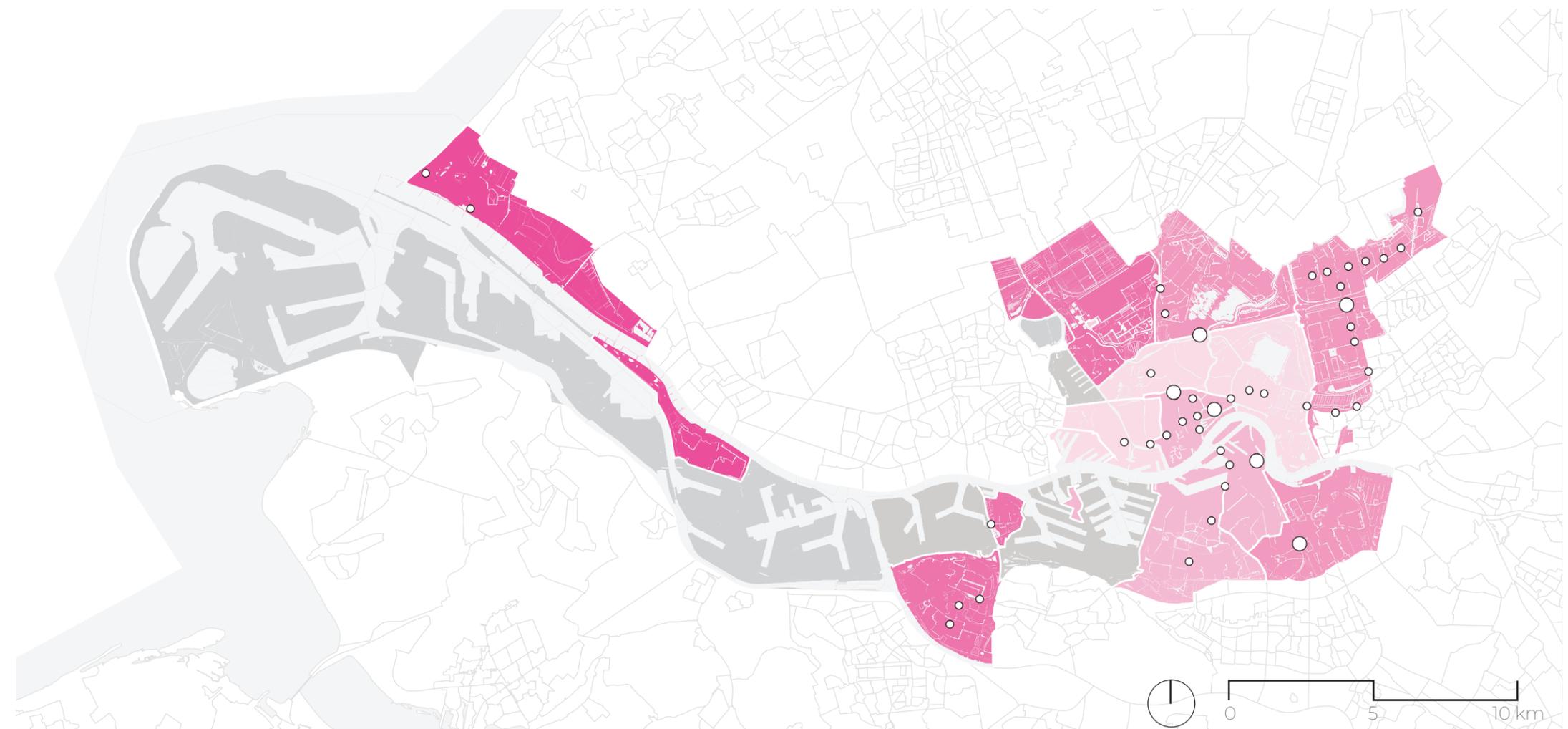
This map shows the average amount of cars per household for the neighborhoods of Rotterdam, in combination with the metro and train stops. This overlap shows that the city center has a better public transportation network than peripheral areas of the city, where in result, there is a higher average of car ownership, in order to be able to transport themselves.

Sources used: AlleCijfers, OpenStreetMap & PDOK



Representation of the areas accessible by public transport.

1. Botlek Europoort Maasvlakte - no data
2. Charlois - 0,6
3. Delfshaven - 0,5
4. Feijenoord - 0,6
5. Hillegersberg-Schiebroek - 0,8
6. Hoek van Holland - 1,1
7. Hoogvliet - 0,9
8. IJsselmonde - 0,8
9. Kralingen-Crooswijk - 0,5
10. Nieuw Mathenesse - 0,4
11. Noord - 0,5
12. Overschie - 0,9
13. Pernis - 1,0
14. Prins Alexander - 0,8
15. Rotterdam Centrum - 0,7
16. Rotterdam Noord-West - no data
17. Rozenburg - 1,1
18. Spaanse Polder - no data
19. Vondelingenplaat - no data
20. Waalhaven-Eemhaven - no data



- Train station
- Metro station
- No data
- 0,4 - 0,5 cars per household
- 0,6 - 0,7 cars per household
- 0,8 cars per household
- 0,9 - 1,0 cars per household
- 1,1 cars per household
- Water

Figure 25: A map of the average car property per neighbourhood in Rotterdam and the public transport stations.

# THE RANGE OF PUBLIC TRANSPORT STATIONS

## BASED ON INHABITANTS AND AMENITIES

This map shows the amount of inhabitants per neighborhood in combination with the metro and train stations in Rotterdam. It shows that the most populated neighborhoods are near the city center, where there are also the most public transport options.

Sources used: AlleCijfers, OpenStreetMap & PDOK

The amount of inhabitants per neighborhood:

1. Botlek Europoort Maasvlakte - 15
2. Charlois - 70.525
3. Delfshaven - 77.250
4. Feijenoord - 79.440
5. Hillegersberg-Schiebroek - 44.855
6. Hoek van Holland - 10.565
7. Hoogvliet - 36.180
8. IJsselmonde - 62.670
9. Kralingen-Crooswijk - 56.010
10. Nieuw Mathenesse - 2.410
11. Noord - 52.795
12. Overschie - 20.205
13. Pernis - 4.965
14. Prins Alexander - 97.430
15. Rotterdam Centrum - 42.565
16. Rotterdam Noord-West - 5
17. Rozenburg - 12.605
18. Spaanse Polder - 70
19. Vondelingenplaat - 0
20. Waalhaven-Eemhaven - 35

- Train station
- Metro station
- No data
- 0,4 - 0,5 cars per household
- 0,6 - 0,7 cars per household
- 0,8 cars per household
- 0,9 - 1,0 cars per household
- 1,1 cars per household
- Water

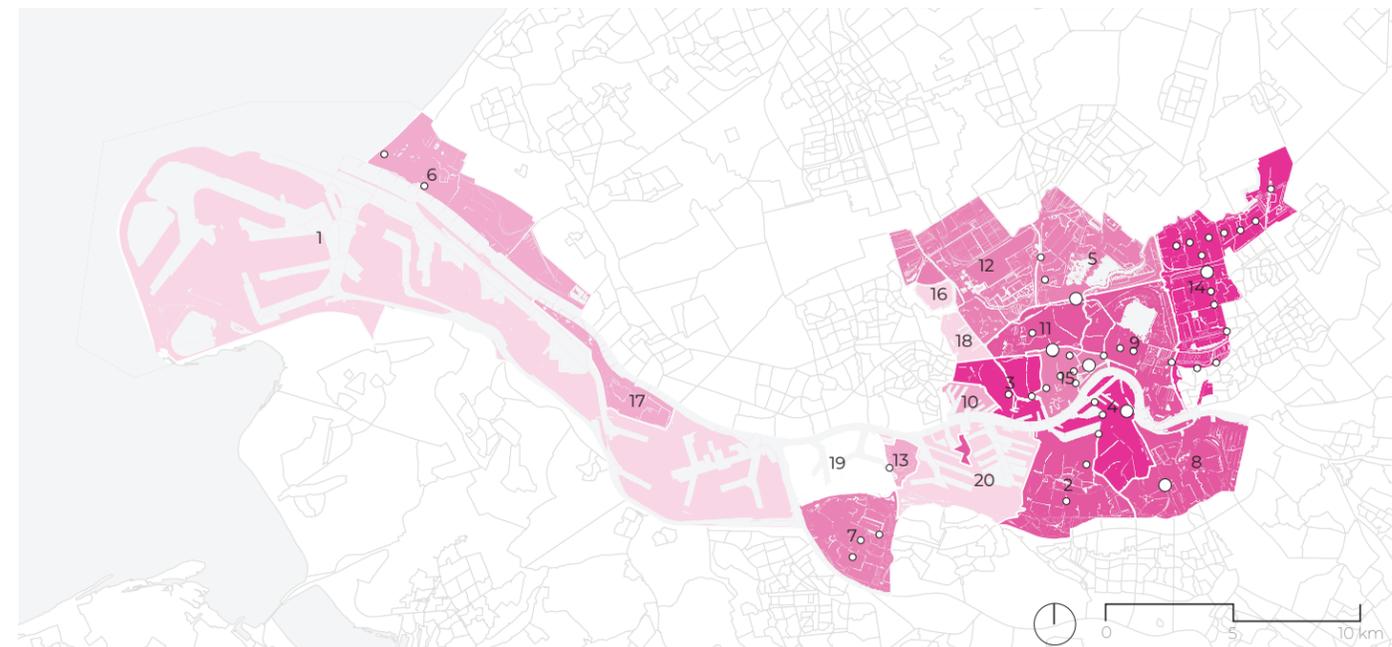


Figure 26: A map of the public transport stations and the inhabitants per neighborhood.

This map shows the amenities in combination with the metro and train stations, with a range of 800 meters (which is the maximum acceptable for rail stations) (Yang et al., 2013).

A lot of amenities are not covered within those ranges, meaning that many areas are not well accessible for people that are dependent on transporting themselves through public transport.

Sources used: AlleCijfers, OpenStreetMap & PDOK

- Train station with range of 800 m
- Metro station
- Amenity
- Amenity region
- Water

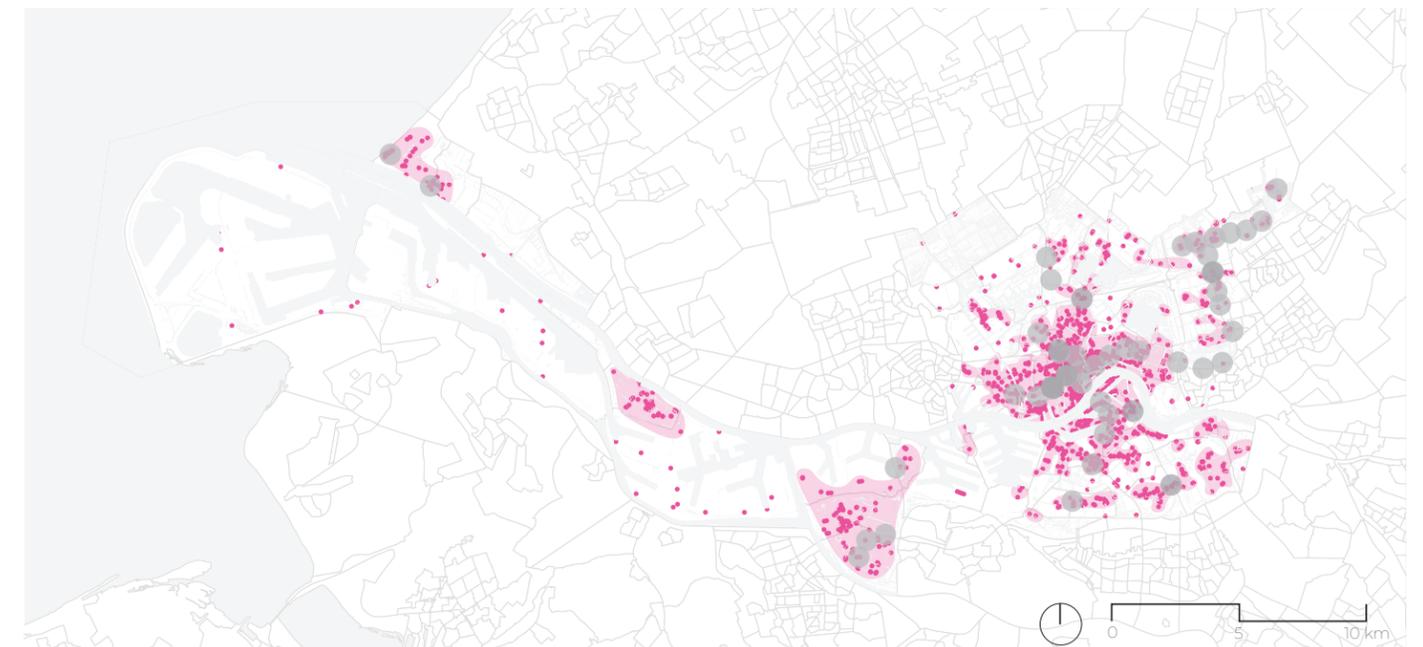


Figure 27: A map of the amenities and range of public transport stations.

# SPACE SYNTAX ANALYSIS

FOR NON MOTORISED NETWORK WITH A RANGE OF 800 M

This space syntax analysis shows how cyclists and pedestrians can get around the streets of Rotterdam within a range of 800 meters.

It shows which streets and connections are best accessible and well connected within walking and cycling distance. A range of 800 meters has been used, because this is about the maximum range that people are willing to walk (Yang et al., 2013).

Thus, it shows the most central routes and centers in the city, while also identifying places that should be adjusted in the slow mobility network in order to improve it.

Sources used: OpenStreetMap & PDOK



Figure 28: The space syntax analysis on Rotterdam.

# QUALITY ANALYSIS

## ANALYSING THE CONNECTIVITY OF TRAIN STATIONS AND IMPORTANT STOPS IN ROTTERDAM

Train stations are usually considered as high quality transportation stations. In this chapter, we aim to explore the quality of the train stations located in Rotterdam.

The quality of the train station is measured using a matrix. It takes into account the concentration of amenities in the area, the accessibility (that is the connections available), the safety and the supporting facilities and covers a radius of 800m walking distance.

This method was inspired by a similar method followed in the book *Ruimte en Lijn* by Atelier Zuidvlegel where the spatial quality of the train station is measured using a proposed matrix.

**Amenities:** It is a measure of the concentration of amenities available in the area for public use.

**Accessibility:** It is a measure of possible connections available from the train station and the waiting times for those options of bus, tram and metro.

**Safety:** The availability of street lights and their functionality and the presence of traffic cameras are checked with this category.

**Supporting facilities:** As Rotterdam is primarily a car-based city, the availability of P+R and parking garages significantly affects the use of public transport, thus it is measured. It also accounts for the population living in that area.

The 4 factors are then given a rating out of 100 and then averaged to find the total rating of the train station. The ratings are an indicator of how good a train station in terms of safety and accessibility for the people living around it and using it for last mile transport.

-  Built environment (no industrial site)
-  Industrial area
-  Airport
-  Railway (train)
-  Train Station



Figure 29: Location for Train Stations (Sources used: OpenStreetMap & PDOK)

# QUALITY ANALYSIS

STATION: ROTTERDAM CENTRAL



Figure 30: 800m walking radius around the train station (Sources used: Google Earth & Google Maps)



**Amenities:**

Meduim High Concentration of Amenities

Accessibility: Connections available from the Train Station:

- Bus: Station Available
- Tram: Stop Available
- Metro: Station Available

Safety:

- Street Lights: Available and is lit
- Traffic Cameras: Available

Supporting Facilities:

- P+R: Available
- Parking Garage: Available

Quality of the Connections:

- Available Bus Connections: 12 lines
- Available Tram Connections: 7 lines
- Available Metro Connections: 2 lines

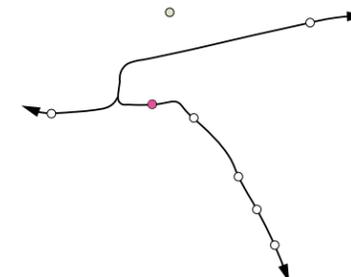
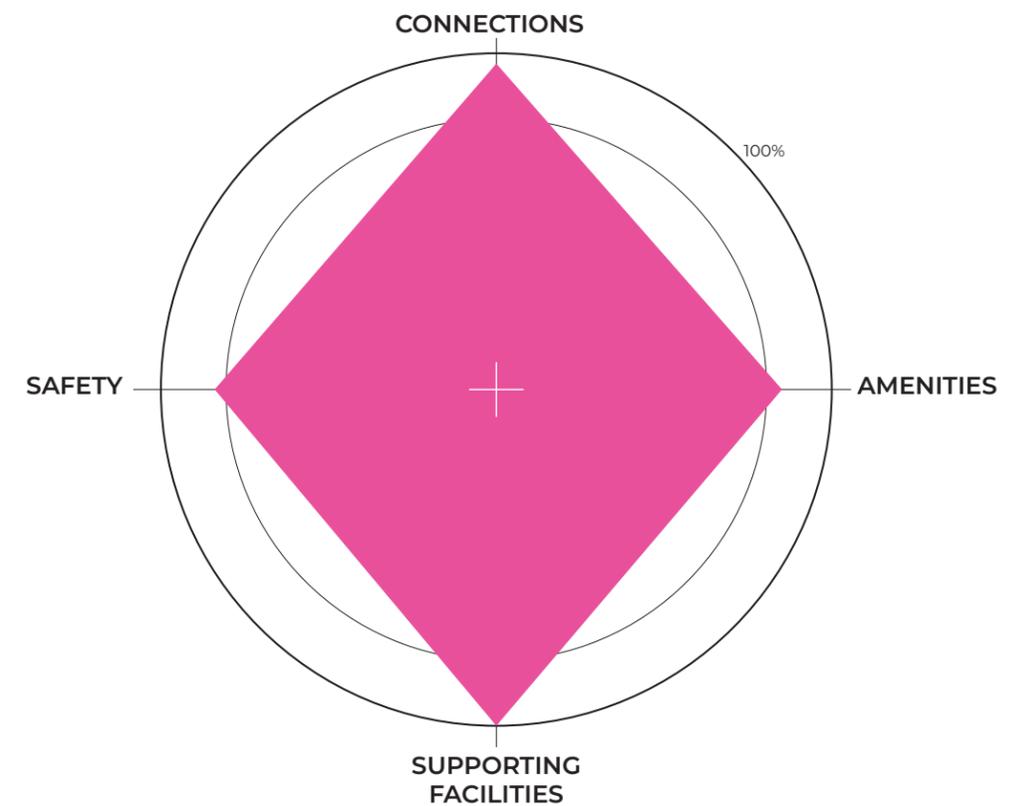
Approximate wait time:

- Bus: 10 to 30 minutes
- Tram: 10 to 30 minutes
- Metro: 10 minutes

Living Population: 30,000-50,000

Total Rating: 87.5%

- Connections: 95%
- Amenities: 80%
- Safety: 80%
- Supporting facilities: 100%



# QUALITY ANALYSIS

STATION: ROTTERDAM BLAAK



Figure 31: 800m walking radius around the train station (Sources used: Google Earth & Google Maps)



**Amenities:**

High Concentration of Amenities

Accessibility: Connections available from the Train Station:

- Bus: NOT Available
- Tram: Stop Available
- Metro: Station Available

Safety:

- Street Lights: Available and is lit
- Traffic Cameras: Available

Supporting Facilities:

- P+R: NOT Available
- Parking Garage: Available

Quality of the Connections:

- Available Bus Connections: 2 lines
- Available Tram Connections: 2 lines
- Available Metro Connections: 3 lines

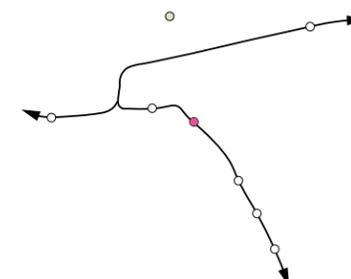
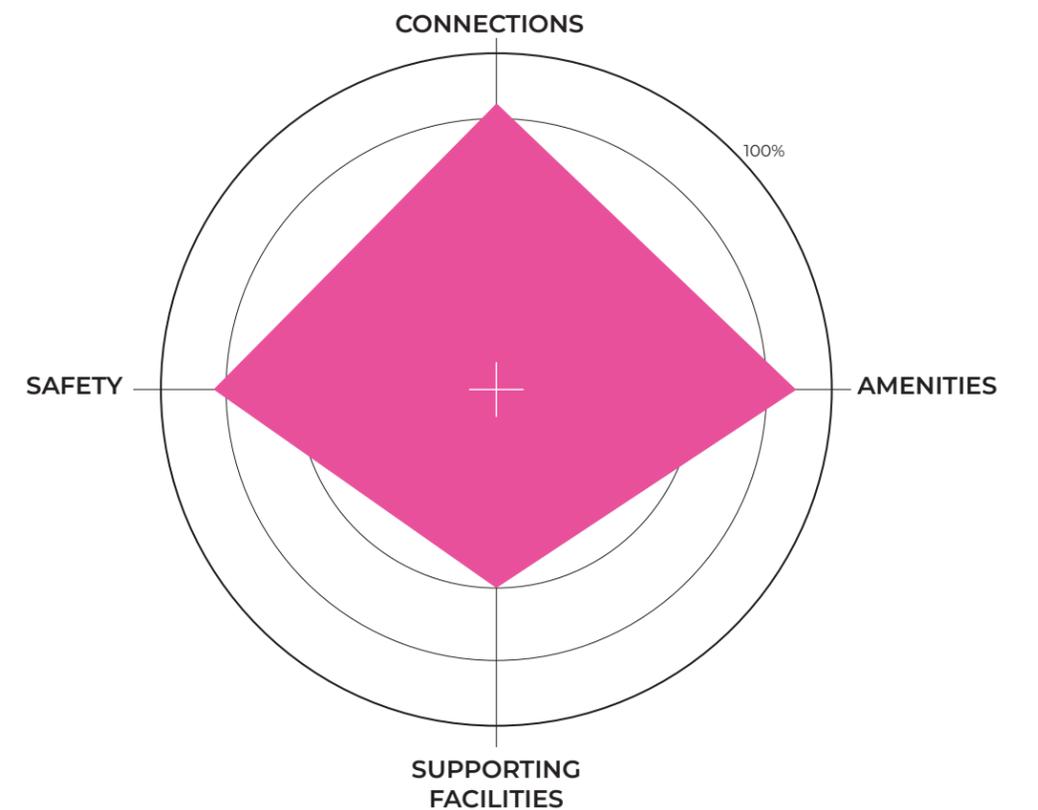
Approximate wait time:

- Bus: 15 to 20 minutes
- Tram: 10 to 30 minutes
- Metro: 10 minutes

Living Population: 30,000-50,000

Total Rating: 73.75%

- Connections: 80%
- Amenities: 85%
- Safety: 80%
- Supporting facilities: 50%



# QUALITY ANALYSIS

STATION: ROTTERDAM ALEXANDER



Figure 32: 800m walking radius around the train station (Sources used: Google Earth & Google Maps)



**Amenities:**  
Medium High Concentration of Amenities

**Accessibility:** Connections available from the Train Station:  
Bus: Station Available  
Tram: NOT Available  
Metro: Station Available

**Safety:**  
Street Lights: Available and is lit  
Traffic Cameras: NOT Available

**Supporting Facilities:**  
P+R: Available  
Parking Garage: Available

Quality of the Connections:

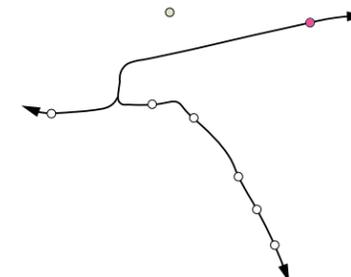
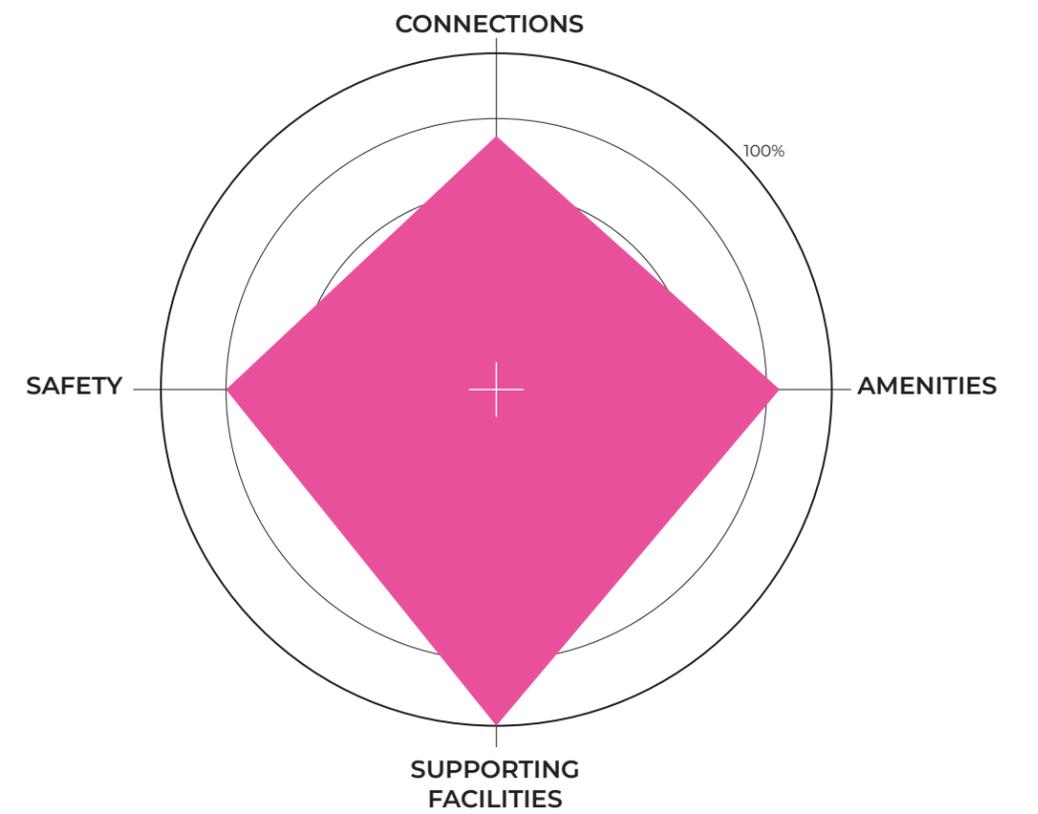
Available Bus Connections: 4 lines  
Available Tram Connections: 0 lines  
Available Metro Connections: 2 lines

Approximate wait time:  
Bus: 10 to 30 minutes  
Tram: Not applicable  
Metro: 10 minutes

Living Population: >90,000

Total Rating: 81.25%

Connections: 70%  
Amenities: 80%  
Safety: 75%  
Supporting Facilities: 100%



# QUALITY ANALYSIS

STATION: ROTTERDAM ZUID



Figure 33: 800m walking radius around the train station (Sources used: Google Earth & Google Maps)



**Amenities:**  
Low Concentration of Amenities

**Accessibility:** Connections available from the Train Station:  
Bus: Stop Available  
Tram: Stop Available  
Metro: NOT Available

**Safety:**  
Street Lights: Available and is lit  
Traffic Cameras: NOT Available

**Supporting Facilities:**  
P+R: NOT Available  
Parking Garage: Available

Quality of the Connections:

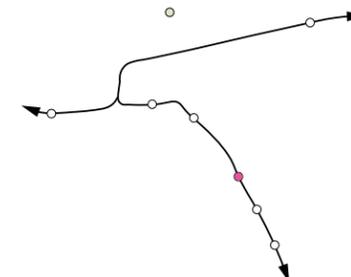
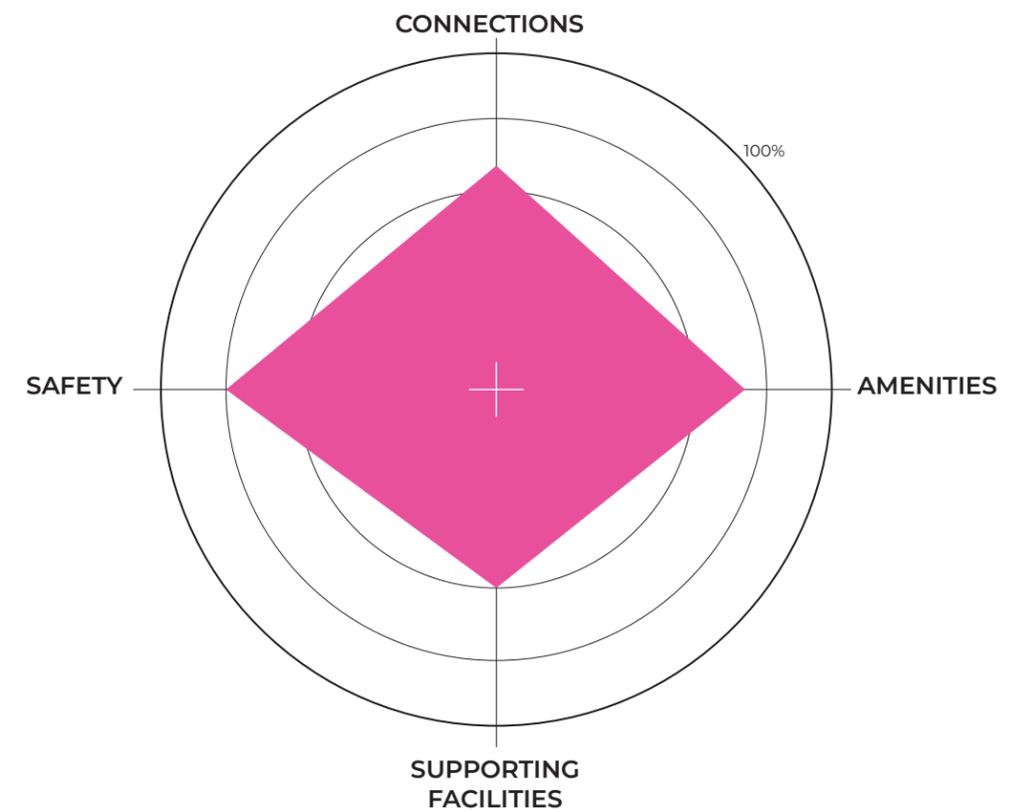
Available Bus Connections: 1 line  
Available Tram Connections: 1 line  
Available Metro Connections: 0 lines

Approximate wait time:  
Bus: 10 to 15 minutes  
Tram: 7 to 10 minutes  
Metro: Not applicable

Living Population: 70,000 - 90,000

Total Rating: 65%

Connections: 65%  
Amenities: 70%  
Safety: 75%  
Supporting Facilities: 50%



# QUALITY ANALYSIS

STATION: ROTTERDAM STADION



Figure 34: 800m walking radius around the train station (Sources used: Google Earth & Google Maps)



**Amenities:**  
Medium Concentration of Amenities

**Accessibility:** Connections available from the Train Station:  
Bus: Stop Available  
Tram: Stop Available  
Metro: NOT Available

**Safety:**  
Street Lights: Available and is lit  
Traffic Cameras: NOT Available

**Supporting Facilities:**  
P+R: Available  
Parking Garage: Available

Quality of the Connections:

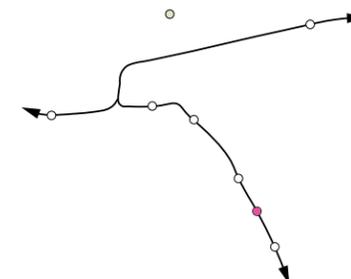
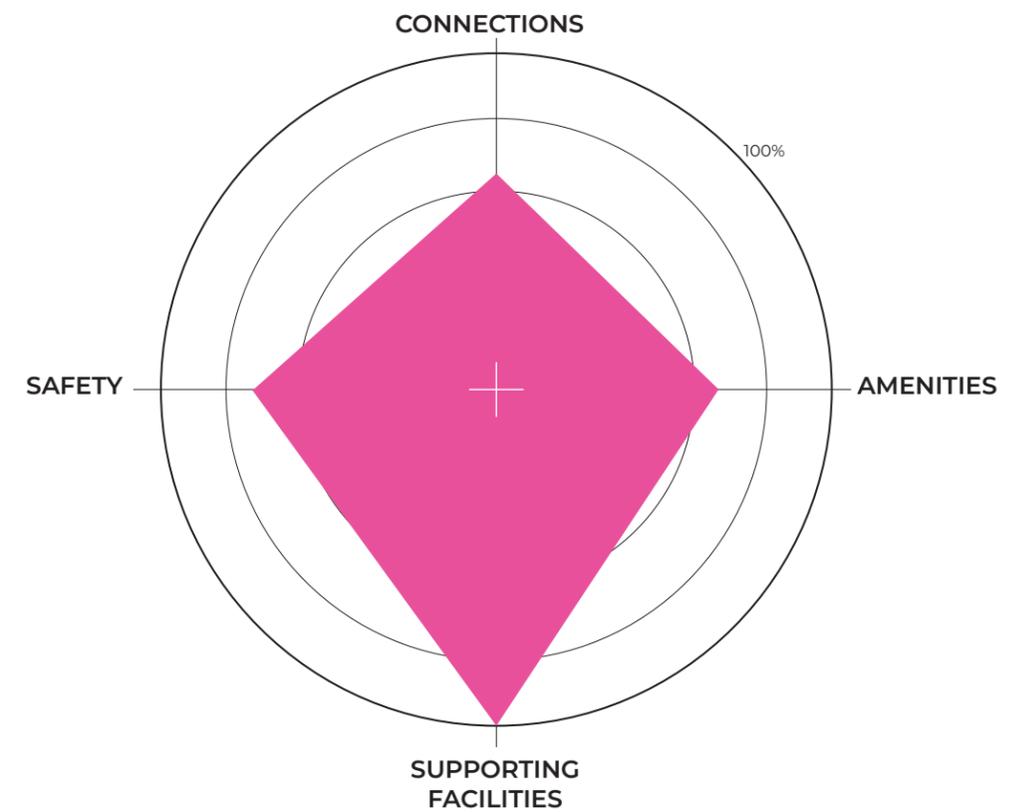
Available Bus Connections: 1 line  
Available Tram Connections: 1 to 2 lines  
Available Metro Connections: 0 lines

Approximate wait time:  
Bus: 30 minutes  
Tram: 7 to 10 minutes  
Metro: Not applicable

Living Population: 70,000 - 90,000

Total Rating: 72.5%

Connections: 60%  
Amenities: 60%  
Safety: 70%  
Supporting Facilities: 100%



# QUALITY ANALYSIS

BUS STOP: ROTTERDAM THE HAGUE AIRPORT

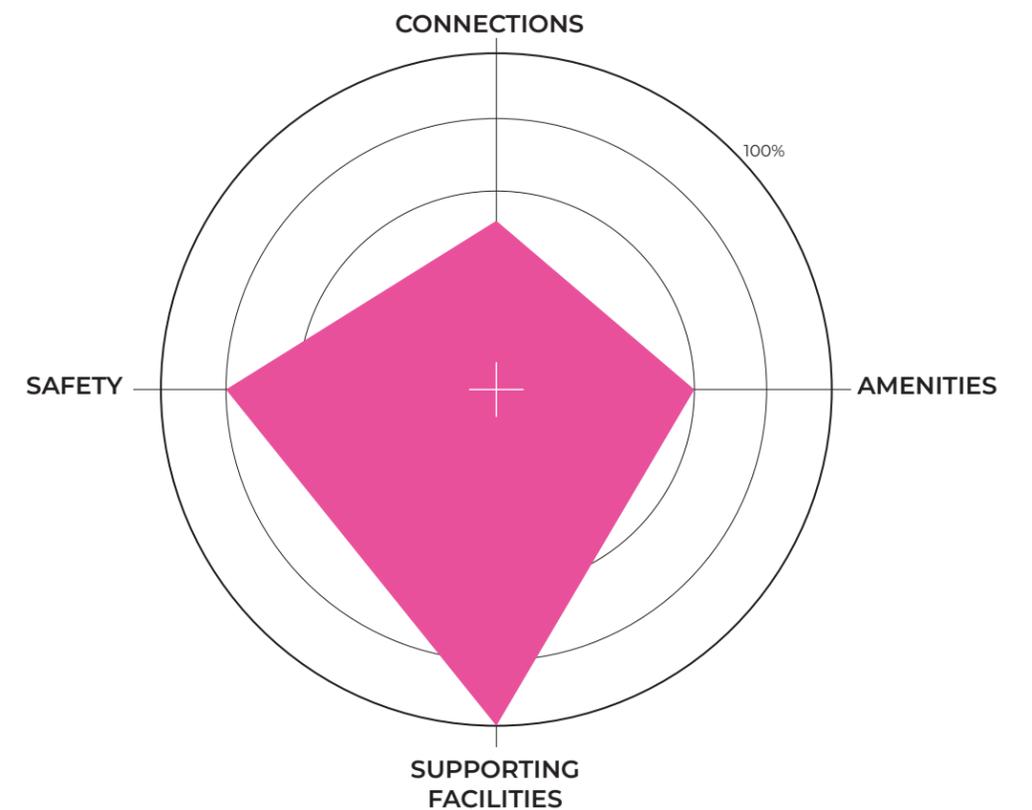
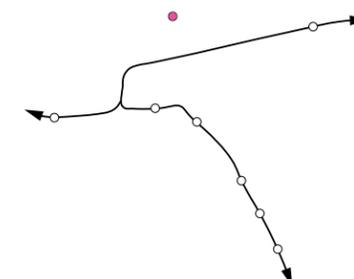


Figure 35: 800m walking radius around the train station (Sources used: Google Earth & Google Maps)



- Amenities:**  
Low Concentration of Amenities
- Accessibility:** Connections available from the Bus Stop:  
Train: NOT Available  
Tram: NOT Available  
Metro: NOT Available
- Safety:**  
Street Lights: Available and is lit  
Traffic Cameras: NOT Available
- Supporting Facilities:**  
P+R: Available  
Parking Garage: Available

- Quality of the Connections:**  
Available Bus Connections: 1 line  
Available Tram Connections: 0 lines  
Available Metro Connections: 0 lines
- Approximate wait time:**  
Bus: 15 minutes  
Tram: Not applicable  
Metro: Not applicable
- Living Population:** >30,000
- Total Rating:** 66.25%
- Connections:** 40%
- Amenities:** 50%
- Safety:** 75%
- Supporting Facilities:** 100%



# QUALITY ANALYSIS

STATION: ROTTERDAM LOMBARDIJEN



Figure 36: 800m walking radius around the train station (Sources used: Google Earth & Google Maps)



**Amenities:**  
Medium Concentration of Amenities

**Accessibility:** Connections available from the Train Station:  
Bus: Station Available  
Tram: Stop Available  
Metro: NOT Available

**Safety:**  
Street Lights: Available and is lit  
Traffic Cameras: Available

**Supporting Facilities:**  
P+R: Available  
Parking Garage: Available

Quality of the Connections:

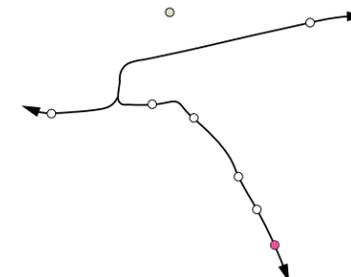
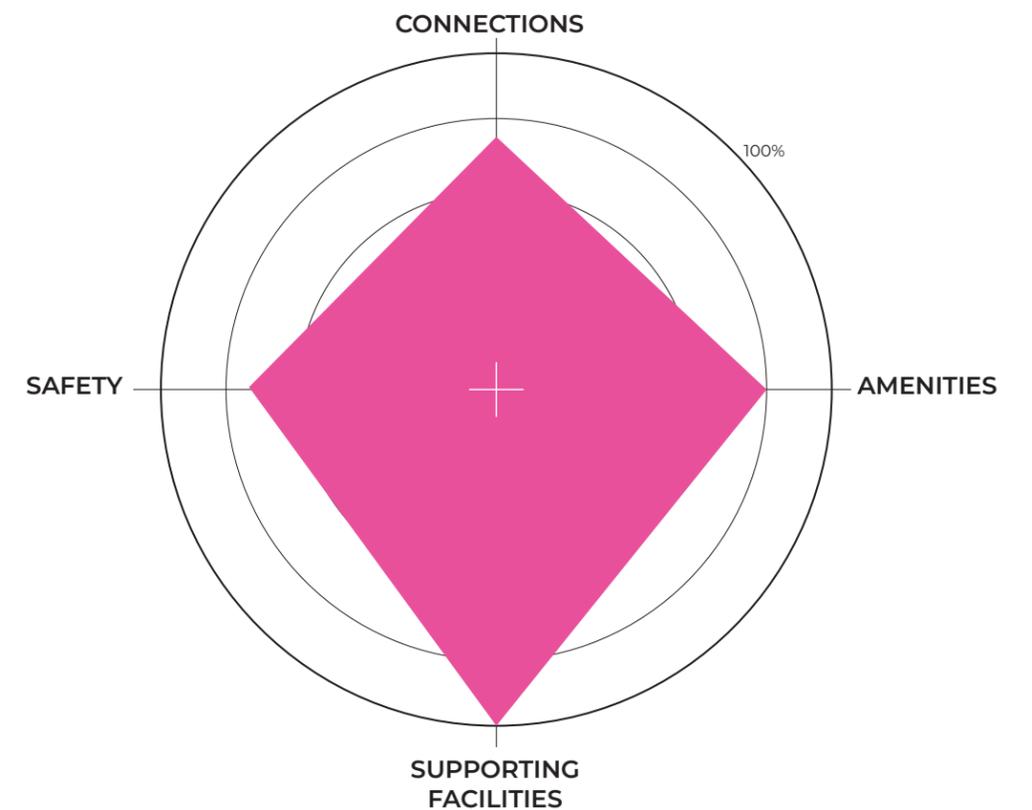
Available Bus Connections: 11 lines  
Available Tram Connections: 1 line  
Available Metro Connections: 0 lines

Approximate wait time:  
Bus: 15 to 30 minutes  
Tram: 10 minutes  
Metro: Not applicable

Living Population: 70,000 - 90,000

Total Rating: 78.75%

Connections: 70%  
Amenities: 75%  
Safety: 70%  
Supporting Facilities: 100%



# QUALITY ANALYSIS

STATION: SCHIEDAM CENTRUM

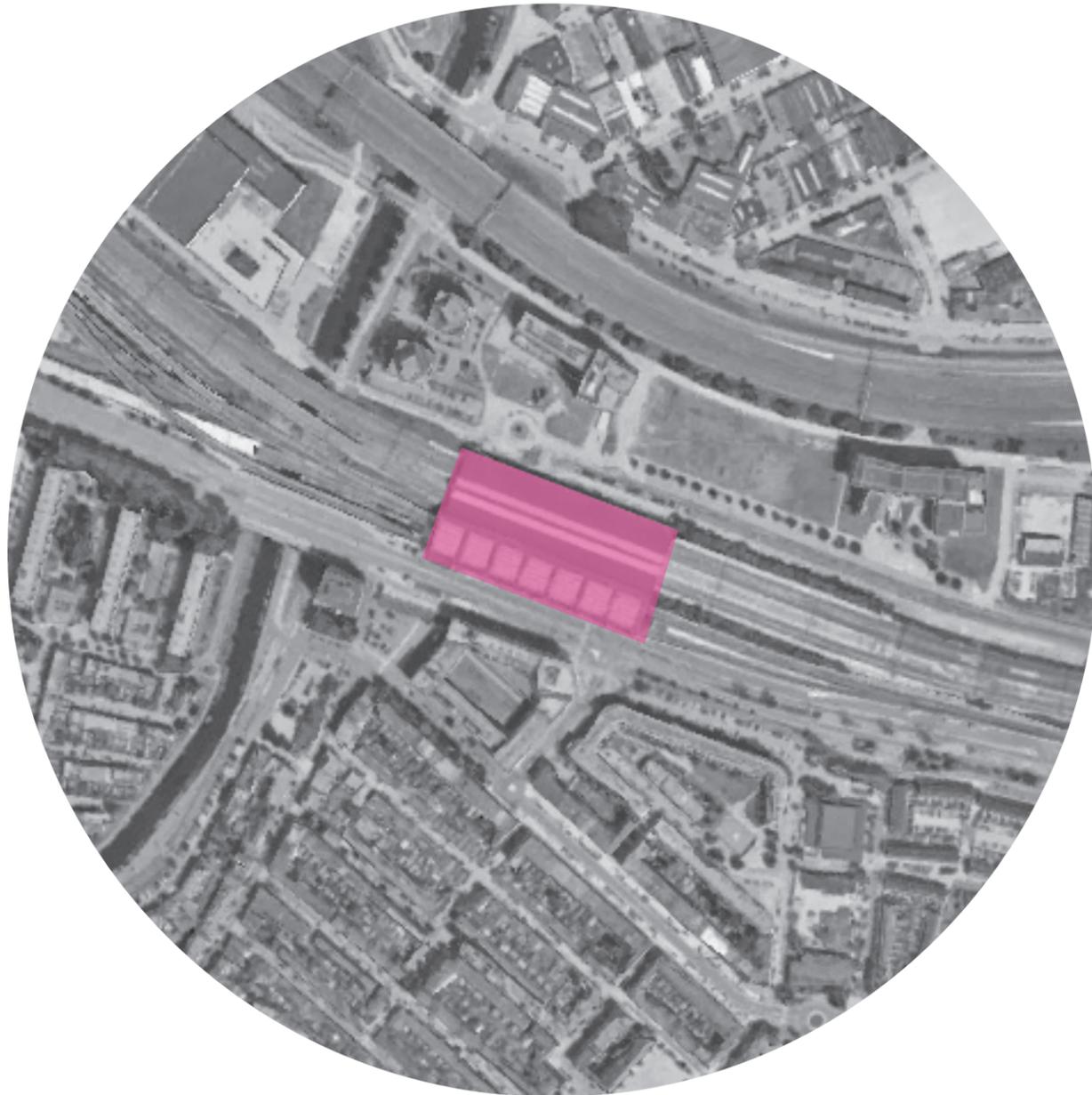


Figure 37: 800m walking radius around the train station (Sources used: Google Earth & Google Maps)



**Amenities:**  
Medium Concentration of Amenities

**Accessibility:** Connections available from the Train Station:  
Bus: Stop Available  
Tram: Stop Available  
Metro: Station Available

**Safety:**  
Street Lights: Available and is lit  
Traffic Cameras: Available

**Supporting Facilities:**  
P+R: Available  
Parking Garage: Available

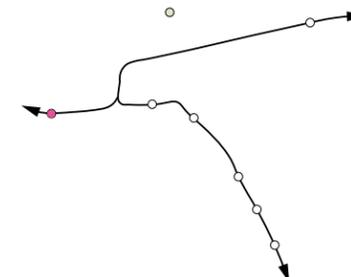
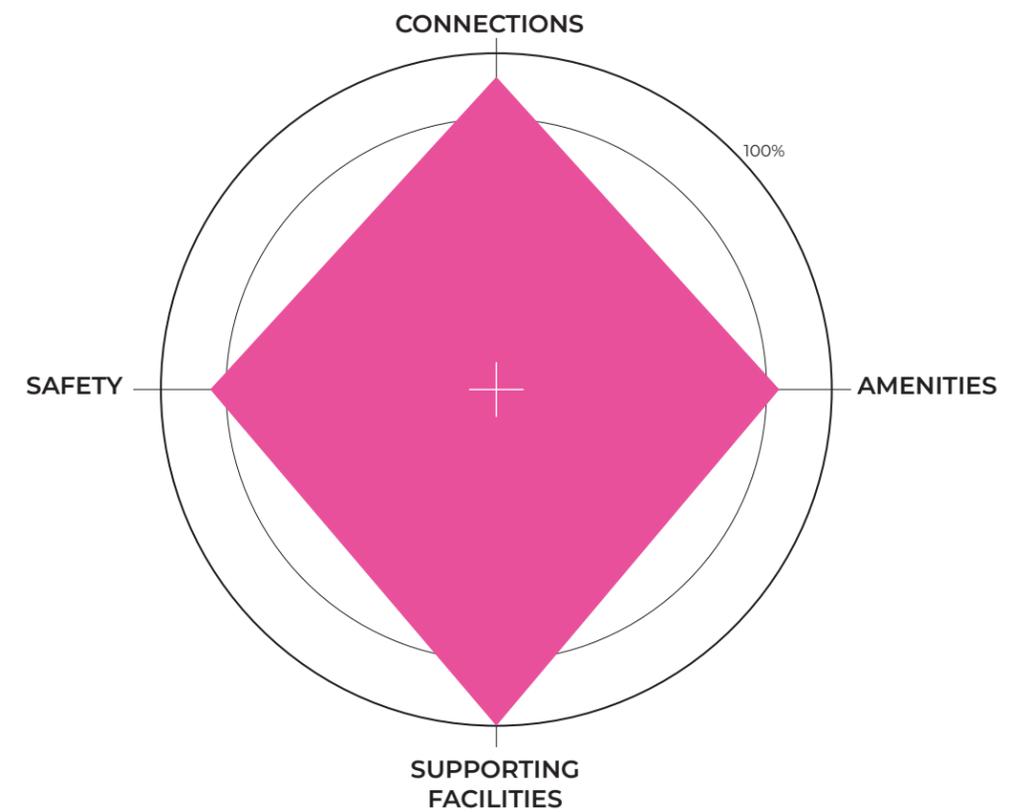
Quality of the Connections:

Available Bus Connections: 8 lines  
Available Tram Connections: 2 lines  
Available Metro Connections: 3 lines

Approximate wait time:  
Bus: 10 to 15 minutes  
Tram: 7 to 10 minutes  
Metro: 10 minutes  
Living Population: 70,000 - 90,000

Total Rating: 87.5%

Connections: 90%  
Amenities: 80%  
Safety: 80%  
Supporting Facilities: 100%



# QUALITY ANALYSIS

## ANALYSING THE CONNECTIVITY OF TRAIN STATIONS AND IMPORTANT STOPS IN ROTTERDAM

Through this qualitative analysis we explored the connectivity of the train stations and important stops in Rotterdam in context to 800m walking distance radius, accessibility for the people living around it and using it for last mile transport.

Rotterdam Central scored 87.5% and is overall a well functioning and well connected station.

Rotterdam Blaak scored 73.75%, with its major drawback being the lack of a P+R nearby.

Rotterdam Alexander scored 81.25%, it is quite well connected although there is a lack of tram stops near the station.

Rotterdam Zuid scored 65%, the lowest scoring station, it is not well connected, there is only one bus and tram line and it highly limits the accessibility and last mile mobility.

Rotterdam Stadion scored 72.5%, although connected quite well, it is a temporary station, only operational during Feyenoord games.

Rotterdam the Hague Airport scored 66.25%, it is a stop and only connected by one bus line, limiting accessibility.

Rotterdam Lombardijen scored 78.75%, it only has one connecting tram line and due to having crimes reported in that area, it is not a popular choice by users.

Schiedam Centrum scored 87.5% and is overall a well functioning and well connected station. Although outside of Rotterdam, it is an important transit station that is heavily used to travel to Rotterdam and is an exemplary station for future consideration.

Like train stations, metro stations are also considered as high quality transportation stations. Due to time restrictions, we were unable to explore the quality of the metro stations located in Rotterdam, but we do believe further research is needed to make a more impactful design. Additionally, for safety concerns, we feel more research is needed with crime rates in that area and street interviews to make the safety factor we analysed more concrete and definitive.

- Built environment (no industrial site)
- Industrial area
- Airport
- Railway (train)
- Train Station
- Railway (metro)
- Metro station



Figure 38: Location for Train and Metro Stations (Sources used: OpenStreetMap & PDOK)

# EXISTING ROAD INFRASTRUCTURE ANALYSIS

## WEST KRUISKADE STRAAT

The existing streetscape of West Kruiskade Straat shows the existence of multiple transportation movement in a crowded street near the center of Rotterdam. It shows the on-street parking taking over the pedestrian areas and the movement of pedestrian on the busy streets.



Figure 39: West Kruiskade, Sources used: Google Earth & Google Maps

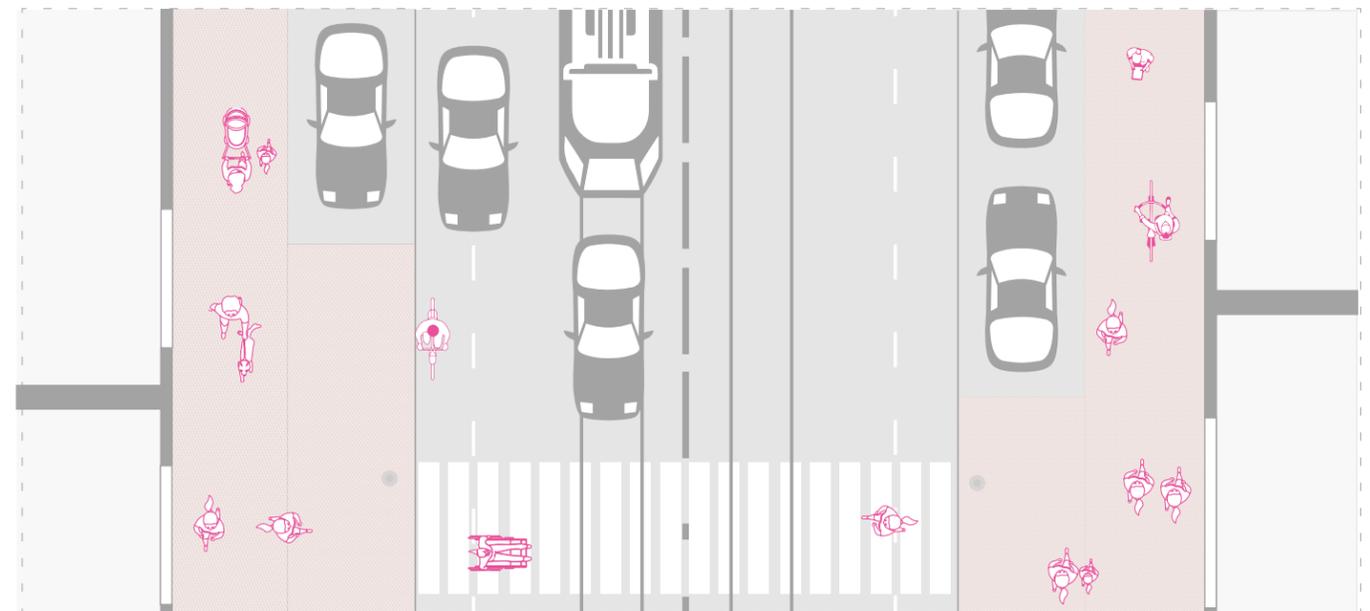
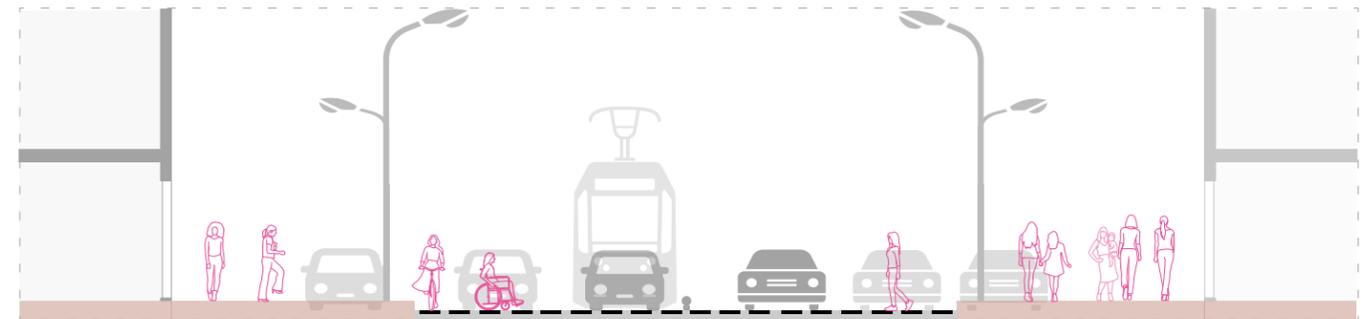


Figure 40: West Kruiskade Current Design

# EXISTING ROAD INFRASTRUCTURE ANALYSIS

## ZUIDPLEIN, CHARLOIS

The existing streetscape of Zuidplein in Charlois shows the existence of multiple wide car lines on both ways and only one bus lane. It shows how much priority is given to the car dependent movement in comparison to the bike lanes and walkways.



Figure 41: Zuidplein Sources used: Google Earth & Google Maps

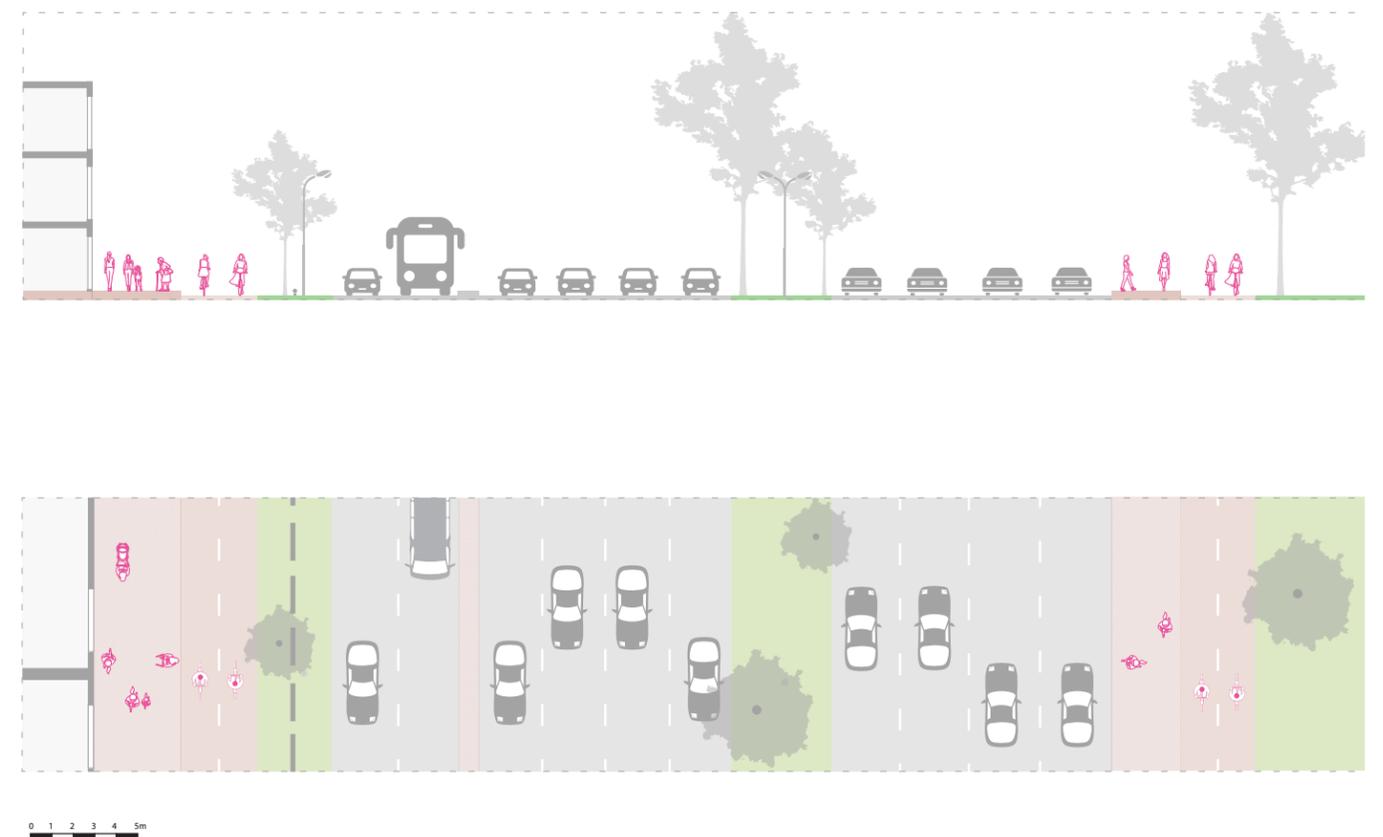


Figure 42: Zuidplein Current Design

# EXISTING ROAD INFRASTRUCTURE ANALYSIS

## HILLEGERSBERG CENTRUM

The existing streetscape of Hillegersberg Centrum shows the existence of multiple transportation movement in a two lane street with trams and cars running on the same lanes. It shows the on-street parking of cars and bicycles taking over the pedestrian areas and the movement of pedestrian on the busy street.



Figure 43: Hillegersberg-Schiebroek Sources used: Google Earth & Google Maps

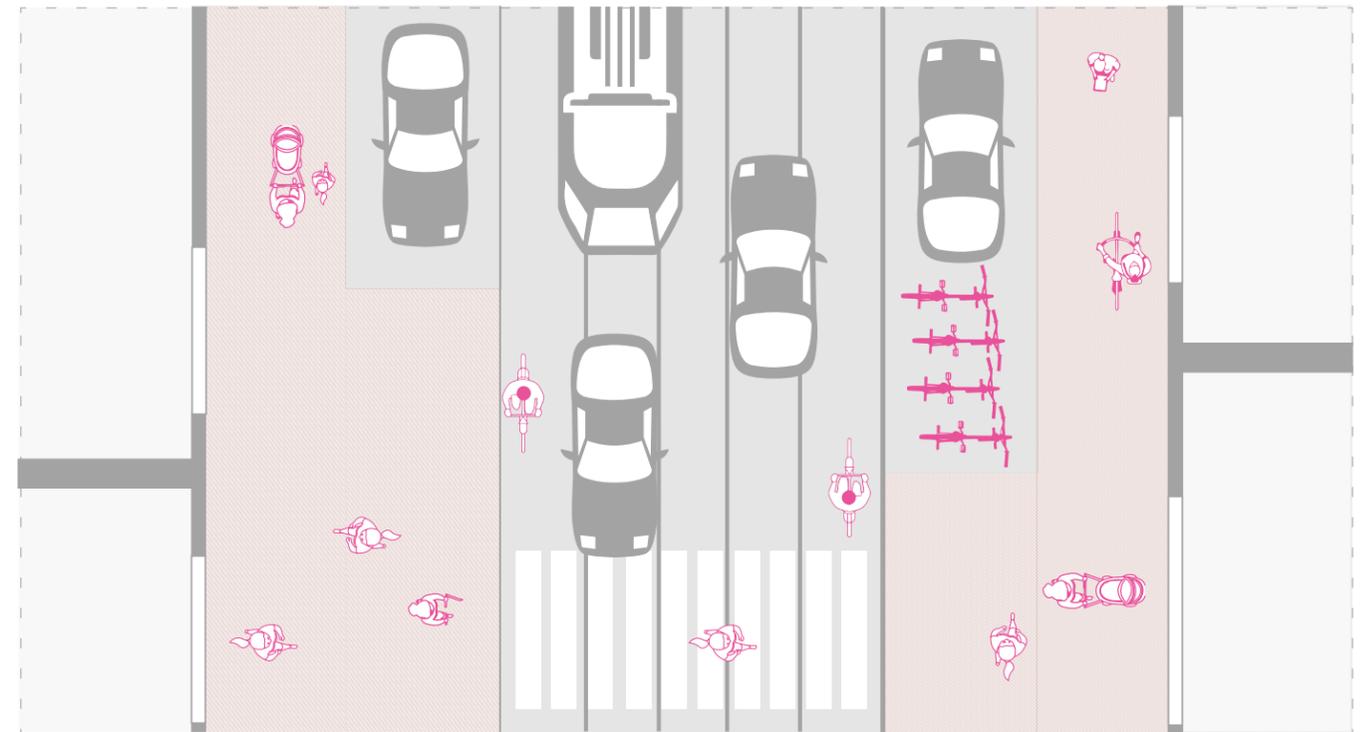
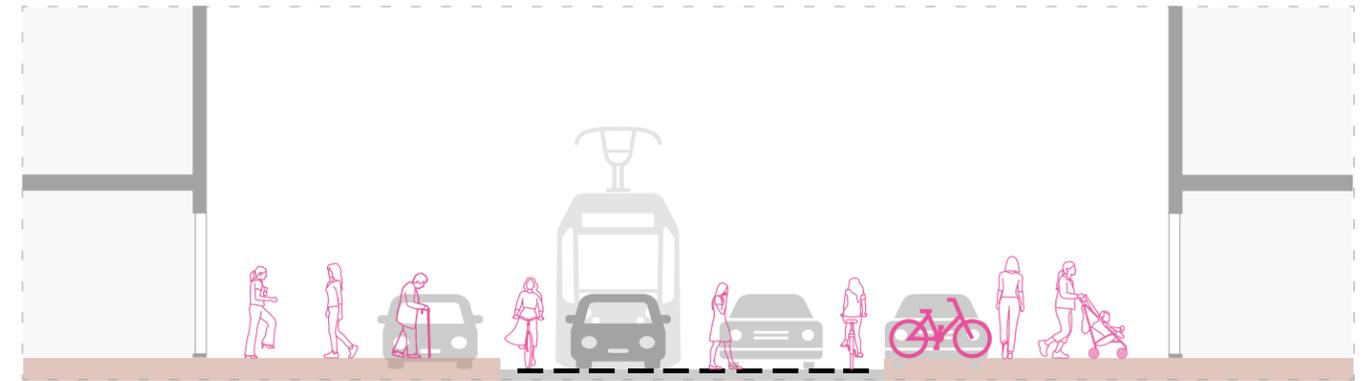


Figure 44: Hillegersberg-Schiebroek Current Design

# EXISTING ROAD INFRASTRUCTURE ANALYSIS

## RECREATIONAL BIKE PATH, CHARLOIS

The existing streetscape of this area in Charlois showcases the recreational bike path. It can be seen that the car lanes are singular and broken up with green borders in between. The absence of streetlights by the bike path and the lack of pedestrian walkway is quite noticeable.



Figure 45: Charlois, Sources used: Google Earth & Google Maps

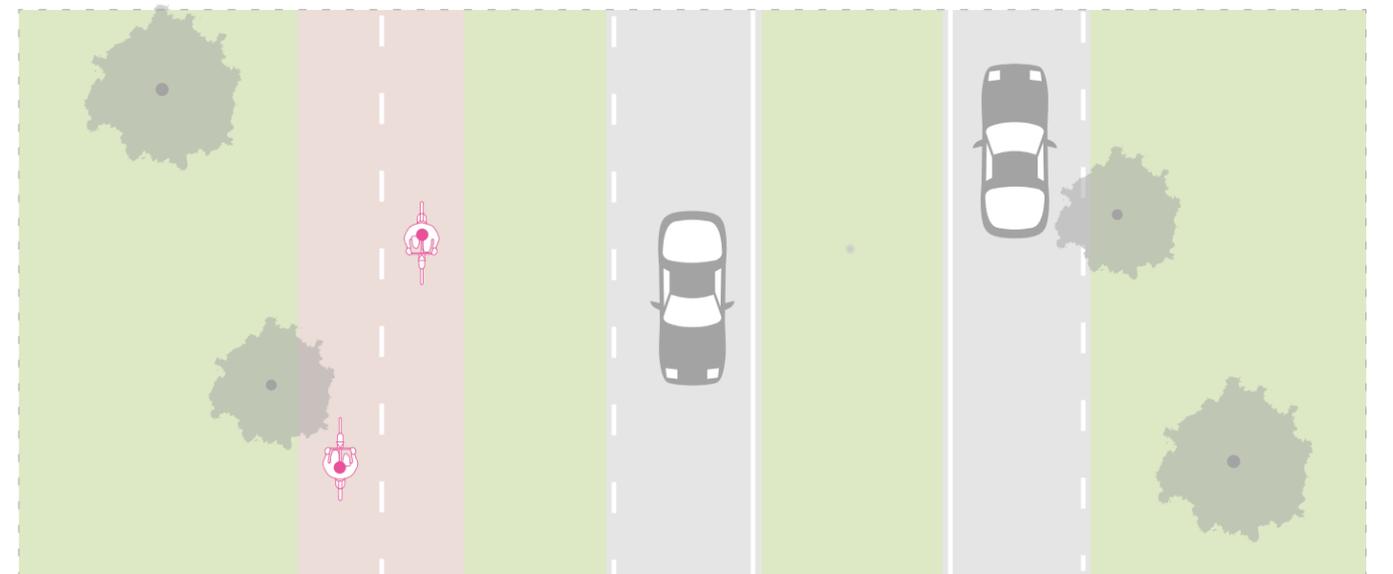
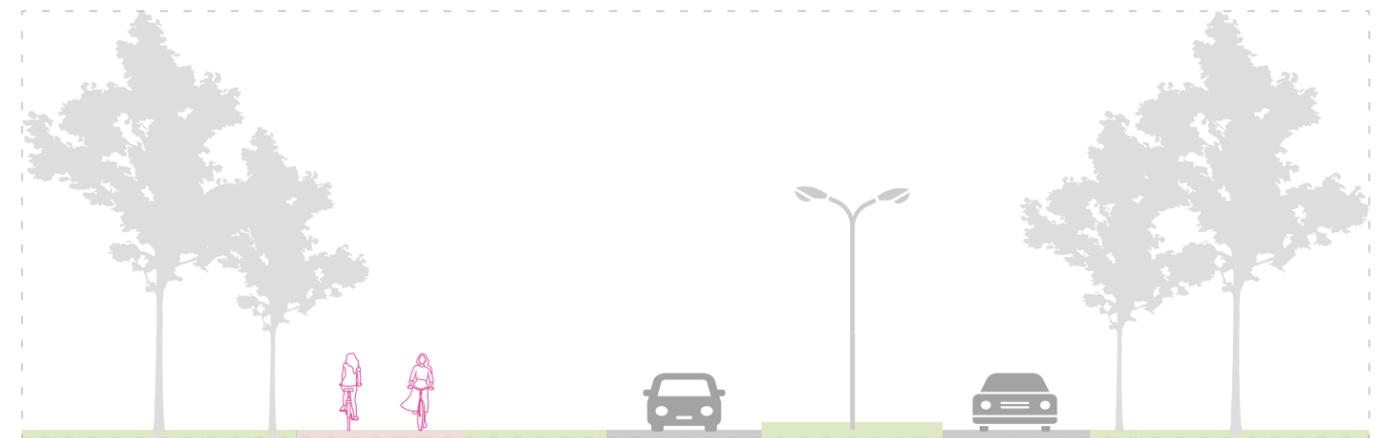


Figure 46: Charlois Current Design

# ANALYSIS

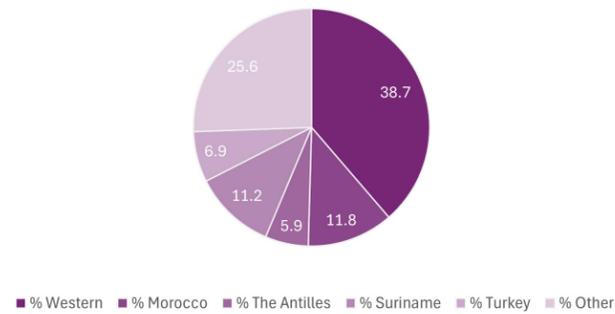
## DEFINING THE COMMUNITY - MEDIA ANALYSIS

### Hillegersberg-Schiebroek

Hillegersberg-Schiebroek is a neighborhood in Rotterdam that is still dominated by apartment buildings, more so than other types of housing (AlleCijfers.nl, 2025). However, compared to other areas, it also features a notable proportion of larger homes, such as row houses, corner houses, and (semi-)detached houses (Fieldtrip, 2025). The area's population is diverse, with a significant representation of residents with non-Western migration backgrounds, other

then Marocco, Suriname, Antiles and Turkey, which are common in the Netherlands. In comparison to Charlois, the demographic profile of residents from Hillegersberg-Schiebroek is distinct, with a higher proportion of both older residents (45+) and younger children (0-15 years). This is likely due to the neighborhood's child-friendly urban design and its relatively quiet, residential atmosphere, making it an attractive place for families (Fieldtrip, 2025).

Migration background Hillegersberg-Schiebroek



Migration background Hillegersberg-Schiebroek

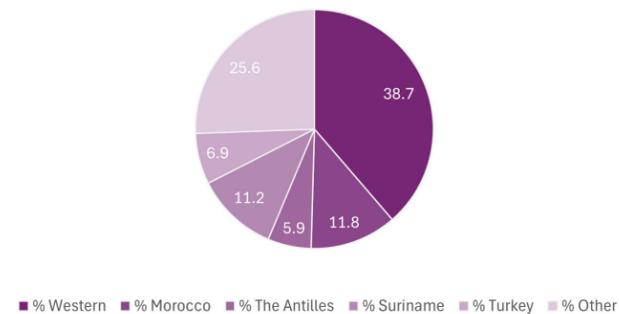


Figure 47: Housing types Hillegersberg-Schiebroek (AlleCijfers.nl, 2025)

Figure 48: migration background Hillegersberg-Schiebroek (AlleCijfers.nl, 2025)

# ANALYSIS

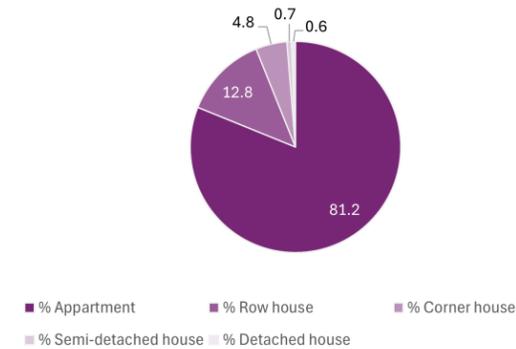
## DEFINING THE COMMUNITY - MEDIA ANALYSIS

### Charlois

Charlois is a densely built neighborhood in Rotterdam, where apartment buildings make up the majority of the housing stock (AlleCijfers.nl, 2025). The population is highly diverse, with a wide range of migration backgrounds, including a large share of residents from non-Western origins such as Morocco, Turkey, Suriname, and the Antilles. In Charlois there are a notable large amount of people within the age group 25-45 years.

This is likely linked to the neighborhood's urban character: affordable and well accessible by public transport, due to the Metro-line. This makes it an attractive area for young adults and working-age residents.

Housing types Charlois



Migration background Charlois

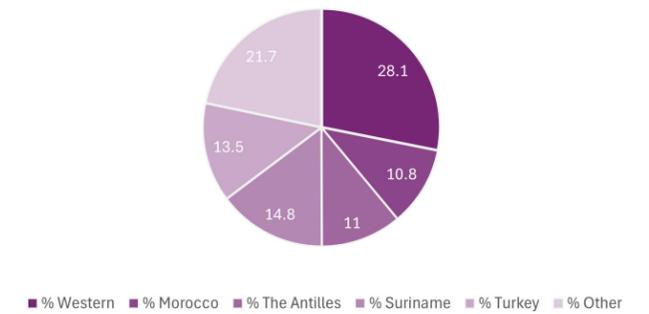


Figure 49: Housing types Charlois (AlleCijfers.nl, 2025)

Figure 50: migration background Charlois (AlleCijfers.nl, 2025)

Age groups of inhabitants Hillegersberg-Schiebroek

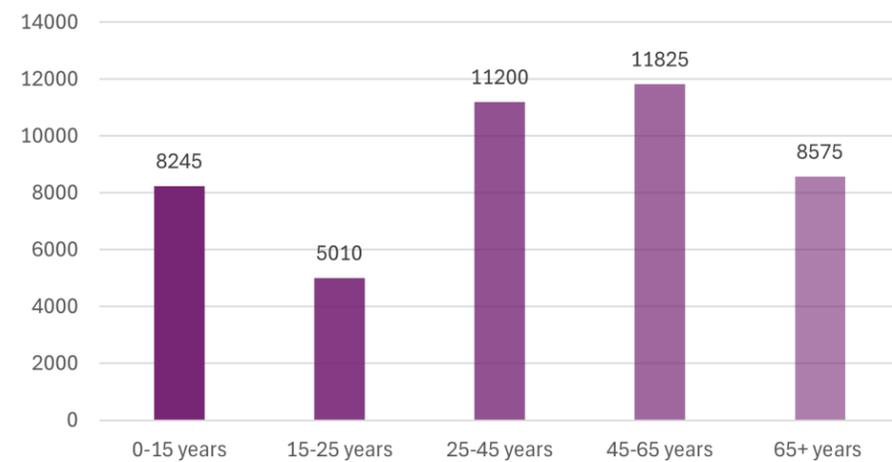


Figure 51: Age groups of inhabitants Hillegersberg-Schiebroek (AlleCijfers.nl, 2025)

Amount of inhabitant per age group Charlois

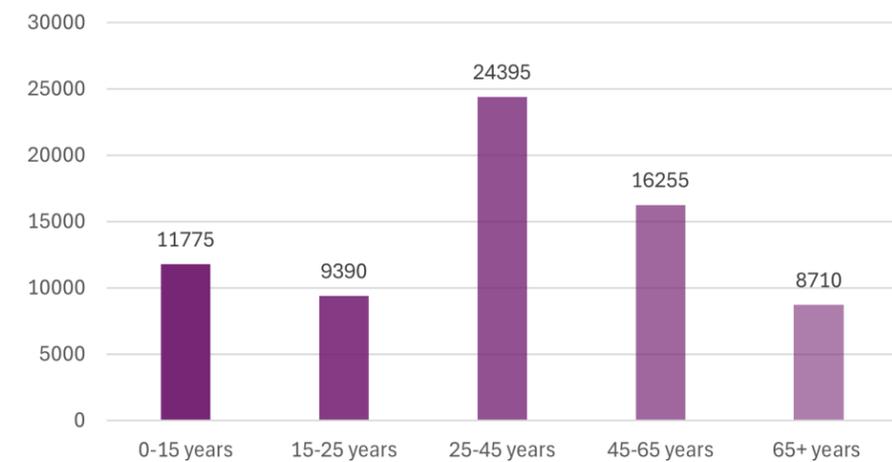


Figure 52: Age groups of inhabitants Charlois (AlleCijfers.nl, 2025)

# ANALYSIS

## DEFINING THE COMMUNITY - FIELD TRIP

### Woman living in Hillegersberg-Schiebroek

Sterre lives in the centre of the neighbourhood, in one of the apartments above the shops on the shopping street.



Figure 53: Sterre walking home after work (Fieldtrip, 2025)

Most people around the neighbourhood earn enough to invest in their own transportation mode. Sterre does not have a lot of money to spare. She didn't grow up in the Netherlands and she never learned how to bike. Everyday she goes with the public transport to work.

The tram and bus are within walking distance (4-5 min). The tram has a direct connection to Rotterdam Centraal, with the bus she would need to transfer to the metro.

If she missed the tram, she has to wait for 20 minutes for the next one. Recently they changed this from 15 to 20 minutes, because the tramline is not used often.



Figure 54: Sterre waiting for public transport (Fieldtrip, 2025)

### Public transport to Rotterdam Central Station

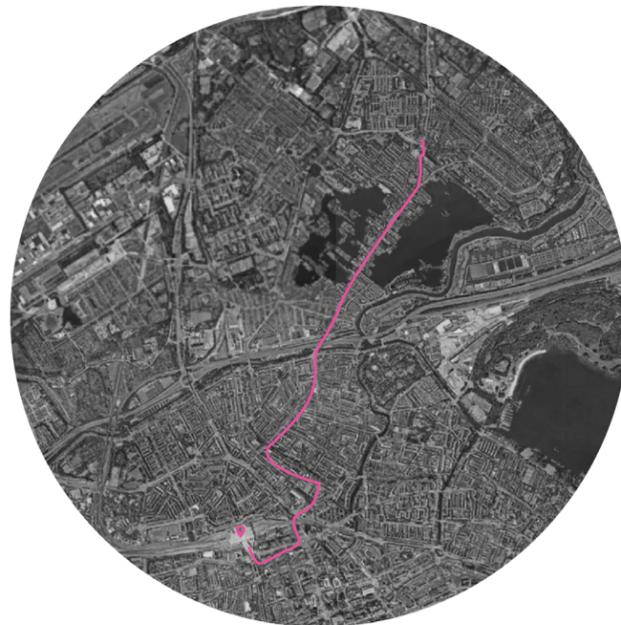


Figure 55: Route options to Rotterdam Centraal from Sterre's house (Fieldtrip, 2025)

# ANALYSIS

## DEFINING THE COMMUNITY - FIELD TRIP

If she would learn how to bike she could use the sharing bikes that are available in the neighbourhood.



Figure 56: Bike hub in Hillegersberg-Schiebroek (Fieldtrip, 2025)

If she would have a car she would have to park her car in a closed area.



Figure 58: Parking near Sterre's house (Fieldtrip, 2025)



Figure 57: Street next to Sterre's house (Fieldtrip, 2025)



Figure 59: Street next to Sterre's house (Fieldtrip, 2025)

She didn't start with taking lessons because she thinks the streets are too busy for someone that is just a beginner. The bike could get stuck in the tramline, the cars are on the same street and they are always driving too fast and now there are electric bikes that go up to 30 km/h it feels dangerous.

# ANALYSIS

## DEFINING THE COMMUNITY - FIELD TRIP

### Woman living in Hillegersberg-Schiebroek

Kika lives in a detached house on a quiet street in Hillegersberg.



Figure 60: Kika walking away from her home (Fieldtrip, 2025)

She works at an energy company that is located on the east part of the city. She lives with her husband and two children. In the morning during the week she brings her children to school with a shared electrical cargo bike from the hub in her street. Afterwards she directly goes with the same bike to her work. In the afternoon she picks up her children again and travel home after doing some groceries at the supermarket. She doesn't have time to switch to another bike, so she uses the same bike for all her trips. If it rains she takes the car.



Figure 61: Kika walking towards the micromobility hub the street of her house (Fieldtrip, 2025)



Figure 62: Shared micromobility cargo bike on the streets in Hillegersber-Schiebroek (Fieldtrip, 2025)

# ANALYSIS

## DEFINING THE COMMUNITY - FIELD TRIP

She never takes public transport because she doesn't like having to carry everything herself. She dislikes the need to follow strict schedules and finds it inconvenient to endure long waiting times, particularly given the infrequent tram service.

### Public transport to Rotterdam Central Station



Figure 63: Route options to Rotterdam Centraal from Kika's house (Fieldtrip, 2025)



Figure 64: Kika driving away in her car (Fieldtrip, 2025)

On Saturday in the weekend she drops off one of her kids at the hockey association and then goes to the market in the centre with her husband and the other kid. They always take the car because they need to take a lot of stuff with them: the hockey stuff, groceries, two kids, shopping bags, etc. On Sunday the whole family takes the car to go to an outdoor activity outside the city.



Figure 65: Kika driving during the weekend with the family to the beach (Fieldtrip, 2025)



Figure 66: Kika driving during the weekend with the family to the beach (Fieldtrip, 2025)

# ANALYSIS

## DEFINING THE COMMUNITY - FIELD TRIP

### Woman living in Charlois

Anika lives in Charlois. She lives in the same apartment building as where she grew up.



Figure 67: Anika walking out of her house (Fieldtrip, 2025)

She works as a cleaning lady at the shopping mall Zuidplein. She goes there every day with her car. She used to have a bike as well, but it got stolen very fast. Her car is parked at a parking lot near her house and from work she gets free parking in the parking garage near the shopping mall.



Figure 68X: Anika entering her car (Fieldtrip, 2025)



Figure 69: Anika walking towards her car (Fieldtrip, 2025)

# ANALYSIS

## DEFINING THE COMMUNITY - FIELD TRIP

### Public transport to Rotterdam Central Station



Figure 70: Route options to Rotterdam Centraal from Anika's house (Fieldtrip, 2025)



Figure 71: Anika waiting for the bus (Fieldtrip, 2025)

If her car needs to go to the garage, she has to take the public transport. She always hates when this happens. The only public transport options nearby is the bus. The bus takes her directly to work, but the waiting time is often very long. Especially because the buses don't adhere to the fixed times.

The other options for her would be to walk to the metro station Slinge. This would be a 15 minute walk.



Figure 72: Anika walking towards the metro station Slinge (Fieldtrip, 2025)

The convenience of her working location is that there are all different kind of shops available there. After work she can get her groceries and other necessities before going home. This gives her the opportunity to bring home the groceries for her old neighbour as well.

# ANALYSIS

## DEFINING THE COMMUNITY - FIELD TRIP

### Woman living in Charlois

Kate is living in Old-Charlois, which is the historical centre of Charlois. She lives in a semi-detached house.



Figure 73: Kate next to her house (Fieldtrip, 2025)

She lives with her husband and four children. Her husband works in finance. She takes care of the family and the household. Her mobility pattern is very diverse. The only things she does daily are buying groceries and necessities and bringing the kids to school. Other than that, she goes to the park with her youngest, to her friends for a drink, to her parents to take care of them and then she goes home to cook and clean the house. Most of her trips are within the neighbourhood. Occasionally her and her family go on a trip to the city centre.

Public transport to Rotterdam Central Station



16 min 22 min 1 hour 6 min 19 min

Figure 74: Route options to Rotterdam Centraal from Kate's house (Fieldtrip, 2025)

# ANALYSIS

## DEFINING THE COMMUNITY - FIELD TRIP

She does most of her trips by walking. If it rains she goes with the public transport. The tram stops right in front of her door. The bus stop is also within walking distance.



Figure 75: Kate walking around in the neighbourhood and towards the tram and bus stops (Fieldtrip, 2025)

# Analysis

Defining the community - survey outcomes + street interviews

## What is your transportation mode to reach these areas? (multiple answers applicable)

I am afraid to fall with the bike, because of my age, this is why I travel with the Car or Public transport. Due to bad public transport connections to my friends in Kralingen, I usually take the car ~ Woman Hillegersberg 65+ years

Due to bad public transport connections, I travel with the car ~ Woman Hendrik-Ido-Ambacht 56-65 years

## Do you feel comfortable/safe in all transportation modes?

“Changing transport options is always a hassle, because of the walking distance from station to stop and the waiting time” ~ Woman Hillegersberg 65+ years

## How can public transport be improved?

Less walking  
Less transfers  
Hygiene  
Cheaper  
Better lighting

## What contributes to the feeling of safety?

Hygiene  
Surrounded  
by people

## If you had to walk to your nearest public transportation stop?

'15 min' ~ Woman Charlois 26-35 years

'10 min by bike' ~ Woman Charlois 18-25 years

## Between which times do you usually travel?

During  
the day  
Rush-hour

## What are your usual criteria for deciding on transportation mode?

Frequency  
Money  
Distance  
Convenience  
Circumstances  
Time of the day

## Have you heard about Low-emission zones?

Yes, it means I have to watch out with buying a car' ~ Woman Charlois 26-35 years

## Do you think Low-emission zones will affect your everyday life?

It is great that there implementing sustainable regulations, but doing so they should also improve public transport' ~ Woman Hillegersberg 36-45 years

# PROFILES

## STORY OF TINEKE

Tineke is a woman in her late sixties who lives in Hillegersberg, a quiet neighborhood known for its green streets and calm atmosphere. After working hard all her life alongside her husband, she now enjoys a comfortable retirement. Financially, they're secure. They are able to cover both the fixed and variable costs of transportation without too much worry.

Despite this stability, getting around isn't always simple for Tineke. Public transport in her area is irregular and often unreliable, and

the systems aren't well connected. Because of this, and her nervousness about biking due to the lack of separate bike lanes, she relies heavily on her car. It's her main way of getting around, especially when she needs to travel farther than walking distance.

Even though there are tram and bus stops nearby, Tineke often faces long waiting times, sometimes up to 20 minutes. And when they finally arrive, the unpredictable schedule makes it hard to plan her trips.

She'd prefer to use public transport more, but the hassle and uncertainty discourage her.

Technology doesn't make it easier either. Using apps or navigating digital tools isn't second nature to her, and although she has an OV-chip card, she finds it hard to confidently plan trips using her phone.

Physically, Tineke is still quite capable. She holds a driver's license and is independent in many ways. But her hesitation to bike,

especially in areas without dedicated lanes, limits her mobility options. Safety is always on her mind. She's worried about falling off the bike or, worse, getting hit by a car on the busy streets where drivers often speed.

Still, Tineke appreciates that her neighborhood is relatively safe for walking and using public transport. She dreams of a transport system that's more connected, more intuitive, and above all, more welcoming to people like her.

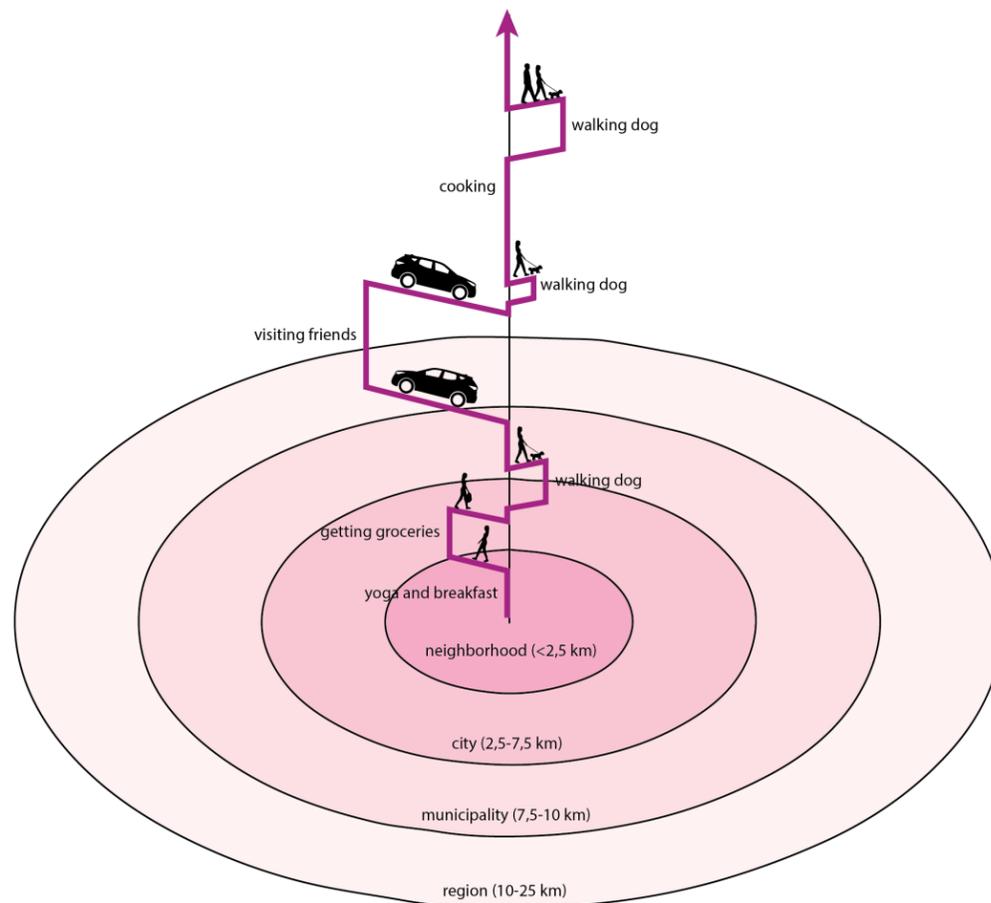


Figure 76: Most common daily travel pattern of Tineke



Figure 77: Picture of Tineke with her dog in front of her house

# PROFILES

## STORY OF SARA

Sara is a 35-year-old expat living in Hillegersberg, Rotterdam, with her newborn. She enjoys the spacious apartment she shares with her baby, though balancing motherhood with her professional life can be a challenge. Sara works three days a week at a hospital in the city center, while the other days are dedicated to taking care of her baby at home.

To get to work, Sara uses her electric bike. It allows her to commute quickly without the hassle of parking her car or waiting for public transport. The bike ride is smooth, and

she enjoys it a lot. However, on rainy days, Sara prefers to drive her electric car. The car offers comfort and convenience when the weather makes cycling less enjoyable.

After a long day at the hospital, Sara often walks to the grocery store near her apartment. It's a small task, but it's part of her routine. If she's in a hurry or has a lot on her plate, Sara pre-orders her groceries online, which makes life a little easier. It saves her time and ensures that she doesn't have to worry about the logistics of shopping with a baby.

The weekends are a welcome break. Sara enjoys visiting friends, shopping in Rotterdam's city center, or spending time outdoors. She likes to explore nature spots outside the city, taking her baby along for the fresh air. These weekend trips often take her to different parts of the Metropol region. Whether it's a visit to a friend or a walk in the park, she values the chance to unwind and spend time with her child.

Despite having a reliable bike and car for transportation, Sara finds that getting around with her baby can sometimes be a challenge.

Public transport is an option, but she finds it difficult to navigate with a stroller, especially since buses and trams are not always equipped for families. The journey often requires extra planning, deciding at what time to leave the house or if she will need to transfer between different modes of transportation.

Sara wishes the city offered more family-friendly options that could make her life easier. The current system doesn't always meet the needs of parents like her, who need to balance their daily tasks while making sure their child is safe and comfortable.

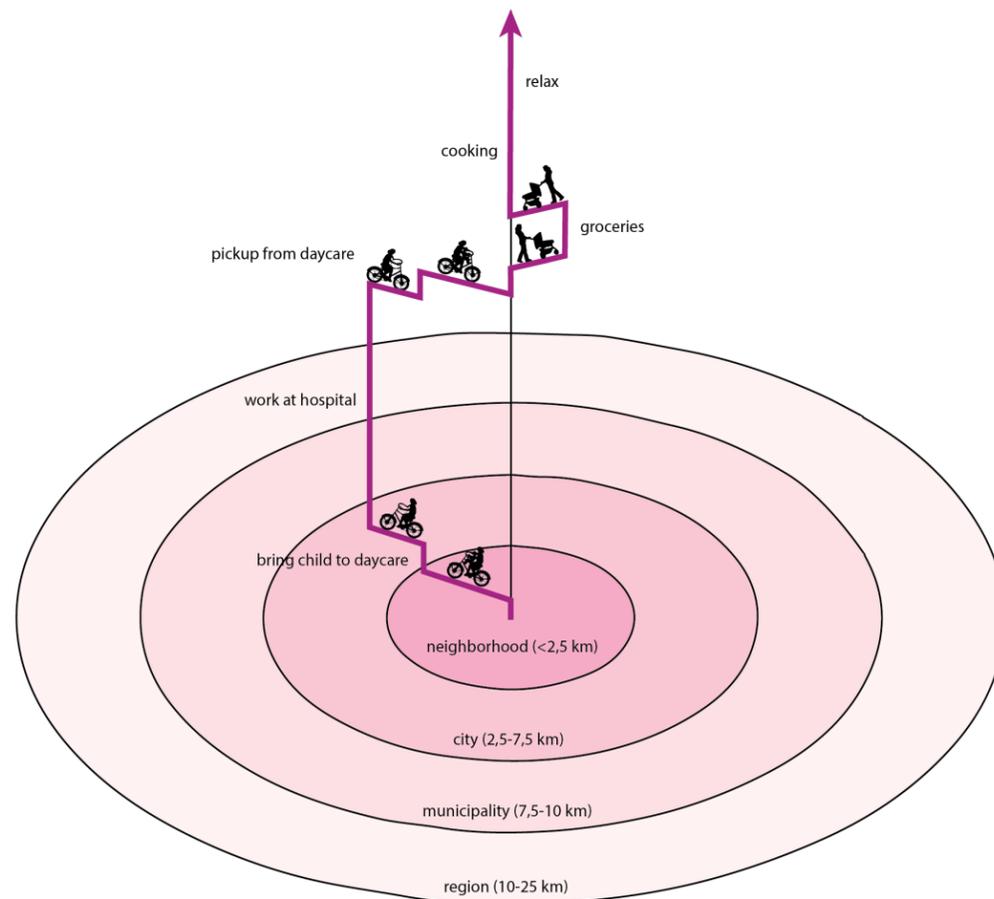


Figure 78: Most common daily travel pattern of Sara



Figure 79: Picture of Sara with her kid in front of her house

# PROFILES

## STORY OF MIRIAM

Miriam is 50 years old and lives in Charlois, Rotterdam, with her husband. They live in a cozy apartment, where she enjoys the quiet life with her partner. Miriam works at a hospital nearby, a job she's held for many years. During the weekdays, she commutes to work using her bike, which she finds both practical and reliable. The hospital is just a short ride away, so she doesn't mind the daily journey. If the weather is bad, Miriam switches to the bus, which is a more convenient option when it rains.

Every evening, after her workday, Miriam takes

a walk around her neighborhood. It's part of her routine to stay active and keep fit. The walk helps her unwind and clear her mind, a time to reflect on the day and enjoy some fresh air.

For short trips, such as grocery shopping or picking up a few items, Miriam usually walks or takes her bike. She likes the simplicity of walking to the local shops, making the most of her daily exercise. However, there are times when she needs to travel further, and for that, she takes the bus.

On weekends, Miriam's routine shifts. She and her husband drive to visit their children, who have moved out. With her children no longer living at home, Miriam was able to save enough money to buy a second-hand car. The car makes weekend visits much easier and more comfortable. While she doesn't earn a lot of money, the second-hand car was an affordable way to stay connected with her children, especially since public transport doesn't always fit her needs for longer trips.

Miriam's life is simple but fulfilling. She values

the time spent walking and biking around her neighborhood, but the car has become an essential part of her weekend plans. It gives her the freedom to visit her children without the hassle of public transport or relying on other forms of mobility.

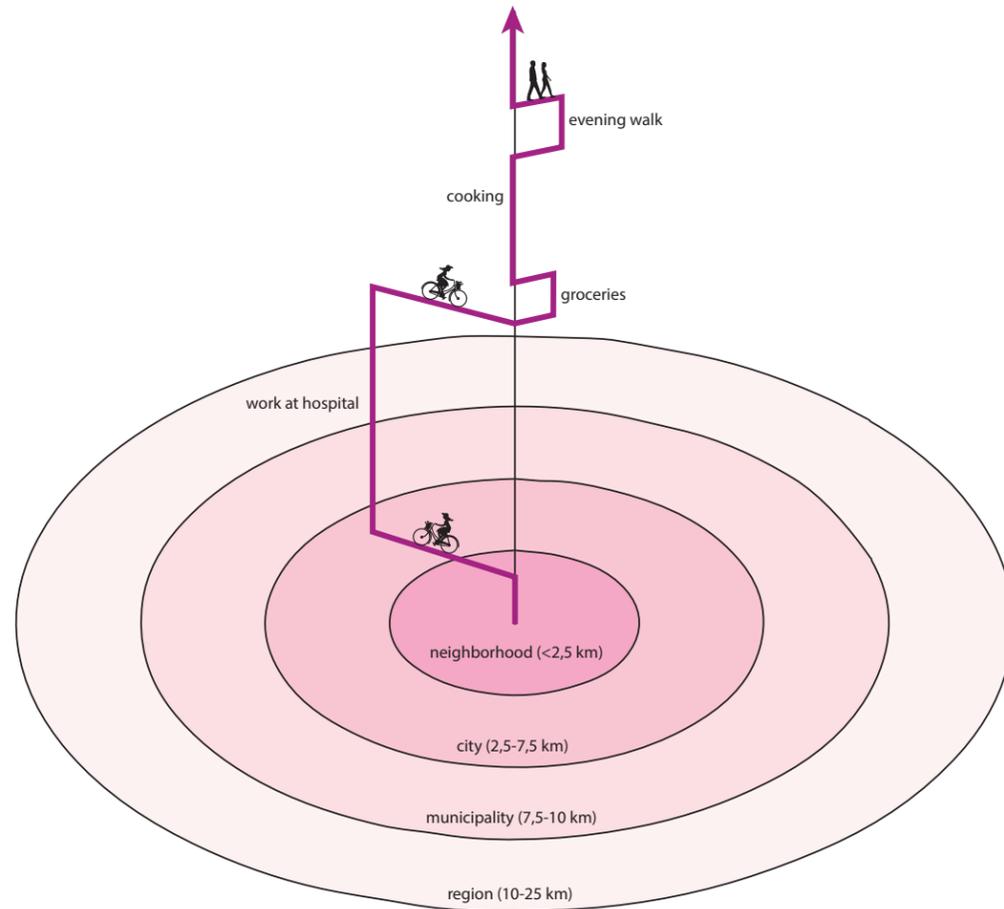


Figure 80: Most common daily travel pattern of Miriam



Figure 81: Picture of Miriam with her bike in front of her house

# PROFILES

## STORY OF NORA

Nora is 38 years old and lives in Charlois, Rotterdam, with her husband and child. She works in a store at Zuidplein, a busy shopping area not far from her home. Nora has chosen not to get her driver's license since her husband always takes the car, leaving her without the need for one. Growing up outside the Netherlands, she never learned to bike, and that's not something she's taken up since moving here. But her trips are always short, and she manages with walking and public transport.

During the day, Nora prefers to walk to work. It's a predictable, reliable option that fits well into her schedule. The walk gives her the chance to stretch her legs and enjoy a bit of quiet time before work. But when it's dark or raining, she opts for the bus. The bus is more comfortable and keeps her dry, but it's not as predictable time-wise as walking.

In the mornings, Nora's routine starts with taking her daughter to school. Afterward, she heads to work, either walking or taking

the bus. When the school day ends, she picks up her daughter, and on Mondays and Wednesdays, she takes her to ballet. While her daughter is in class, Nora goes grocery shopping. It's a small window of time, and she likes to get everything done efficiently.

When she and her daughter get home, Nora focuses on cooking for the family. It's her time to unwind and prepare a meal for everyone. Although her daily travels are short, they are well-

planned, as her life is full of little responsibilities and tasks that require her attention.

Nora may not rely on biking or driving, but she's made her transportation choices work for her. She has found a rhythm that fits her family's needs, balancing her work schedule, school runs, and the occasional trip to the store. But for Nora, getting around by foot and bus feels like enough, and she doesn't mind not having a driver's license or the ability to bike.

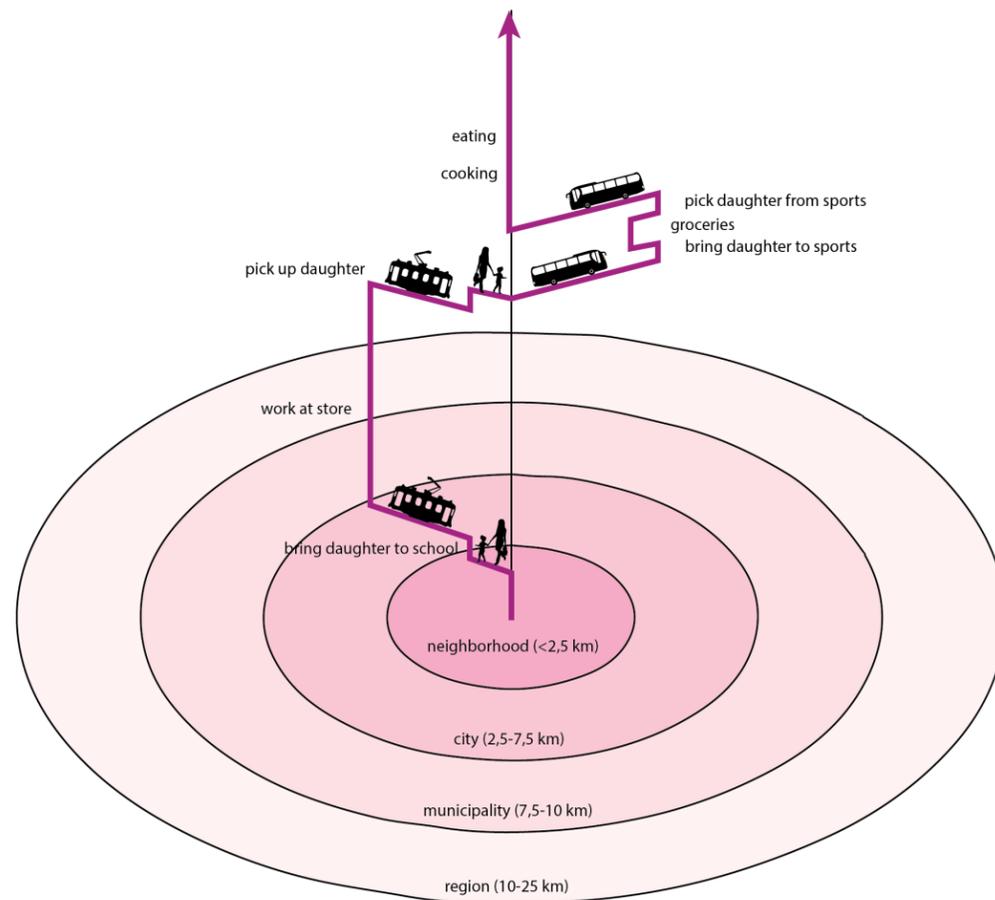


Figure 82: Most common daily travel pattern of Nora



Figure 83: Picture of Nora with her daughter in front of her house

# STAKEHOLDER ANALYSIS

## POWER AND INTEREST MATRIX

The energy transition in the Netherlands is changing the transportation industry, but without inclusive policies, it risks accelerating **mobility poverty**, particularly for women. To address mobility poverty, it is essential to amplify marginalized voices and ensure inclusive policy development. Women from low-income households' face challenges such as limited access to private transport, time poverty, and safety concerns. A power-interest matrix helps clarify the roles of various stakeholders in addressing these issues.

Stakeholders with **Low Power, High Interest** include women from low-income backgrounds, feminists, climate activists, and marginalized communities. Although they are deeply affected, they lack institutional power but are committed to advocating for a fair transition. Their participation through public consultations, focus groups, and collaboration with NGOs is crucial to magnify their voices and promote inclusive solutions and give them agency.

**High Power, High Interest** stakeholders, such as urban planners, municipalities, energy providers, electric vehicle producers, and researchers, hold notable influence over policy and infrastructure. Municipalities are especially significant as they control land use and public transport systems, allowing them to incorporate gender-sensitive policies. They can implement inclusive mobility solutions, such as affordable public transport and bike-sharing systems, while researchers can contribute by conducting gender-focused studies to support evidence-based decision-making.

**High Power, Low Interest** stakeholders, including investors, fossil fuel companies, and large transport operators, have significant control over infrastructure and investments. However, they often lack interest in addressing social equity unless pressured by regulation or public opinion. These actors can participate by shifting focus to sustainable and inclusive projects.

Finally, **Low Power, Low Interest** stakeholders, such as wealthy inhabitants and electric car owners, may face fewer mobility challenges. Encouraging them to support inclusive policies and raise awareness can help build broader societal support for equitable transitions.

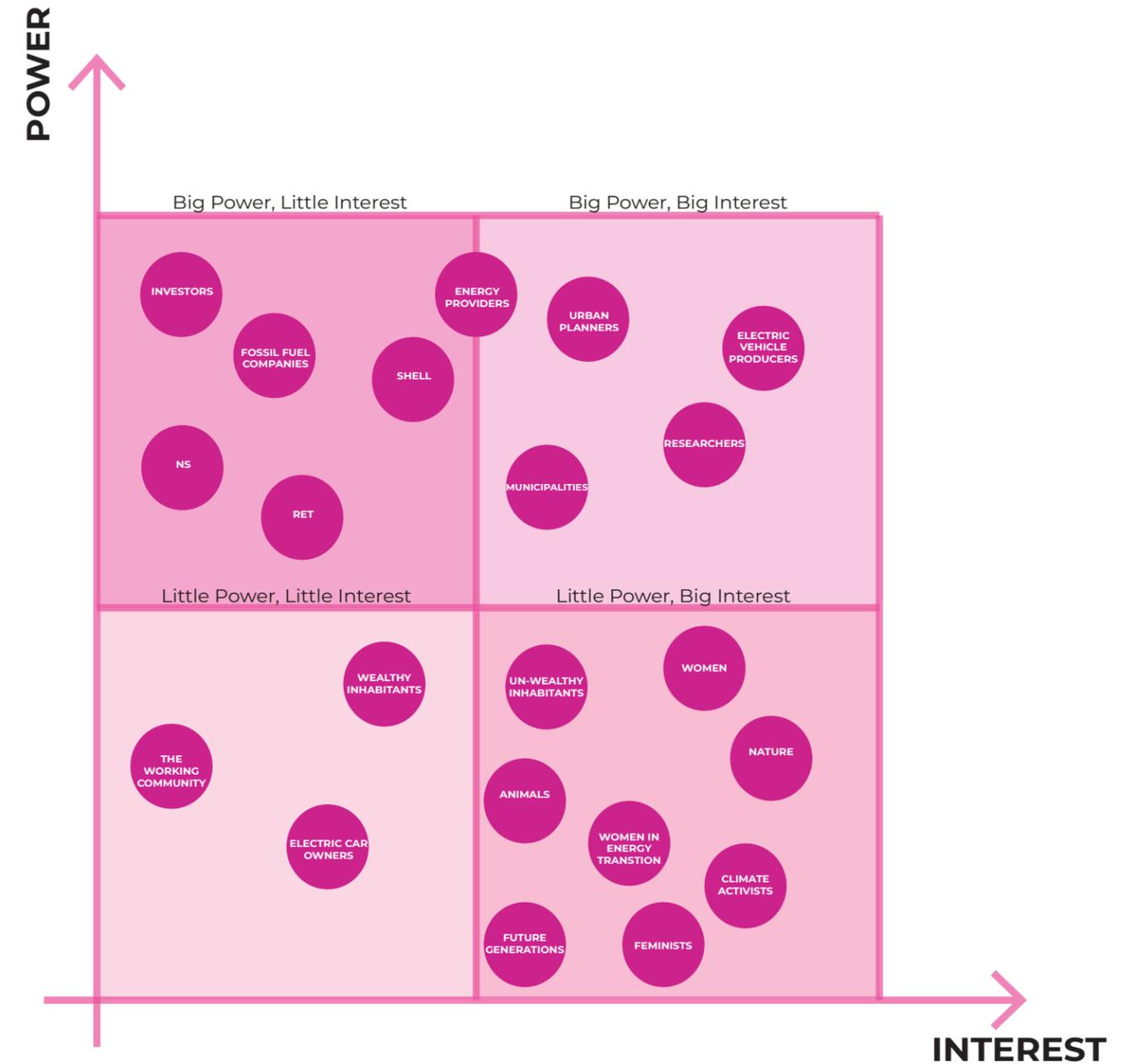


Figure 84: Power-Interest Matrix

# MICROMOBILITY

## MICROMOBILITY AS THE NEW URBAN TRANSPORTATION

Micromobility is the new trend in urban mobility. “Micromobility” is a combination of “micro”, which means extremely small, and “mobility” which means to be mobile and move around. The term “micro” refers to the short distances that are travelled and the lightweight vehicles, which are typically less than 500 kg (Dediu, H.,2019). The Transportation & Development Policy (ITDP) defines micromobility as a collection of small, lightweight vehicles that operate at speeds that are less than 25km/h (Power, M, 2020). Micromobility can make short distance travel more accessible and affordable. With the different options of vehicles (human powered and electric) and technology from mobile networks and GPS, micromobility can grow into an ‘on-demand’ service (Dediu, H.,2019). Traditional bicycles and micro-vehicles such as e-scooters and e-bikes are popular worldwide. Shared and private micro-vehicles are increasing on the streets. In recent years, various options have been introduced in cities around the world (Galatoulas et al., 2020).

Micromobility has the potential to solve a large part of the transport related problems in an urban areas. For example, it can reduce private car ownership. One of the main potentials is to solve the “first and last mile” to public transport by improving access to this service. This then creates more access to other services and opportunities. It contributes to changes in mobility patterns and behaviours. Increasing the micromobility can contribute away from a car-centred urban mobility system (Holm Møller et al., 2019). This can result into the city becoming a zero emission mobility zone.

# MICROMOBILITY OPTIONS

## MICROMOBILITY OPTIONS FOR AN INCLUSIVE URBAN ENVIRONMENT

To research which micromobility options would work best for an inclusive urban environment we looked at leverage points by M. East (2024).

The important leverage point that is used for decision making it which options of micromobility to implement was:

Leverage point 29 - Promoting the use of electric bikes.

By adding electric micromobility options, there is a fairer distribution of opportunities (East, M., 2024). Figure 85 gives an overview of the micromobility vehicles that will be incorporated in the following vision.

	WHAT?	HOW?		WHY?
		MANUAL	ELECTRIC	
	BIKE	✓	✓	Bikes are part of the dutch culture so it is important to also give more options in that category.
	CARGO BIKE	✓	✓	Adding the cargo bike offers an option to transport cargo and kids. Having the electric version makes it easier to use when having to travel slightly longer distances.
	TRICYCLE	✓	✓	By adding the tricycle you have a stable option. According to our community, this offered a stable option for the elderly.
	STEP		✓	The electric step is an option that is already in the current system. This option we will also implement
	MOBILITY SCOOTER		✓	The mobility scooter is an option that is focused on people with a disability who are not able to bike.
	SCOOTER		✓	The scooter is a micromobility option that is already implemented in the system. With this option you will be able to travel within the region.
	MICRO CAR		✓	The micro car offers an enclosed option for traveling for a longer distance. With this option you will be able to travel within the region.

Figure 85: Micromobility matrix

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### **CHAPTER 4. VISION**

4.1 VISION STATEMENT

4.2 VISION FOR THE REGION

4.3 VISION FOR ROTTERDAM

4.4 CONNECTING THE HUBS

# THE PINK LANE

## VISION STATEMENT

We envision a safe and inclusive mobility system that addresses the needs of women by improving last-mile connectivity to and from public transport, particularly in peripheral urban areas. By promoting accessible and affordable micromobility solutions, we aim to create more interconnected cities. This will lay the groundwork for a seamless, interregional mobility network that serves all communities equitably.

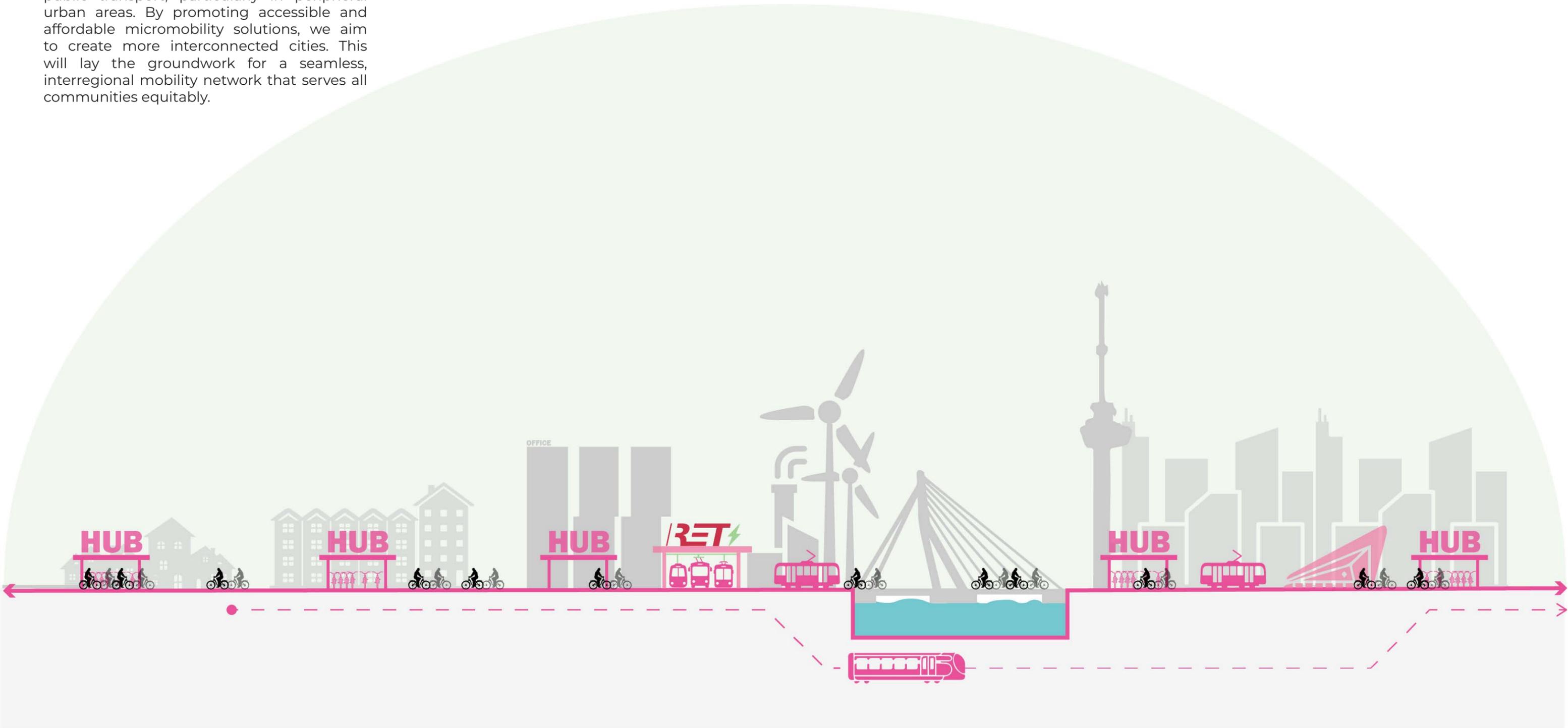


Figure 86: Vision Section

# THE REGIONAL VISION

This map gives a schematic overview on what the hub system would look like in combination with the regional train network, after everything is phased out.

The map shows the Rotterdam-the Hague metropolitan area with existing high urban areas and train stations.

The level 3 hubs that are visible in the map are the ones at the train stations, to show how they are connected to each other through the train tracks and to their environment through the micromobility.

The level 2 hubs are mostly present in the high urban areas, since the most amenities are there.

And finally the level 1 hubs are present in the urban areas as well as in the peripheral areas, to connect those better.

The goal of the map is to show that all areas (urban and peripheral) are well interconnected through the combination of public transport and the implementation of micromobility.

- Level 3 hubs
- Level 2 hubs
- Level 1 hubs
- Interconnections through micromobility
- Interconnections through train network
- High urban areas
- Water
- Land



Figure 87: A vision map for the metropol region.

# THE PINK LANE

## VISION FOR ROTTERDAM

This vision map of the Pink Lane illustrates how the micromobility network, fully integrated with public transport, can transform urban mobility. By strategically placing hubs of different levels across the city, micromobility can become the primary mode of sustainable transportation in Rotterdam. This approach ensures safe, accessible, and efficient last-mile transfers, strengthening the public transport system. The result is a more interconnected city that prioritizes sustainability, space efficiency, and ease of movement. The Pink Lane marks a key first step in Rotterdam's journey toward becoming a zero-emission city. This will contribute to the national goal of a zero-emission Netherlands.



Figure 88: A vision map for the Rotterdam



# THE PINK LANE

## CONNECTED MOBILITY NETWORK

This vision introduces a layered network of micromobility hubs. It is designed to support the daily mobility needs of residents in Charlois, especially women. The figure shows how different hub levels connect across the neighborhood. It also visualises typical travel patterns of women in this area.

The smallest hubs in the framework are Level 1 hubs. These are located within residential streets. They allow residents to use shared micromobility directly from their homes. This includes trips to local amenities, visits to friends and family, or travel to public transport. These hubs make the first and last mile of a journey easier. They are especially relevant for women, who often make multiple short trips during the day.

Level 2 hubs are medium-sized. They are placed at local points of interest such as parks, health centers, and shopping areas. These locations attract more people. The hubs offer more shared vehicles.

Level 3 hubs are the largest. They are located at major transport interchanges like train stations, P+R sites, and the airport. These places see large volumes of people moving in and out of the city. The Level 3 hubs support connections between micromobility and long-distance travel. They offer a wide range of shared vehicles and infrastructure like charging stations.

The strategy that supports this vision will clearly define where hubs will be placed. It will also specify the size of each hub and the types of vehicles available.

The hub system is designed with inclusivity in mind. Women in often make complex, multi-purpose trips. These trips include travel to schools, supermarkets, care facilities, community centers, and social visits. Many of these destinations are spread out across the city.

The hub network connects these places. It supports short local trips as well as longer journeys.

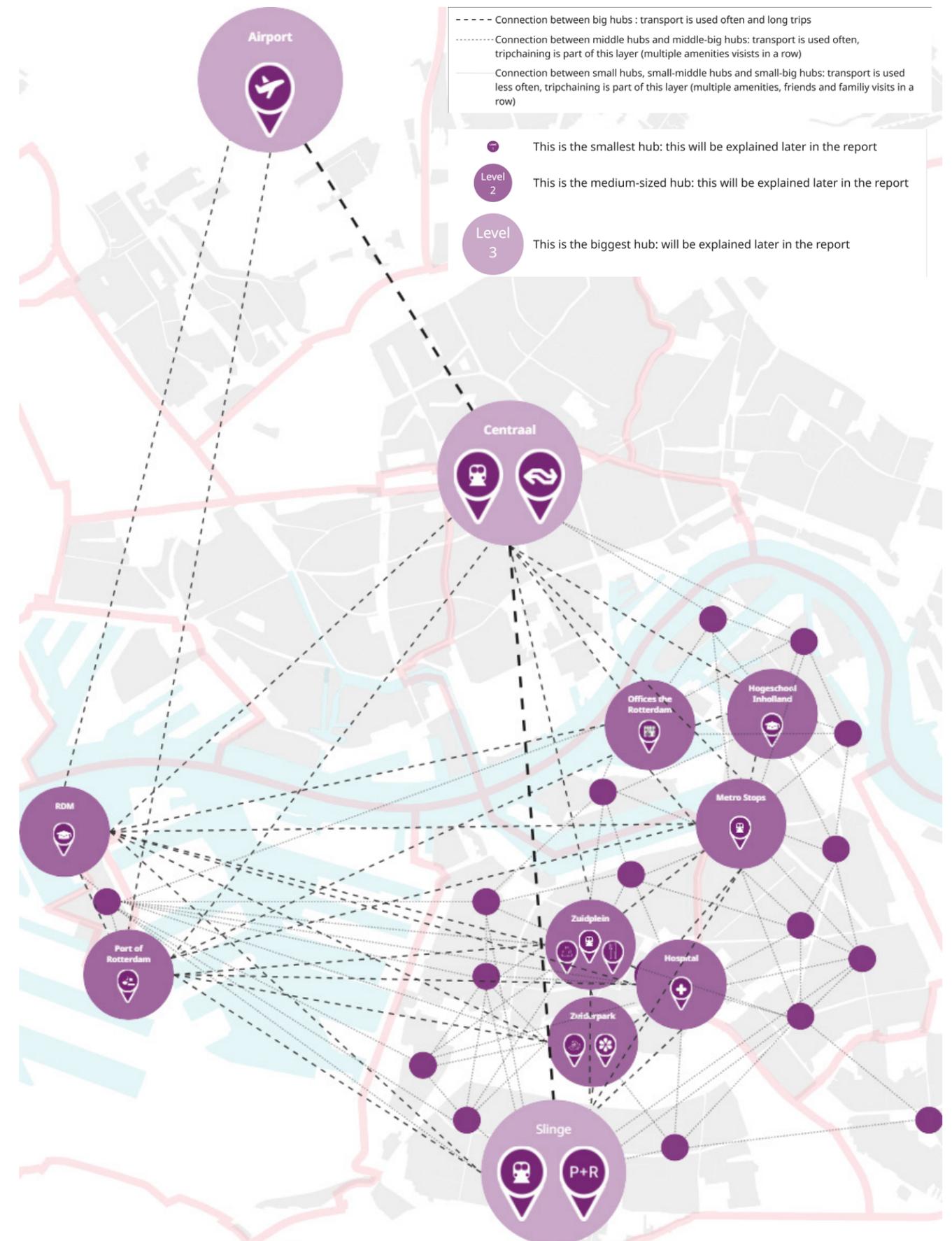


Figure 89: Hub Connections

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# POLICIES

## GUIDELINES FOR INCLUSIVE AND SAFE URBAN MICRO MOBILITY

The policies are divided into four major categories: **economic, environmental, safety and equity.** This policy framework focuses on micromobility and the reimagination of urban infrastructure to better accommodate women, so as to allow a gender-inclusive energy transition. Micromobility—bikes, cargo bikes, e-bikes, scooters, and mobility scooters—offers flexible, accessible transportation options catering to last-mile transport and daily short movements. It helps to bridge the gap between public and private transport.

The **micromobility infrastructure** needs to be created in place of the car-centric movement. A new typology is required, where streets are categorised by **slow mobility** speed limits. It will gradually increase speed zones—from pedestrian areas (5 km/h) on the edges to slow traffic zones (10–15 km/h) and electric public transport zones (15–30 km/h) toward the center. This will improve safety and usability, particularly for women, families, and the more vulnerable groups. Reduced speed limits in city centers, fewer parking spaces, and enhanced mobility alternatives will further support this transition.

The urban space has to be redesigned to allocate space for safer and more inclusive streetscape. **Economically and environmentally,** our policies prioritize shared mobility over private car ownership. We are proposing a monopoly model for shared micromobility, this would eliminate competition, lower user costs, and make services more accessible across demographics. This would be further facilitated by forging connections with the current transportation providers like NS, RET and HTM and bringing the micromobility options under the OV Chip card and having all mobility options under a common mobile phone application.

Providing and maintaining public goods is an essential step in facilitating this energy transition. Upgrading bus stops, increasing street lighting, adding hygiene facilities, and improving access to surveillance in areas with higher crime rates can help **create safer, more comfortable environments,** especially for women. These public goods should also be inclusive and sustainable, for example installing solar-powered, motion detected streetlights and adding solar panels in the electrical charging stations so that the e-bikes can be self-sufficient.

Environmental goals also include the **complete elimination of CO<sub>2</sub> emissions** in urban areas. Replacing fossil-fueled vehicles with electric options and maximizing the lifecycle of energy and infrastructure are key strategies. These transitions are both spatial and economical, requiring an improvement of the urban systems historically designed by men and for men. Thus, **more women must be involved in urban design and in the decision-making process.** Through government initiatives in closing the gender pay gap and by treating urban planning as a political and cultural act, one can challenge patriarchal norms and actively participate in shaping more gender-equal cities.

Together, these policies aim to create a city where mobility is accessible, affordable, safe, and sustainable for everyone—especially women.

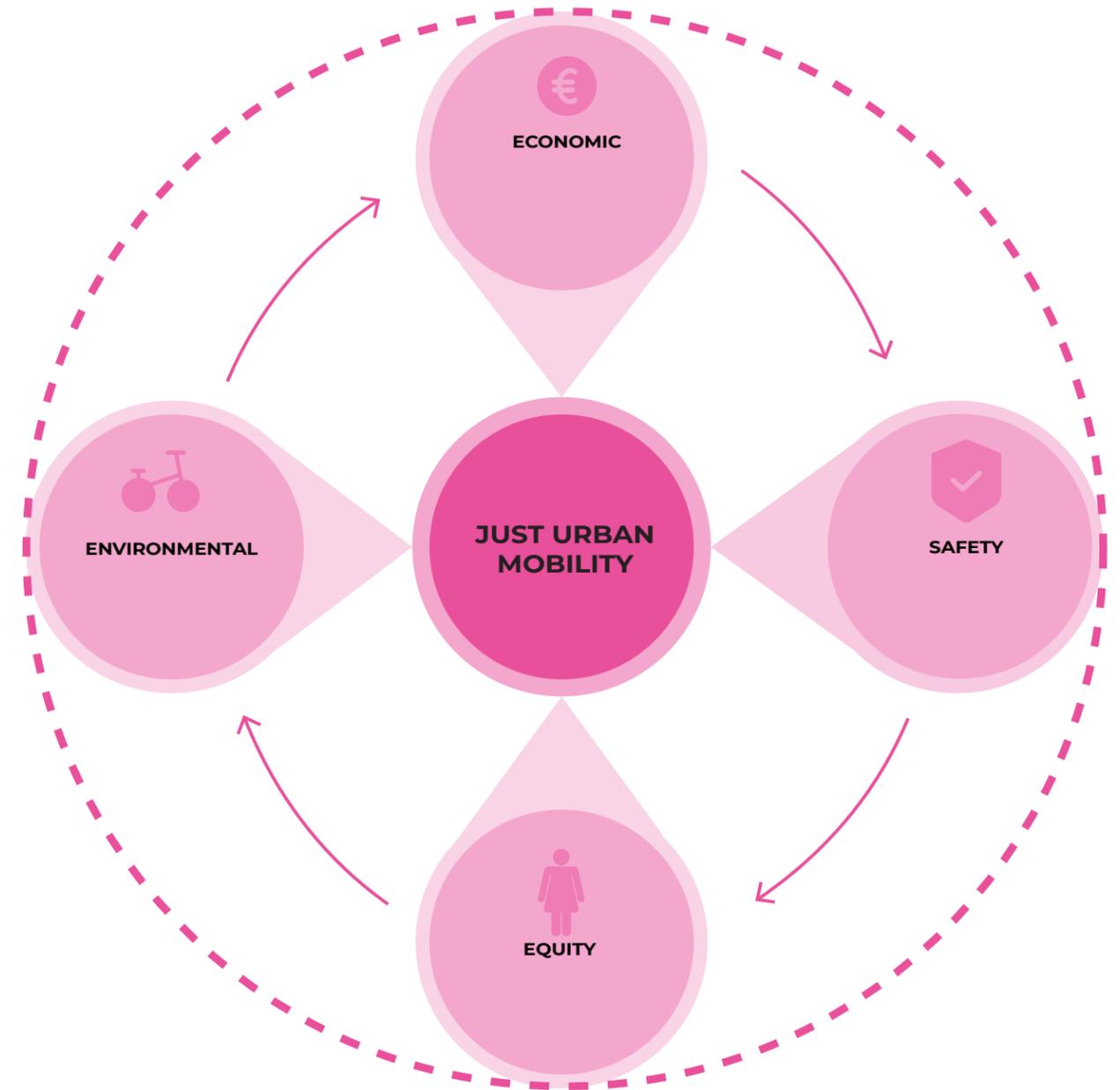


Figure 90: Policy Framework

# POLICIES

## GUIDELINES FOR INCLUSIVE AND SAFE URBAN MICRO MOBILITY

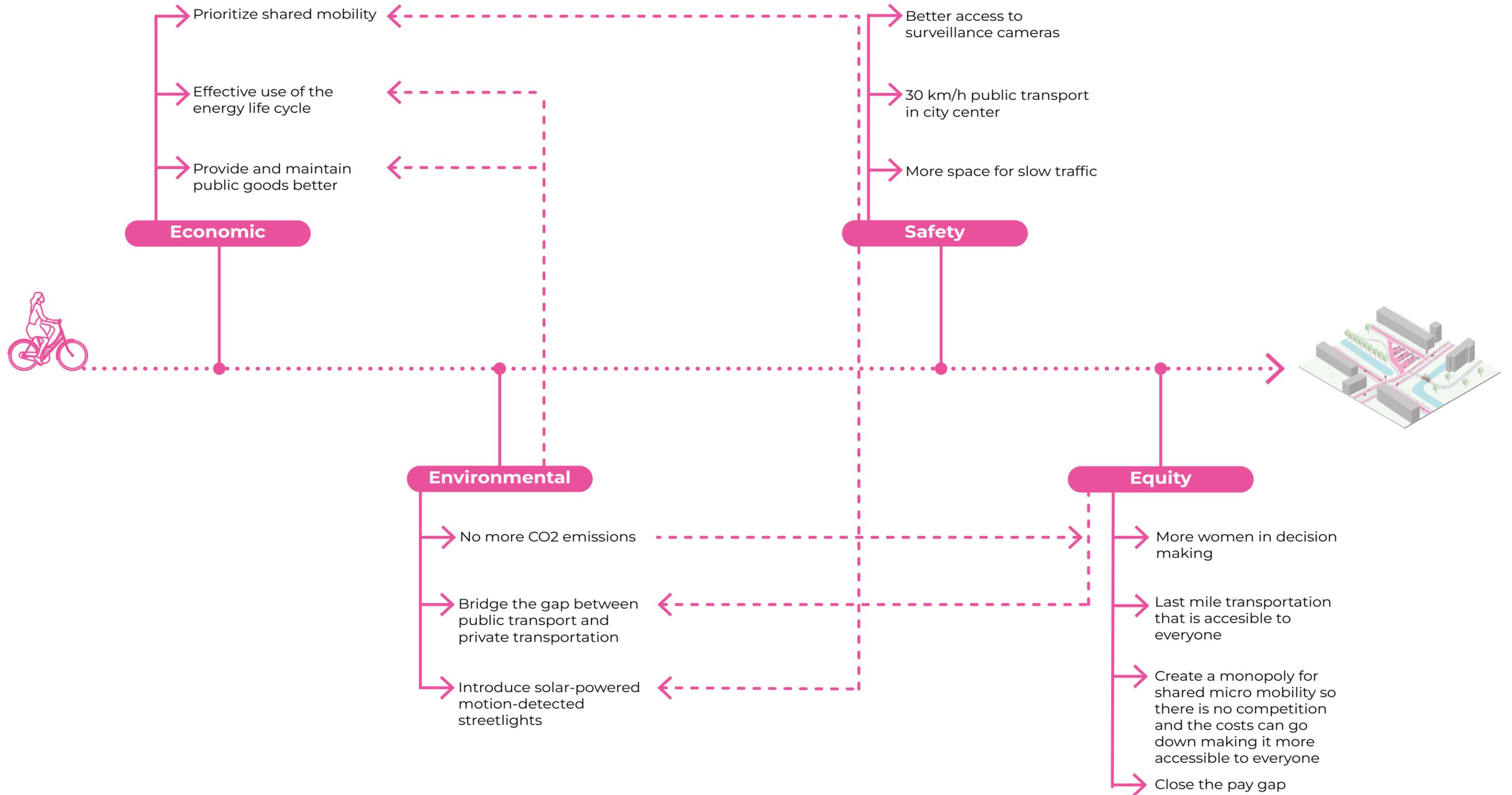


Figure 91: Policy Guidelines

# THE TIMELINE

AS A GANTT CHART

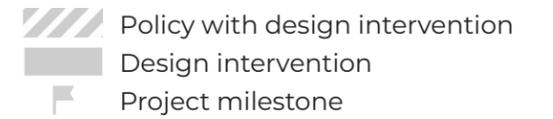


Figure 92: The timeline in a Gantt chart.

# THE TIMELINE

AS A VISION

Start of the project!  
**2025**

All hubs are placed and supporting infrastructure is implemented in the inner city of Rotterdam  
&  
The end of mobility poverty in the inner city of Rotterdam

**2035**

All hubs are placed and supporting infrastructure is implemented in the metropol region  
&  
End of mobility poverty in the metropol region

**2045**

**2030**

All hubs are placed and supporting infrastructure is implemented in Charlois  
&  
No more new fossil fueled cars

**2040**

All hubs are placed and supporting infrastructure is implemented in Rotterdam

**2050**

All hubs are placed and supporting infrastructure is implemented in the Randstad  
&  
End of mobility poverty in the Randstad  
&  
The Netherlands is emission free



Figure 93: Visual representation of the current transportation system.



Figure 94: Visual representation of the transition for the transportation system.



Figure 95: Visual representation of the transportation system in 2050.

# PHASING OF THE PINK LANE

## AS A VISION

This page shows the phasing of the implementation of the pink lane.

It starts on the smallest scale, with adjusting the local roads, which are eventually connected to each other through the pink lanes that are added to the provincial roads.

Adjusting the highways is the last step to make the pink lane a regional network that improves mobility within cities as well as between peripheral areas and other cities.

The diagram on the right is an abstract representation of the inner neighborhood connections, the inner city connections and the outer city connections through the pink lanes that are implemented in the mobility network.

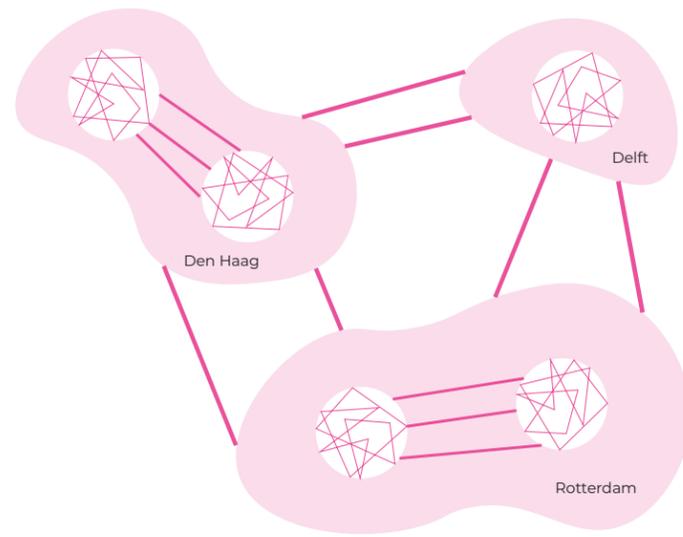


Figure 96: Abstract representation of the pink lane network.

Sources used: PDOK & OpenStreetMap

- Current pink lanes
- Newly added pink lanes
- High urban areas

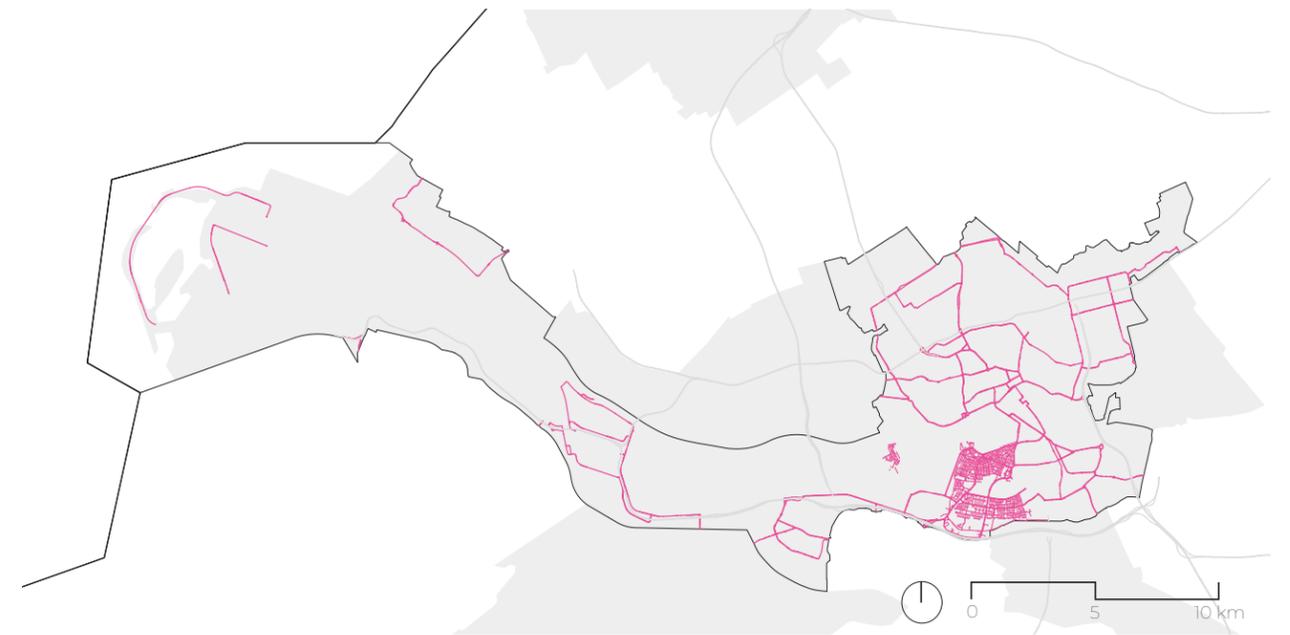


Figure 98: The streets with a pink lane on city level (the provincial roads).

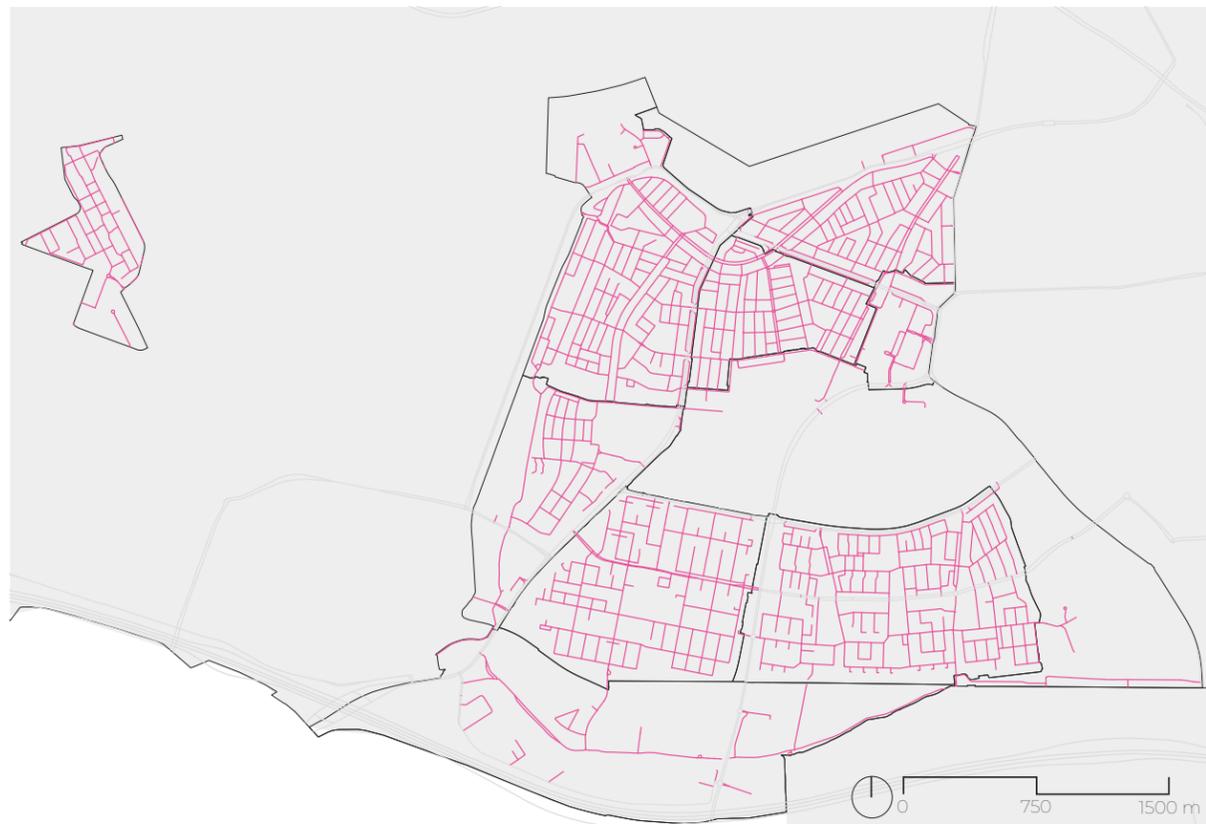


Figure 97: The streets with a pink lane on neighborhood (Charlois) level (the local roads).

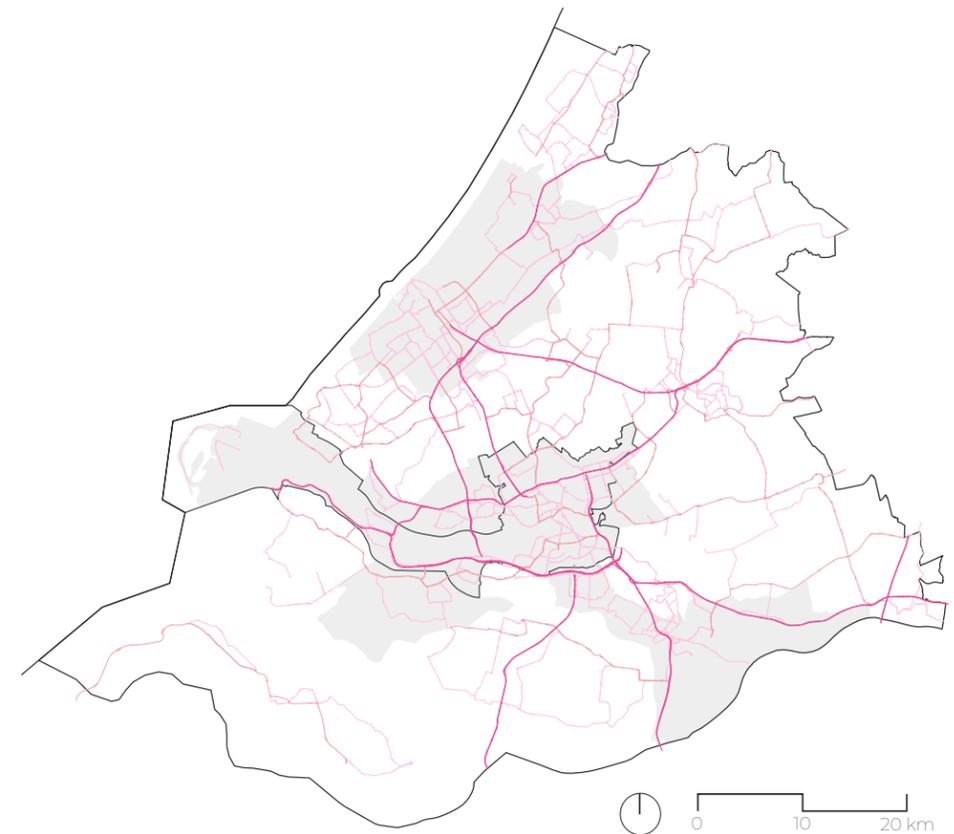


Figure 99: The roads with a pink lane on regional level (the highways).

# THE LEVEL 3 HUB

## REGIONAL CONNECTIVITY HUB

Woman powered micro mobility options available



Electric micro mobility options available



The level 3 hubs are located near train stations and Park & Rides. The hubs are located here because there they can function as in between station between different types of mobility and lead to better regional connectivity.

There is a wide selection of micro mobility types present, so all types of travel are suited. It also has the most amount of vehicles, with extensive parking for the micro car.

The hubs are very well accessible and located near the exit of the public transport stops or P&R parkings, so they connect well with the micro mobility from the hubs.

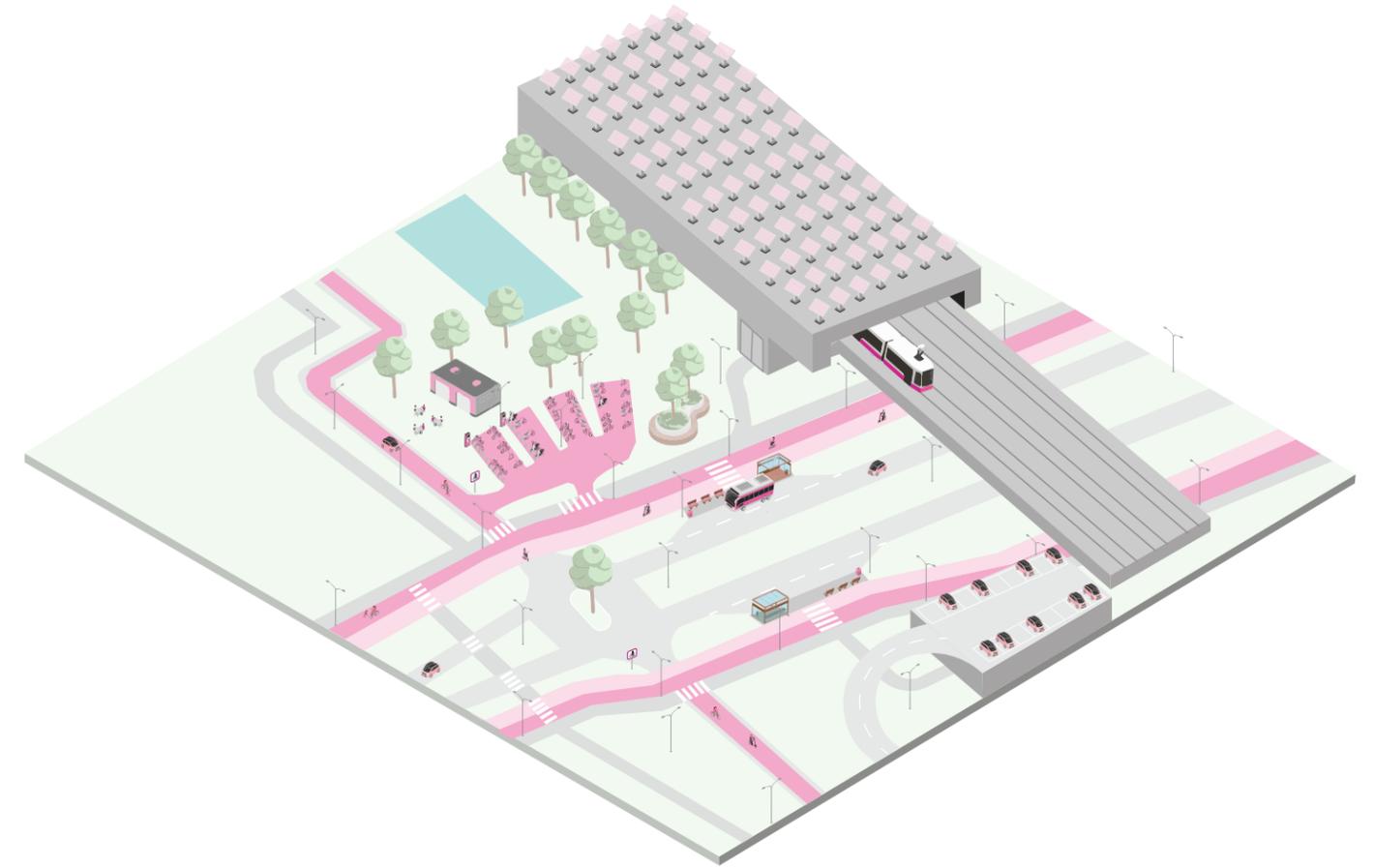


Figure 100: An abstract example of a level 3 Hub at the Slinge Metro Station in Rotterdam.



Figure 101: The locations for level 3 hubs in Rotterdam (sources used: OpenStreetMap, CBS & PDOK)

# THE LEVEL 2 HUB

## AMENITY POINT HUBS

Woman powered micro mobility options available



Electric micro mobility options available



The level 2 Hubs are located near amenity points, like leisure, education, public transport stops, parking places, sports and public services. The hubs are placed here to improve accessibility to the essential services, and to make them vehicle transit friendly for trip chaining, that a lot of women do daily.

There is a medium sized selection of vehicles present, which is focused on user friendly options, like the tricycle and mobility scooter. The capacity of this selection is moderately sized, and depends on the location and demand for the vehicles.

The hubs are positioned near main entrances of amenities and are designed to be wheelchair friendly.

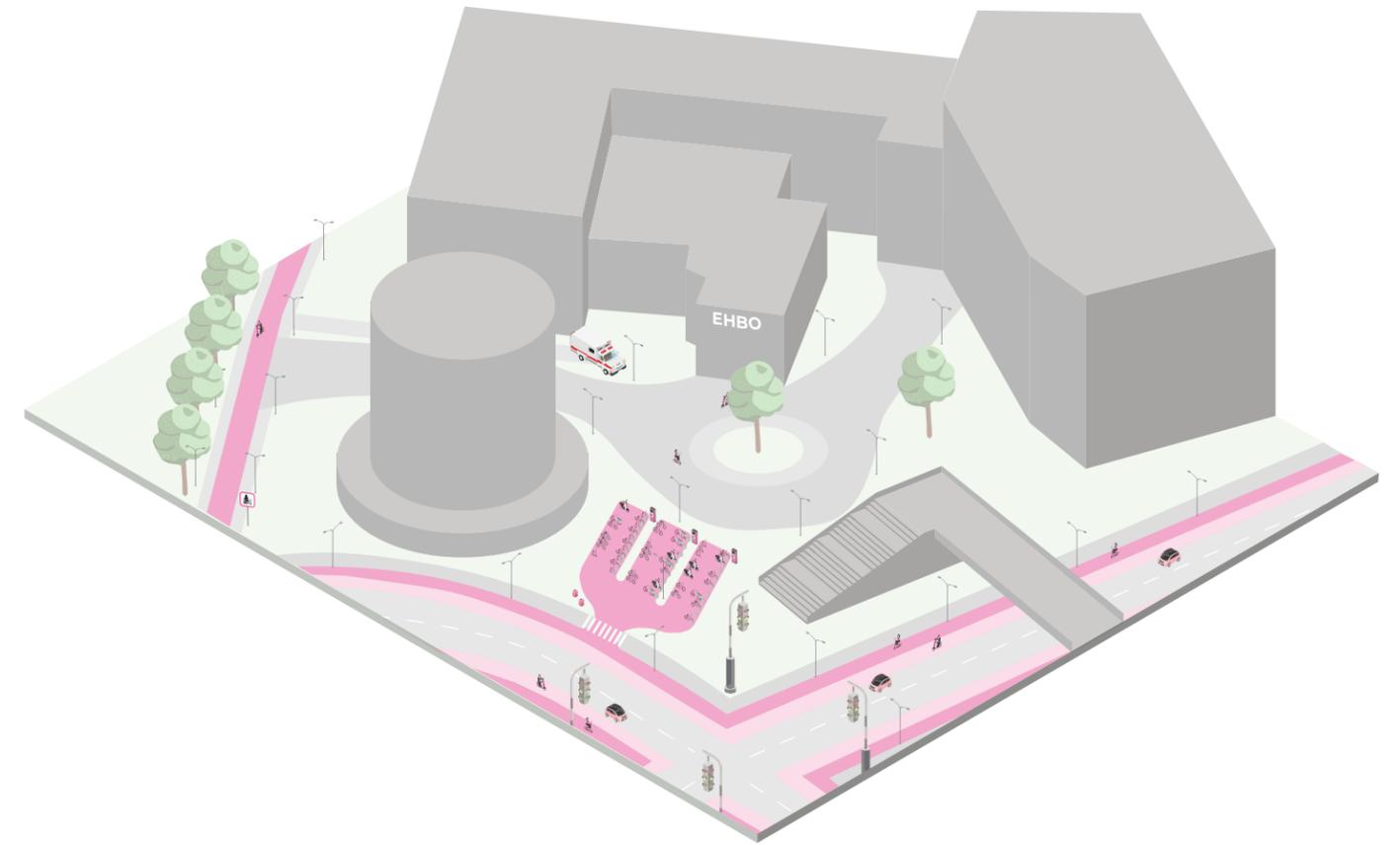


Figure 102: An abstract example of a level 2 Hub at the Ikazia Hospital in Rotterdam.

-  Buildings
-  Water
-  Level 2 hub at hospital/doctor 800 m range
-  Level 2 hub at emergency service with 800 m range
-  Level 2 hub at park with 800 m range
-  Level 2 hub at sports with 800 m range
-  Level 2 hub at theatre with 800 m range
-  Level 2 hub at educational service with 800 m range
-  Level 2 hub at super-market with 800 m range



Figure 103: Locations for level 2 Hubs in Charlois (sources used: OpenStreetMap, CBS & PDOK).

# THE LEVEL 1 HUB

## NEIGHBORHOOD HUBS

Woman powered micro mobility options available



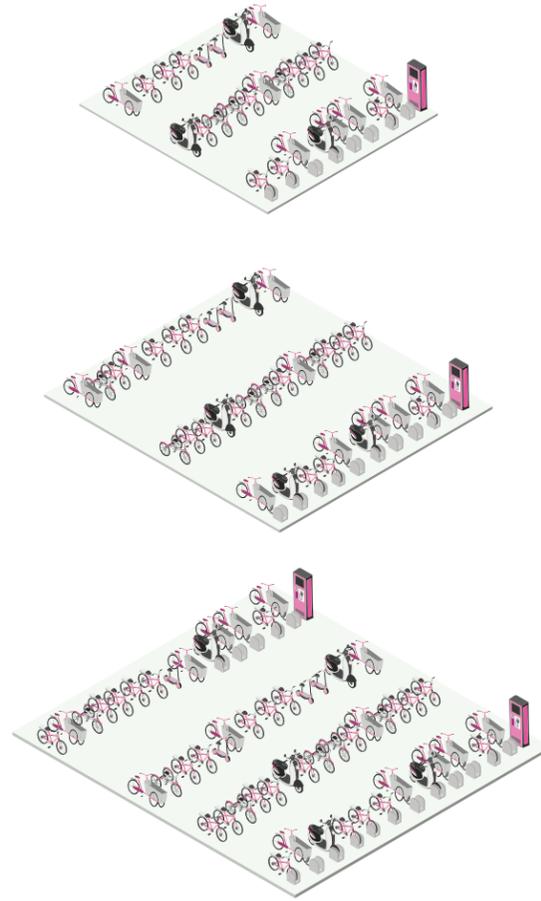
Electric micro mobility options available



The level 1 Hubs are located near neighborhoods and function for everyday accessibility for all. There are located at places where there is no reach of any other hub. The purpose of placing these hubs in residential areas is to ensure easy access for local users to encourage daily use of micro-mobility instead of personal (fossil fueled) mobility. It is an addition for everybody who does not own a vehicle but also for those who might be in a hurry and can then take the e-scooter.

There is a bit of a smaller selection of vehicles than the other hubs, because the level 1 hub is focused mostly on daily needs for small distances, which focuses more on bikes, e-bikes and cargo bikes, to get groceries or take the children to school. The capacity is also a bit less than the other hub levels, but is very adaptable to neighborhood settings, like the amount on inhabitants, the amenities and the available space for the hubs.

Through the years there is an expected drop in car ownership, leading to more use of micro mobility and thus of the hubs. Therefore the hubs are located in spaces where there is space for spatial expansion of the hubs.



Potential sizes of the hubs.

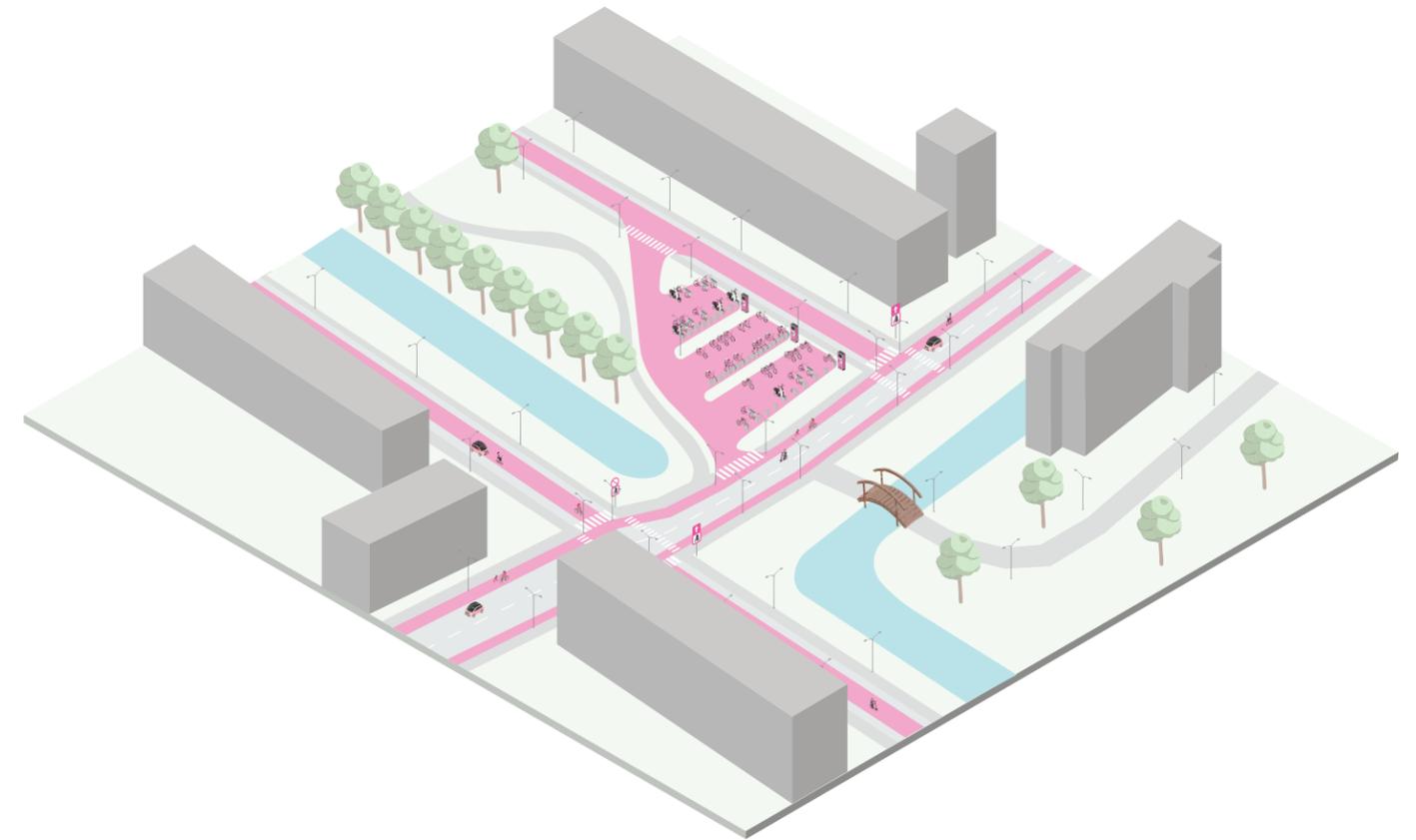
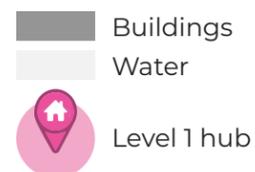


Figure 104: An abstract example of a level 1 Hub in Carnissensingel, Rotterdam.

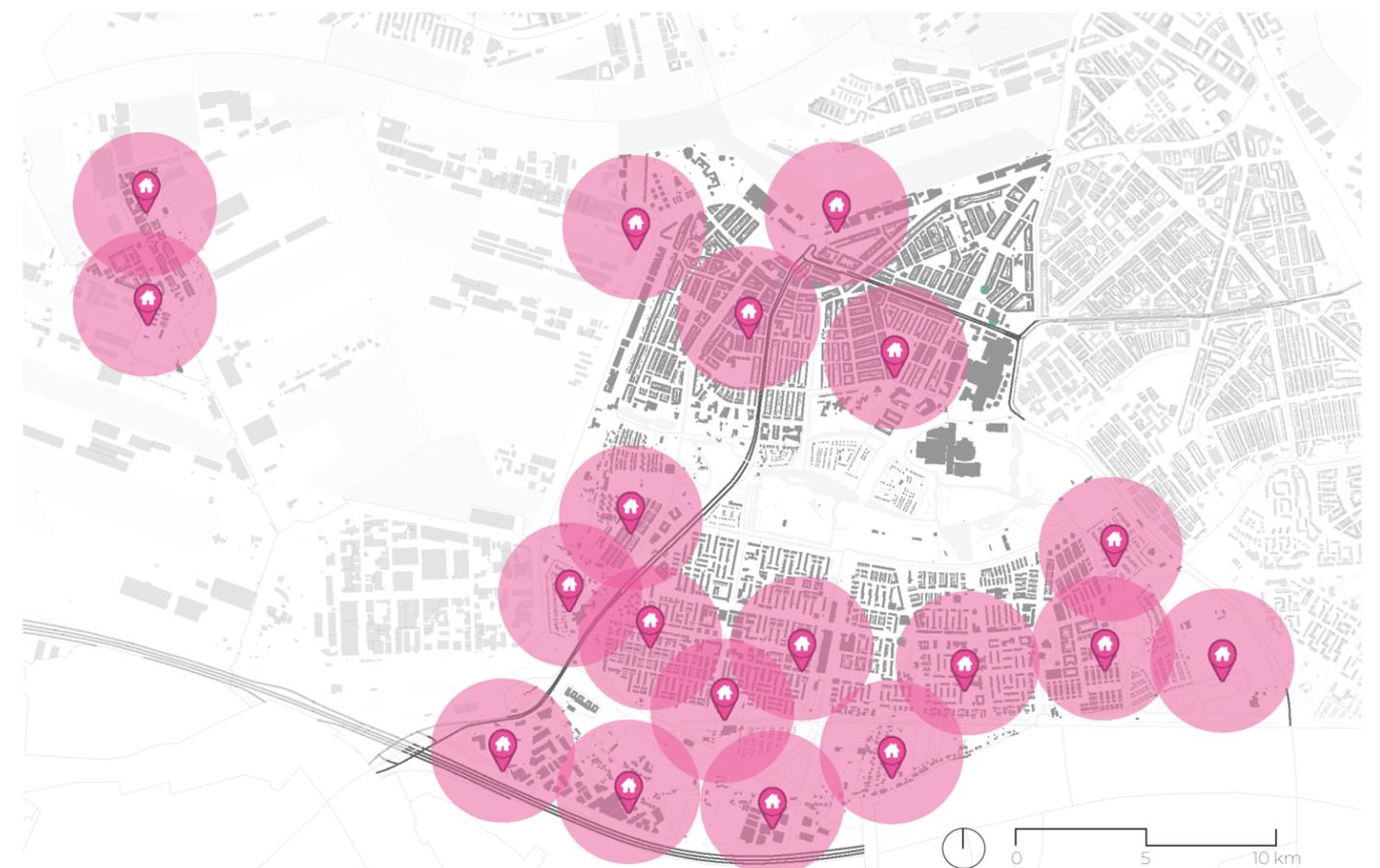


Figure 105: Locations for level 1 Hubs in Charlois (sources used: OpenStreetMap, CBS & PDOK).

# MICROMOBILITY HUB QUANTITY

## IMPORTANT FACTORS FOR MICROMOBILITY HUB

To be able to meet the supply to the demand of the quantity and type of micromobility, we tried to come up with a design formula. This formula is not a perfect one, but it does include some important factors which will also be explained. This formula was formed through research layers and "Cycling Facts 2023" by KiM & Kolkowski L. in 2023.

### Population Density (P)

It is important to know how many people live within a walking radius of approximately 800m of a hub. This will give a local user number. Important factors to take this into account is the "time of day" population. The typology of the area is also important to determine this number (residential, mixed use, etc.). It is also important to know if there are more men or women in the area since women tend to use micromobility more.

### Micromobility Usage (U)

Not everyone will use micromobility. Knowing the gender ratio can be of importance because women use micromobility more often than men. Micromobility is also not used very often by little kids (maybe 5 and under). And income and car ownership are also of importance (lower car ownership = higher usage potential).

### Average trip frequency (F)

Average trips per day per user depends on what type of amenities are present in the neighbourhood.

### Average trip duration (T)

Short inter-hub trips means a faster reuse of the micromobility vehicle.

### Redundancy factor (f)

To prevent shortages, a constant has to be taken into account. The redundancy factor can be a constant of 1,3. This number is based on the amount of bikes an average Dutch person has.

With these important layers we came up with the following formula:

$$\text{Micromobility} = (P \times U \times F \times T) \times f$$

Example:

A neighbourhood in Charlois has 100 people (P), 60% have to adopt micromobility (U=0,6). Each takes at least 2 trips a day, home-to-work-to-home. Since they residents use micromobility to go to the nearest train station, the trip turnover is 2.

To cater to a 100 people you need approximately:

$$M = (100 \times 0,6 \times 2 \times 0,2) \times 1,3$$

$$M = \text{approximately } 31,2 \text{ vehicles.}$$

$$M = 32 \text{ vehicles}$$

Although it is not a perfect number, it does give an estimation of the number of options you will need at a neighbourhood hub. At least a third of the people would have a micromobility option.

Other important factors to take into account:

### Micromobility Mix Factor

The type of micromobility that needs to be present. To determine this number it is important to look at the household composition and if there are a lot of old people living in the area.

### Weather Conditions

Micromobility may be used less in extreme weather conditions.

# MICROMOBILITY DESIGN

## WOMEN ACCOMMODATING

To make the micromobility more women accommodating the design of the micromobility vehicles should become more women accommodating. Through research and leverage points from May East (2024), we incorporated the design principles for micromobility vehicles:

1. The micromobility vehicles should have saddles that are also tailored to women. An example is by adding a "skirt saddle" to the bikes. This makes it more comfortable to travel.
2. The vehicles should also have a built in light or reflective surface on the wheels so that you are also seen from the side when using the vehicles. This makes it safer.

3. The vehicles should have options with baskets so that women could put their stuff in it, making it more convenient.
4. The vehicles should have a built in gadget to put your phone down. This makes it safer and more convenient for navigating.
5. Bike should always have a behind foldable seat where you can put your grocery bag or a small child. This makes it more comfortable, convenient and safe to travel with a big bag or small child.

Figure # gives a schematic visual of the bike design.



Figure 106: Representation of a new design bike  
Source image of skirt saddle: [https://www.selleroyal.com/nl\\_nl/rok.html](https://www.selleroyal.com/nl_nl/rok.html)

# A ZERO EMISSION CITY CENTER

## REDESIGNING A LOCAL ROAD

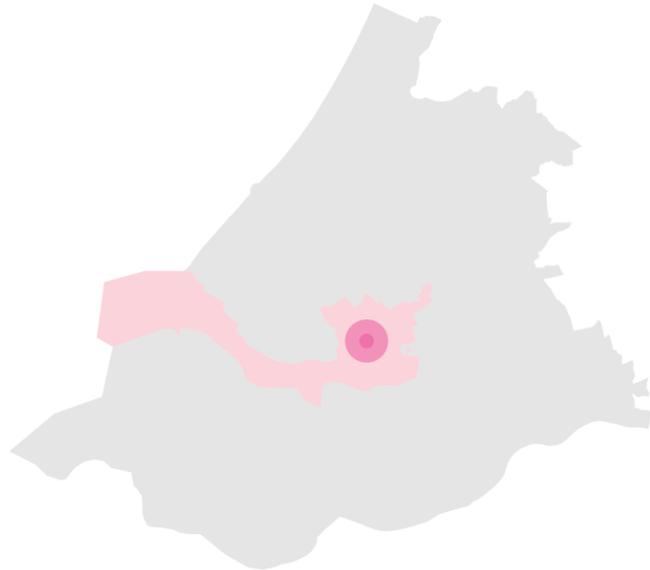


Figure 107: Zero-emission zone in Rotterdam

In 2030 the city center of Rotterdam will become a zero-emission zone. All traffic within the city center and its surrounding area will consist exclusively of zero-emission vehicles. Public transport and micromobility will be the primary modes of transportation. To implement the zero emission zone, the center of Rotterdam will become a car-free zone.

Only limited zero-emission car traffic will be permitted:

### Destination vehicles

These are vehicles that must access specific locations within the zone. Examples include: transportation for people with disabilities, moving trucks, delivery trucks, etc. All destination vehicles must be zero-emission and will be subject to regulations on access times and routes.

### Emergency vehicles

These are vehicles that must be able to move freely and quickly through the city in case of emergencies. Examples include: police cars, ambulances, fire trucks, etc. Emergency vehicles are exempt from restrictions to ensure fast response and public safety.

### The Pink Lane

To implement a new design for the pink lane within the city center's infrastructure network, we must consider several essential criteria such as new policies to go with micromobility and design principles.

#### Policy Considerations

- The maximum speed for all vehicles within the city center should be 30km/h. This includes public transport
- Within the pink lane, vehicles with a slower speed should always be on the right. The left part of the lane should have enough space so users can pass safely
- Give extra space to adults traveling with you children and the elderly to ensure comfort and safety
- Always be respectful to one another within shared urban spaces

#### Design principles

Through research, observations and inspiration from the leverage points that May East discusses in "What if Women Designed the City?", design principles were formed:

1. The pink lane needs to be wide to accommodate the increasing micromobility use
2. Public goods such as streetlights, trash bins, benches, etc. should be regularly maintained and strategically placed to ensure visibility and accessibility
3. Increase the green infrastructure to enhance the environmental performance
4. Improve surface transitions and reduce level differences to make it more friendly for "wheeled" vehicles like mobility scooter, wheelchairs and strollers

## SAMPLE OF IMPLEMENTATION AT WEST-KRUISKADE IN ROTTERDAM

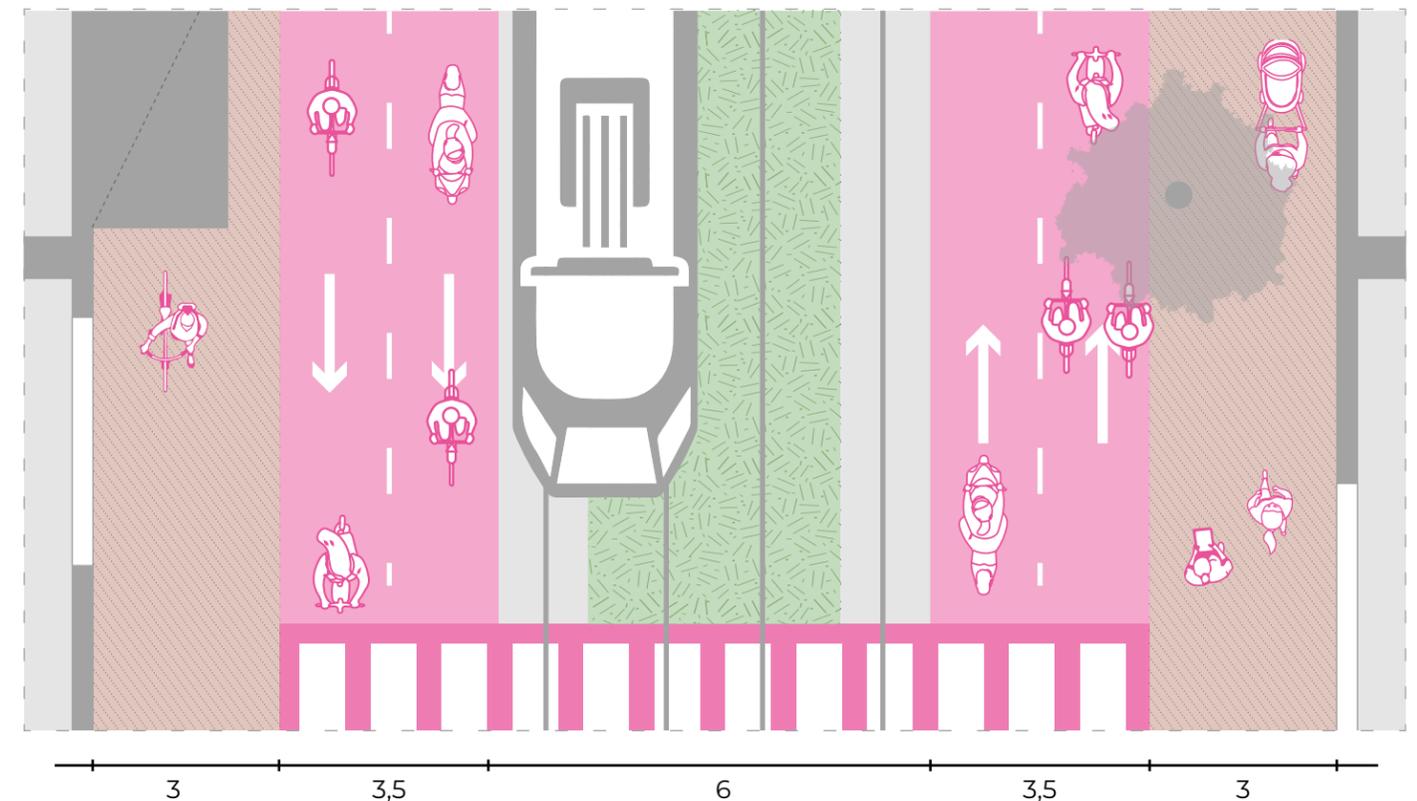
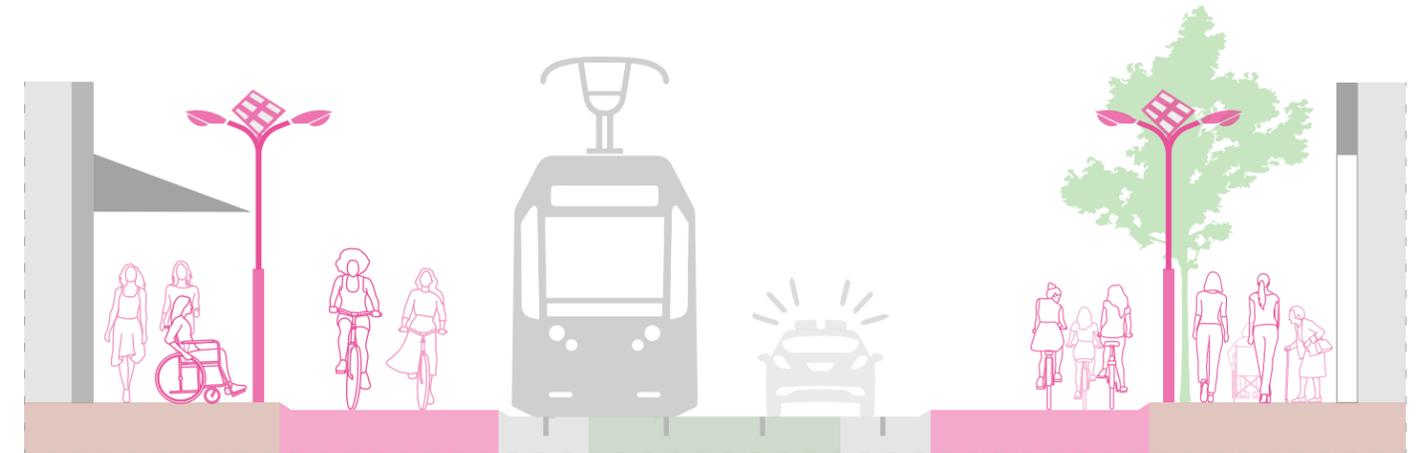


Figure 108: New implementation on a local road

# A ZERO EMISSION CITY

## REDESIGNING A PROVINCIAL ROAD

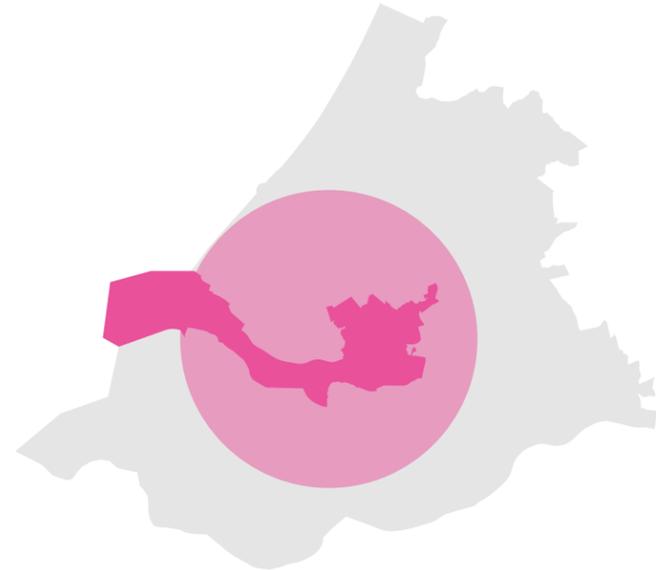


Figure 109: Zero-emission zone in Rotterdam

In 2040 Rotterdam will be a zero-emission city. This means that all vehicles operating in the city must be zero-emission. This will contribute to a healthier urban environment.

The city center of Rotterdam is already a car-free zone. This policy will be reinforced by requiring all private zero-emission vehicles entering the city to be parked at designated Park + Ride (P+R) facilities at the city's edge. From there, travelers can continue their journey to the city center using public transport or micromobility options available at nearby mobility hubs.

As the zero-emission policy extends beyond the center, the entire city will shift toward cleaner and more sustainable transport. With fewer cars on the roads, less space will be needed for them. This means that more space will become available for micromobility outside of the center. This also makes it possible to focus on the integration with the public transport.

### The Pink Lane

To implement a new design for the pink lane within the peripheral area, we must consider several essential criteria such as new policies to go with micromobility and design principles.

#### Policy Considerations

- The maximum speed for zero emission vehicles will be between 50-80 km/h. This depends on the time of day. For micromobility the maximum speed will be 45 km/h
- On the pink lane, vehicles with a slower speed should always be on the right. The left part of the lane should have enough space so users can pass safely
- Give extra space to adults traveling with you children and the elderly to ensure comfort and safety
- Always be respectful to one another within shared urban spaces

#### Design principles

Through research, observations and inspiration from the leverage points that May East discusses in "What if Women Designed the City?", design principles were formed:

1. The pink lane needs to be wide to accommodate the increasing micromobility use
2. Public goods such as streetlights, trash bins, benches, etc. should be regularly maintained and strategically placed to ensure visibility and accessibility
3. Increase the green infrastructure to enhance the environmental performance
4. Improve surface transitions and reduce level differences to make it more friendly for "wheeled" vehicles like mobility scooter, wheelchairs and strollers
5. Public transport stops should be self-sufficient and be more comfortable and well-maintained

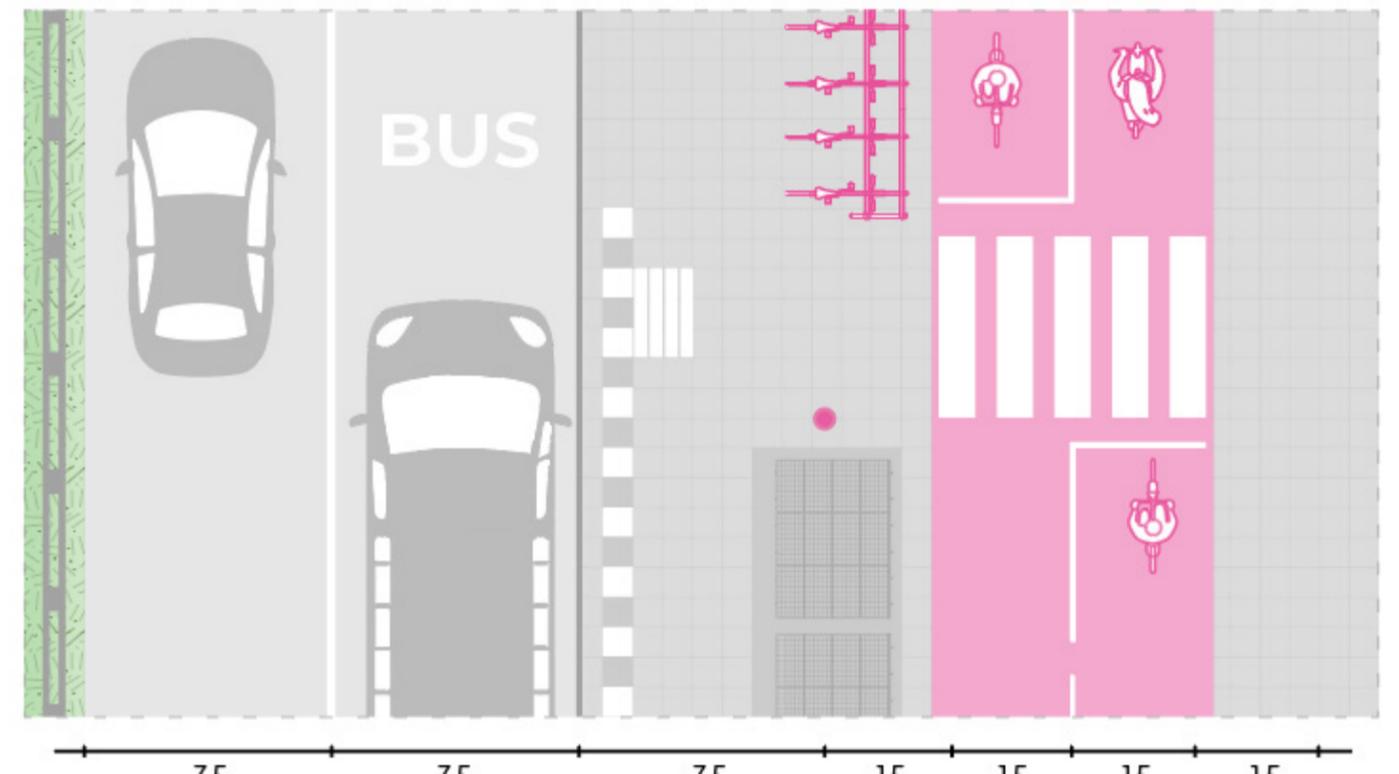
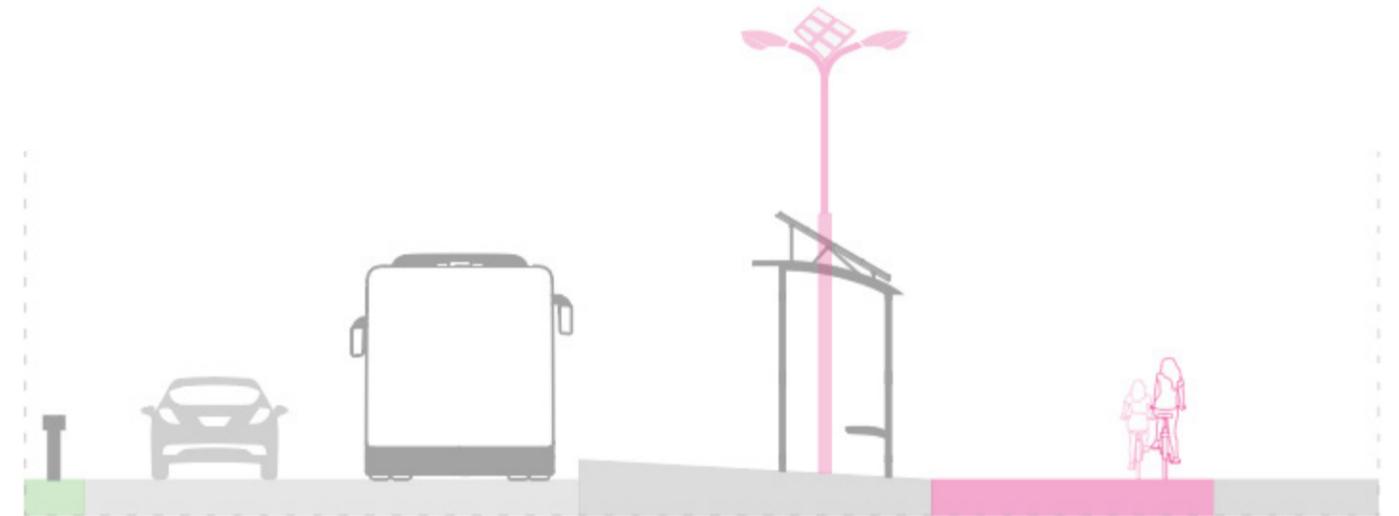


Figure 110: New implementation on a provincial road

# A ZERO EMISSION RANDSTAD

## REDESIGNING A NATIONAL ROAD

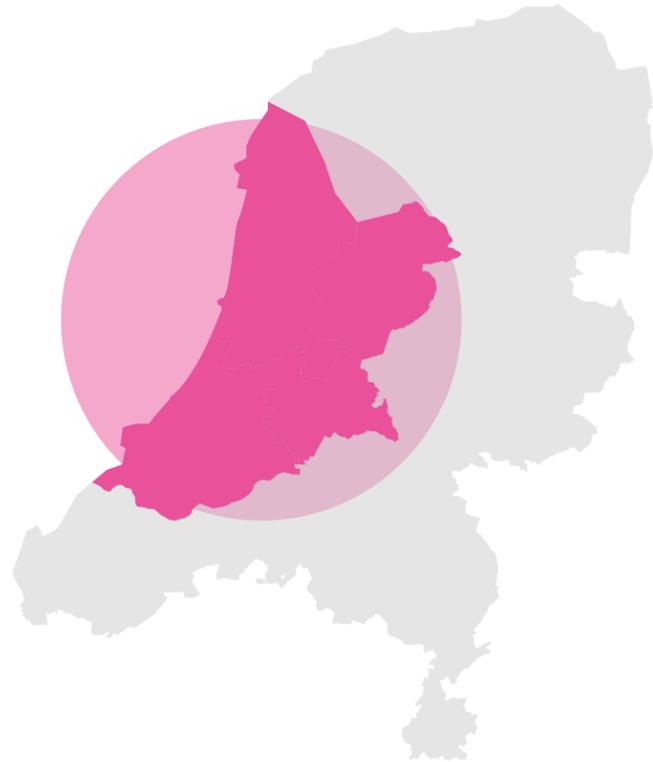


Figure 111: Zero-emission Randstad

In 2050 the Randstad region (North Holland, South Holland, Flevoland and Utrecht) will operate on zero-emission modes of transport. This ambitious vision represents a shift in how we move through and experience urban and regional space.

An important part of the mobility transition includes a complete redesign of the highways. As the use of cars will go down, less space is needed for cars. This opens up the opportunity to reimagine highways for the new mobility networks. To support this shift, dedicated micromobility highways will be needed designed specifically for this fast-growing class of sustainable transport. These high-capacity lanes will ensure safe, efficient, and comfortable travel for users across the region.

### The Pink Lane

To implement a new design for the pink lane within the region, we must consider several essential criteria such as new policies to go with micromobility and design principles.

#### Policy Considerations

- The maximum speed for zero emission vehicles will be between 80-100 km/h. This depends on the time of day. For micromobility the maximum speed will be 45 km/h to ensure safety
- On the pink lane, vehicles with a slower speed should always be on the right. The left part of the lane should have enough space so users can pass safely
- Give extra space to adults traveling with you children and the elderly to ensure comfort and safety
- Always be respectful to one another within shared urban spaces

#### Design principles

Through research, observations and inspiration from the leverage points that May East discusses in "What if Women Designed the City?", design principles were formed:

1. The pink lane needs to be wide to accommodate the increasing micromobility use
2. Public goods such as streetlights, trash bins, benches, etc. should be regularly maintained and strategically placed to ensure visibility and accessibility
3. Increase the green infrastructure to enhance the environmental performance
4. There should be enough safety barriers to ensure the safety of its users. Especially for micromobility users as they are more vulnerable.

## SAMPLE OF IMPLEMENTATION

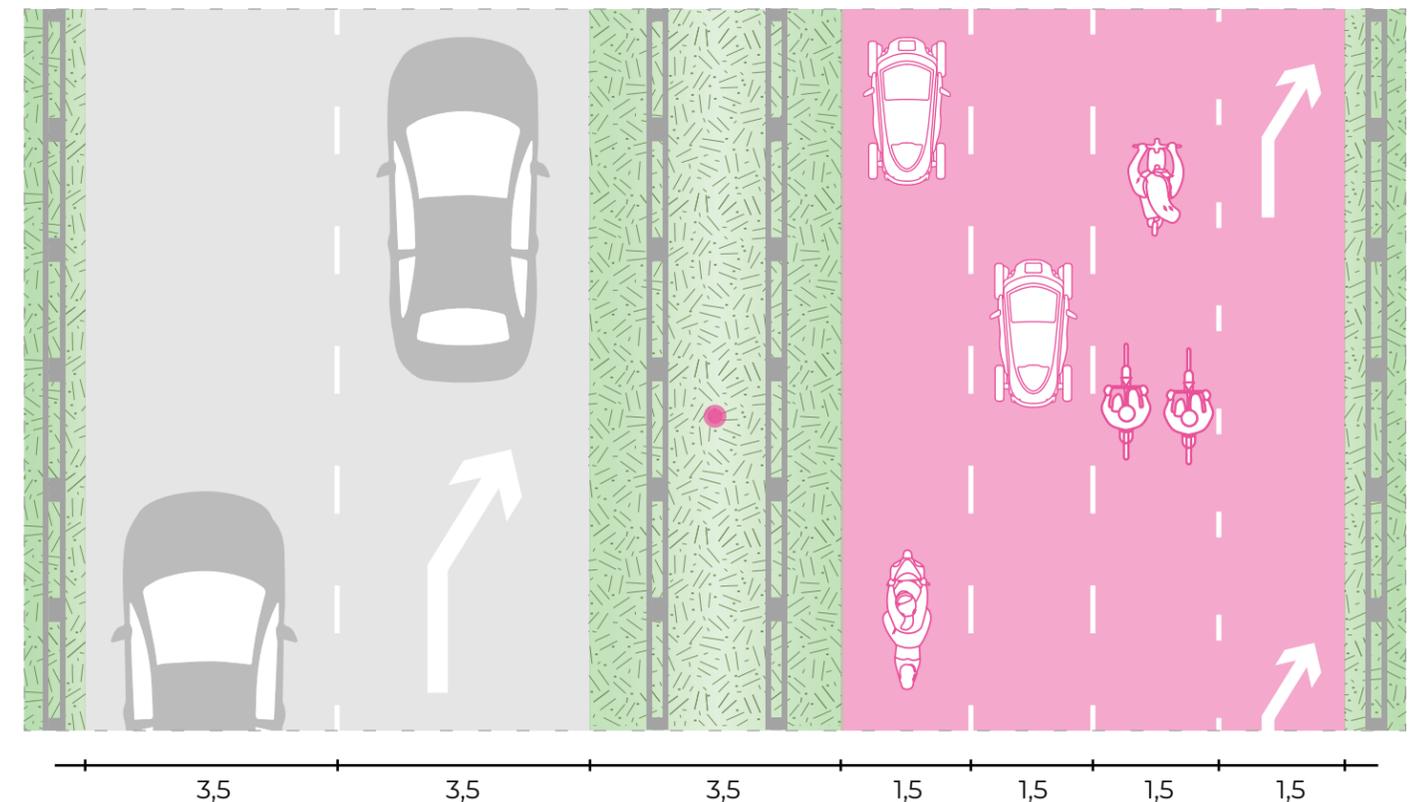
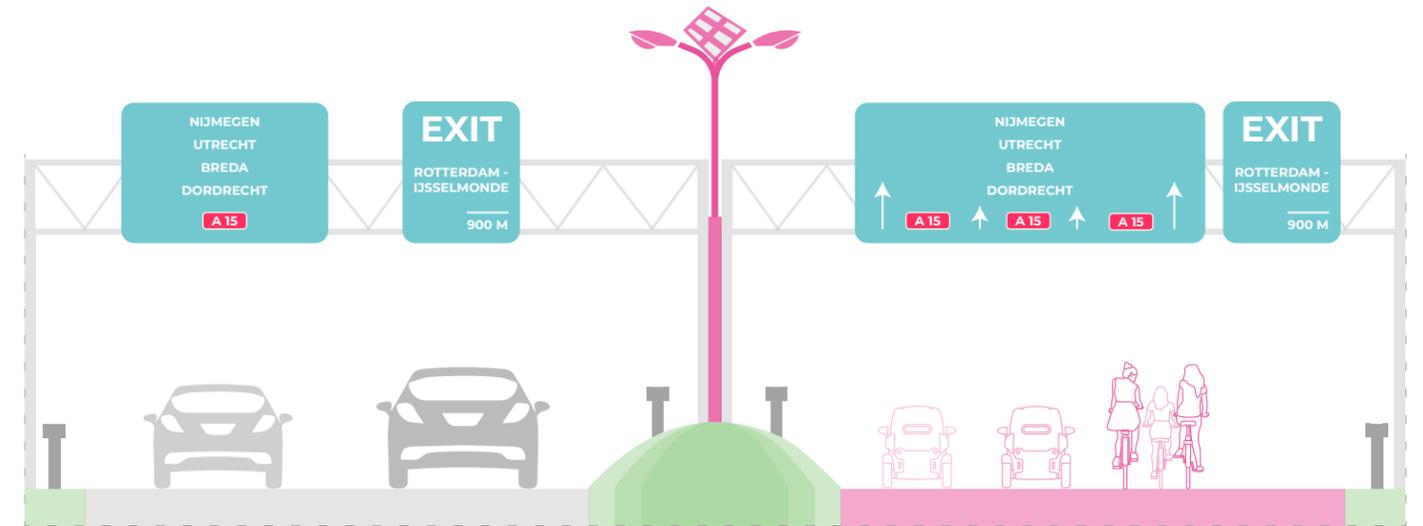


Figure 112: New implementation on a national road

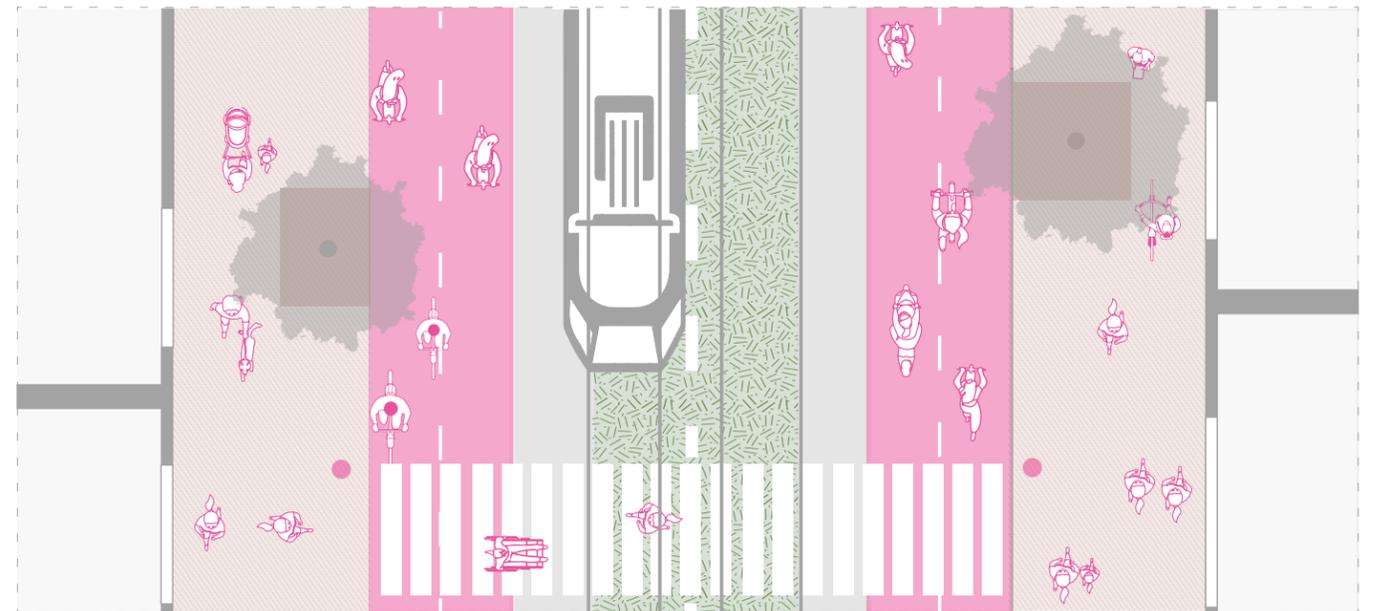
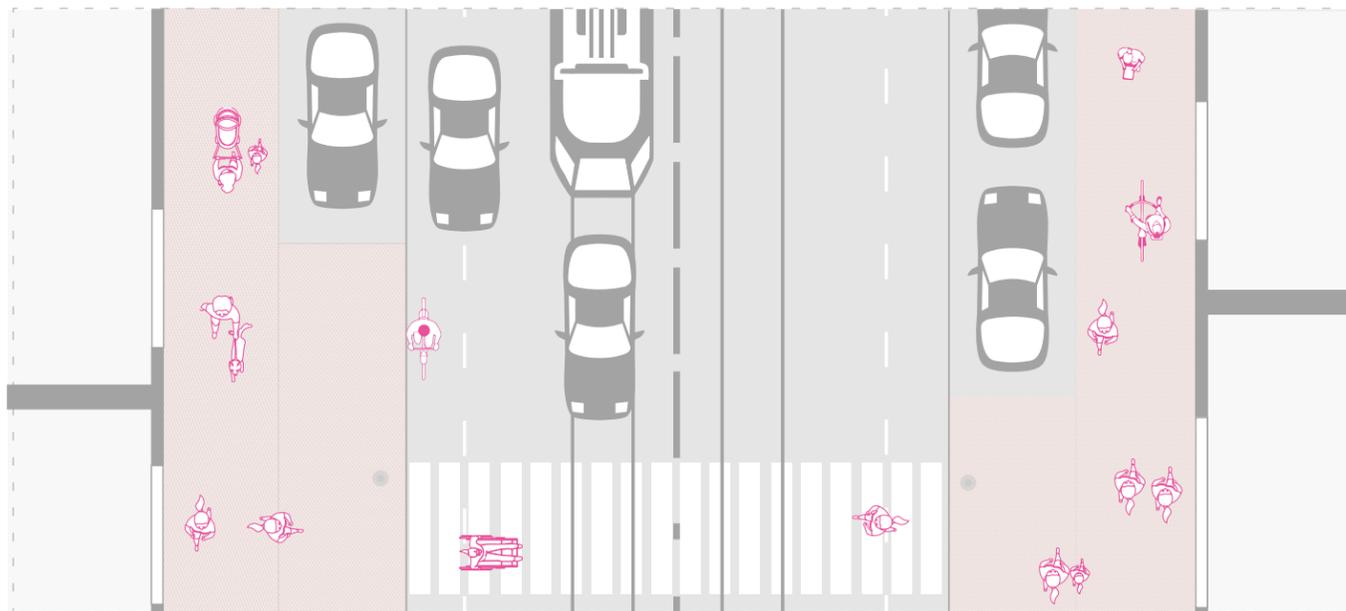
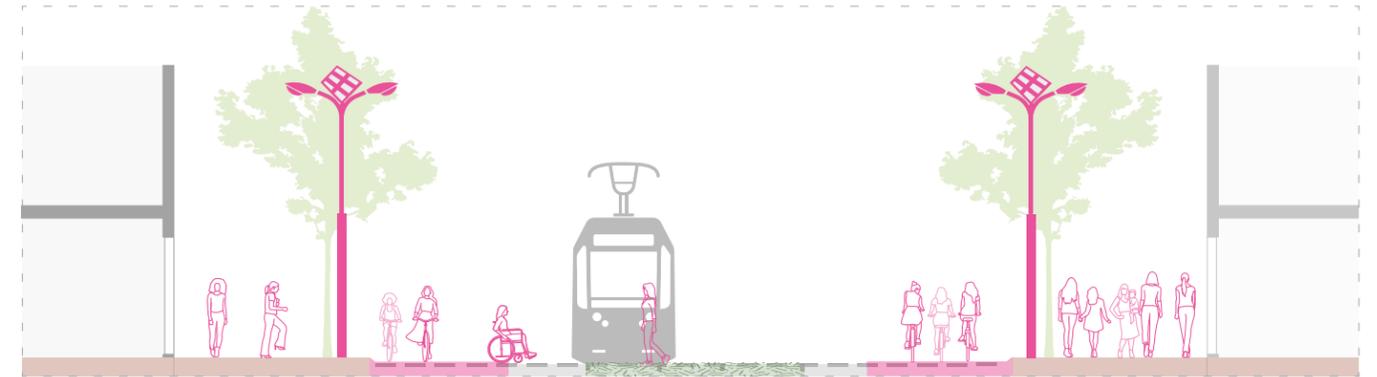
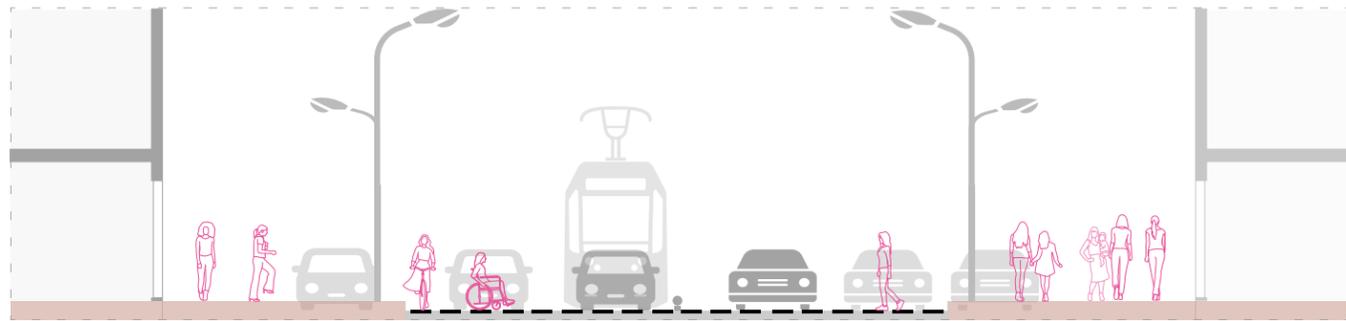
# SPATIAL IMPROVEMENT

## WEST KRUISKADE STRAAT

The new streetscape of West Kruiskade Straat shows the implementation of the pink lane. It shows the street being mostly occupied with public transport and micromobility and having an overall slow mobility in the central area of Rotterdam.

**BEFORE**

**AFTER**



0 1 2 3 4 5m

Figure 113: Before and after

0 1 2 3 4 5m

PEDESTRIAN 15 25 PUBLIC TRANSPORT & PRIORITY 30 MICRO MOBILITY 25 15 PEDESTRIAN

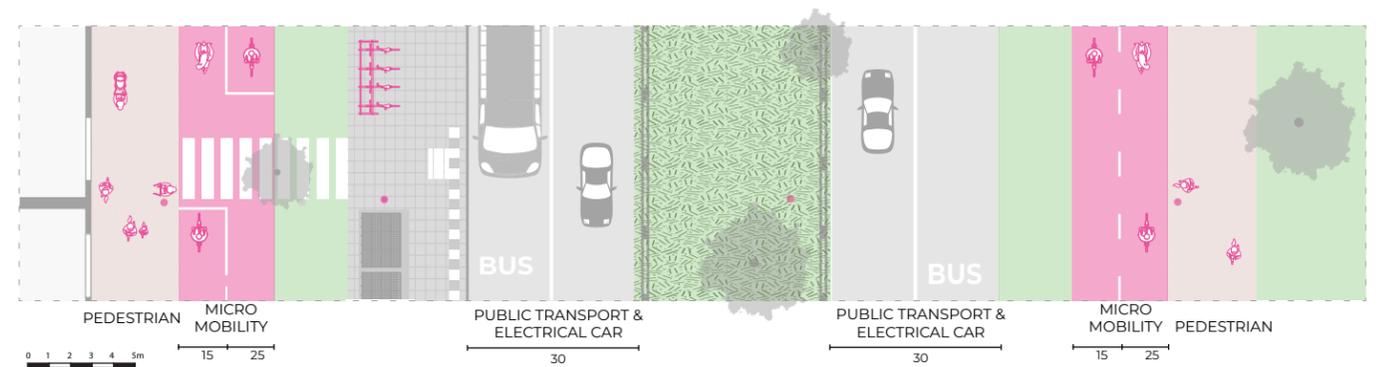
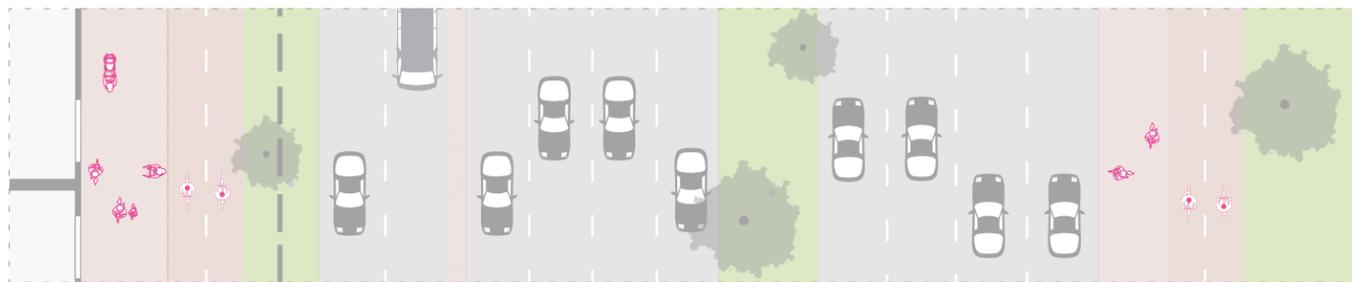
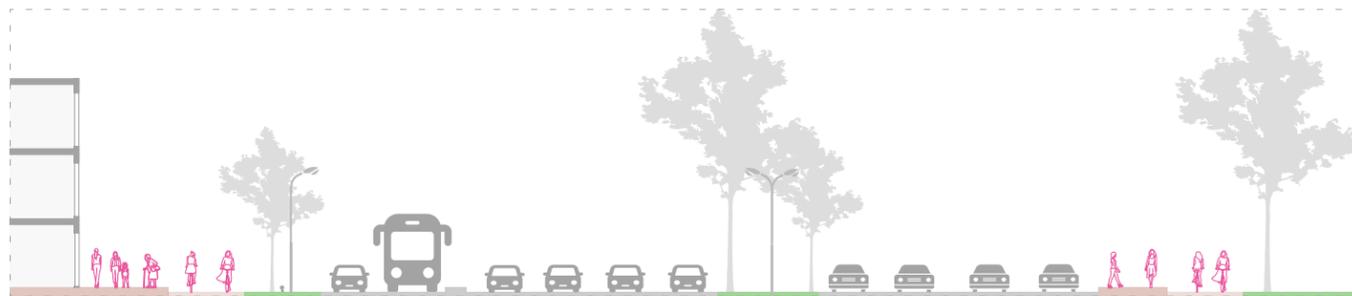
# SPATIAL IMPROVEMENT

ZUIDPLEIN, CHARLOIS

The new streetscape of Zuidplein shows the implementation of the pink lane in the provincial road with new Bus lanes and more accessible public transport. It shows the street being mostly occupied with public transport, electrical cars and micromobility and having an overall slow mobility in the peri-Urban area of Rotterdam.

**BEFORE**

**AFTER**



0 1 2 3 4 5m

Figure 114: Before and after

0 1 2 3 4 5m

15 25

30

30

15 25

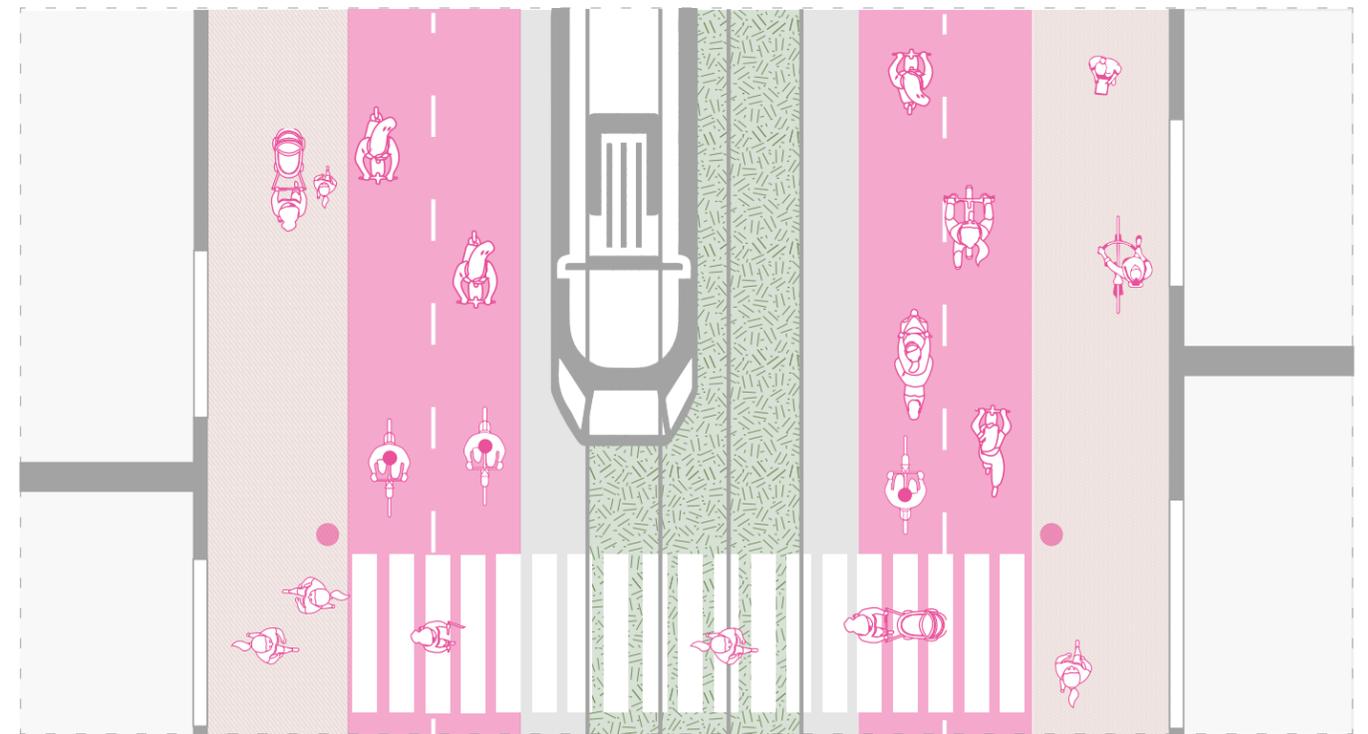
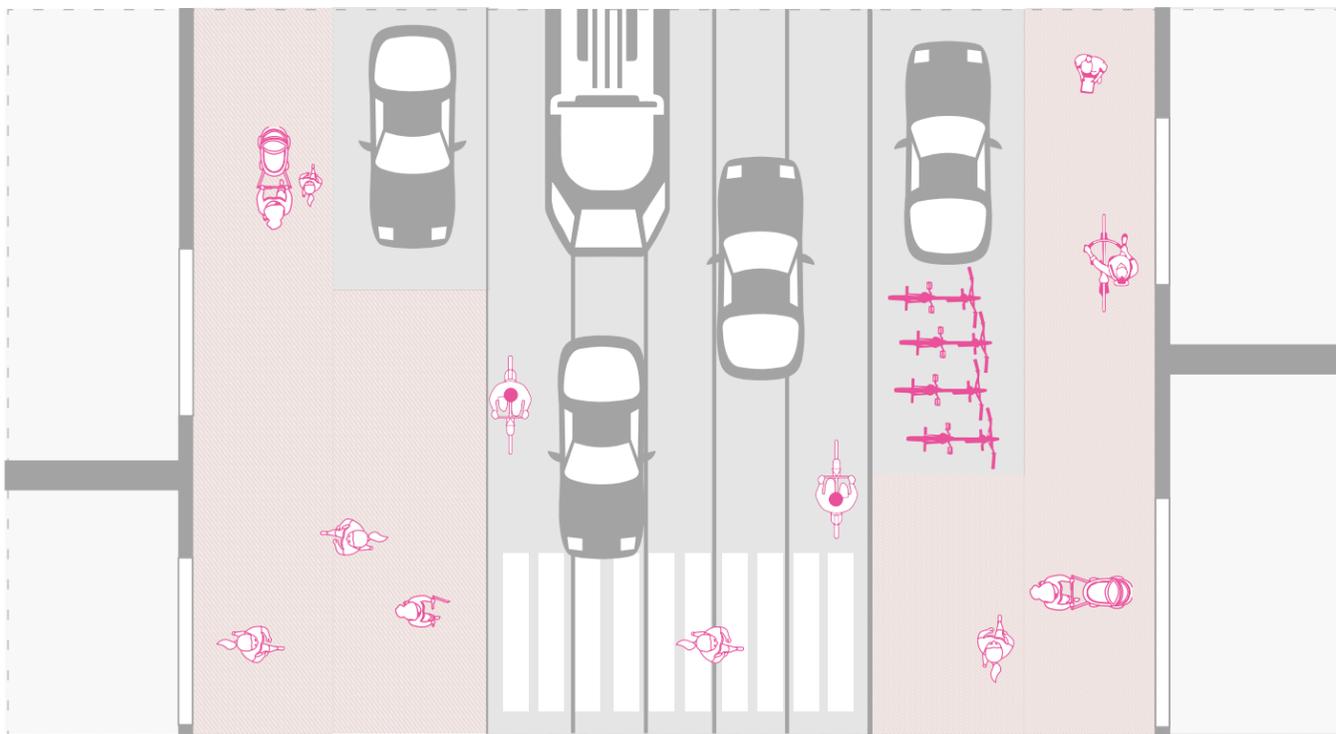
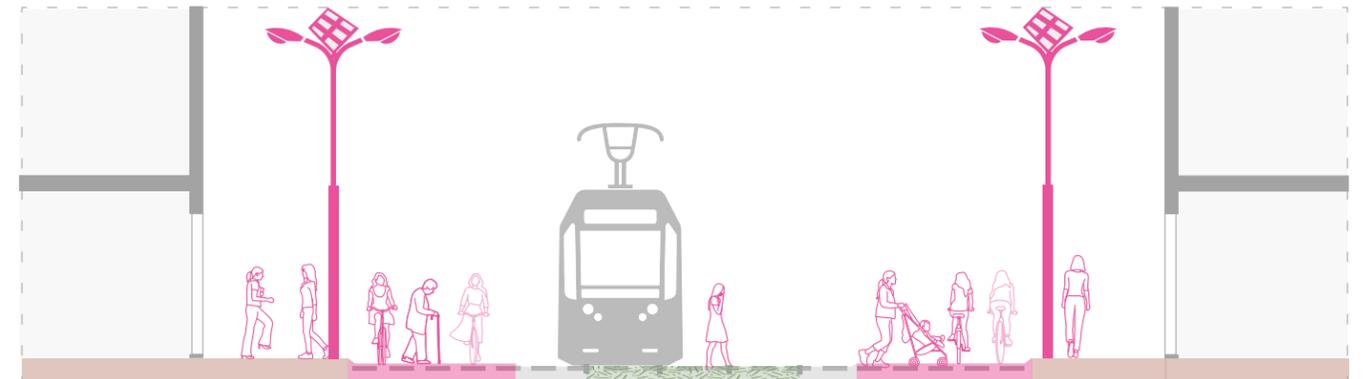
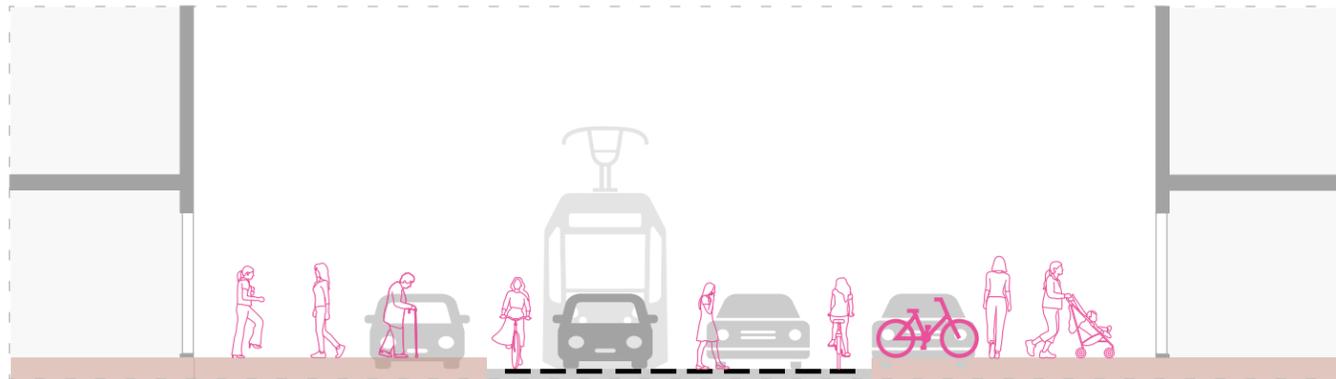
# SPATIAL IMPROVEMENT

## HILLEGERSBERG CENTRUM

The new streetscape of Hillegersberg Centrum shows the implementation of the pink lane. It shows the street being mostly occupied with public transport and micromobility and having an overall slow mobility in the center.

BEFORE

AFTER



0 1 2 3 4 5m

0 1 2 3 4 5m 15 25 30 25 15

Figure 115: Before and after

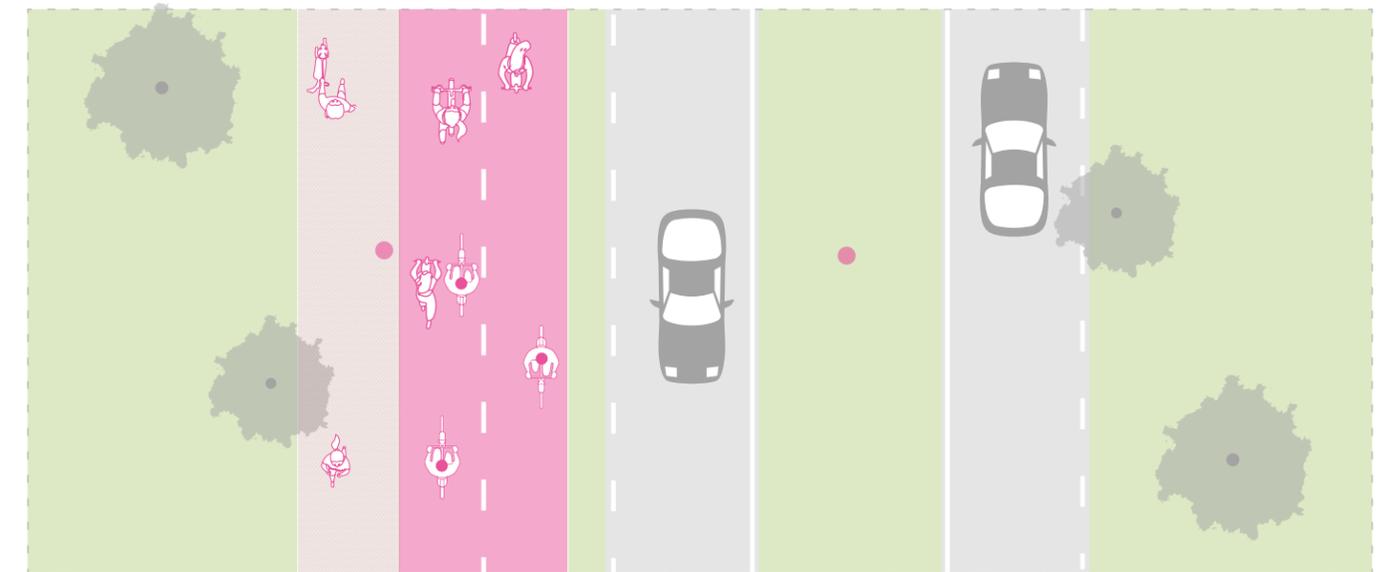
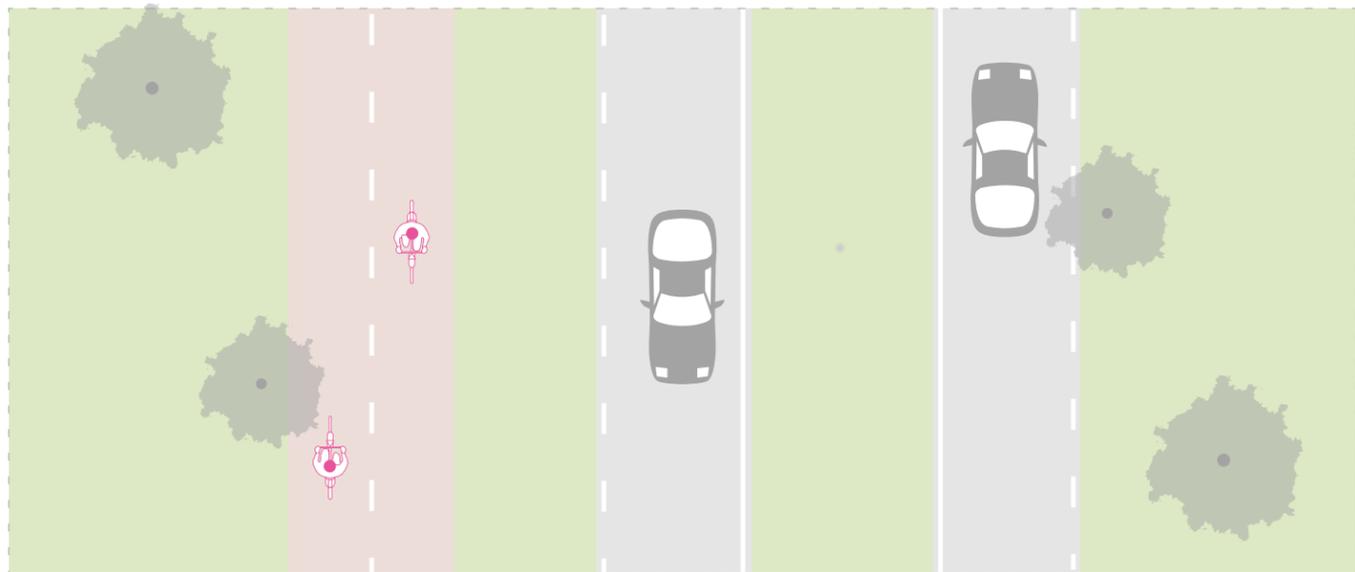
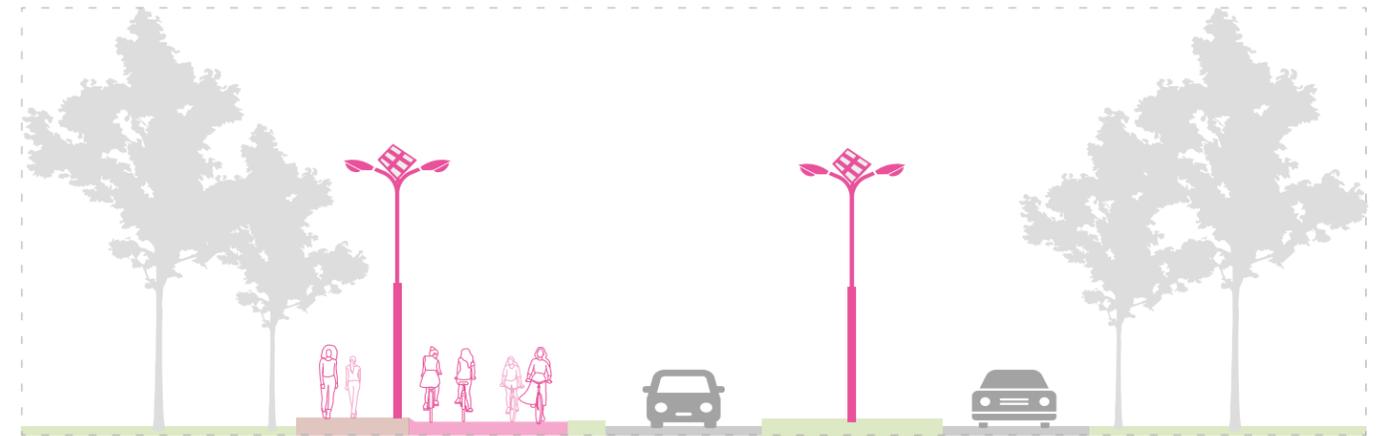
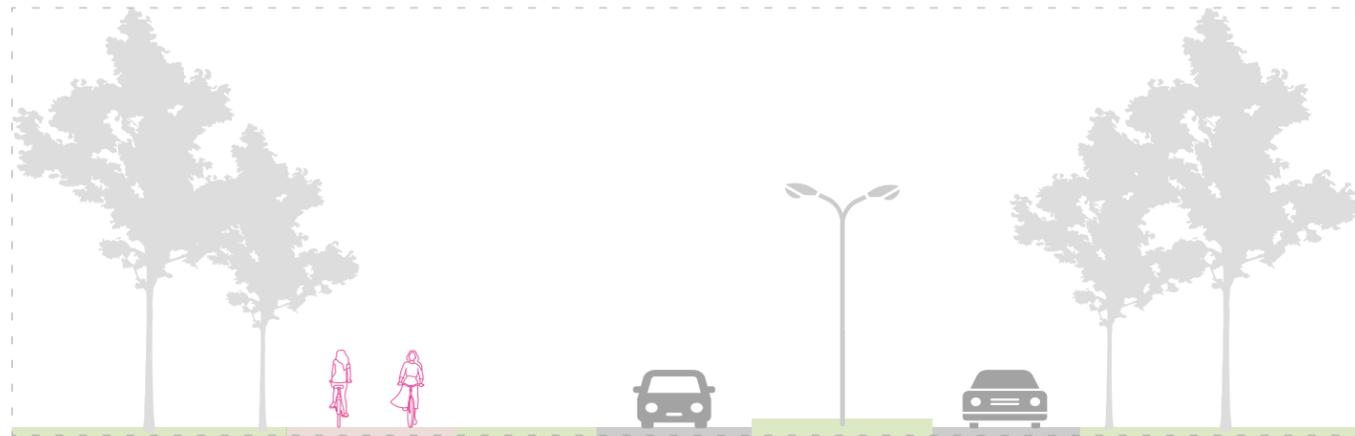
# SPATIAL IMPROVEMENT

## RECREATIONAL BIKE PATH, CHARLOIS

The improved streetscape of this area in Charlois showcases the recreational bike path. The introduction of motion-detected solar powered streetlights by the bike path and the addition of pedestrian walkway is the provision of public goods much required in this street.

**BEFORE**

**AFTER**



0 1 2 3 4 5m

Figure 116: Before and after

0 1 2 3 4 5m

PEDESTRIAN 15 25 CAR LANE 30 CAR LANE 30

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### **CHAPTER 6. SYNTHESIS**

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# CONCLUSION

To conclude, we revisited our research and sub research questions and tried to answer them based on how we observed, analysed and worked on the project.

What are the mobility profiles of women living in peripheral areas of cities in the Netherlands?

Women living in peripheral neighborhoods like Charlois and Hillegersberg-Schiebroek rely on a mix of transport modes influenced by age, family duties, income, and the availability of infrastructure. In Charlois, a lower-income area with many residents from non-Western migration backgrounds, women commonly walk or use public transport due to affordability and dense urban form. Here, cycling is less common, especially among older women or those lacking confidence or safe infrastructure.

In contrast, Hillegersberg-Schiebroek is wealthier and less dense, with a mixed reliance on cars and private shared micromobility, especially among older adults and families with children. Poor public transport connectivity and safety concerns discourage use of sustainable modes like public transit or cycling. Younger women and working mothers in both neighborhoods often “trip chain”—linking errands, work, and caregiving into one journey—which requires flexibility in mobility options.

Public transport is a vital fallback but is hampered by long waits, inconvenient transfers, and safety issues, especially during off-peak hours in both the locations. Many women report feeling unsafe on public transport and at stops due to poor lighting, isolation, and lack of cleanliness. Cycling is popular among younger women when weather and infrastructure permit, but many switch between modes depending on time, safety, or childcare needs.

Barriers such as digital illiteracy among older women, financial limitations, and a lack of inclusive design (e.g., stroller access, gender-sensitive spaces) further complicate mobility. These challenges make everyday travel stressful and hinder the shift to more sustainable, active transport modes.

How can micromobility systems be adapted to better support the diverse travel patterns and needs of women to promote sustainable and inclusive transportation?

Micromobility systems can support women’s needs by offering versatile vehicles like cargo bikes and shared e-bikes that accommodate caregiving and multitasking. Infrastructure must prioritize safety through protected bike lanes, better lighting, and slower traffic speeds, especially in peripheral areas. Hubs should be located near homes, public transport, childcare, and shops to match women’s daily routines.

To ensure accessibility, shared vehicles should be affordable, easy to book, and available for longer trips. Real-time integration across transport modes can simplify “trip chaining”. Continuous updates based on usage data and feedback will help adapt services. Addressing safety, convenience, and affordability is key to making micromobility a practical option for not only women but all vulnerable communities.

How can public transport stations/stops and transfer to last-mile mobility be adapted to better accommodate the diverse travel patterns and needs of women to promote sustainable and inclusive transportation?

To better serve women’s diverse travel needs, public transport stations should prioritize safety, connectivity, and inclusive infrastructure. This includes enhanced lighting, surveillance, and secure waiting areas, as well as amenities like restrooms and nursing rooms.

Stations must offer seamless last-mile options—such as e-scooters, shared bikes, and shuttle links—particularly in areas with poor tram or bus connectivity.

Applying the 800-meter accessibility model used in Rotterdam, high-performing stations like Rotterdam Centraal and Schiedam Centrum demonstrate the importance of well-integrated, amenity-rich hubs. In contrast, lower-scoring stations with poor multimodal links and limited facilities are less supportive of women’s mobility. Inclusive design and stronger last-mile connections are essential to make public transport safer, more convenient, and more sustainable for all users.

What policies are needed to accommodate the vision?

To realize the vision of the Pink Lane and inclusive micromobility, policies must shift urban design away from car-centric models toward safer, slower, and more accessible streets. Economic policies support a monopoly-based shared micromobility system to lower costs and broaden access. Environmental measures promote electric transport and solar-powered infrastructure, aiming to eliminate fossil-fueled vehicles. Safety-focused policies include creating speed-based zones and redesigning streets for vulnerable users like women and families. Equity policies emphasize involving women and marginalized groups in planning and ensuring investments in inclusive infrastructure like lighting and hygiene facilities.

Current policies in the Netherlands are largely car-focused, so this framework introduces a significant reorientation toward shared, sustainable mobility for short-distance travel. Implementation begins in 2025 in Charlois, expands citywide by 2040, and reaches Randstad integration by 2050, targeting zero emissions and ending mobility poverty.

‘How can spatial planning and design contribute to an inclusive and gender-sensitive urban mobility system that supports the complex travel needs of low-income women in peripheral neighborhoods in the Netherlands during the energy transition?’

Spatial planning and design play a critical role in building an inclusive, gender-sensitive urban mobility system, especially for low-income women living in peripheral neighborhoods such as Charlois. These women often have complex travel patterns involving multiple short trips throughout the day—for work, caregiving, shopping, and social visits. To meet these needs, the “Pink Lane” vision proposes a layered micromobility hub network that is closely integrated with the public transport system, ensuring both accessibility and sustainability.

This hub system consists of three levels. Level 1 hubs, located within residential areas, provide easy, walkable access to shared micromobility vehicles like bikes and scooters. These small-scale hubs support daily local travel and make it easier for women to connect to nearby amenities or public transport stops. Level 2 hubs are situated near community destinations such as parks, healthcare centers, and shopping districts. They offer more shared mobility options and serve as important connectors for mid-range trips. Level 3 hubs, found at key transport interchanges like train stations, airports, and park-and-ride locations, provide high-capacity infrastructure and connect local travel with regional and long-distance transport.

This strategic placement of hubs ensures that women in both central and peripheral areas are well connected, not just within their neighborhoods, but to the city as a whole. By improving last-mile connectivity and enabling seamless transfers between micromobility and public transport, the system removes major barriers to mobility.

## CONCLUSION

It directly addresses common issues such as safety, affordability, and reliability—factors that disproportionately affect low-income and caregiving women.

Moreover, by embedding this hub system into the urban fabric, the design supports the broader energy transition goals. It reduces car dependency, lowers emissions, and promotes the use of electric and shared mobility options. This integrated, inclusive approach not only makes daily life more manageable for women in peripheral neighborhoods but also helps create a more equitable and sustainable transport system for the future Netherlands.

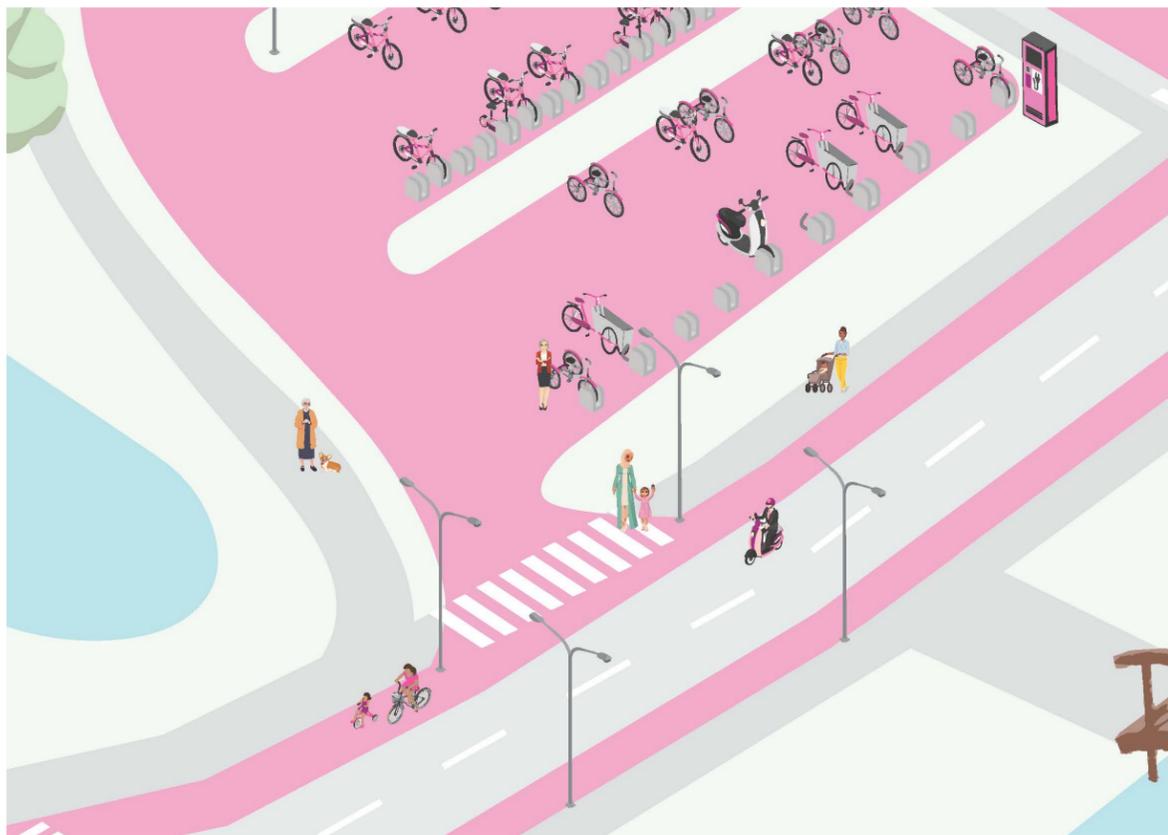


Figure 117: A level 1 hub with the profiles.

# DISCUSSION

## RANKING OUR PROJECT THROUGH A SWOT

What would the Netherlands look like if our vision turned into reality? A country that is fully functioning with a transportation system is dominated by (public) micromobility, public transport and zero-emission vehicles (mainly shared and priority vehicles). We will use a SWOT Analysis to check how our project will perform if it was fully implemented and functional.

### Strength

**Environment Friendly:** The massive reduction in CO<sub>2</sub> Emissions will help combat climate change. There would be less noise and air pollution, cities would be quieter, cleaner, and have better air quality. After catering the infrastructure to micromobility, previous space used by roads could be replaced with parks, urban farms, and pedestrian-friendly areas.

**More Accessible Mobility Options:** There would be more mobility options accessible to everyone using public transportation, from trains and metros to buses and trams to electric bicycles and cargo bikes to mobility scooters and micro-cars. The varied amount of options will establish a more connected transportation network for all.

**Better Mental Wellbeing:** The public realm will change drastically as the mobility changes are implemented through the regional scale. The greener, quieter cities will improve mental well-being and reduce stress levels.

### Weakness

**Weather Dependence:** Micromobility is less practical for harsh weather conditions like snow, rain and storms. The use might be affected significantly during bad weather conditions.

**Less Privacy:** Using shared transport and micromobility means less privacy compared to owning/using a car. People might not be comfortable with the reduced privacy.

**Logistics Mobility:** No trucks or delivery vans means supply chains must shift to drones, cargo bikes, or underground systems. This might not be very cost efficient and can cause backlash from entrepreneurs and businesses.

**Zwarte Saturday:** The holiday season movement to International destinations will put a lot of pressure on the highways where people take their cars to go to holiday outside the Netherlands to other locations in the European Union or farther.

### Opportunity

**Inter Regional Connectivity:** As the micromobility movement and public transport connectivity is improved, the movement between regions throughout the country will improve significantly, allowing people to move more easily inter regionally.

**Better Physical Health:** As the people chose micromobility options for daily movement, like walking and biking, the population becomes more active, it would reduce obesity and related diseases and boost better physical health.

**New Infrastructure:** The new pink lanes and public goods will add more value to the public space and make the new public environment more safe and inclusive for the generational population, making it a more just city.

**Rise of Alternative Vehicles:** In combination of the provided shared micromobility, the shift to private micromobility can also be foreseen. New forms of microcars, autonomous pods, or even exoskeleton suits could emerge to fulfil the public demand for private micromobility.

### Threat

**Technology:** It is both a threat and opportunity, for some people that already own and use bikes it can be a threat, whereas for people who want to use shared micromobility it is an opportunity to have accessible options. E-bikes and scooters that self-charge and when positioned in the charging docks can be challenging to people unfamiliar to technology. Using a mobile phone application to combine all forms of public transport options under one account in combination with the OV Chip card can be a challenge to people who do not have access to smartphones but an effective tool for the more tech savvy people.

**Mobility Monopoly:** The monopoly created for public transport and shared mobility can be very tricky as it can also trigger a price hike and become very expensive to the general public. Monitoring from the government and policies should be in place to keep that from happening but the success cannot be guaranteed.

**Business Impact:** Businesses and entrepreneurs might still need to travel long distances for work and may be hindered. The travel time may remain the same regardless of distance and people opt to live at cheaper areas and travel farther than live in expensive neighbourhoods, this might lead to overcrowding during peak hours.

**Emergency Movement:** In case of emergencies, for example, serious health conditions like a heart attack, the patient might be limited with only a micromobility option or waiting for an ambulance.

To summarise, the project will be effective but we do realise that there are some limitations that can be improved on in the future with more research and participatory actions.

# DISCUSSION

## RANKING OUR PROJECT THROUGH A SWOT

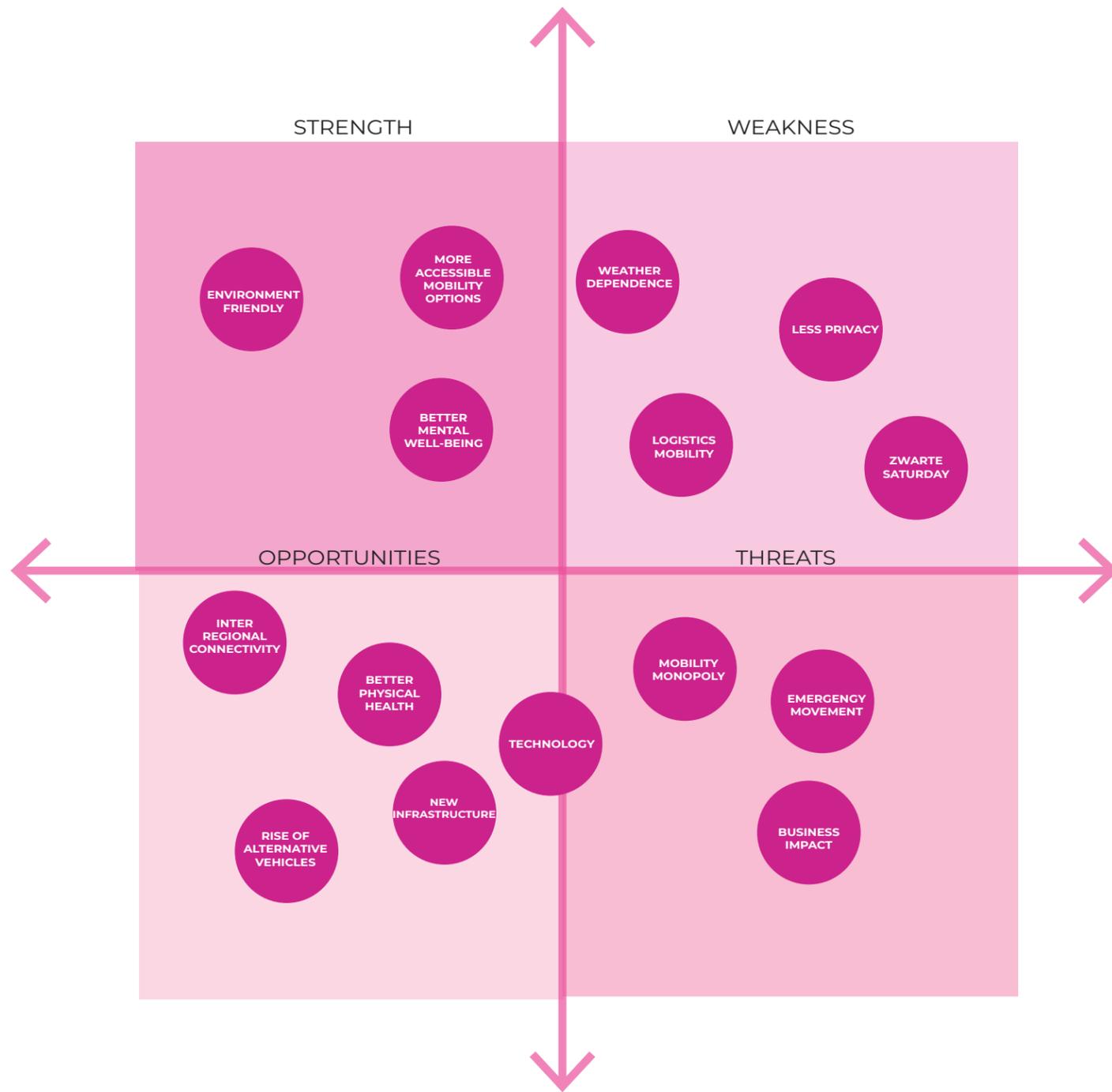


Figure 118: SWOT ANALYSIS

# DISCUSSING LEVERAGE POINTS

## WHAT IF WOMEN DESIGNED THE CITY? BY MAY EAST

We used the books at

‘Leverage Point 4 – Shifting from a mentality of maintenance to an attitude of care’  
It is important that people shift to a mentality that the urban spaces is their backyard and that maintaining them is also everyone’s responsibility. Respect your public spaces.

‘Leverage Point 7 – Devising a library of women tailored bike saddles’  
Designing the micromobility vehicles through a woman’s lens to make them more inclusive for everybody to use. Uncomfortable saddles should be something from the past. Next to saddles, it is also important to add a new design like in Chapter # where the bike becomes a more accessible vehicle.

‘Leverage Point 10 – Working with men to redistribute power, balance representation and transform legal and planning systems’  
Women should be more included in all processes. This will prevent a system that is designed by men for all.

‘Leverage Point 12 – Improving natural surveillance by design’  
By designing public goods such as bus stops with an open concept, you improve the surveillance with “passive” eyes on the streets.

‘Leverage Point 15 – Encouraging active travel as a way of life’  
By adding a prioritized micromobility network, we want to promote the usage of micromobility above alle other transportation options.

‘Leverage Point 17 – Designing ‘fresh air routes’ and low emissions zones from the perspective of women and infants’  
By making Rotterdam a zero emission mobility city and expanding this to the Randstad, the air quality will improve.

‘Leverage Point 20 – Co-developing sympathetic infrastructure enabling a sense of co-ownership and care’  
By adding traffic separations and maintaining the street lights will make it feel more safe and make it accessible for everyone. Maintain these. By adding ramps and automatic doors at the busses, you make it accessible for people with a disability. By improving public goods for women, you improve the public.

‘Leverage Point 21 – Maximising use of available local resources in urban interventions’  
This one was more of an idea of how we can expand the lifecycle of bikes by reusing and recycling old bikes for the micromobility usage

# SUSTAINABLE DEVELOPMENT GOALS

In 2015, the United Nations established the Sustainable Development Goals (SDGs) to combat poverty, protect the environment, and ensure global peace and prosperity by 2030 (UNDP, z.d.). These goals provide a framework for building a more just and sustainable world, by tackling pressing issues like poverty, hunger, gender inequality and climate change (United Nations, 2015).

The SDGs are very interconnected: progress in one area often influences other progresses as well. To achieve them all, there should be a balance between social, economic and environmental sustainability, with a focus on the group that is in most need. This report reflects that commitment by addressing how energy poverty, in terms of mobility, affects women more than men.

This section of the report shows the specific SDGs that are impacted by the project, including the SDG icons, the UN targets for the goals and explanations of how the project contributes to these targets.



End poverty in all its forms everywhere

The energy transition will most likely enlarge the energy poverty, however, through the implementation of micro mobility and more safety, people will be less likely to fall into energy poverty in forms of transportation. Also transport becomes cheaper through the implementations.



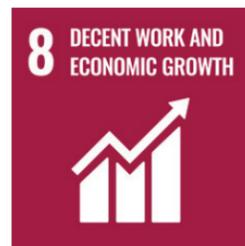
Ensure access to affordable, reliable, sustainable and modern energy for all

The project motivates the use of shared and public transport, which leads to a decrease in energy consumption, by making it more affordable, accessible and safe. And the energy transition leads to less greenhouse gas emissions.



Ensure healthy lives and promote well-being for all at all ages

The implementation of more, cheaper and higher quality of mobility that is mostly outside and with movement, will result in better physical health of the people. The safer environments will improve the mental health.



Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

Better accessibility and safer transportation improves economic chances for women (and men), since they then have more access to job opportunities.



Achieve gender equality and empower women and girls

Safer, more accessible and affordable transportation options are crucial for economic and social participation of women and girls. Improving the mobility network closes the mobility gap between male and female.



Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

The infrastructure is improved by the micro mobility that is connected to the public transport network to improve last mile connectivity, to make mobility more inclusive and sustainable.



Reduce inequality within and among countries

Equal access to transportation reduces the gap between opportunities for men and women. Involving women in the operation, maintenance and management of the shared micro mobility also helps to break down the gender gap.



Make cities and human settlements inclusive, safe, resilient and sustainable

Improving the safety and shifting towards shared and public electric transportation means that there will be less emissions of greenhouse gasses, while adding to the importance of shared public goods and making transportation more inclusive and safe.



Ensure sustainable consumption and production patterns

More use of micro mobility and public transport instead of personal and fossil fueled vehicles means that less energy is consumed. The shift from fossil fueled to electric means that the energy can be ecofriendly generated.



Take urgent action to combat climate change and its impacts

Motivating people to use shared and public transport that is either women powered or electric leads to less use of personal and fossil fueled mobility choices, decreasing a city's ecological footprint.



Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

Stimulating the use of shared and public transportation, in combination with more safety leads to less emissions, improving ecosystems.



Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

More accessible, affordable and safe transportation leads to more equality in mobility. More women in decision making leads to a more inclusive society.



Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development

Private and public stakeholders will be working together to reach the goals for sustainable and inclusive mobility and make it widely available for the lowest prize possible.



\*<https://www.un.org/sustainabledevelopment> The content of this publication has not been approved by the United Nations and does not reflect the views of the United Nations or its officials or Member States

# PERSONAL REFLECTION

ANIKA

Starting this project, I was very concerned about the regional scale as I do not have any experience working at such a large scale and the task seemed really daunting. In the first week, the SDS and Capita Selecta lectures and workshops gave us a lot of perspective about the themes. It provided a lot of clarity and we chose a theme that was important to us. During the excursion, we realised that mobility poverty is a real, tangible problem affecting the daily lives of many people. As a Bangladeshi woman living in the Netherlands without cycling experience, I rely heavily on public transportation for my daily commute. With the upcoming energy transition, this dependence will be significantly impacted, and I will need to be more mindful of last-mile connectivity, as an increasing number of people will shift to public transport due to reduced accessibility to private vehicles.

Our vision was deeply influenced by our personal experiences, especially as women impacted by the energy transition. This attachment fuelled our motivation and gave us direction. Recognizing that we ourselves could be part of the transition community brought emotional clarity and commitment to the project. Our tutors were very supportive and helped balance our emotionally driven approach by encouraging us to consider diverse perspectives. This helped refine our development strategy to be inclusive and grounded in real stakeholder needs.

The methodology course was very insightful and strategically structured. The weekly in-class exercises, the booklets and the discussions were extremely helpful to outline our storytelling. The course provided us with a lot of knowledge about citizen participation and research practices with participatory approaches. It helped us understand how to approach communities with sensitivity and openness, fostering a collaborative space where honest, often avoided conversations could happen. We tried to understand the hopes and dreams of communities in a regional design process by involving them throughout the research and design phases. Through stakeholder analysis, media analyses, observation, street interviews and surveys, we tried our best to incorporate

community perspectives in our project within a limited time. Additionally, framing ourselves as part of the affected community allowed us to empathize and connect more authentically with the issues at hand. This approach allowed us to design not just for people, but with them, ensuring their dreams and concerns were reflected in our final outcomes.

Working in an all girls team and focusing on women in energy transitions was a unique experience. It was both frustrating to look at the challenges we face and empowering to see how we can change the system to cater to the needs of the many as to create a just and fair energy transition. This was the first project where we worked with each other very collaboratively from the beginning till the end and it was an intense workload. At times, I was skeptical of what our outcome would be, I could not see what we would achieve from the project. However, as a group, when we could not see a way out, we carved out a new path, **by the women, for the women, the pink lane.**

STERRE

The biggest challenge in this project for me was working at a large regional scale. It brought both spatial complexities, since I had never worked on this scale before, and substantial complexity, because it made it harder to manage all the different stakeholders that are involved in the process. This helped me to understand the importance of finding balance between many different interests, priorities and layers at the same time.

The complexity is something that I realized while making the timeline for our project, since it takes a lot of time for a project like this to become reality. It involves many small steps and milestones that slowly lead towards the bigger vision, which is the result that you would love to see the next day already. It's a process of patience, which is something that I often struggle with. However, it showed me the importance of phasing and setting realistic goals that help to plan and set tangible expectations.

With academic research that we did before, like mapping and literature reviews, we usually focus on top-down problems. This course, however, taught me the importance of including bottom-up input to understand problems that are experienced first hand. Executing the interviews was something out of my comfort zone, since I find it hard to address people that I do not know. Luckily, we all took on different roles during the fieldtrip, which was the beginning of our work as a group where everybody put their skills together for the best results. After the interviews were done, we were so happy we had done it, because it really gave us insight on how to design for a community and to look at a project through their lenses. I also learned that real issues don't always align with the issues that we think we can establish through data. Combining both these approaches has helped me to understand the full picture of regional planning.

To combat inequality, I don't think that focusing on any transition community is the solution. Rather we should focus on the marginalized groups within the transition communities that are affected the most or that are already the

most disadvantaged. If we improve things for them, it means that we make the whole system better for everyone. For example, when we designed for women's mobility needs, we ended up improving accessibility for all communities. Eventually the community was just the premise for action.

Taking transition into account while making spatial plans is crucial, because of the uncertainties in the social, cultural and economic fields. Because we can't predict the future (and neither can supercomputers), I think that spatial plans should focus on 'no-regret' decisions, that have a positive outcome, no matter how things change. For the Pink Lane vision, we did this by using the capabilities approach, resulting in a mobility network that makes it easier for people to participate in society and live the lives that they value (Robeyns & Byskov, 2023).

Briefly, I have learned that planning for more equity starts with prioritizing marginalized groups and focusing on their problems with a bottom-up approach, in combination with a top down approach for spatial analysis. Improving the world for marginalized groups ultimately improves the world for everyone.

# PERSONAL REFLECTION

KATE

The third quarter started off rather vaguely for me. I had just come out of a stressful second quarter and had to continue straight away. From the first lecture it felt like this subject would be a challenge. It was the first time I had to work on a large scale and that made me insecure. How was I going to do this? In the first week we wrote a short text about how we saw the future and what energy transition meant to us. Based on these texts we were divided into groups. My group happened to consist of 4 girls. We were on the same page from the start and worked well together. We wanted to focus on consumerism within the energy transition, although we did not yet know exactly what that meant. This meant that we had to look for consumers, so people. So we decided to do our excursion in South Holland. Via metro line D. During our excursion with the metro from The Hague to Rotterdam we got to know each other better. Every time we got off at a metro stop, a comment was made like “oh if we had a bike, maybe we could explore the place further. Kika and I also made a few comments about certain stops: “I once had to cycle home here alone” or “The public transport didn’t run anymore then.” These complaints and conversations made us realize something important: mobility poverty affects young women differently. Our own experiences actually formed the basis for a community: women in the mobility transition. In the beginning, we had a broad focus and it took time to narrow it down to a clear story. Nevertheless, the process was valuable. All the personal stories and conversations gave me new insights. The book *Invisible Women* in particular had a great impact on me. I discovered how the world is designed by and for men. That made me angry, but also more aware. I now see things that I didn't notice before, such as the icon on cycle paths often showing a man's bike. I started thinking about how the city is actually not designed for women. I found that very interesting. The project gave me space to delve deeper into that.

My personal experience became the reason, but through research I discovered that many women struggle with the same problems. That made it feel justified to make a plan that really takes into account the wishes and needs of women. Another important part of our project was micromobility. That idea arose from our complaints during the excursion. I said then: “If only I could have rented an e-bike, then I would have done all this by bike.” Or: “If only I could have taken a bike here to go to the next stop.” We discussed how other cities have shared scooters and how that is still limited in the Netherlands. That’s how we came up with our solution: a network of shareable micro-vehicles, specifically designed for the needs of women. Reflecting on the project, I see how far we have come. At first I had my doubts about the community approach, but now I see how much it has brought me. Instead of top-down thinking, we really started looking at people and their experiences. That has changed my way of designing. I am no longer focused on systems, but also on social factors and communities. This course has taught me to take my personal experiences seriously as a designer. I always heard that you should keep your distance, but I have noticed that involvement can be powerful. I have learned a lot about energy transition, about women in mobility, but also about myself. I now see this course as an important turning point in my development as a designer. I am grateful for the collaboration, the learning process and all the insights I have gained. Furthermore, I am also proud of the quality of products that I have delivered to this course. For the first time, in my opinion, I have made such beautiful things, which also communicate good things. I really thought this project was the best I have done in my life and I find it an interesting subject for a graduation project. Too bad this course was only 10 weeks.

KIKA

This studio can be marked as a step into new territory for me. This course was an elective within my Master Metropolitan Analysis, Design and Engineering at AMS Institute. It offered the chance for me to engage with a different faculty and way of working. From the start, it was clear that the studio was more grounded in spatial design than I was used to. My natural approach is to begin with literature and conceptual frameworks, but this course required earlier engagement with spatial analysis. This is something I hadn't done as extensively before.

Fortunately, I could rely on my group. While I brought experience in research and argumentation from my background in Technology, Policy and Management, my team members and workshops during the lectures encouraged and helped me develop new skills in tools like QGIS, InDesign, and Atlas.ti. I had used some of these programs before, but never in such an integrated way. Learning to use them in connection with the project helped me become more comfortable with the tools. This did make the quarter feel quite intensive at times, especially given the amount of input in the early weeks. We had the content lectures, methodology classes, workshops, and regular feedback moments. At times, it felt like much of our time was spent discussing rather than designing. But looking back, those discussions were often necessary to clarify our goals and direction.

One of the strengths of the course was the freedom we had in defining our project focus. The energy transition covers a broad range of themes: from mobility to grid connections. This is also why it took our group a while to determine a clear direction. Eventually, we chose to focus on mobility poverty in peripheral areas, with specific attention to the experiences of women. This topic raised relevant questions and discussion within the studio, but also with other people I spoke to. The topic encouraged me to reflect on my own experience: growing up in Rotterdam, I became aware of the subtle ways in which I adapted my behaviour in the city, especially related to safety and mobility.

The literature about this topic as well as the personal stories we came across during the project led to broader observations in my daily life. Many design decisions in public space still overlook the needs of women: such as the lack of public toilets, bike designs not suited for the female body, or office thermostats set to male defaults. These are not just practical inconveniences, but signs of how spatial design can unintentionally exclude certain groups.

Because the course allowed for a community-oriented perspective, there was space for these observations to become part of the project. That felt appropriate, given the topic. It showed me that using gender as a lens in spatial planning requires more than just data. It also asks for attention to lived experiences, and for thoughtful choices in design and method. Although there is growing awareness around inclusivity in urban design, there is still room to improve how these perspectives are embedded structurally. This studio gave me insight into how research and design can support that process.



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Figure 95 (3)

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Figure 12 (woman waiting for train)

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Base for the outlines of women: <https://www.dimensions.com/>

# APPENDIX 1: THE QUESTIONNAIRE

Timestamp	What is your age?	What is your gender?	What is your occupation?
10/03/2025 11:53:19	26-35	Female	Student
10/03/2025 12:43:29	18-25	Female	student
10/03/2025 13:51:04	26-35	Female	Researcher
10/03/2025 14:10:19	18-25	Female	Student
10/03/2025 14:38:21	18-25	Female	Student
10/03/2025 15:52:23	26-35	Female	Student
10/03/2025 15:58:34	18-25	Male	Student
10/03/2025 20:54:18	18-25	Female	student
10/03/2025 22:13:28	26-35	Male	Student
12/03/2025 11:16:42	46-55	Female	housewife, from brazil, husband works here
12/03/2025 11:19:41	46-55	Female	Lawyer
12/03/2025 11:24:28	66 and above	Female	Pensioen
12/03/2025 11:33:10	18-25	Female	Au pair
12/03/2025 11:44:26	36-45	Female	Zieke huis
12/03/2025 11:45:04	56-65	Female	werken
12/03/2025 13:17:44	18-25	Female	Kfc
12/03/2025 13:23:55	18-25	Female	Pabo
12/03/2025 13:32:06	26-35	Female	Koerier
12/03/2025 14:14:01	26-35	Female	Dishwasher
12/03/2025 14:22:26	26-35	Female	Ziek

What does your daily routine look like?
Home to work to school to home to gym to home
Breakfast, biking to the TU Delft/train to Amsterdam Institute/ back to my house/ either run from my house/go to training in Rotterdam with the train/ back to my house in Delft and sleep
Walking to university- work all day - walk back home - do sports or house chores or hang around - sleep
Wake up, go to uni, have lunch at home, study some more at uni, eat with roommates, drink a beer or watch movie with friends
Mainly going to the university and work my job afterwards. When I have some free time, i like to hang out with my friends
Walk to tram/bus stop, go to the central station,take another bus, go to class,come back the same way. Sometimes hangout with friends
Uni
Morning: wake up, morning stuff - walk to metro - take metro to schiedam - take train to delft - walk to school Day: school :D Evening: reverse travel routine, cooking dinner (and possibly lunch for next days), freetime stuff and spending time with roommate
Study, work, eat on repeat and some fun from time to time.
bring son to school, gym, housewife, sleeping in evening
Not working in netherlands, home daugther, home, gym/yoga, groceries, home, work at home, class ballet, home
Groceries, shopping, meeting friends, go into the city centre
Wake up early, take kids to school, free time, pick up kids, feed them, play with them
Huis werk hiis
klaarmaken, met auto, stukje terug is het gratis, benzine, in de straat parkeren
Home work gym home
Huis school met ov weer naar huis sporten of werken
Home work home
Work at home
Wandelen ov en elektrische fiets

Are you aware of how it will change your everyday life?	Have you heard about Low emission zones?
No	Yes
Yes	Yes
It probably won't change my everyday life since I'm mostly using bike or walking for transport	Yes
Yes	Yes
No	Yes
No	Yes
Kinda	Yes
No	Yes
No	No
	Yes
No	No
	Yes
	No
	No
	Yes and means i have to watch out with buying a car
	Yes, it means I have to watch out with buying a car' ~ Woman Charlois 26-35

What does your usual weekend look like?	Where do you travel from?
Home to station (depends on where i'm going) and then to home	
Go with the train to a running event/group training in Rotterdam. Go to my boyfriend with the train + tram	Delft
Buy groceries at the local market, do sports, visit friends or family outside town	Delft
go to work and in the evening do something fun or visit my parents	Delft
Chaotic between working my job and hanging out with friends. We normally hang out at one of our places or we do something in the city	Rotterdam
Meet with friends, clean house, do groceries and cook, call family back home.	Delft
Leisure	Delft
doing home stuff or walking around the town, running errands, groceries, cooking/little meal prep	Vlaardingen Oost
Usually some studying and then going out probably for drinks.	Rotterdam to Delft
city, look at new cities, museums	liges in hillegersberg, walking, 15 min walj
	-
The same	Hillegersberg
Go around, far places, explore Netherlands	Kralingen
Buiten wisselend	Hillegersberg
	hi ambacht
Work	Slinge to marco iplein
Werken wedstrijd zondag is chill	Ridderkerk naar rotterdam
Home if the weather is nice then go outside	Slinge to centraal with metro
	Kralingen to kop van zuid
	Charlois naar centeum

Do you feel comfortable/safe in all transportation modes?
Yes
No
sometimes yes, sometimes not when there are people causing issues
Yes
Yes
Yes
Kinda
Yes
Yes
Yes
Yes
The metro is nice but changing transport options is a hassle but the tram is needed in the neighbourhood cause a lot of people use it. Although they changed the time step to 20 minutes
Yes
Niet savonds
Prefer not to say
No
Eigenlijk wel want kan rekening houden
Yes
Train it's expensive and dirty and doesn't work well
Yes
"Changing transport options is alwasy a hassle, because of the walking distance from station to stop and the waiting time" ~ Woman Hillegersberg 65+

What is your transportation mode to reach these areas? (multiple answers applicable)
Walk, Bike, Tram, Train
Walk, Bike, Tram, Train
Walk, Bike, Train, Car
Bike, Train, Car
Metro/subway and walking
Walk, Bus, Tram, Train
Walk, Bike, Bus, Tram, Train
Walk, Train, Metro
Walk, Bike, Bus, Train
Walk, Car, Electrical Car
Walk, Bike, Tram, Train
Car, Sometimes tram + metro she bows a lot of her friends from the same age go with the bike because public transport is difficult here especially to Kralingen and if you are my age it is just way easier to go with the car. Not far walking etc.
Walk, Bike, Train, Metro
Walk, Bike, Electrical Car, Electrical Bike
Car, slechte aansluiting
Walk, Bike, Tram, Metro
Walk, Bus, Metro
Walk, Bike, Train,
Walk, Bike, Tram, Metro
Walk, Bus, Tram, Train, Electrical Bike, Metro
I am afraid to fall with the bike, because of my age. this is why I travel with the Car or Public transport. Due to bad public transport connections to my friends in Kralingen, I usually take the car ~ Woman Hillegersberg 65+
Due to bad public transport connections, I travel with the car ~ Woman Hendrik-Ido-Ambacht 56-65

How can it be improved?
More surveillance, less waiting time
No aggression in public transport would be nice
More frequent public transportation
It could be cheaper
More frequent bus/trams, better lighting
Keep them cars away
No sketchy people hanging around, well maintained stations (no broken stuff that looks somebody damaged it, clean floors), not needing to walk next to dark bushes in the dark
It could be cheaper, and maybe the train cleaner.
Metro line to hillegersberg so one transport option and easy transfer options and less walking
Less delays, cheaper
No comment
Is dan ergens anders zitten en altijd om je heen kijken
The price go down
Cheaper and cleanliness
Metro stonk heel erg hygienevertragingen
Hygiene
Cheaper
Less walking
Big interconnected metro-line instead of bus/tram connections
Better lighting



Do you know about the government's action plan about transitioning to more sustainable transportation modes?	What will that mean for you?
Yes	Nothing yet
Yes	Not much for now cause I can't effort a car yet and I have free public transport during the week.
Yes	Not much
Yes	
Yes	Nothing will really change in my experience
Yes	Not much
Yes	
No	No idea, I fear it will make it even more expensive.
Yes	Maybe the production of energy comes from renewable sources.
No	
No	Idk
Yes	Now it means that there removing transport options
Yes	
No	Idk
Prefer not to say	
No	

If you had to bike to your nearest public transportation stop, how long would it take?	What are some common routes you take regularly?
3min	Within Delft
10 minutes to the train, 2 minutes to the bus	Route from my house to the university/trainstation and back, route to rotterdam for my training and back
5-10 minutes	Home -> work -> home, home -> station -> home, home -> sports facility -> home
5 min	Uni-home
1 minute	I take the same public transport track daily between Rotterdam and Delft
	Walking to the tram/bus stop
2 minutes	From home to uni
2 min (bus), 5 min (metro)	house - school
5 minutes	Bike to train station, Rotterdam to Delft train, Delft campus by bus or walk
	mostly within neighborhood
2hrs	
2 minutes	
Not long, but the tram doesn't go really often	Home work home
Can bike and takes 10min 20min by walking	