

# From Streets to Spaces

Designing sustainable mobility to improve liveability and accessibility in post-war neighbourhoods



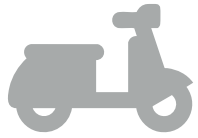
Brenda van der Meer

15-01-2026

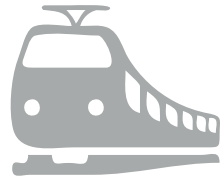
1st mentor: Rients Dijkstra

2nd mentor: Machiel van Dorst

TNO Supervisor: Maiara Uliana



How did you travel here today?



# Car-dominance

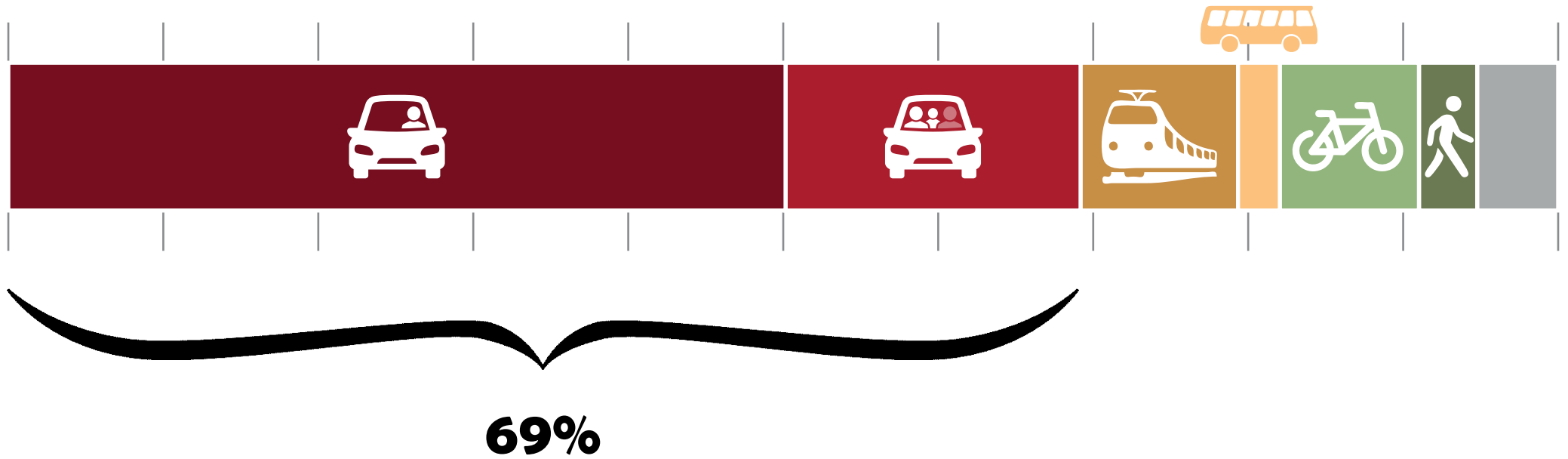
## Travelled distance by mobility mode in 2023 in The Netherlands



Mobility of persons aged 6 years and older by mode of transport in 2023 (CBS, 2023)

# Car-dominance

Travelled distance by mobility mode in 2023 in The Netherlands



Mobility of persons aged 6 years and older by mode of transport in 2023 (CBS, 2023)



Residential Street in Hoge Vucht (Breda), photo by author



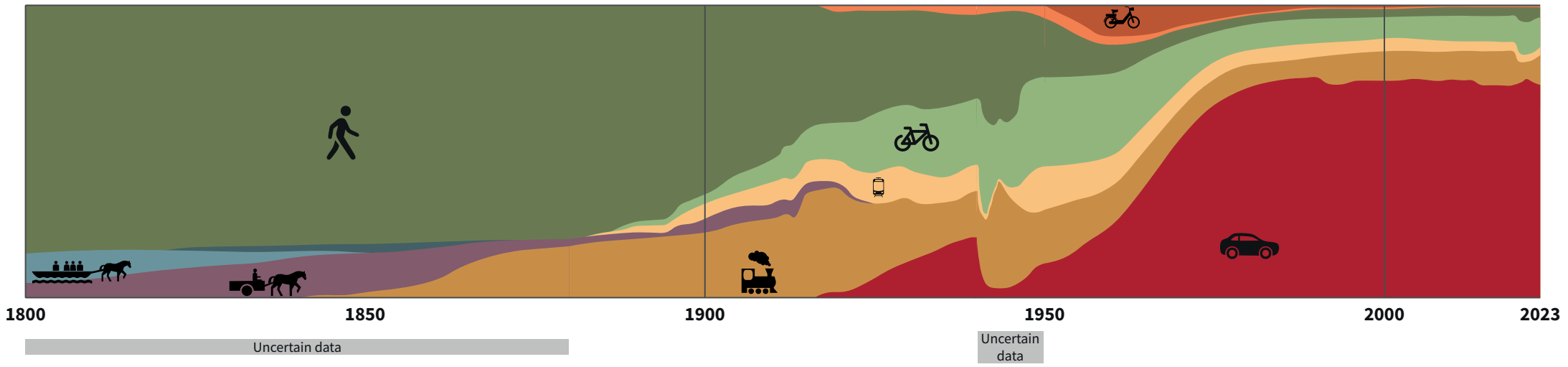
Residential Street in Hoge Vucht (Breda), photo by author

# History

5 km  
per person  
per day

Modal split travel distance

32 km  
per person  
per day



- Legend**
- Motorcycle
  - Moped
  - Walking
  - Cycling
  - Tram/bus
  - Train
  - Private car
  - Steamboat
  - Tow barge
  - Horse-drawn carriage

Timeline modal split mobility, data from CBS Statline (2024b, 2024c); Filarski & Mom (2008); Mom & Filarski (2008)



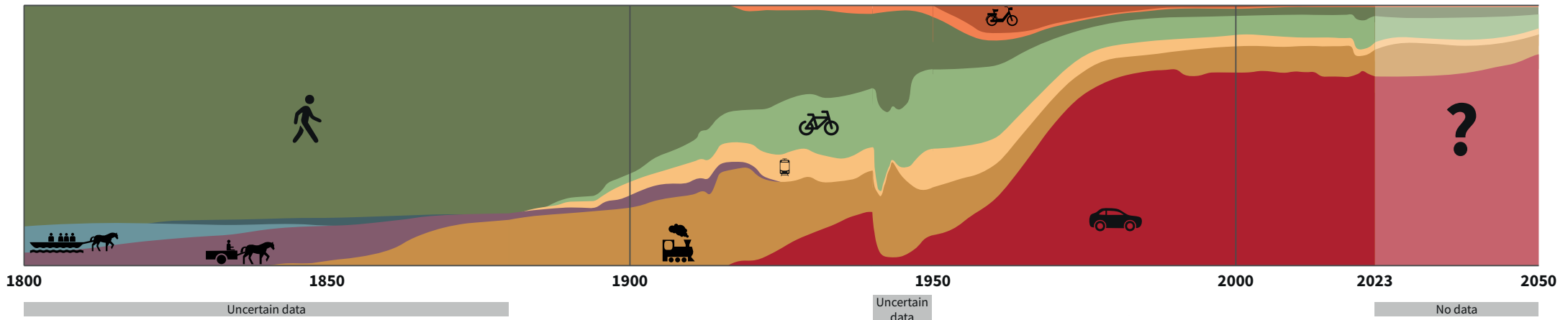
Street in Delft in the 19th century (Springer, 1877)

# Future

5 km  
per person  
per day

Modal split travel distance

32 km  
per person  
per day



### Legend

- Motorcycle
- Moped
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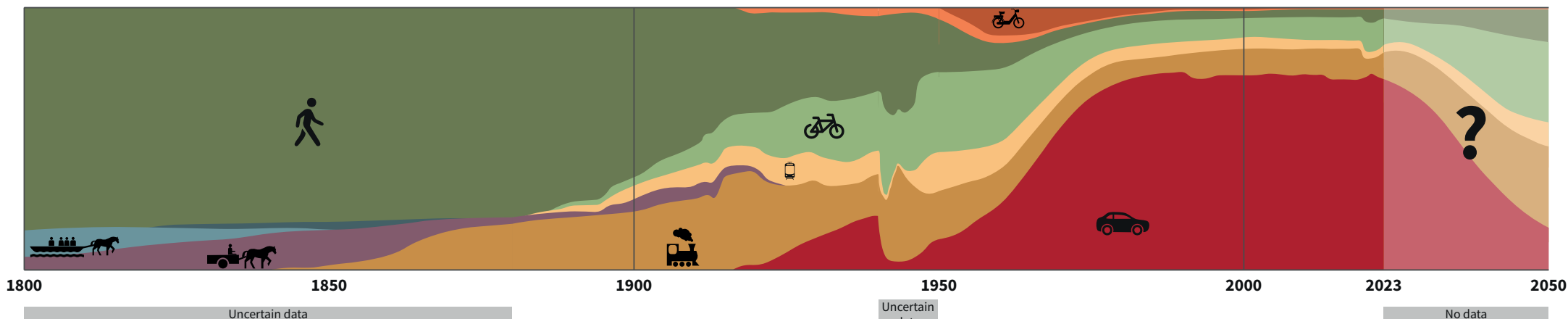
Timeline modal split mobility, data from CBS Statline (2024b, 2024c); Filarski & Mom (2008); Mom & Filarski (2008)

# Future

5 km  
per person  
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Modal split travel distance

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**Legend**

- Motorcycle
- Moped
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- Cycling
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- Train
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Timeline modal split mobility, data from CBS Statline (2024b, 2024c); Filarski & Mom (2008); Mom & Filarski (2008)



Green cycling street in Hoge Vucht (Breda), image by author

## Environmental problem



## Problematization

**“90% reduction in transport-related greenhouse gas emissions by 2050”**  
~ EU green deal (2019)

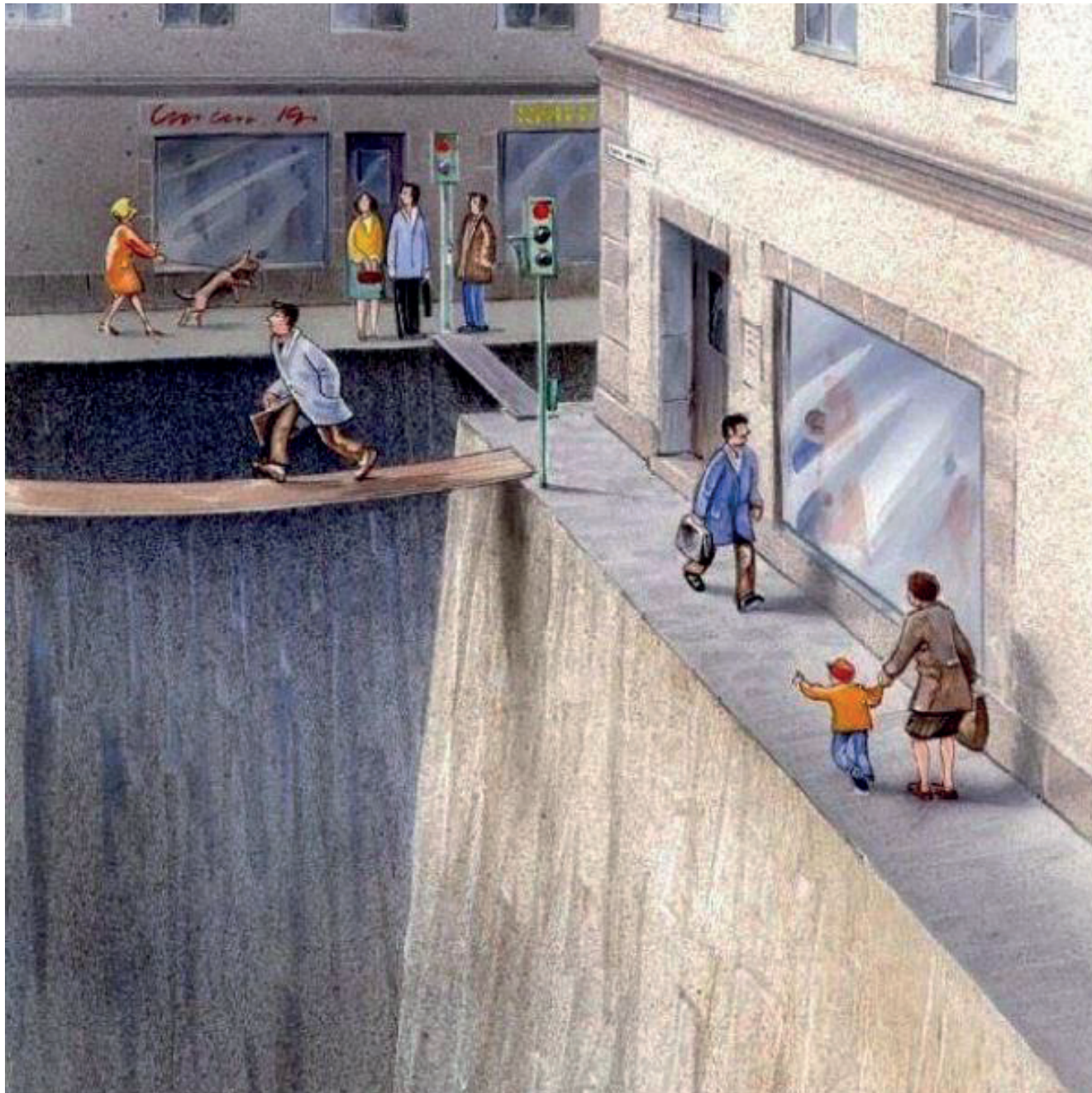
### CO2 emissions per passenger-kilometer (in grams)



Calculated by Milieu Centraal based on data from CE Delft, TNO, and EVDB.

CO2-emissions per passenger-kilometer in grams (Milieu Centraal, n.d., edited by author)

Social problem

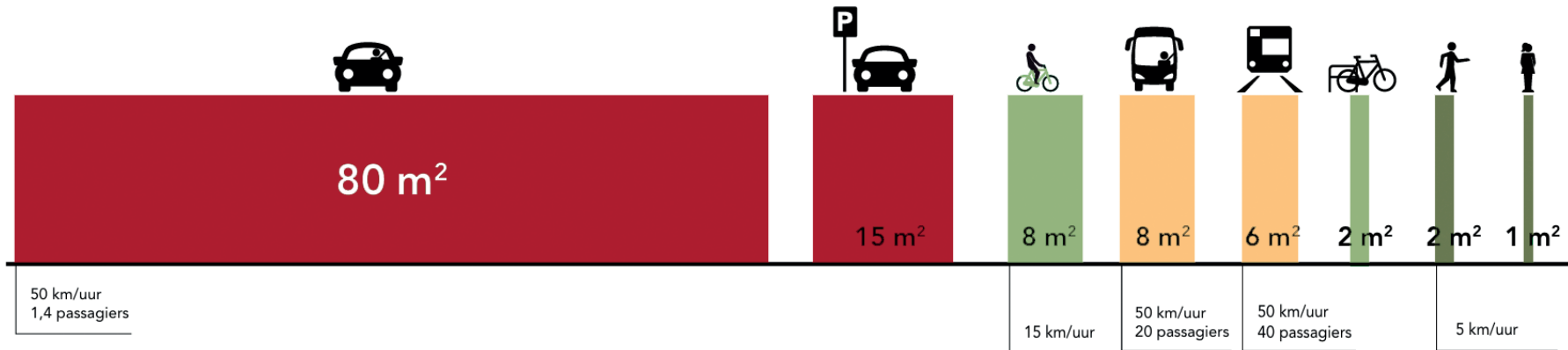


Cities are built for cars, not pedestrians (Jilg, 2017)

## Spatial problem



# Problematization



Road space (Gemeente Amsterdam, 2020, edited by author)

# Problematization



**We need a mobility transition!**

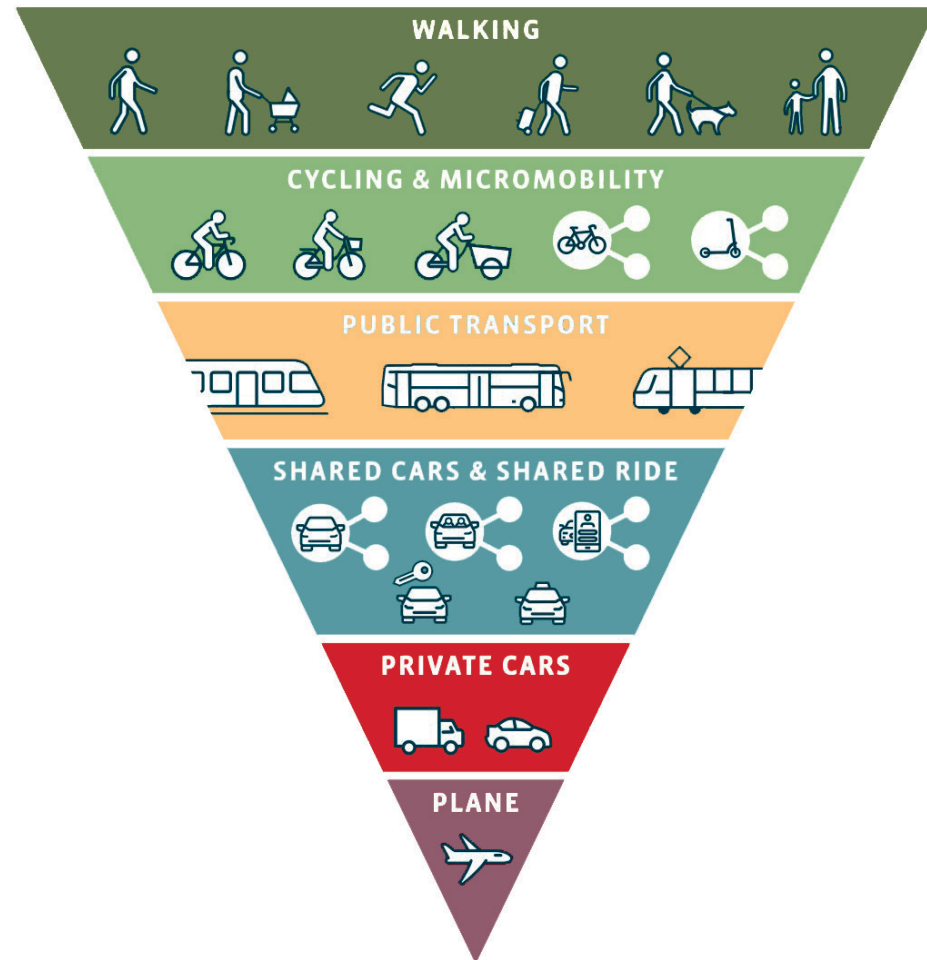
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# Sustainability



## Sustainable mobility

# MOBILITY PYRAMID



**Healthy**  
**Cheap**  
**Efficient in use of space**  
**Little emissions**



**Unhealthy**  
**Expensive**  
**Inefficient in use of space**  
**Polluting emissions**

Mobility pyramid (SHARE-North, 2021, p.21, edited by author)

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We need a mobility transition!

How?

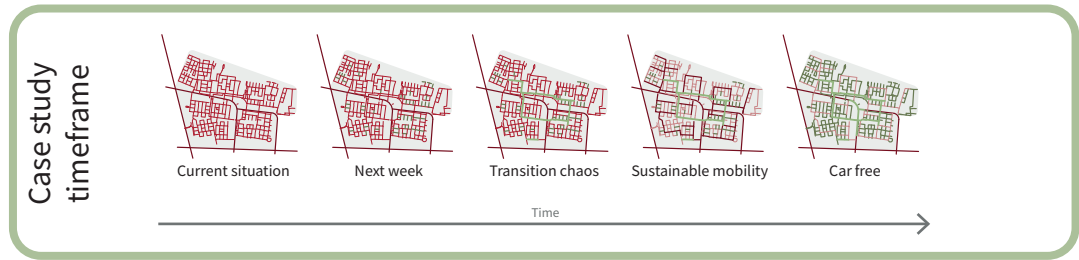
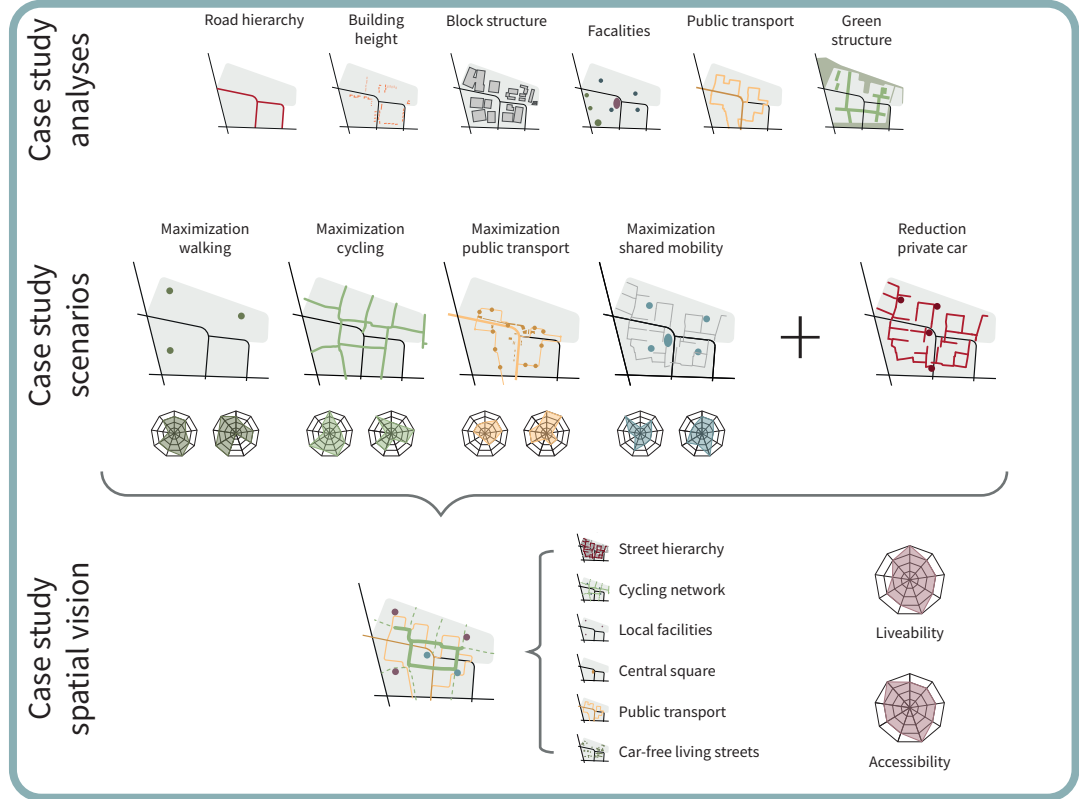
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## Research question

How can sustainable mobility improve liveability and accessibility in post-war neighbourhoods through spatial design, both now and in the future?

# Methodology

**RQ: How can sustainable mobility improve liveability and accessibility in post-war neighbourhoods through spatial design, both now and in the future?**



Introduction

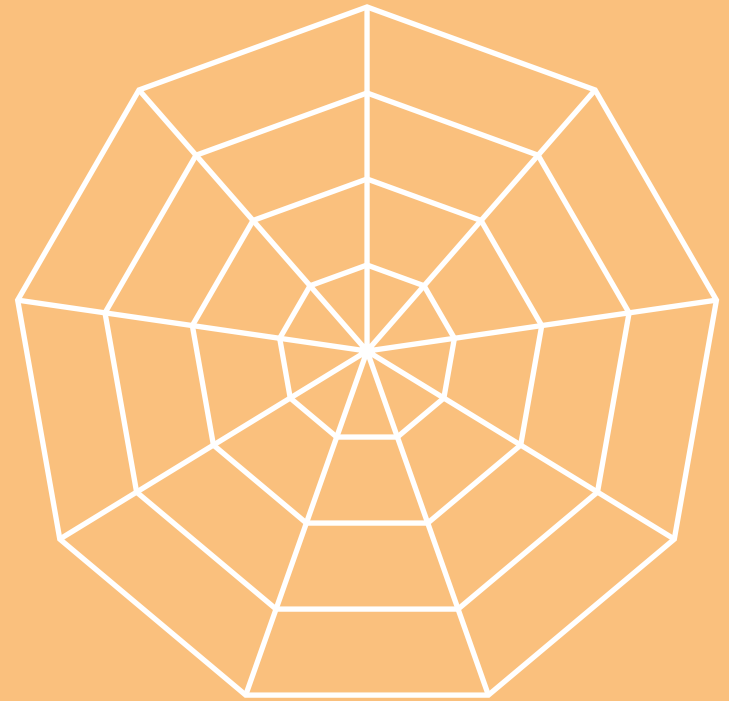
**Frameworks**

Analysis

Spatial design

Timeframe

Conclusion



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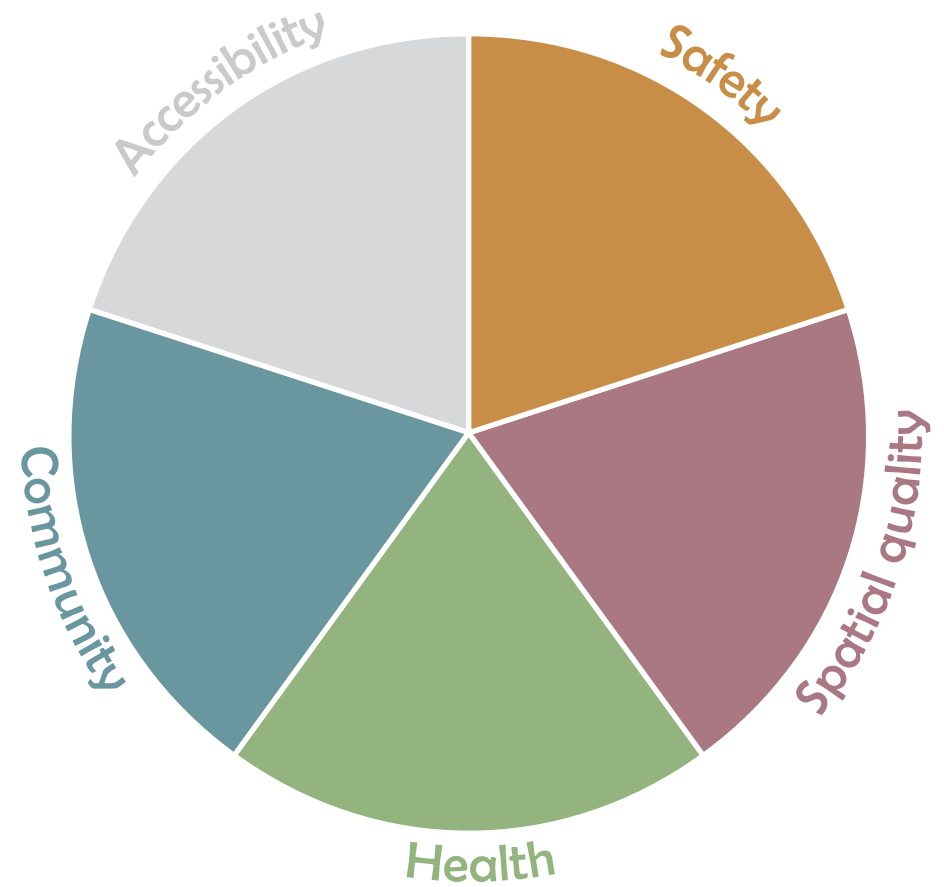
# Liveability

*“Liveability is the extent to which the **environment** meets the demands and desires of the **people** who use it”*

~ Leidelmeijer & van Kamp (2003, p.59)

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# Accessibility

**Proximity:**  
Where is the destination?



# Accessibility

**Proximity:**  
Where is the destination?



**Travel opportunities:**  
How can you get there?

## Accessibility



## Accessibility



# Spider charts

## Liveability

## Accessibility

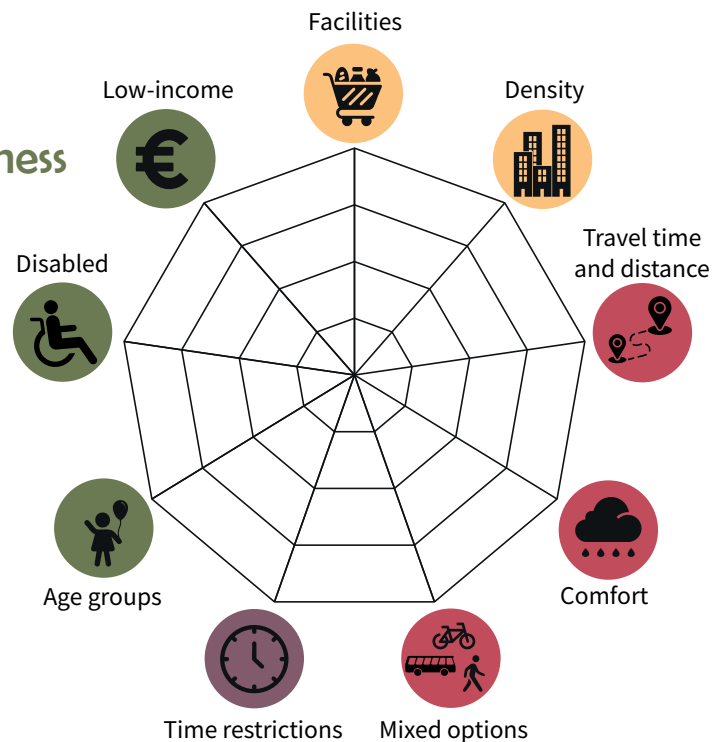
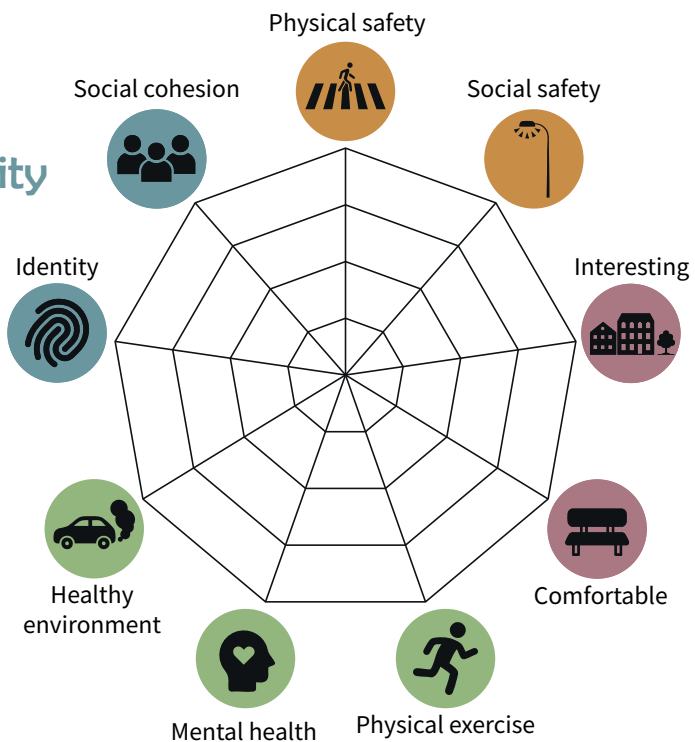
### Safety

### Proximity

### Community

### Inclusiveness

### Spatial quality



### Health

### Time

### Mobility

# Spider charts

## Liveability

## Accessibility

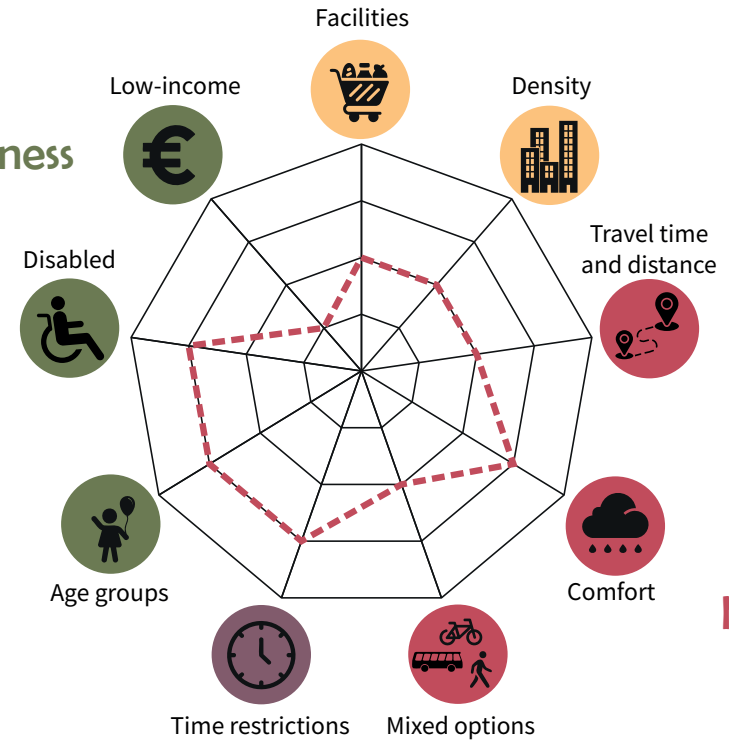
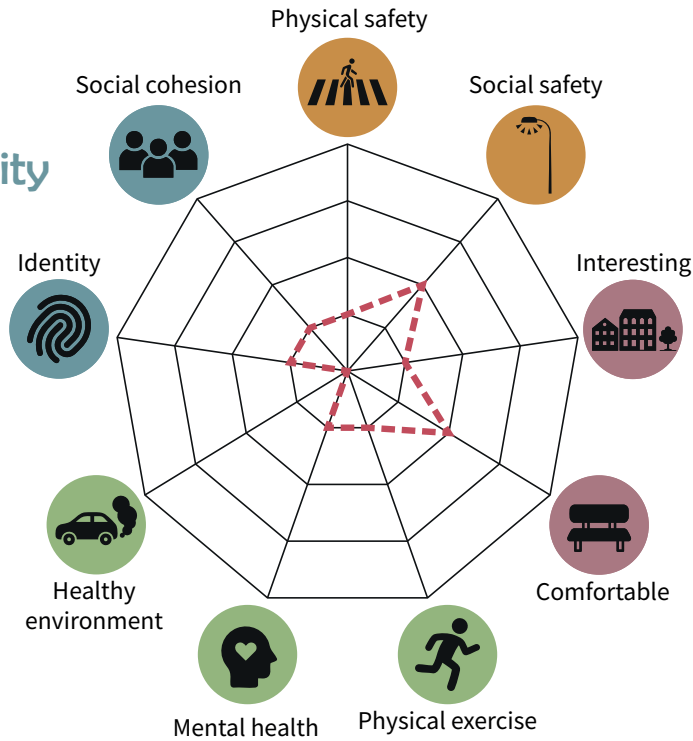
### Safety

### Proximity

### Community

### Inclusiveness

### Spatial quality



### Mobility

### Time

--- Current situation

Introduction

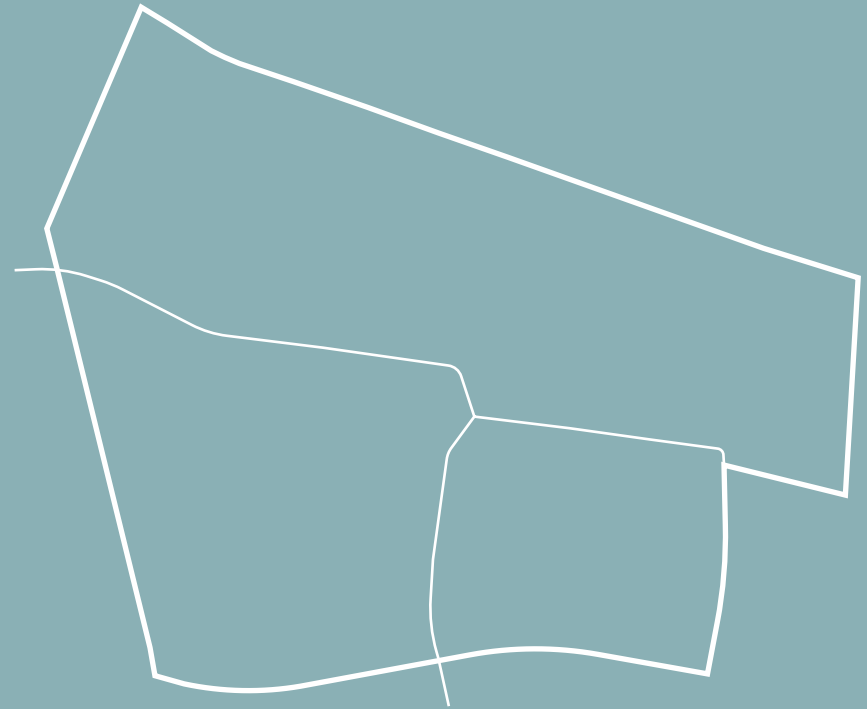
Frameworks

**Analysis**

Spatial design

Timeframe

Conclusion



## Case study area



Location of Breda in The Netherlands



Location of Hoge Vucht in Breda

# Hoge Vucht, Breda

0 m 500 m



## Legend

- Border Hoge Vucht
- Vegetation
- Water
- Industry
- Blocks
- Buildings
- Roads
- Sports field



**1960s**  
Wisselaar  
Biesdonk  
Geeren-Noord  
Geeren-Zuid




**2008**  
Waterdonken

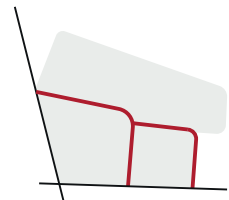
# Parkways

0 m 500 m

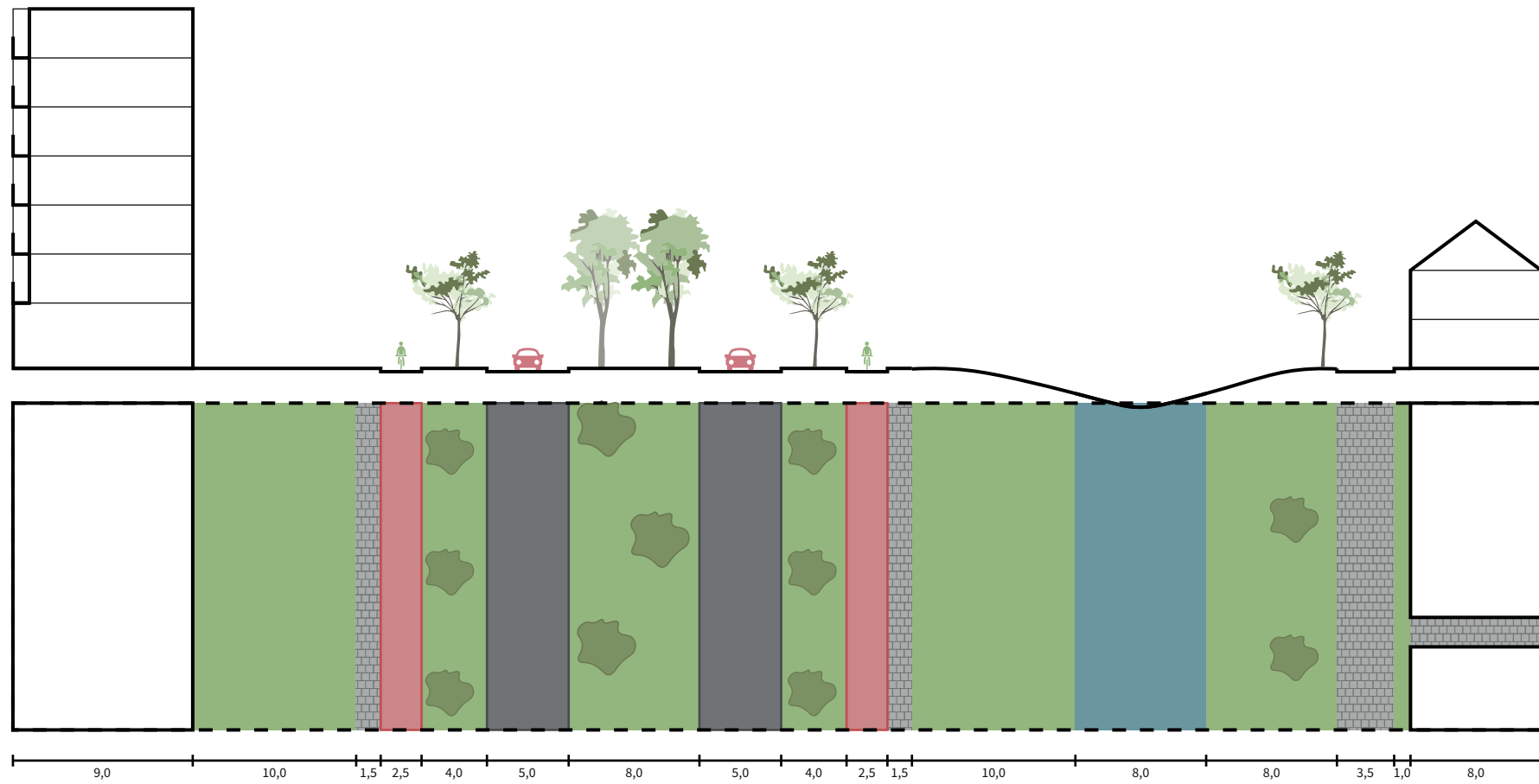


## Legend

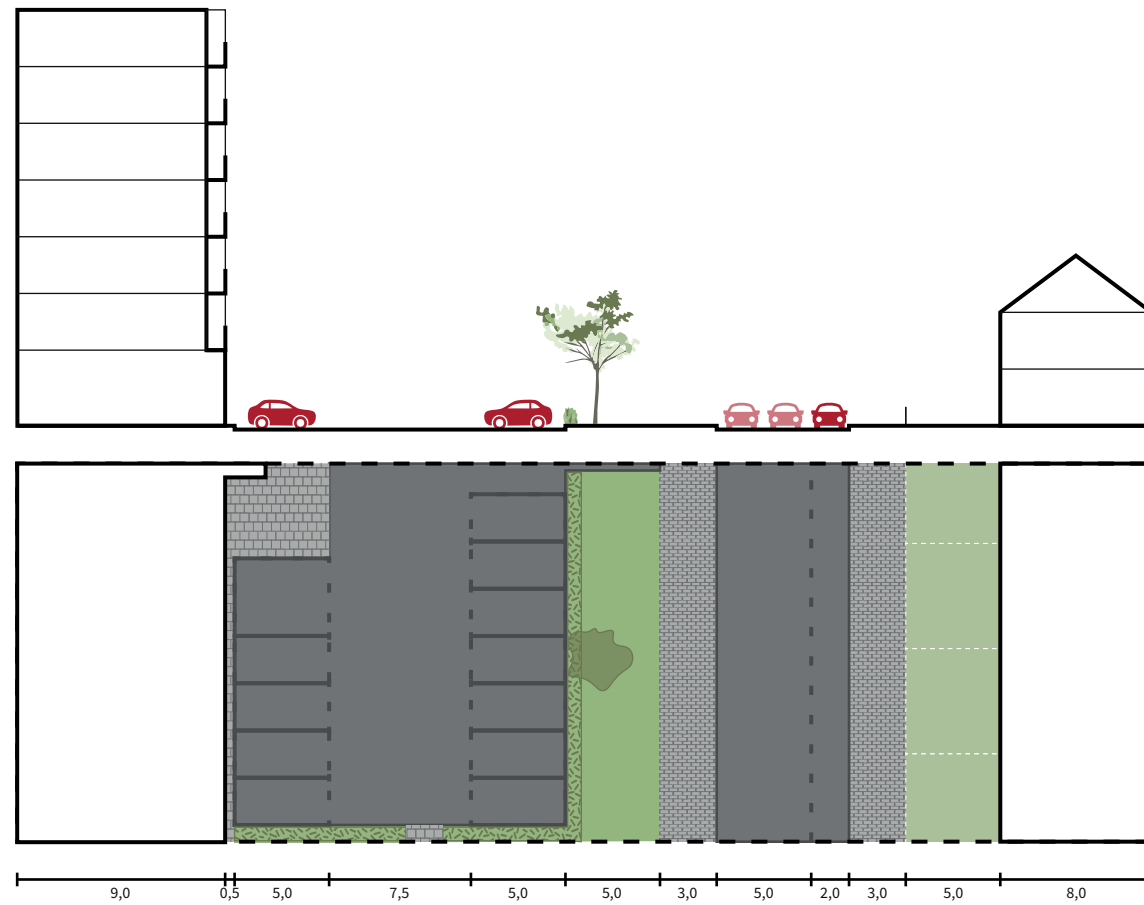
-  Primary road
-  Neighbourhood connector
-  Local access route
-  Dike road
-  Dike road unpaved
-  Cycling connection
-  Pedestrian connection
-  Bus trap



# Parkways



## Edge street

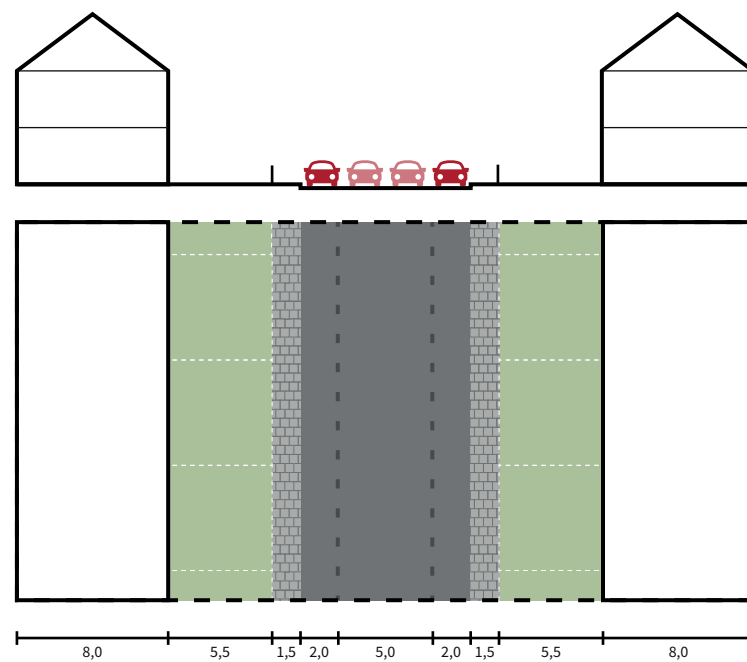




't Kruispunt

Parking lot next to gallery flat in Hoge Vucht (Breda), photo by author.

## Residential street





Typical residential street in Hoge Vucht (Breda), photo by author

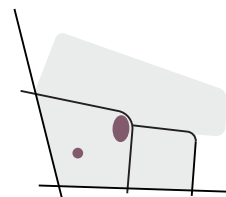
# Facilities

0 m 500 m

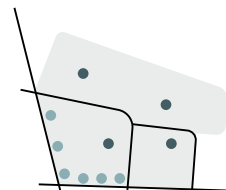


## Legend

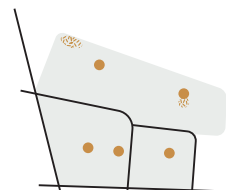
- Shop
- Education: primary school
- Education: other
- Community centre
- Sports
- Health
- Office
- Industry
- Planned building
- Community garden



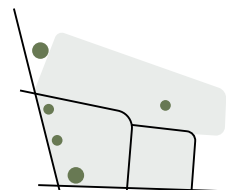
Retail



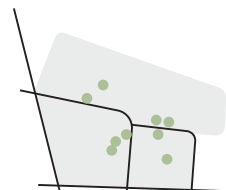
Education: primary school  
Education: other



Community centre  
Community garden



Sports



Health



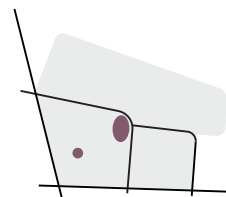
# Facilities

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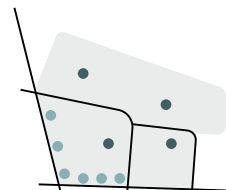


### Legend

- Shop
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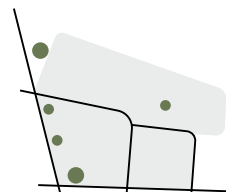
Retail



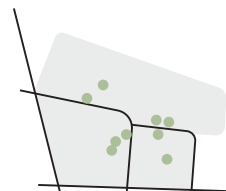
Education: primary school  
Education: other



Community centre  
Community garden



Sports



Health



Travel time and travel distance to central shopping centre (Google Maps, 2025)



Parking lot next to shopping centre in Hoge Vucht (Breda), photo by author

Introduction

Frameworks

Analysis

**Spatial design**

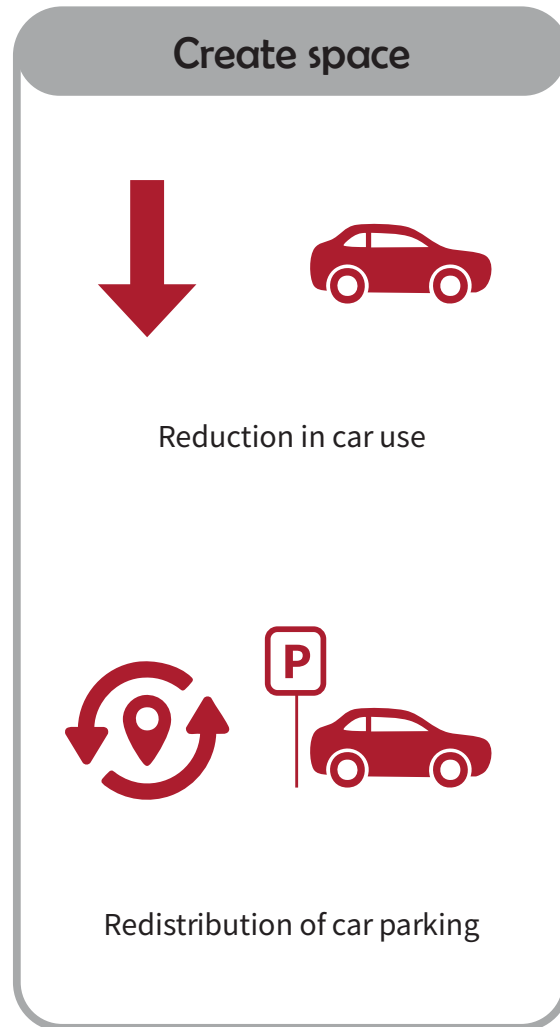
Timeframe

Conclusion

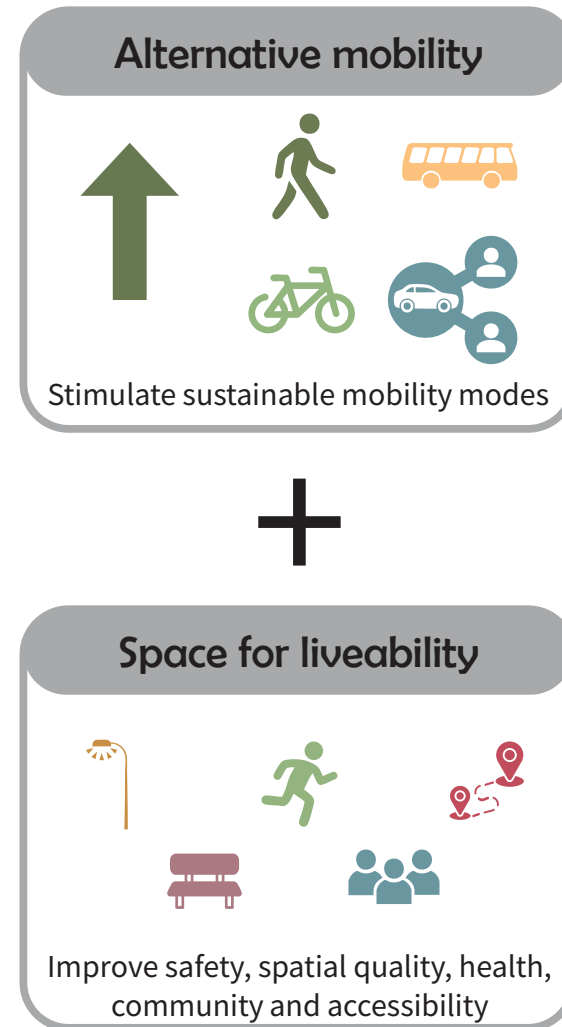


## Spatial design

Redistribution of the car:

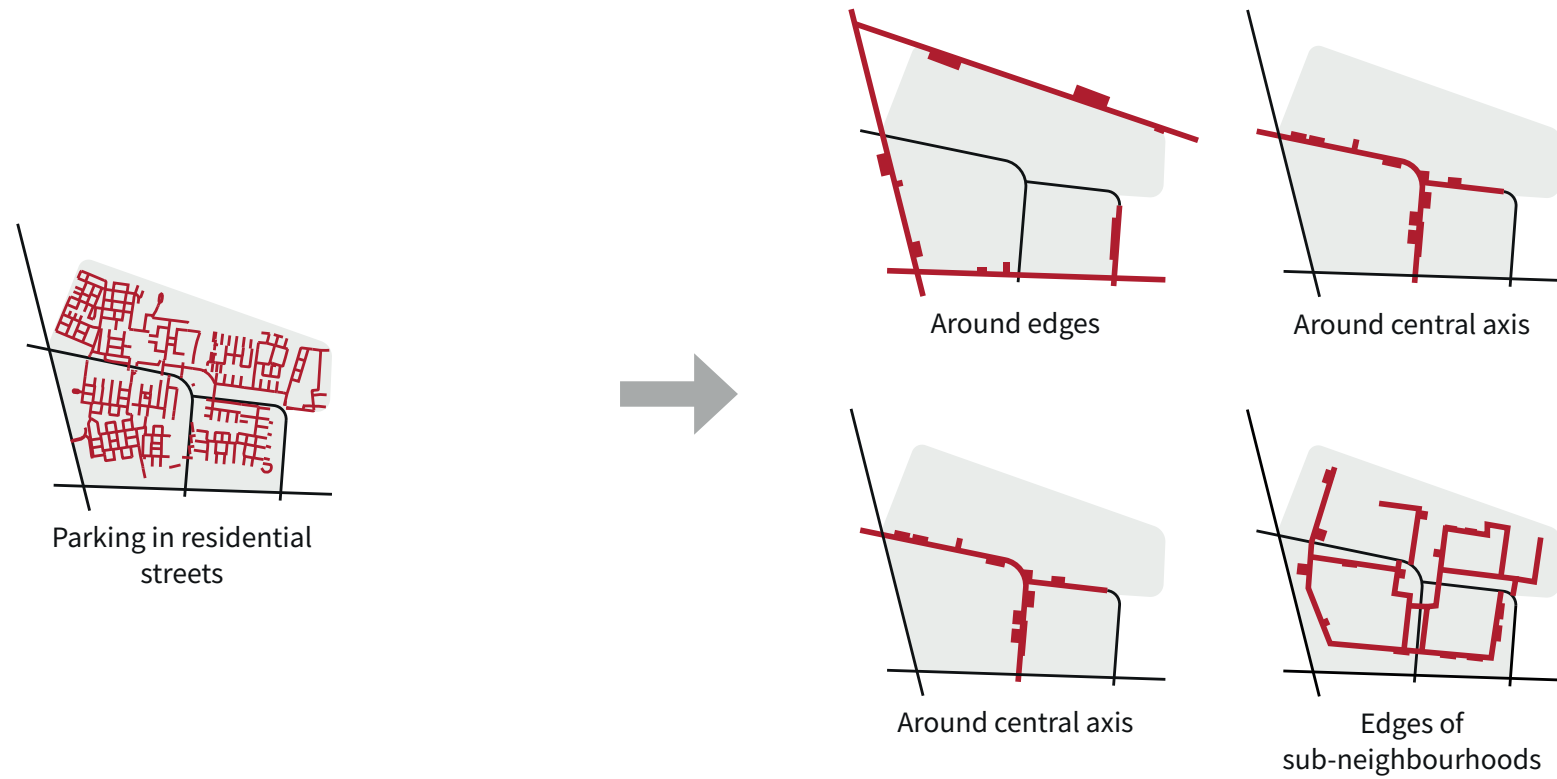


4 scenarios:



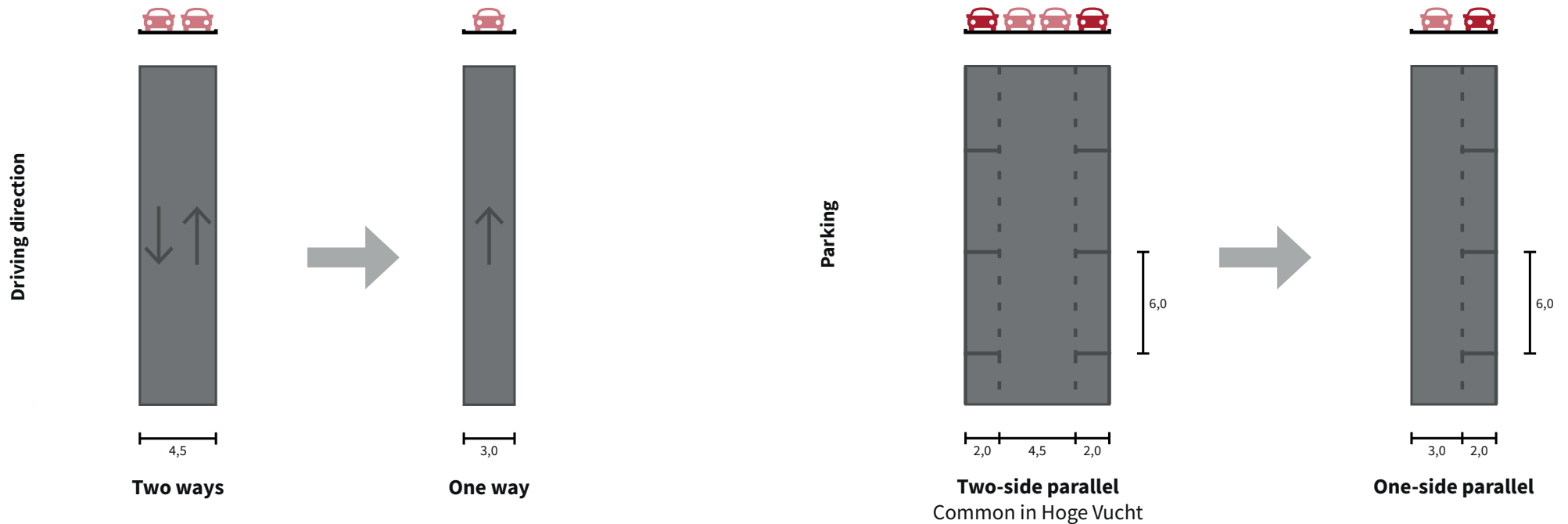
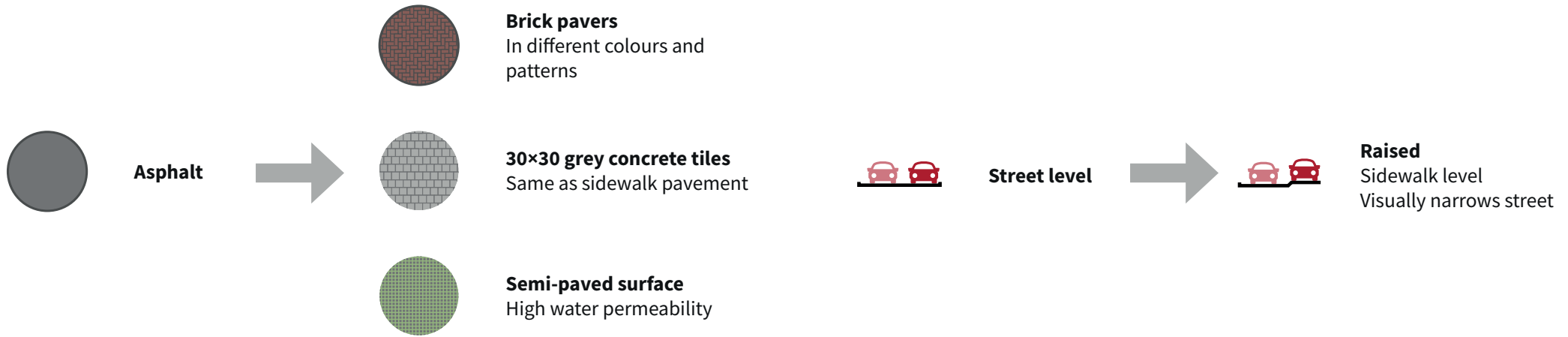
## Redistribution private car

*Neighbourhood scale*



# Redistribution private car

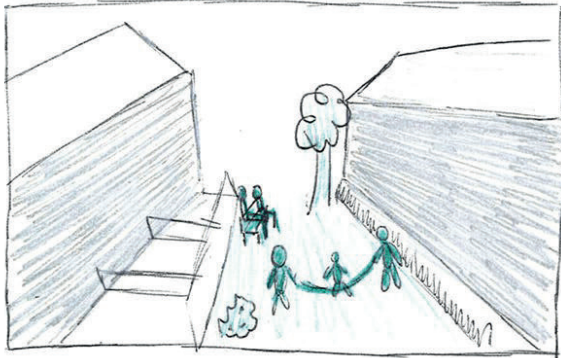
Street scale



## Scenarios

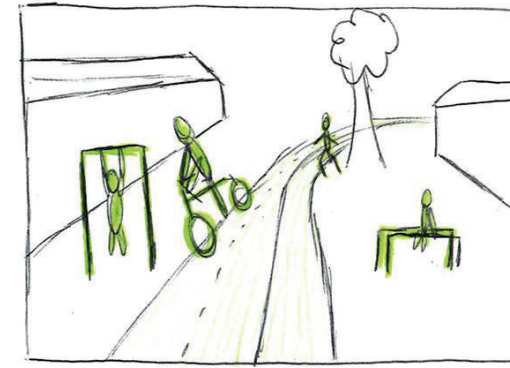
### From young to old

The inclusive neighbourhood



### Active flow

The healthy neighbourhood



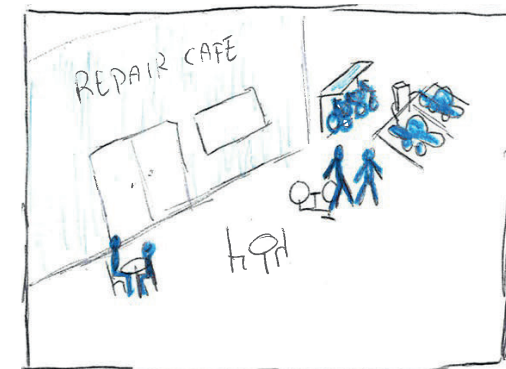
### Urban life

The diverse urban neighbourhood



### Shared roots

The community neighbourhood



## Scenarios

### From young to old

The inclusive neighbourhood



### Active flow

The healthy neighbourhood



### Urban life

The diverse urban neighbourhood



### Shared roots

The community neighbourhood



# Scenarios

## From young to old The inclusive neighbourhood



## Active flow The healthy neighbourhood



## Urban life The diverse urban neighbourhood

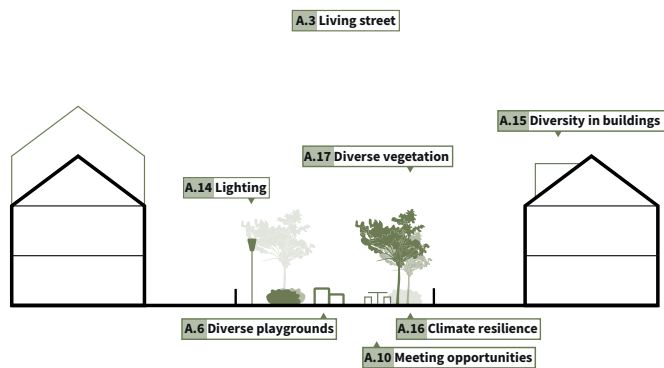


## Shared roots The community neighbourhood



# Scenarios

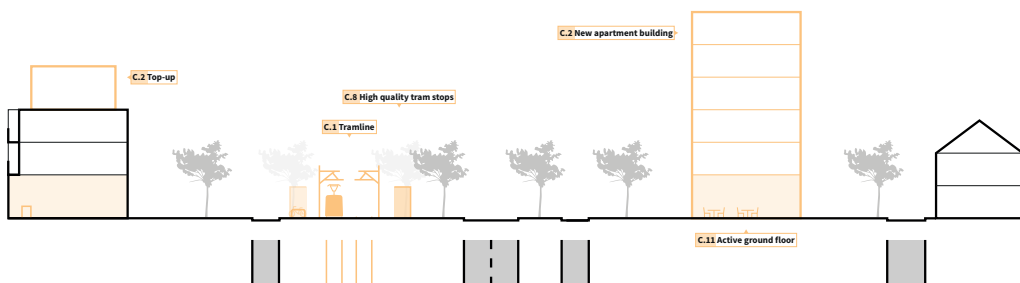
## From young to old The inclusive neighbourhood



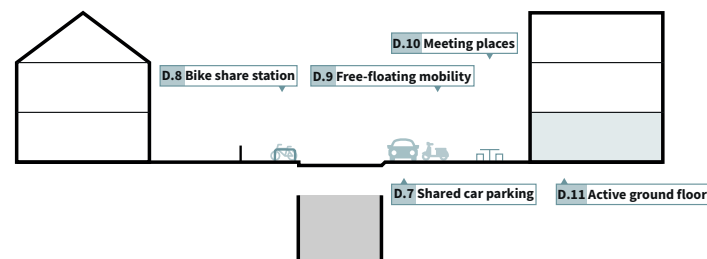
## Active flow The healthy neighbourhood



## Urban life The diverse urban neighbourhood



## Shared roots The community neighbourhood



# Active flow

## The healthy neighbourhood

### Neighbourhood scale

0 m 500 m



#### Legend

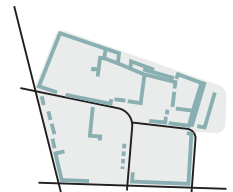
- Bike street
- Bike path next to road
- Bike bridge
- Jogging route
- Facility
- Sports building
- Sports field
- Fitness equipment
- Urban sports field
- Skate park
- New car connection



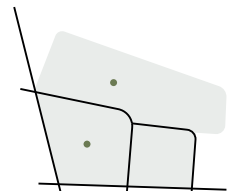
Fast bike routes



Jogging routes



Ecological connections

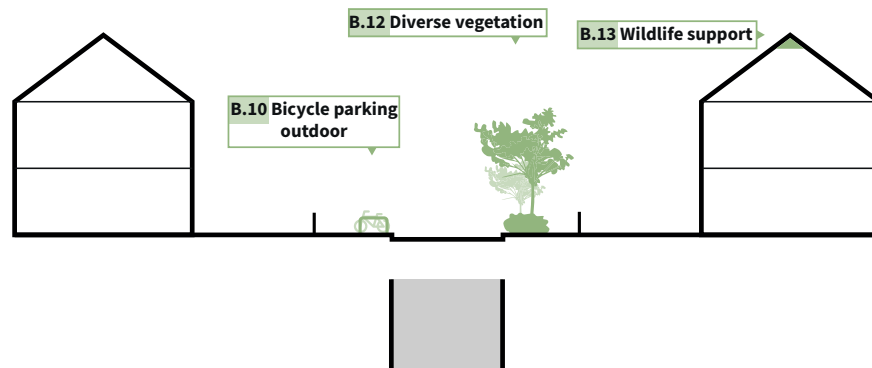


Urban sports park and skate park

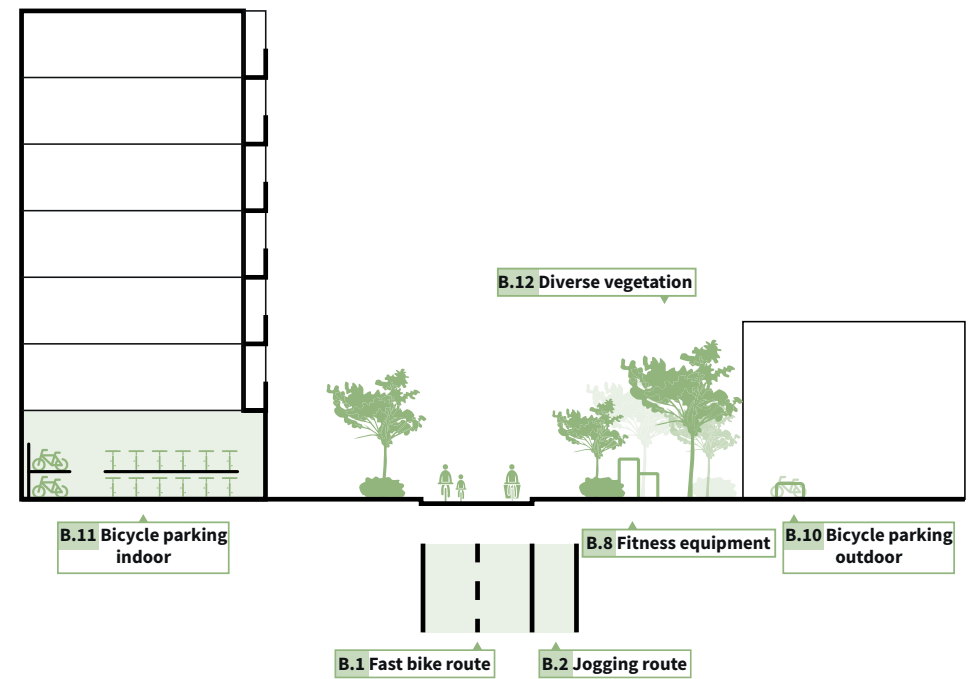


## Active flow

The healthy neighbourhood  
Street scale



Residential street



Car-free bike network

## Scenarios

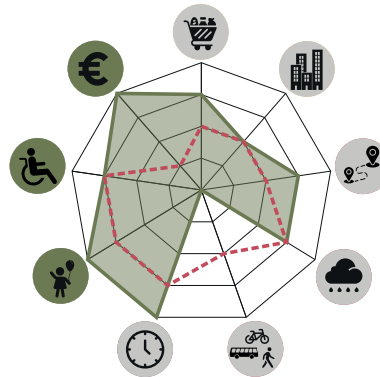
### From young to old

The inclusive neighbourhood

Liveability



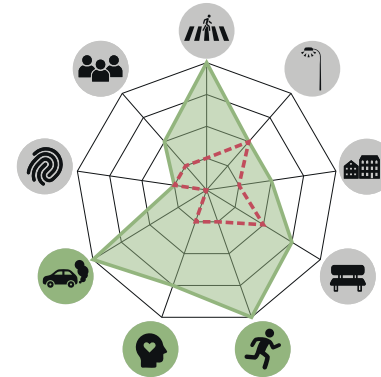
Accessibility



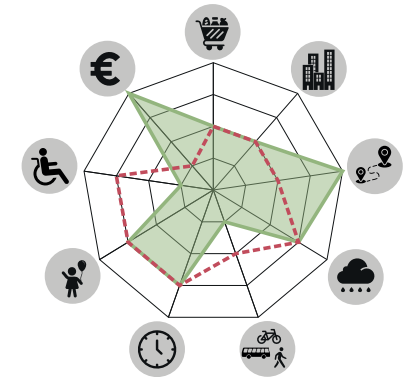
### Active flow

The healthy neighbourhood

Liveability



Accessibility



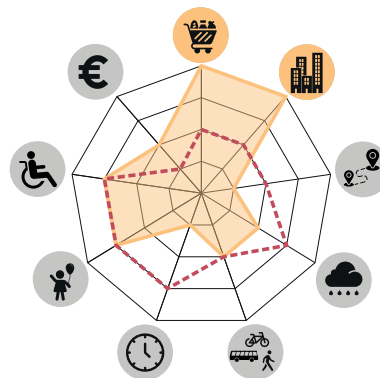
### Urban life

The diverse urban neighbourhood

Liveability



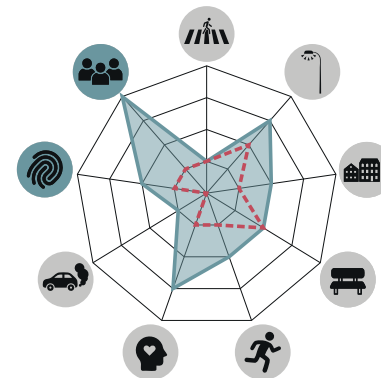
Accessibility



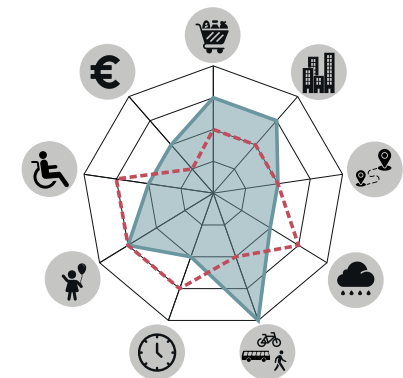
### Shared roots

The community neighbourhood

Liveability



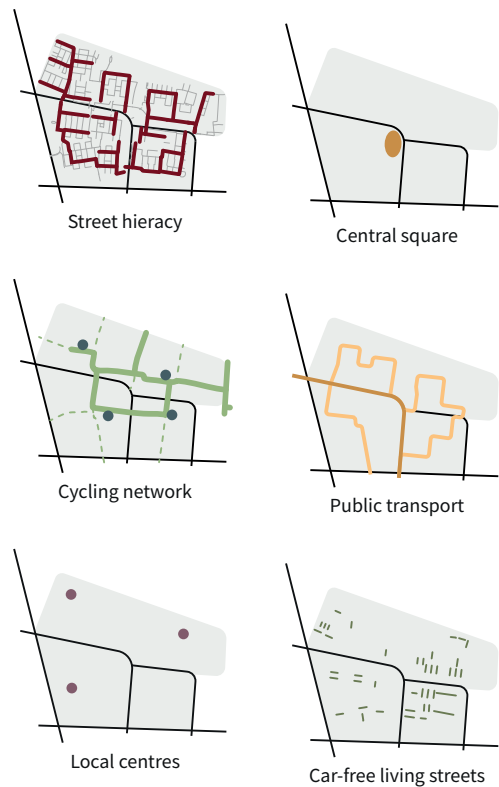
Accessibility



--- Current situation

# Spatial vision: Hoge Vucht for the people!

The sustainable and liveable neighbourhood  
Neighbourhood scale



0 m 500 m



## Spatial vision: Active mobility






The sustainable and liveable neighbourhood

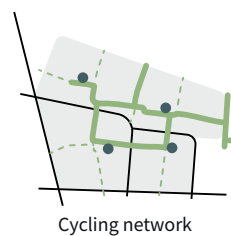
*Neighbourhood scale*

0 m 500 m



### Legend

-  Car-free cycling loop
-  Separated bike path
-  Bike path next to road
-  Jogging route
-  Primary school/ high school





School street in Hoge Vucht (Breda), photo by author



Green cycling loop in Hoge Vucht (Breda), image by author

## Spatial vision: Street hierarchy

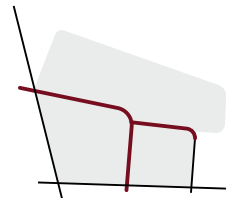
The sustainable and liveable neighbourhood  
Neighbourhood scale

0 m 500 m



### Legend

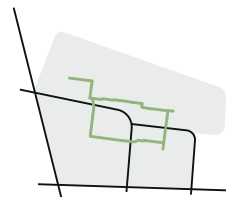
-  Primary road
-  Neighbourhood connector
-  Local access route
-  Residential street
-  Car-free cycling loop
-  Car-free living street
-  Parking garage



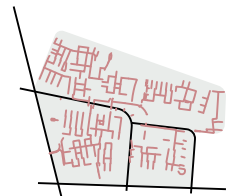
Parkways



Local access streets



Green cycling loop



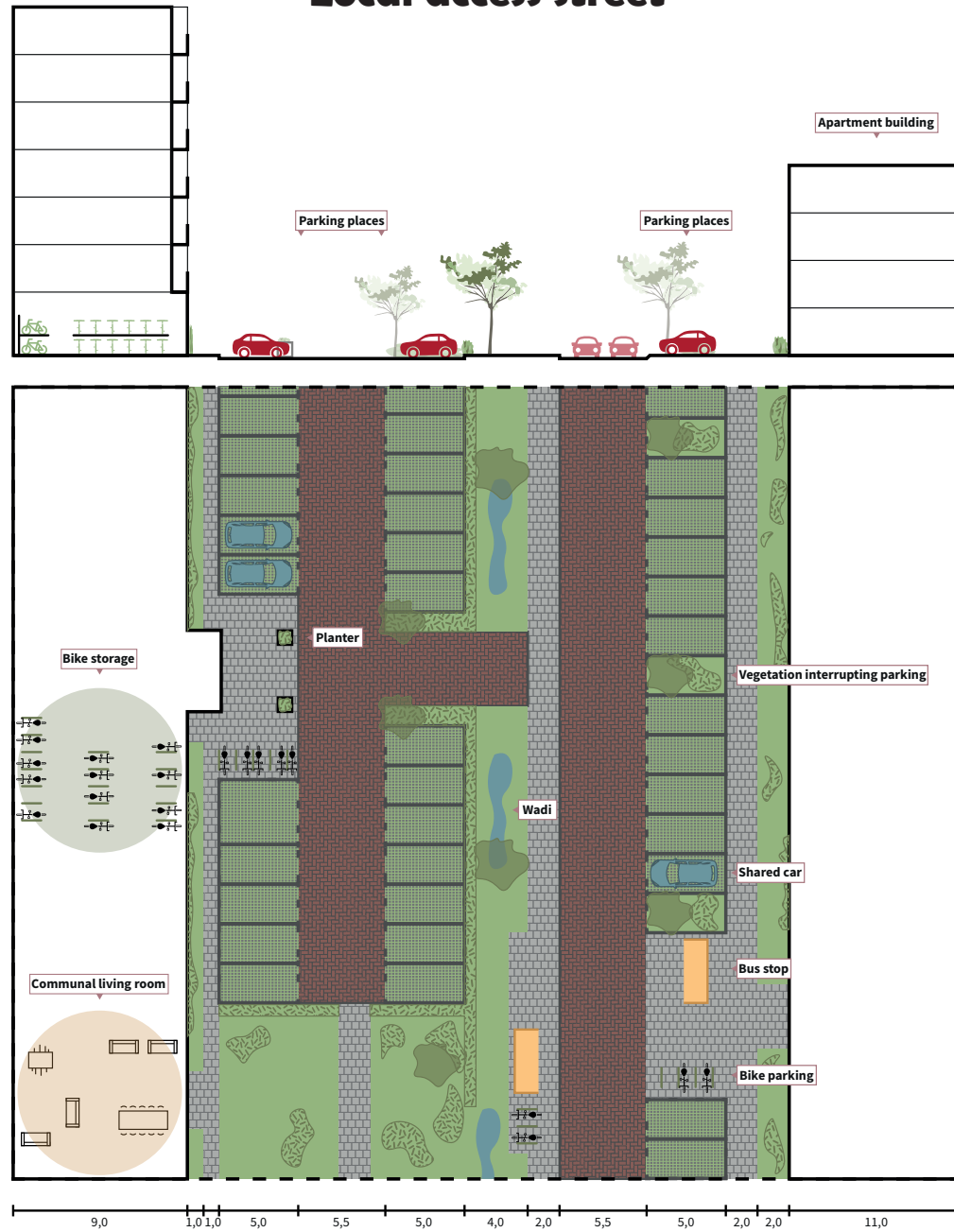
Residential streets



Car-free living streets



# Local access street





Bruno Renardstraat

73-GSP-4

65-231-20

65-231-20

65-231-20

65-231-20

64-GHS-7

05-TH-JN

Residential street in Hoge Vucht (Breda), photo by author



Living street in Hoge Vucht (Breda), image by author

## Spatial vision: Facilities

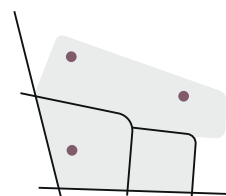
The sustainable and liveable neighbourhood  
Neighbourhood scale

0 m 500 m

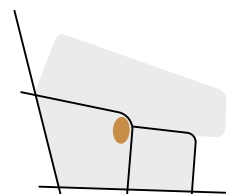


### Legend

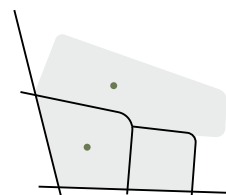
- Local centre
- Community centre
- Community garden
- Health facility
- Pavement cafés
- Urban sports park
- Skate park
- Existing facilities



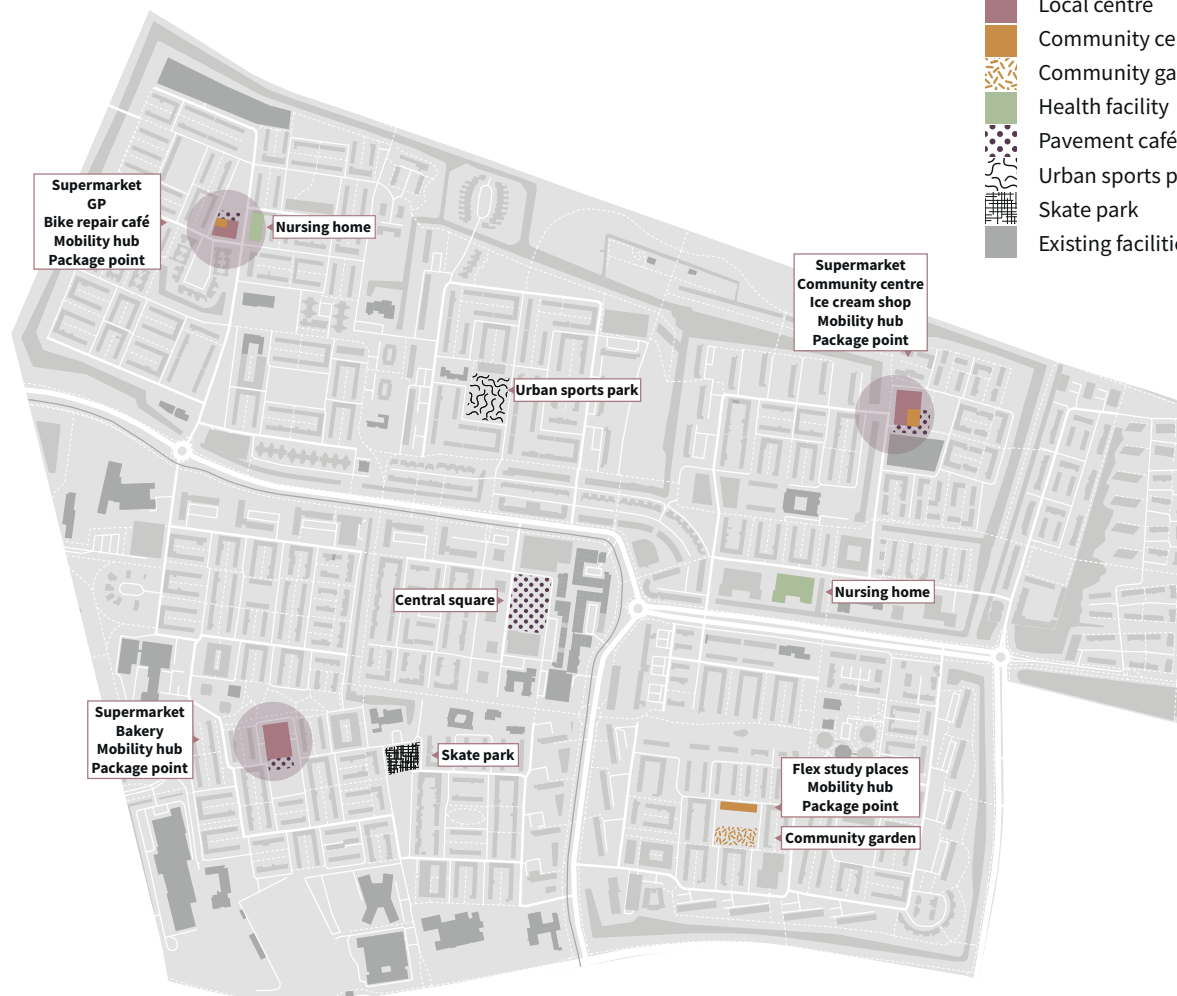
Local centres



Central square



Urban sports park  
and skate park



## Spatial vision: Shared mobility

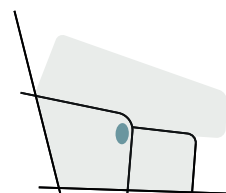
The sustainable and liveable neighbourhood  
Neighbourhood scale

0 m 500 m

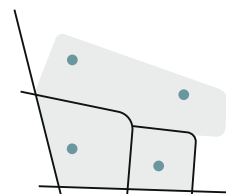


### Legend

- XL mobility hub
- Medium mobility hub
- Small mobility hub
- Shared bike station
- Community building
- High rise apartment building
- Primary road
- Neighbourhood connector
- Local access street



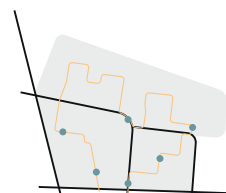
XL mobility hub



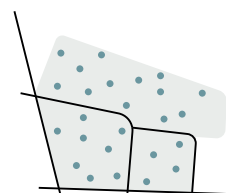
Sub-neighbourhood mobility hub



Small shared mobility hub at apartment building



Shared bikes at bus stops



Shared car in residential



## Spatial vision: Public transport

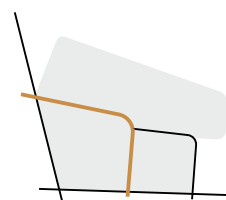
The sustainable and liveable neighbourhood  
Neighbourhood scale

0 m 500 m

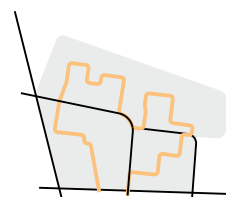


### Legend

- Tramline
- Tram stop
- Busline
- Bus stop
- Densification around public transp



Tramline



Busline





Street in Hoge Vucht (Breda), photo by author



2 Kievitsloop 3min  
2 Kievitsloop 18min

SUPERMARKT

HUB

BUURT HUIS

BUURTTUIN

Local centre in Hoge Vucht (Breda), image by author

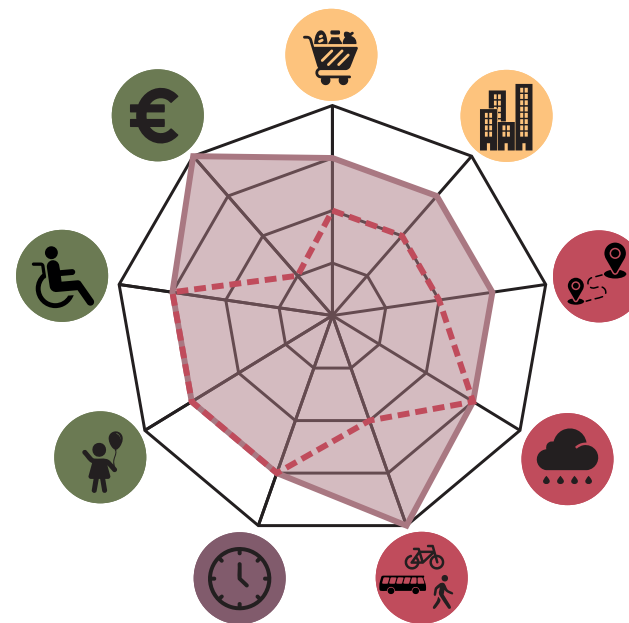
## Final design

The sustainable and liveable neighbourhood  
Neighbourhood scale

### Liveability

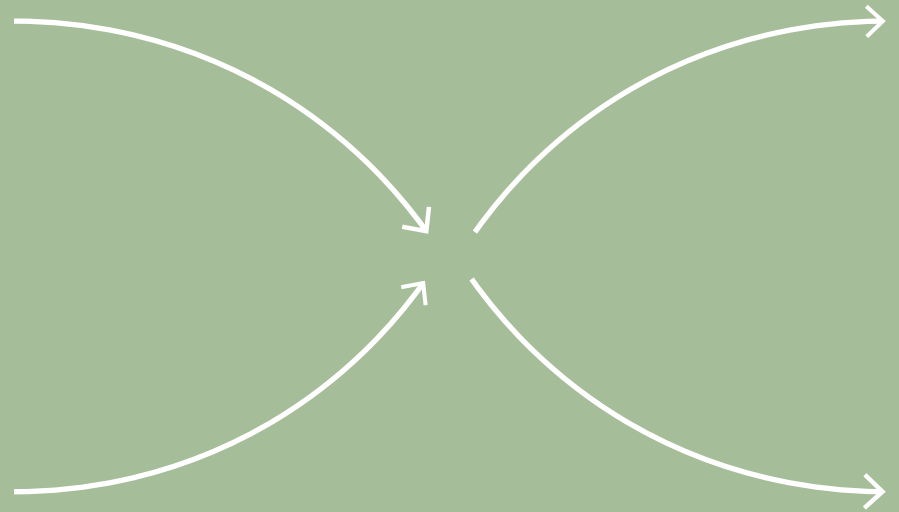


### Accessibility

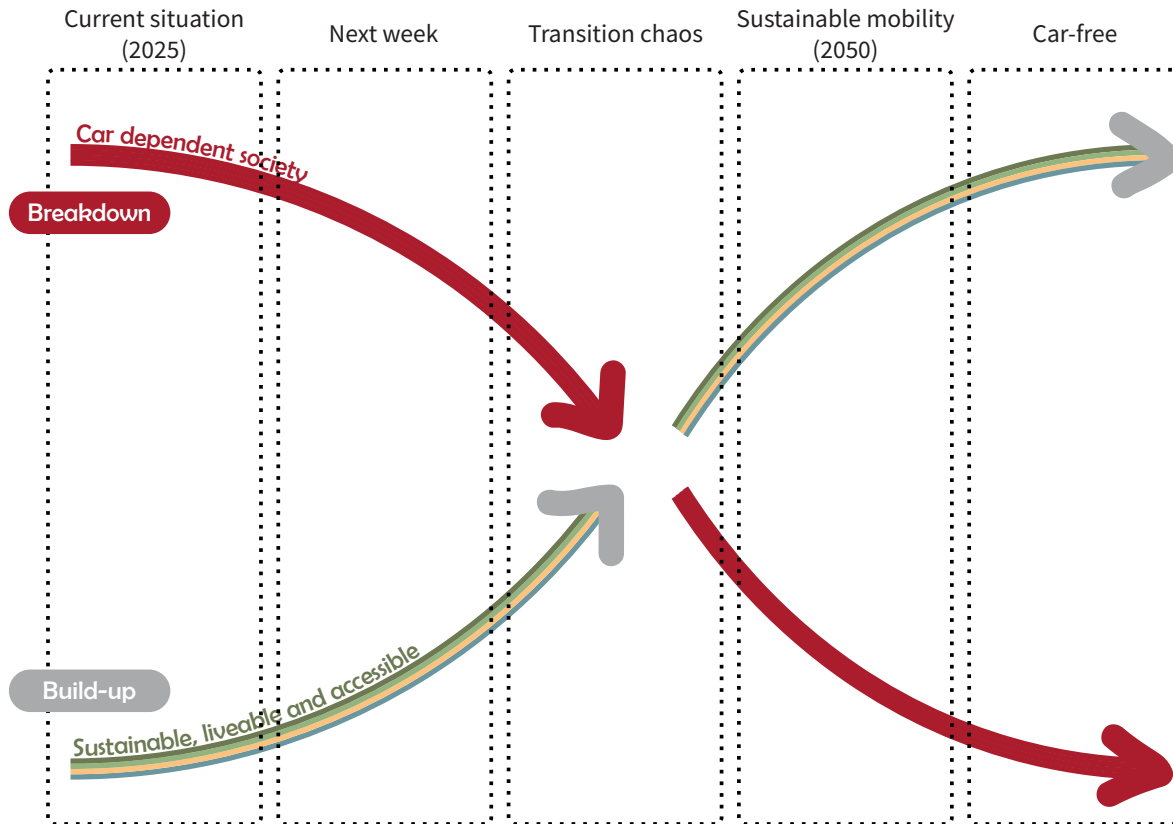


--- Current situation

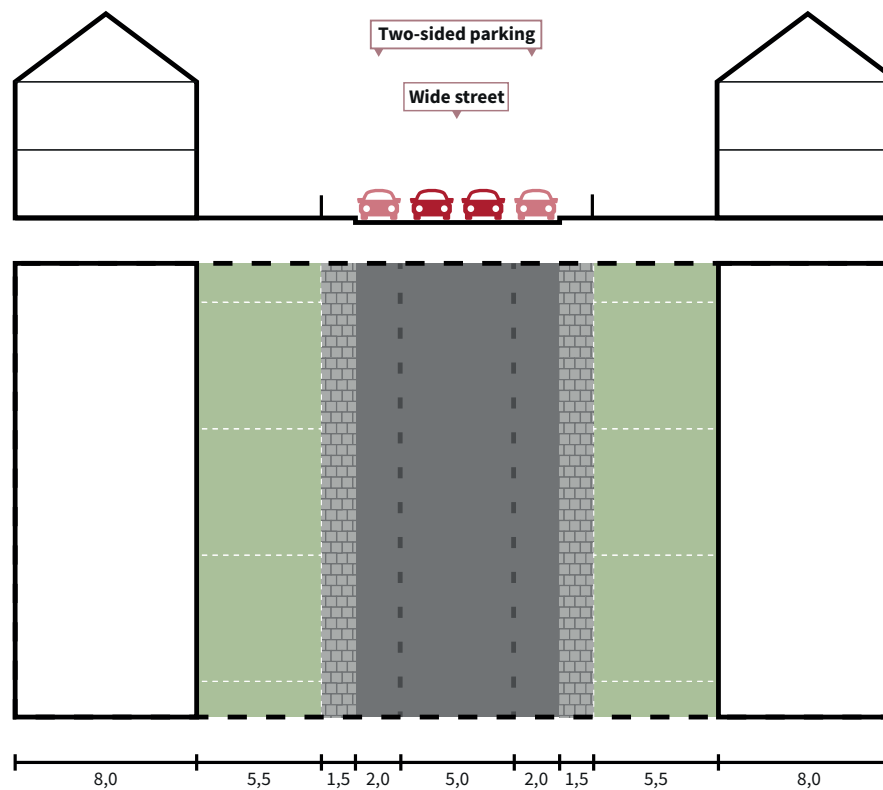
Introduction  
Frameworks  
Analysis  
Spatial design  
**Timeframe**  
Conclusion



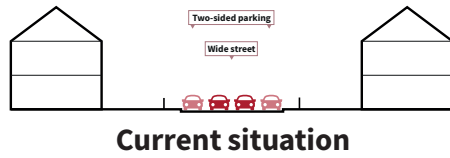
## Time frame



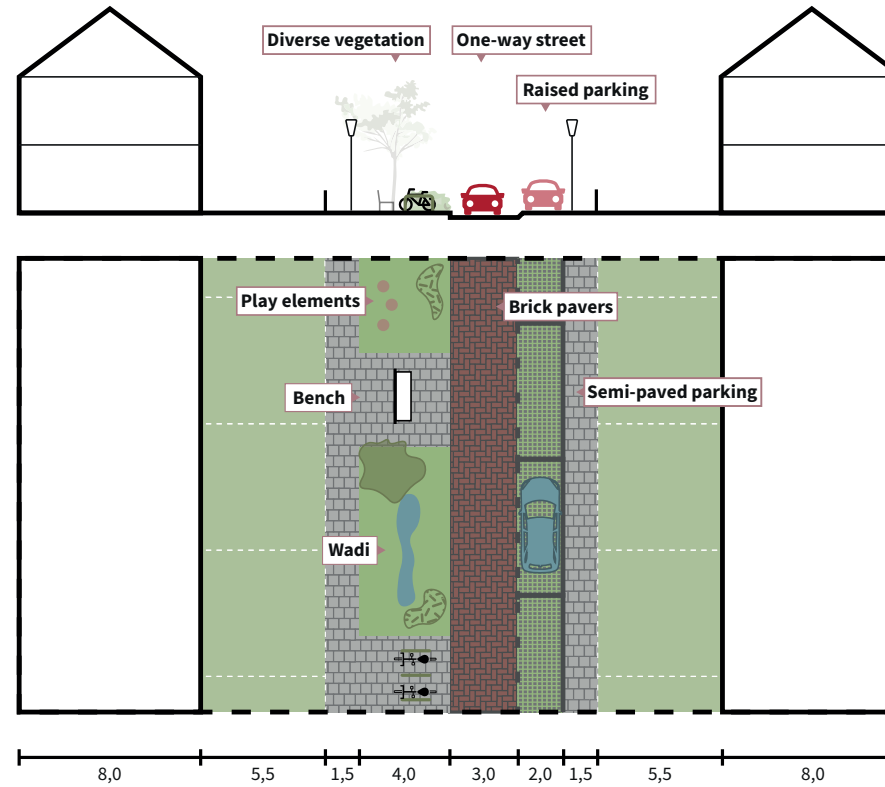
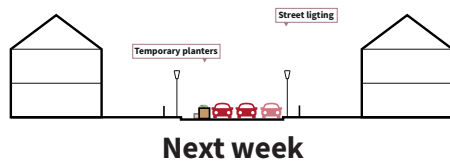
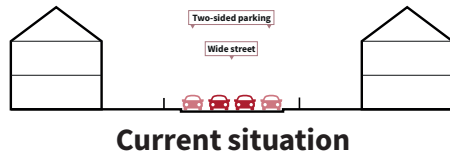
## Current situation



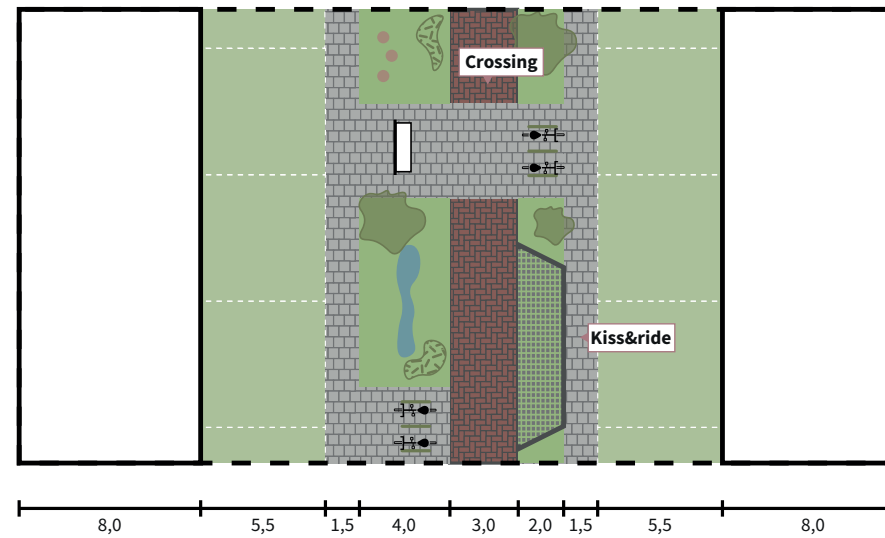
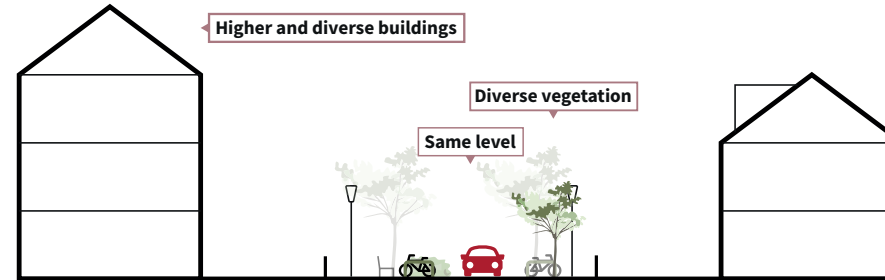
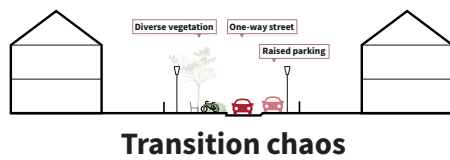
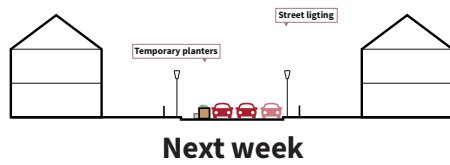
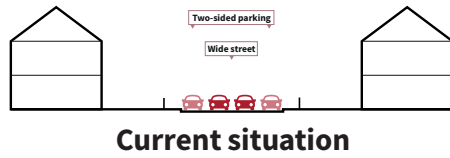
## Next week



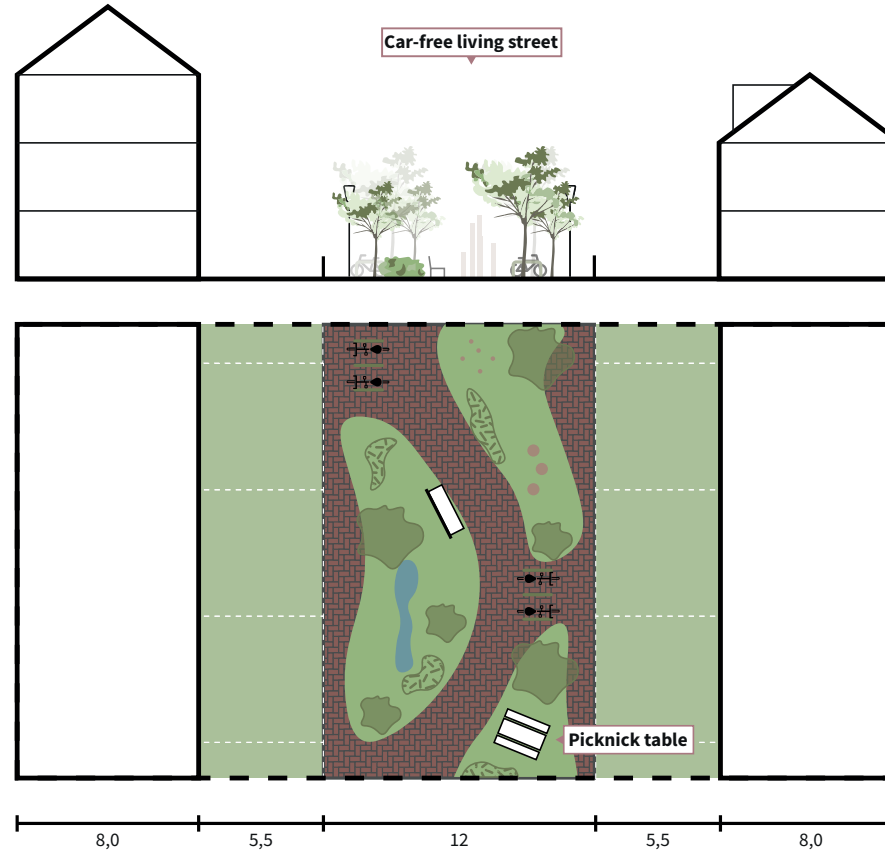
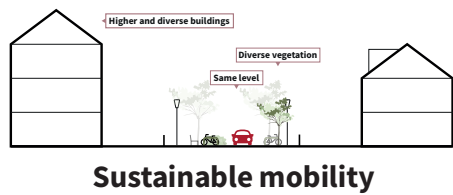
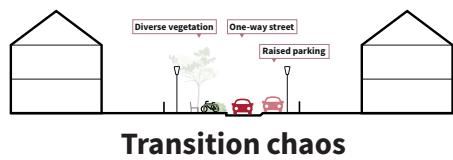
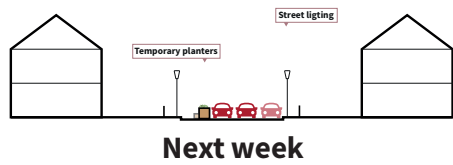
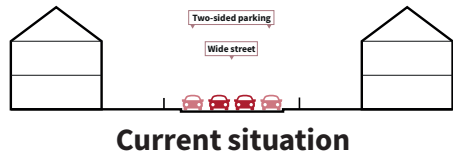
## Transition chaos



# Sustainable mobility



# Car-free

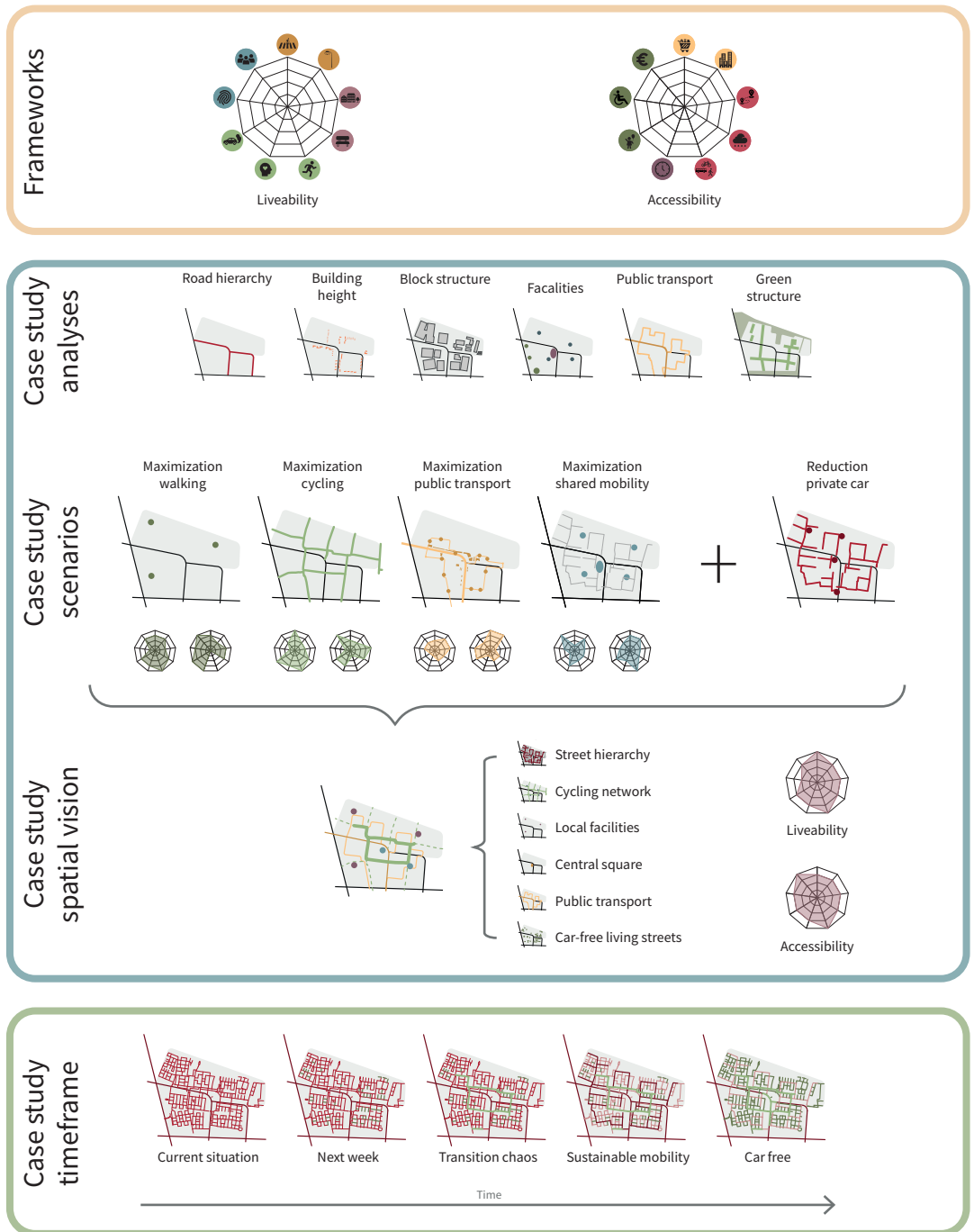


Introduction  
Frameworks  
Analysis  
Spatial design  
Timeframe  
**Conclusion**



# Conclusion

**RQ: How can sustainable mobility improve liveability and accessibility in post-war neighbourhoods through spatial design, both now and in the future?**



# From Streets ...



# From Streets to Spaces

