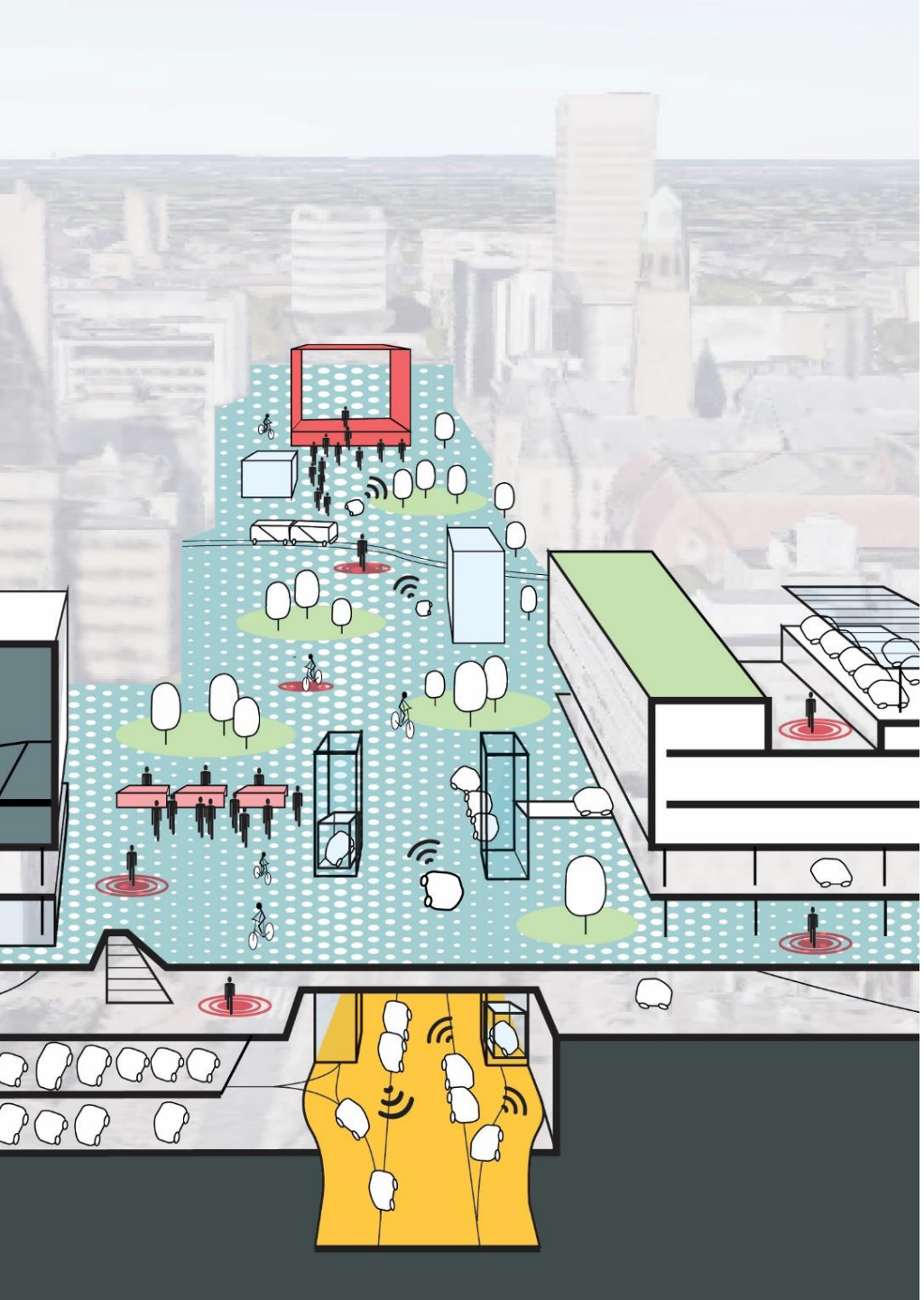


Self-driven MRDH

A Method to Assess the Impact of Automated Vehicles on Urban Liveability in the Rotterdam The Hague Metropolitan Region

Vincent Babeș

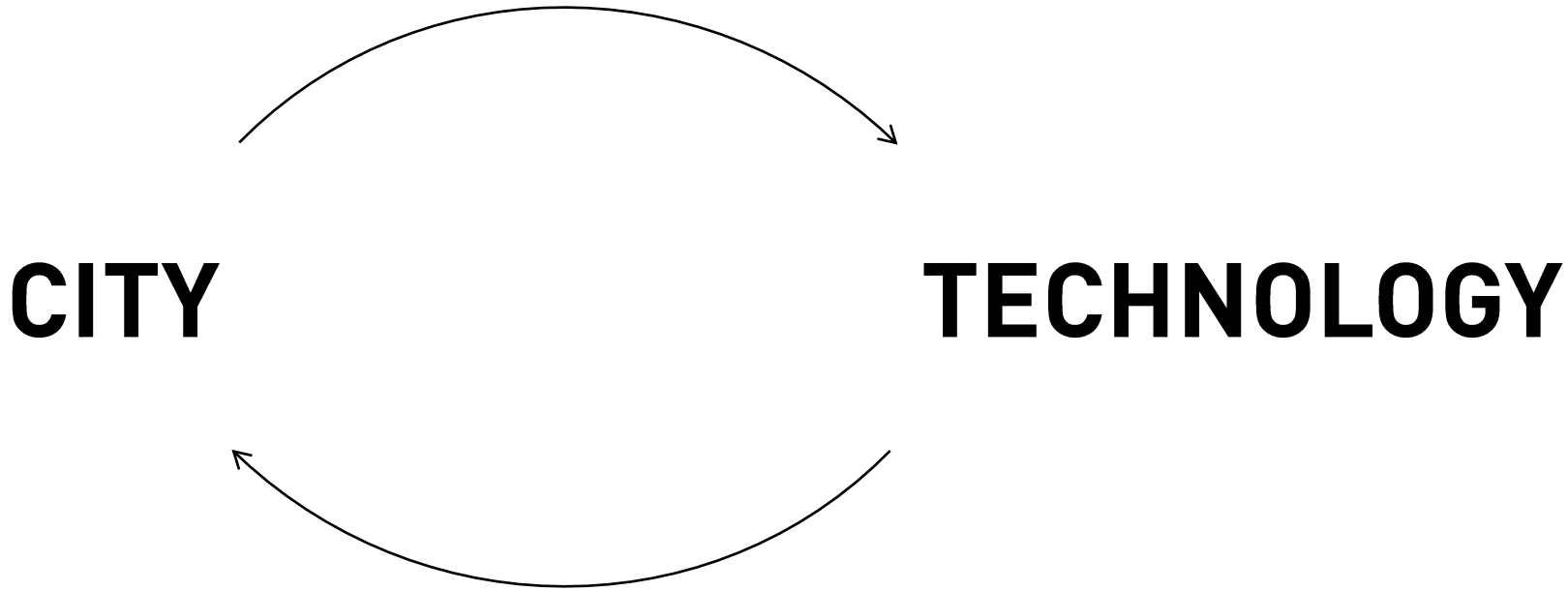
European Post-Master in Urbanism / P5 presentation / 26 June 2017

Mentors: Alexander Wandl, Luisa Calabrese, Paola Pellegrini

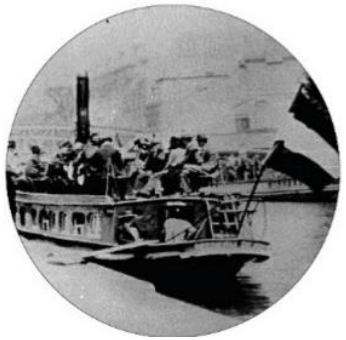
EMU URBANISM

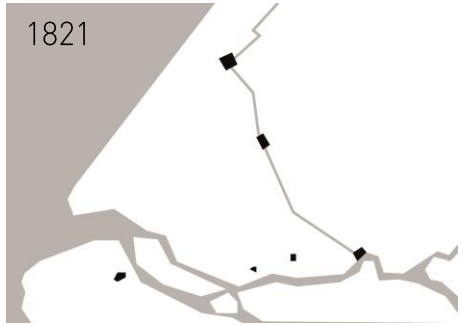
TU Delft Delft University of Technology

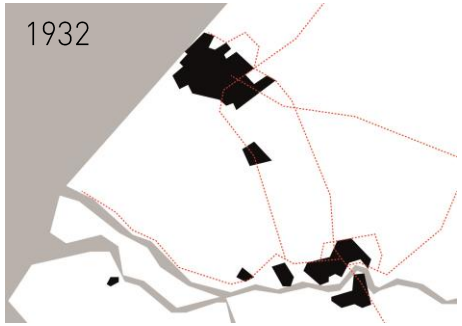
Hypothesis

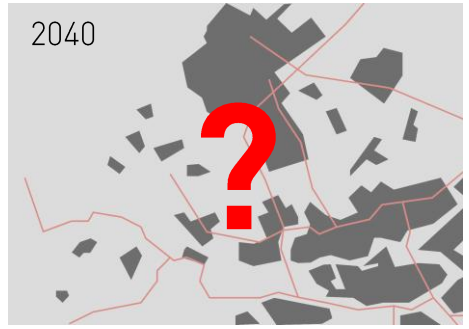


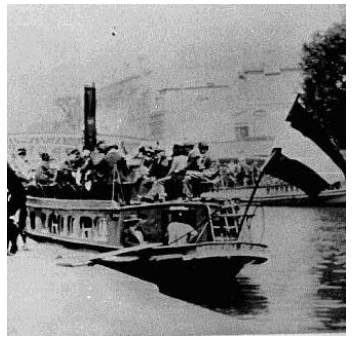
Mobility and the city. Automated vehicles, the next disruption?











Sources:
www.tijdreis.nl
Google, Street View

Mobility and the city. Automated vehicles, the next disruption?

+

SAFETY

AUTONOMY

TIME VALUE

SHARING

LESS PARKING SPACE

LOWER EMMISSIONS

-

URBAN SPRAWL

ENERGY USE

ETHICS

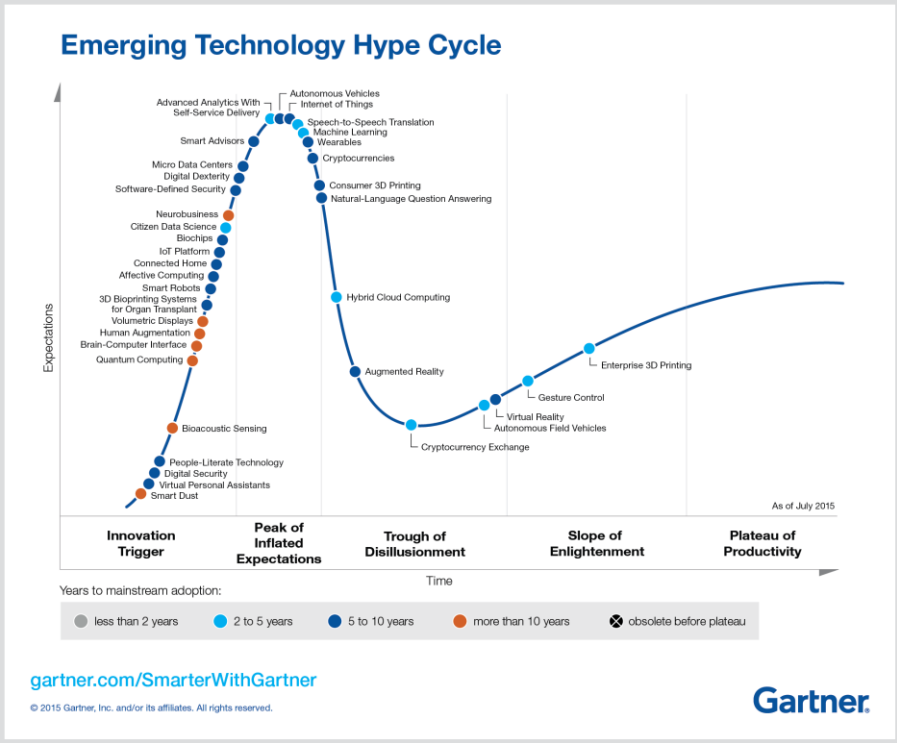
HEALTH

JOBS

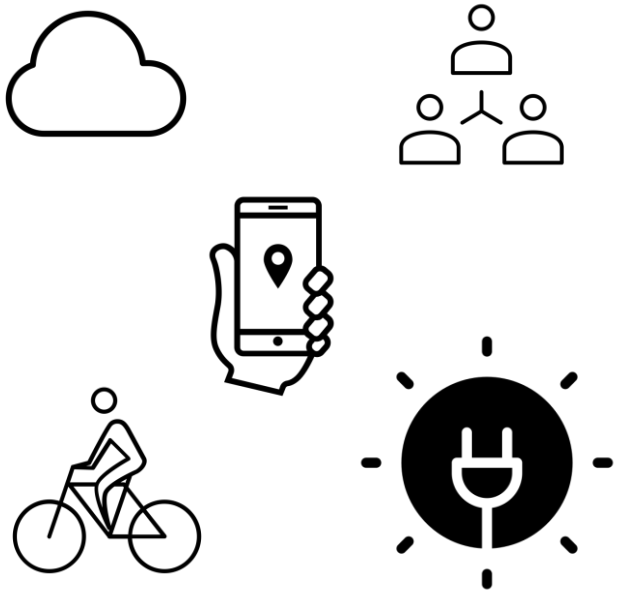
Sources:
Policy and society related implications of automated driving: a a review of literature and directions for future research, Milakis et al, TU Delft, 2015
Smart Mobility and Societal Challenges: an implementation perspective, Jeekel JF, TU Eindhoven, 2016
Social desirability and mobility impacts of early forms of automated vehicles, Pulyaert S, TNO/TU Delft, 2016

Scientific and societal relevance

Development



Mobility trends



Societal impact

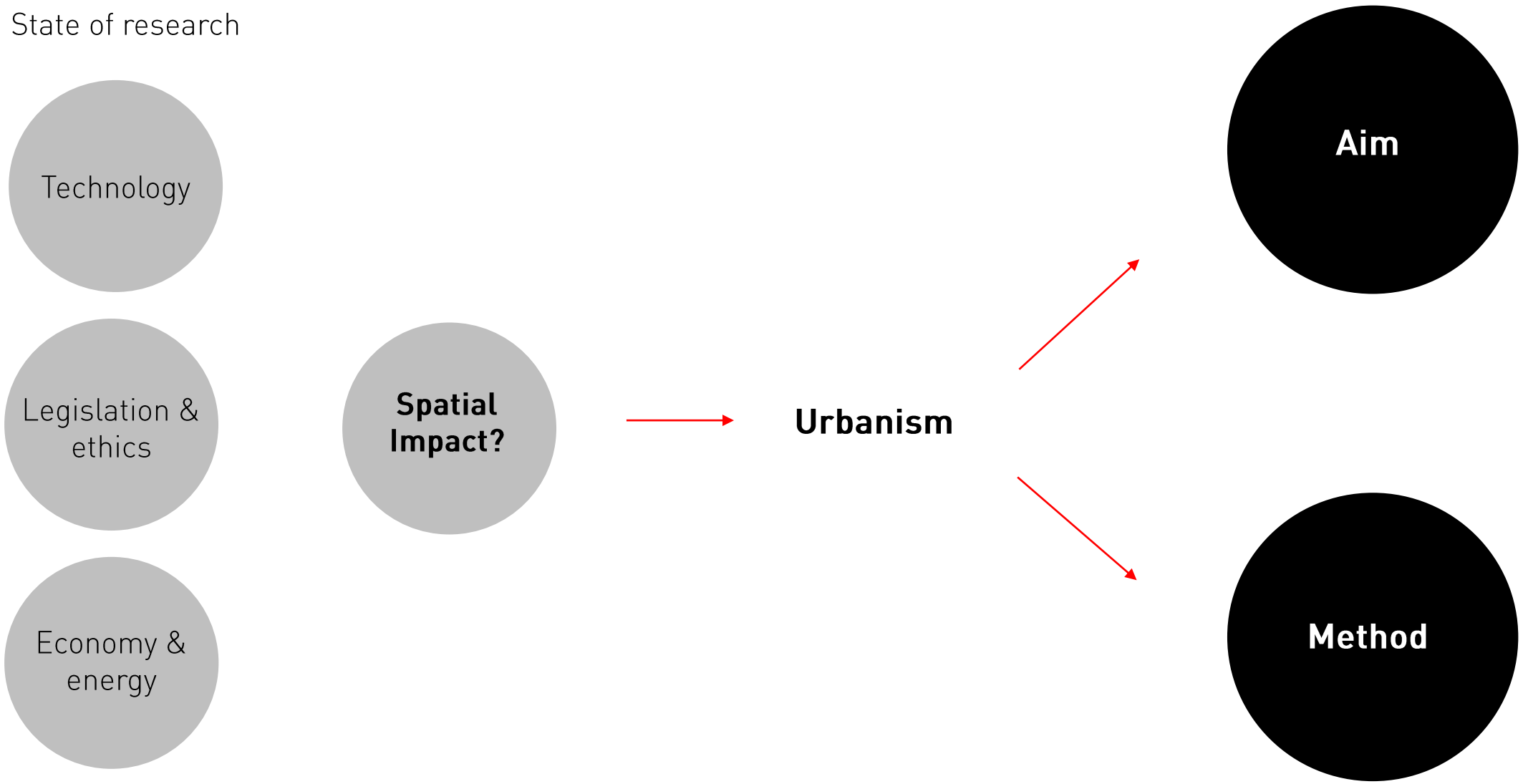
Sources:
www.gartner.com
Artificial Intelligence and Life in 2030, Report of the 2015 Study Panel, Stanford University
Smart Mobility and Societal Challenges: an implementation perspective, Jeekel JF, TU Eindhoven, 2016
Social desirability and mobility impacts of early forms of automated vehicles, Pulyaert S, TNO/TU Delft, 2016

Problem statement

Despite the potentially important positive and negative effects of automated vehicles on mobility and human life in general, their spatial impacts represent a research gap which must be addressed.

Where does the urbanist stand?

State of research

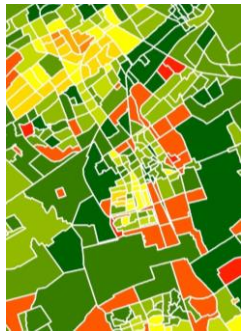


Sources:
Farah, H (2016) *State of Art on Infrastructure for Automated Vehicles*
Milakis, D, van Arem, B & van Wee, B (2017) "Policy and society related implications of automated driving: a review of literature and directions for future research"

Aims. Definitions of liveability

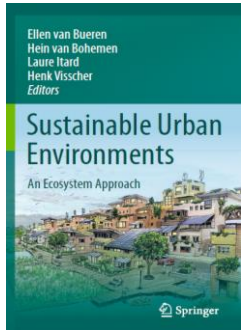
Administrative

Amount of housing
Distance to jobs
Crime rate
Air pollution level



Academic definition

Contact with nature
Social encounter
Control & safety
Prosperity



Urban theory

Sidewalk width
Shading
Active ground floors

Sources:
www.leefbaarometer.nl
M. v. Dorst, Liveability, 2012
Downtown is for people, J. Jacobs, 1958
Cities for people, J. Gehl, 2010

Liveability evaluation criteria

Regional

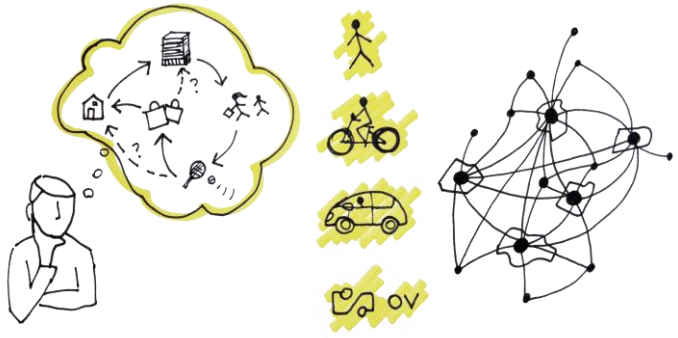
- Mobility performance & impact
- Built & natural environment
- Society & economy

Local

- Mobility performance & impact
- Built & natural environment
- Society & economy

Aims. Regional criteria of liveability

Mobility system:
Coverage, efficiency and modal choice
Reduced air and noise pollution

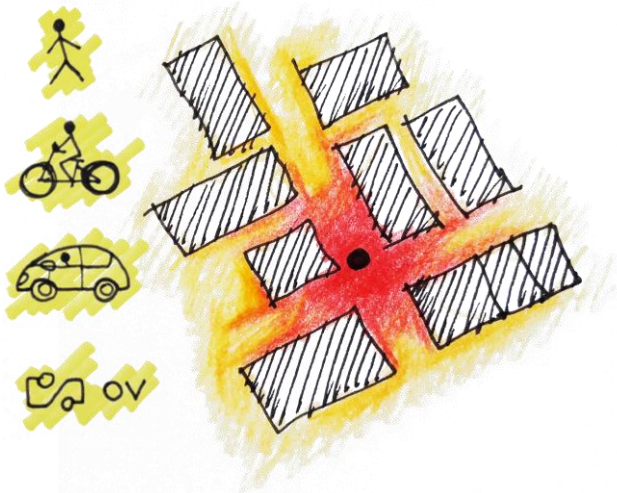


Contact with (open) nature

Housing and work premises:
sufficient and diverse (type, location)

Aims. Local criteria of liveability

Accessibility and spatial integration



Contact with nature next to home and work

Spaces for socio-economic encounter

Control and safety

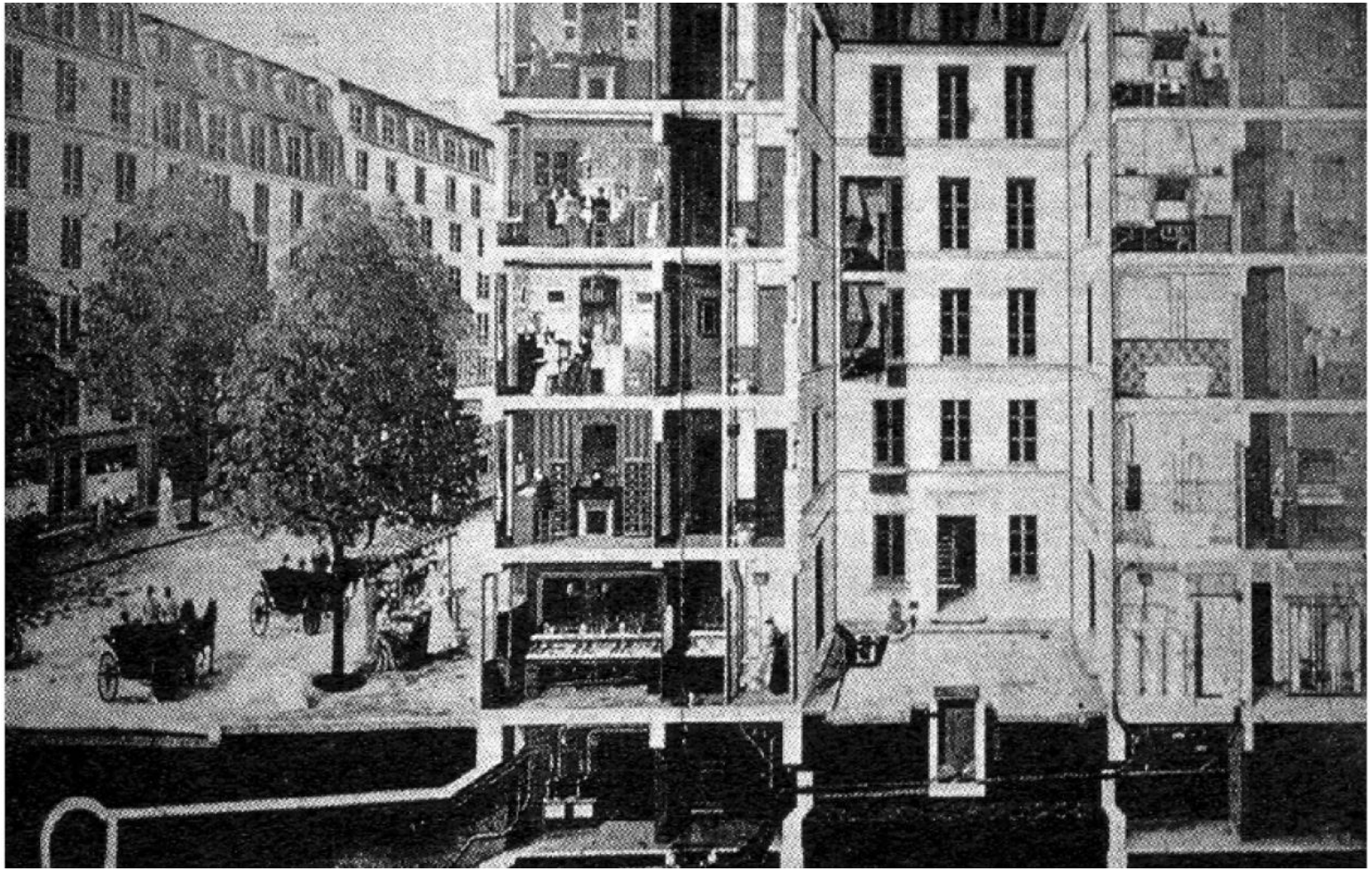
How can we assess the impact of automated vehicles on urban liveability through instruments specific to urbanism?

What directions of research, design and policy should be followed in the future in order to enhance urban liveability in the context of automated vehicle adoption?

Are the tools specific to urbanism useful to assess the impact of automated vehicles on the urban environment?

How can the urbanist/architect be ahead of the times by imagining the living environments and lifestyles resulting from technological innovation?

Building a method. Foresight and through-sight

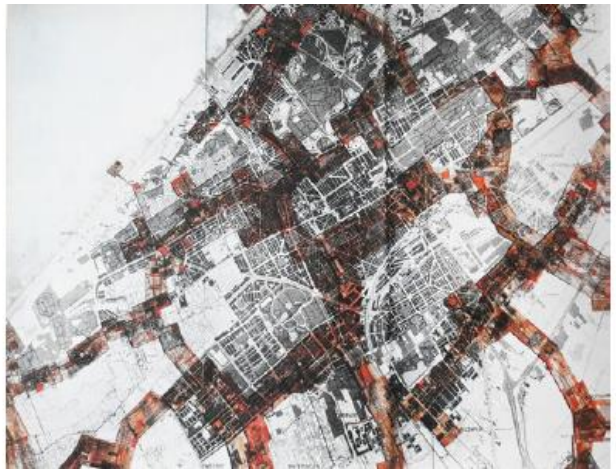


Haussmann, Boulevard cross-section in Plan for Paris, 1859.

Sources:
Calabrese, LC (2004), Reweaving UMA

Building a method. Scenario construction

- Recognised method to imagine the future
- In the post-war Dutch planning tradition
- Analytical (Salewski)
- Radical proposal, background for discussion (Vettoretto)



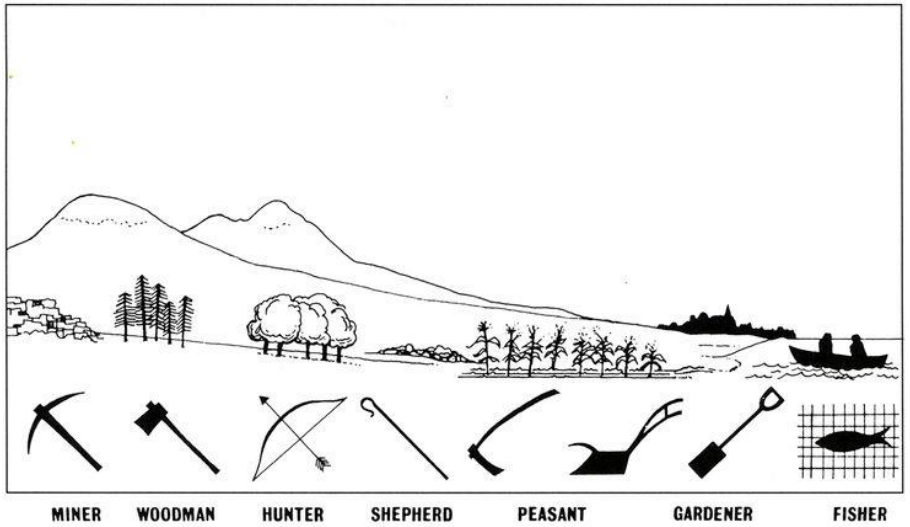


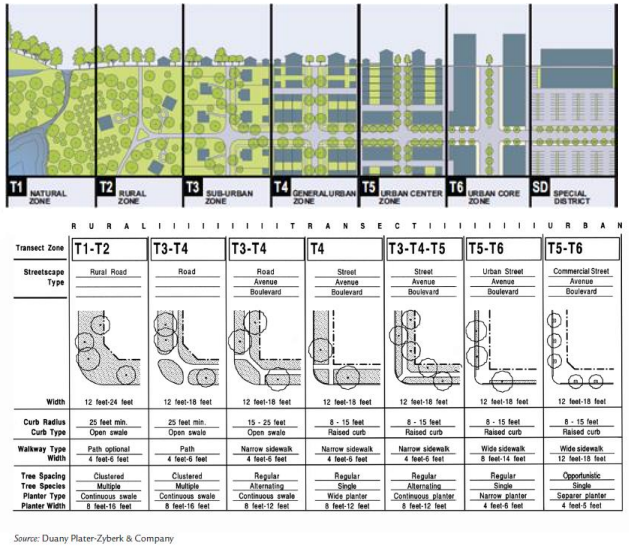
Sources:
Constant Nieuwenhuis, New Babylon / Den Haag, 1964. From Salewski, C (2012). Dutch New Worlds. Scenarios in Physical Planning and Design in the Netherlands, 1970-2000, 010 Uitgewerij, Rotterdam
VROM Atelier Randstad 2040, One Architecture, Matthijs Bouw, Randstad 2040, 2008: Kuststad / Coast City. idem.
AIR-Alexander, OMA, New Urban Friontiers, 1993: Point City and South City. idem.

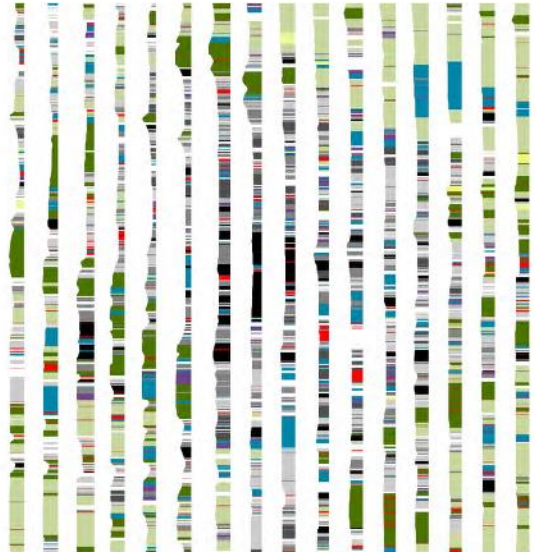
Salewski, C (2012) Dutch New Worlds. Scenarios in Physical Planning and Design in the Netherlands, 1970-2000
Vettoretto, L (2003) Scenarios: an introduction, some case studies and some research prospects, Universita Iuav di Venezia.

Building a method. Transect analysis

- Recognised territorial analysis method
- Geddes: valley section
- Duany: Smart codes



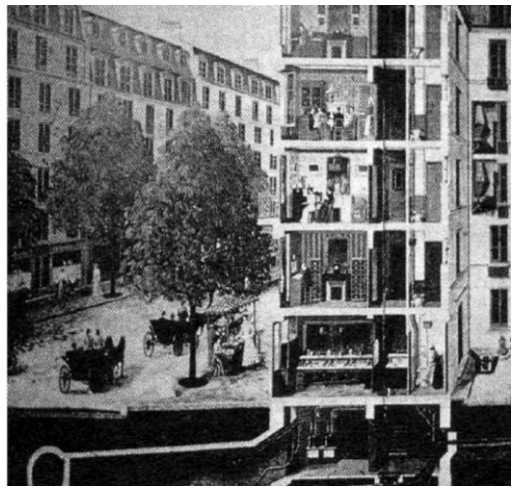


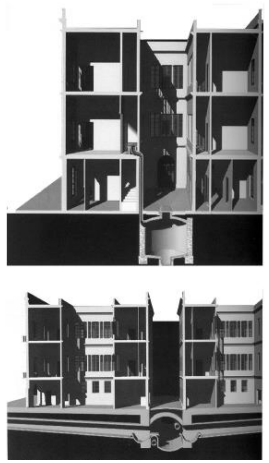


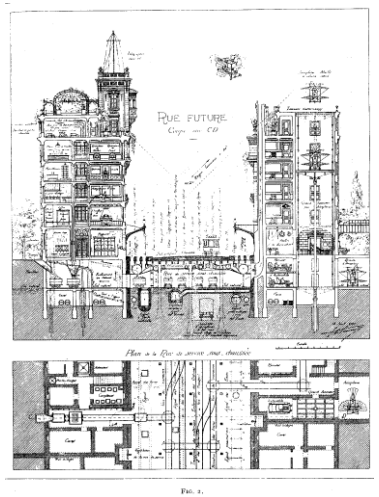
Sources:

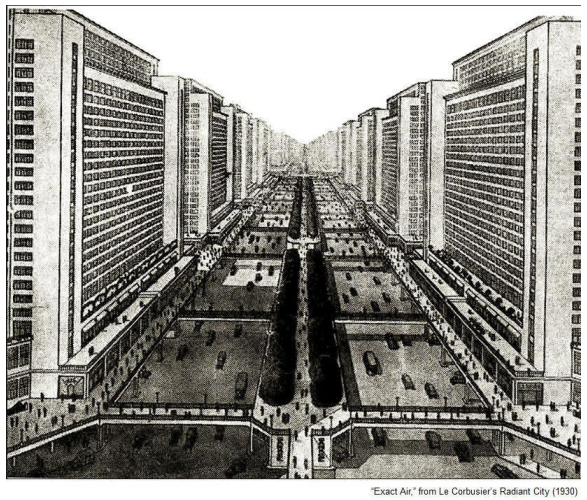
Duany, A & Talen, E (2002) "Transect Planning"
Secchi, B & Viganò, P (2009) La ville poreuse: chantier 2, competition entry project, Atelier International du Grand Paris

Building a method. Visionary urban sections







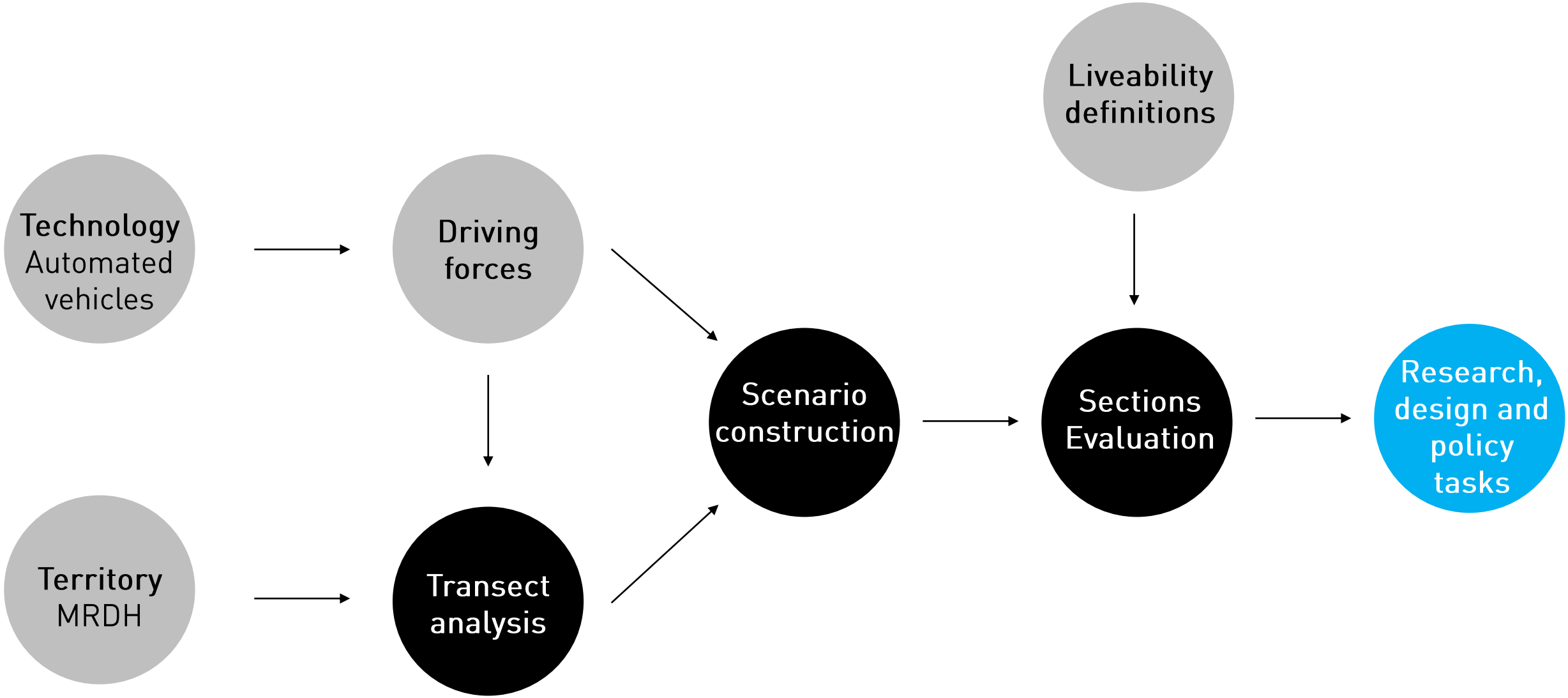


"Exact Air," from Le Corbusier's Radiant City (1930)

Sources:

George-Eugene Haussmann, Plan for Paris, (1853-1877), boulevard and building section. From Calabrese, LC (2004). Reweaving UMA Ildefons Cerda, Enlargement plan for Barcelona, 1859, typical section. idem.
Eugene Henard, Rue Future, 1911. From Lewis, P, Tsurumaki, M & Lewis, DJ (2016). Manual of section, Princeton Architectural Press, New York.
Harvey Wiley Corbett, City of the Future, 1913. From Lewis, P, Tsurumaki, M & Lewis, DJ (2016). Manual of section, Princeton Architectural Press, New York.
Le Corbusier, Ville Radieuse 1930. From Calabrese, LC (2004). Reweaving UMA.

Building a method. Foresight and through-sight



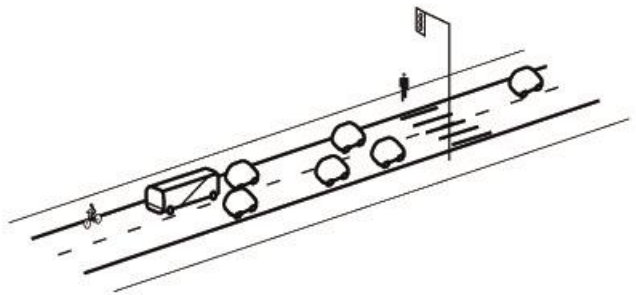
Automated vehicles. Literature review

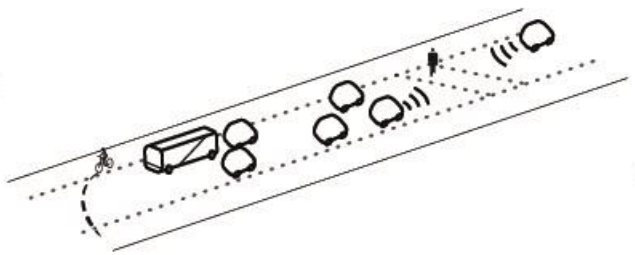
- Level 5 automation: technology is in control in all cases
- Foreseen introduction in the Netherlands in 2025, largely available in 2040
- Spatial impacts: road, networks, fields

Sources:
Development of automated vehicles in the Netherlands: scenarios for 2030 and 2050, Milakis et al, TU Delft, 2016
Autonomous driving and urban land use, Heinrichs, 2016
Policy and society related implications of automated driving: a a review of literature and directions for future research, Milakis et al, TU Delft, 2015
Smart Mobility and Societal Challenges: an implementation perspective, Jeekel JF, TU Eindhoven, 2016
Social desirability and mobility impacts of early forms of automated vehicles, Pulyaert S, TNO/TU Delft, 2016
Farah, H (2016) *State of Art on Infrastructure for Automated Vehicles*

Automated vehicles. Spatial impacts on roads

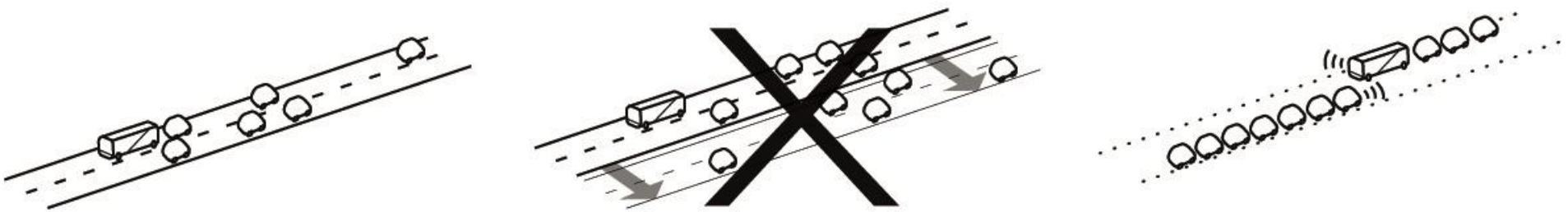
safety and public space quality
smart sensoring
shared space
dynamic street management





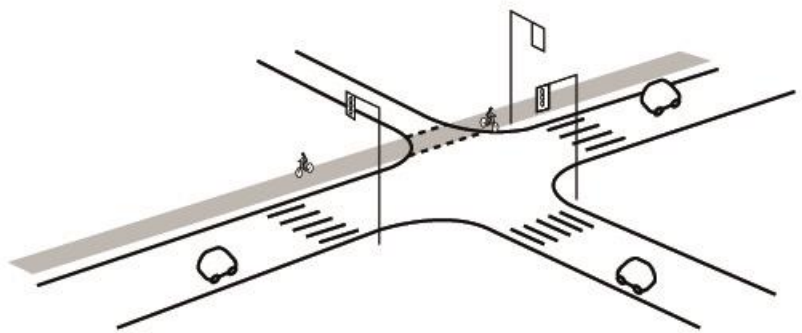
Automated vehicles. Spatial impacts on roads

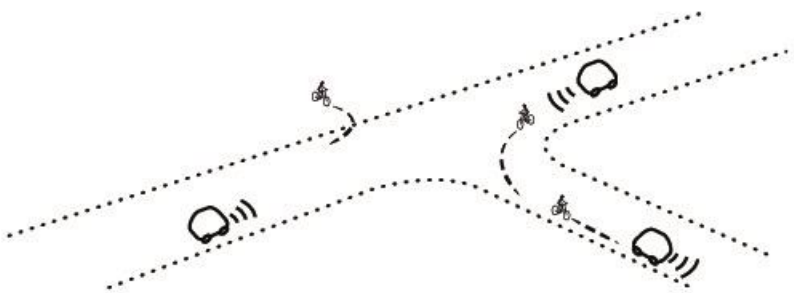
road capacity
high intensity traffic in the same road space



Automated vehicles. Spatial impacts on roads

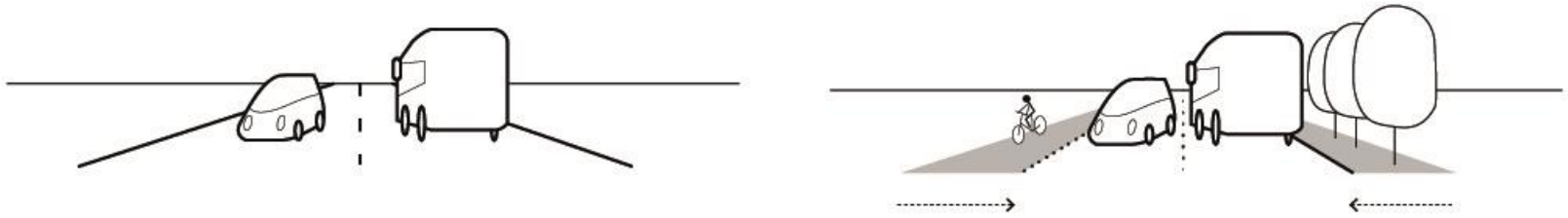
intersection management
smart sensoring





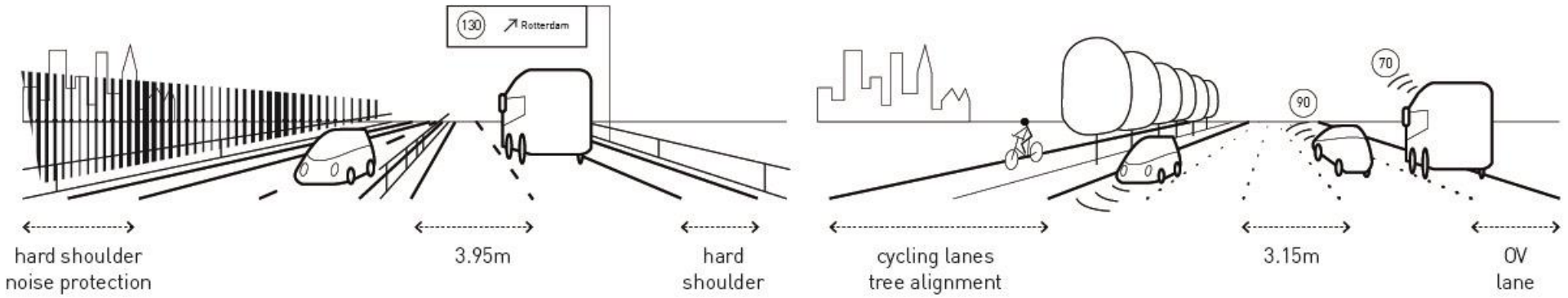
road profiles: provincial road

new design opportunities through narrower lanes



Automated vehicles. Spatial impacts on roads

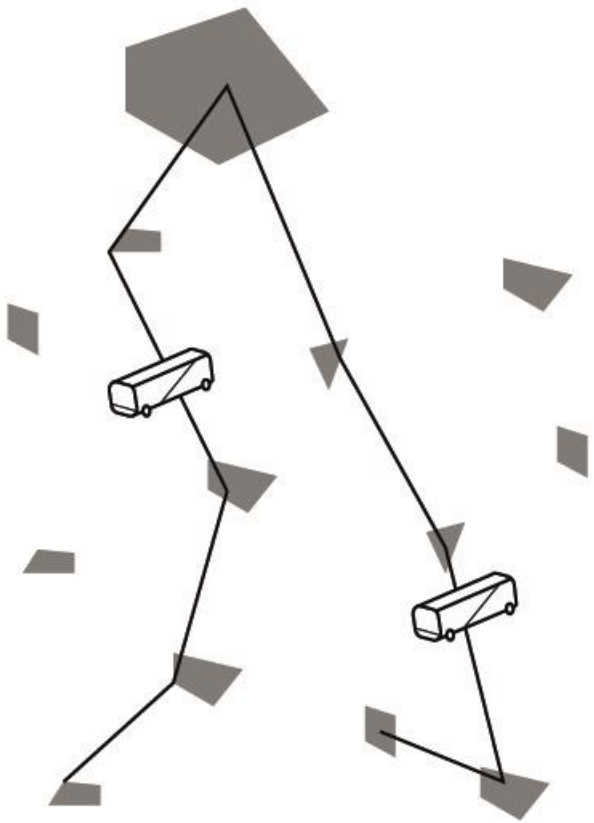
road profiles: motorway
lower investment
less pollution
sharing
active mobility
landscape integration

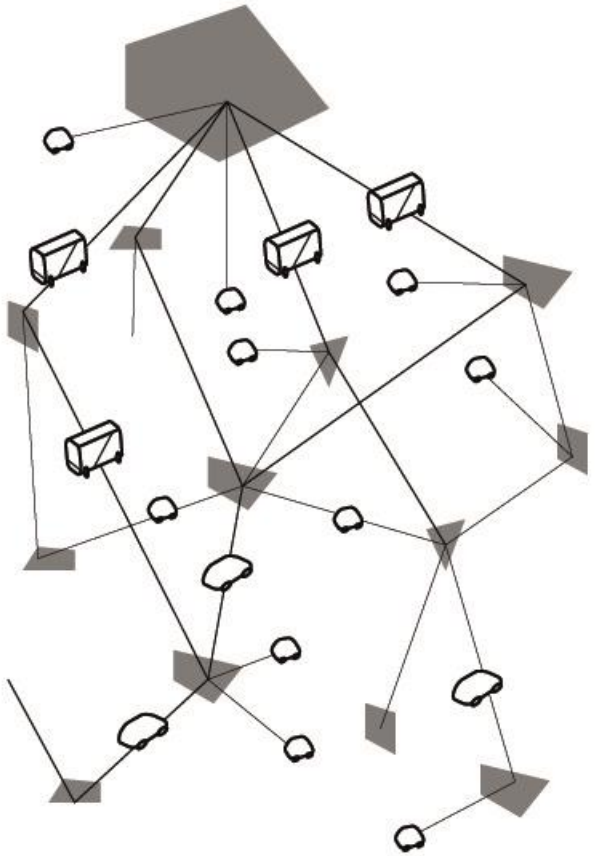


Automated vehicles. Spatial impacts on networks

public transport in low density areas

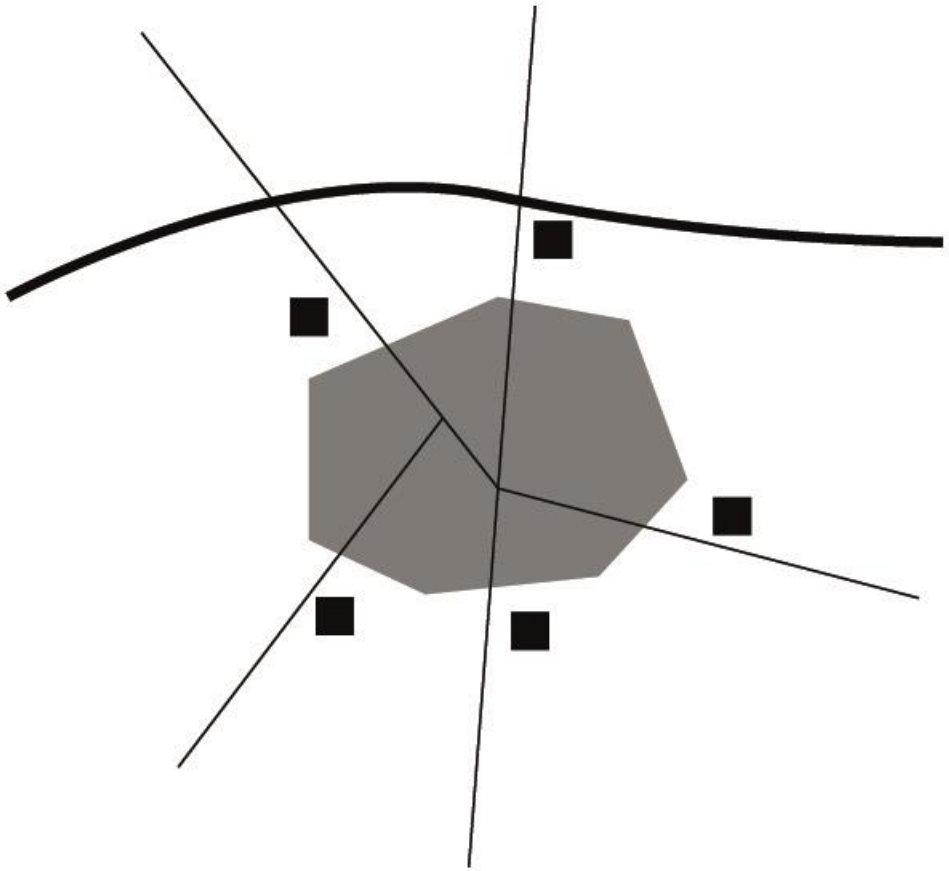
on-demand and economically sustainable coverage of rural areas

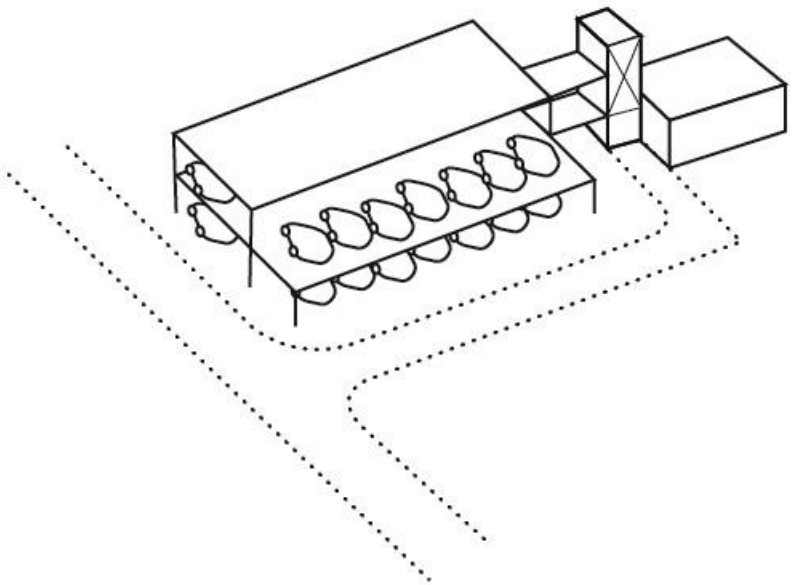




Automated vehicles. Spatial impacts on networks

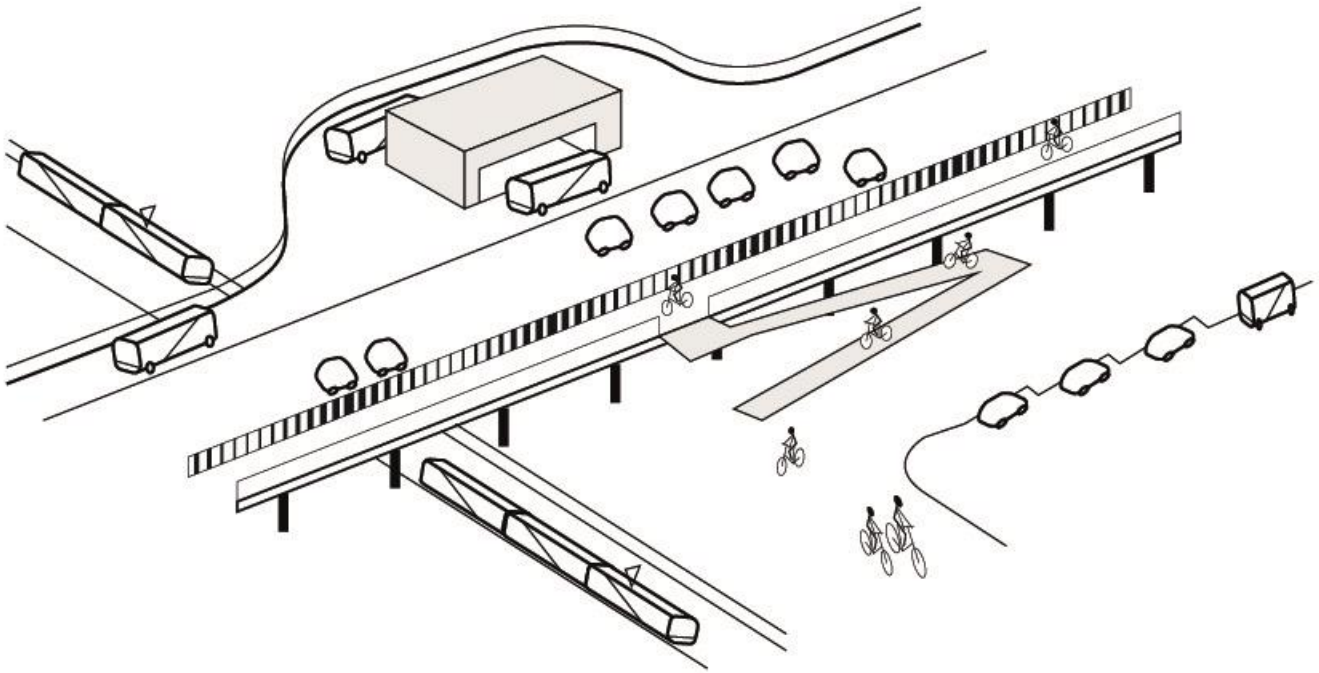
parking racks & service points
self-parking for cars on cheap land





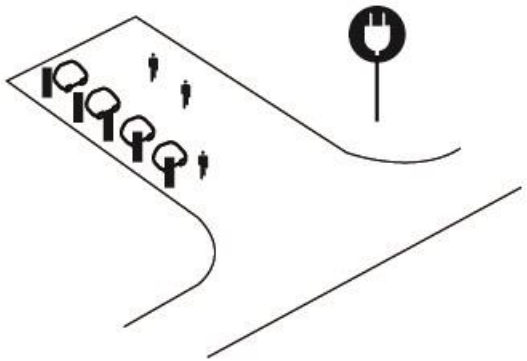
multimodal hubs

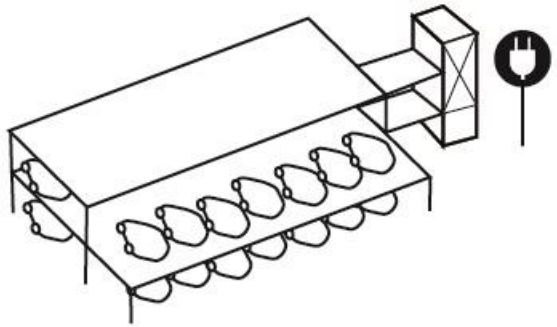
synergy of high and low intensity transport modes
transfer from long distance to local active mobility

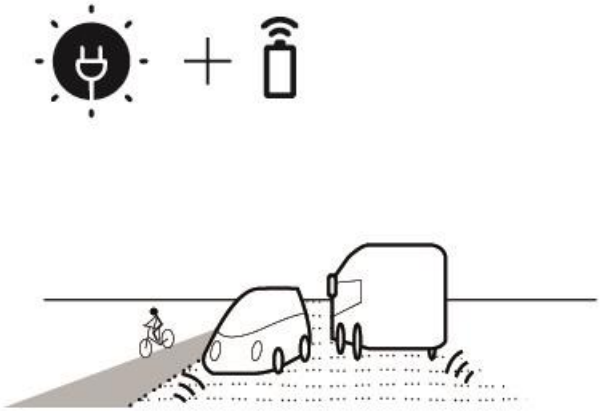


Automated vehicles. Spatial impacts on networks

energy
e-charging points
charging while parking
car as battery
solar roads with wireless charging

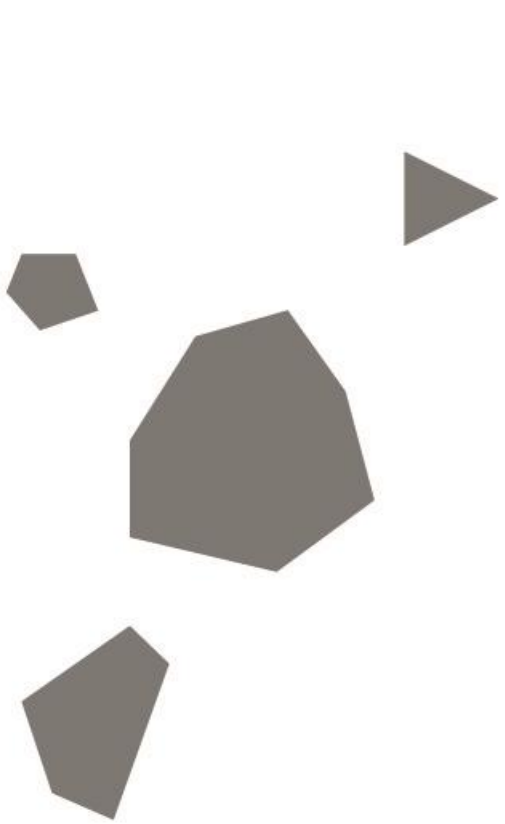


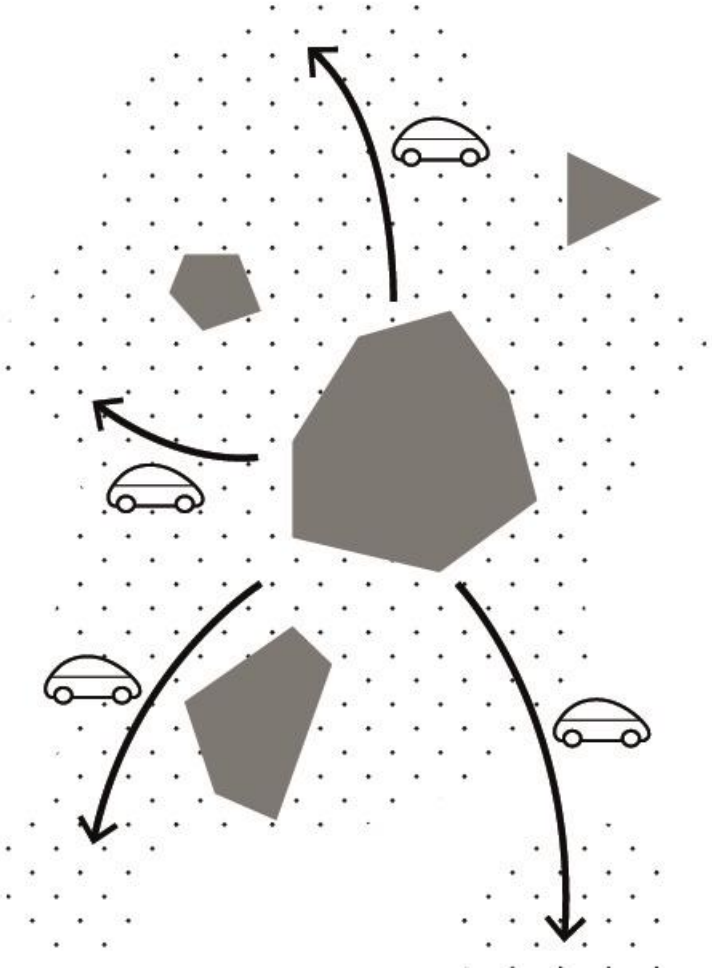




Automated vehicles. Spatial impacts on fields

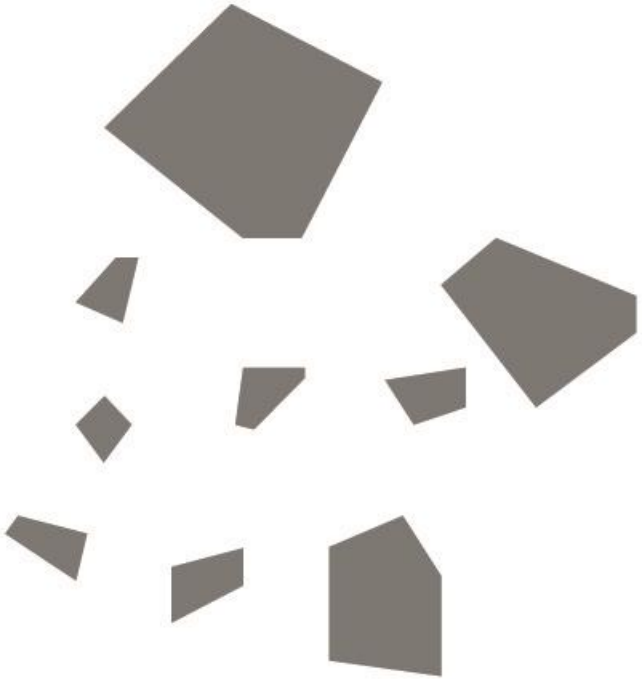
low-density development

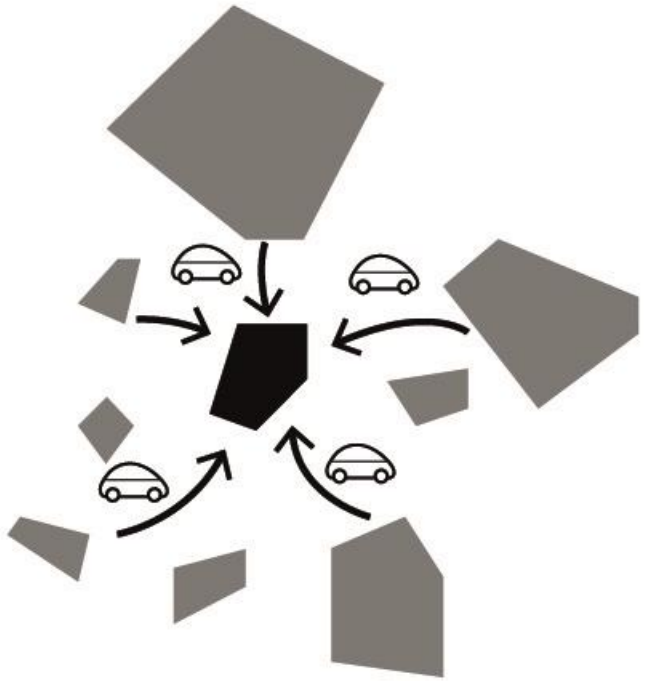




Automated vehicles. Spatial impacts on fields

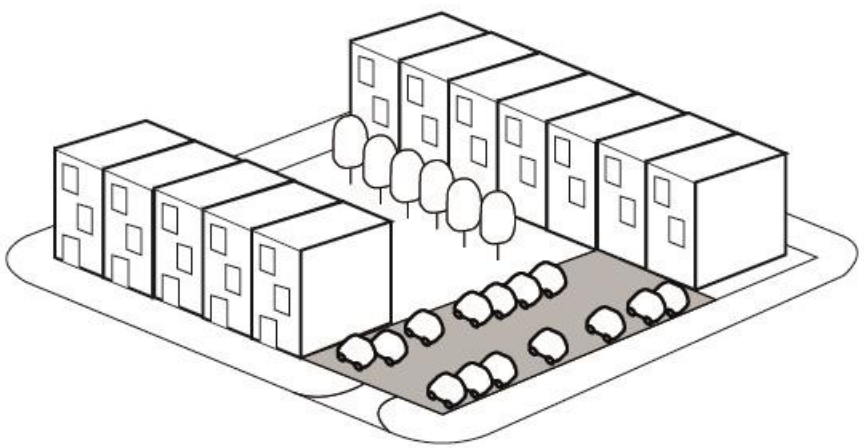
new centralities

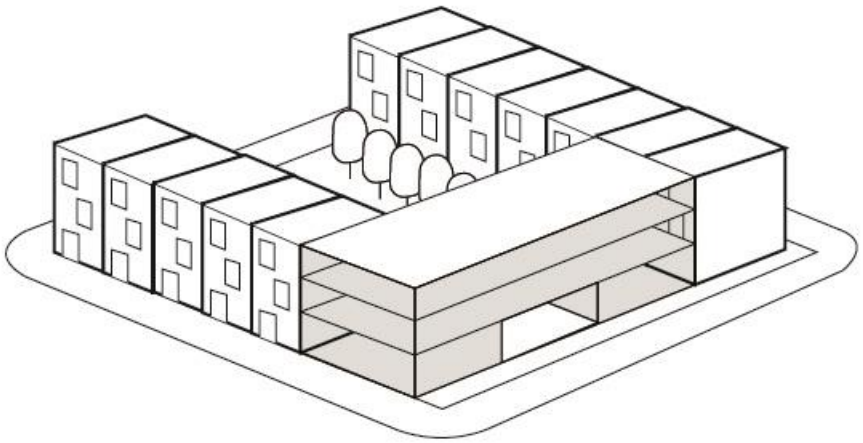




Automated vehicles. Spatial impacts on fields

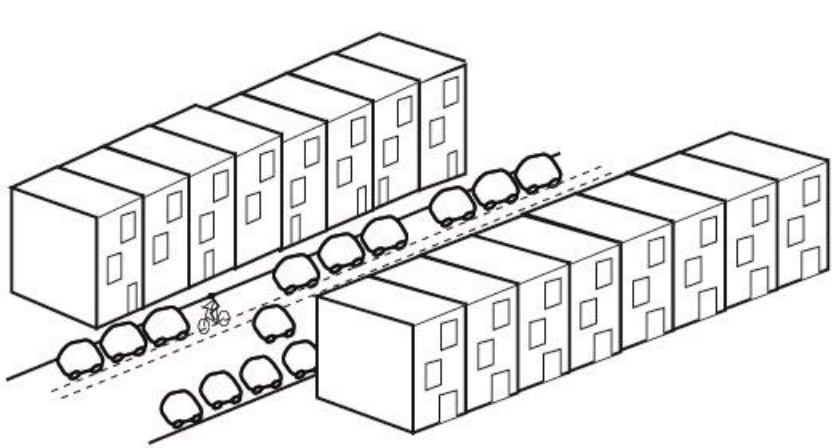
urban infill
less parking requirement enables higher density

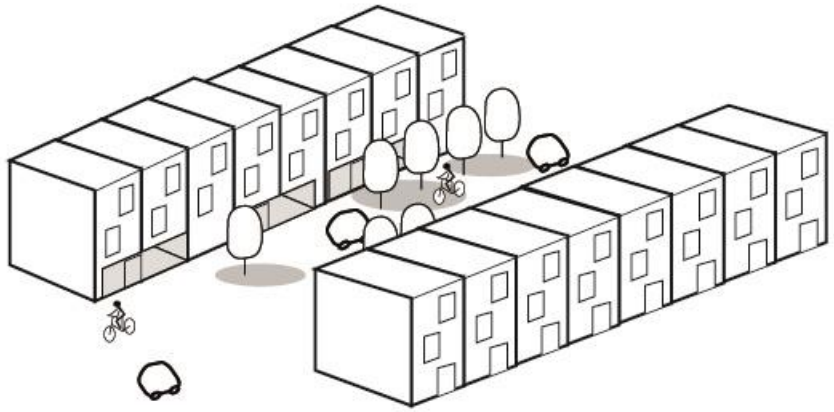




Automated vehicles. Spatial impacts on fields

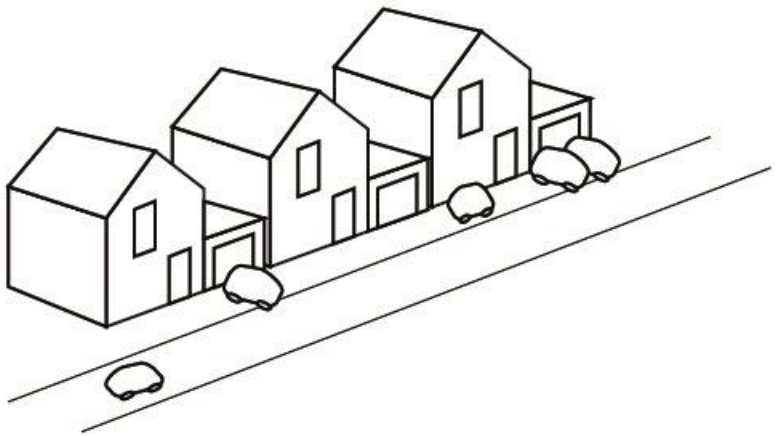
no on-street parking
active streetscape





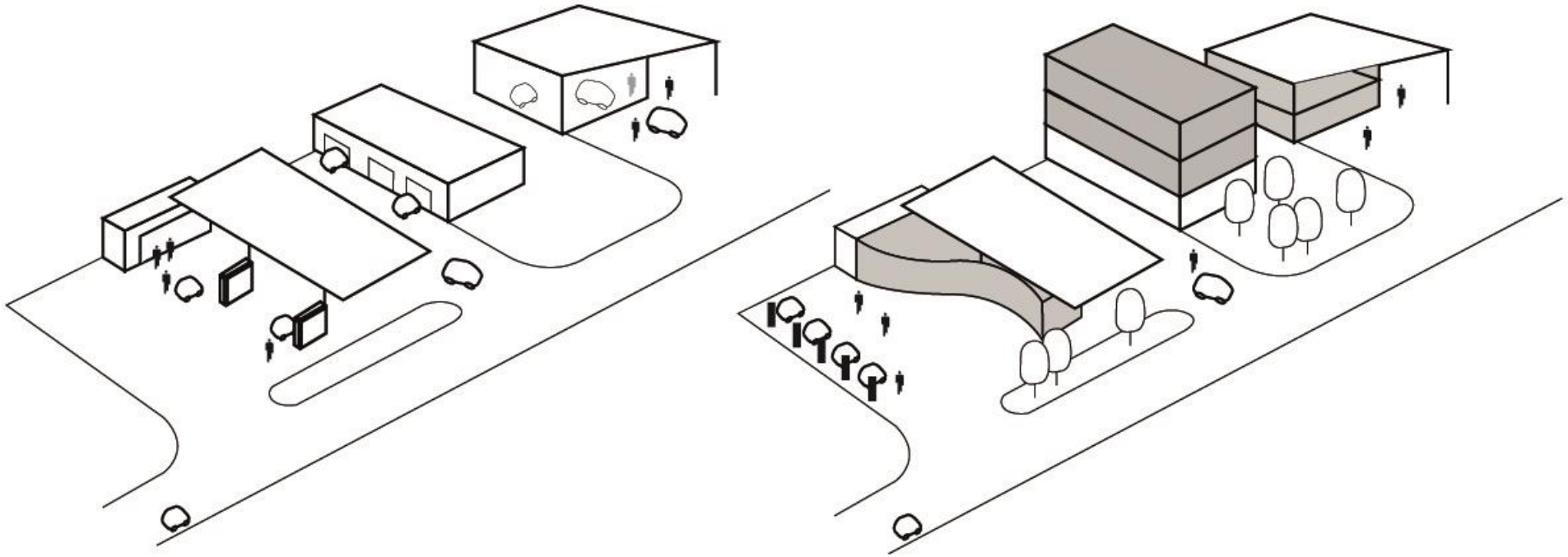
Automated vehicles. Spatial impacts on fields

residential parking reconversion
new uses in residential areas

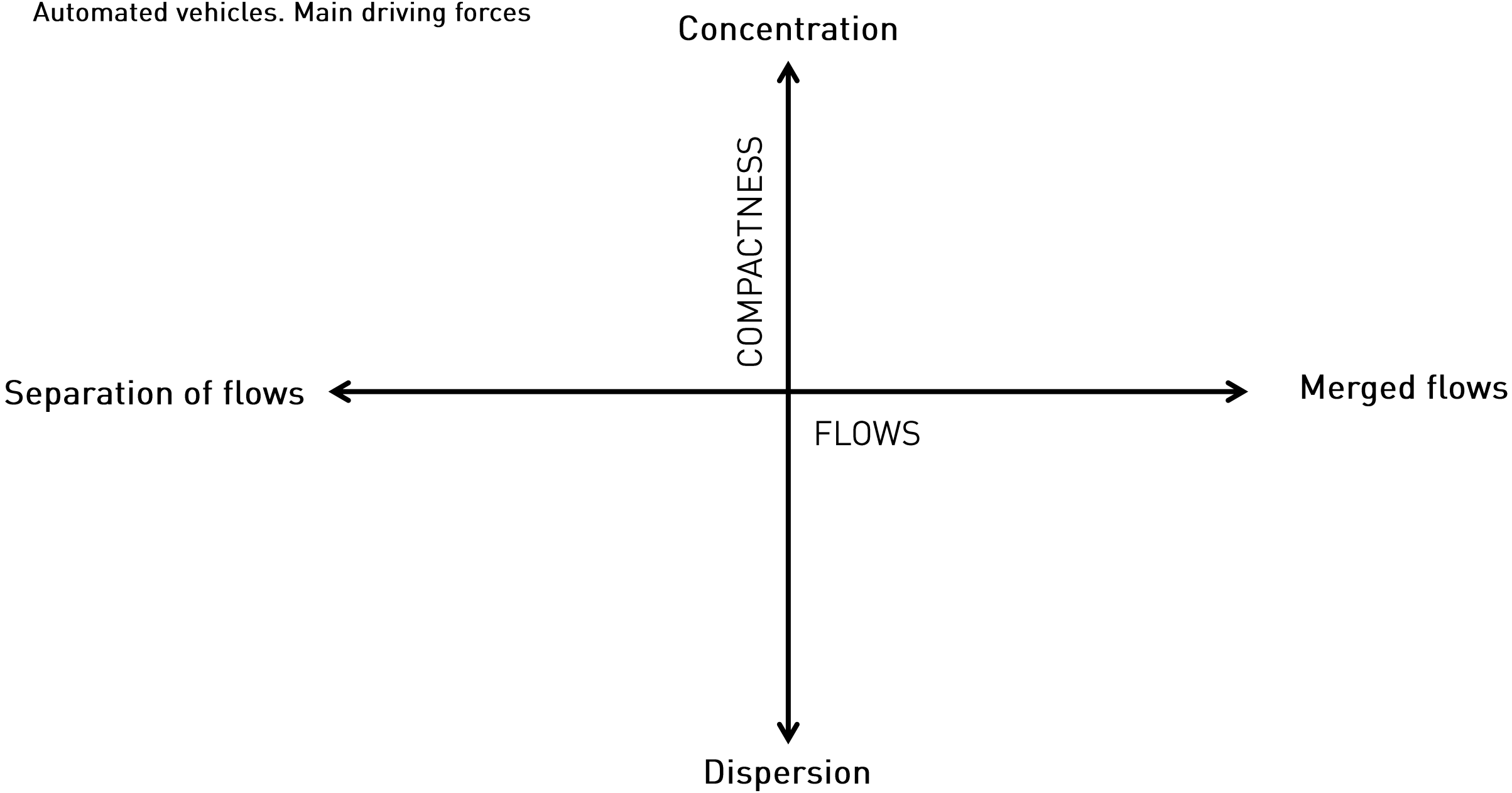


Automated vehicles. Spatial impacts on fields

car-related economy
restructuring of car-related economy
new uses in attractive areas



Automated vehicles. Main driving forces



MRDH. A dynamic region

2 244 159
inhabitants

2 246
people per 1 km²

23
municipalities

121 330
companies

170
GDP bn Euros

1165
total area km²

166 / 999
water / land km²

144
built km²

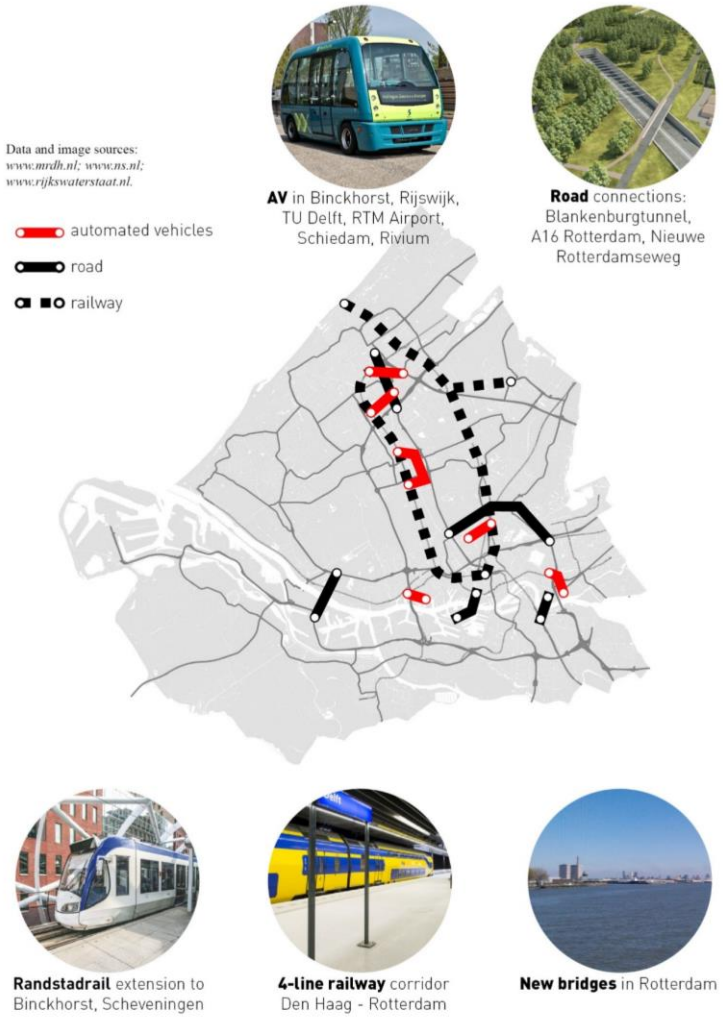
117
asphalt cover km²

Data sources: OECD Territorial Reviews, *Metropolitan Region Rotterdam The Hague*;
CBS, *Wijk- en Buurtkaart 2016;*
Kadaster Basisregistratie Topografie, *Top10NL.*

Map source: Google Earth Pro sattelite imagery.

MRDH. Trends of urbanisation and infrastructure

Networks



Fields

Urban expansion north of Rotterdam, aerial view, 2017. Photograph by author.

Urbanization after 2005. Data from Corine Land Cover 2012, CBS and code.waag.org

MRDH. Mapping the mobility landscapes





Images by author




MRDH. Spaces of cars on the move

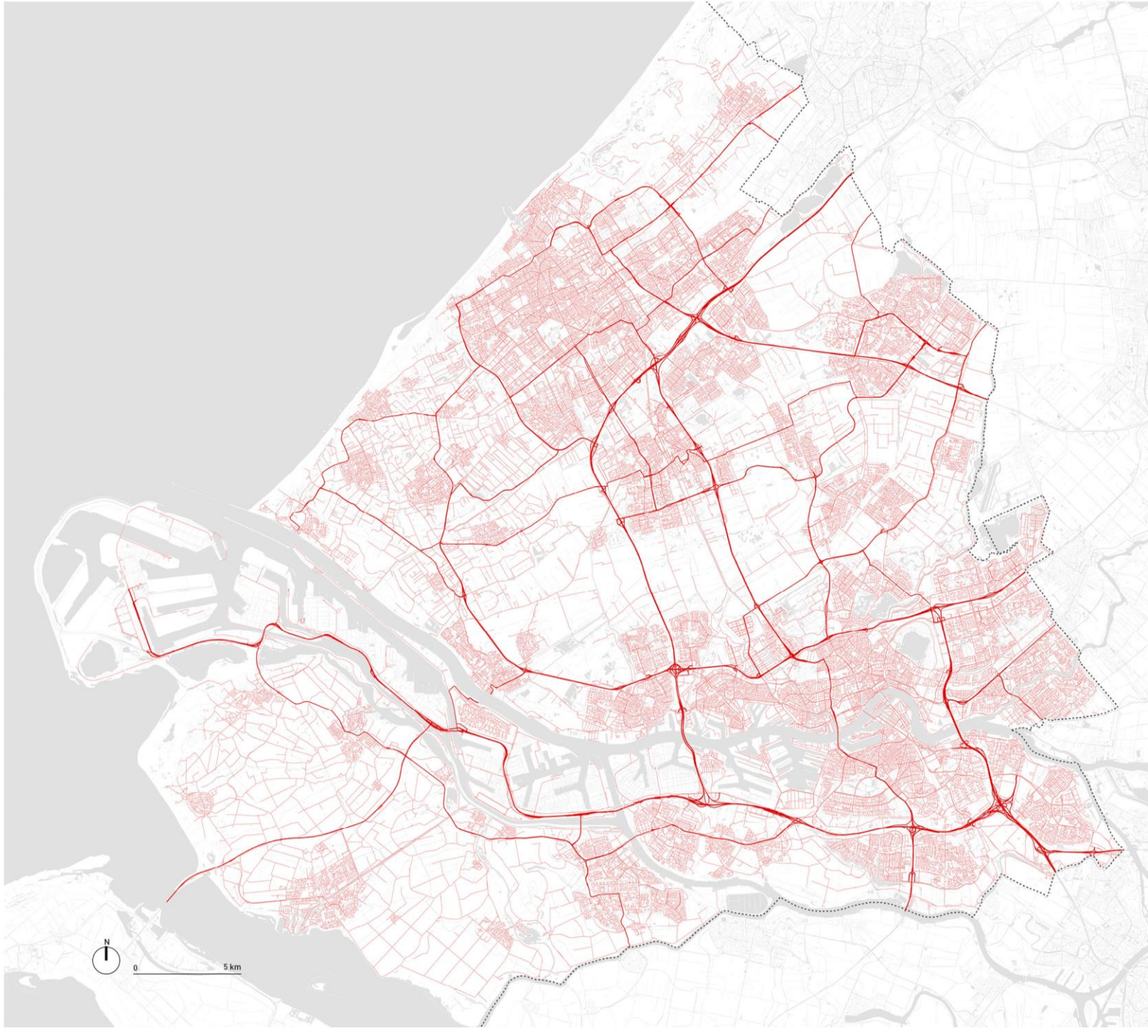
Main road network
Local streets

Main roads 490 km

Secondary roads and urban streets 7915 km

Road network 8405 km

Figure 86. Surfaces occupied by road type. Measured in GIS based on 'wegen_lijn' and 'wegen_vlak' layers from top10nl, CBS 2015.



MRDH. Spaces of cars idle

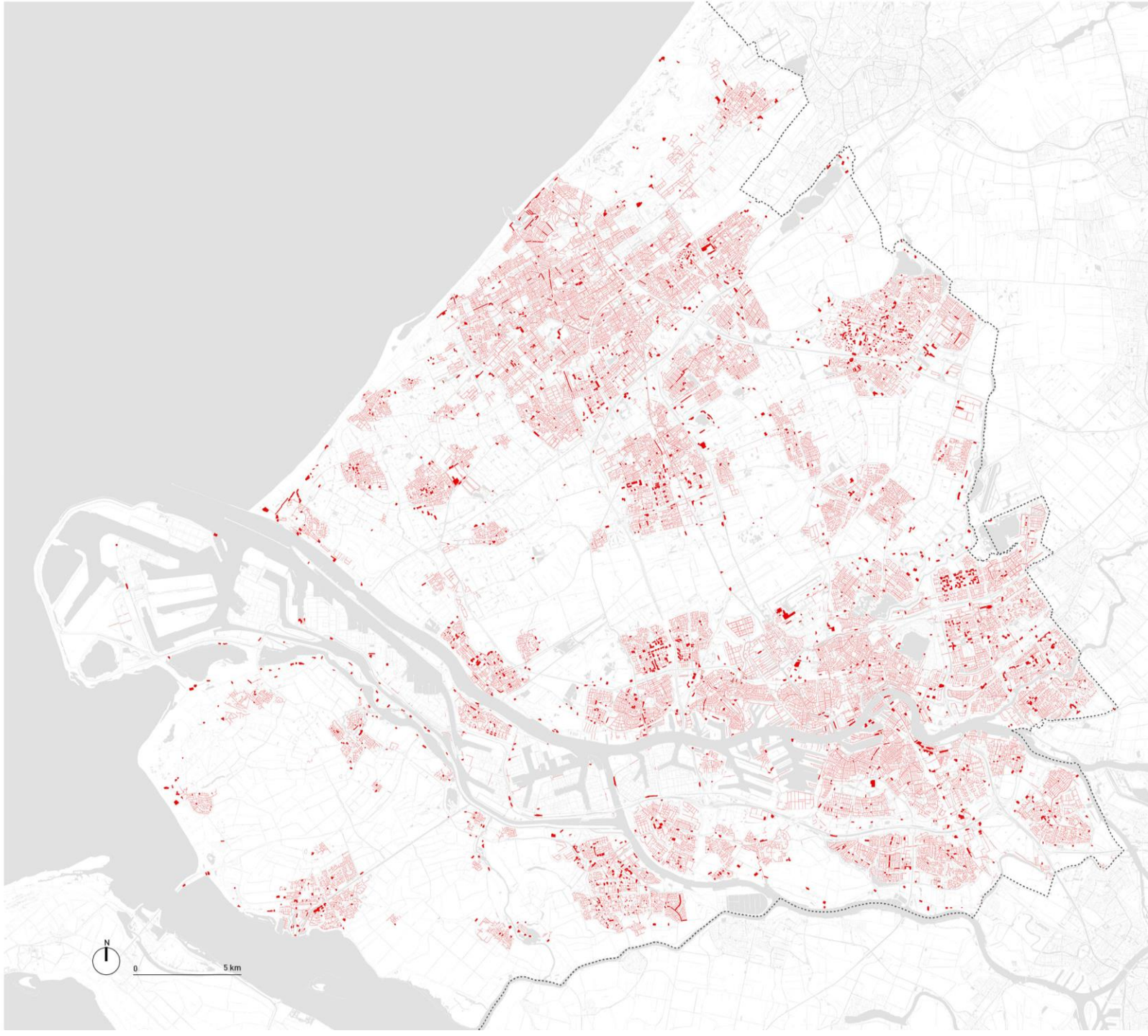
Large parkings
On-street parking

Parking areas 5,8 km²

On-street parking
12,5 km²

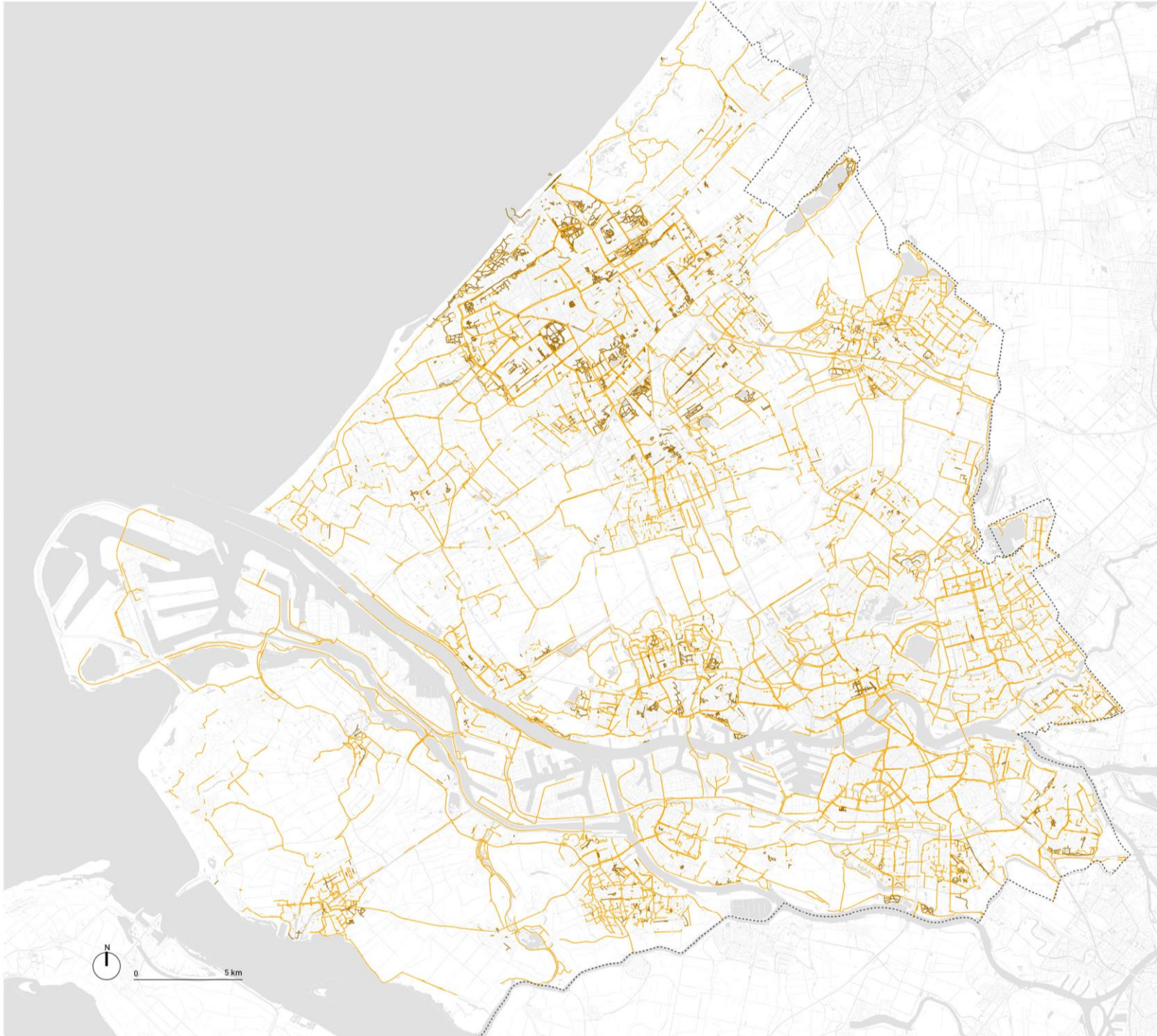
Parking **18,3 km²**

Figure 88. Surfaces occupied by parking types. Measured in GIS based on 'wegen_lijn', 'wegen_vlak' and 'gebouw' (typegebouw = 'parkdak') layers from top10nl, CBS 2015.



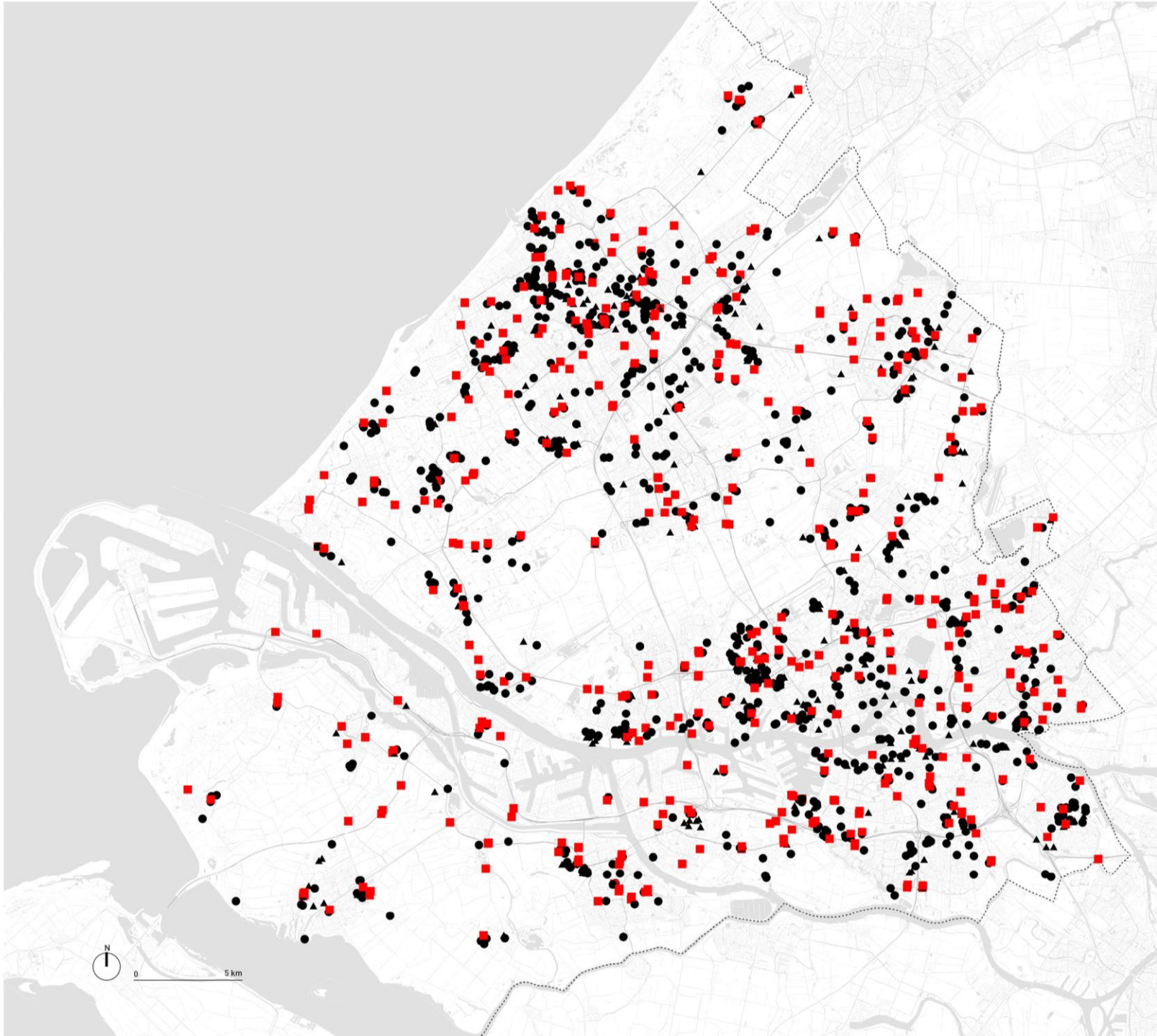
MRDH. Spaces of no car

Pedestrian areas
Cycling infrastructure

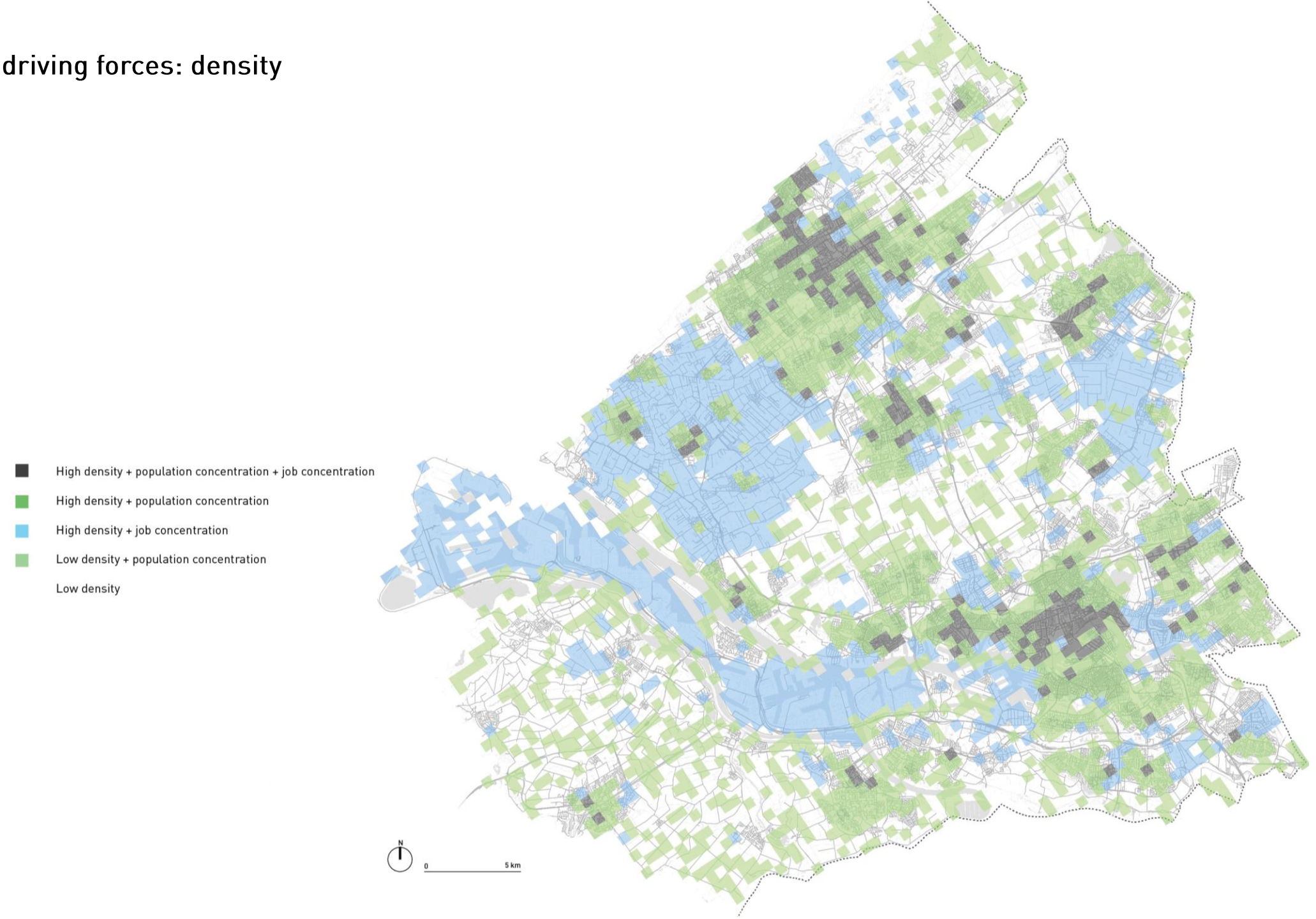


MRDH. Spaces of car-related economy

- Fuel stations
- Car sales
- Car service



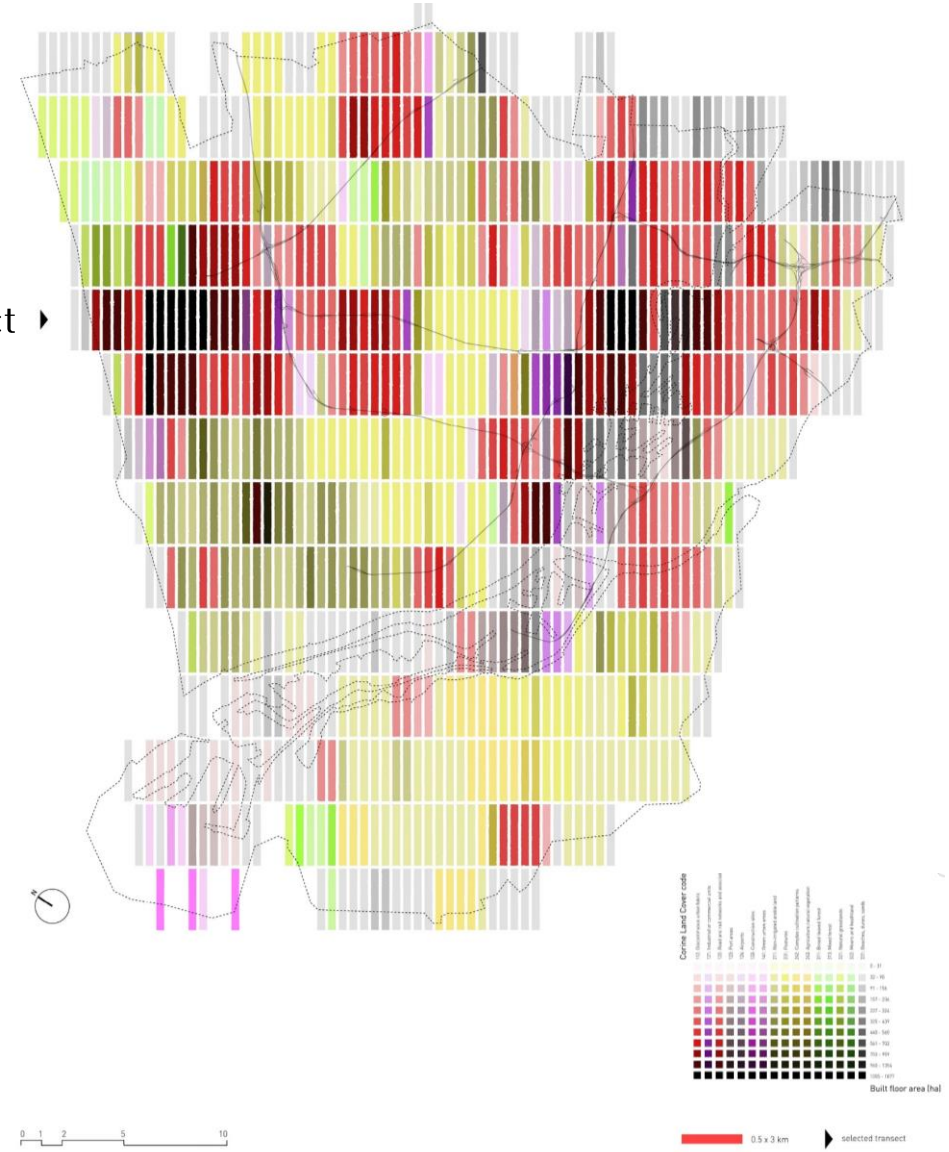
MRDH. Mapping the driving forces: density



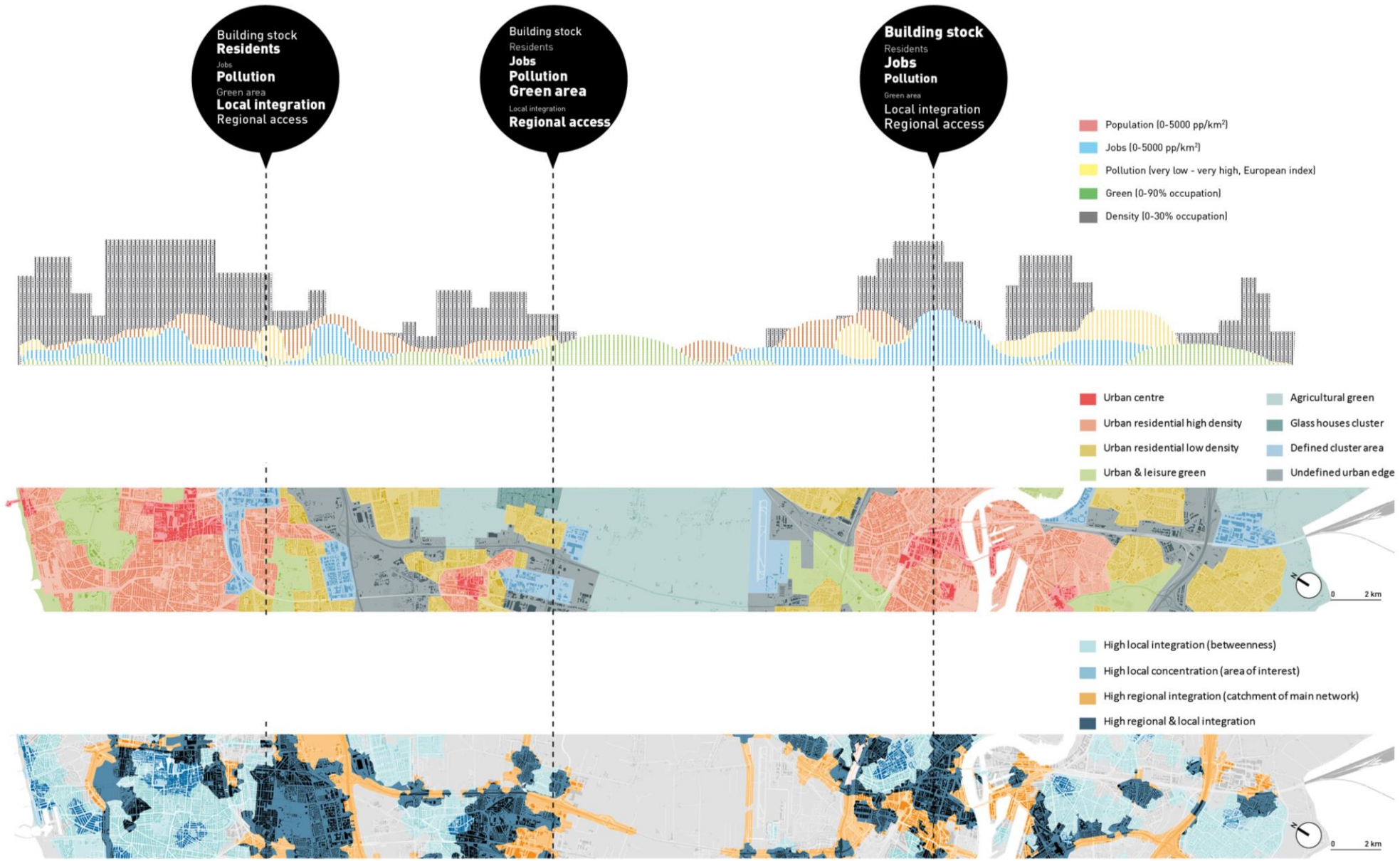
MRDH. Mapping the driving forces: flows

MRDH. Transect choice: density-program matrix

main urban transect



MRDH. Transect analysis and liveability

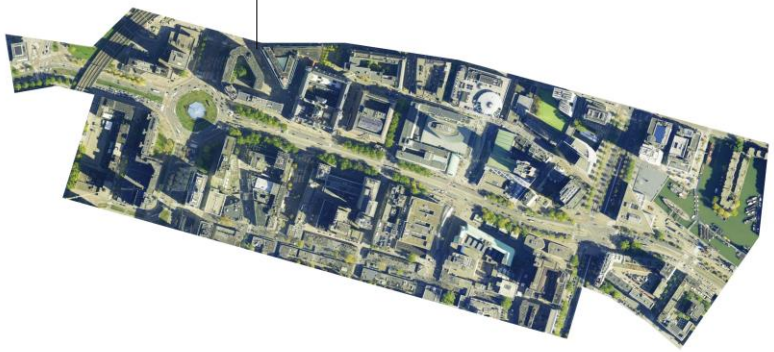


MRDH. Case study locations

Urban edge
Delft

Residential
The Hague

City centre
Rotterdam



Scenario construction: hypotheses and driving forces

Agenda 2040

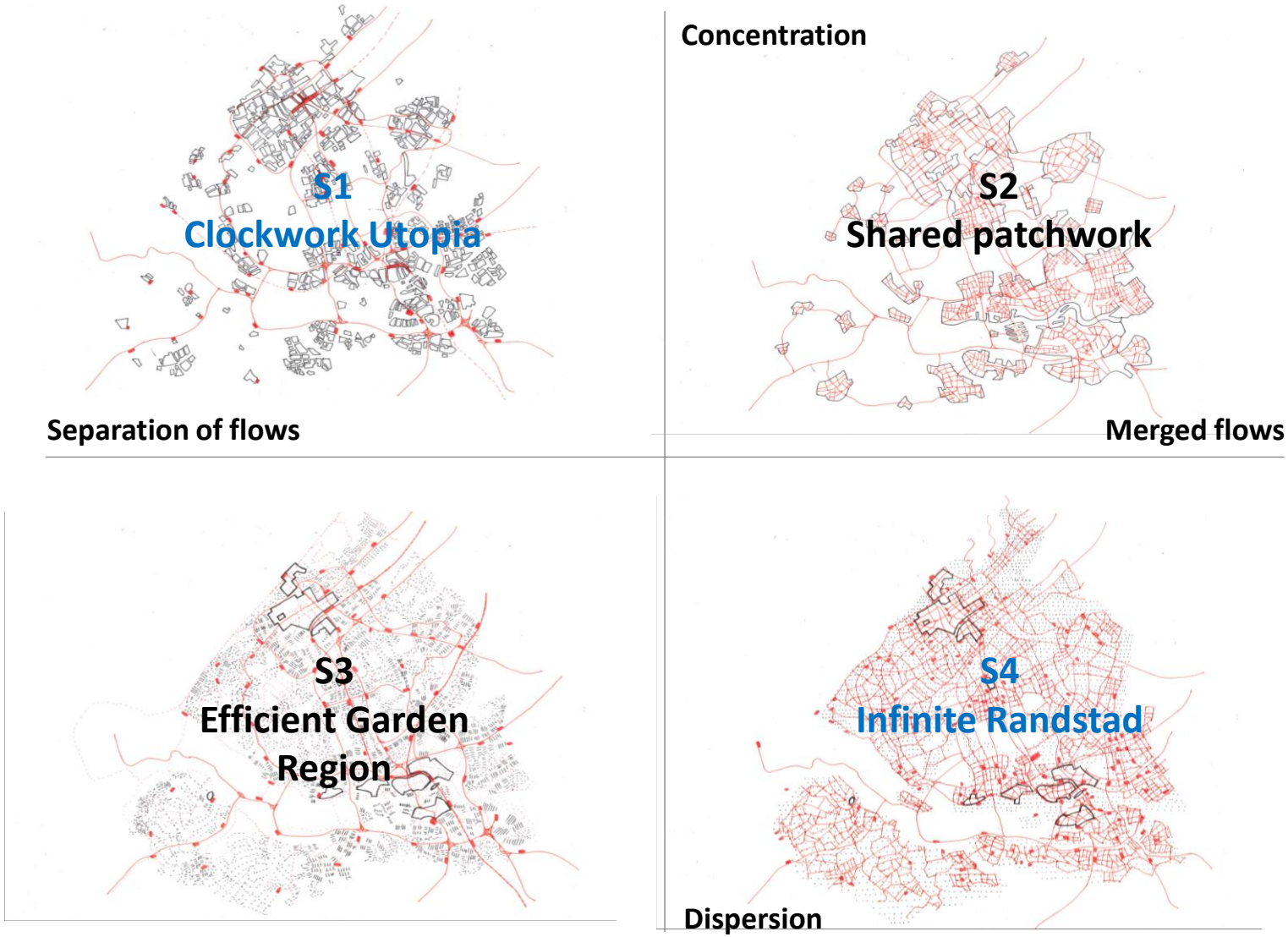
380.000 new housing units

80.000 new work places

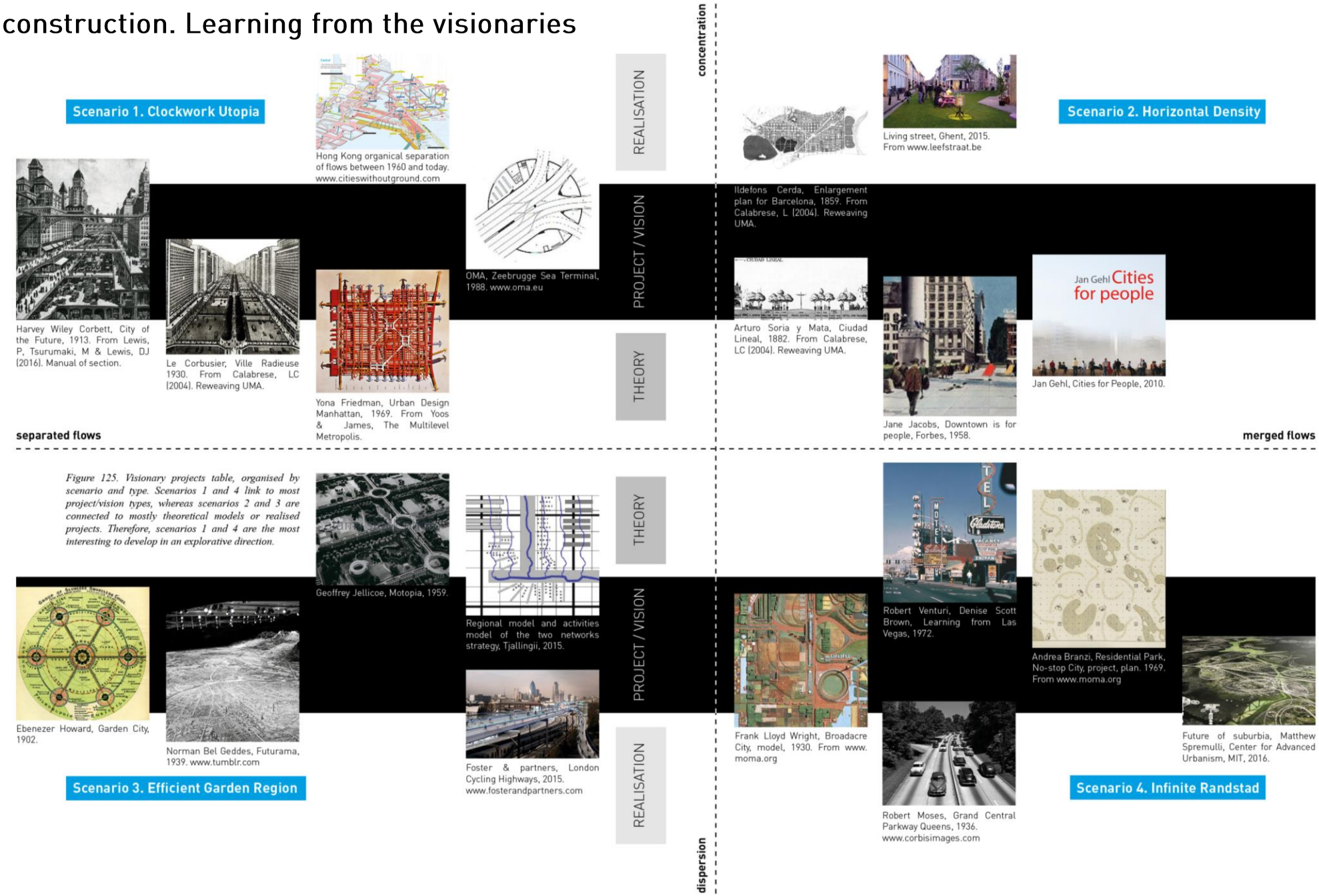
Source: www.vrudh.nl

Fully automated vehicles available from 2025

Source: Milakis et al

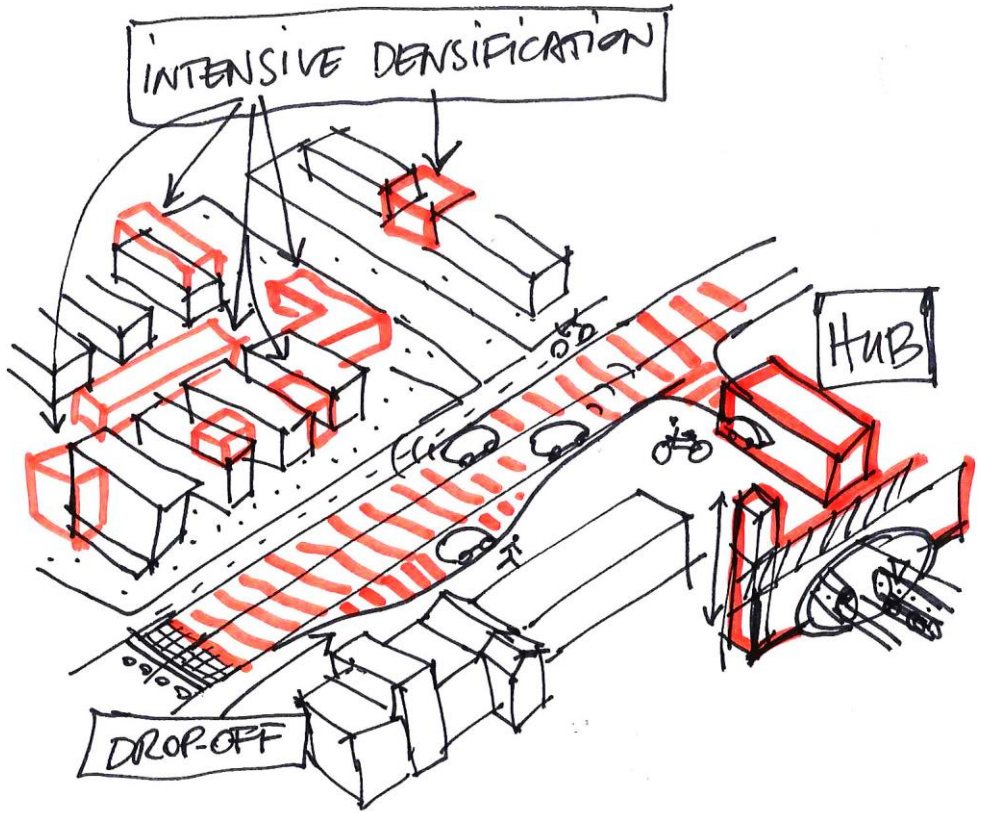


Scenario construction. Learning from the visionaries

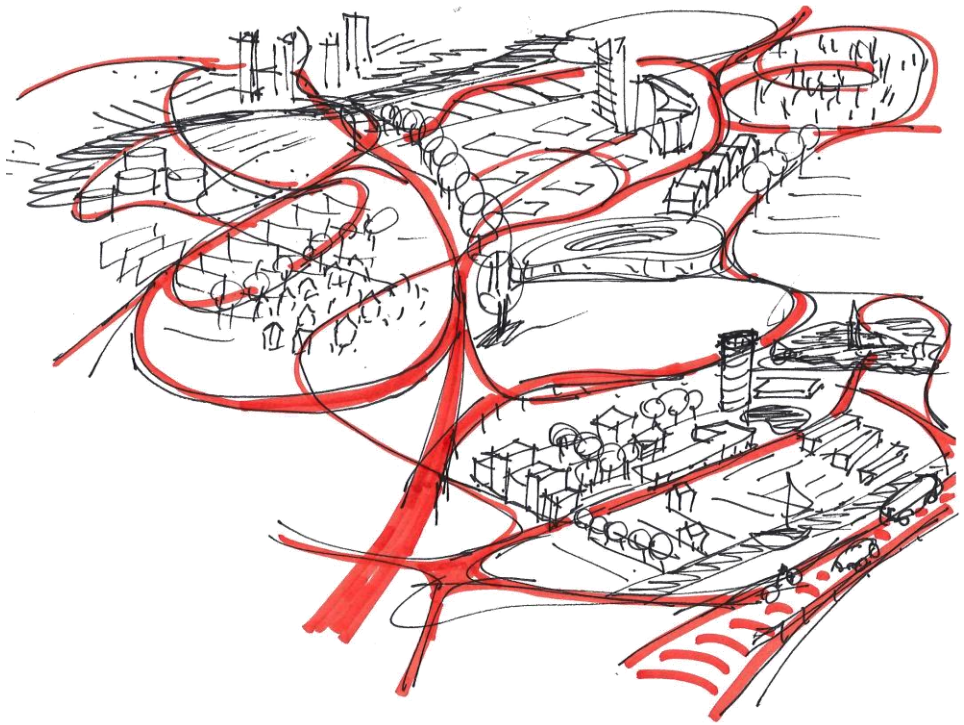


Scenario development. Clockwork Utopia and Infinite Randstad

S1
Clockwork Utopia



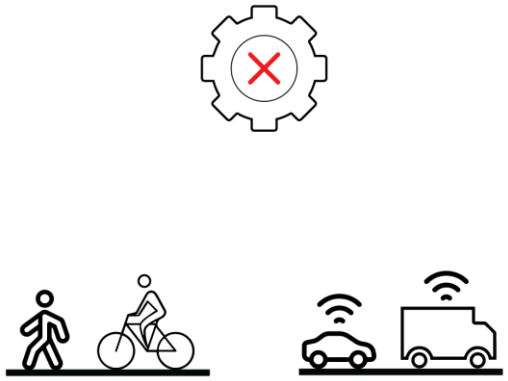
S4
Infinite Randstad



Scenario development. Clockwork Utopia and Infinite Randstad

S1
Clockwork Utopia

HUMAN CONTROL



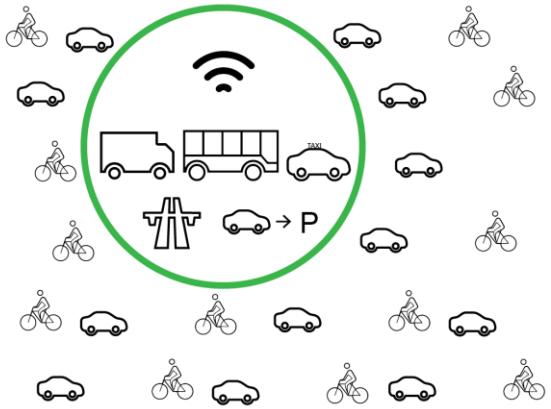
S4
Infinite Randstad

HUMAN-MACHINE COOPERATION

Scenario development. Clockwork Utopia and Infinite Randstad

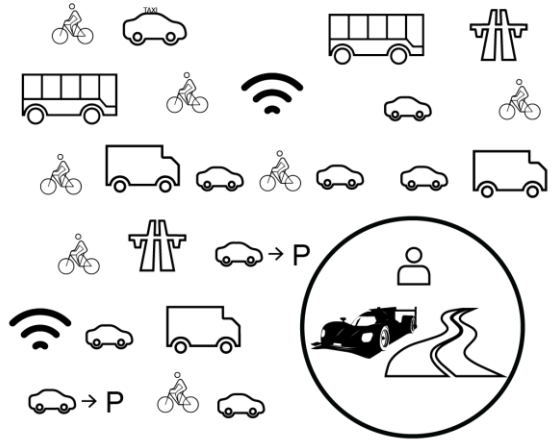
S1
Clockwork Utopia

AUTOMATION EXCEPTION



S4
Infinite Randstad

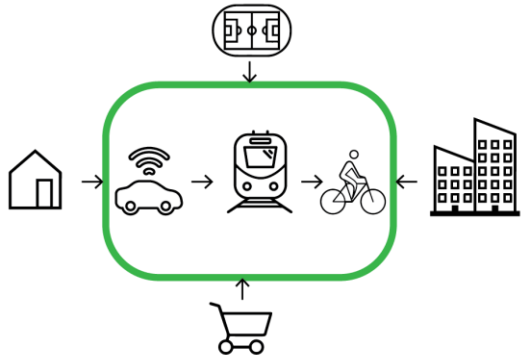
AUTOMATION COMMON



Scenario development. Clockwork Utopia and Infinite Randstad

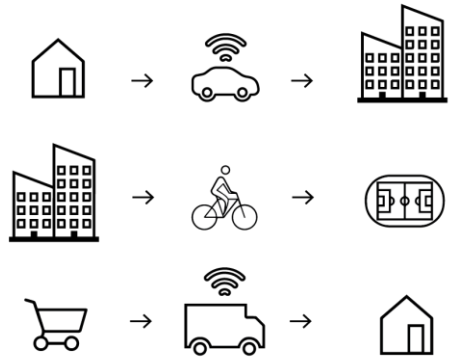
S1
Clockwork Utopia

MOBILITY SYSTEM MULTIMODAL



S4
Infinite Randstad

DOOR TO DOOR ON ONE MODE



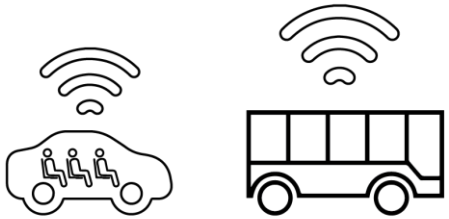
Scenario development. Clockwork Utopia and Infinite Randstad

S1
Clockwork Utopia

S4
Infinite Randstad

SHARED

PUBLIC TIME

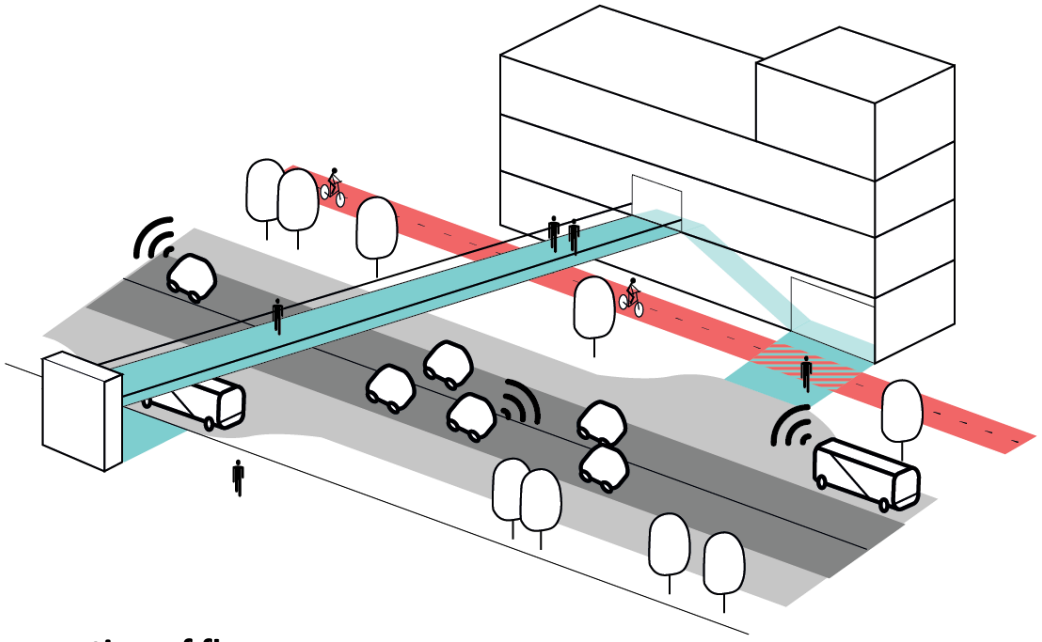


INDIVIDUAL

PRIVATE TIME

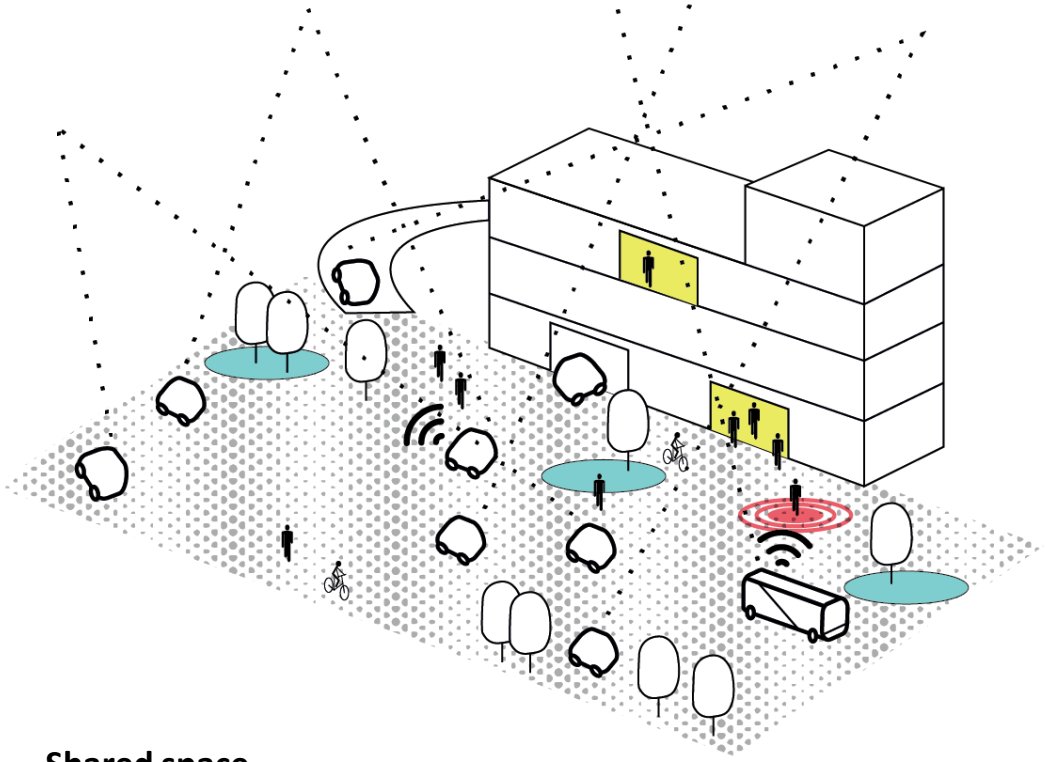
Scenario development. Clockwork Utopia and Infinite Randstad

S1
Clockwork Utopia



Separation of flows

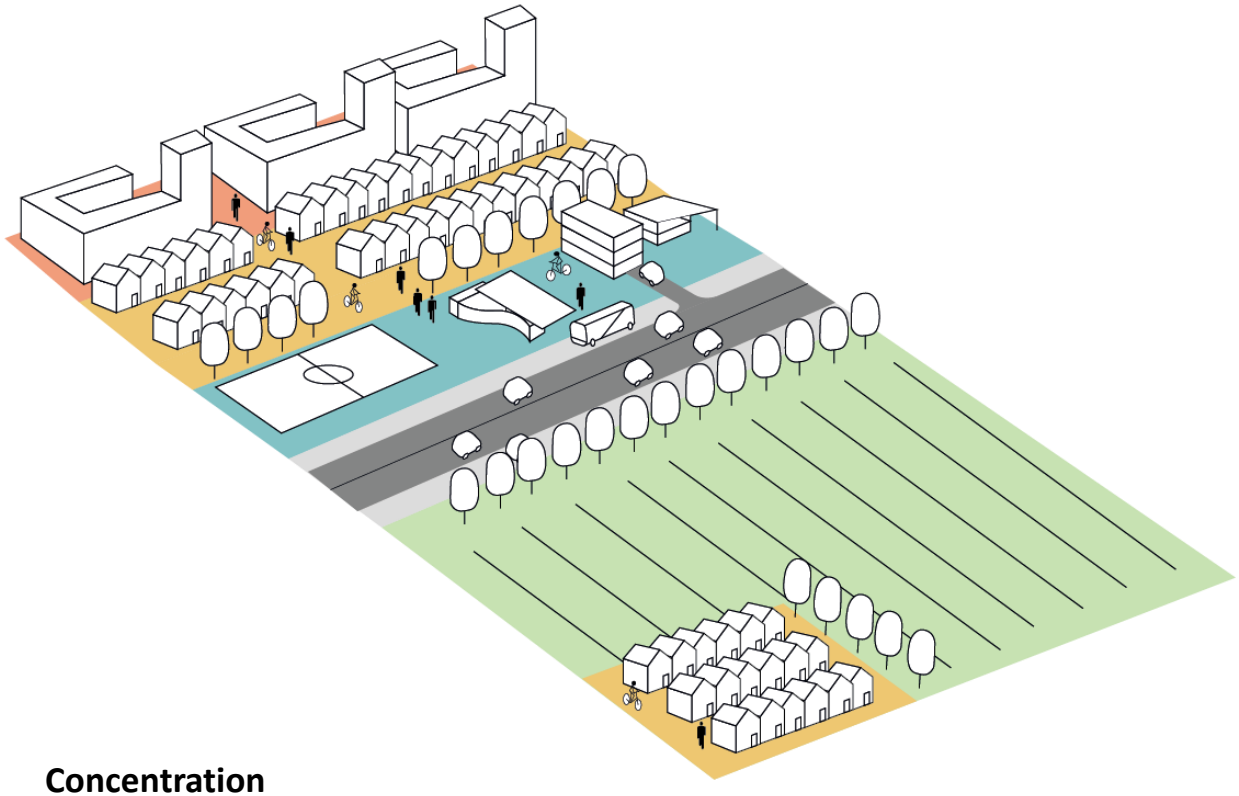
S4
Infinite Randstad



Shared space

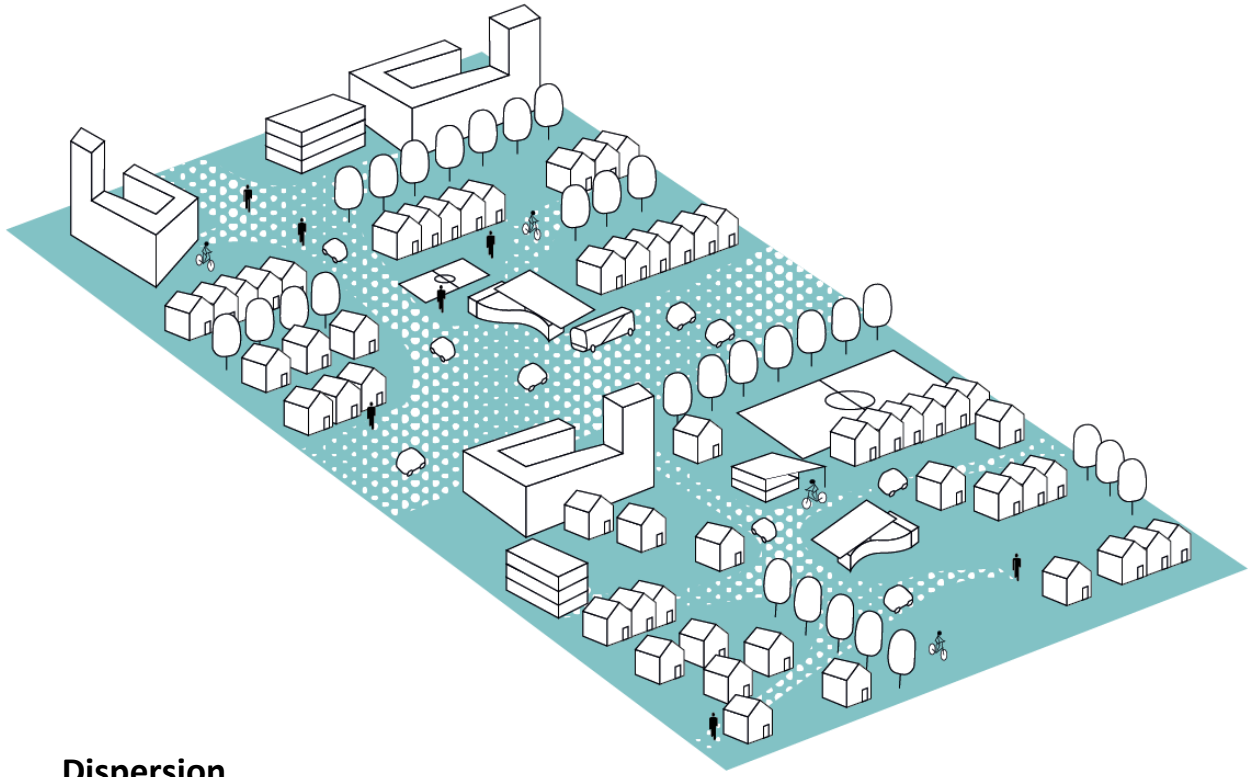
Scenario development. Clockwork Utopia and Infinite Randstad

S1
Clockwork Utopia



Concentration

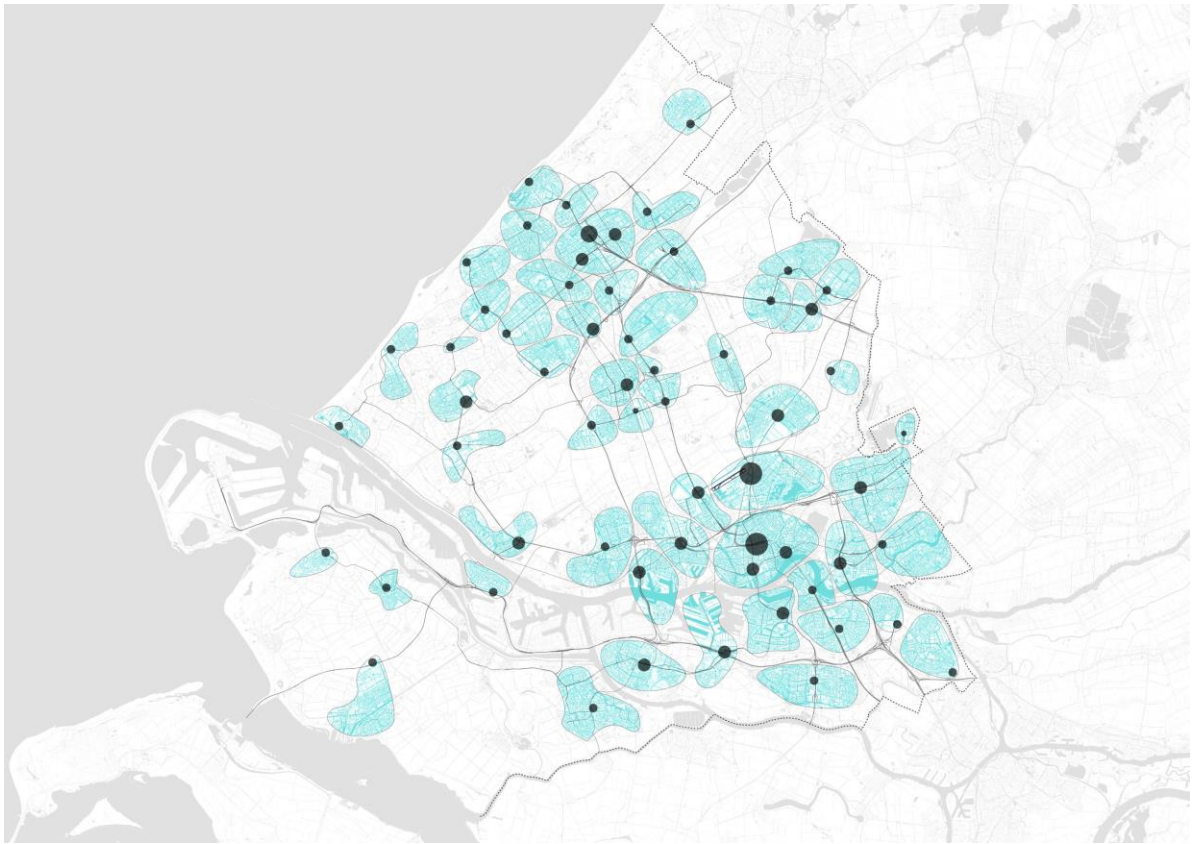
S4
Infinite Randstad



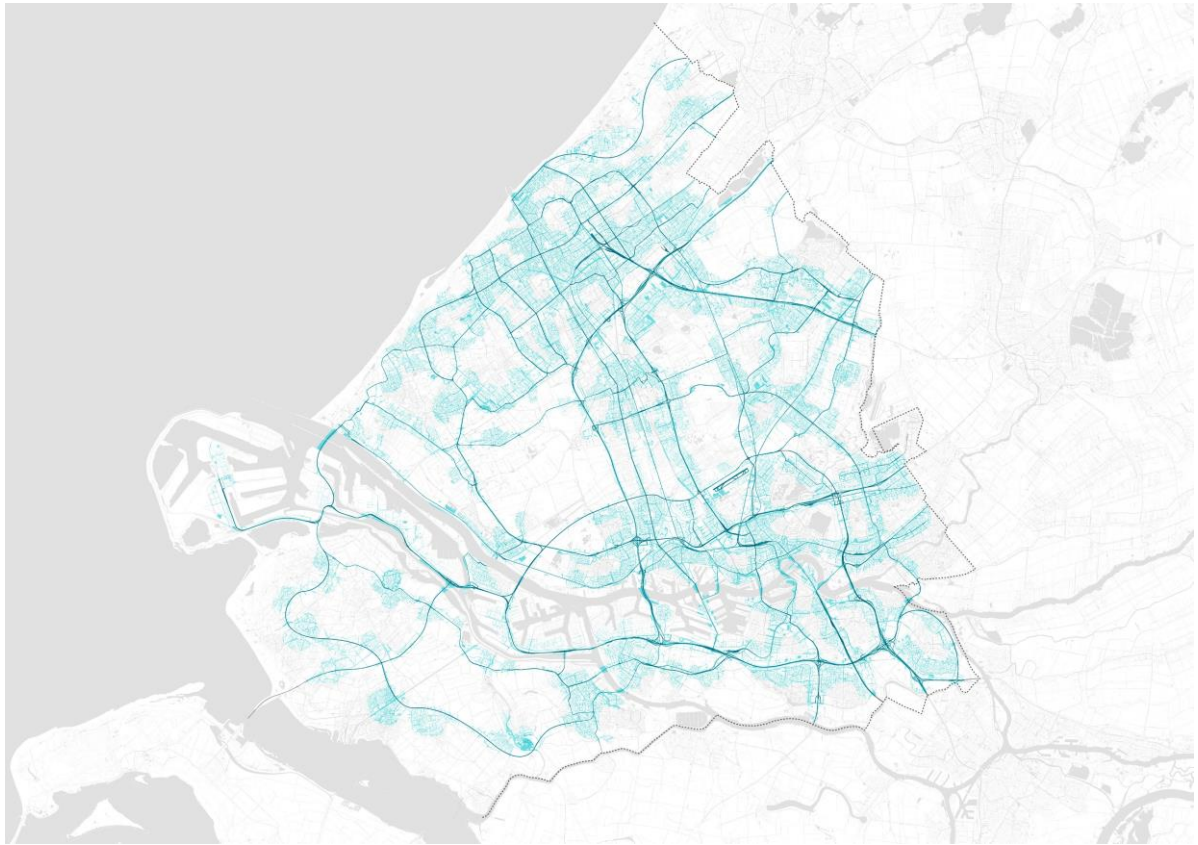
Dispersion

Scenario development. Clockwork Utopia and Infinite Randstad

S1
Clockwork Utopia

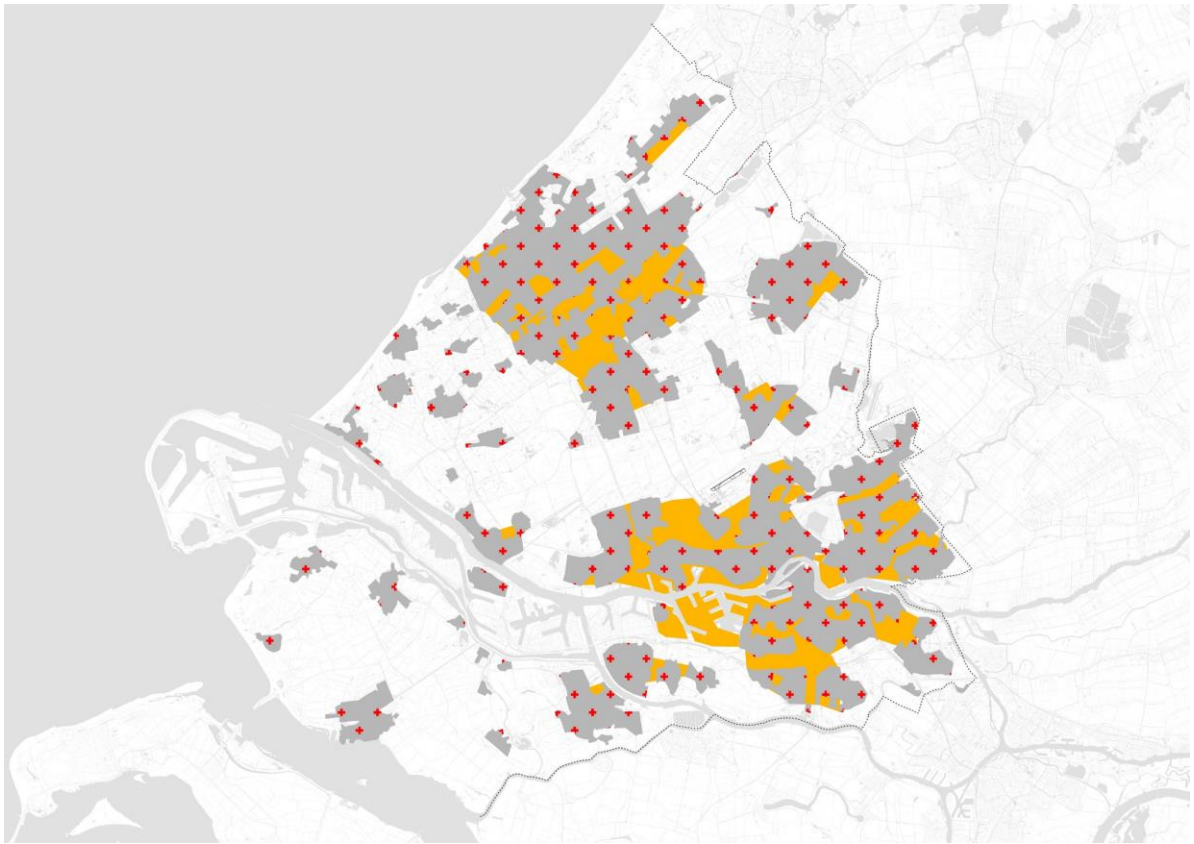


S4
Infinite Randstad

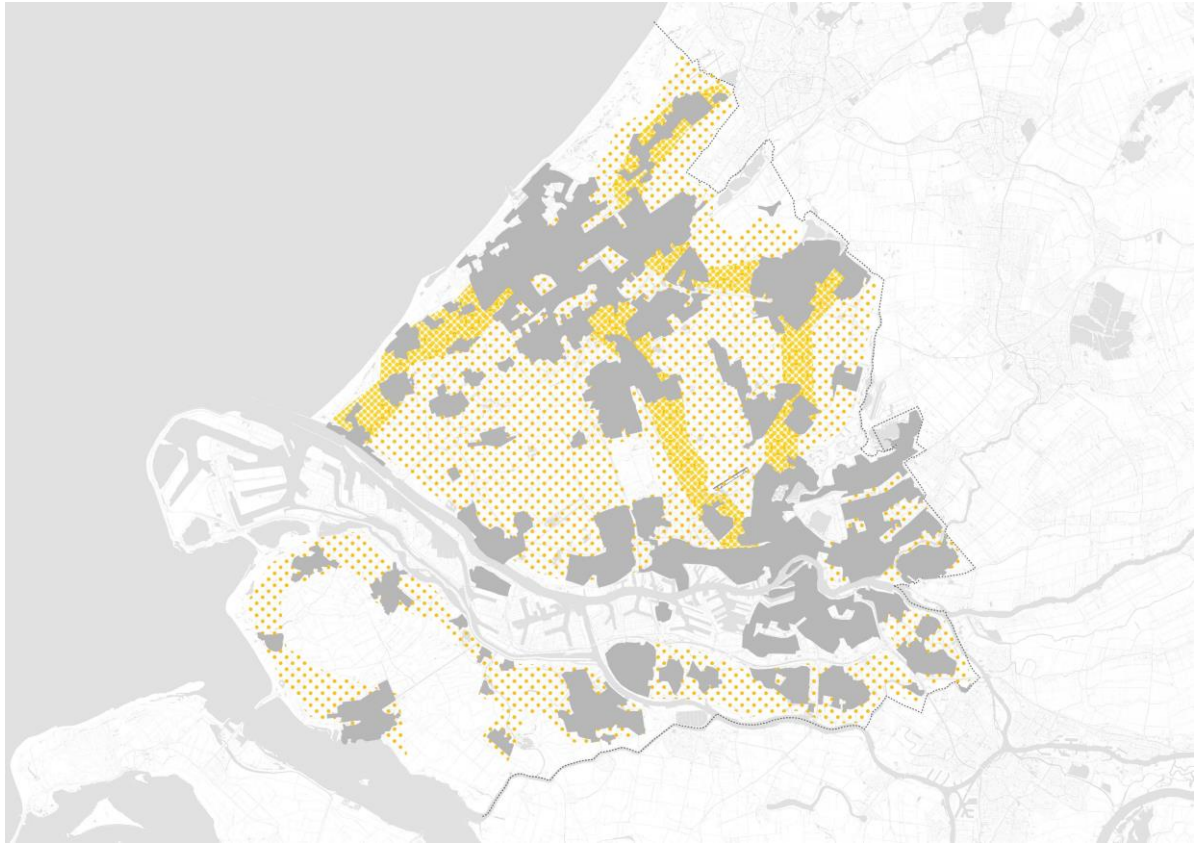


Scenario development. Clockwork Utopia and Infinite Randstad

S1
Clockwork Utopia

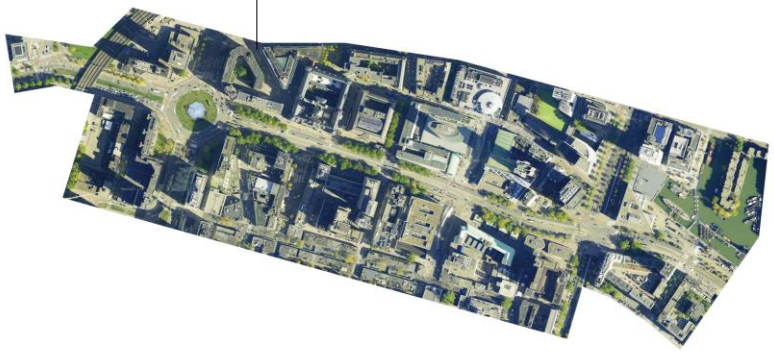


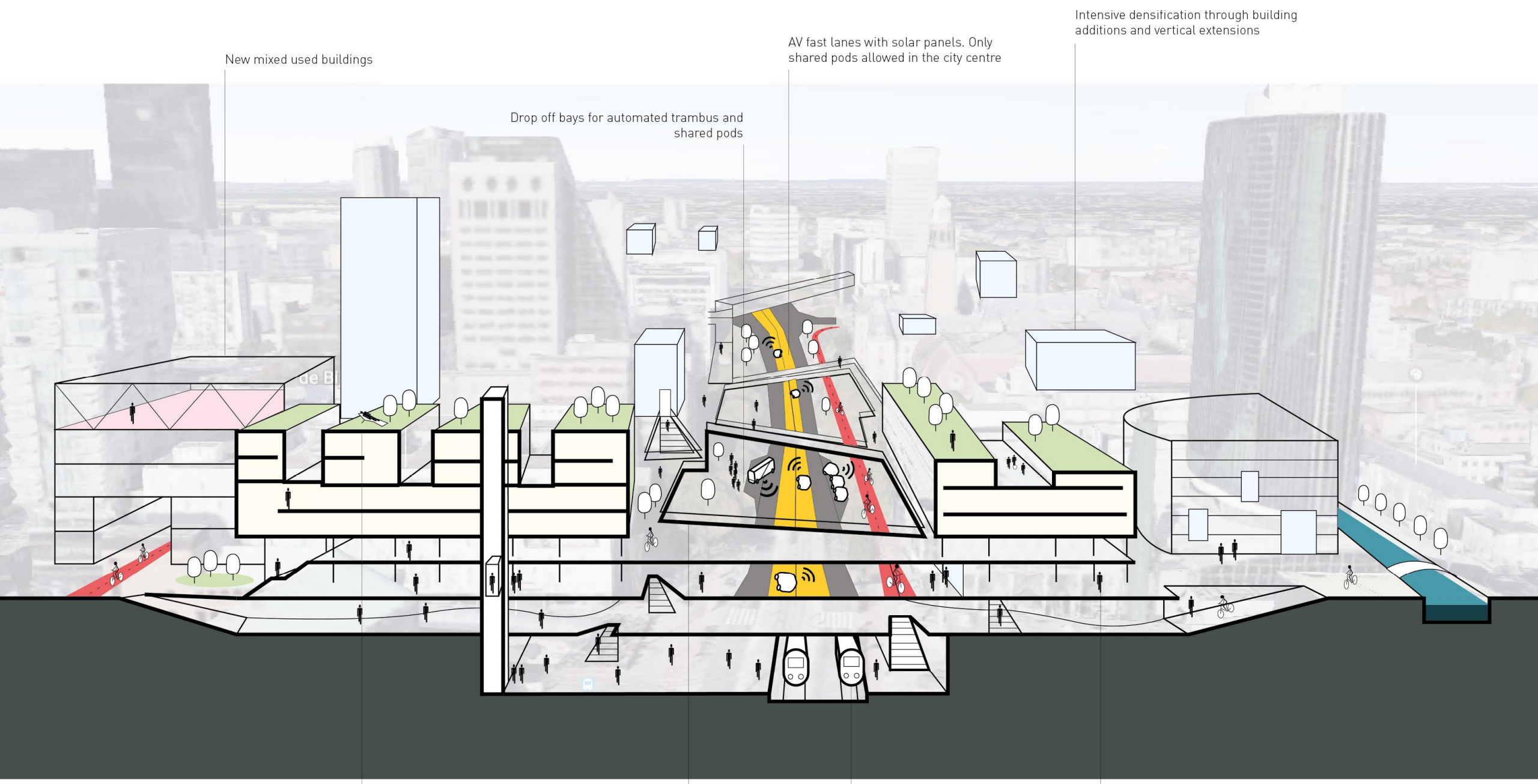
S4
Infinite Randstad

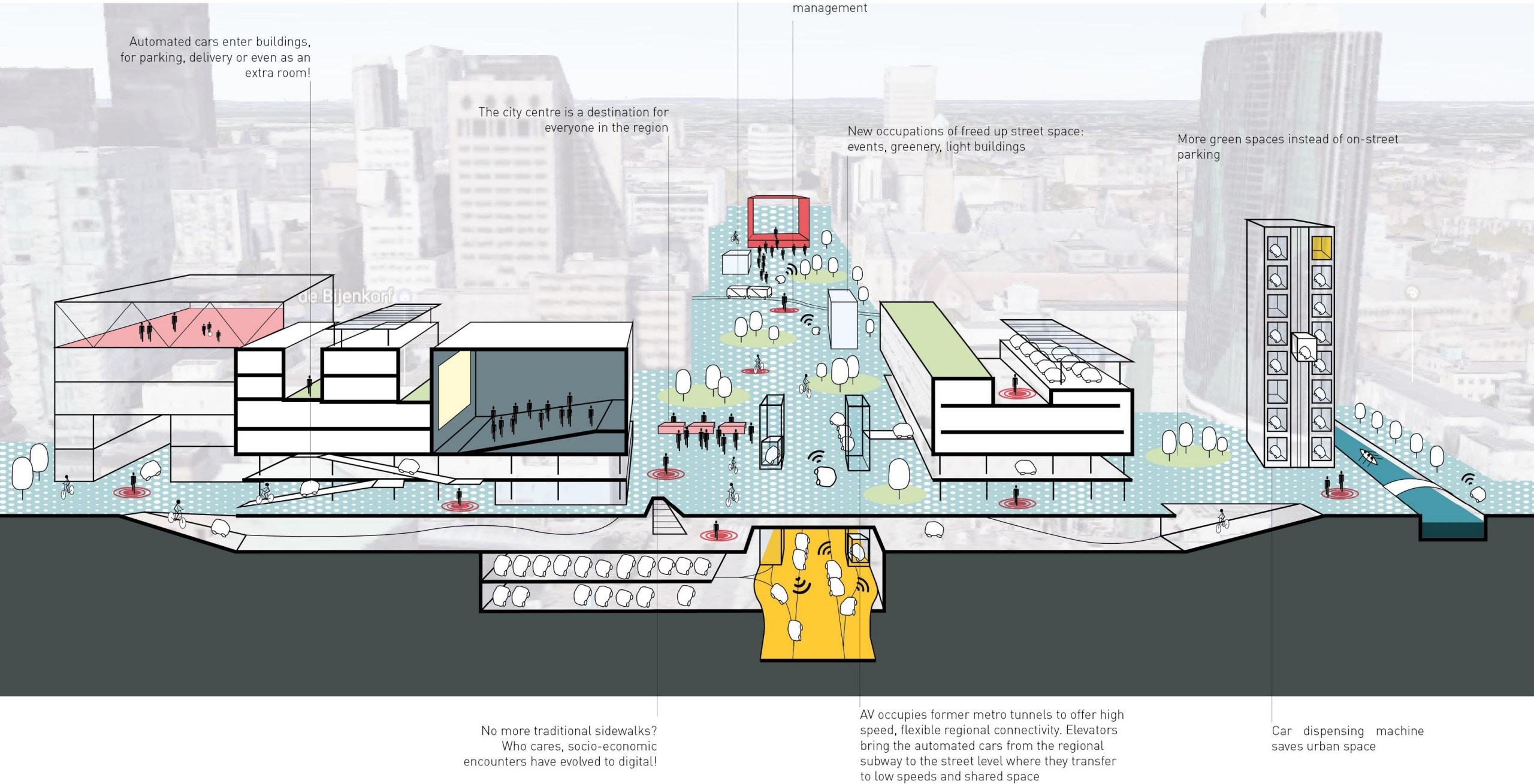


Scenario development. Clockwork Utopia and Infinite Randstad

City centre
Rotterdam

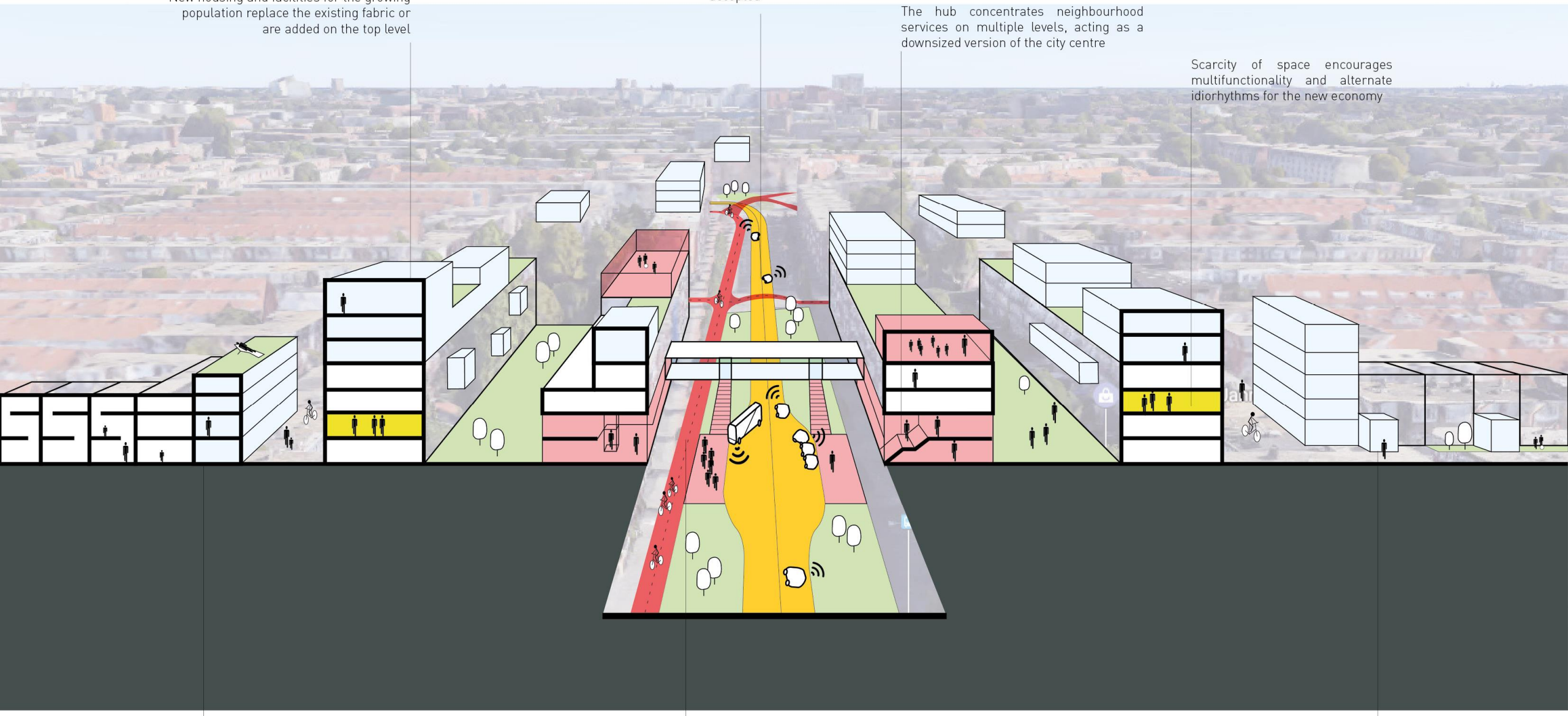


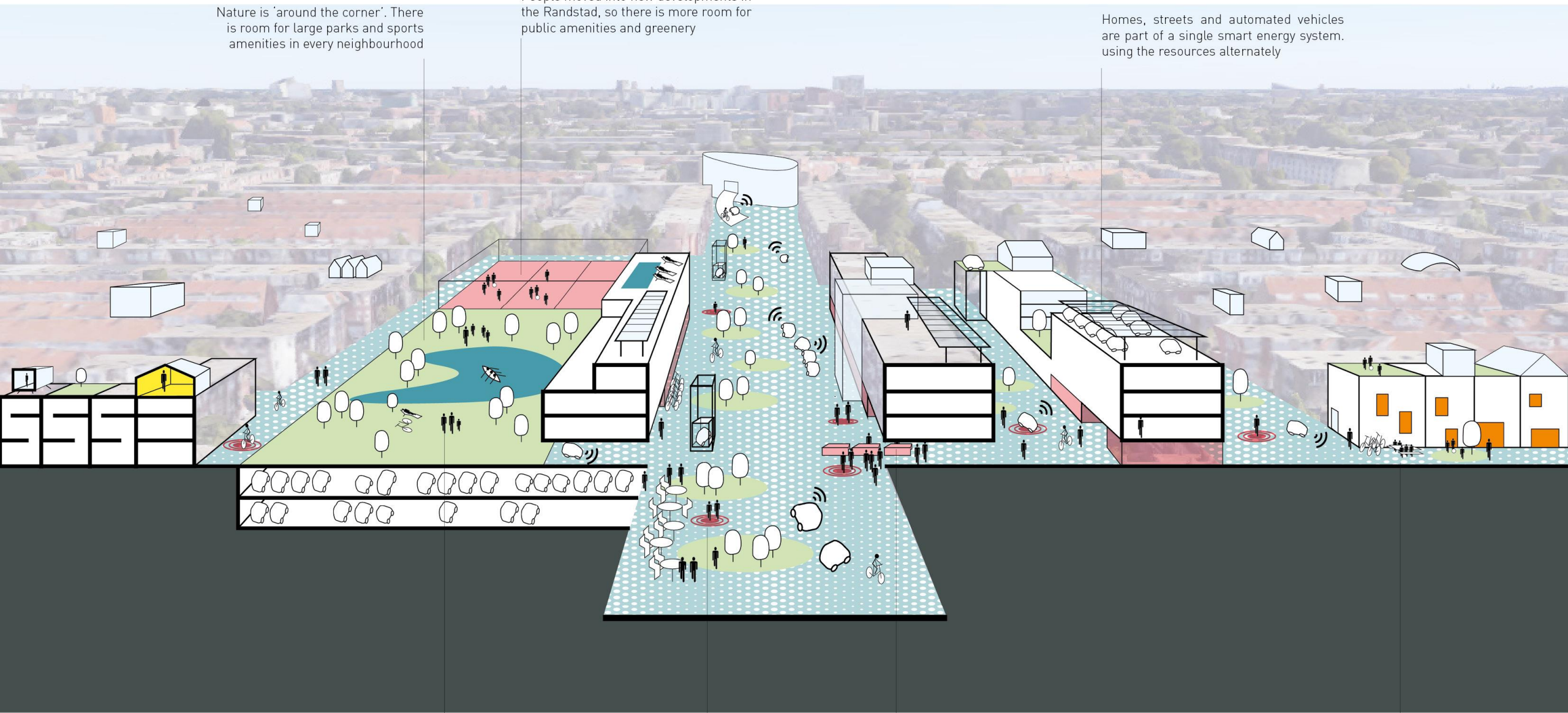

New mixed used buildings
Drop off bays for automated trambus and shared pods
AV fast lanes with solar panels. Only shared pods allowed in the city centre
Intensive densification through building additions and vertical extensions
Living in the city centre
Multi-level urban core
Regional transport is delivered by automated metro trains
Increased leisure time is spent in the city centre: culture, shopping, bars, sport facilities.


Automated cars enter buildings, for parking, delivery or even as an extra room!
Trams are still in use in the city centre
Smart surface design integrates safety, energy, connectivity and water management
The city centre is a destination for everyone in the region
New occupations of freed up street space: events, greenery, light buildings
More green spaces instead of on-street parking
de Bijenkorf
No more traditional sidewalks? Who cares, socio-economic encounters have evolved to digital!
AV occupies former metro tunnels to offer high speed, flexible regional connectivity. Elevators bring the automated cars from the regional subway to the street level where they transfer to low speeds and shared space
Car dispensing machine saves urban space

Scenario development. Clockwork Utopia and Infinite Randstad

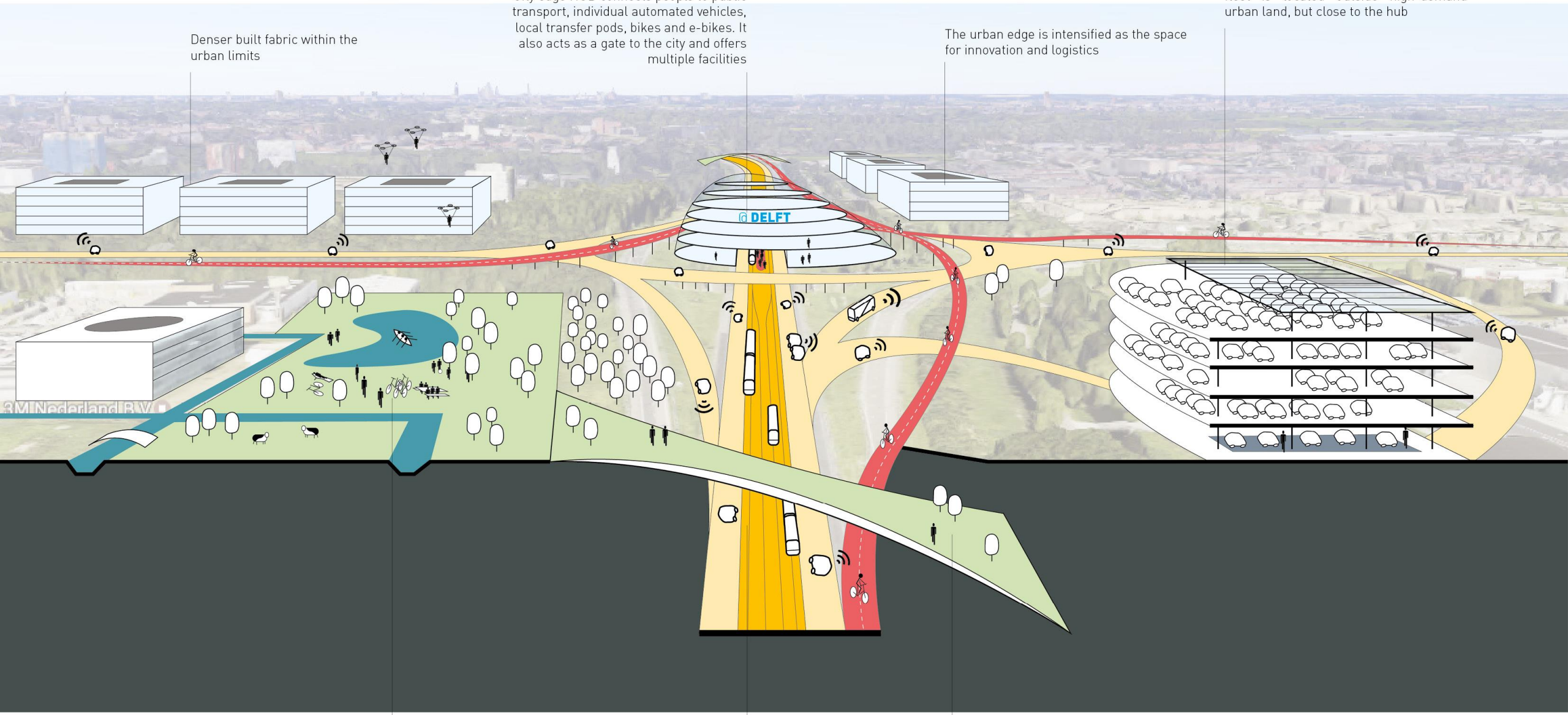
Residential
The Hague


New housing and facilities for the growing population replace the existing fabric or are added on the top level
Smart road used mostly by shared pods, but individual AVs of residents are accepted
The hub concentrates neighbourhood services on multiple levels, acting as a downsized version of the city centre
Scarcity of space encourages multifunctionality and alternate idiorhythms for the new economy
Living denser is the new normal
Former parking space becomes building extension, bicycle lane or green area
Old garages and parkings are refunctionalised in a neighbourhood-wide strategy


Nature is 'around the corner'. There is room for large parks and sports amenities in every neighbourhood
People moved into new developments in the Randstad, so there is more room for public amenities and greenery
Homes, streets and automated vehicles are part of a single smart energy system. using the resources alternately
Vibrant community and family-centred life
Shared space is designed for low speed and mixed use
Public and commercial uses occupy the ground floor to create a lively street. AV are welcome as well
Freed-up parking becomes hobby space, office, student room or simply the family terrace

Scenario development. Clockwork Utopia and Infinite Randstad

Urban edge
Delft



Denser built fabric within the urban limits

City edge HUB connects people to public transport, individual automated vehicles, local transfer pods, bikes and e-bikes. It also acts as a gate to the city and offers multiple facilities

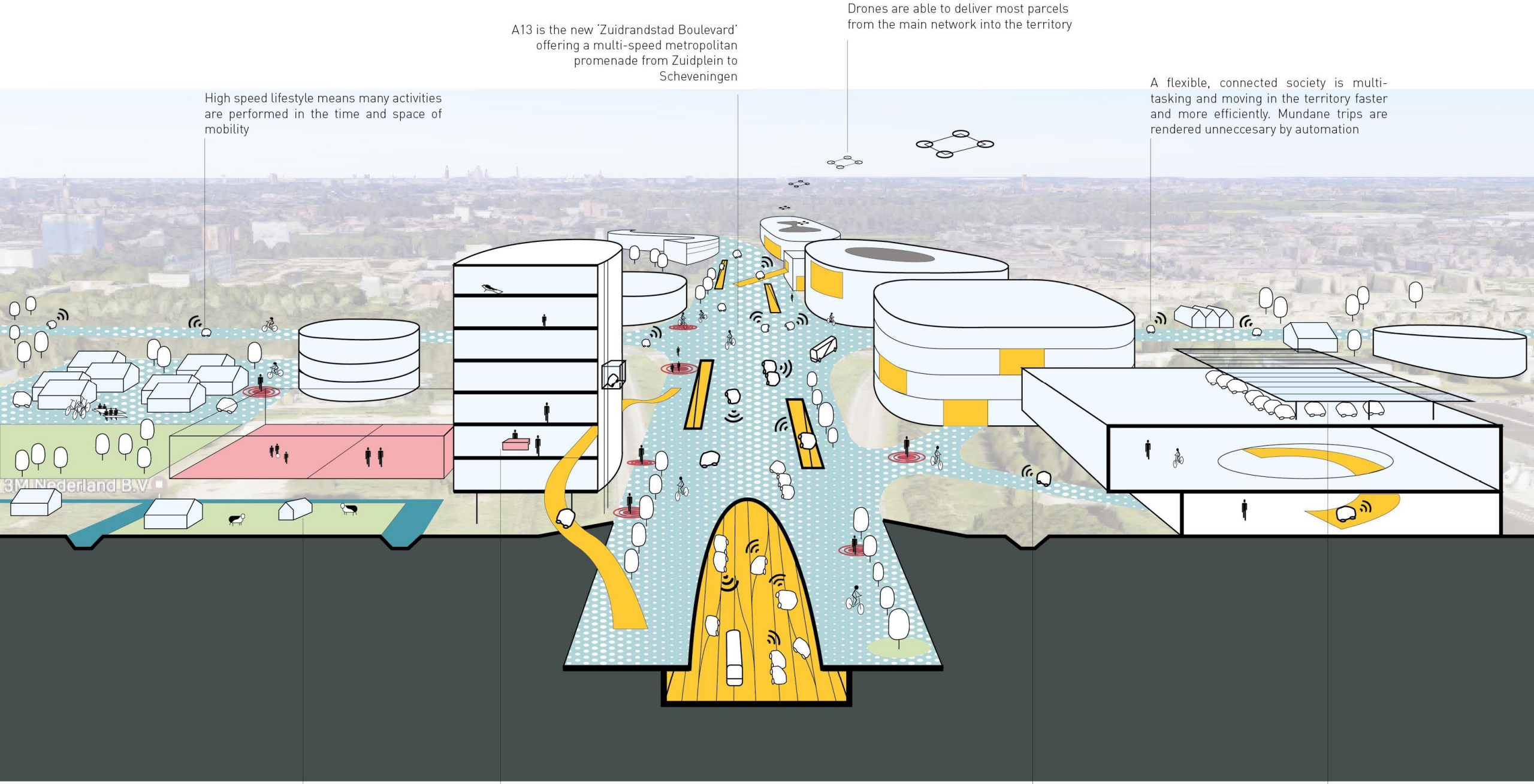
The urban edge is intensified as the space for innovation and logistics

Parking and maintenance of urban pod fleet is located outside high-demand urban land, but close to the hub

Urban residents enjoy 'open' nature on the city edge, where they can relax or practice new sports enabled by technology

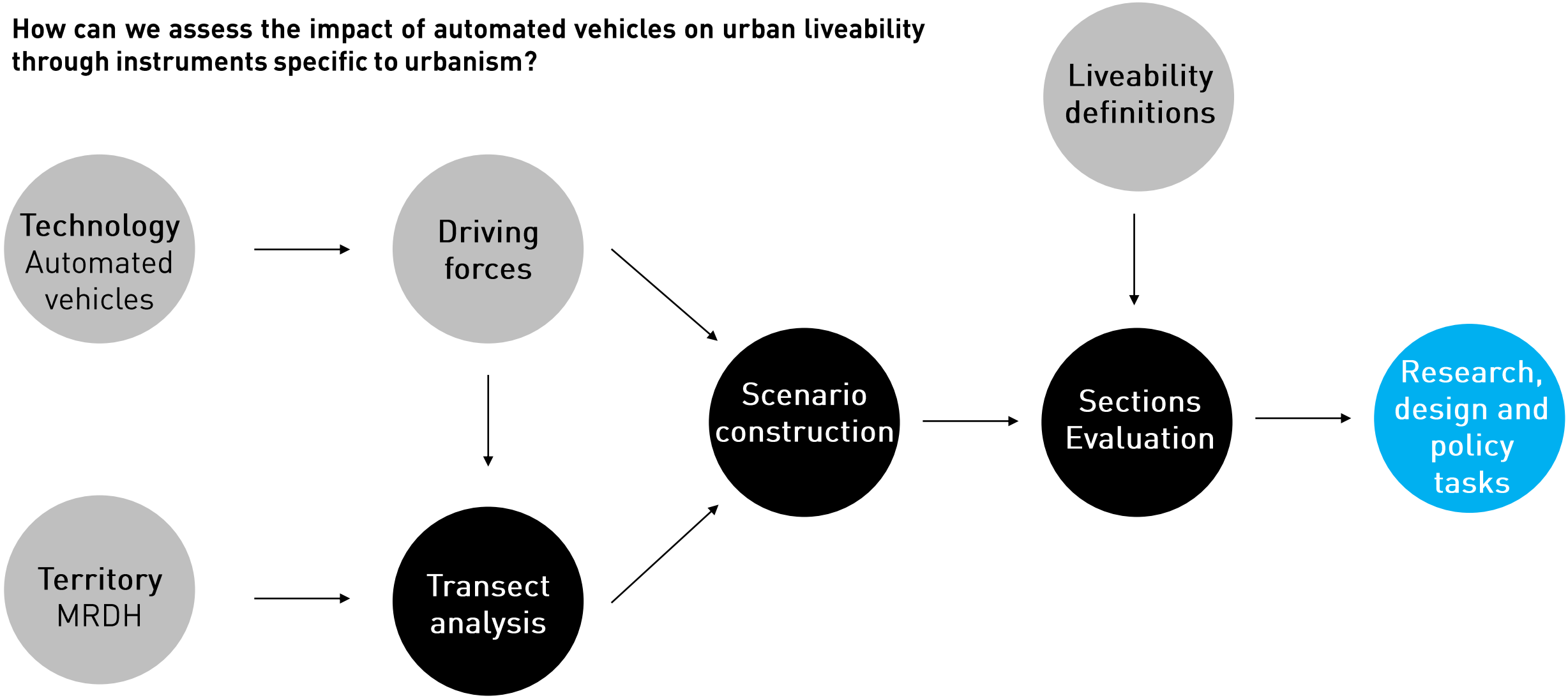
The motorway is integrated in the public transport system

Ecoducts ensure safe crossing of the highway and ecosystem continuity


A13 is the new 'Zuidrandstad Boulevard' offering a multi-speed metropolitan promenade from Zuidplein to Scheveningen
Drones are able to deliver most parcels from the main network into the territory
High speed lifestyle means many activities are performed in the time and space of mobility
A flexible, connected society is multi-tasking and moving in the territory faster and more efficiently. Mundane trips are rendered unneccesary by automation
3M Nederland B.V.
New types of vicinity: office in the polder, house on the highway
New architectural typologies allow real door-to-door experience. Welcome to the drive-in office
Same-level access to regional infrastructure
Buildings, roads and cars are part of the smart energy grid

Reflection

How can we assess the impact of automated vehicles on urban liveability through instruments specific to urbanism?



Reflection

What directions of research, design and policy should be followed in the future in order to enhance urban liveability in the context of automated vehicle adoption?

RESEARCH

- Electric vehicles
- Synergies with other mobility trends
- Pedestrian & cyclist safety
- Societal acceptance of AV
- Urban sprawl impact

DESIGN

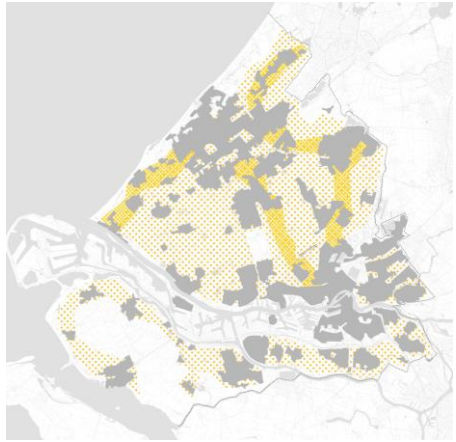
- Design of street profile
- Transfer hubs
- Accessibility
- Social and economic encounter in shared space
- New programs

POLICY

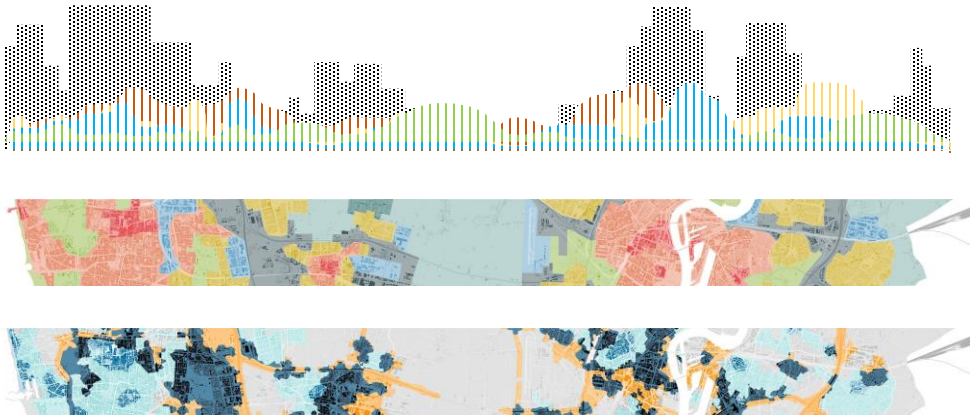
- Encourage sharing and electric
- Limit city centre access
- Serve marginal areas
- Parking areas
- Tackle economic disruptions
- Encourage active mobility

Reflection. Methods

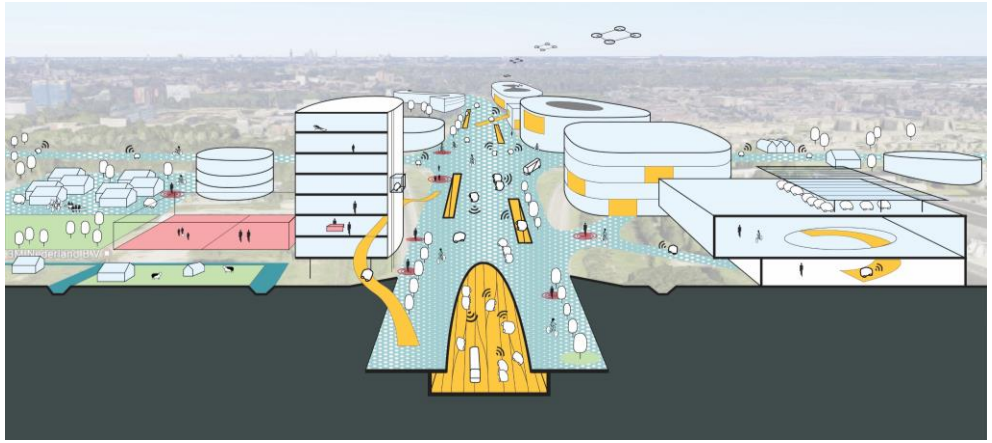
Are the tools specific to urbanism useful to assess the impact of automated vehicles on the urban environment?



SCENARIO



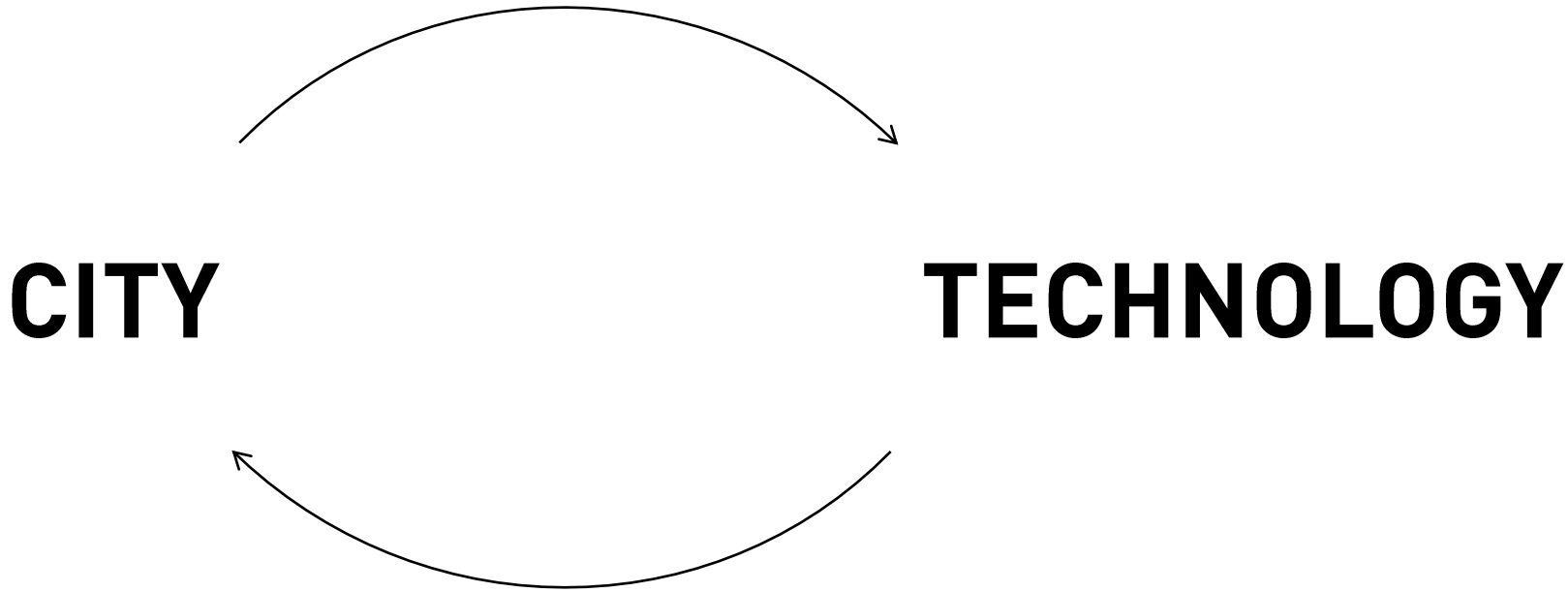
TRANSECT

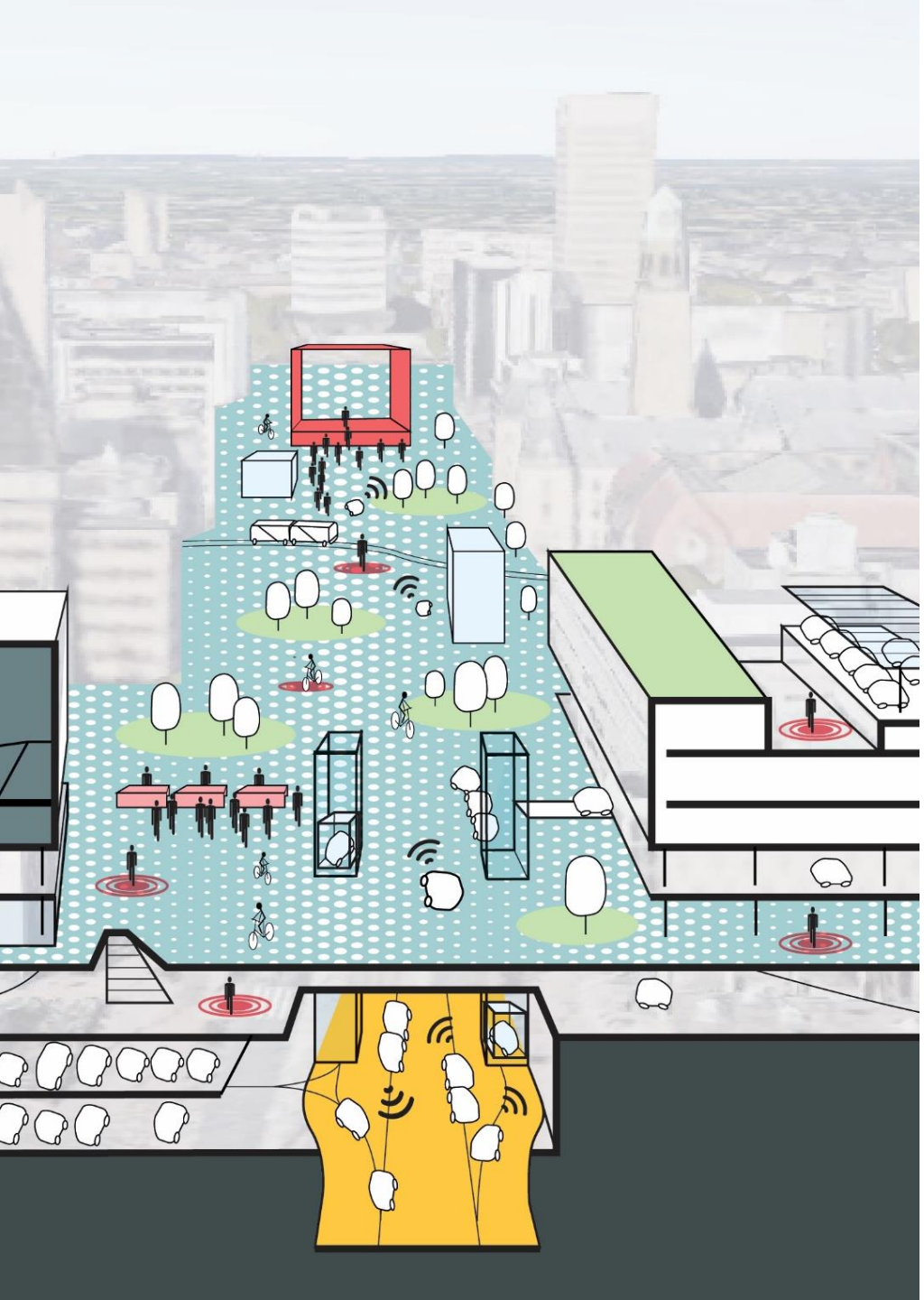


SECTION

Reflection. Forerunners not followers

How can the urbanist/architect be ahead of the times by imagining the living environments and lifestyles resulting from technological innovation?





Self-driven MRDH

A Method to Assess the Impact of Automated Vehicles on Urban Liveability in the Rotterdam The Hague Metropolitan Region

Vincent Babeș

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