SUSTAINABLE MOBILITY IN POST-INDUSTRIAL DEVELOPMENT

A research to sustainable mobility in post-industrial development applied to Merwe-Vierhavens, Rotterdam

MSc Graduation thesis presentation | **Stefan Vermeulen** | 4604881

PRESENTATION OUTLINE

1. Context
2. Theory + analysis
3. Strategy
4. Conclusion

MOBILITY SHIFT

The use of vehicles with internal combustion engines results in excessive CO_2 emissions and other environmental issues. - Fulton et al., 2017

Together with non-motorized transportation, electric, hybrid, shared and autonomous vehicles could be revolutions to engage towards a sustainable way of mobility use. - Transport & Environment, 2019

De Toyota Mirai waterstofauto © Toyota

'Waterstof? Niemand ontkomt er aan', claimt Toyota

Hoewel steeds meer autofabrikanten waterstof niet langer zien als energiebron voor personenauto's, blijft Toyota naar eigen zeggen 'vol inzetten' op een zogenoemde waterstofsamenleving. „Dat gaat verder dan auto's alleen. We kunnen er niet omheen en zullen het straks allemaal gebruiken."

Roland Tameling 07-12-20, 10:00
Laatste update: 11:46

Greenwheels breidt in Delft uit met vijf deelauto's. © Jeroen Zondag

Greenwheels breidt uit in Delft met vijf deelauto's

Met meerdere mensen een auto delen die niet van jezelf is, om zo het aantal voertuigen op de weg te beperken en de CO2-uitstoot te verminderen. De gedachte achter Greenwheels slaat aan in Delft, want het bedrijf breidt in de stad uit met vijf nieuwe deelauto's in de rode bedrijfskleur.

Peter van de Stadt 24-12-20, 14:05
Laatste update: 16:08

Een begroende auto dient als reclame voor de elektrische taxi's van Uber Green. © Uber

Uber-chauffeurs worden verplicht elektrisch te rijden

Taxiplatform Uber maakt de overstap naar elektrische taxi's, te beginnen in Amsterdam in 2025. Chauffeurs die het niet zien zitten om een elektrische auto aan te schaffen, of het niet kunnen betalen, mogen dan niet langer voor Uber rijden.

Ton Voermans 30-12-20, 09:19
Laatste update: 10:13

De beroemde Renault 5 keert terug als elektrische auto © Renault

Grootse plannen bij Renault: beroemd 'Vijfje' herleeft als elektrisch model

De Renault 5 komt terug: zojuist wekte de Franse automaker het beroemde model weer tot leven in de vorm van het studiemodel '5 Prototype'. Uiteindelijk verschijnt het nieuwe 'Vijfje' daadwerkelijk op de weg als volledig elektrische auto, als onderdeel van een reeks grote vernieuwingen bij Renault.

Roland Tameling 14-01-21, 12:04
Laatste update: 12:13

Terug naar het oude 'normaal' met lange files in de spits, of niet? © Peter Hilz

In een schone auto over een filevrije snelweg, is dat haalbaar?

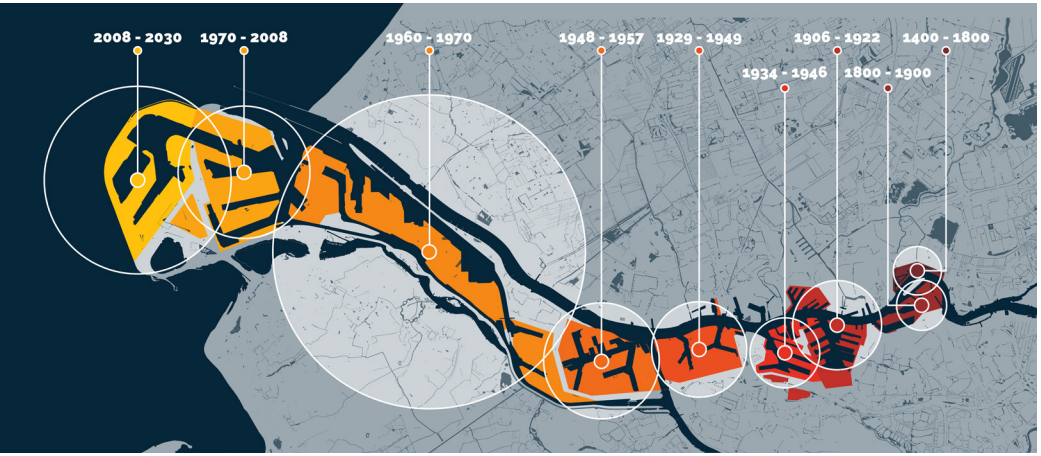
WELKOM 2021 **Zoevend in een elektrische auto over een lege snelweg. Wordt dat 2021? Of staan we na de vaccinaties weer dagelijks met rokende brandstofauto's in de file?**

Ton Voermans 08-01-21, 14:17
Laatste update: 14:27

De deelscooters van GO Sharing rijden al in veel plaatsen, zoals Tilburg, Breda, Den Bosch en Oosterhout (foto). Het bedrijf wil het werkgebied uitbreiden naar Waalwijk. © Pix4Profs-Ron Magelse

Gaat Waalwijk aan de elektrische deelscooter? GO Sharing staat in de startblokken

WAALWIJK - Inwoners van Waalwijk moeten binnenkort ritjes kunnen maken op groene elektrische deelscooters. Het bedrijf GO Sharing staat in de startblokken om zijn werkgebied verder uit te breiden. „We willen in Waalwijk eerst vijftig scooters plaatsen", aldus een woordvoerder. „Dat kunnen er later meer



Development Port of Rotterdam (Port of Rotterdam, 2018)

INDUSTRIAL SHIFT

(Heavy) industry is moving out of the cities, which leaves these sites prime for redevelopment - Van der Knaap, 2002

There is need for 1 million homes before 2030, in form of densifiction instead of expantion - Kajsa Ollongren, 2018

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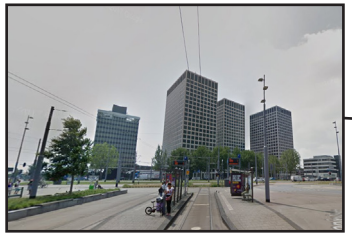
Location:
Merwe-Vierhavens

01 CONTEXT

Merwe-Vierhavens:

- ± 100 ha
- Developed 1910-1915
- Largest fruit port worldwide
- Focus of Municipality of Rotterdam
- Potential growth area
- Innovation District

01 CONTEXT



Marconiplein

Van Helmontstraat

Keileweg

Images from Google Maps 2018

01 CONTEXT

Marconistraat

Galileistraat

Lekhaven

Images from Google Maps 2018

0 250 500 1000m

PROBLEM STATEMENT:

'Industrial sites need to be redeveloped as the industry is moving out and the current urban structure is not fit for the new functions.

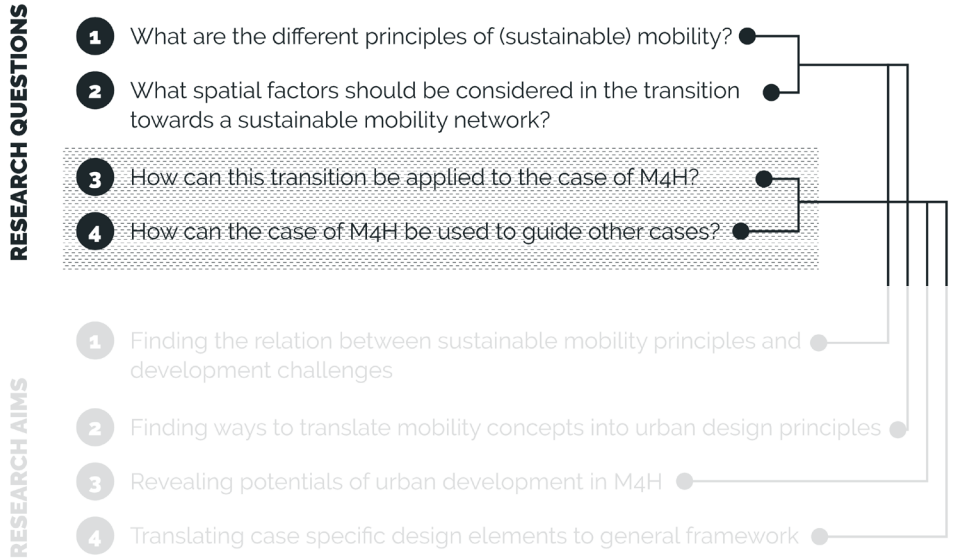
This, together with densification and other environmental challenges causes pressure on open space, which results in social, economic and environmental unsustainability'

HYPOTHESIS:

'The mobility shift towards sustainable principles can be a way to steer the development of post-industrial sites towards a sustainable environment'

RESEARCH QUESTION:

'How can sustainable mobility guide the redevelopment of post-industrial sites towards a sustainable environment?'



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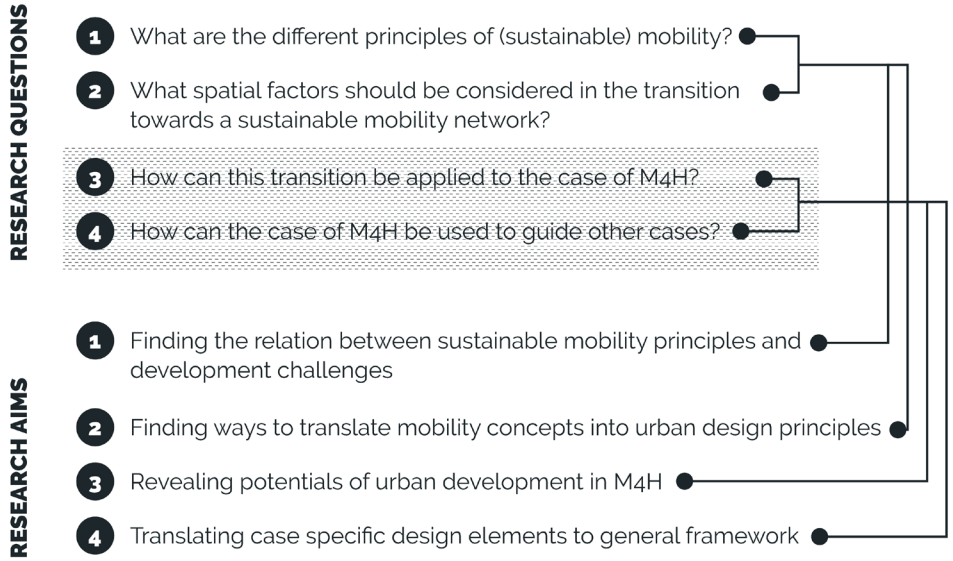
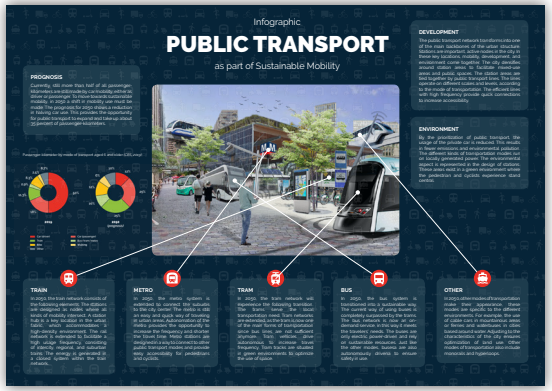


‘How can sustainable mobility guide the redevelopment of post-industrial sites towards a sustainable environment?’

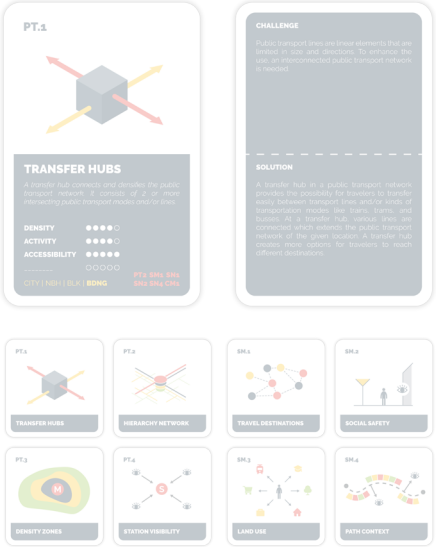
1

Defining the mobility transition



2

Translation into development patterns



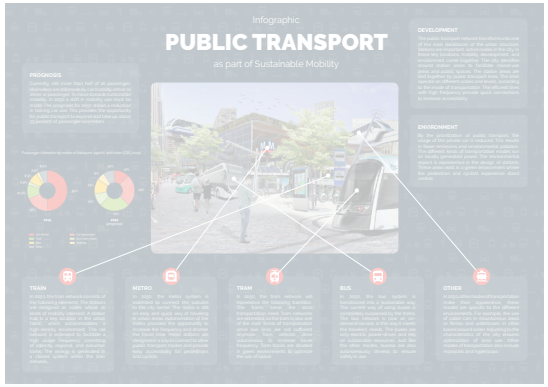
3

Implementation of sustainable mobility in the redevelopment process

‘How can sustainable mobility guide the redevelopment of post-industrial sites towards a sustainable environment?’

1

Defining the mobility transition



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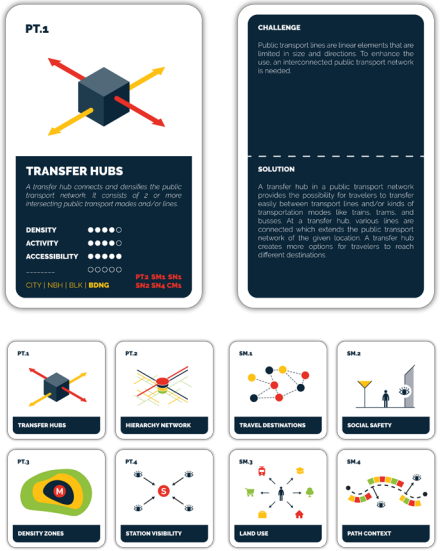

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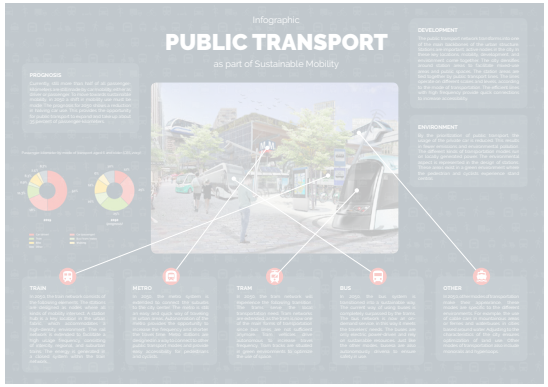

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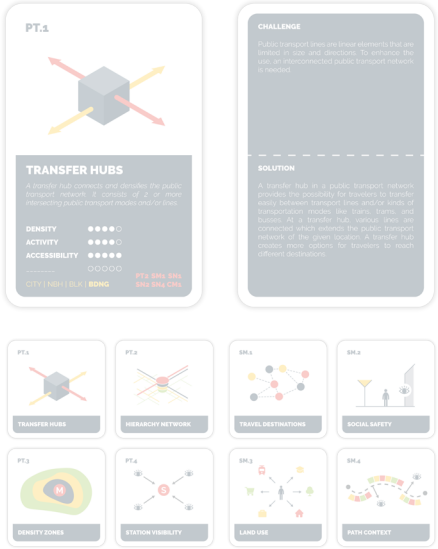

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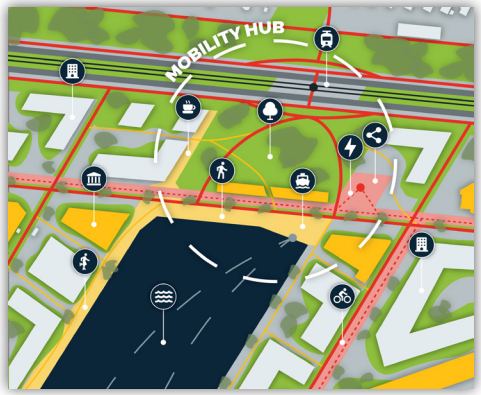

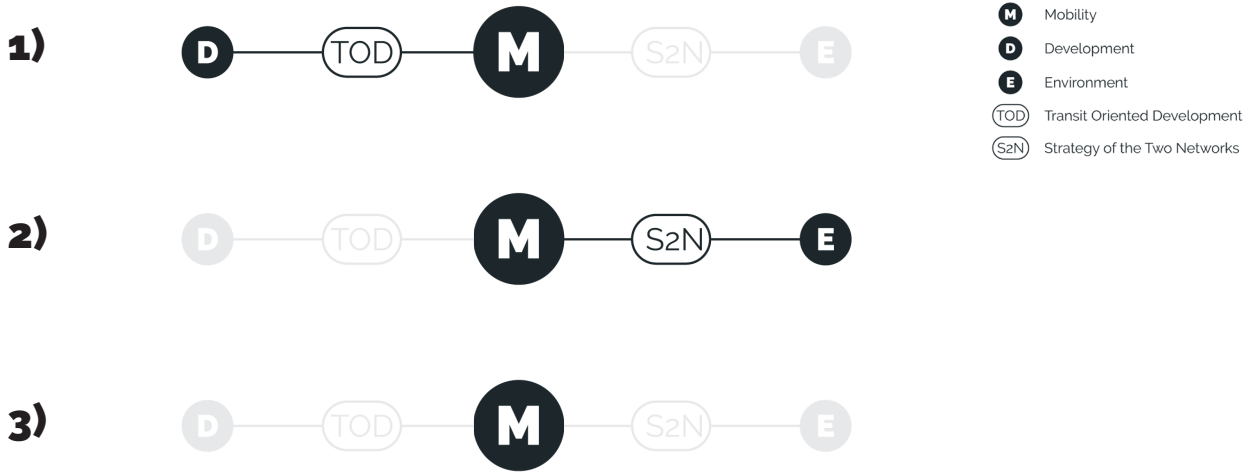
1)
D
TOD
M
S2N
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3)
D
TOD
M
S2N
E
M Mobility
D Development
E Environment
TOD Transit Oriented Development
S2N Strategy of the Two Networks

1)

M Mobility
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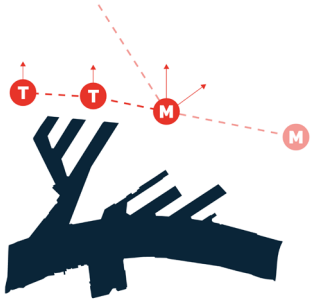
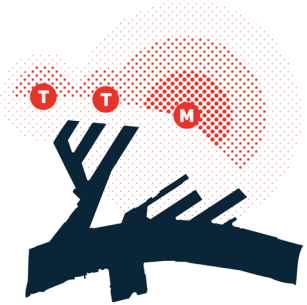
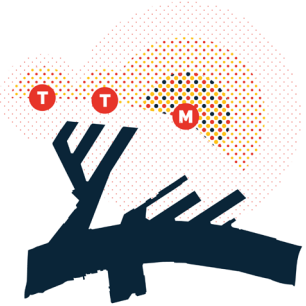
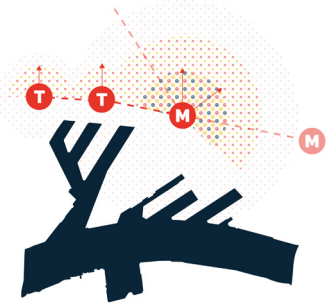
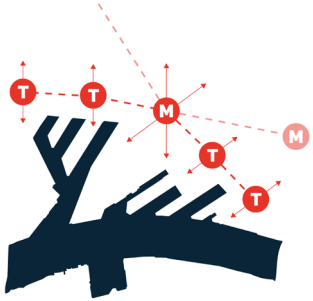
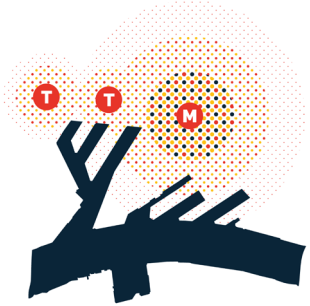
Strategy of Transit-Oriented Development (TOD)

Main development is spatially focused around transit stations to integrate transit and land use - *Zhang, 2007*

Key components of successful TODs are density, transit accessibility and pedestrian friendliness - *Dittmar & Ohland, 2012*

	Accessibility	Building density	Function diversity	TOD conclusion
Current M4H:				
Potential M4H:				

2)

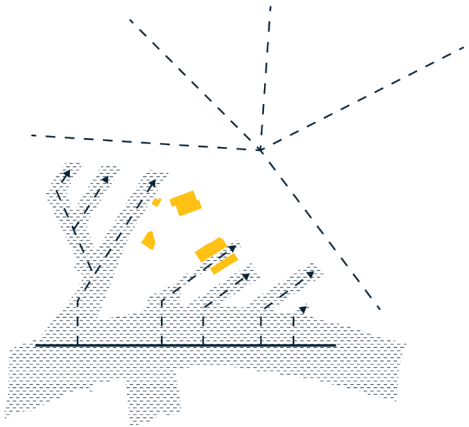
- M Mobility
- D Development
- E Environment
- TOD Transit Oriented Development
- S2N Strategy of the Two Networks

Strategy of the Two Networks (S2N)

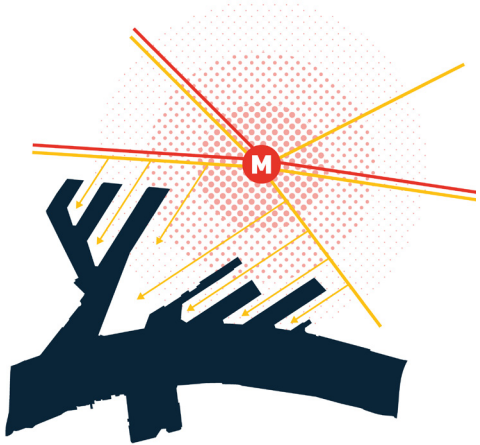
A guiding model for planning and design considering the carrying structures of the urban landscape - Tjallingii, 2005

The water network and traffic network are interrelated and considered equal in design - Tjallingii, 2015

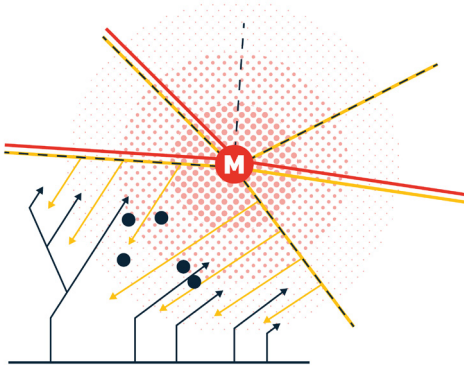
Slow network M4H



Fast network M4H



Slow + fast network M4H



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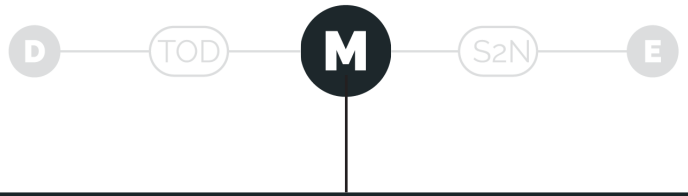

M Mobility
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Sustainable Mobility

'To ensure that our transport systems meet society's economic, social and environmental needs whilst minimising their undesirable impacts on the economy, society and the environment' - *European Commission, 1992*

SUSTAINABLE MOBILITY

BEHAVIOURAL TRANSITION
Influenced by urban design

TECHNOLOGICAL TRANSITION
Influences urban design

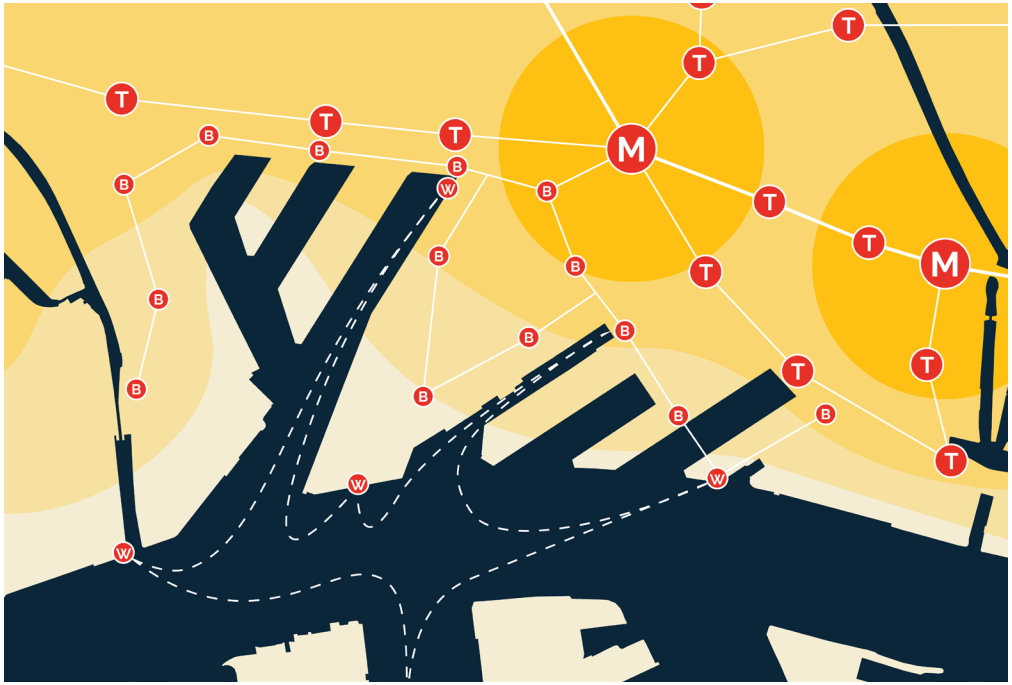
Public transport

Slow mobility

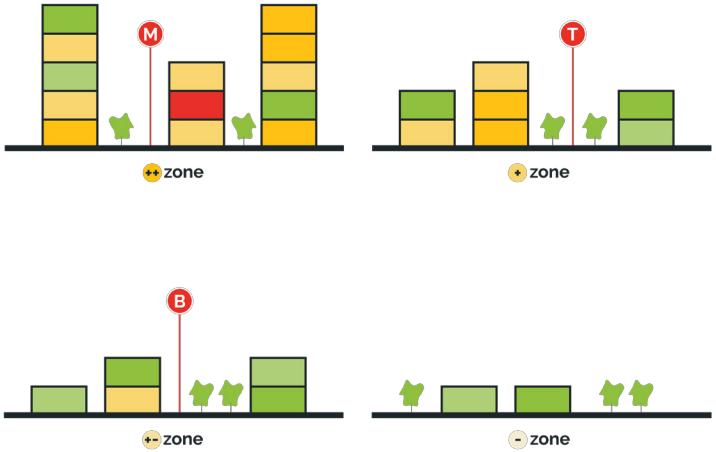
Sharing network

Clean mobility

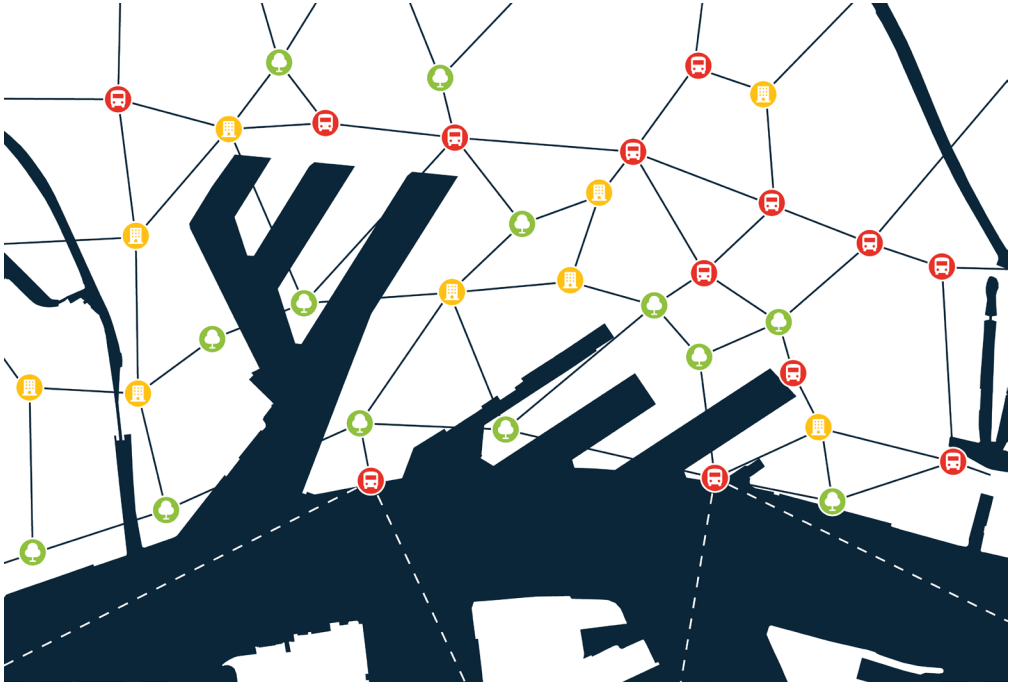
Public transport



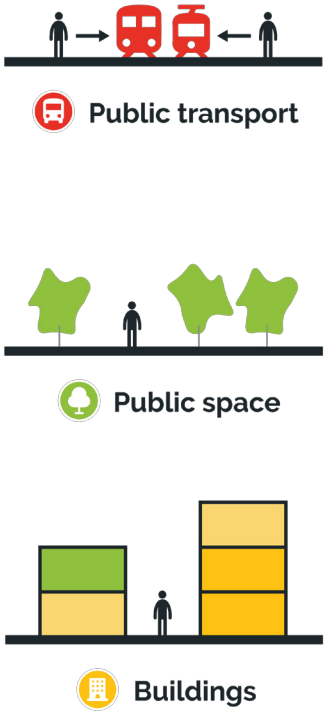
Density zones



Slow mobility

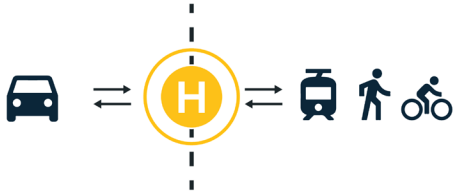


Network of destinations

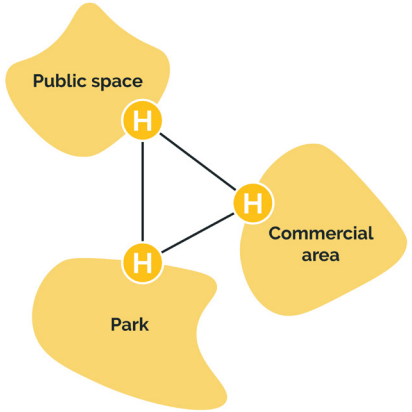


Sharing network

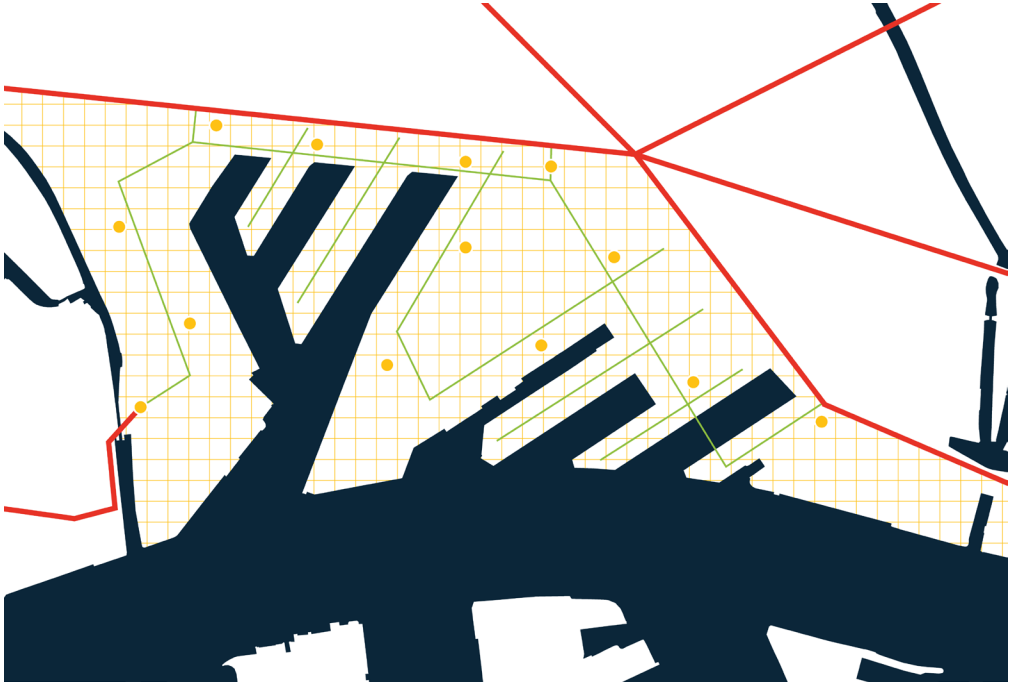
Entrance zones



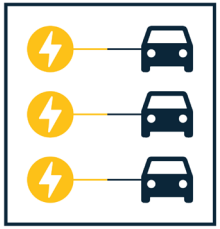
Mobility hubs



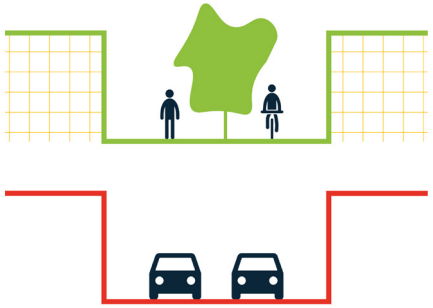
Clean mobility



Charging network



Street layout



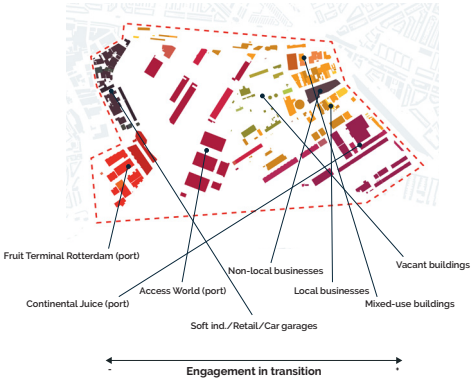
03 STRATEGY

Key-elements city scale

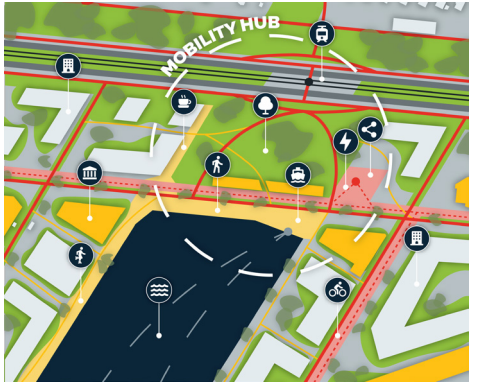
Key-elements local scale

Timeline

Stakeholders



Design intervention



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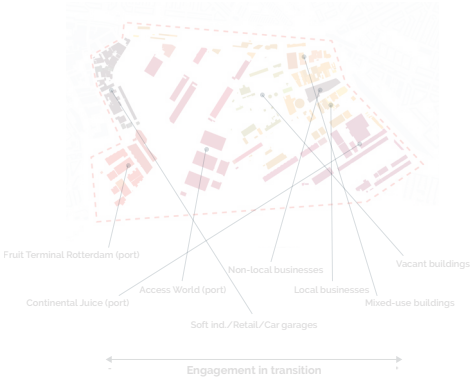
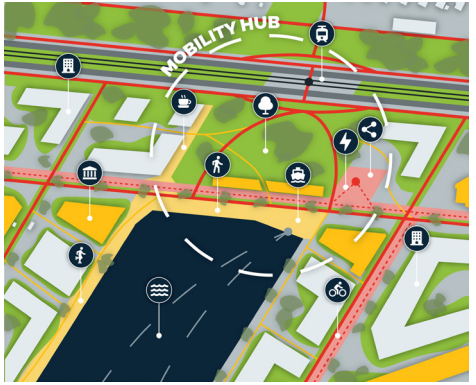


Design intervention



03 STRATEGY

KEY-ELEMENTS LOCAL SCALE

1) Main Road
2) Local Streets
3) Green Network
4) Water Network
5) Buildings

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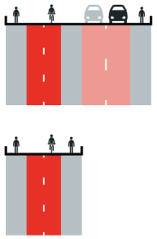

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KEY-ELEMENTS LOCAL SCALE

1) Main Road
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LEGEND

- Entrance hub
- Sharing hub
- Central activity
- Slow road
- Local public
- Tram line
- Metro stop
- Waterbus line
- Monument
- Iconic buildings
- Build up area
- Water
- Greenery
- Active waterfront

03 STRATEGY

KEY-ELEMENTS LOCAL SCALE

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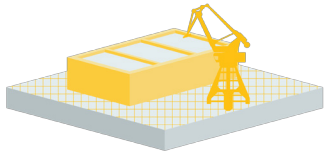
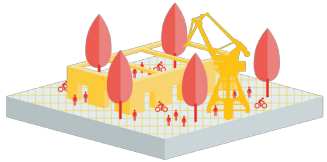
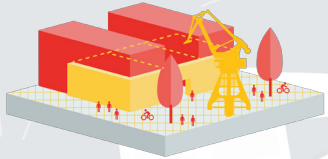




Low density

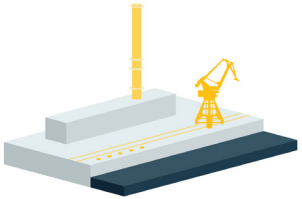
Mid-low density

Mid-high density

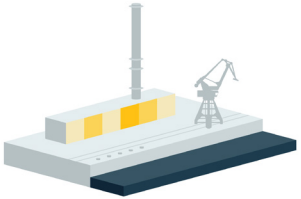


High density

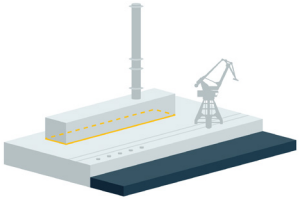
INDUSTRIAL CHARACTER M4H



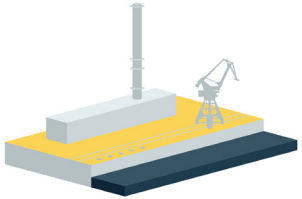
Non-functional elements



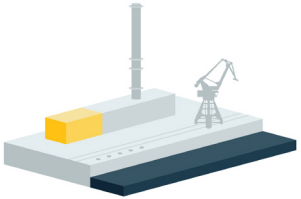
Facades



Block/plots



Open space



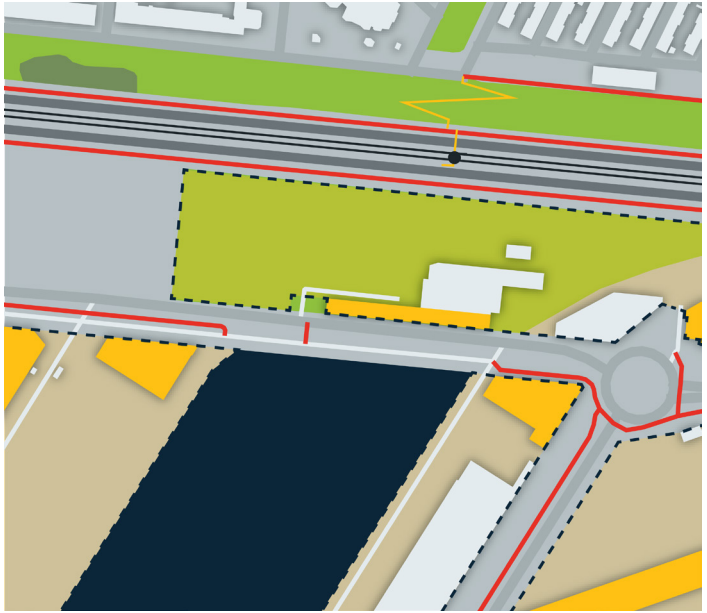
Functions

GROTE MERWEHAVEN

FERRO DOME PLEIN

DESIGN INTERVENTION CURRENT SITUATION

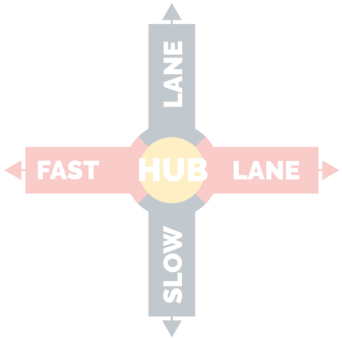
Current situation from Google Maps, 2019

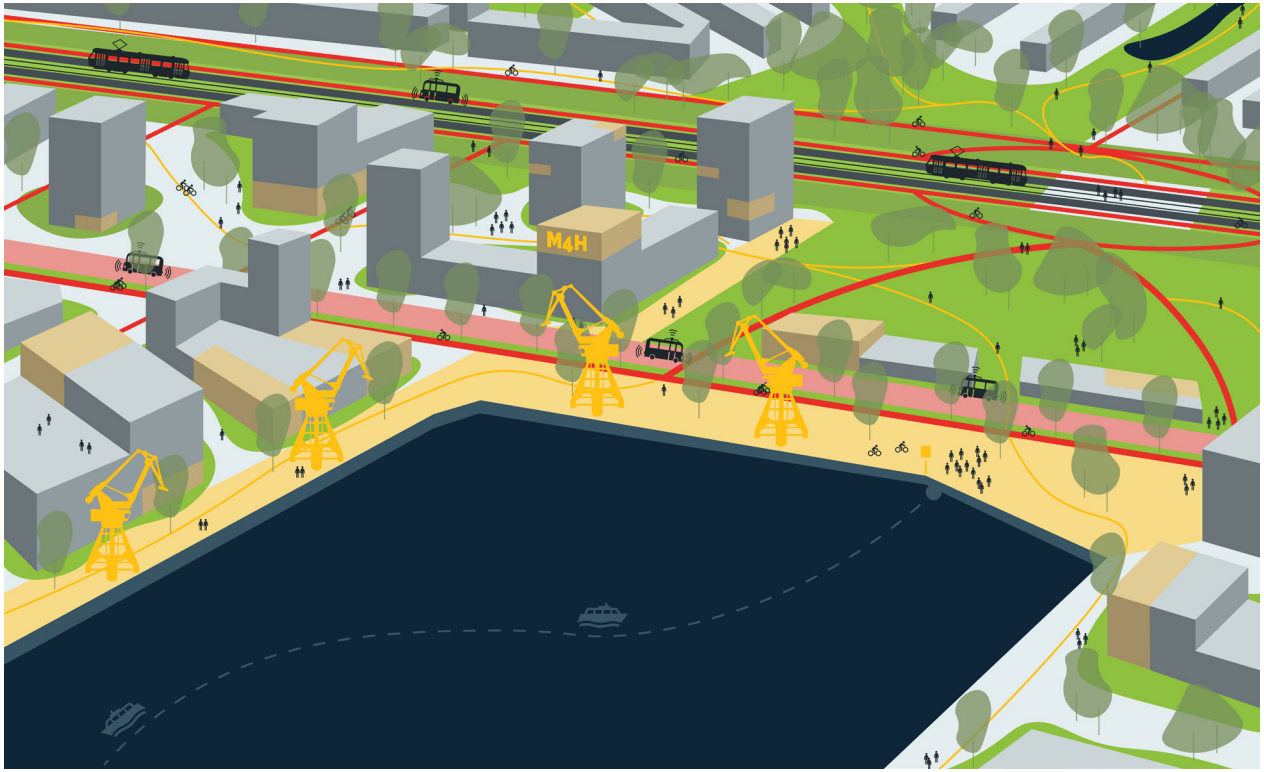


DI - CURRENT SITUATION

Current situation from Google Maps, 2019

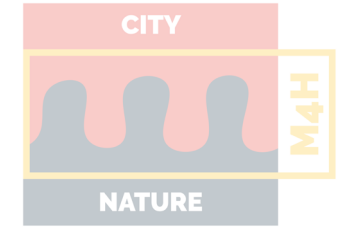
DI - NEW SITUATION

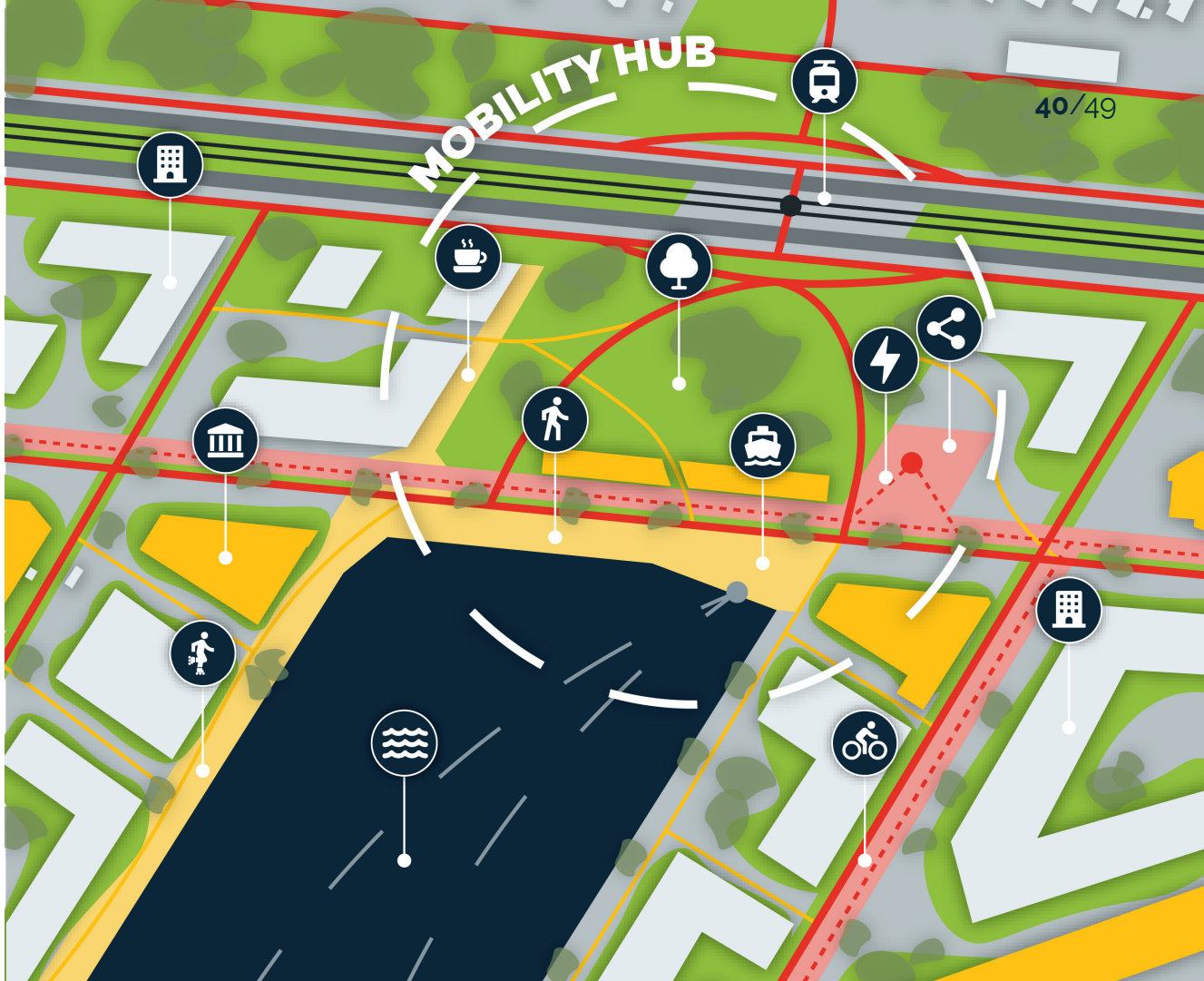




03 STRATEGY

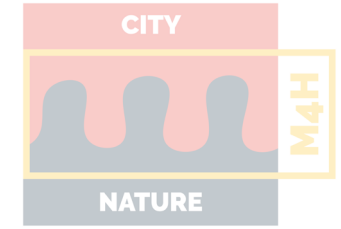
DI - NEW SITUATION

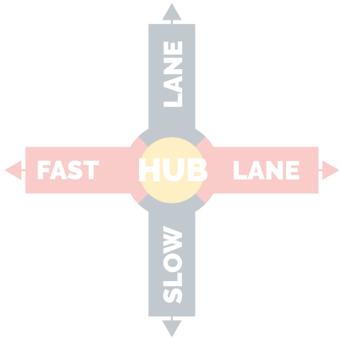


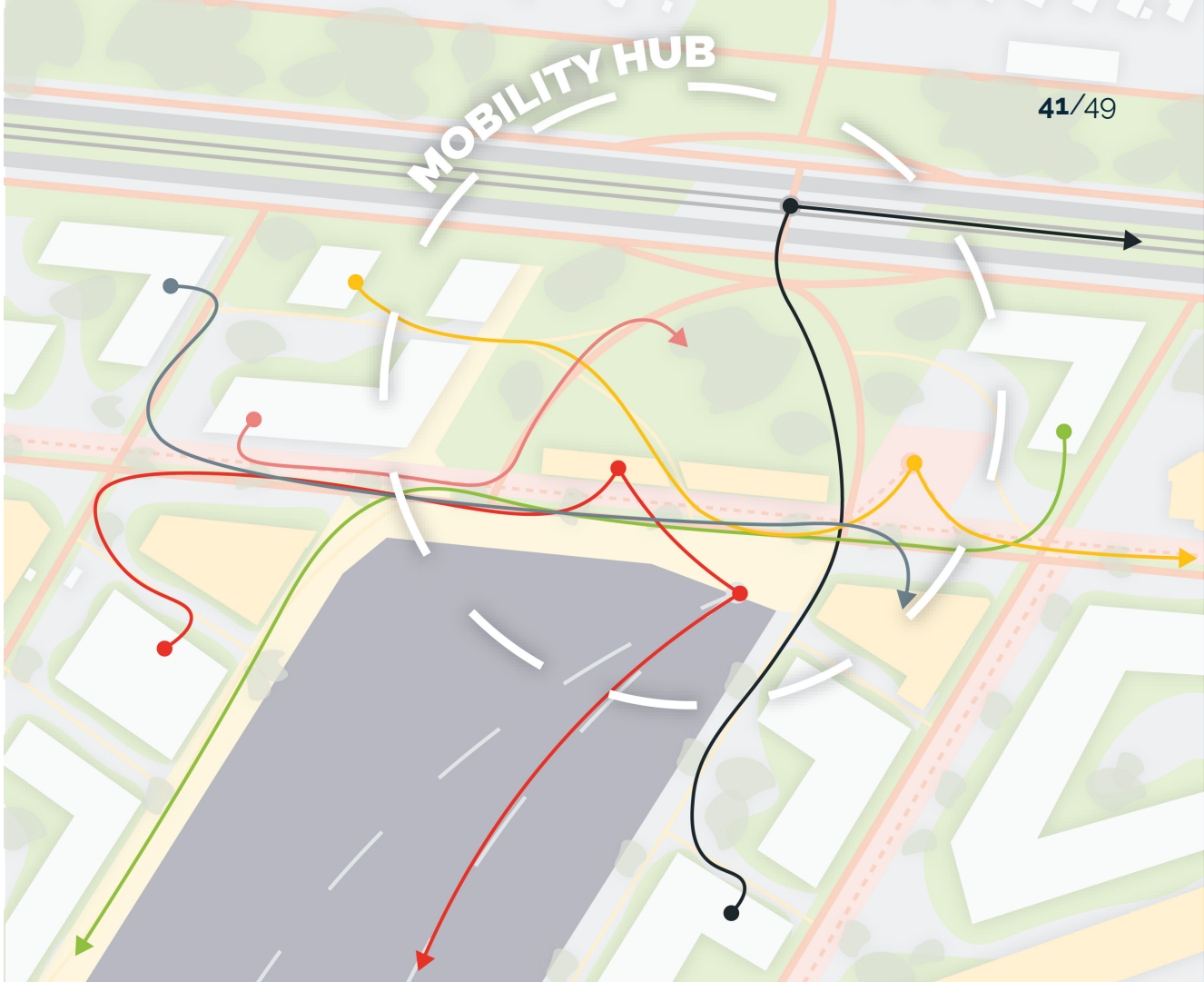


03 STRATEGY

DI - ACTIVITY

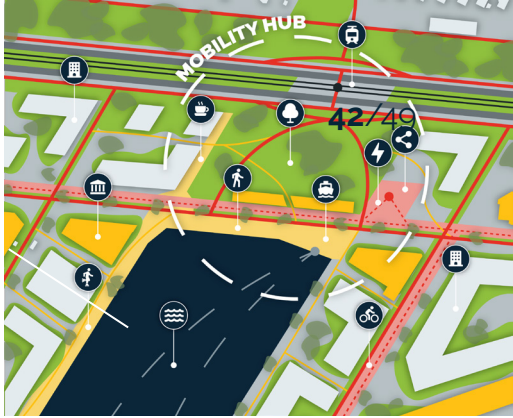


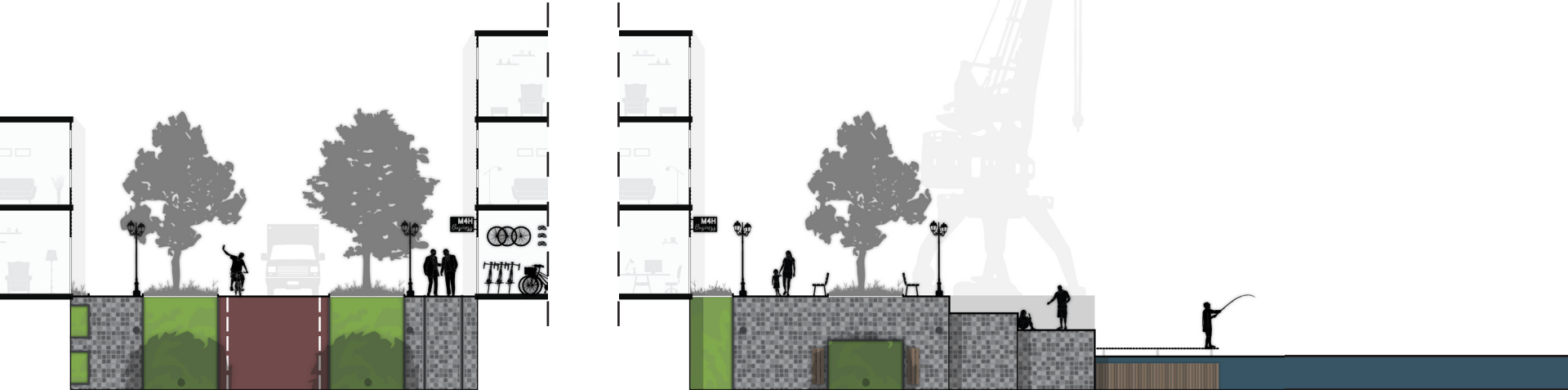




03 STRATEGY

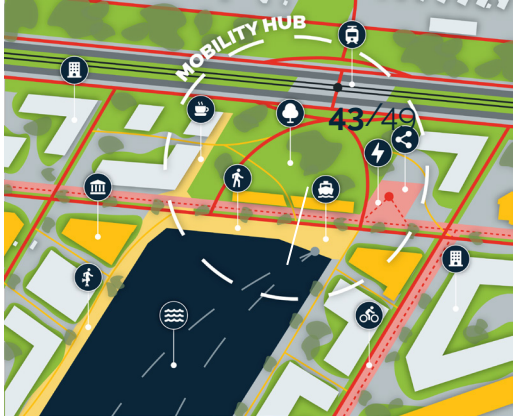
DI - NEW SITUATION





03 STRATEGY

DI - NEW SITUATION



03 STRATEGY

PT.1

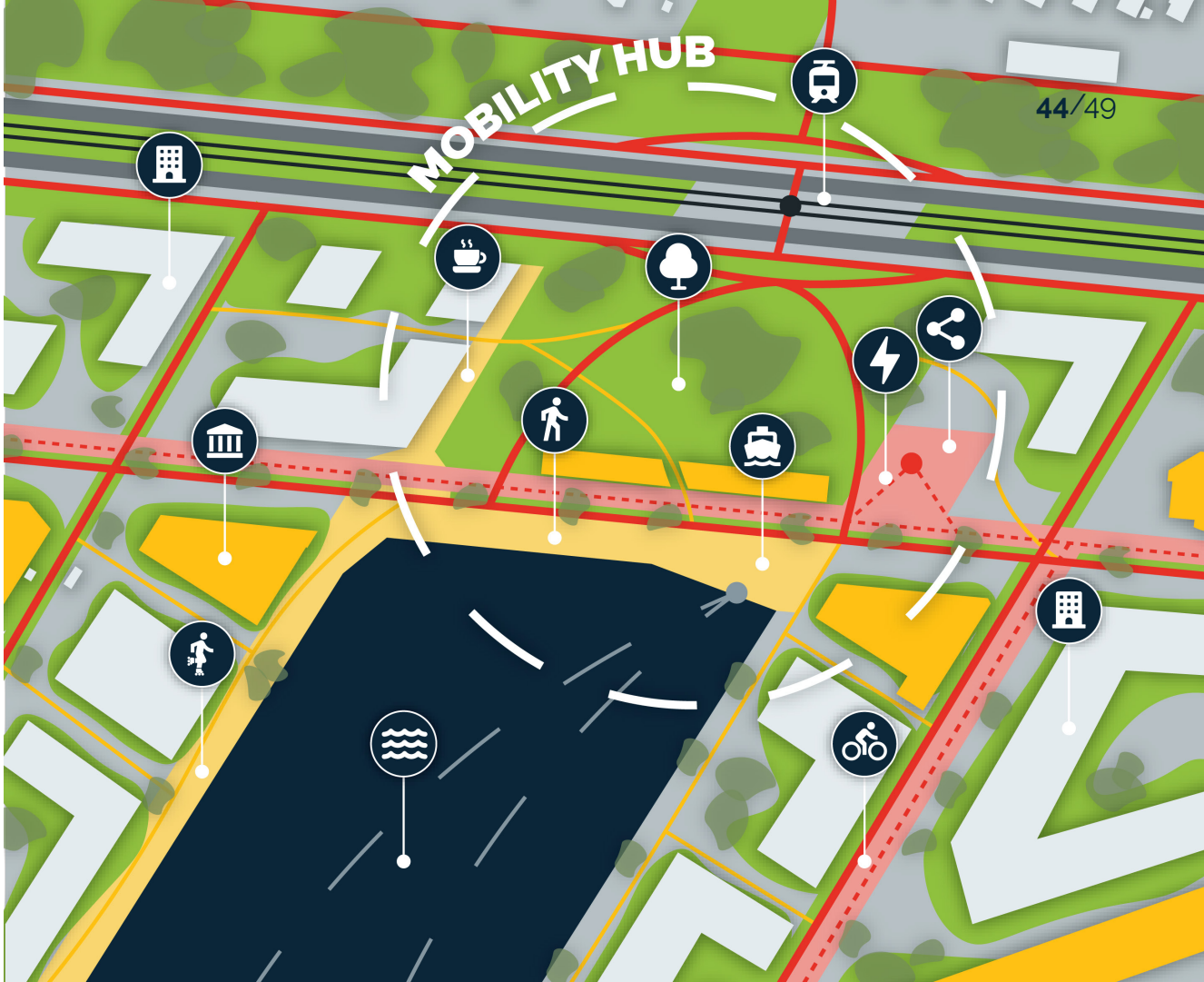
TRANSFER HUBS

PT.2

HIERARCHY NETWORK

SN.4

CENTRALITY



PUBLIC TRANSPORT (PT)

PT.1

TRANSFER HUBS

PT.2

HIERARCHY NETWORK

PT.3

DENSITY ZONES

PT.4

STATION VISIBILITY

PT.5

STATION ACCESSIBILITY

PT.6

TITLE

PT.7

TITLE

PT.8

TITLE

SLOW MOBILITY (SM)

SM.1

TRAVEL DESTINATIONS

SM.2

SOCIAL SAFETY

SM.3

LAND USE

SM.4

PATH CONTEXT

SM.5

PHYSICAL SAFETY

SM.6

PATH QUALITY

SM.7

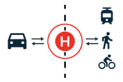
TITLE

SM.8

TITLE

SHARING NETWORK (SN)

SN.1



TRANSITION ZONES

SN.2

PARKING HUBS

SN.3

COMMUNITY

SN.4

CENTRALITY

SN.5

TITLE

SN.6

TITLE

SN.7

TITLE

SN.8

TITLE

CLEAN MOBILITY (CM)

CM.1

CHARGING NETWORK

CM.2

LOCAL POWER GENERATE

CM.3

NO EMISSION ZONE

CM.4

TITLE

CM.5

TITLE

CM.6

TITLE

CM.7

TITLE

CM.8

TITLE

NR.

Image/diagram

TITLE

Short discription

DENSITY ●○○○○
ACTIVITY ●○○○○
ACCESSIBILITY ●○○○○
-------- ●○○○○

SCALE . **RELATED TO**

CHALLENGE

Explanation

SOLUTION

Explanation

PT.1

TRANSFER HUBS

A transfer hub connects and densifies the public transport network. It consists of 2 or more intersecting public transport modes and/or lines.

DENSITY ●●●●○
ACTIVITY ●●●●○
ACCESSIBILITY ●●●●●
-------- ○○○○○

CITY | NBH | BLK | **BDNG**

PT2 SM1 SN1 SN2 SN4 CM1

CHALLENGE

Public transport lines are linear elements that are limited in size and directions. To enhance the use, an interconnected public transport network is needed.

SOLUTION

A transfer hub in a public transport network provides the possibility for travelers to transfer easily between transport lines and/or kinds of transportation modes like trains, trams, and busses. At a transfer hub, various lines are connected which extends the public transport network of the given location. A transfer hub creates more options for travelers to reach different destinations.

Infographic

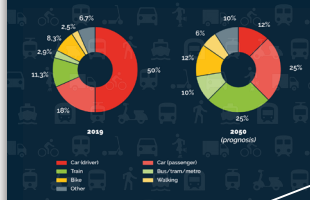
PUBLIC TRANSPORT

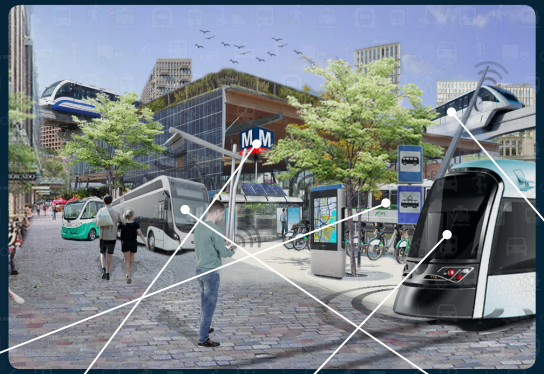
as part of Sustainable Mobility

PROGNOSIS

Currently, still more than half of all passenger-kilometers are still made by car mobility, either as driver or passenger. To move towards sustainable mobility, in 2050 a shift in mobility use must be made. The prognosis for 2050 shows a reduction in halving car use. This provides the opportunity for public transport to expand and take up about 35 percent of passenger-kilometers.

Passenger-kilometer by mode of transport aged 6 and older (CBS, 2019)





DEVELOPMENT

The public transport network transforms into one of the main backbones of the urban structure. Stations are important, active nodes in the city. In these key locations, mobility, development, and environment come together. The city densifies around station areas to facilitate mixed-use areas and public spaces. The station areas are tied together by public transport lines. The lines operate on different scales and levels, according to the mode of transportation. The efficient lines with high frequency provide quick connections to increase accessibility.

ENVIRONMENT

By the prioritization of public transport, the usage of the private car is reduced. This results in fewer emissions and environmental pollution. The different kinds of transportation modes run on locally generated power. The environmental aspect is represented in the design of stations. These areas exist in a green environment where the pedestrian and cyclists experience stand central.

TRAIN

In 2050, the train network consists of the following elements. The stations are designed as nodes where all kinds of mobility intersect. A station hub is a key location in the urban fabric, which accommodates a high-density environment. The rail network is extended to facilitate a high usage frequency, consisting of intercity, regional, and suburban trains. The energy is generated in a closed system within the train network.

METRO

In 2050, the metro system is extended to connect the suburbs to the city center. The metro is still an easy and quick way of traveling in urban areas. Autonomation of the metro provides the opportunity to increase the frequency and shorten the travel time. Metro stations are designed in a way to connect to other public transport modes and provide easy accessibility for pedestrians and cyclists.

TRAM

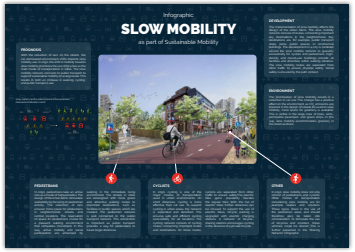
In 2050, the tram network will experience the following transition. The trams serve the local transportation need. Tram networks are extended, as the tram is now one of the main forms of transportation since bus lines are not sufficient anymore. Tram vehicles drive autonomous to increase travel frequency. Tram tracks are situated in green environments to optimize the use of space.

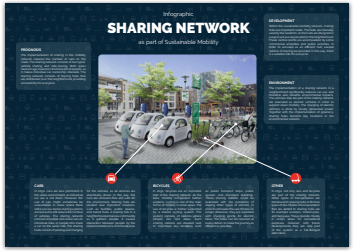
BUS

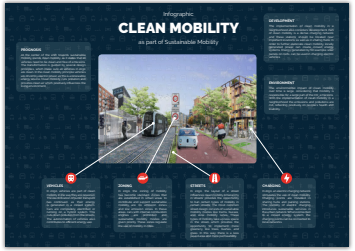
In 2050, the bus system is transitioned into a sustainable way. The current way of using buses is completely surpassed by the trams. The bus network is now an on-demand service, in this way it meets the travelers' needs. The buses are only electric power-driven and rely on sustainable resources. Just like the other modes, busesa are also autonomously drivena to ensure safety in use.

OTHER

In2050,othermodesoftransportation make their appearance. These modes are specific to the different environments. For example, the use of cable cars in mountainous areas or ferries and waterbuses in cities based around water. Adjusting to the characteristics of the city ensures optimization of land use. Other modes of transportation also include monorails and hyperloops.





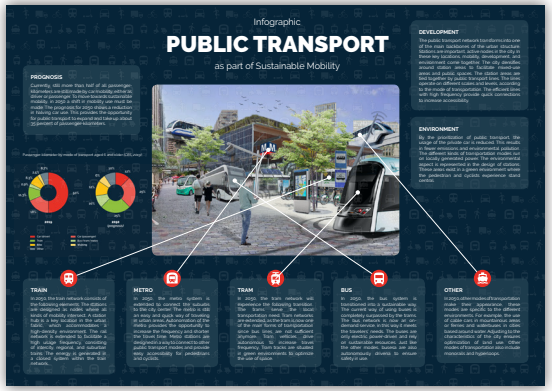


04 CONCLUSION

‘How can sustainable mobility guide the redevelopment of post-industrial sites towards a sustainable environment?’

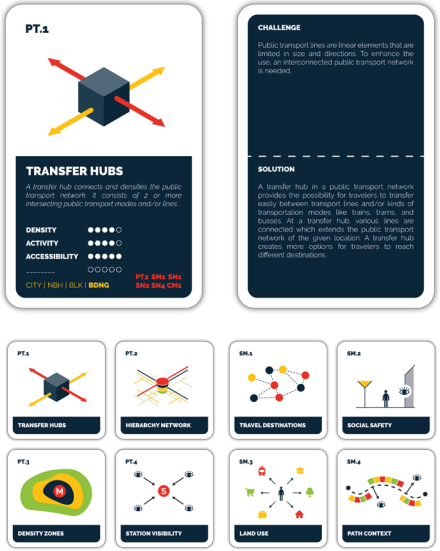
1

Defining the mobility transition



2

Translation into development patterns



3

Implementation of sustainable mobility in the redevelopment process