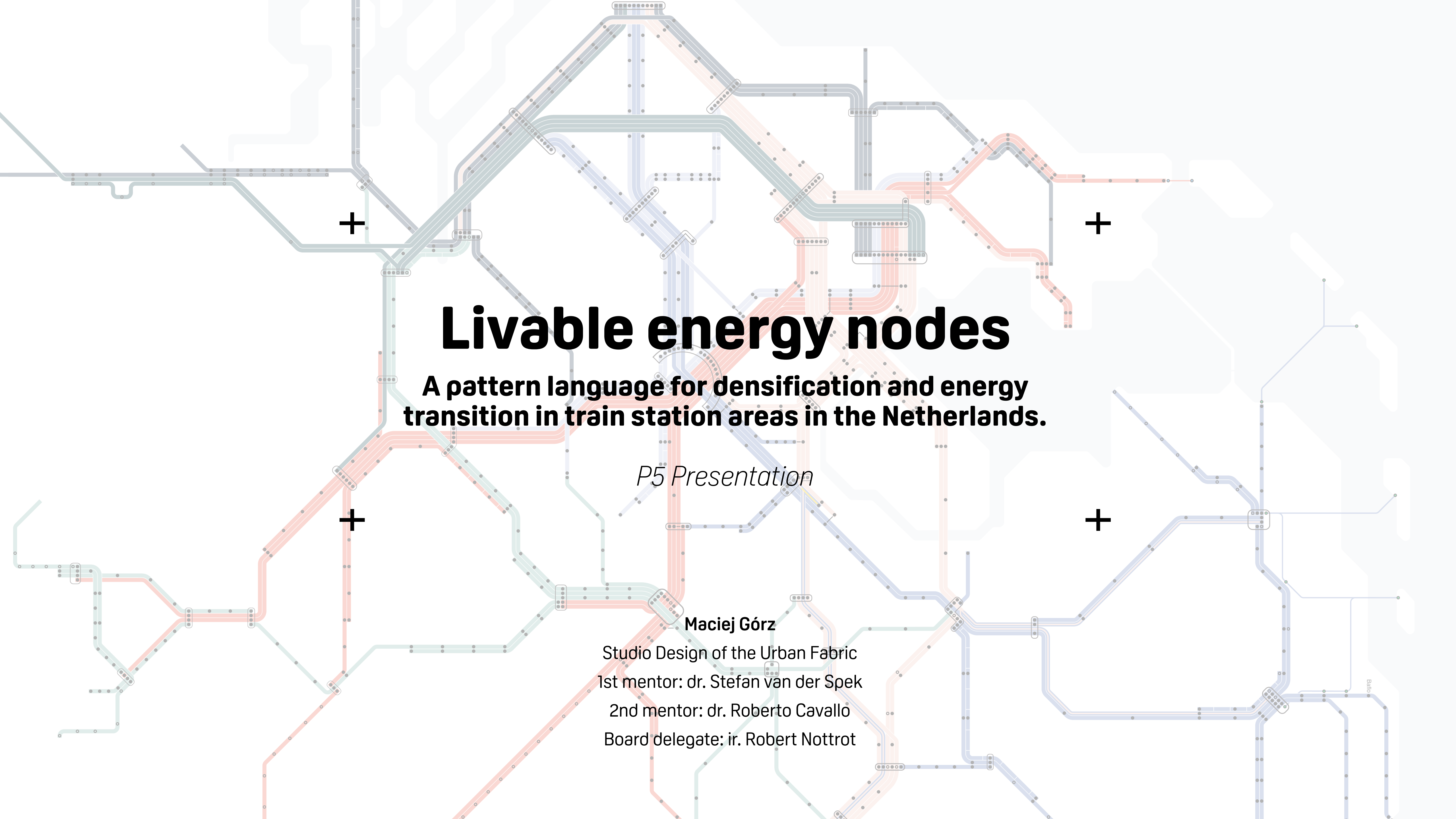




Livable energy nodes

A pattern language for densification and energy transition in train station areas in the Netherlands.

P5 Presentation

Maciej Górz

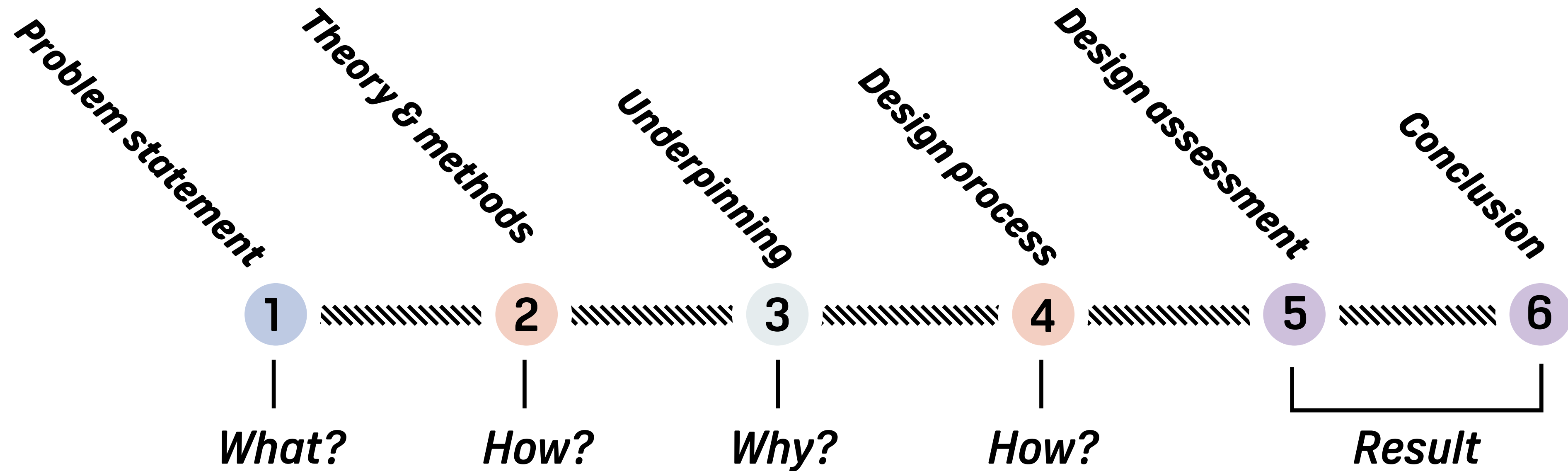
Studio Design of the Urban Fabric

1st mentor: dr. Stefan van der Spek

2nd mentor: dr. Roberto Cavallo

Board delegate: ir. Robert Nottrot

Presentation plan



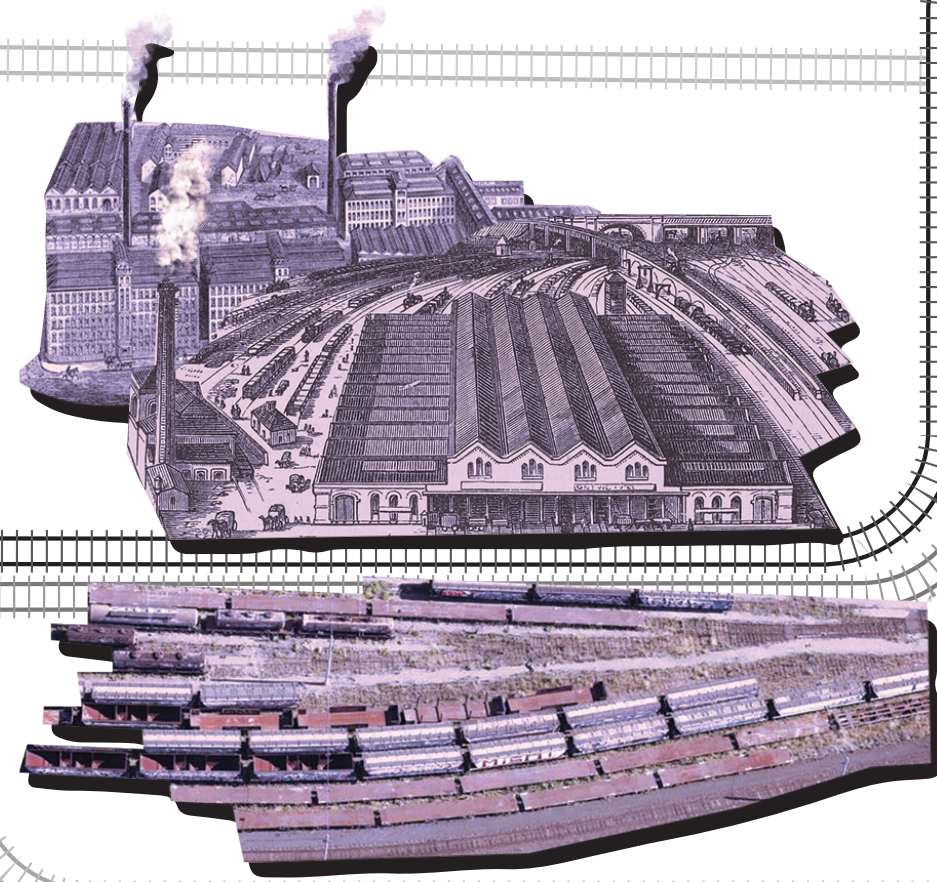
Rail x city

Paradigms



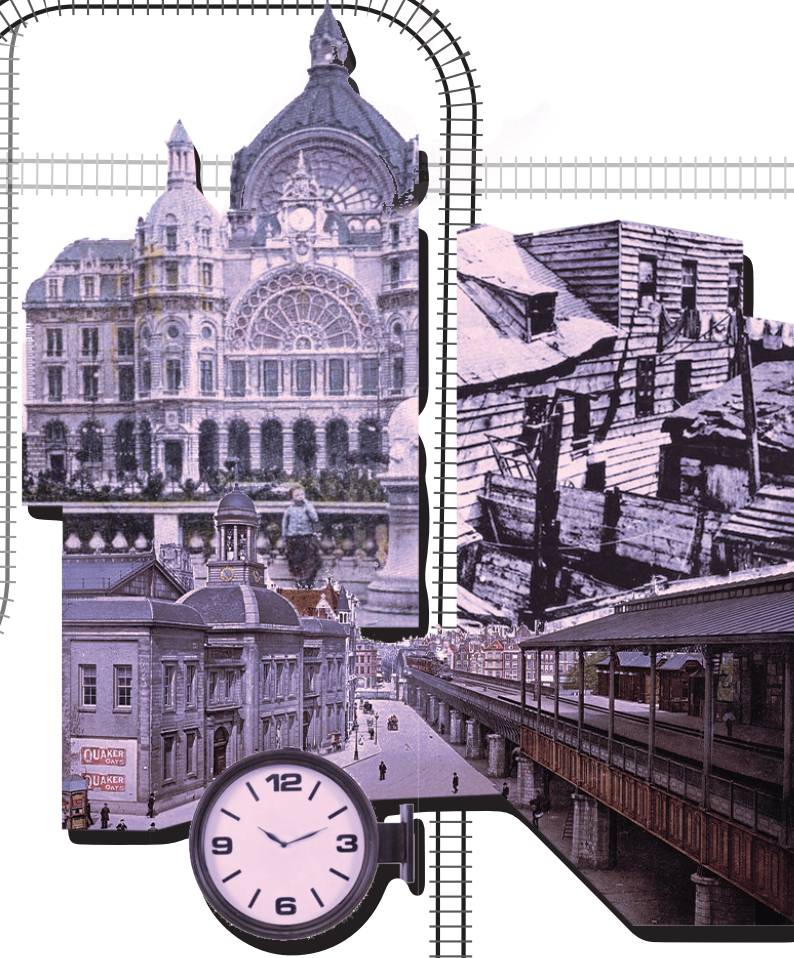
1850

Gate to the city



1880

City-industry
interface



1900

Cathedrals of
progress



1960

Uniformized
machine



1990

Business
districts

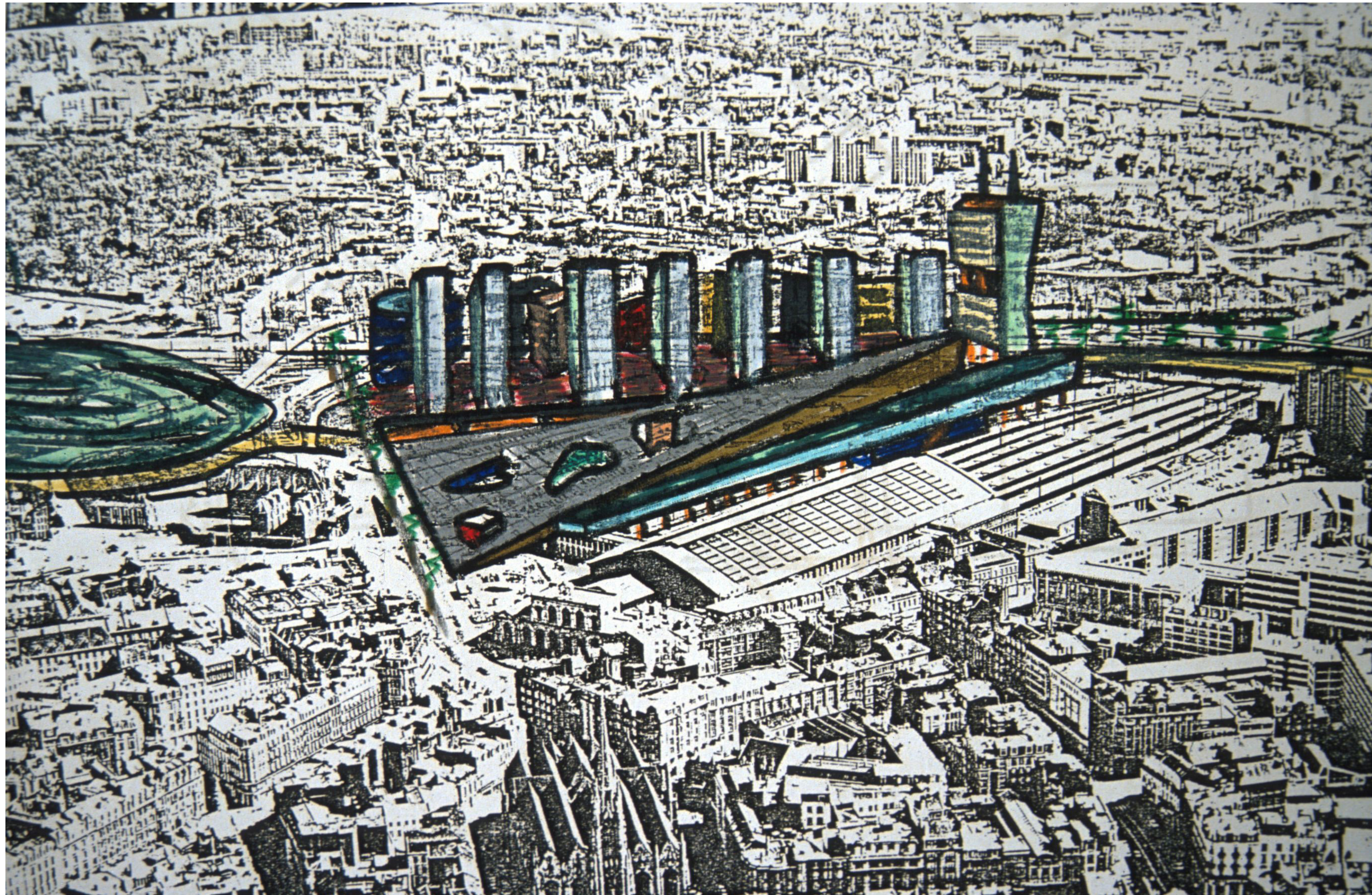
- 1 ● Problem statement
- Theory & methods
- Underpinning
- Design process
- Design assessment
- Conclusion



Claude Monet, 'La gare Saint-Lazare', 1877

Source: commons.wikimedia.org/wiki/File:Claude_Monet,_The_Gare_St-Lazare,_1877.jpg

Train station: A place of fossil energy consumption



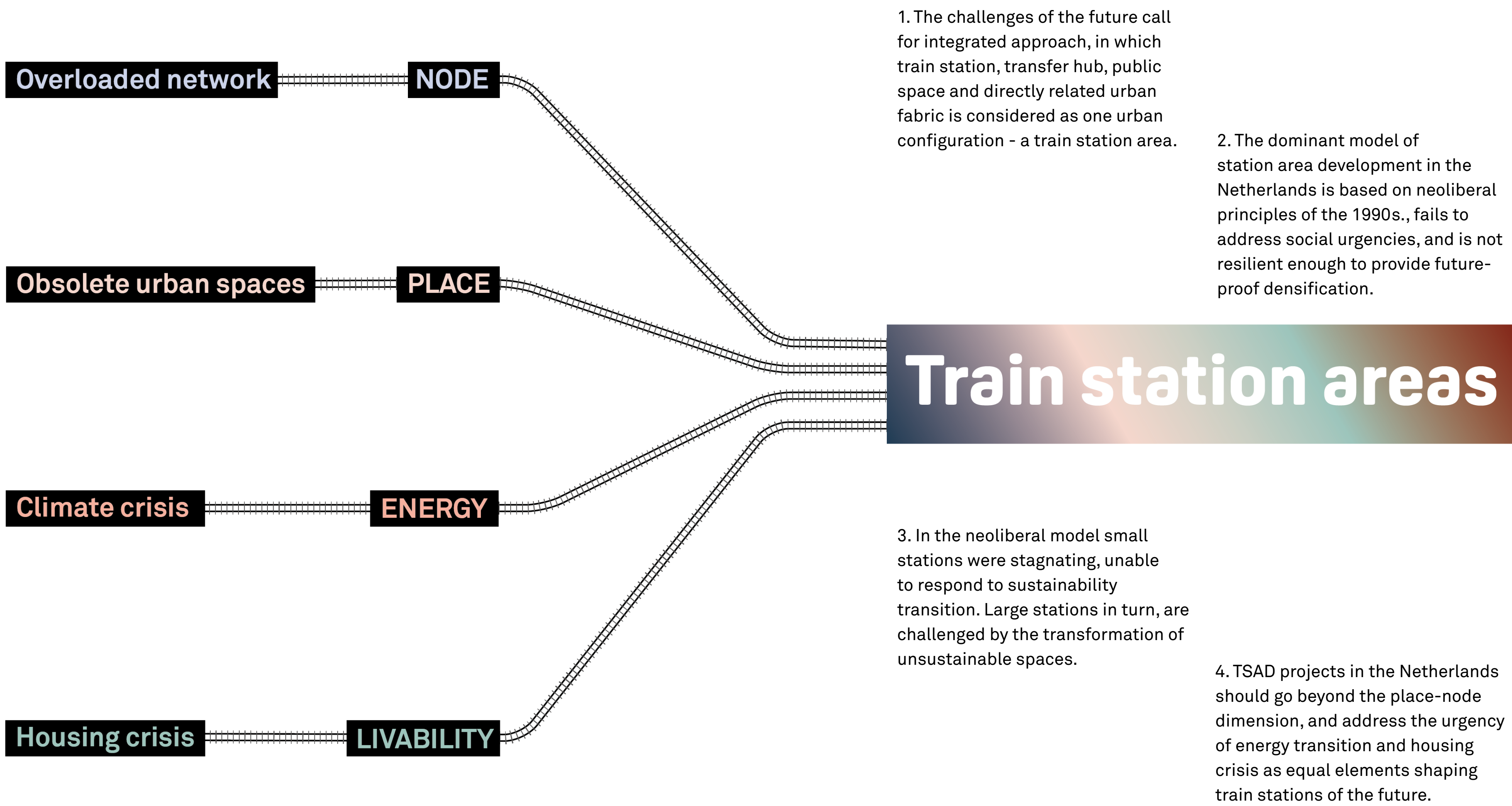
Train station: An epicenter of work in the city

Euralille, OMA, 1990, a hallmark project of neoliberal TSAD, the current paradigm.

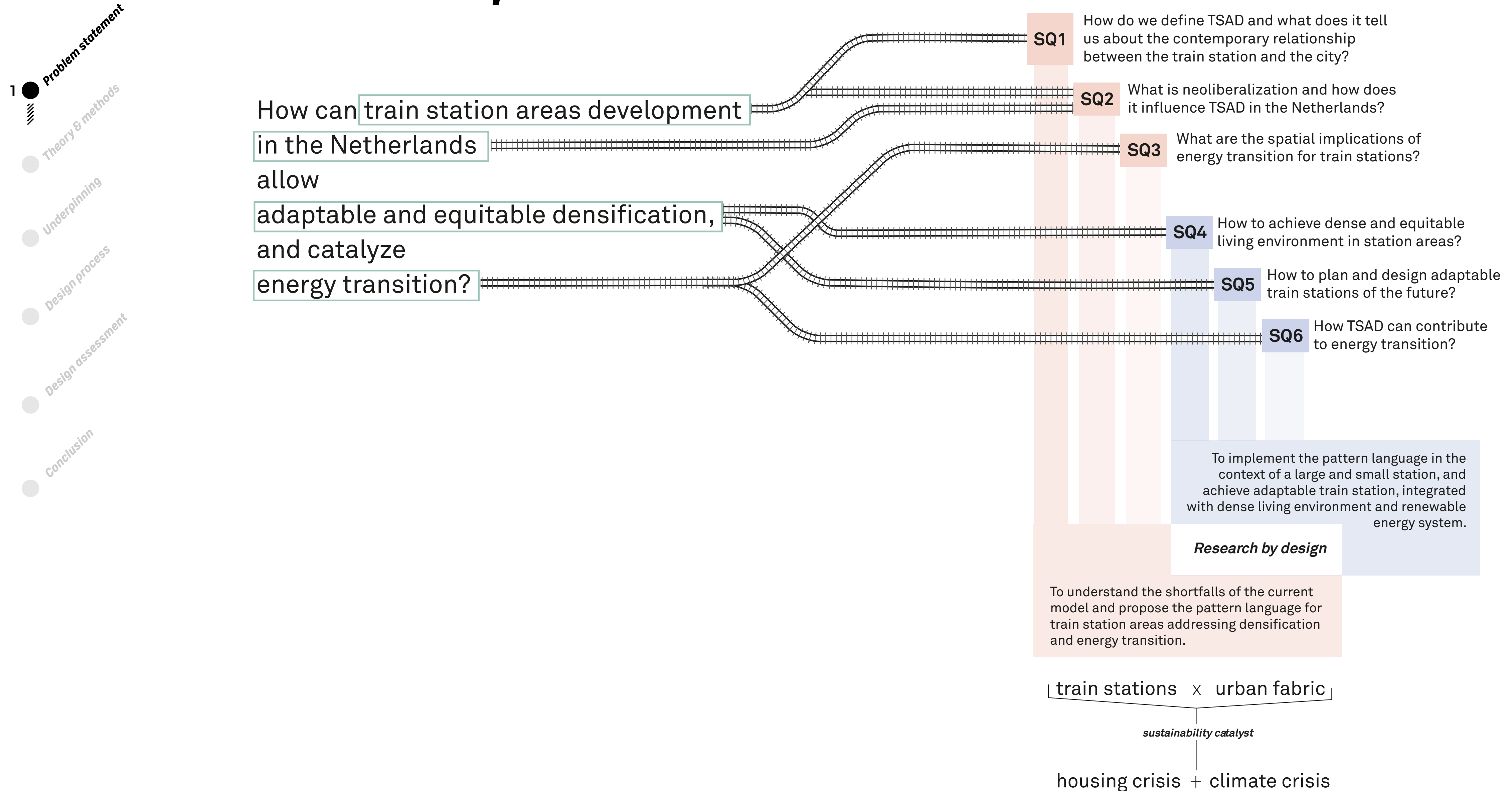
Source: <https://bit.ly/2TG3YjP>

Problem statement

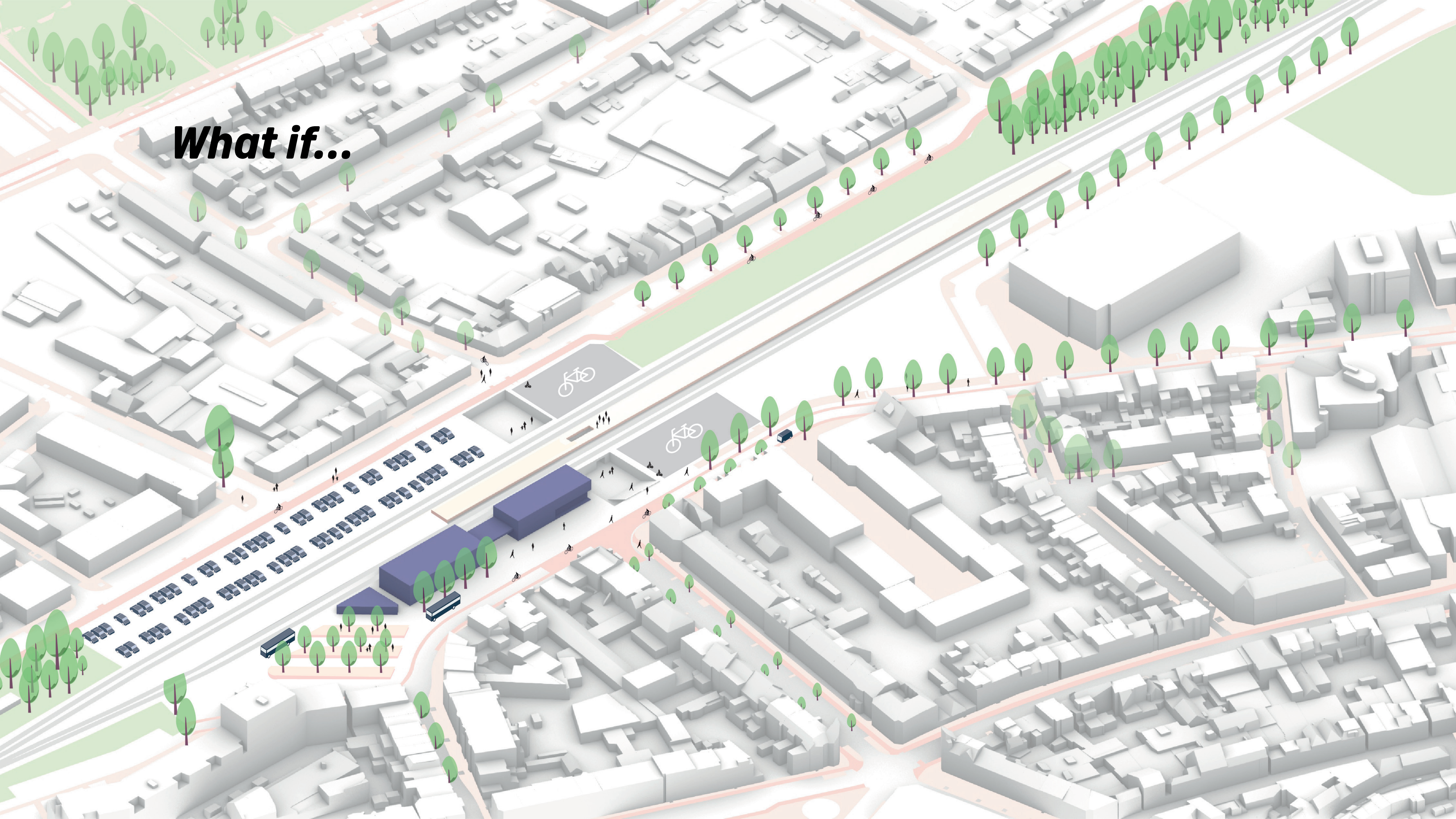
- 1 ● Problem statement
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Research question



What if...



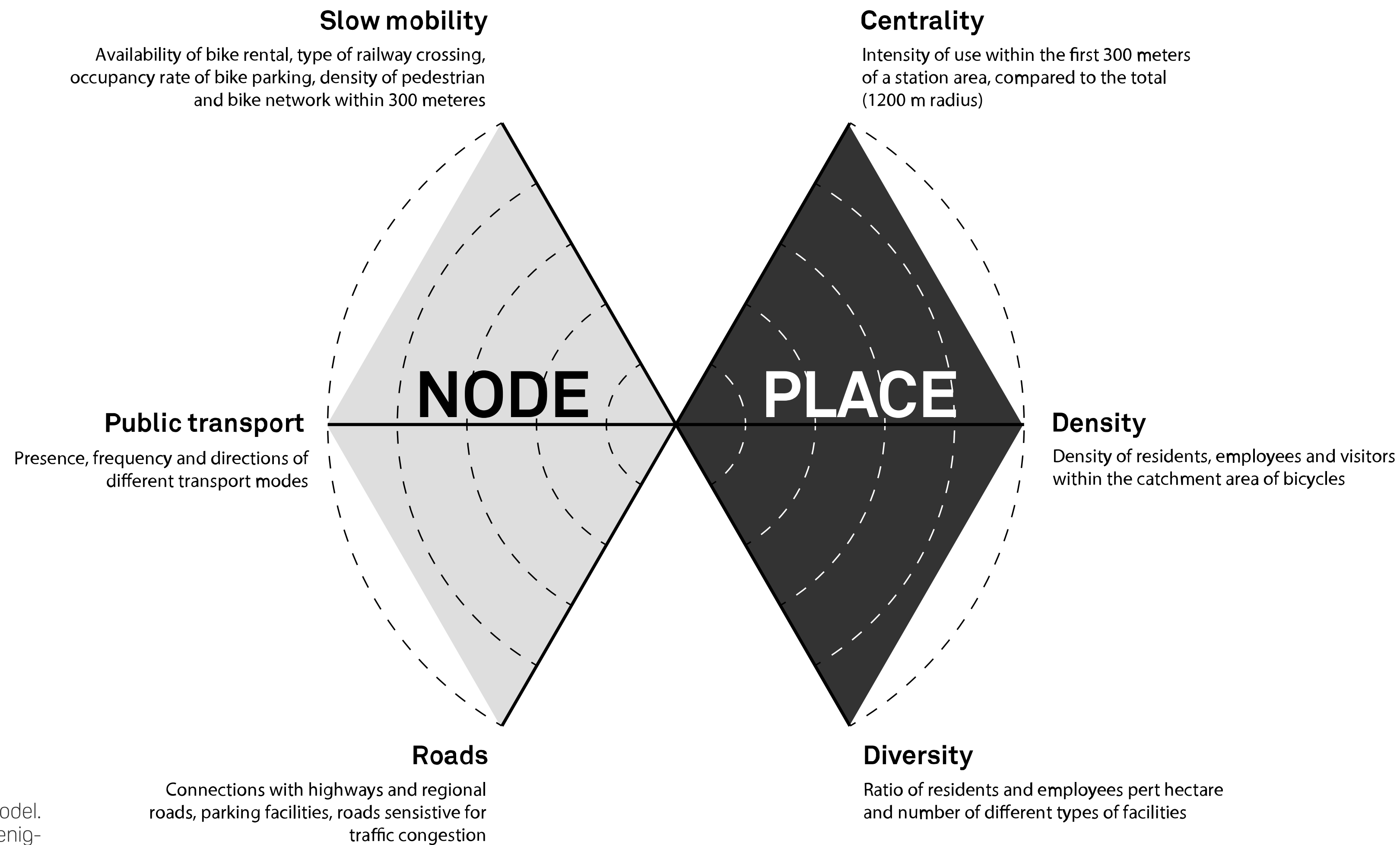
What if...



02 • Theory & methods

Established butterfly model - Bertolini & Spit, 1998

- 1 Problem statement
- 2 **Theory & methods**
- Underpinning
- Design process
- Design assessment
- Conclusion

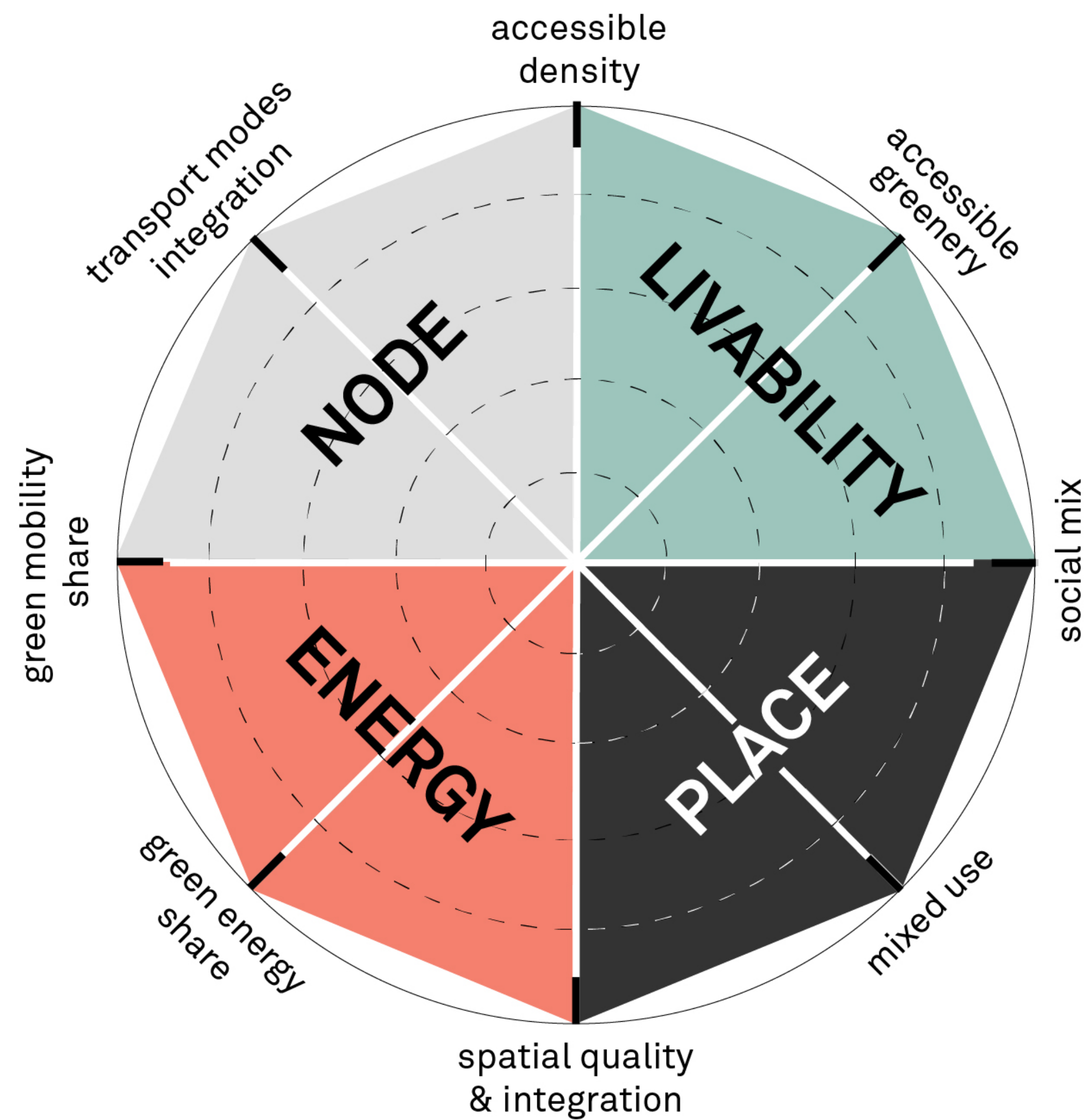


The butterfly model.
Source: based on Vereniging Deltametropool (2013).

02 • Theory & methods

Proposed rose model

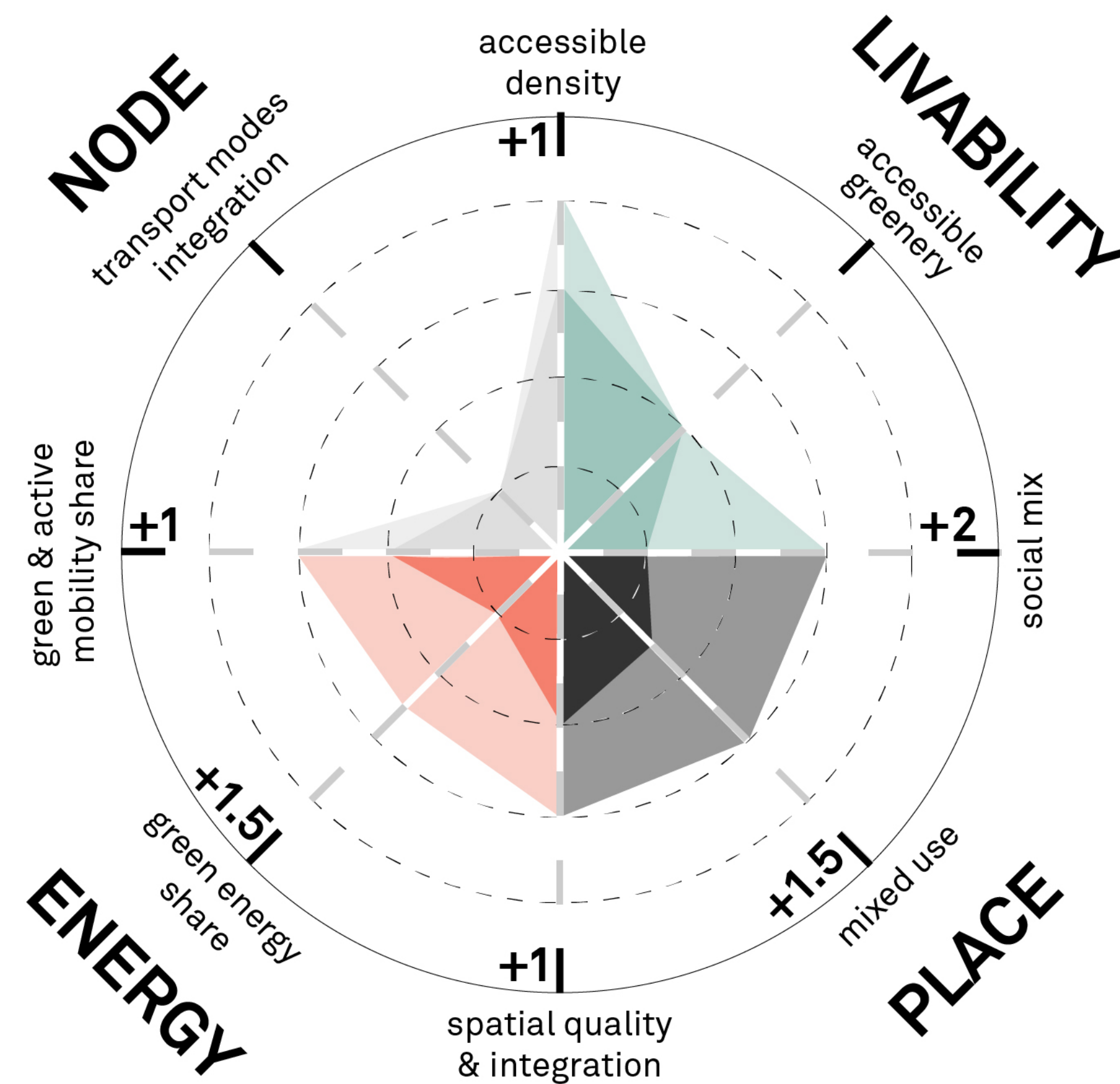
- 1  Problem statement
- 2  Theory & methods
-  Underpinning
-  Design process
-  Design assessment
-  Conclusion



02 • Theory & methods

Assessment framework

- 1 Problem statement
- 2 Theory & methods
- Underpinning
- Design process
- Design assessment
- Conclusion

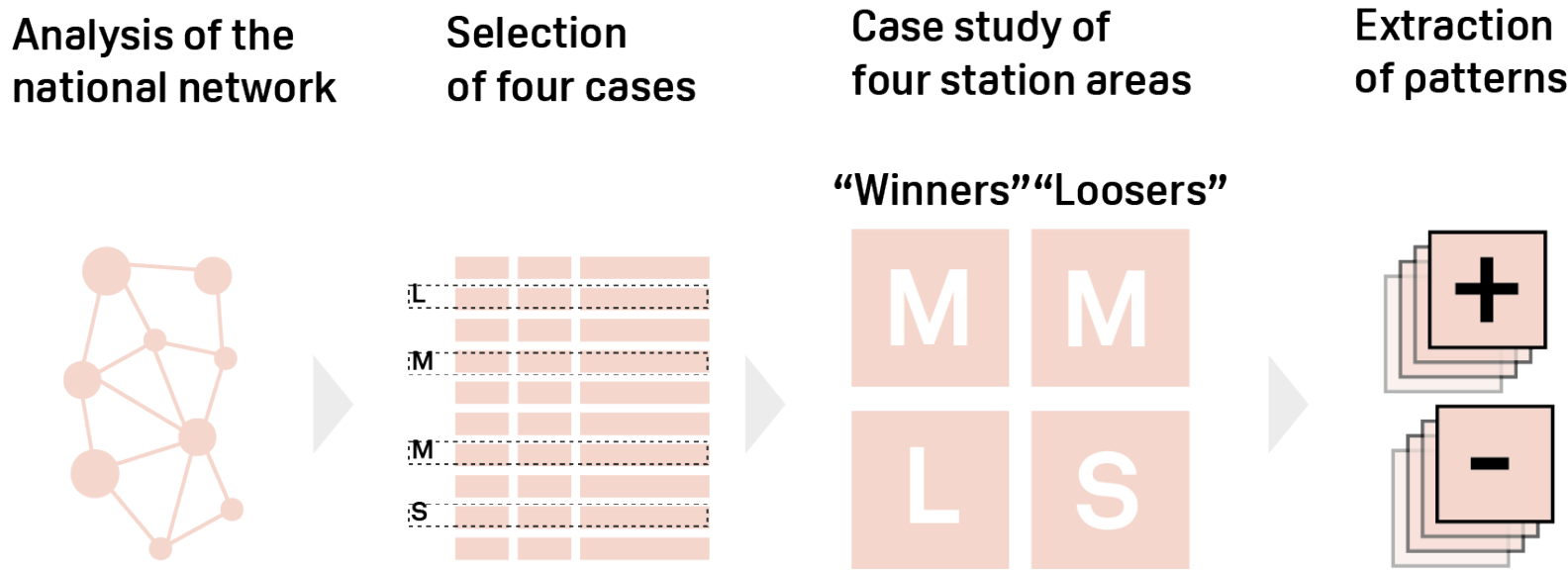


02 • Theory & methods

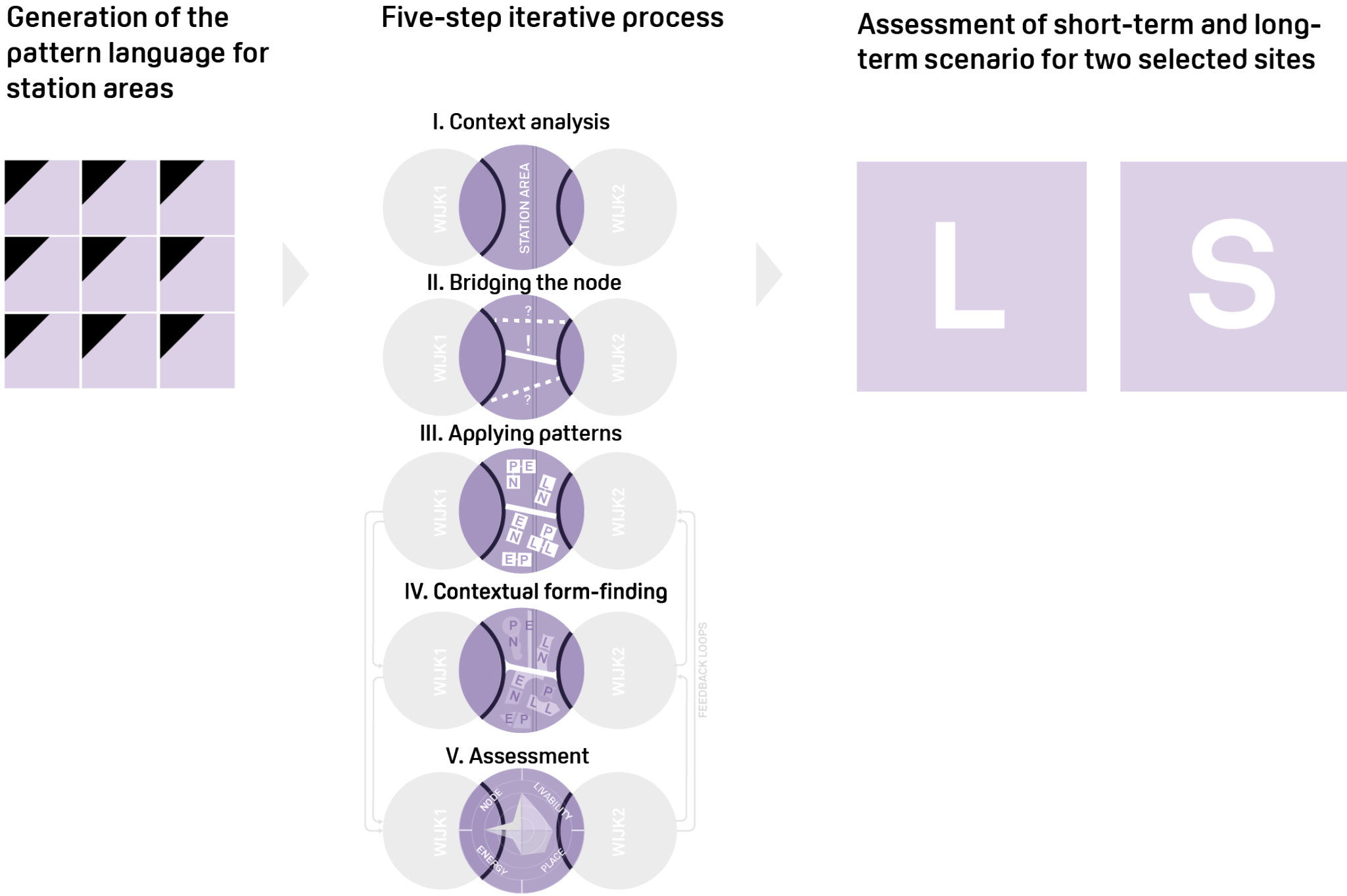
Process

- 1 ● Problem statement
- 2 ● Theory & methods
- Underpinning
- Design process
- Design assessment
- Conclusion

Underpinning /deductive part



Design process /inductive part



02 Theory & methods

What are patterns and how do they work

Interrelated patterns offer more possibilities than a toolbox and may help with decision-making and defining the program of station area with multiple stakeholders.

P.9

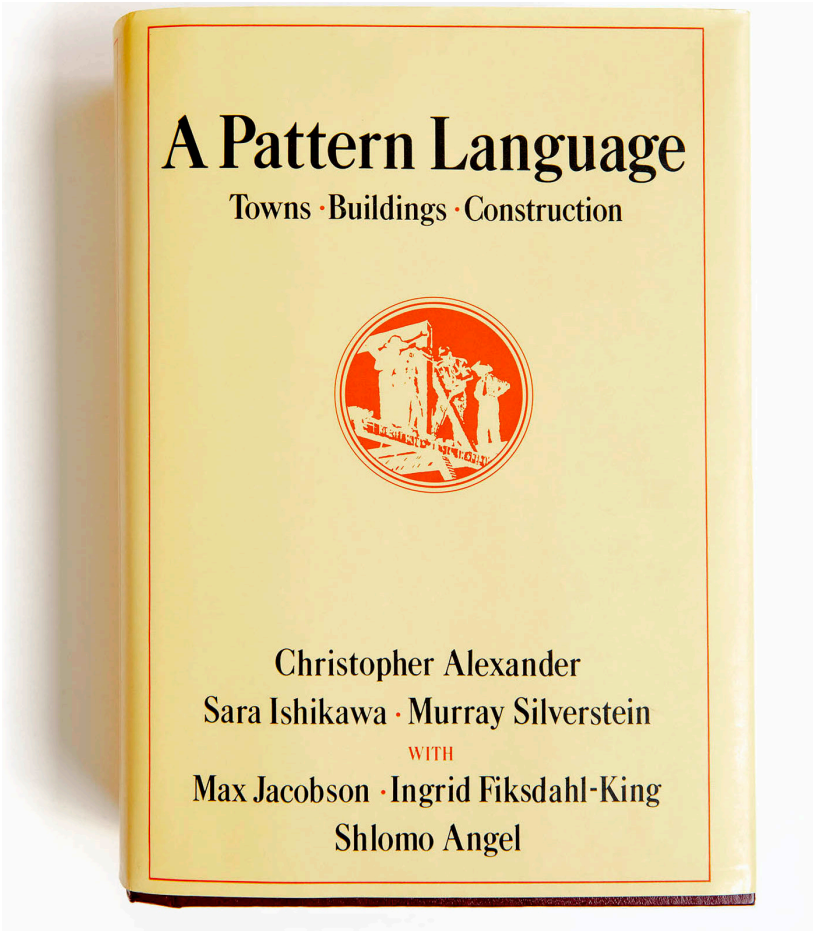
Walkable streets with flexible program guiding to station

ACTION

Activating streets parallel to tracks can relieve the existing station streets which are overcrowded or have little potential. Street profile should be dedicated to active mobility, while functions in plinth should be as adaptable as possible and complementary to the existing station street.

Synergy with :
[P.5] [P.6] [P.7] [P.8] [N.5] [L.9] [E.7]

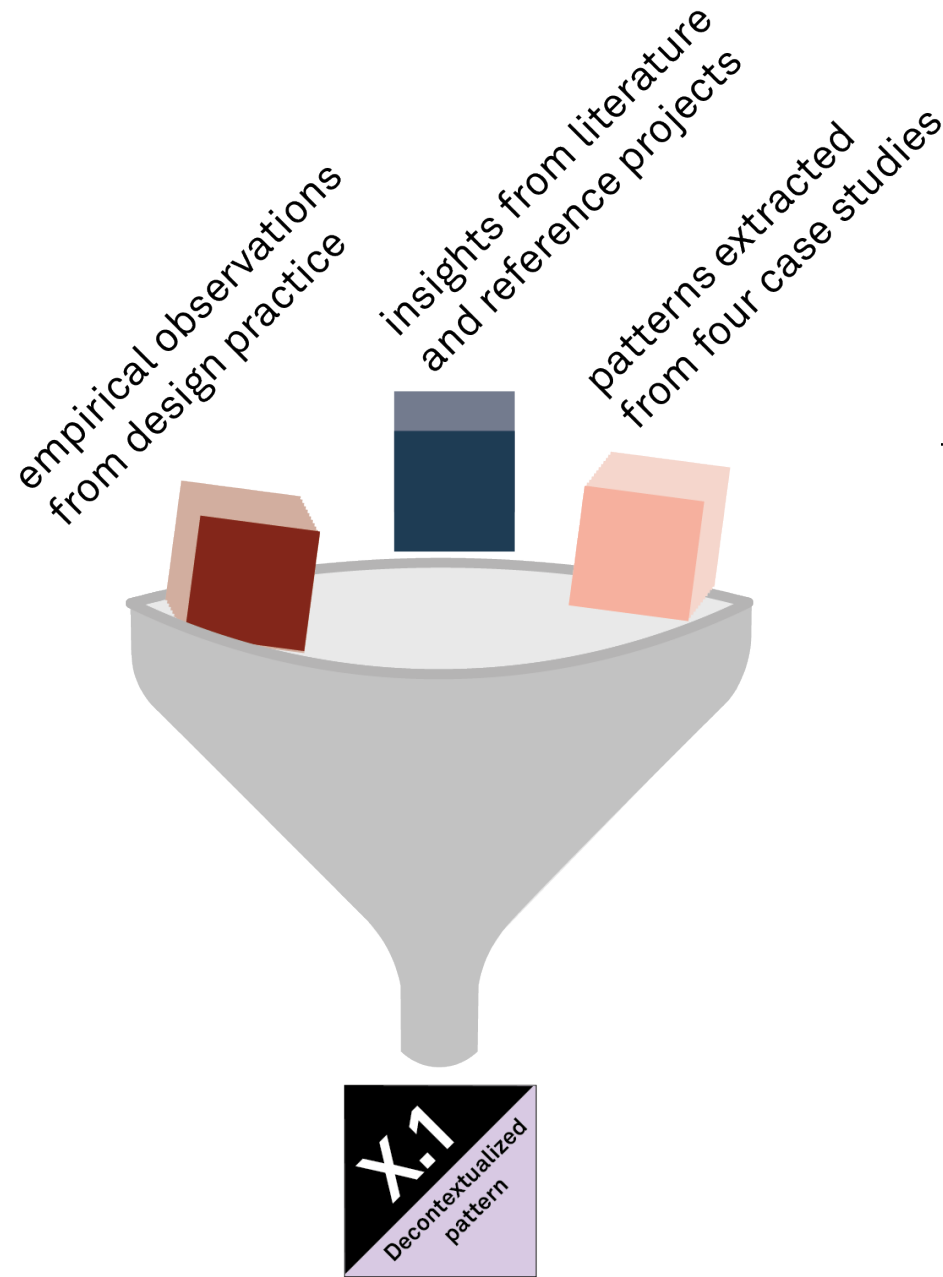
1	2	3	5	10	20	30	40	50yr
Municipality	Railway company	Private sector						



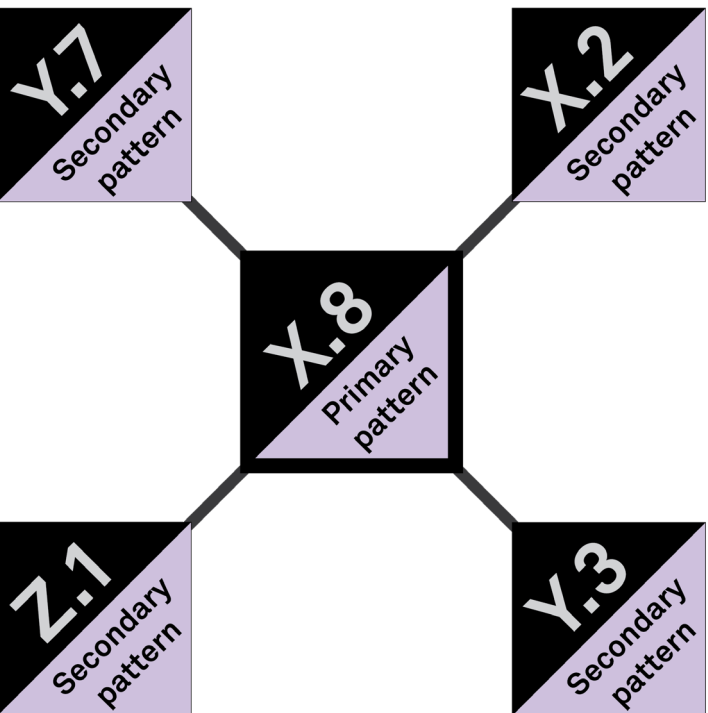
Cover of A Pattern Language. Source: Harvard GSD, <https://bit.ly/3v9oNoG>



Workshop in Zwolle, pattern language of Cities of Making. Source: Birgit Hausleitner



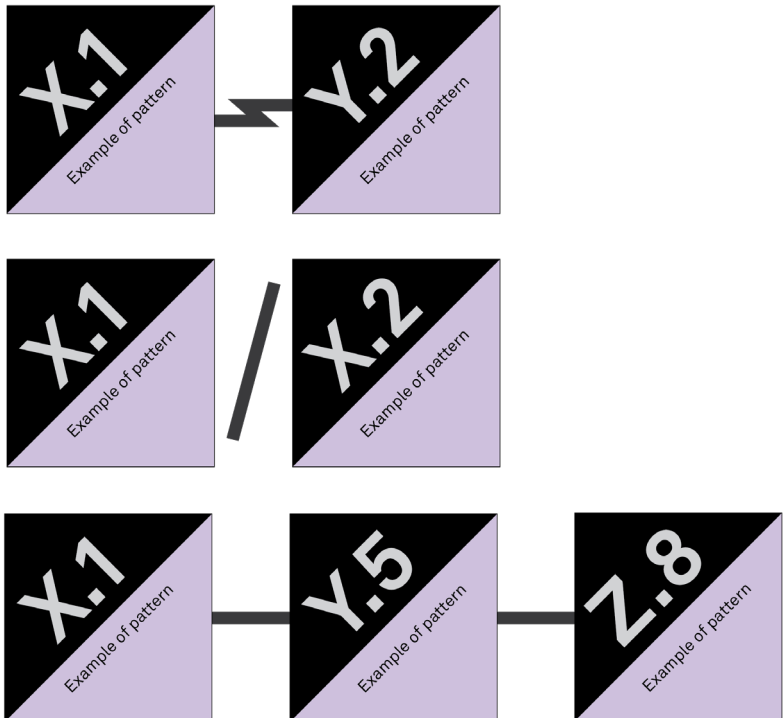
Hierarchy



Time frame



Relationships



Tension creates a design challenge and may require compromises to be solved.

Mutually exclusive patterns hinder each other and should not be applied together. It guides to reject the patterns.

Synergy guides selection and means that a specific combination of patterns can bring better effects than implementing them separately.

- 1 Problem statement
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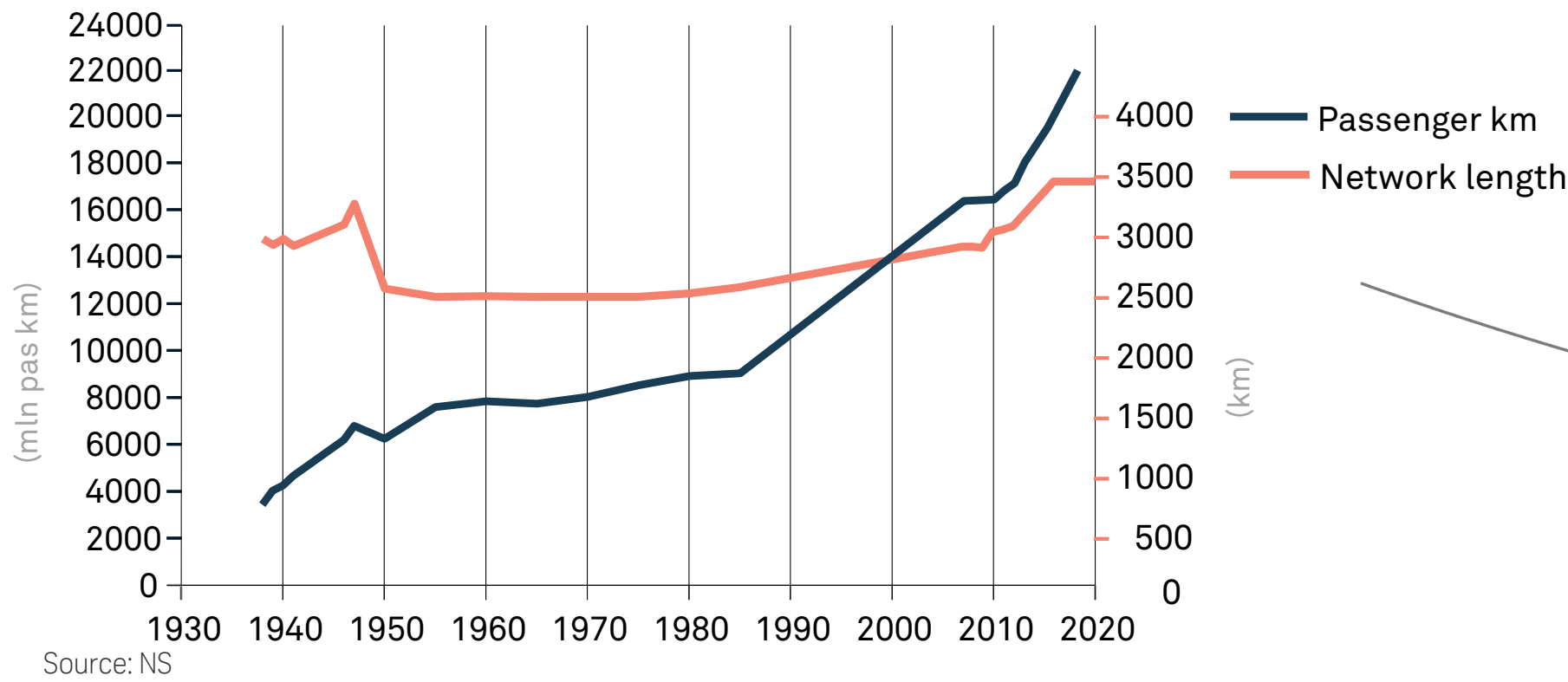
03 • Underpinning

Post-covid future belongs to rail



The advent of high-speed rail since the 1980s. initiated a rail renaissance in Europe. Train started to become a sustainable alternative to flights.

Dutch rail network usage vs length



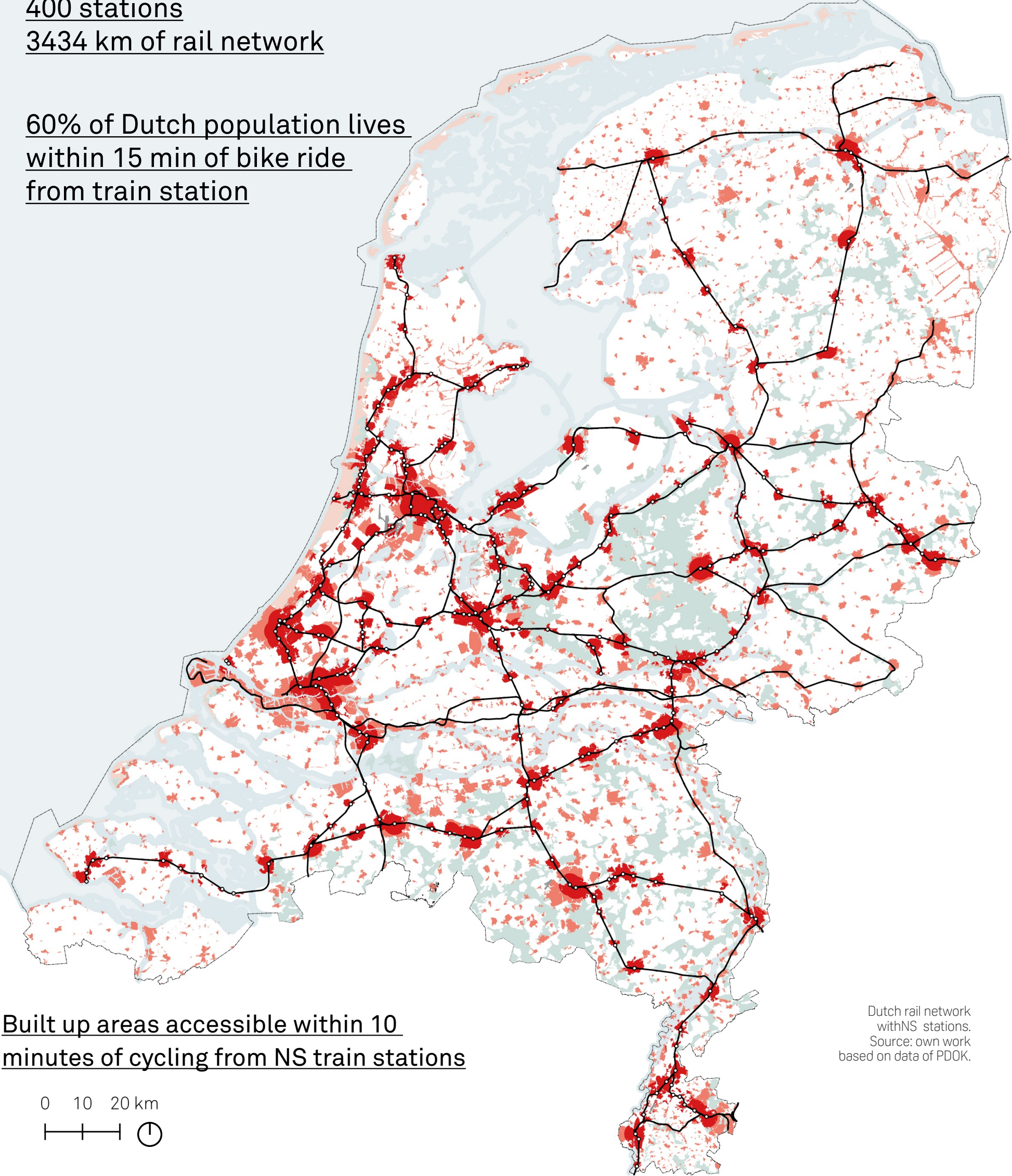
High-speed rail in Europe in 2019. Source: adapted from https://en.wikipedia.org/wiki/High-speed_rail_in_Europe

03 • Underpinning

- 1 Problem statement
- 2 Theory & methods
- 3 Underpinning
- Design process
- Design assessment
- Conclusion

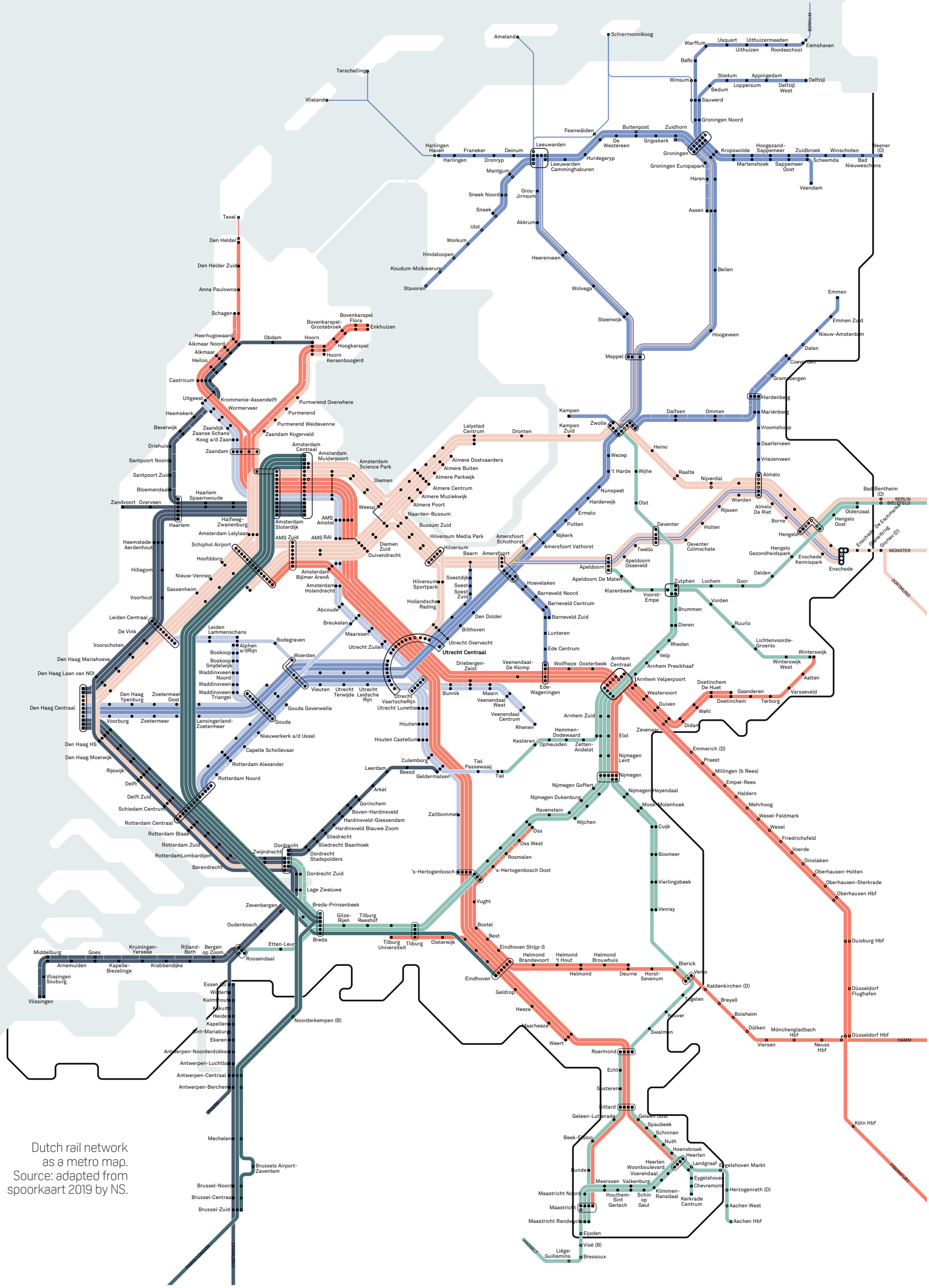
400 stations
3434 km of rail network

60% of Dutch population lives
within 15 min of bike ride
from train station



Built up areas accessible within 10 minutes of cycling from NS train stations

Dutch rail network with NS stations. Source: own work based on data of PDOK.

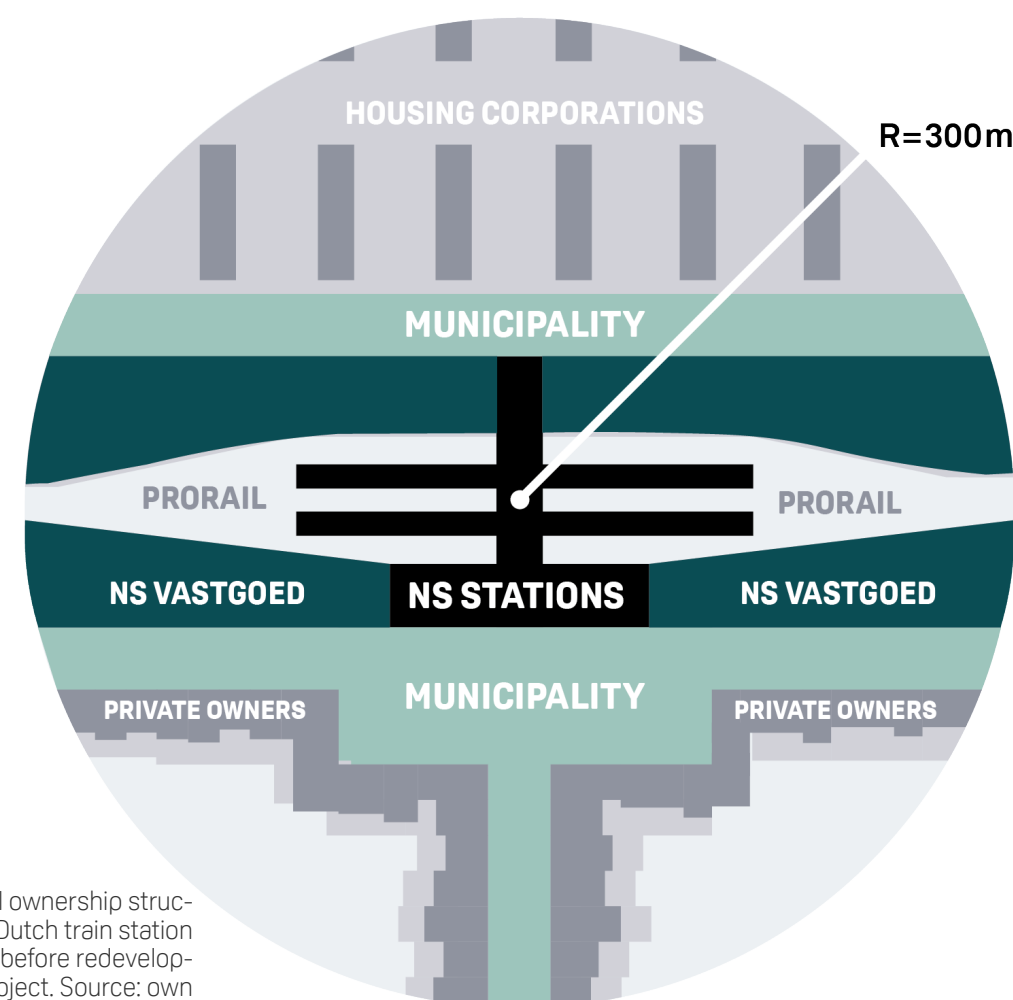


Dutch rail network as a metro map. Source: adapted from spookkaart 2019 by NS.

03 • Underpinning

Two most relevant social urgencies for train stations

Housing crisis



330 000

estimated housing shortage in 2020

In 2012 train station areas were framed in the policy as one of the main areas for densification.

Housing shortage is not the problem of Randstad only: in the forecast for 2025 there are only two peripheral subregions, with the surplus of homes.

Since 1995 housing prices in the Netherlands are growing much faster than the average income.

Index 1975=100

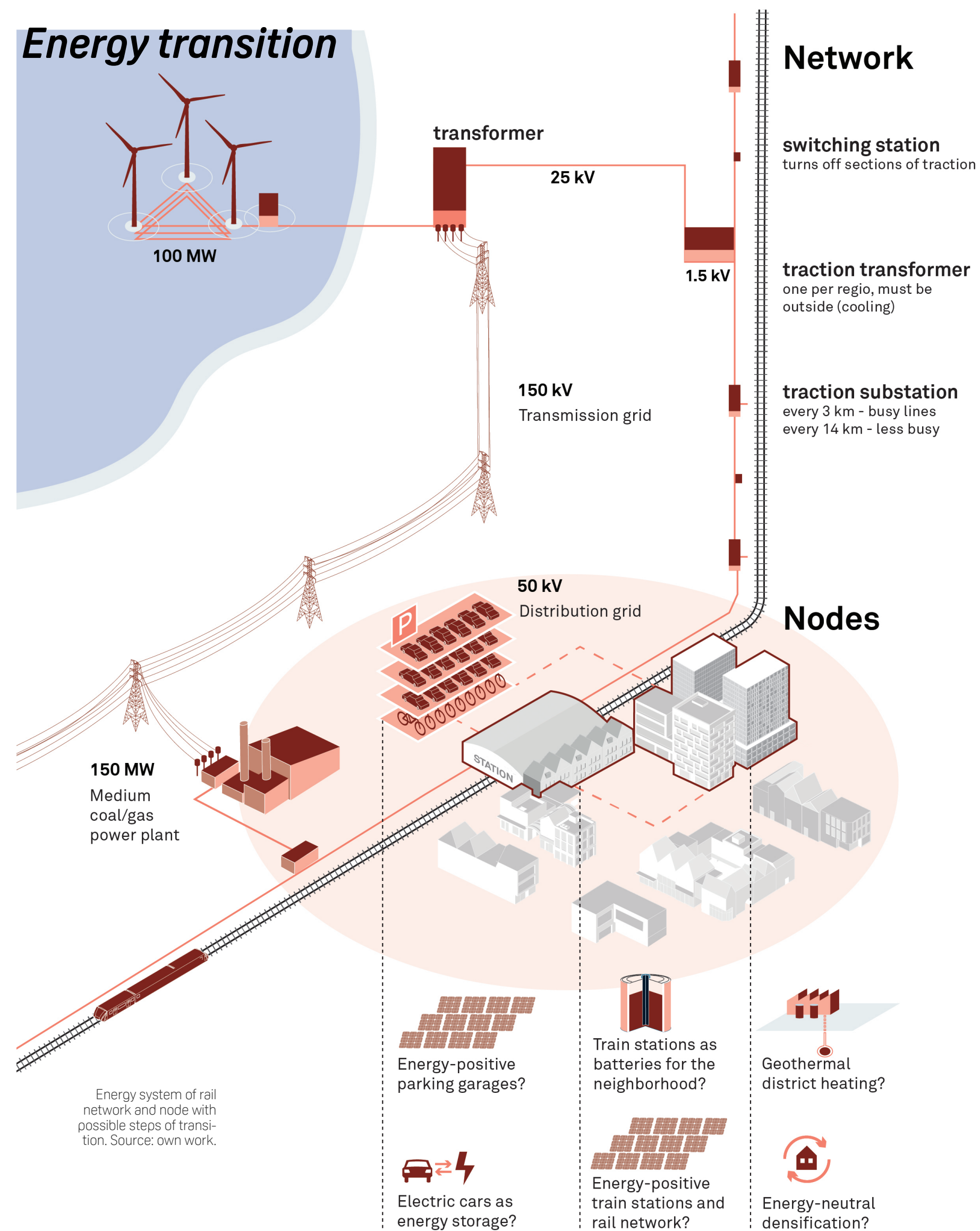
average house prices

average income

The change of house prices and average income in the years 1975-2020. Source: Raboresearch



Energy transition



03 • Underpinning

- 1 Problem statement
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- 3 Underpinning
- Design programme
- Design assessment
- Conclusion



Large stations: fossil-powered hubs of capital allocation?

Neoliberalization:

Growing disparity between small and large stations, between Randstad and other regions



Small stations: missing sustainability transition through stagnation?

03 • Underpinning

Conclusion



		Class	Realized TSAD	Densification plan	City population	Name	2018	2017	2016	2015	2014	2013	Change [%]	
New Key Project	1	IC station	Kathedraal		358 500	Utrecht Centraal	194.385	186.313	181.644	176.552	176.292	170.207	▲ 14.2	1. Amsterdam Sloterdijk
	2	IC station	Kathedraal		872 700	Amsterdam Centraal	192.178	184.614	174.179	167.427	162.103	168.800	▲ 13.8	
	3	IC station	Kathedraal		651 400	Rotterdam Centraal	96.690	92.928	91.750	85.246	81.811	80.015	▲ 20.8	
	4	IC station	Kathedraal		544 800	Den Haag Centraal	91.437	87.107	82.057	77.783	76.216	71.997	▲ 27.0	
	5	IC station	Kathedraal		-	Schiphol Airport	92.214	85.859	78.896	71.585	68.689	69.437	▲ 32.8	
	6	IC station	Kathedraal		124 900	Leiden Central	79.376	77.703	75.699	71.100	71.680	70.905	▲ 11.9	
	7	IC station	Mega		231 600	Eindhoven	65.468	62.919	61.844	60.450	59.466	59.782	▲ 9.5	
	8	IC station	Mega		872 700	Amsterdam Sloterdijk	58.800	54.330	50.611	47.615	47.804	45.194	▲ 30.1	
New Key Project	9	IC station	Mega		872 700	Amsterdam Zuid	60.819	54.706	45.771	43.716	42.265	41.389	▲ 46.9	2. Breda
	10	IC station	Mega		154 200	's-Hertogenbosch	47.347	45.937	45.397	43.172	41.953	41.962	▲ 12.8	
	11	IC station	Mega		176 700	Nijmegen	45.403	44.705	44.044	43.195	43.149	44.051	▲ 3.1	
	12	IC station	Mega		127 500	Zwolle	41.100	45.507	43.542	41.618	40.591	38.594	▲ 6.5	
	13	IC station	Mega		157 500	Amersfoort	43.710	42.604	40.861	39.675	39.651	38.279	▲ 14.2	
	14	IC station	Mega		159 200	Arnhem Centraal	43.677	42.987	40.588	39.164	38.442	38.316	▲ 14.0	
	15	IC station	Mega		163 000	Haarlem	42.040	41.166	39.822	37.399	38.367	37.040	▲ 13.5	
	16	IC station	Mega		544 800	Den Haag HS	33.612	32.956	37.124	34.946	35.603	38.210	▼ -12.0	
New Key Project	17	IC station	Mega		103 000	Delft	38.423	35.544	34.490	31.630	31.249	32.049	▲ 19.9	3. Enschede
	18	IC station	Mega		217 000	Tilburg	34.503	34.531	34.045	32.158	32.093	33.232	▲ 3.8	
	19	IC station	Mega		183 900	Breda	35.863	34.414	32.916	30.554	30.296	31.029	▲ 15.6	
	20	IC station	Mega		872 700	Amsterdam Amstel	33.717	31.688	30.570	29.773	29.549	28.703	▲ 17.5	
	21	IC station	Mega		90 200	Hilversum	26.697	25.922	25.778	24.105	23.490	23.321	▲ 14.5	
	22	IC station	Plus		118 600	Dordrecht	24.483	24.351	24.434	23.172	23.020	22.765	▲ 7.5	
	23	IC station	Plus		651 400	Rotterdam Blaak	24.006	22.548	24.226	23.368	21.273	19.856	▲ 20.9	
	24	IC station	Mega		207 900	Almere Centrum	27.124	25.888	24.127	23.784	24.071	23.334	▲ 16.2	
S1	25	IC stop	Mega		872 700	Amsterdam Bijlmer ArenA	28.111	26.427	23.922	22.684	21.545	18.961	▲ 48.3	4. Bergen op Zoom
	26	IC station	Plus		73 000	Gouda	23.696	23.139	22.763	21.298	21.139	20.621	▲ 14.9	
	27	IC station	Plus		156 900	Zaandam	22.765	21.643	21.177	20.790	21.515	21.778	▲ 4.5	
	28	IC station	Plus		82 900	Deventer	20.903	20.785	20.862	19.739	19.647	19.476	▲ 7.3	
	29	IC station	Plus		79 000	Schiedam Centrum	23.164	21.654	19.636	18.630	18.721	18.581	▲ 24.7	
	30	IC station	Plus		109 400	Alkmaar	21.026	20.951	19.620	18.930	19.512	19.693	▲ 6.8	
	31	IC station	Plus		232 700	Groningen	17.768	17.937	19.133	19.706	19.091	19.916	▼ -10.8	
	32	IC station	Plus		158 900	Enschede	9.792	17.558	18.525	18.508	17.227	17.142	▲ 2.4	
S2	33	IC station	Plus		115 700	Ede-Waeningen	18.369	17.893	17.758	17.599	17.458	17.366	▲ 5.8	5. Rotterdam
	34	IC station	Plus		651 400	Rotterdam Alexander	18.310	17.938	17.207	16.756	17.598	17.318	▲ 5.7	
	35	IC station	Plus		544 800	Den Haag Laan van NOI	16.660	15.751	15.317	14.516	13.872	11.299	▲ 47.4	
	36	IC station	Plus		121 500	Maastricht	11.854	11.649	15.254	15.633	15.960	17.068	▼ -30.5	
	37	IC station	Plus		162 400	Apeldoorn	14.840	15.034	14.857	14.628	14.354	14.015	▲ 5.9	
	38	IC stop	Plus		872 700	Duivendrecht	13.126	13.063	14.447	14.383	14.231	13.068	▲ 0.4	
	39	IC station	Plus		77 900	Lelystad Centrum	14.531	14.153	13.858	13.369	13.035	12.693	▲ 14.5	
	40	IC station	Plus		80 600	Hengelo	6.951	12.921	13.535	13.437	13.345	14.008	▼ -7.8	
S3	41	IC station	Plus		73 200	Hoorn	14.306	13.718	13.469	13.527	13.425	13.709	▲ 4.4	6. Almere
	42	IC station	Plus		58 200	Roermond	11.378	11.482	13.136	13.274	12.938	13.611	▲ -16.4	
	43	IC stop	Plus		52 200	Woerden	13.358	12.872	12.414	11.948	12.222	11.648	▲ 14.7	
	44	IC station	Plus		37 500	Sittard	10.286	10.698	12.125	12.110	12.259	12.634	▲ -18.6	
	45	IC station	Plus		47 500	Zutphen	11.988	11.936	11.895	11.732	11.670	12.104	▲ -1.0	
	46	IC station	Plus		72 800	Almelo	8.092	10.860	10.803	10.618	10.560	10.908	▲ -0.4	
	47	IC station	Plus		77 000	Roosendaal	10.317	10.400	10.679	10.399	11.003	11.123	▲ -7.2	
	48	IC station	Plus		73 000	Alohen aan den Riin	10.759	10.286	9.930	9.725	9.977	10.130	▲ 6.2	
S4	49	IC station	Plus		93 000	Leeuwarden	10.393	9.822	9.661	9.682	9.492	9.151	▲ 13.6	7. Maastricht
	50	IC stop	Basis		49 500	Driebergen-Zeist	8.787	9.321	9.330	9.235	9.393	9.267	▲ -5.2	
	51	IC station	Basis		57 900	Oss	8.270	8.247	8.351	8.078	8.211	8.606	▲ -3.9	
	52	IC station	Basis		50 100	Weert	7.690	8.084	7.856	7.694	7.571	7.390	▲ 4.1	
	53	IC stop	Basis		58 000	Heerhugowaard	7.434	7.401	7.357	7.352	7.580	7.818	▲ -4.9	
	54	IC station	Basis		36 000	Castricum	7.493	7.364	7.287	7.024	7.050	7.011	▲ 6.9	
	55	IC stop	Basis		28 000	Goes	7.148	7.187	7.197	7.160	7.302	7.660	▲ -6.7	
	56	IC station	Basis		86 800	Heerlen	4.864	4.546	7.130	7.491	7.088	7.255	▲ -33.0	
S5	57	IC station	Basis		92 400	Helmond	7.419	7.345	7.054	6.807	6.705	6.847	▲ 8.4	8. Utrecht
	58	IC stop	Basis		53 100	Bergen op Zoom	6.979	6.967	6.963	6.939	7.015	7.220	▲ -3.3	
	59	IC station	Basis		27 400	Heemstede-Aerdenhout	7.118	6.862	6.755	6.396	6.439	6.222	▲ 14.4	
	60	IC stop	Basis		207 900	Almere Buiten	7.532	7.314	6.488	6.458	6.788	7.304	▲ 3.1	
	61	IC station	Basis		29 500	Heereveen	6.236	6.185	5.946	5.893	5.802	5.782	▲ 7.9	
	62	IC stop	Basis		127 500	Amersfoort Schothorst	7.003	6.412	5.895	5.762	5.963	5.642	▲ 24.1	
	63	IC station	Basis		41 500	Beverwijk	5.239	5.295	5.782	5.572	5.823	6.237	▲ -16.0	
	64	IC stop	Basis		28 500	Meppel	6.342	5.989	5.765	5.638	5.522	5.346	▲ 18.6	
S6	65	IC stop	Basis		29 500	Schaën	5.325	5.410	5.311	5.326	5.484	5.580	▲ -4.6	9. Groningen
	66	IC stop	Basis		73 200	Hoorn Kersenboezerd	5.117	5.158	5.111	5.149	5.361	5.388	▲ -5.0	
	67	IC stop	Basis		109 400	Alkmaar Noord	4.792	4.688	4.723	4.836	5.066	4.950	▲ -3.2	
	68	IC stop	Basis		39 700	Middelburg	4.666	4.559	4.657	4.549	4.547	4.800	▲ -2.8	
	69	IC stop	Basis		24 100	Heiloo	4.762	4.662	4.591	4.676	4.788	4.614	▲ 3.2	
	70	IC stop	Basis		32 100	Deurne	4.486	4.365	4.379	4.333	4.498	4.703	▲ -4.6	
	71	IC station	Basis		64 400	Venlo	4.966	4.272	4.356	4.370	4.133	4.571	▲ 8.6	
	72	IC stop	Basis		66 900	Veenendaal-De Klomp	4.446	4.370	4.229	4.007	3.807	3.745	▲ 18.7	
S7	73	IC stop	Basis		124 900	Leiden Lammenschans	4.591	4.219	4.039	3.886	3.786	3.643	▲ 26.0	10. Dordrecht
	74	IC station	Basis		41 100	den Helder	4.143	4.044	3.985	3.946	4.040	4.180	▲ -0.9	
	75	IC station	Basis		13 700	Dieren	3.607	3.704	3.623	3.641	3.777	3.848	▲ -6.3	
	76	IC station	Basis		17 100	Steenwijk	3.825	3.646	3.363	3.232	3.102	3.021	▲ 26.6	
	77	IC station	Basis		43 900	Etten-Leur	3.459	3.333	3.293	3.241	3.260	3.449	▲ 0.3	
	78	IC stop	Basis		19 100	Bodegraven	3.232	3.159	3.033	2.924	2.970	3.005	▲ 7.6	
	79	IC station	Basis		33 100	Viissingen	2.728	2.769	2.939	2.955	2.858	2.999	▲ -9.0	
	80	IC stop	Basis		13 500	Horst-Sevenum	2.654	2.541	2.720	2.675	2.643	2.635	▲ 0.7	
S8	81	IC stop	Basis		18 700	Enkhuizen	2.326	2.312	2.414	2.393	2.485	2.604	▲ -10.7	11. Almere
	82	IC stop	Basis		8 300	Hoogkarspel	2.197	2.272	2.322	2.300	2.318	2.300	▲ -4.5	
	83	IC stop	Basis		10 700	Bovenkarspel-Grootebroek	2.216	2.213	2.285	2.301	2.318	2.399	▲ -7.6	
	84	IC stop	Basis		7 900	Anna Paulowna	2.066	2.121	2.108	2.137	2.175	2.333	▲ -11.4	
	85	IC stop	Basis		41 100	Den Helder Zuid	2.146	2.184	2.105	2.082	1.997	1.918	▲ 11.9	

Table 3. Comparison of IC stations and stops in terms of ridership. Source: own work based on data by NS Stations and CBS.

Selection of 4 cases:
2 - “winners” of the neoliberal game, where TSAD project was realized.
2- “losers” that did not attracted capital.

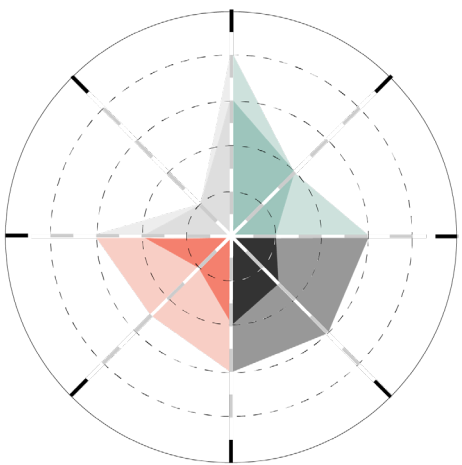
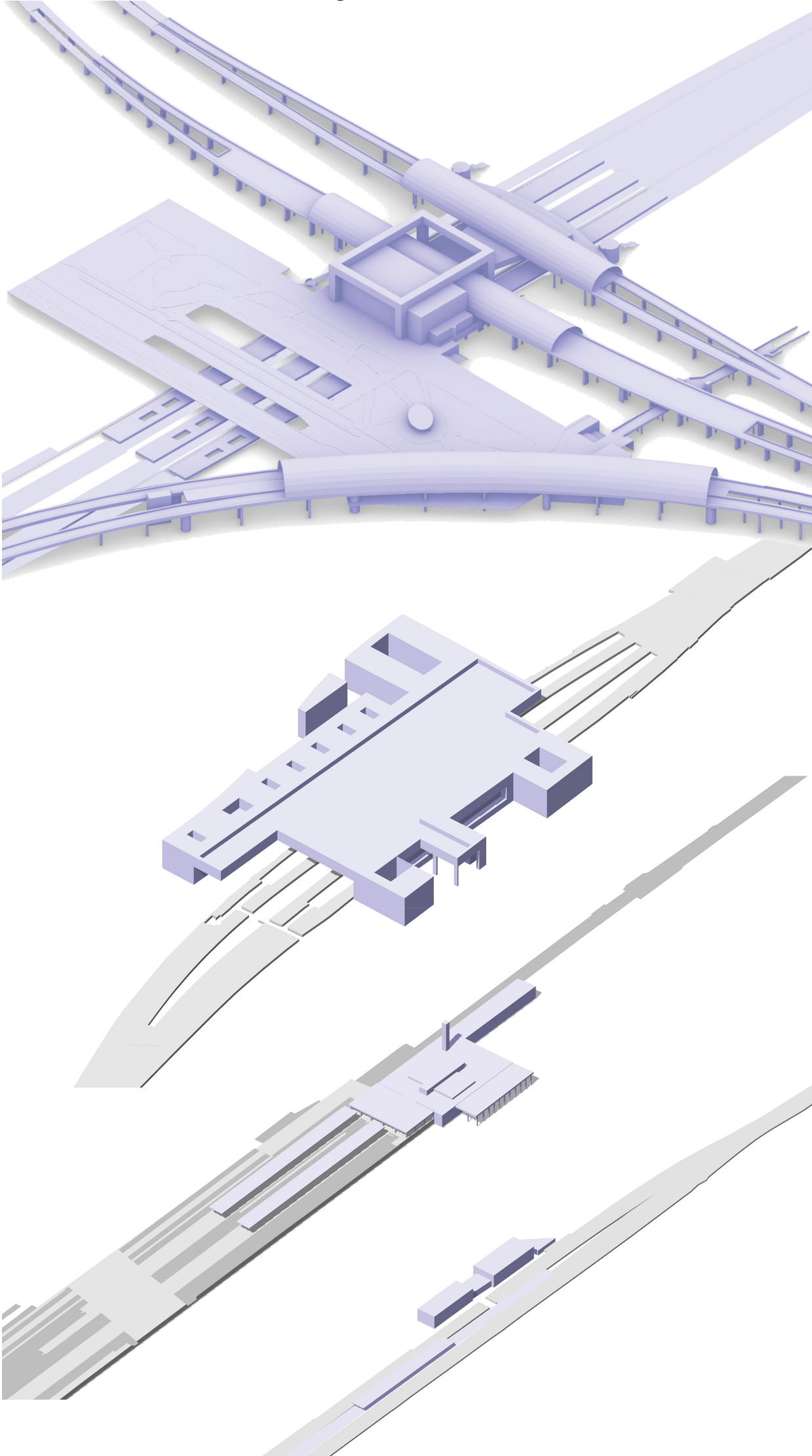
03 • Underpinning

Conclusion

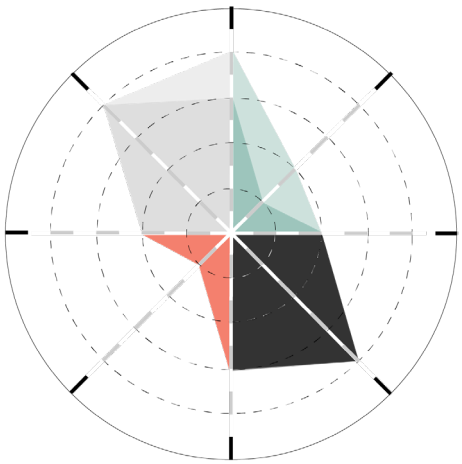
- 1 Problem statement
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Four case studies in the first half of the project are initial input to the pattern language.

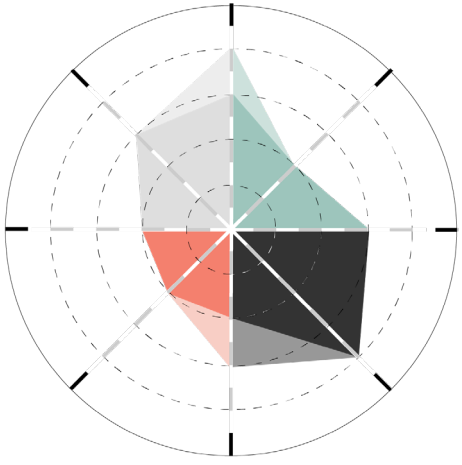
Analyzed cases



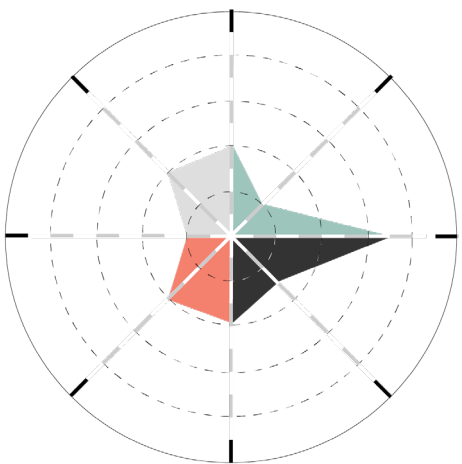
Amsterdam Sloterdijk



Breda

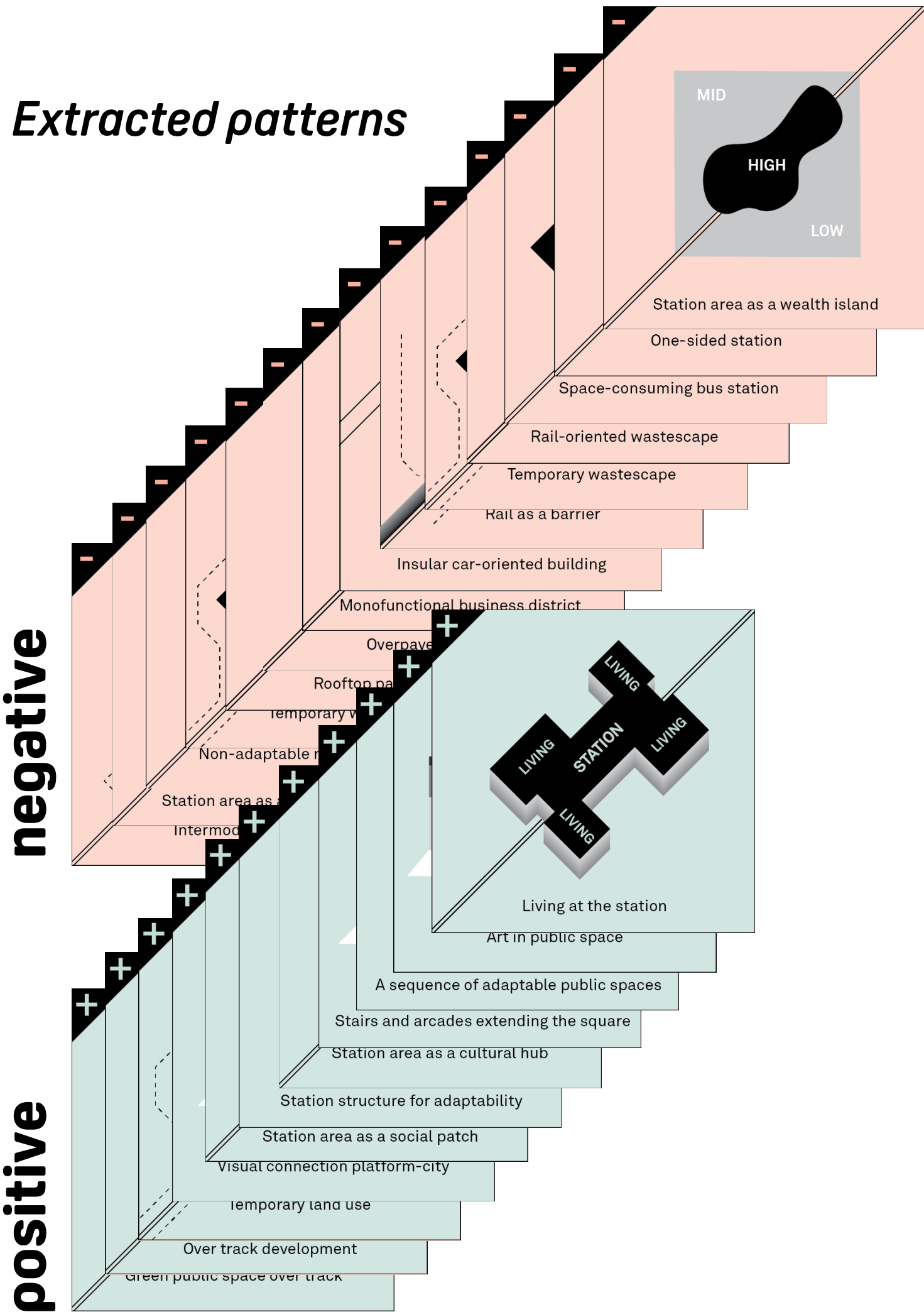


Enschede



Bergen op Zoom

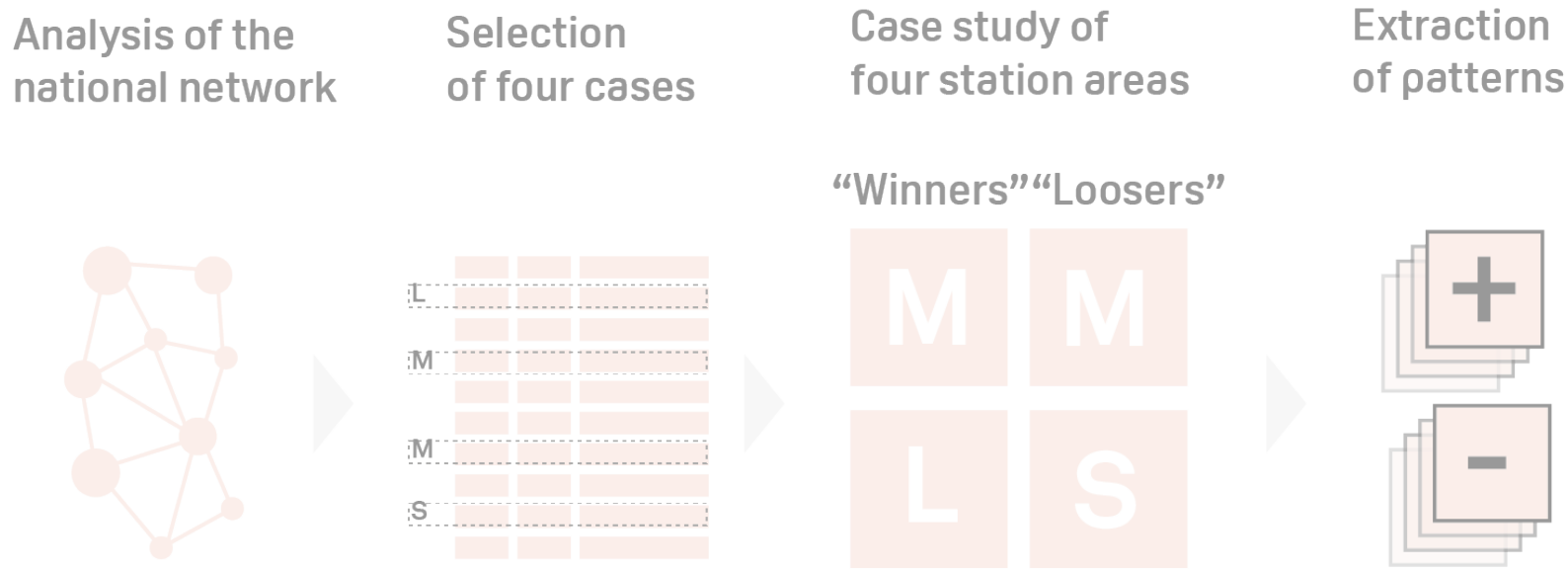
Extracted patterns



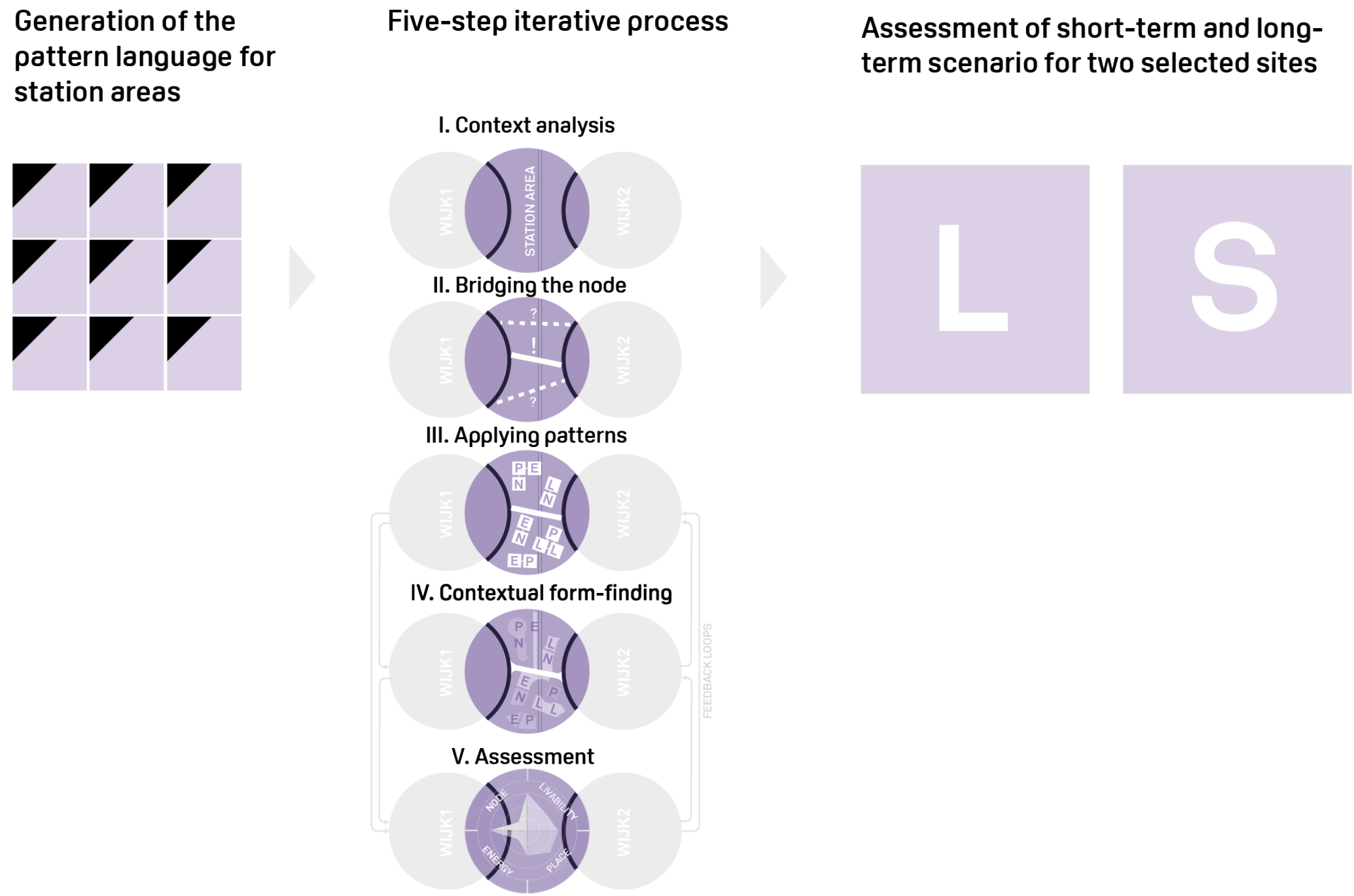
04 • Design process

- 1 Problem statement
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Underpinning /deductive part



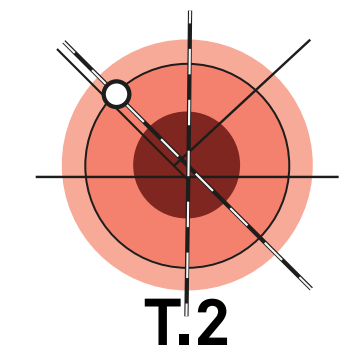
Design process /inductive part



04 • Design process

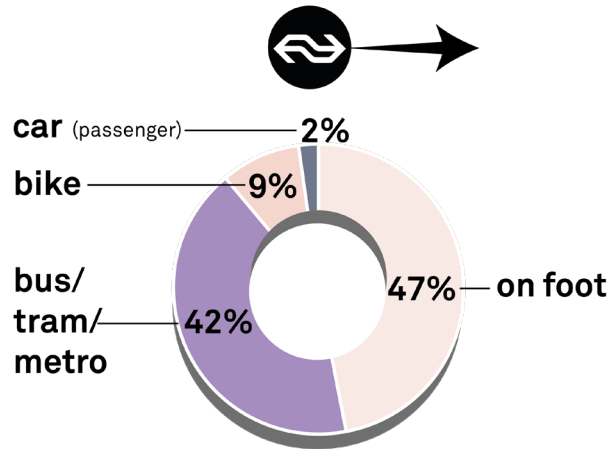
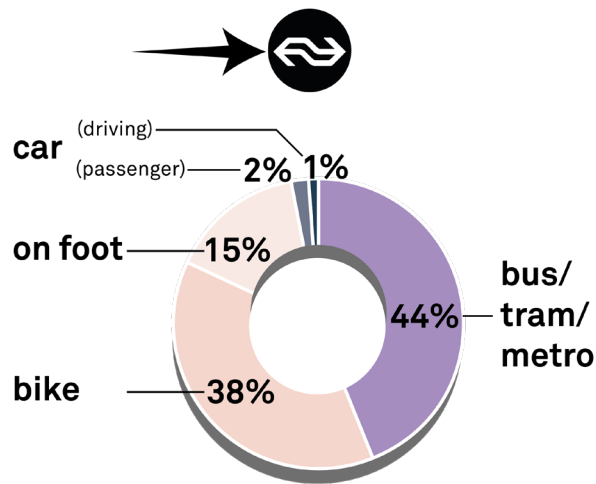
Selected design sites

Amsterdam Sloterdijk

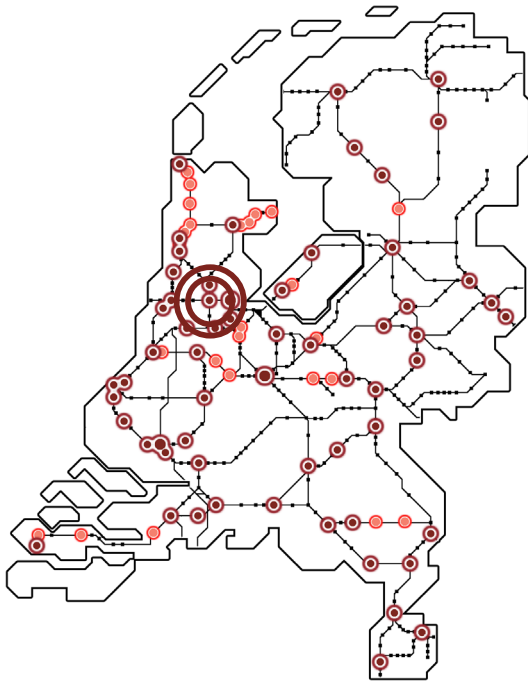


Class: mega
Daily ridership (2018): 58 800
Change 2013-2018: +30,5%

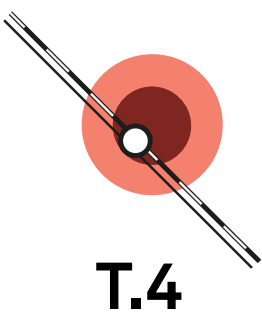
Complex mobility hub in a business center of the 1990s. Ambitious densification goals, but low livability.



Aerial source: https://www.quarter-avenue.nl/fotos/24_foto1_slider_groot.jpg

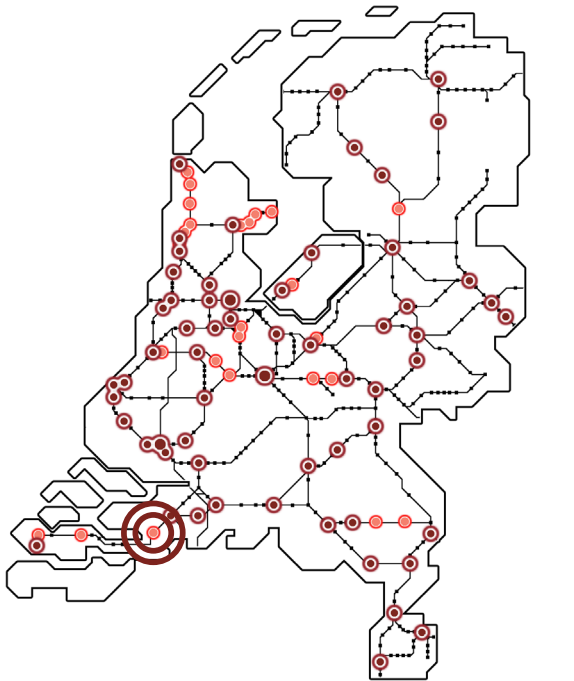
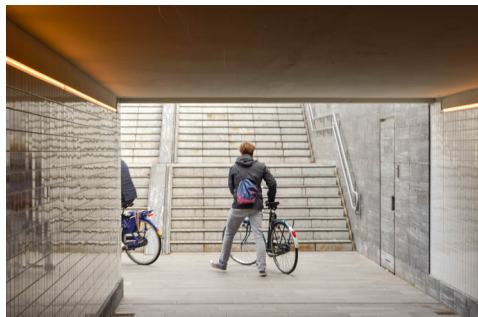
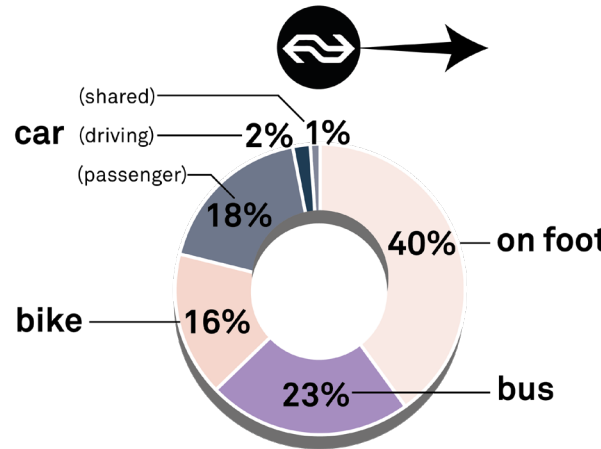
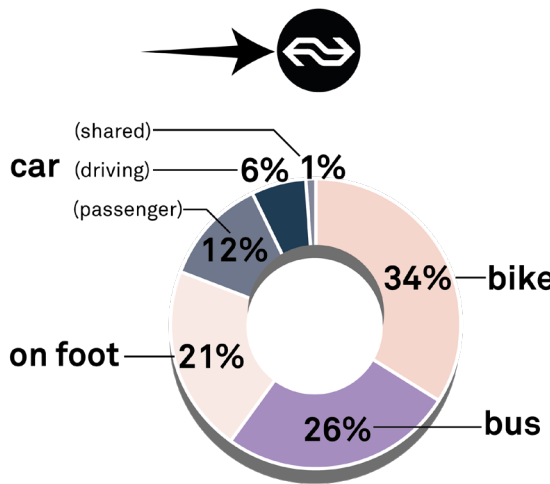


Bergen op Zoom



Class: basic
Daily ridership (2018): 6 979
Change 2013-2018: -3.3%

Stagnating station in a small city, no major change since the 1980s.

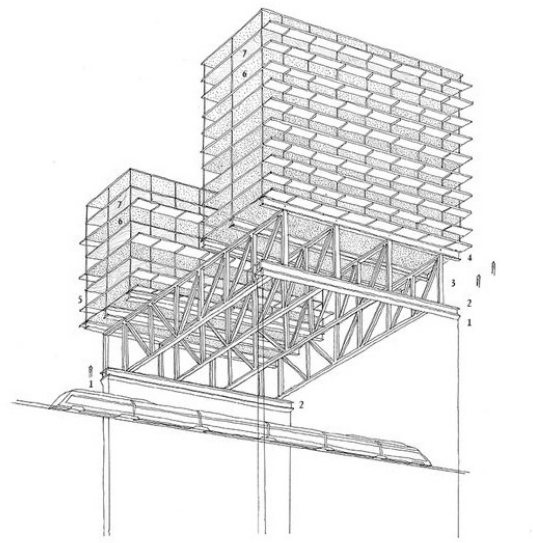


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Example from the catalogue of 36 patterns

References:



Sketch for over track development in Paris ZAC Rive Gauche. Source: <http://cms.tvk.fr/>



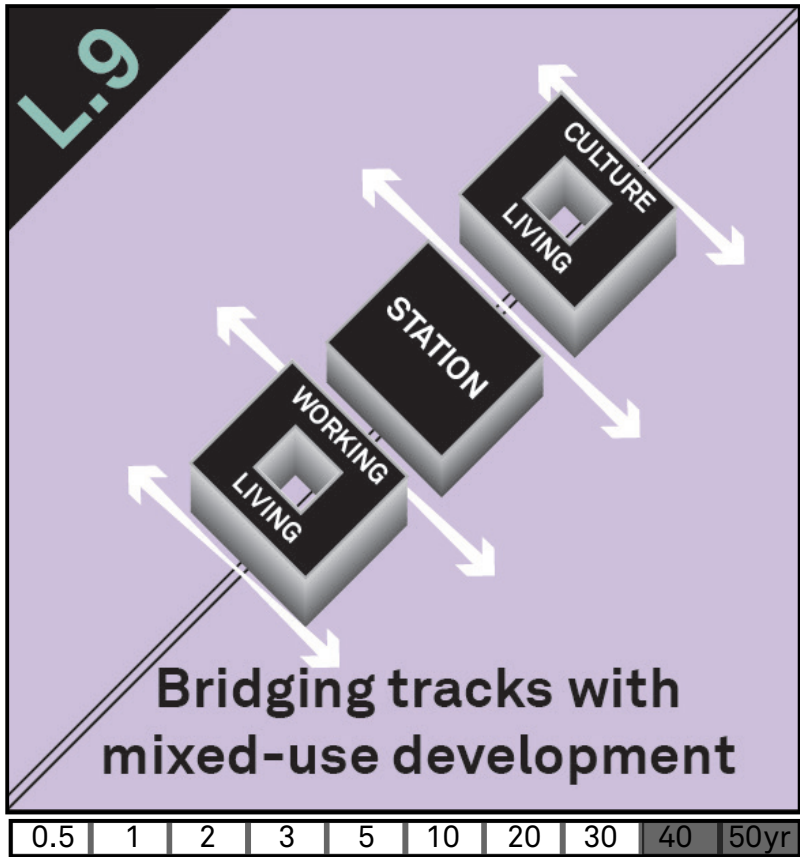
Planned over track development, Paris Rive Gauche. Source: osm.org



Existing over track development in Paris Clichy-Batignolles. Source: Google Earth



Study for over track development in Utrecht Central Station. Source: Next Architects



Short-term 0.5 1 2 3 5 10 20 30 40 50yr Long-term

HYPOTHESIS Building over tracks, creates an opportunity for densification. It can reduce nuisance, create new public spaces and connections across the tracks, while not obstructing the train traffic.

THEORETICAL BACK UP Over track development was already realized in the vicinity of stations Utrecht Centraal, Herleen, Zaandam, Amsterdam Centraal, Rijswijk. Amsterdam Sloterdijk and Utrecht Centraal. Recent development in Paris or plans in London show that it may also create inclusive high-density living environment.

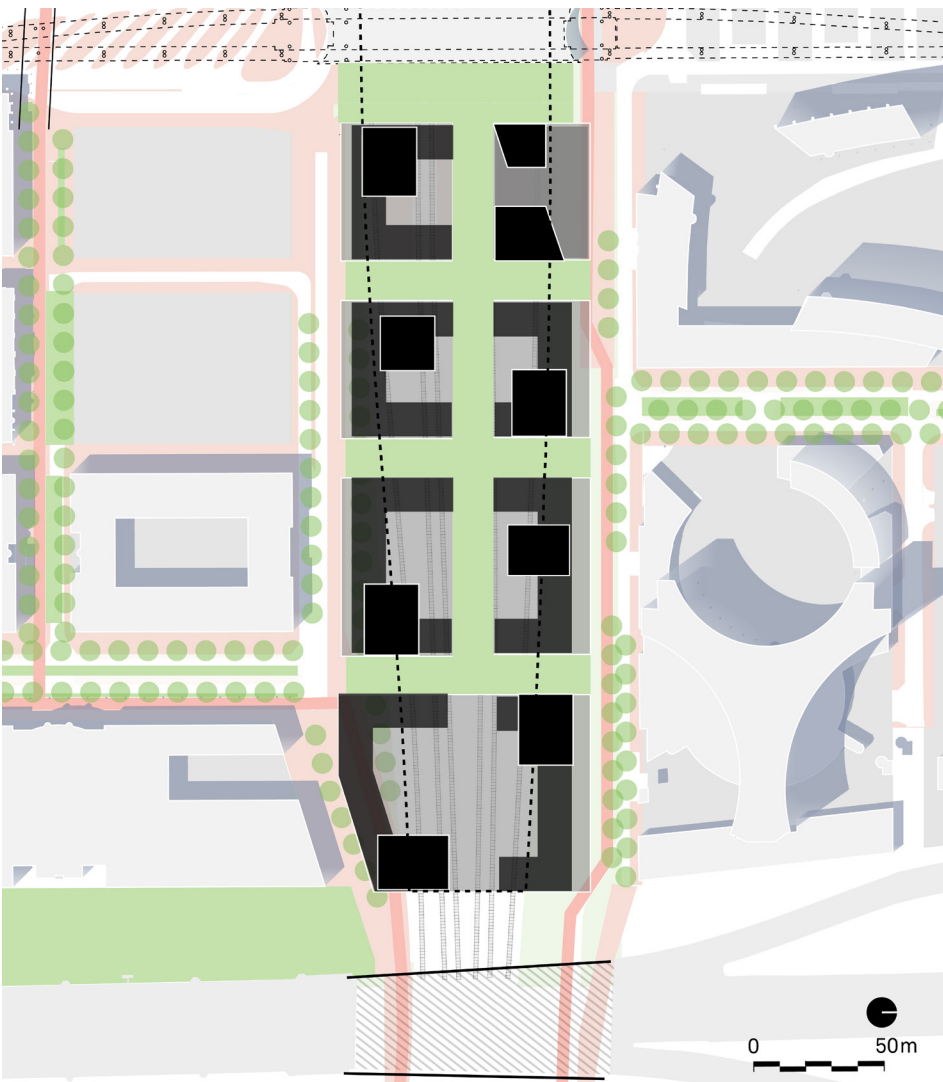
PRACTICAL IMPLICATION

- Over track public spaces will be located 8 meters above the tracks.
- Bridge-like construction spans can be integrated in buildings and public spaces design, limitation can become an
- In case of multiple tracks, development can cover only external ones, creating an acoustic barrier for the station area and livable streets parallel to tracks.

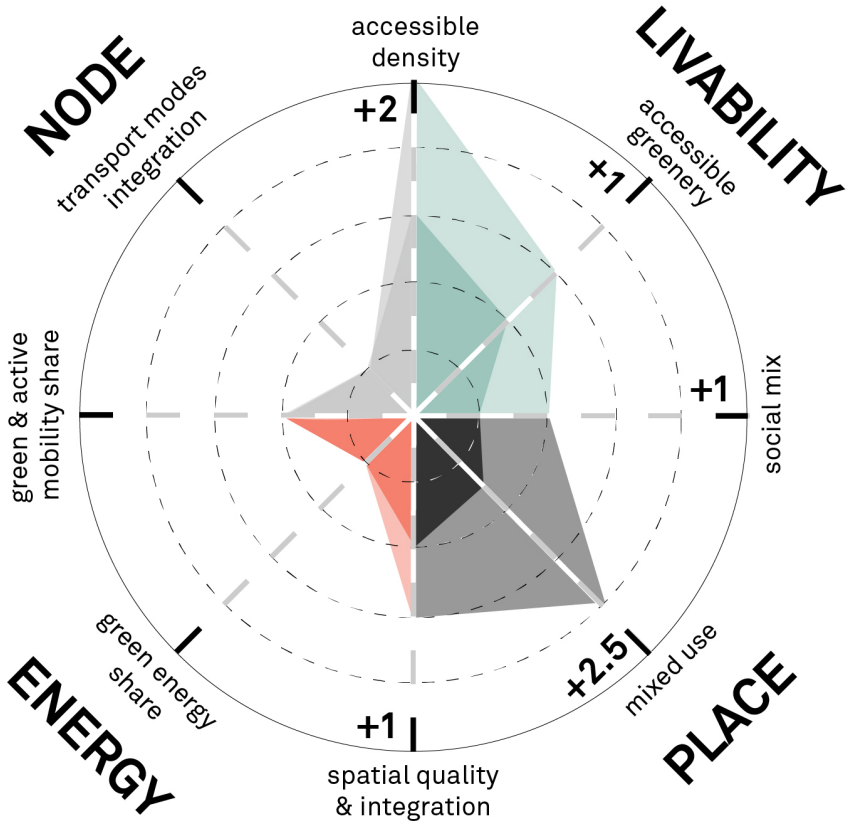
RELATION WITH OTHER PATTERNS

- Synergy with [N.4] [N.9] [E.4] [L.3] [L.4] [L.5]
- Tension with [L.6] [P.2] [P.5] [P.7]
- Mutually exclusive with [L.2] [N.1] [E.1]

Amsterdam Sloterdijk



ASSESSMENT

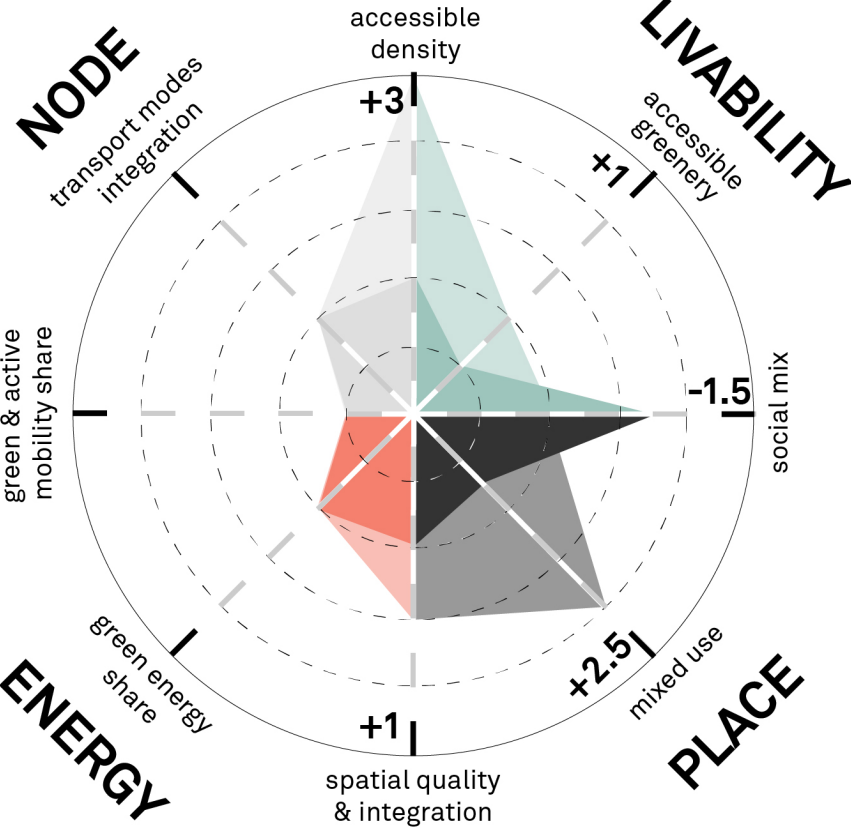


Observation: Over track development has a large potential in Sloterdijk, but it also creates pressure on existing facilities and spaces, forcing to apply many other patterns.

Bergen op Zoom



ASSESSMENT



Observation: Over track development is technically possible, but a large density is required to make it financially feasible, it threatens the existing social mix.

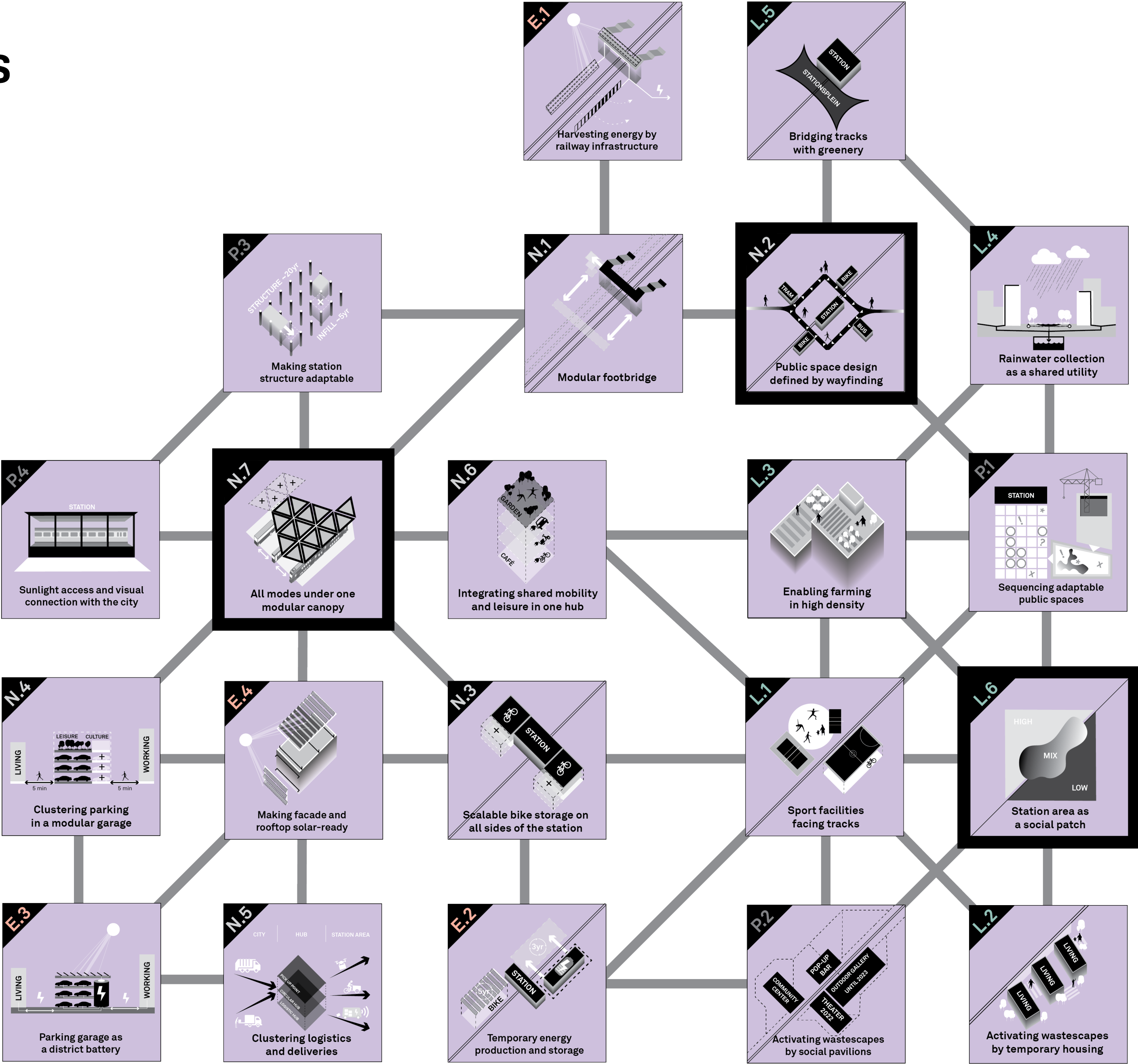
04 • Design process

Synergy of short-term patterns

The pattern language can be represented on a diagram of patterns' interrelations.

Synergies guide in selection of patterns.

- 1 Problem statement
 - 2 Theory & methods
 - 3 Underpinning
 - 4 Design process
- Design assessment
- Conclusion



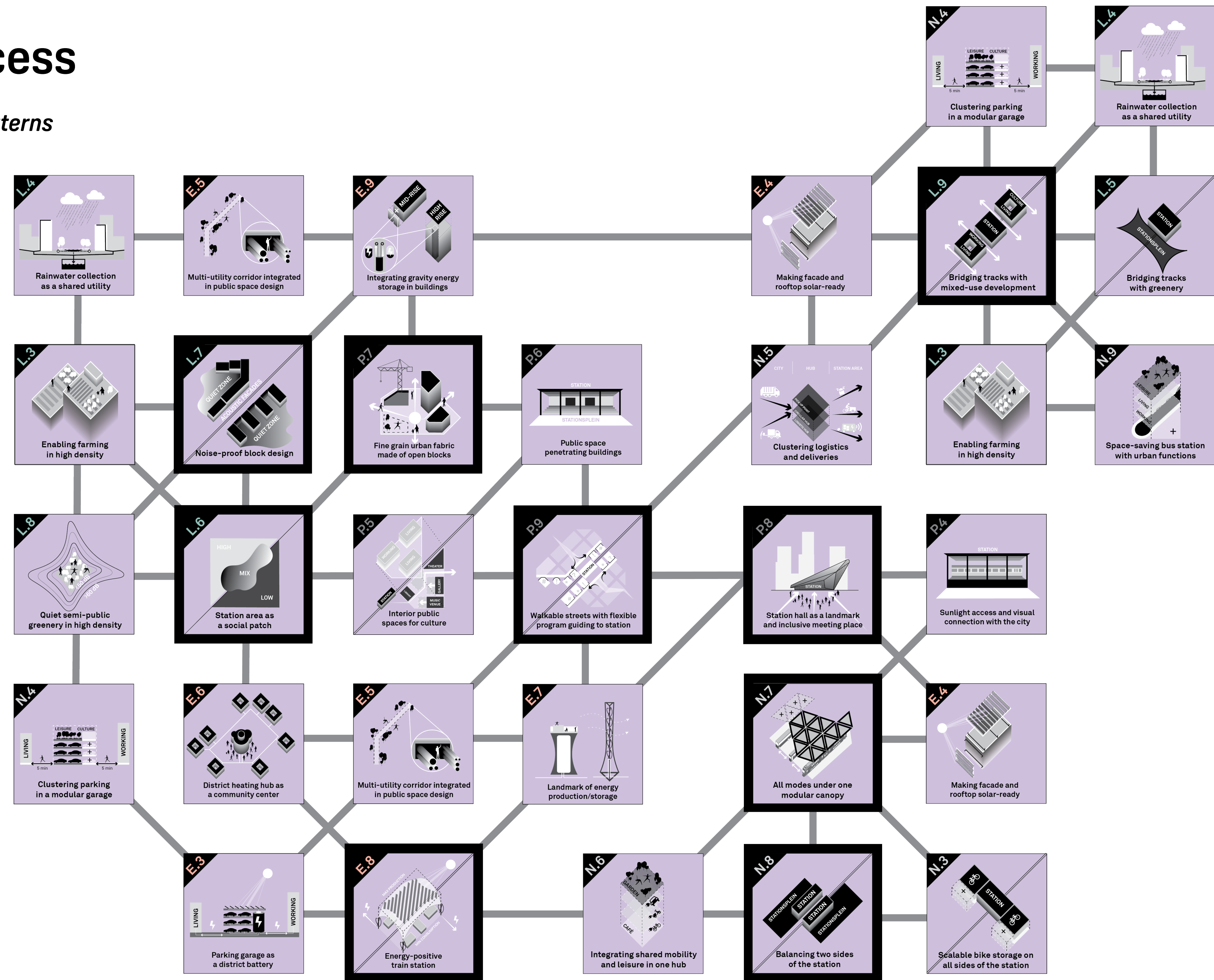
04 • Design process

Synergy of long-term patterns

The pattern language can be represented on a diagram of patterns' interrelations.

Synergies guide in selection of patterns.

- 1 Problem statement
 - 2 Theory & methods
 - 3 Underpinning
 - 4 Design process
- Design assessment
- Conclusion

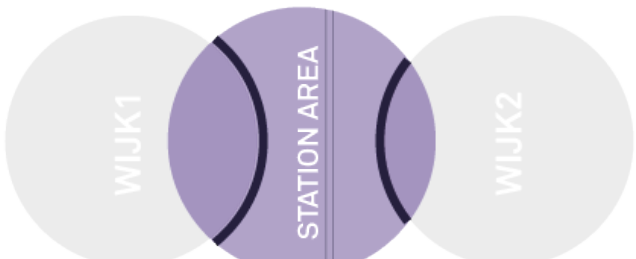


04 • Design process

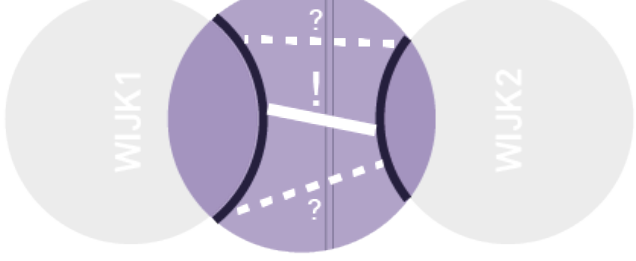
Two scenarios per site

Design process will be demonstrated on the example of short-term scenario for Bergen op Zoom.

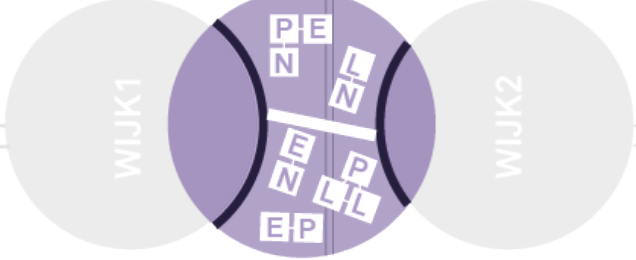
I. Context analysis



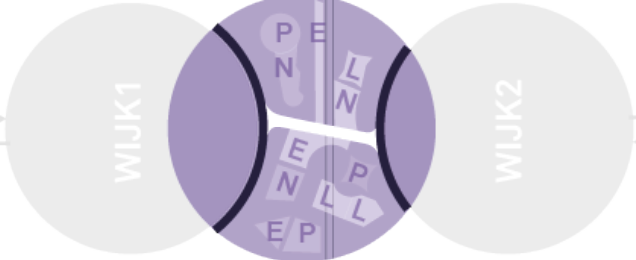
II. Bridging the node



III. Applying patterns



IV. Contextual form-finding



V. Assessment



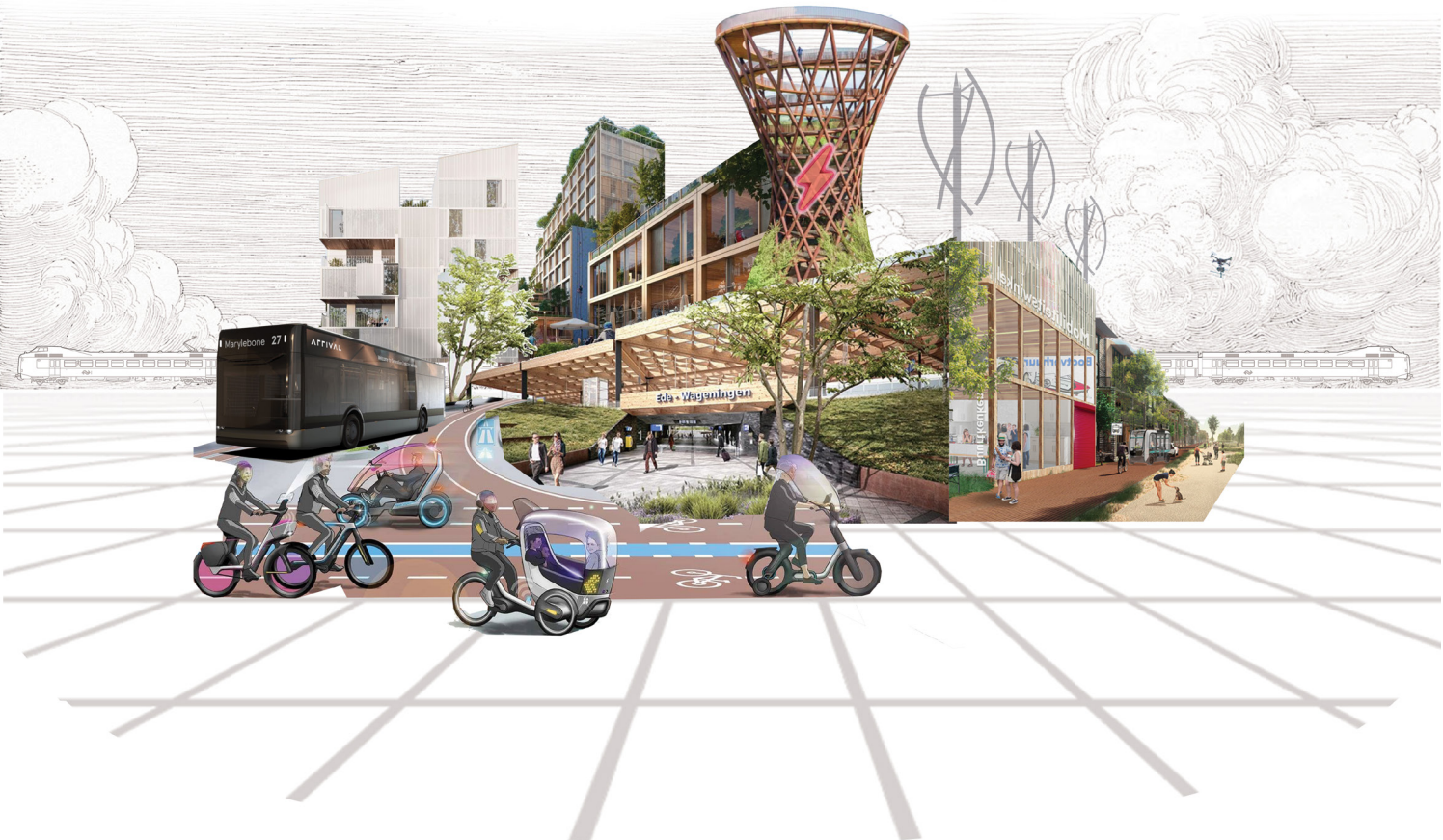
FEEDBACK LOOPS

Bergen op Zoom

2026: New energy

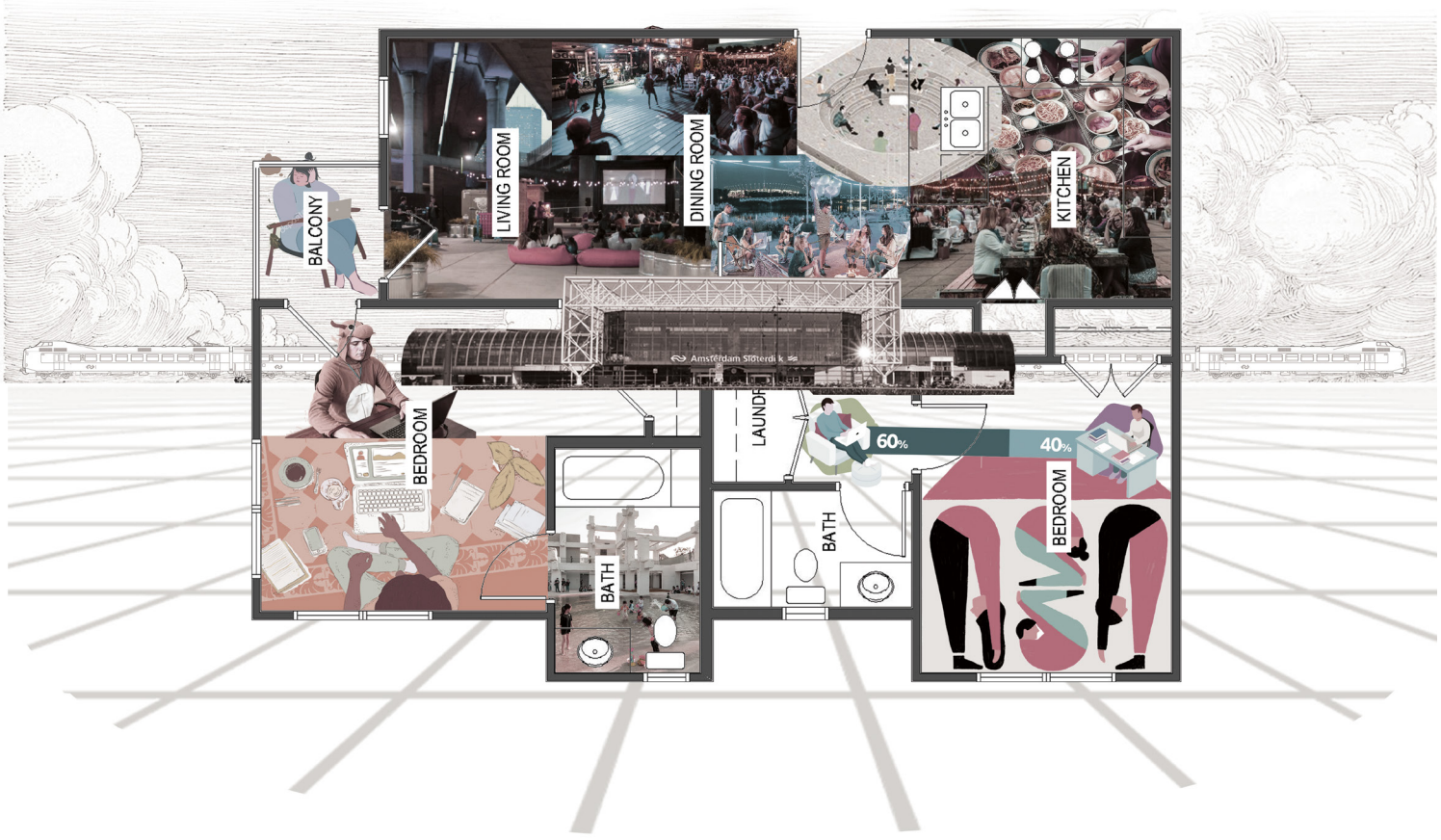


2040: Glocal transition

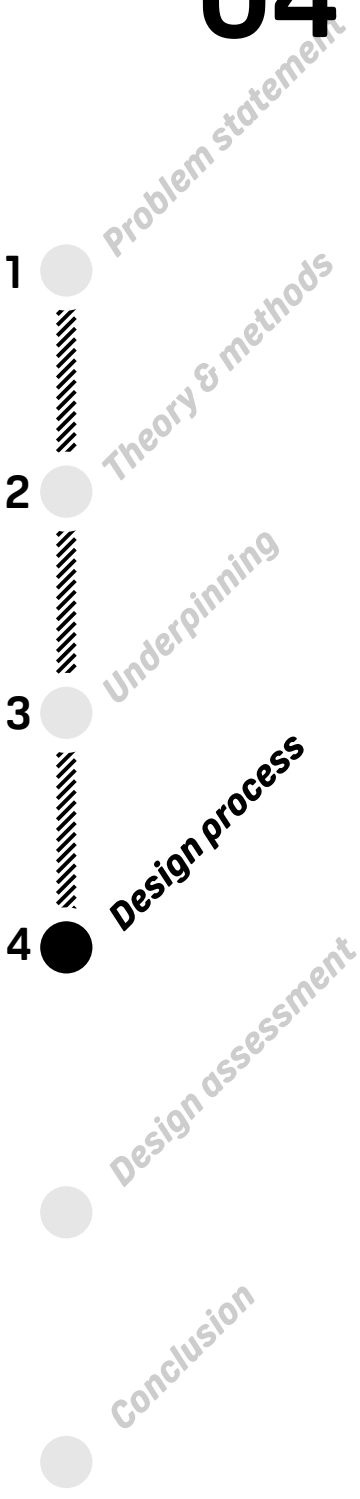
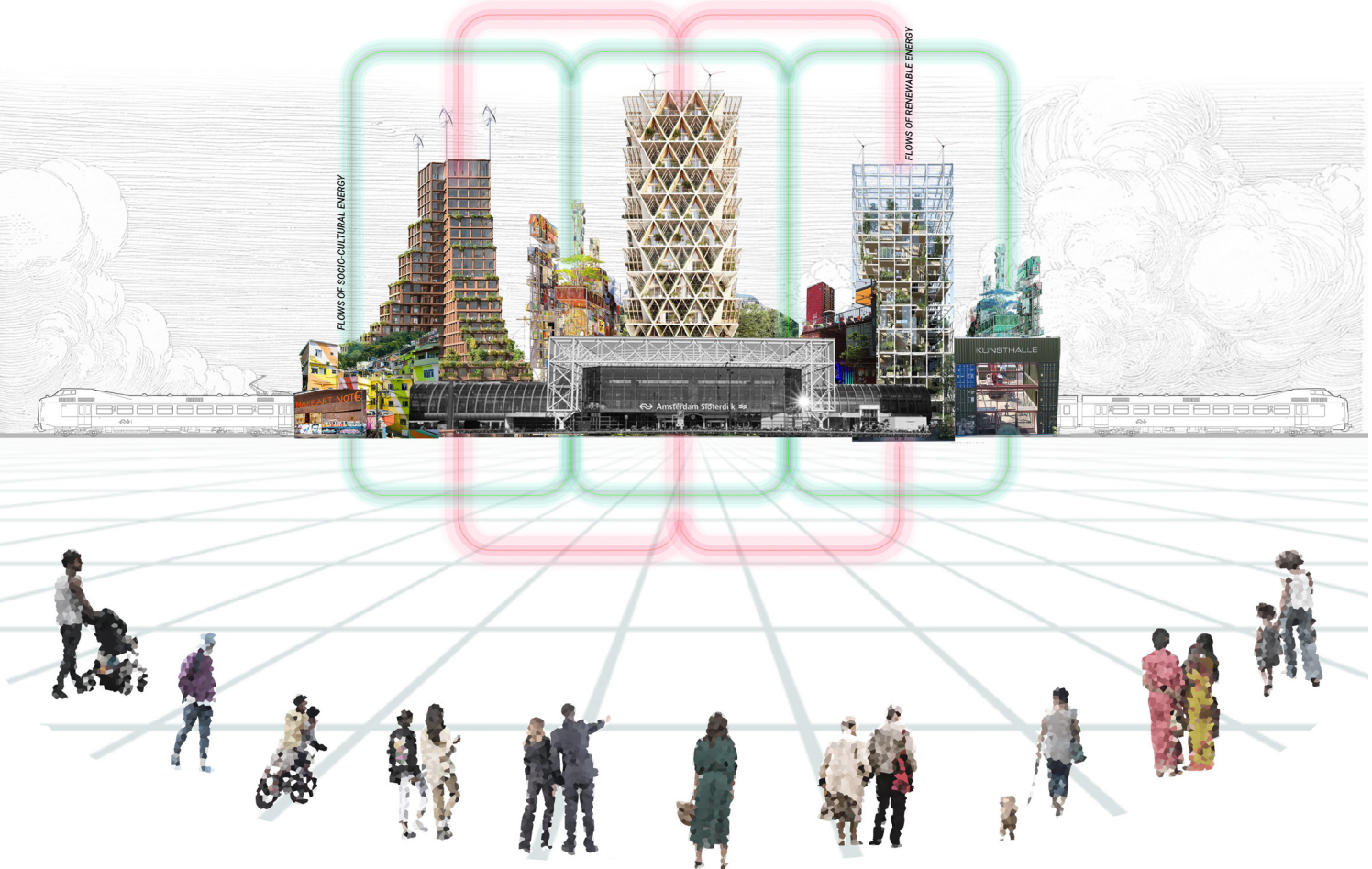


Amsterdam Sloterdijk

2026: Home office hub



2040: Inclusive city over tracks



04 • Design process

Bergen op Zoom 2026: New energy

SHORT-TERM SCENARIO



What if...

A new, post-pandemic economic crisis caused by crash of the housing market has hit smaller cities. Things are not going well in Bergen op Zoom. Young people are leaving the city en masse.

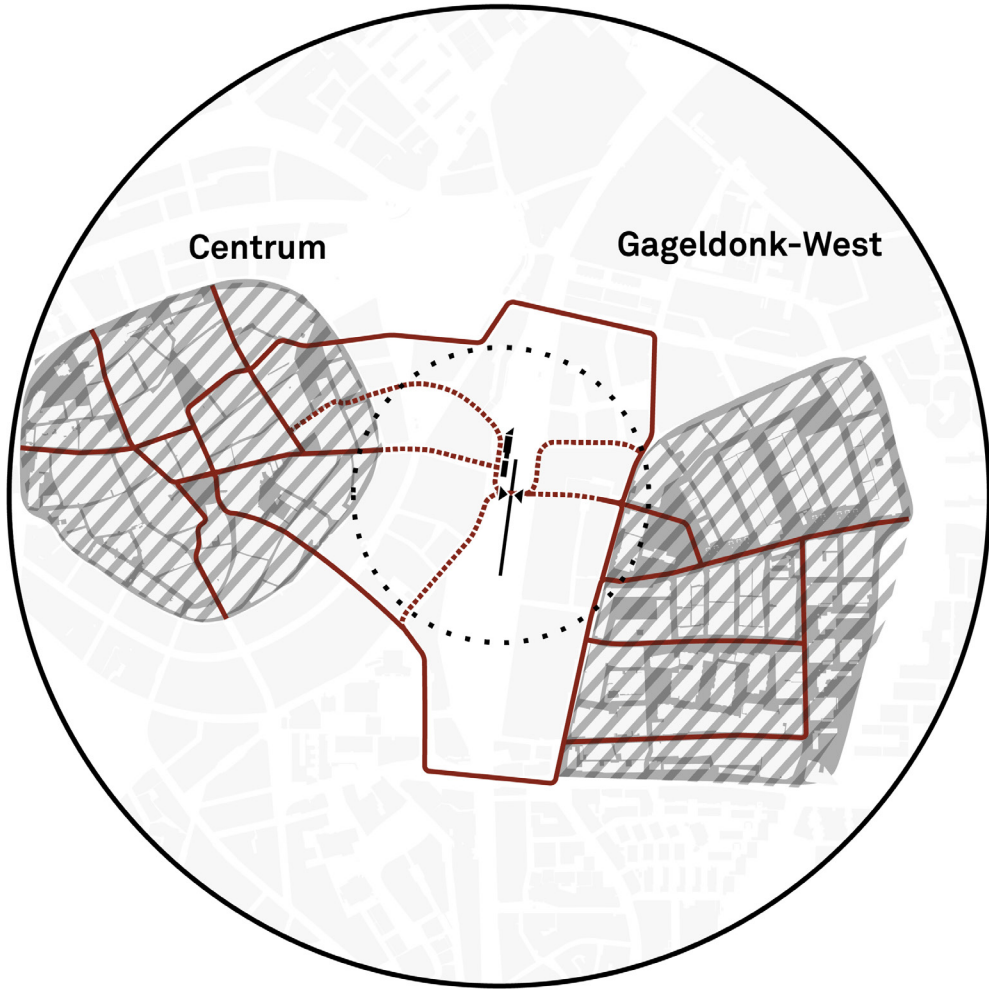
What if the train station area could breathe a new life into the whole city?

- 1 Problem statement
- 2 Theory & methods
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- Conclusion

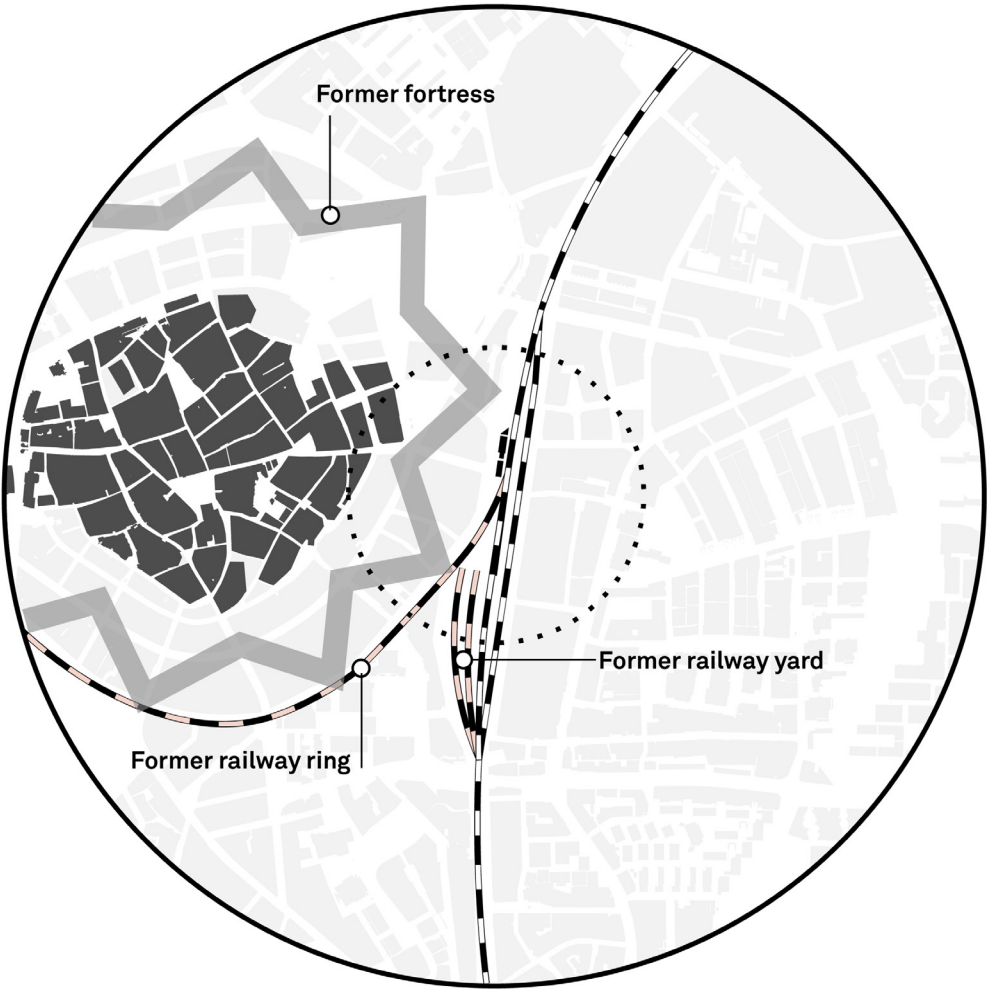
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Context analysis - Bergen op Zoom

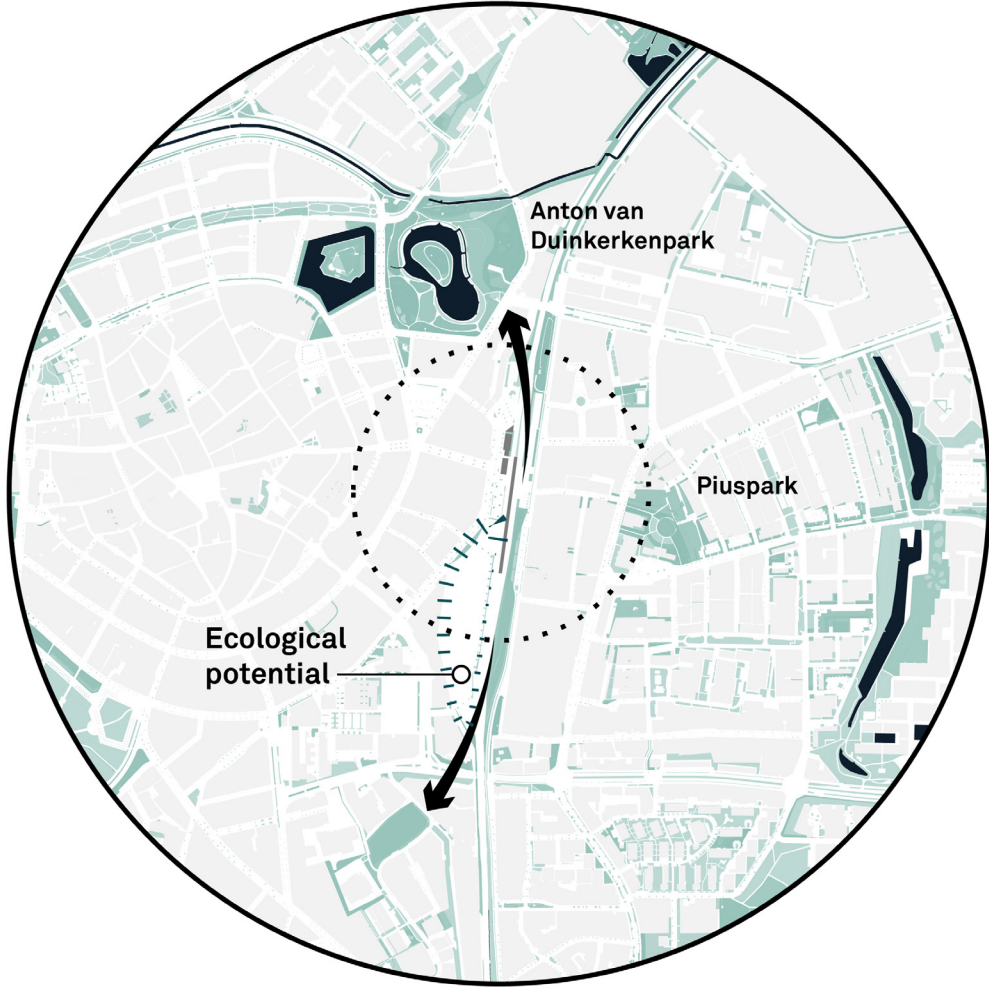
- 1 Problem statement
- 2 Theory & methods
- 3 Underpinning
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Train station as a bridge



History

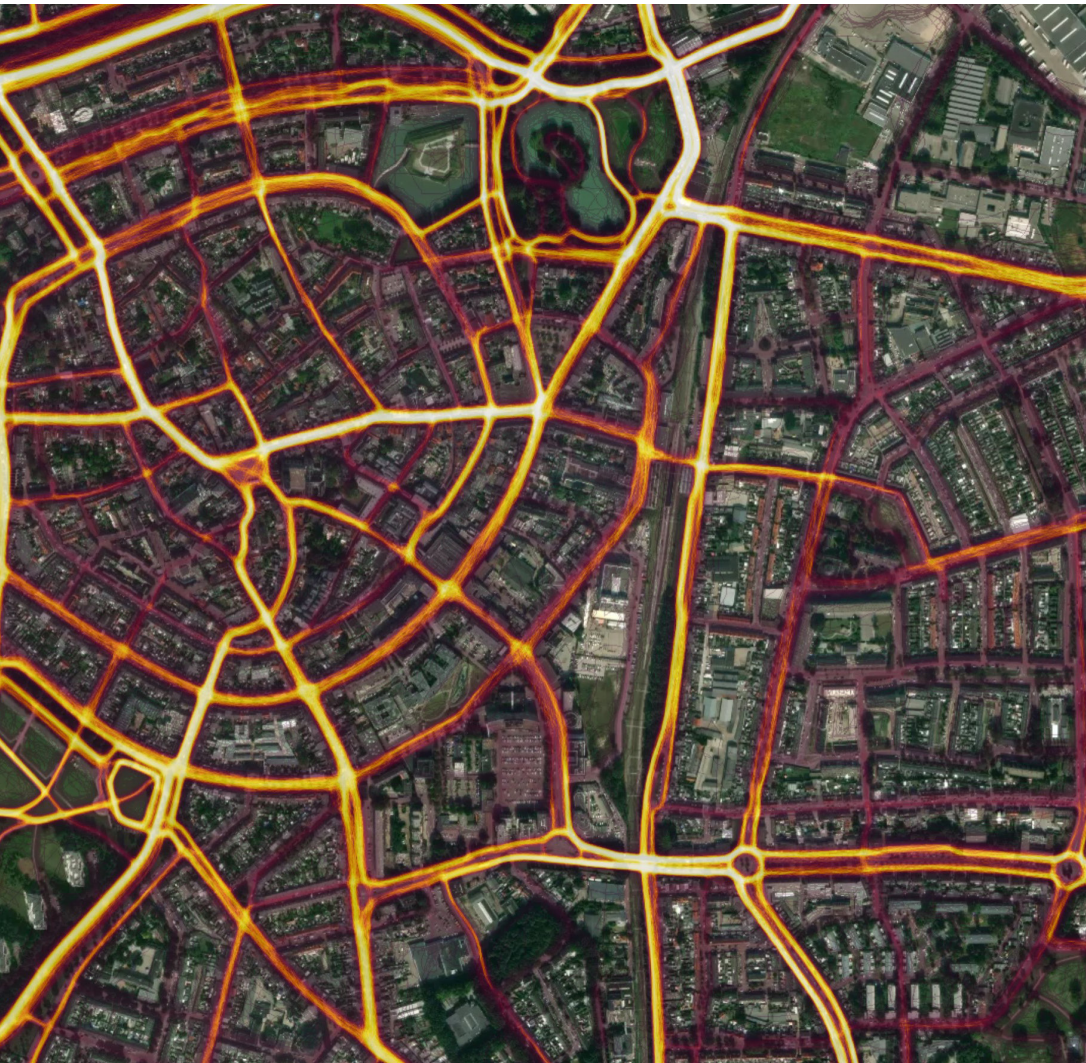


Blue-green structure



Active mobility and plinths

Activities
heatmap



Running
alternative to tunnel
needed, potential in link-
ing to the northern park

Cycling

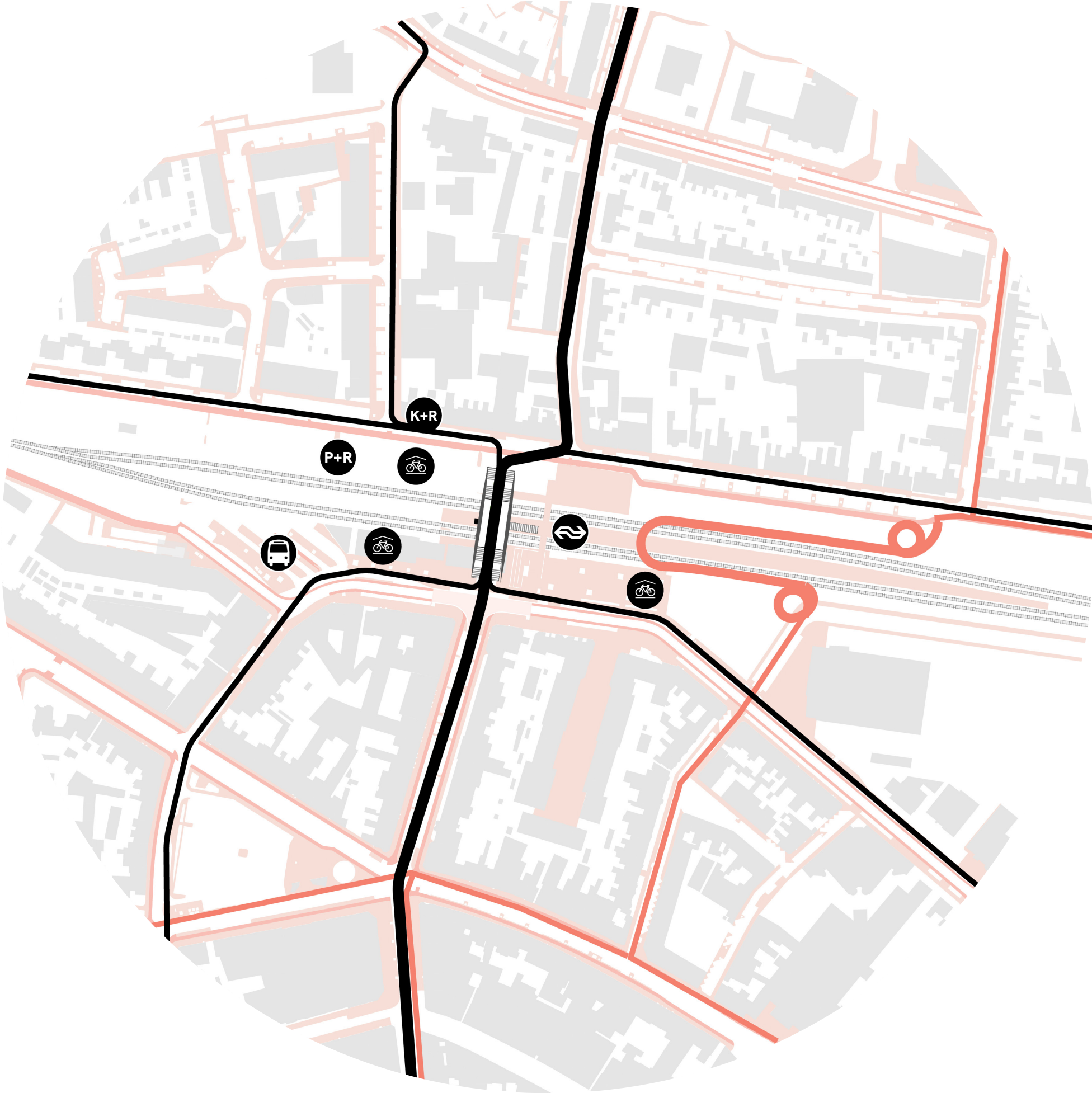
tunnel acts as a barrier,
no clear connection east-
west



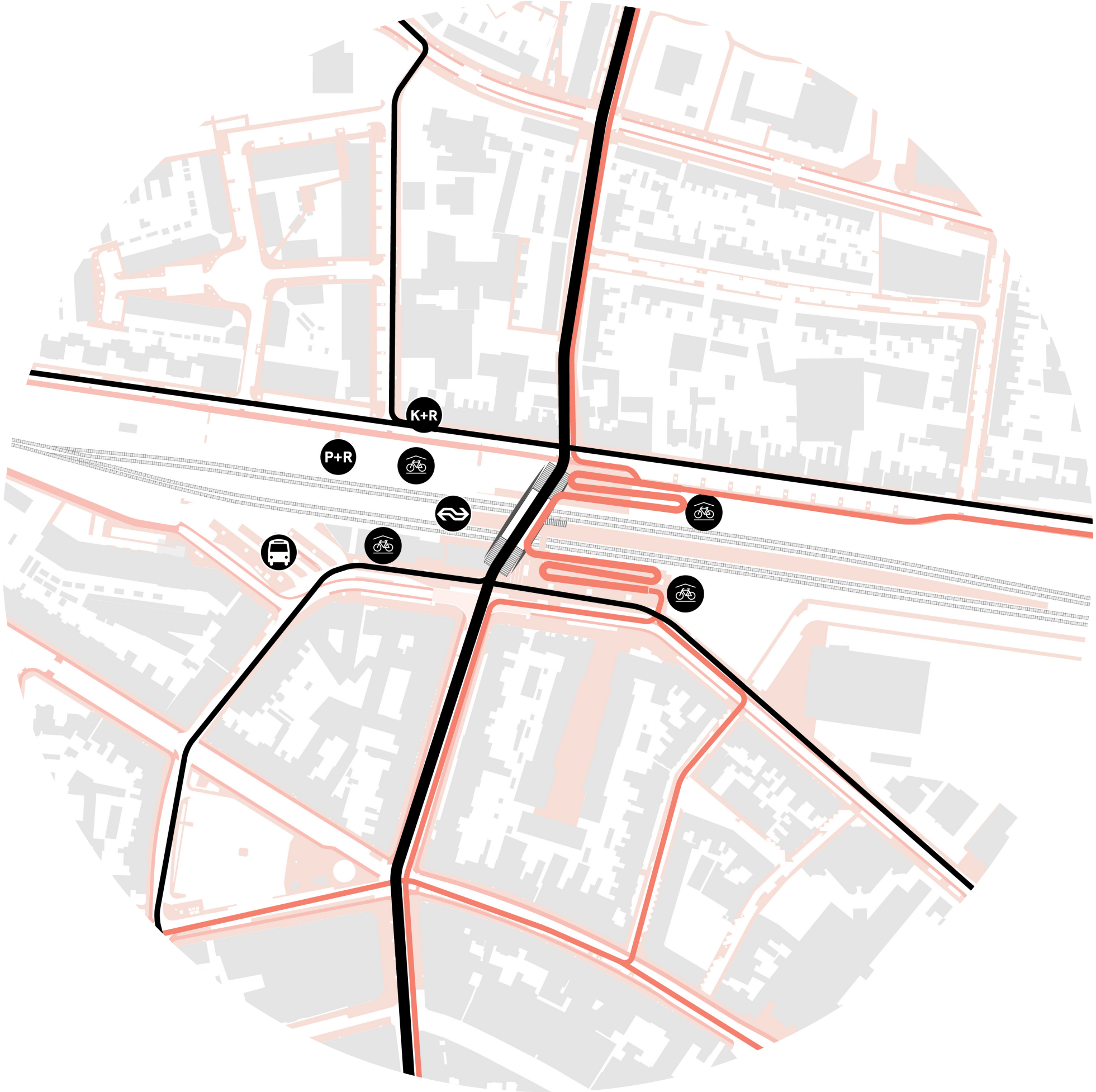
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Bridging the node - Bergen op Zoom

- 1 Problem statement
- 2 Theory & methods
- 3 Underpinning
- 4 Design process
- Design assessment
- Conclusion



Step I Central footbridge + cycling bridge

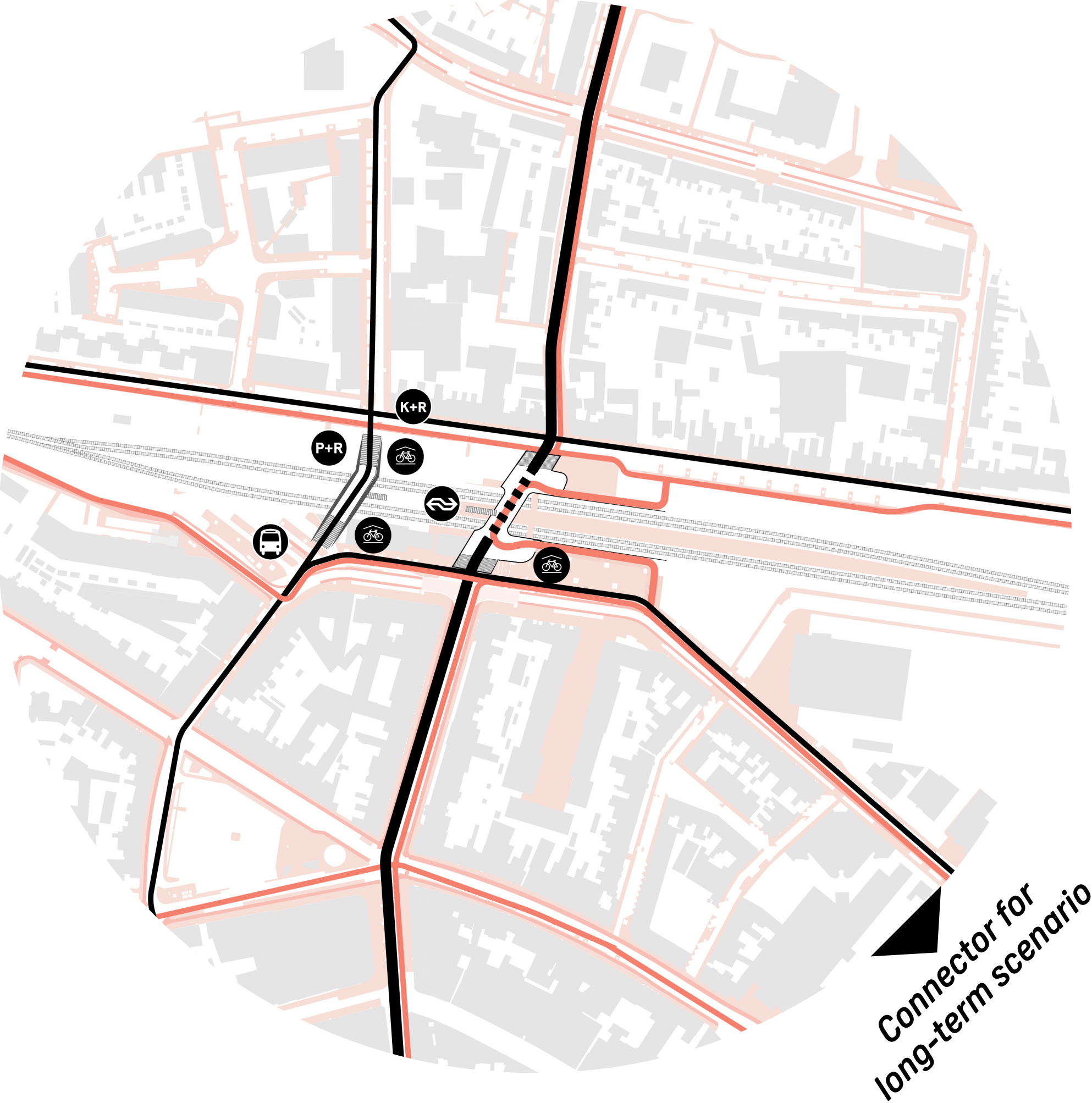


Step II Cycling bridge next to central footbridge

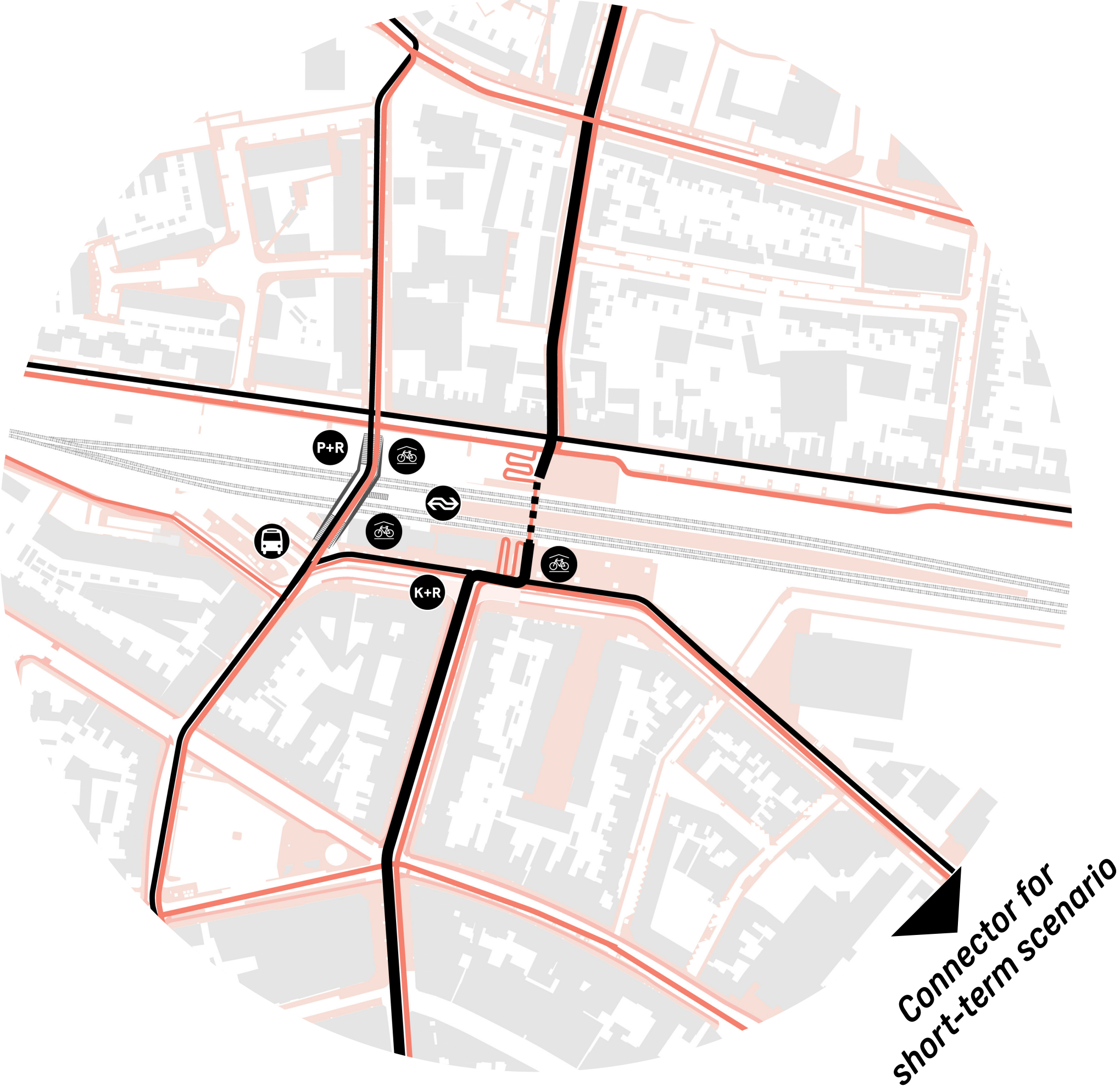
04 • Design process

Bridging the node

- 1 Problem statement
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Step III Footbridge + tunnel with bike ramps integrated in urban blocks



Step IV Short-term: a new footbridge connecting bus station and parking facilities.

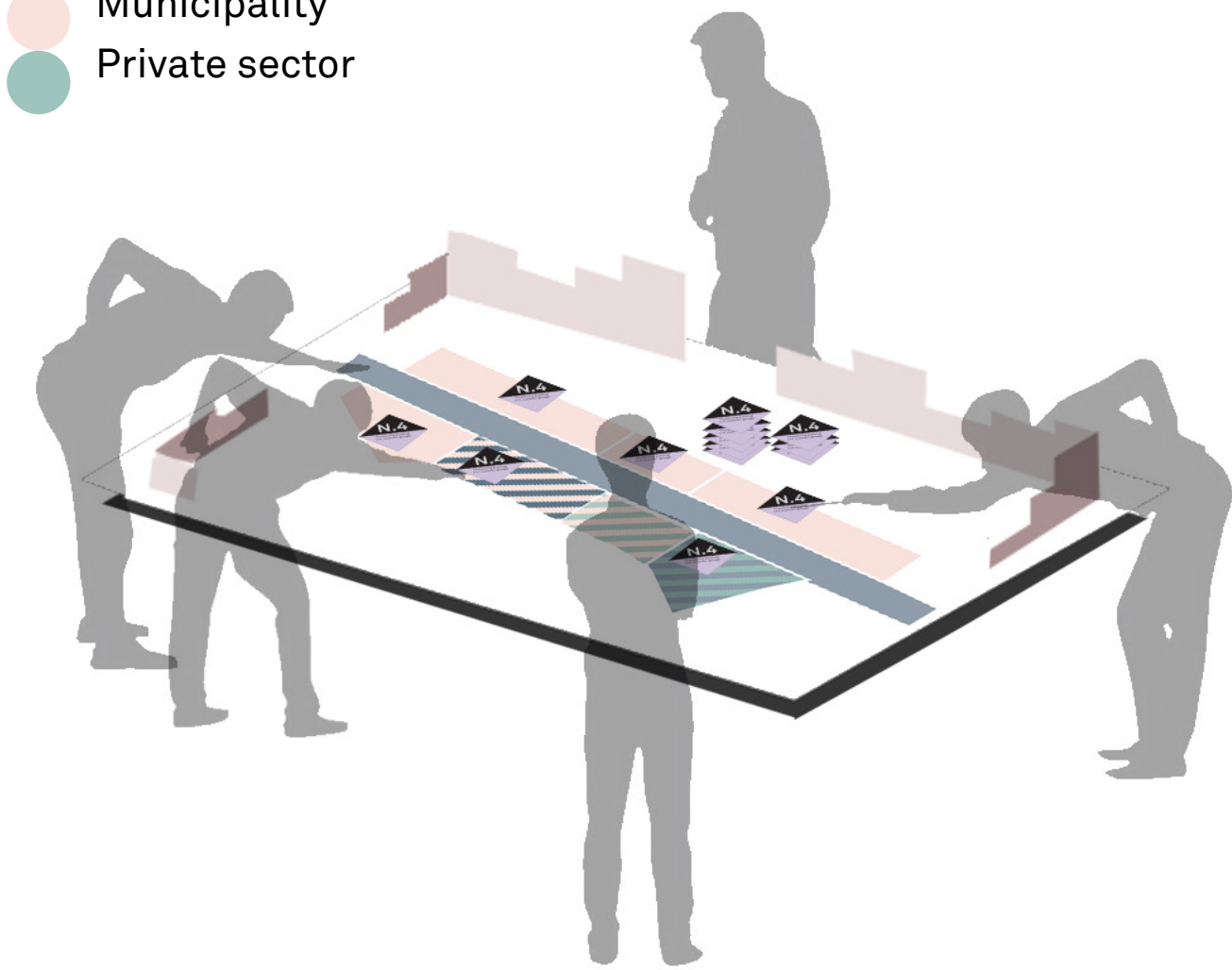
04 • Design process

Applying patterns

Applying patterns is in fact programming the station area during workshops with relevant stakeholders. Here, different land ownership is considered.

Each pattern has indication which actors may be involved in its implementation.

- Railway company
- Municipality
- Private sector

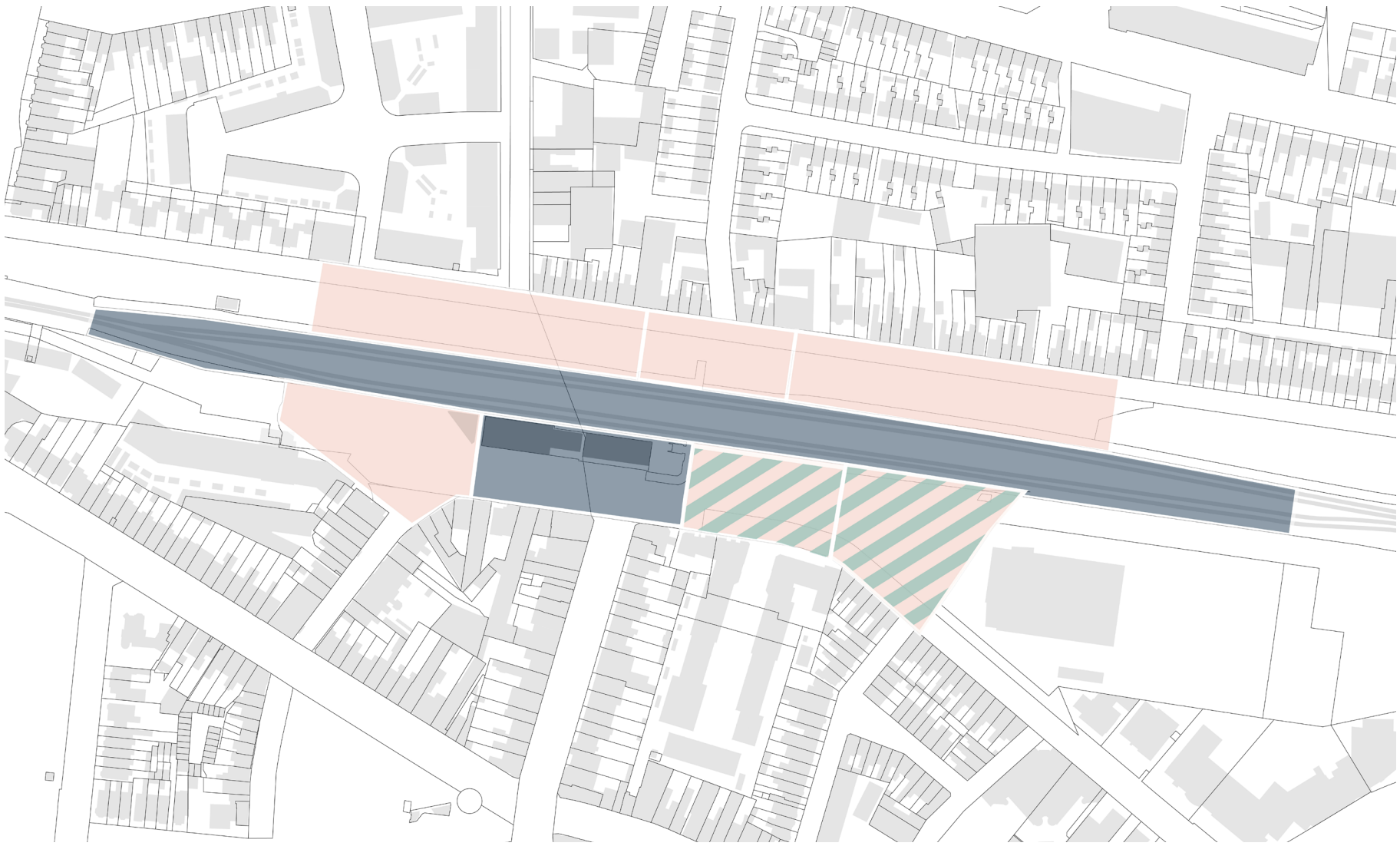


Selection

- Is based on:
- problems and potentials of the site
 - scenario goals
 - pattern synergies

Rejection

- Is based on:
- problems and potentials of the site
 - scenario goals
 - pattern tensions
 - mutually exclusive patterns

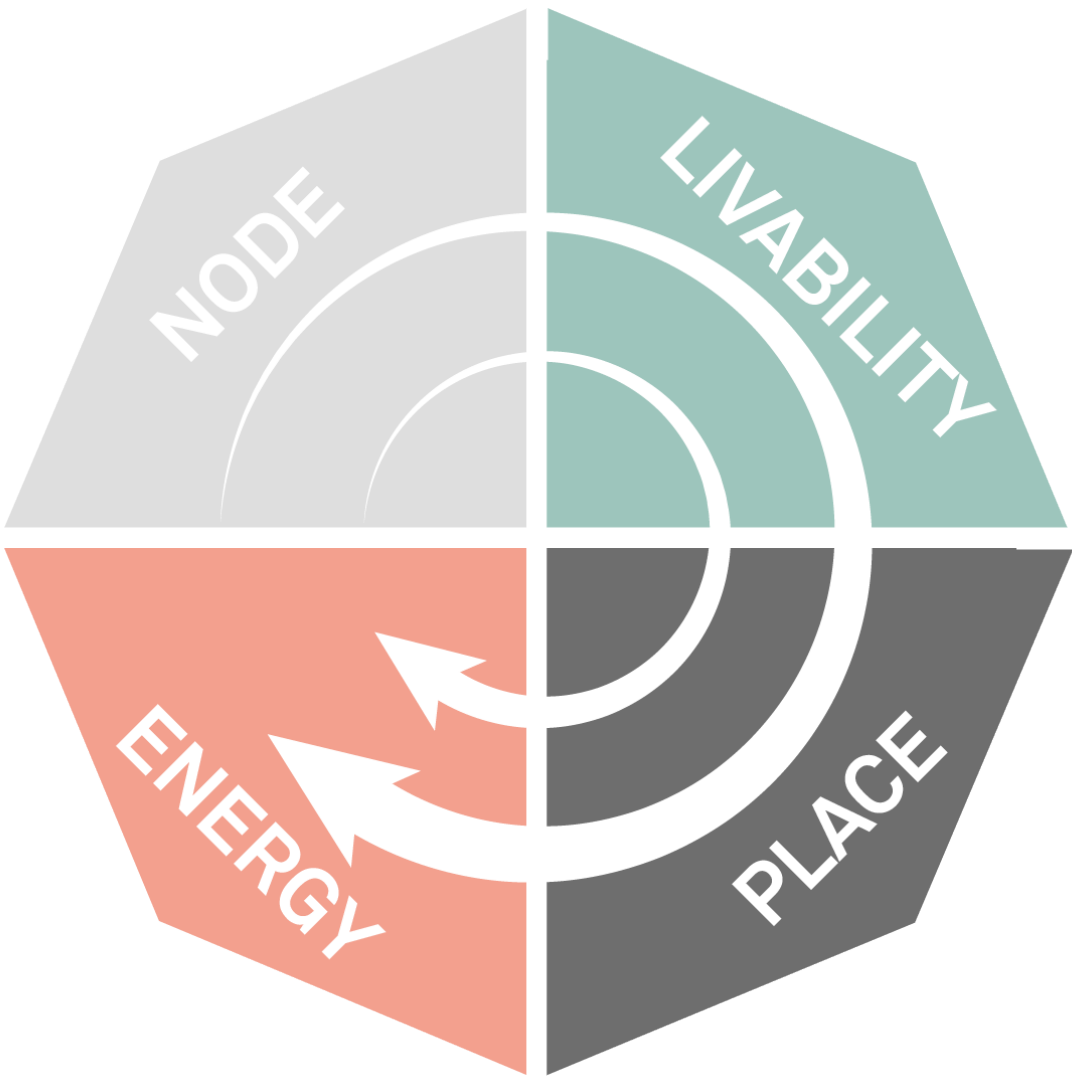


Order

Patterns are selected and applied clockwise, following the rose model, starting from node. There are two rounds:

1/ **Preselection**

2/ **Verification and adjustment.**



04 • Design process

Applying patterns

Bergen op Zoom 2026: New energy

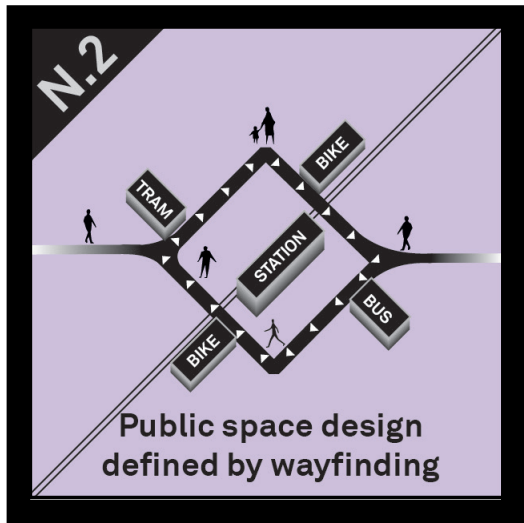
Node

- Problem

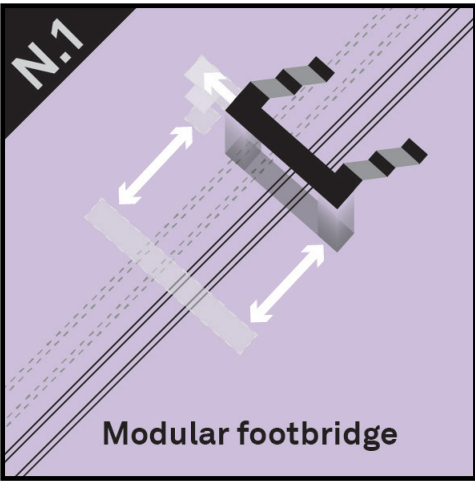
Tunnel as a barrier, long distance between bus station and platforms, generic public spaces.
- Potential

Improved quality of the connector guiding passengers, optimizing P+R and bike storage.
- Goal

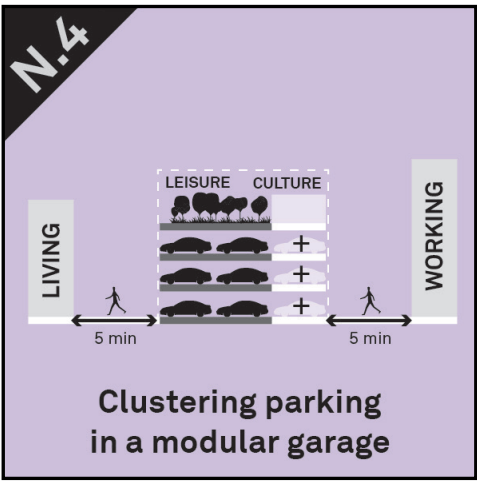
Minor intervention in the existing station without demolition, shortening distances between modes of transport, making station facilities compact and adaptable.



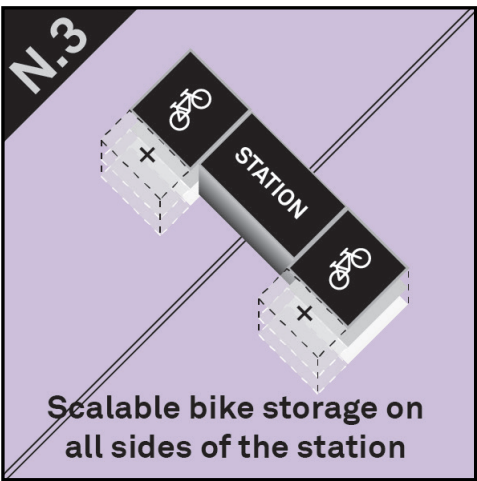
Pattern can go well with P.1, N.1 and be an unifying element of design of public spaces.



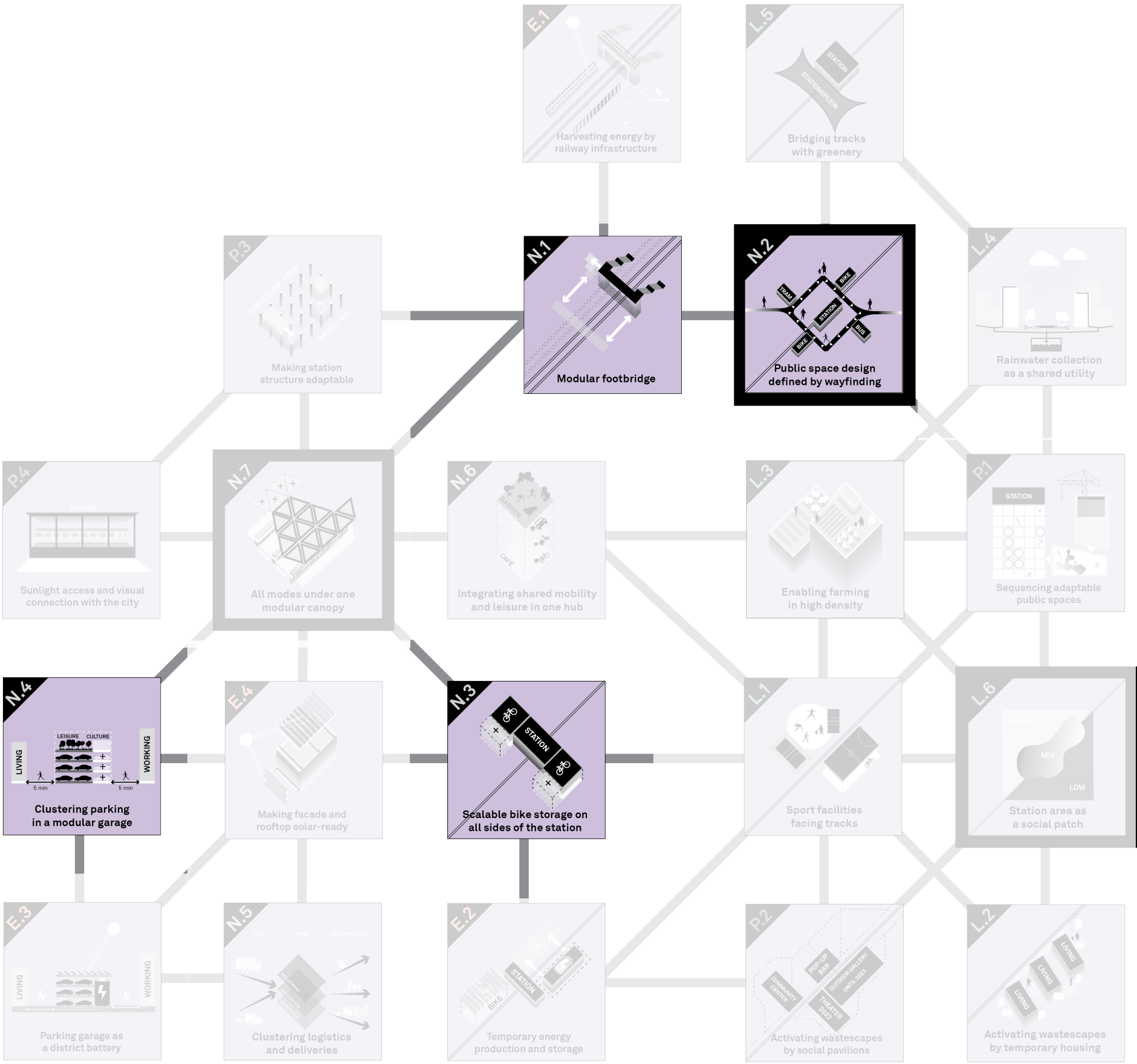
Pattern allows new connection shortening the distance between modes of transport, without demolition of the station building.



It may help to make a more compact, modular node and free up space for patterns P.1, P.2, L.1 or L.4.



Multi-level storage may solve shortage problems while saving space. Relocation may shorten distances within the node.



04 • Design process

Applying patterns

Bergen op Zoom 2026: New energy

Livability

- Problem

Lack of green spaces for leisure and social interaction, lack of social amenities.
- Potential

Good social mix of the neighborhood, station area as a transition zone between two districts of different socio-economic profiles.
- Goal

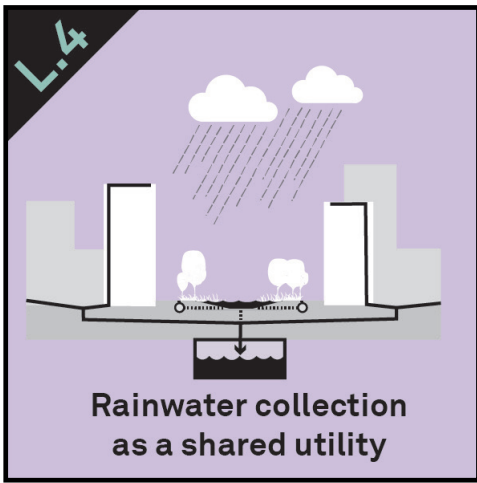
Station area as an adaptable pocket park co-created by residents of Centrum and Gagel-donk-West.



All free plots in station area needs to be activated for social purposes.



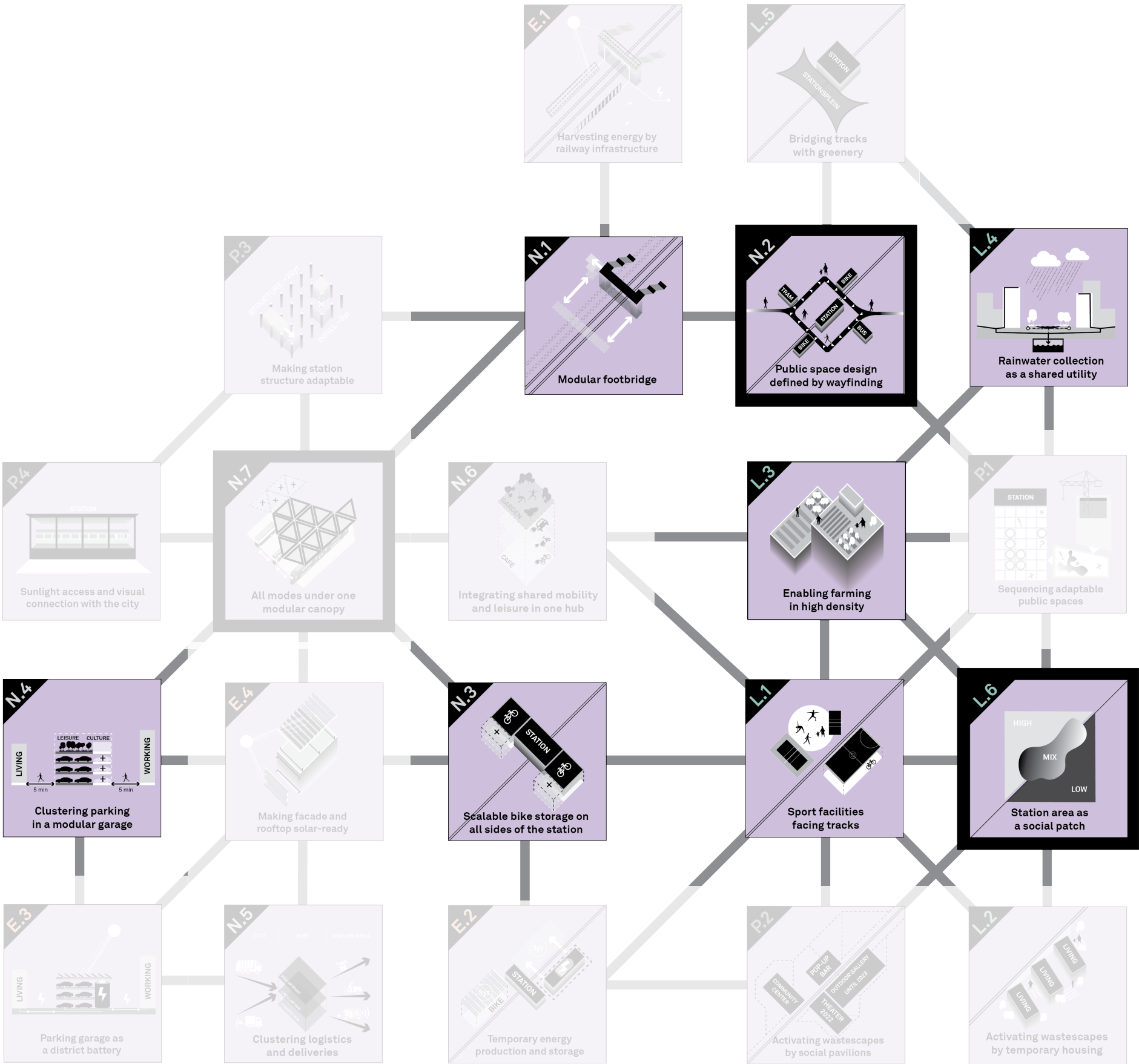
Pattern allows to intensify the use of infrastructure, can be introduced on the existing square for bike storage.



Pattern may help to improve the station as a meeting place with pleasant microclimate.



Pattern could activate railway buffers for intergenerational activity.



04 • Design process

Applying patterns

Bergen op Zoom 2026: New energy

Place

Problem

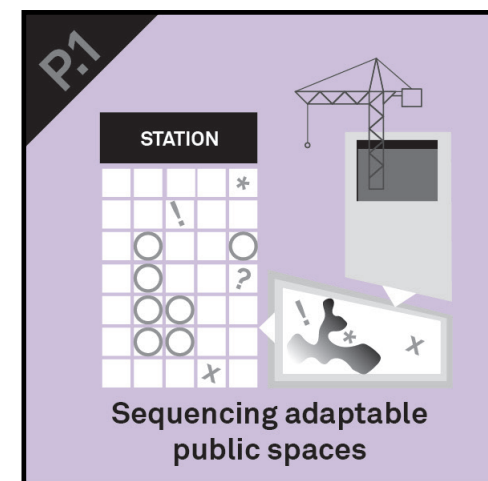
Poor continuity of functions and public spaces from Centrum to Gageldonk-West, lack of active streets and urban functions.

Potential

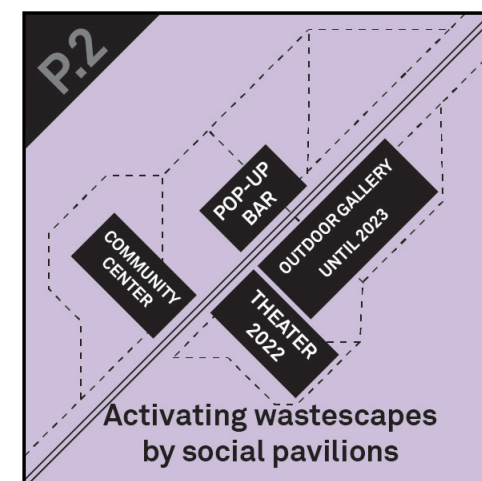
Activating streets parallel to tracks and empty plots.

Goal

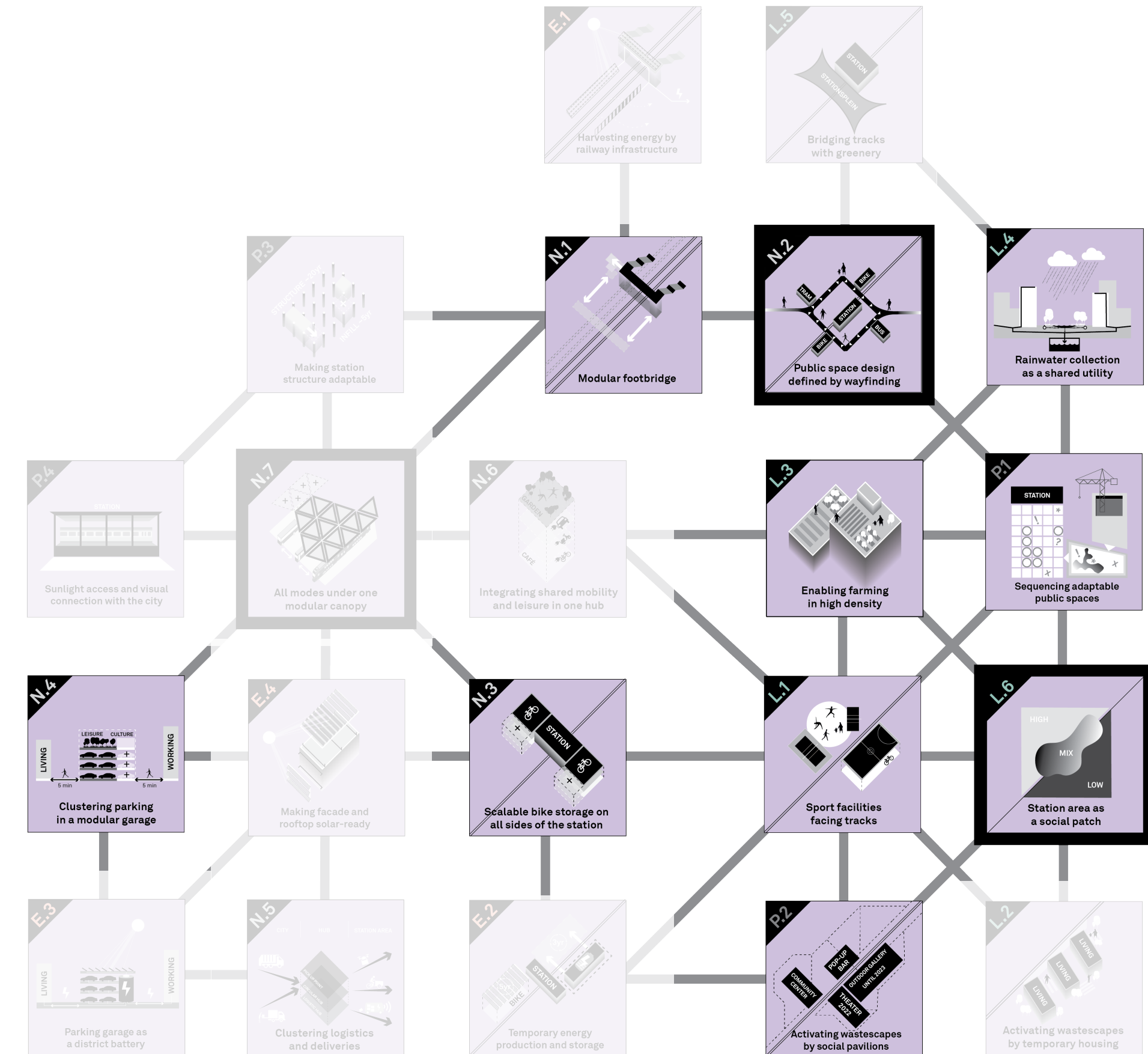
Pilot project of urban renewal: inclusive spaces for social interaction, culture and entrepreneurship.



Pattern can help to activate the eastern side of the station (Gageldonk-West) until long-term transformation.



Pattern allows to add temporary structures with commercial and seasonal cultural program i.e. to empty plot owned by ProRail.



04 • Design process

Applying patterns

Bergen op Zoom 2026: New energy

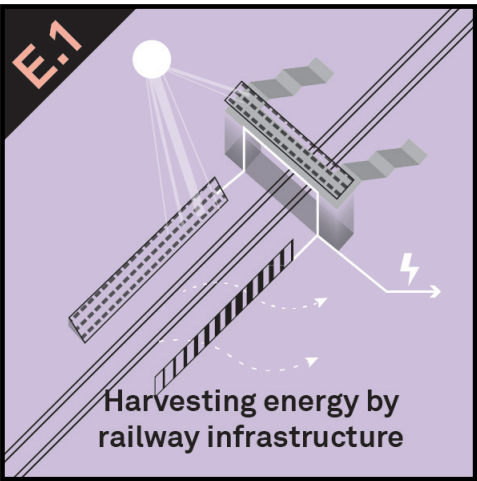
Energy

- Problem

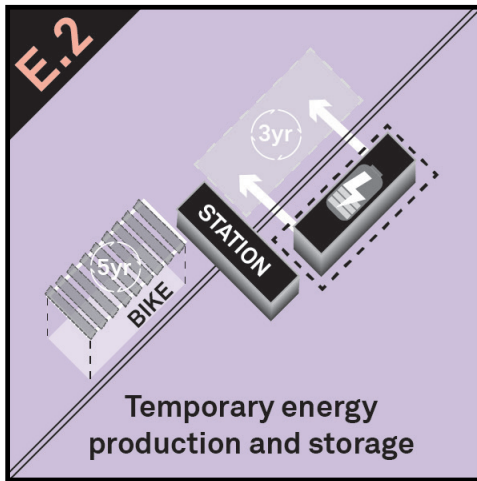
No district heating and green energy generation, low energy labels of most of the buildings and the station.
- Potential

Potential for new district heating and wind energy (wind tunnel south-north).
- Goal

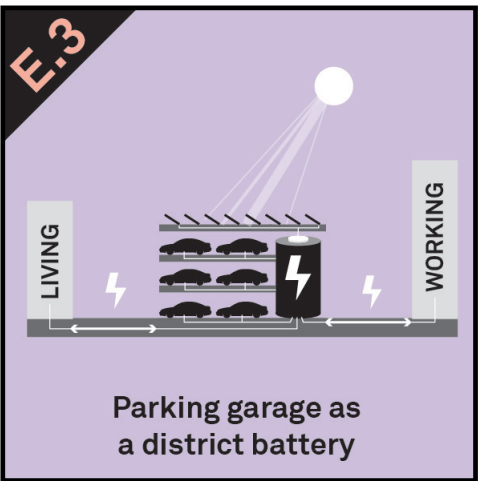
Energy-neutral temporary program, station area as a testing lab for small-scale wind turbines and storage.



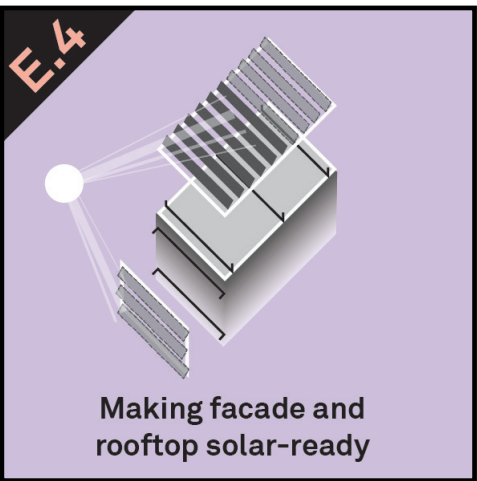
Pattern may allow to use potential of the fenced railway area (ProRail) for wind energy generation.



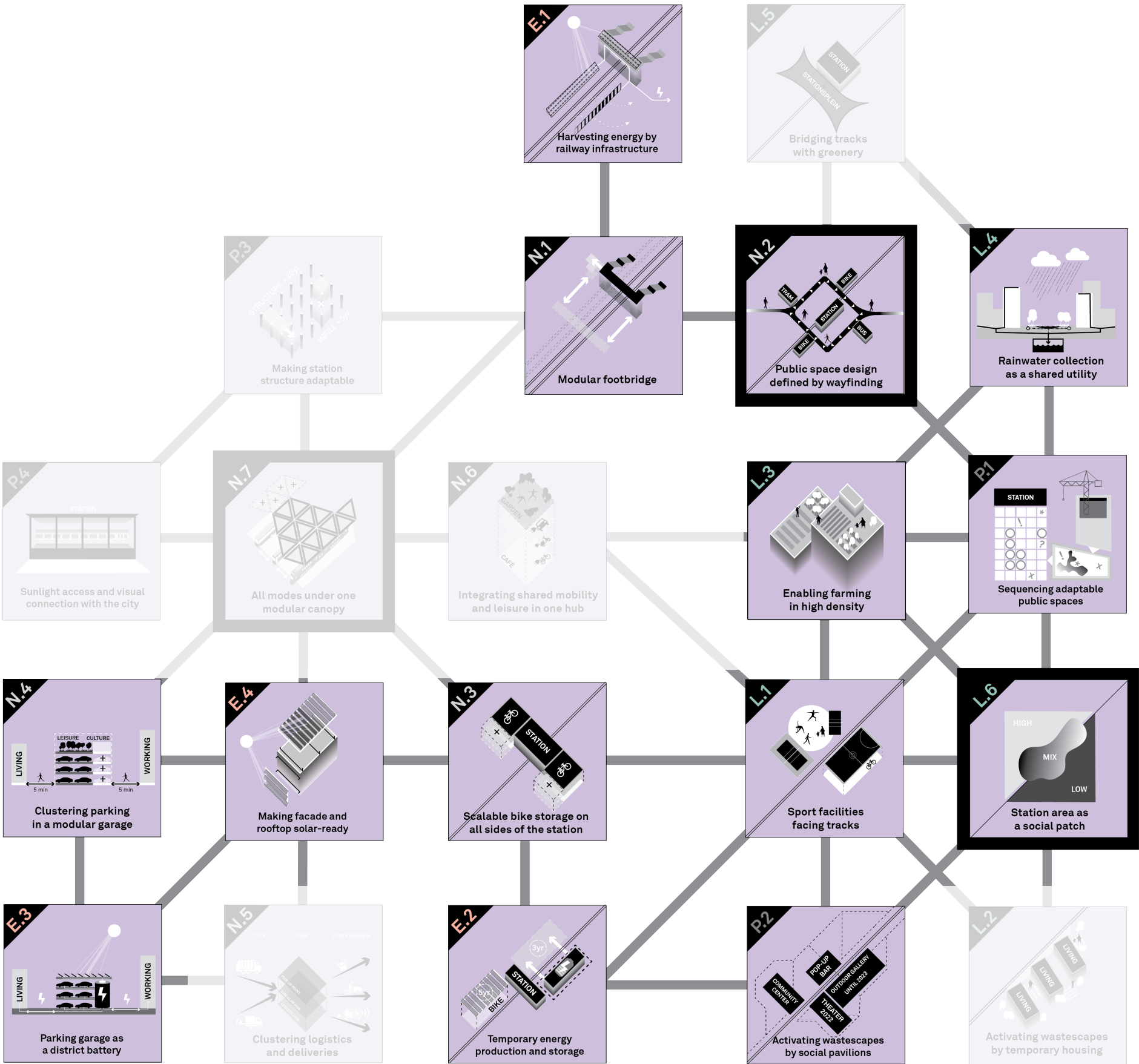
Solar canopies and mobile batteries can synergize with P.1, P.2. and achieve energy-neutrality of the temporary program.



New compact parking garage can be the first district battery in Bergen op Zoom.



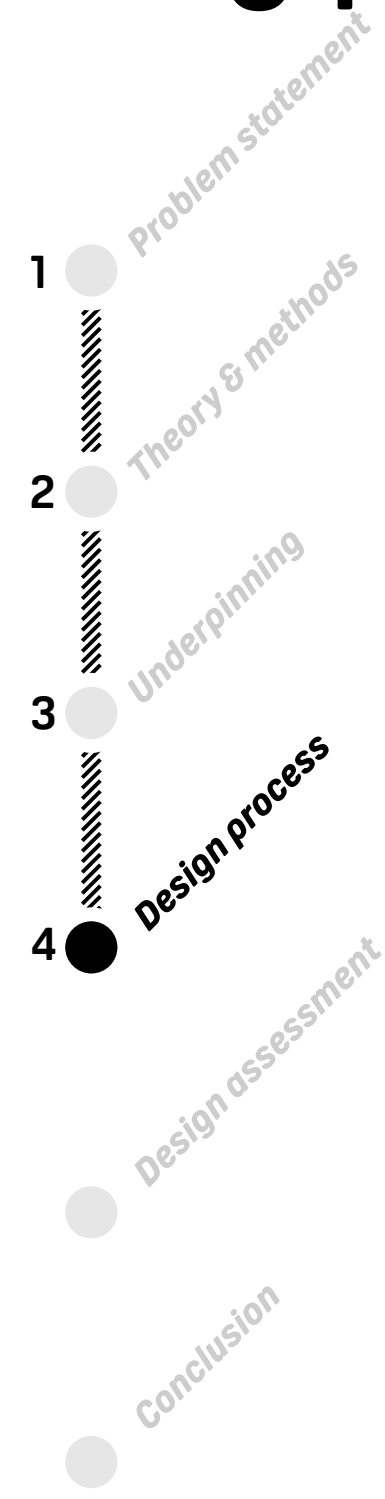
Pattern allows minor intervention in the station building, so it can cover its heating and electricity demand from solar energy.



04 • Design process

Applying patterns

Rejected short-term patterns:



Node

Livability

Place

N.7 All modes under one modular canopy An overarching canopy would require a major intervention in the existing station building and may hinder E.1.	N.5 CITY HUB STATION AREA Clustering logistics and deliveries Planned densification solves parking within each plot. P+R is used only by 1% of passengers, shared mobility is more relevant.	N.6 GARDEN CAFE Integrating shared mobility and leisure in one hub Short term is insufficient for full transition to shared mobility. P+R may be more useful as a district battery.
L.5 STATION STATIONSPLEIN Bridging tracks with greenery No ecological value in bridging east-west, tension with E.1, mutually exclusive with a new footbridge N.1.	L.2 LIVING LIVING LIVING Activating wastescapes by temporary housing There is little demand for temporary housing in Bergen op Zoom, and it creates tension with active social spaces P.2.	
P.4 STATION Sunlight access and visual connection with the city Existing station building is blocking the view; minor intervention in station structure gives no opportunity to apply this pattern.	P.3 STRUCTURE -20yr INFILL -5yr Making station structure adaptable Major intervention in station structure would mean partial demolition, which scenario aims to avoid.	

Tensions:

N.7 All modes under one modular canopy	L.5 STATION STATIONSPLEIN Bridging tracks with greenery
E.1 Harvesting energy by railway infrastructure	L.5 STATION STATIONSPLEIN Bridging tracks with greenery
P.4 Sunlight access and visual connection with the city	L.5 STATION STATIONSPLEIN Bridging tracks with greenery
E.4 Making facade and rooftop solar-ready	P.4 Sunlight access and visual connection with the city
E.4 Making facade and rooftop solar-ready	L.1 Sport facilities facing tracks
E.1 Harvesting energy by railway infrastructure	N.7 All modes under one modular canopy

Mutually exclusive:

E.4 Making facade and rooftop solar-ready	L.3 Enabling farming in high density
N.4 Clustering parking in a modular garage	N.6 Integrating shared mobility and leisure in one hub
E.3 Parking garage as a district battery	L.3 Enabling farming in high density
P.2 Activating wastescapes by social pavilions	L.2 Activating wastescapes by temporary housing
E.2 Temporary energy production and storage	L.3 Enabling farming in high density
N.1 Modular footbridge	L.5 STATION STATIONSPLEIN Bridging tracks with greenery

04 • Design process

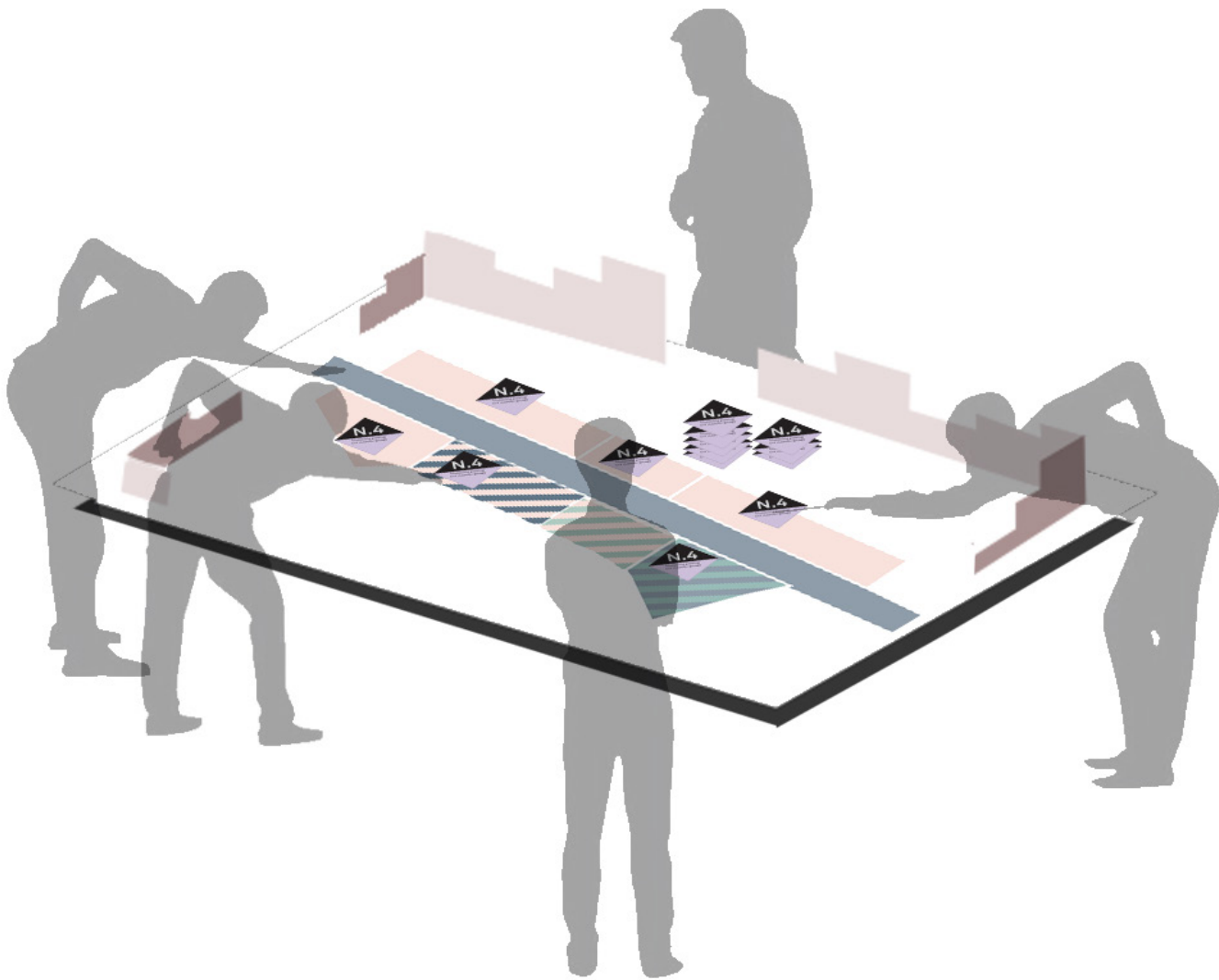
Applying patterns

Bergen op Zoom 2026: New energy

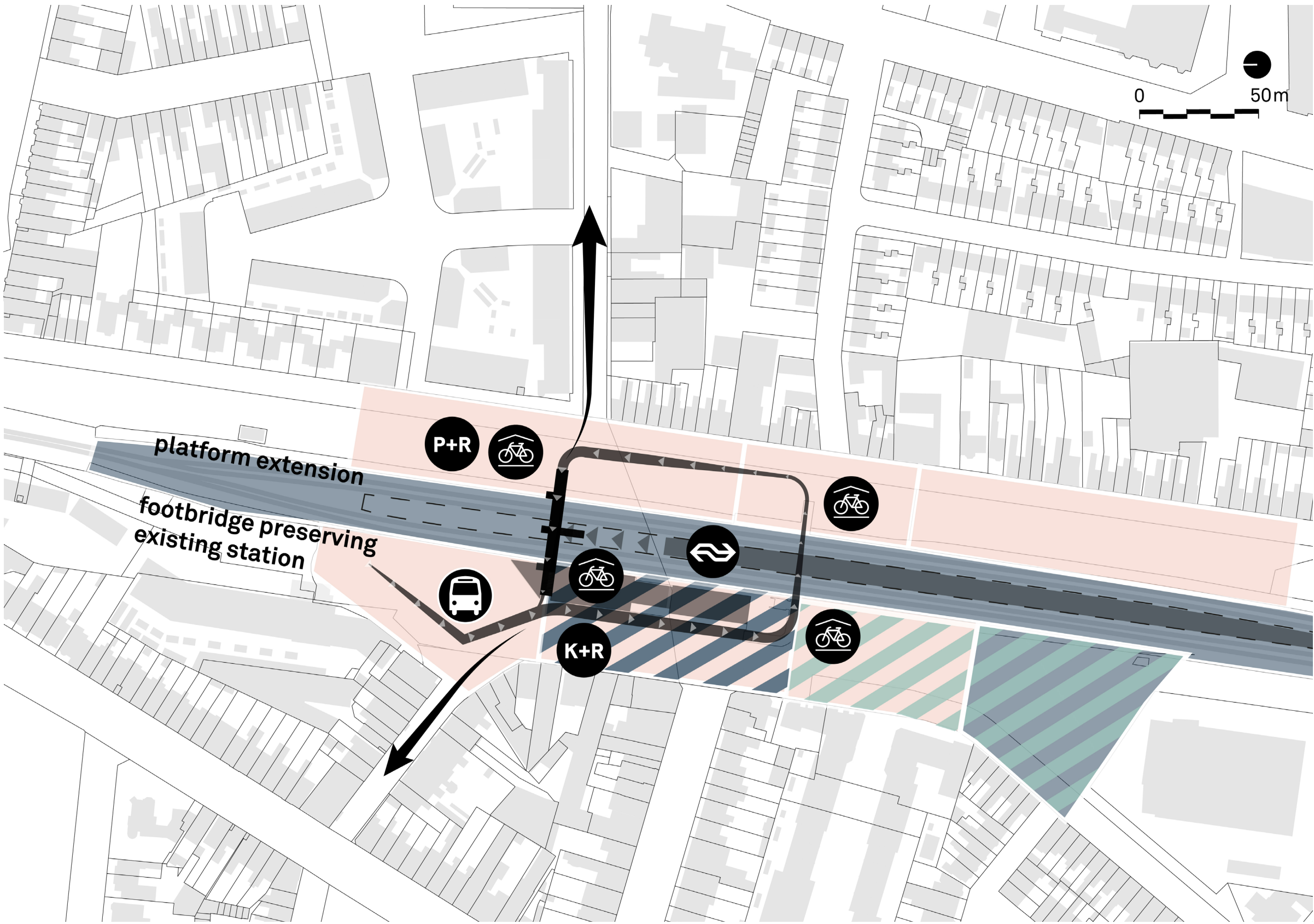
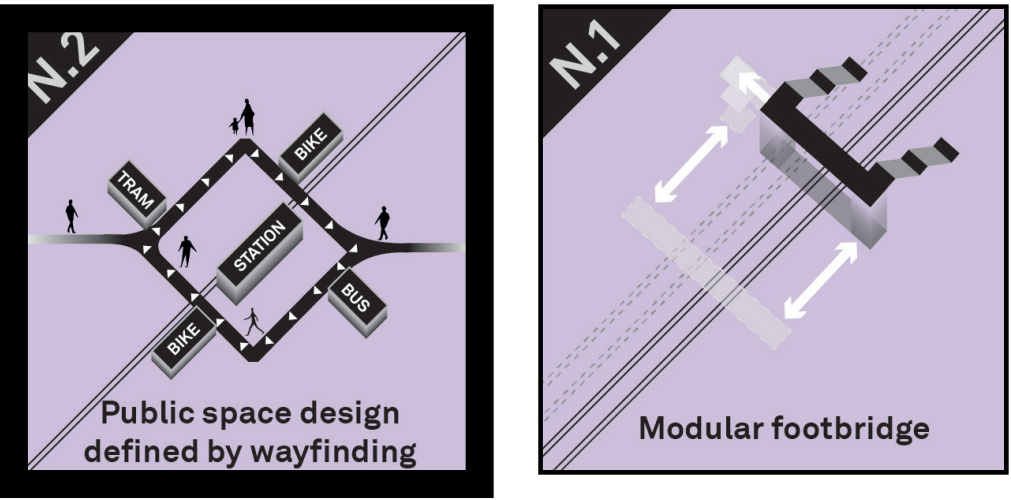
Node: Minor intervention in the existing station without demolition, shortening distances between modes of transport, making station facilities compact and adaptable.

Legend

- Railway company (NS/Prorail)
- Municipality
- Building owned by NS, plot by municipality
- Owned by NS/Prorail, potential to be redeveloped by private sector
- Owned by municipality, potential to be redeveloped by private sector



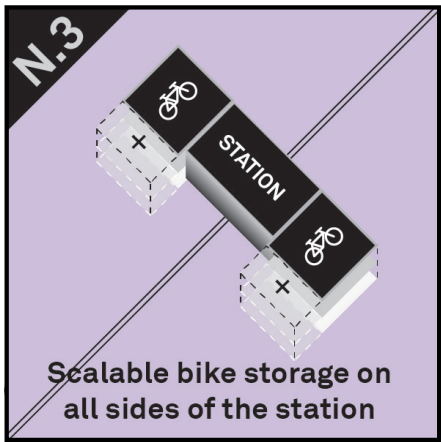
The loop that should guide by colors or material is connecting already localized footbridge with the existing tunnel.



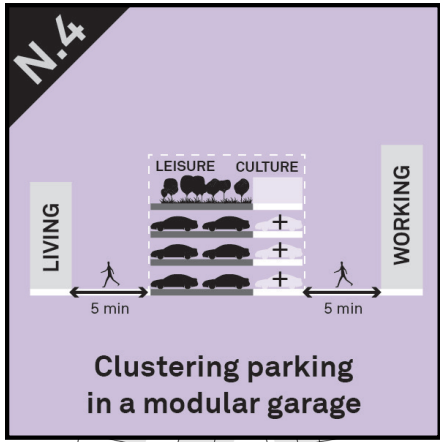
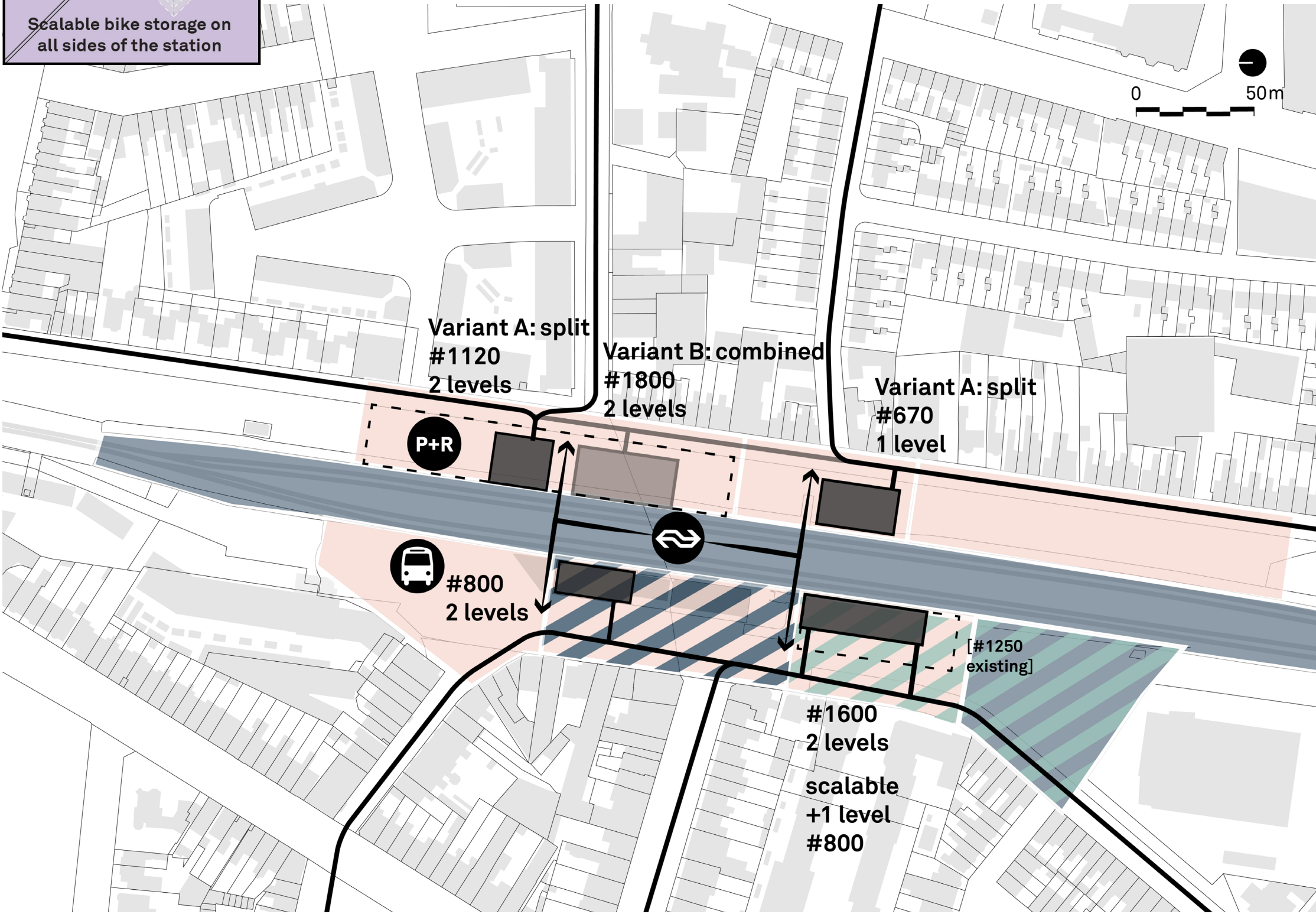
04 • Design process

Applying patterns

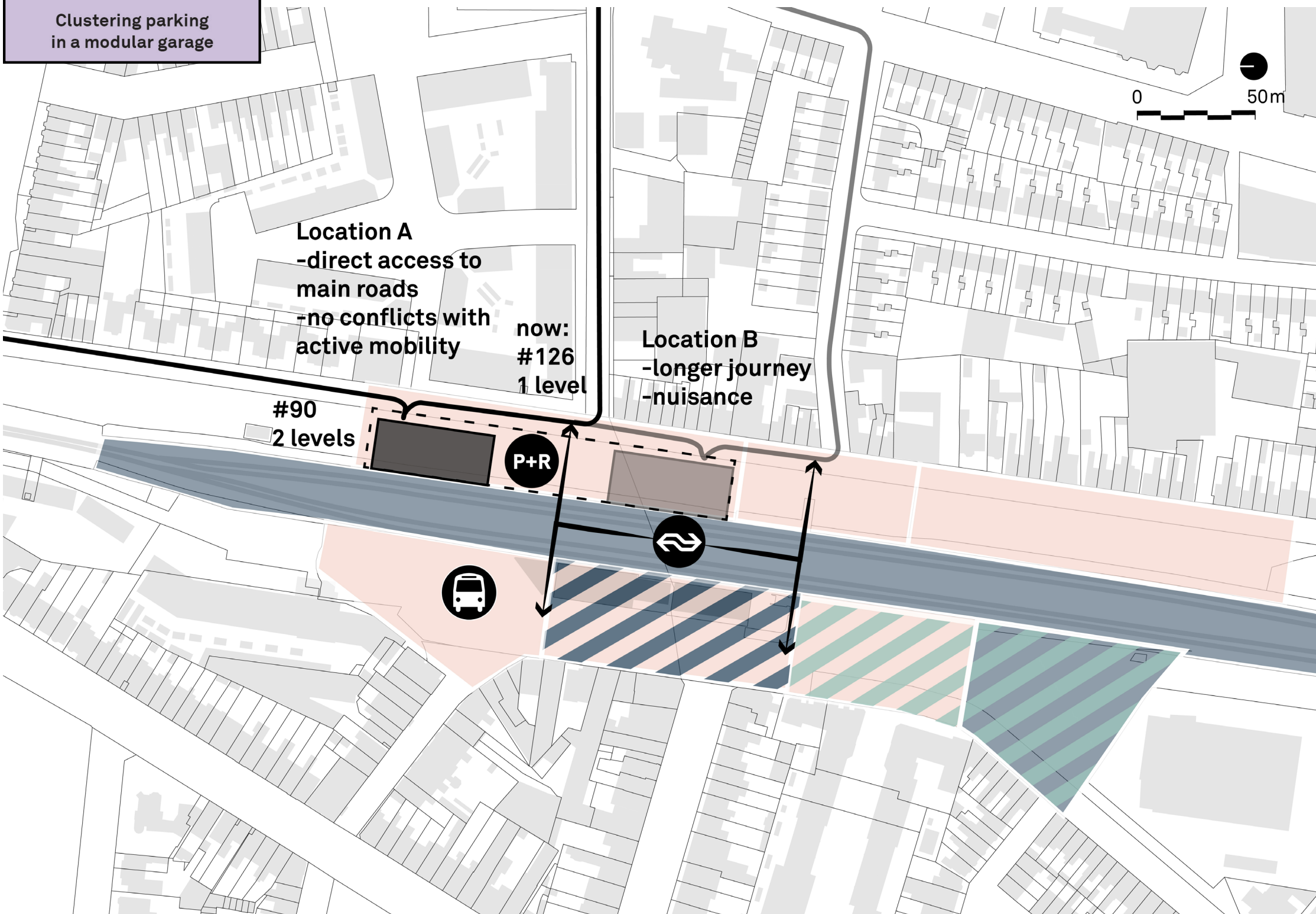
- 1 Problem statement
- 2 Theory & methods
- 3 Underpinning
- 4 Design process
- Design assessment
- Conclusion



Variant A is optimal, since it provides more balanced distribution and frees the space in the middle for social program.



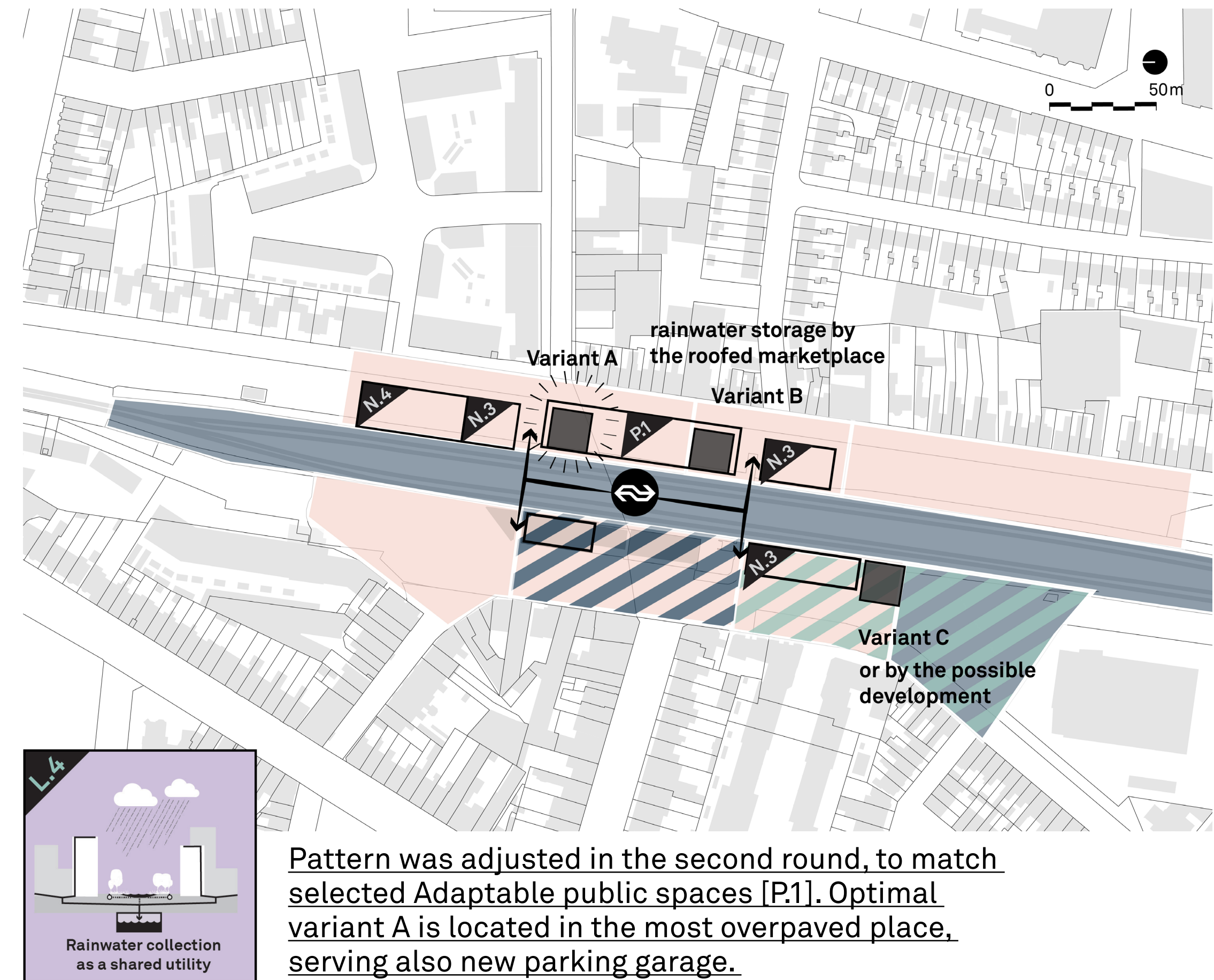
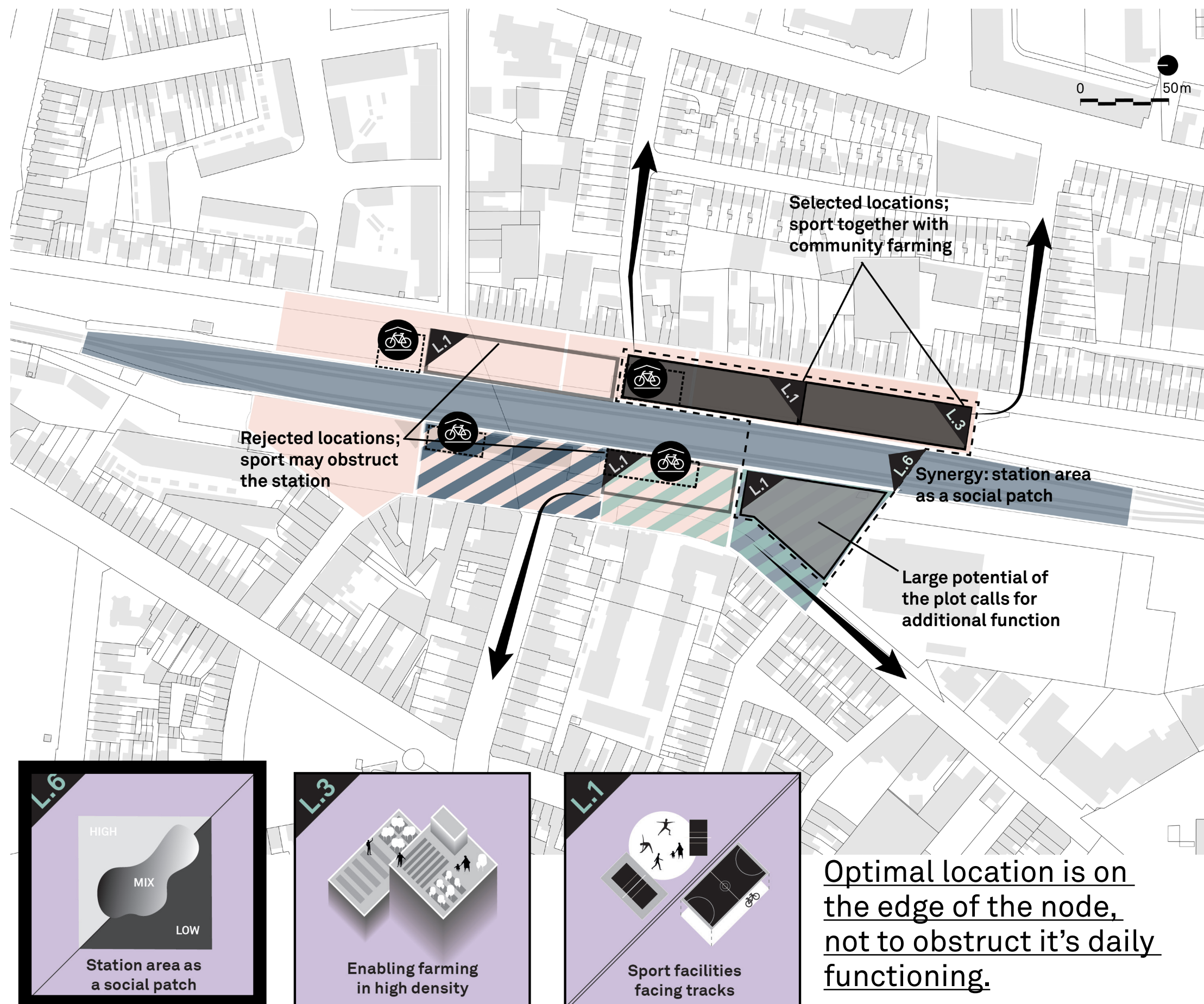
Only locations within the existing P+R are considered. Location A is optimal, because of better connection with the road network.



04 • Design process

Applying patterns

Livability: Station area as an adaptable pocket park co-created by residents of Centrum and Gageldonk-West.

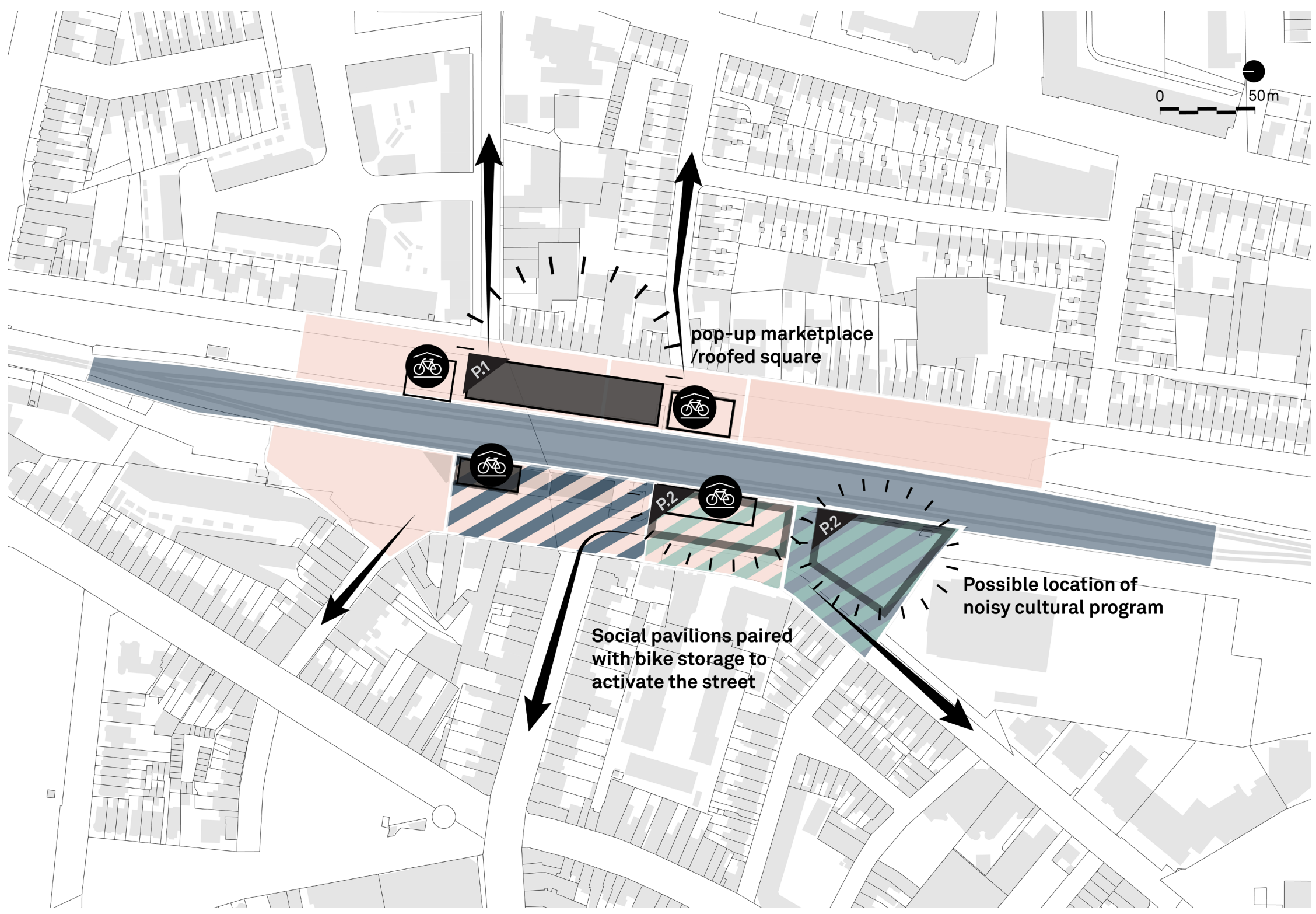
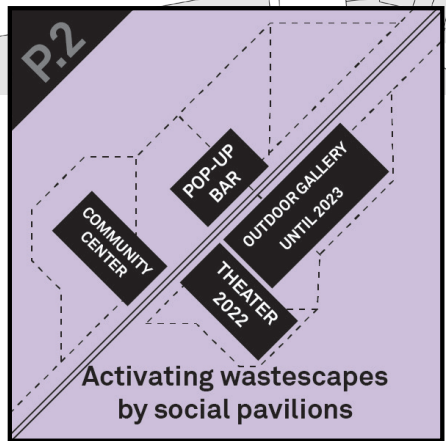
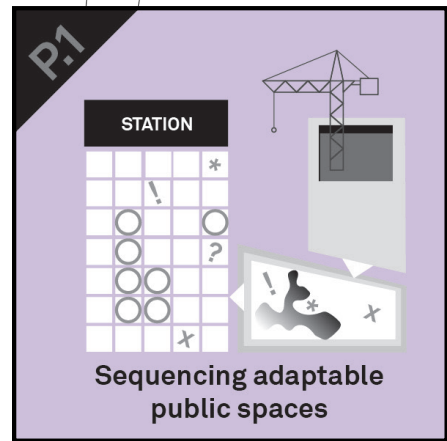
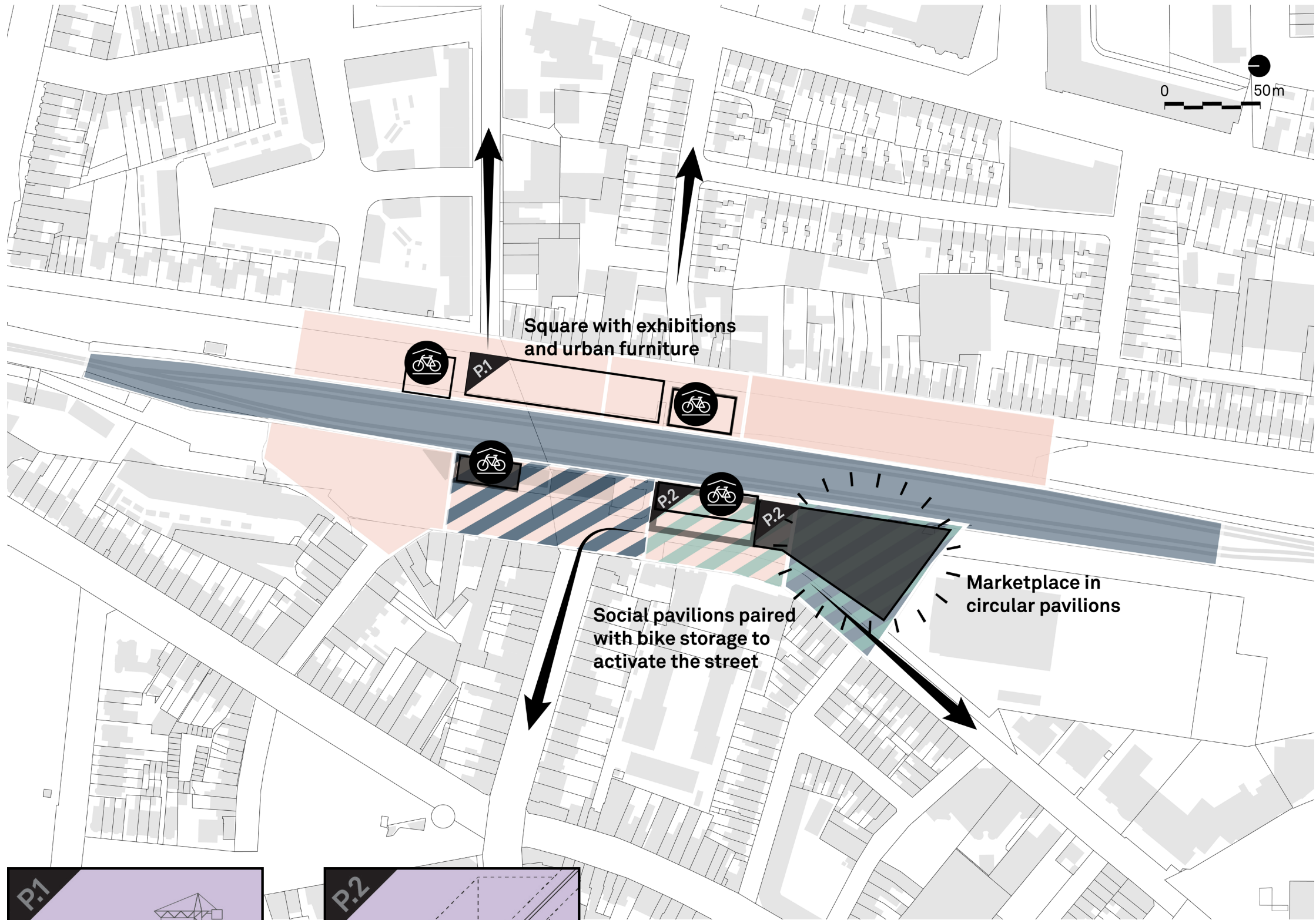


04 • Design process

Applying patterns

Place: Pilot project of urban renewal:
inclusive spaces for social interaction,
culture and entrepreneurship.

- 1 Problem statement
- 2 Theory & methods
- 3 Underpinning
- 4 Design process
- Design assessment
- Conclusion



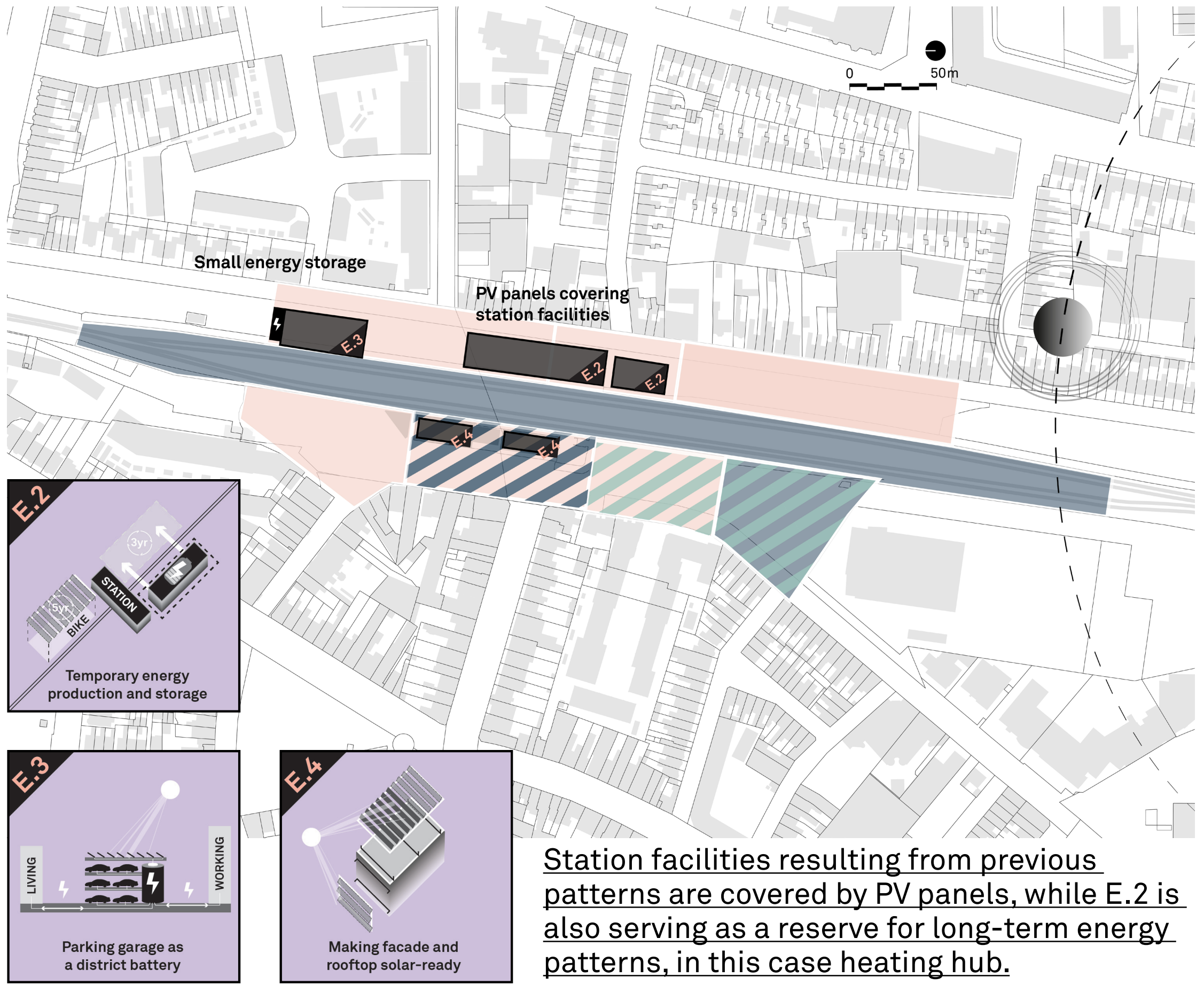
A roofed square can be created on the side of Gageldonk-West, after rearranging bike storage and P+R. Currently there is no marketplace in the neighborhood.

04 • Design process

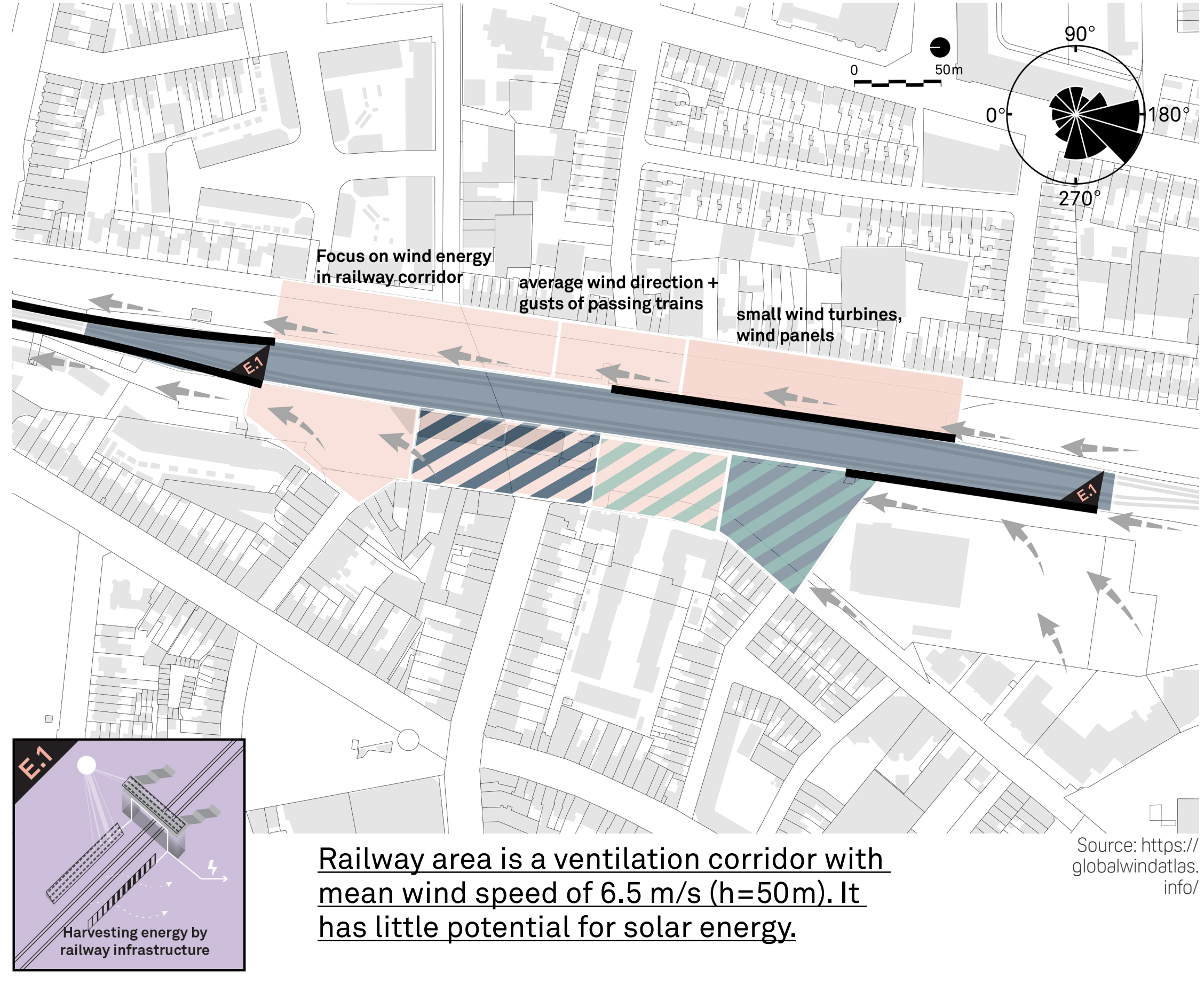
Applying patterns

- 1 Problem statement
- 2 Theory & methods
- 3 Underpinning
- 4 Design process
- Design assessment
- Conclusion

Energy: Energy-neutral temporary program, station area as a testing lab for small-scale wind turbines and storage.



Station facilities resulting from previous patterns are covered by PV panels, while E.2 is also serving as a reserve for long-term energy patterns, in this case heating hub.



Railway area is a ventilation corridor with mean wind speed of 6.5 m/s (h=50m). It has little potential for solar energy.

Source: <https://globalwindatlas.info/>

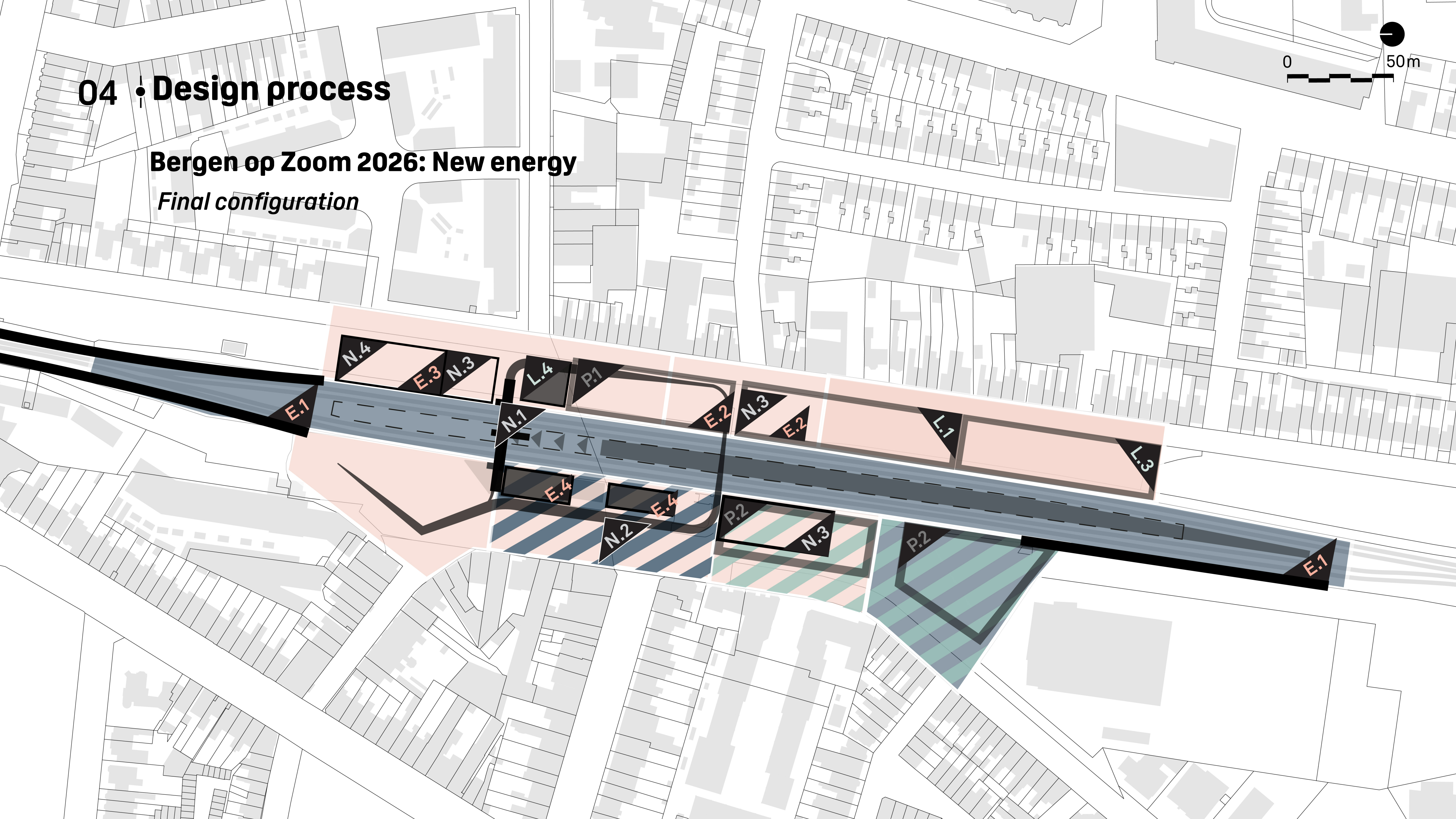
04 • Design process

Bergen op Zoom 2026: New energy

Final configuration

0

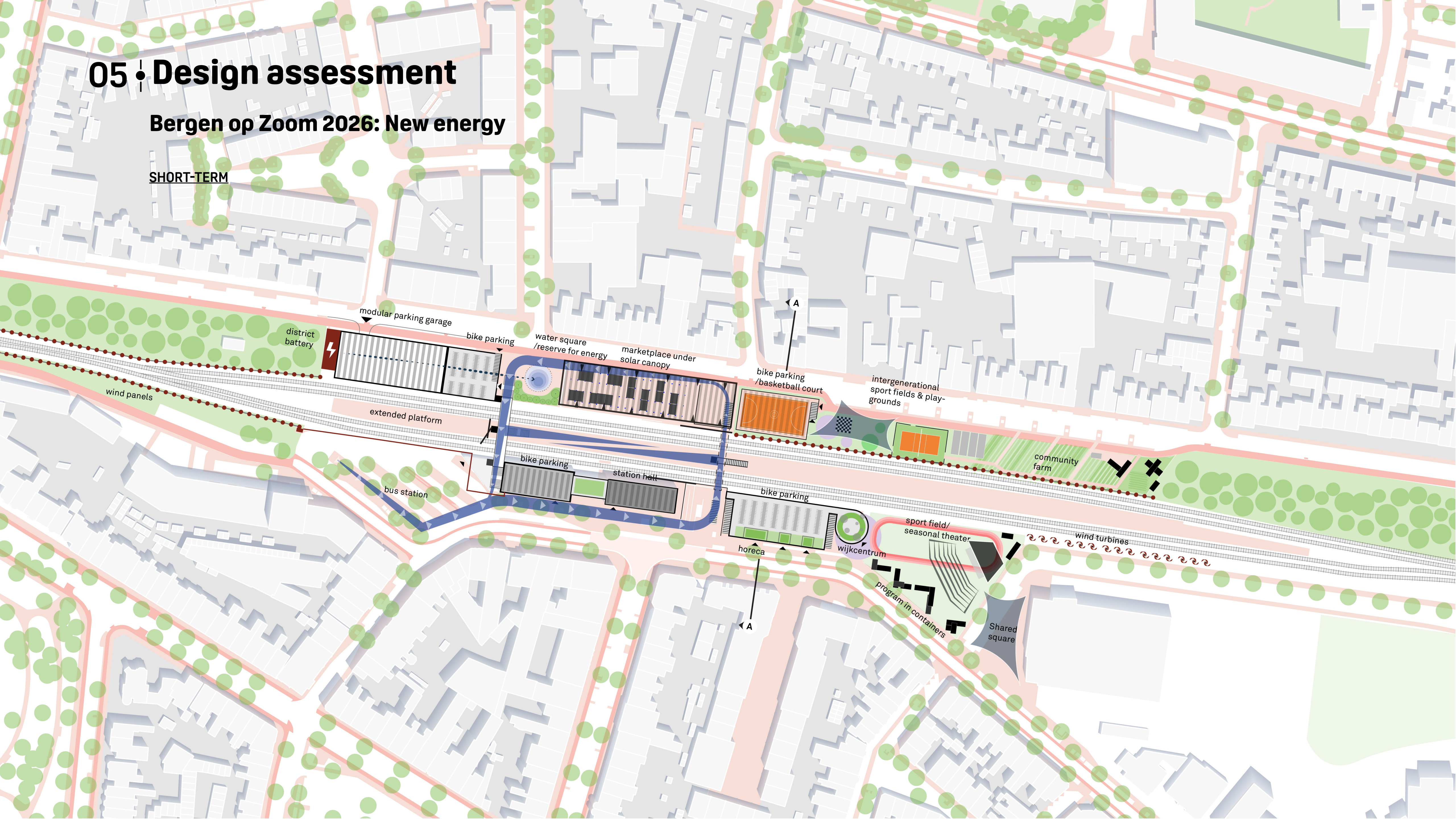
50m



05 • Design assessment

Bergen op Zoom 2026: New energy

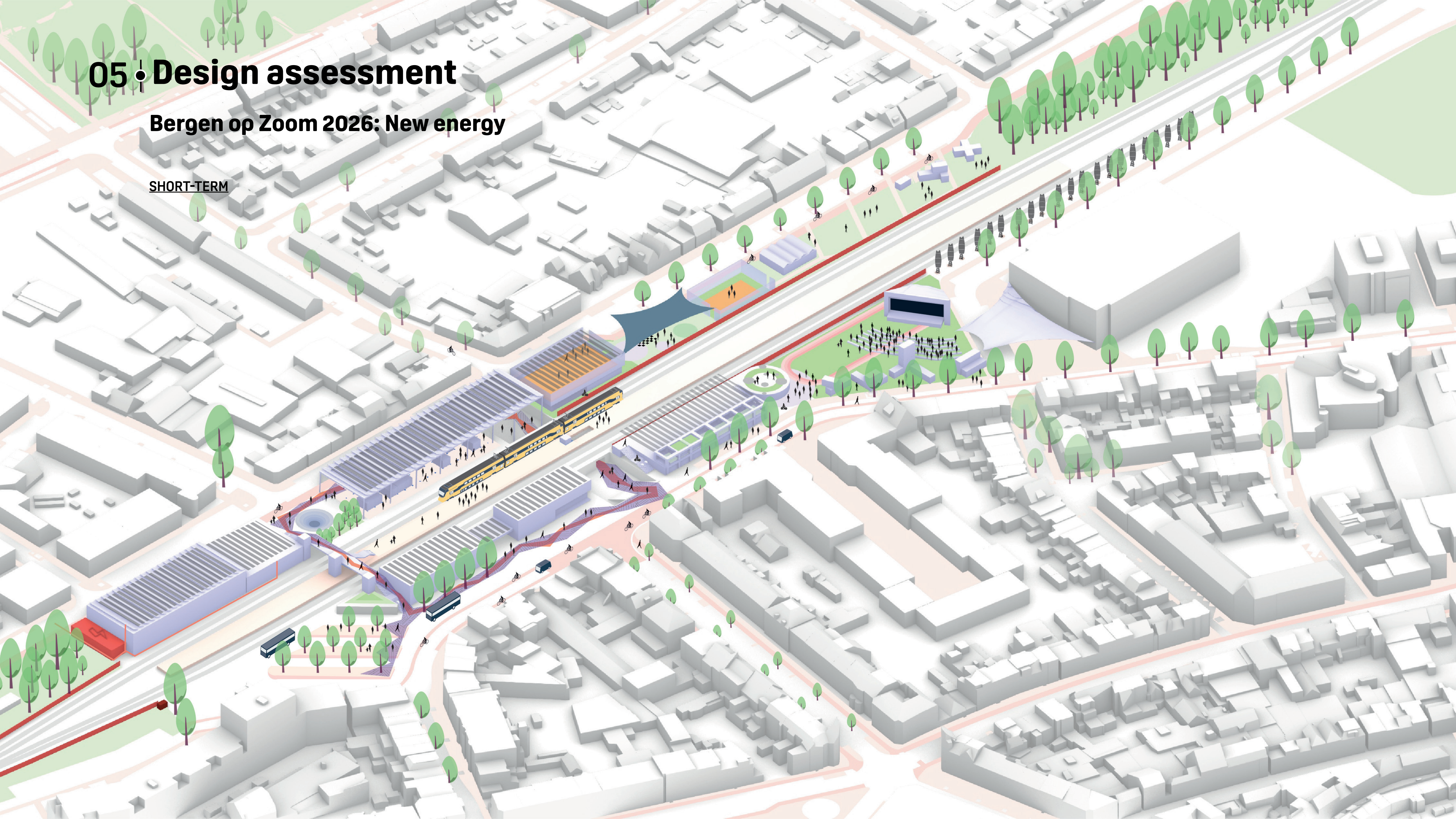
SHORT-TERM



05 • Design assessment

Bergen op Zoom 2026: New energy

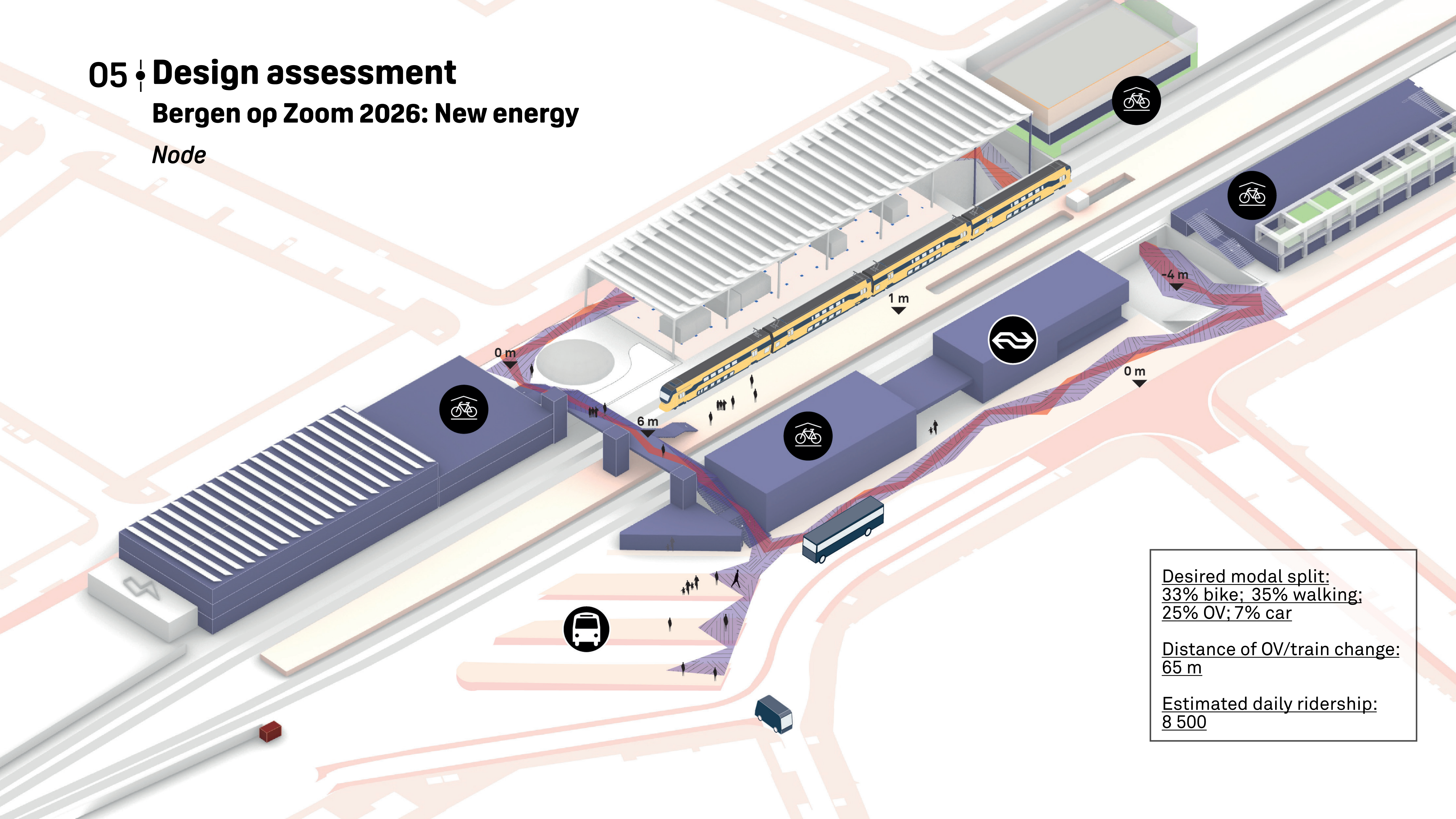
SHORT-TERM



05 • Design assessment

Bergen op Zoom 2026: New energy

Node



Desired modal split:
33% bike; 35% walking;
25% OV; 7% car

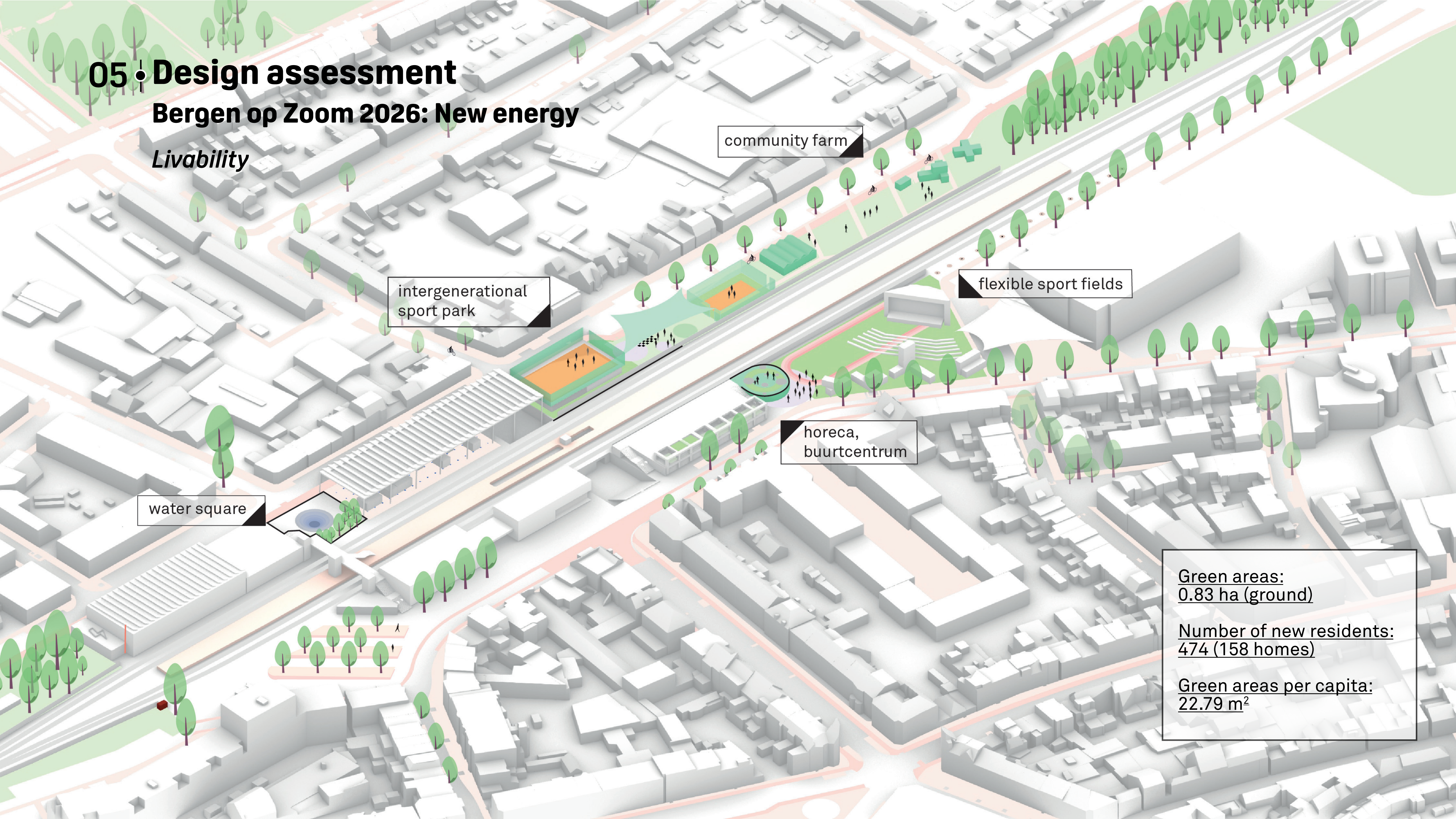
Distance of OV/train change:
65 m

Estimated daily ridership:
8 500

05 • Design assessment

Bergen op Zoom 2026: New energy

Livability



community farm

intergenerational
sport park

flexible sport fields

water square

horeca,
buurtcentrum

Green areas:
0.83 ha (ground)

Number of new residents:
474 (158 homes)

Green areas per capita:
22.79 m²

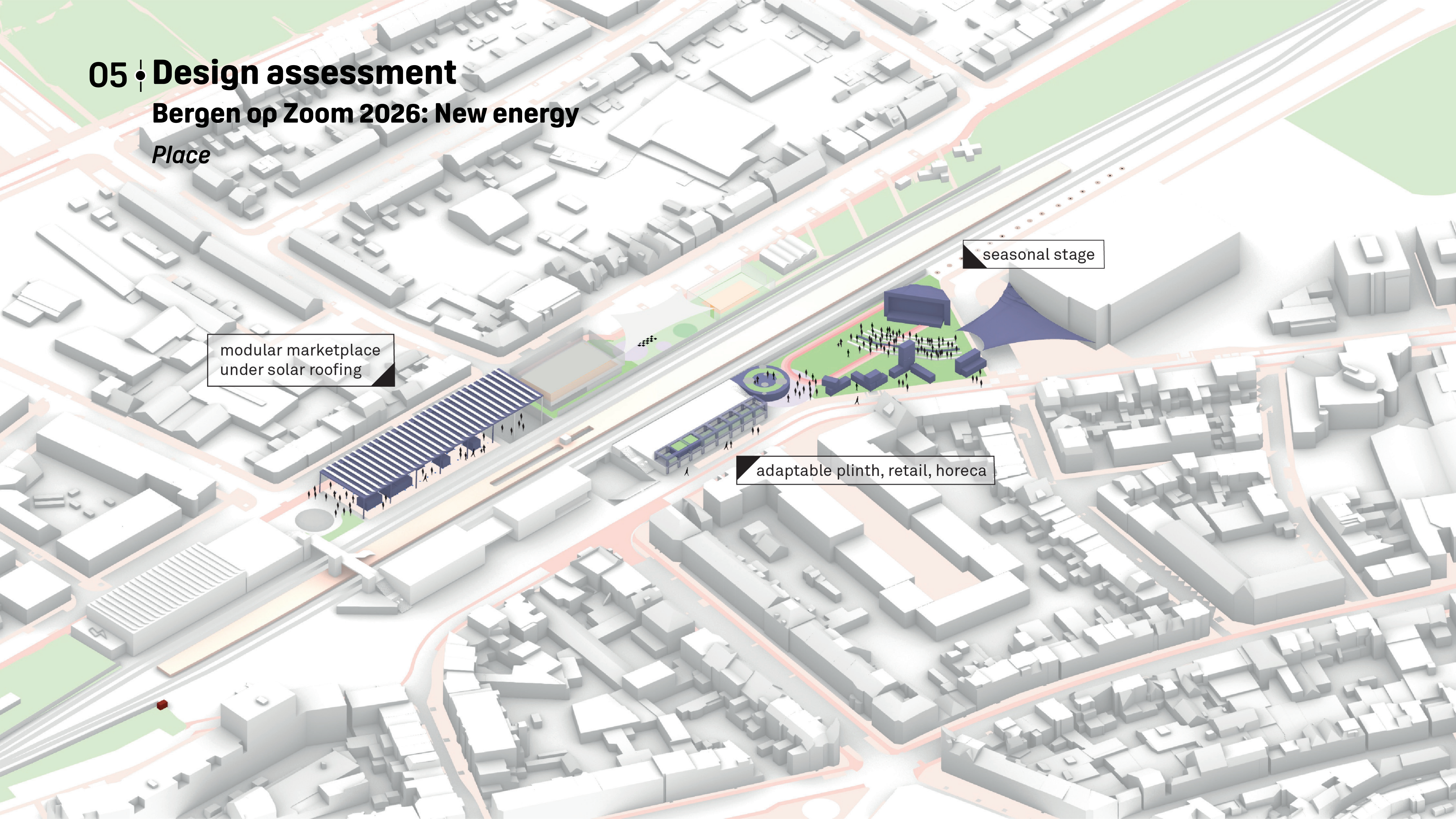
05 • Design assessment

Bergen op Zoom 2026: New energy Place

modular marketplace
under solar roofing

seasonal stage

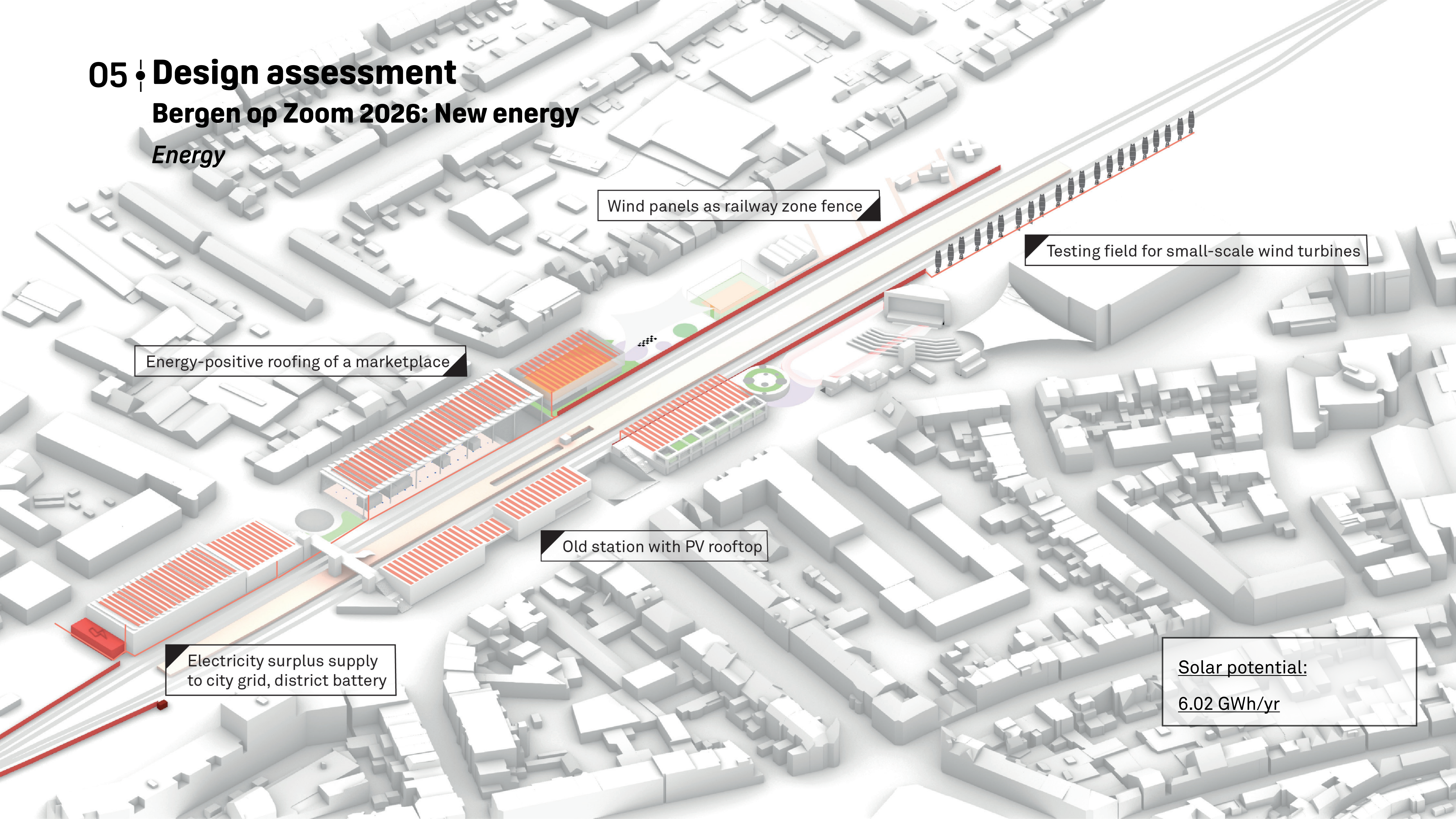
adaptable plinth, retail, horeca



05 • Design assessment

Bergen op Zoom 2026: New energy

Energy



Wind panels as railway zone fence

Testing field for small-scale wind turbines

Energy-positive roofing of a marketplace

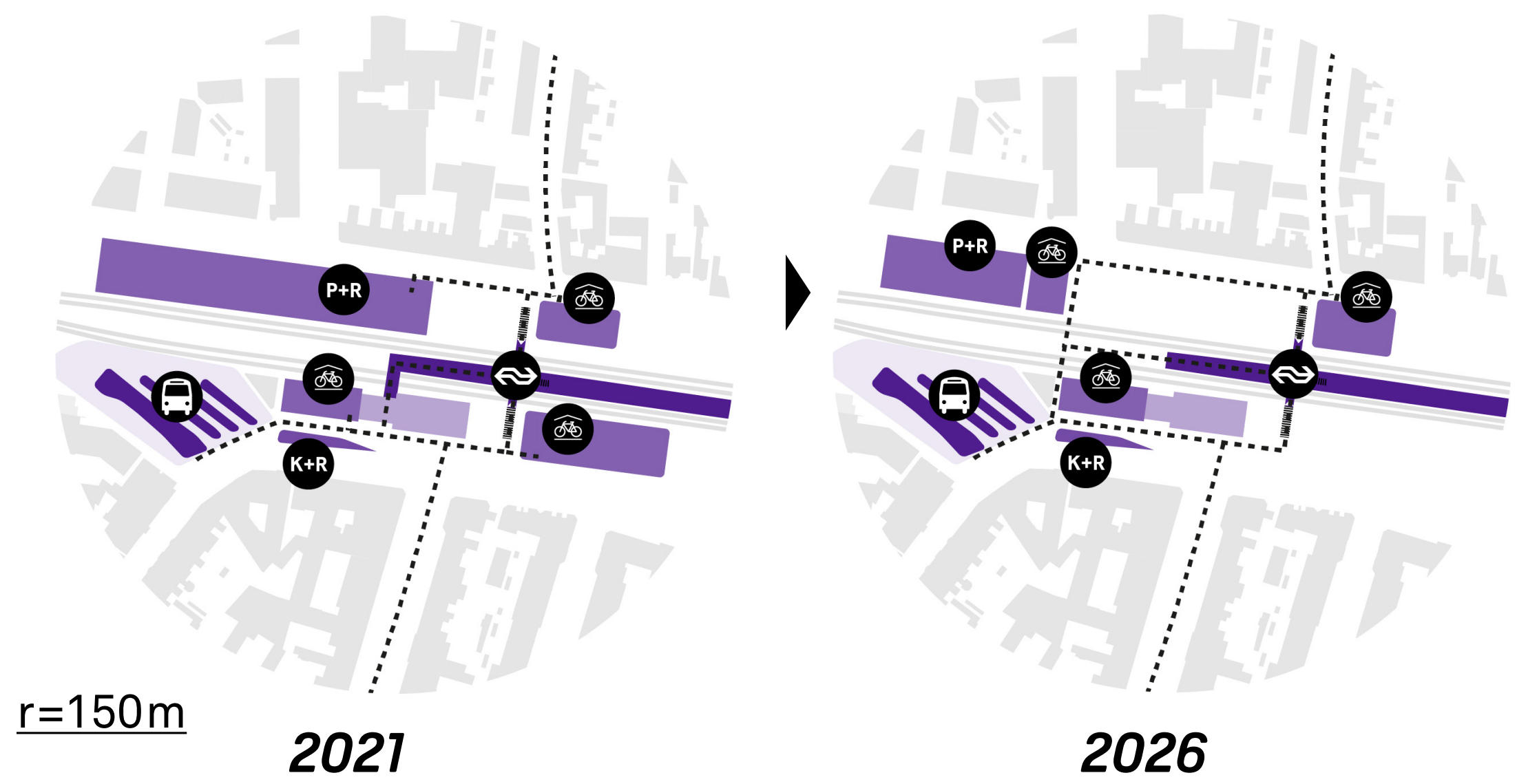
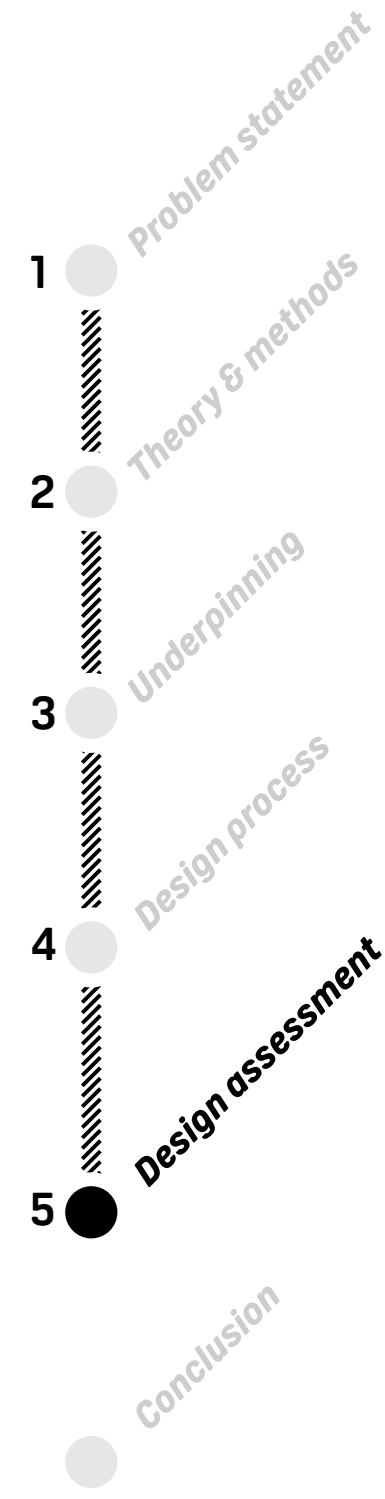
Old station with PV rooftop

Electricity surplus supply
to city grid, district battery

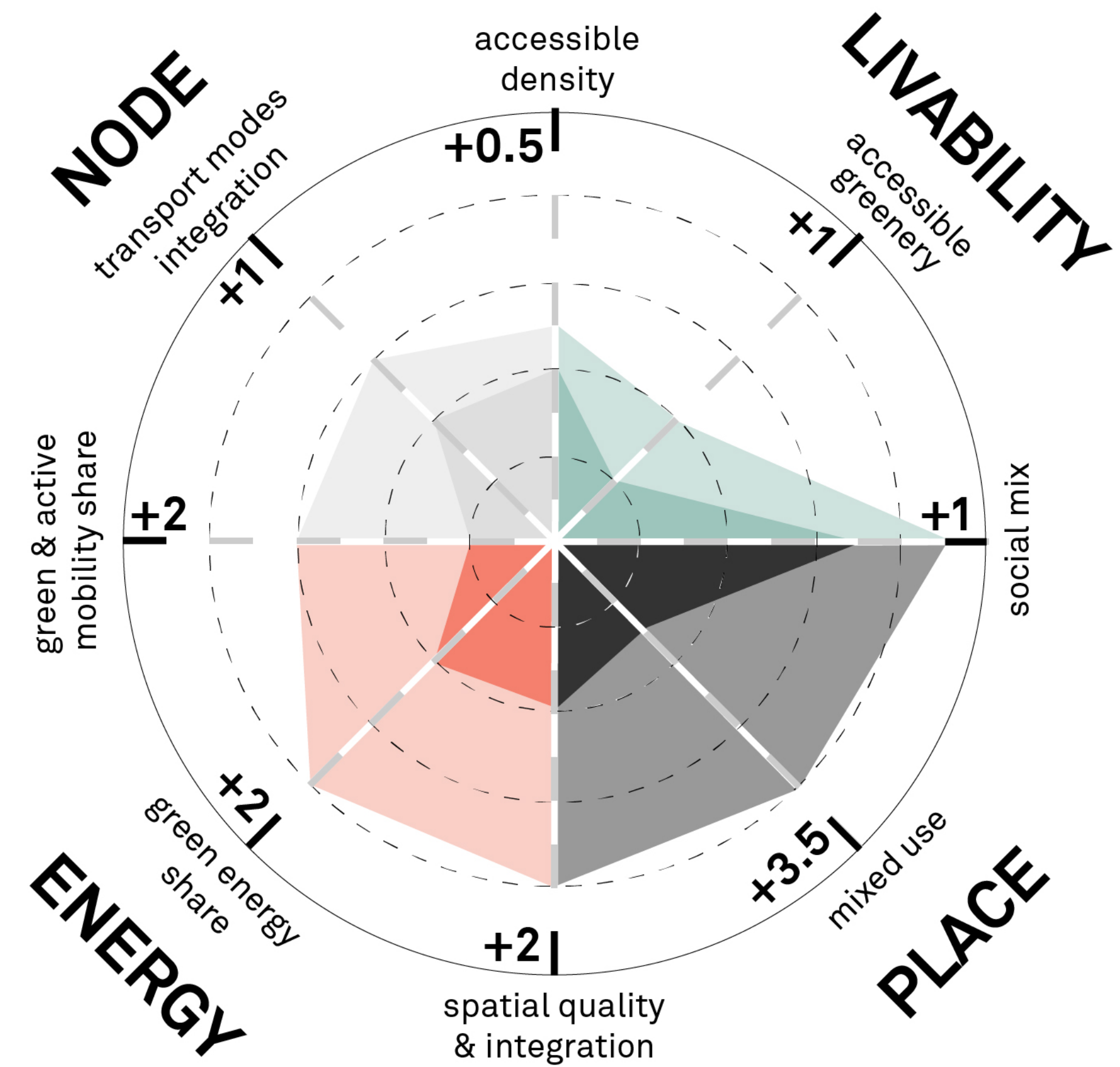
Solar potential:
6.02 GWh/yr

05 • Design assessment

Bergen op Zoom 2026: New energy



- Train station redevelopment can be a temporary, pilot project for urban renewal.
- Also in the short term it is possible to address the energy transition - potential of station area as a testing lab.



05 • Design assessment

Bergen op Zoom 2040: Glocal transition

LONG-TERM SCENARIO



What if...

After the pandemic, work from home is trending, and it results in a revival of small cities.

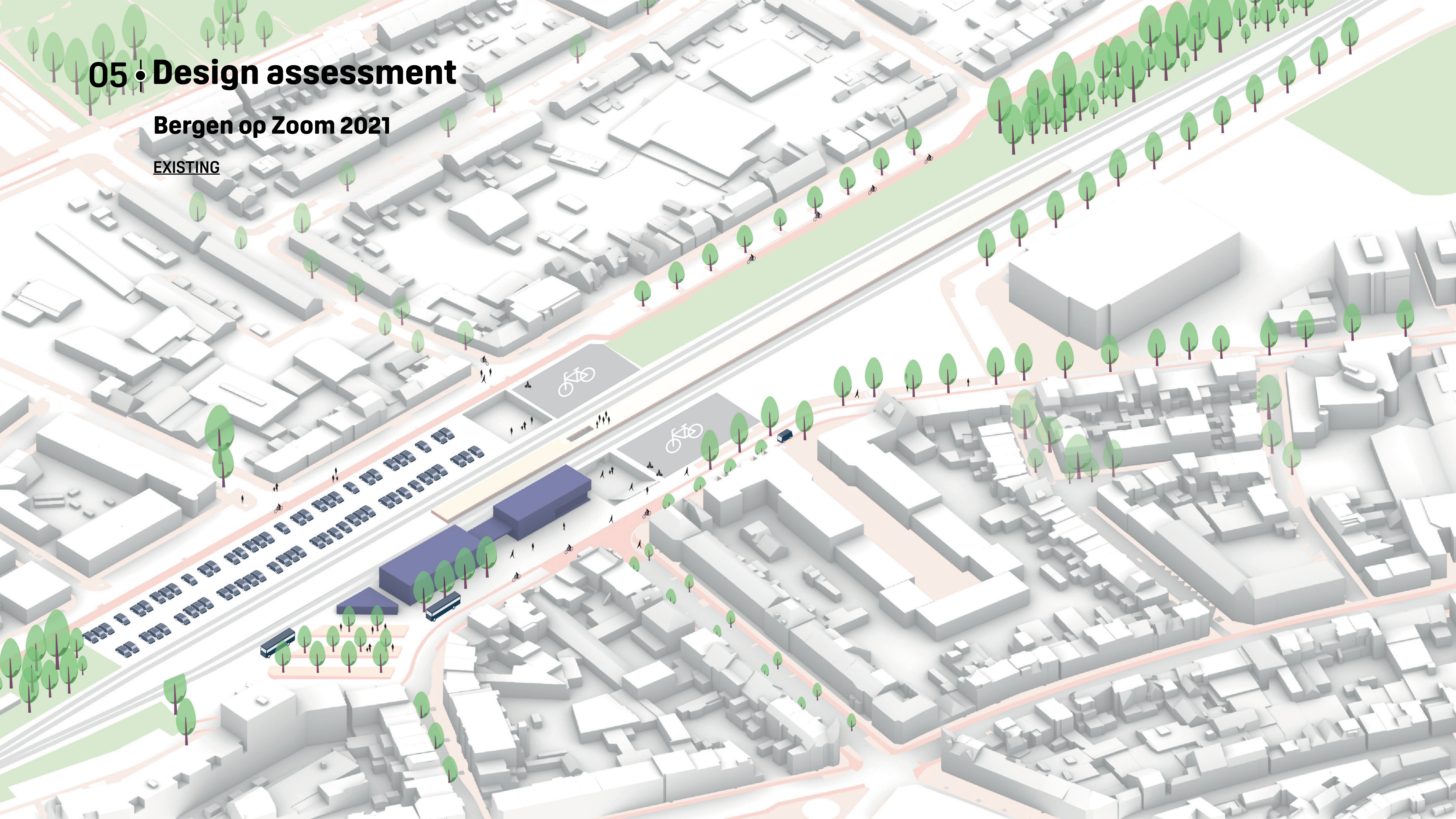
Developing a new station could help the city to benefit from the new trend and finally catch up with the energy transition.

The challenge is to make the new station, energy infrastructure and housing harmoniously coexist in a relatively small area.

05 • Design assessment

Bergen op Zoom 2021

EXISTING



05 • Design assessment

Bergen op Zoom 2040: Glocal transition

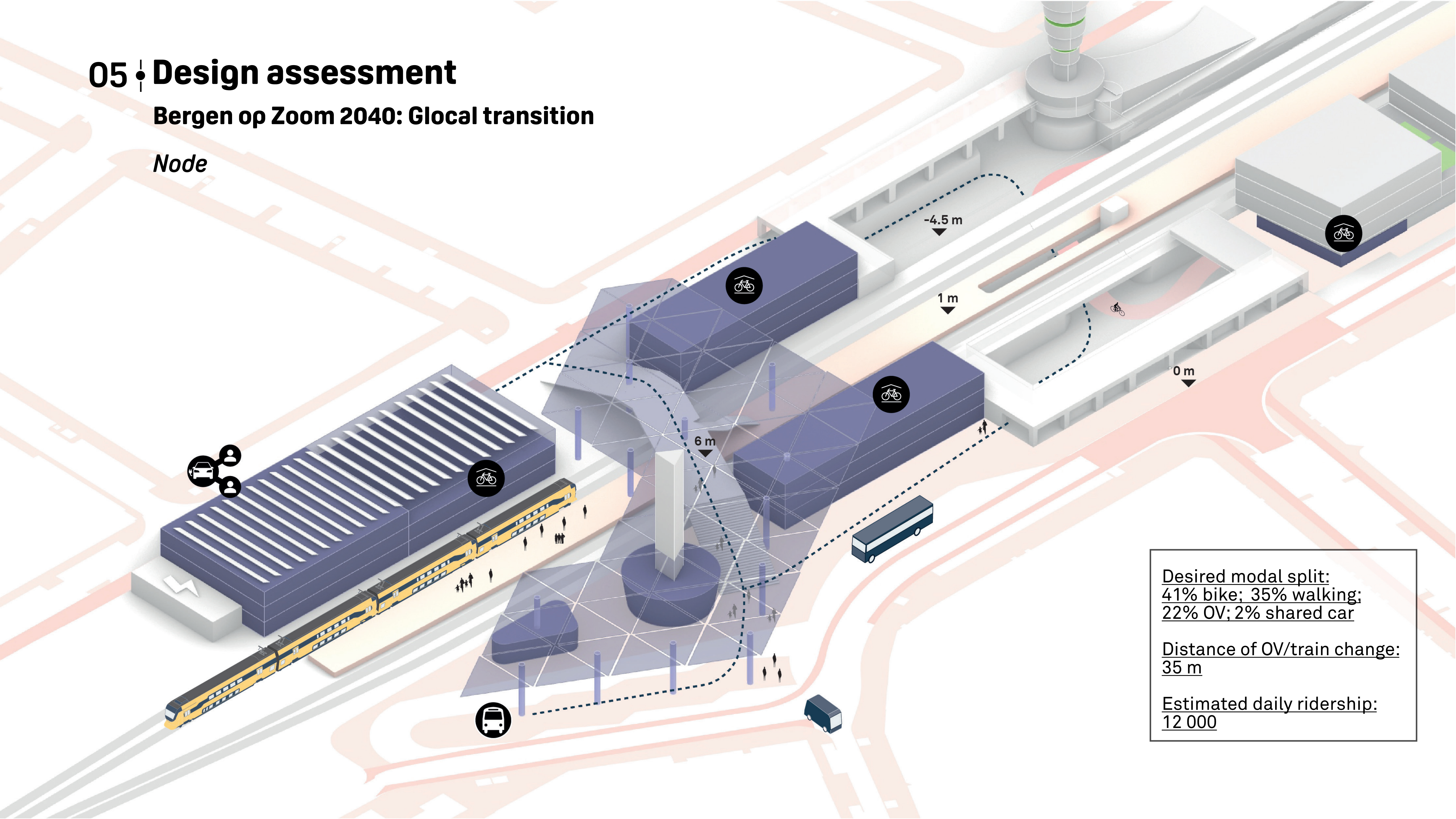
LONG-TERM



05 • Design assessment

Bergen op Zoom 2040: Glocal transition

Node



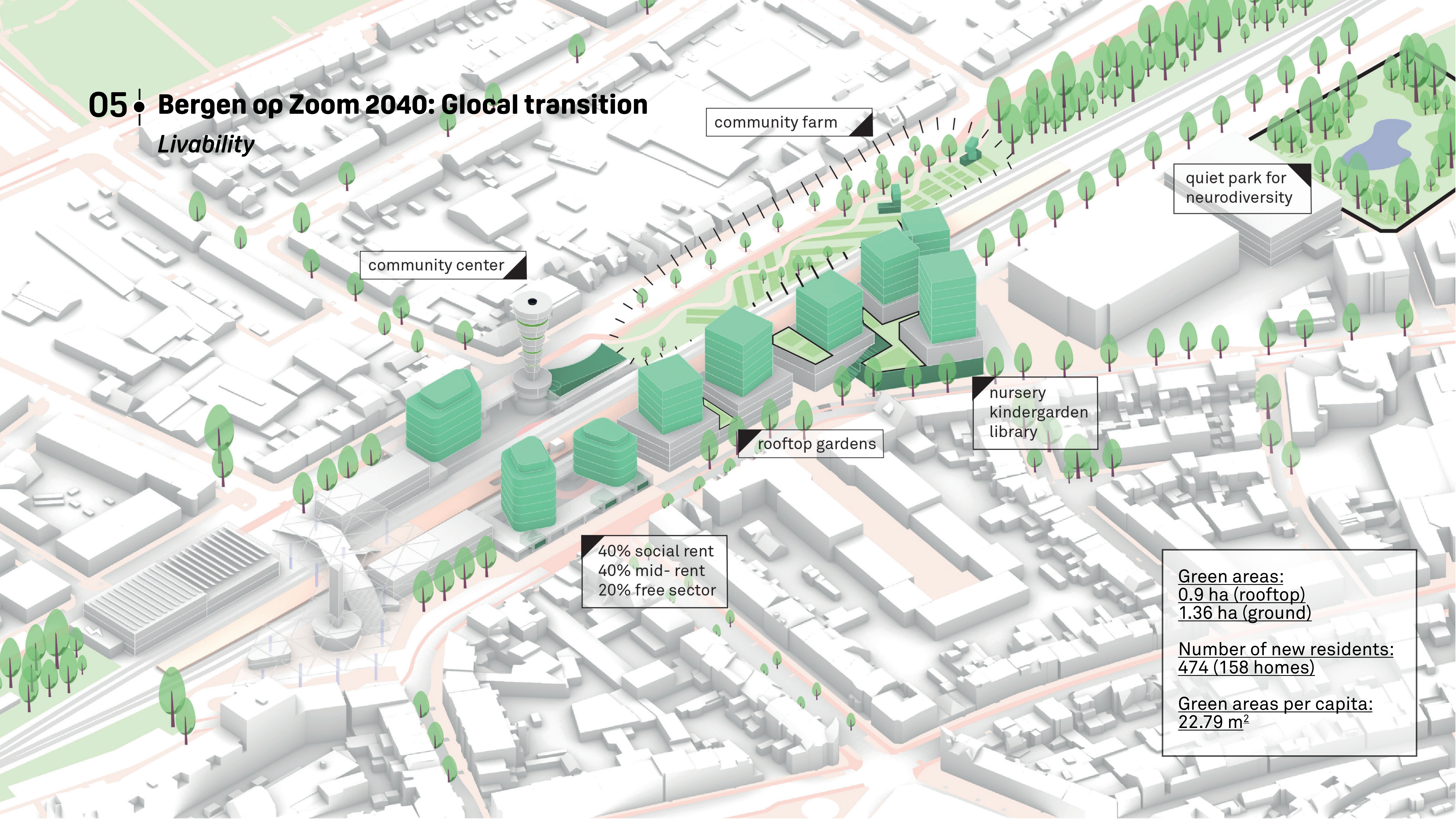
Desired modal split:
41% bike; 35% walking;
22% OV; 2% shared car

Distance of OV/train change:
35 m

Estimated daily ridership:
12 000

05 • Bergen op Zoom 2040: Glocal transition

Livability



community center

community farm

quiet park for
neurodiversity

nursery
kindergarten
library

rooftop gardens

40% social rent
40% mid- rent
20% free sector

Green areas:
0.9 ha (rooftop)
1.36 ha (ground)

Number of new residents:
474 (158 homes)

Green areas per capita:
22.79 m²

05 • Design assessment

Bergen op Zoom 2040: Glocal transition

Place



parking for residents
& employees

475 new workplaces

FSI 2.44

59% living

22% working

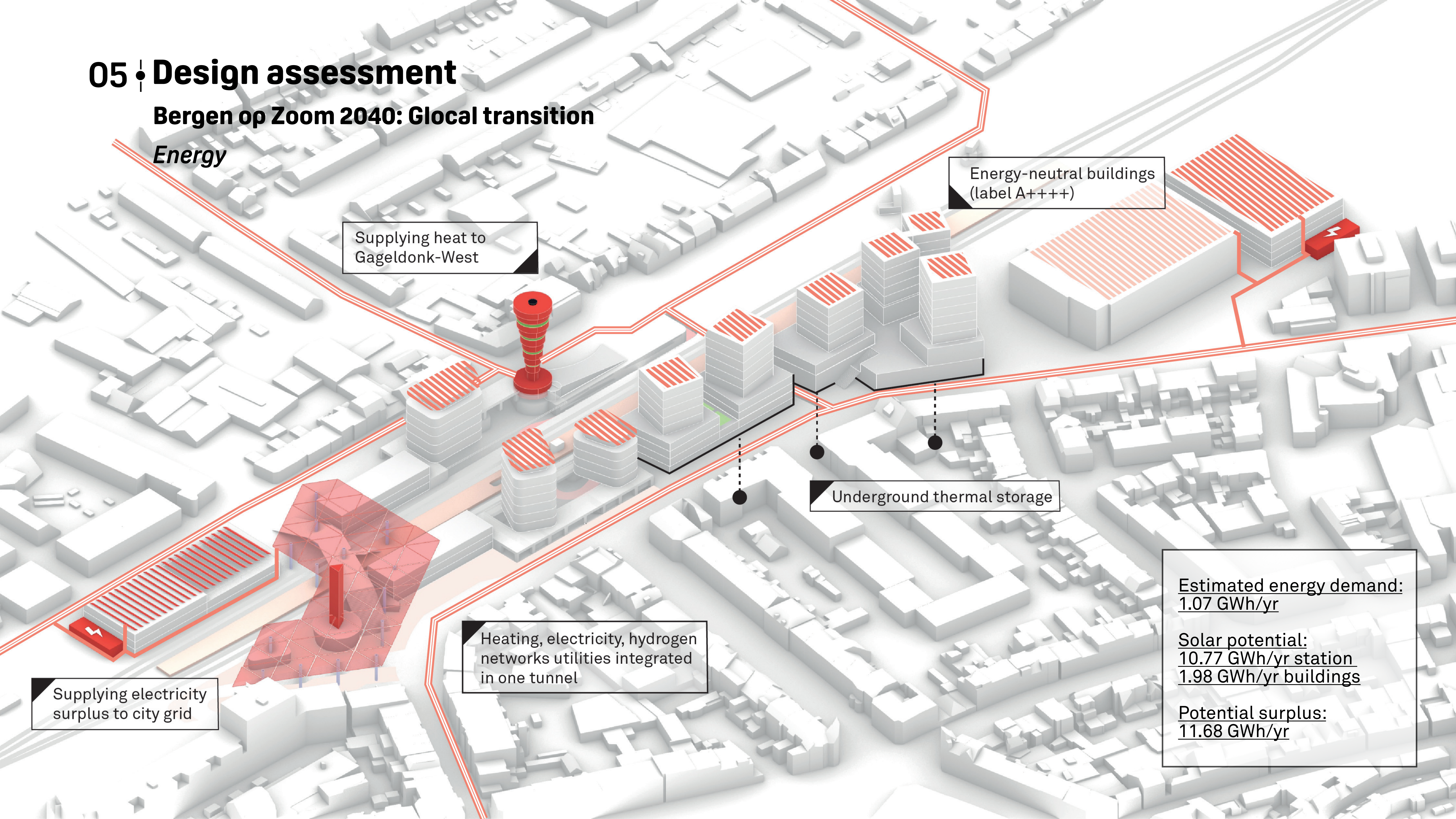
11% retail/culture/horeca

8% social amenities

05 • Design assessment

Bergen op Zoom 2040: Glocal transition

Energy



Supplying heat to
Gageldonk-West

Energy-neutral buildings
(label A++++)

Underground thermal storage

Heating, electricity, hydrogen
networks utilities integrated
in one tunnel

Supplying electricity
surplus to city grid

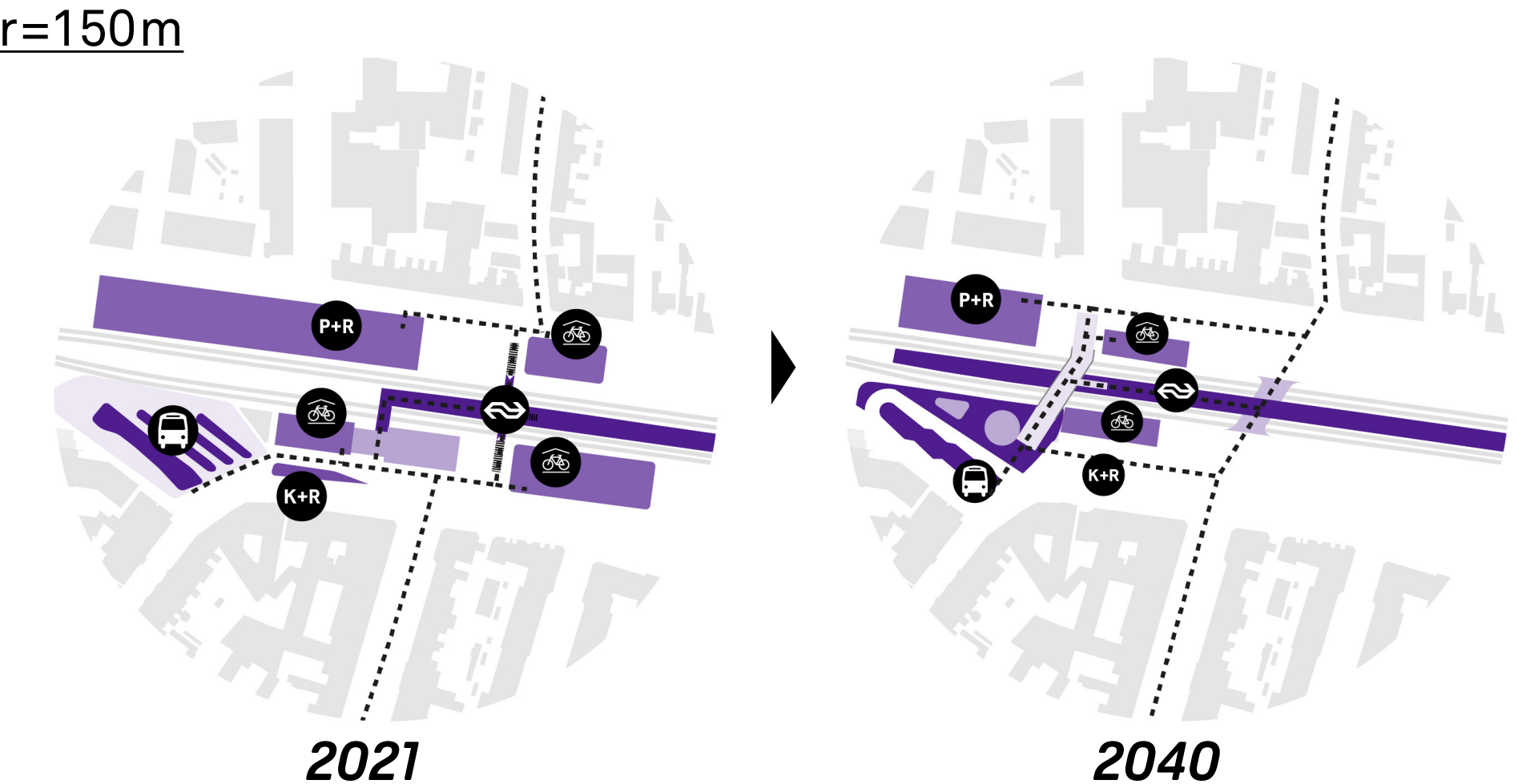
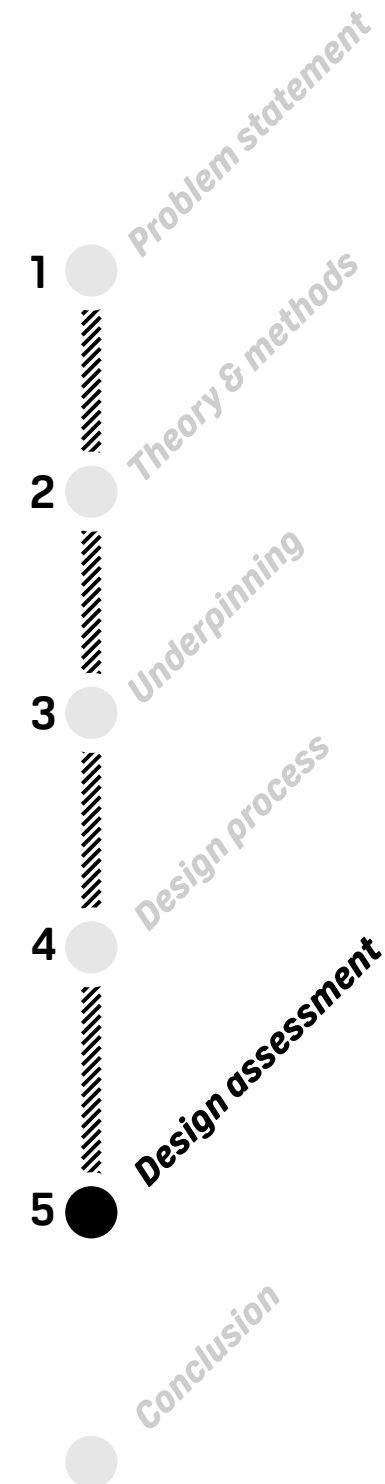
Estimated energy demand:
1.07 GWh/yr

Solar potential:
10.77 GWh/yr station
1.98 GWh/yr buildings

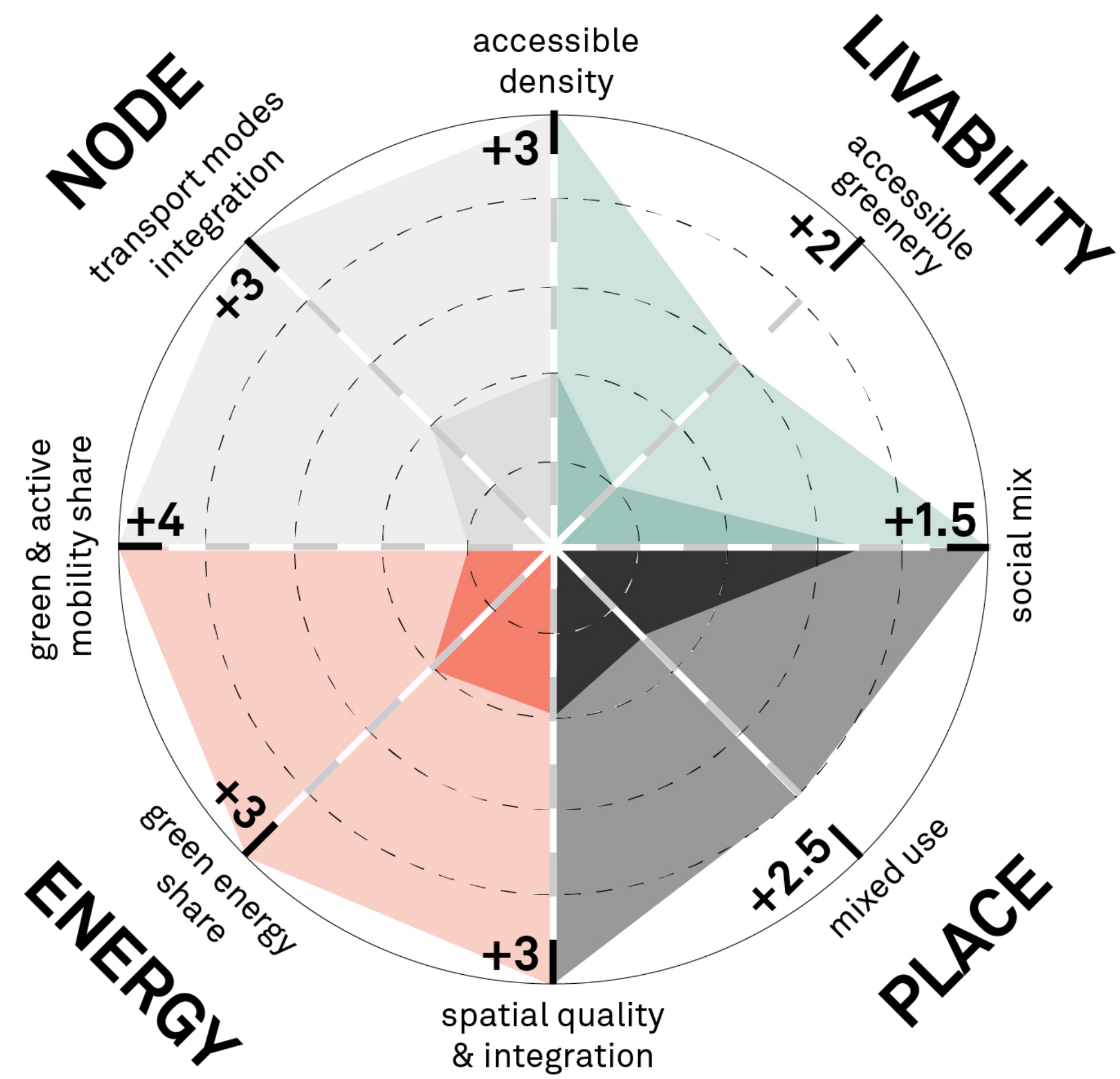
Potential surplus:
11.68 GWh/yr

05 • Design assessment

Bergen op Zoom 2040: Glocal transition



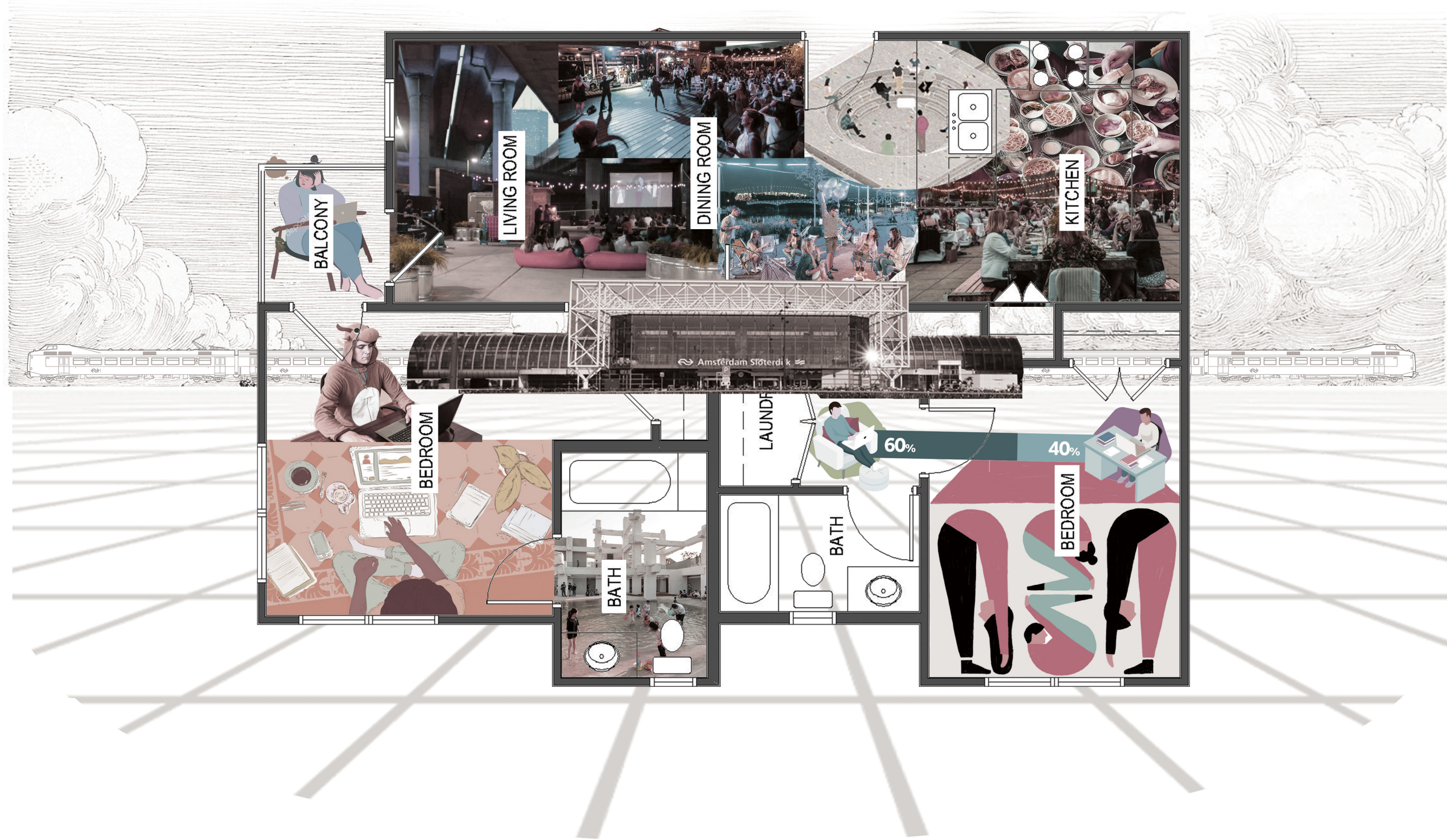
- Benchmark demonstration of balanced energy node.
- High adaptability possible in small city context.
- Challenging to provide sufficient green spaces.



05 • Design assessment

Amsterdam Sloterdijk 2026: Home office hub

SHORT-TERM SCENARIO



What if...

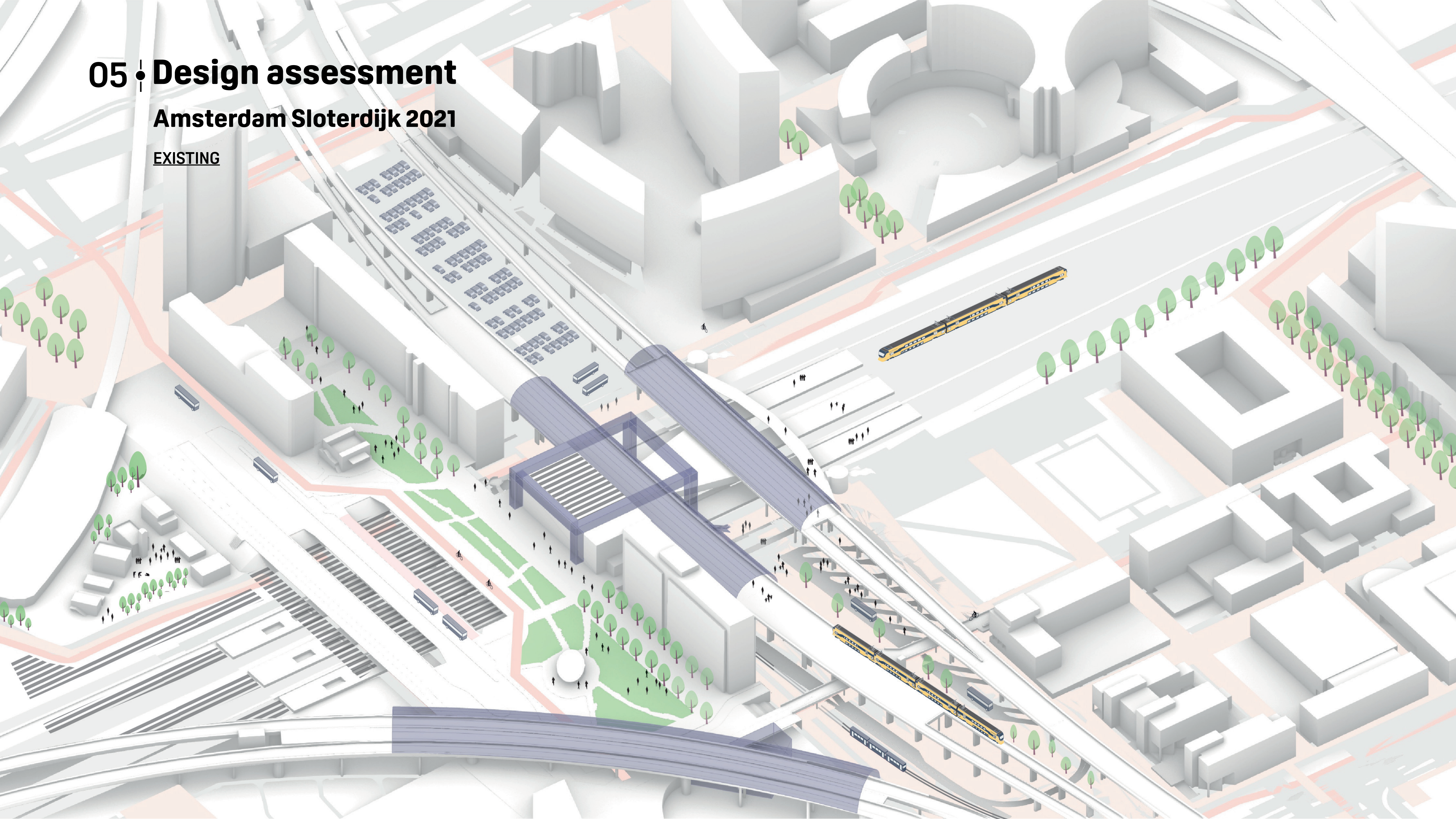
Since the end of the pandemic, working from home becomes widespread in Amsterdam. New train station should be an urban living room, in the middle of a calm home office.

How to introduce clarity to the confusing node by temporary means?

05 • Design assessment

Amsterdam Sloterdijk 2021

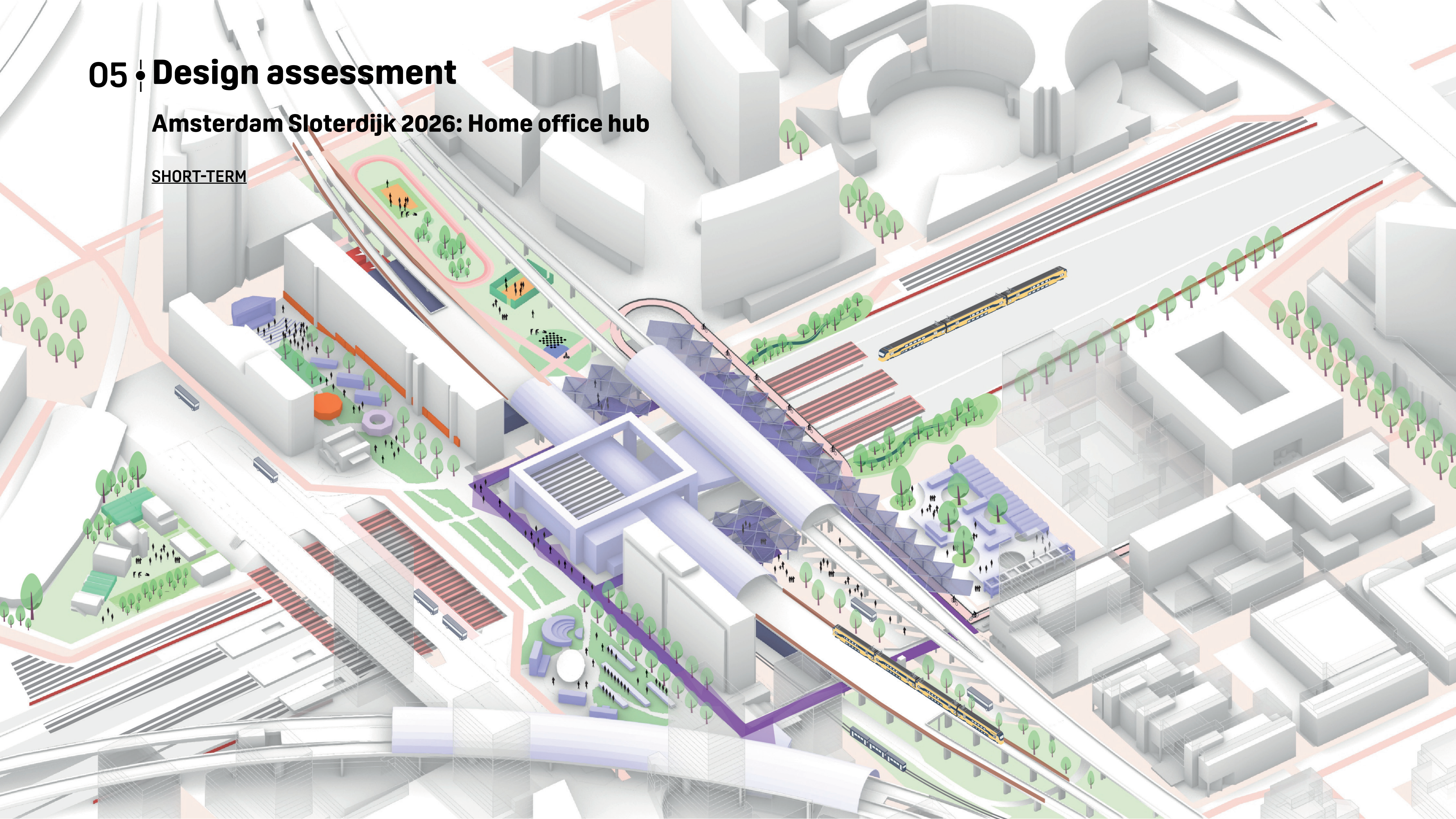
EXISTING



05 • Design assessment

Amsterdam Sloterdijk 2026: Home office hub

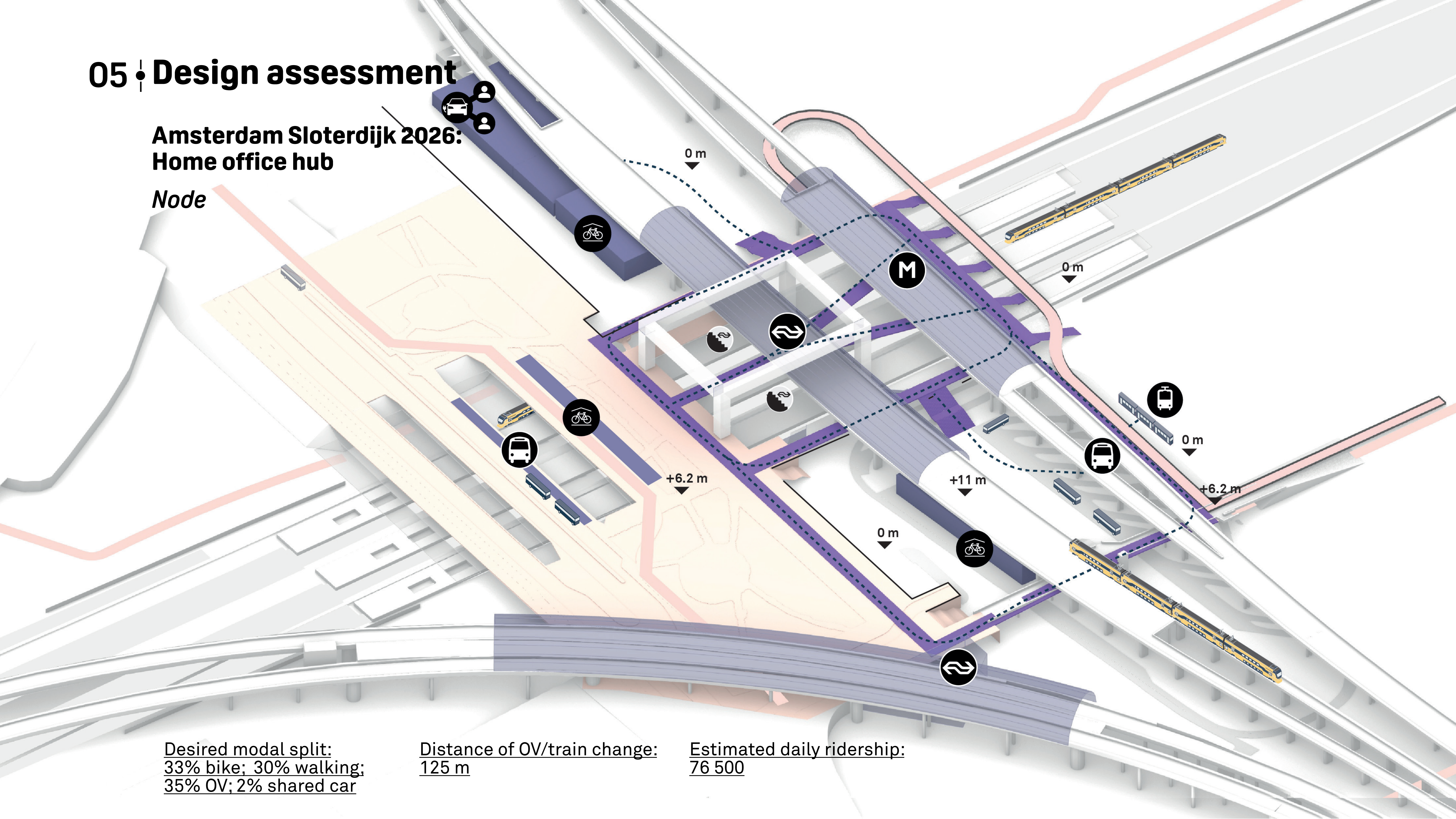
SHORT-TERM



05 • Design assessment

**Amsterdam Sloterdijk 2026:
Home office hub**

Node



Desired modal split:
33% bike; 30% walking;
35% OV; 2% shared car

Distance of OV/train change:
125 m

Estimated daily ridership:
76 500

05 • Design assessment

Amsterdam Sloterdijk 2026: Home office hub

Livability

sport park

rain gardens

extended whole-year
Tuin van BRET

Green areas:
4.13 ha (ground)

Number of new residents:
4500 (planned by
municipality)

Green areas per capita:
9.19 m²

05 • Design assessment

Amsterdam Sloterdijk 2026: Home office hub

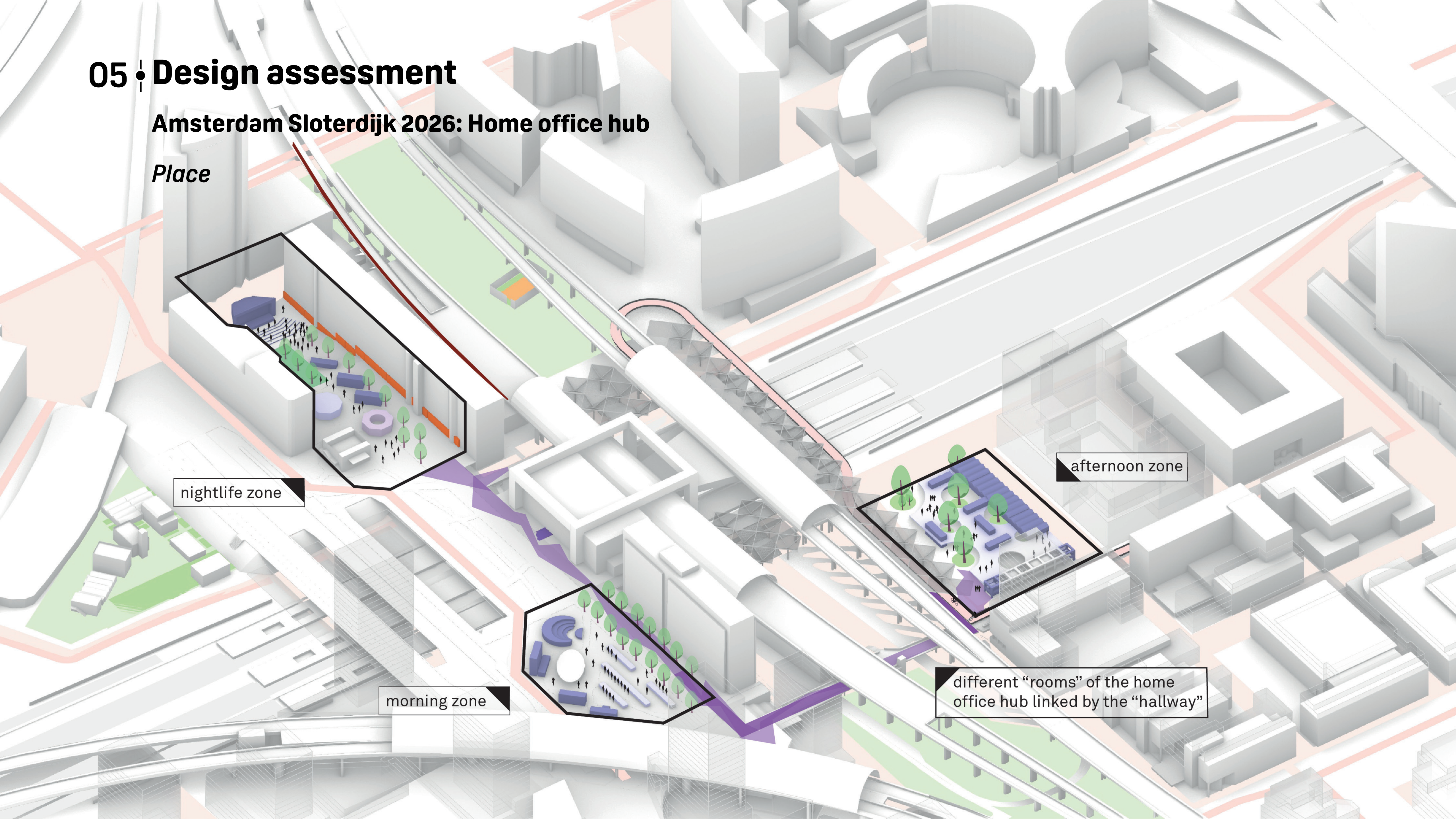
Place

nightlife zone

morning zone

afternoon zone

different “rooms” of the home
office hub linked by the “hallway”



05 • Design assessment

Amsterdam Sloterdijk 2026: Home office hub

Energy

Distribution grid 50kV

Electricity surplus supply
to city grid, district battery

Wind panels as railway zone fence

Solar canopies over platforms

Energy-neutral farm & reserve for heating hub

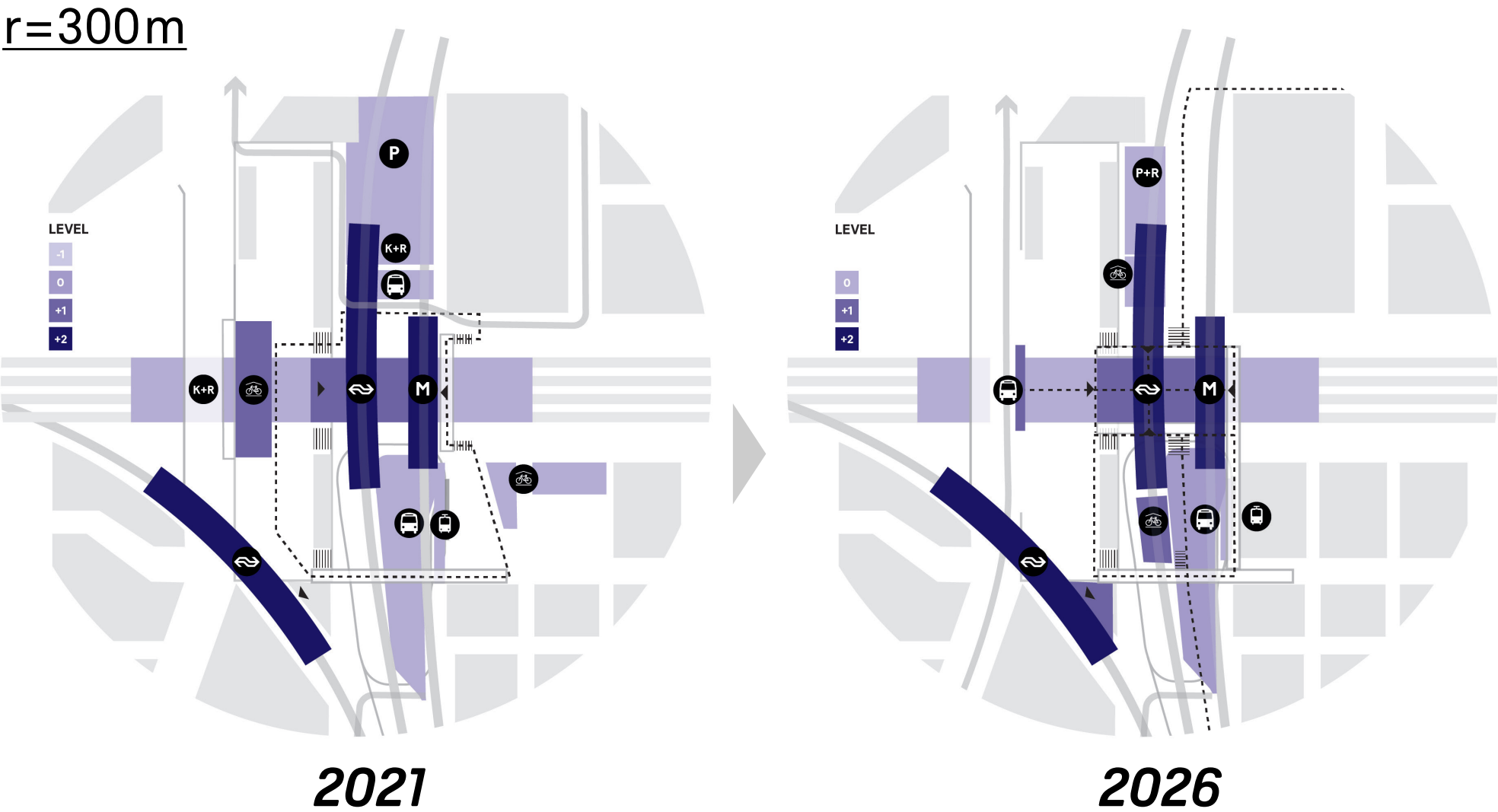
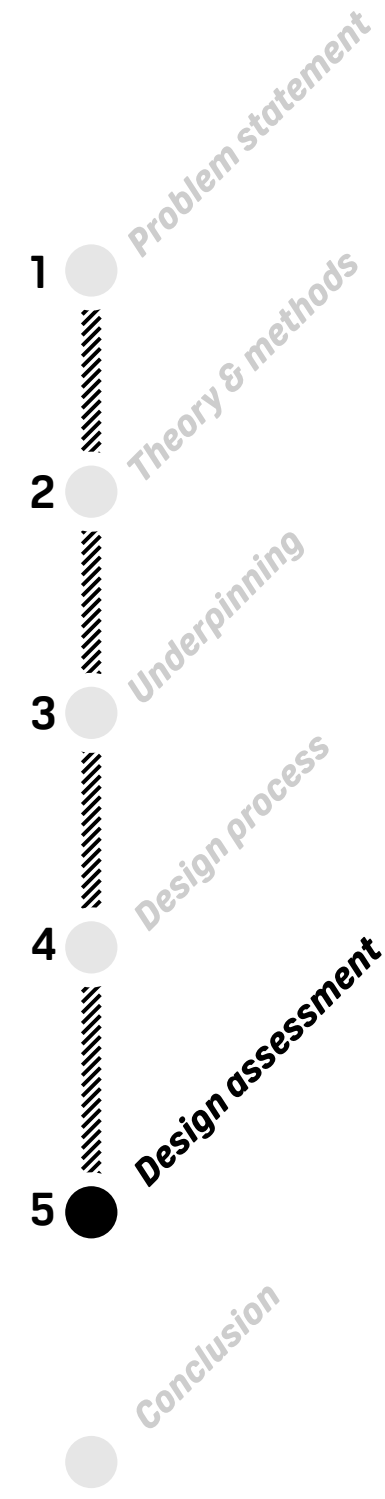
Existing station hall
with PV rooftop

Energy-neutral food hub

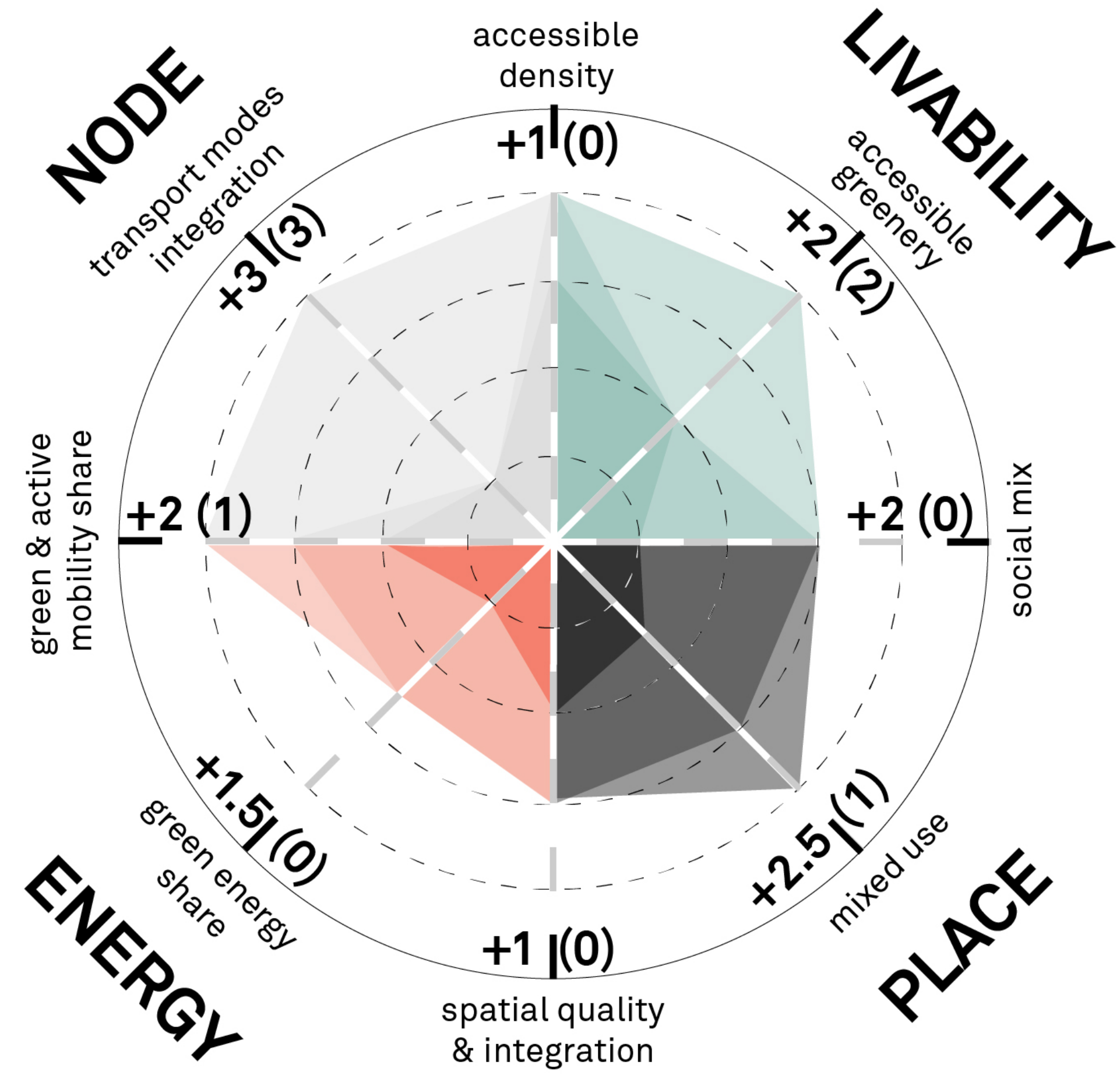
Solar potential:
17.51 GWh/yr railway
infrastructure

05 • Design assessment

Amsterdam Sloterdijk 2026: Home office hub



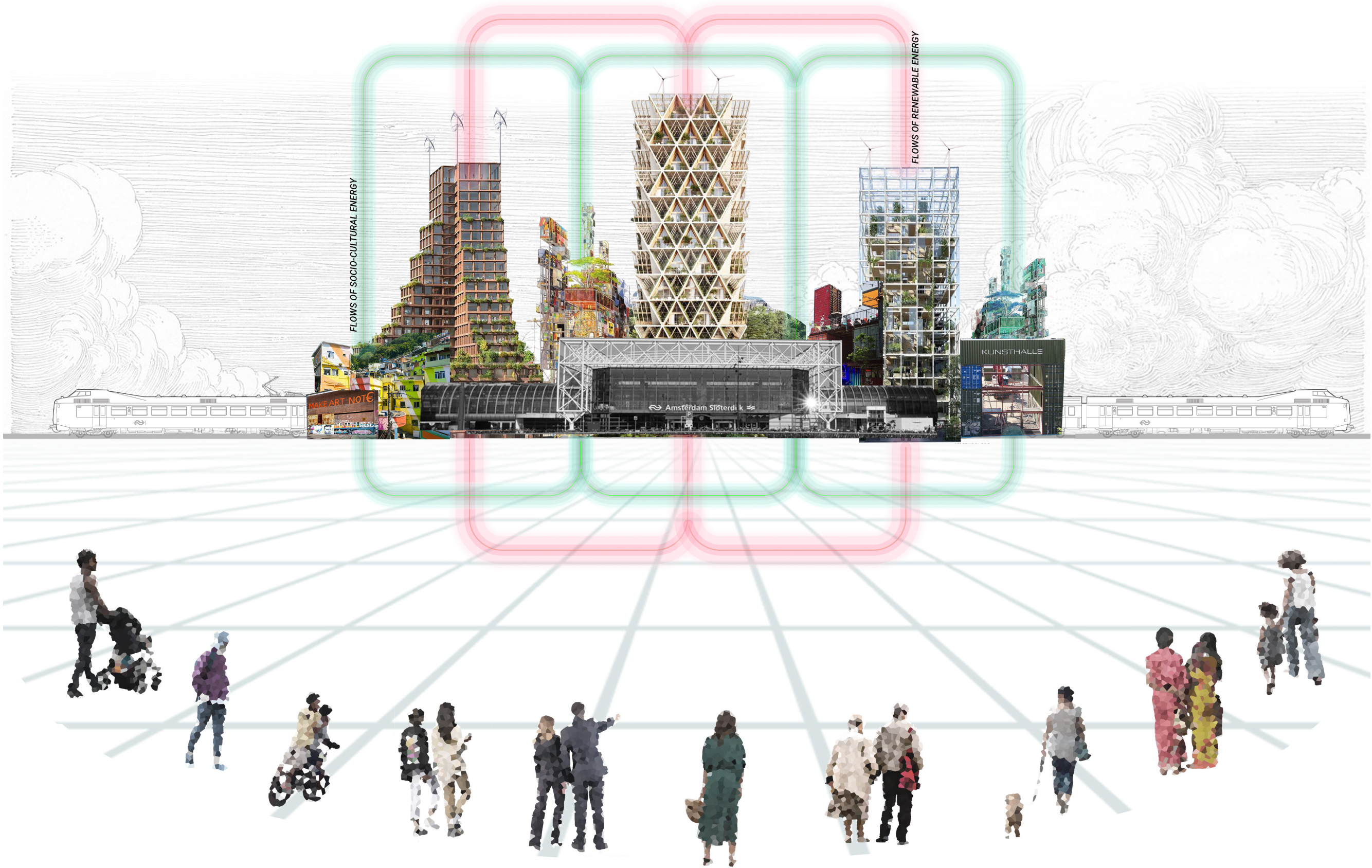
- Relatively small intervention of new connection north-south can bring a large improvement to the node.
- Easiest win: replacing P+R.
- Risk for low inclusivity; to develop an island for white collars working from home.



05 • Design assessment

Amsterdam Sloterdijk 2040: Inclusive city over tracks

LONG-TERM SCENARIO



What if...

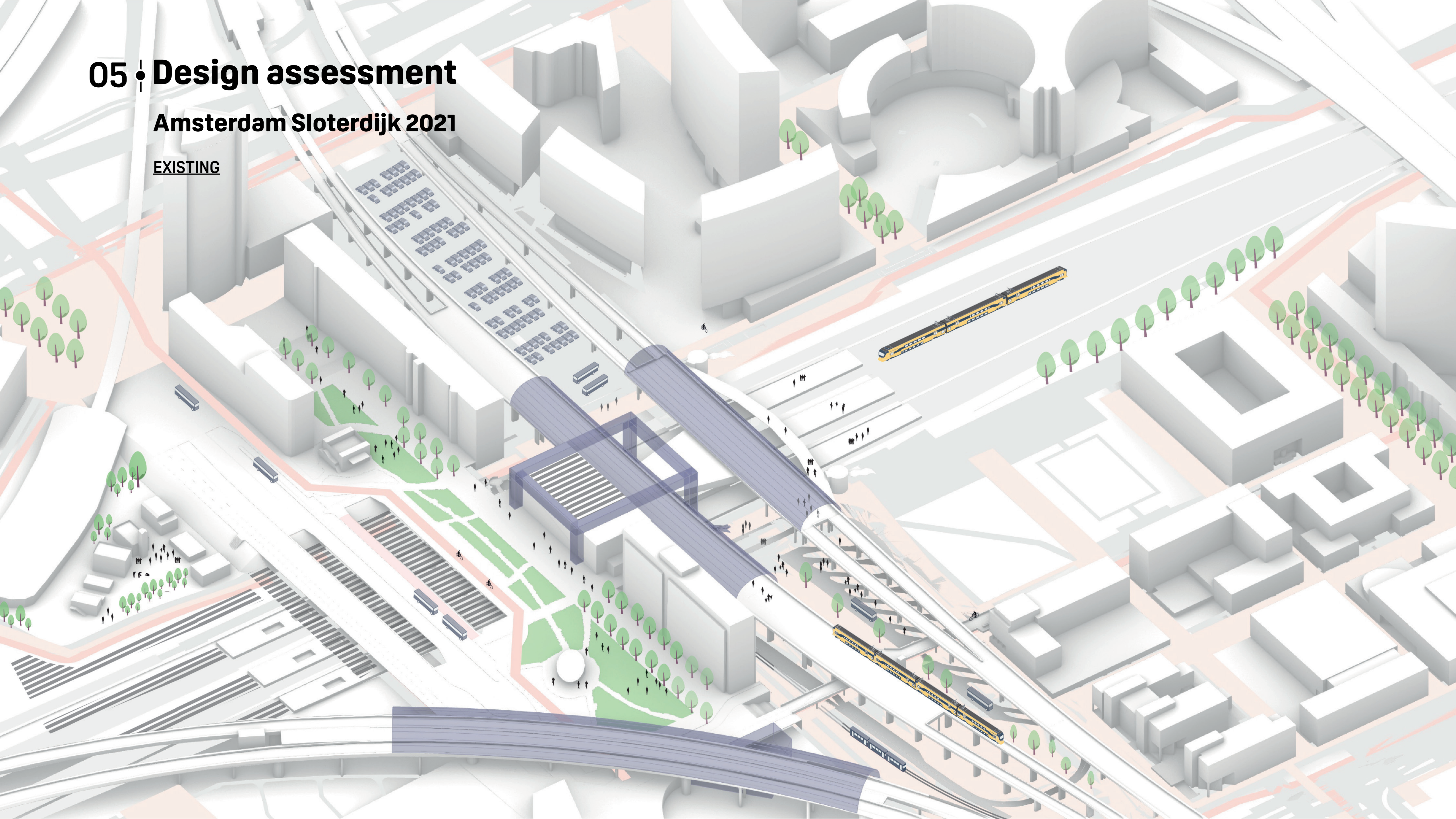
In 2030 due to political instability abroad, migration to Amsterdam intensifies. New districts become instantly cosmopolitan.

Municipality together with NS and ProRail decides to join forces to redesign the station and build as many homes as possible, without compromising energy goals.

05 • Design assessment

Amsterdam Sloterdijk 2021

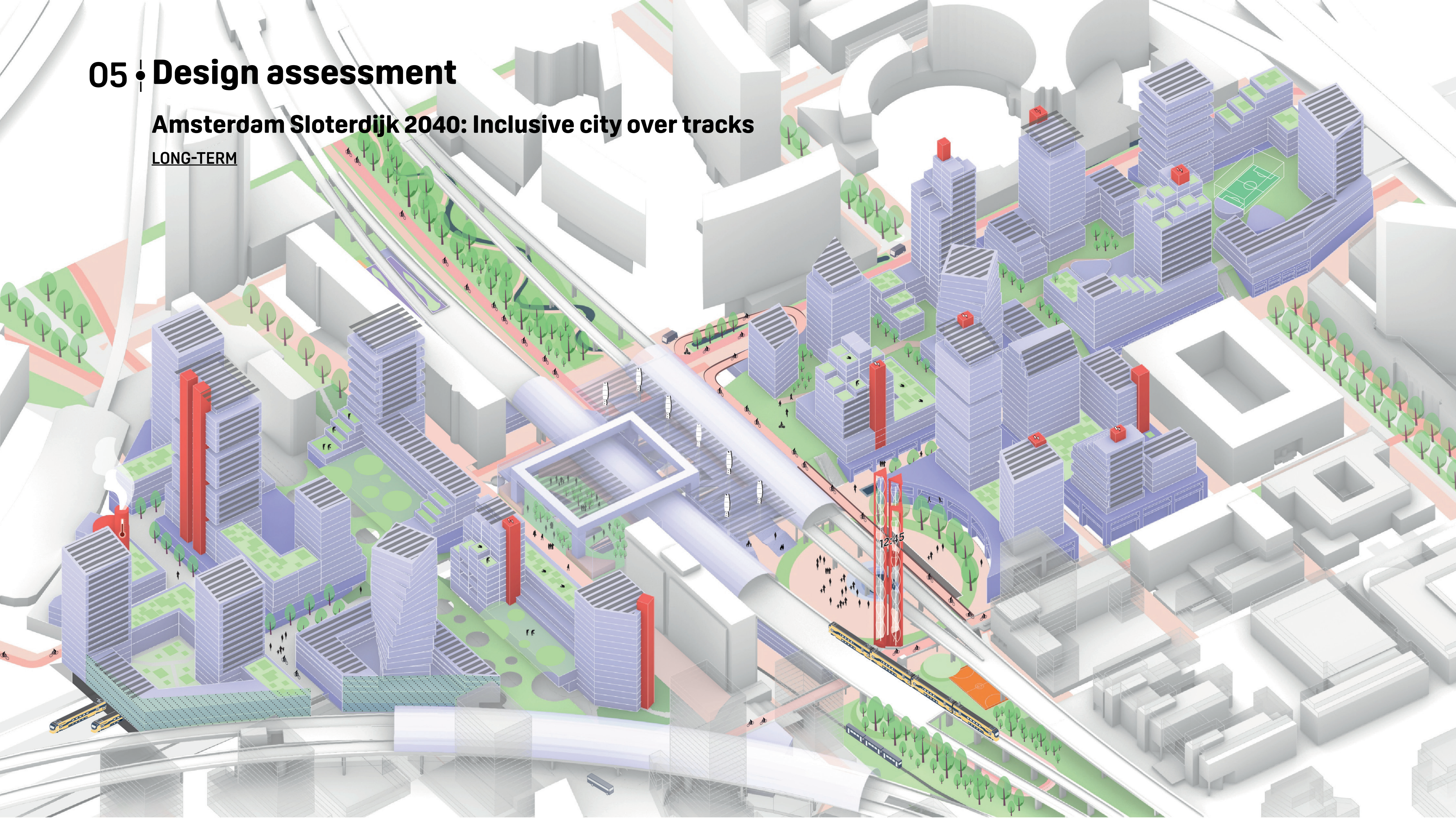
EXISTING



05 • Design assessment

Amsterdam Sloterdijk 2040: Inclusive city over tracks

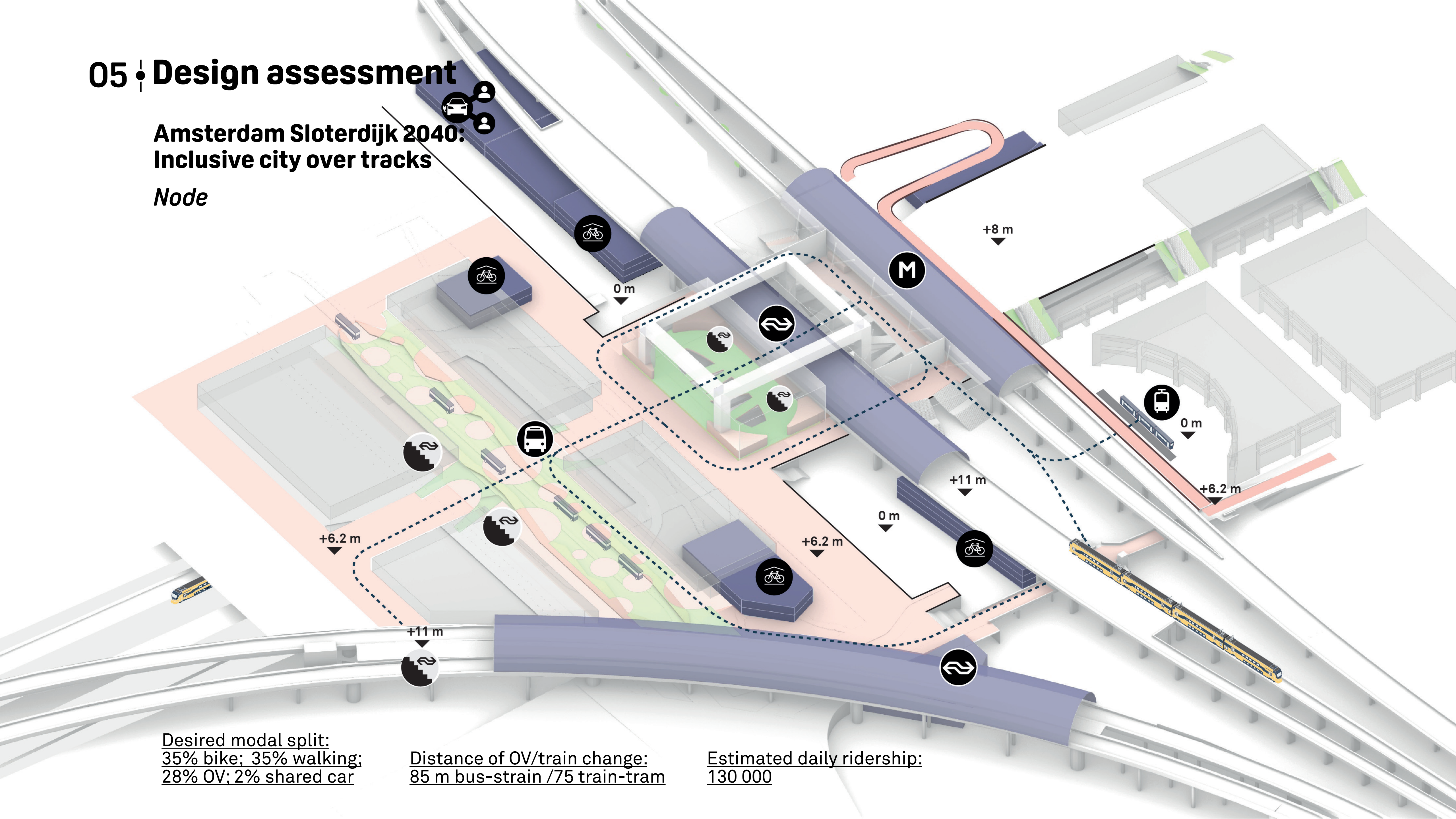
LONG-TERM



05 • Design assessment

**Amsterdam Sloterdijk 2040:
Inclusive city over tracks**

Node



Desired modal split:
35% bike; 35% walking;
28% OV; 2% shared car

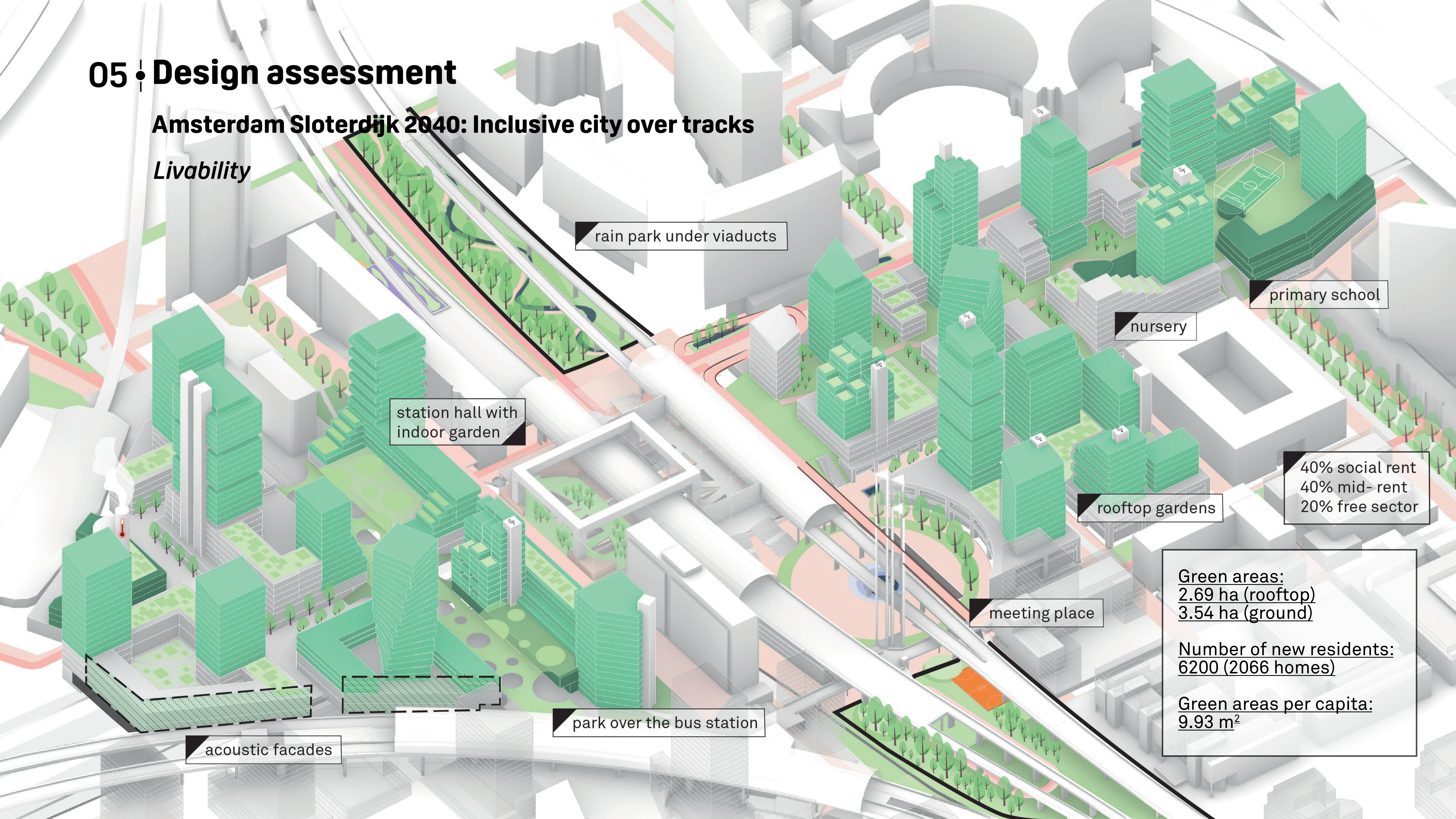
Distance of OV/train change:
85 m bus-strain / 75 train-tram

Estimated daily ridership:
130 000

05 • Design assessment

Amsterdam Sloterdijk 2040: Inclusive city over tracks

Livability



rain park under viaducts

primary school

nursery

station hall with
indoor garden

40% social rent
40% mid- rent
20% free sector

rooftop gardens

meeting place

park over the bus station

acoustic facades

Green areas:
2.69 ha (rooftop)
3.54 ha (ground)

Number of new residents:
6200 (2066 homes)

Green areas per capita:
9.93 m²

05 • Design assessment

Amsterdam Sloterdijk 2040: Inclusive city over tracks

Place

Preserved construction
of the old station

Shopping canal street

Cultural venues

5 680 new workplaces
FSI 3.25

61% living

23% working

9% retail/culture/horeca

7% social amenities

05 • Design assessment

Amsterdam Sloterdijk 2040: Inclusive city over tracks

Energy

Distribution grid 50kV integrated in multi-utility tunnel

Energy-neutral station with rooftop wind turbines

Energy-neutral buildings (label A++++)

Solar facade freeing up rooftops for gardening

Gravity batteries in shafts

Heating hub Sloterdijk-Centrum

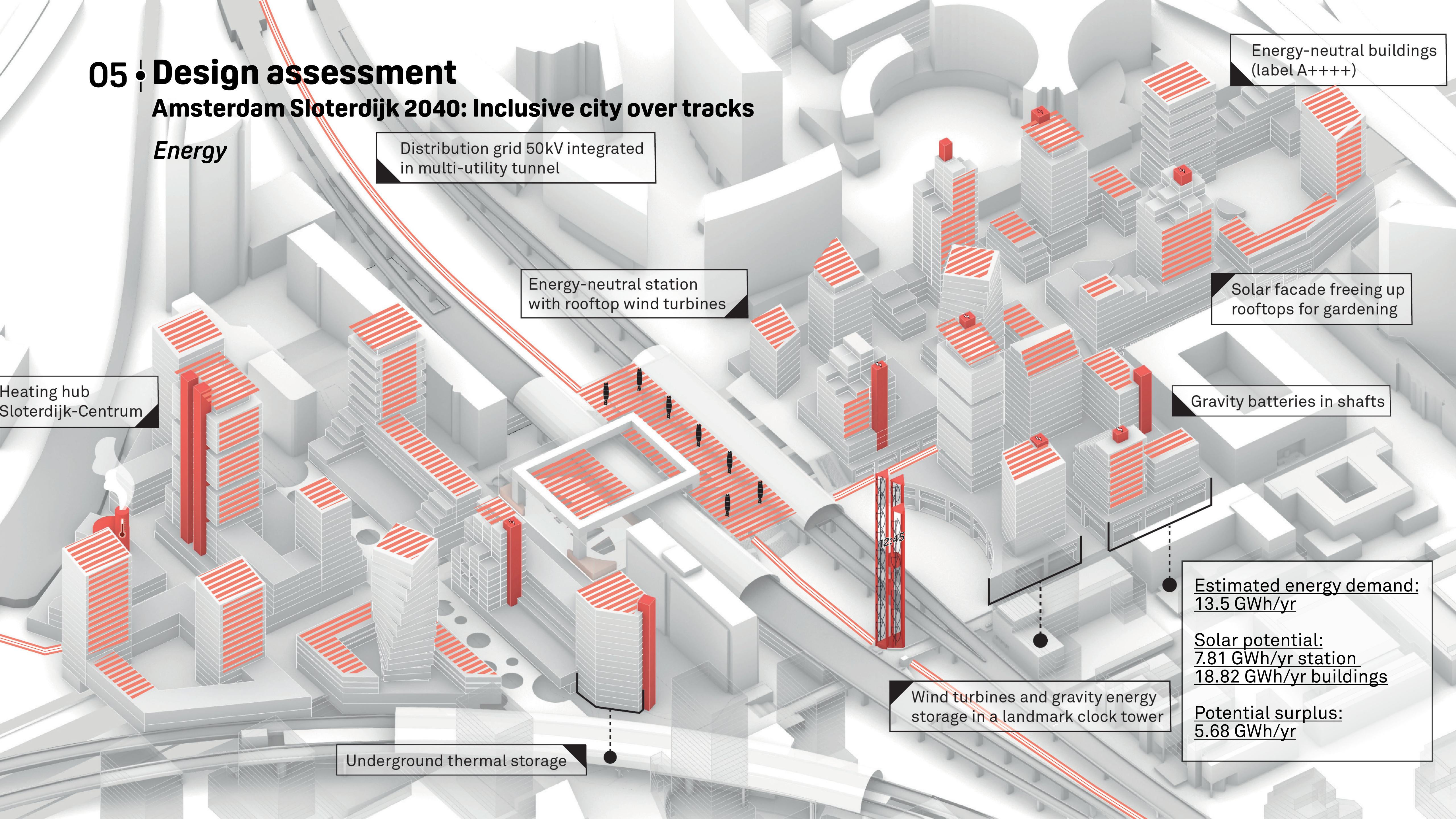
Estimated energy demand:
13.5 GWh/yr

Solar potential:
7.81 GWh/yr station
18.82 GWh/yr buildings

Potential surplus:
5.68 GWh/yr

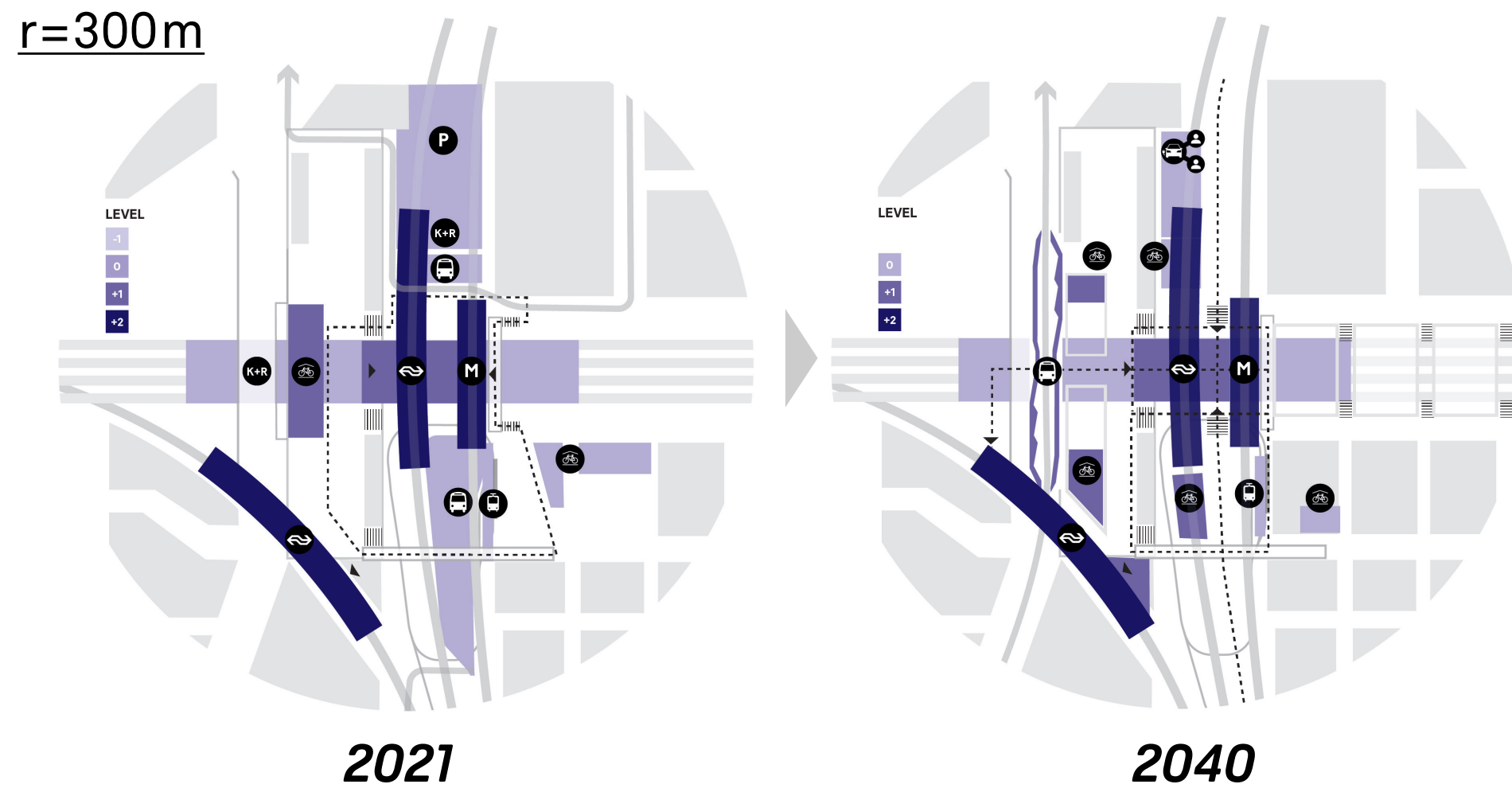
Wind turbines and gravity energy storage in a landmark clock tower

Underground thermal storage

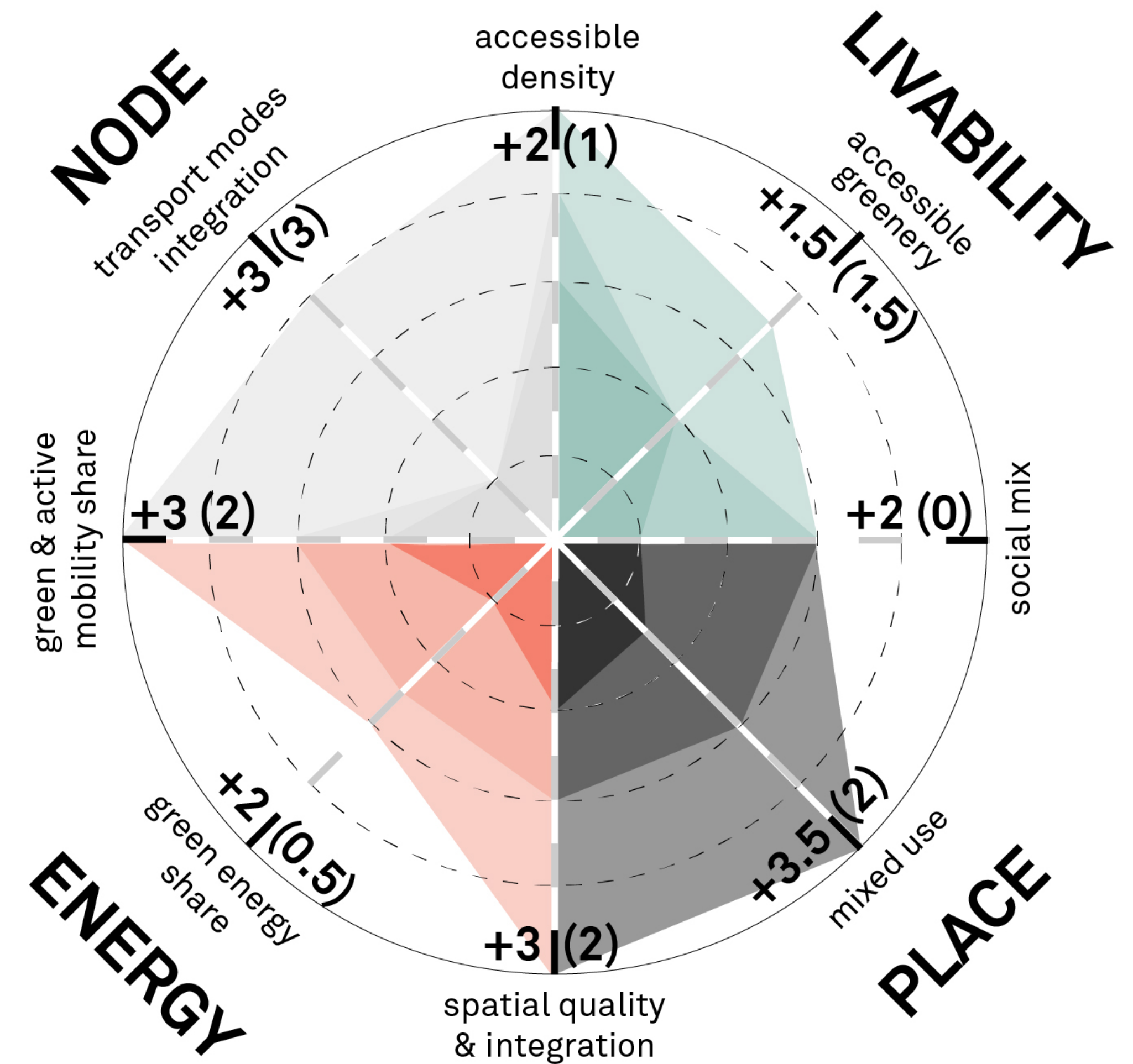


05 • Design assessment

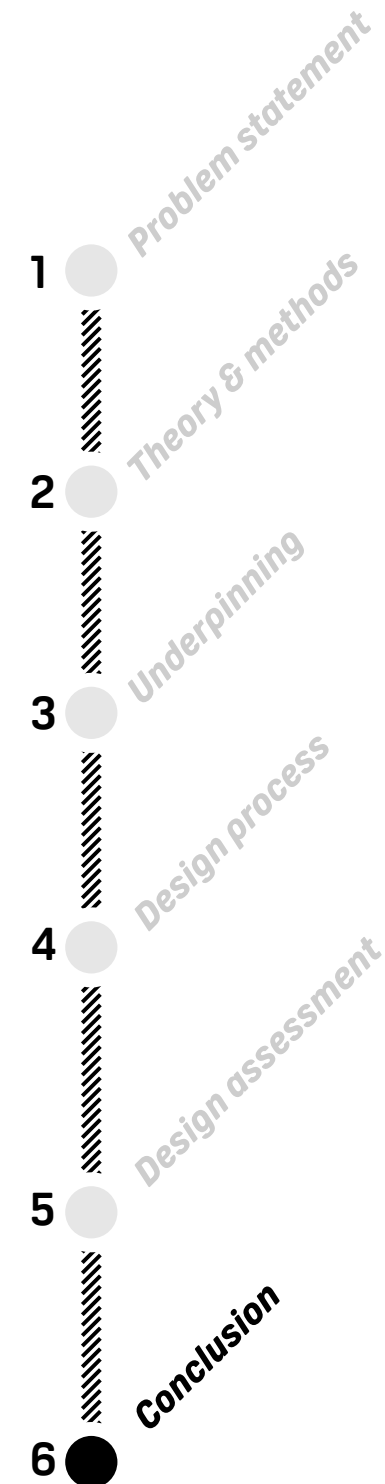
Amsterdam Sloterdijk 2040: Inclusive city over tracks



- Over-track densification could bring demanded spatial and functional cohesion to business district fragmented by infrastructure.
- It may be challenging to achieve the energy-neutrality of high-rise development; need for innovations such as gravity storage.
- Extreme densification and integration of train station and the city may not lead to the desired balance in the rose model.



06 • Conclusion



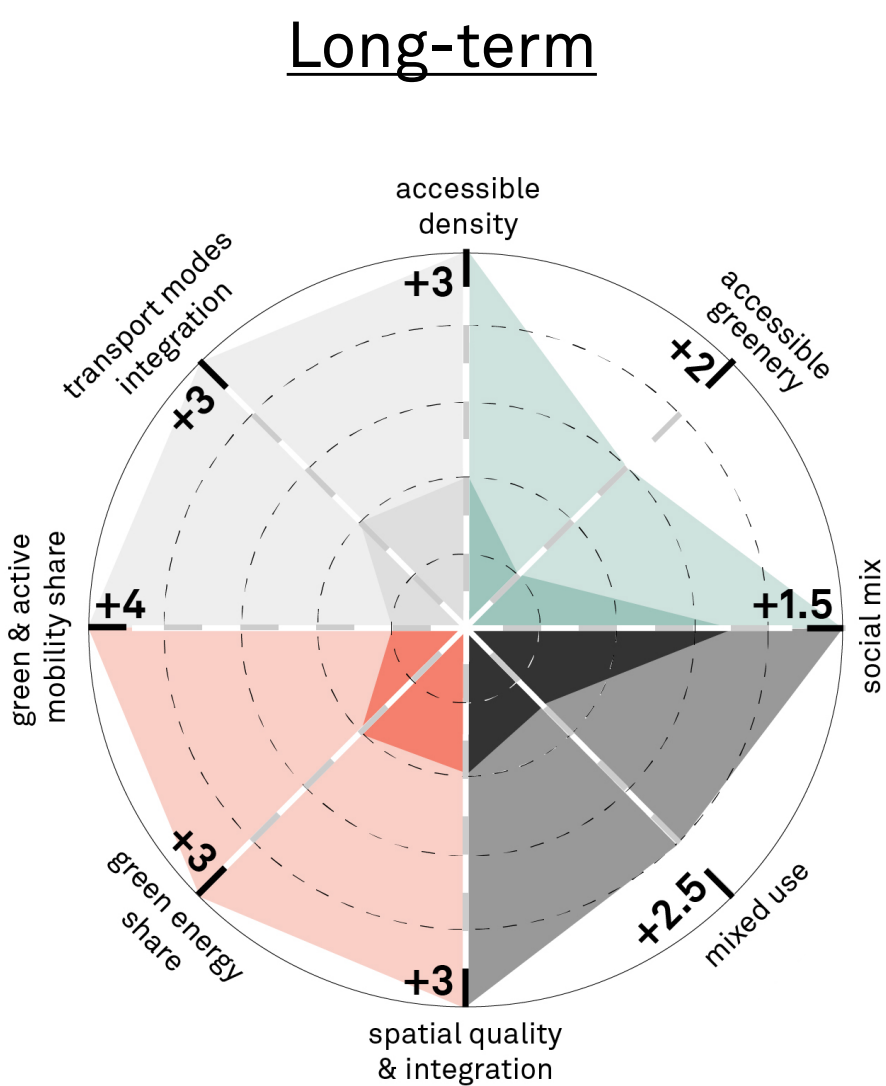
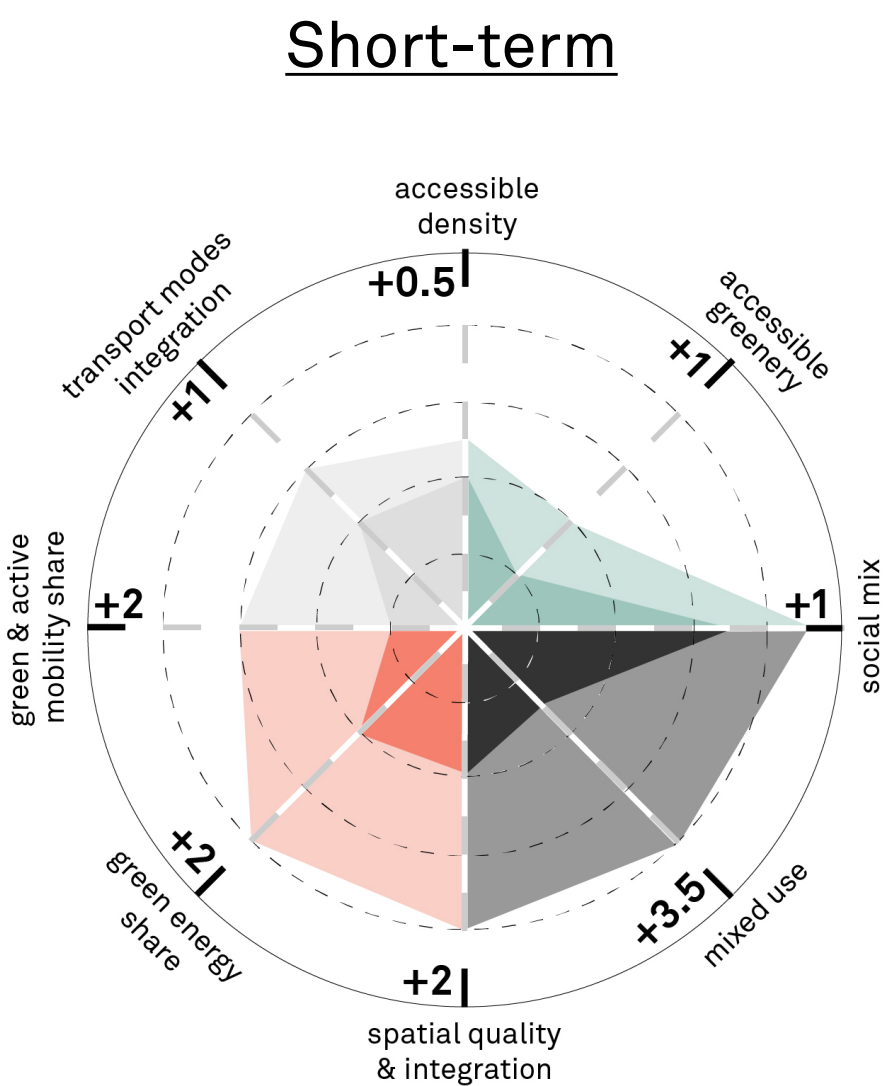
There is a natural tension between dimensions of energy and livability, between place and node:

- Maximizing energy generation may limit accessible greenery and contribute to heat island effect.
- Integrating train station in mixed use urban fabric may result in lower clarity of the node than of the independent station.

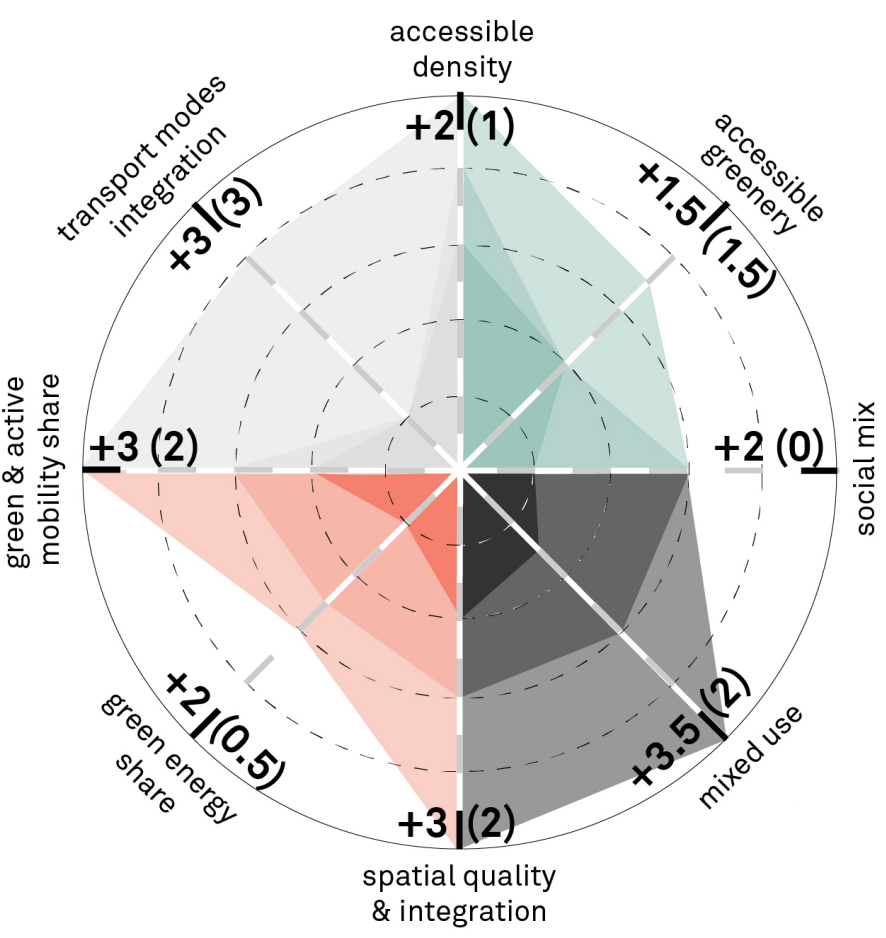
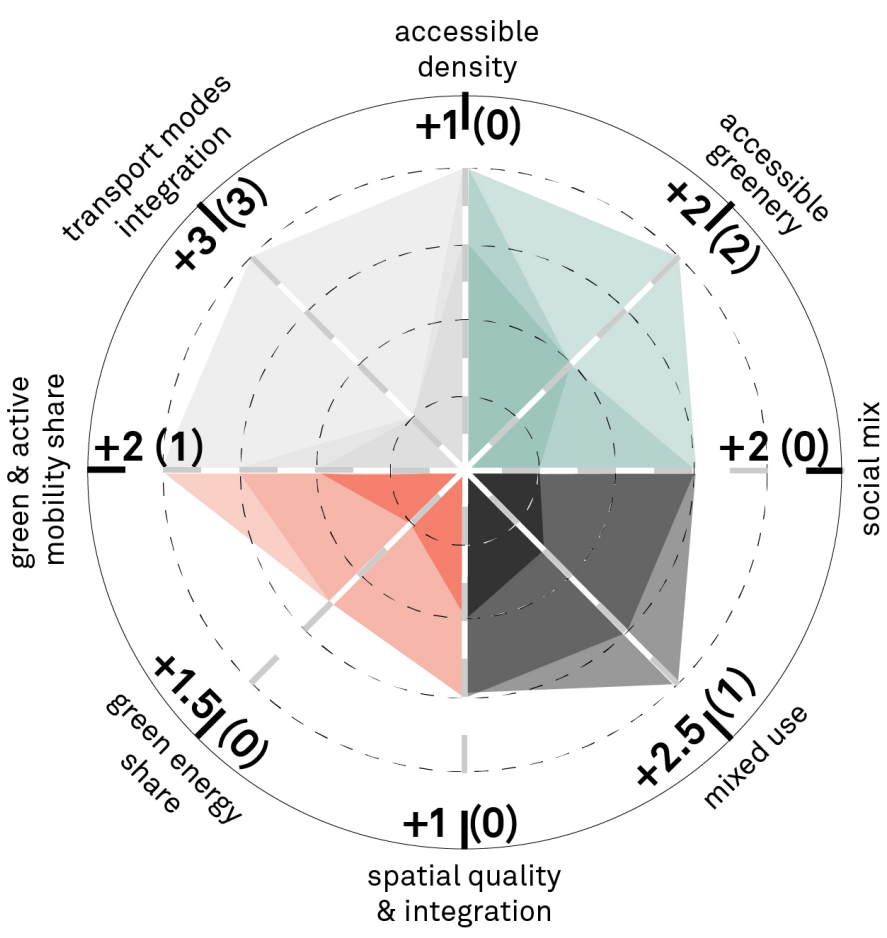
Maximizing densification around the nodes may hinder the energy transition. Its spatial claim needs to be preserved by dedicated energy zoning.

Ambitious visions 2040+ are hindering the potential of station areas available here and now. Every train station area could have long-term and short-term vision.

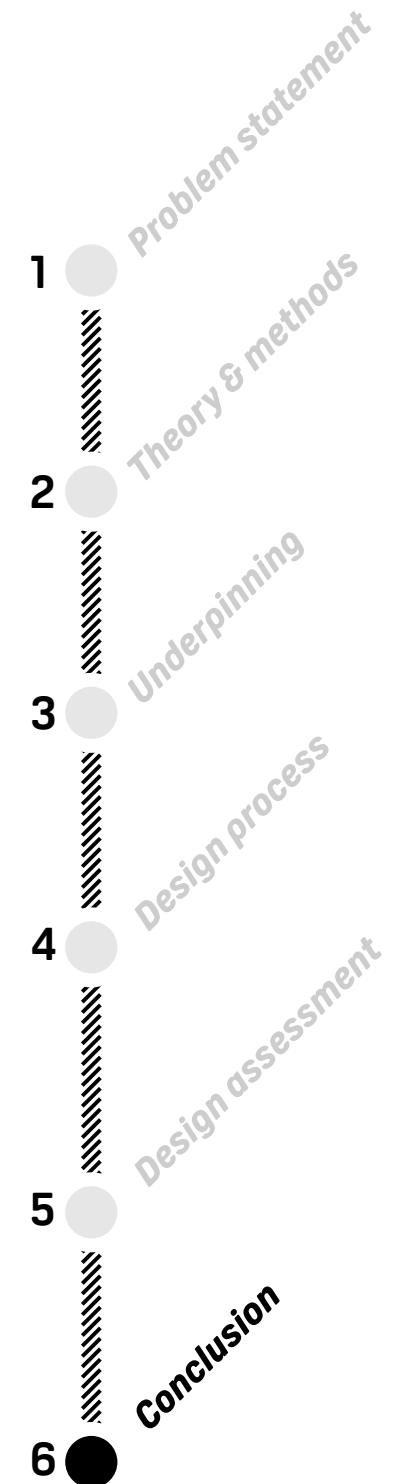
Bergen op Zoom



Amsterdam
Sloterdijk



06 • Conclusion



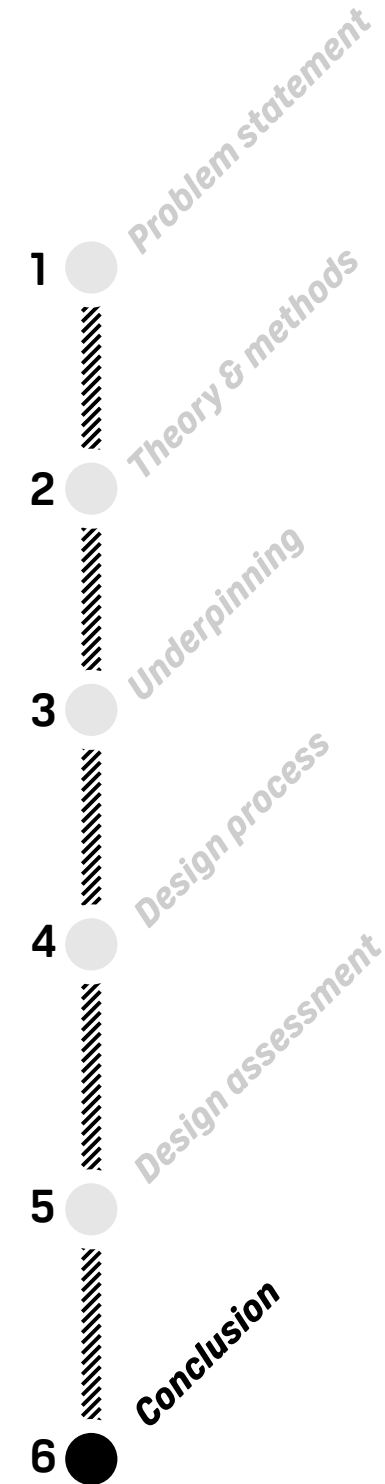
RQ

How can train station areas development in the Netherlands allow adaptable and equitable densification, and catalyze energy transition?

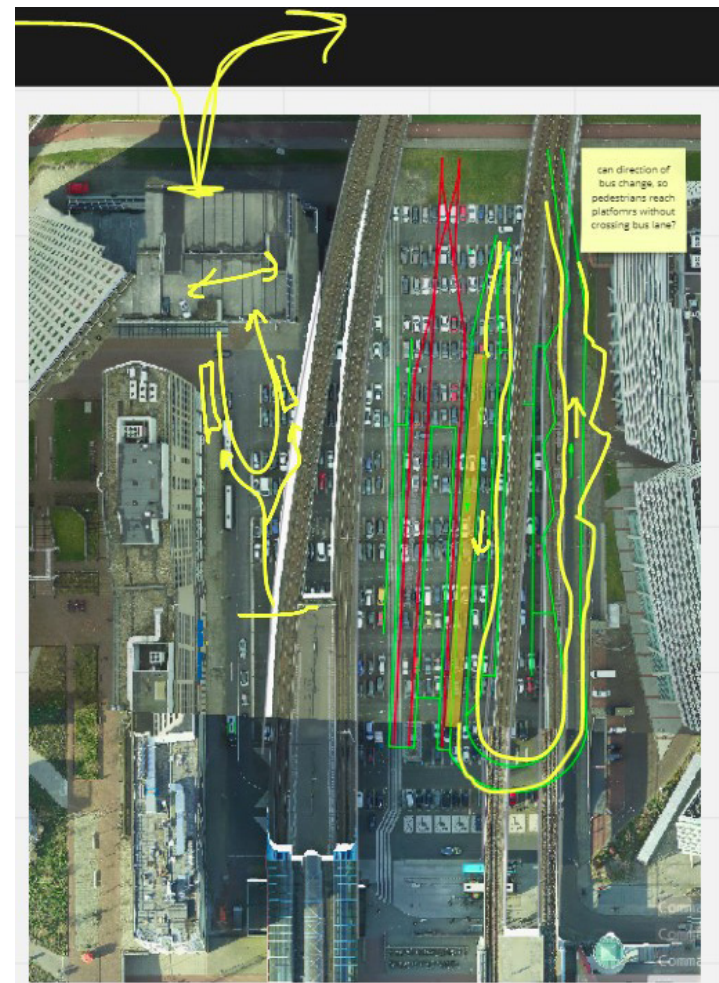
- SQ1** How do we define TSAD and what does it tell us about the contemporary relationship between the train station and the city?
- SQ2** What is neoliberalization and how does it influence TSAD in the Netherlands?
- SQ3** What are the spatial implications of energy transition for train stations?
- SQ4** How to achieve dense and equitable living environment in station areas?
- SQ5** How to plan and design adaptable train stations of the future?
- SQ6** How TSAD can contribute to energy transition?

- SQ1** TSAD is a field dealing with redevelopment of train station areas in the european context since the rail renaissance of the 1990s. The relationship of train station with the city is two-fold: they are simultaneously a connector and attractor.
- SQ2** Since the 1990s. railway grounds were privatized and developed by private investors to maximize profit. Model available only to large stations increased disparities.
- SQ3** Spatial implications of energy transitions are partly unpredictable. That is why station areas should introduce energy zoning, including also future spatial reserves (ie. with short-term land use).
- SQ4** Following Amsterdam, secured ratio of affordable housing in station areas is needed. Commercial part of the project should be used to fund social program, not increase profit.
- SQ5** Using systematic approach to address climate and housing crisis in every project. A coherent nationwide agenda for train station areas in needed.
- SQ6** Train stations can become landmarks of energy transition: the esthetic infrastructure that efficiently generates energy, supports city centers and brings social change.

06 • Reflection



Interactions between practive and academia.



Sketches for potential bus .tram station in Sloterdijk.
Source: PosadMaxwan

Influence of the pandemic.



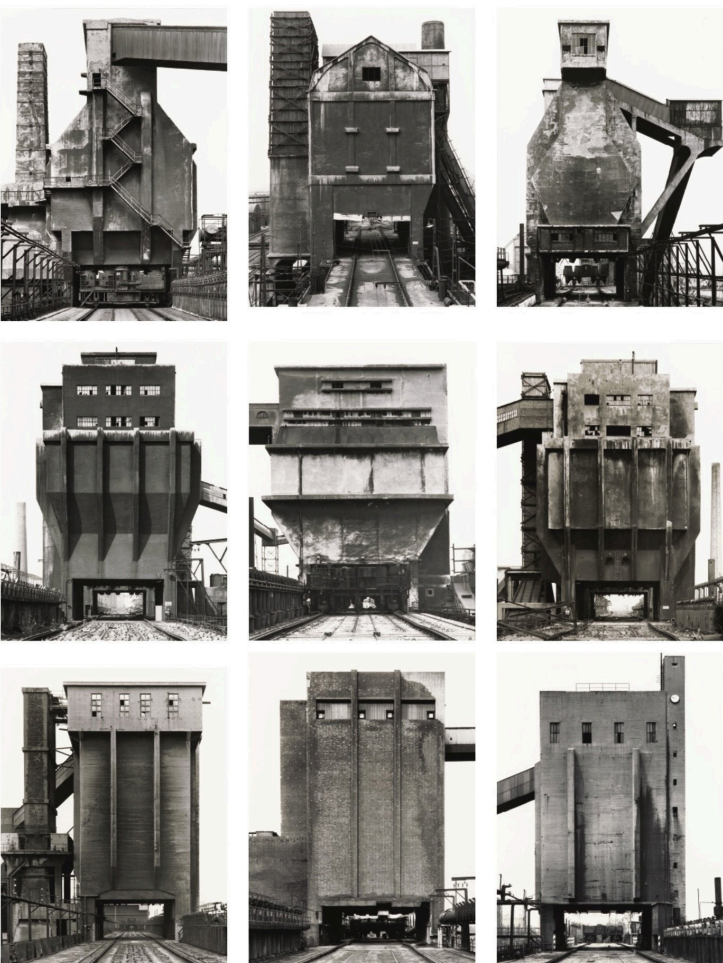
Covid measures introduced in NS train stations. Source: <https://bit.ly/2SH2Ejn>

Sometimes it is better not to build at all.



Interview with Lacaton & Vassal: http://www.reduce-re-use-recycle.info/Projekt_3_0_id_21.html

Towards new heritage.



Bernd and Hilla Becher, Typologies (cooling towers). Source: https://www.tate.org.uk/art/images/work/T/T01/T01923_9.jpg