

P5 07.07.17 | Kanaän, or the suburb of the polycentric metropolis

Delft University of Technology master graduate project
Chair of Architectural Engineering, Intecture studios
Fall 2016 • spring 2017





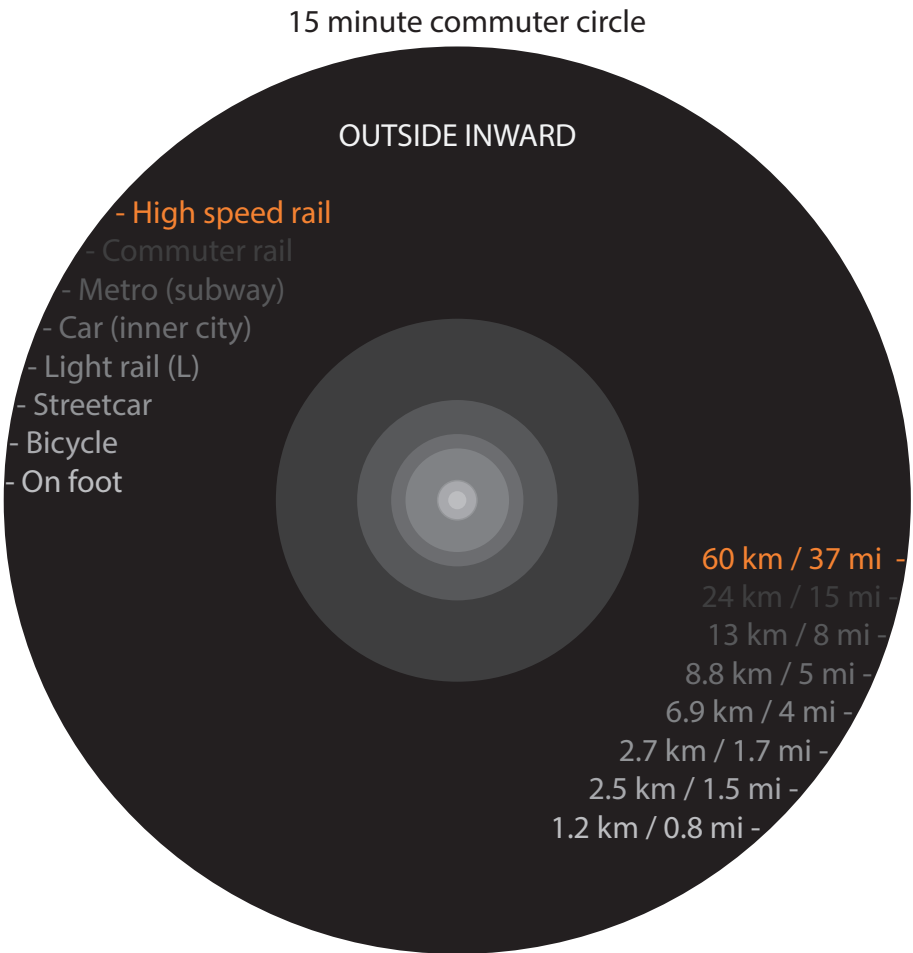
Chicago



CHICAGO'S BIGGEST CHALLENGE IS
BASED ON TRANSPORT

Accompanying its strong asset base, Chicago has significant challenges. After a strong post-industrial economic recovery in the 1990s, growth in population, employment, productivity, and GDP all underperformed trends in other major U.S. cities in the first decade of this century. This is partly because the region is not fully utilizing its stock of labor, as persistent concentrated poverty, high crime, and underperforming schools curtail economic opportunity in African-American and Latino communities. Chicago's struggles with local accessibility also contribute to the underutilization of labor. The City of Chicago boasts one of the more comprehensive public transit systems in the country, and local leadership has recently stressed alternative forms of travel, including bike lanes and car-sharing programs. But where the region struggles is connecting workers to jobs. Nearly 80 percent of the metropolitan area's working-age residents live near a transit stop (the average among top 100 U.S. metros is 69 percent), but only 24 percent of the region's jobs are reachable via transit in under 90 minutes, well below the 100-metro average of 30 percent.¹⁵ Decades of sprawl have pushed two-thirds of jobs beyond 10 miles from the downtown.

SOURCE:
the brookings institution;
the 10 traits of globally fluent metro areas



Downtown commute
from:

1. Waukegan National Airport
(45 miles)

2. Dupage County Airport
(41.8 miles)

3. O'hare International Airport
(18 miles)

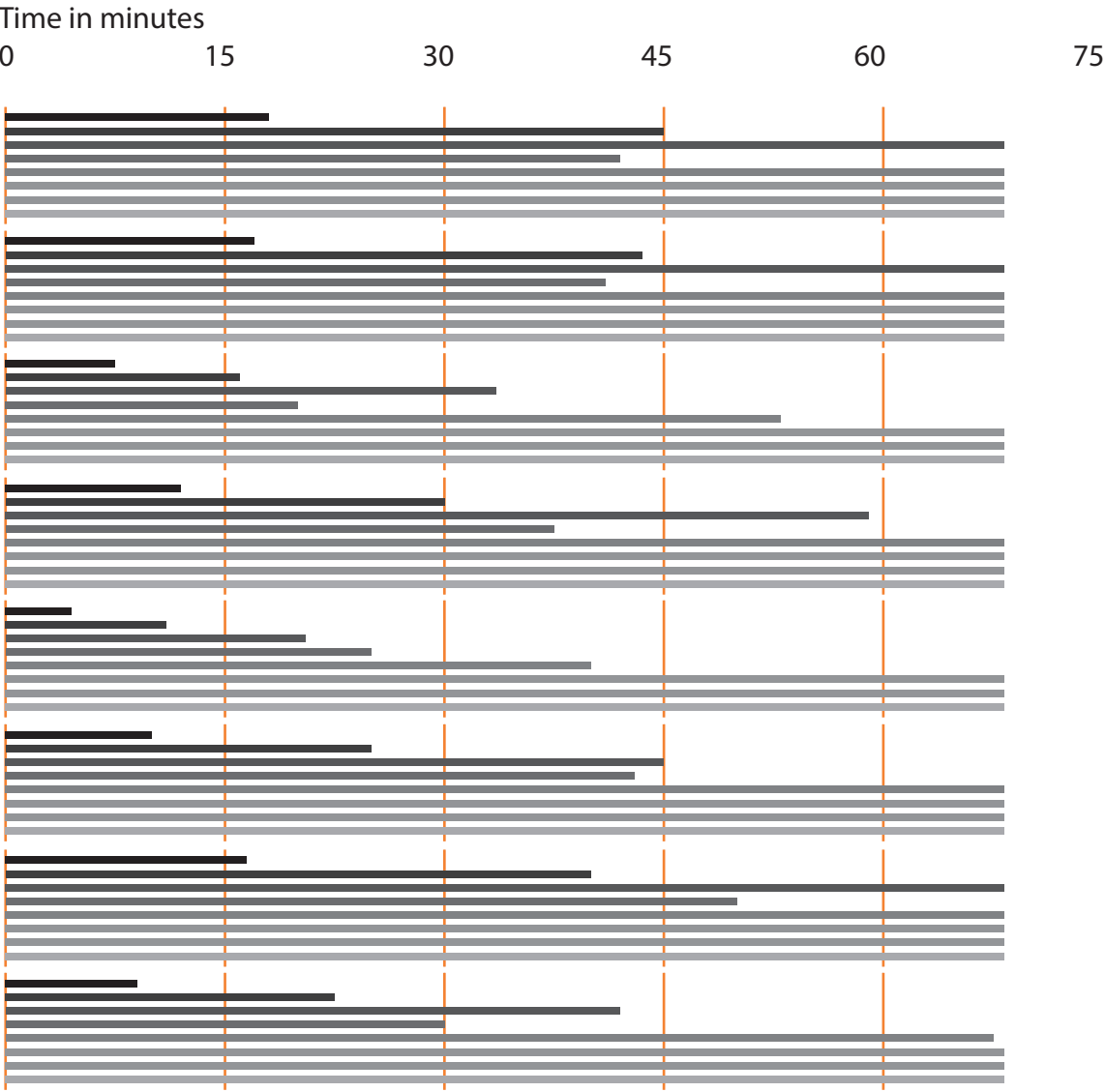
4. Bolingbrook's Clow
International Airport (32 miles)

5. Chicago Midway
International Airport (10.8 miles)

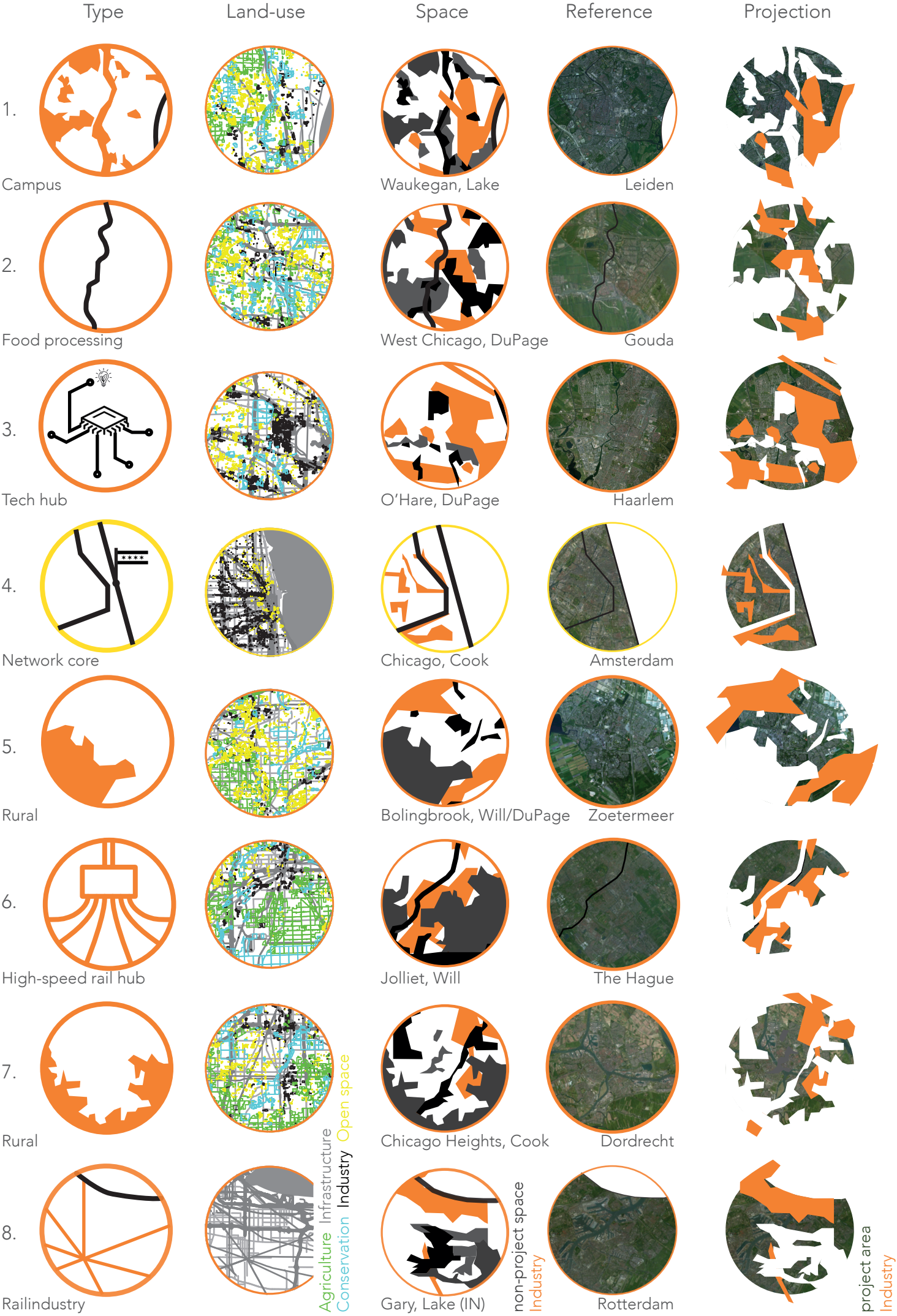
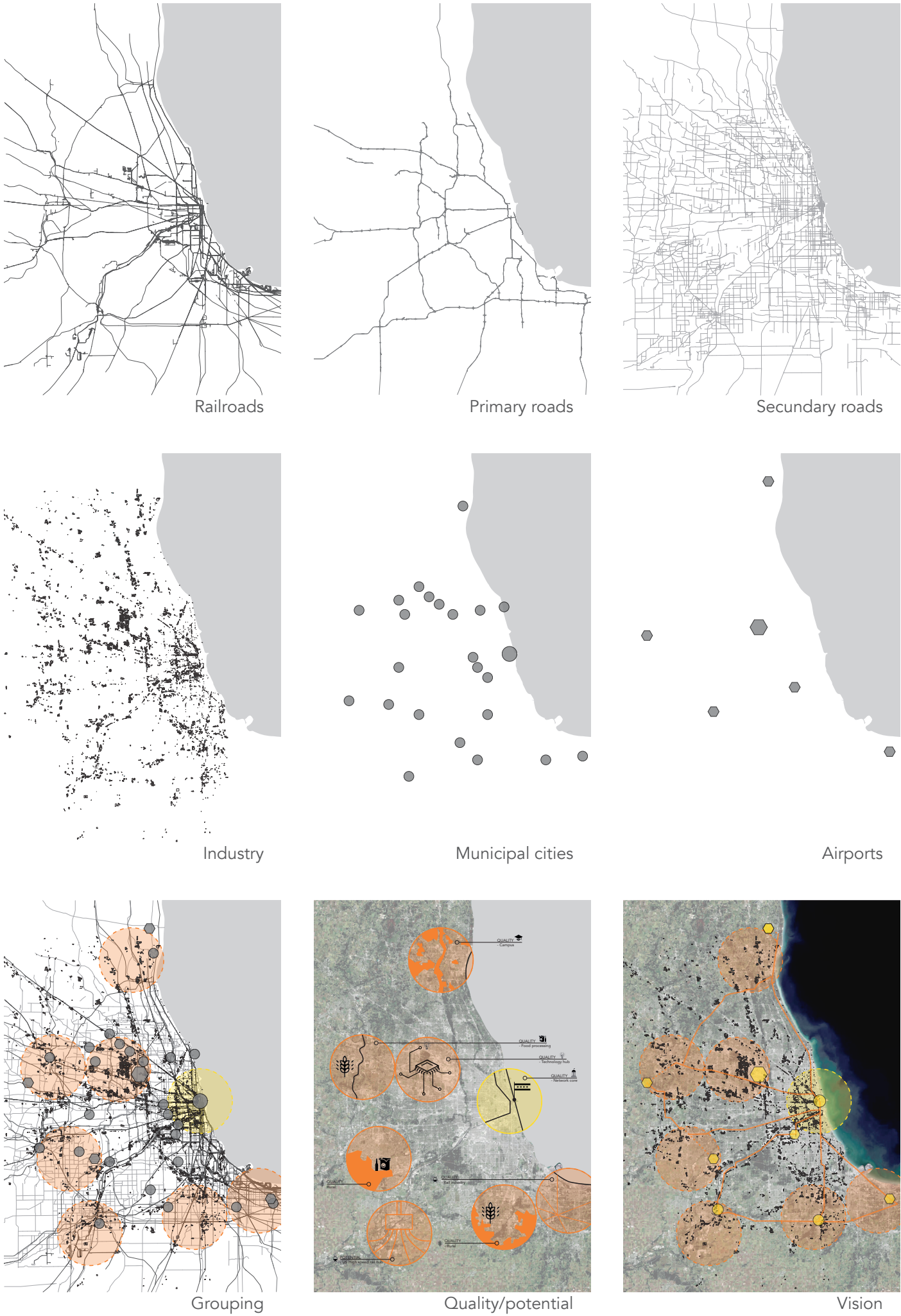
6. Gary Airport
(24.5 miles)

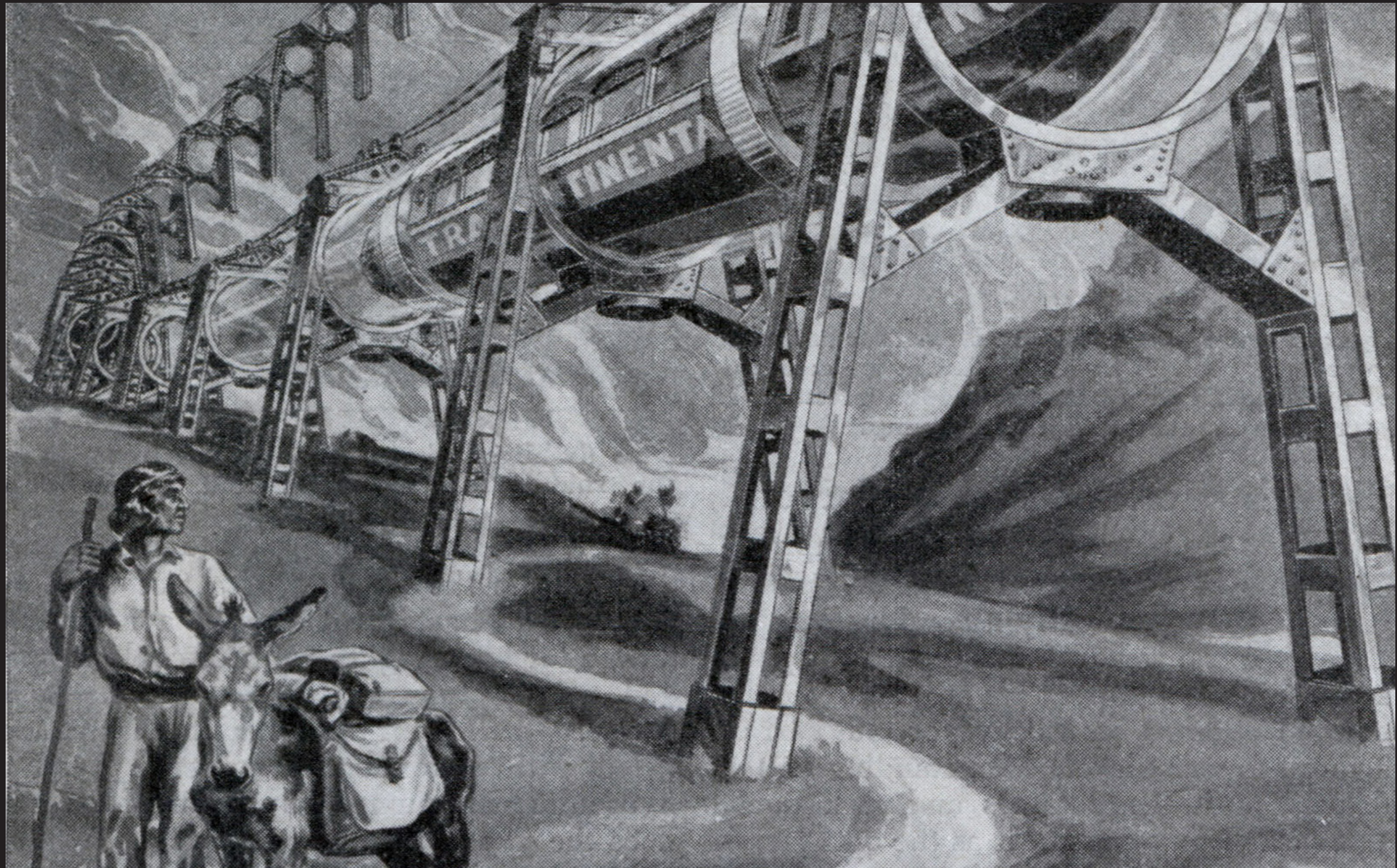
7. City of Joliet
(39.7 miles)

8. Village of South Holland
(22.7 miles)



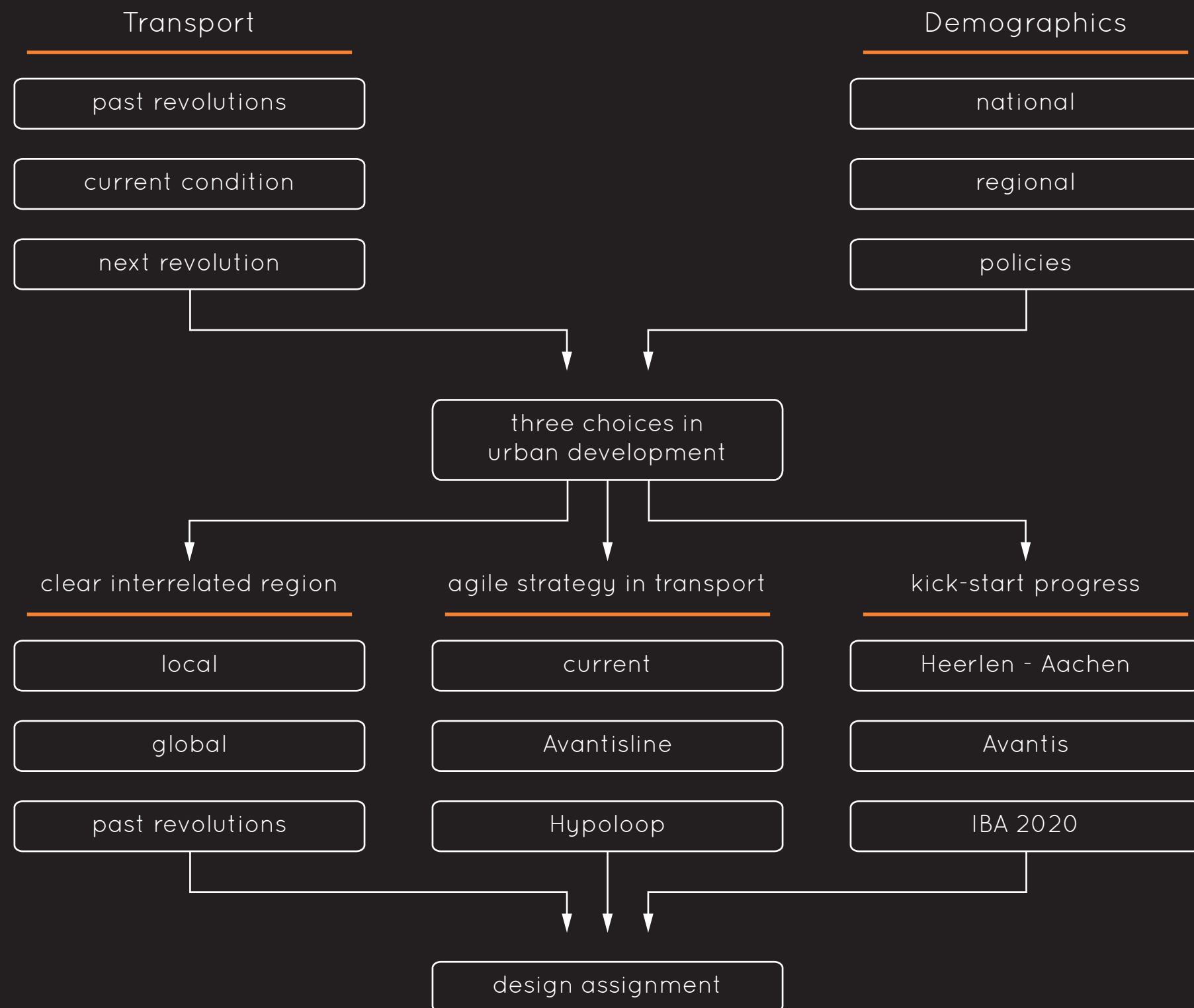
Chicago to Randstad | metropolitan comparison





IMPACT OF MOBILITY ON OUR SETTLEMENT AND USE PATTERNS

HOW CAN THE ENERGY TRANSITION IN MOBILITY SERVE POLICY INITIATIVES ADDRESSING THE DECLINE OF POPULATION?



- Past revolutions
- Current condition
- Next revolution

Britain's railway revolution of 1830 to 1850



Great wartime pause in motorisation in the US



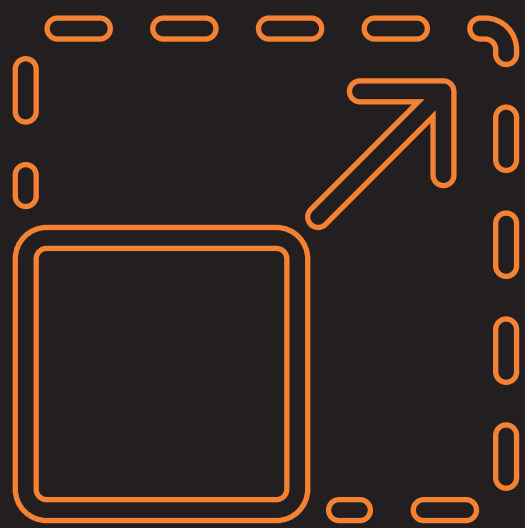
Big switch in transatlantic travel in the 1950s

Air freight revolution of 1980 to the present



High speed rail revolution of 1960 to 1985

Past revolutions
Current condition
Next revolution



Scale



Speed



Efficiency



Accessibility



Forced back to autarkic ways of life

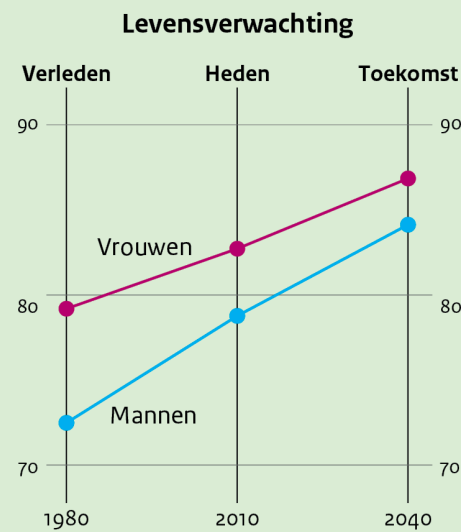
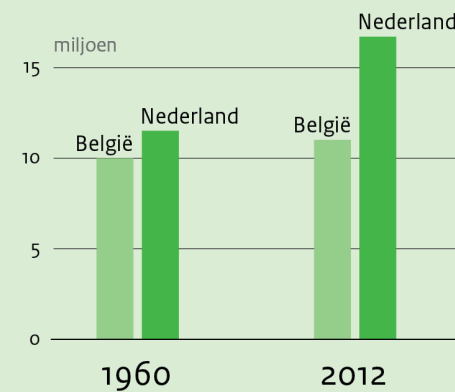


Develop new means of transport

NEDERLANDSE BEVOLKING TRENDS EN KEERPUNTEN

Nederland groeiland

De bevolking van Nederland neemt al decennialang sterk toe. In 1960 had Nederland 11,5 miljoen inwoners, in 2012 zijn er ruim 5 miljoen meer: 16,7 miljoen inwoners. Buurland België maakte een veel minder sterke bevolkingsgroei door: van 10 miljoen inwoners in 1960 naar 11 miljoen in 2012. Hoewel het tempo van de Nederlandse bevolkingsgroei in de toekomst wel afneemt, is de groei er nog niet uit. In 2040 zijn er naar verwachting 17,8 miljoen Nederlanders; nog zo'n één miljoen meer dan nu.

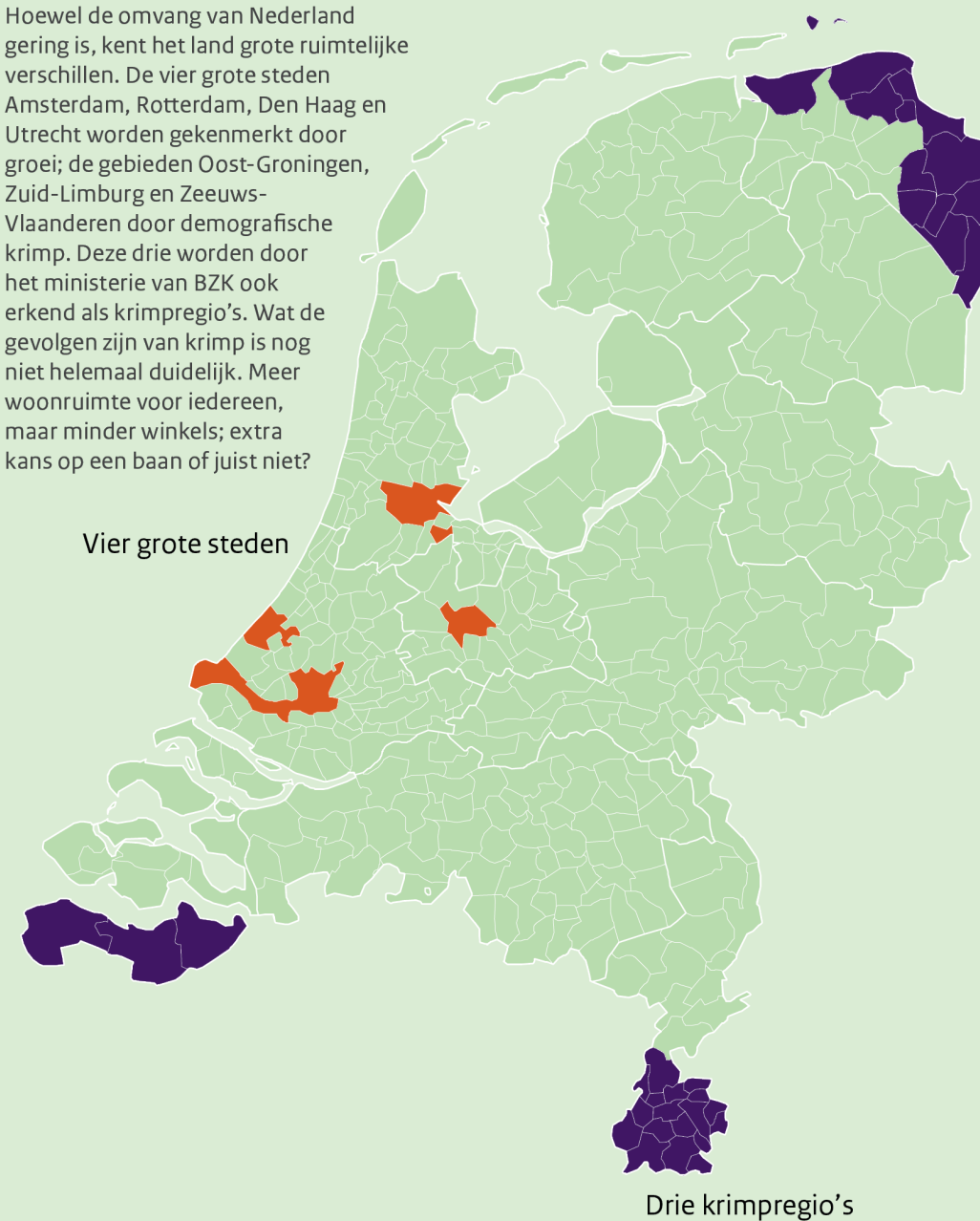


Nederlanders worden steeds ouder

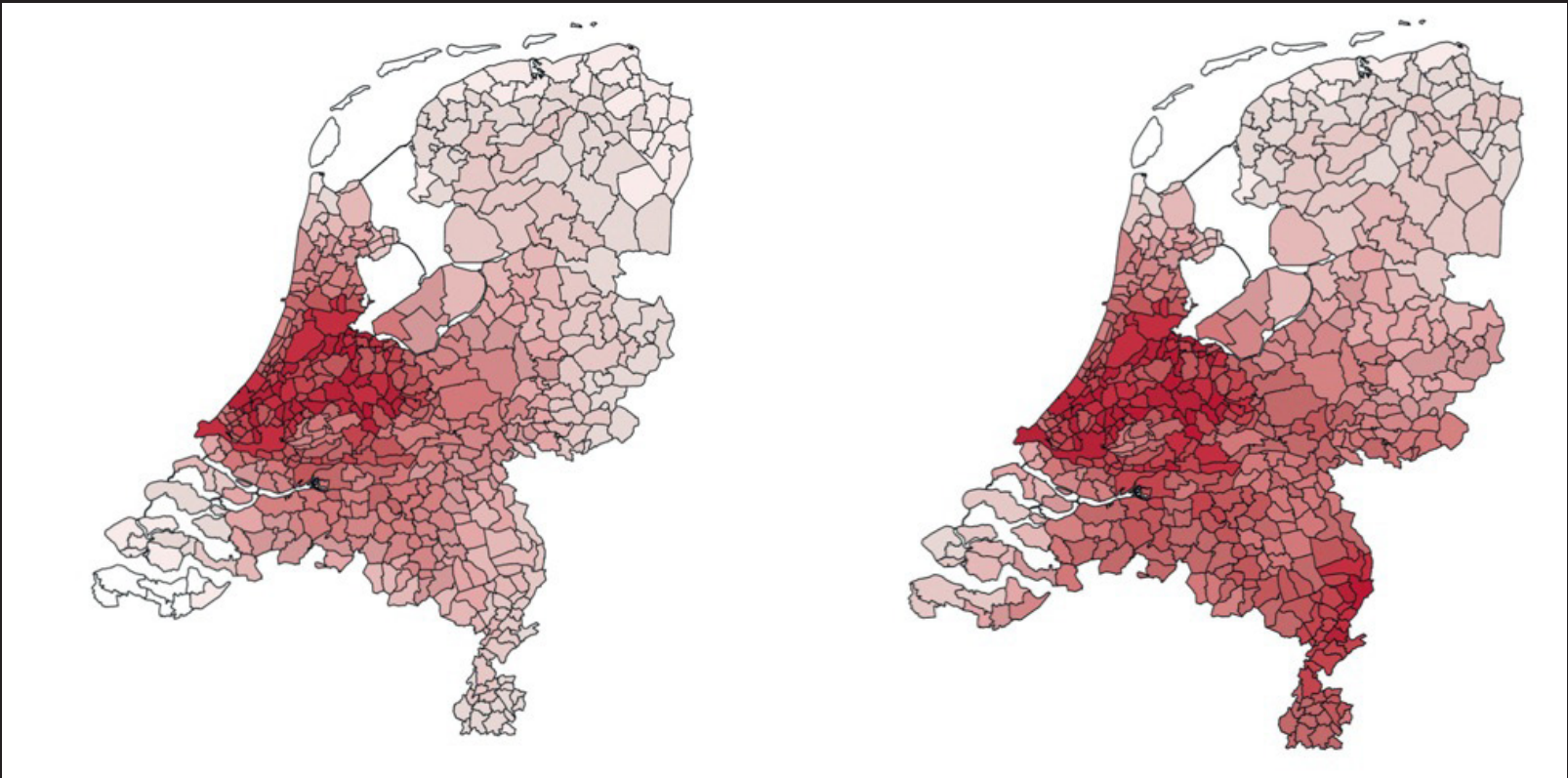
Zowel mannen als vrouwen worden steeds ouder. Voor mannen was in 1980 de levensverwachting bij geboorte 72,5 jaar en voor vrouwen 79,2 jaar. Langzaam maar zeker wordt dit verschil tussen mannen en vrouwen kleiner. In 2040 is naar verwachting de levensverwachting bij geboorte verder opgelopen naar 84,1 jaar voor mannen en 86,9 jaar voor vrouwen. Overal in Nederland stijgt de levensverwachting, hoewel er duidelijke regionale verschillen blijven bestaan. Mede hierdoor zal de vergrijzing in de ene regio sterker zijn dan in de andere.

Groei en krimp

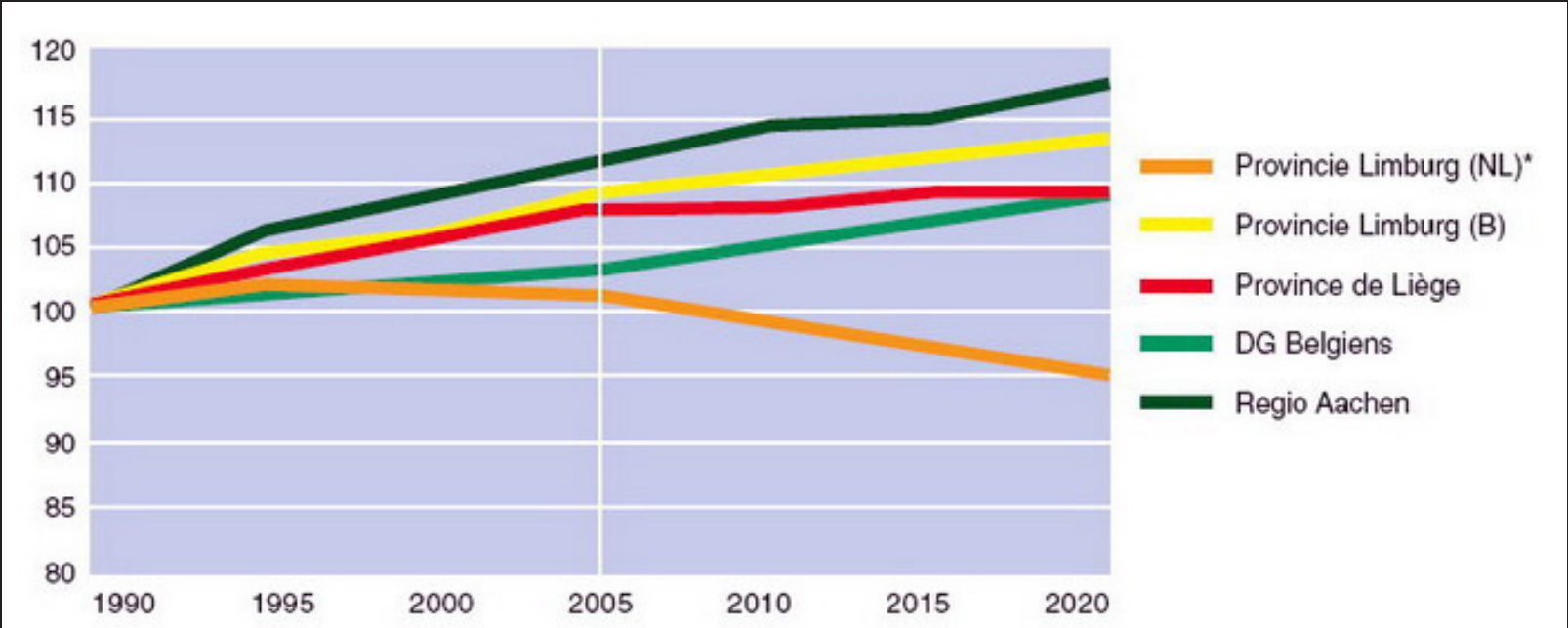
Hoewel de omvang van Nederland gering is, kent het land grote ruimtelijke verschillen. De vier grote steden Amsterdam, Rotterdam, Den Haag en Utrecht worden gekenmerkt door groei; de gebieden Oost-Groningen, Zuid-Limburg en Zeeuws-Vlaanderen door demografische krimp. Deze drie worden door het ministerie van BZK ook erkend als krimpregio's. Wat de gevolgen zijn van krimp is nog niet helemaal duidelijk. Meer woonruimte voor iedereen, maar minder winkels; extra kans op een baan of juist niet?



Trends and changes in Dutch population



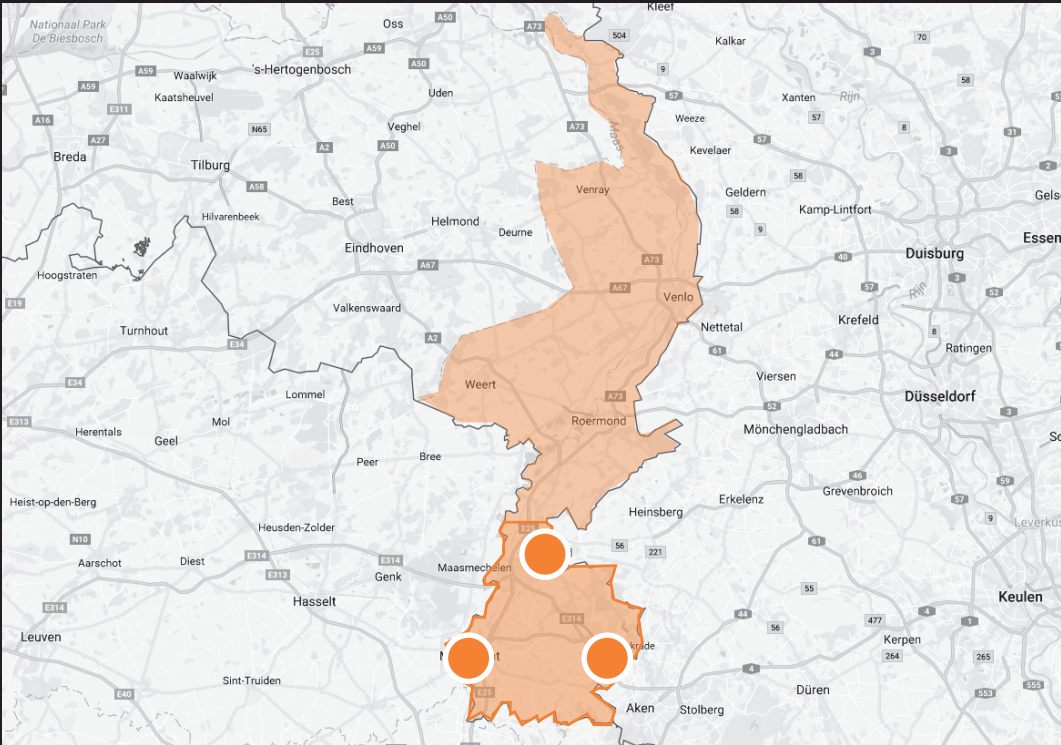
Jobs reachable in an hour, within (left) and across (right) borders



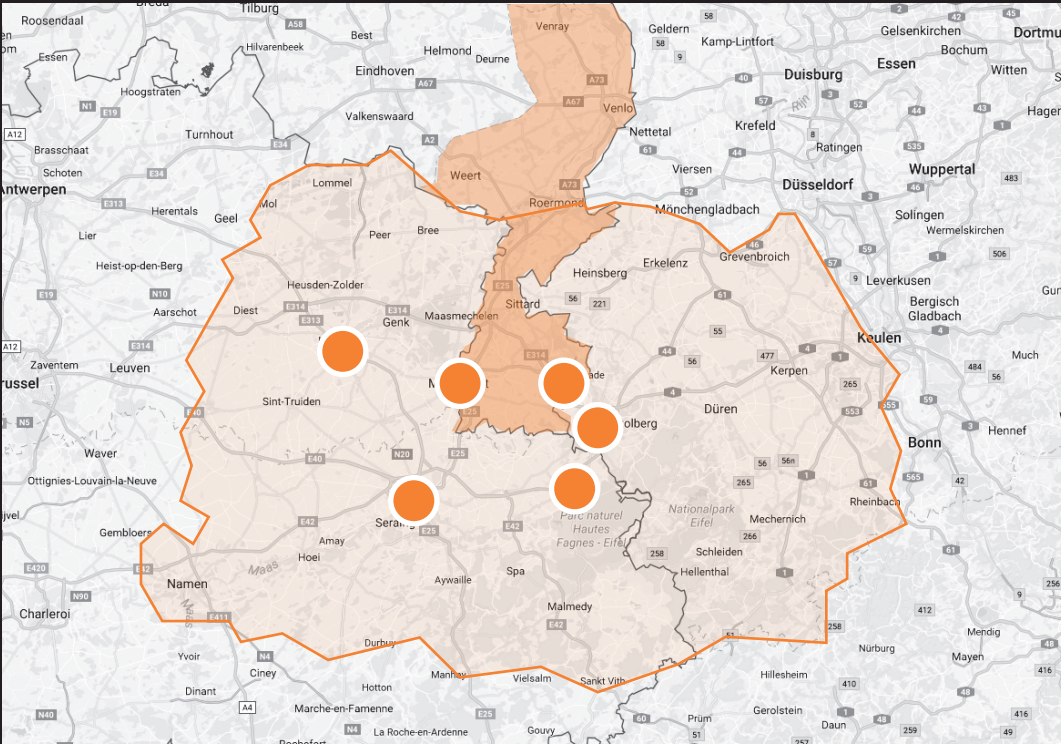
Population prospects regions around Parkstad



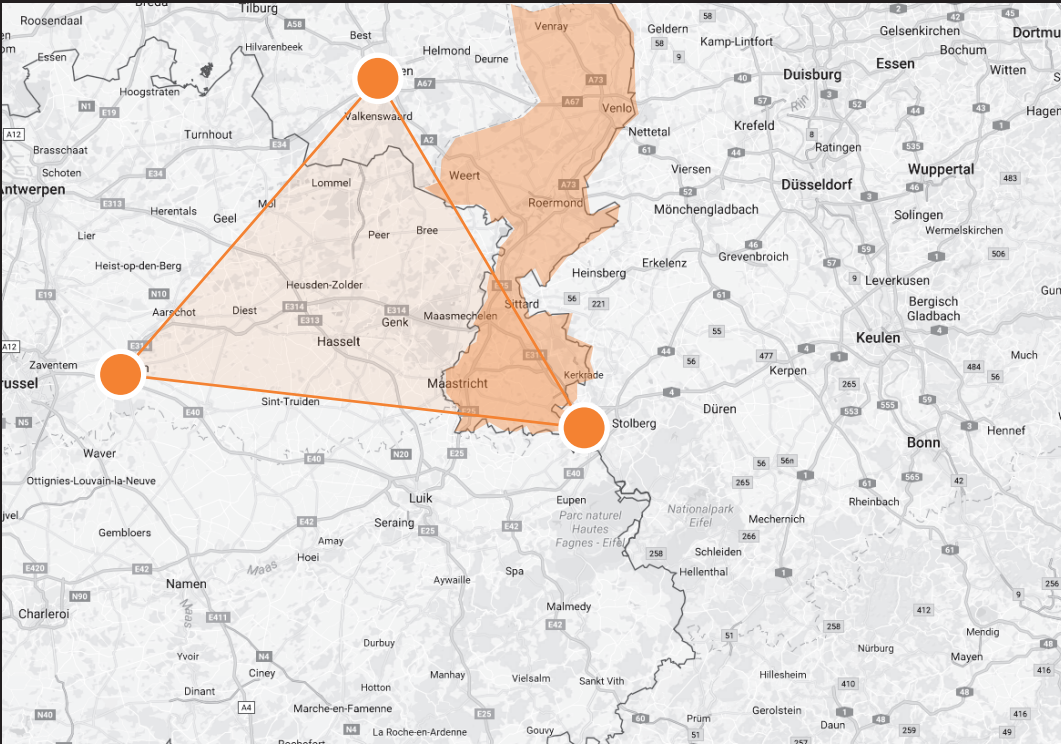
Limburg within the Netherlands



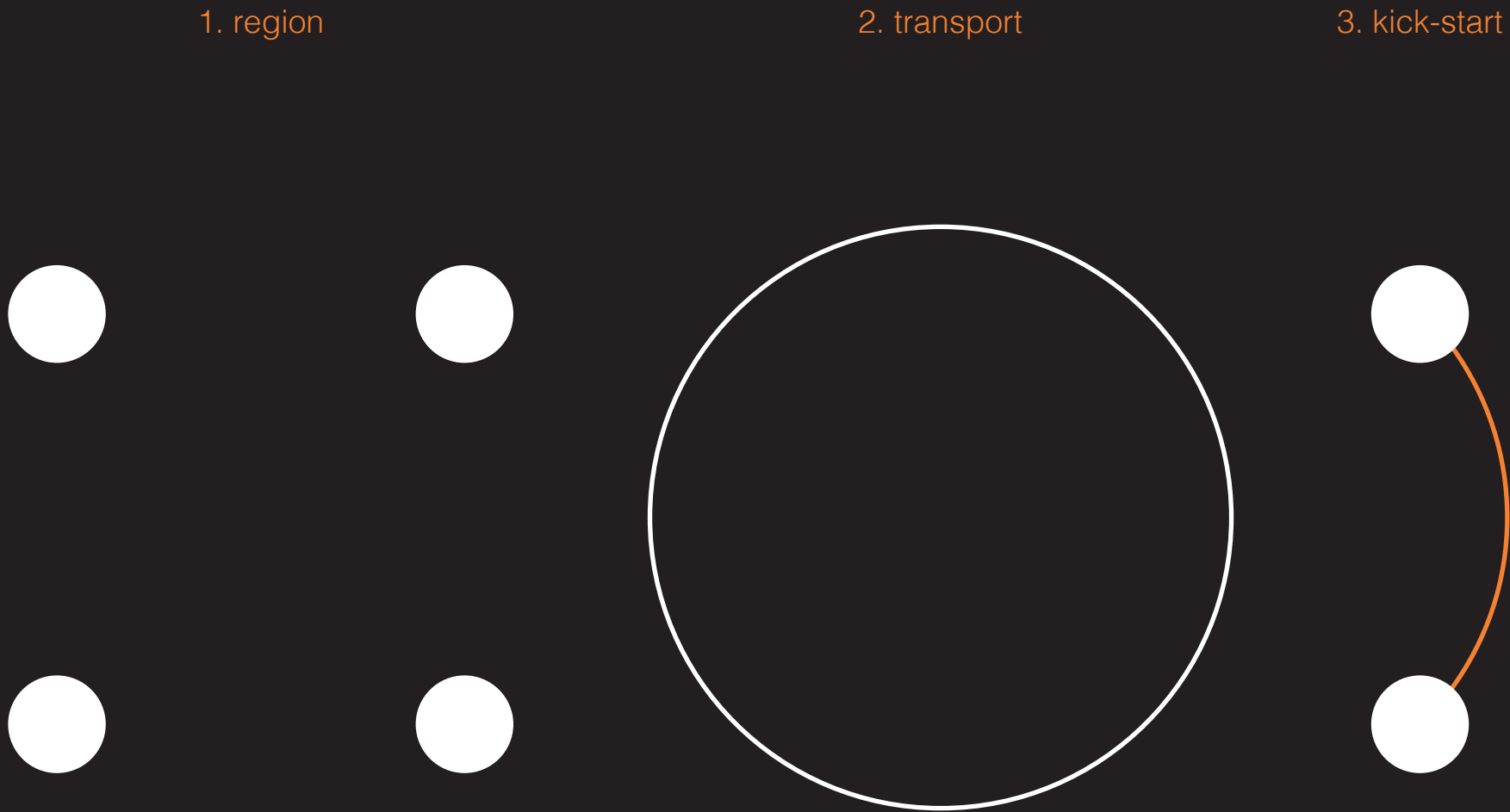
Limburg as part of the South Limburg campus program

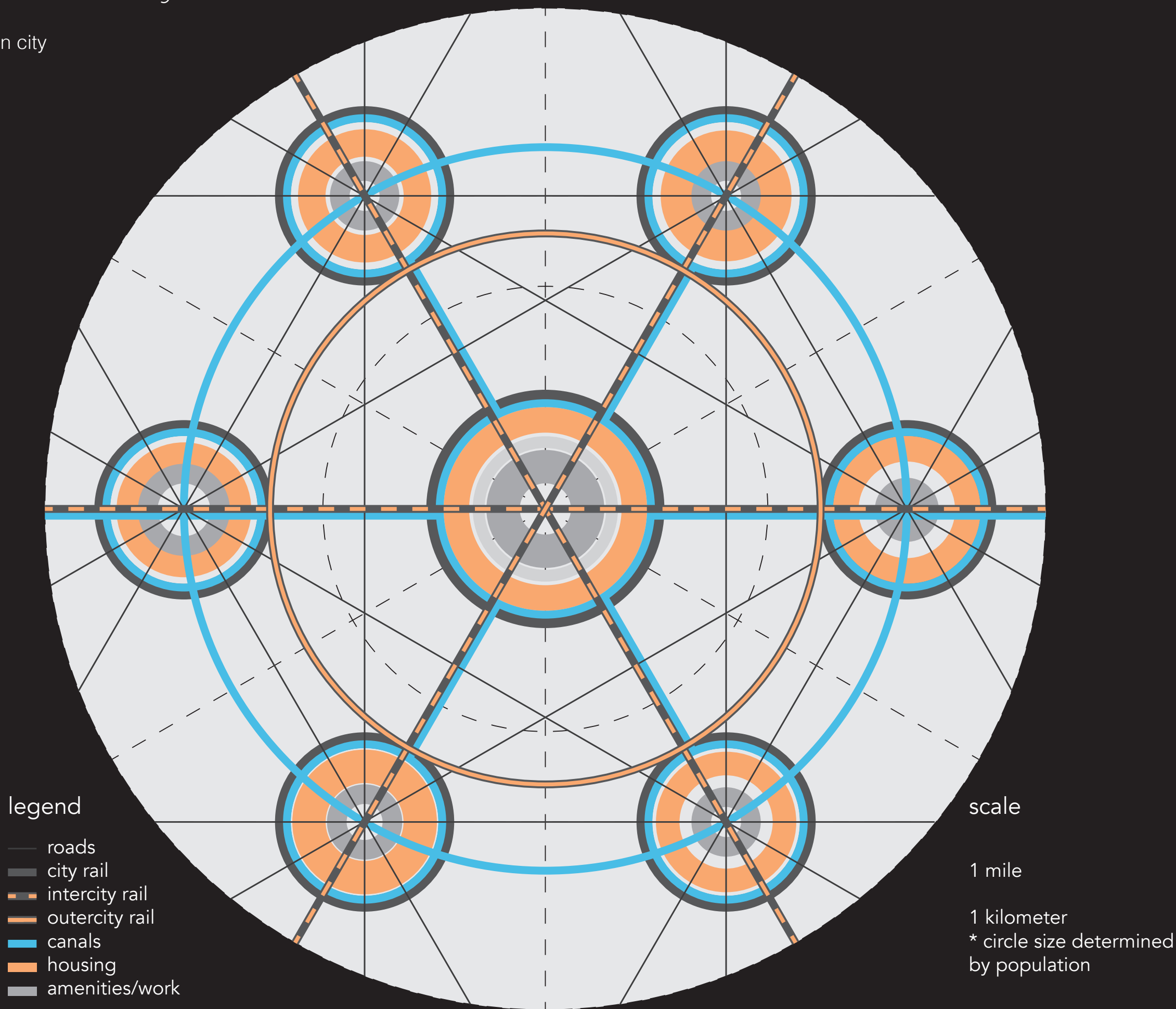


Limburg as part of the Meuse-Rhine Euroregion



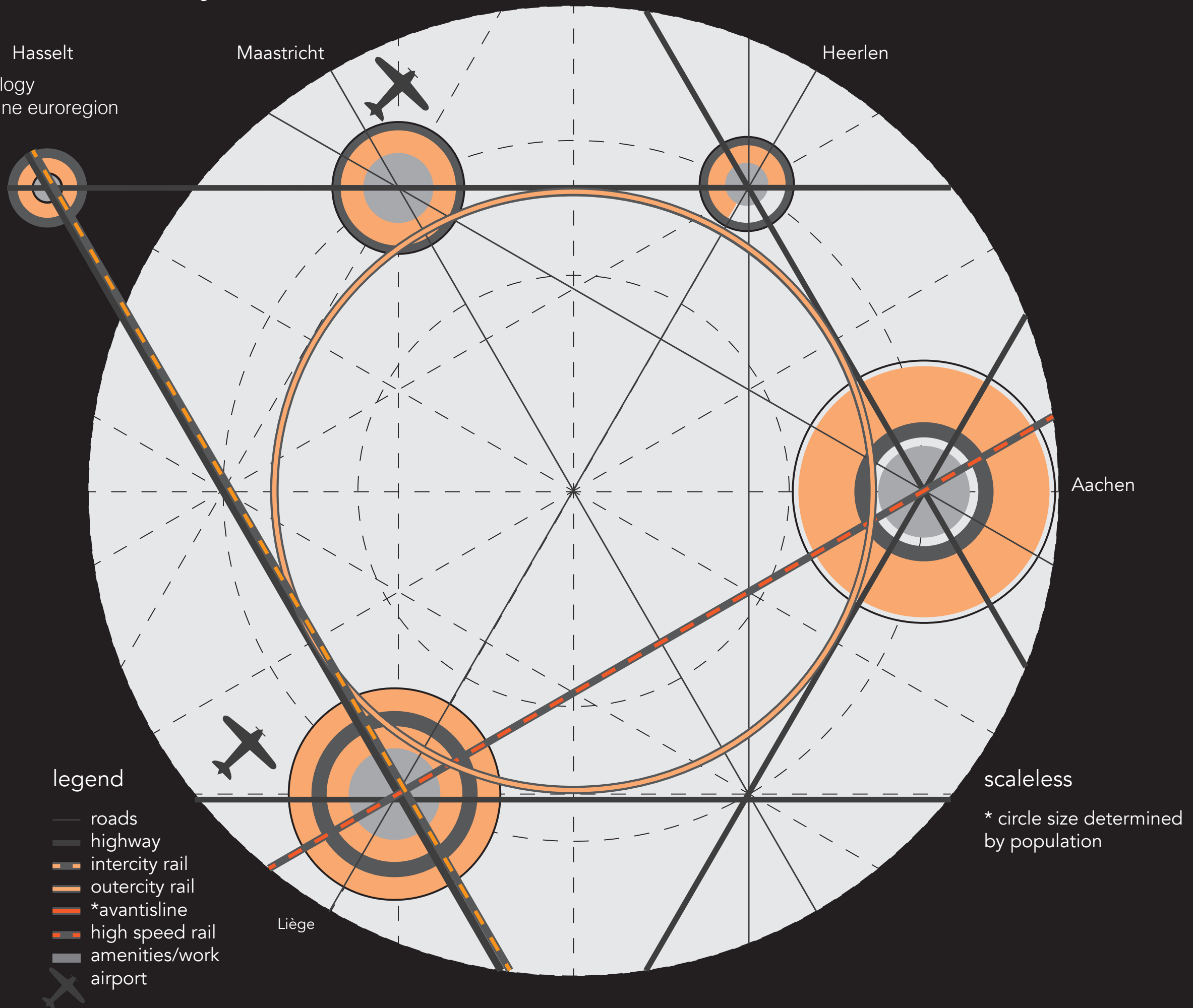
Limburg within the ELA triangle of innovation institutes





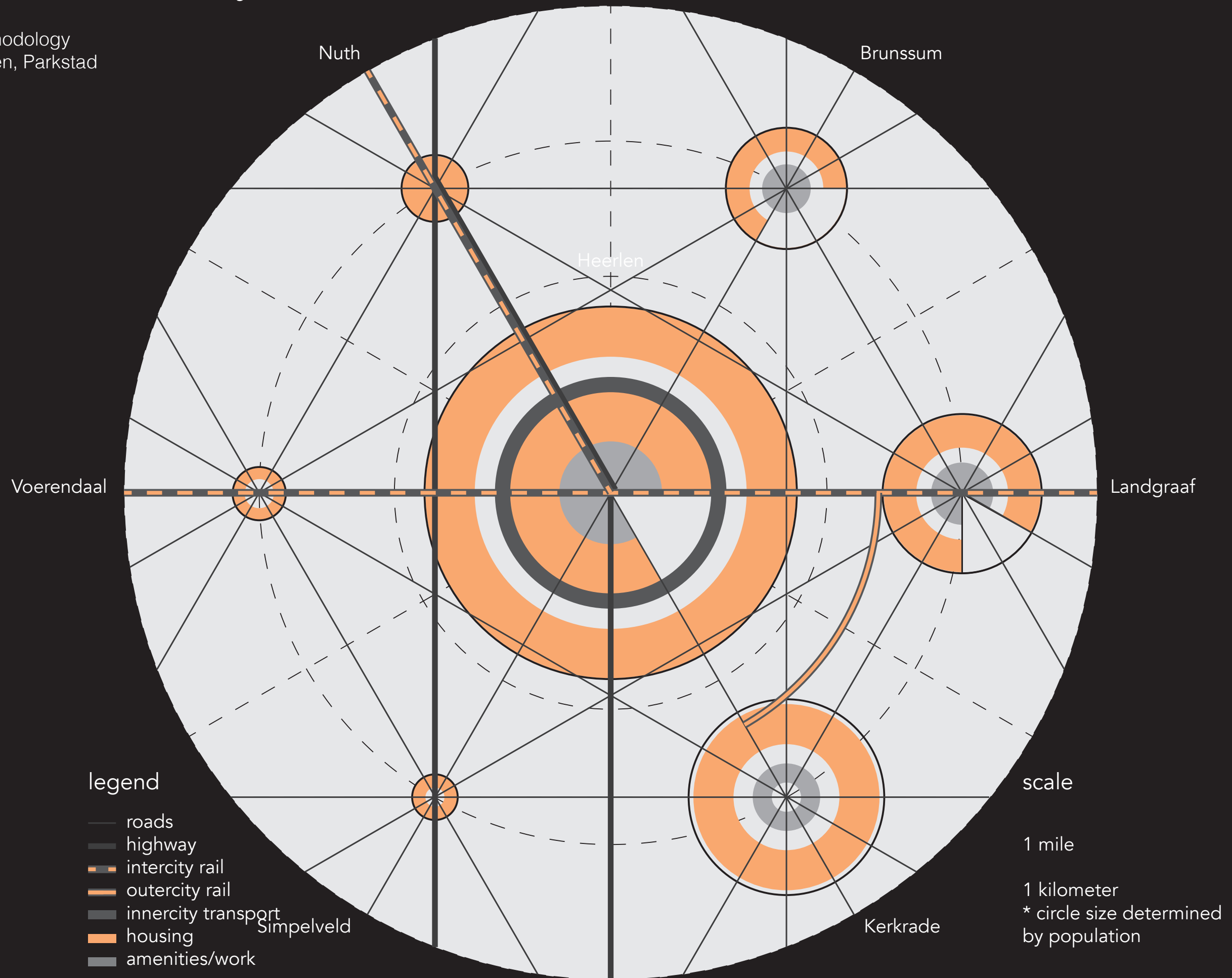
Research | Clear interrelated region

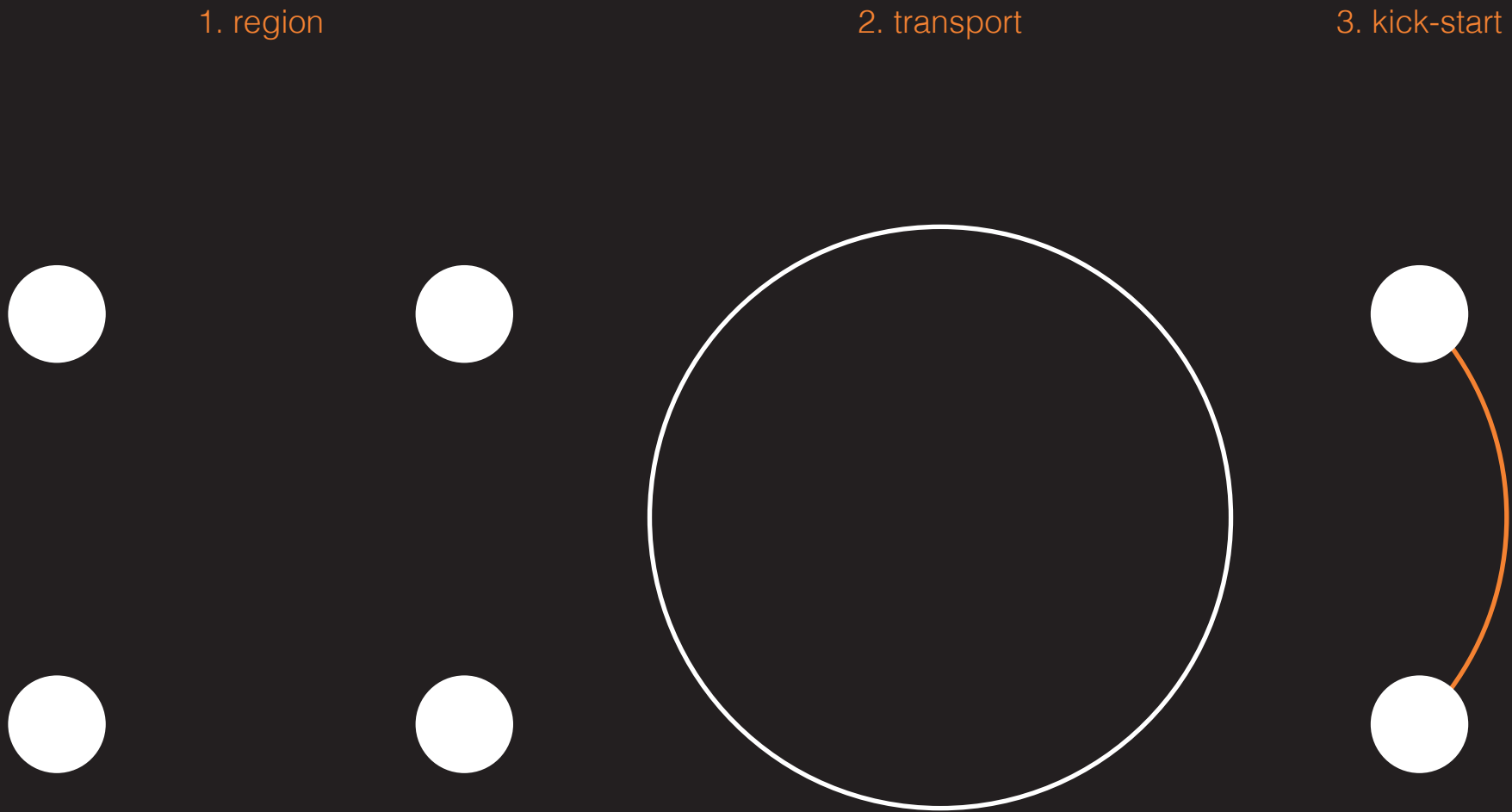
Garden city methodology
applied to Meuse-Rhine euroregion



Research | Clear interrelated region

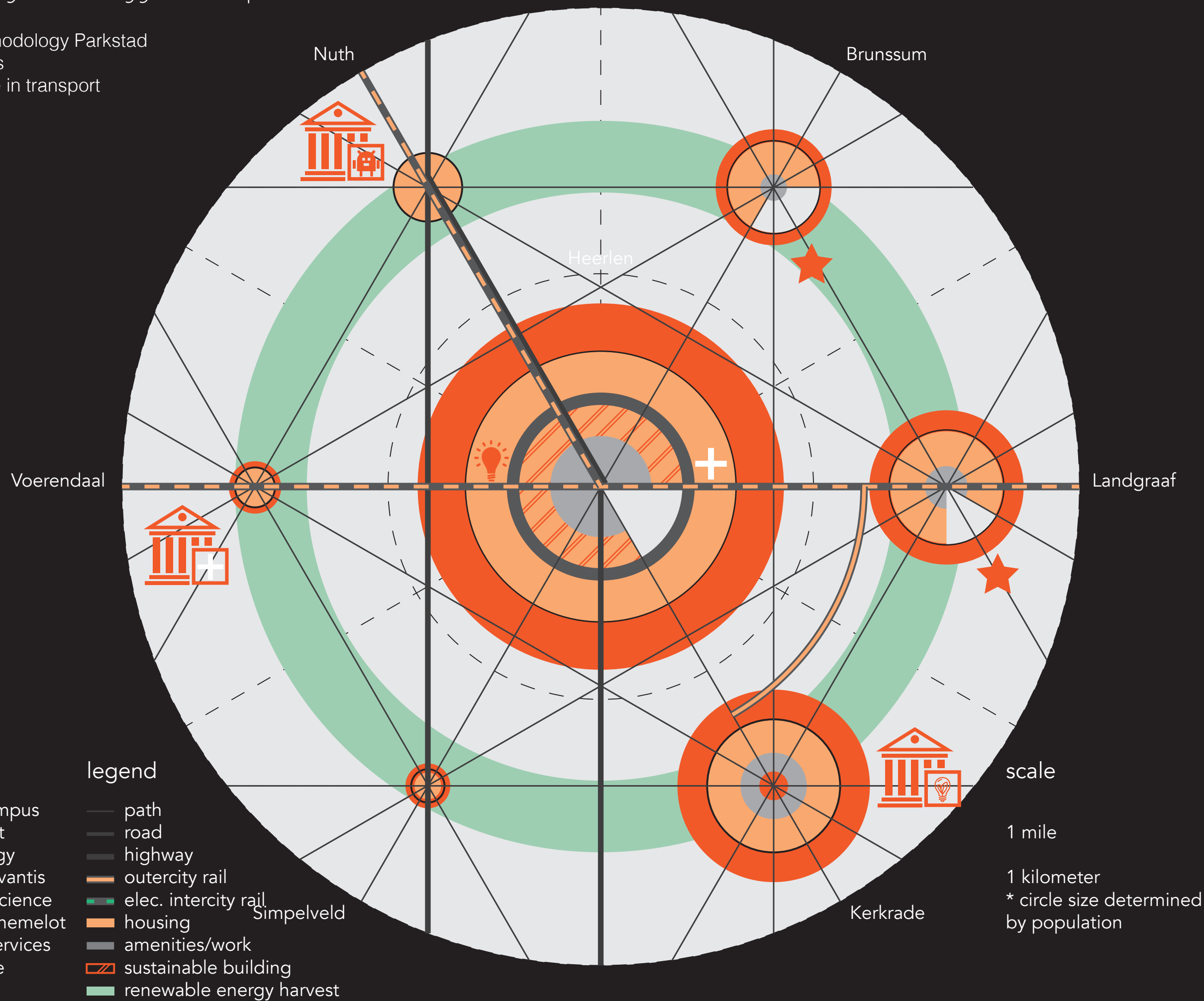
Garden city methodology
applied to Heerlen, Parkstad





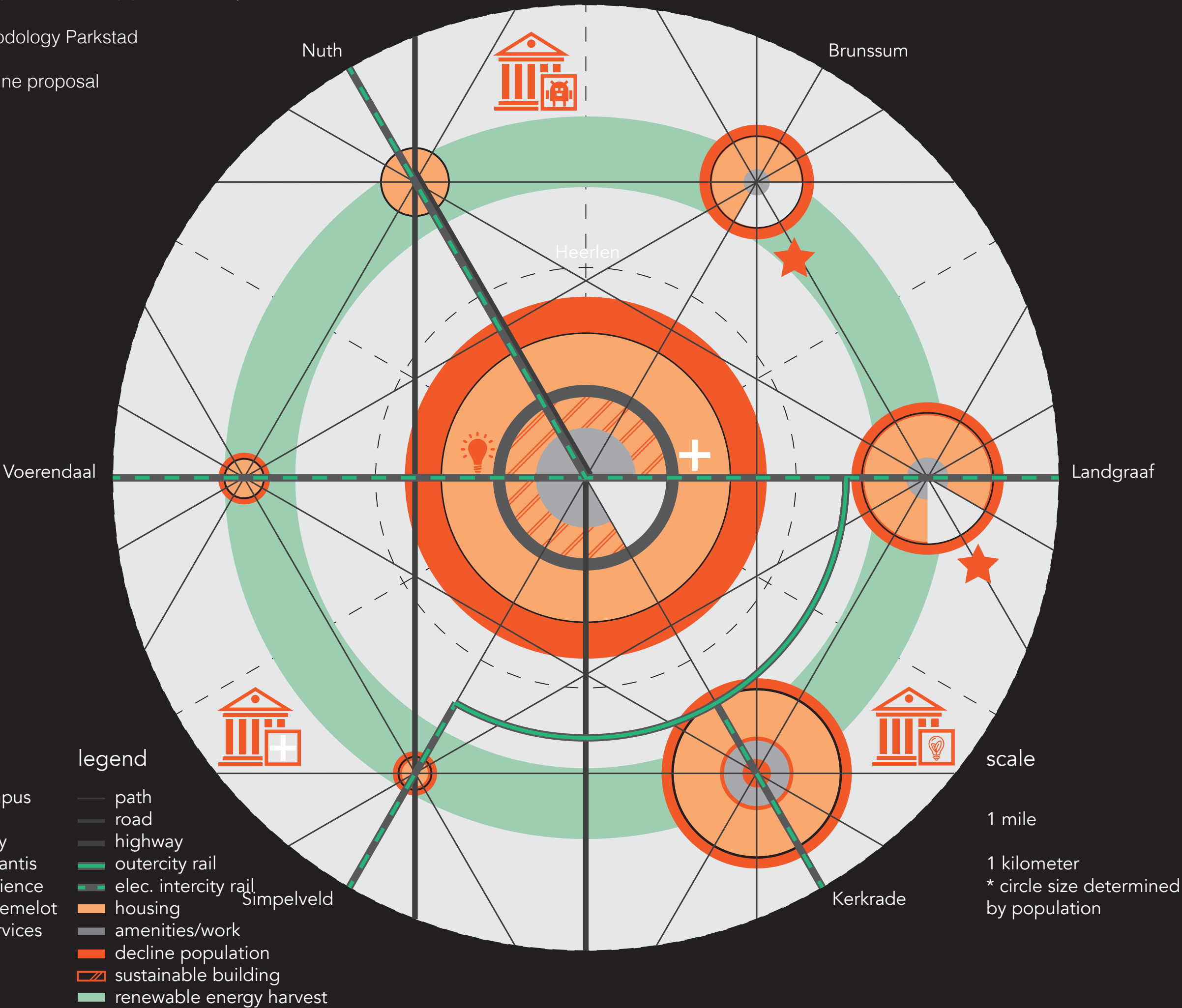
Research | Agile strategy in transport

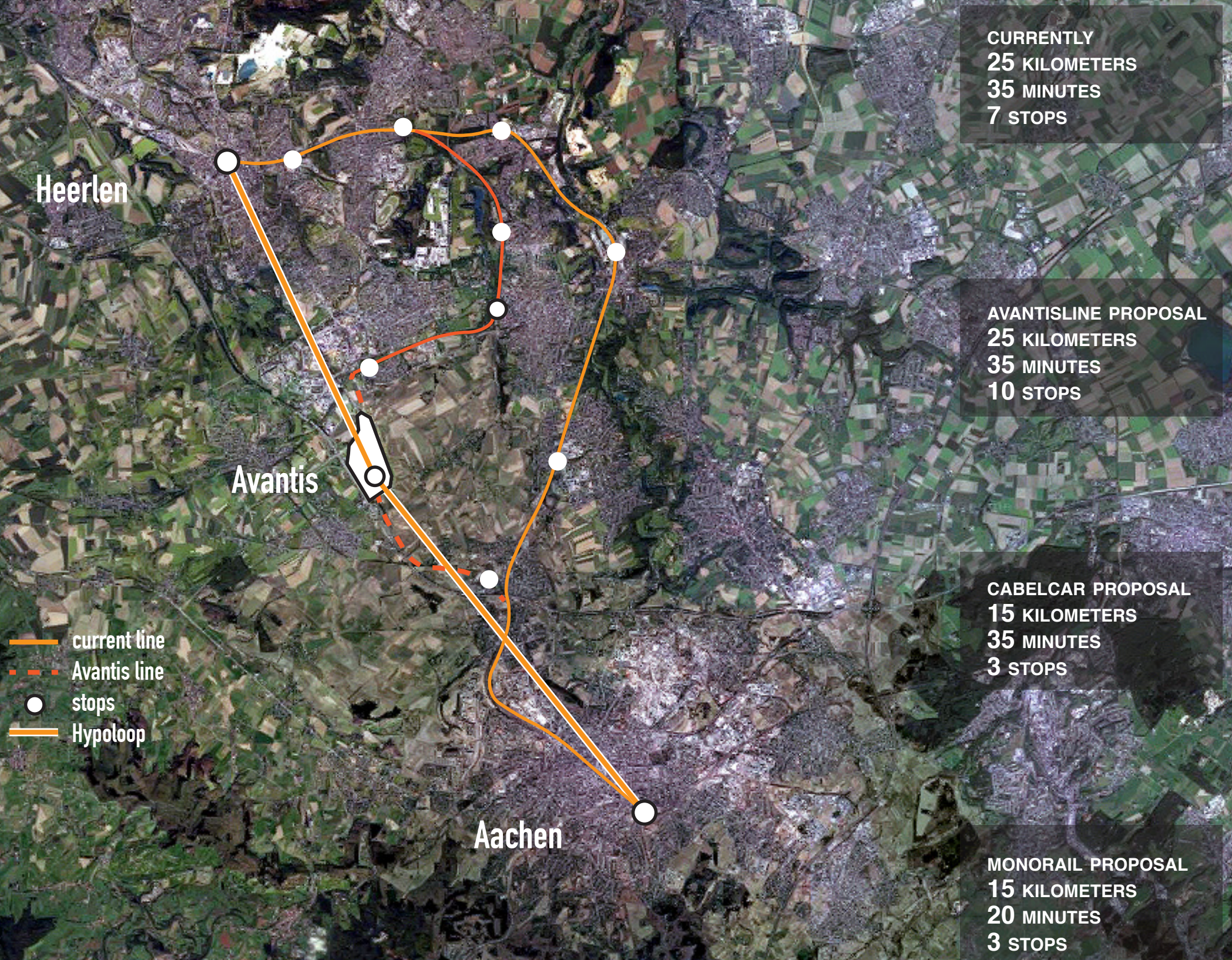
Garden city methodology Parkstad
including policies
without a change in transport



Research | Agile strategy in transport

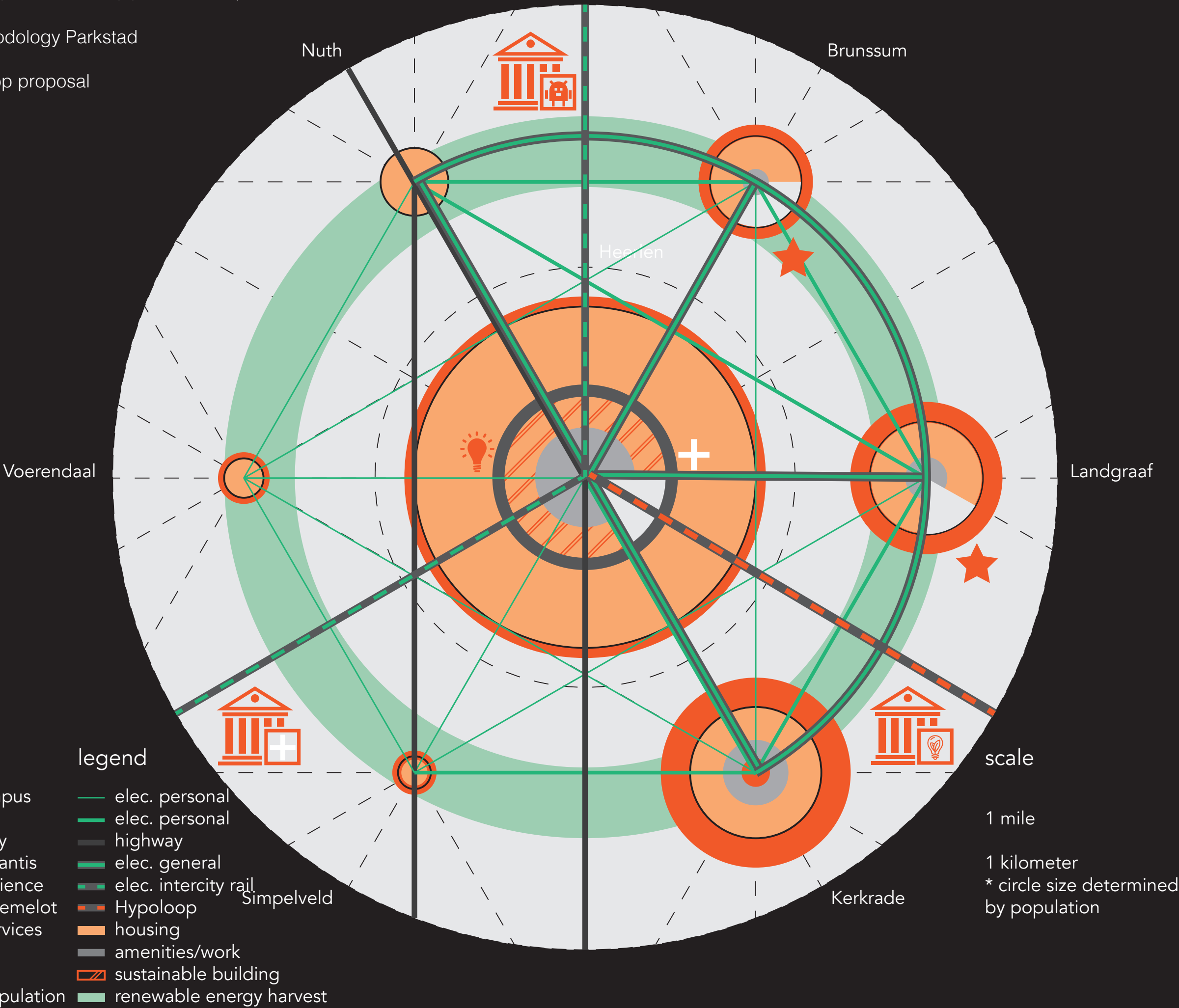
Garden city methodology Parkstad
including policies
including Avantisline proposal



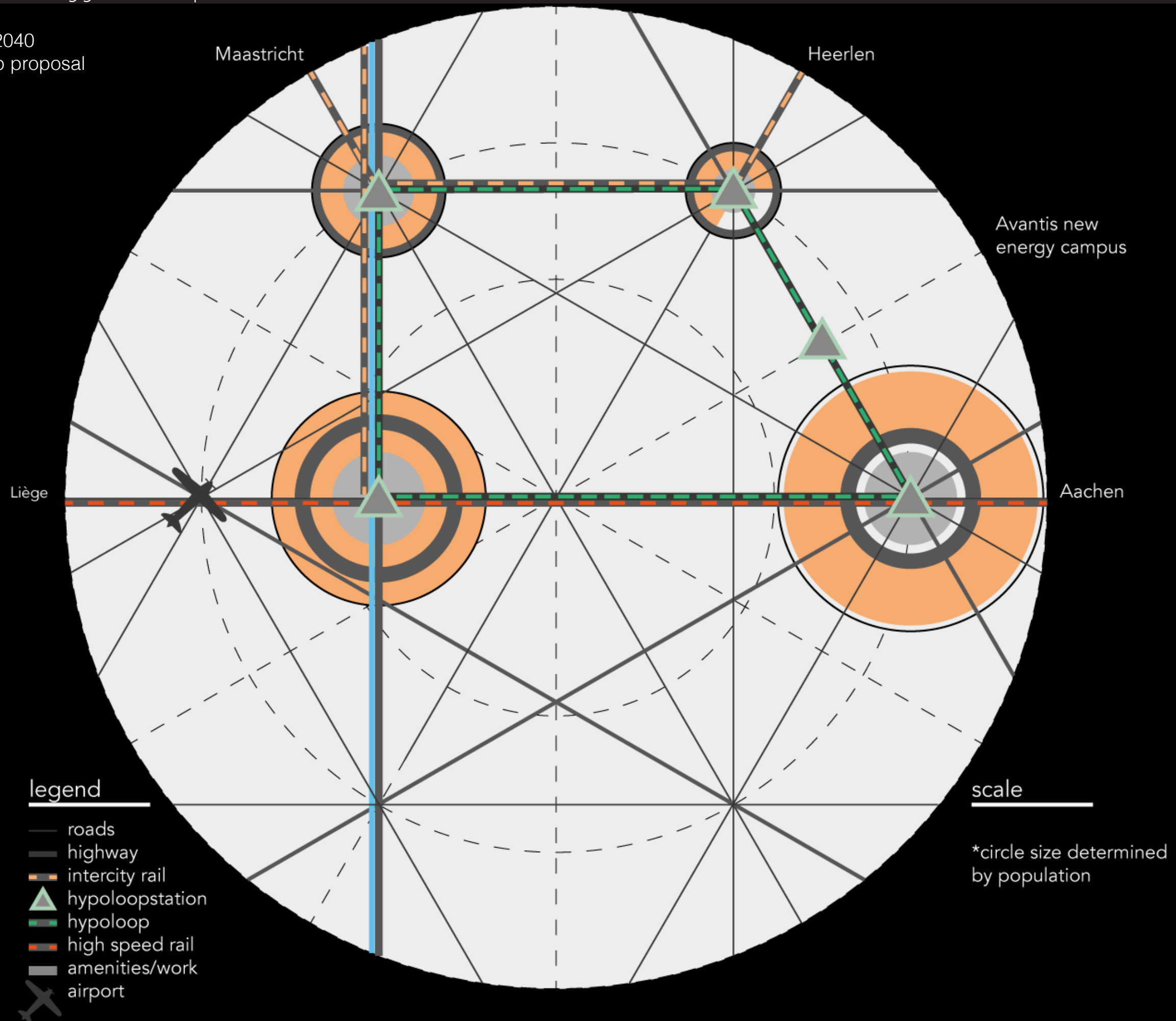


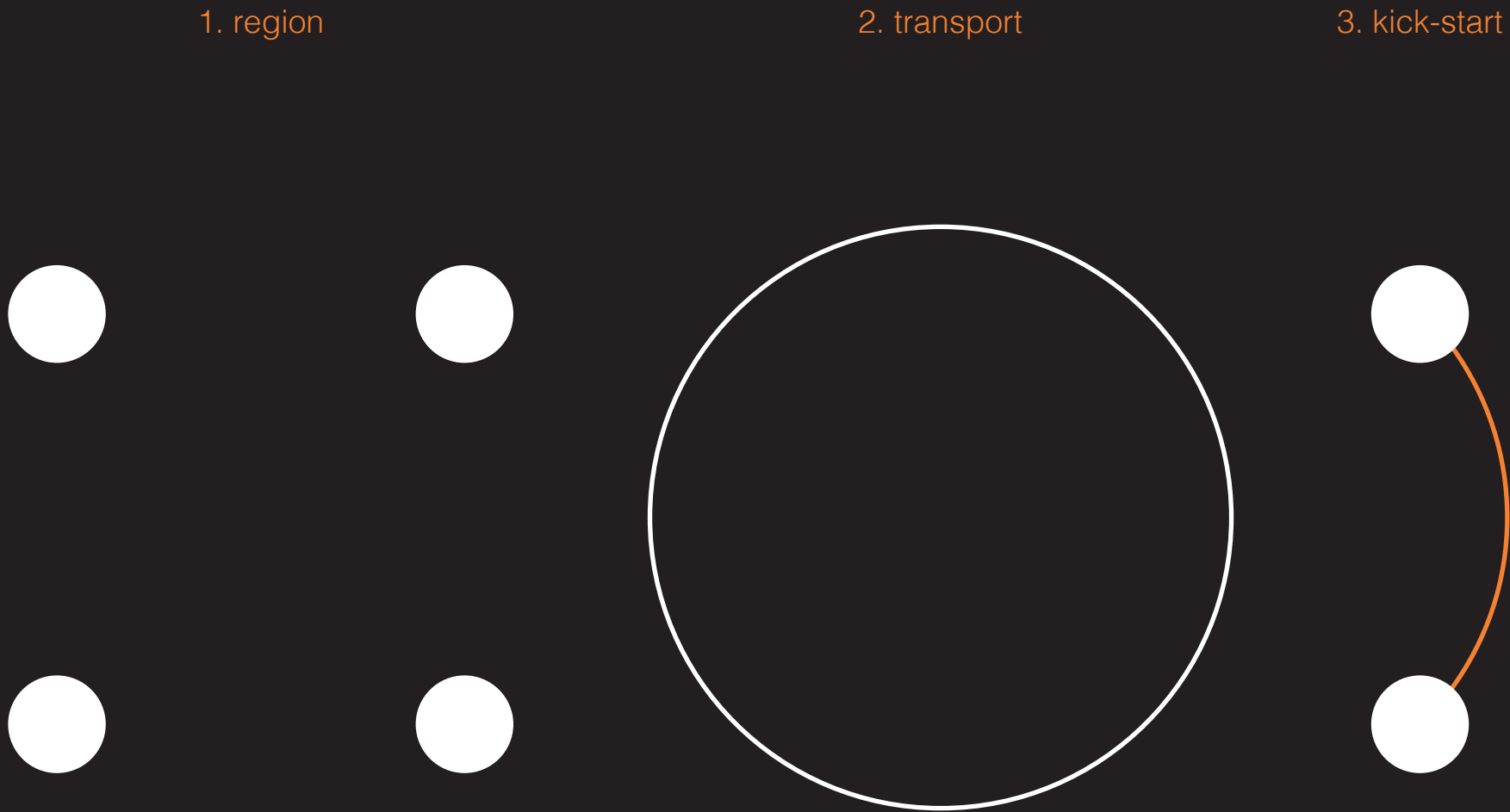
Research | Agile strategy in transport

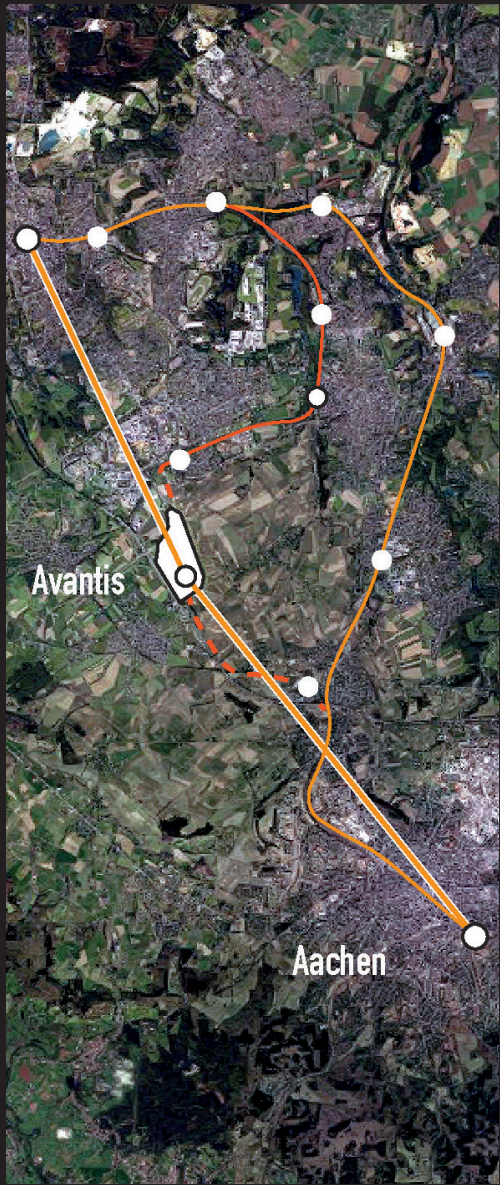
Garden city methodology Parkstad
including policies
including Hypoloop proposal



Meuse-Rhine region in 2040
after including Hypoloop proposal







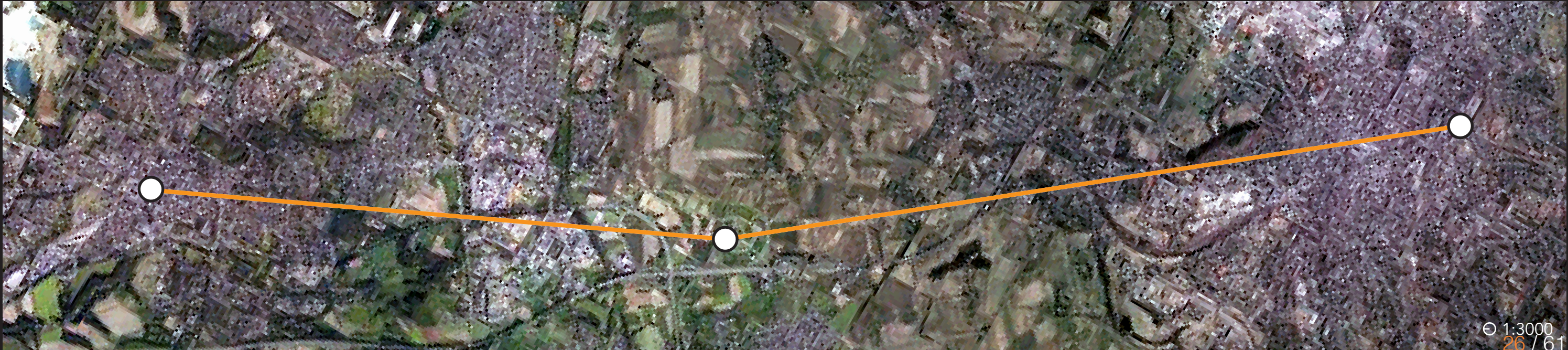
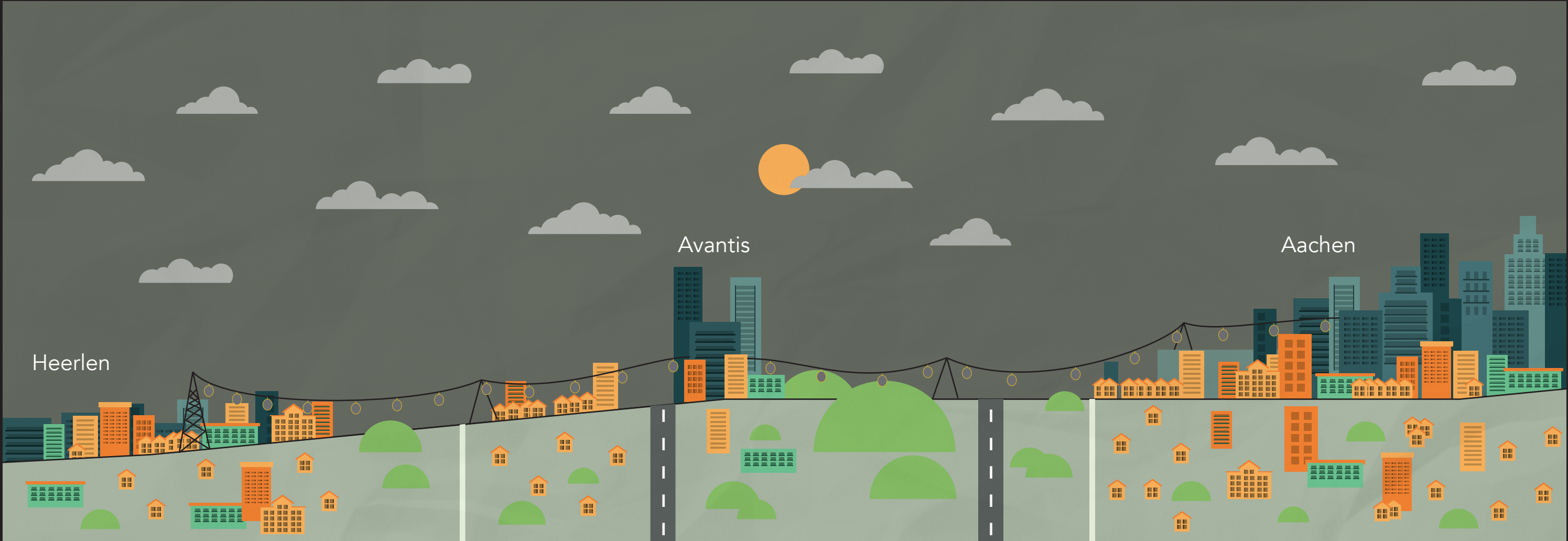
Heerlen - Aachen
key link



Avantis new energy campus
key economy

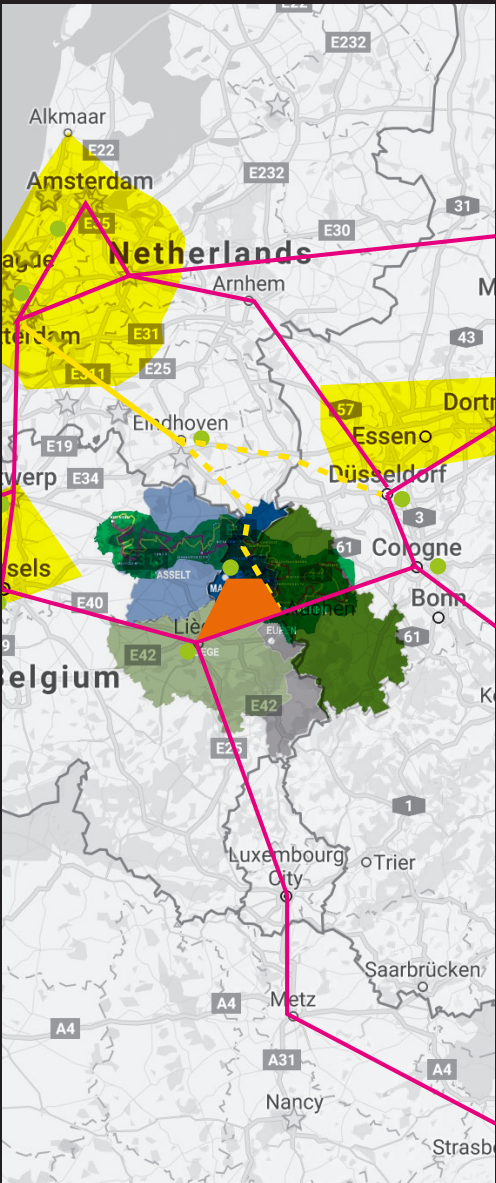


IBA Parkstad 2020
key event



Research | Design intervention

Envision Parkstad following the choices for a clear interrelated region, an agile strategy in transport and a way to kick-start progress. Design a Hypoloop station for a restrategised Avantis new energy campus that can also be used with a contemporary mode of transport.



Region



Transport

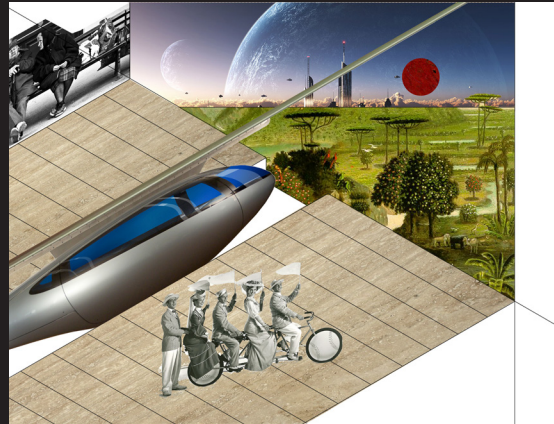


Kick-start

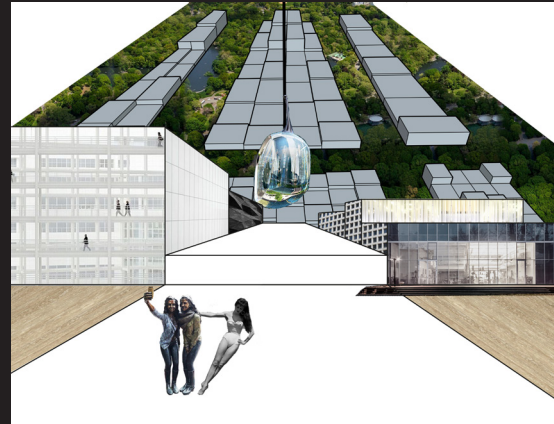




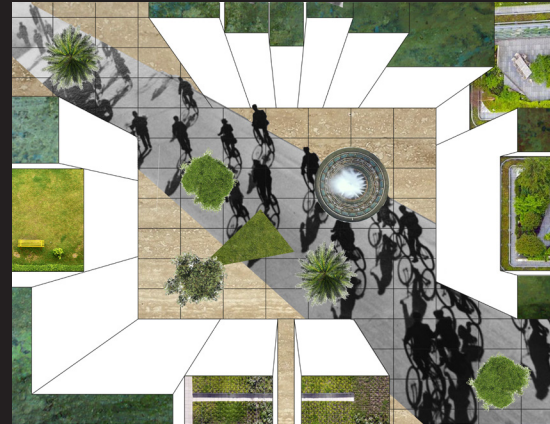




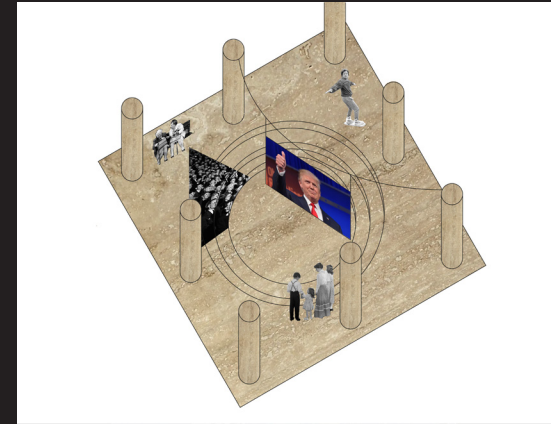
1. Reception



2. Strip



3. Central area



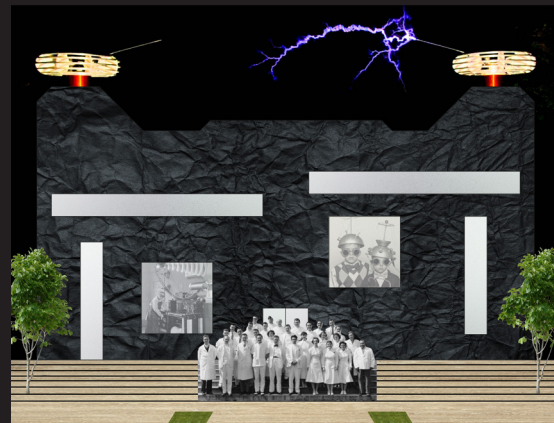
4. Ceremonial square



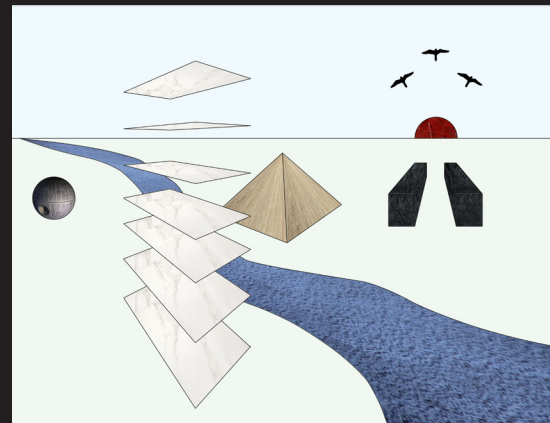
5. Baths



6. Square of arts



7. Institute of energy



8. Garden of elements



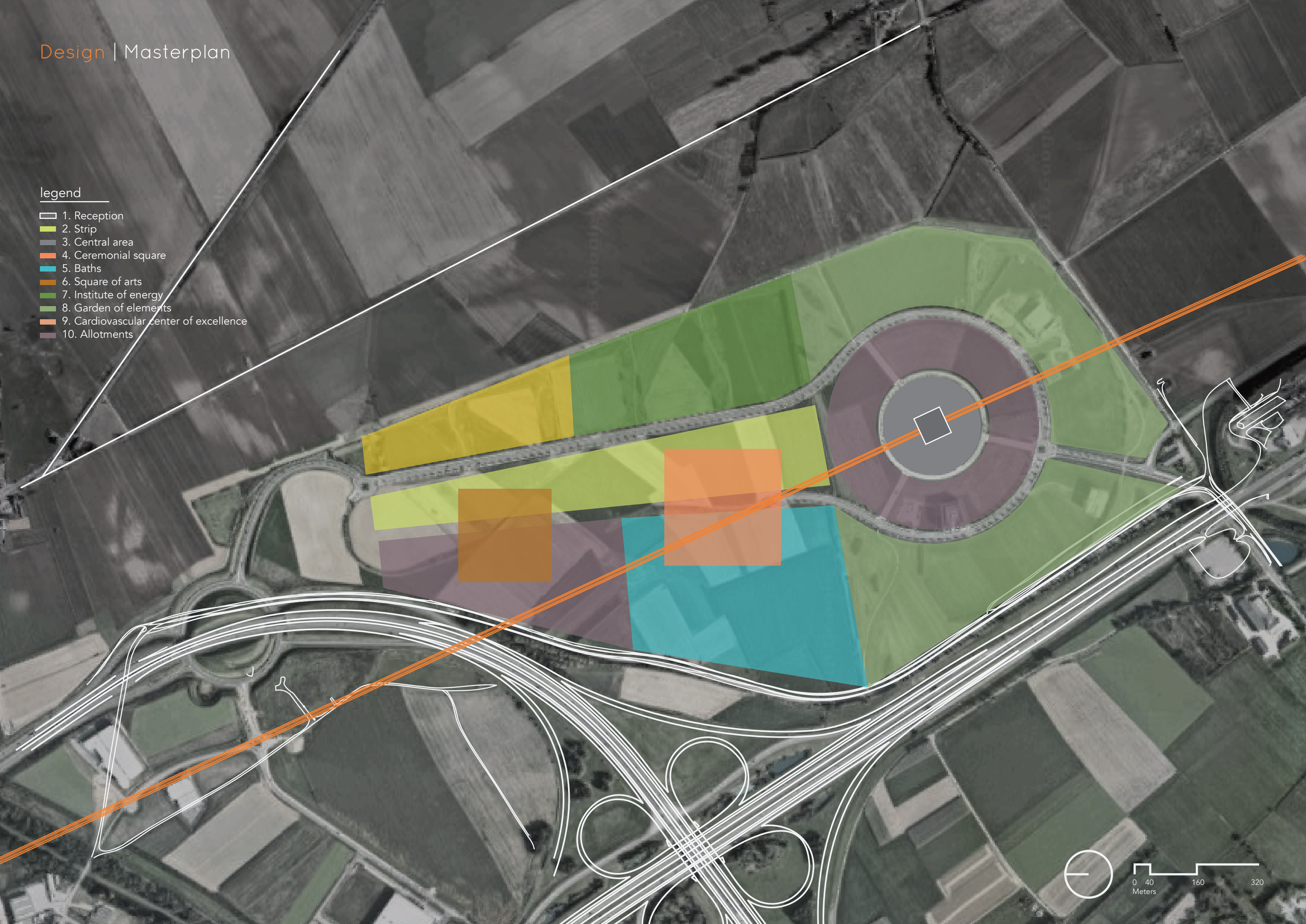
9. Cardiovascular center of excellence

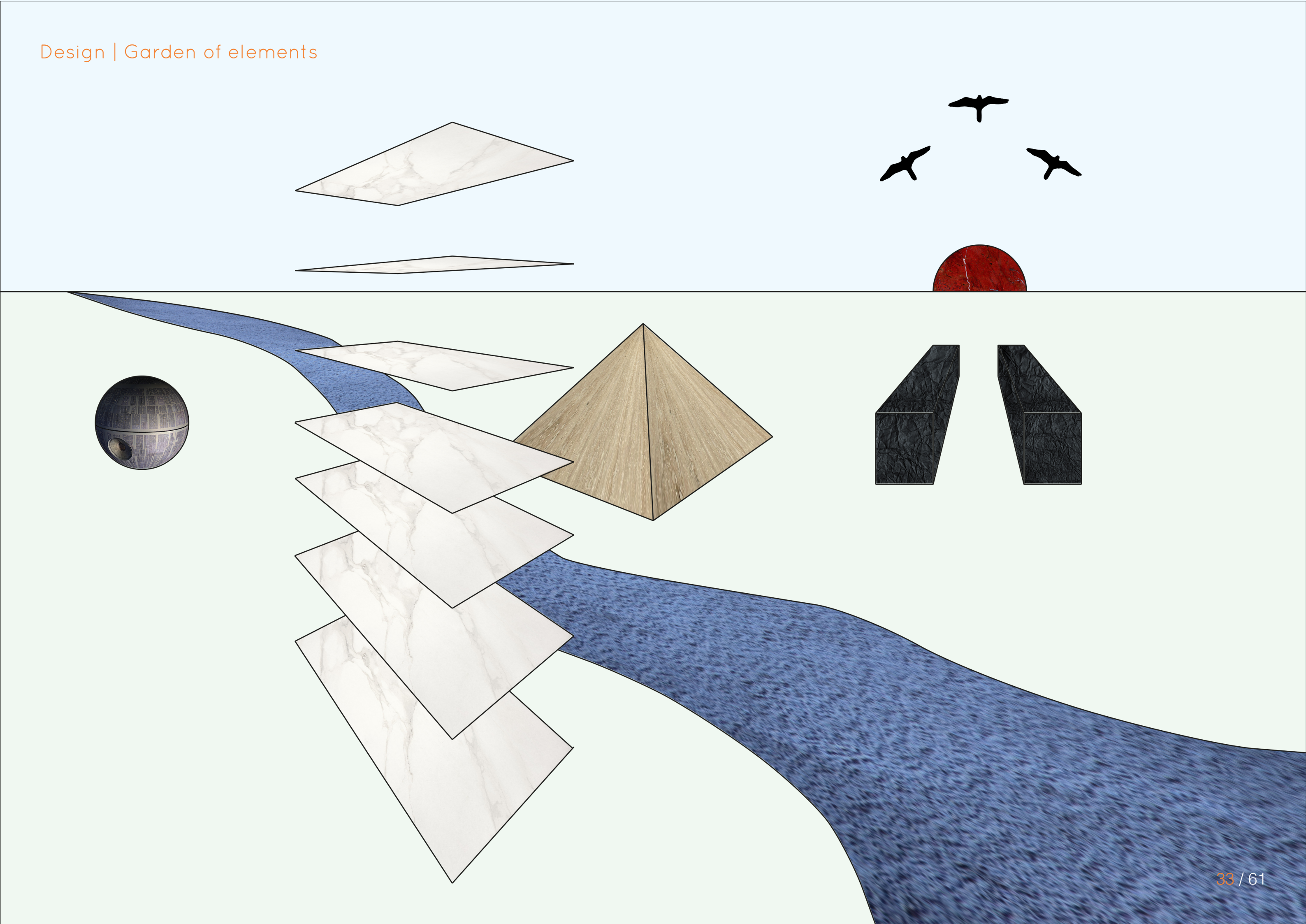


10. Allotments

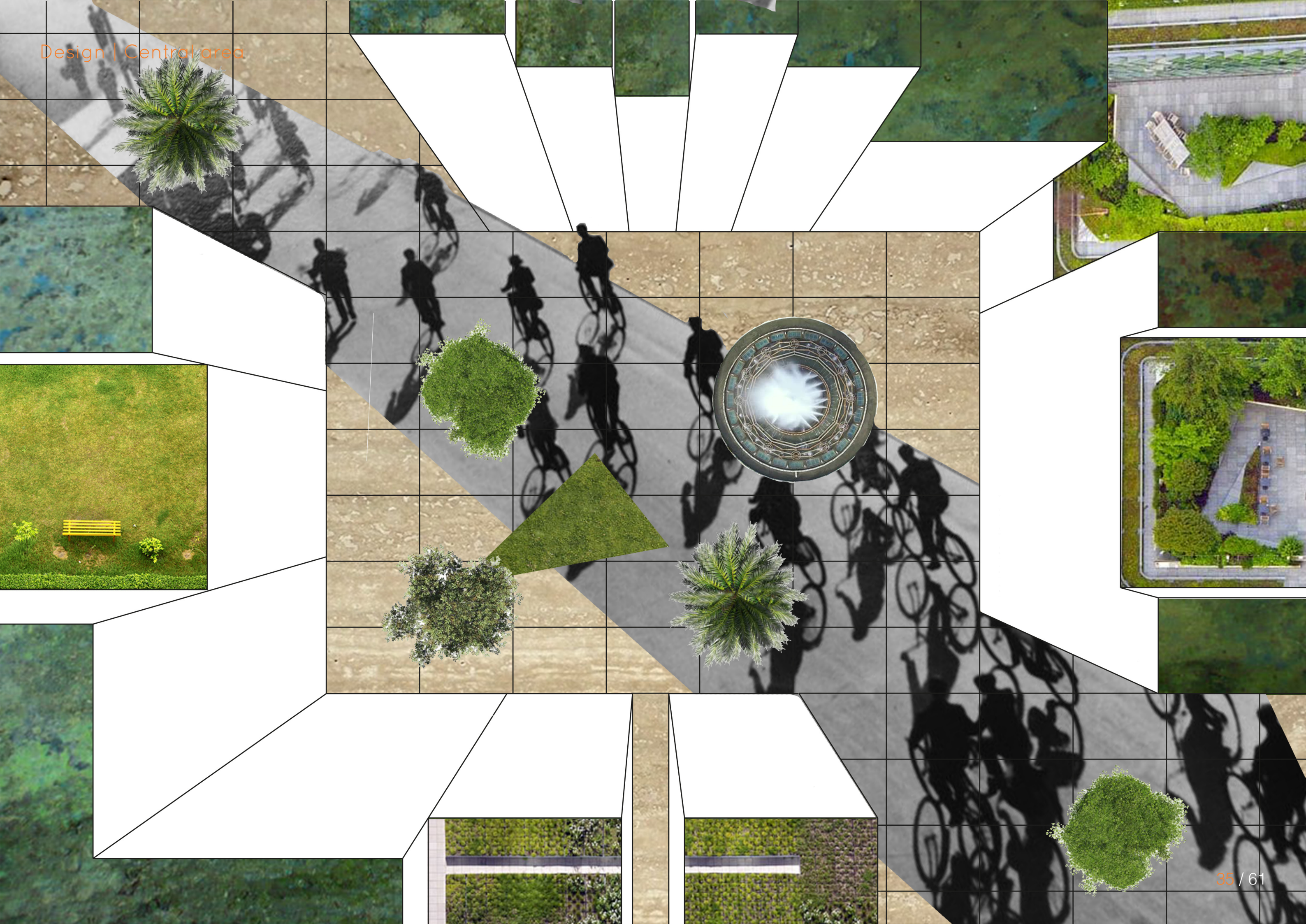
legend

- 1. Reception
- 2. Strip
- 3. Central area
- 4. Ceremonial square
- 5. Baths
- 6. Square of arts
- 7. Institute of energy
- 8. Garden of elements
- 9. Cardiovascular center of excellence
- 10. Allotments

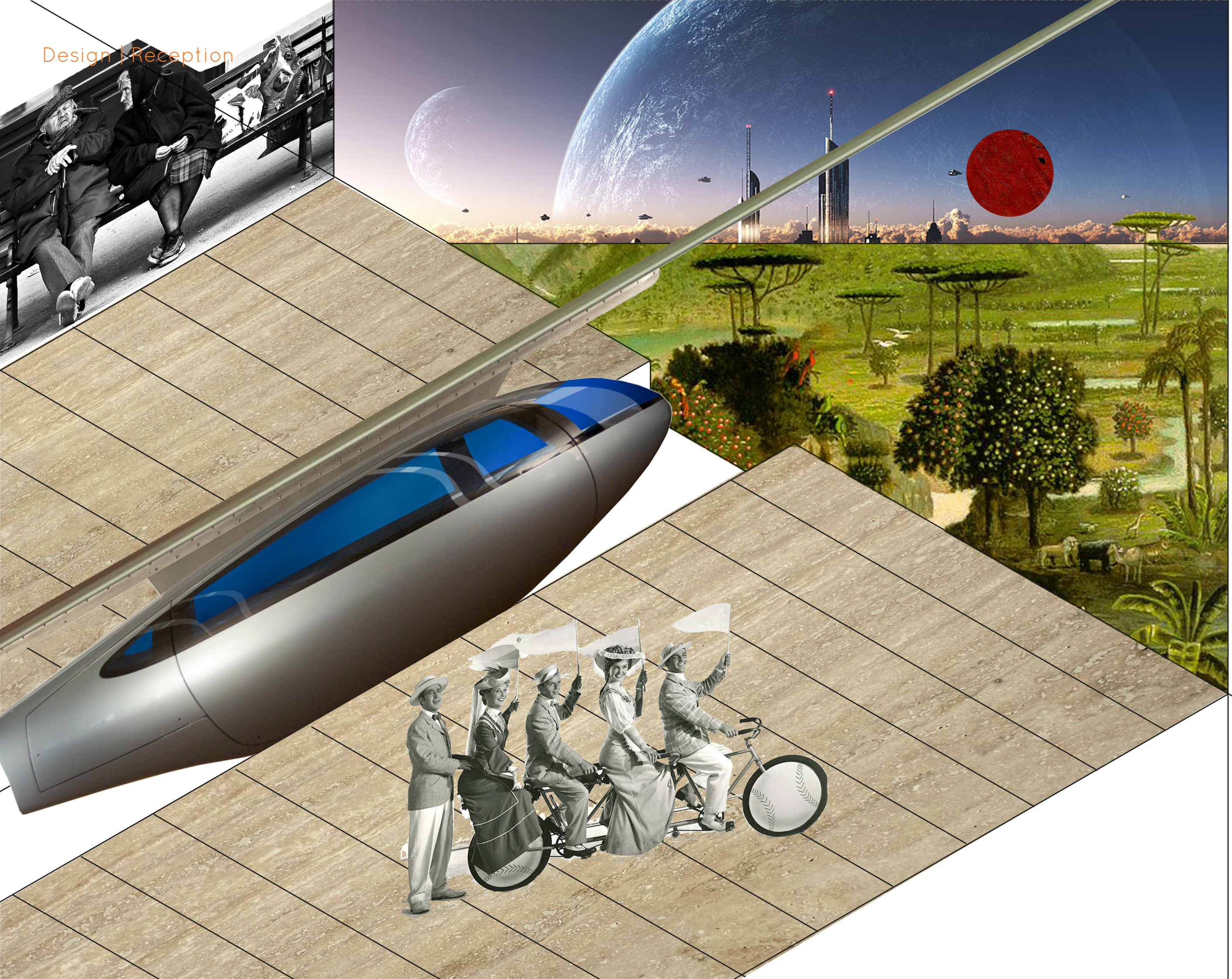




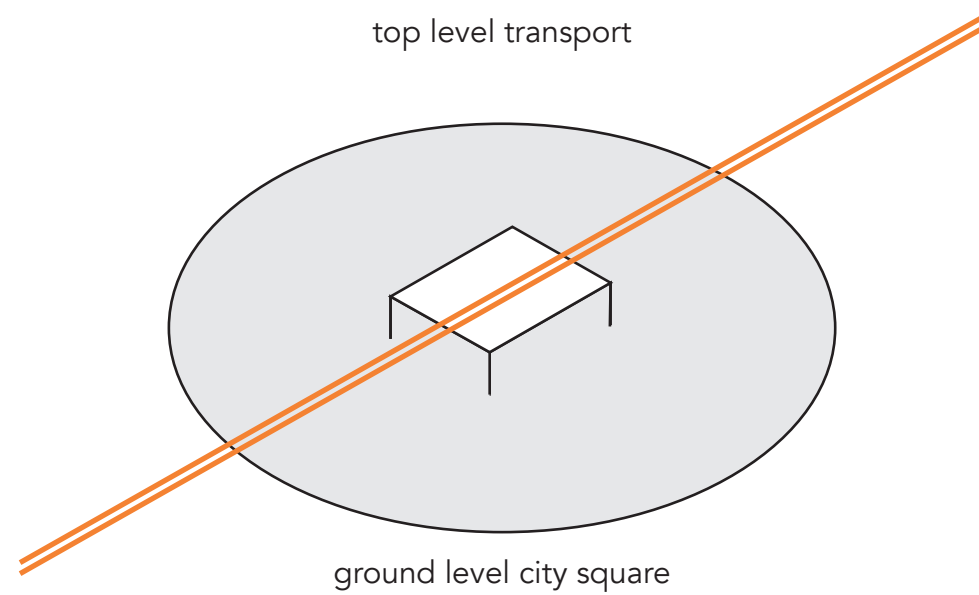




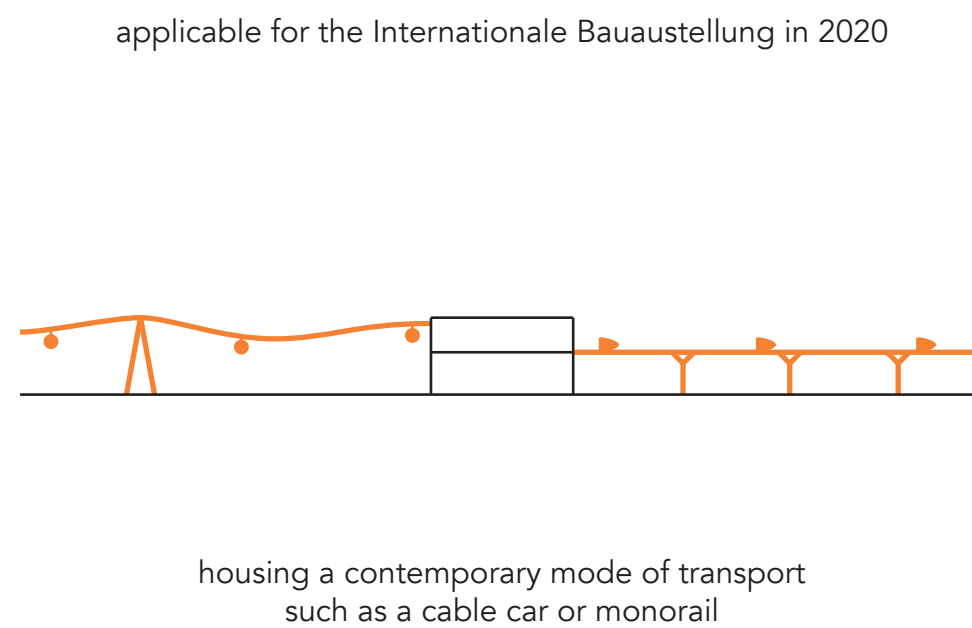
Design | Reception



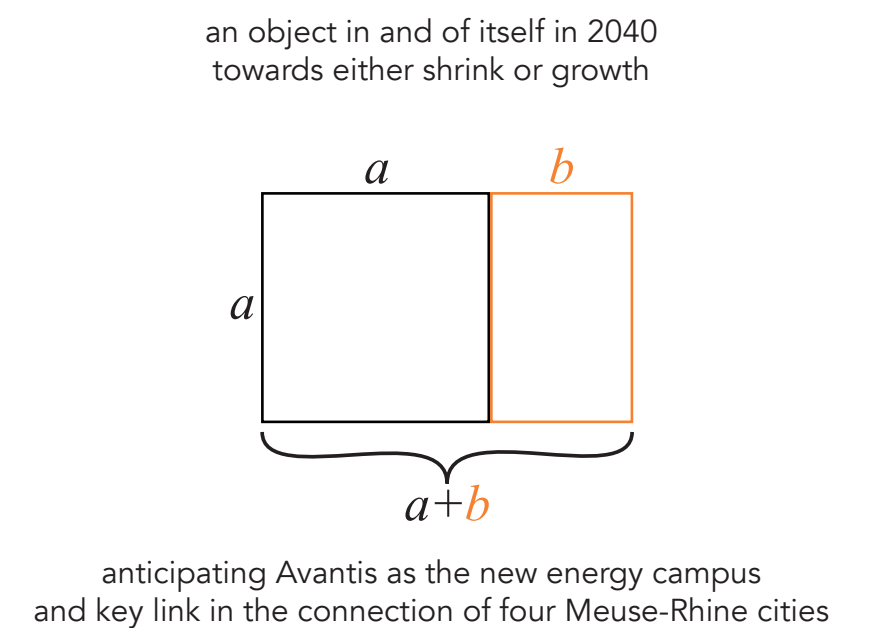
1. INTERWOVEN PROGRAM



2. SPECIFIC



3. GENERIC

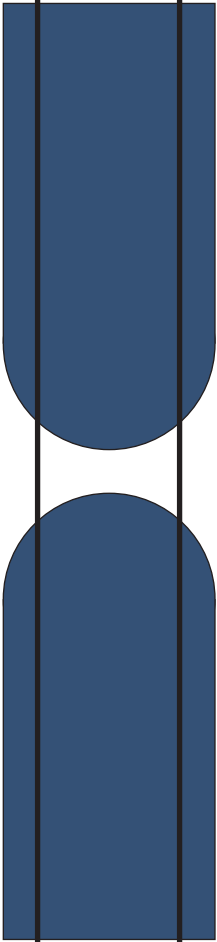
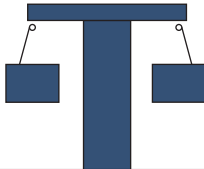


1. Transport lines

◦ ◦

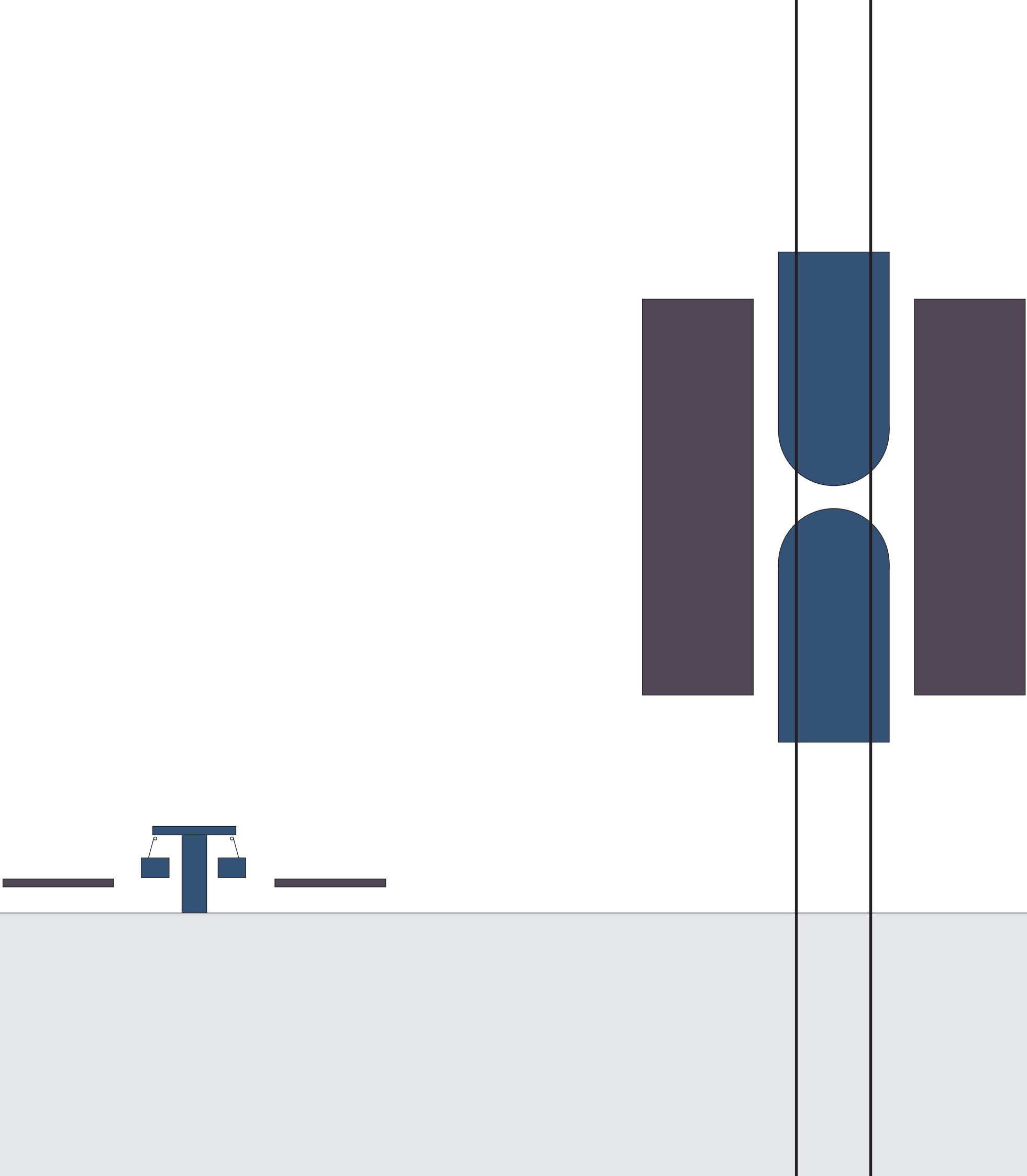
Design | Station

- 1. Transport lines
- 2. Stations



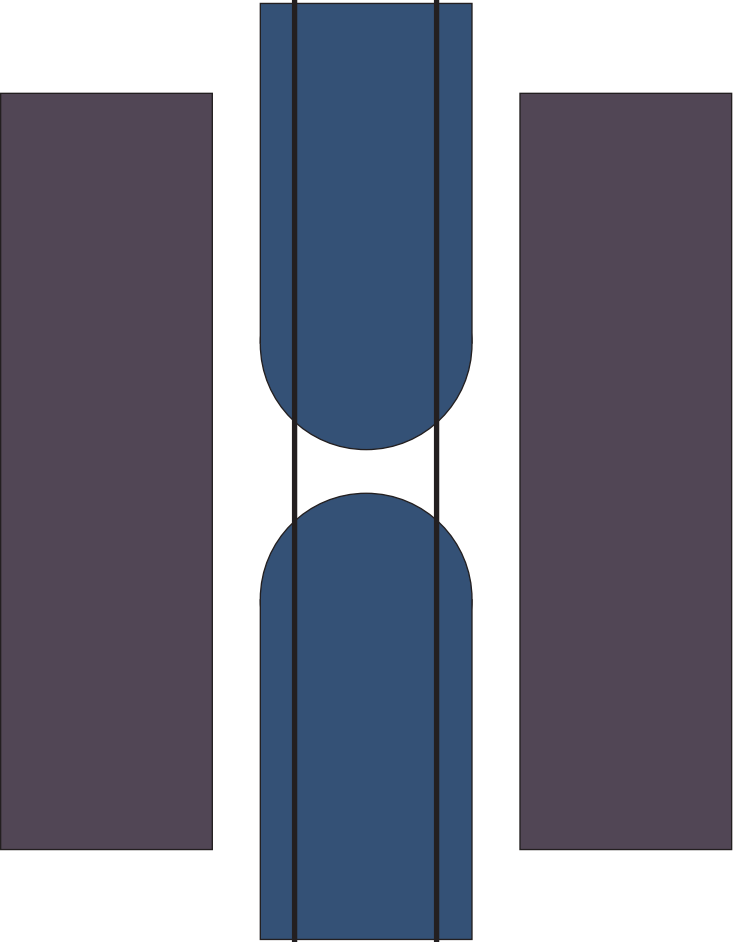
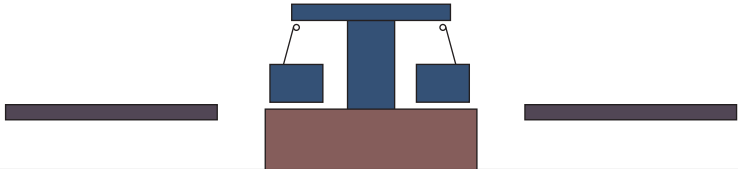
Design | Station

- 1. Transport lines
- 2. Stations
- 3. Platforms



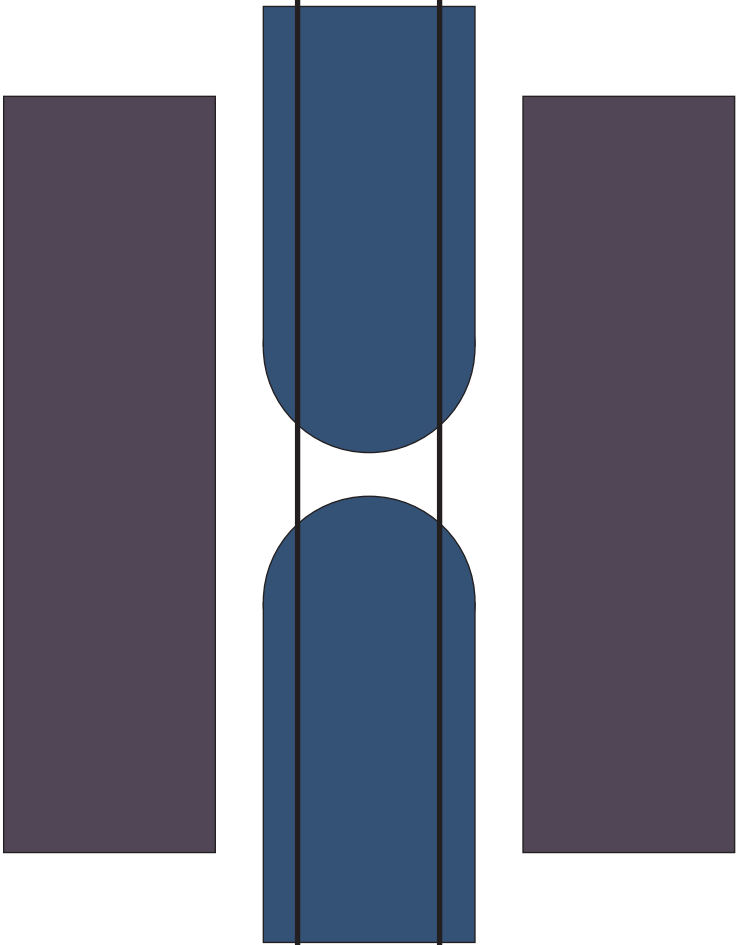
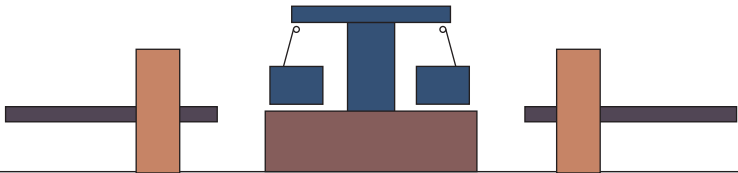
Design | Station

- 1. Transport lines
- 2. Stations
- 3. Platforms
- 4. Transport necessities



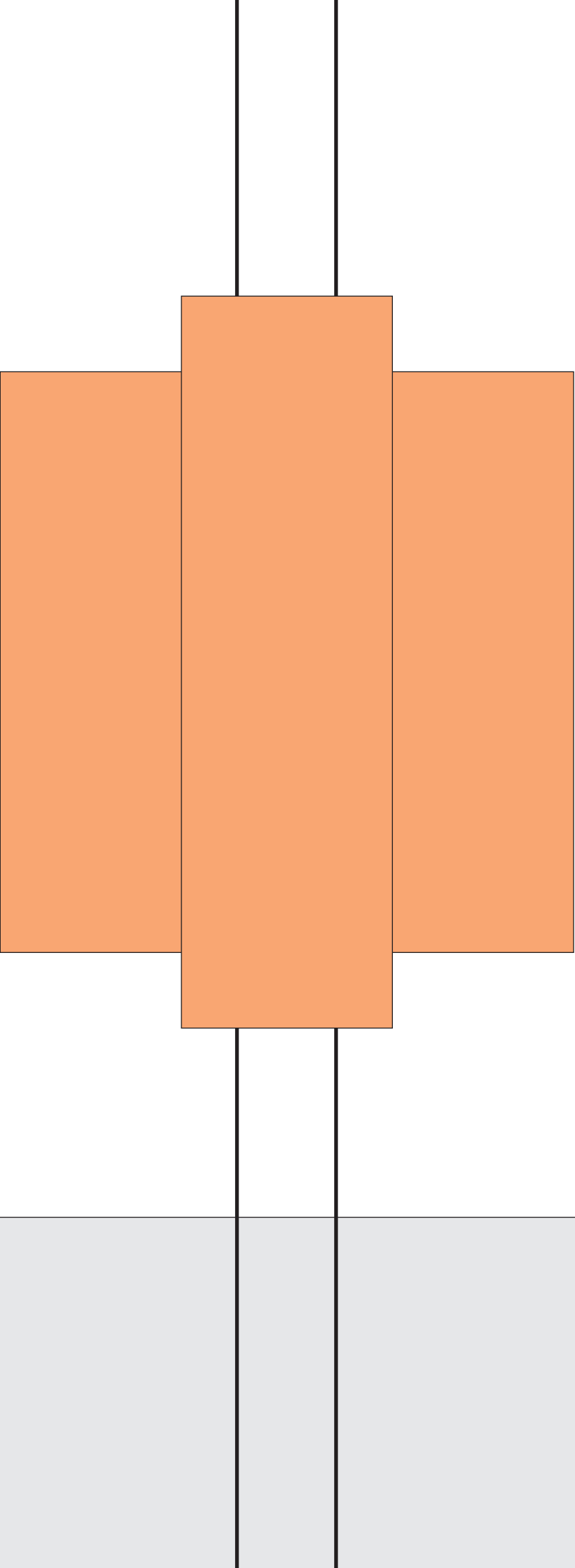
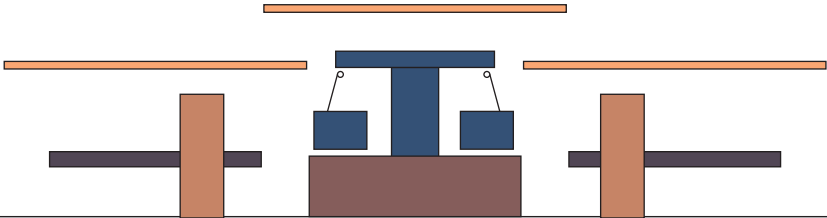
Design | Station

- 1. Transport lines
- 2. Stations
- 3. Platforms
- 4. Transport necessities
- 5. Vertical movement



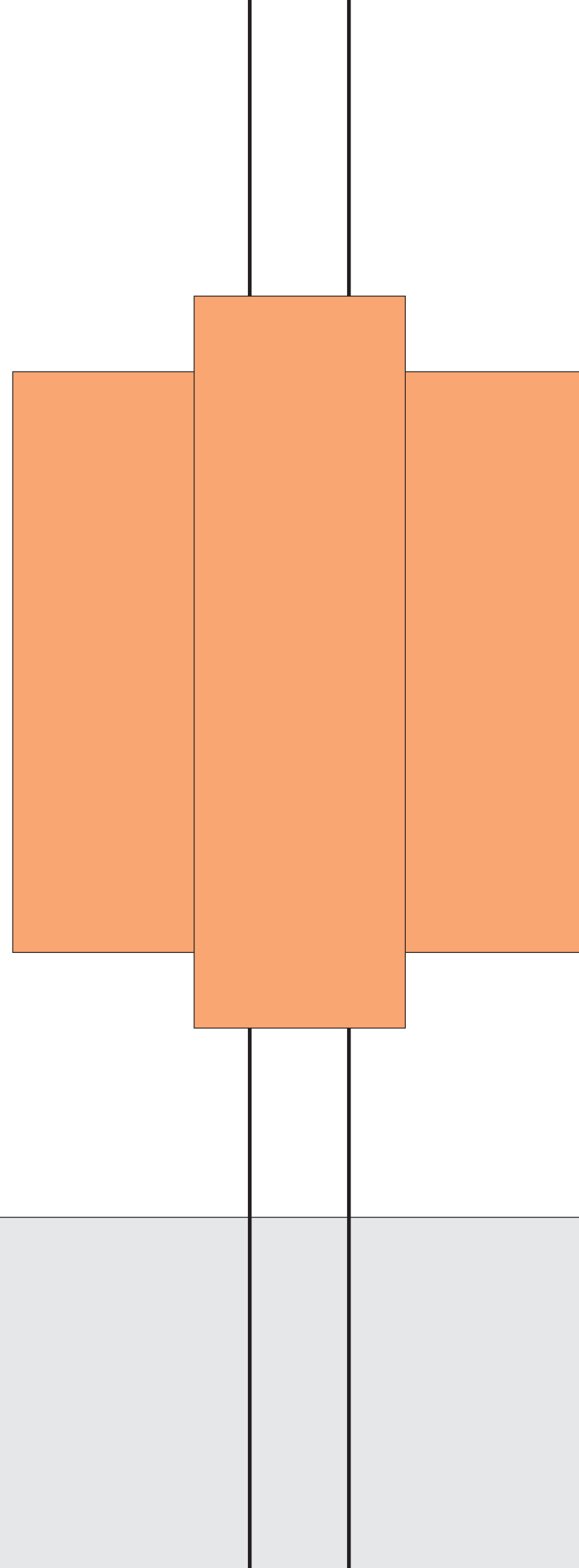
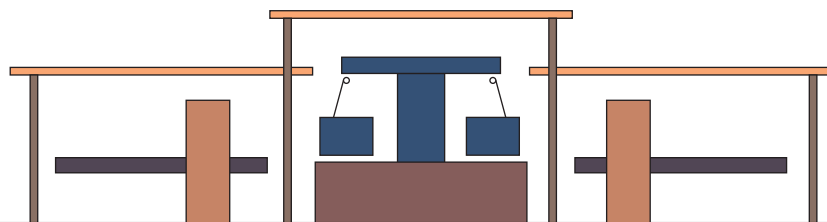
Design | Station

- 1. Transport lines
- 2. Stations
- 3. Platforms
- 4. Transport necessities
- 5. Vertical movement
- 6. Roof



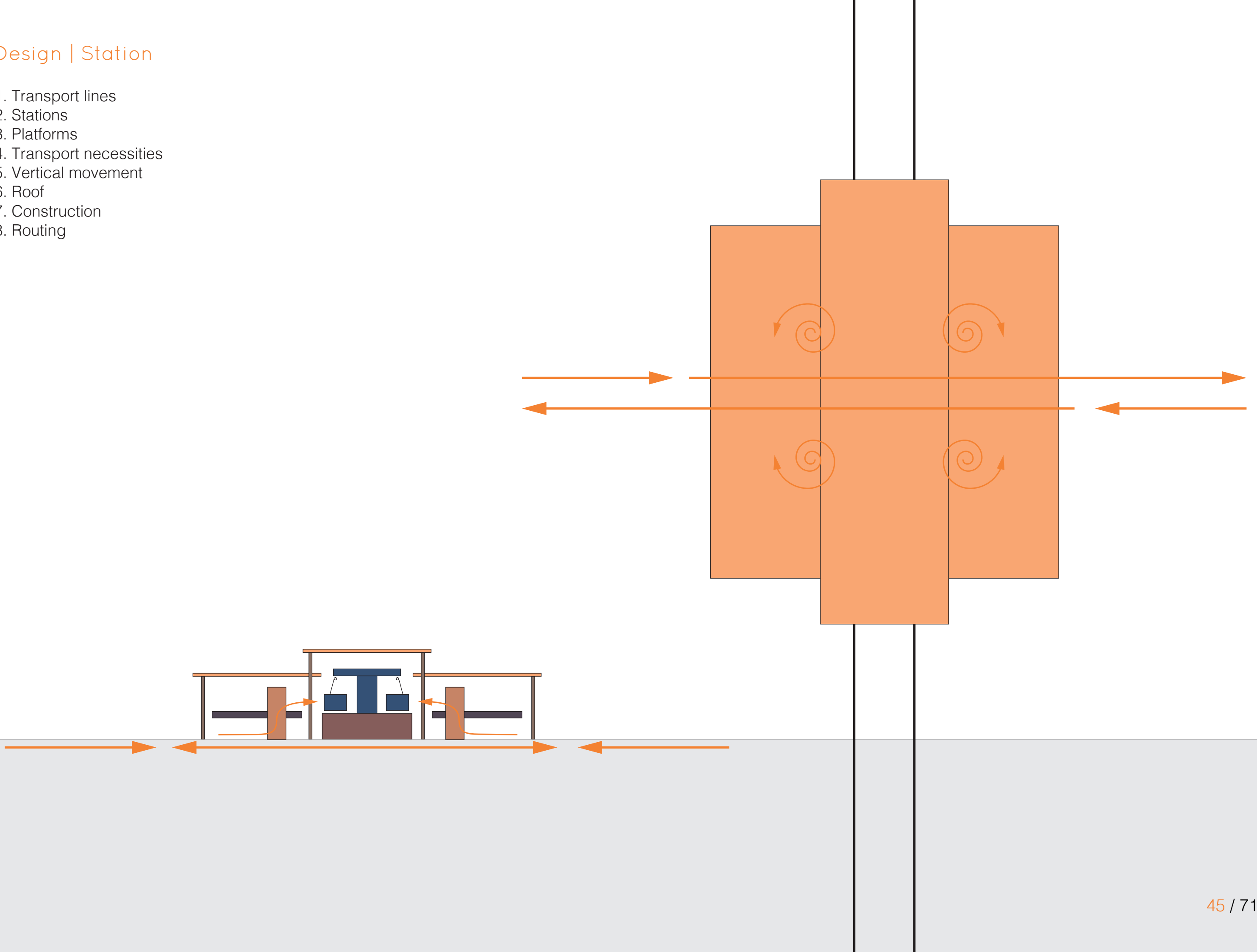
Design | Station

1. Transport lines
2. Stations
3. Platforms
4. Transport necessities
5. Vertical movement
6. Roof
7. Construction



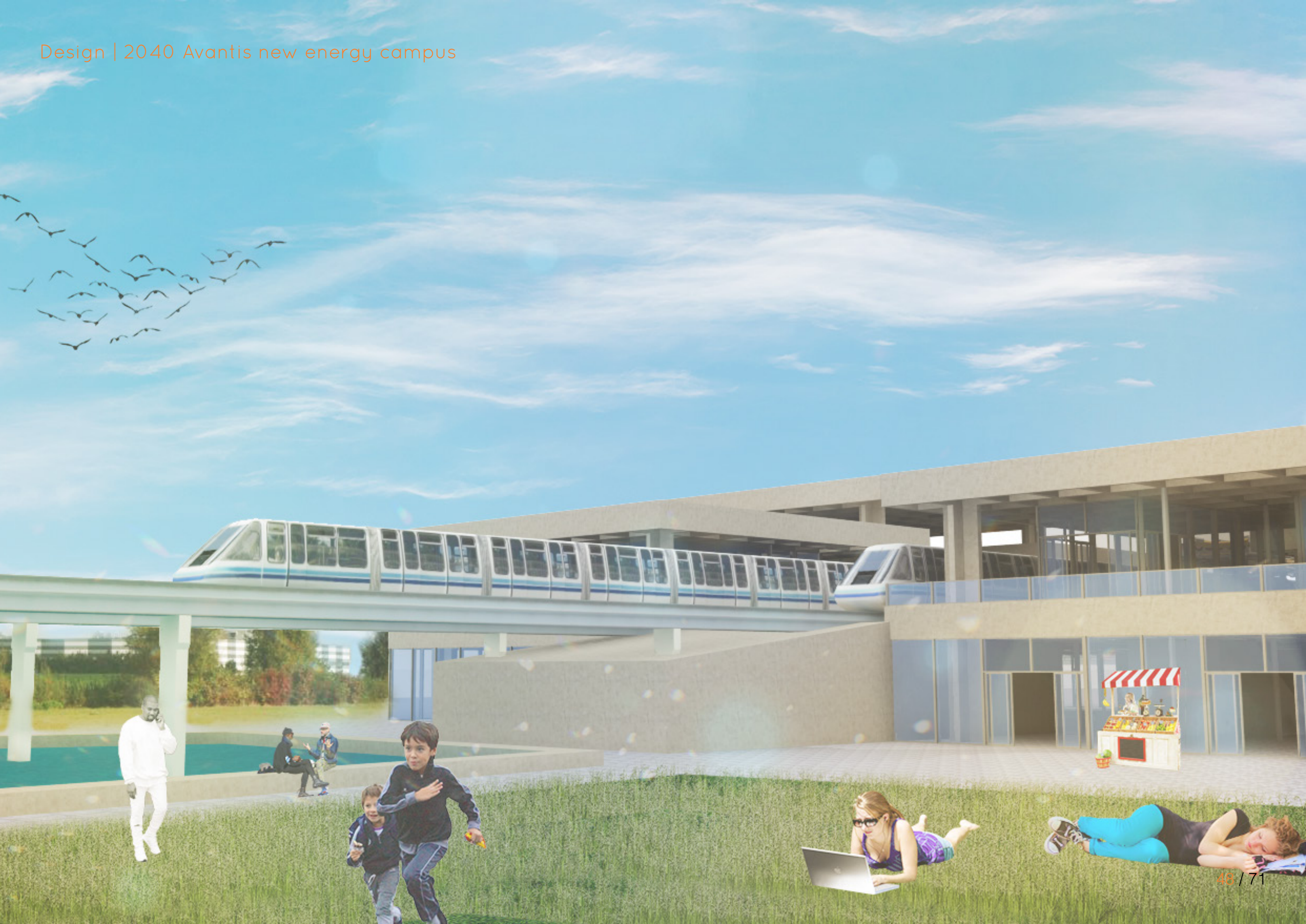
Design | Station

1. Transport lines
2. Stations
3. Platforms
4. Transport necessities
5. Vertical movement
6. Roof
7. Construction
8. Routing



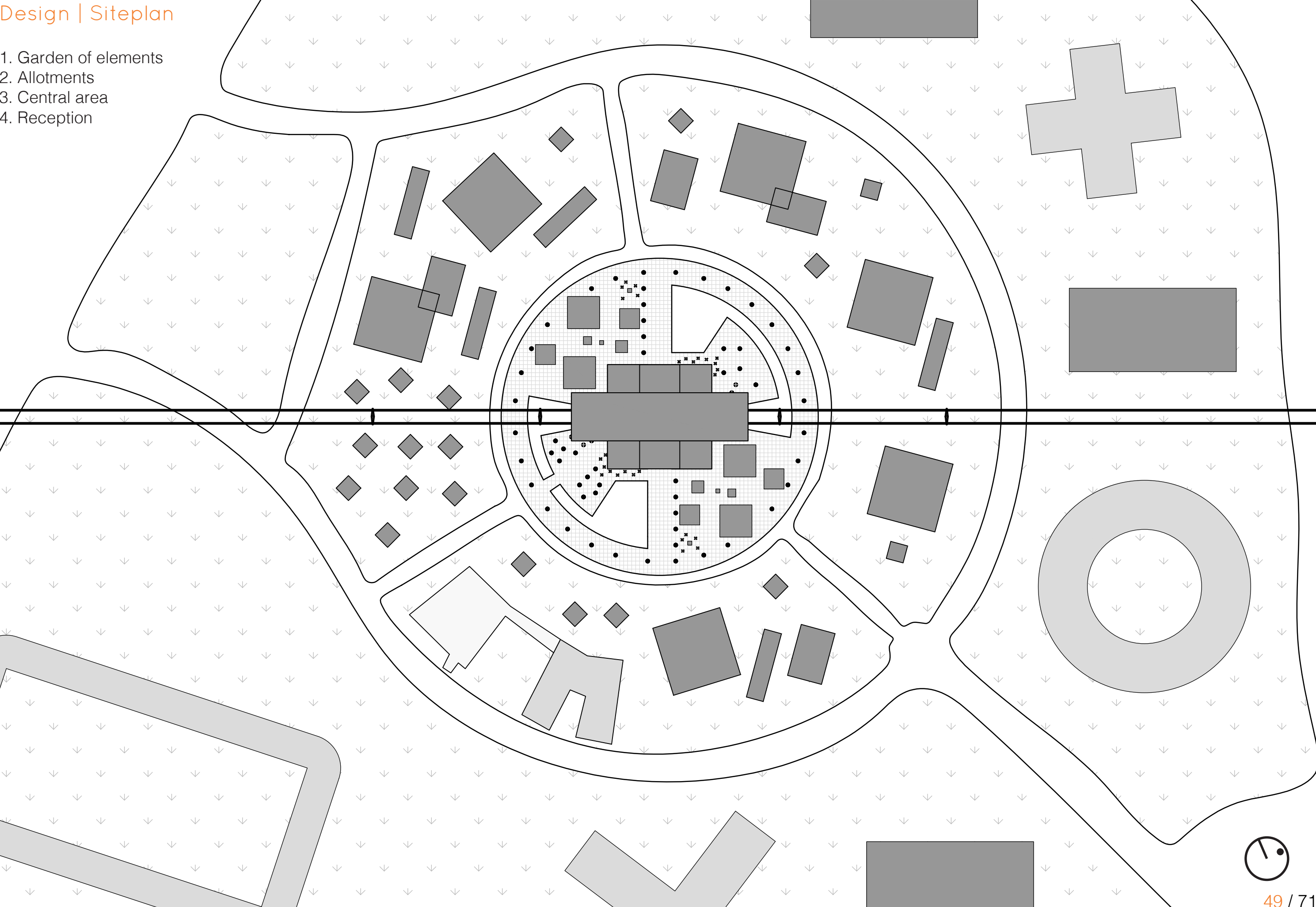






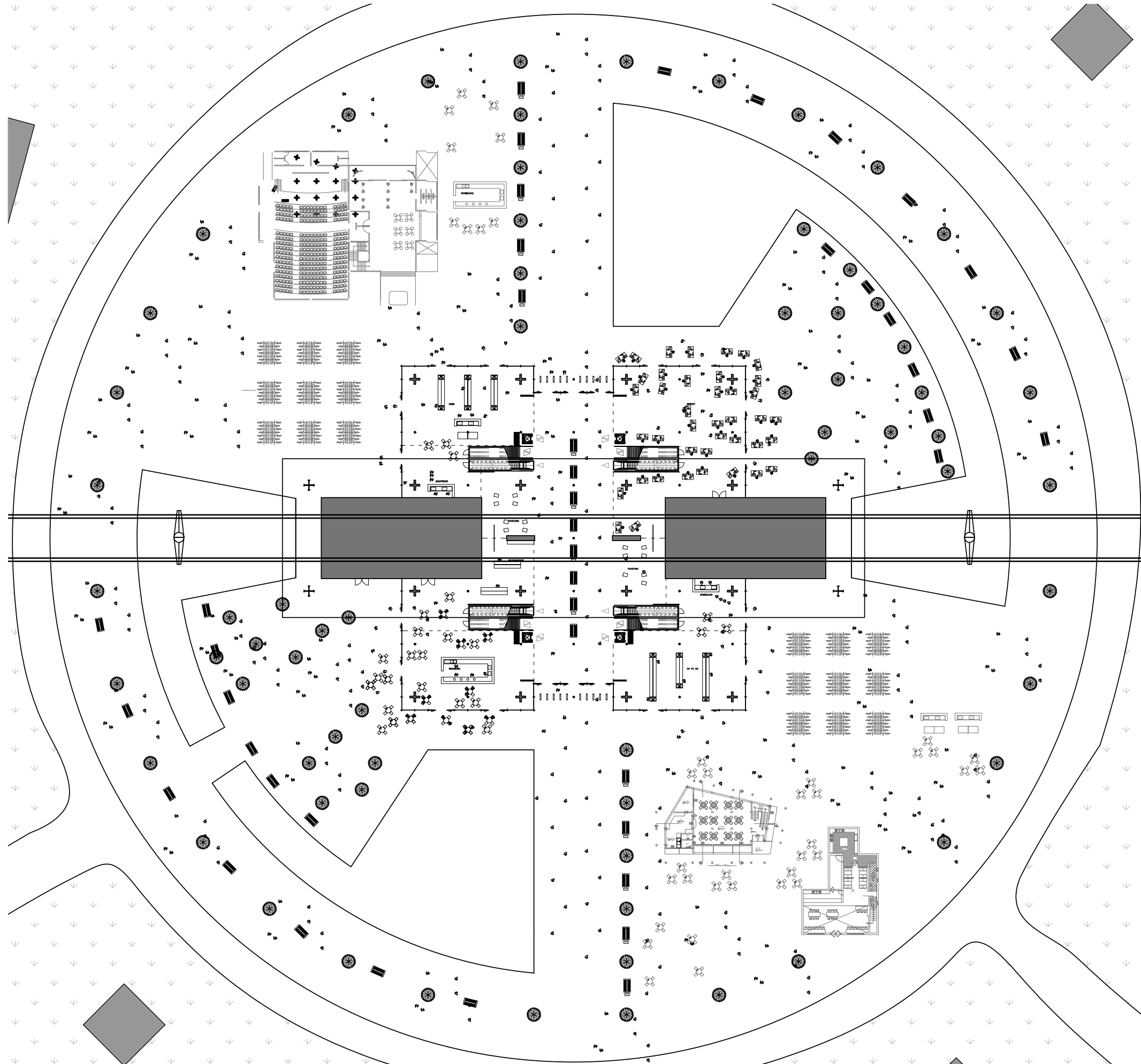
Design | Siteplan

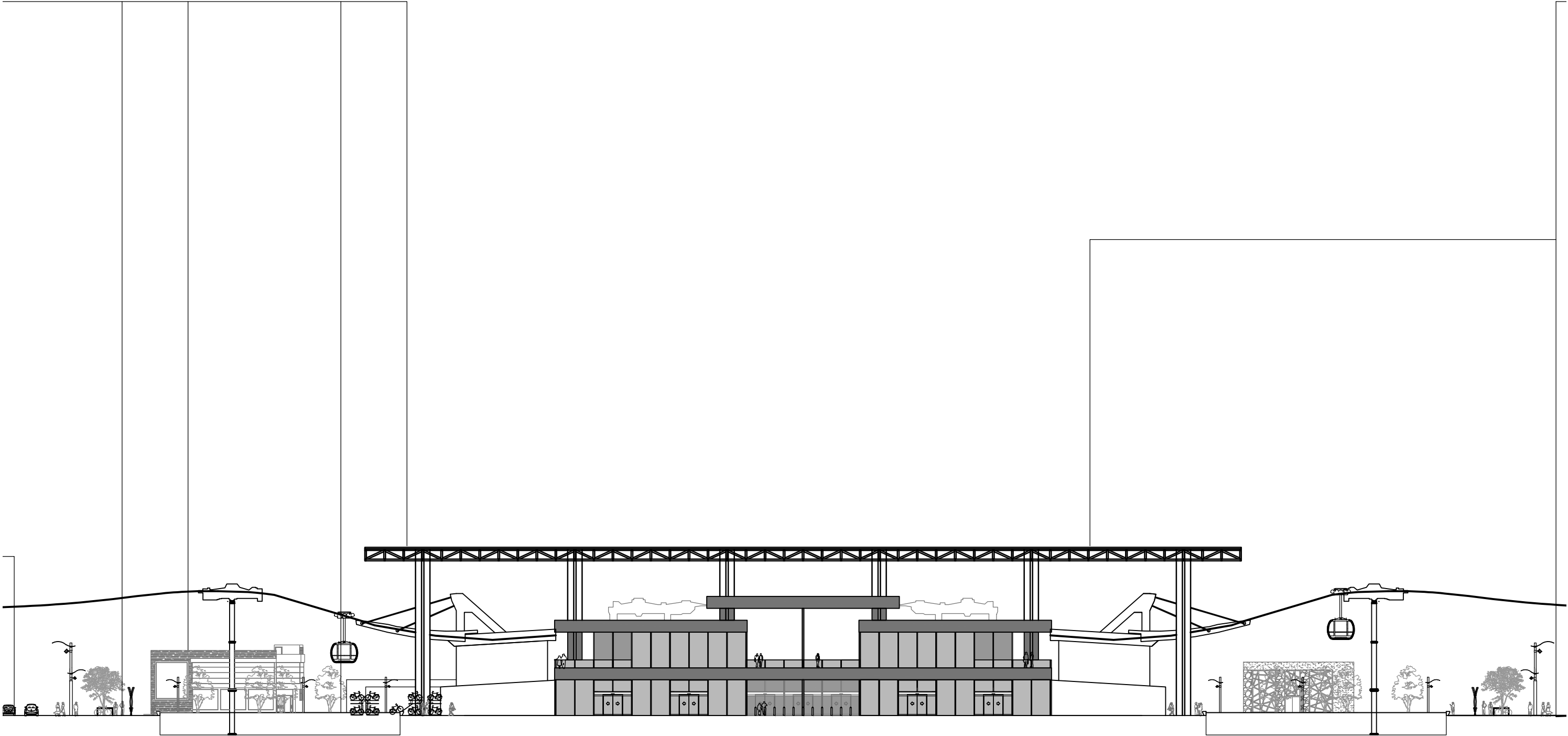
- 1. Garden of elements
- 2. Allotments
- 3. Central area
- 4. Reception

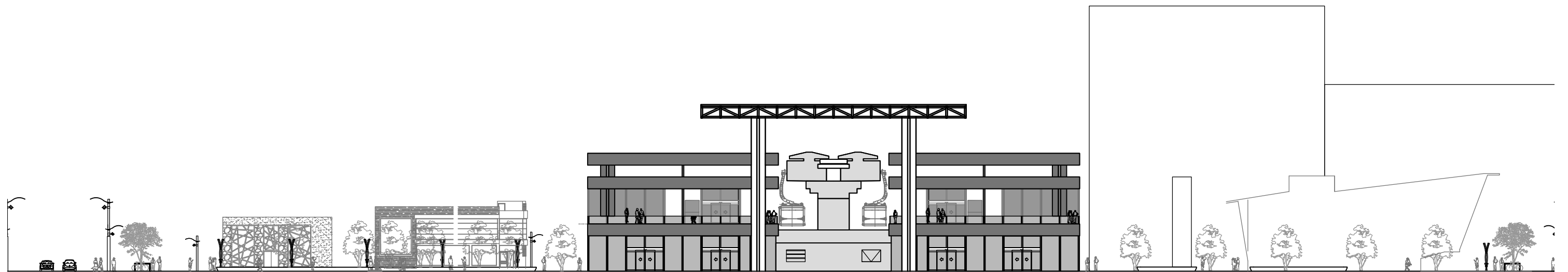


Design | Siteplan

1. Central area
2. Reception

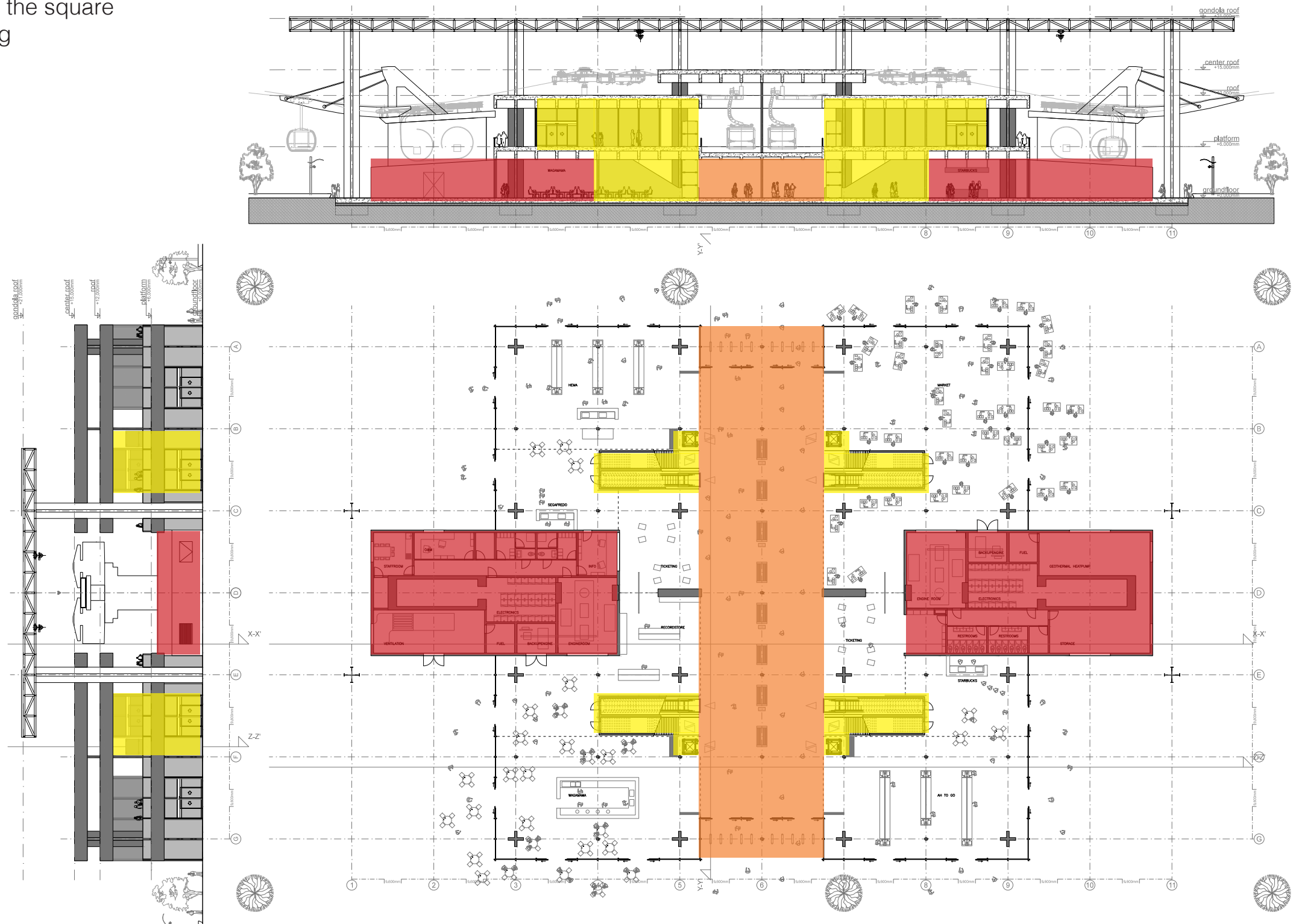






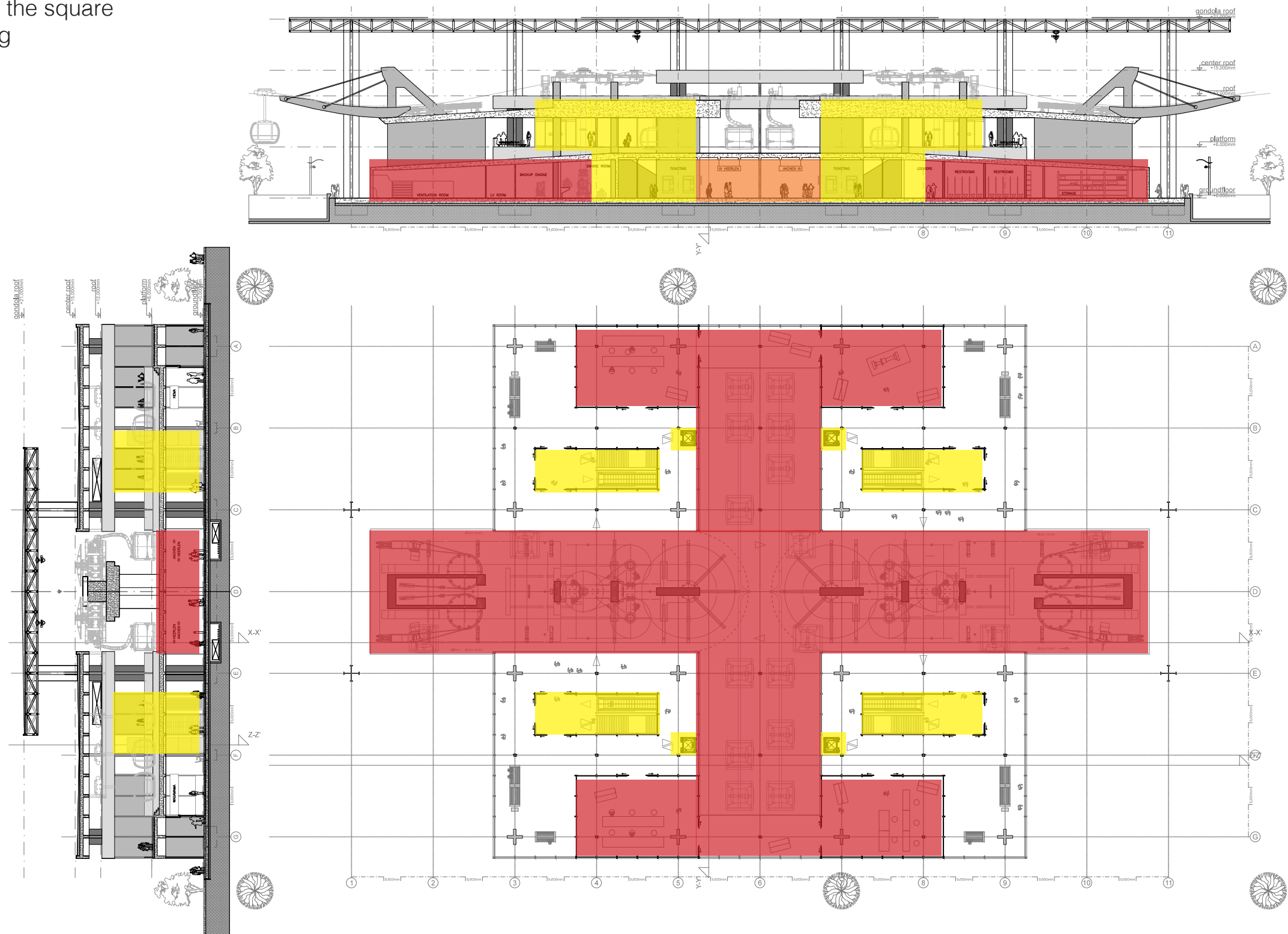
Design | Groundfloor spacing

- 1. Walkway through the building
- 2. Necessary cable car program
- 3. Vertical displacement to platforms
- 4. Left spaces to relate to the square as much as to the building



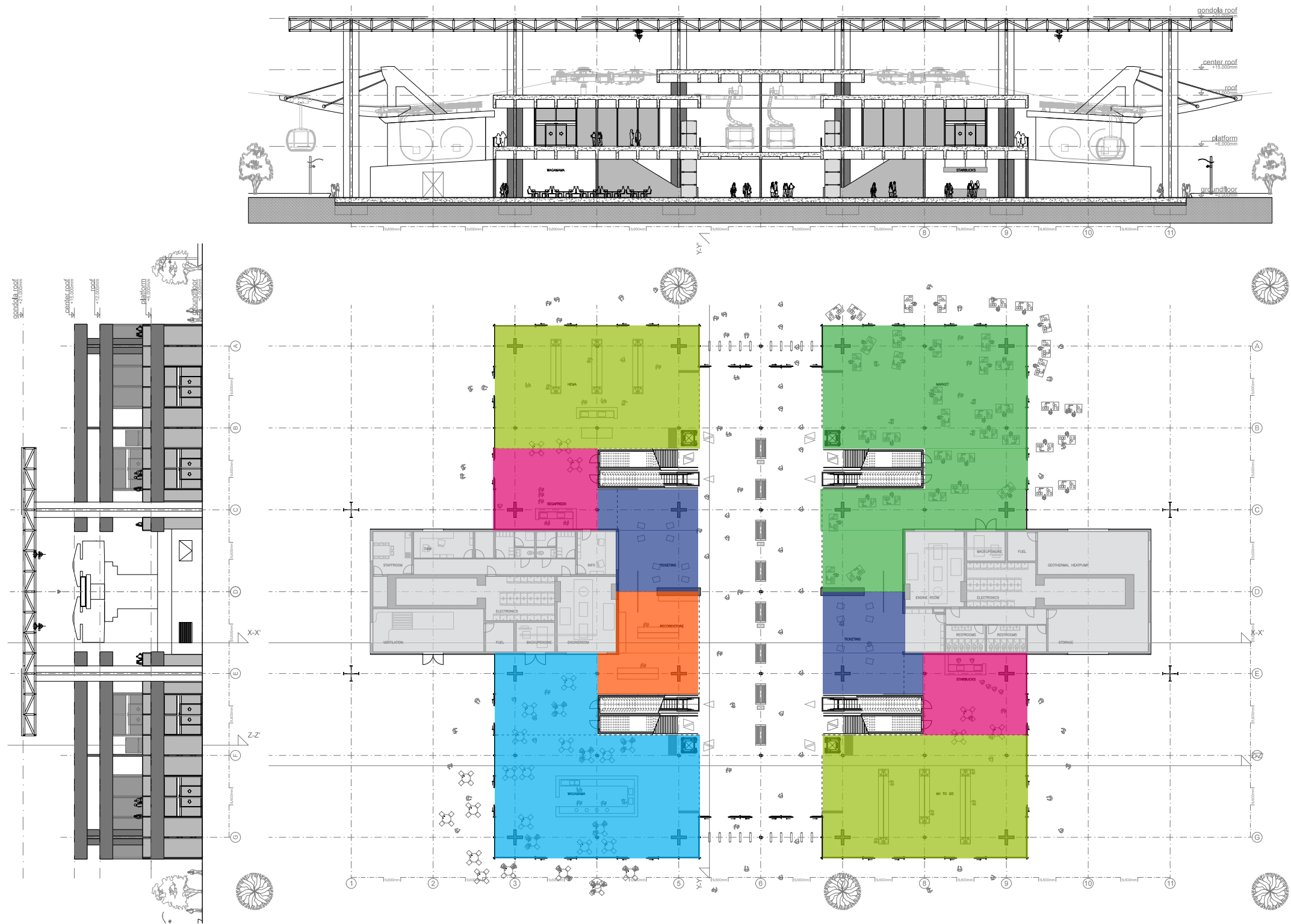
Design | First floor spacing

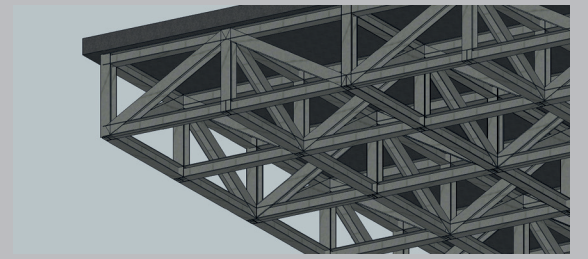
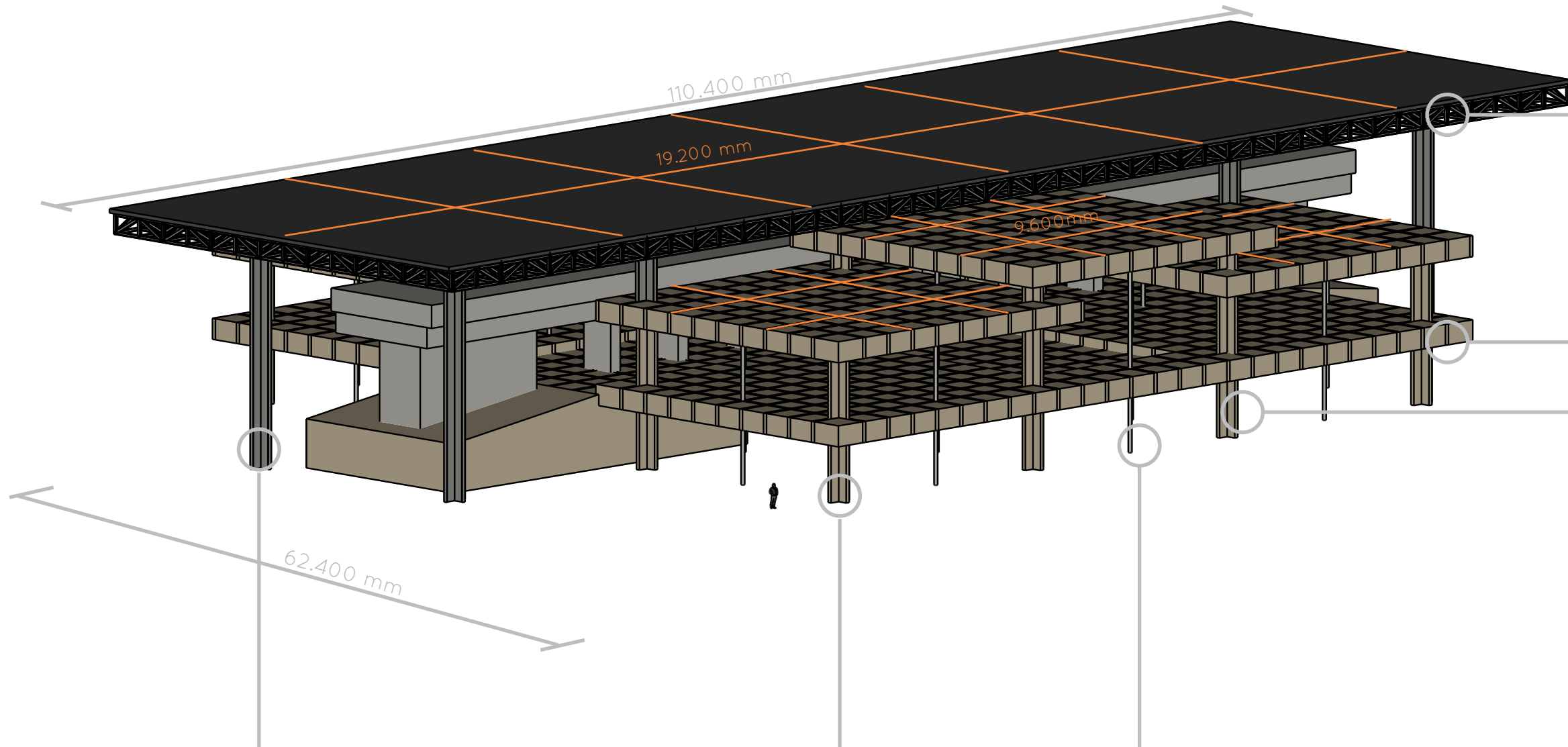
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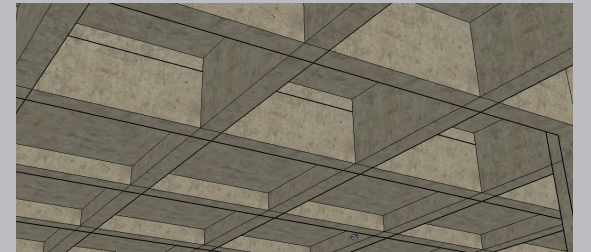
Design | Example contemporary program

- 1. Marketplace (Fenixloods/Markthal Rotterdam)
- 2. Ticketing&Info
- 3. Coffeecorners
- 4. Recordstore
- 5. Food to go shops
- 6. Restaurant





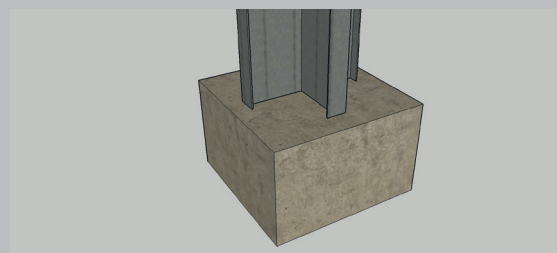
Steel truss roof
A trussed steel roof is required to span 19200mm, with overhang on all sides measuring 7200mm. All beams are HEB260 to carry roof weight and pulley system. The column runs through for portal construction.



Concrete cassette roof
The concrete structure has cassette roofing of a 2400x2400mm grid, beam body width 300mm, floor height 500mm and total height 1500mm. total height is reduced to 800mm in center parts due to gondola runway.



Steel primary column
The center roof is supported with steel cross section columns. Total width 1800mm, flange width 300mm and body thickness 20mm. Tallest column 21000mm, others are placed on top of concrete structure.



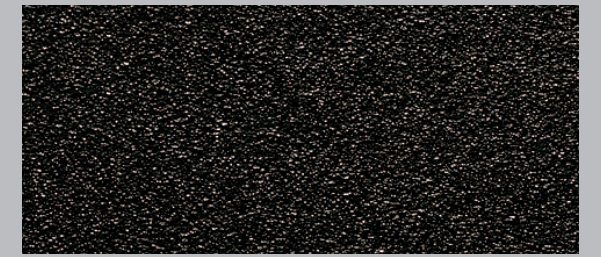
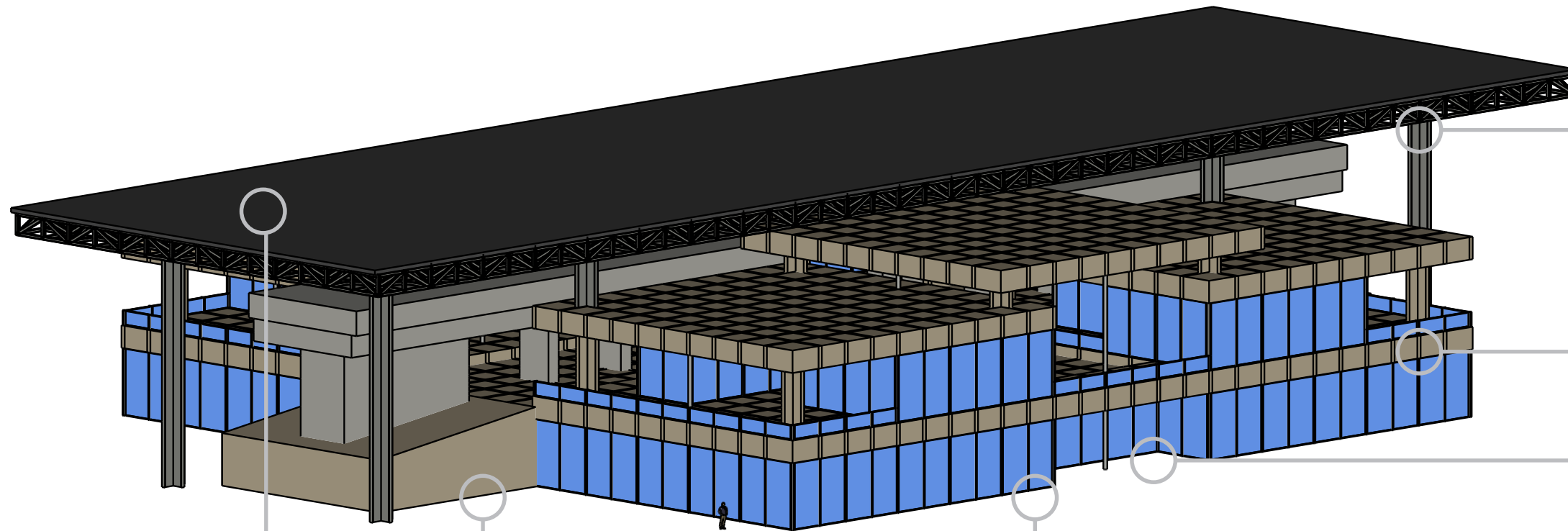
Concrete Foundation
All columns have a concrete base of 2400x2400x1500mm.



Steel secondary column
Round steel columns (273x16mm), height 4500mm, are placed in between the concrete columns to reduce span length to 9600mm. max floor size to carry 4800x7200mm.



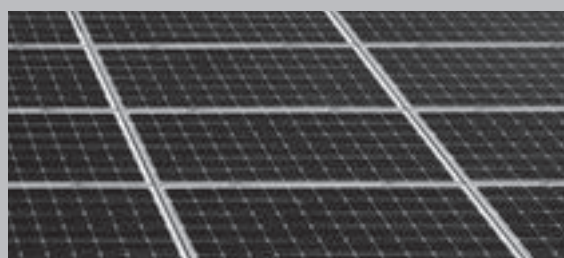
Concrete column
Similar size to the Steel primary, 1800mm total width, 300mm body width, height 4500mm. Cast on site with the cassette floor and extra steel reinforced due to the portal construction method.



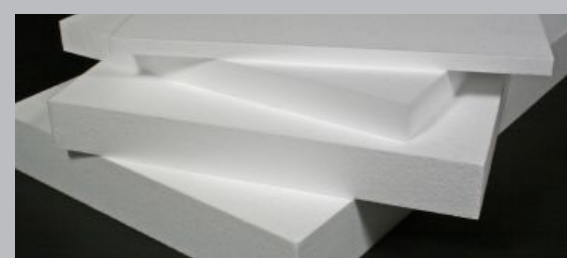
Steel
One of two major structural components is steel. all steel used is S275 strength, has been galvanized and is then powder coated. Graphite black (RAL9011)



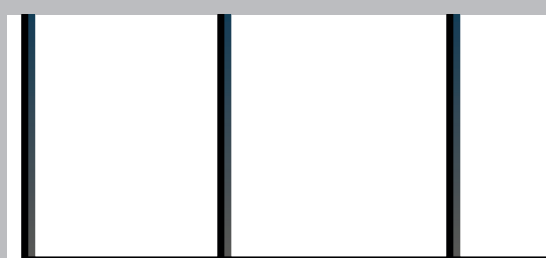
Concrete
The second major structural component used is concrete. High strength, fibre reinforced, concrete is used due to the portal construction method and 300mm body width. Poured on site in 2,4x1,5m size. Mix Beige (RAL1001) / Silk Grey (RAL7044)



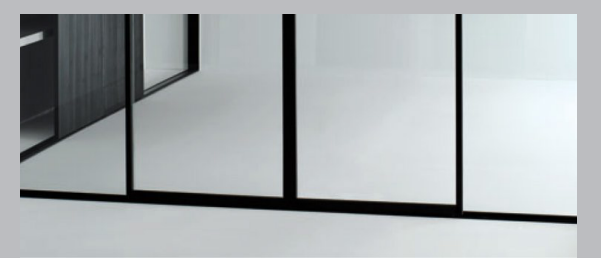
PV-panel
The roof is covered with PV panels providing 120kWh per m2 per year. The structure totals 0.5 million kWh annually.



Foundation
After the column bases have been poured on site, the floor area is covered with EPS floorinsulation. The Limburg area is suited for a 'funderen op staal' method. Ventilation shafts are included in the floor.

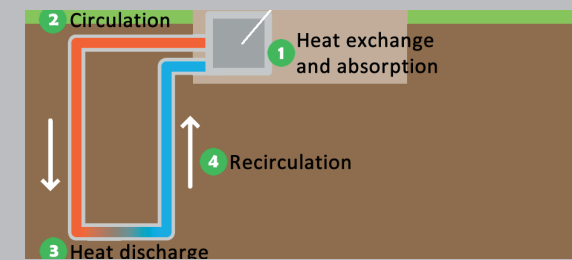
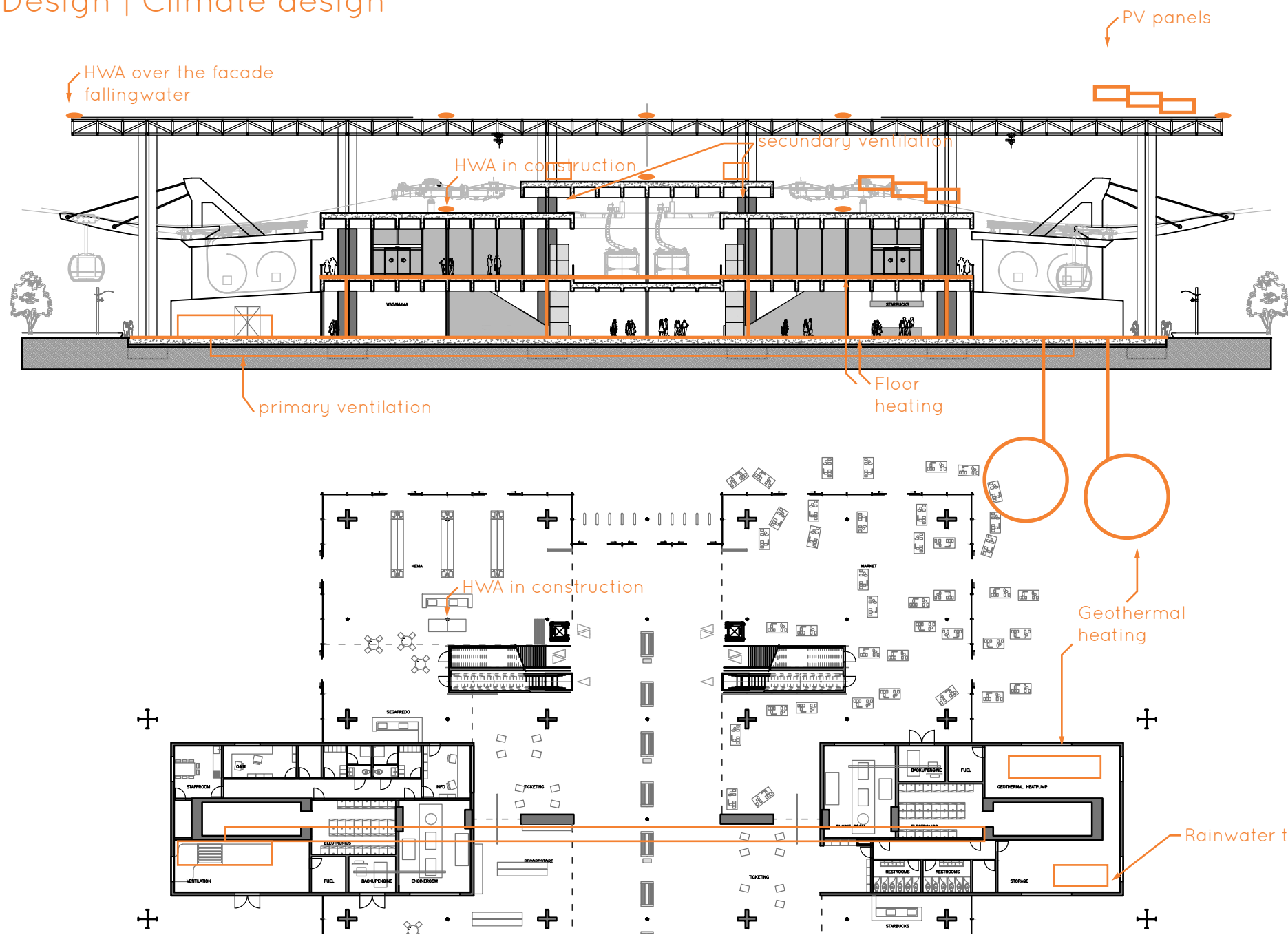


Facade
The open segments of the facade are covered in double glass (HR++) panels of 2,4x4,5m in aluminium window frames of the same aesthetics as the construction.



Doorways
The structure can be entered through automatic sliding doors. These doors are 4,8m total width and 3m tall. All metal and glass compents have the same properties as the facade.

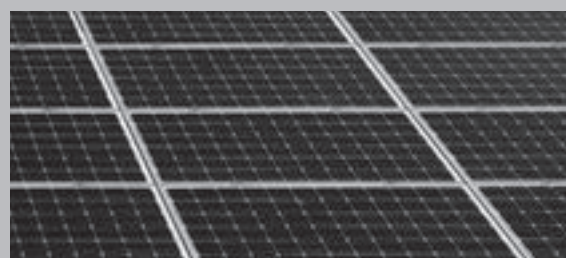
Design | Climate design



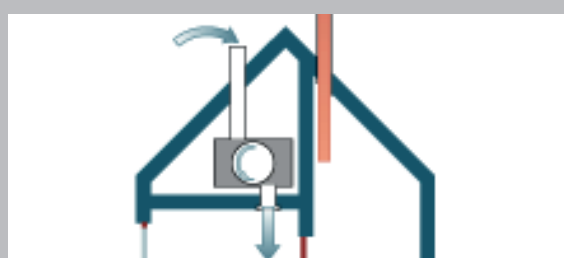
Geothermal heat pump
Using a closed-loop pump allows for the use of ground water providing a constant inside temperature of about 16 degrees celsius all year round.



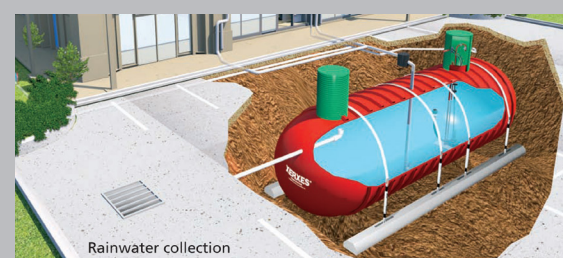
Floor heating
Seeing it is a heavy structure, floor heating can be placed as the 'veins' to the mass exchanging excess heat or cold from the body to the heatpump aquifers allowing for constant temperatures.



PV-panel
The roof is covered with PV panels providing 120kWh per m2 per year. The structure totals 0.5 million kWh annually.



Ventilation
The ventilation of the bottom floor is drawn in from the side of the building, taken through the floor and and blown into the center at ceiling height. The top ventilation blows in through the roof cassette.



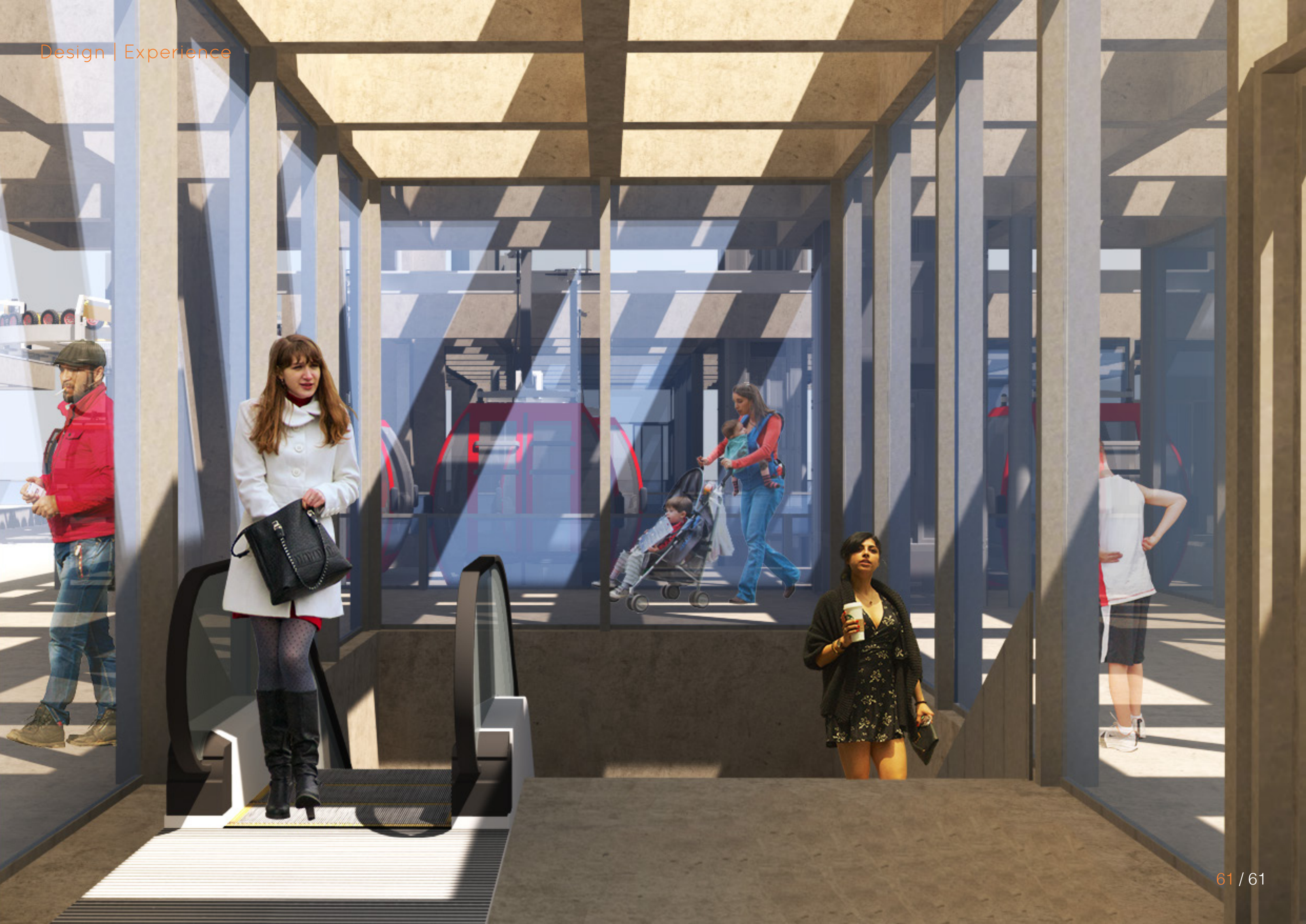
Rainwater collection
The large roofsurfaces allow for a great deal of grey water collection that can be used for the restrooms and cooling water in the engine rooms.



Concrete
The use of Ultra high strength concrete allows for slim structures, filling the cassettes with lightweight concrete or bubbledeck systems further reduces the amount of concrete needed.

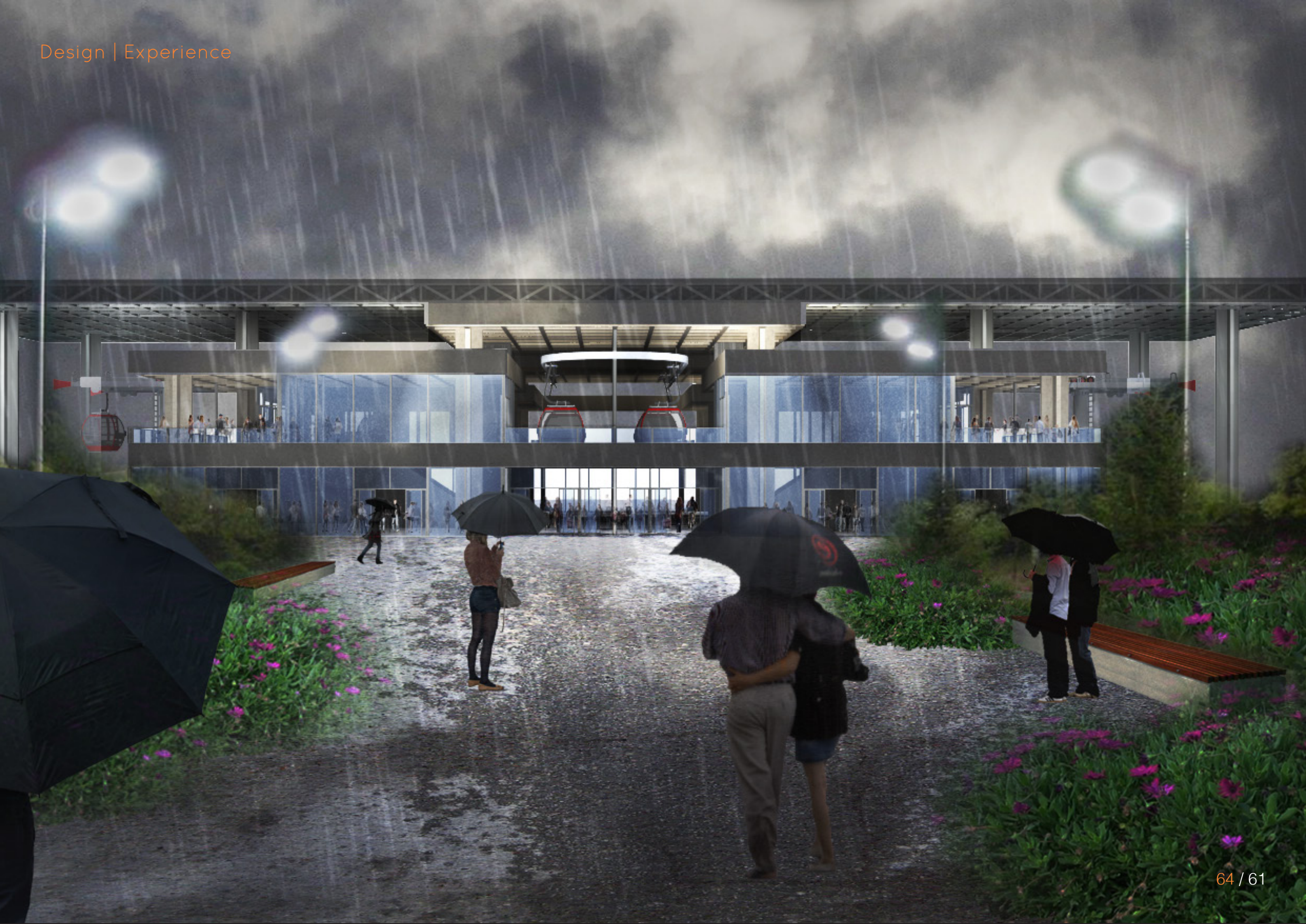
















STATION AVANTIS







The proposal

Location

Avantis European Science and Business Park
Heerlen
Parkstad, Limburg
The Netherlands

Objective

Improve the connection of the four core cities in the Meuse-Rhine region. Connect Heerlen to Aachen and position Parkstad in a clear hierarchical plan of transport ranging from local to international scale.

Design

Envision Parkstad following the choices for a clear interrelated region, an agile strategy in transport and a way to kick-start progress. Conceive a Hypoloop station for the Avantis business park that can also be used with a contemporary mode of transport.

Intervention

Following from central area and reception theme, a station and square have been designed to facilitate the 2020 IBA with a proficient mode of public transport. This will generate interest towards the development of Avantis as a new energy campus that may one day host a Hypoloop type transit.

P5 07.07.17 | Kanaän, or the suburb of the polycentric metropolis

Delft University of Technology master graduate project
Chair of Architectural Engineering, Intecture studios
Fall 2016 • spring 2017

