

S(OIL), WIND & MOTION

Urban proposal for a fossil free energy port in Gothenburg

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Architecture and Urban Space Design

Chalmers University of Technology

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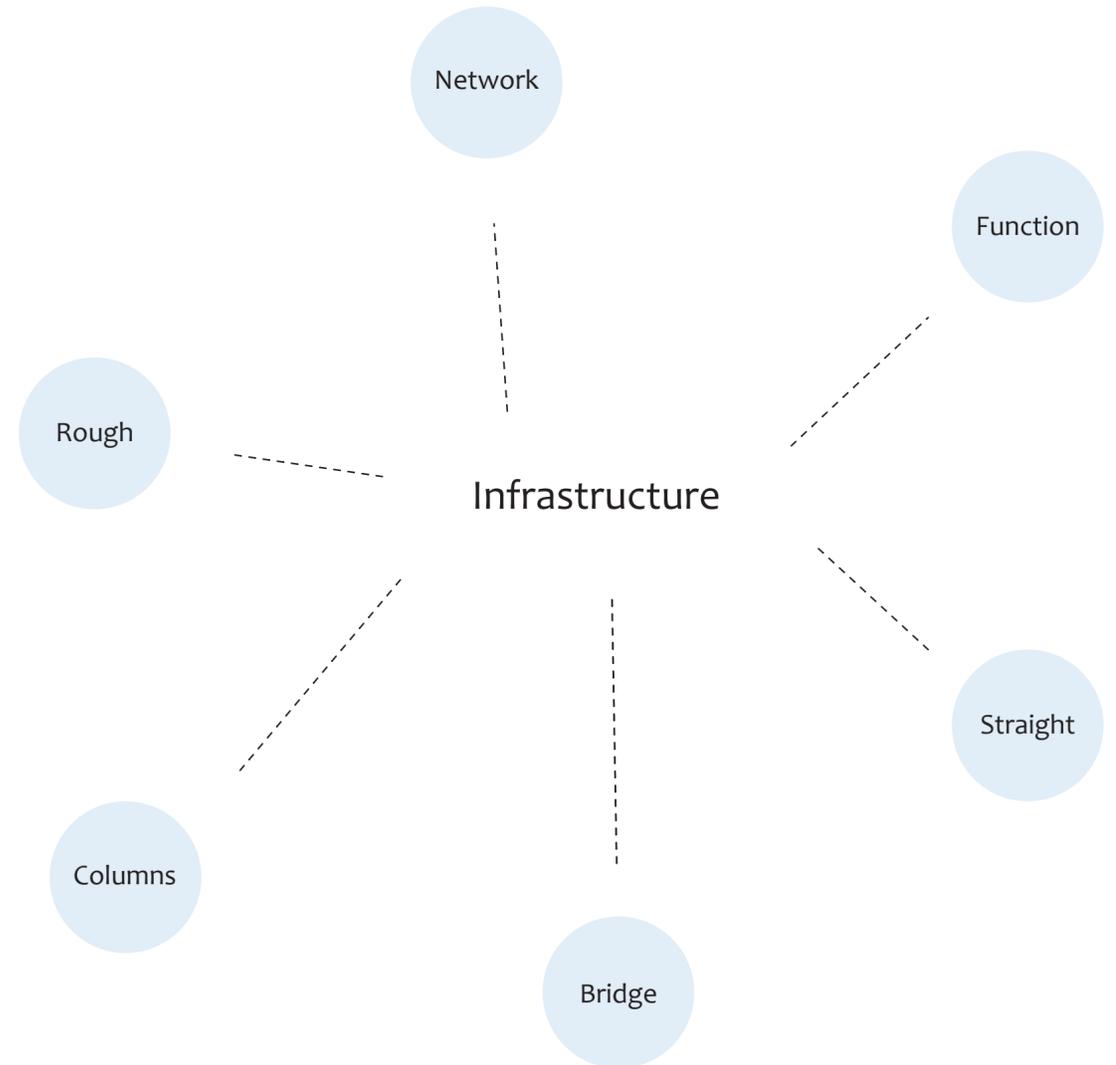
1. Hybrids of Coexistence

In the first phase of the project, an artistically-motivated concept design for an original crosbreed assembly between elements of infrastructure and human spaces will be developed. The explorations will result in a meaningful hybrid spatial effect and functionality.

1.1 Hybrid Space

Could infrastructure be instrumental for a completely different logic of human space? Is there accidental potential for artistic meaning and new modes of human activity within the natural features and functions of infrastructure?

In this subchapter, a crossbreed between a selected human space and infrastructure type will be explored, resulting in a new spatial effect and functionality of the hybrid space.



Selected Infrastructure Type

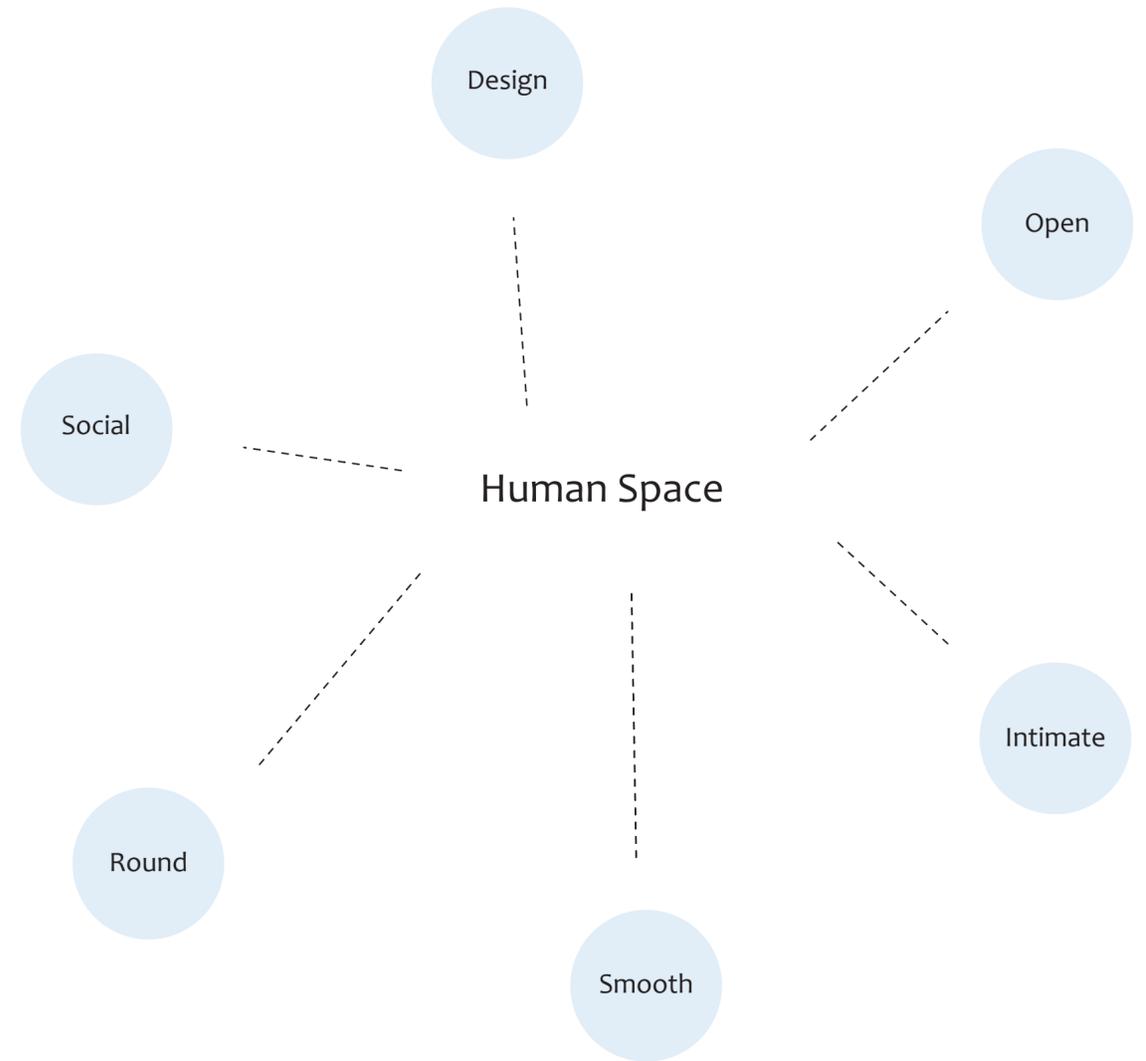
The selected infrastructure type is a bridge where the main function is to transport vehicles or people from A to B. The bridge is straightforward, with column supports and minimal focus on the design.



Lilla Västerbron, Stockholm, Sweden, 1935



Ölandsbron, Öland, Sweden, 1972



Selected Human Space

The selected human space is a curved niche in a part of a building, serving as a social space where people can gather, have a good time and enjoy a beautiful view.

Human Space References



Våghuset, White Arkitekter, Gothenburg, Sweden, 2022



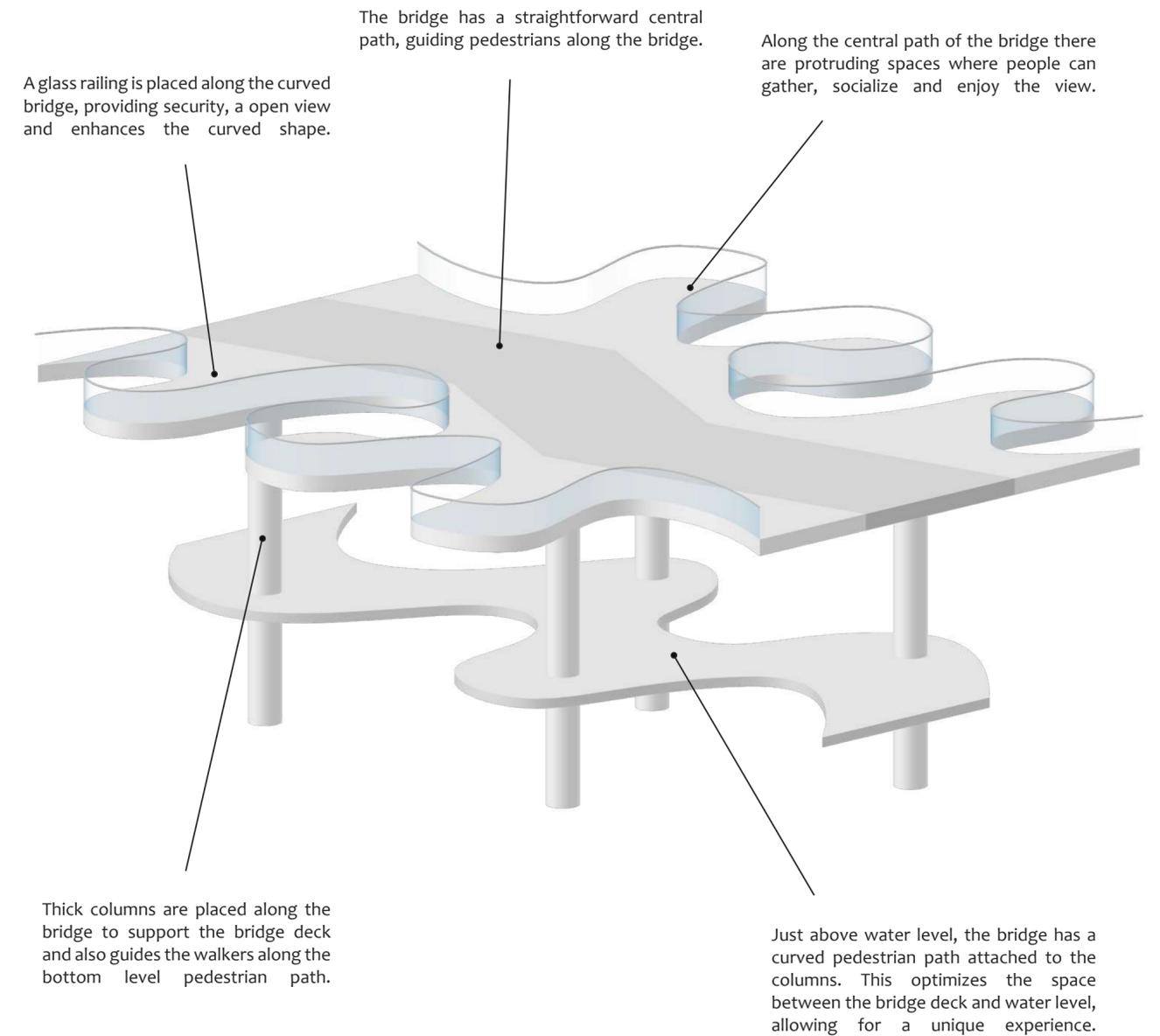
Salesforce Tower, Pelli Clarke Pelli Architects, San Francisco, USA, 2018

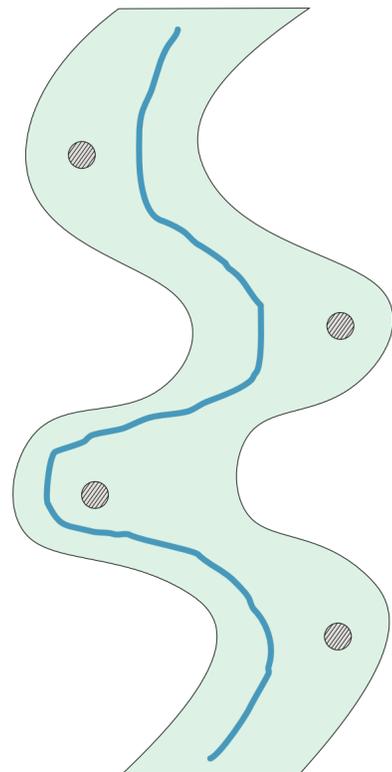
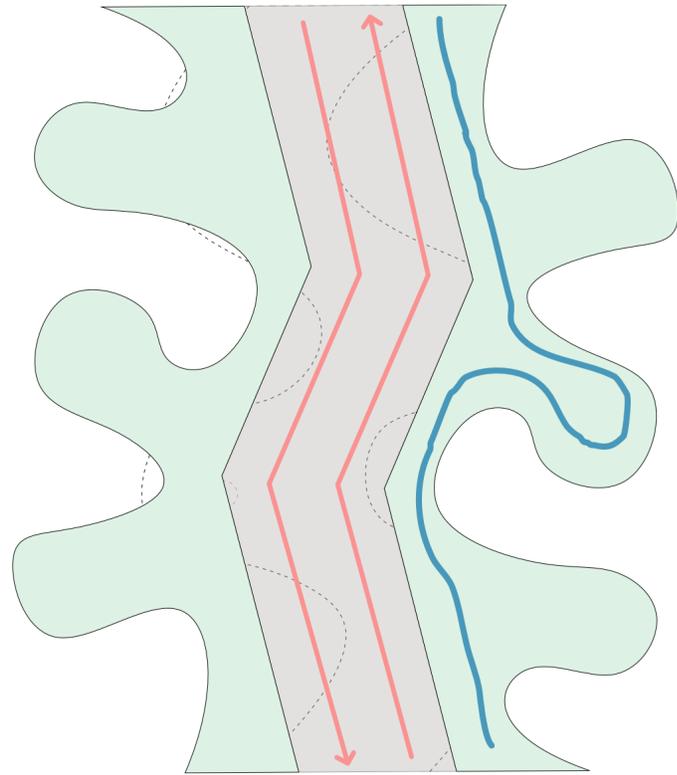


Scandinavian Seashell house, WAFAI Architecture, Sweden, 2020

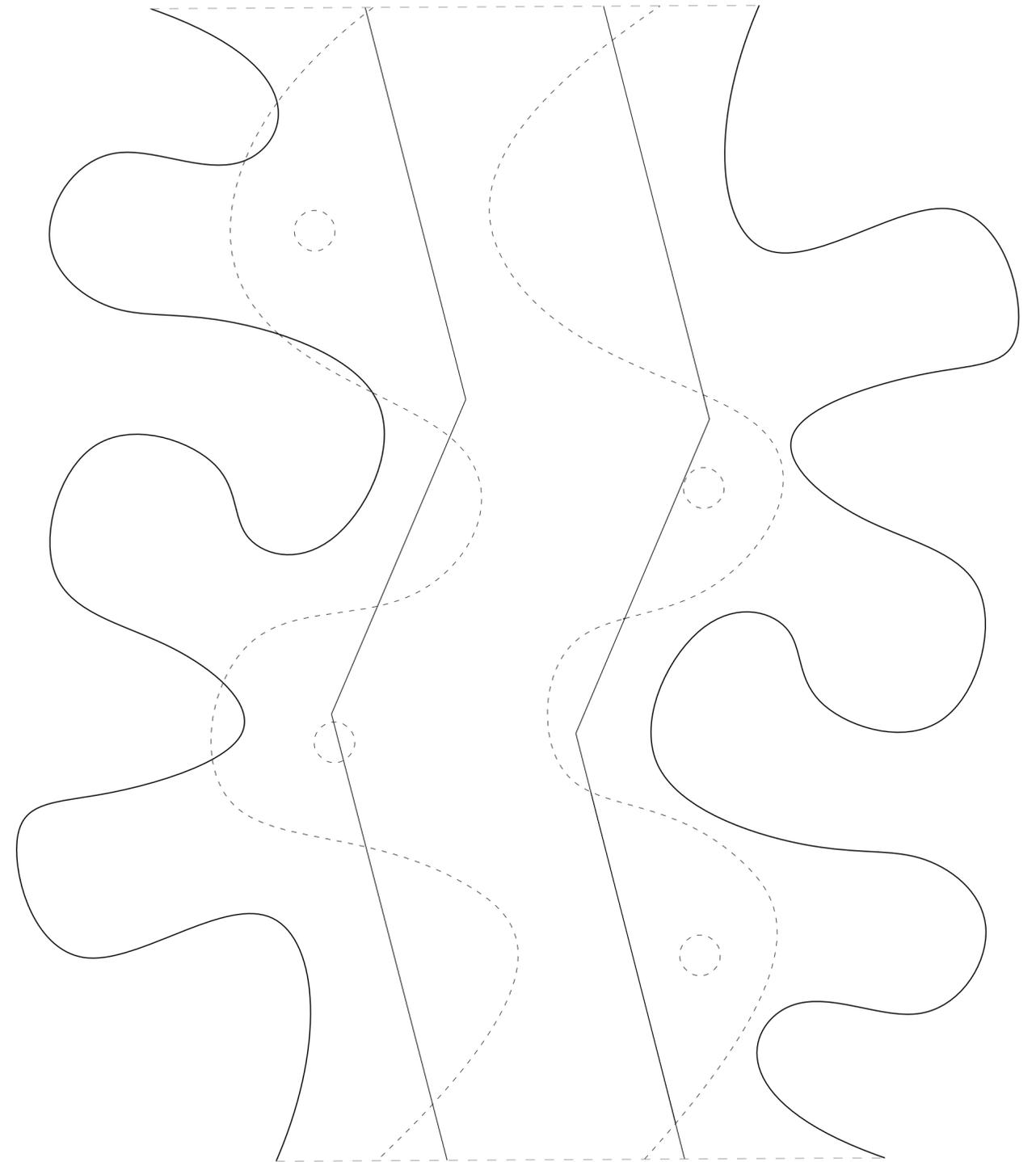
Hybrid Space

This hybrid bridge is a pedestrian bridge but also a place for people to gather and socialize. A straightforward path along the center of the bridge guides pedestrians along the bridge. Along the central path there are protruding spaces where people can socialize and enjoy the view. These spaces are curved to enhance the feeling of solidarity. The bridge deck is supported on columns that are randomly placed. To optimize the space between the bridge deck and water level, there is a pedestrian path attached to the columns just above water level allowing for a unique experience.



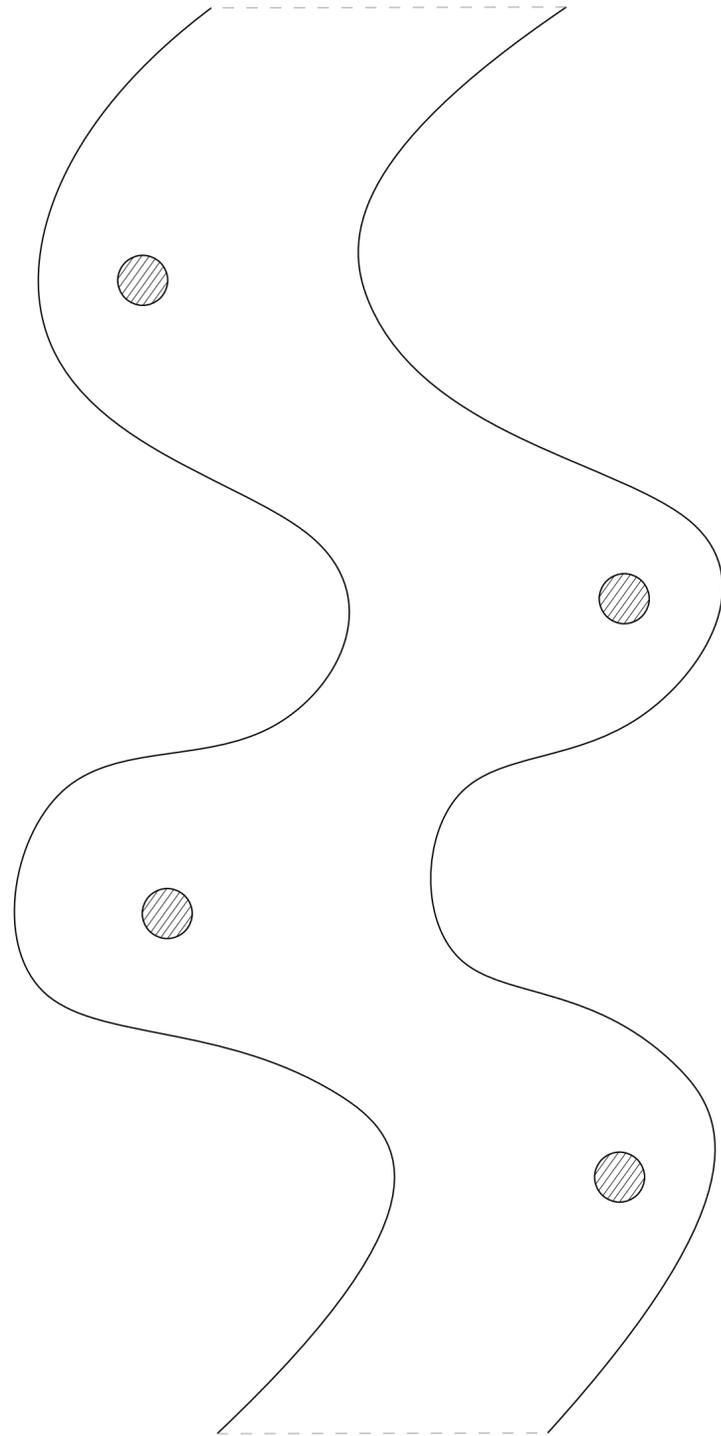


- Infrastructure agents
- Human space agents
- Human space elements
- Infrastructure elements

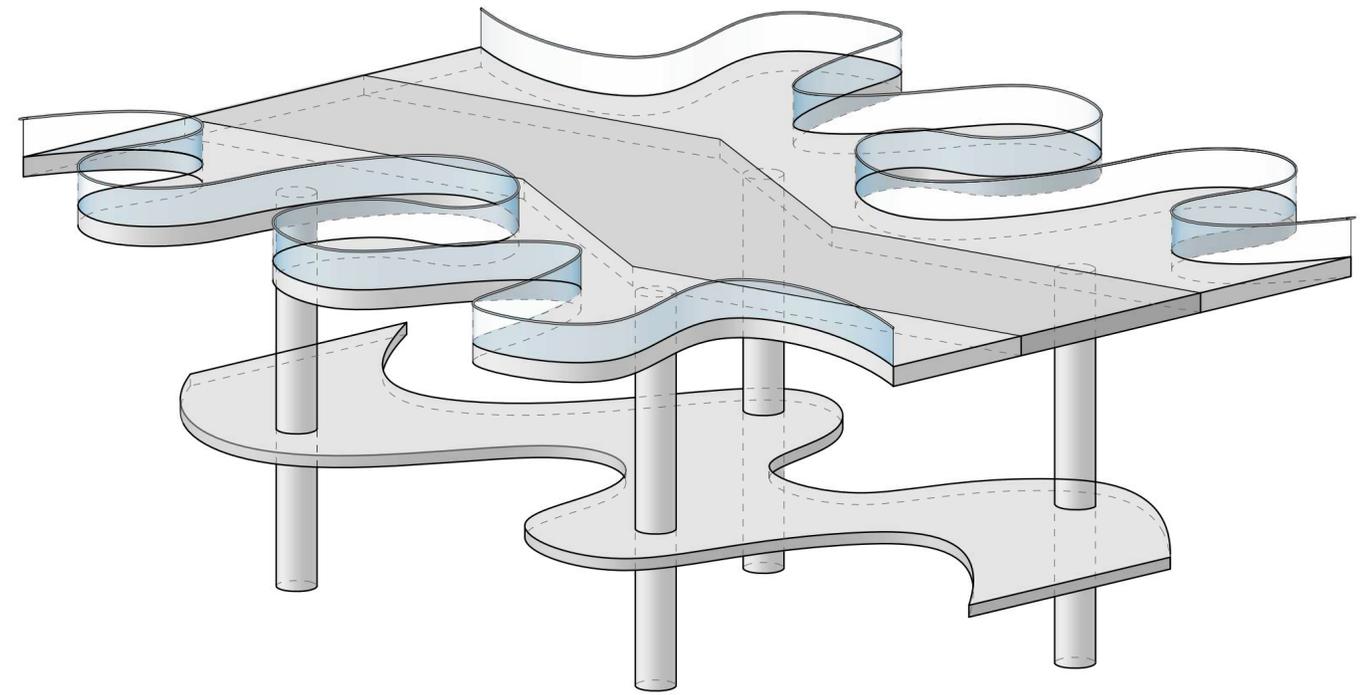


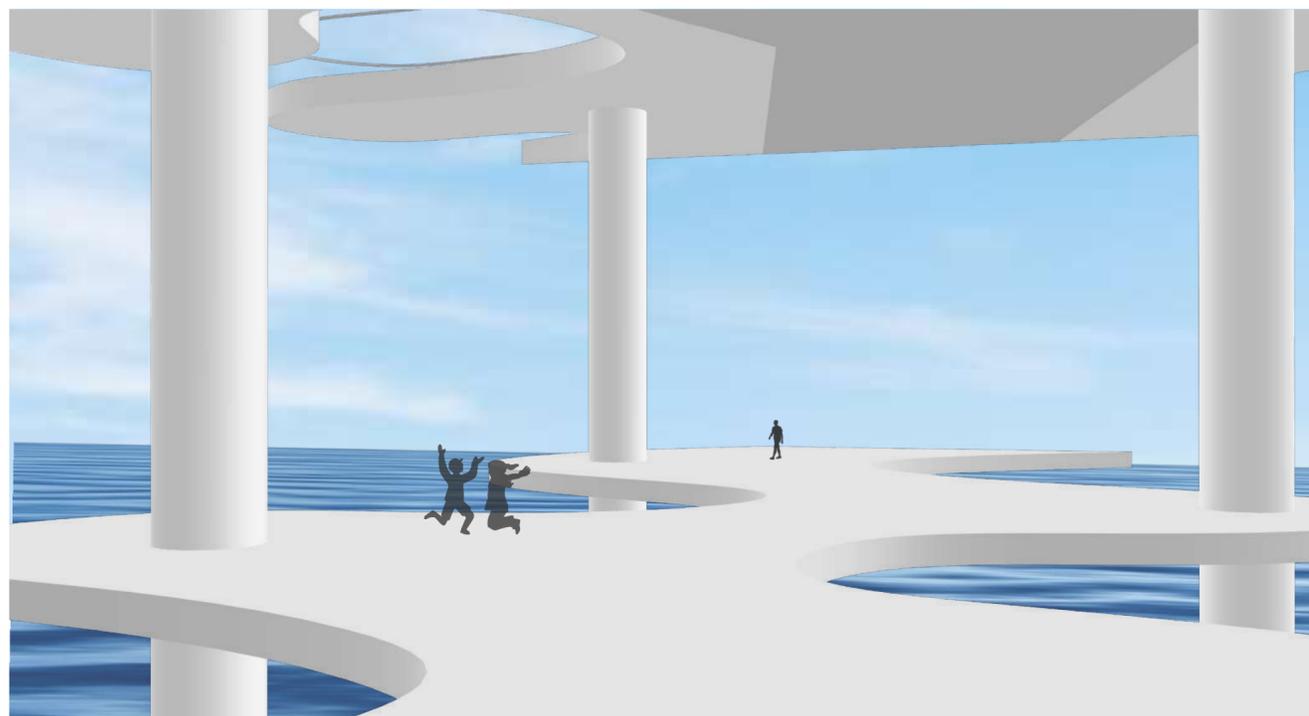
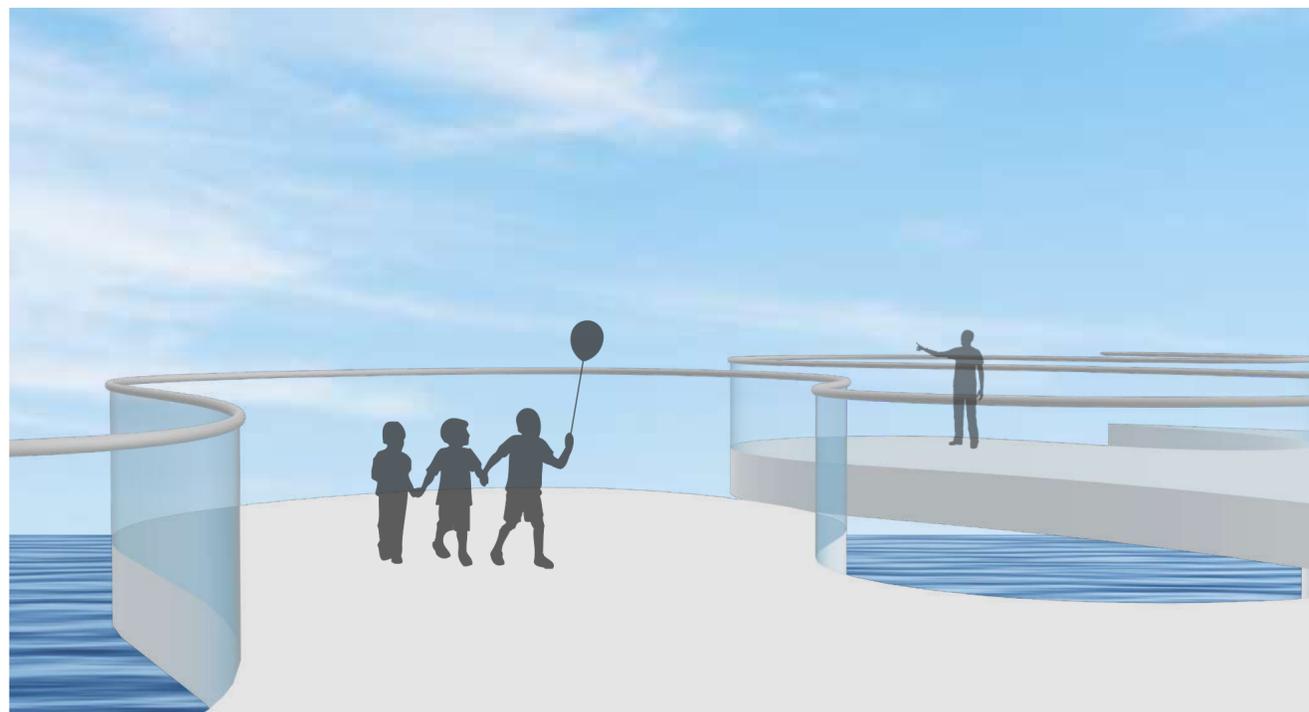
Bottom Level

Scale 1:100



Axonometric



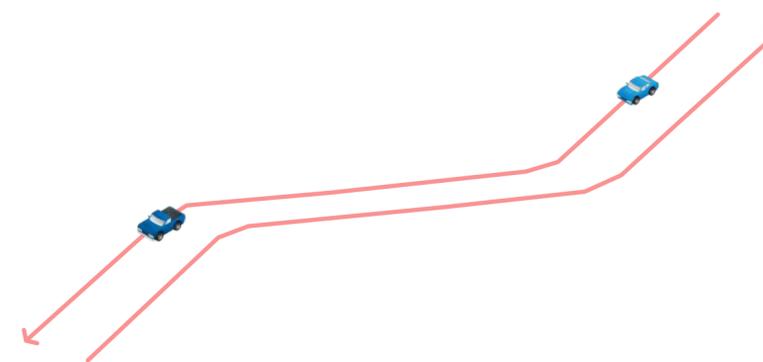


Design Procedure

The hybrid space system can be built up according to a design procedure that starts from a given infrastructure agent behavior. The infrastructure agent determines the infrastructure elements required to produce the infrastructure agent behavior. The human space elements according to the hybrid space system can then be determined from the produced infrastructure system. Lastly, the human space agents can be speculated according to the human space elements.

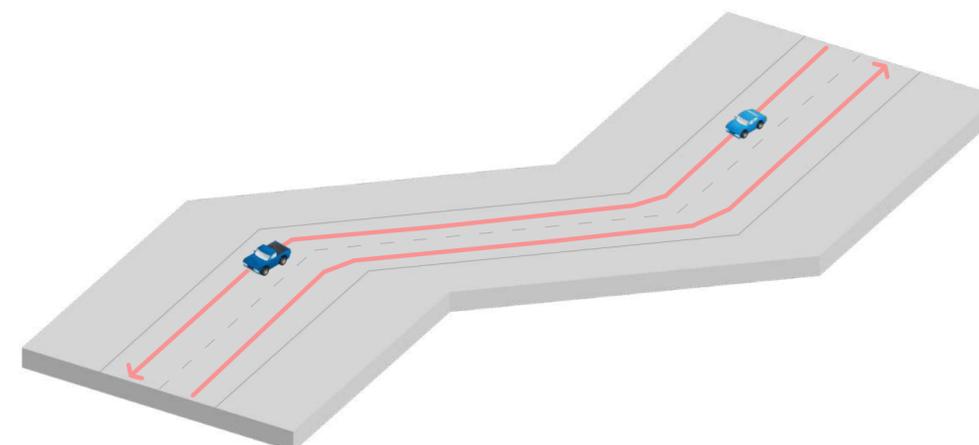
Infrastructure agent

In this case, the infrastructure agent is transporting vehicles along a path.



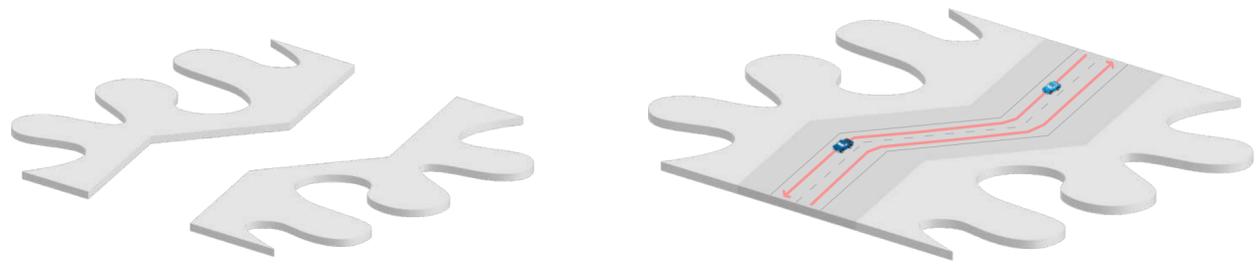
Infrastructure element

The infrastructure element required for transporting the vehicles is a road. Also, columns will be required to support the road. These will be added after the human space elements are set since they will require supports as well.



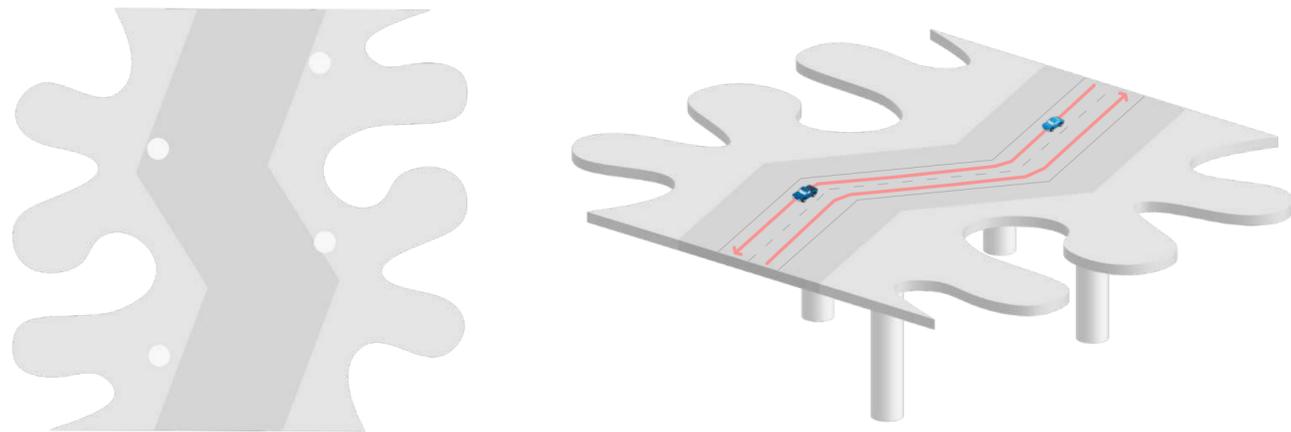
Human space elements

The human space elements are curved spaces protruding from the road, where people can gather and enjoy their time.



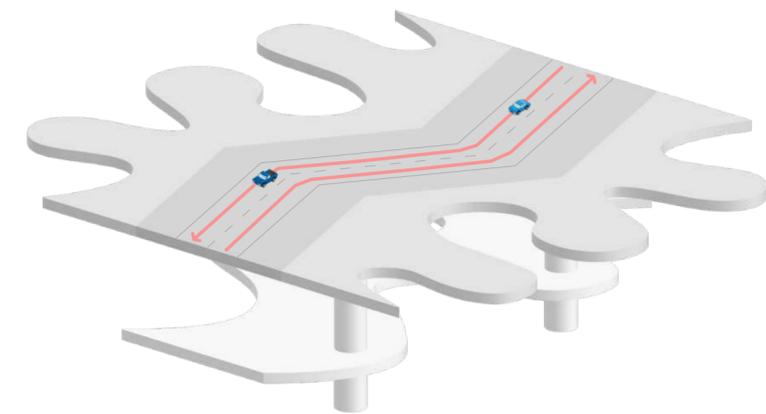
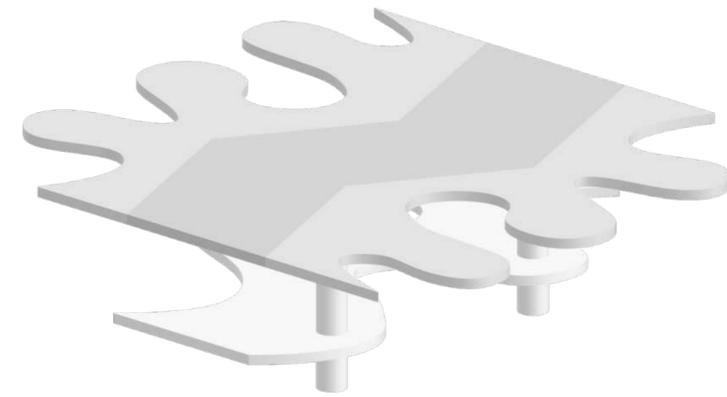
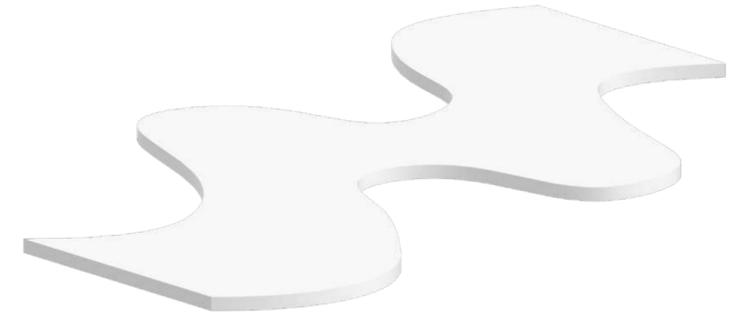
Infrastructure elements

Columns, acting as infrastructure elements, can now be added to the slab consisting of the road and human spaces. The columns are placed diagonally to each other and logically according to the mass proportion of the slab.



Human space elements

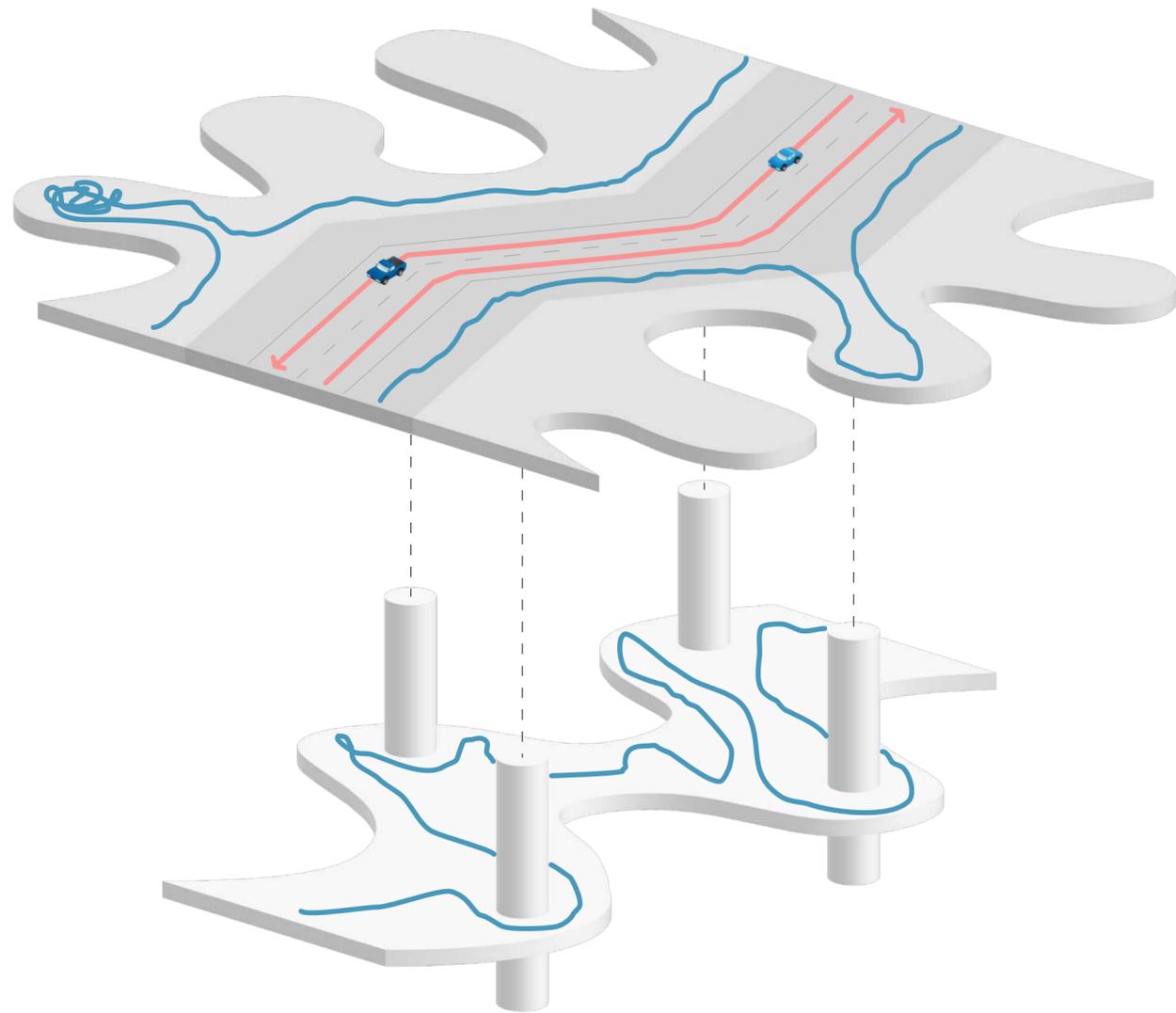
Now the last human space elements can be added. This is a curved pedestrian path placed under the main bridge.



Human space agents

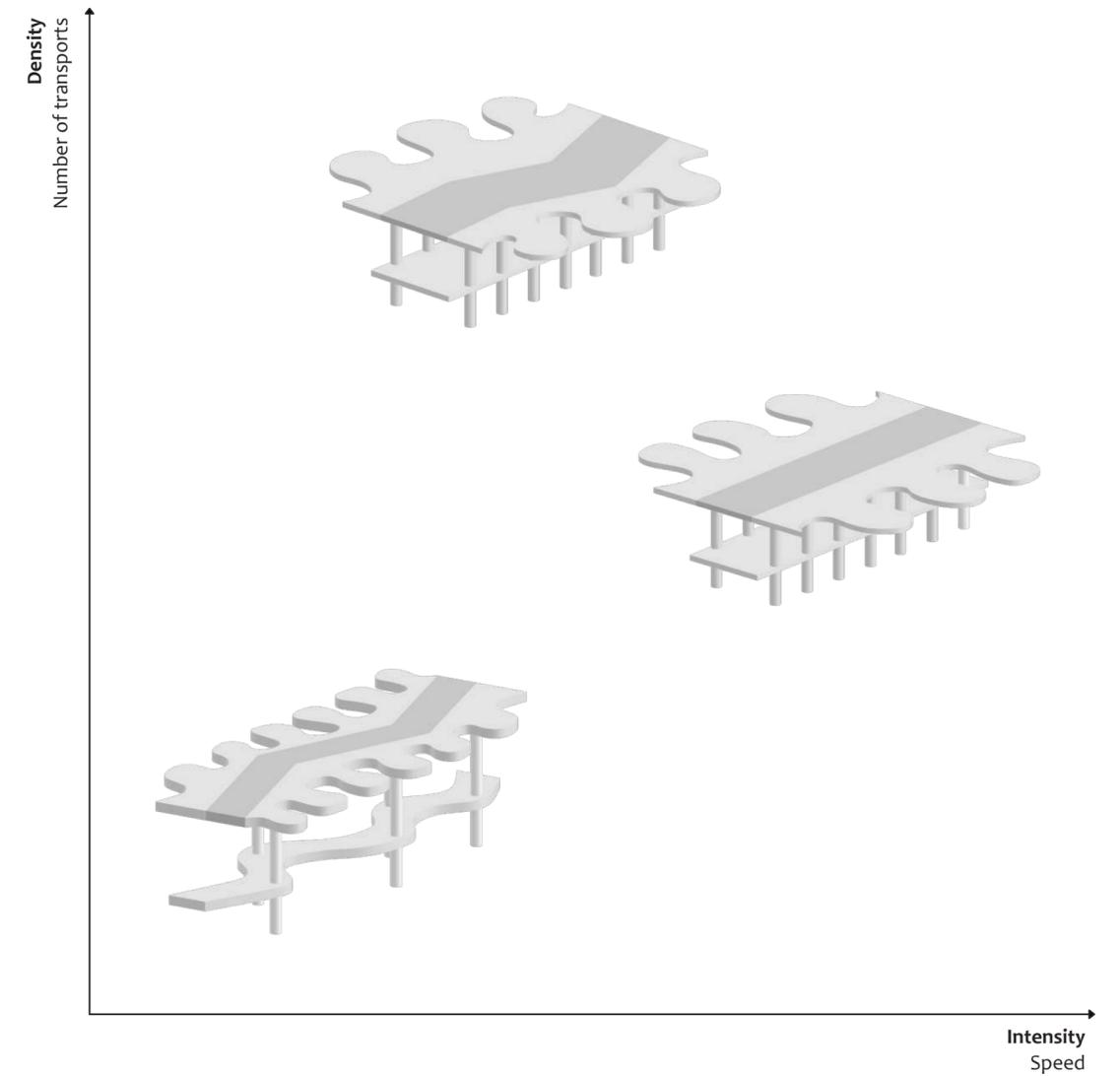
The human space agents are speculated according to the human space elements. In this case the human space agents are the people visiting the bridge. Their behavior could be walking to a human space niche and staying there or walking along the bridge but taking a quick view from a niche. On the bottom level a behavior could be to walk along the curved path.

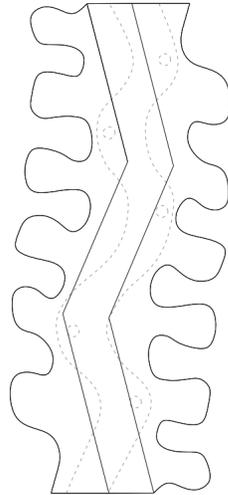
- Infrastructure agents
- Human space agents



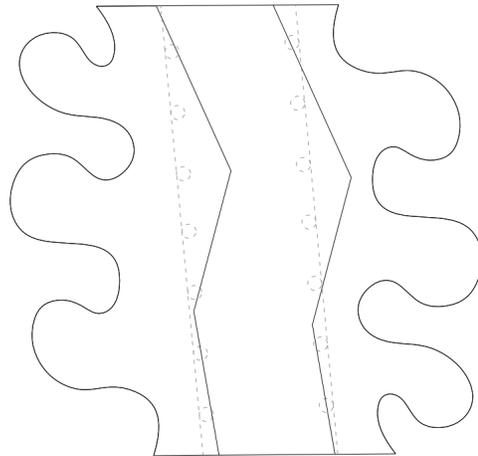
Infrastructure Agent Variations

The diagram below shows how the design of the hybrid space changes when varying the density and intensity of the infrastructure agents. The density corresponds to the number of transports on the bridge (vehicles or people) and the intensity in this example corresponds to speed of the transports.

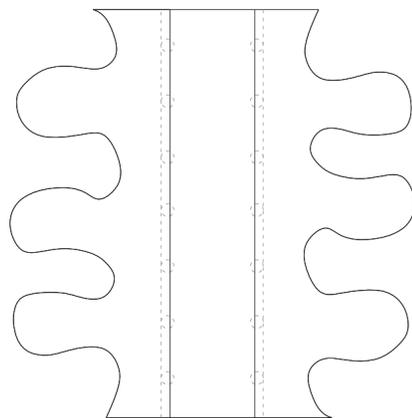




Bicycle path
More and smaller human spaces



Several lanes for vehicles
Fewer and larger human spaces



Increased speed of vehicles
Straight lanes allowing for increased speed,
larger human spaces but not as wide

1.2 Growth Network

In this subchapter, a concept for how a unit of the hybrid space would multiply outwards will be developed. The resulting network or sequence will possess a meaningful large-scale effect and functionality.

Growth Network Type

The selected growth network type is stacking.

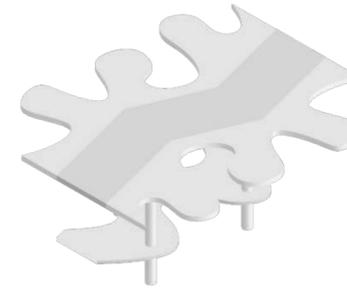


Burj Khalifa, SOM, Dubai, UAE, 2010



Turning Torso, Santiago Calatrava, Malmö, Sweden, 2005

Growth Network Concept



Hybrid space



Hybrid space growing vertically



Walls as stiffeners



Rotation of the system



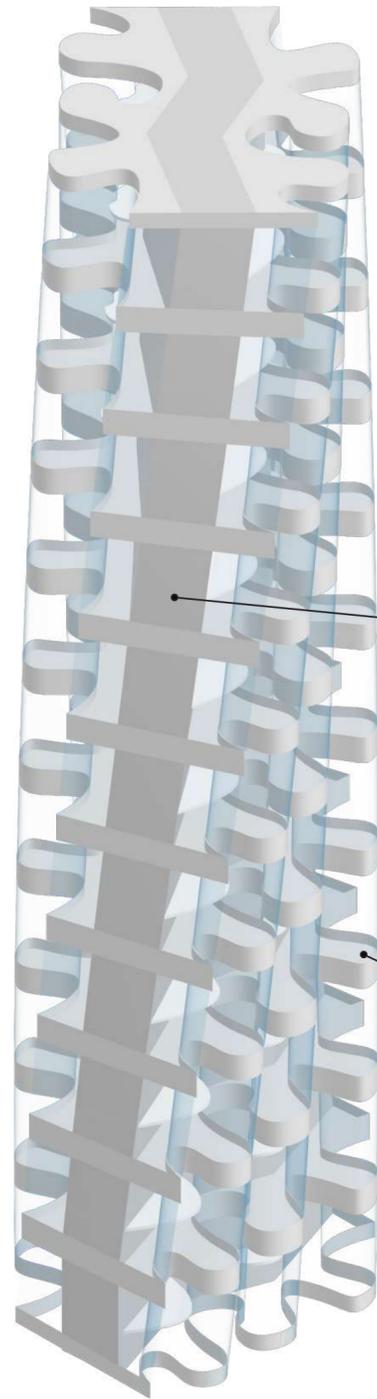
Facade



Glazed facade and balconies

Growth Network System

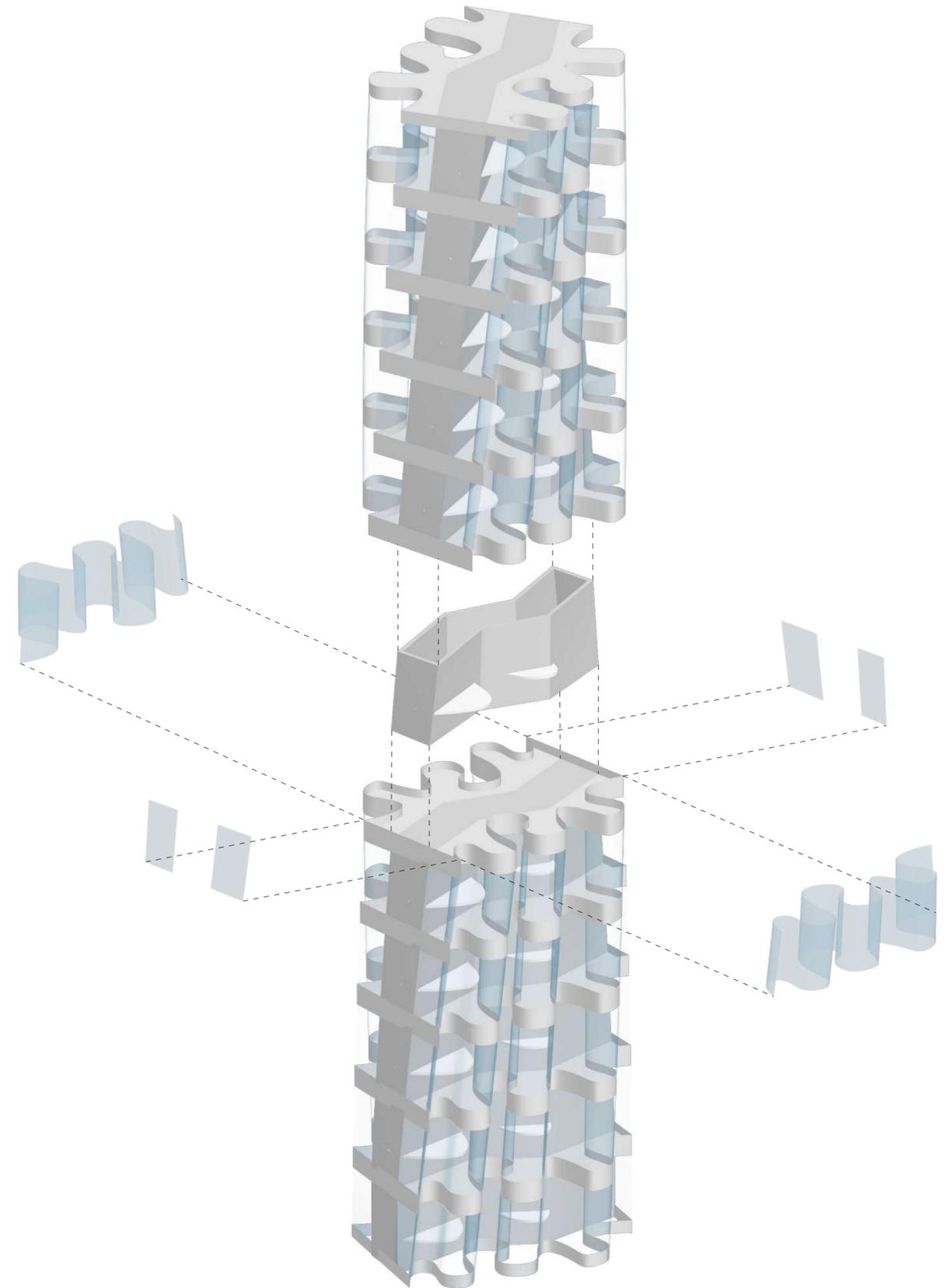
When the initial hybrid space grows vertically, the new growth system consists of a high-rise structure. In this case there are no infrastructure agents, meaning that the structure doesn't support infrastructure. Instead, the structure could be seen as a building or a viewing platform, where the human spaces act as balconies and the core could provide office spaces or stairs.



Walls are added to the system, replacing the columns of the initial hybrid space. This is to provide enough stiffness to the new structure. This also allows for new activities to take place inside the walls as they form a new space. Lastly, they enhance the rotation of the structure.

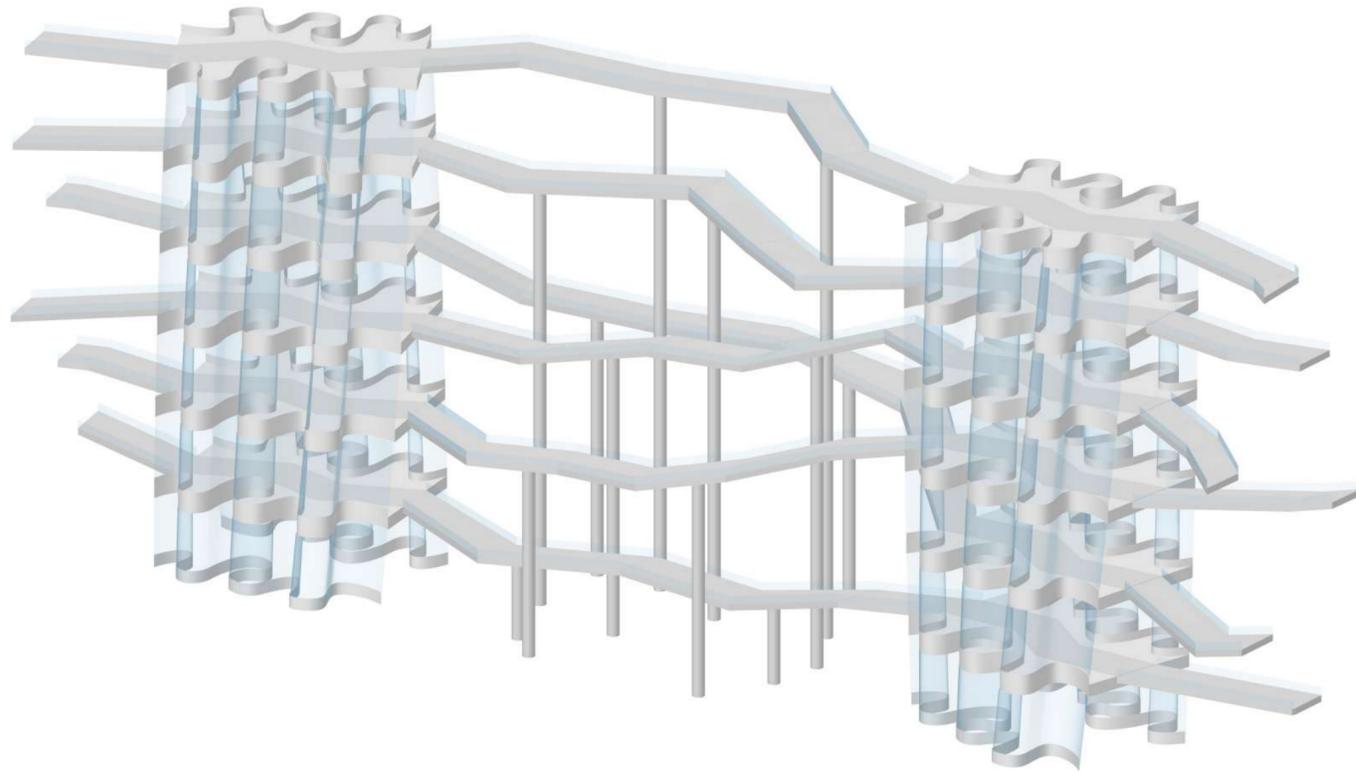
The human spaces act as balconies protruding from the core of the structure.

Components of the Growth Network System



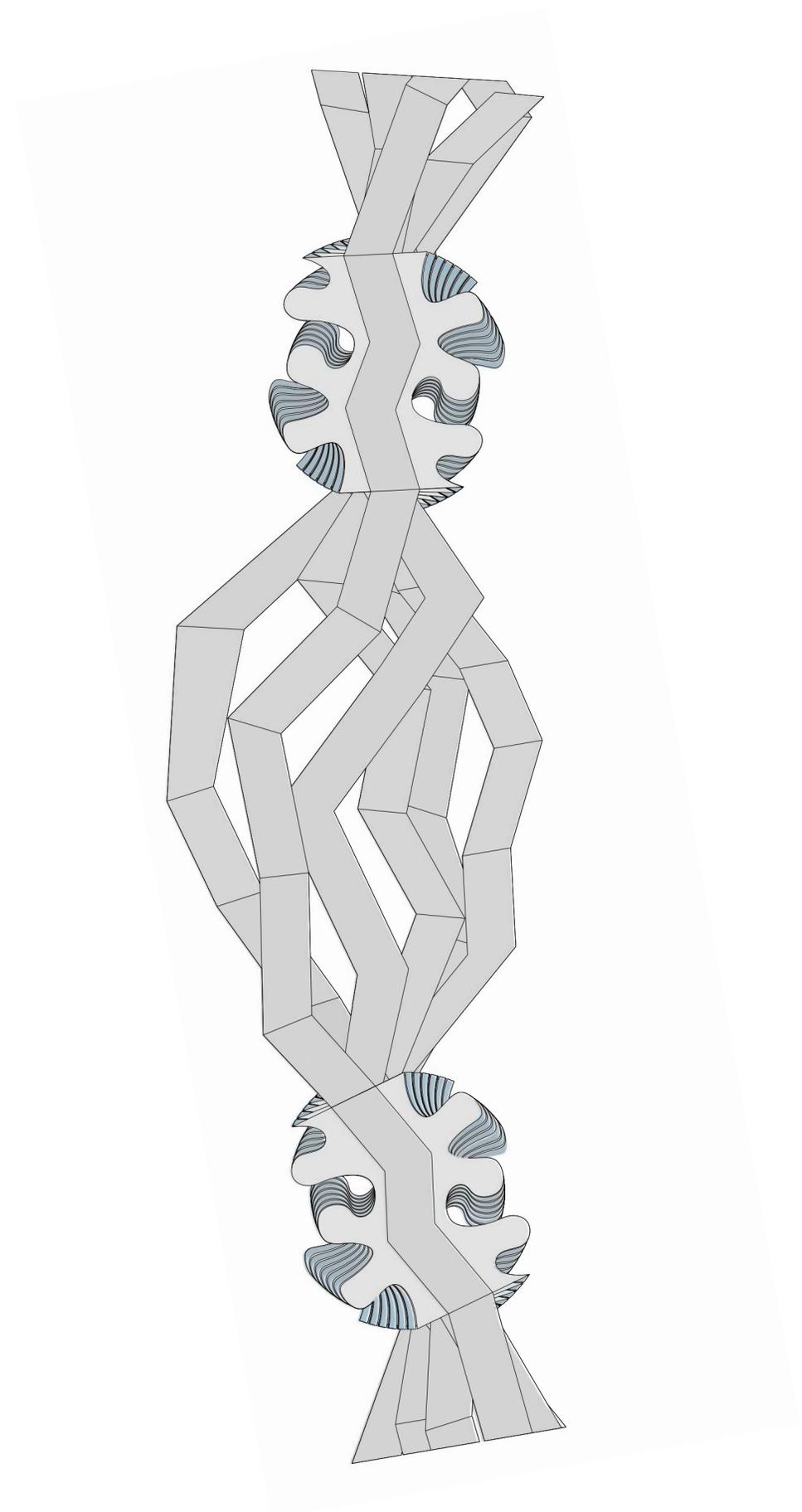
Growth Network System

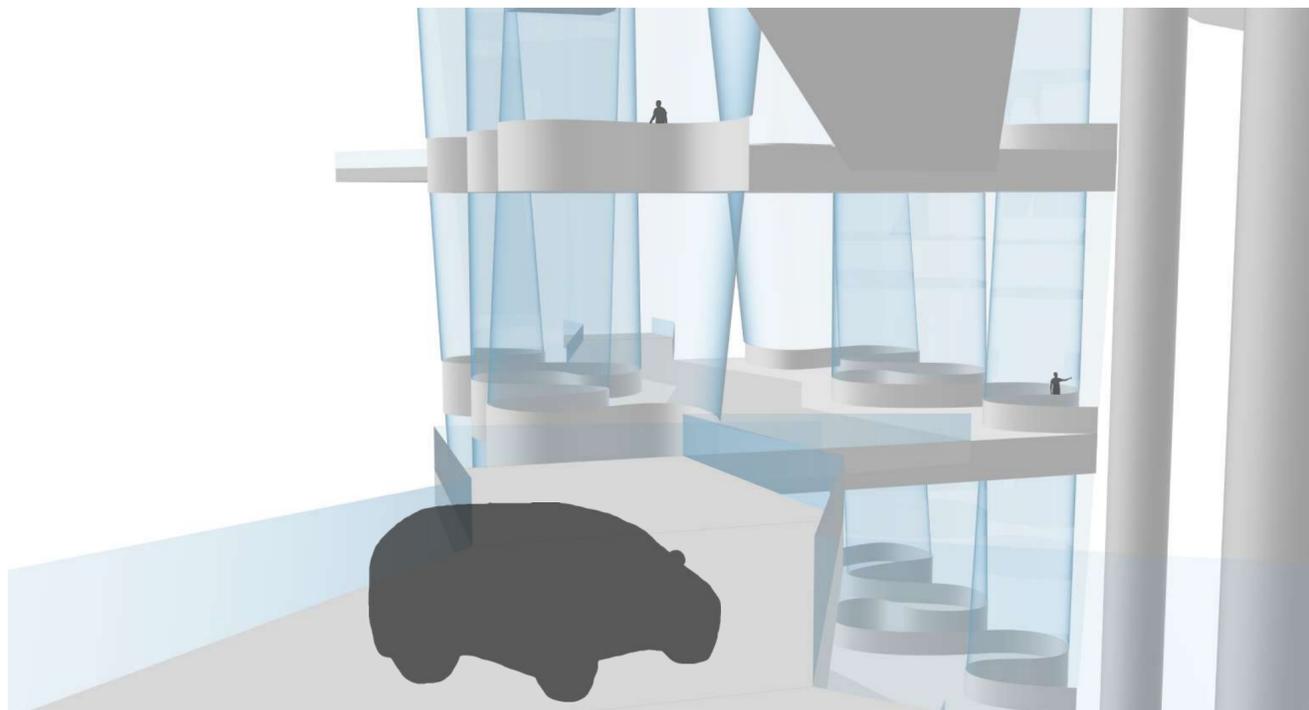
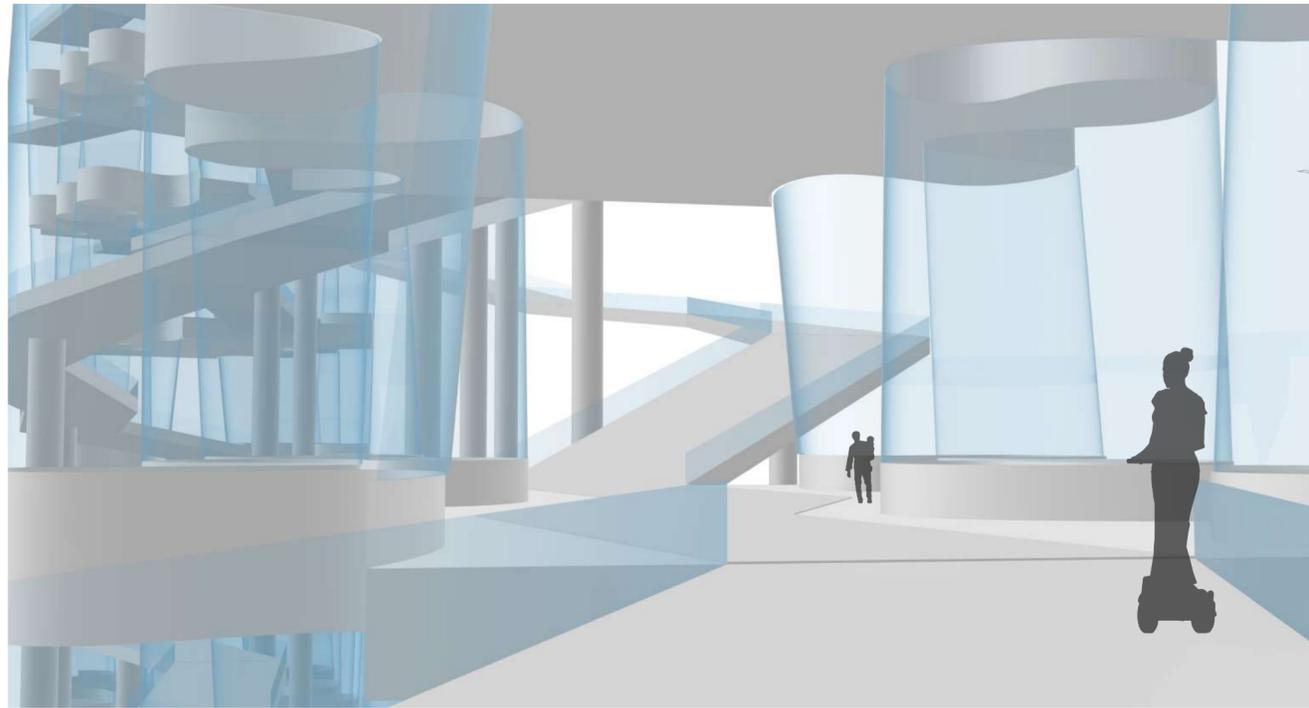
In this version of the growth system, the infrastructure agent is transporting vehicles and pedestrians from one point to another through the high-rise structures. This results in a complex network of roads, enabling travellers to reach their destination from different heights and levels. The high-rise structures provide support for the roads, along with the columns, and also serve as a viewing platform from the balconies.



Top View

Scale 1:500





2. Architectural Experimentation

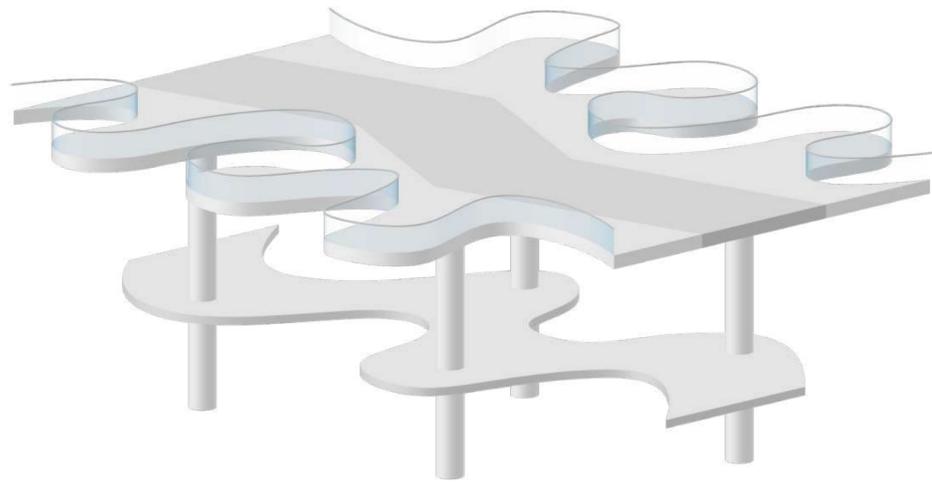
From this point on, two other students join for a team collaboration. The first following pages present a recap of the three individual projects that will be the point of departure for the team project.

In the second phase of the project, the existing waterfront contexts along the Göta Älv river will be problematized and their alternative futures will be reimagined as visionary developments restructured and evolved by the growth networks in the previous phase.

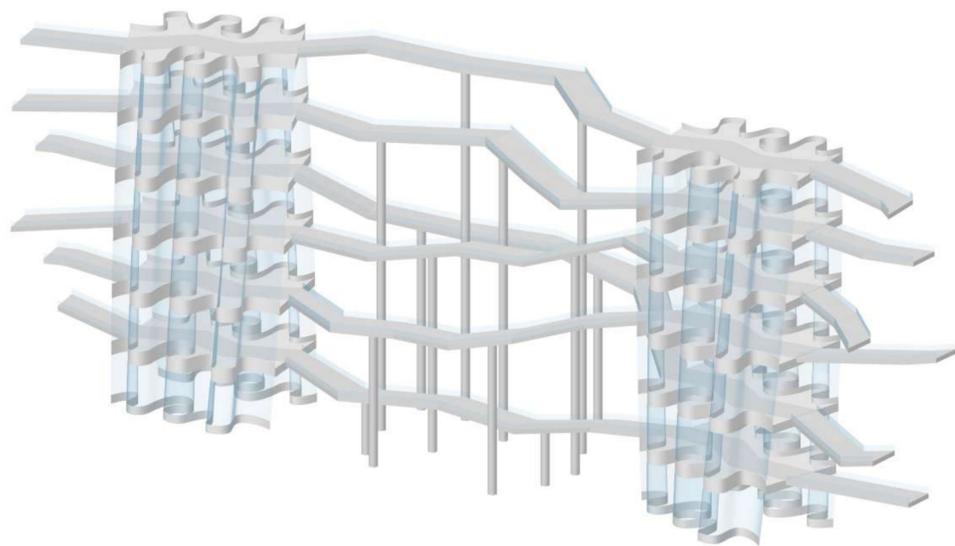
Samira's Project

Infrastructure: Bridge
Agent: Vehicles

Human space: Curved social space
Agent: Socializing people



Growth type: Stacking



Camilla's Project

Infrastructure: Gas station
Agent: Fuel

Human space: Dance floor
Agent: Dancing people



Growth type: Parasitic



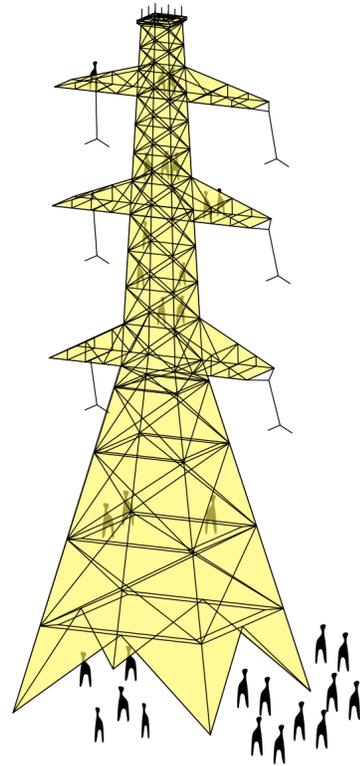
Axel's Project

Infrastructure: Power grid

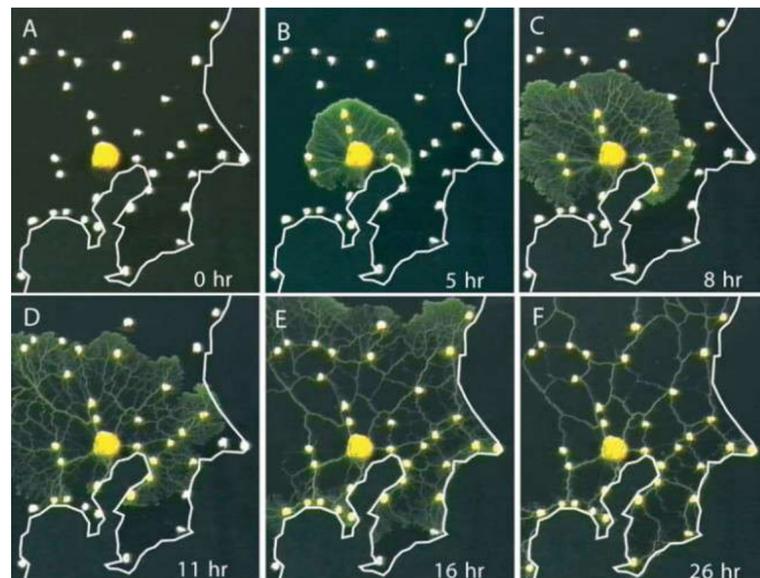
Agent: Electricity

Human space: Gaming cafe

Agent: Gaming people



Growth type: Slime mold



2.1 Problematized Waterfront

In this subchapter, an inseparable relationship between the key infrastructure agent and key human space agent within the context will be crafted. These agents will then be mapped to show how they currently behave in the context and also how they could grow into a hypothesized network to tackle a large-scale issue that has been problematized.

Problematization Type

Once upon a time, the harbours of the world were the heart of the city. There was action, motion and it was a big part of everyday life. Using Gothenburg as an example, it is clear how urban development has forced the harbour out of the city.

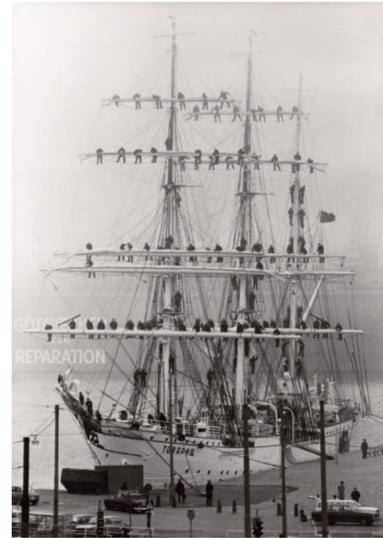
As a result, many people living in harbour cities have no relationship at all with this part of their heritage. The public can barely access the harbour and what was once a friend is now a stranger. Is the identity of harbour cities lost?

1968



Gullbergskajen och Holmen

1978



Innerhamnen Södra

2000



Skandiahamnen

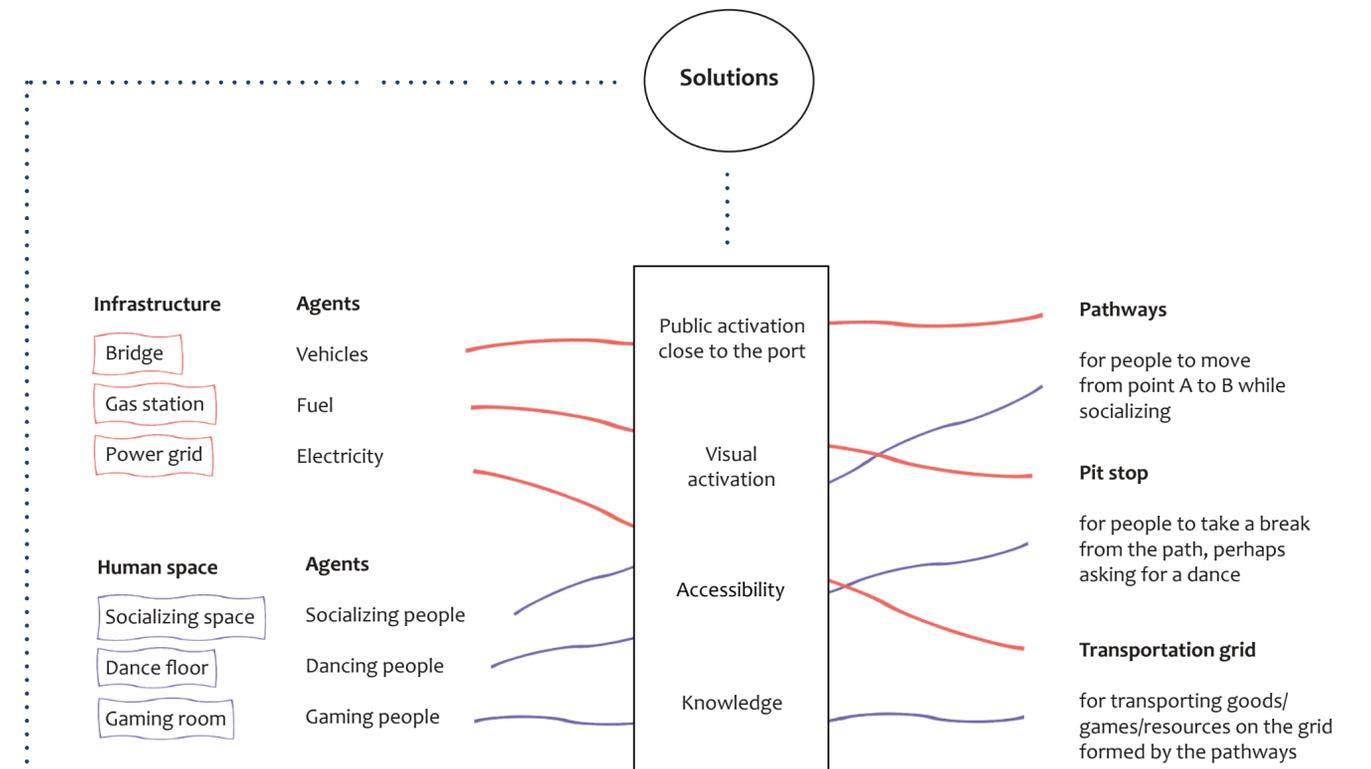
2020



Skandiahamnen

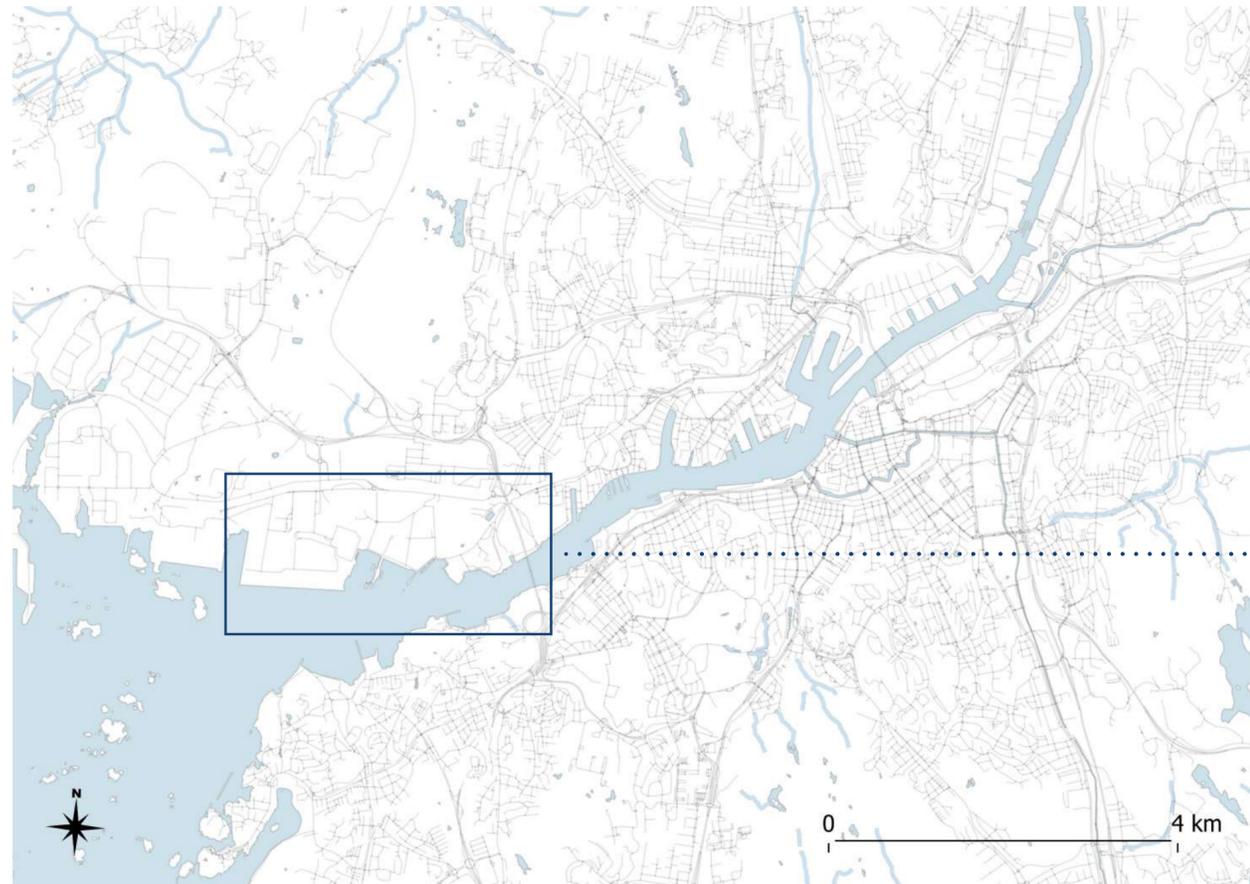
Intervention Concept

The following diagrams illustrate a concept of how our combined networks would collaboratively intervene to solve the problematized waterfront.

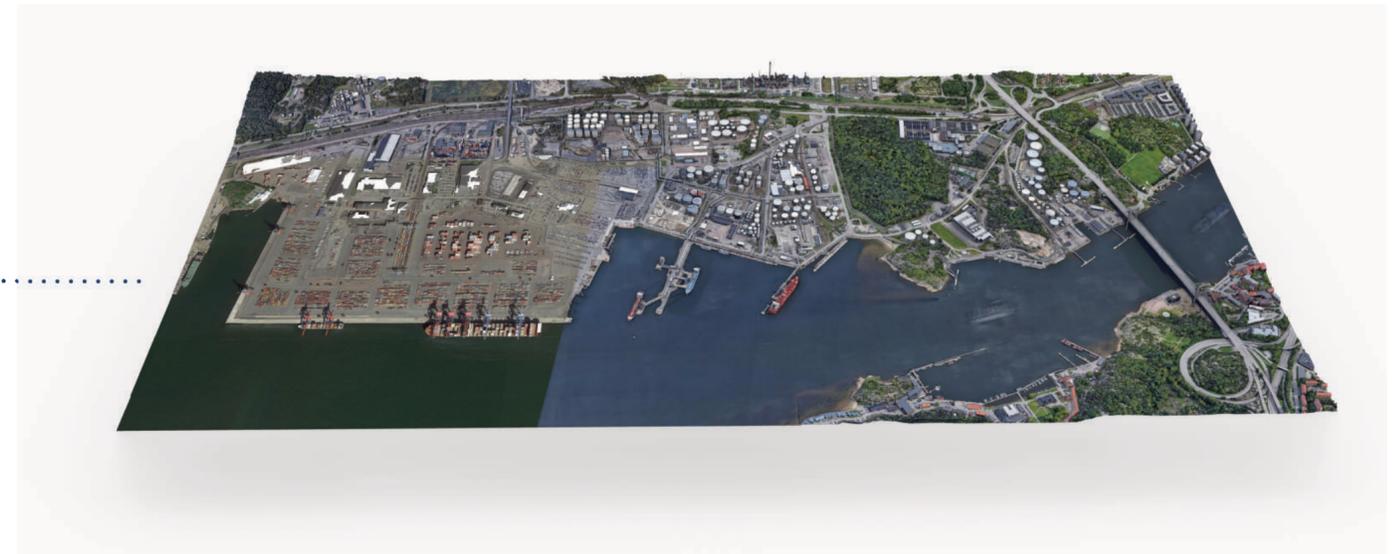


Context Selection

The waterfront territory along the Göta Älv river that demonstrates the highest intervention potential for the selected problem is the harbour area itself, narrowed down to Skandiahamnen and Skarvikshamnen.



Context Model

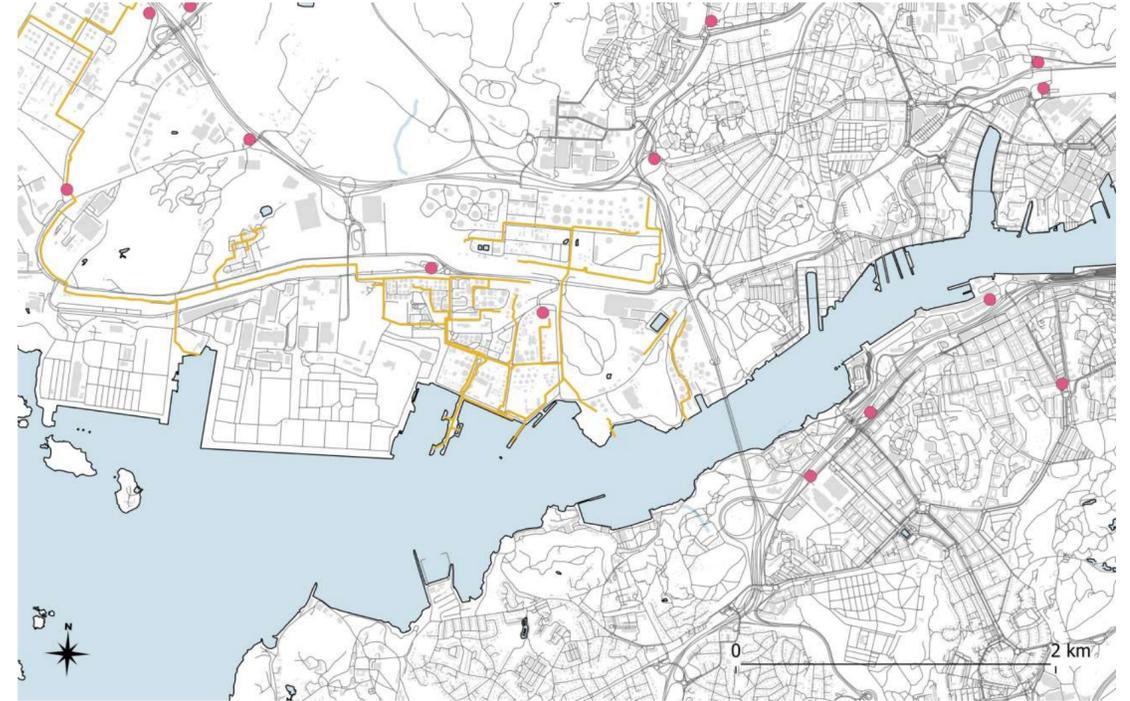


Problematization Cartography

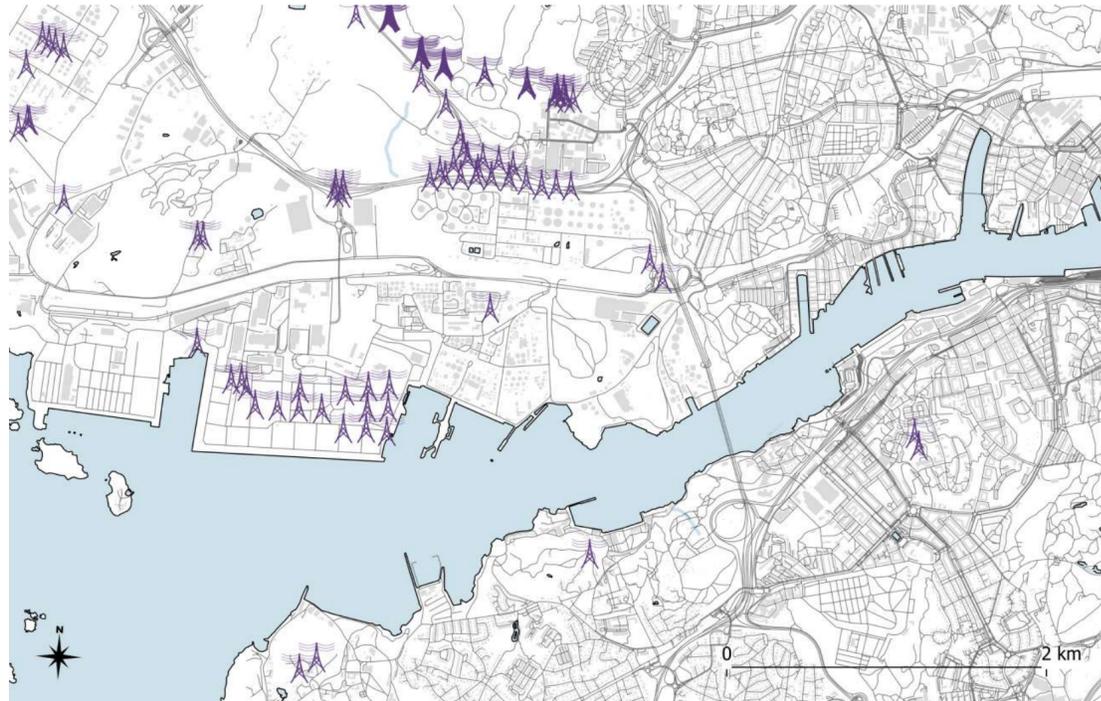
The existing behaviors (paths, intensities, densities) of each team member's infrastructural and human space agents have been mapped to cartographically illustrate the waterfront problem.



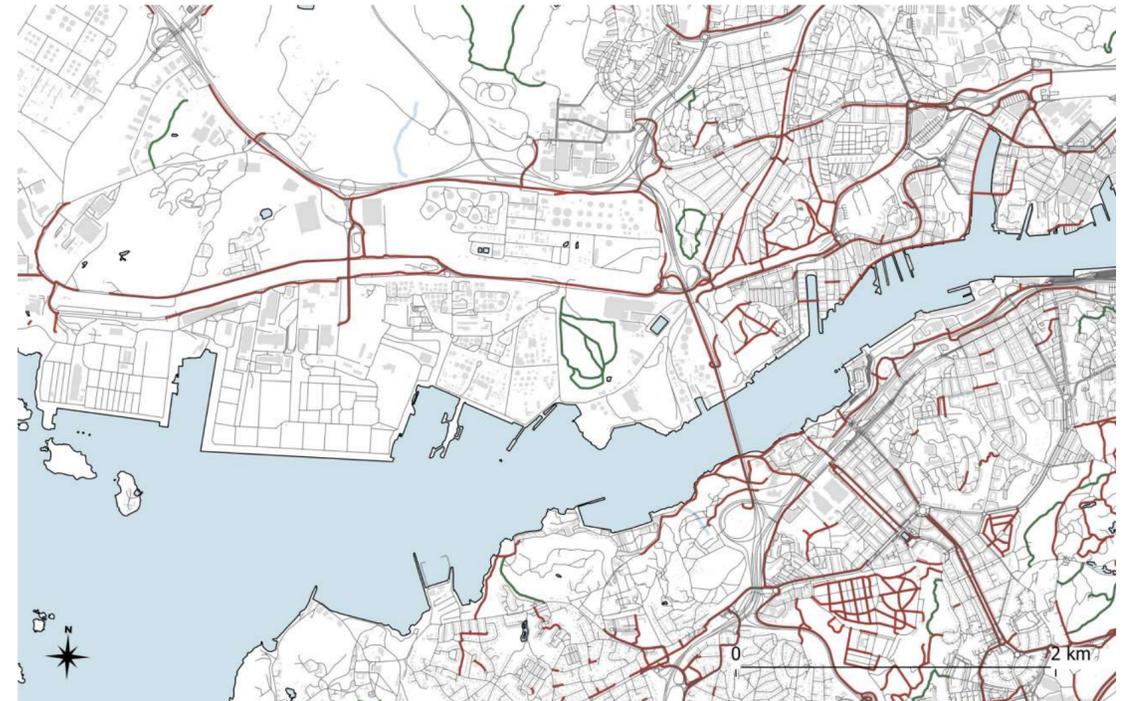
Traffic Flow Areas with dense traffic flows run just outside of the harbour area, clearly highlighting the lack of public movement within the harbour.



Gas Stations / Oil Flow There are two existing gas stations inside the harbour area along with heavy flows of oil in the underground pipelines.



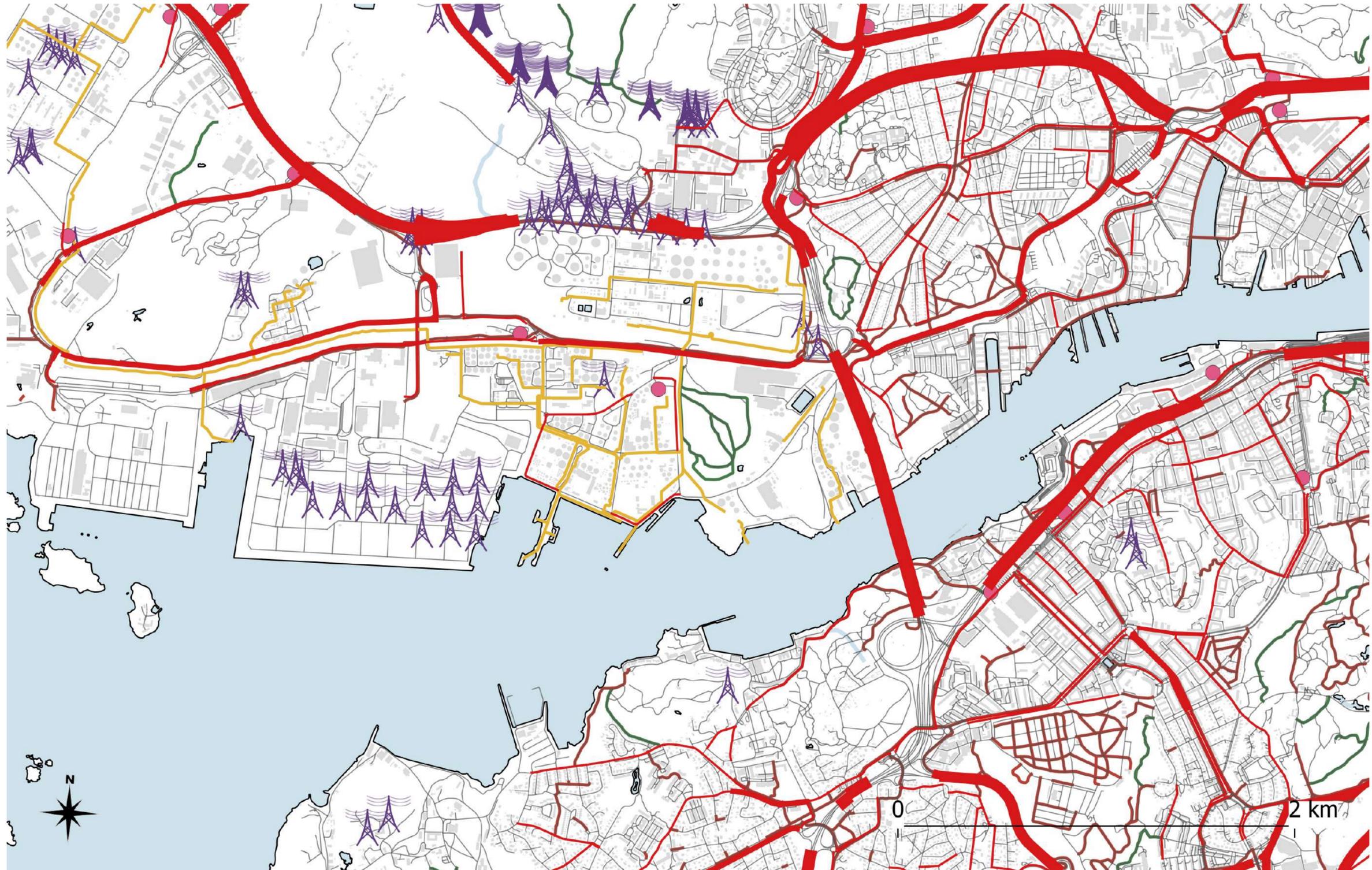
Power Towers There are several power towers located in the harbour area, making it possible to use existing towers as a base structure of the network.



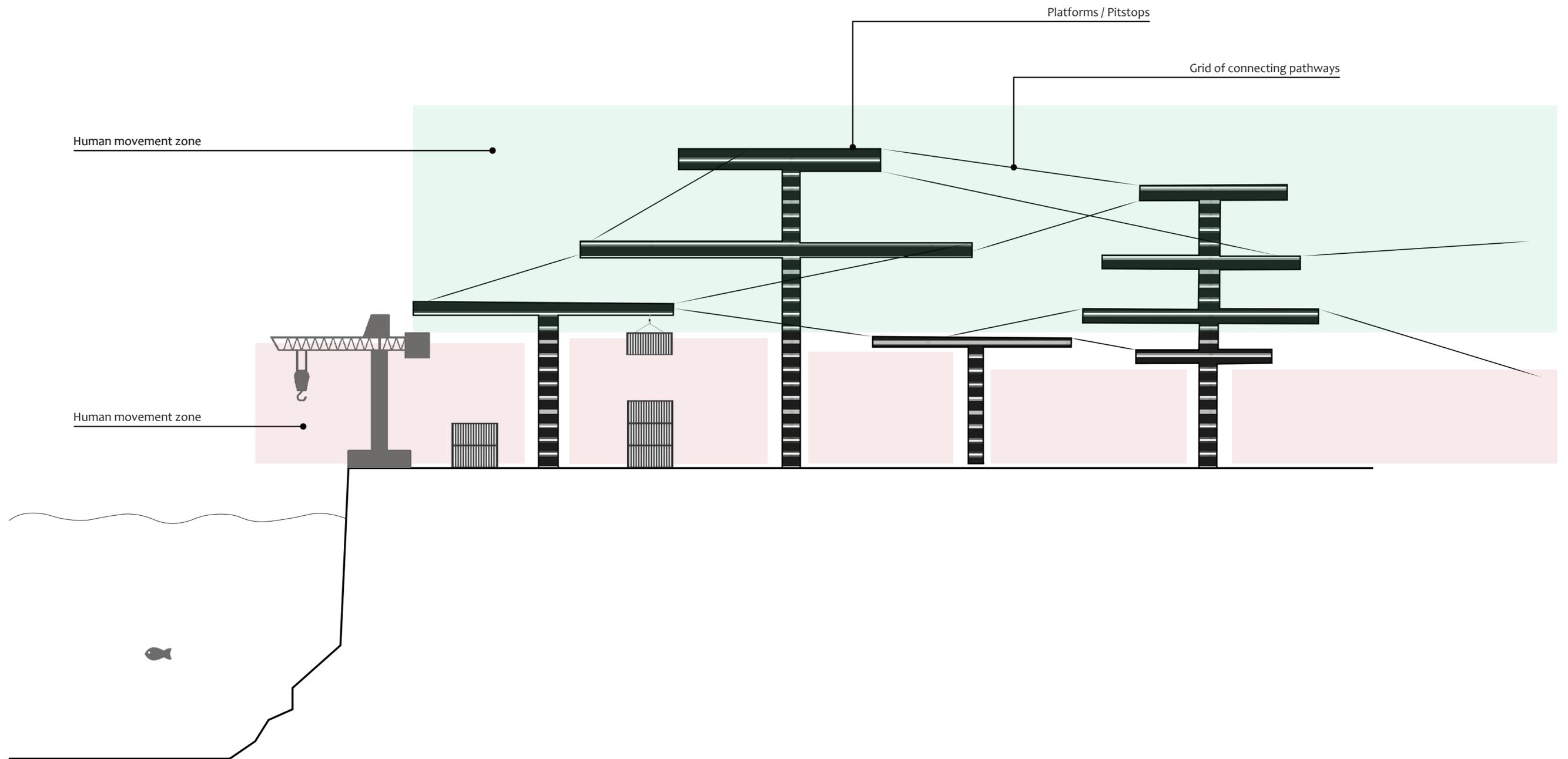
Pedestrian / Bicycle Pathways / Green Areas There is no public movement or any green areas in the harbour area, except for in Rya Skog.

Superimposed Map

In the superimposed map below all of the team member's infrastructural and human space agents have been mapped to show how all the existing behaviors interact.



Concept Diagram



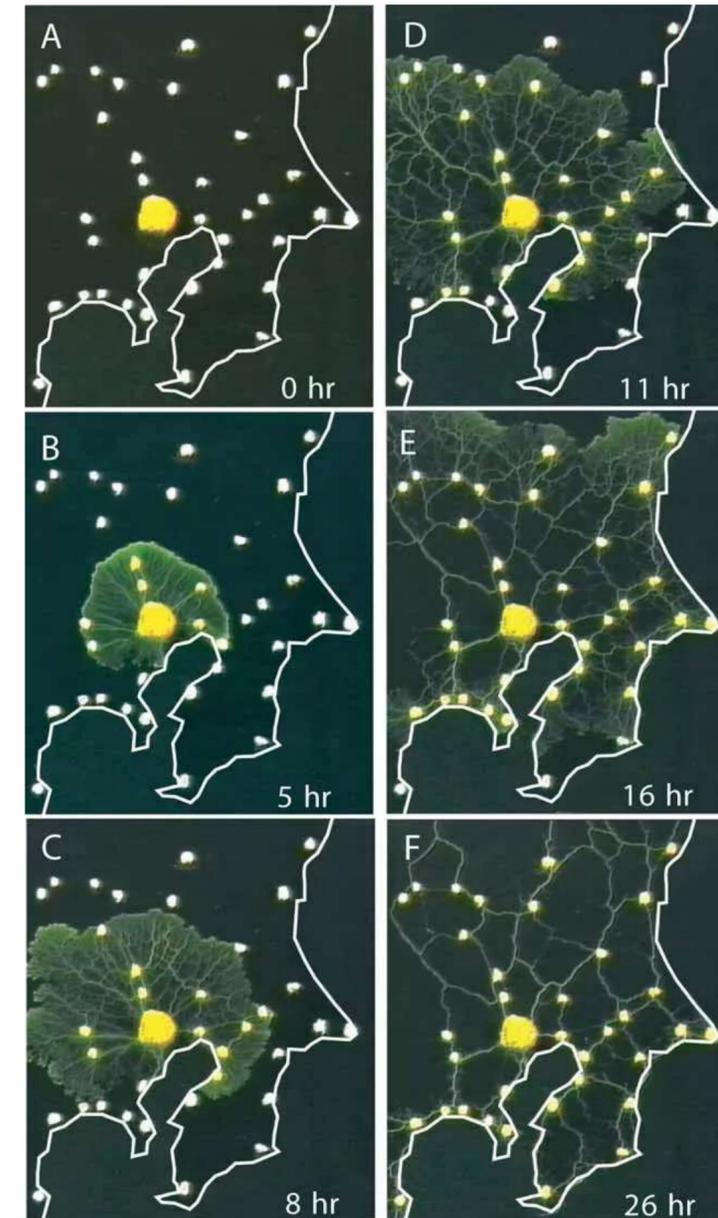
2.2 Waterfront Prototype

In this subchapter, a conceptual massing model of the hybrid waterfront context will be developed. The waterfront context, or waterscape, will be derived from improvisationally and collaboratively translating the hybrid space networks integrated with contextual assets.

Growth Type - Slime Mold

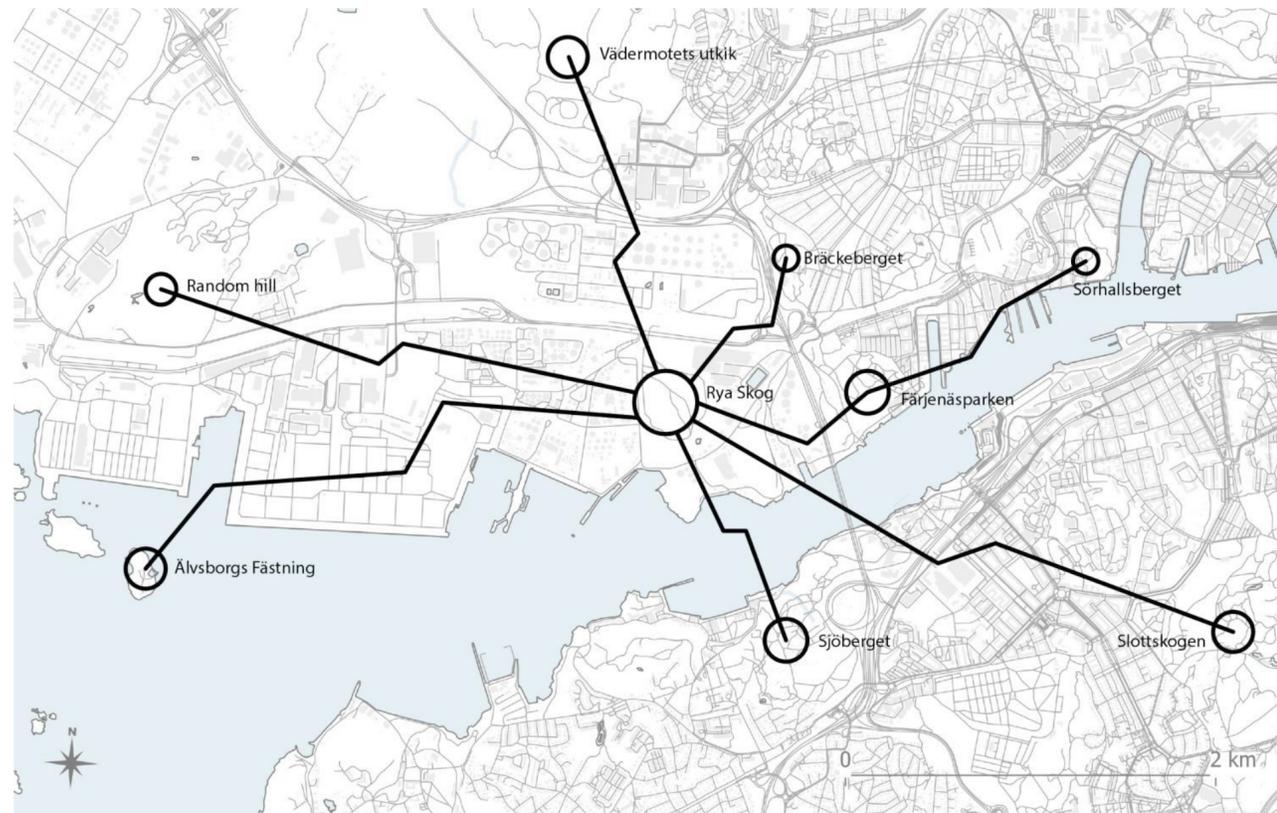
Physarum polycephalum, also called “the blob”, is a brainless organism that can solve mazes and make decisions. The slime is pathfinding, searching for wild food resources by sensing the environment. The slime grows across a large space, reorganizing itself and retracting its body to the shortest path into a configuration that allows it to eat optimally.

Our network grows in a similar manner. The network searches for greenery when it grows and once it finds green spaces, it generates the most optimal path to the next green space.



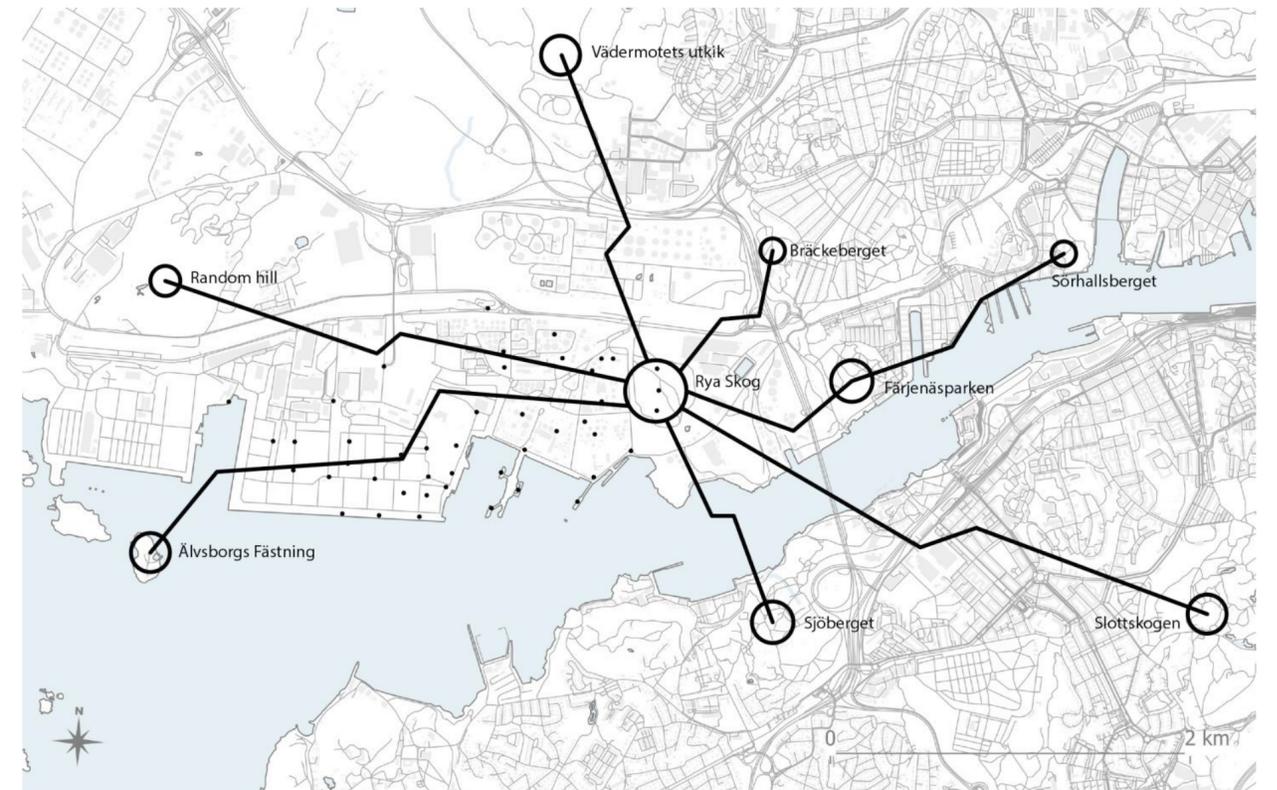
Parasite Network

The network spreads from Rya Skog, searching for greenery and thrives where there are people, movement and soul. When it has found what it is looking for, it generates the most optimal path just like the slime mold. However, in the harbour area there are no green spaces, but the network continues to search.



Parasite Network Nodes

To begin structuralizing the suprastructure networks, local assets have been mapped in relation to the infrastructure networks. The assets range from existing power towers within the area, placed where existing roads merge, silos or other oil related infrastructures or boat docking points. The assets have been translated into a system of points that serves as nodes in the suprastructure network.



Early Network Sketches

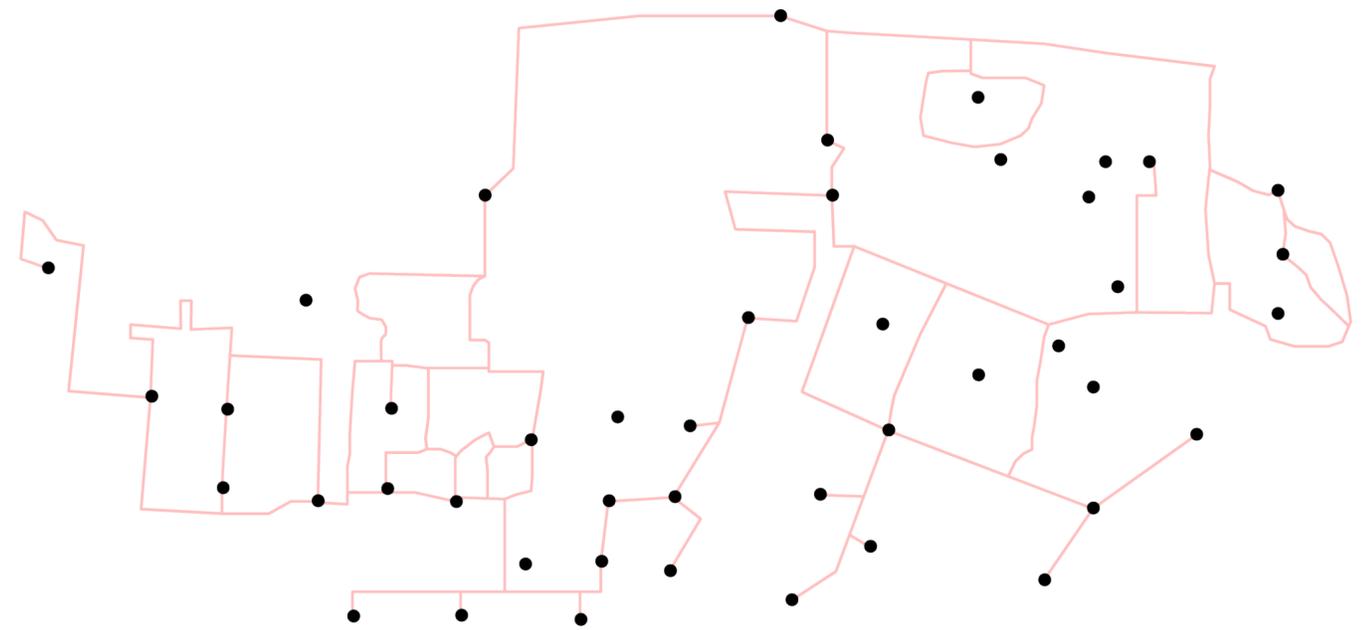
To continue the process, the scale has been narrowed down to the harbour area. The growth of the network has been explored, more precisely how the network tries to find green areas to anchor to and what happens when it doesn't find what it is looking for.

The three different networks have been studied individually, each with its own purpose. Together they form an alternative reality above the harbour area, making it a part of the city once again.

Pink Network - Movement

Infrastructure: Bridge → Pathway
Growth Type: Stacking

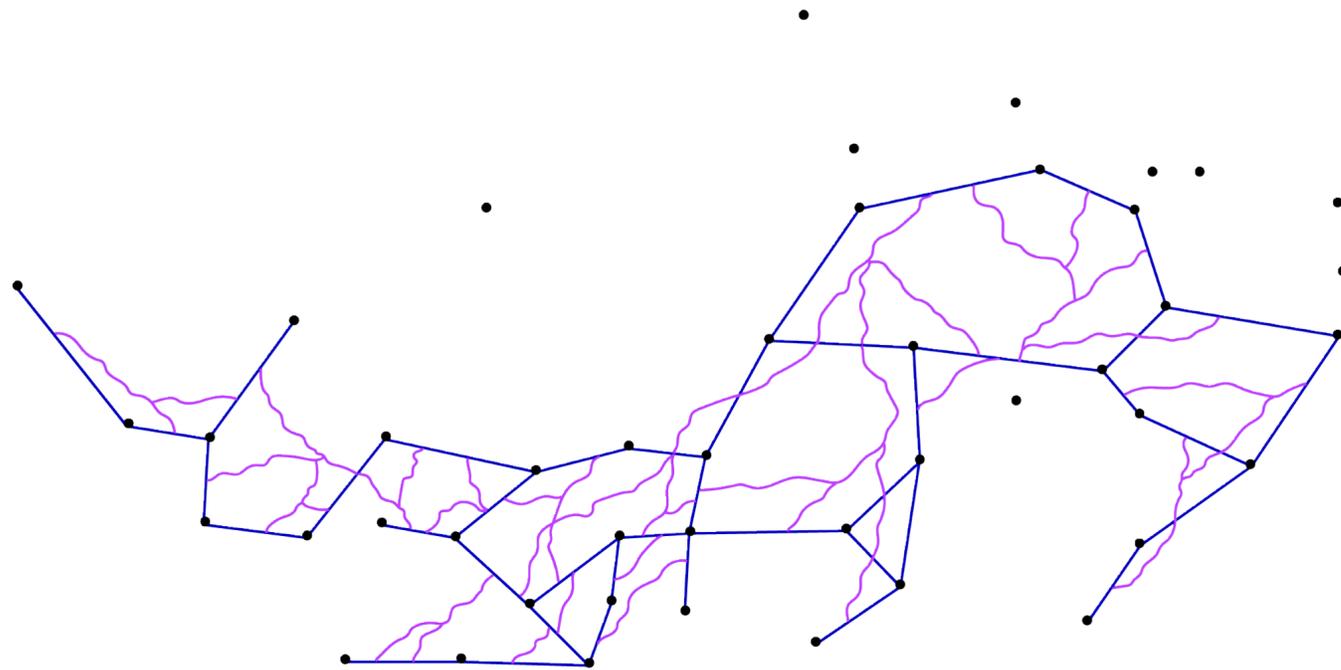
The movement network is a network of pathways for people to move from point A to point B. The network is formed by the projection of the existing system of roads and pathways in the harbour area. These existing roads and pathways are inaccessible to the public, making the new movement a reinforcement of the existing one. While some nodes are disconnected from the network, others have several connections which results in a higher flow of people. A higher flow in some nodes results in the need of stacking pathways above each other in 3D.



Blue Network - Life

Infrastructure: Power grid → Supply grid
Growth Type: Slime mold

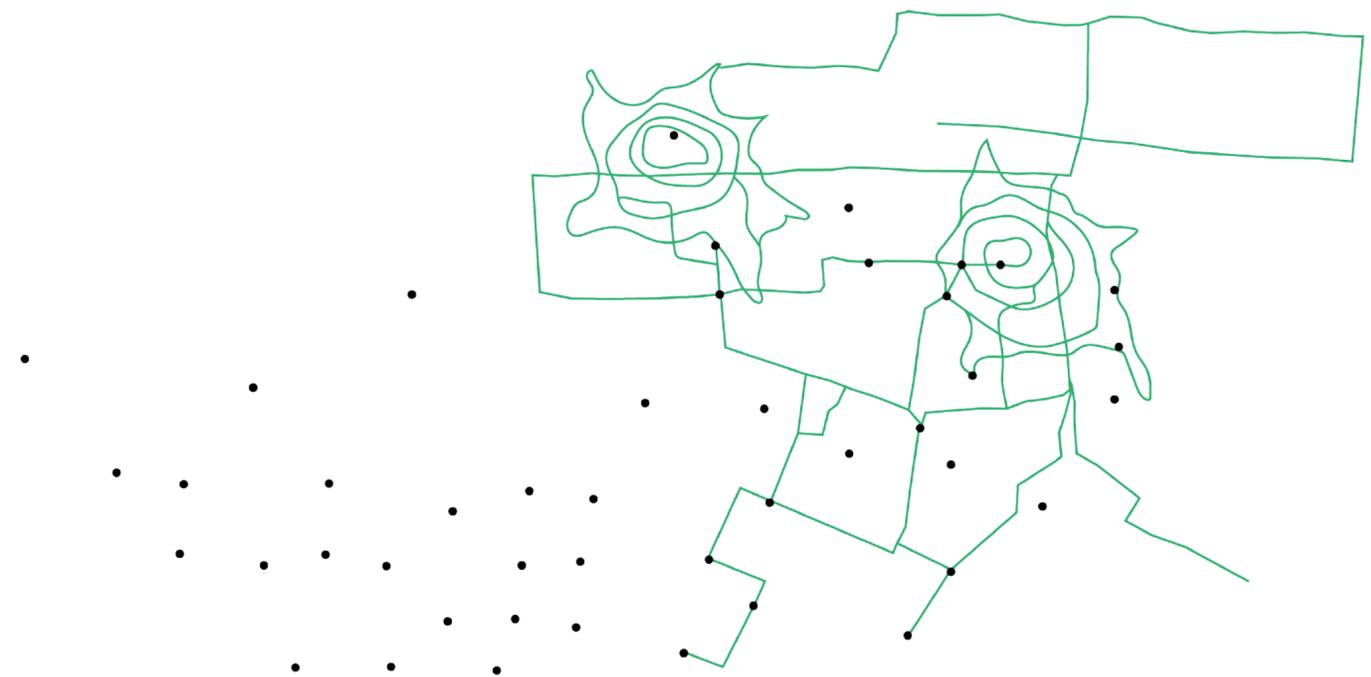
Life can't survive without water, therefore the life network supplies water needed by the networks and human spaces. Initially the network is forced into straight paths, but just like the slime mold it wants to optimize its paths and live its own life.



Green Network - Soul

Infrastructure: Gas station → Pit stop / Platform
Growth Type: Parasitic

Existing gas stations and nodes with specifically dense movement on the site are hosts to a parasitic network growth. The parasite is human friendly and aims to neutralize the gas stations and transform them into pleasant platforms for human activities by causing explosions of greenery. The greenery needs water to thrive, supplied by the life network while people transfer to the platforms through the movement network.

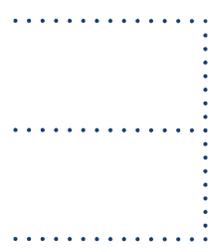


Superimposed Network - Life, Movement & Soul

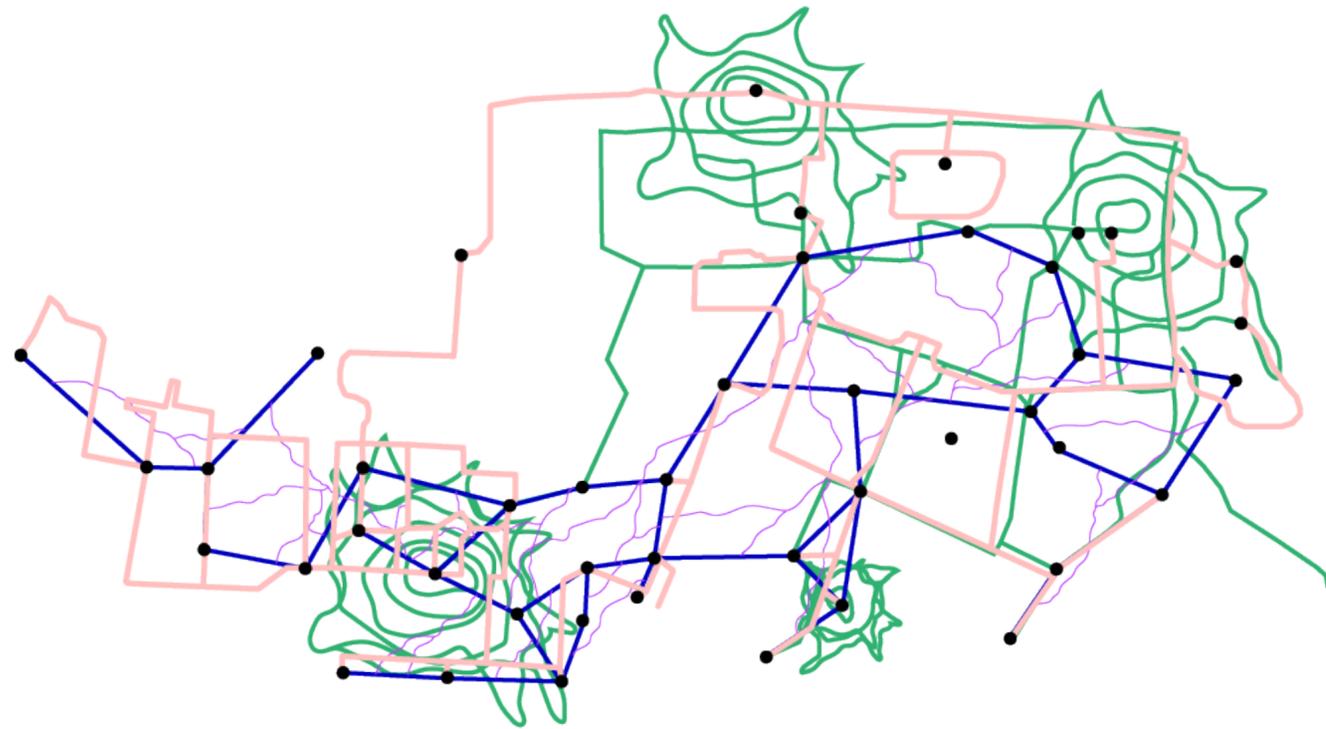
The movement network forms pathways in the sky above the harbour area allowing people to walk, run, ride a bike or perhaps dance in the clouds above the harbour.

The life network is the blood vessel, distributing water to even the smallest part of the suprastructure. Where there is water, there is life.

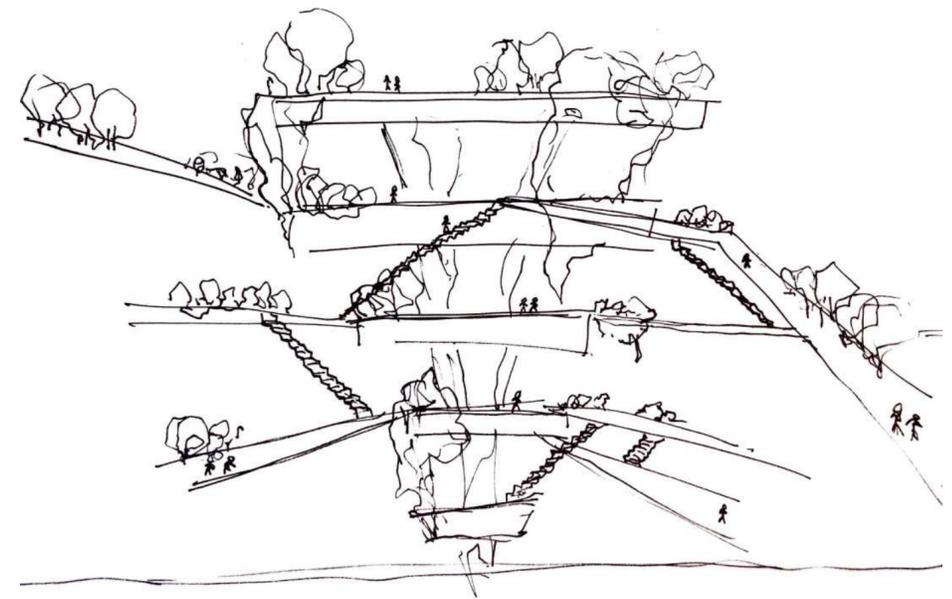
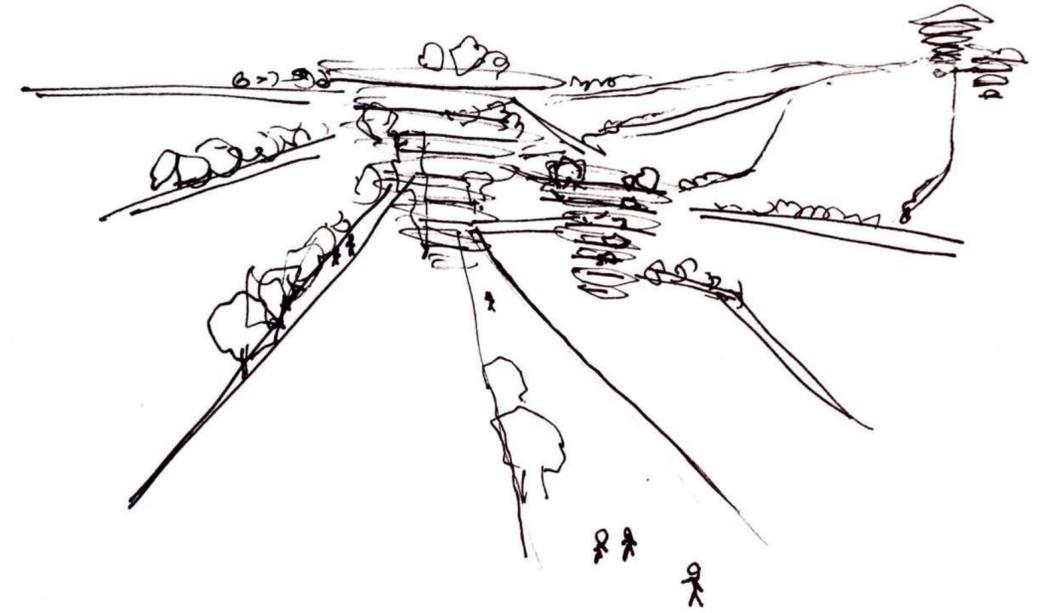
The soul network sets roots where fossil fuels are located, trying to counteract and neutralize the space and transform it into parks in the skies.



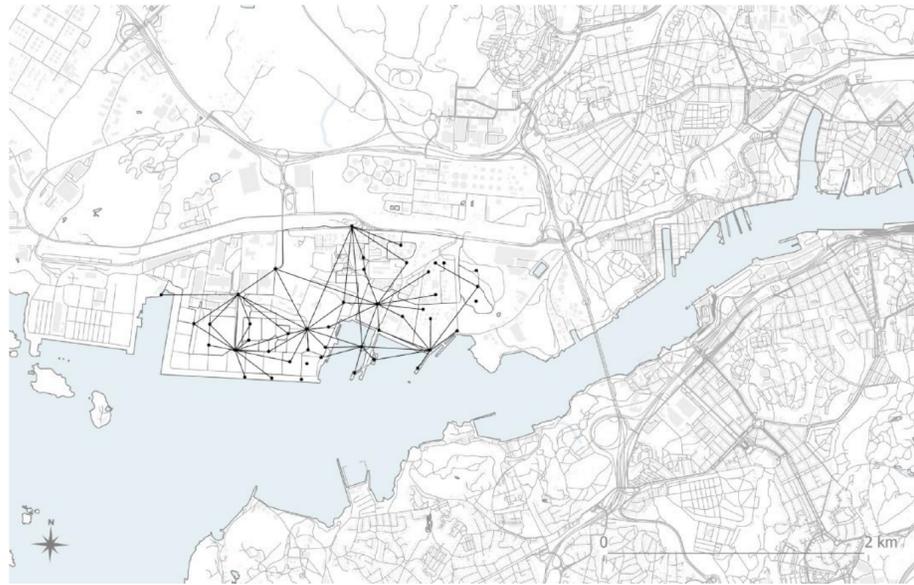
When combining the individual networks, a supernetwork is formed which lives symbiosis together to bring back life, movement and soul into the harbour area.



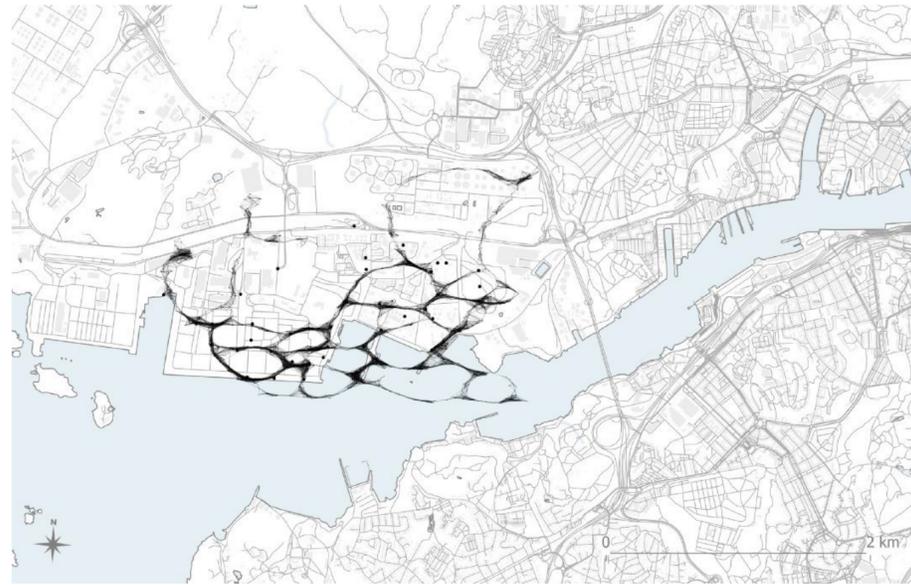
Sketches - The Platforms



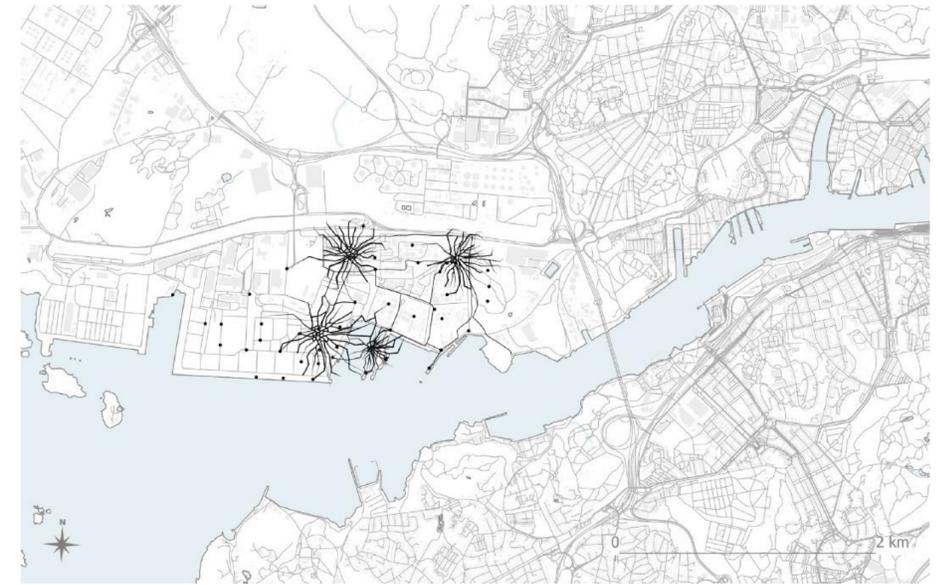
Network Illustrations



Pink Network - Movement
Growth: Stacking



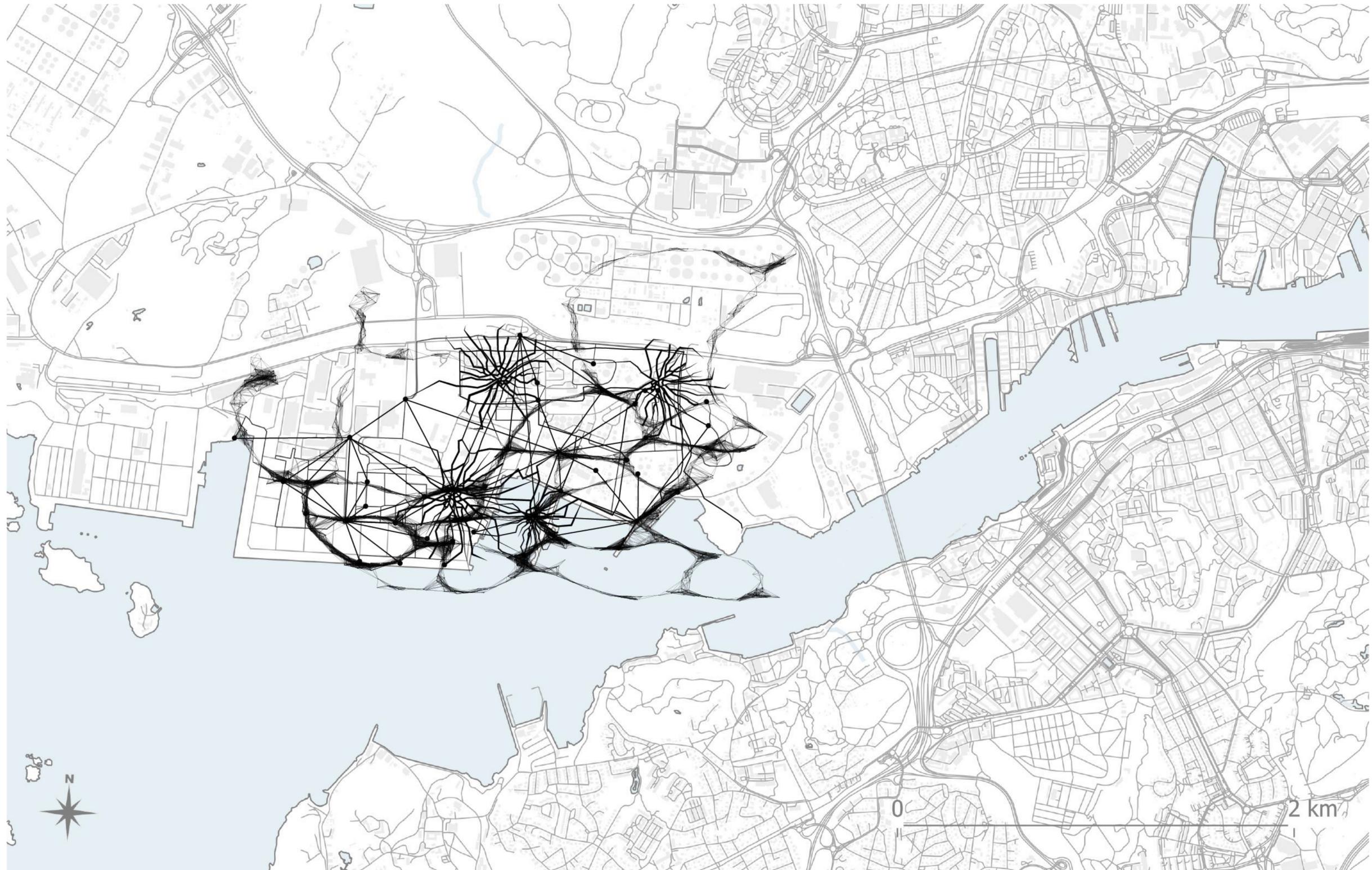
Blue Network - Life
Growth: Slime mold



Green Network - Soul
Growth: Parasitic

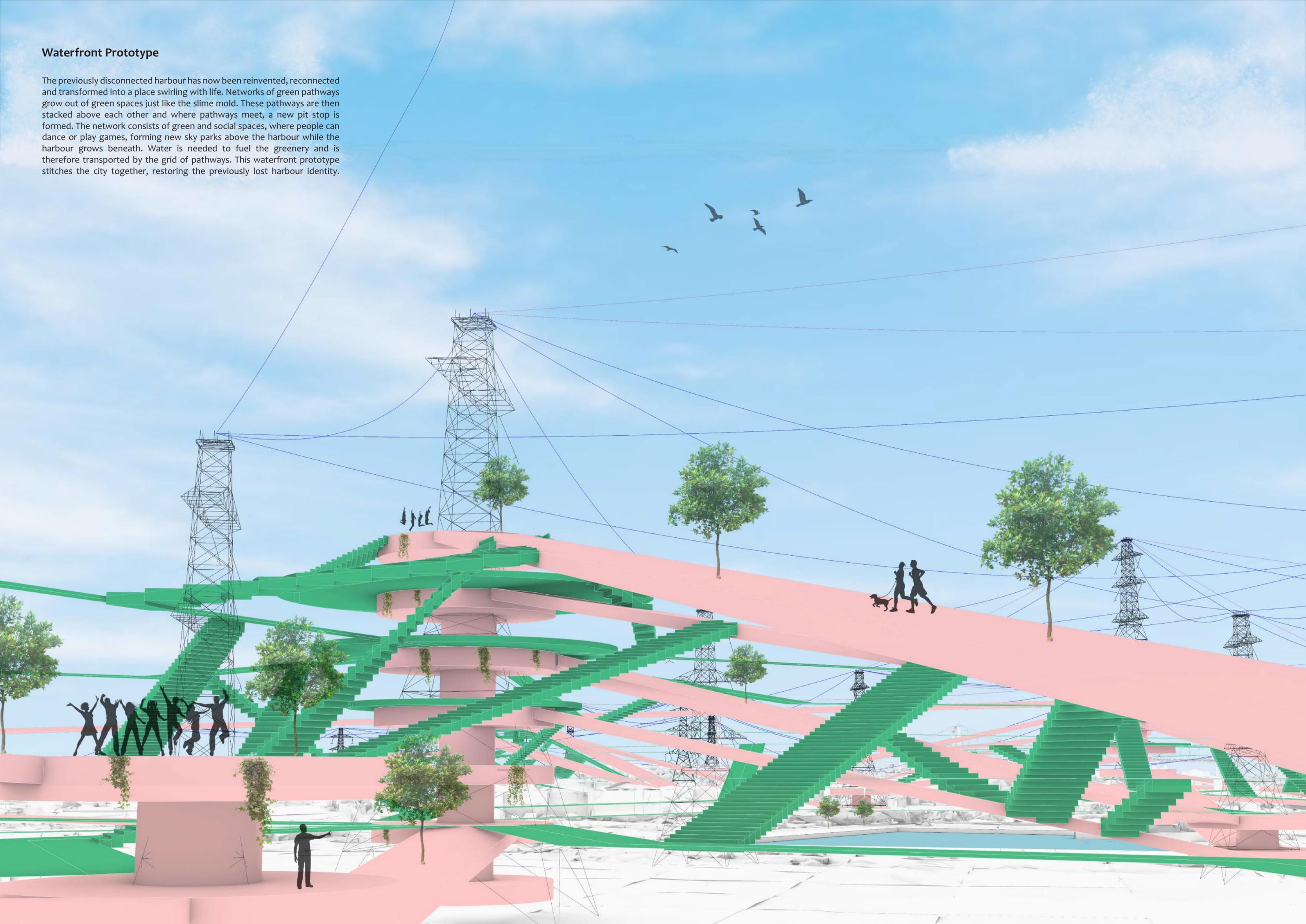
Superimposed Network Illustrations

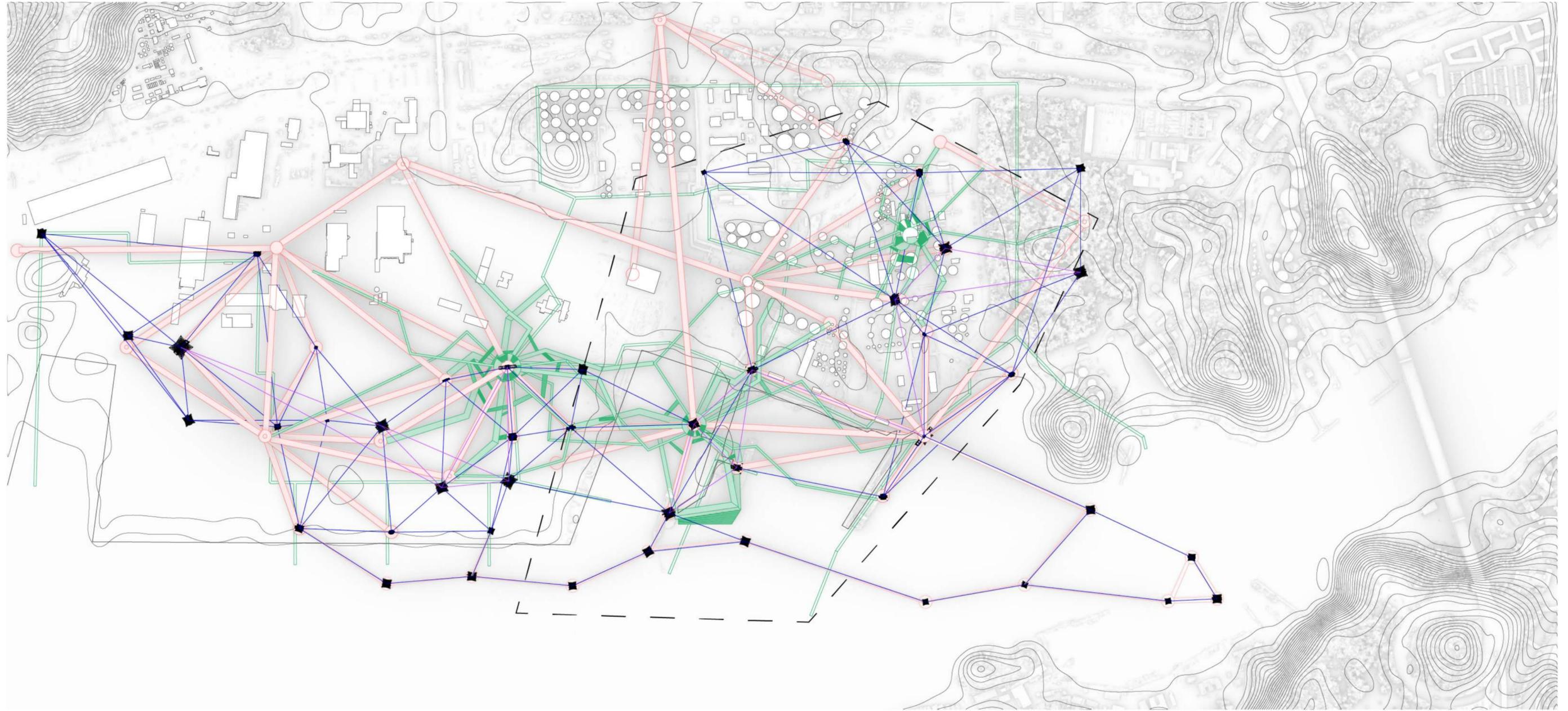
Life, Movement & Soul



Waterfront Prototype

The previously disconnected harbour has now been reinvented, reconnected and transformed into a place swirling with life. Networks of green pathways grow out of green spaces just like the slime mold. These pathways are then stacked above each other and where pathways meet, a new pit stop is formed. The network consists of green and social spaces, where people can dance or play games, forming new sky parks above the harbour while the harbour grows beneath. Water is needed to fuel the greenery and is therefore transported by the grid of pathways. This waterfront prototype stitches the city together, restoring the previously lost harbour identity.





Connectivity To Water

The site beneath the network consists of different types of typologies. The networks are therefore divided into three different zones where the growth network adapts to the underlayer with varying accessibility to the ground depending on the activity below.

Zone A

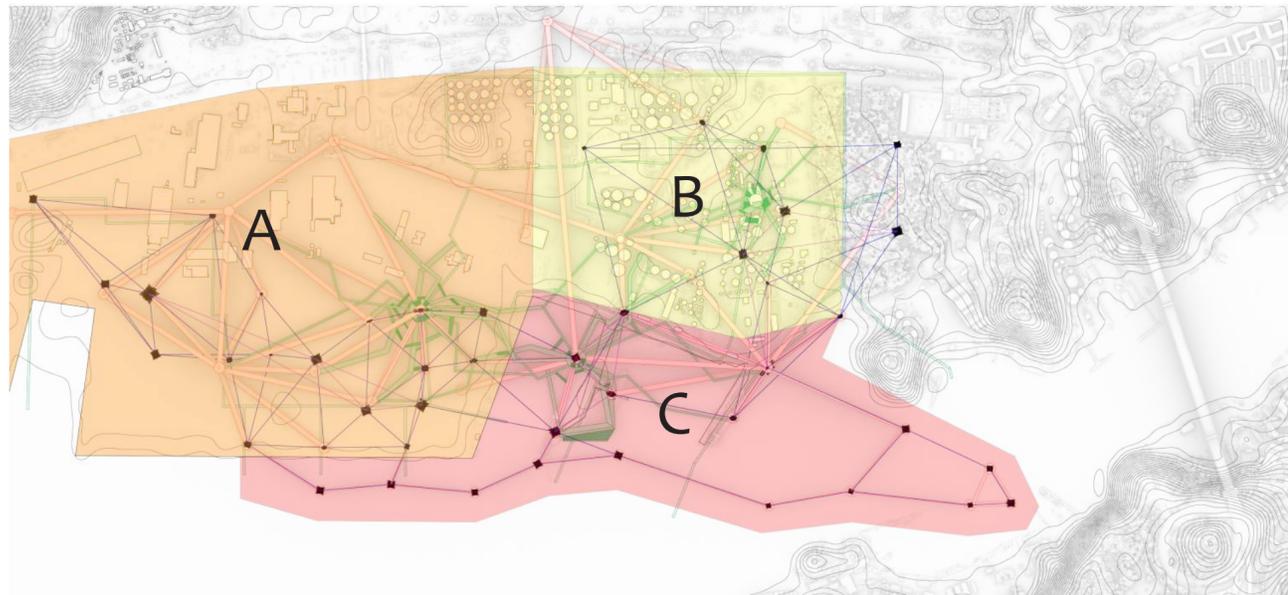
The area beneath this zone consists of harbour industry with high movement, which needs space to function. The network in Zone A is lifted up high in the air and provides no public access to the ground.

Zone B

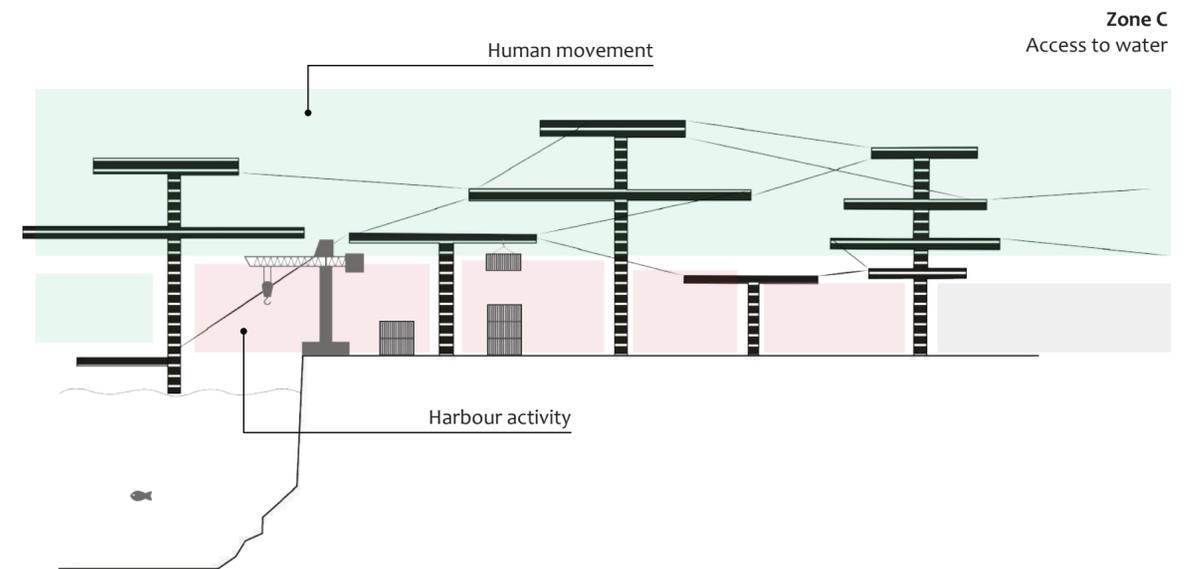
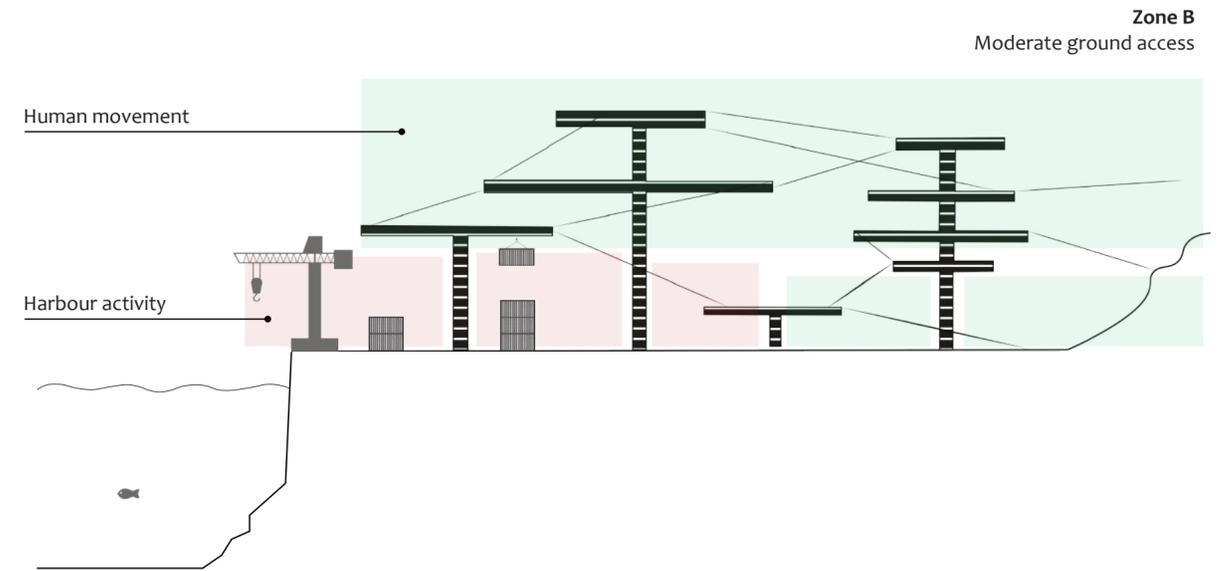
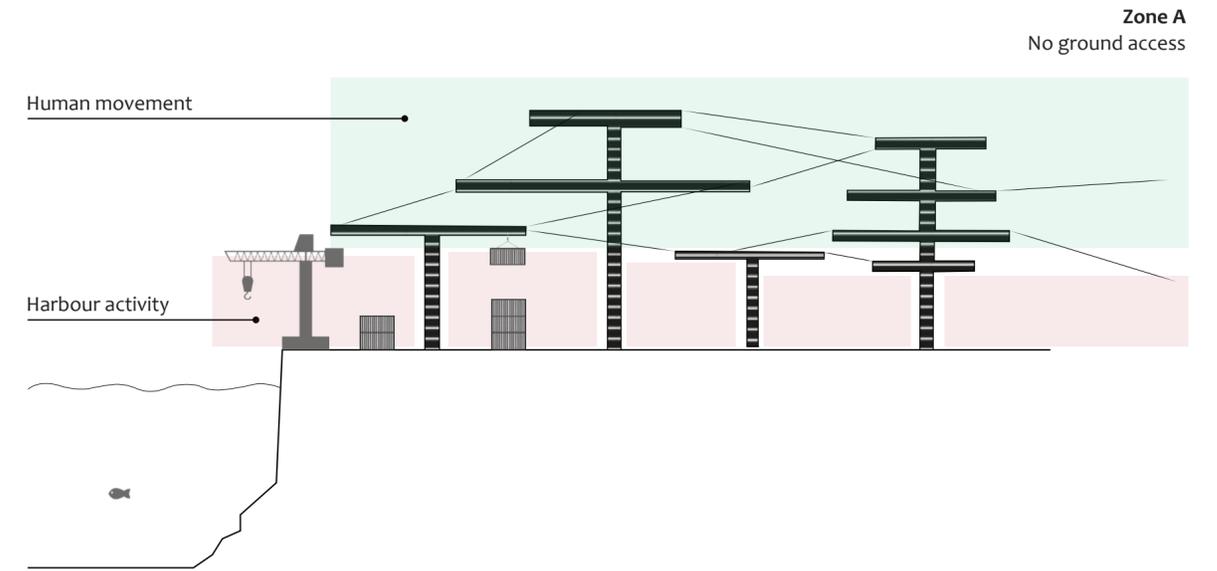
The area beneath this zone is of mixed type with different public accessibility. The network in Zone B provides public connections to Rya Skog in the East and touches the ground in some nodes.

Zone C

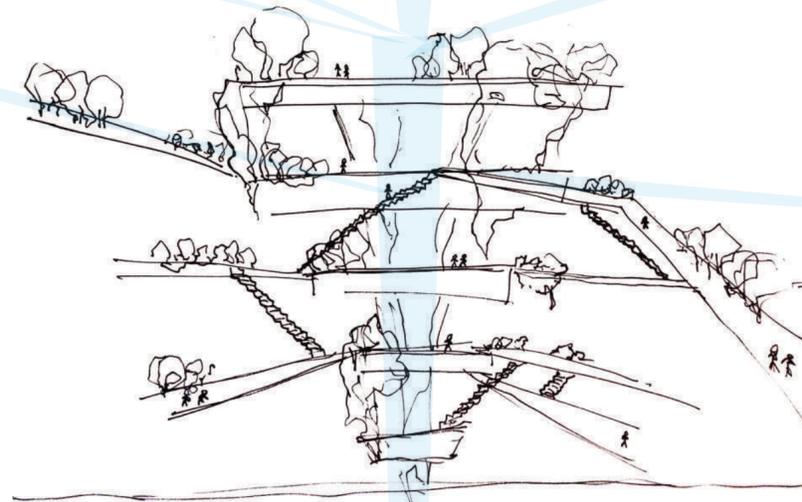
The area beneath this zone consists of water. The network in Zone C is kept high up in the air in some parts to allow ships to dock. In other parts, the network takes a dive to provide public access to the water.



Human Movement vs Harbour Activity



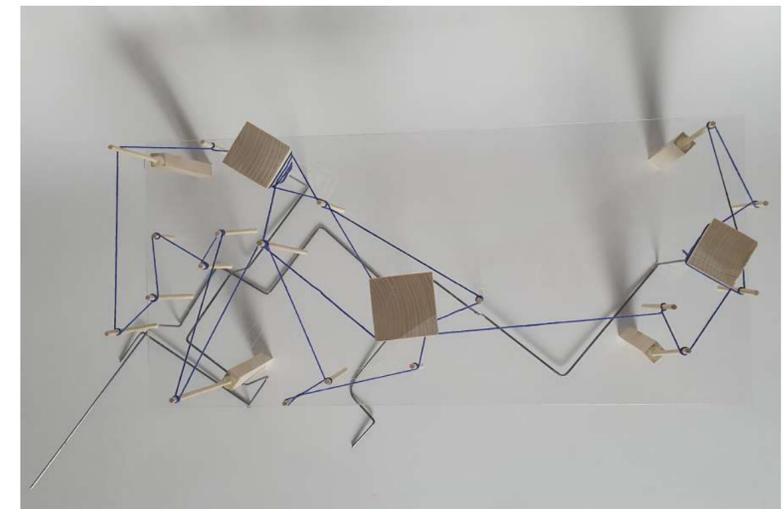
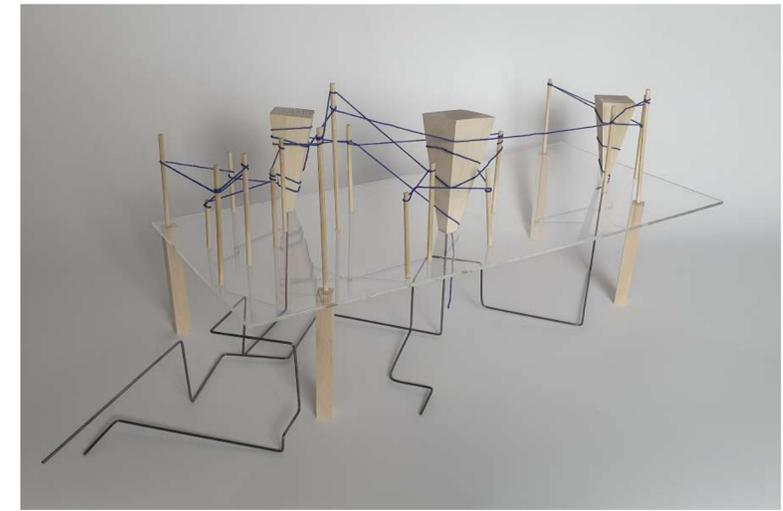
Water Sketch

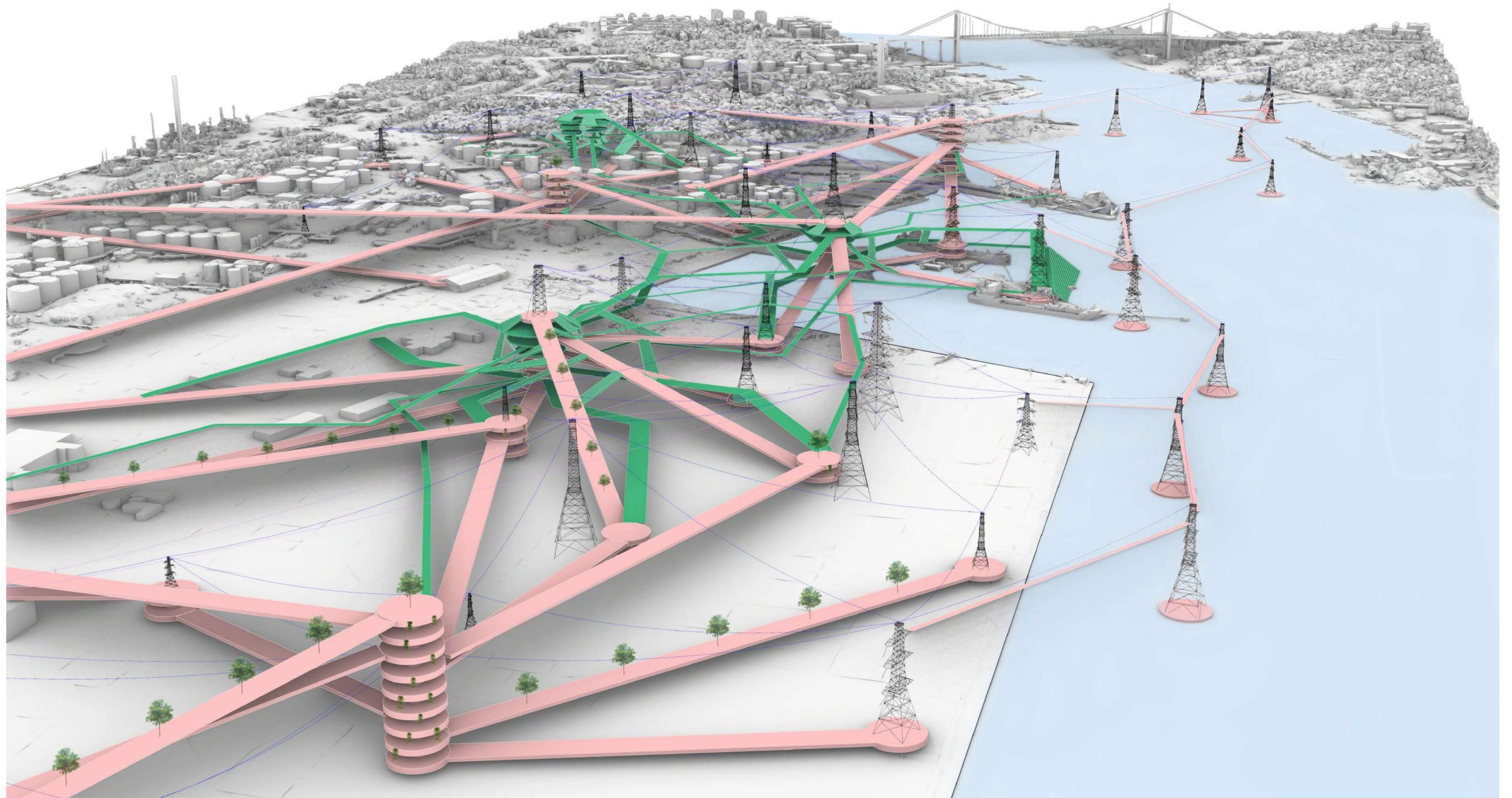


*Water is being pumped into the pipes,
filtered in the platform towers,
giving life to the growing trees,
further distributed into the network,
spreading life as it grows.*

Physical Model

A abstract physical model was built to showcase the different parts of the waterfront prototype (the platforms, oil pipes and flow of water) and how they are connected to one another.





3. Project Definition

In the third phase of the project, a deep design of the waterfront prototype will be developed. This will result in qualitatively rich urban design and hybrid architectural proposals. This will be achieved in two different scales, where the first part is to develop the prototype into a thoroughly designed suprastructure. The second part is to develop a individually chosen critical segment of the suprastructure into a focused hybrid architectural project, articulating the qualitative aspects of the hybrid spaces.

3.1 Waterscape Suprastructure

In this subchapter, the waterfront prototype will be developed into a waterscape suprastructure. The suprastructure will be a combination of the hybrid networks and contextual assets designed as one seamless entity.

3.1.1 Midterm Review

In the following pages, the first draft proposal of the waterscape suprastructure that was presented on the midterm review will be shown.

Axonometric

The network below consists of green spaces on top of and around silos and two different type of towers with different functions. Movement towers are placed nearby, enabling visitors to transport between different silos and towers. The movement towers are also green observation towers and they provide structural stability to the network and connecting pathways. Power towers provide the network with solar energy and are also vertical gardens with platforms serving as parks.



Plan



Movement towers with a spiral core to shift between different levels in the network.

Stabilizing the network and supporting the connecting pathways.

Clusters of old oil silos transformed into green spaces vibrating with life. Inside the silos, vertical gardens are growing.

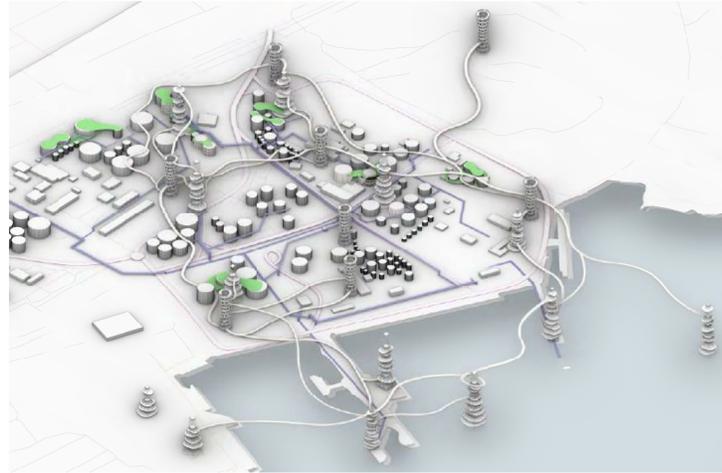
Old oil pipes are converted into pedestrian pathways, creating a small-scale connectivity between silos.

Multipurpose power towers supplying the network with solar energy, simultaneously being vertical green nodes with vertical gardens and park-like platforms.

Areas on the ground are left untouched to enable continuation of harbour activity

Growth of Green Space

The growth of green spaces occurs in different stages over time. In the first stage there are some green platforms on the silos, starting to connect with nearby silos. In the later stages, green platforms are also growing on the ground level and silo parks are starting to form.



Stage 1



Stage 2



Stage 3

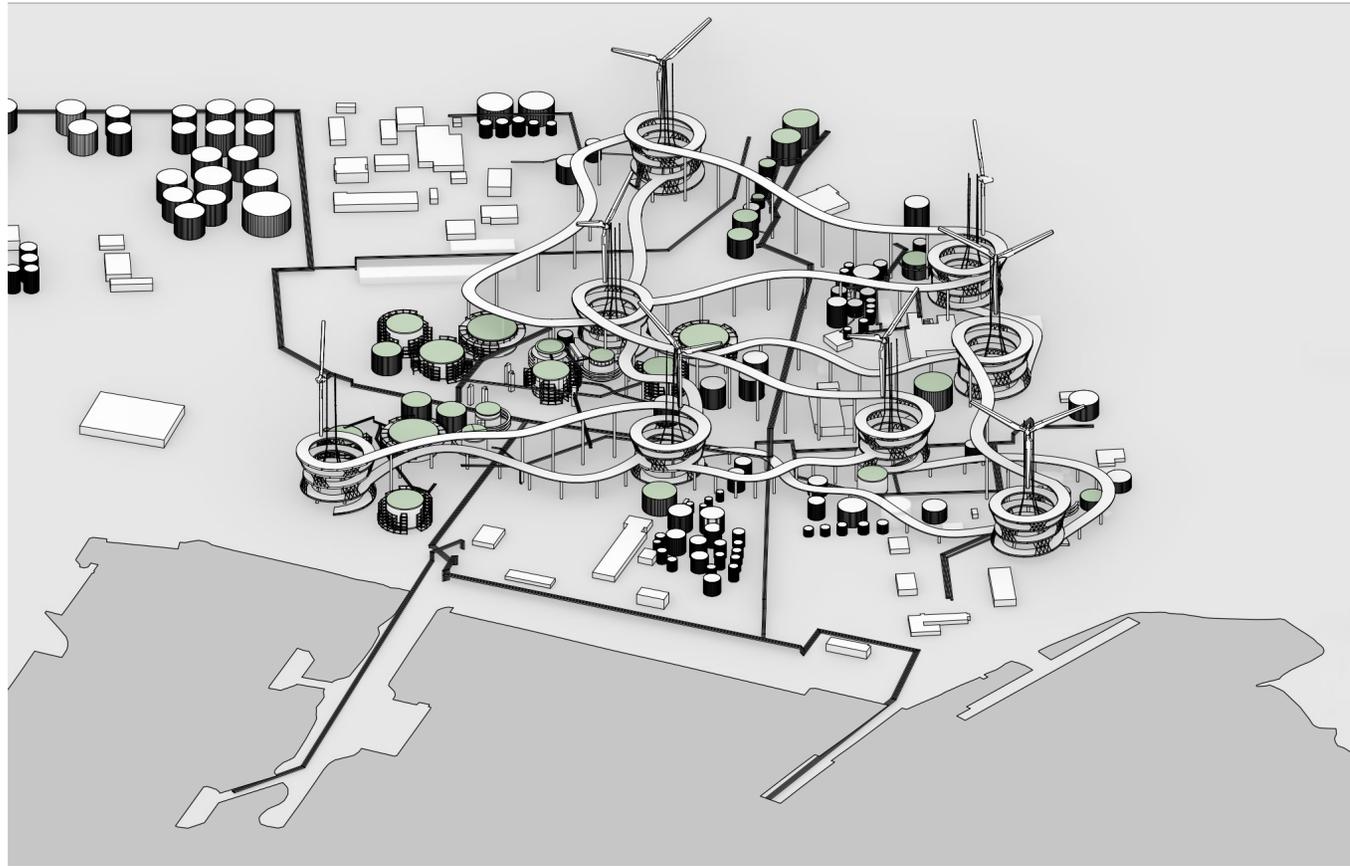
3.1.2 Final Proposal

In the following pages, the final proposal of the waterscape suprastructure will be shown.

S(OIL), Wind and Motion

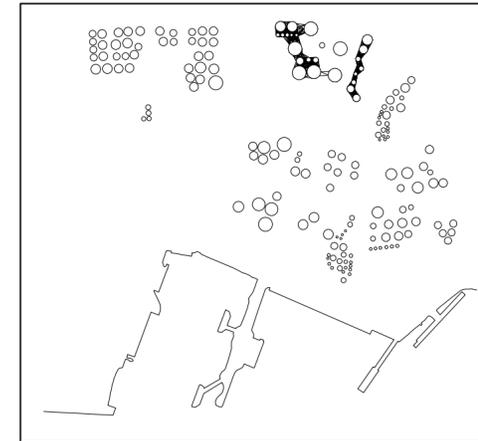
Skarvikshamnen in Gothenburg, also known as the “energy port”, handles energy and controls the flow of fossil fuels into the city and other parts of the country. However, the future for fossil fuels is not too bright. How will this space be used when the use of fossil fuels decreases?

S(OIL), Wind and Motion is a network hovering above the harbour, enabling the coexistence of harbour and city. The network is adaptive, adapting to the level of activity in the harbour below. As the demand for fossil fuels decrease, the activity in the harbour will simultaneously decrease and nature will start to claim back its space.

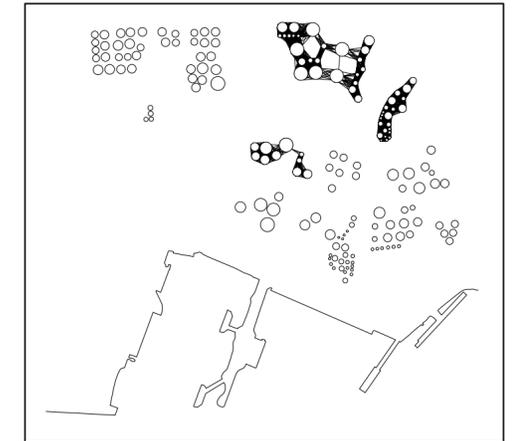


Network Growth Illustrations

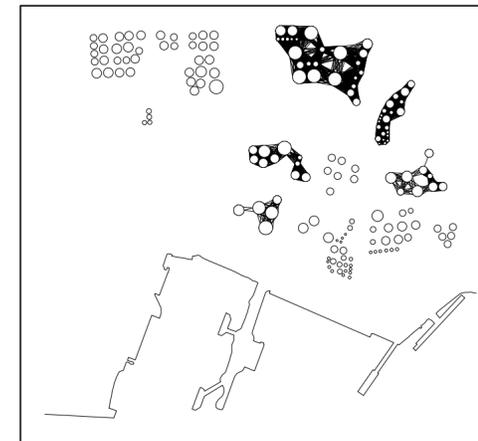
For the network to spread, all that is needed is to plant a seed. The network seeks out nearby silos according to different distances over time and connects to the nearby silos, clinging on to more and more as time goes by and the harbour activity decreases,



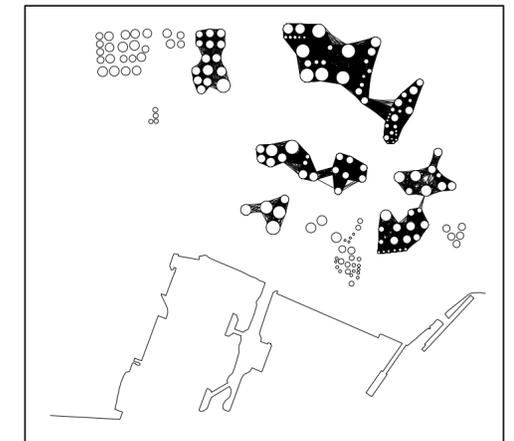
Stadium 1
20 meters



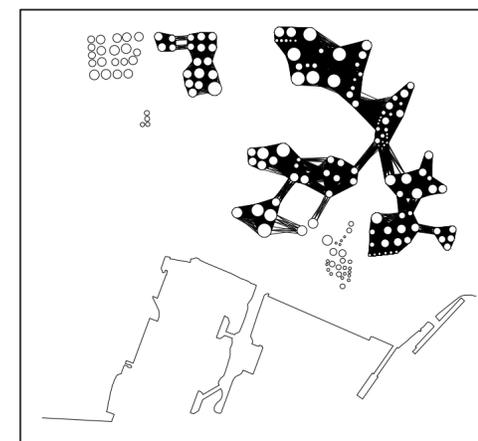
Stadium 2
40 meters



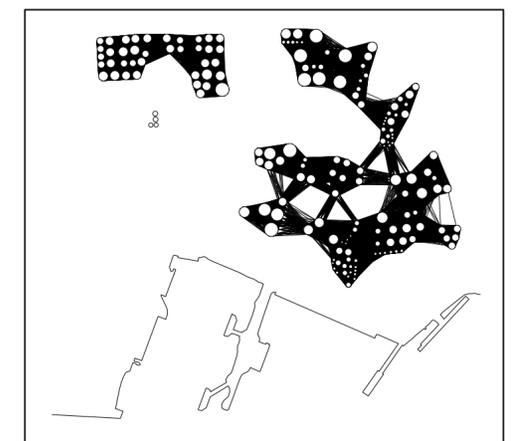
Stadium 3
60 meters



Stadium 4
80 meters



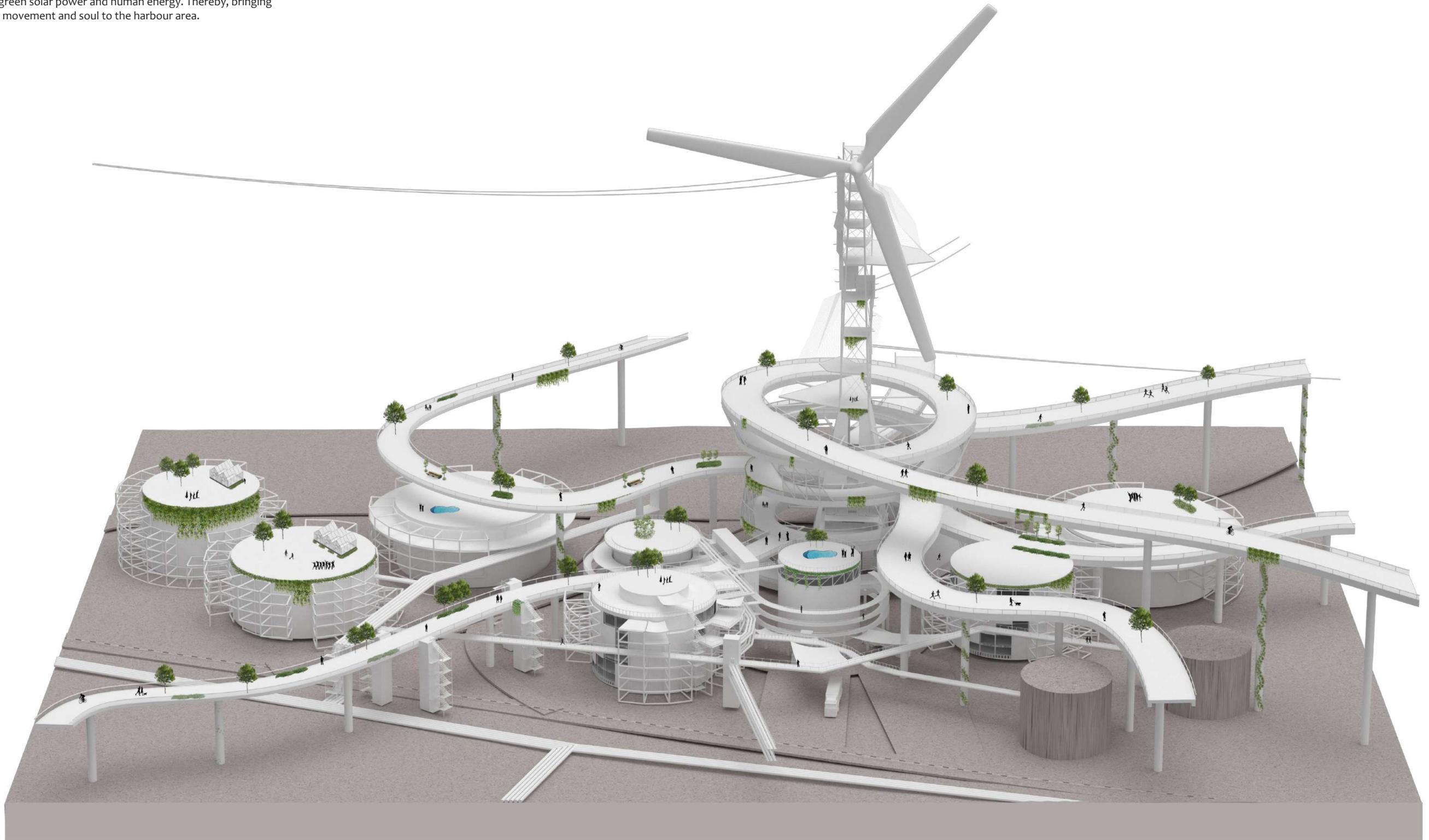
Stadium 5
100 meters



Stadium 6
Total takeover

Waterscape Suprastructure

The waterscape suprastructure makes the dead space of the previous harbour come alive again by activation and celebration. The network allows the city to expand above the harbour, enabling movement on the pathways, collecting energy through the power towers and allowing for green growth in the silos. The network aims to shift the focus away from fossil fuels to another type of energy. Energy such as food, green solar power and human energy. Thereby, bringing back life, movement and soul to the harbour area.



3.2 Waterscape Project

In this subchapter, the final proposal for the waterscape project will be presented. The waterscape project is an individually chosen part of the waterscape suprastructure that is further developed in a higher design resolution.

For this individual part, the *motion* part of the suprastructure will be further explored and developed. That is, how the movement of people on the waterscape suprastructure will be designed.

Network of Spirals

Power towers are placed in silo parks to emphasize the ongoing greenery and vibrant life in the area. The spread of the network of spirals follows the growth of the slime mold. Since the power towers are full of greenery, life and soul, pathways surround each tower in a spiral, which is where the parasite thrives. It then seeks other towers and encompass them with spirals. Along the way, the pathways wind around silos since they are also full of life. This results in a motion network where visitors can move in different levels around the entire site.



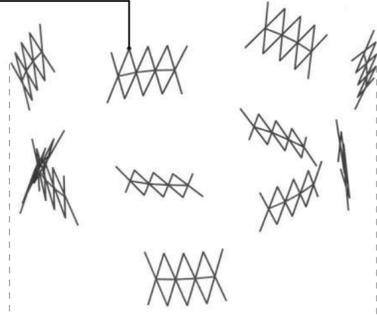
Waterscape Project

The motion network mainly consists of a green and vibrant spiral pathway winding around a power tower. From the spiral, there are openings allowing for pathways to connect to and seek for other towers. The network of pathways allow for people to walk, run or enjoy the view of the waterscape suprastructure. On the spiral pathway, people can socialize, observe the view, move in different levels to get access to other pathways and spirals or perhaps visit the platforms of the power tower.

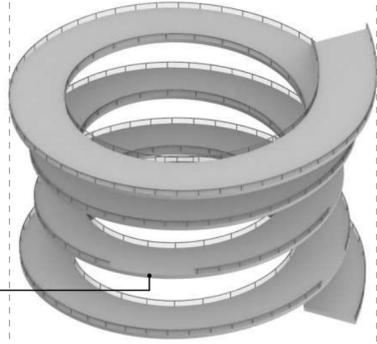


Exploded Axonometric

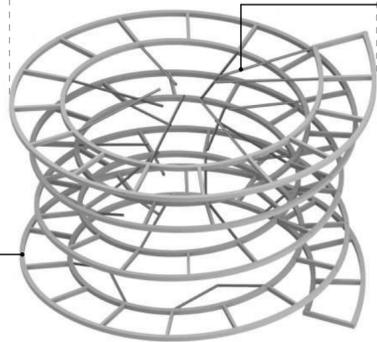
Structural bars on the facade, providing stability and intimacy



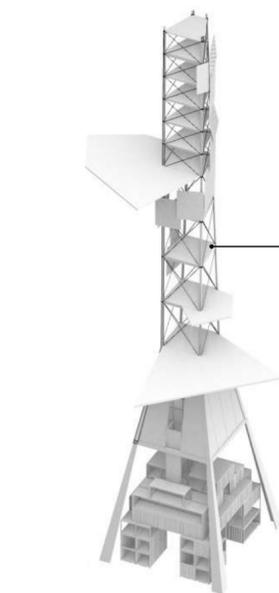
Opening on the spiral for pathways to attach to



Inner bars attaching the spiral to a tower placed in the center



Structural system for the spiral pathway



The inner bars of the spiral are attached to the structural system of the tower

4. Exhibition and Publication

In the fourth and last phase of the project, the team and individual projects will be showcased through a self-produced exhibition and publication. The work of all students and teams in the master studio *Architecture and Urban Space Design* will be disseminated to generate new knowledge and impact disclosure to the public.

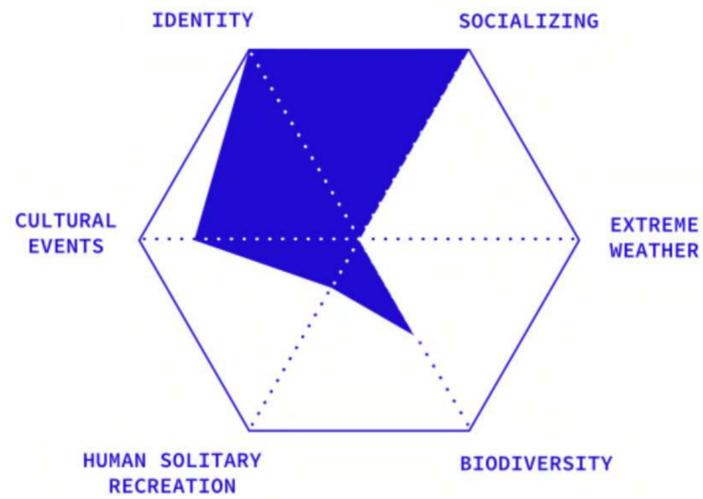
The exhibition will be of physical and digital character, where one of the main presentation modes will be A1 posters. These posters of the individual and team projects will be shown in the following pages.

S(OIL), WIND & MOTION

ARK128 - URBAN SPACE DESIGN - FT 2021

GROUP C

CAMILLA ERLANDSSON
AXEL SVENSSON
SAMIRA SARRESHTEDARI



S(OIL), WIND & MOTION

Urban proposal for a fossil free energy port in Gothenburg

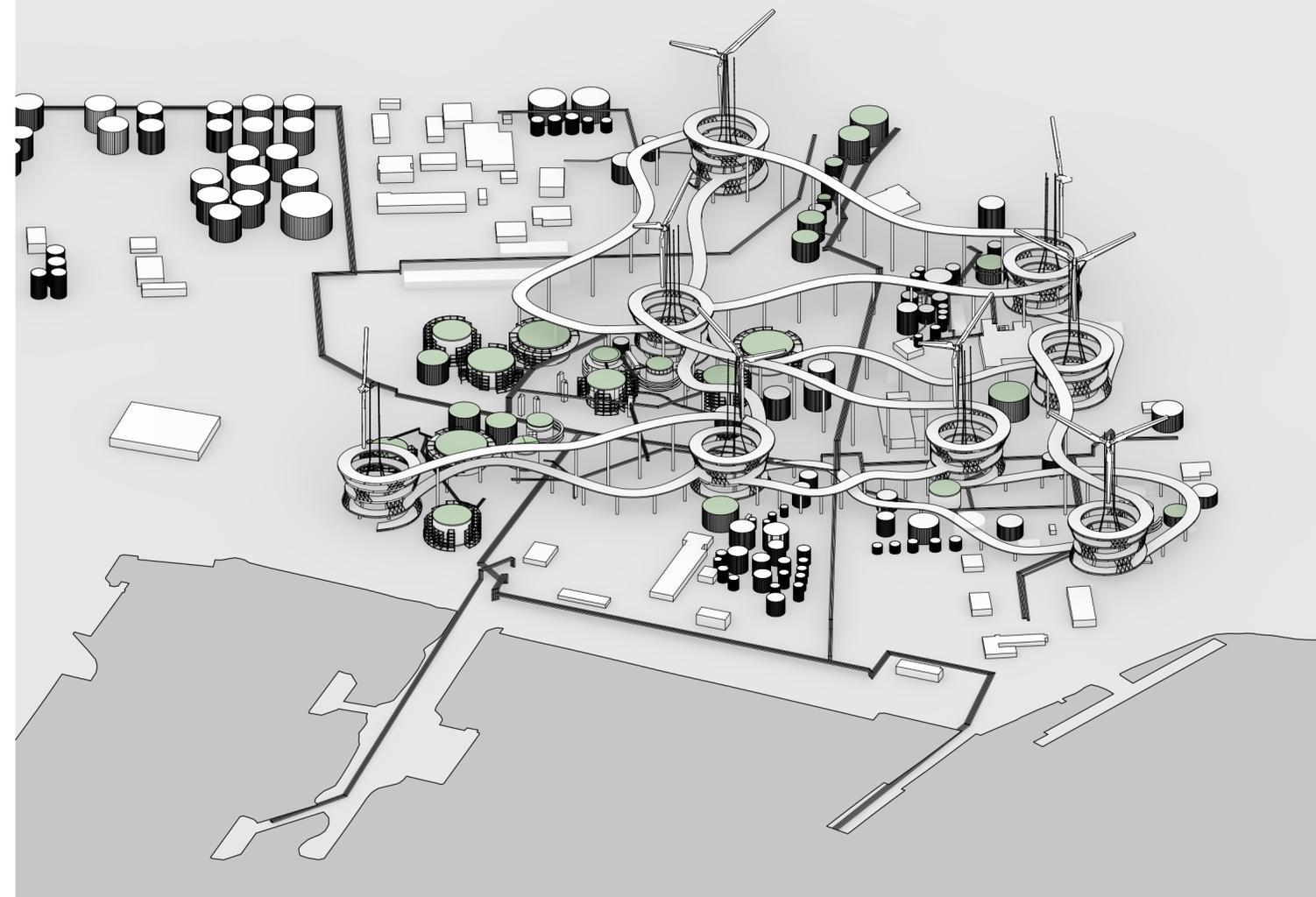
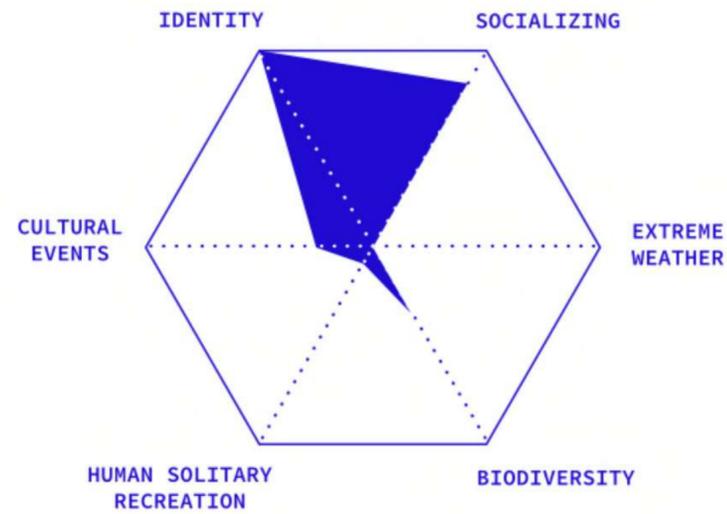


S(OIL), WIND & MOTION

ARK128 - URBAN SPACE DESIGN - FT 2021

GROUP C

CAMILLA ERLANDSSON
 AXEL SVENSSON
 SAMIRA SARRESHTEDARI



S(OIL), WIND & MOTION

INTRO

Gothenburg is a harbour city, but do we feel like it? The harbour is somewhere out there, hiding beyond the big green bridge, just out of reach and out of sight. We have lost the connection to the harbour, and there by our identity as a harbour city. We need to blur the lines and reclaim our heritage.

To begin solve this problem, we head out to Skarvikshamnen in Gothenburg, also known as the "energy port". As the name might give away, this area handles energy and controls the flow of fossil fuel into the city and other parts of the country. But as we might know, the future for fossil fuel is not too bright. What will become of the space when the use of fossil fuel decreases?

PURPOSE

The S(OIL), Wind and Motion is a network hovering above the harbour enabling the co-existence of harbour and city. It is an adaptive network, adapting to the level of activity in the harbour below. As the demand for fossil fuel decreases, the activity in the harbour will simultaneously decrease and the network enables nature to claim back its space. For example, this area here is still active harbour area, not allowing the network to grow so much, while in other areas the network is widespread.

Making the dead space come alive by activation and celebration. A way for the city to expand above the harbour, enabling

movement on the pathways, energy collecting trough the towers, and for growth in the silos. The network aims to shift the focus of the area away from fossil fuel to another type of energy. Energy like in food, green solar power and human energy. Thereby bring back life, movement, and soul to the area.

GROWTH

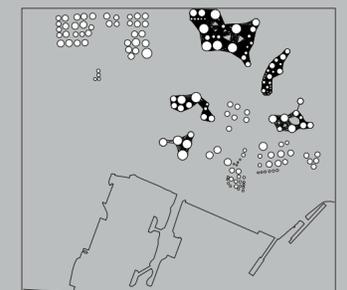
All we need to do is plant a seed. The seed connects to nearby structures on the site, clinging on to more and more as time goes by and the harbour activity decreases. The diagram below shows the growth pattern.



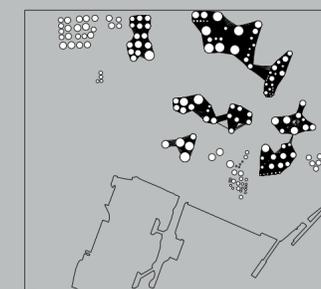
Stadium 1 - the seed has been planted and the network connects to silos within 100m reach.



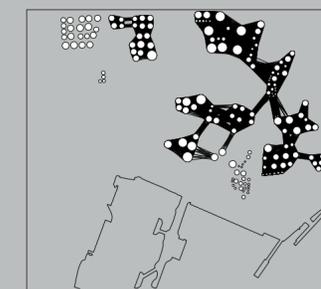
Stadium 2 - 80m



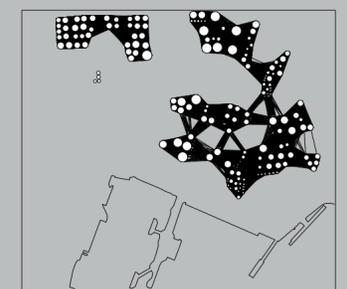
Stadium 3 - 60m



Stadium 4 - 40m



Stadium 5 - 20m



Stadium 6 - the network has claimed the area completely.

