Zhang Yifan

Shorelines:

Re-thinking and learning from the industrial heritage in Gothenburg

CHALMERS

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Master´s thesis

Examiner: Ana Betancour; Tutor: Carl-Johan Vesterlund; Joaquim Tarrasó

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ABSTRACT

View over the inner city harbour area from the well known Seaman's tower in 1950s
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View over the inner city harbour area from the well known Seaman's tower in 2012
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Abstract:

The port of Gothenburg has from the late 18th century until the 1960s served as industrial centre of the region and point of arrival and departure for migrants of all nationalities. The harbour activities have formed the main identity of Gothenburg, but the character of this socio-economic heritage is disappearing today, the old shipyard areas have been abandoned or replaced. The future of these large areas in the very heart of the city is a challenged topic. Gothenburg is seeking a new contemporary identity disconnected from the history and thus losing of old qualities and knowledge.

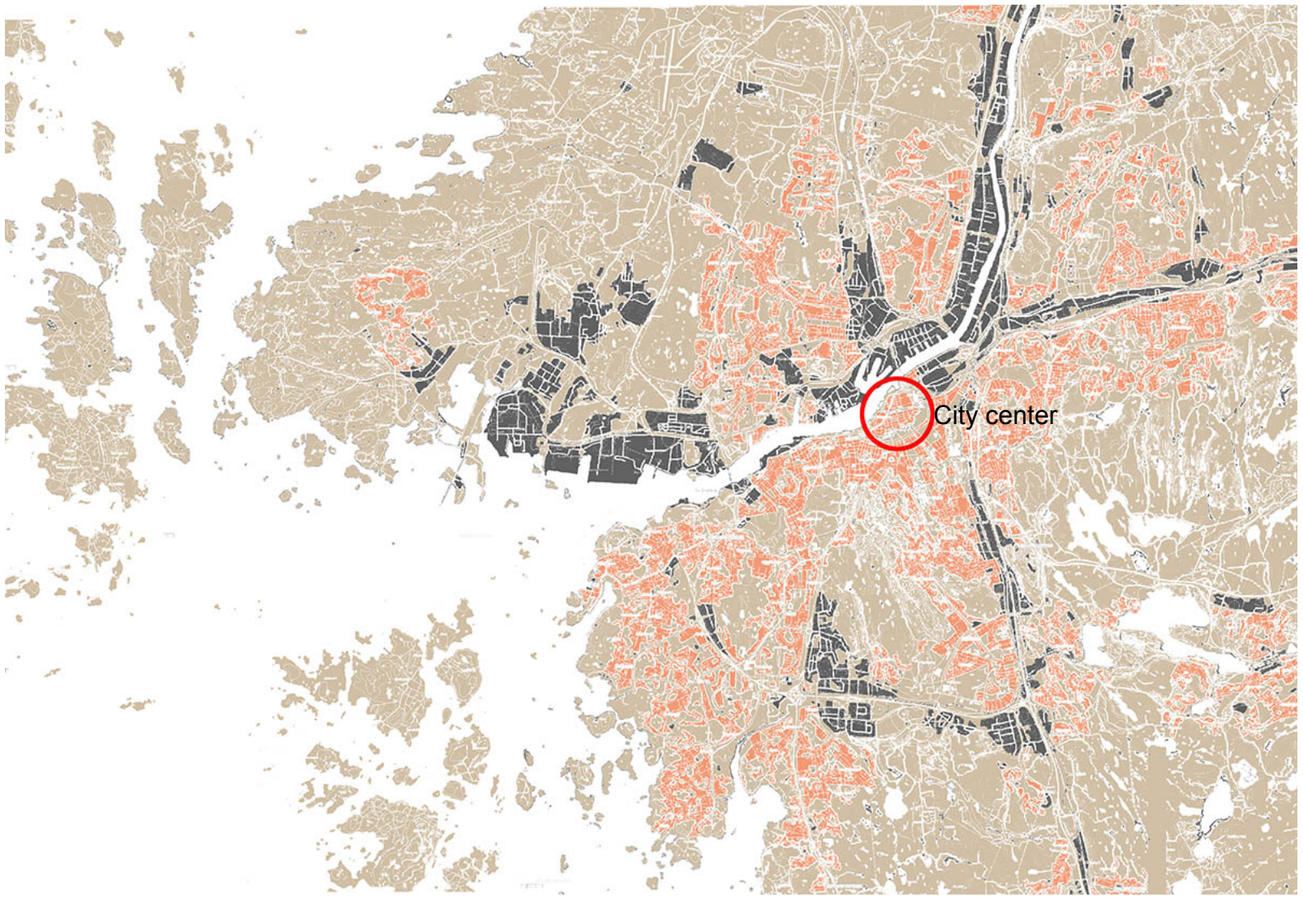
What could we learn and gain from the history and industrial heritage beyond the nostalgic view as tourist attraction and things and images kept in the museum? What if the harbour identity of Gothenburg could find a way of continuing under the contemporary economic and sustainable challenge, a future where the old and new identity, knowledge and technology might benefit from each other? These are the questions that thesis tries to explore.

Based on research of the principles of shipbuilding technology the proposal is a new building system of floating structures along the shorelines of Gothenburg. A scenario where the old ship building knowledge and facilities would play a role of making new products meeting the current needs. The aim to is allow the close relationship between people and water to occur again, where the water step by step can become the centre of the city once again.

The design is based on a system of modules where each module has its own variety according to different needs for mobility, flexibility and scale. Sustainable energy and strategies for dealing with the threat of flooding are key aspects of the design, exploring a new marine urban lifestyle based on historical culture and knowledge.

CONTEXT

Background



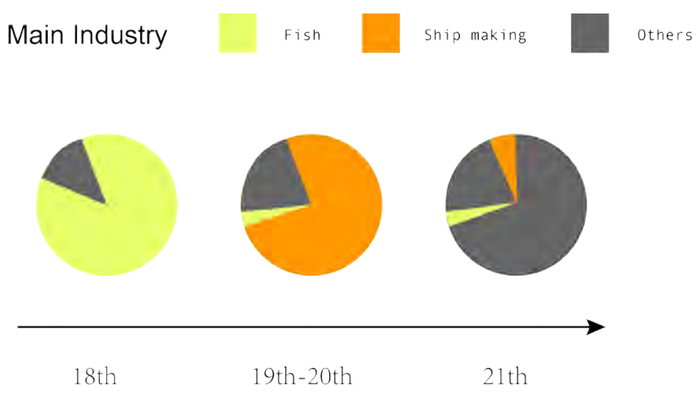
There are a lot of space along the riverbank which were industry area of Gothenburg only decades of years ago. Some of them still are, some are now left wasted and some seeking its future with confusion. They are located very inside the city center, having the advantage of riverbank but are very absent from the other part of city and people.

The shoreline of the Göta river, is cut into discontinued pieces and could not be enjoyed by Gothenburg citizens or tourists. Nowadays, the glory of industry is gone. Gothenburg is seeking new identity of event city and culture city. Likewise the river which was the heart of the whole city in every aspect now becomes the backyard and disconnected from the history.

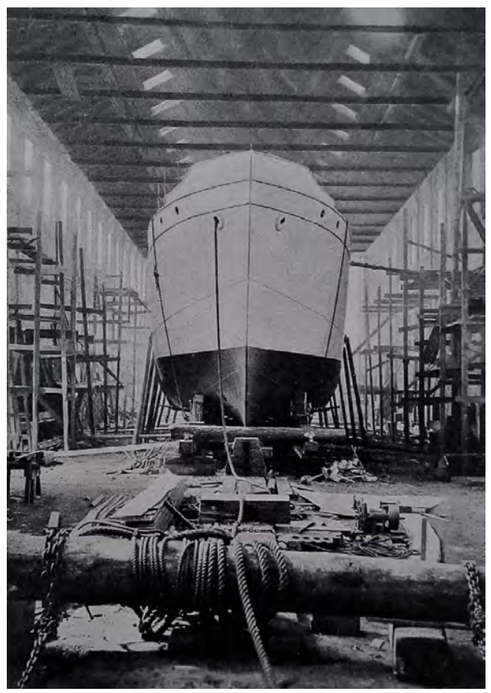
Industry area

Greenery

Residential and others

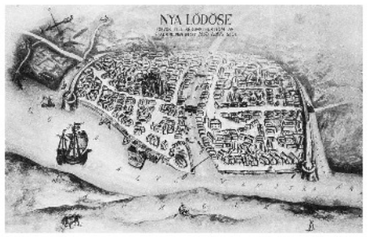


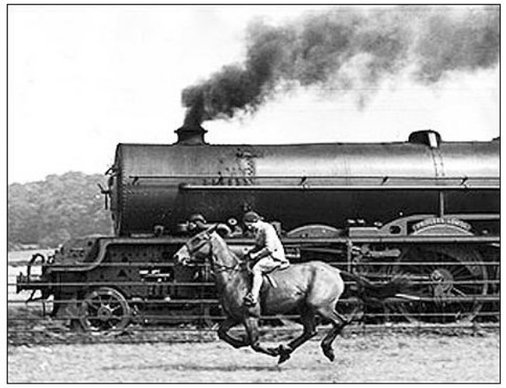
Old shipyard industry



History Context

History relationship
of river and the city





City Identity

City Development

1621

Gothenburg originally lay at a sheltered location further up the river Göta. Large sailing ships were obliged to dock outside the city, where cargoes were loaded onto barges for transport to Gothenburg or towns along the river.

Gothenburg was founded in 1621 for Sweden's strategy to build a city on the west coast used as a defence and trading centre with western Europe.

1800

1850s

Rural poverty caused by crop failures, together with rapid population growth, cultural and political suppression and facilitated means of travel created a massive urbanization process.

1900

These flows of people shaped the city; the areas near the dock were filled with emigration agencies, hotels, stores, pubs and brothels open all hours. Many had worked to buy a ticket.

Rapid industrialization and urbanization was now underway; canals were extended and railways built, with steam power making it possible to control arrival and departure times.

1922

The port moved into the heart of the city，a more central and very morden port structure was developed

1930

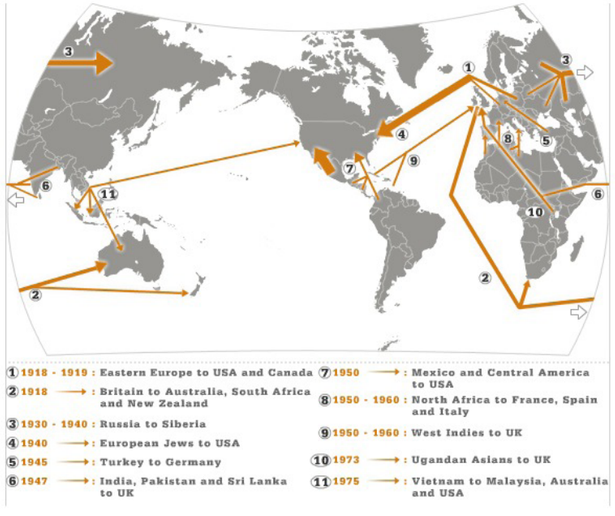
WWII

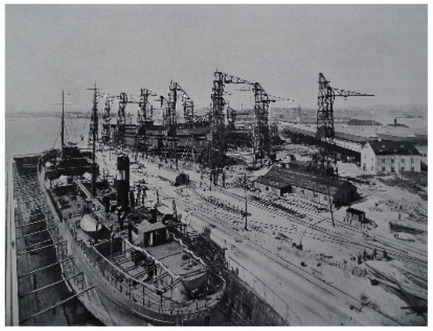
25 per cent of the Swedish population, 1.3 million people, migrated to other parts of the world

People & Jobs & Community

For centuries you could always get a job for the day near the waterfront – running errands for a shipmaster or loading and unloading a ship.

During the 18th and 19th centuries, Gothenburg continued to welcome foreigners, above all craftsmen and merchants, mainly from England and Scotland, often extensively involved in trade





Nostalgia is perhaps the main feature in the creation and legitimization of the harbour city narrative. Historical aspects are used only when they improve the image of an attractive city fit for a particular lifestyle. A recycled maritime heritage attracts a flow of people and capital to Gothenburg, marketed as a "harbour city".

Gothenburg had a strong industrial feel, visible to all entering the city.

Open structure with hundreds of cranes, ships being launched from the shipyards and quays serving as meeting places and esplanades are widely used in representations of Gothenburg as a port city.

The first container port opened; little by little, the whole structure of Gothenburg's inner city port moved out of the city. Today, almost all operations are concentrated in the outer docks.

The Swedish shipbuilding industry was hit by a major crisis in the 1970s and after 1980 almost nothing was left. Gothenburg's former image as a great industrial city soon became a symbol of something lost.

Together with the closure of the shipyards, this caused rapid and extensive changes in the urban landscape. Industrial wastelands opened up, cranes were removed and the city fell silent. Inner-city, working-class areas close to the water were demolished and former residents moved to newly built suburbs.

politicians and private industry began drawing up plans to transform the post-industrial city into a "knowledge" or "event" city. The regeneration of the old dock has been promoted as furthering the city's "harbour identity". But the identity is presented as clean, silent, and with a view.

The maritime focus is rather on research on ship design, logistics and shipping finance.

The physical port structure is very much off limits. At the same time, local politicians and private businesses have turned to the old, inner−city dock areas

1950s | **1960s** | **Decay** | **1970s** | **1980s** | **Now**

Seamen, shipyard and dockworkers lived close together in areas by the water, crossing the river to the docks on one of the many ferries going back and forth. The workers were a dominant part of the city's appearance.

The growth of the shipyards and other industries in the city required more manpower than was available. Women were employed in traditional male occupations and immigrant labourers became crucial.

Gothenburg's shipbuilding industry employed 15,000 people and ensured work for many other businesses that supplied the shipyards with goods and services.

The shipyards played a formative role in creating the image of the city, generating income and developing a strong sense of community amongst the many workers.

Industries dependent on shipbuilding faced recession and tens of thousands of employees lost their jobs.

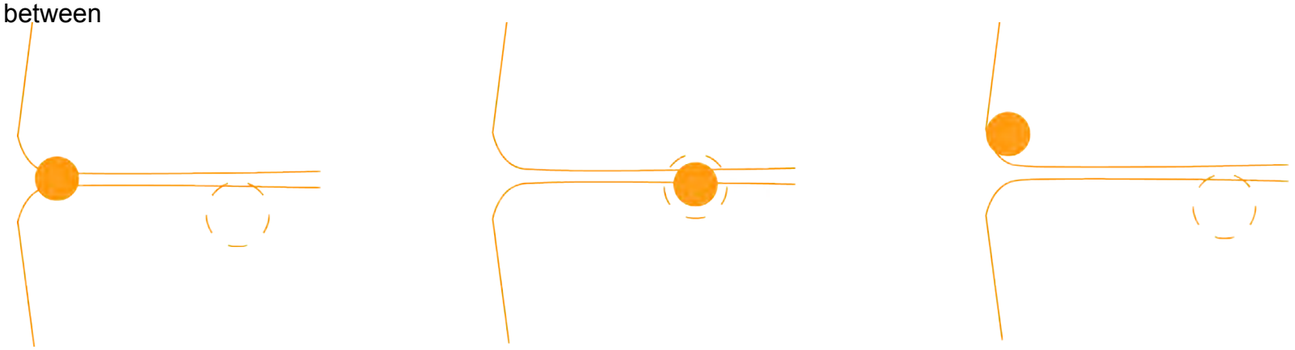
Living standards there were higher but communities that had developed over the course of a century were shattered.

Now only 150 workers are working on the old shipyard doing the business of ship repair and maintain.

Migration to the city is extensive, but people do not arrive by boat, and of course no longer work in any maritime industry.

Conclusion of History Context

Transition of relationship between port and city center



1621-1900

1900-1970s

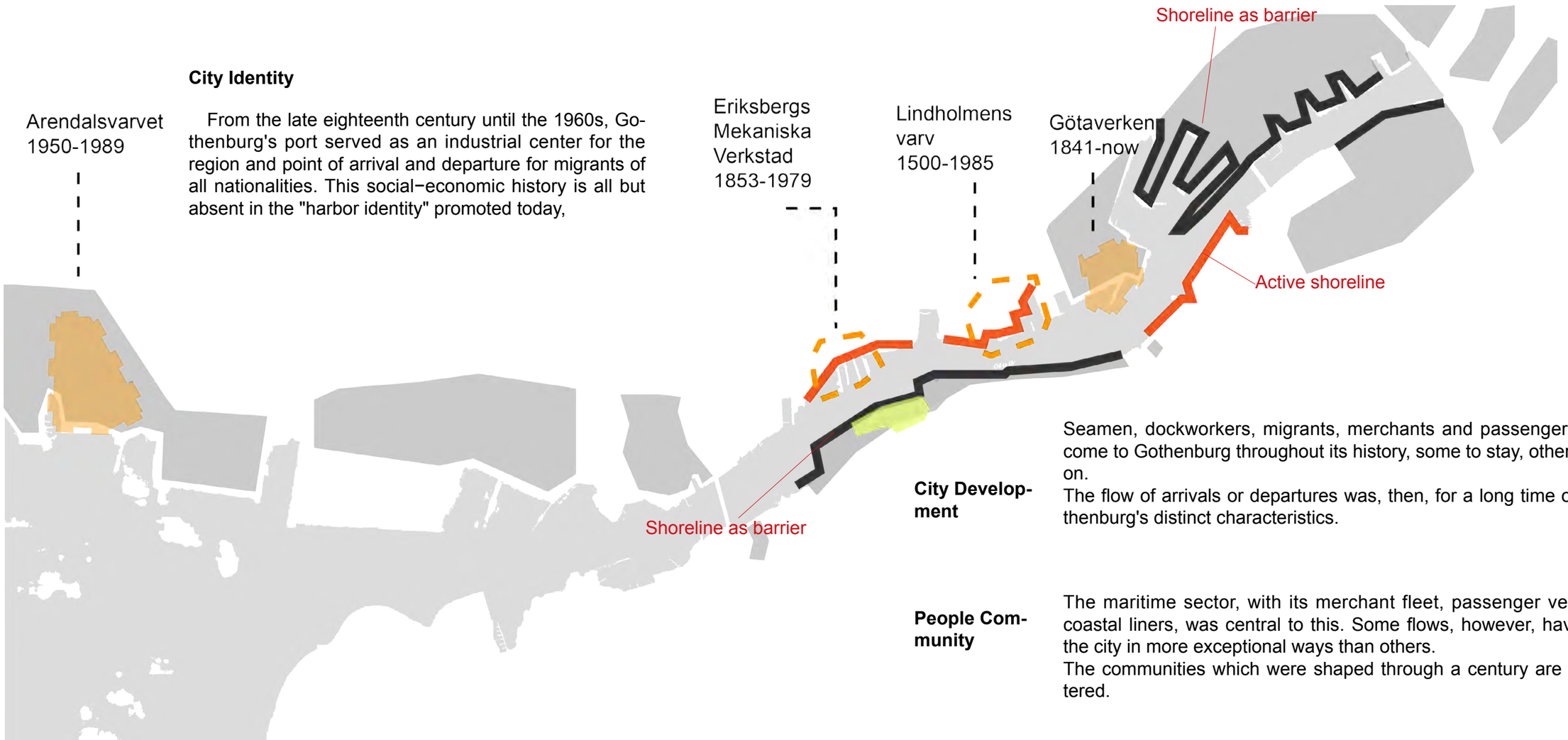
1970s-now

Port

City Center

City Identity

From the late eighteenth century until the 1960s, Gothenburg's port served as an industrial center for the region and point of arrival and departure for migrants of all nationalities. This social−economic history is all but absent in the "harbor identity" promoted today,



City Development

Seamen, dockworkers, migrants, merchants and passengers have all come to Gothenburg throughout its history, some to stay, others to move on.
The flow of arrivals or departures was, then, for a long time one of Gothenburg's distinct characteristics.

People Community

The maritime sector, with its merchant fleet, passenger vessels and coastal liners, was central to this. Some flows, however, have shaped the city in more exceptional ways than others.
The communities which were shaped through a century are now shattered.

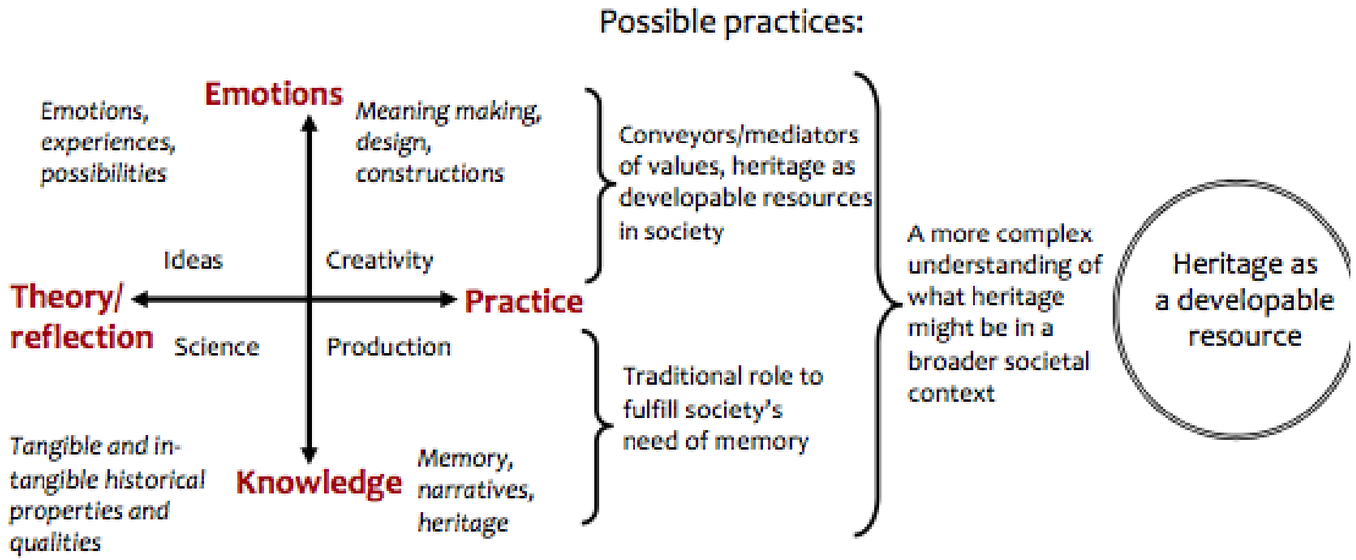
Analyze methods-Theory support

Bosse Lagerqvist
(Department of Conservation, University of Gothenburg)

Heritage valuation – different directions:
- Knowledge; interpretable significant history
- Experience; the emotions that could be aroused by the object
- Use; economical, social, cultural, ...

Starting point and guiding valuation:
- Threat towards what is perceived as heritage
- or possibilities to reuse and develop heritage resources (instrumental, aesthetical)?

One possible conclusion in regards to develop a more coherent heritage practice



The integration of society into its heritage and the heritage into its societal context

Randall Mason: Assessing Values in Conservation Planning Methodological Issues and Choices

Critical points on heritage practices and values
- heritage conservation is a sociocultural activity, not simply a technical practice;
- the contexts of a heritage conservation project – social, cultural, economic, geographical, administrative – need to be considered as seriously as the artifact/site itself;
- heritage values are, by nature, varied, and they are often in conflict;
- traditional modes of assessing "significance" rely heavily on historical, art historical, and archaeological notions held by professionals, and they are applied basically through nondisciplinary means;
- integration of economic values with cultural values presents a particular challenge;
- a combination of methods from a variety of disciplines should be included in any comprehensive assessment of the values of a heritage site;
- a more encompassing assessment of heritage values, and integration of these different values, will lead to better, more sustainable conservation planning and management;

Industrial sites – properties, qualities and valuation
- the industrial plant as a economic factor in society locally/ nationally, including comparable sites elsewhere (i.e. the branch);
- the buildings interpreted as representatives for architecture, building technology, adaption to production processes, local traditions, and other historical layers of information;
- the product that was manufactured and its contextual meaning and importance;
- the production process and its changes over time and significant historical events;
- the people involved in the process of production – management/administration/ workers and their relations and conflicts, as well as competences, knowledge and crafts involved;
- the impact of the site on the surrounding community – social, economic, cultural, political, environmental, etc.

Leads up to different interpretations of authenticity and consequences for interventions and future management

VALUES AND CHALLENGES

Values Evaluation

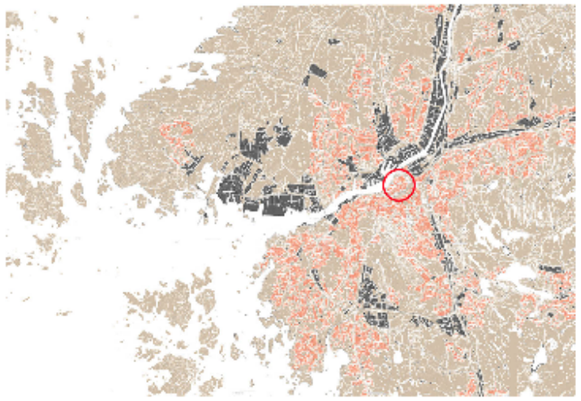
1. Urban Structure

River Advantage

Besides riverbank, water resource avialable

Position

Large area left very near the centre of the city, great potential and various possibilities



Surroundings

Close to residents and commercial area, in the heart of existing urban fabirc

2. Remaining Industry Heritage

Industry Buildings

The unique characters of the industry building enable different functions with needs of large and open space and other possibilities

Ship building facilities

The left huge machines which are capable of processing ship building related material and technique is still working at the harbor even though with much shrunk bussiness scale

Harbor facilities

Being one of the biggest ship building cities in the whole world in the history, Gothenburg has the very sophisticated system of berthing and arranging big number and various ships

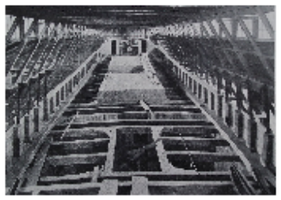
3. Knowledge/ Labour

Technique

One of the biggest ship building city in the world 50 years ago, capable of building very big modern ships

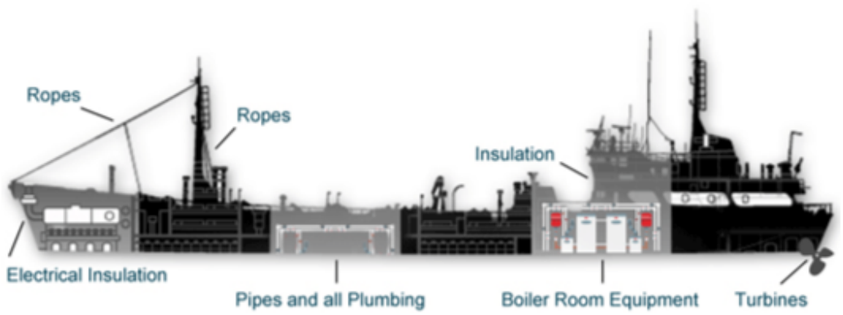
Employed workers

15,000people left from ship building industry of Gothenburg in 1970s, now only 150 workers still working for ship repair and maintain.



Experiences

Start to build ship from 1500s, experienced from wooden ships to machinery ships



4.Identity

City Images

The left industry facilities as crane and others are an important part of the image of the harbour

Menmory

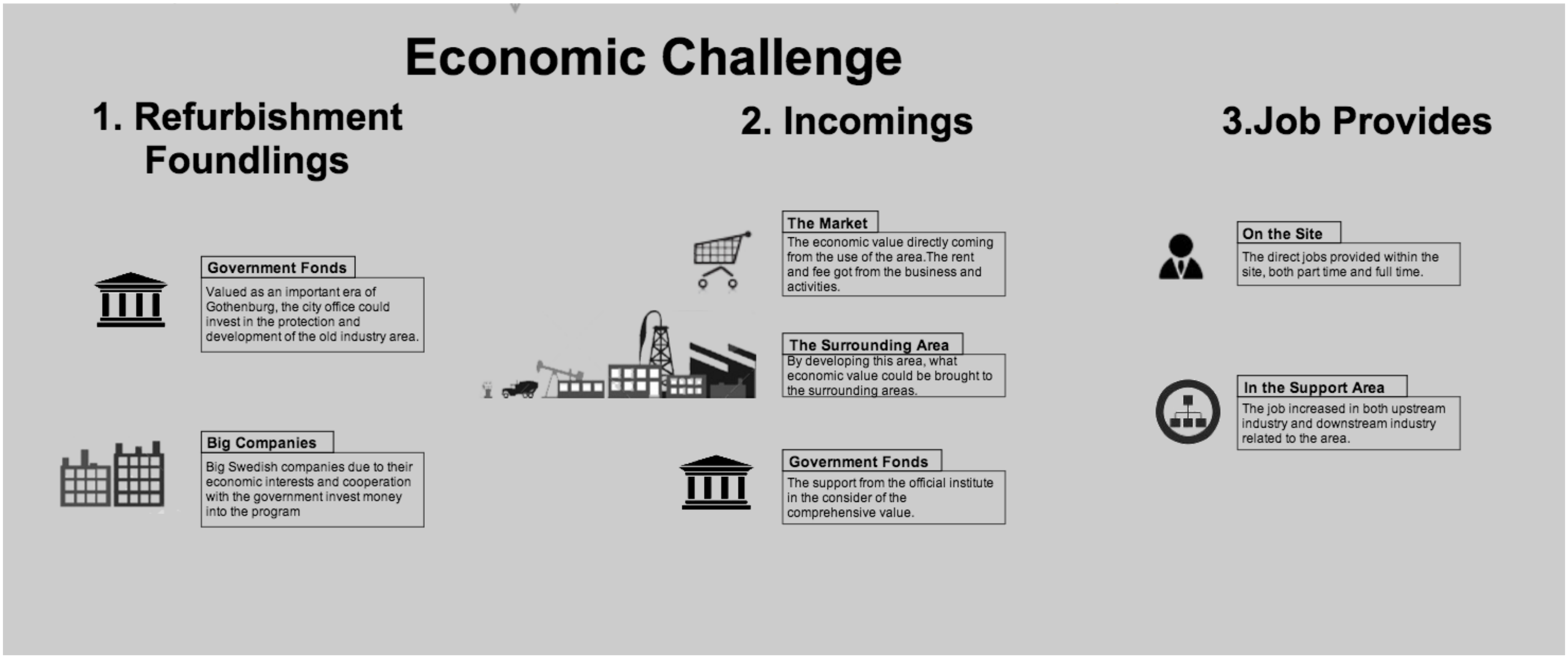
The relationship of people and water. The memory of the old glory time.

Lifestyle

The water based lifestyle and "work style" , the port was the centre of activities of people.

Challenges Evaluation

Economic Challenge
According to the theory of Bosse Lagerqvist, industry heritage involves comprehensive value which should face also economic and social challenge. It is not asking the project to get the economic balance but the effect it could benefit the local economy in different ways should also be considered. Taking the fact that industry heritage protection is a very complicated work in reality which involves a lot of departments, people and money, taking this in a more practical way is the right attitude to have.
It is not a compromise of its value, it just takes the economic challenge into account at the beginning of the project. This would enable the project becoming more reliable and easier to realize and also maybe more successful in the future.



Sustainable Challenge

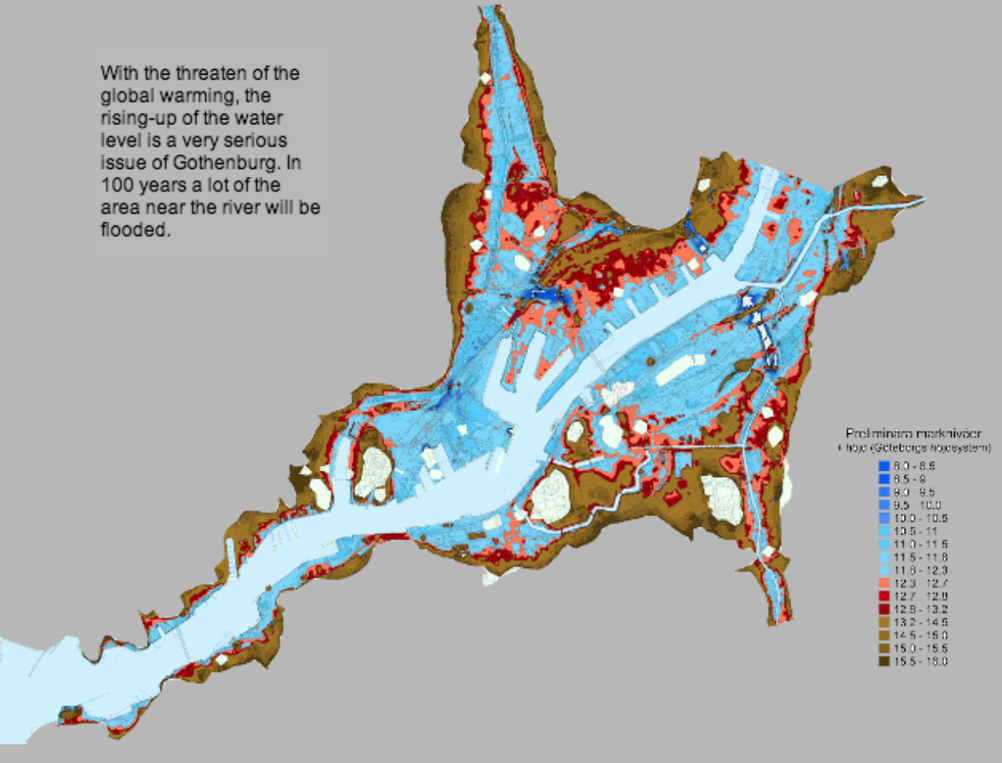
The importance of sustainability is undeniable now in the global environment, and Gothenburg is a city that already practiced on sustainability on a lot aspects of the life. Also it involves the future picture of Gothenburg a lot. E.g. as a port city near the sea with a big river going through the city center, flooding issue is hot topic in the debate and concept design of new construction and refurbishment of old buildings. It is not just the theory, it is a real problem which will challenge the city in next 50-100 years.

Also the other aspect of global warming problem as fossil energy consumption keeps a challenge. Gothenburg has done a great job on using green energy and keep looking for new energy solution. Sustainable challenge is always a thing we should keep in mind before we start the designing progress.

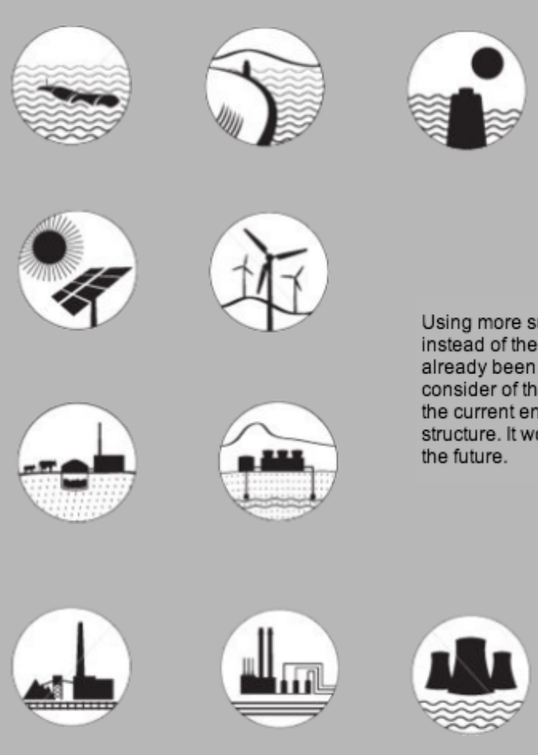
Sustainable Challenge

1. Flooding Threaten

With the threaten of the global warming, the rising-up of the water level is a very serious issue of Gothenburg. In 100 years a lot of the area near the river will be flooded.



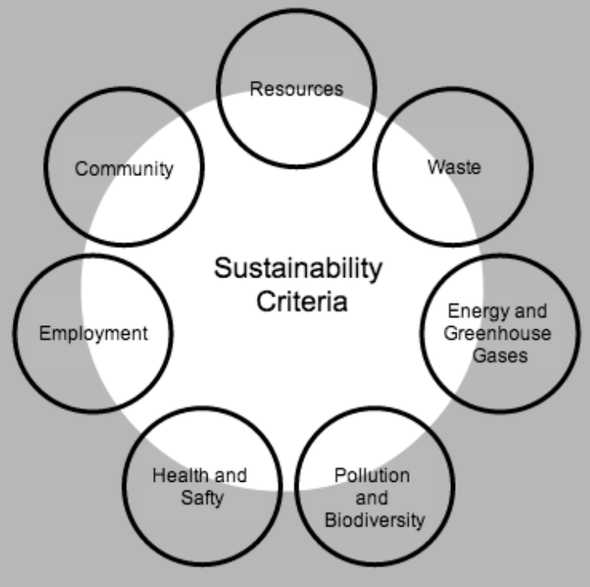
2. Energy Consume



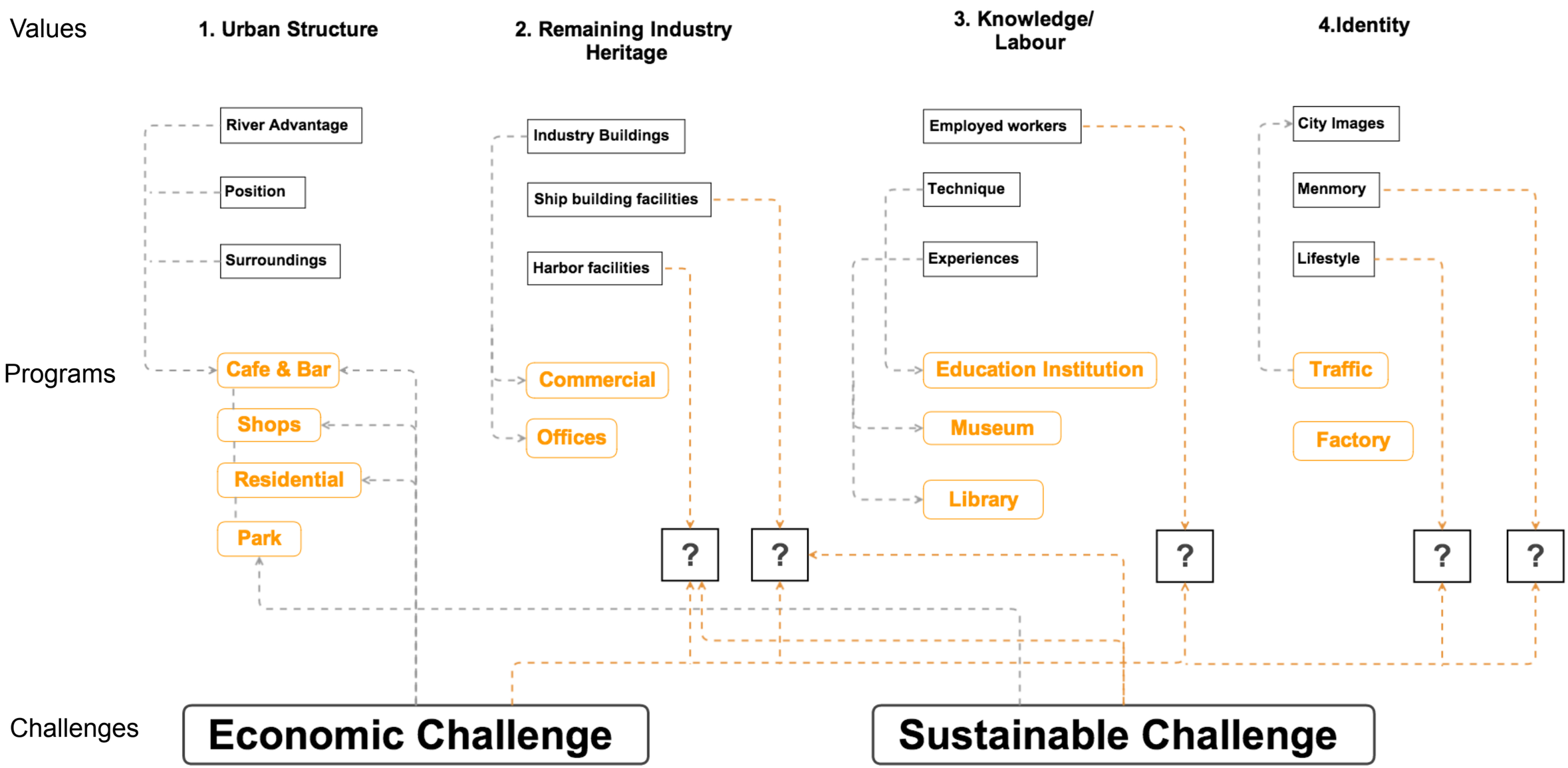
Using more sustainable energy instead of the fossil energy has already been a very important consider of the new projects and the current energy consumption structure. It would be more in the the future.

3. Materials Recycling

If the material has a longer recycling and using period, if it is recyclable is also a very important thing as the contemporary challenge. This includes both the material itself and the materials costed to make and maintain the product.



Programs and Problems



There are several aspects of the values of industry heritage area in Gothenburg, and facing together with the economic and sustainable challenges make it very complicated to fulfill more aspects with traditional programs. There are certain values that could not be kept facing the economic challenges and the new identity the city is seeking. Sustainable challenge is also a problem in the planning strategy level, which could have the chance to be solved in the detailed solution but lack of solution with the traditional program planning.

There are so many conflicts with the values of the industry heritage area of Gothenburg, the intangible values as lifestyle, production, experience, relationship of people and city, and identity are especially fragile but important. Is there a better way to use the value and change the situation of disconnection of the history and culture of this old core area of this city? It is a research and a question to this thesis project.

What if?

What if the challenges lead us to look for a new project which could keep more aspects of the values and make them benefit our future?

What if we can reuse the old experiences and technology and lifestyle under contemporary context?

What if the history could find its way to continue instead of been erased and painted with totally a different picture?

What if the old shipbuilding technology could benefit creating the new floating building system which could adapt into the new needs of people and city, meanwhile providing us a new but historical and cultural related lifestyle?

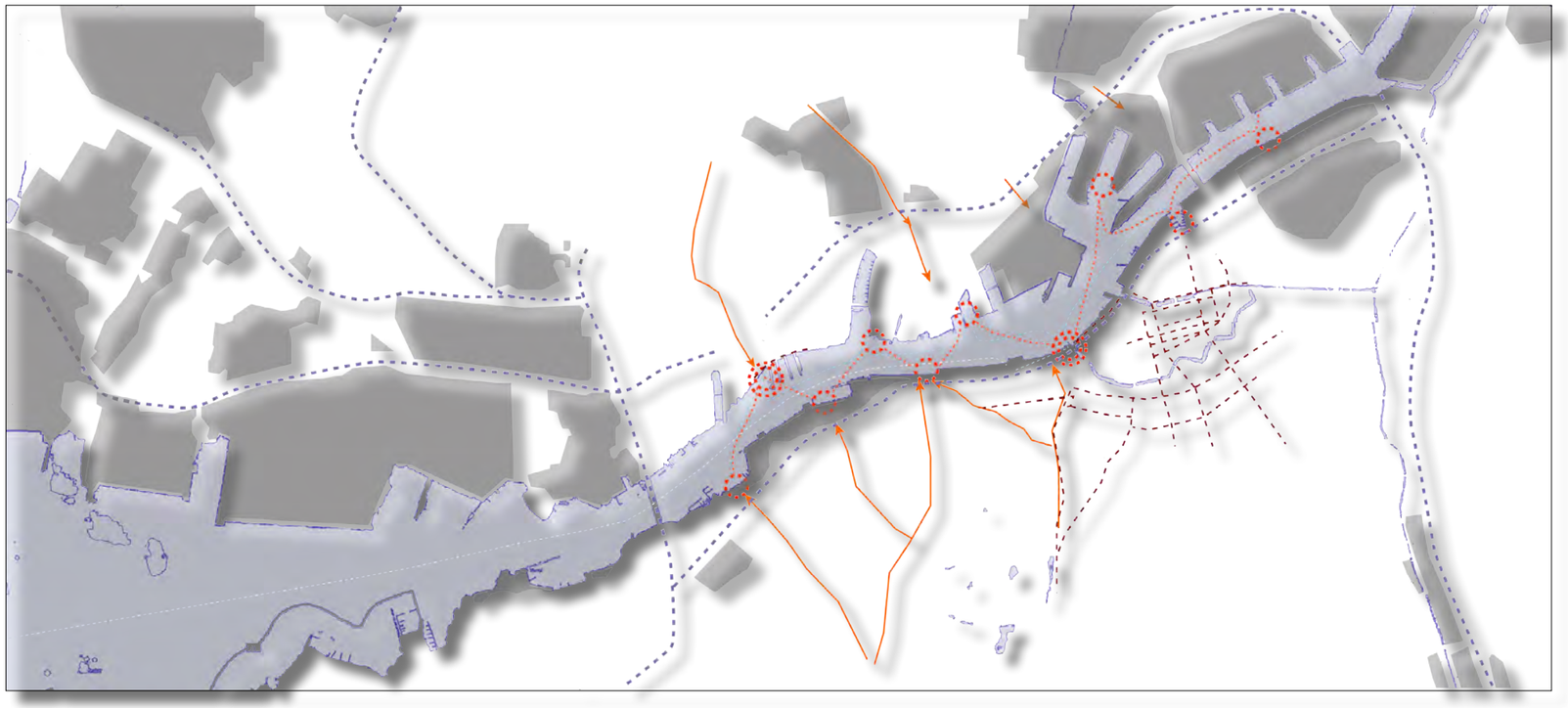
What if the shoreline become center of city again and provide people with flexibility and attraction brought by water?

What if the relationship between people and water become active again and find its own value in nowadays context?

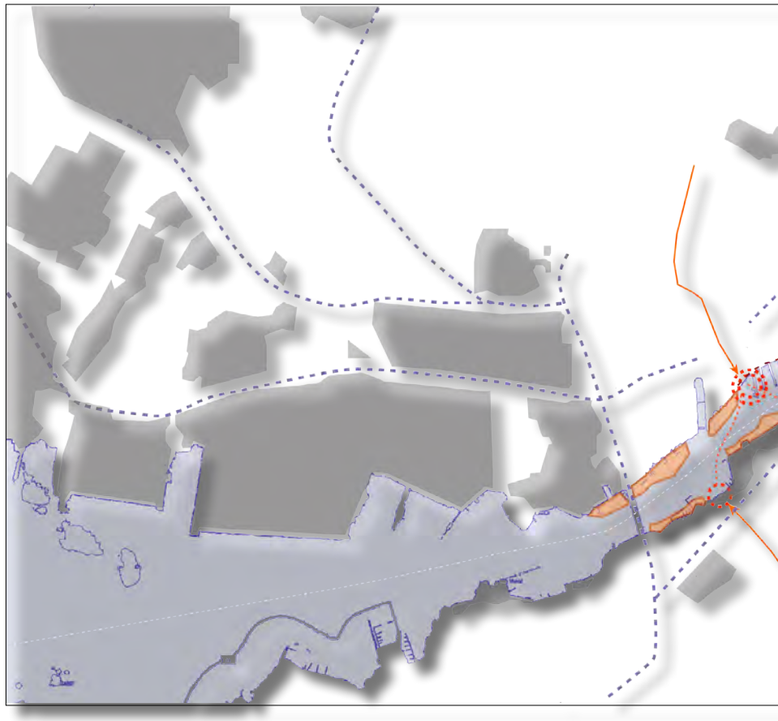
STRATEGY

Strategies

The strategy of building up new system is by steps. Water gives ship buildings possibility to move and realize different combination. And space having interesting relationship with water is always attraction to people. Ship building could work at specific spot to active the local area and also could develop into the new water surface city public space system. The character of ship enable the flexibility of buildings in water, make the riverbank area great ability to adapt into different situation in different steps. And with those ship building system, the water is not the barrier anymore, but the real attractive space in the heart of the city.

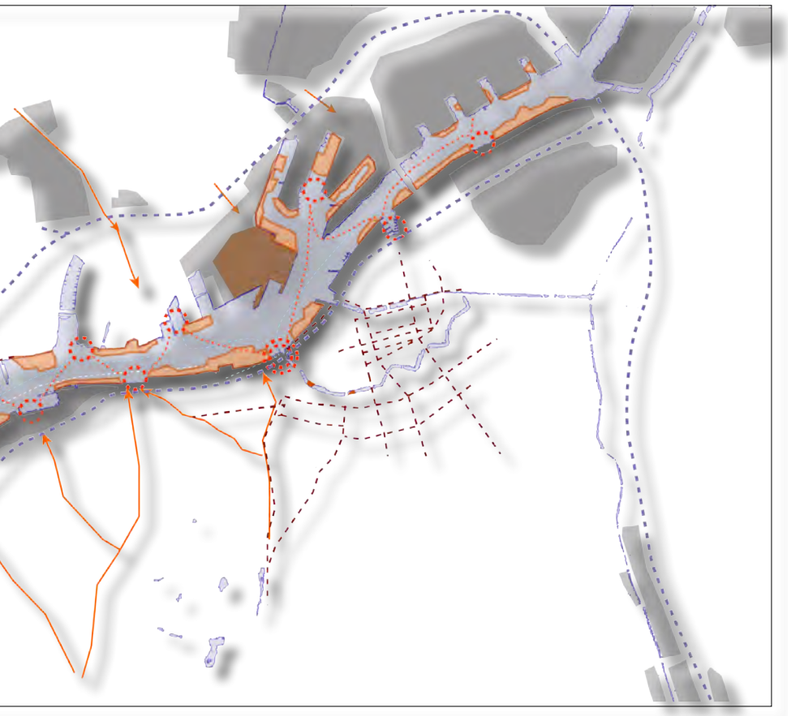


STAGE 1

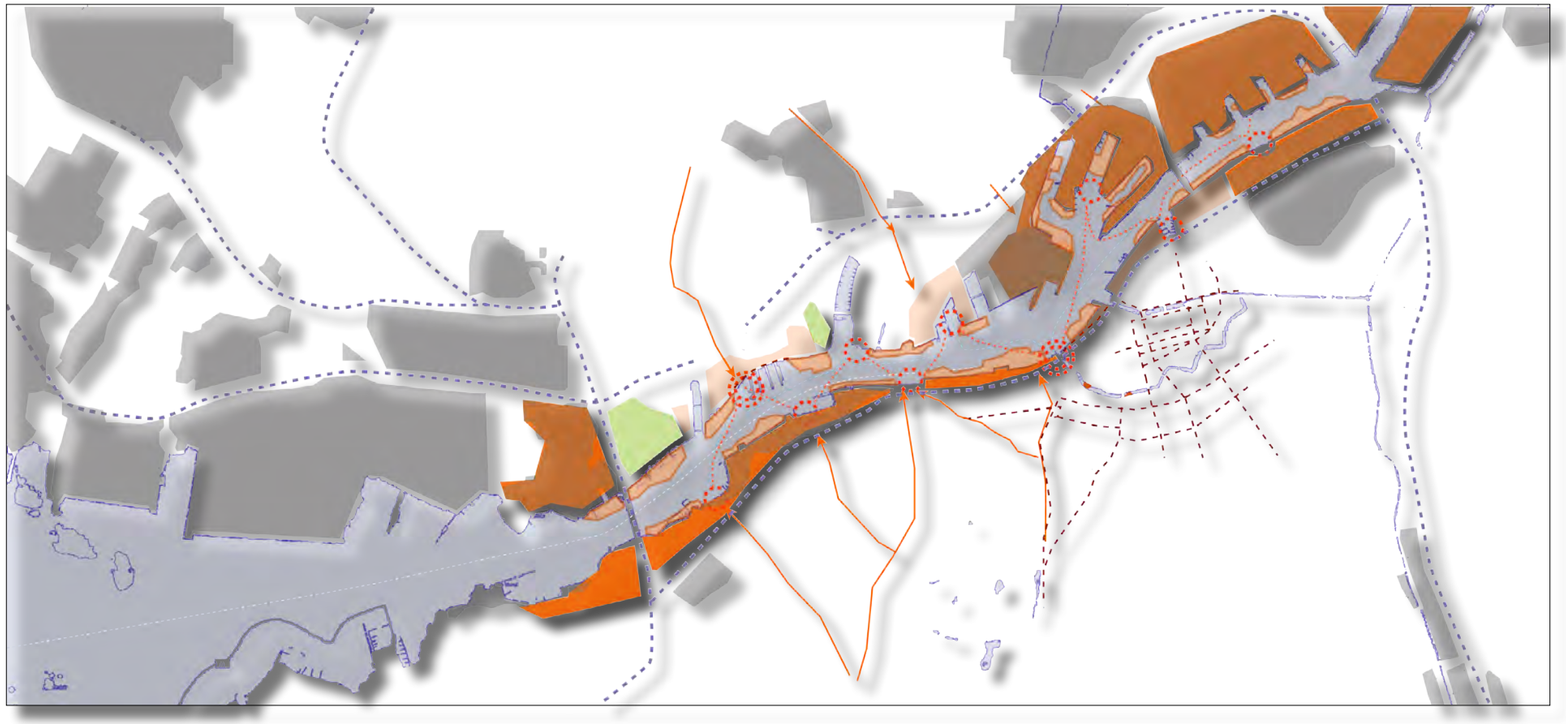


1st, choose the potential spot along the riverbank in the transition industry area to be active. Park our new ship buildings at the spot and use them as attraction to the local area. While more traffic and people flow coming in and out of the area, the barrier which blocks the shoreline will be gradually open up, and the area nearby would be active also. The potential hot spot will become part of the city network and urban structure. While the ship building group reach its target, it could move easily to next potential spot. Or with enough budget, a new ship building group could be built. It depends on the situation after it runs for sometime and the plan of the planners. With more than one potential spot built up in one time, there is attraction between those spots. Ferries could be arranged to connect those spots with other side of the river, and the connection of two sides of river will be enhanced.

2nd, connect those active dots along the riverbank with walkab
space, change the disconnected situation of the shorelines. The ac
attraction between the two sides will be bigger and more ferries co



STAGE 2



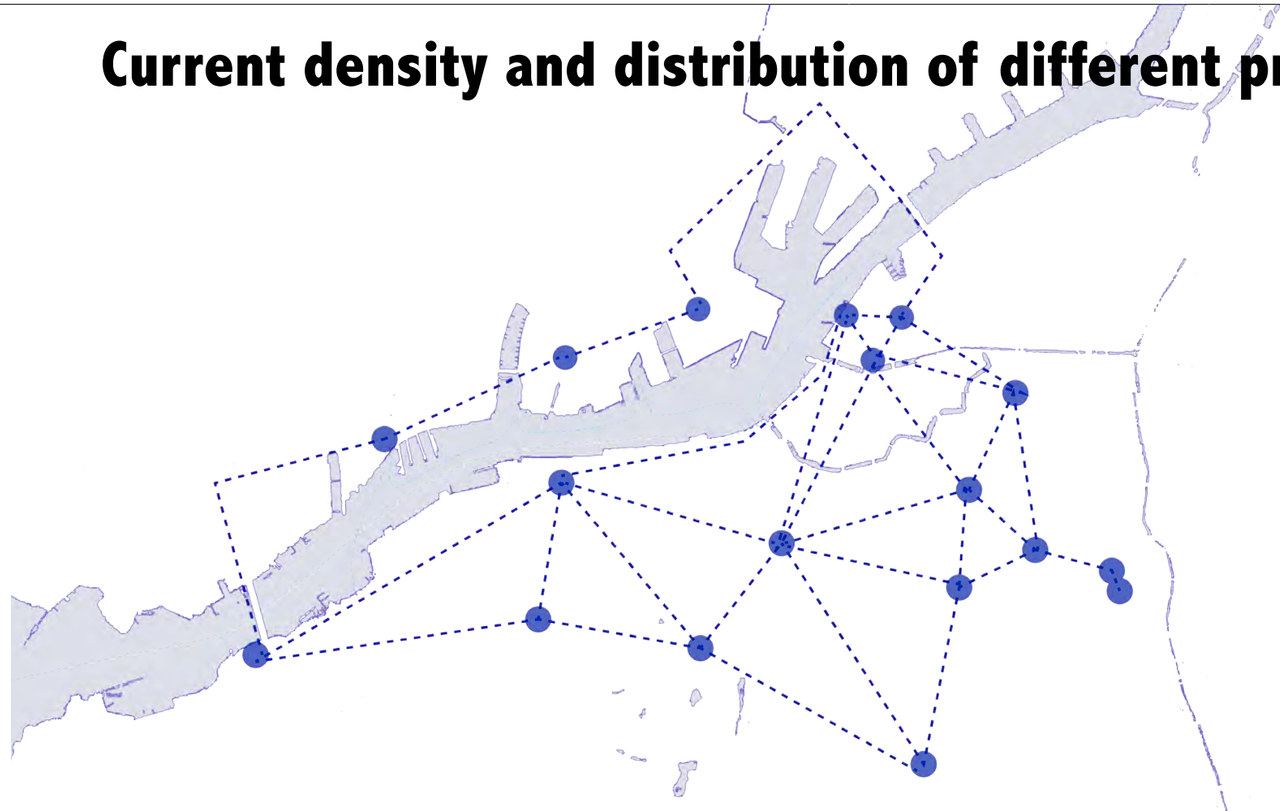
STAGE 3

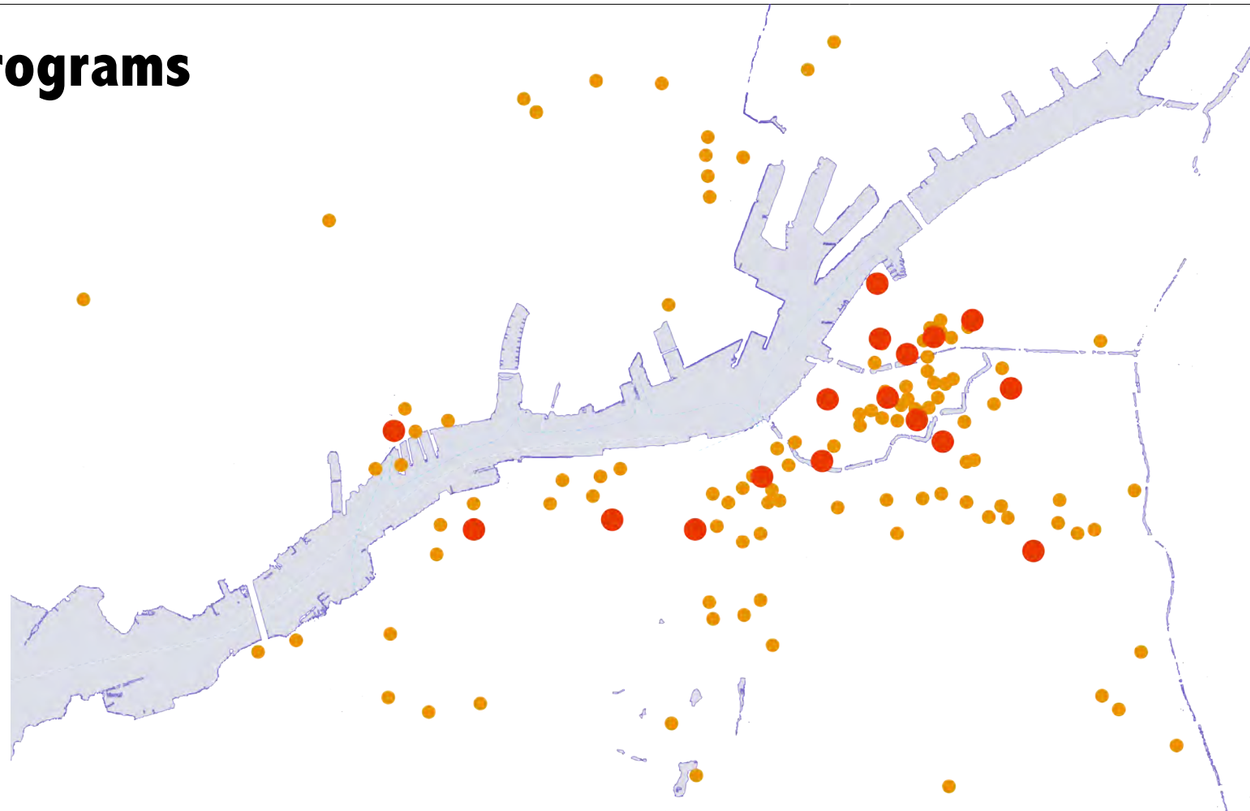
ble floating spaces. Continue the shorelines with enjoyable public
ctive spots become active areas and also the city center area. The
me and go all the time, the port become very busy as the old days.

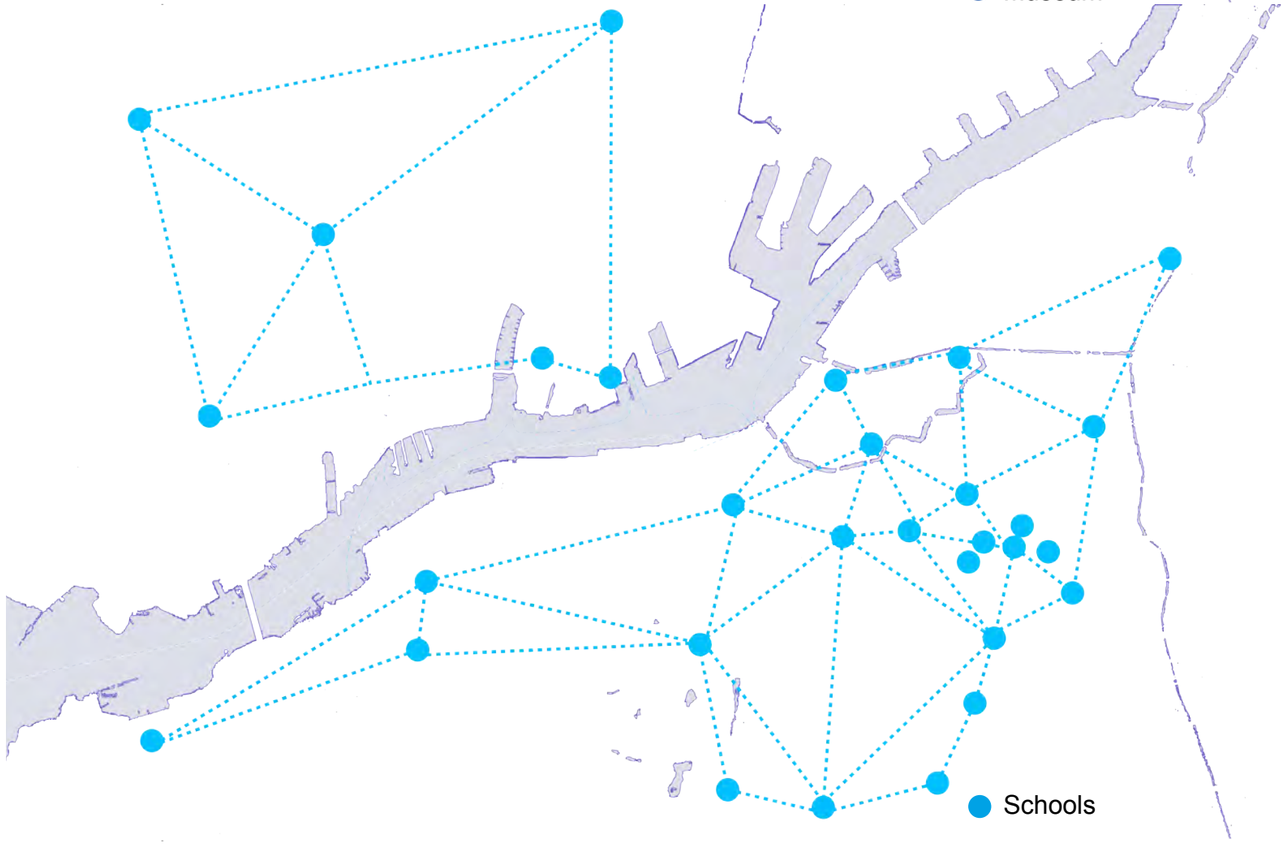
3rd, the drive of the development of the shoreline will influent and change the whole industry area in the city center. The barrier will be erased, the public space will continue along the river and the river will not be the end of land, the flexible shoreline formed by the ship buildings could always change its shape and organization of programs according to the needs of development. This enable the city to develop in a more wise way, grow up and always has the chance to adjust itself and meanwhile in a certain way avoid the waste caused by unreasonable or unsuccessful city planning.

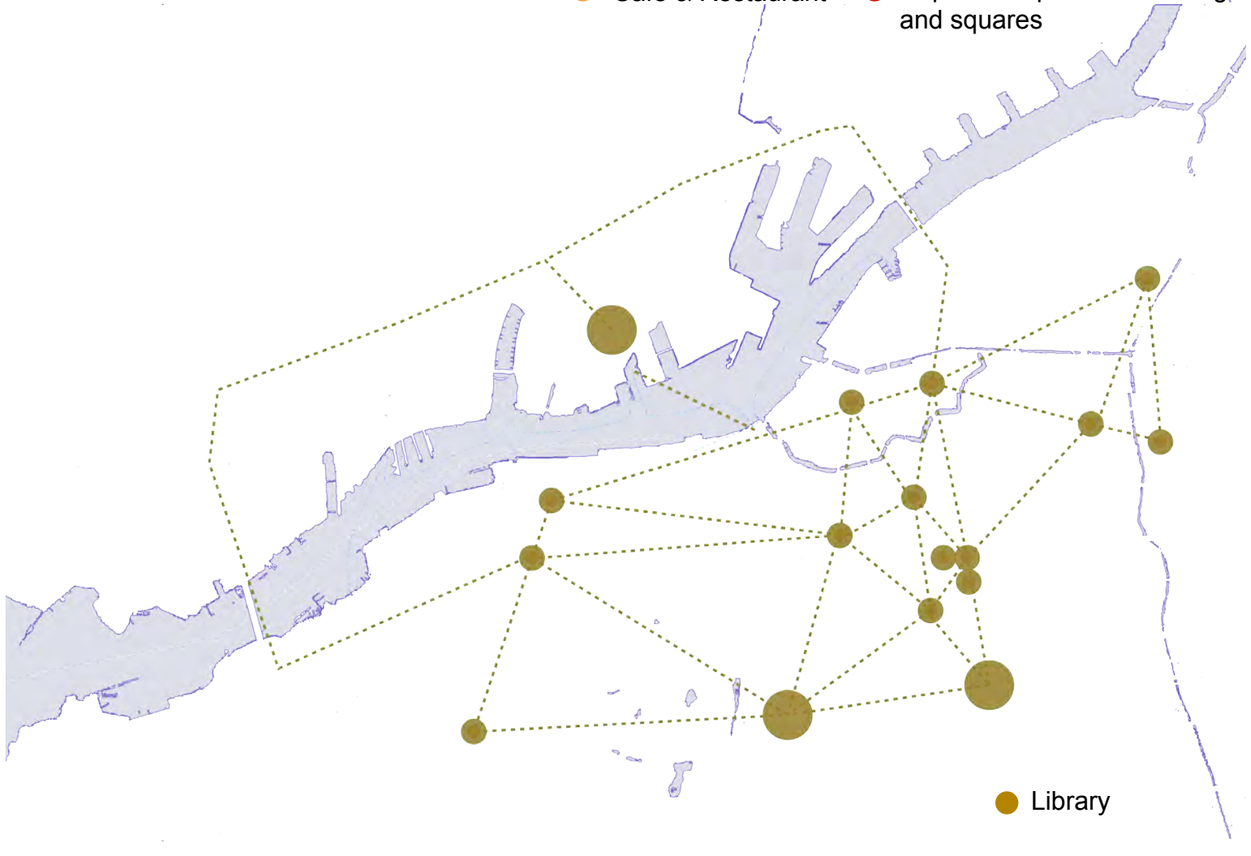
There will be flexibility in different levels. The small ship buildings could even work as floating function travel ling from one side of the river to the other, and people could use them following the schedule.

Current density and distribution of different programs









Strategy in different scales

The industry heritage areas are almost all along rivers, so 3 different more detailed strategy could adapt to the 3 different scale of water. And the water scale is also related to the position of the areas, all of these 3 scales organize a whole new water public space system.
The programs of the ship building would refer to the existing programs and would improve the existing network.

GENERATOR

As the old shipyard factory, now it uses the technology facilities and experience of shipbuilding and bring them to serve manufacturing the new ship-building. As a big local-product factory and also modern exhibition center, the place offer people to come and chose the modularized but also personal flexible ship-building. It will keep the most important identity and image of Gothenburg, and make it adapt the challenges of today and open up a new window for it.

XL

The strategy of development of area on Göta river has three layers: 1st one is the expansion of the river bank. The shrinking potential of the width of the river due to the shrinking harbor function inside the city and the expansion need of city could push the wide shoreline more to the center line of river. 2nd is the attraction active spots along the river to attract people to go to and gradually change the barriers blocking people from the shoreline. 3rd the water and floating structure relationship could bring the opportunity of reshaping the shoreline and adjusting the program in the ever-changing future according to the needs of change or expansion.

M

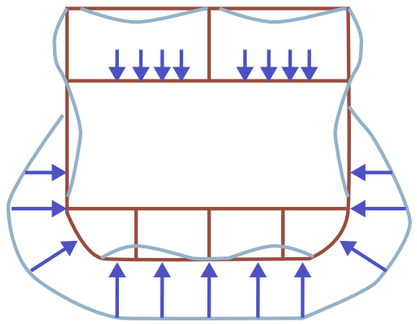
In this city center area with the width of the water as 32m-42m, the area is mostly active. But with very low bridges, only paddan tourist boat could past. River serves people as a view, but has much more potential. Floating spaces taking advantage of flexibility of water could even make the space more interesting for events and daily life and bring people closer relationship with water.

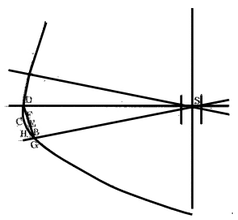
S

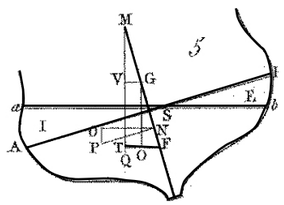
The old industry area along the creek in this area was center of the area, but now been cut off by the barriers such as railway, highway and wide street. The creek was one of the important ways materials get in and out, and with very beautiful view today, it is mostly abandoned and could not be enjoyed by people. The floating structure floating all the way along this creek is kind of review of the old orders and story and also could active the space more and record the change of the area as an observer with modern facilities.

Basic principals of ship design study

[1] Force Analysis

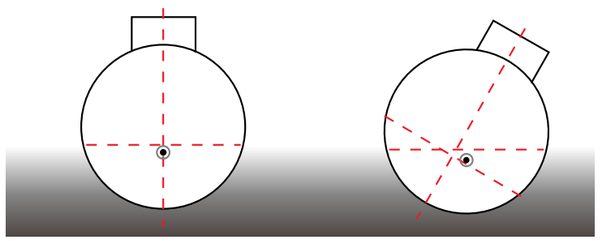






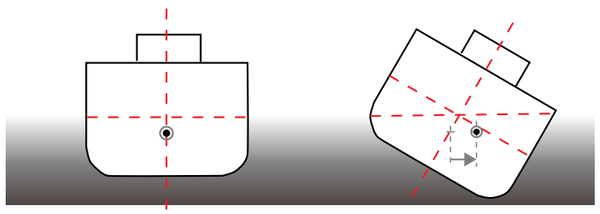
The forces a ship is taking are complicated. It mainly includes water buoyancy, self gravity, pressure from the loads, force from waves movement and from wind, and frictions.
The bottom part of a ship is the crucial parts to take most of the pressure.

[2] Stability



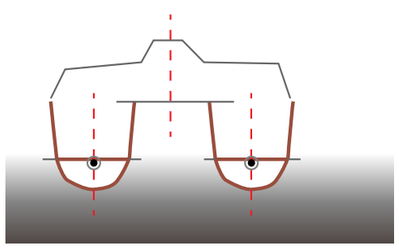
Weight pushes hull into water

CoB stays in the same place because no change in submerged shape



Water tries to fill hole, pushing hull up (buoyancy)

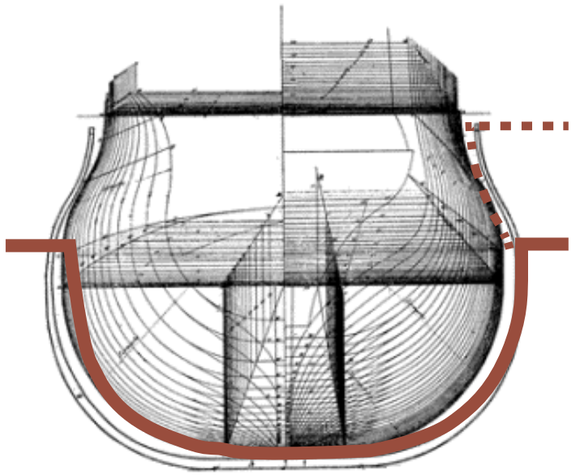
CoB moves over because submerged shape changes



Catamaran has two CoBs and is much more stable.

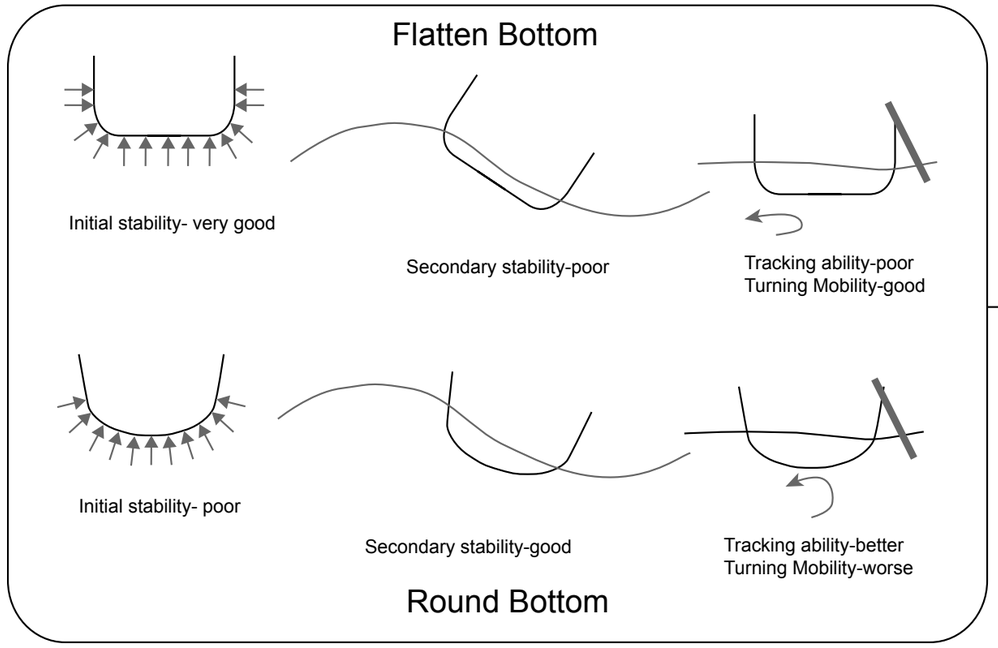
metacentre - (shipbuilding) the point of intersection between two vertical lines, one line through the center of buoyancy of the hull of a ship in equilibrium and the other line through the center of buoyancy of the hull when the ship is inclined to one side; the distance of this intersection above the center of gravity is an indication of the stability of the ship

[3]

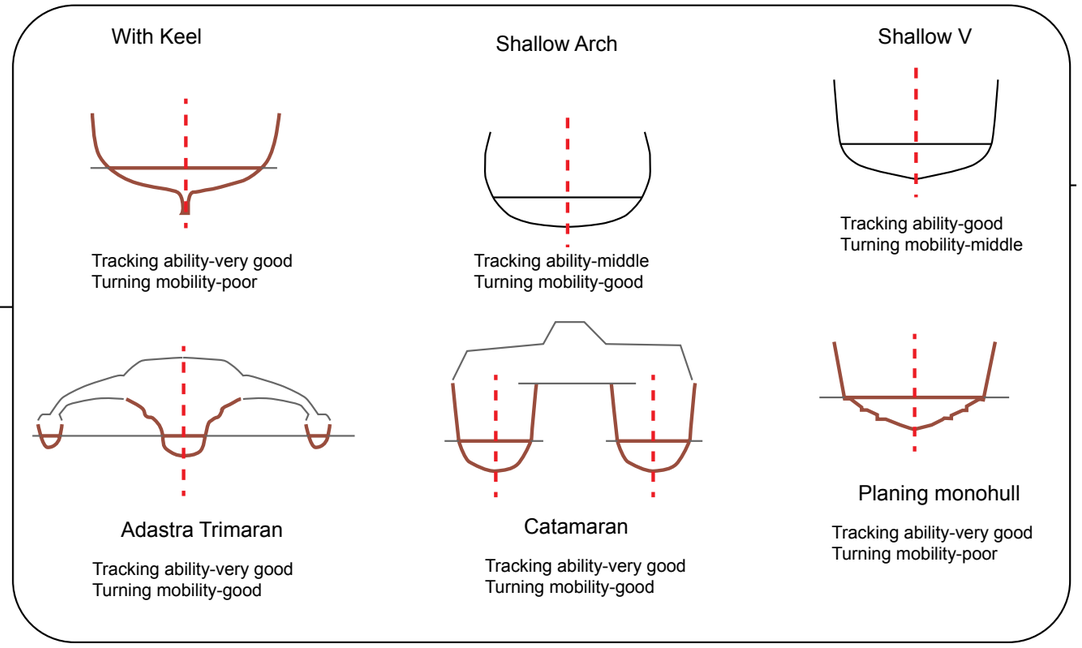


More space to take loads, more space to be under the water. and meanwhile more surface to connect the water, so the friction is bigger. Also more depth of the bottom, and the gravity point would be higher, and stability should be considered in a balance.

[4] Prototype



[5] Comprehensive Type



The design of the bottom part of a ship is about making choice. The result is a compromised decision of all the aspects related. There is no perfect curve, but best solution according to the needs.

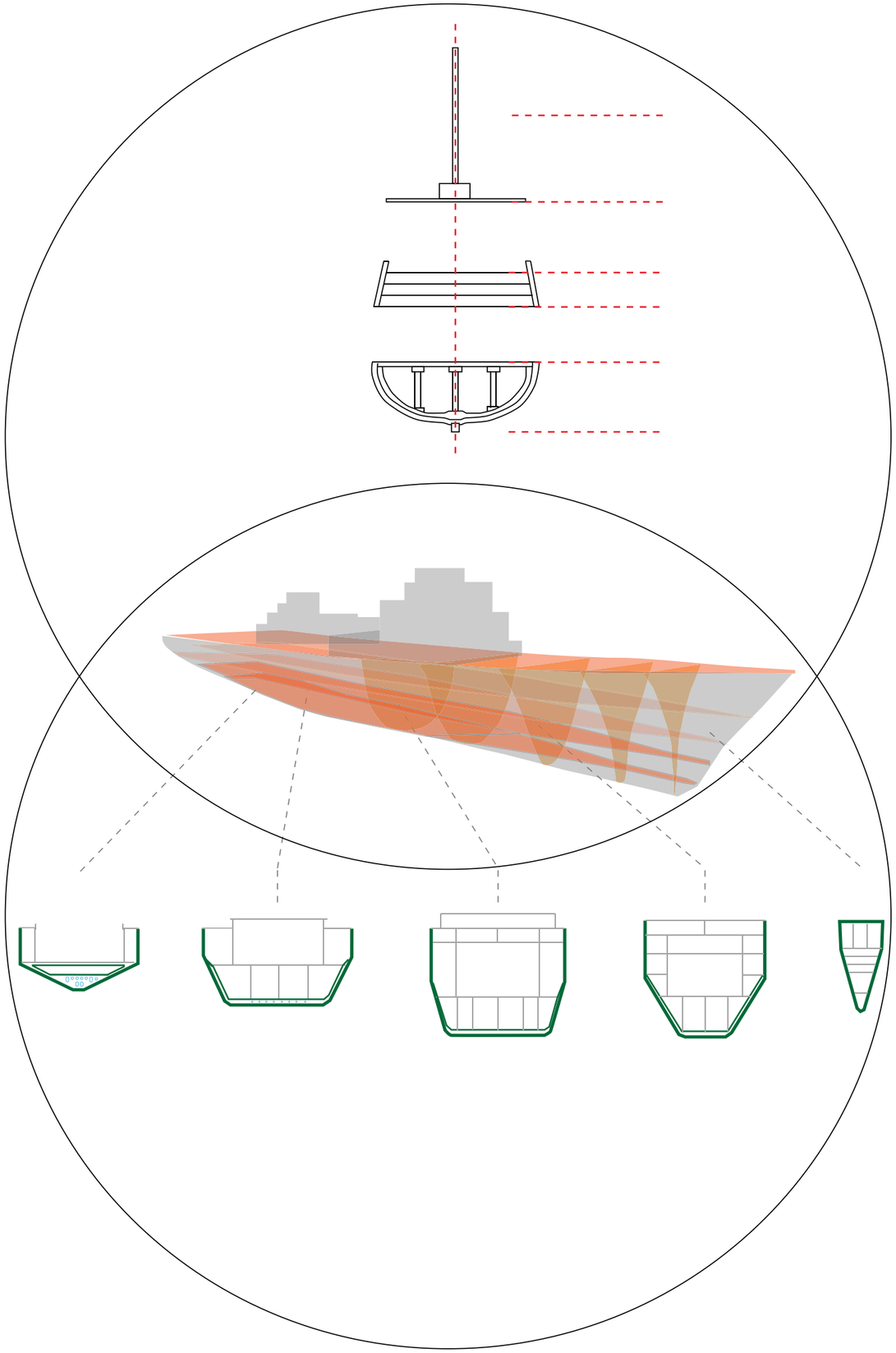
With the design considering stability, flatten bottom and round bottom are two extreme prototypes. Flatten bottom has very good initial stability, is very stable in still water, but when the wave comes and reach certain angle, it will risk of flipping over easily, which means its secondary stability is poor. As the opposite, the round bottom has poor initial stability, small weight imbalance and waves will make it shake, but when big waves come, it is much harder for it to flip over.

Tracking ability of flatten bottom is poor and the round bottom is a little better, but with a v-shape or a keel under the bottom, the tracking ability will be much improved. But in the other way, the turning ability could be much compromised. So the design of a ship is always about what aim to gain. It is a choice between speed, initial stability,secondary stability, load capability, tracking ability, turning ability, understanding the principles could help us design the ship buildings according to our needs.

[7] Composition of bottom

The composition of a ship could be defined vertically from upside to bottom. According to the forces the structures dealing with, there are very different requirements. So the division of the structure is very clear,

The heaviest structure is at the bottom. More weight distributed on the bottom, more stable the structure is in the water. Lighter structure on the top, more stable



Other

Main Deck

Place of human activities in good weather.

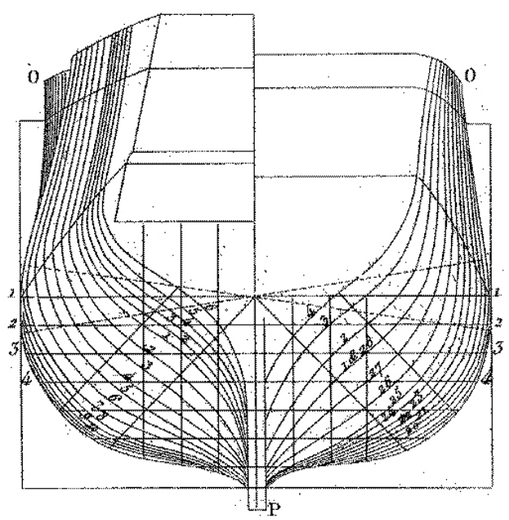
Secondary Decks

Does not take the water pressure. Store goods and people.

Bottom Structure

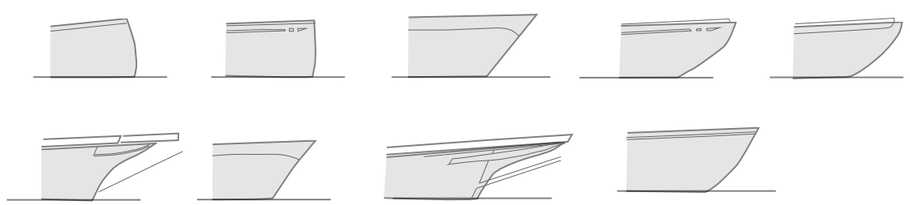
This part is the most important structure that take the pressure from water gravity, the other structure is built based on this.

[6] The curve of bottom



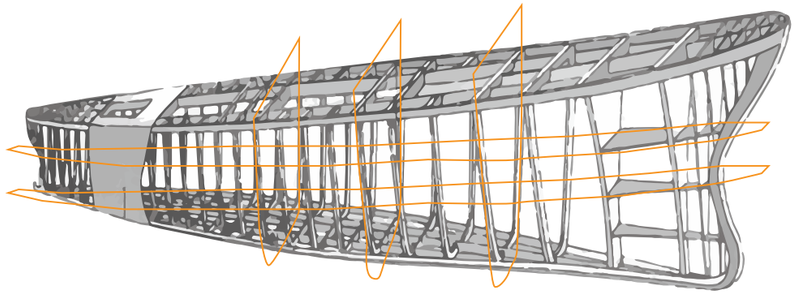
The sections of a ship in different part continuously change. The core character could be told by the front section, middle section, back section. Usually the design start from the middle section which decides the load capacity and the others, then goes to the two sides. With the changing shape of the bottom, the diverse function requirement cold be better fulfill.

[8] Shape of the front part of boat



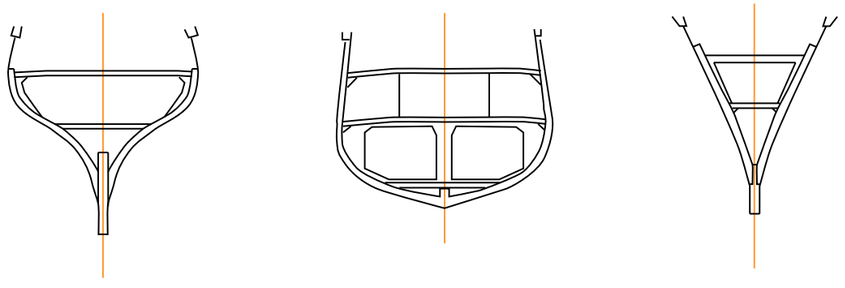
The shape of the ship front refers mainly to speed and stability.

[9] Skeleton



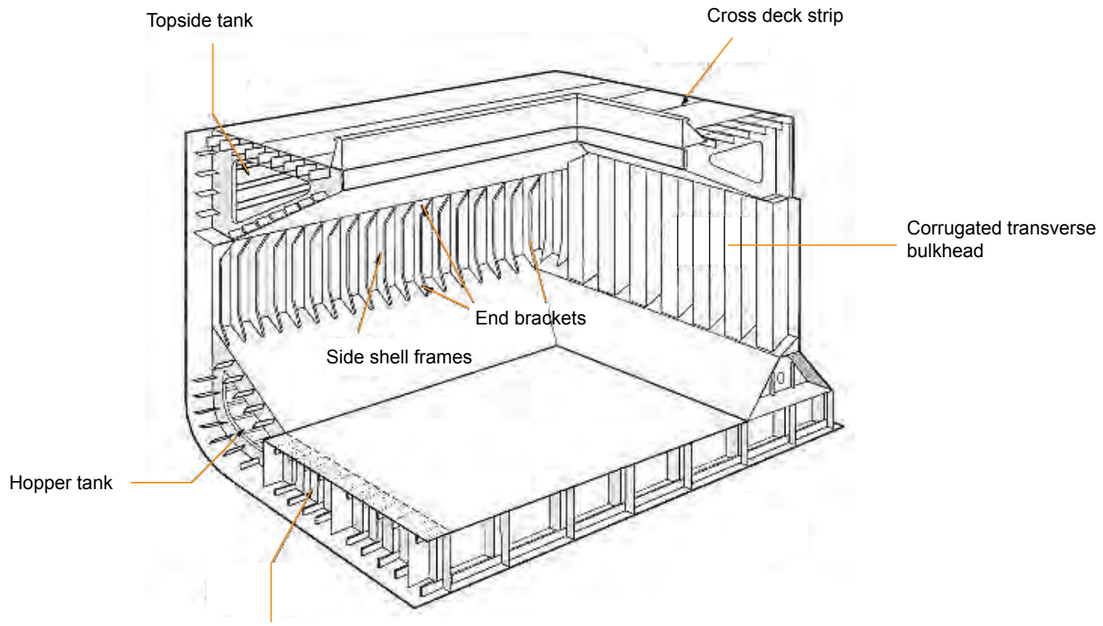
The frame of the bottom has much bigger density than normal buildings in order to support pressure from water. Around every 0.6-1 meter of the long section, there is a frame in wooden or steel structure. And horizontal structure to connect the frames. Then substructure will be built to support them.

Section of Different Part



There are several ways to build up the bottom and the lighter structure based on it. The deck could work as enhanced element, it could both be hanging structure or supported from the bottom by regular columns.

[10] Substructures

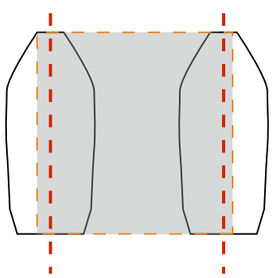


Double bottom tank

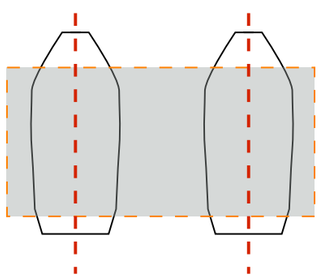
The water pressure the bottom take is very big, so the density of the substructure is relatively high. In mot case, these structures are covered by decoration and floors. And in part of the space between the layers, water could be stored temporarily.

[12] Mooring System

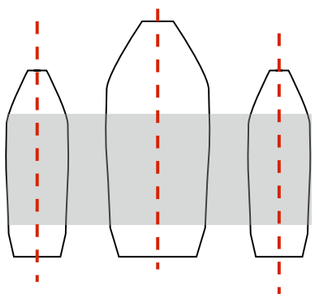
When using the deck to connect two boats and make it a catamaran, the size of the deck should cover at least half the boat on each side.



The most commonly used way is using the deck wider than the edges of the boat on each side.



Same condition when connecting more boats.



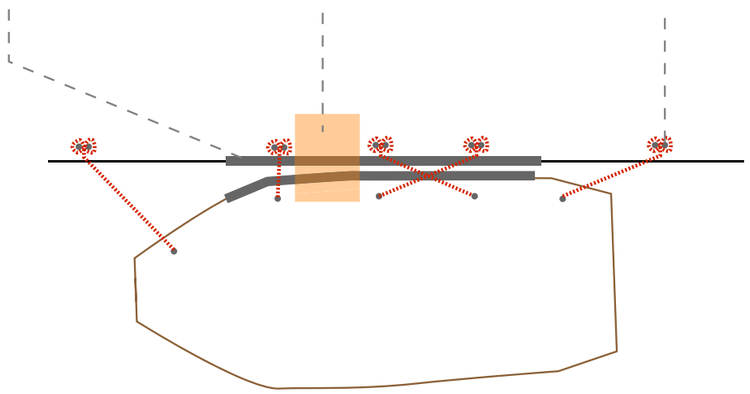
There are several ways of mooring a ship to the land or to another ship. When mooring to the land, ropes are mainly used. 8-shape knots which connect several different part of ship could fix it to the land well. The bumping elements in between will protect the attrition caused by the movement of waves.
When connecting two ships or more together, decks could help fixing them, the surface of the deck should at least cover half of the both ships, and better more.

Damping element
The bumping elements to give protection of edge surfaces

Deck
Using deck to connect the land and also using the friction of land to fix the boat better.

Ropes
Using ‘8’ shape or the other type of clinch to connect the mooring points on the land.

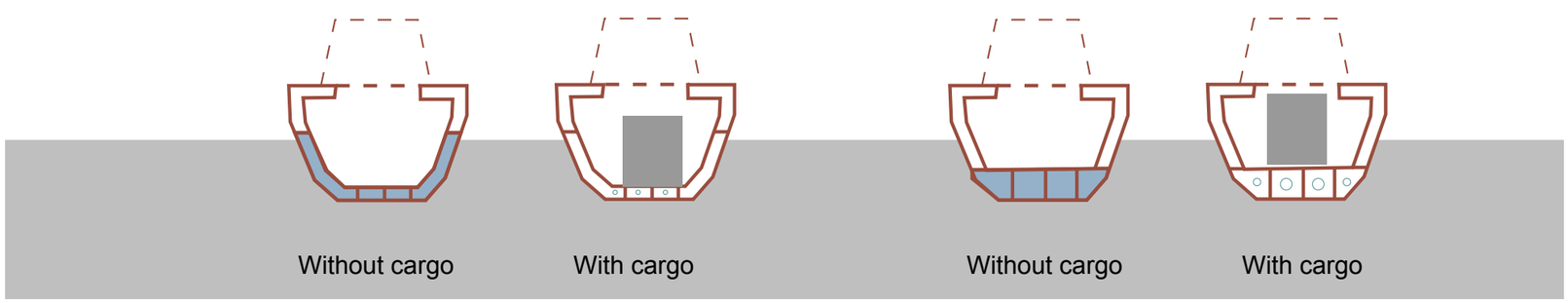
Multiple connection points
make sure to moor the boat stable.



A ballast tank is a compartment within a boat, ship or other floating structure that holds water.

In order to provide adequate stability to vessels at sea, ballast is used to weigh the ship down and lower its center of gravity. International agreements under the Safety Of Life At Sea (SOLAS) Convention require cargo vessels and passenger ships to be constructed so as to withstand certain kinds of damage. The criteria specify the separation of compartments within the vessel and also the subdivision of those compartments. The International agreements rely upon the states which have signed the agreement to implement the regulations within their waters and on vessels which are entitled to fly their flag. The ballast is generally seawater which is pumped into tanks known as ballast tanks. Depending on the type of vessel, the tanks can be double bottom (extending across the breadth of the vessel), wing tanks (located on the outboard area from keel to deck) or hopper tanks (occupying the upper corner section between hull and main deck). These ballast tanks are connected to pumps which can pump water in or out. These tanks are filled in order to add weight to the ship once cargo has been discharged, and improve its stability. In some extreme conditions, ballast water may be introduced to dedicated cargo spaces in order to add extra weight during heavy weather or to pass under low bridges.

[11] Ballast System



General goals

As elements of the whole new ship building system, different scales load different function and characters.

For the scale S, the new floating structure is about creating a kind of connection of the interesting spots along the narrow and long river. The scale is small. With the width of river about 11 meters, the structure will be around 8 meters wide at most. It should be attractive, conflict and also harmonious with ever changing surroundings along the river. It is a space to stop, and also a sculpture to admire. It is actually a recorder that records what it “sees and hears” happening in the city.

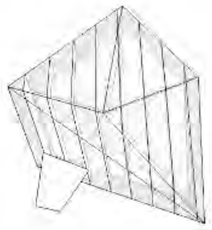
For the scale M and XL, there will be more than one spot or floating structure to occupy certain spots. Flexibility of re-combination is needed, so is the flexibility of adapting into diverse context. Modulated element with certain freedom to organize functions is the solution to deal with this.

But scale M and scale XL have certain difference in needs, so the module is designed parallel and with possibility to work together.

For Scale M, the mobility is middle. There may be one festival this week on one spot and another one for next month. The dimension of the module is very fix cause the bridges divide the width of the river into much smaller number like 9 meters to pass through. The bottom part of the ship building should be designed able to pass under the bridges and could take the building to move by the man power or help of engines; the upper part of the building should take the responsibility to realize the needs of diversity of functions needed.

For scale XL, the mobility is relative lower for the main expansion part from the land. With the large opening water surface, there is enough space for group of ship buildings with various functions. The shape of the building complex has more possibility. For scale XL, the combination of different size of space is very special and important to make a interesting and attractive space.

Characters and requirement of different scales

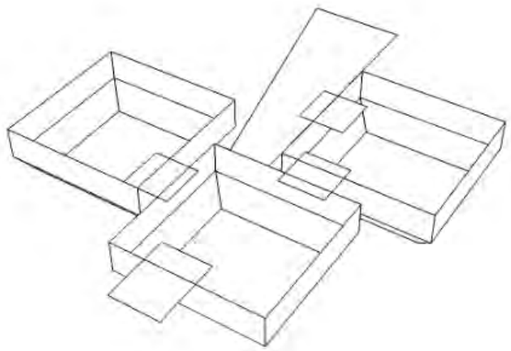


S

Dimension of water surface: Width: 12m-17m; depth: 2m

Density of Bridges: every ca. 250m

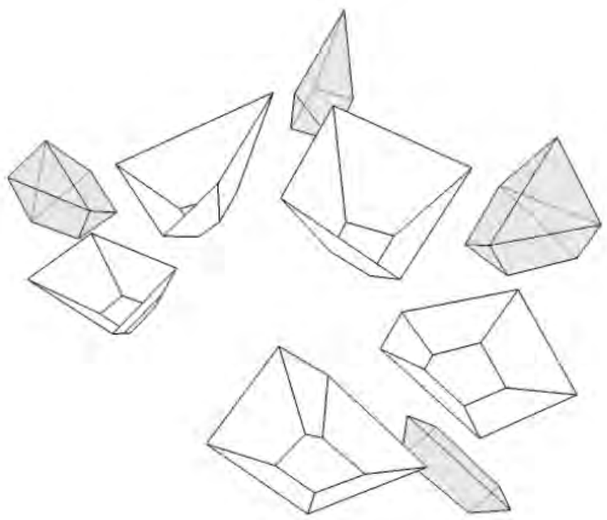
- **Key Space**
  - Deck
  - Interior
    - Under water
    - Above water
  - Mast
- **Flexibility of Assembling**
  - with Land
    - High
    - Medium
  - with other Module
    - High
    - Medium
    - Low
- **Mobility**
  - Daily
  - Monthly
  - Yearly
- **Variety**
  - Program
    - High
    - Medium
    - Low
  - Demention
    - High
    - Medium
    - Low



M

Dimension of water surface: Width: 32m-42m; depth: 5m

Density of Bridges: every ca. 180m



XL

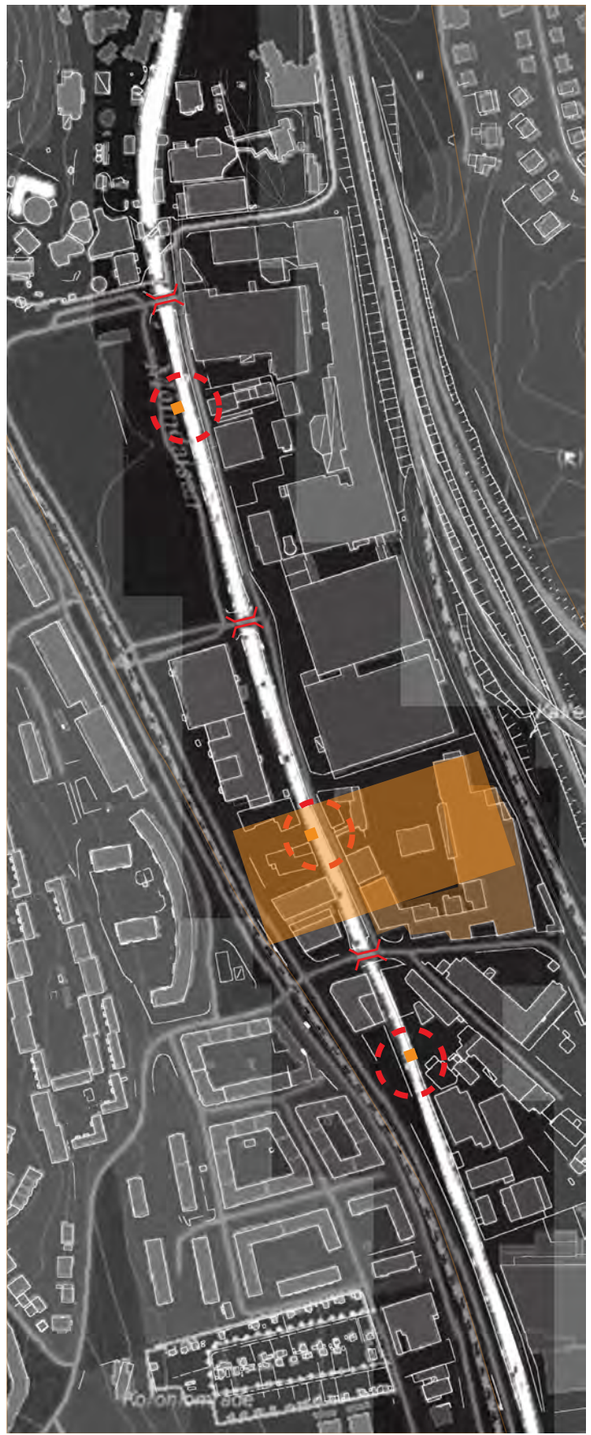
Dimension of water surface: Width: 250m-500m

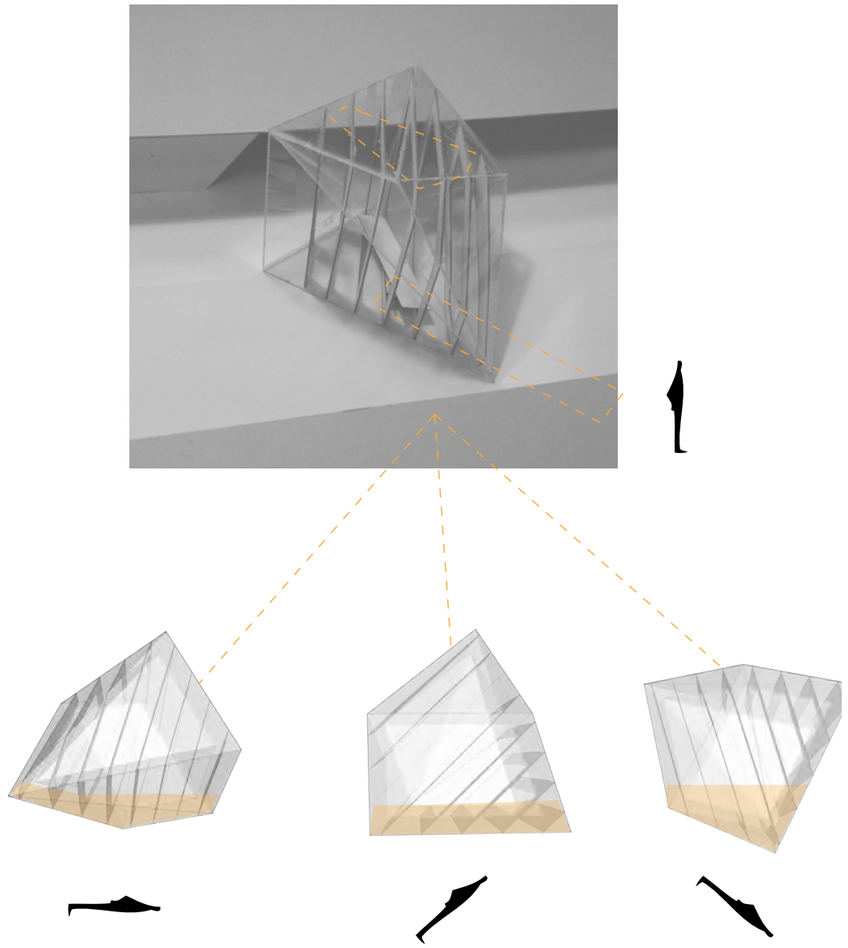
Density of Bridges: very low

	S	M	XL
Deck		★	★
Under water		★	★
Above water	☆		
Mast			★
High	☆	★	★
Medium			
Low			
High			★
Medium		★	
Low	☆		
Daily	☆		
Monthly		★	
Yearly			★
High			★
Medium	☆	★	
Low			★
High			★
Medium	☆		
Low			

DESIGN-S

[s]

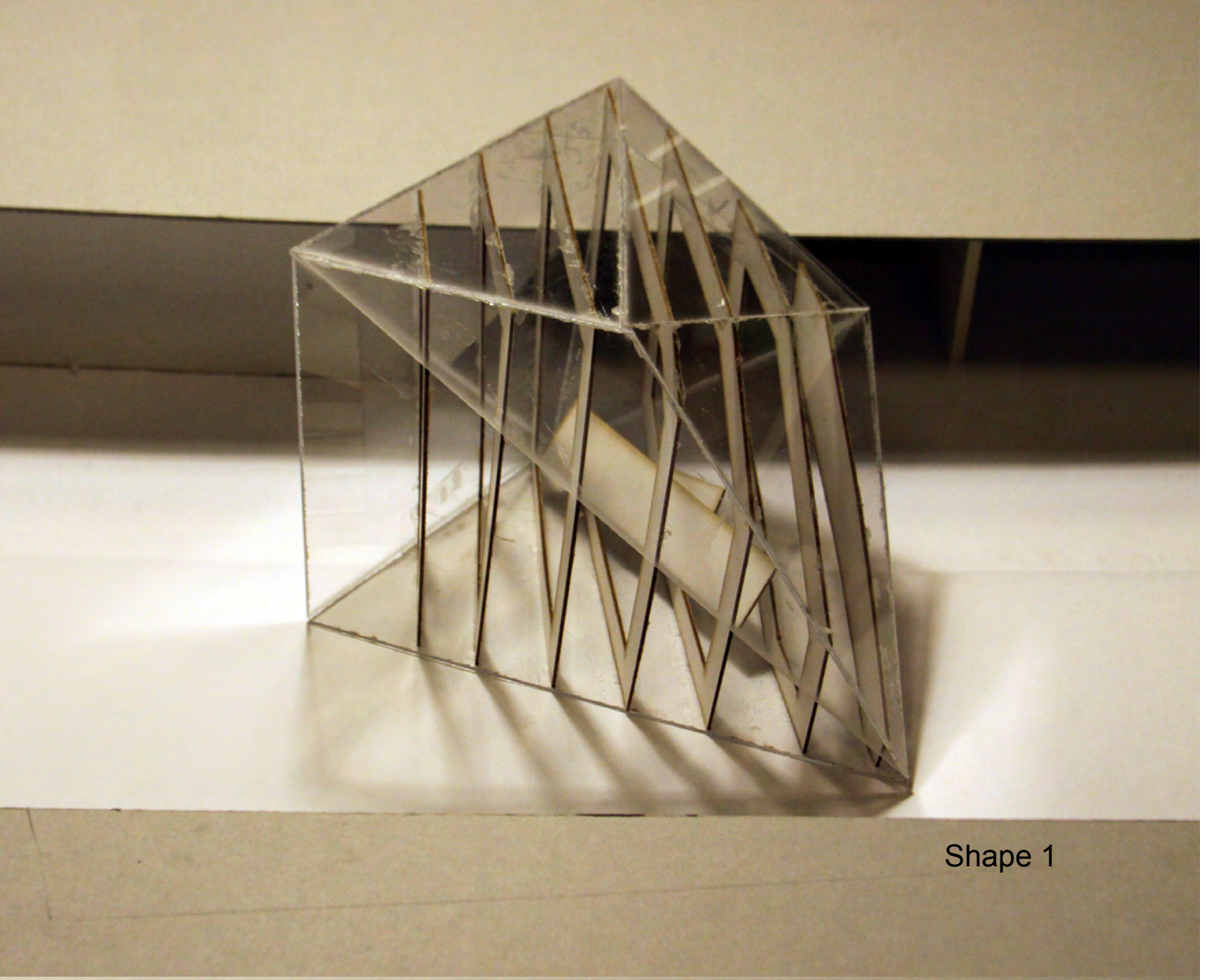




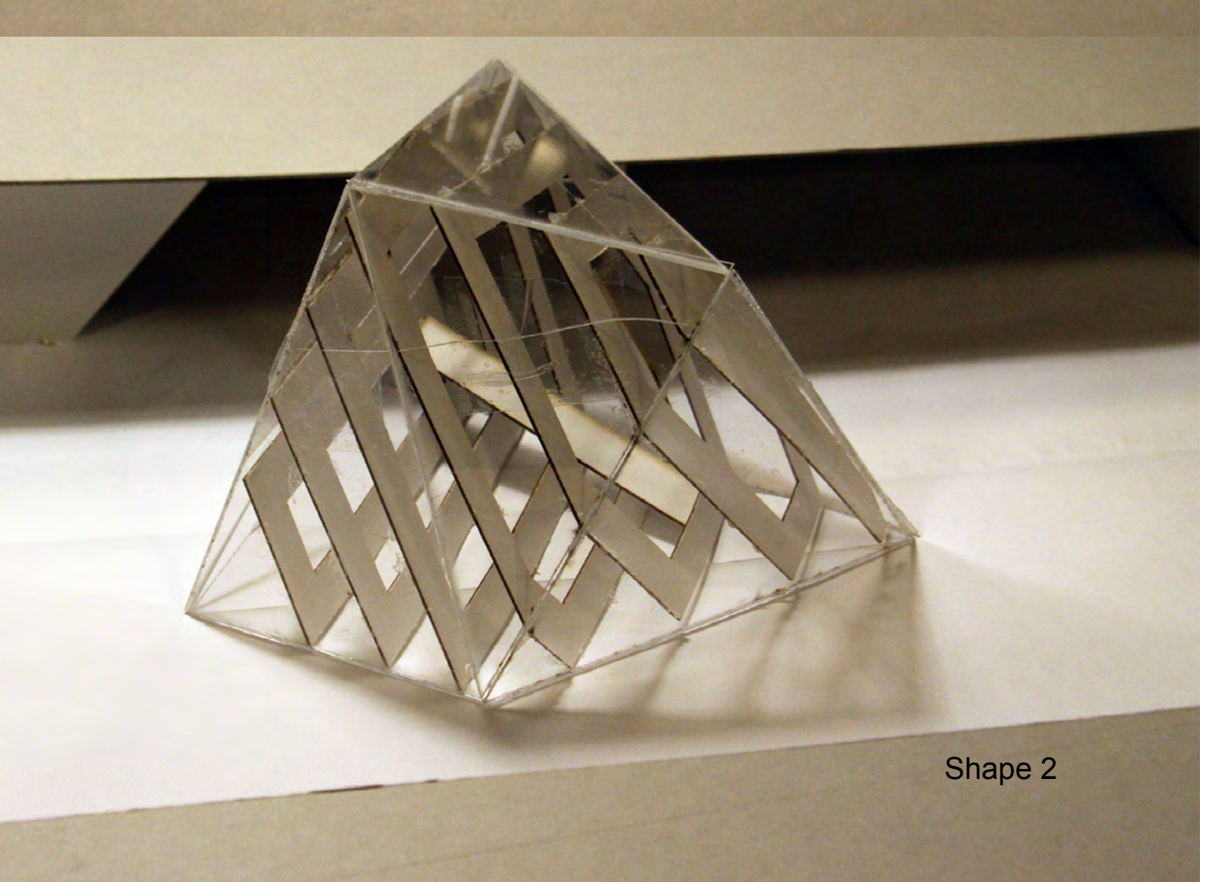
REVERSE USE OF STABILITY

Flatten bottom surface and balanced shape could give a good first stability, but the missing of the round corner make the structure easy to flip over in the water. As a small structure with the simple function and complex environment, this give it the flexibility to reshape and counter different context.
The program is a “recorder” to let people and city randomly record their words, images and store those information in the database with modern technology.

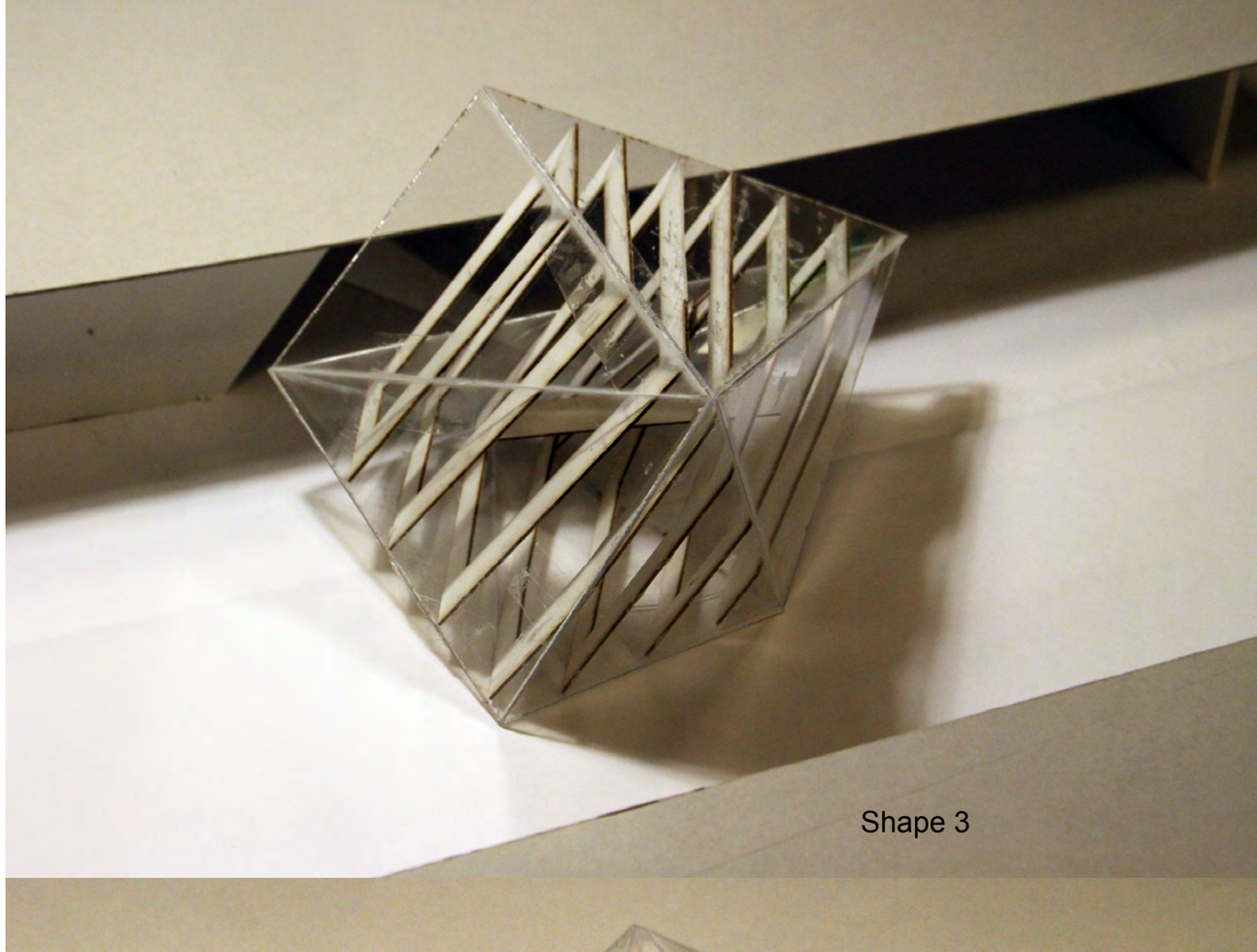
The answer to the question of adapting with changing environment along the river for scale S is to have a body that could show its different shapes and faces at different spot. The shape of the single body has so many versions, thanks to the convenience brought by water and floating relationship, it could easily realize the flipping over to another face. The structure covers all the surfaces and have the gap of 1meter between each other enable opening up a hole to get in and out. And the structure is exposed, with the recording devises attached to them.



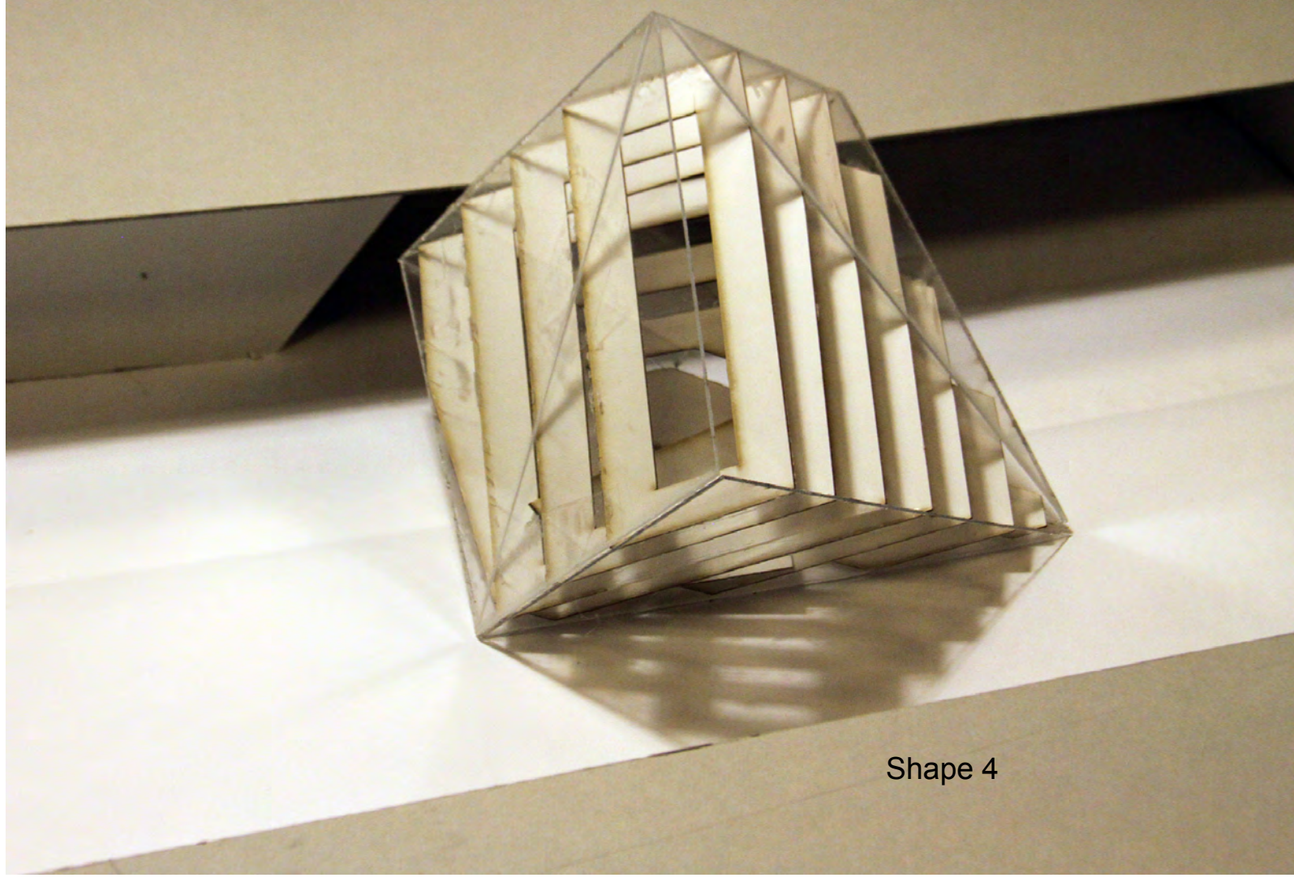
Shape 1



Shape 2



Shape 3



Shape 4

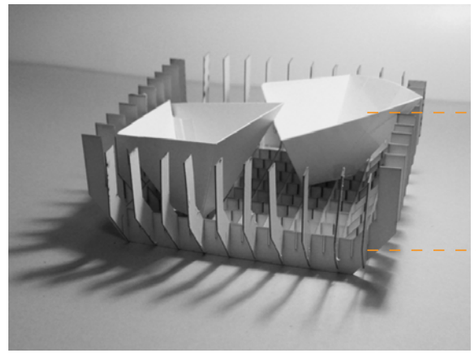
DESIGN-M

[M]

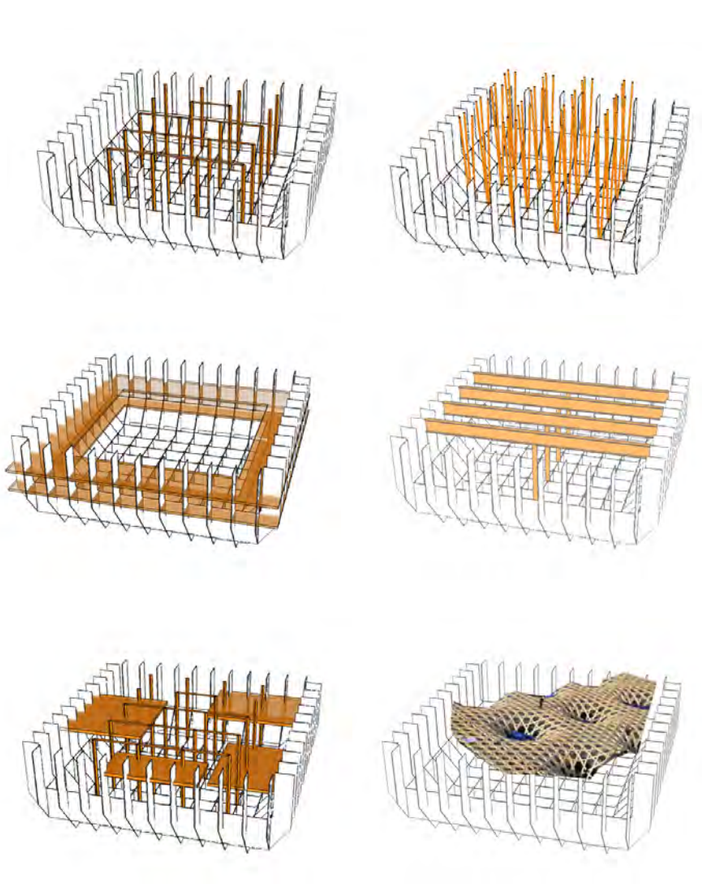
The size of basic element of scale M is decided by the result of field-research of dimensions of biggest space that could pass through most of the bridges in the area. After the calculation we have a box with width of 10 meters and height of 5 meters, so the limit of the element is 9*5.

In order to load more possibility of functions and achieve more space under the limit, the module is designed to be a square in the plan. The angles of the curve , the load capacity and the proportion of the width and depth has been tested, then one of the solution is chosen. With the frames of the bottom part settled, the upper structure will be developed according to the force analyze of a ship in the water. The possibility of the upper space and structure is explored in the design.

Concept Model

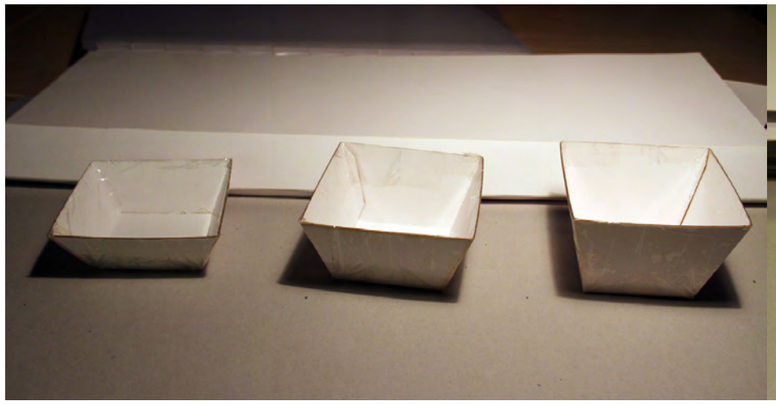


Structure Proposals



Model test

LOAD CAPACITY & PROPORTION



ANGLE OF BOTTOM

Result tested with loads in the water:

depth: too shallow
Stability: low

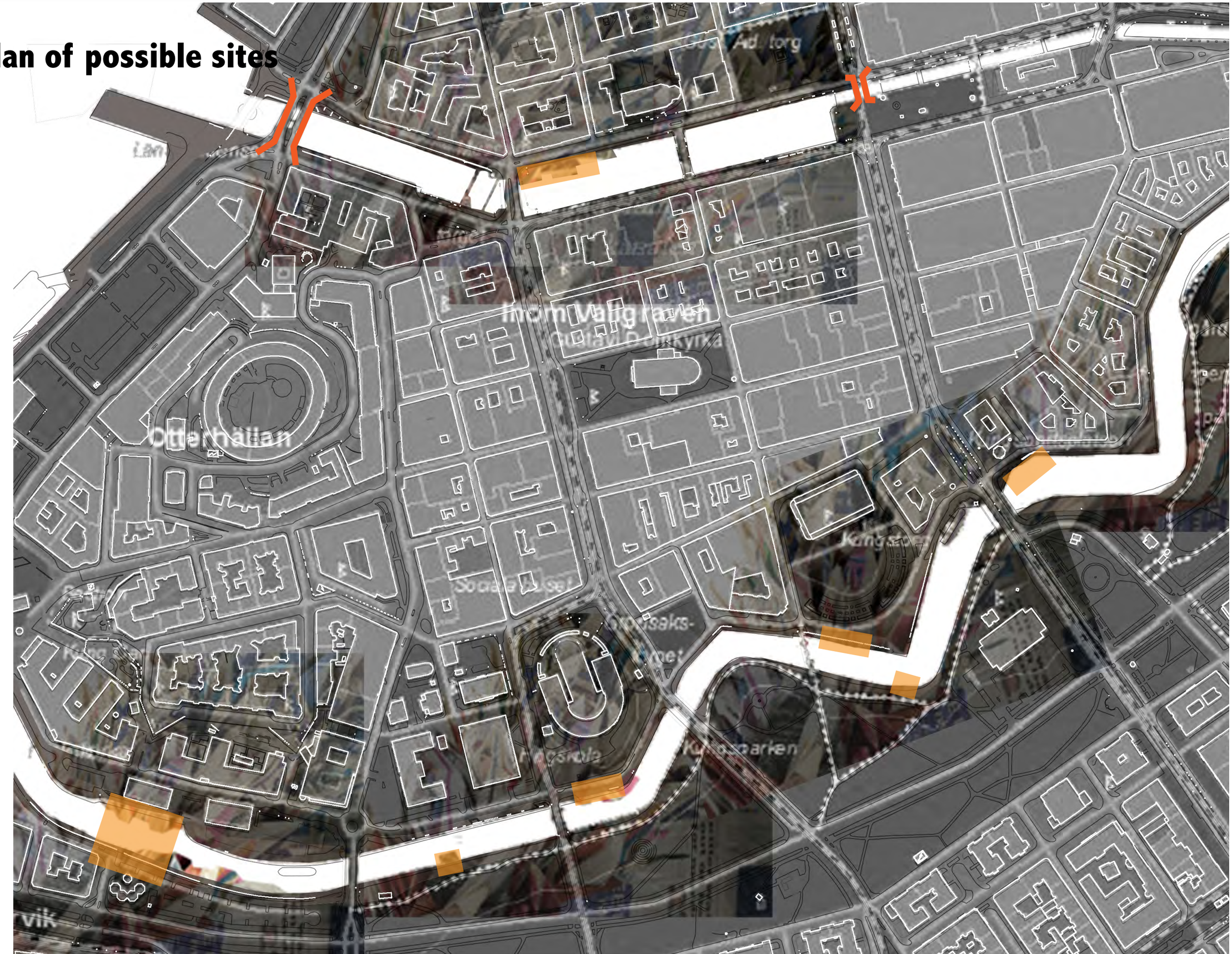
depth: middle
Stability: high
✓

depth: too high
Stability: middle

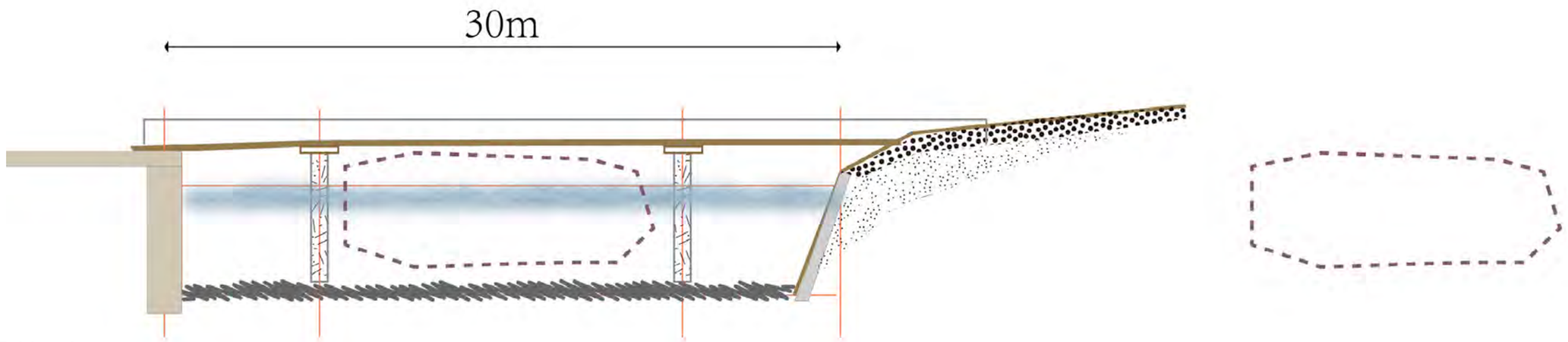
Initial stability: middle
Secondary stability: high

Initial stability:high
Secondary stability: high
✓

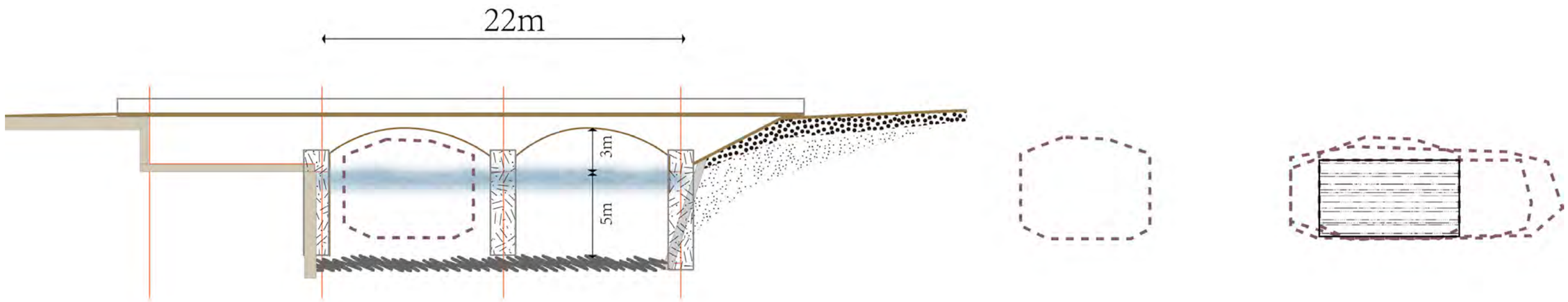
Plan of possible sites



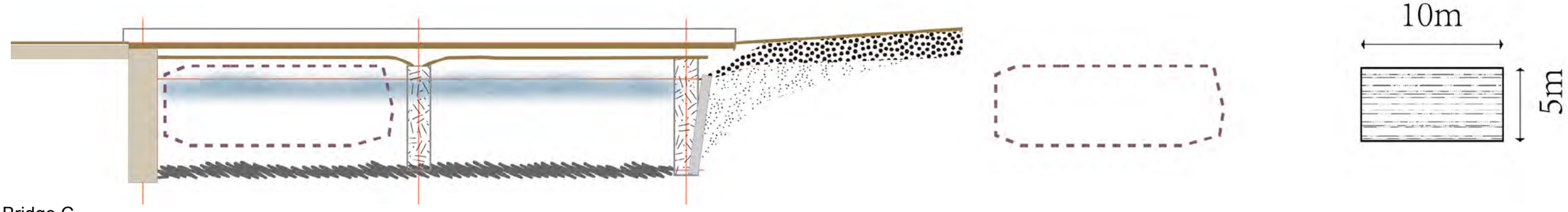
Dimensions of bridges



Bridge A

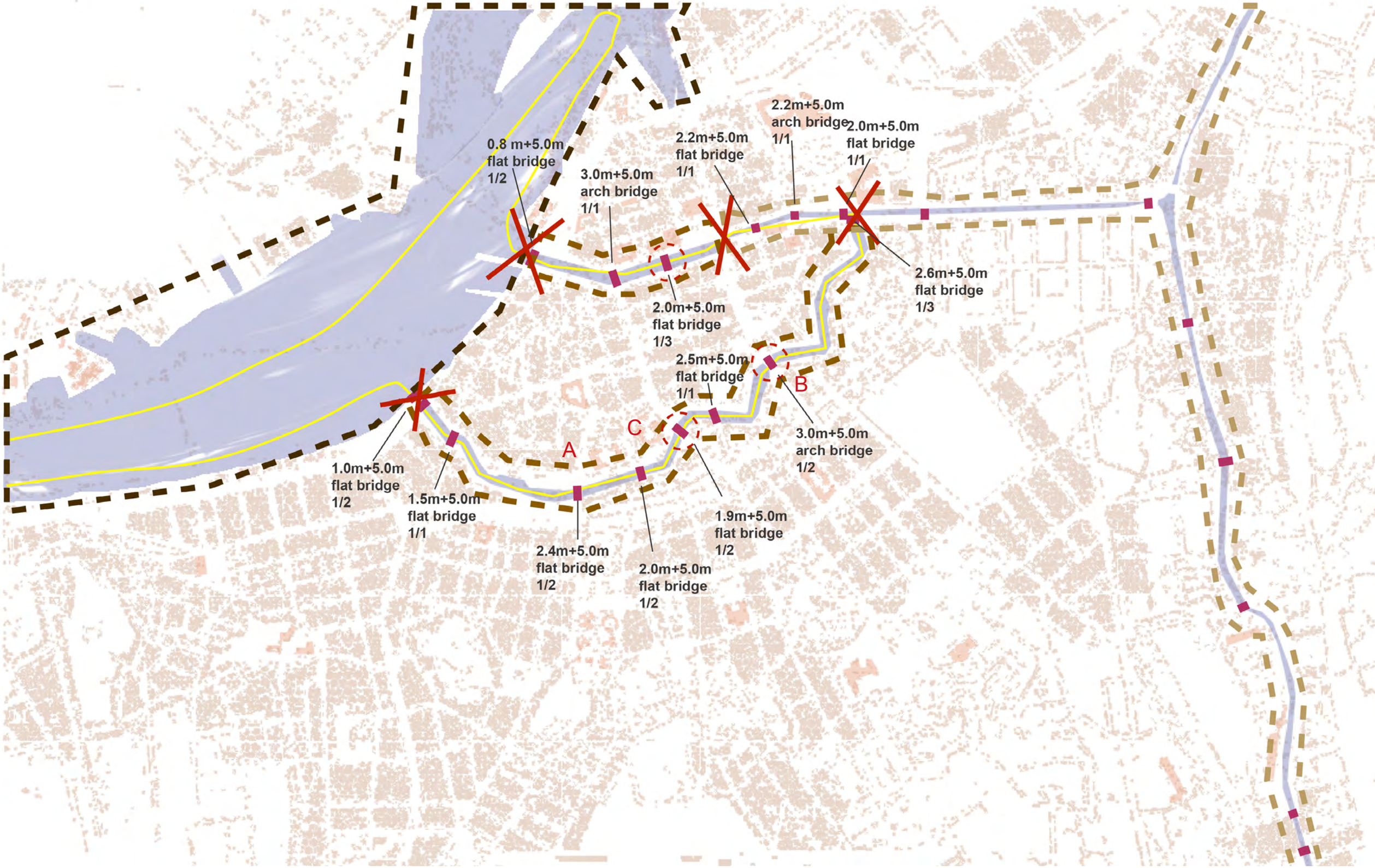


Bridge B

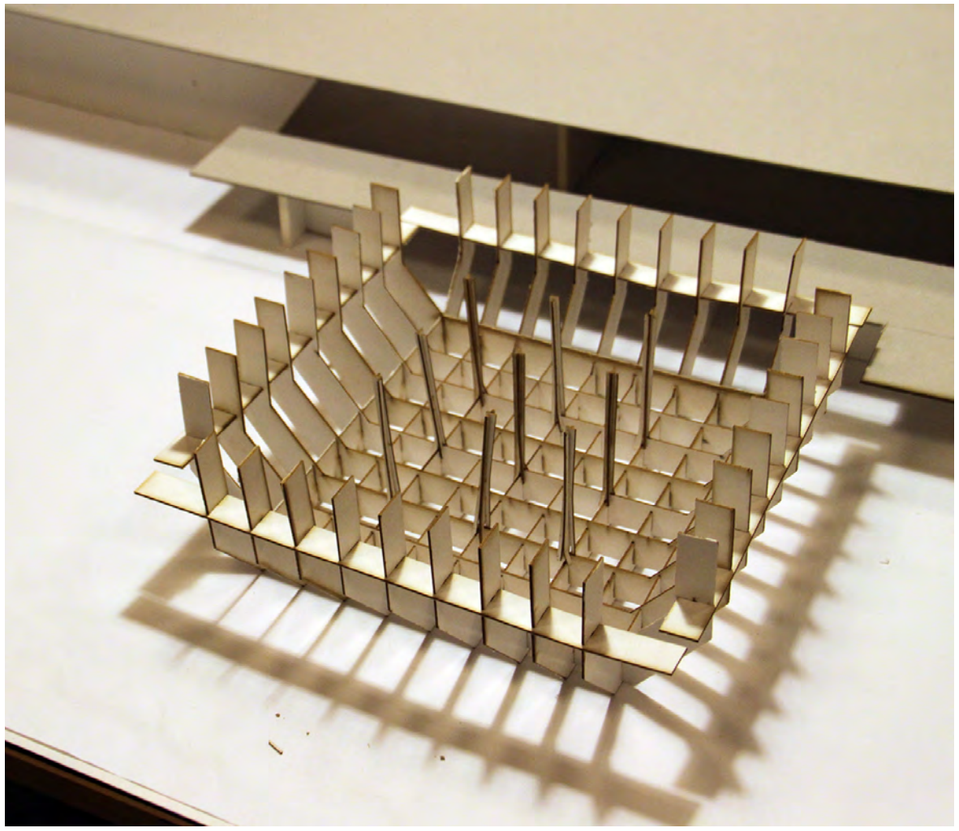


Bridge C

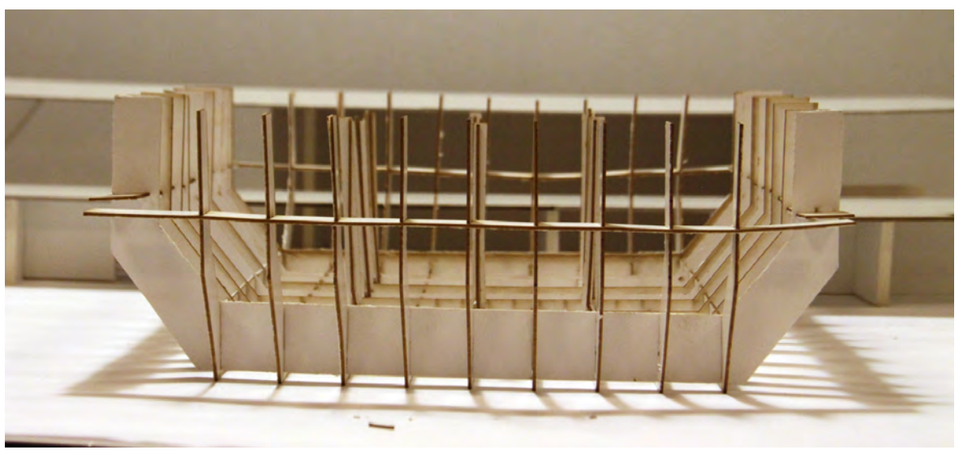
Mapping and measurement of bridges

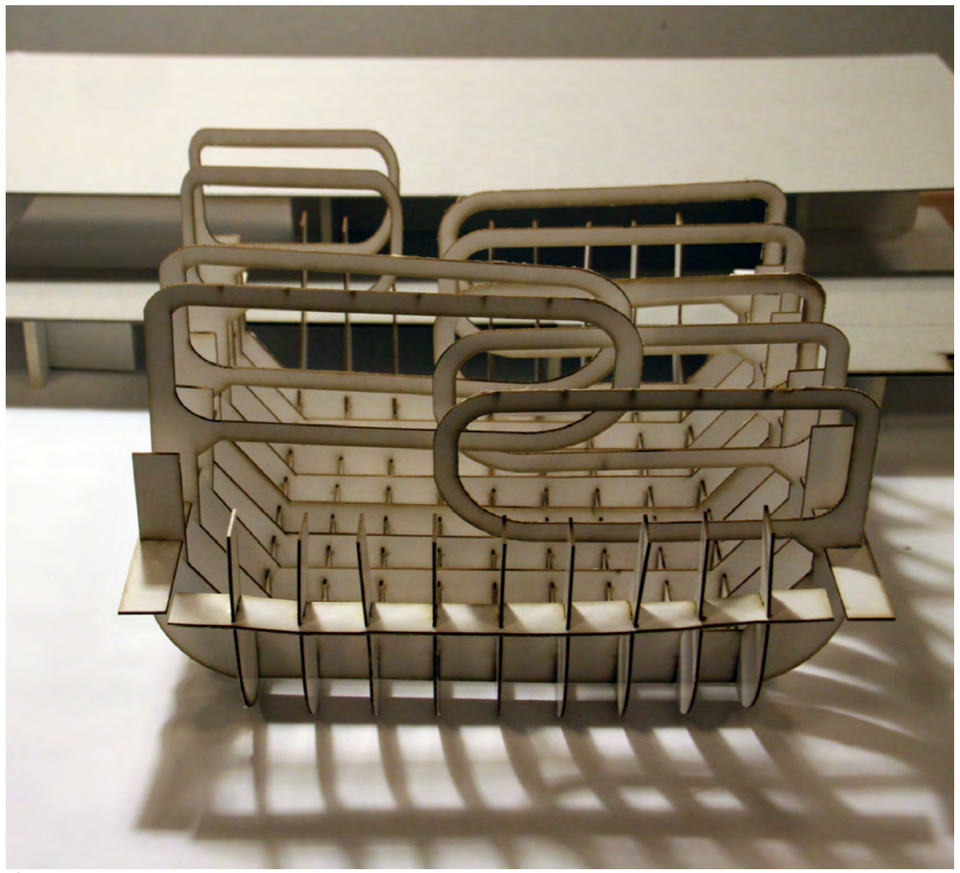


M-PROGRESS MODELS

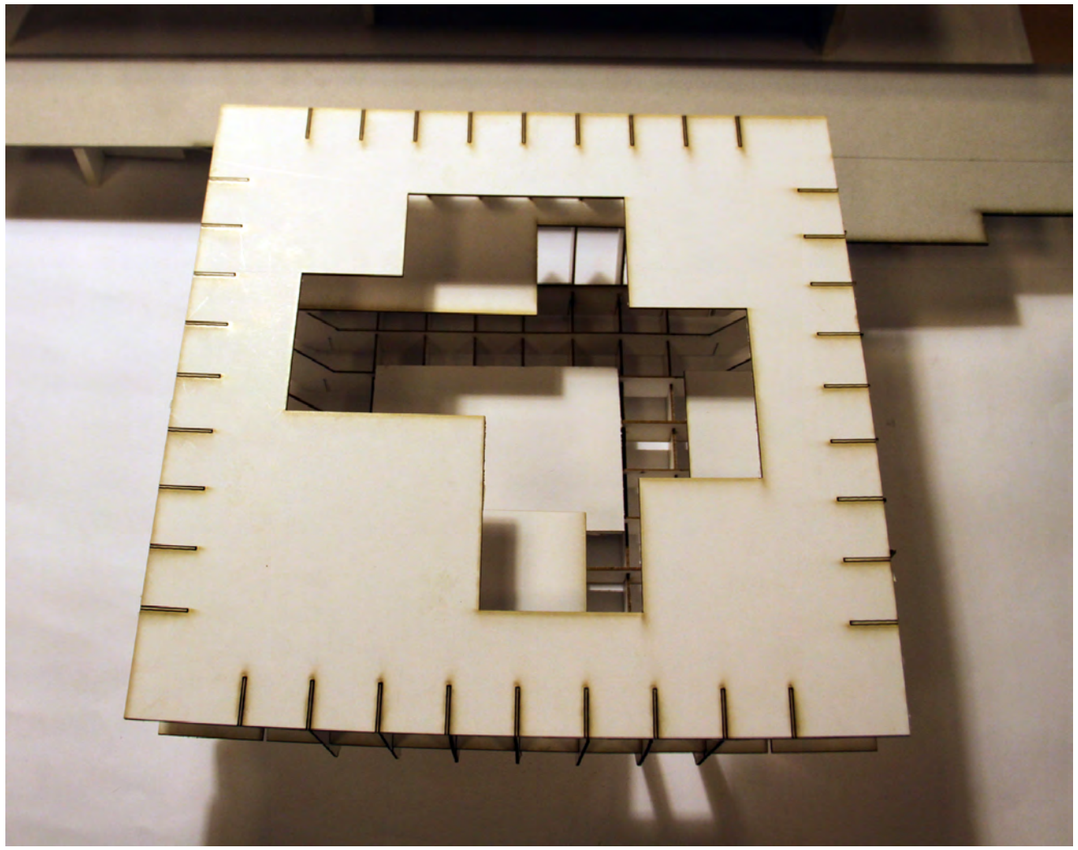


Solution A

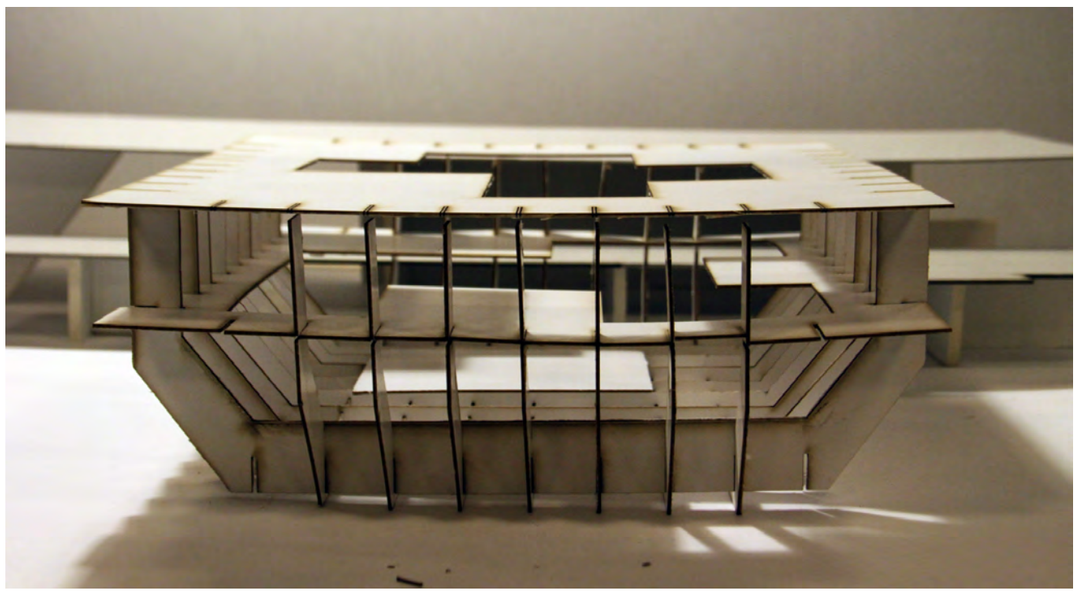


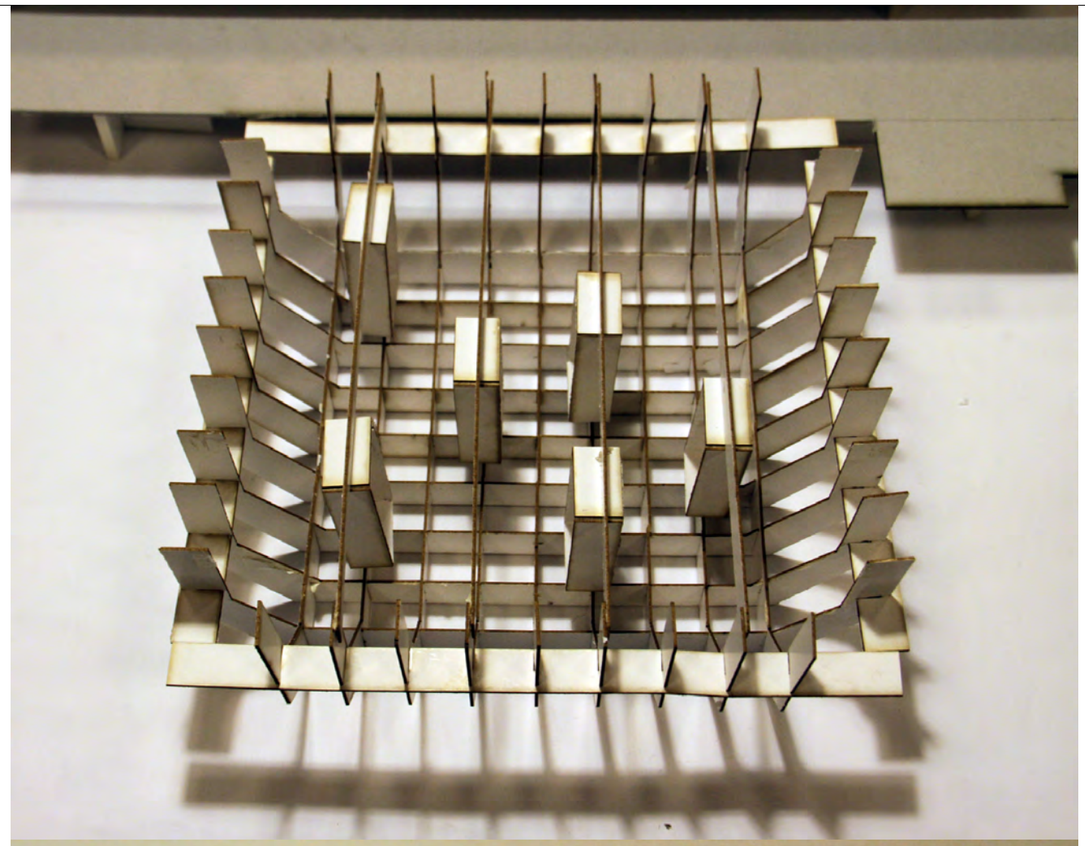


Solution B

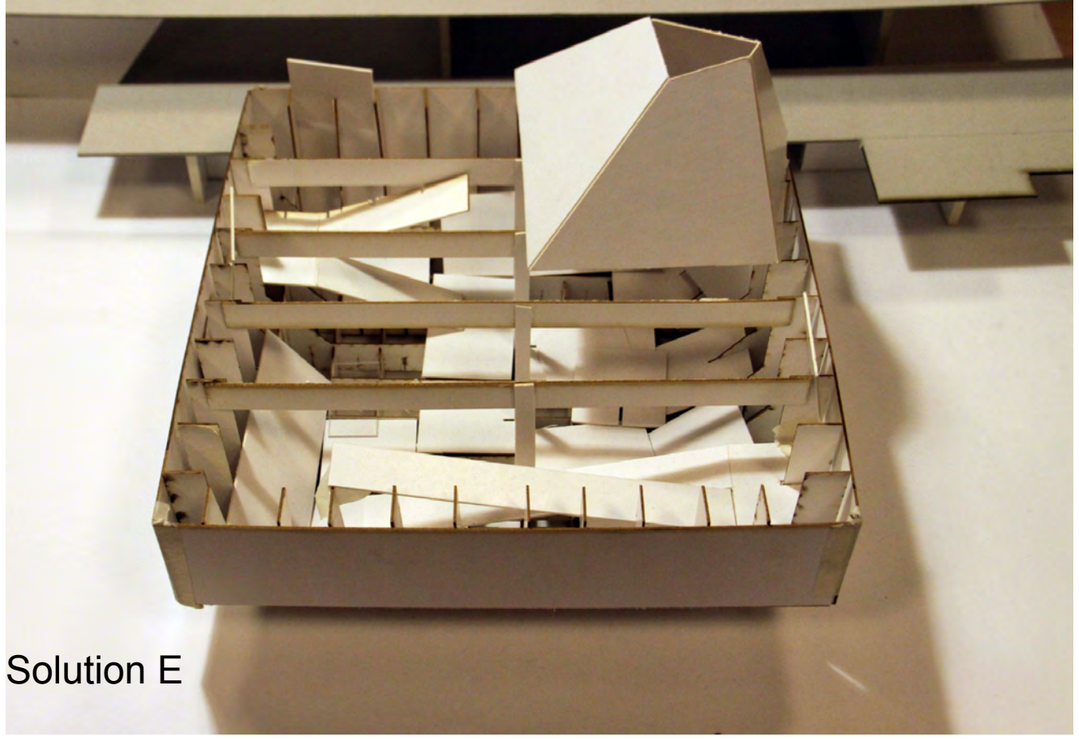


Solution C





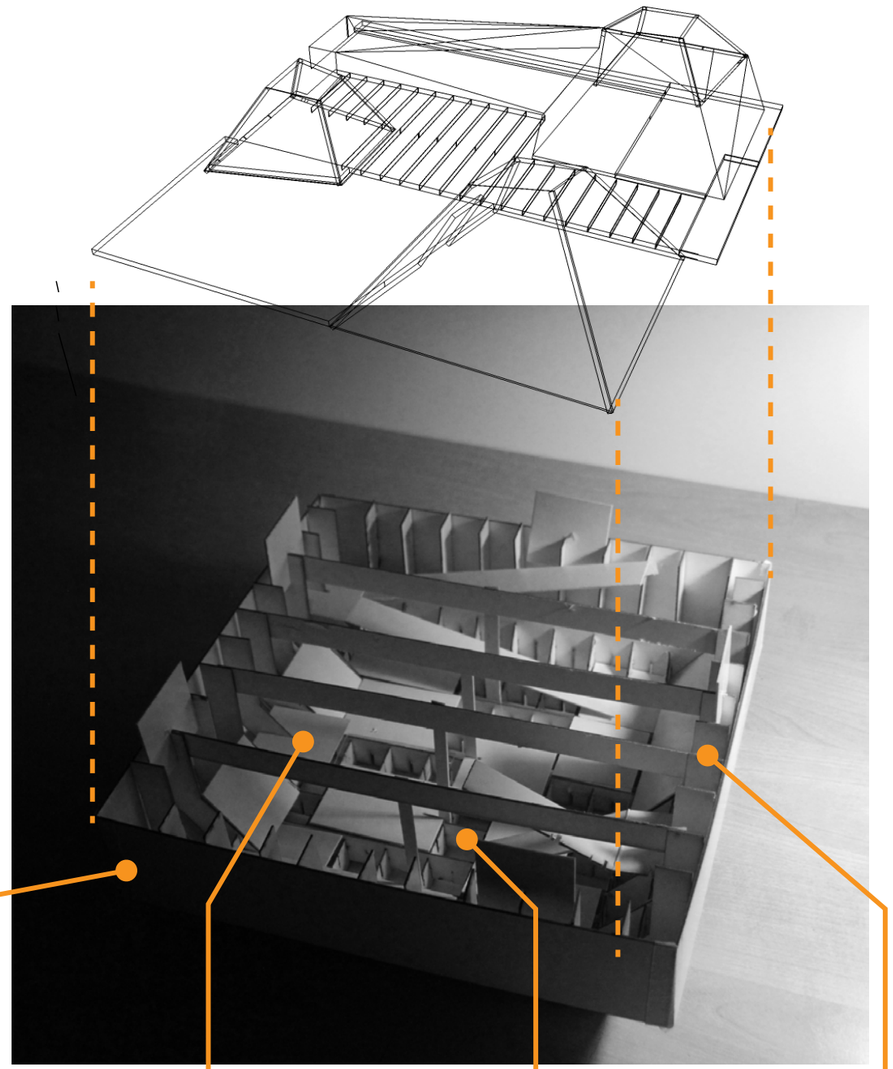
Solution D



Solution E

M-1 LIBRARY

Technique references



[4]

BOTTOM CURVE

[7]

STRUCTURE LOGIC

[10]

SUBSTRUCTURE & SPACE

[11]

BALLAST SYSTEM

BOTTOM CURVE

The main issue considered in this floating space design are stability which requires high level and mobility which should be middle. Also the wave do not need to be worried a lot. According to this, the flatten bottom with the round shape in the corner is chosen. And not like a boat to have a clear front and back for speed, the landscape beams and portrait beams are with equal size.

STRUCTURE LOGIC

The building is composed by three part like a boat, the bottom structure which takes the loads and the water pressure; the deck which enhance the connection of the beams and also form the basic surface to enter the building; the other structure built on the bottom (much lighter structures and materials to make the whole building stable in water and also because no need to consider water pressure).

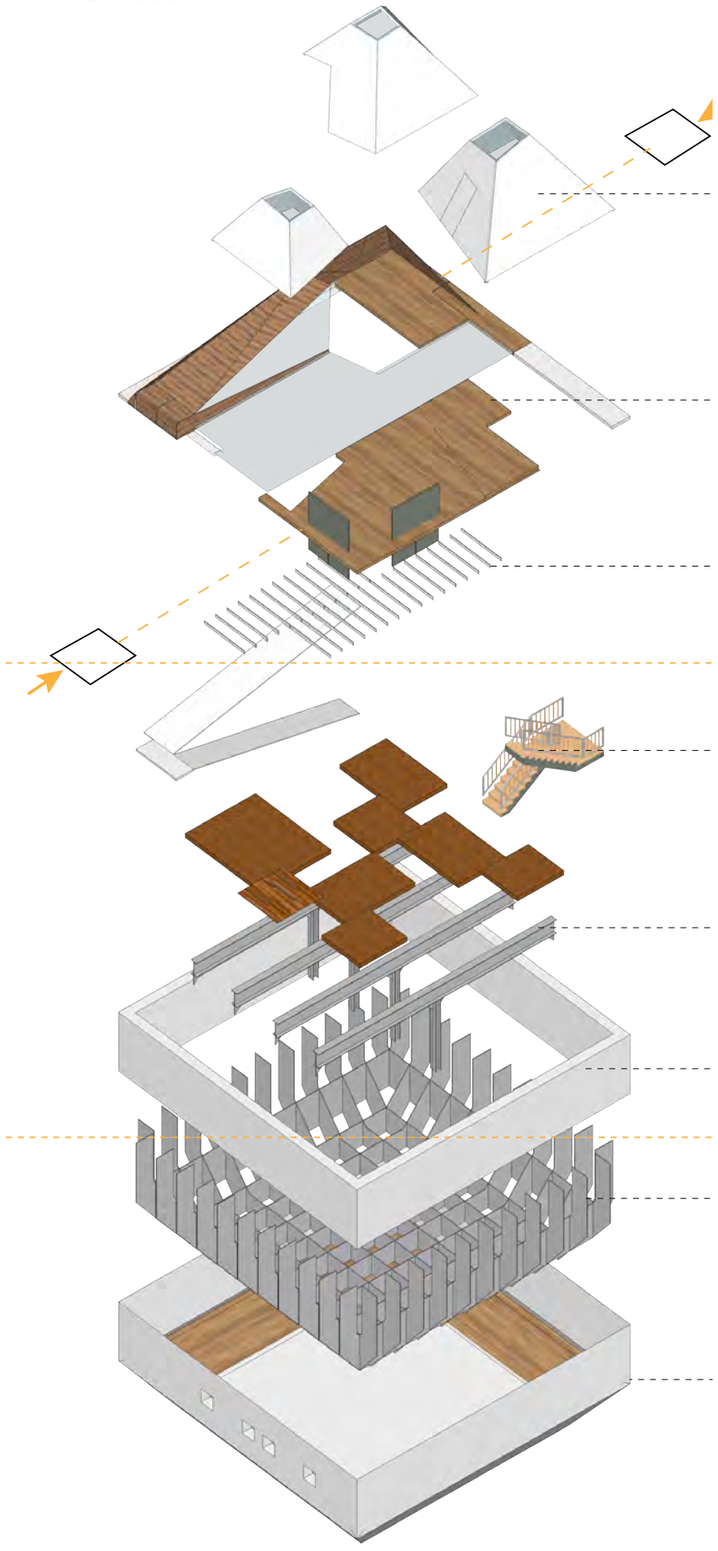
SUBSTRUCTURE & SPACE

Between the main beams, the substructure which enhance the stability of beams are also crucial. The building exposes those structures and make them part of space, put them in the crucial position meanwhile using them as furniture and small rooms to interact, so the special quality of space is shown.

BALLAST SYSTEM

Empty space between the outside shell and one inside shell allow water to come in when necessary. So the building could adjust its height of deck and depth in the water to be flexible towards different situation along the river in certain level and also the water level change caused by flooding.

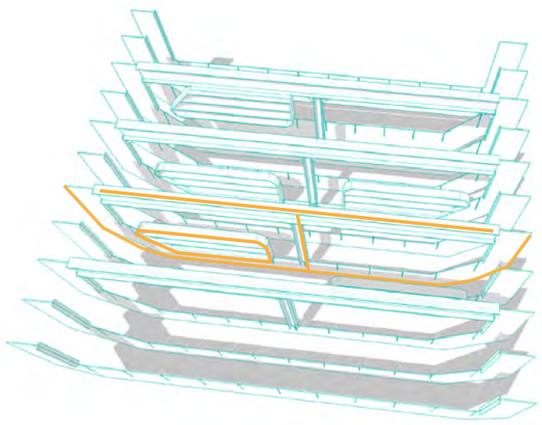
Main elements



The structure order is very clear from bottom to top. The main function and weight is below water to benefit the stability. Compared to normal buildings, the main surface to open the window and get the day illumination is on horizontal level-the roof part of the traditional building. On the vertical surfaces-the “walls” of the building, auxiliary windows could be open above the water level.

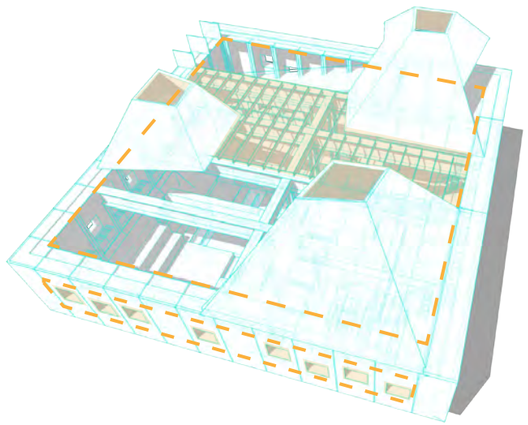
The furniture and function organization is combined with the structure and sub-structure of the building. The high-density frames on the walls and floors could serve as bookshelves, containers, and chairs. The special structure also create special industry atmosphere of space, give people interesting experience in the under water space.

Unique qualities of space



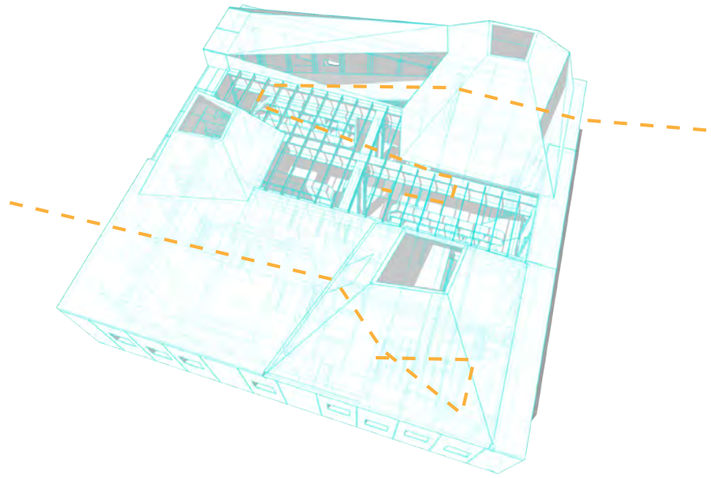
Bookshelf as part of structure

When the structure could also perfectly serve for the function use, the strength of combination of beauty and function is very infectious.



Surface to open windows

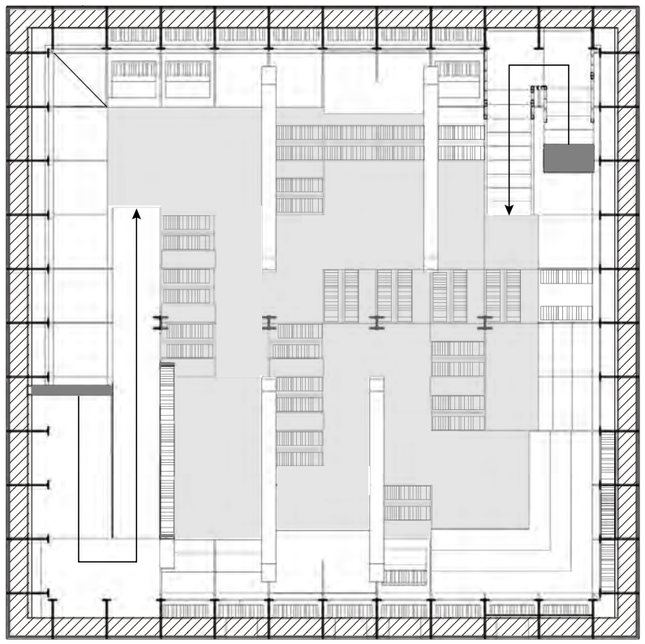
Compared to normal buildings, the main surface to open the window and get the day illumination is on horizontal level-the roof part of the traditional building.



Flow of People

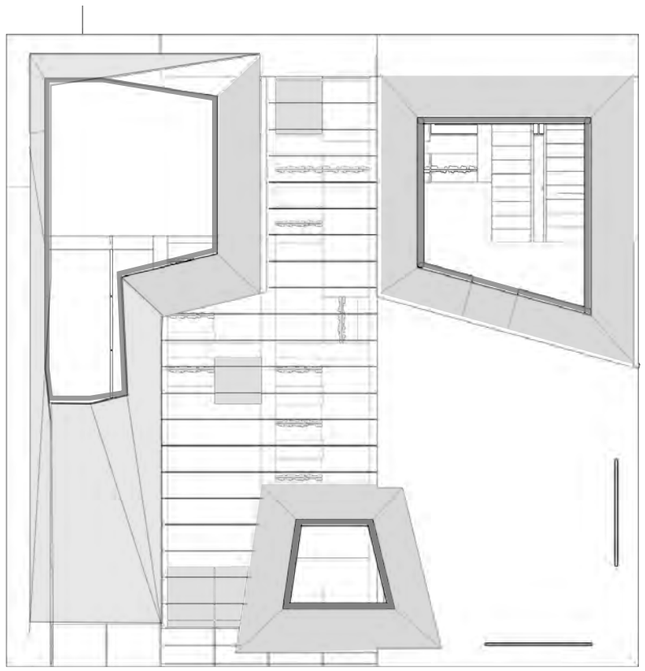
The entrance of the building is on the deck level. Coming into the main part of the library is the progress of going from the above water to the space below the water level. The opening of the surfaces creates integrated space of two levels. The deck with the opening view let people to enjoy the sunshine in good weather on the floating structure in the water.

Plans



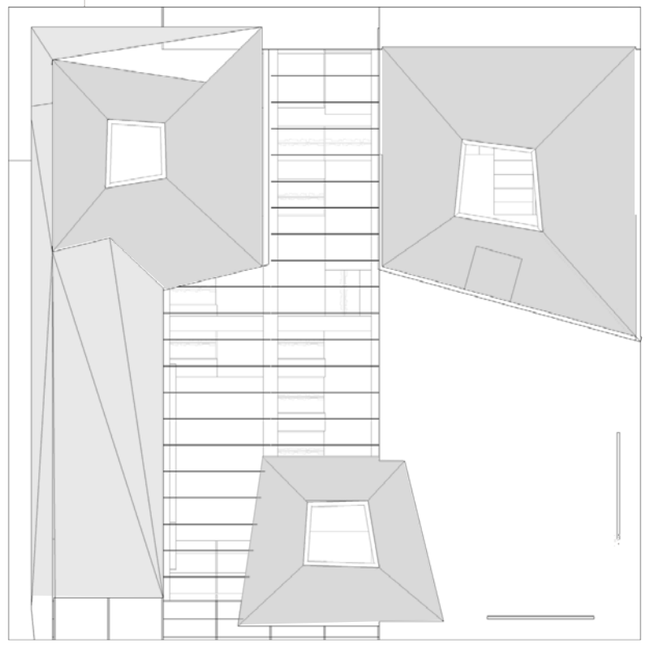
Bottom Floor

The space serves for bookshelves is 3-dimentional. Sitting on the floor or in the holes along the walls and enjoying the sunshine coming from the deck gives very casual atmosphere. Everything is like from one entirety, and everything talks to the others. This is a ship building space designed for the library.



Deck Floor

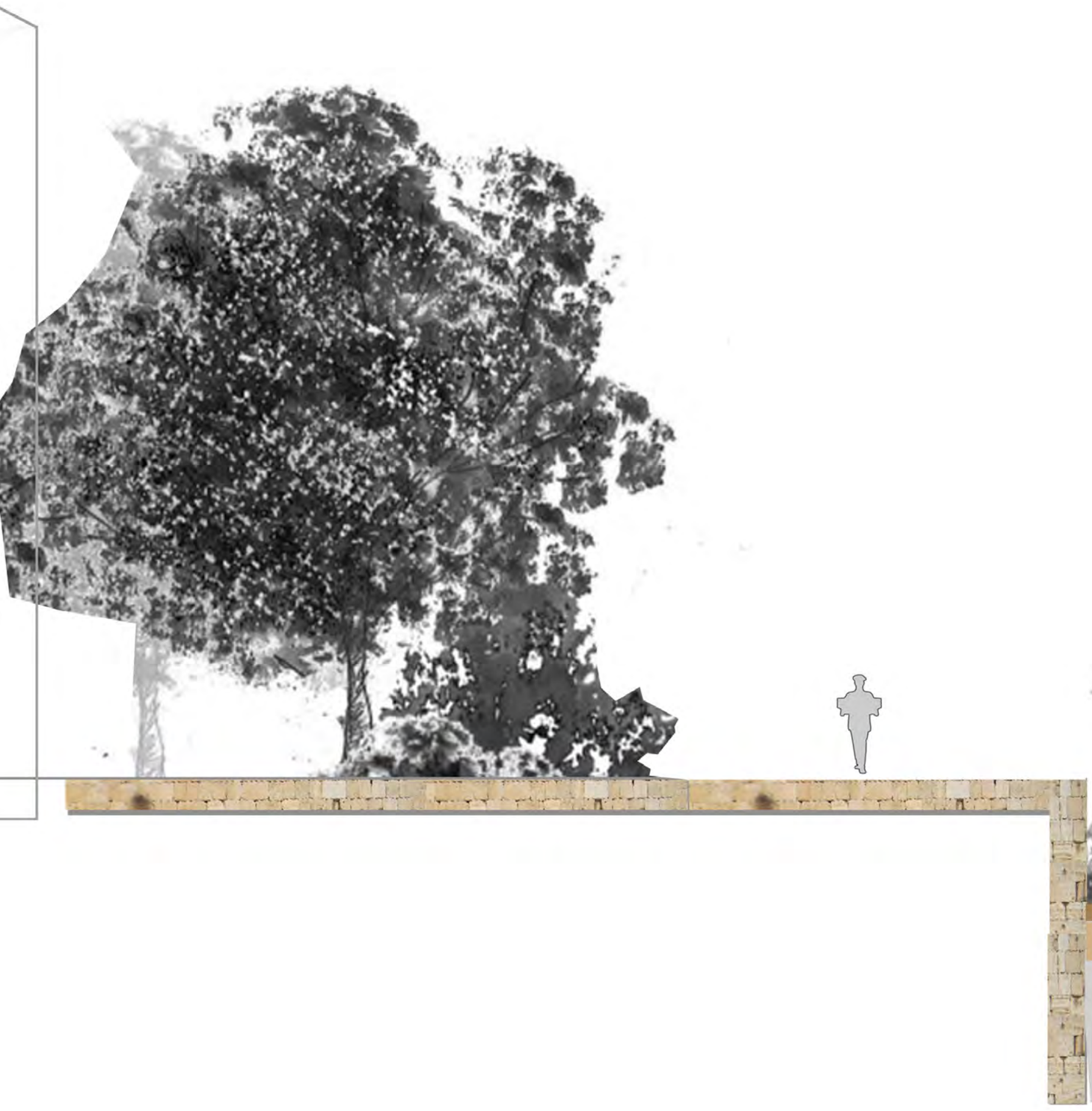
The deck level includes platform to walk and sit, and people could also watch the space in the bottom and in surroundings.

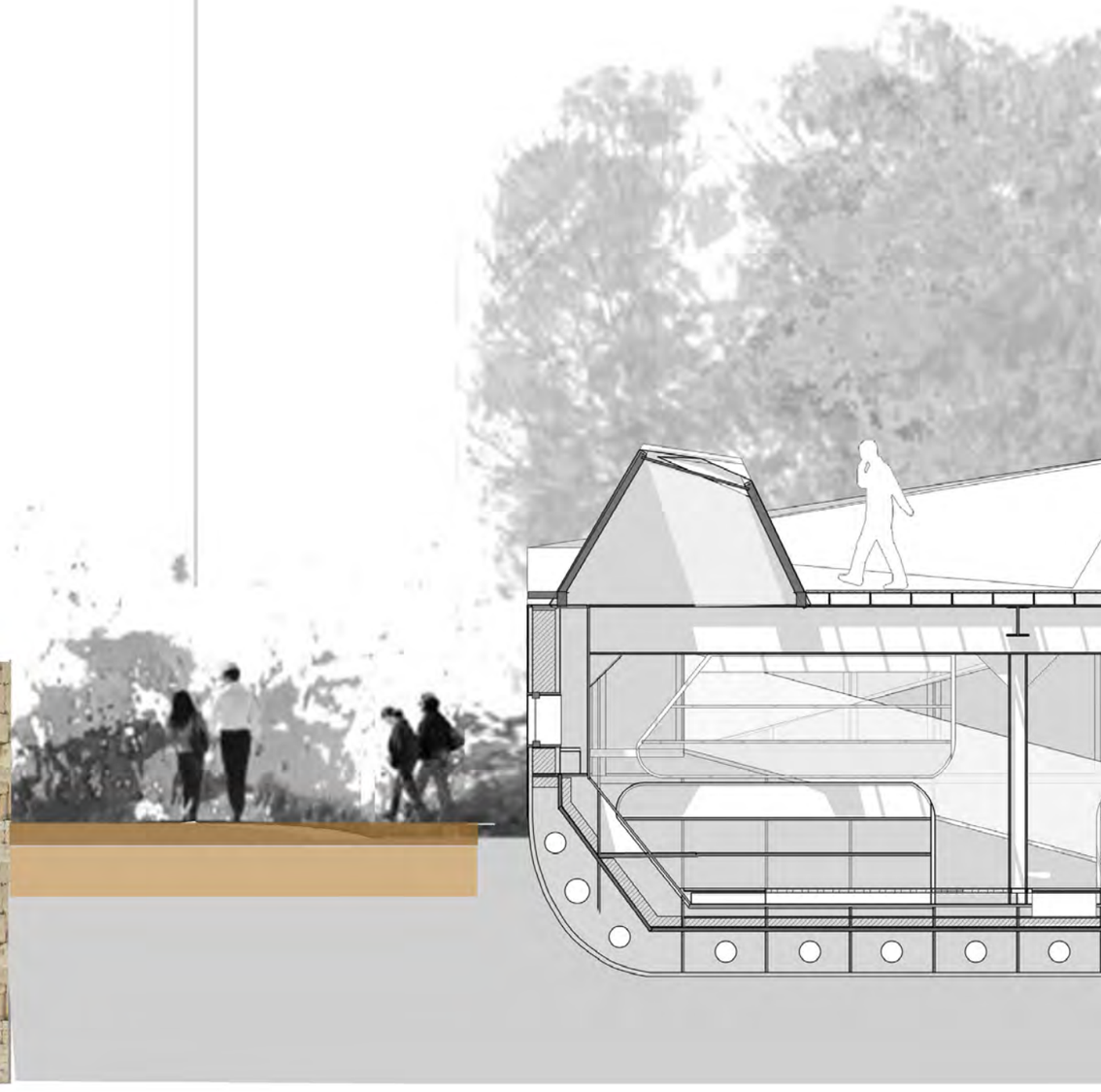


Roof Floor

The rising-up structures enable people to climb up simulate the space for sailors on the mast.

Section





[x L]

There are three parts of elements in scale XL: the fixed expansion deck, the ship building group, the flexible small functions as in scale M.

The new decks work as receiver of the ship buildings, it creates the basic infrastructure for ship buildings to park and for people to get on board.

The ship building group take advantage of the flexibility and mobility enabled by water, brings dynamic relationship with original industry riverbank area. The mobility of this part is lower than scale M, but still the monthly change of the location of one ship building group is expected.

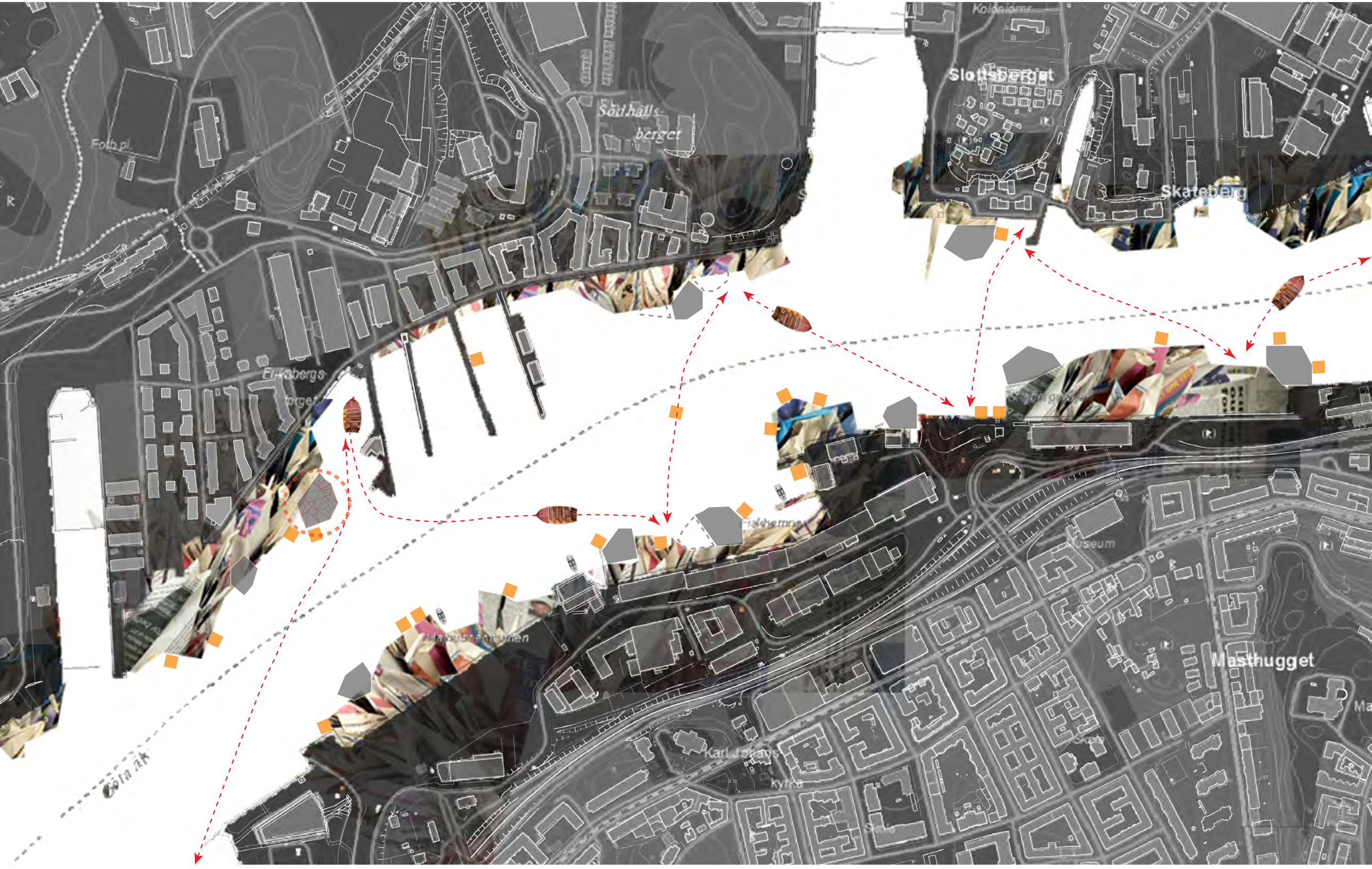
Scale M could still exist in this area as an additional part of the ship building group. The possibility of attaching it to the scale XL is considered in the beginning of the design. Then the variety of mobility is realized in Scale XL to accomplish more complicated combination and fulfill more kinds of needs in reality.

The plan

At stage of strategy 1, the potential position of the ship building group is decided based on the existing city network of road and programs.

Then the expansion of decking area is developed according to the local needs. The deck is combine both with simple deck and the floatable structures. The ship buildings come and go, form the changable and diverse space along those areas.

At stage of strategy 2 and 3, the shore line area is busier. The demand of more space let more ship building groups to be developed. Some of them become stable in one location, others keep traveling between the two sides of the river. In the extreme situation, the continue of the ship building group and the new decks form a land.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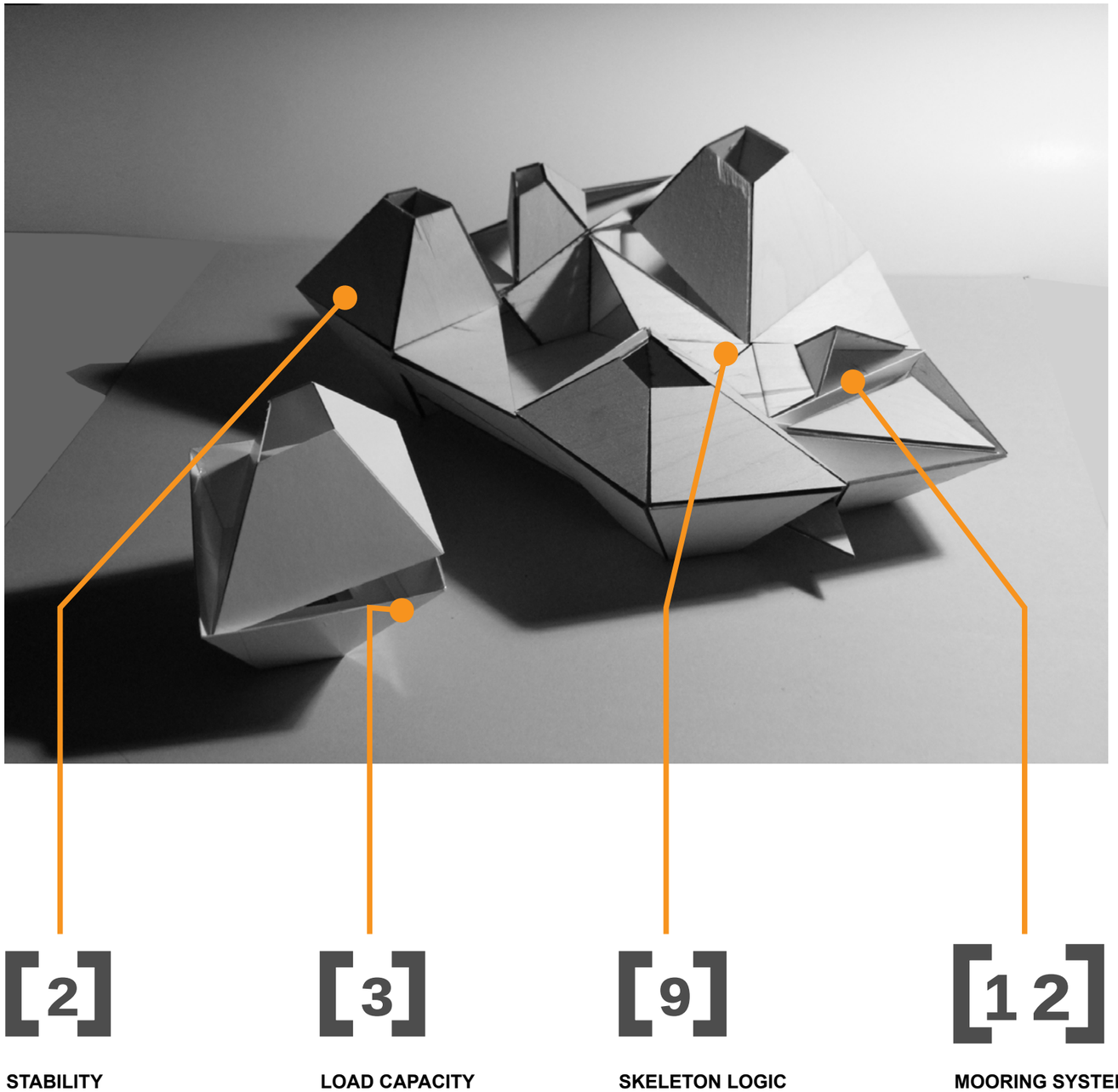
Skateberg
Masthugget
Foth pl.
Erikbergs
Karl Johans
Kyrka
Göta älv

Technique references



[2]

STABILITY

[3]

LOAD CAPACITY

[9]

SKELETON LOGIC

[12]

MOORING SYSTEM

STABILITY

Considering both the stability and the flexibility of module, the logic of catamaran is chosen and adapted in the project. Individual floating structures are hold together with connection structures. Every element does not need to be stable floating, by connecting at least 3 of them, they become very stable together.

LOAD CAPACITY

Deeper bottom under water make more space and lower moving speed. And according to the need it is suitable for this project.

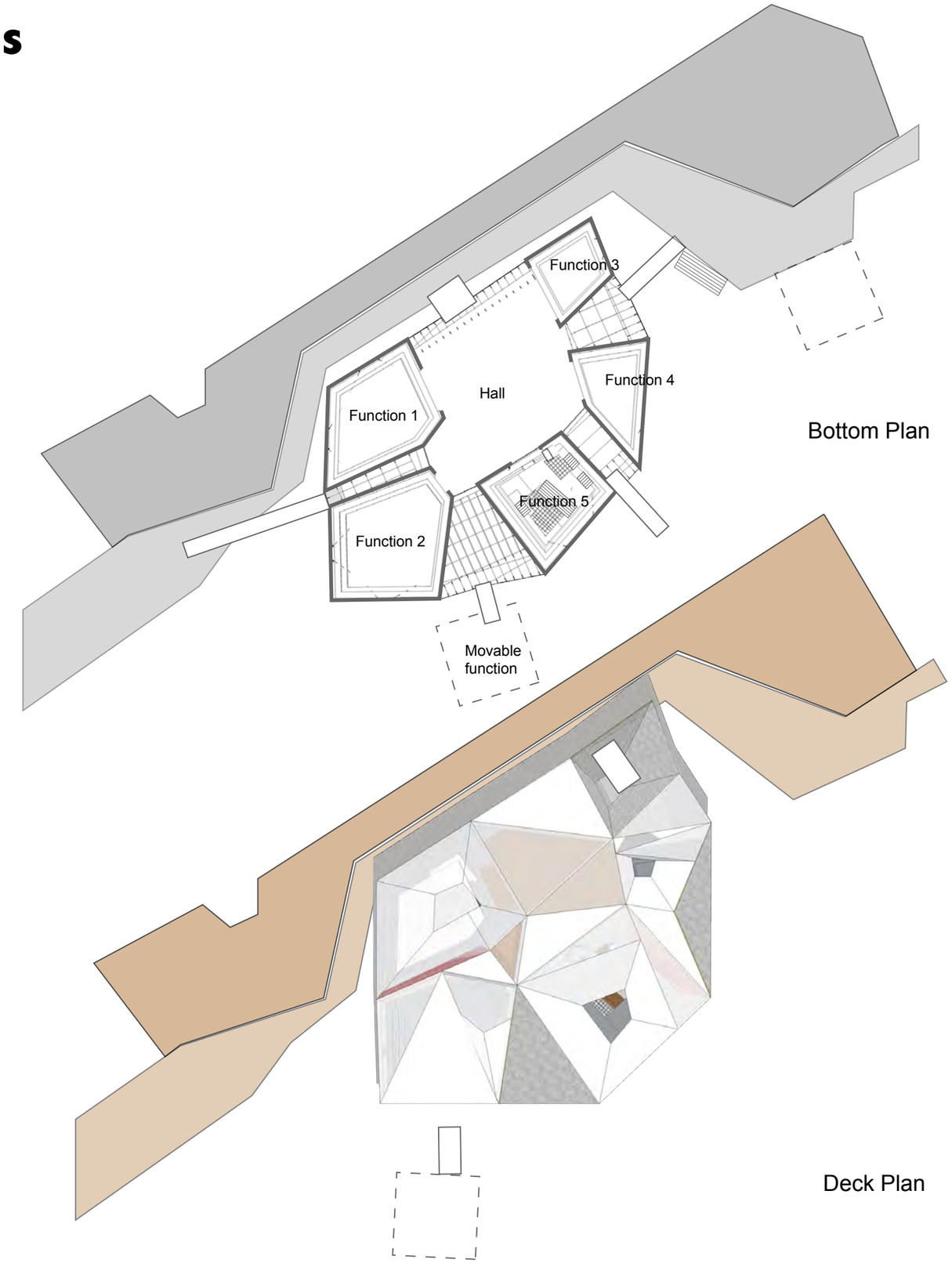
SKELETON LOGIC

The force analyze of ship enable not just the arrangement of beams not just along vertical section but also horizontal section. The horizontal beams (also with catamaran logic) could free the shape of the bottom into the dis-symmetry shape, and form the dynamic landscape above and inside.

MOORING SYSTEM

Adapt the principles of mooring system of two whips or ship and land could bring more possibility of combining elements.

Plans

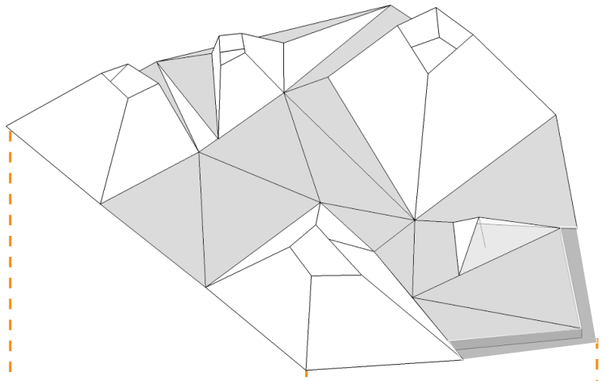


Bottom Plan

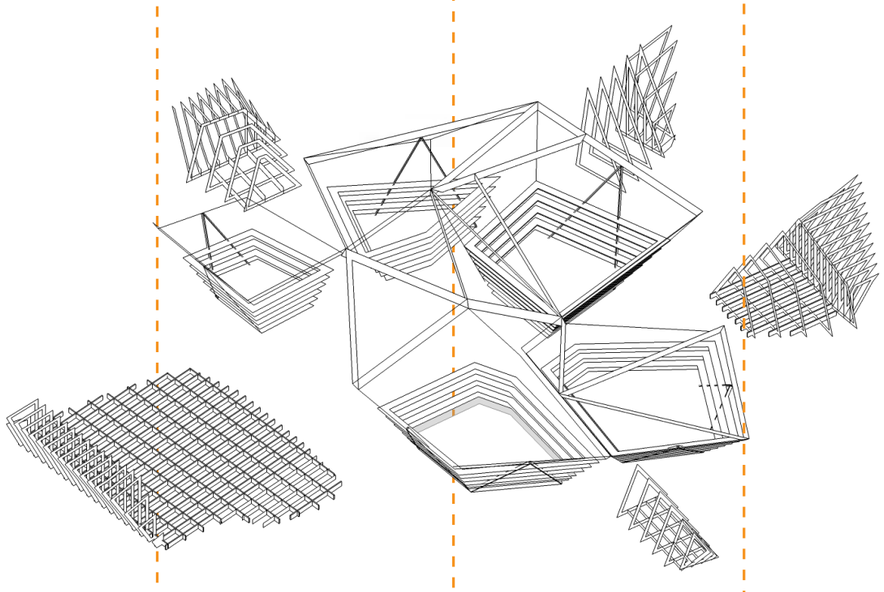
Most people may enter the buildings on the bottom level. there are panels connecting the land with the ship building, and the ropes to fix it tightly to the land. There is a main hall in the middle of the functions, and the gaps between the function bodies become naturally passageways and the secondary halls to the attached movable functions.

Deck Plan

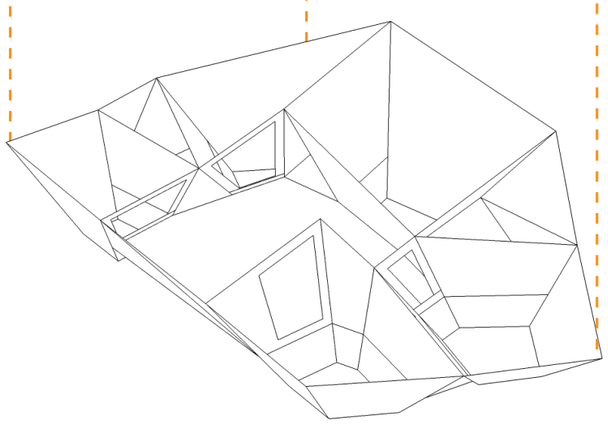
The deck plan create interesting landscape for the public. On this level, people could go down under the water or climbing up on the "hills", or sitting at some place to enjoy the river and the sun. Also greenery and sun panels could be arranged on the surfaces The materials above each function below could be very dependent on the needs and do not need to be the same with the functions nearby.



Upper lighter Structure

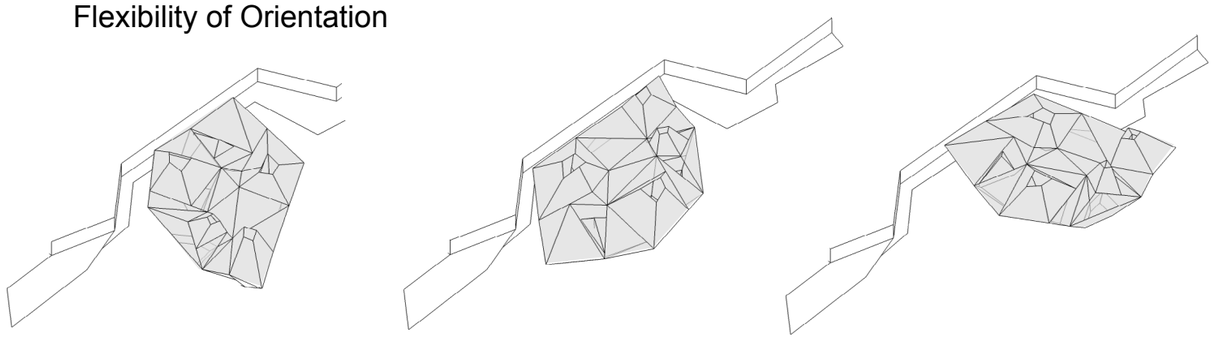


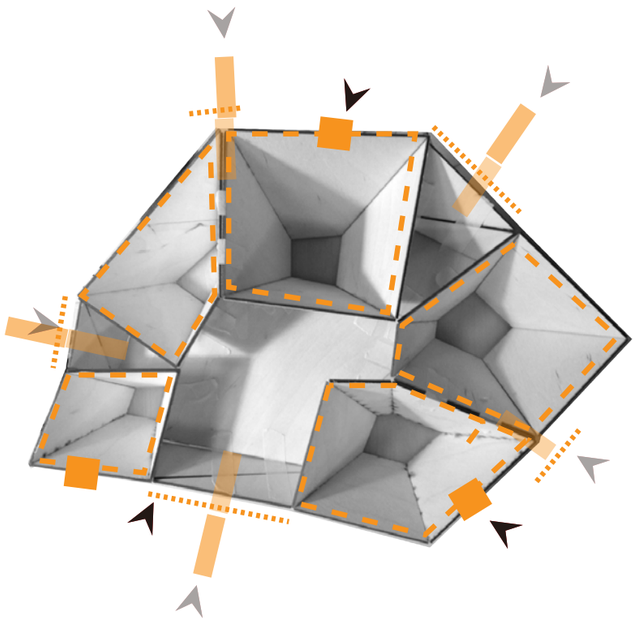
Beams of Bottom and Connection



Bottom Shell

Flexibility of Orientation





Possible Entrance

Entrance on deck level

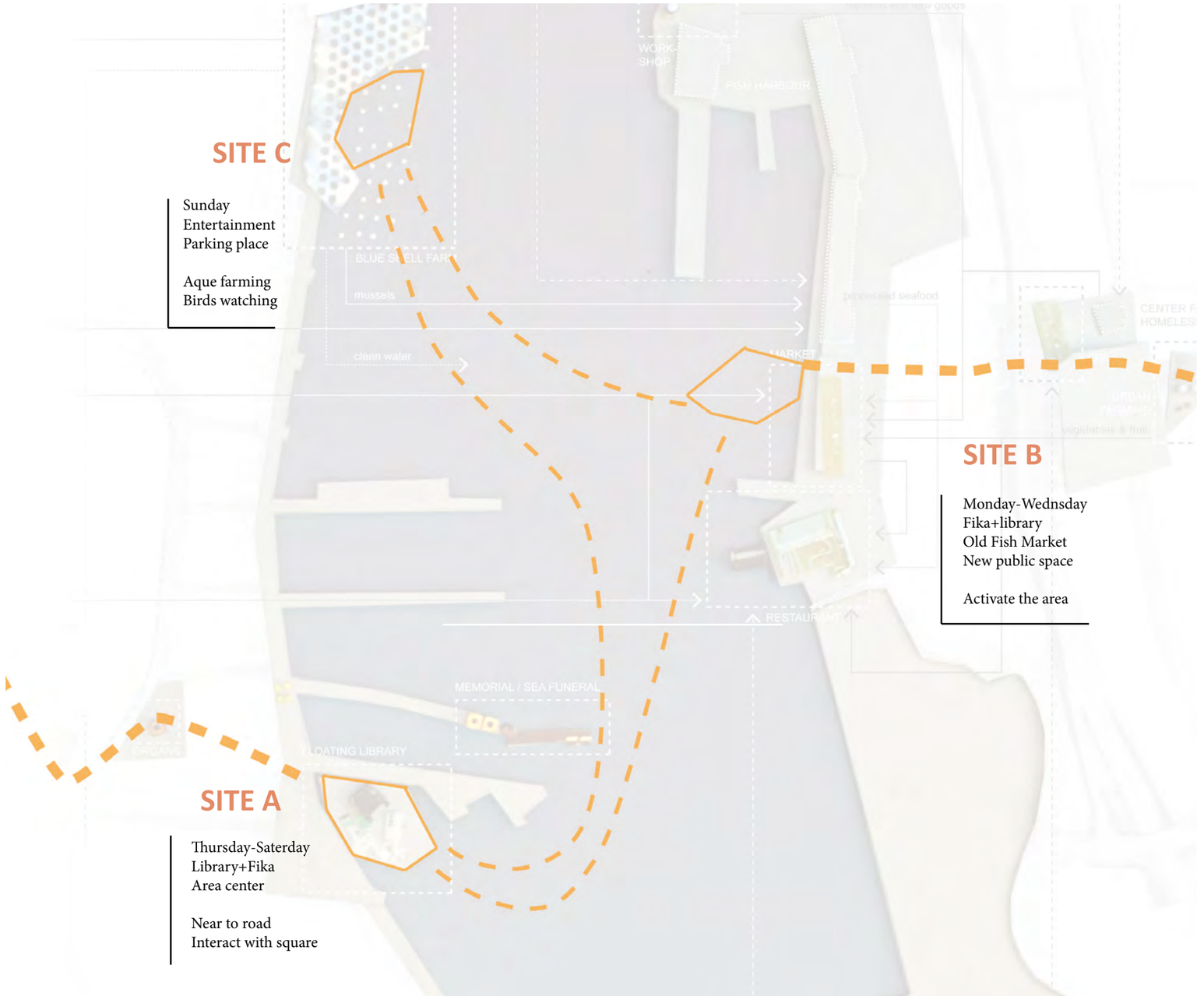
Entrance on bottom level

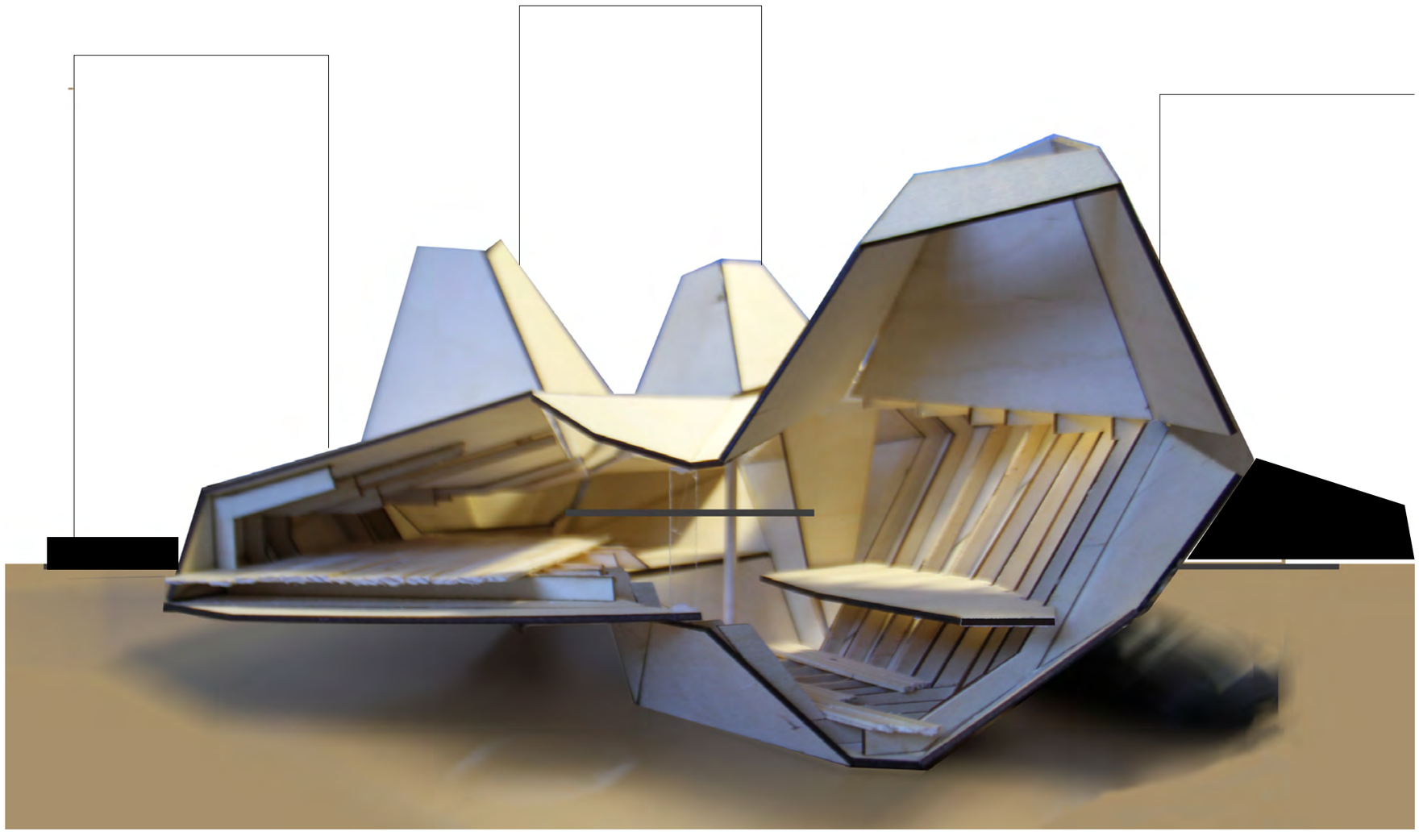
Mobility of the ship building group

People on north and south side of the river could share the popular ship building group by schedule.

The mobility of it could be weekly, monthly or seasonly. People who want to go there could check the information ont he website.

The mobility of the ship building group could enhance the connection of two sides of the river both mentally and physically. And it also enable one ship building group to give people diverse experience with the space and water.





CONCLUSION

The new ship building system organizes the new network of the shoreline area in the center of Gothenburg recurring the old glory and identity of the city in the long history. The traditional technology together with the contemporary techniques and concept find its way to combine and create new interesting space. The value of the industry heritage is not just about facilities and buildings, it is also about intangible values as culture, people, lifestyle, experience and identity.

The new ship building system keeps more parts of these values facing the contemporary challenges and walk into the future.

Water brings a lot of possibility into the traditional buildings, learning from the ships enable us to create a totally new way to use the buildings. This thesis gives its answer of this topic.

It is a brave suggestion based on research and study. With the development of the technology of gaining electricity from the sea by ships, now it is only 1/3 of the price of sun panels. The ship building system has a bright future.

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