HEXON PUERTO

International project
VIDA MODULAR EN EL AGUA

Group 8

INTRODUCTION

For this international project, we are designing a new urban prototype for a floating community in Rotterdam's M4H zone. The design is inspired by the award-winning No Footprint House in Costa Rica, developed by A-01 (with Oliver Schütte as lead architect), as well as the recently published catalog for Nature-Based Solutions (NBS).

Whereas the original No Footprint House is based on a tropical climate and an individual housing design, we are focusing on a larger-scale collective housing concept tailored to the physical, ecological, social, and economic conditions of the city of Rotterdam. The community will be built on the water and will consist of modular, circular, and CO_2-negative housing modules, integrated into a flexible and expandable net-work of floating platforms.

Within an interdisciplinary team (Design – Engineer – Build), we are working together on a concrete and feasible design concept that not only functions on a building scale but also gives a sustainable and social boost to neighborhood development within M4H.

MAIN QUESTION:

How can we design, build, and realize a local urban prototype of a floating community in Rotterdam's M4H zone, inspired by the design philosophy of A-01 (including the No Footprint House and Nature-Based Solutions), in a way that is ecologically, technically, and socially future-proof?

OBJECTIVE QUESTION:

What are the structural and design principles underlying the No Footprint House, and how can these be further developed and applied in the design of an urban, floating prototype in Rotterdam's M4H zone?

DESIGN

Main research question:
What is the optimal program and design for a local urban prototype of a floating community in M4H, inspired by the design philosophy of A-01?

Applied approach and rationale:
We translated the modular 3x3-meter structure of the No Footprint House into a scalable residential structure on water.

Instead of a single residential house, we designed a flexible neighborhood structure with communal spaces, squares, and walking routes.

By applying Nature-Based Solutions – such as green roofs, water purification, and biodiversity zones – we promote climate adaptation.

The design focuses on social interaction through shared facilities, paths, and places to stay.

We combined functionality, community, and ecology into a single circular, floating residential concept that fits into the Rotterdam context.

TECHNOLOGY

Main research question:
Which technical measures are most suitable for a floating urban prototype, within the vision of A-01?

Applied approach and rationale:
Instead of a steel frame (as with NFH), we opted for CLT (wood construction) to reduce weight and maximize CO_2 storage.

The supporting structure rests on prefab concrete pontoons, suitable for tides and loads.

Insulated facades, triple glazing, and sliding panels replace the open slats of the NFH and make it suitable for the Dutch climate.

The energy system consists of solar panels, a wind turbine, and rainwater collection, combined with passive ventilation.

The technical choices are tailored to comfort, sustainability, and adaptability, both at the residential and neighborhood levels.

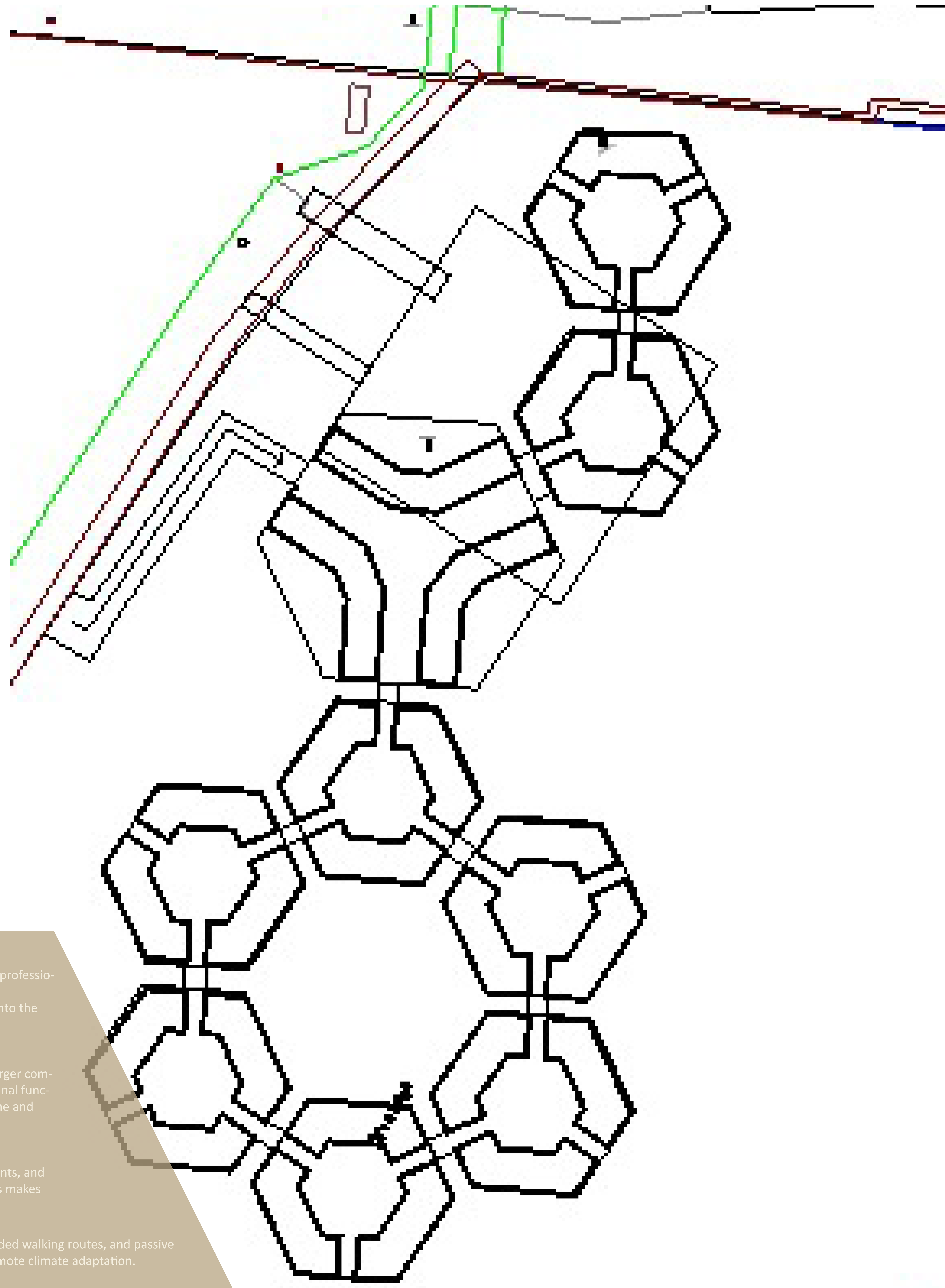
EXECUTION

Main research question:
Which construction methods and logistical solutions are most suitable for the realization of this floating prototype in Rotterdam?

Approach and rationale:
We opted for prefabrication of modules on shore to guarantee quality and speed. Construction will take place through phased assembly on the water, allowing the project to grow in line with demand. After the foundation phase, the next phases are planned to be executed partly simultaneously.

The logistics are methodically integrated into the process using SBL, as described in the last poster—a sustainable approach to managing logistics in alignment with planning.

We strive for local cooperation with partners and suppliers to embed the implementation in a circular, sustainable, and socially responsible manner.



DESIGN PRINCILES

The target audience for this concept is students and young professionals.
Our reinterpretation of the No Footprint House translates into the following design principles:

Modular and scalable:
Based on the NFH's 3x3-meter grid, but now applied to a larger composition of floating platforms with residential units, communal functions, and public space. The composition is adaptable in time and space.

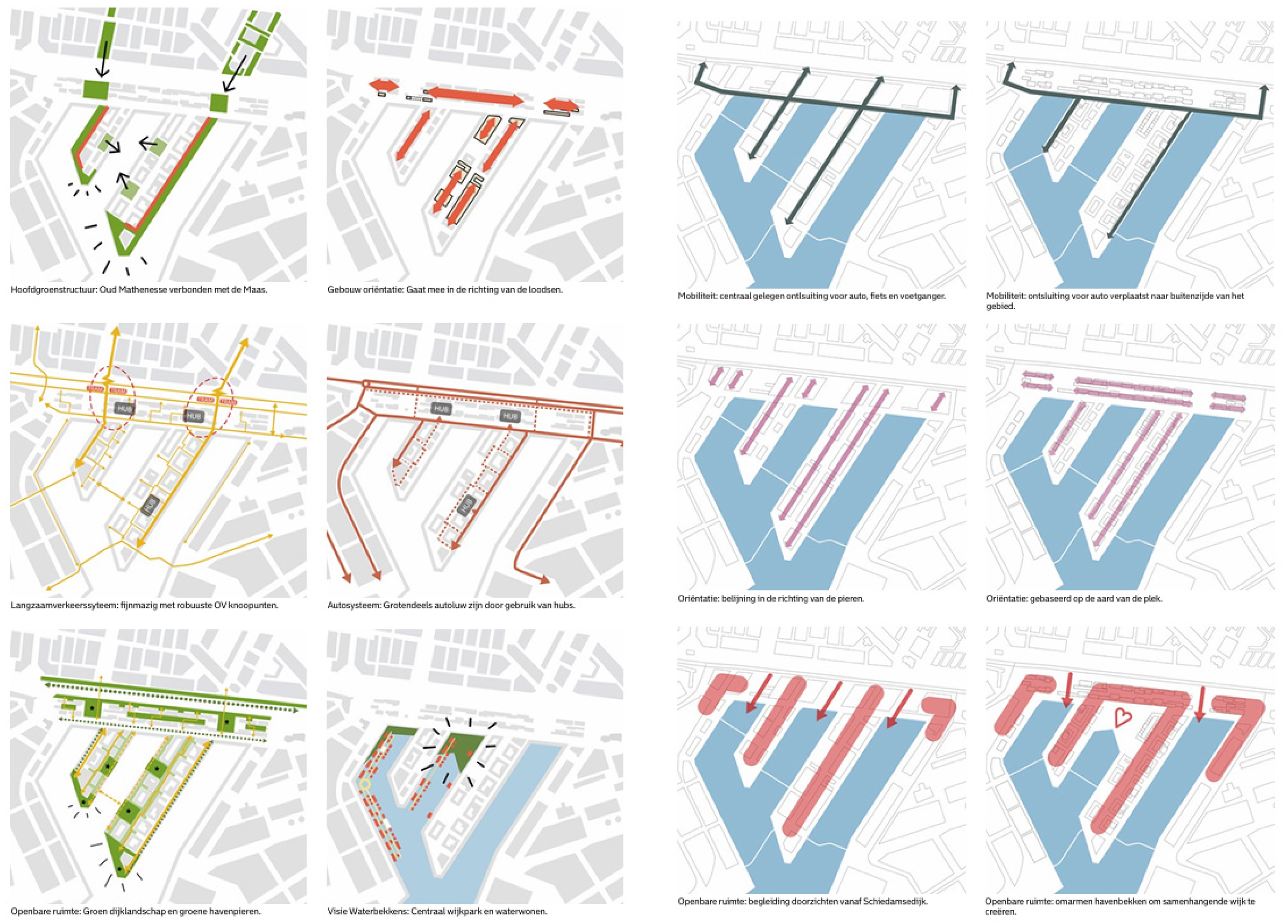
CO_2-negative and biobased:
Maximum use of timber construction (CLT), reusable elements, and local biobased materials. Energy generation via solar panels makes the system energy-positive in the long term.

Nature-Based Solutions (NBS):
Green roofs, water-purifying plants, biodiversity zones, shaded walking routes, and passive ventilation are used to minimize ecological impact and promote climate adaptation.

Collective living structure:
The community revolves around shared functions: think of a floating marketplace, shared workspaces, a shared greenhouse, and places to stay in the green. The design encourages interaction, safety, and ownership.

Local and context-specific:
The design takes into account tidal effects, possible contamination of the subsoil, noise pollution from the port area, and existing restrictions from the M4H master plan (such as external safety zones).

- Location: Floating community in the M4H zone, Rotterdam
- Modular: Flexible and scalable grid system
- CO_2-negative: Biobased materials, renewable energy
- Floating design: Phased expansion on the water
- Neighborhood feel: Common areas and walking routes
- Wooden construction: CLT instead of steel
- Target group: Affordable starter homes for two people
- Single storey: Ground-level, accessible living units



LOCATION ANALYSIS

Gustoweg lies on the western edge of Rotterdam's M4H area, serving as a transition between port industry and emerging creative developments. The area hosts a mix of light industrial functions and creative makers. According to the city's masterplan, it will gradually shift into a live-work district, although amenities like shops and cafés are still scarce. These are expected to grow with further development.

The site is well connected via the A20 highway and public transport, with travel times under 20 minutes to Rotterdam or Schiedam. The location is accessible for construction logistics, but peak-hour traffic may cause occasional delays.

Soil conditions reflect the site's industrial history, with potential contamination and a base of clay and peat topped with sand. Water levels are influenced by tides from the North Sea. While the area currently lacks greenery, future plans prioritize biodiversity and climate adaptation through green roofs, shading, and water retention systems.

The environment remains industrial and underdeveloped, with some noise and emissions. Plot size depends on the removal of the Floating Farm. Nearby ship activity limits full development in the short term, as part of the plot is still in active port use.

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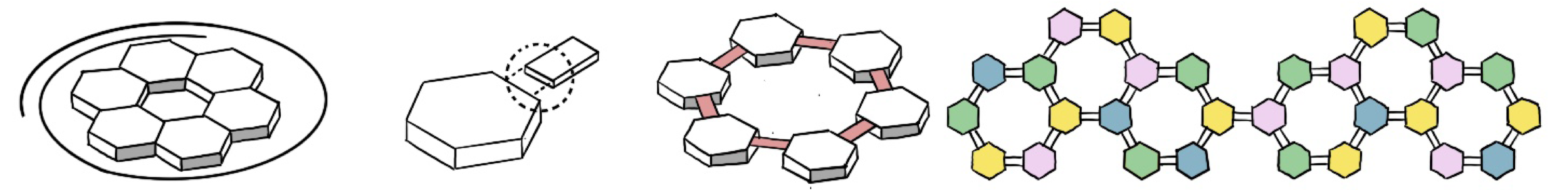
CONCEPT DESIGN



A. The independence of the hexagonal platform relative to the square platform, with the breakwater surrounding the unified platform

B. Hexagonal and square platforms that interlock for future expansion as a dynamic growth strategy

C. Six hexagonal models and five square models combined to create a neighborhood

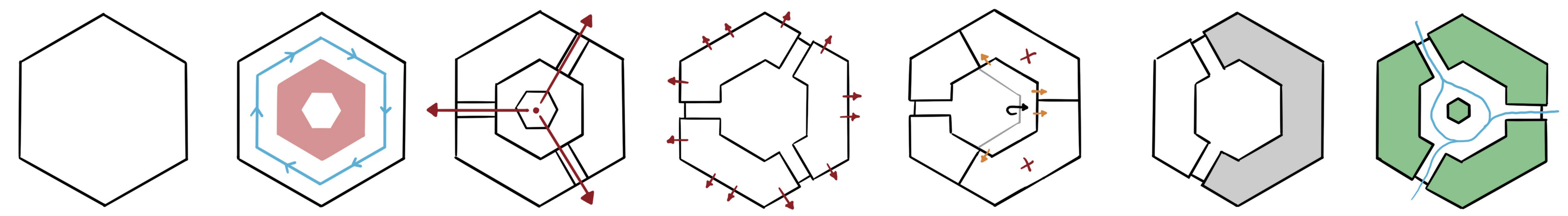
Green spaces between the blocks serve as communication areas

The blocks are connected to each other via these connections

D. Laying walking paths in all blocks alongside each other

Linear arrangement due to the flow of wind from the swa to the blocks and to reduce the moisture content

There are four different designs within the hexagon. Yellow has a full terrace, Yellow has part terrace and part green roof with solar panels. Blue has an extra floor with two units and Green has an extra floor with four units



A. Select hexagonal geometry

2. Determine the position of the units in the walls of the main geometry so that the central space is used for the courtyard and the entrance area

3. Place the units perpendicular to the hexagonal diameters

4. Remove the cover units to create a patio and a path for air conditioning

5. Add more floors to give a playful view of the sightlines

6. Certain units have a roof terrace that can be accessed via a staircase

7. Greenery is integrated by covering the roofs with greenery and the walls with green walls. In the middle, there will be a planter that centers the walking route

SWOT-ANALYSE

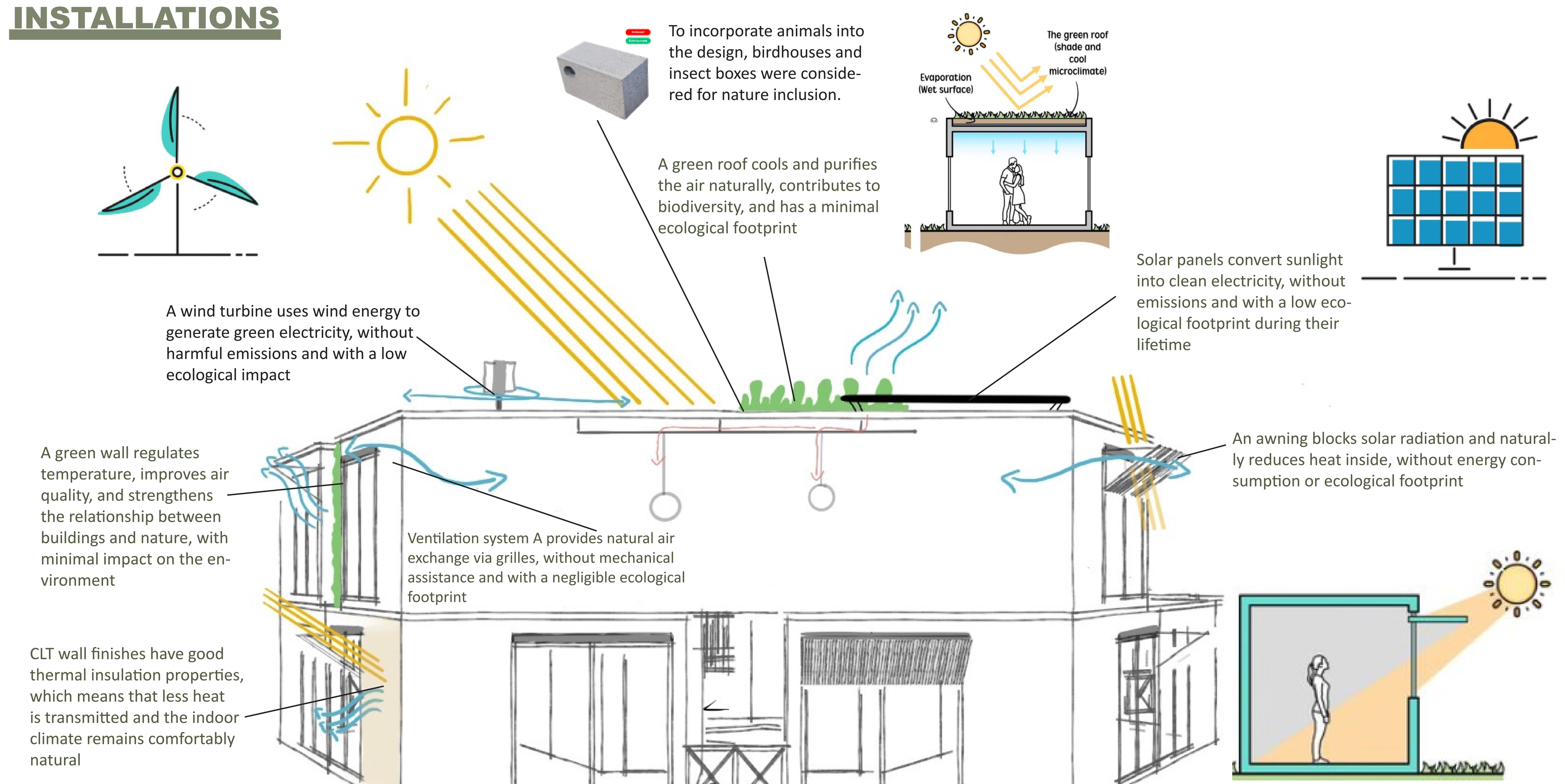
Strengths:
Creative hotspot centered around Club Gusto
Strategic location within the emerging M4H district
Space for light industry and experimental use

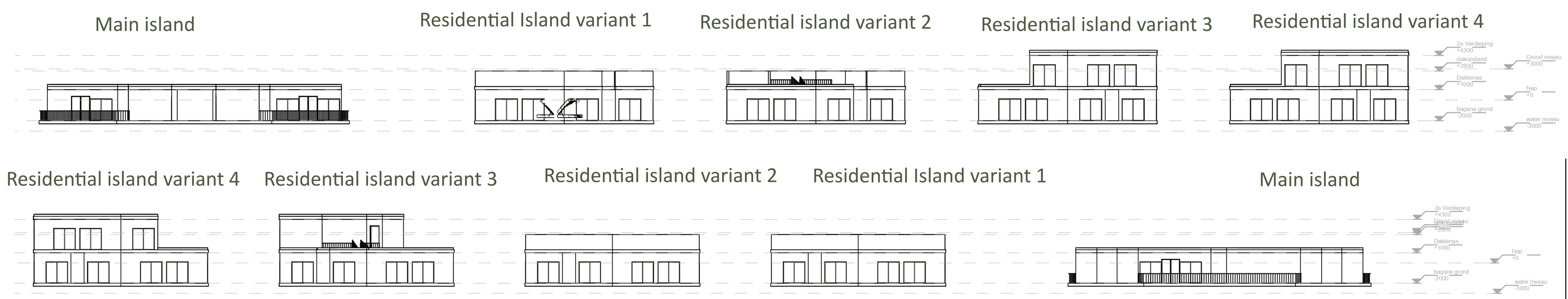
Weaknesses:
Outdated buildings with low energy efficiency
Limited pedestrian infrastructure and public transport access
External safety zones restrict development

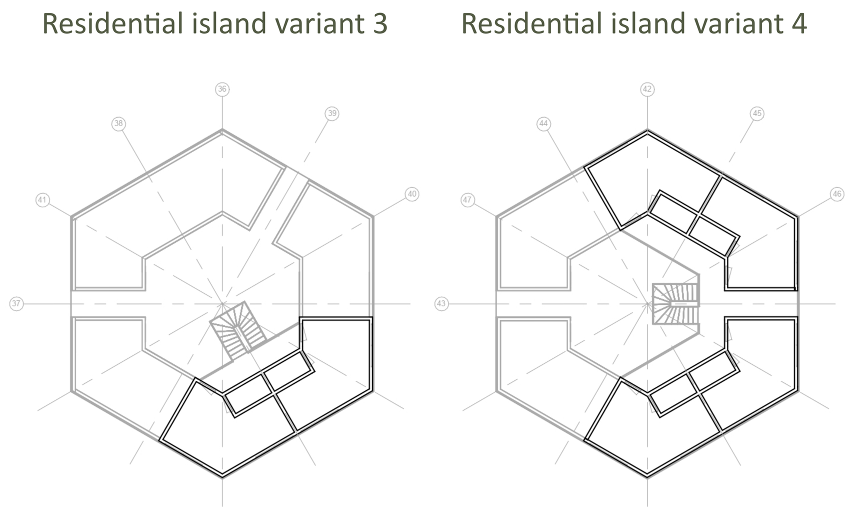
Opportunities:
Potential for live-work clusters
Small-scale cultural and artisanal hubs
Sustainable redevelopment with circular economy focus

Threats:
Nuisance from truck traffic and industrial activity
Restrictive zoning regulations
Competition from other M4H subareas

INSTALLATIONS





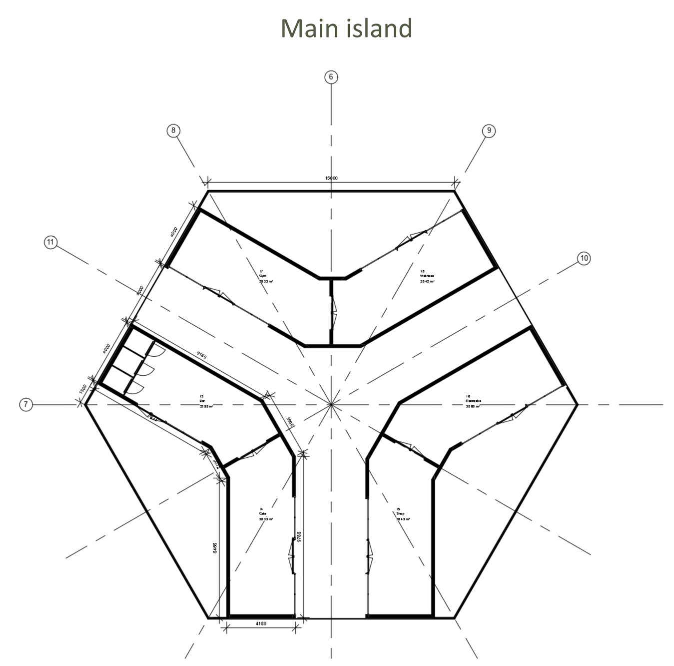


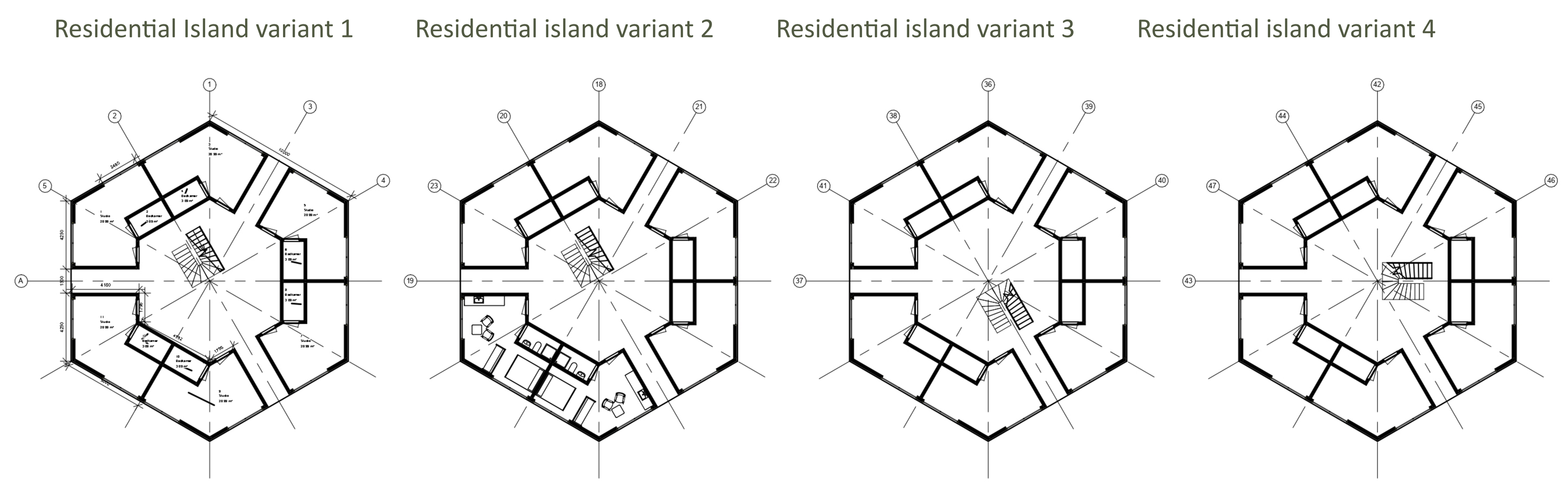
VIEWS AND FLOOR PLANS

Hexon Puerto was designed with the intention of making it easy to expand in the future by simply building an island and connecting it to the nearest island. This will create a city on water! Hexon Puerto has a hexagonal shape. This shape was deliberately chosen because it offers an excellent functional layout. Since these are floating homes, we first looked at the platform shape. This had a significant impact on how the homes would look.

Why this shape? Other shapes were too large, or impractical. By using a hexagonal platform, multiple islands can be easily connected to create a kind of beehive. In addition, because we used a hexagonal shape and placed the homes evenly around it, it also ensures balance on the water. The homes are studios for students. Each residential island has a diameter of 20m, while the main island, where all utilities are located, has a diameter of 30m. Each floor is 3m high on all islands. The main island contains a café, study workspaces, restaurant, and recreational activities.

The residential islands are 21 m² student studios and contain a living room/kitchen/bedroom with a bathroom. There are five variants of the islands: Main Island, Residential Island Variant 1 (ground floor student studios with a full roof terrace), Residential Island Variant 2 (ground floor student studios with a partial roof terrace). Residential island variant 3: student studios on the ground floor and 2 on the first floor without roof terraces; residential island variant 4: student studios on the ground floor and 4 on the first floor without roof terraces.





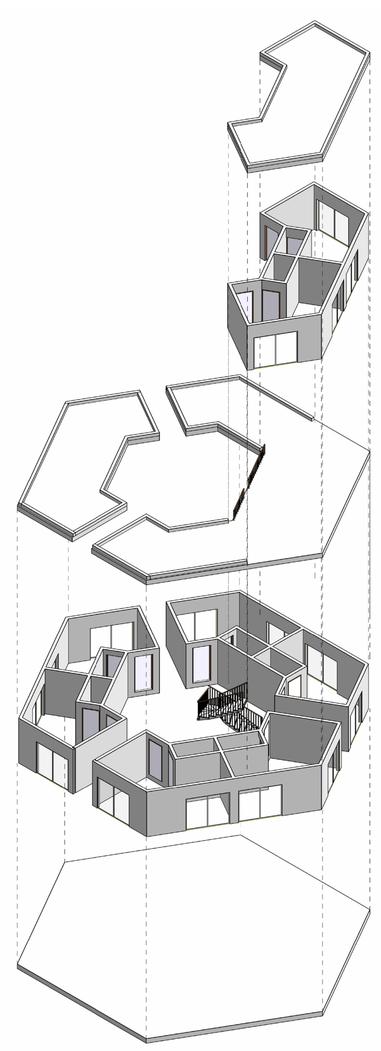
MATERIALIZATION

The islands float on a concrete container construction. The concrete floating containers of De Blauwe Wimpel are made using formwork in which steel reinforcement is installed, followed by the pouring of self-compacting concrete. After hardening, these containers form watertight, hollow structures with sufficient buoyancy to serve as foundations for floating buildings. The containers are delivered prefabricated.

The design features CLT load-bearing walls. Cross Laminated Timber (CLT) is a sustainable material because it stores CO_2 and is made from renewable raw materials. It also offers high strength and stability in multiple directions, making it suitable for load-bearing structures.

The insulation consists of flax wool. Flax wool is a sustainable insulation material because it is made from renewable flax fibers and is completely biobased. It also has good moisture-regulating and sound-insulating properties.

EXPLODED VIEW



VISUALIZATIONS

Residential Island variant 4

Residential island variant 3

Residential island variant 2

Residential Island variant 1

CONCLUSION

With this project, we are translating the essence of the No Footprint House into an innovative, circular, and climate-adaptive floating housing concept for Rotterdam. By combining the principles of modularity, demountability, natural systems, and social connectedness, we are creating a scalable future model for urban living on water, fitting within the transition of M4H to a sustainable and inclusive urban neighborhood.

ENGINEERING & CONSTRUCTION

FLOATING STRUCTURES

- Buoyancy is controlled by pontoons which are 1.76m deep. The submerged part of the pontoons is 1.42m deep (taking into account freeboard).
- Calculation is based on TU Delft guidelines and Archimedes' Law.
- The pipe coupling between the islands ensures that the pontoons do not float away. The connection to the quay is arranged by so-called hooks.

GUIDELINES

The guidelines that have been used are:

- Floor: 10 kN/m2 floor
- Façade: 1 kN/m2 façade
- Archimedes' law
- Gravitational force: 10 m/s2
- Larger island surface: 585m2
- Smaller island surface: 258m2

SAFETY MARGIN

- $1.35 * permanent\ load + 1.5 * 0{,}7 * imposed\ load$
- Permanent load: 90% Floor load
- Imposed load: 10 % Floor load + Façade load.

The calculation for both islands have the same set up. The following calculation is used for the load on the larger island.

- $1.35 * 5265 + 1.5 * 0{,}7 * 1056{,}2 = 8216{,}8\ kN$

BUILDING PHYSICS

- Insulation meets the minimum requirements of the Building Works Decree living environment. Therefore, the total RC-value is above the minimum.
- Ventilation through system A: natural supply and extraction.
- Solar shading prevents overheating.
- Heating through solar radiation on glass.
- Battery in technical room provides additional energy that can be used to heat the rooms if needed, this battery is powered by the solar panels and by the wind energy.

OUTCOME

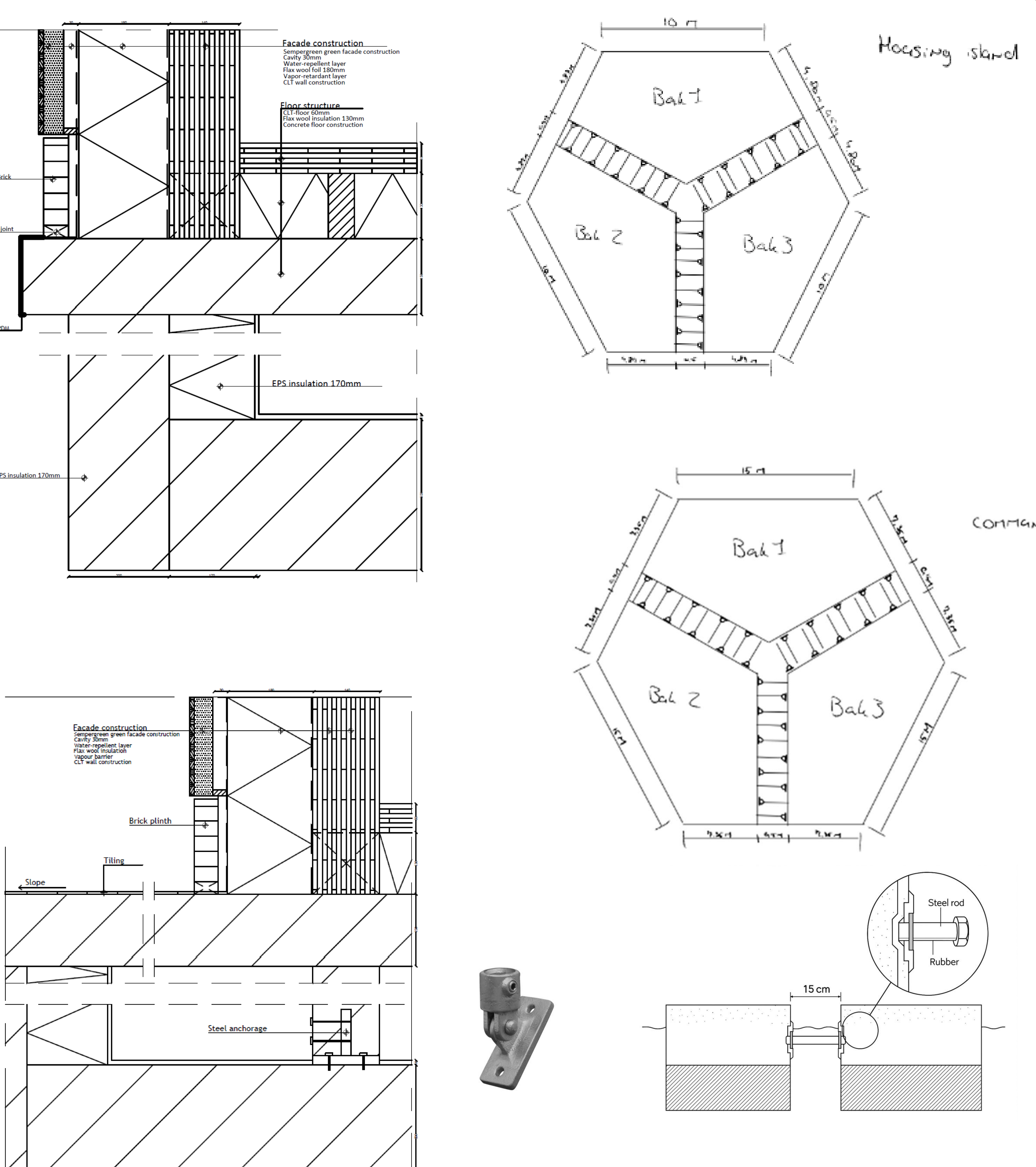
Depth of the pontoons have been calculated by Archimedes' Law. Due to the fact that the water is fresh and salty it has a density of 1012 kg/m3. The density of concrete is 2400 kg/m3. The total depth of the pontoons for the larger island is calculated by the following calculation:

$F = 1012 * 10 * (585 * height) = 5920{,}2 * h \rightarrow$

$Height = \frac{8216{,}8}{5920{,}2} = 1{,}416m \rightarrow 1{,}42m$. Taking the freeboard into the account will give a total height of 1,72m. Due to the standard depths of our provider we use a total depth of 1,76m.

The space between the trays is 15cm. This is filled by the pipe coupling. the diameter of the pins used is 50mm.

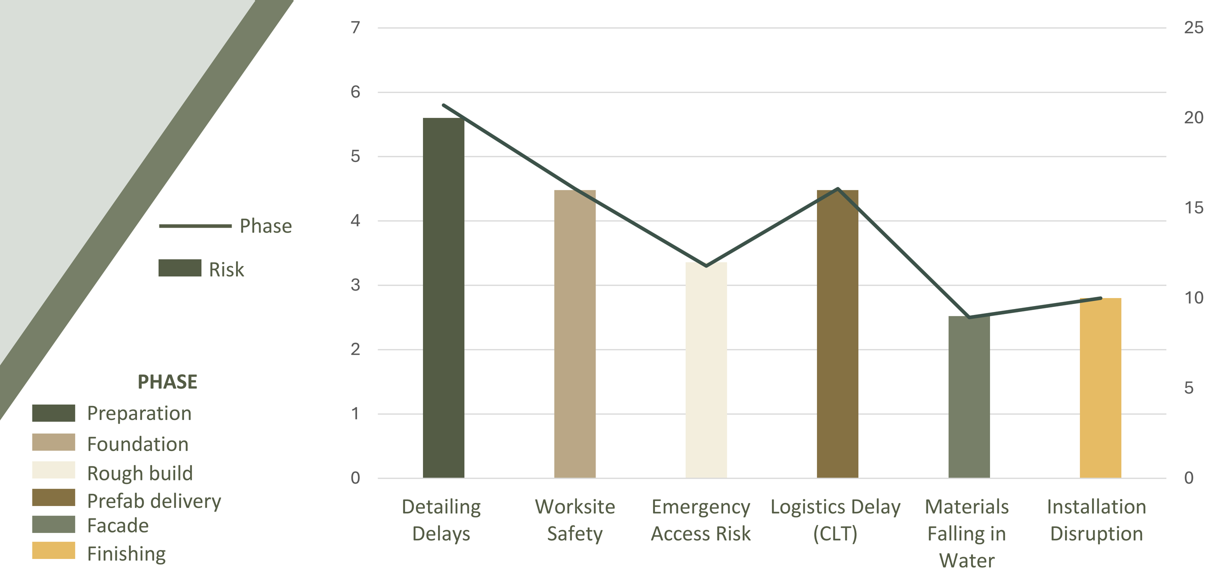
CONSTRUCTION DETAIL



BUILDING & EXECUTION

RISK'S EVALUATION

The biggest risk is detailing errors in CLT, causing delays due to fixed prefab elements. The riskiest phase is foundation work, with major safety risks and limited emergency access. A floating walkway must be included in the site layout to enable safe evacuation.



SUSTAINABLE LOGISTICS

For this project, the Smart Building Logistics (SBL) method is chosen..

What is Smart Building Logistics?

- SBL uses digital tools, data analysis, and smart planning to organize construction logistics more efficiently. It's ideal for space-limited, inner-city projects like this floating site, reducing errors, minimizing disruption, and improving sustainability.

- Aspects of Smart Building Logistics
  - Real-time tracking of transport via GPS
  - Planning software aligned with construction phases
  - 3D models and digital twins simulate storage and delivery routes
  - Sensors and scanners provide insight into material flows on site
  - Zero-Emission Transport

SAFTEY LAYOUT

To ensure safety during construction, various measures have been implemented. Due to the floating nature of the platforms, access is limited. In the event of an emergency during construction, it is essential that workers can evacuate quickly and safely. To facilitate this, floating walkways connected to the quay have been installed. These walkways are designated exclusively for personnel transport and serve as a secure evacuation route when needed.

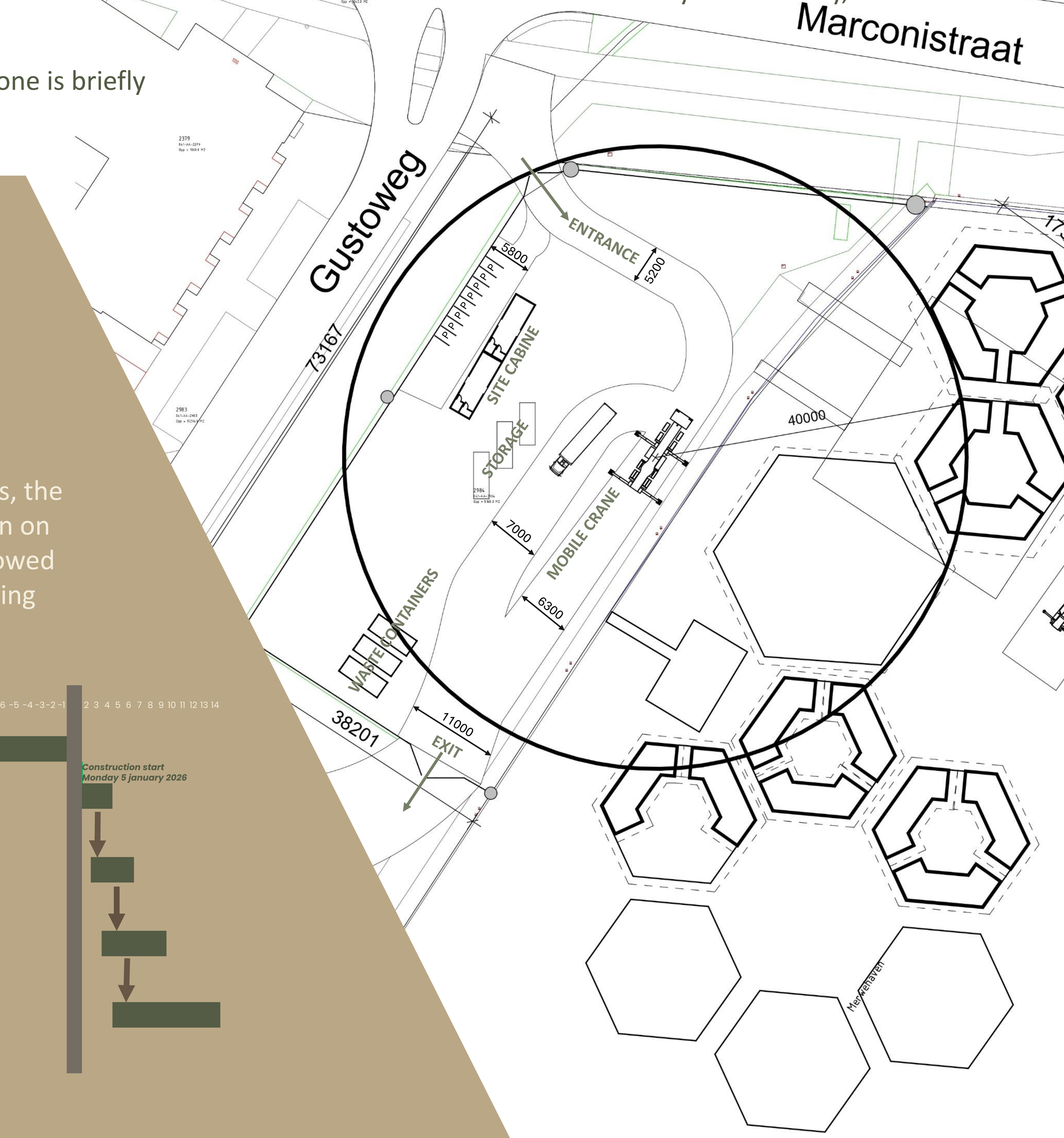
simultaneously, it's essential to protect finishing workers from heavy structural activities. Safety nets are installed around the platforms to reduce the risk of injury.

Moreover, when a new platform is being installed, the previous one is briefly cleared of personnel as an added safety measure.

SITE LAYOUT

The construction site is clearly organized, with the main entrance at the intersection of Gustoweg and Marconiweg. A parking area, site office, and toilets are located directly at the entrance, keeping visitors out of the active zone.

A mobile crane with a 40-meter reach is positioned next to the quay, with space for façade delivery trucks. Waste bins and storage containers for smaller materials are placed nearby. For the floating section, walkways are securely attached to the platforms to ensure safe access. In the final phase, a floating crane is used to lift heavier elements from the water. Construction lights and security cameras are installed at each corner to ensure safety and visibility, even outside working hours.



Crane information
Liebherr LTM 1055-3.3

- Max. lifting capacity: 55 tonnes
- Telescopic boom length: 40 m
- Max. hoist height (with jib): up to 56 m
- Max. radius: 46 m

Scaffolding
Floating;

- Basis Floating System
- Modular floating platform for working on water
- Load capacity: up to 642 kg/m²
- Ideal for construction, maintenance, and inspection tasks

On the plantons:
Layher Allround Scaffolding

- Type: Modular fixed scaffolding
- Connection system: Rosette no
- (8 connection points every 50 c
- Load classes: Up to Class 6 (600 kg/m²) depending on configuration
- Vertical spacing: Standard 2.0

PLANNING

Our building method is CLT, which requires extensive preparation.

Materials must be purchased, ordered in advance, and partially delivered. The construction process begins with placing three pontoons, which are then moved into the correct position. After this, the CLT construction is placed, and work can begin on finishing the façade and the roof. This is followed by finishing of the interior, making the building ready for use.

TIMELINE

1. PREPRATION

2. FOUNDATION
Installing the piles

3. CONSTRUCTION
Cross laminated timber

4. Façade & Roof
Works on the façade
Works on the roof

5. COMPLETION
Rough completion
Soft completion