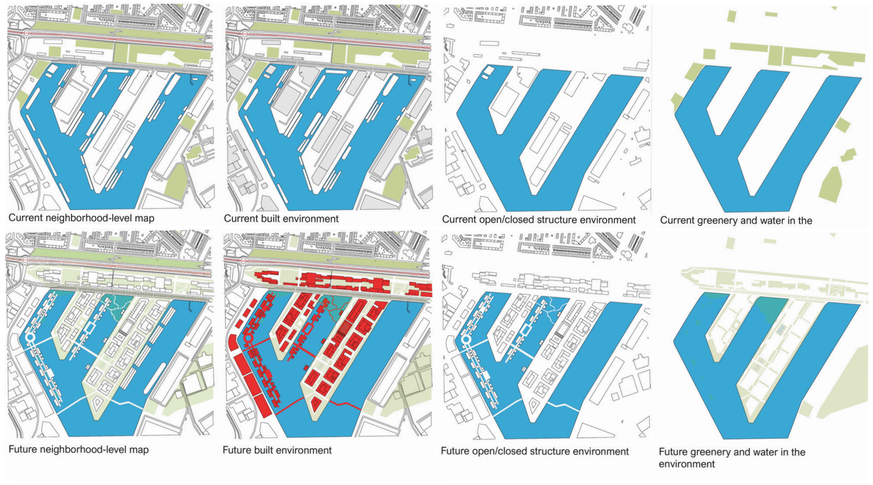
FLOATING COMMUNITY

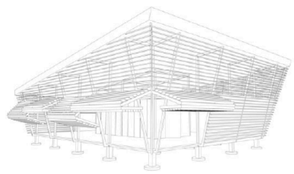
GROUP 11

Environmental analysis

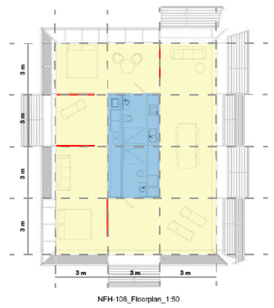


The floating community is being developed in the Merwehaven area of Rotterdam. Currently, this area is filled with old warehouses and port industries, many of which are used as offices or stand empty. Due to these vacant buildings and the industrial setting, it does not create a pleasant environment. The Municipality of Rotterdam has planned developments for this area aimed at significantly improving the living conditions. There will be extensive residential construction, and green spaces will be integrated into the surroundings. The maps above illustrate the difference between the current and future situations across various layers of the environment. In the future scenario, it is evident that more green spaces will be implemented along the harbor quays. With the construction of numerous residences, more people will also be actively engaged in the area. We are confident that implementing the floating community in the future scenario will positively contribute to the quality of life for the community, thereby promoting its development in the future.

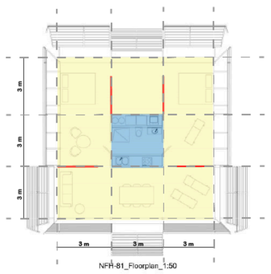
No Footprint House



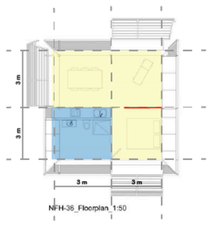
Perspective NFH-108
Family home: 108 m2
12x9



Perspective NFH-81
Mid-size: 81 m2
9x9



Perspective NFH-36
Tiny: 36 m2
6x6



The image next to this text shows how the floor plans are organized. A 3 by 3 grid system is used. With these main dimensions, three different types are developed, utilizing various configurations.

In the center of the floor plan, a core of wet areas such as the bathroom, toilets, and kitchen is implemented. These are grouped together to keep the installations short. Additionally, the core provides stability for the larger versions. In the smallest version, there is no core applied, but the same principle is used. The bathroom, toilet, and kitchen are placed in a grid block measuring 3 by 3 meters. This allows the same design principles to be applied across different scales.

Furthermore, an open floor plan layout is used, with many spaces directly connected to each other. Glass sliding doors can close off spaces as desired, allowing the areas to still be used separately. This maintains a transparent layout with the option to close off rooms.

.

No footprint house: www.designboom.com

Reference projects

https://www.dezeen.com/2022/10/14/land-on-water-floating-homes-mast/

Several trees have been planted on the small island, resulting in a lot of greenery. This creates a cozy atmosphere and helps to reduce CO2 emissions.

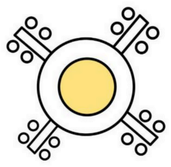
All the houses lead to the point in the middle. This creates a very cohesive feeling of all the houses together. It serves as a meeting place where people can come together and sit comfortably.

The architecture of the homes contributes to an atmosphere that is both inviting and warm, which is essential for creating a pleasant living environment. The use of wood as the primary building material not only enhances the aesthetic warmth, but also promotes a sense of coziness. The unique tent-like design of the houses adds a playful and informal character, giving the impression of a comfortable camping experience. These elements are crucial for the design of a new residential area, with the focus on promoting community spirit and the well-being of the residents.

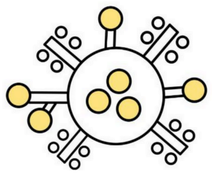
https://www.dezeen.com/2022/10/14/land-on-water-floating-homes-mast/

The second reference project is a floating tennis court. This project was a publicity stunt by Adidas but it's still a nice idea of a way to do land sport on the water. The only problem with this tennis court is that the ball would continually go in the water.
To solve this problem we could make a Padel court, that is a very popular sport right now and its looks like tennis but it is inside a glass cage. That would solve the problem of the balls going into the water. With a sport possibility added to the outside and in the water we can motivate people to live a healthier life and sporting together creates a bond for life.
Our vision is to combine different sports into one field to create a community that can sport toghether.

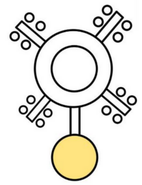
Floating Community Feeling



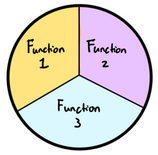
Central meeting point



Smaller, spread out meeting points

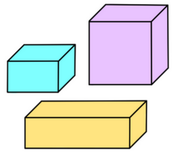


Central entrance

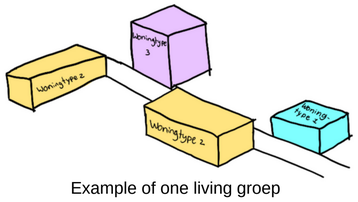


Combination of mulitiple functions within a space

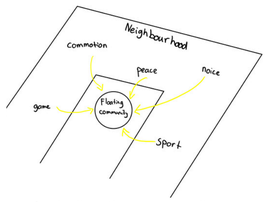
Multiple living groups to create micro community's



Different housing types for different households



Example of one living groep with a combination of different housing types



Including the surroundings in the floating community

For the design, various design principles have been considered to enhance the sense of community and create a living environment that encourages communal use. Above, principles applicable within a community are described. It is important to create one or more spaces where people can come together and meet each other. This can be achieved with a central meeting space, smaller dispersed meeting areas, and a central entrance. Additionally, incorporating multiple functions in a space can bring more people together and facilitate interaction. The use of residential groups fosters more personal interactions on a smaller scale, with different target groups being mixed through various housing types. The surrounding area and neighborhood are also integrated into the community by connecting to the functions offered in the environment and incorporating them into the community. This approach strengthens the surroundings and allows the community to function on both a small and large scale.

The four E's | No footprint house

Equity

The design was initially executed in the large family version measuring 12x9 meters. The design principles were applied, and the design was carried out. Later, the design was optimized, and two smaller versions were created to offer a diverse range. The goal was to see how small the floor plan could be while retaining the original principles. Thus, a small version of 6x6 meters was created, which is also the smallest grid size. Additionally, a medium version of 9x9 meters was designed. Besides the variation in size, other versions were developed to meet the needs and requirements of different clients. The modular system makes it easier to adapt the design

Economy

Building and producing construction materials in Costa Rica was initially more challenging. Materials would need to be collected from different parts of the country, produced elsewhere, and then transported to the construction site. This would result in high transportation costs and significant CO2 emissions. Therefore, all materials were delivered to a single location where the modules could be prefabricated. Everything needed for the construction was brought to the site in one go, making one load of materials sufficient to build the house. Furthermore, many local materials were used. Some elements, such as the steel for the structure, were imported from abroad but could be replaced by local teak wood columns.

Engineering

A core containing the bathroom and kitchen is used for the installations, positioning all installation points in the same space. To reduce the separation between inside and outside, facade doors that can be opened are used. These are comparable to garage doors and are operated by a machine. Instead of solar panels, which would need to be imported from abroad, solar collectors are used. The heat from the sun warms the water through the roof. Additionally, the house is connected to the local network. The modular and prefabricated approach makes assembly on-site easier and more energy-efficient. Maintenance is also simplified as modules can be easily replaced with new ones.

Environment

The climate of the area has significantly influenced the design. Since the house is located in a warm region, ventilation and cooling are crucial. By keeping the facades open and transparent, the entire house is naturally ventilated. The transparency also enhances the relationship between indoor and outdoor spaces.

Target audience

Future situation
For the future, there are a number of plans for the Merwehaven that can strongly determine the target group:

Adults (36-59 years -> with older children): The neighborhood is being developed so that starters can grow into a larger home as soon as enough money is earned and the children are older.

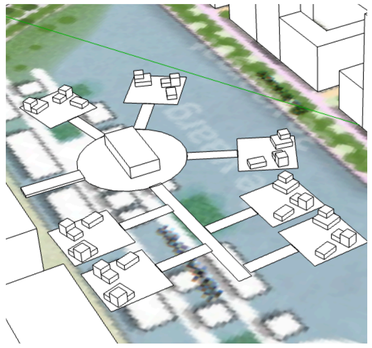
Young adults (25 to 35 years -> just relationships or small children): The master plan of the Merwehaven states that there are sufficient opportunities to grow. This is an important point for starters, as they are focused on growth in work and living.

Students (18 to 25 years -> focused on school or just starting work): The neighborhood is mainly intended for families, for students the neighborhood will be outside their budget.

Conclusion:
The target groups will be young adults and adults as they have the best advantage in the neighbourhood and they are the most likely to stay and grow.

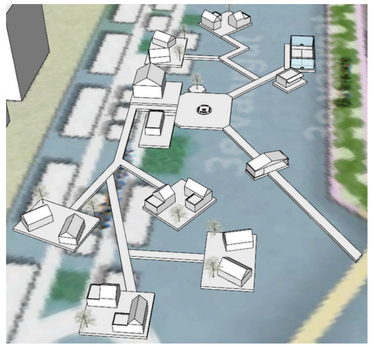
Design variants

Daan Boeter



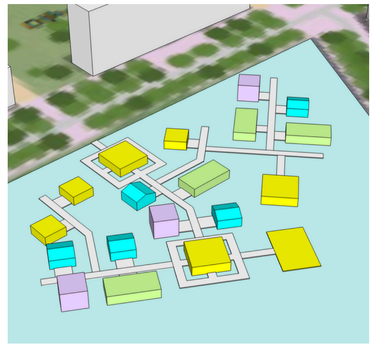
For my design, I chose to place the communal functions on a central platform, from which connections are made to smaller platforms, each housing three residences. This layout ensures that community members naturally encounter each other while traveling to and from their homes. I opted for platform-based residences to provide a shared garden, further strengthening the sense of community.

Anne de Bie



For my design, I have chosen to place various groups of islands with houses together. I have chosen to place adults and young adults together so that the children can play together. The houses with one bedroom are grouped together, so they can experience peace here. Furthermore, all groups are connected to the common center point. This means everyone has to go to the common point and you will quickly run into each other, which gives a sense of community.

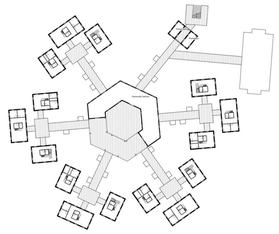
Dilara Okkuscu



For my design, I have applied various components of the design principles. A central entrance has been incorporated with the option to walk through or around the building. Throughout the community, walkways have been created that branch off perpendicularly. Along these pathways, different residential groups with housing types have been added. Small meeting spaces have been created for the residents. The paddle court is placed at the end of the community, overlooking the harbor.

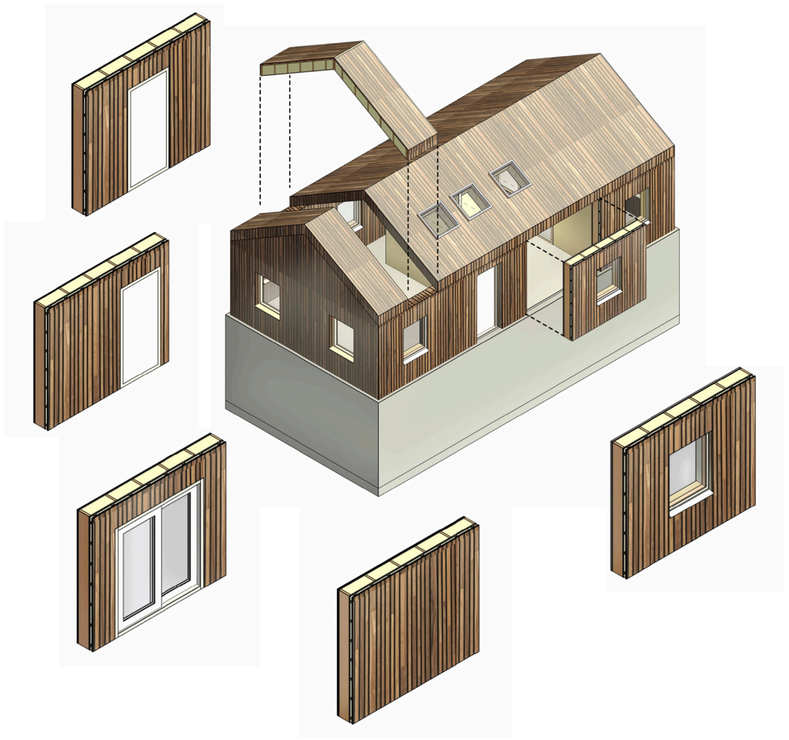
Chosen design

As a design variant, we have chosen a mix of Daan's design and Anne's design. We keep the common central place, but the walkways become equal, so that everything is at equal distances. The paddle court is kept, but the entrance is at the beginning of the community. Furthermore, there will be a building on the common place, with open and closed facade parts. This allows you to sit outside or inside. We also have chosen to do three different kind of houses. One for two persons (in the future a baby is possible), one for three persons and one for four persons.



The standardized module elements

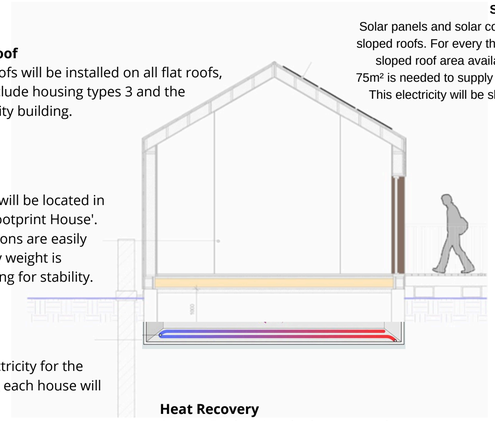
We have chosen to work with prefabricated elements as much as possible. By applying a grid of 3 by 3 meters in the floor plans, the wall elements can be consistently prefabricated to the same dimensions. Several modules have been designed, including solid façades, façades with a center or right-side door, and facades with a center window. These modules were designed with consideration for both aesthetic appeal and feasibility in execution, meeting construction and building physics requirements. They have been optimized and further developed based on these aspects. The floor modules consist of prefabricated wooden channel slab floors of 1,2 by 6 meters, and the diagonal roof is made up of prefabricated roof elements.



Installations

Green Roof
Green roofs will be installed on all flat roofs, which include housing types 3 and the community building.

Solar Panels and Collectors
Solar panels and solar collectors will be installed on all sloped roofs. For every three houses, there is 150m² of sloped roof area available for solar panels, of which 75m² is needed to supply all the houses with electricity. This electricity will be shared through a separate grid system.

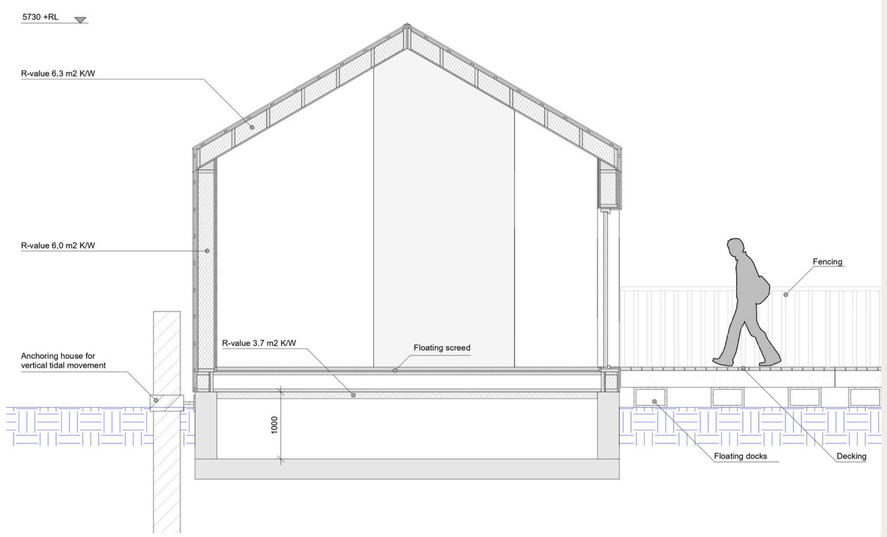


Installation Core
All installations of the house will be located in the core, similar to the 'No Footprint House'. This ensures that all installations are easily accessible and that the heavy weight is centrally located in the building for stability.

Battery
To store the generated electricity for the evening or less sunny days, each house will have a large home battery.

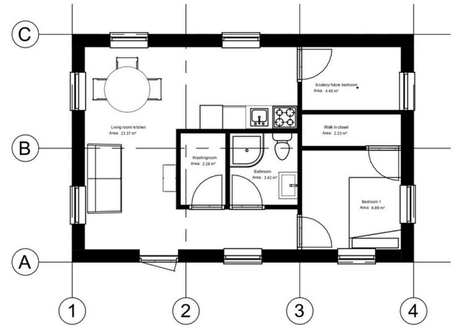
Heat Recovery
System For heating the houses, each building is equipped with a heat exchanger system where the heat from the water is used to heat the house.

Side profile



Floor plans of the houses

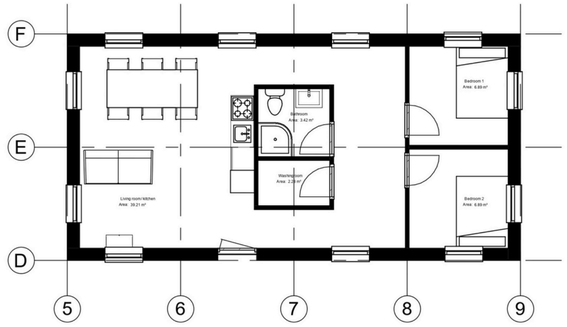
Studio



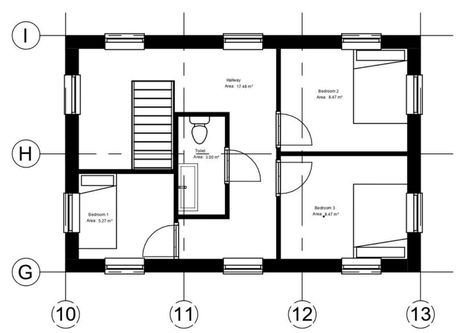
The houses have a 3x3 meter grid, that allows a lot of flexibility.

Operational functions such as stairs and toilets are located in the middle for stabilty on the water.
This way the balance of the house is always in the middle and not on the sides, wich allows an even level of the house on the water.

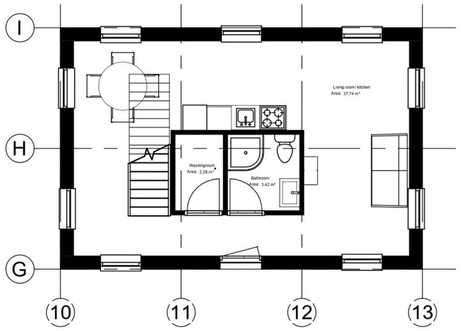
Bugalow



Family | First floor



Family | Second floor



Transportation of the materials

The prefab components are manufactured at Prefab Houtbouw West-Holland. This is a local builder known for delivering high-quality products. From Prefab Houtbouw West-Holland, all components are transported to HUB 010, located in the Port of Rotterdam. At the hub in Rotterdam, the team will gather the building materials, as there is little to no space at the intended construction site. This hub is easily accessible by road and water, which is ideal for the team as it facilitates convenient access for traffic.
There are indoor and outdoor storage options available. This allows for additional value-added services such as assembling, compiling delivery packages, and repackaging.
As a result, the team can make preparations at the hub in advance, rather than having to do it all on the construction site. The packages are assembled into work bundles so that all components can be delivered and assembled at once.

Boat Type

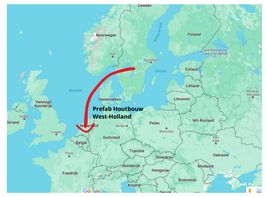
We have chosen a 'Kempenaar' as it is a smaller size of inland shipping vessel. One Kempenaar can hold the equivalent of 22 truckloads of cargo. With all the modules, we will need 2.25 boats. The blue section is for the CLT (Cross-Laminated Timber) floor in the main building. There will also be plenty of room left for the interior walls.

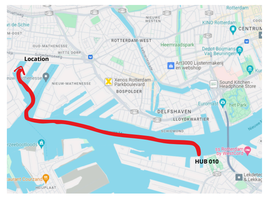


22 x

Length 55 meters - width 6.60 meters
Depth 2.59 meters - loading capacity 655 tons

	Afmetingen	Total
Facade	3 x 2.6 m	256
slanted roof	3,5 x 1.2 m	170
Roof elements	3 x 0.6 m	10
Floor	1.5 x 6 m	150



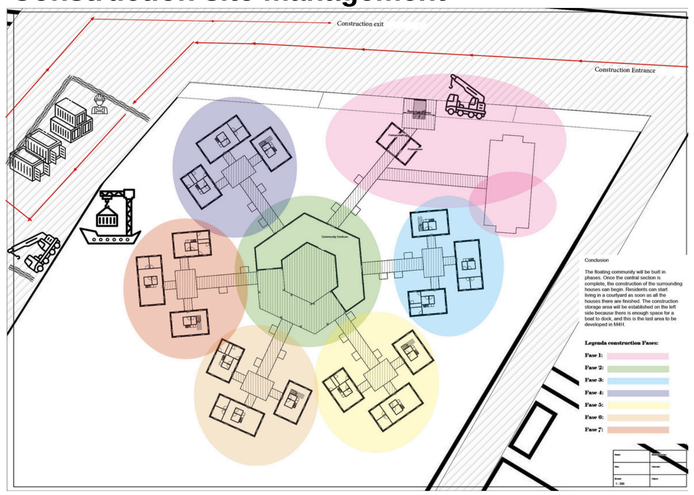


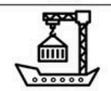
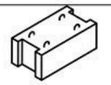
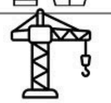
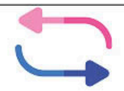
Google Maps: www.google.com/maps

Difference between HSB and Prefab HSB

	Timber Frame Construction	Prefabricated elements in a factory
What is the difference	Traditional construction method The structure is built on-site.	Less flexible as everything needs to be determined precisely in advance; making changes is difficult.
Flexibility	Offers flexibility in design and adjustments during construction.	Less flexible as everything needs to be determined precisely in advance; making changes is difficult. Therefore, you have a longer preparation time because everything needs to be correct in detail.
Quality	Quality cannot be meticulously controlled as it depends on your environment, the products available at the time, and the weather.	Quality is often higher since production is carried out in a controlled environment (factory); the quality of the products is therefore often higher
Weather Condition	Weather-dependent; construction time can be affected by weather conditions.	No weather dependency because production is done in the factory where it is always dry. This allows for better planning of how things will proceed in advance.
Construction time	Due to weather dependency and the size of the construction site, the building time is almost always longer than with prefab.	Since everything is already prepared in the workshop, assembly on the construction site is much faster. They only need to be put together.

Construction site management



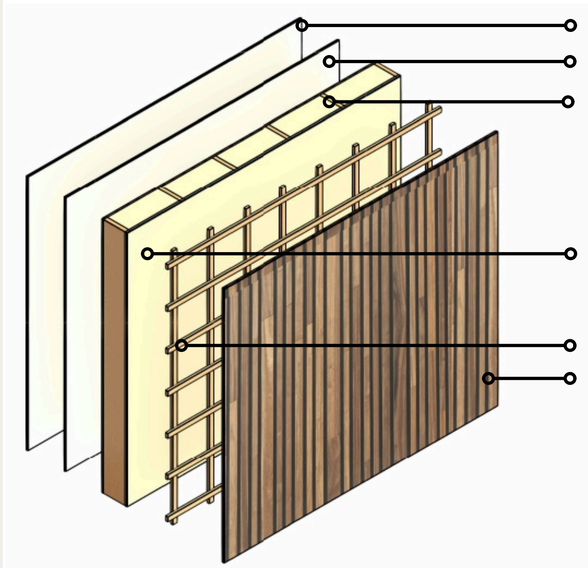
	Preparations
	**1. Preperation before building** **- Make sure the engenering is right, send it to wall construction company.** **- Arrange all logistical aspects to ensure smooth operations.**
	**2. Material Hub** **- Set up a central hub for materials to facilitate easy access and organization.**
	**3. Floating the Basements to their Place** **- Move the basements to their designated locations. After they are made.**
	**4. Stabilize the Basements** **- Ensure the basements are stable and properly aligned to support construction.**
	**5. Load Prefabricated Walls onto the Boat** **- Transfer the prefab walls onto the boat.**
	**6. Transport and Position the Walls** **- Move the boat to the construction site and position the walls correctly on the basements. Ensure all components are securely assembled.**
	**7. Construct the Buildings** **- Erect the main structure. Once three houses are constructed, proceed with interior preparations.**
	**8. Finish the Interiors** **- Begin the interior finishing work for the constructed houses.**
	**9. Continue Building Additional Houses** **- As the interiors of the initial houses are being prepared for occupancy, start building the next set of houses.**

Wood connection for demountable construction

	Screw connection	Nail connection	Mortise en tenon, devotail	Steel connection
Speed	++	+++	-	++
Sustainability	++	-	+++	++
Usage	++	-	++	-
Disassembly	++	--	-/+	+

Conclusion: The screw connection comes out best in the test. It doesn't score poorly anywhere. It is quick to assemble, easy to disassemble and very durable. You can properly support load-bearing parts with a screw connection. So this is the best option for the prefabricated construction.

Facade construction



Plasterboards
Fire proof finishing layer

Plasterboards

Flax board insulation
Flax boards are made from linen, for example, remnants from the linen textile industry, which makes this material contribute significantly to global sustainability. The boards are excellent as insulators and sound absorbers for the house. The wood averages 50db and has an R-value of 6,0 m²K/W at a thickness of 235mm.

OSB panels with water-repellent vapor-permeable foil
Because we are going to use open facade elements, we had to ensure that the wall behind the cladding is sufficiently resistant to water. That's why we chose this option.

Framework

Robinia (pseudoacacia) open vertical facade
Robinia (pseudoacacia) cladding has a durability score of 1, making it a viable alternative to tropical hardwoods like western red cedar. Sourced from responsibly managed forests in Europe, particularly Hungary and Bulgaria, it reduces CO2 emissions during transport. This hardwood is resistant to insects and weather conditions, making it excellent for cladding. It's also removable, contributing positively to the circular economy. The cladding can be applied in various ways, as shown in the image.

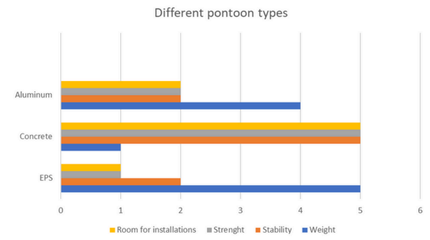
Calculation of facade construction

Layer	Thickness (mm)	Thermal Conductivity (λ) (W/mK)	R-value (m²K/W)
Plaster walls DuraGyp/LaDura	25	1.3	0.2
OSB	18	0.13	-
88% Flax	235	0.040	5.875
12% between wooden studs (38x235mm)	38x235	0.18	1.3
Load-bearing waterproof plywood	18	0.17	0.1
Cavity	44	-	0.18
Wooden vertical cladding	18	0.18	0.1
Total thickness			
Rc value	358		**6.0 m²K/W**

Building physics & construction

Choice of material of the pontoon and references

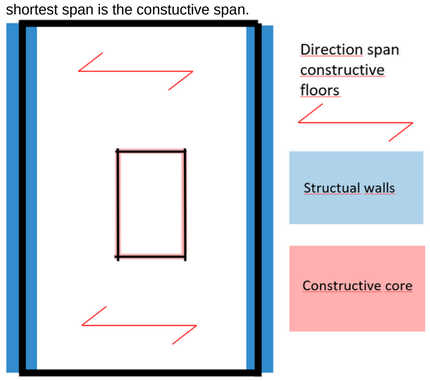
1. Aluminium pontoons from Wikkelboats: it is too lightweight for stability for our homes.
2. Concrete as in the Floating Office Rotterdam uses lightweight concrete, and is stable.
3. EPS pontoons from Drijvend Paviljoen uses a five-layer EPS floor system 20-75 cm, reinforced by concrete beams and slabs, but it cannot support multiple stories due to low stability and strength.

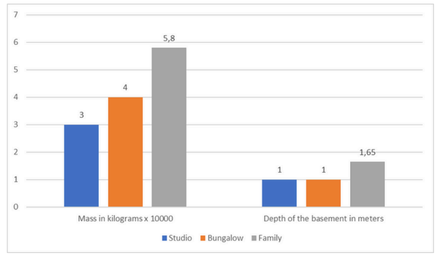


Calculation of the size of the pontoon

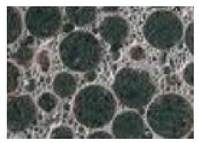
1. Weight of the timber frame construction + interior and installations.
2. Displace the kilograms into cubic meters for the volume.
3. What is the surface of the house in square meters for the surface area.
4. The depth of the pontoon: Volume / surface area.
5. Create extra stability and buoyancy by extra depth.

This is a example of construction of one of the homes. The shortest span is the constuctive span.



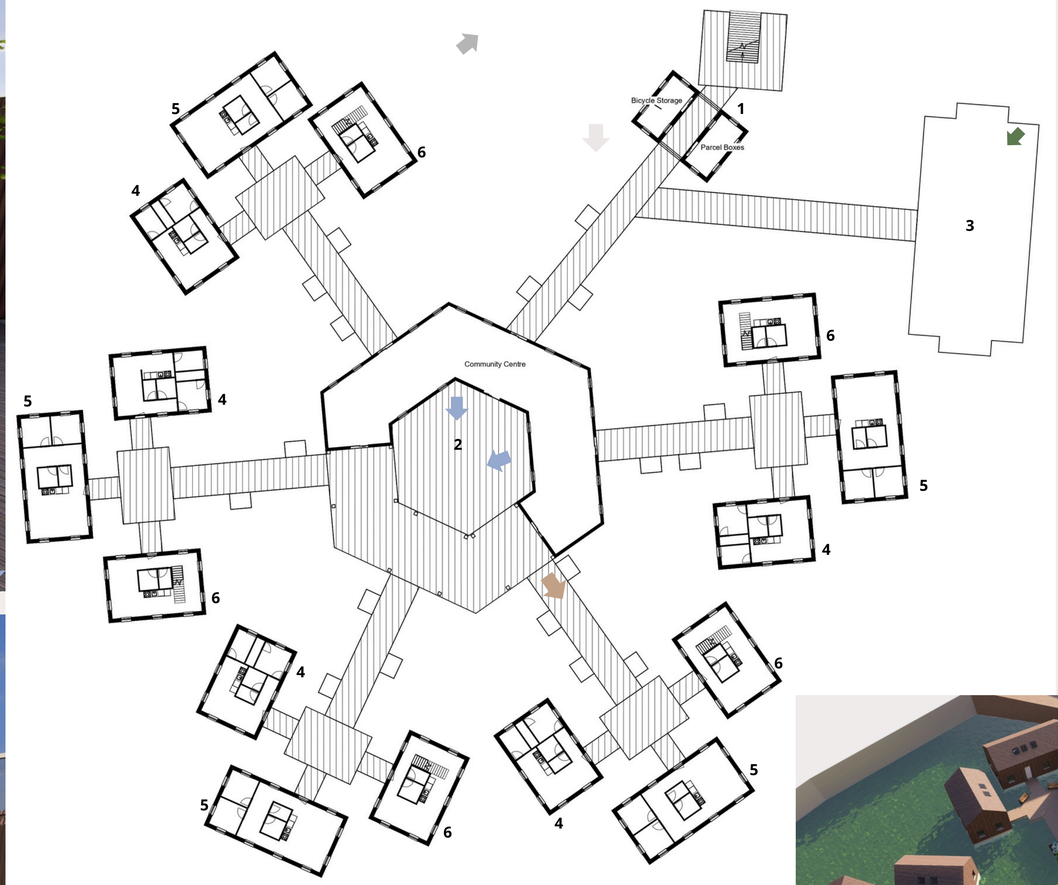


Graph of the mass of the concrete pontoons and depth



This is a magnification of Liapor lightweight concrete, used in our project for the fundation. It is 2,5 to 3 times more expensive than normal concrete, but more sustainable.

liapor (betoniek.nl)



Legend

1. Entree
2. Community Building
3. Sport Field
4. Studio
5. Bungalow
6. Family

Design justification

The design is based on the research conducted. The entrance building and the central building provide meeting spaces for the residents. To leave the community, residents must pass through the central meeting areas, increasing the likelihood of encountering each other. The residential groups are accessible via floating decks and are connected to a small plaza, which then leads to the front doors. This creates an additional layer for residents to meet each other within the residential group. The use of the same facade finishing for the buildings strengthens the cohesiveness of the design. The Sport Field is accessible to both residents and the surrounding community. Additionally, greenery and trees are integrated into the design. These are placed on floating decks that can be relocated seasonally.