FROM WATER TO STRUCTURE

Reconnecting floating architecture and aquatic ecosystems through regenerative design

REFLECTION

Gaspard Marteau
6048382

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Architectural Engineering Graduation Studio
Design Mentor: Dafne Swank
Research Mentor: Mo Smit
Building Technology Mentor: Paddy Tomesen

RESEARCH AND DESIGN RESULTS

The research results provide a practical guide for designing a circular floating building using bio-based materials sourced from local aquatic ecosystems. Each material is associated with the building layers where it performs best. To facilitate the sourcing and lifecycle process, a parametric framework was proposed for calculating the surface of material to cultivate in order to supply the building's construction and replacement needs.

The main design implications include integrating demountability into building components and ensuring easy maintenance access. For example, modularity in the floating platform is one direct consequence of these design implications. New details have also been investigated to allow for a full disassembly of the building parts. For instance, traditional woodworking techniques for joinery were implemented for most of the structural and building elements.

The design process aimed at studying and developing the best spatial and structural solutions for implementing the research findings in a large "culture" hub to foster communities of the future Haven Stad district in Amsterdam. Each design aspect was explored through multiple iterations using hand sketches and physical models. The decisions were made not only by taking into account external factors such as wind, water and sun, but also the user's experience through the layout, the views and the integration of the construction process for the community. The design process explored different scales, with incremental refinement after key decisions were made.

The result of the design is a centre for community and culture composed of five floating buildings arranged together in a cohesive way. Each floating building hosts multiple functions, supporting both community engagement and cultural activities. The key structural language lies in the implementation of a large shed-like roof protecting the users from wind and rain and providing sun shading in the summer. This creates space for various semi-outdoor uses between the insulated inner building and the protective roof. Uses for this intermediate space include circulation, open stairs and ramps, seating stands, bike parking, terraces, as well as storage areas for harvested materials but also energy and water. Moving the insulated and load-bearing facade inward reduces structural weight and material use while improving stability by lowering the centre of mass. Additionally, it offers a direct visual connection between the different floors of the public building.

1- RELATION BETWEEN GRADUATION PROJECT TOPIC, MASTER TRACK AND MASTER PROGRAMME

The topics of floating buildings and bio-based materials are inscribed in a technical and innovative approach to architecture, aligning with the methods and ambitions of the Architectural Engineering Graduation Studio as well as the master track Architecture.

The graduation project topic is particularly connected to the studio's subtopics of Make and Flow. It focuses on the flow of materials in terms of the local sourcing, the growing cycles and life cycles in the building. By designing new processes and a typology of regenerative floating buildings, the project is also about the making of a system.

2- RELATION BETWEEN RESEARCH AND DESIGN

The chosen methodology was based on a reinterpretation of the shearing layer diagram by Stewart Brand. This framework guided the research throughout the process. It was relevant for analysing materials in a structured way and helped to gather enough information for the next phase. The clear organisation of the building layers facilitated easy referencing of research outputs throughout the process. Although this framework worked well for structuring the research, more freedom was taken in reinterpreting the buildings' layers for the design phase. For instance, the building's skin was reinterpreted as two distinct elements: a roof that protects against rain, wind and sun, and a thermally and acoustically insulated façade.

Different methods were used to collect information: interviews, case study analysis, literature review and research-by-design. The approach mostly worked for the intended purpose of the research. However, because of my lack of previous knowledge on wood species, I relied on the information given by experts whom I interviewed. The approach was aimed at gathering the right information and studying it according to the layers of a floating building.

The research influenced my design and recommendations by providing a choice of specific materials to use and proposing ways to implement them in the floating building. The research-by-design method facilitated the start of the design phase by providing a usable base. The design goal helped me to frame and focus the research on the distinct typology of a floating building in a polluted urban environment with additional constraints linked to aquatic ecosystems.

3- ASSESSMENT OF THE WAY OF WORKING

My research approach has proved to be very useful in the design process, as I frequently referred back to the research outputs for some design decisions. The method of interviews allows me to get information that I would not have been able to find in another way, especially because a part of the topic is very experimental and relies on ongoing research programs.

The feedback given by mentors was always constructive and relevant for the design and research process. Rather than giving direct choices on design decisions, the mentors didactically guided me to choose by myself what works best for the project. This way of evaluating the design decisions was key in the development of my project. It will be a valuable methodological lesson for future work. Instead of going for the instinctive choices or the first ideas I had, I learned to study all possibilities and weigh the pros and cons by taking into account a range of architectural aspects such as climate responsiveness, user comfort, experiential quality, and structural efficiency.

The extended time dedicated to the graduation project in comparison to other university projects allowed me to fully explore and develop my own method of working when it comes to designing. It also allowed me to go into detail about all design decisions and not just a few of them. During the process, I have learned a lot about different kinds of biobased materials and their use in architecture which I was not aware of before.

4- ACADEMIC AND SOCIETAL VALUE, SCOPE AND IMPLICATION OF THE GRADUATION PROJECT

The project aims to democratise the use of bio-based materials for the entirety of a floating building's structure by creating knowledge and a theoretical proof of concept. It proposes a new comprehensive framework for applying hyper-locally sourced bio-based materials in floating architecture. This is relevant for stakeholders involved in the construction sector, city planners and especially architects. The project's outcome could accompany professionals in the current development of the floating typology with a new circular and regenerative approach. The practical design guide resulting from the research and its implementation in the project both act together as key theoretical examples for future works in that field.

The regenerative focus of the project has a wider social impact on rethinking the way that (floating) cities are built and maintained throughout their life cycles. The ethical approach to architecture reconsiders the direct local environment and has the objective of regeneration instead of leaving a lasting negative footprint. The simple parametric tool is a practical translation of a theoretical concept based on regenerative circularity. It can be used for enhancing the workflow of architects who want to design regenerative buildings with local resources. The precise calculations of cultivation surfaces resulting from the digital 3D model allow for connecting practical challenges with contemporary digital tools early in the process. The parametric tool could be further developed for real-life practical use by adapting the surface calculation into other units of cultivation, taking into account the characteristics of the different plants like the trees and the algae for instance.

5- ASSESSMENT OF THE VALUE OF THE TRANSFERABILITY OF THE PROJECT RESULTS

My project results, including the research outputs and the design proposal, can be used as a base for future projects aiming to have a regenerative impact on their ecosystems, whether it is in an aquatic environment or not. The same framework and approach could be used by looking at different kinds of landscapes through their local conditions and species. The modularity of the design concept also allows it to be built at a small scale at first. This could give the opportunity to experiment with such a system and typology without taking too much risk.