

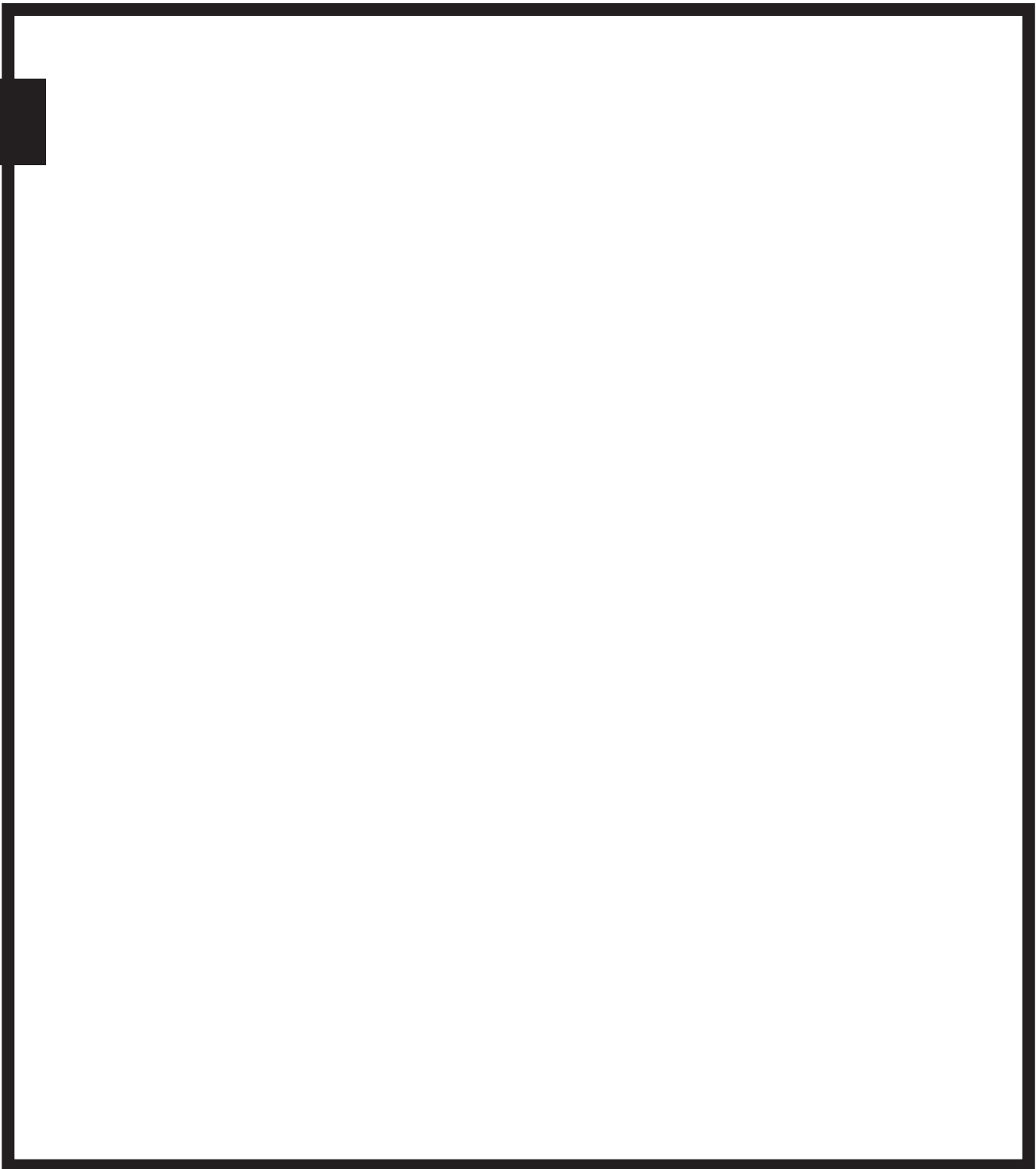
Portfolio

Carlos Larraín L. _____

Selected Works
2020 / 2026

Architect

2026



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CV

Architect with experience in design, construction, and digital fabrication. I am interested in exploring the relationship between architecture, materials, and new technologies, especially how tools like computational design, robotic processes, and 3D printing can open new ways of thinking about and building objects and spaces.

Through my professional and academic experience, I have been involved in the development of architectural projects, prototypes, and collaborative design processes. I enjoy working across different scales, from spatial ideas and material exploration to fabrication and construction details. My goal is to keep learning, experimenting, and exploring new ways to connect design with contemporary methods of making.



Contact

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Barcelona, Spain

Carlos Larraín Lihn

Architect

Education

2025- 2026

Postgraduate in 3D Printing Architecture (3DPA)

Institute for Advanced Architecture of Catalonia (IAAC), Barcelona, Spain

3DPA is an applied research program focused on large-scale 3D printing, with a strong emphasis on sustainable materials, especially earth.

The course combines material experimentation, parametric design, and on-site fabrication, developing work from small tests to full-scale 1:1 prototypes. Its goal is to understand how 3D printing can be used in real construction, exploring material performance, geometry, and building processes.

2024 - 2025

Master in Robotics and Advanced Construction (MRAC)

Institute for Advanced Architecture of Catalonia (IAAC), Barcelona, Spain

MRAC is a program focused on the integration of robotics, digital fabrication, and architecture, exploring new ways of designing and building through emerging technologies.

The program combines computational design, programming, material systems, and robotic control, working directly with industrial robots and full-scale fabrication processes. Through applied research and prototyping, it aims to rethink contemporary construction by connecting design with how things are actually made.

2015 - 2020

Architect (Professional Degree in Architecture)

Universidad del Desarrollo (UDD), Santiago, Chile

Experience

2020 - 2022

Felipe Assadi Architects

Architect Designer

2022 - 2024

Lekker SPA

Senior Architect Designer

2019 - 2024

Universidad del Desarrollo

Studio Teaching Assistant

Skills / Interests

- Computational Design
- Digital Fabrication
- Design Research
- Teamwork
- Critical Thinking
- Parametric Design Approaches
- Architectural Prototyping
- Problem Solving
- Spatial & Architectural Thinking
- Material Exploration



3DPA Team _ 2025 - 2026

2025 - 2026 Project | NYARA House

This project explores the design and construction of a 1:1 3D-printed earth prototype, moving from isolated experiments toward a complete architectural space.

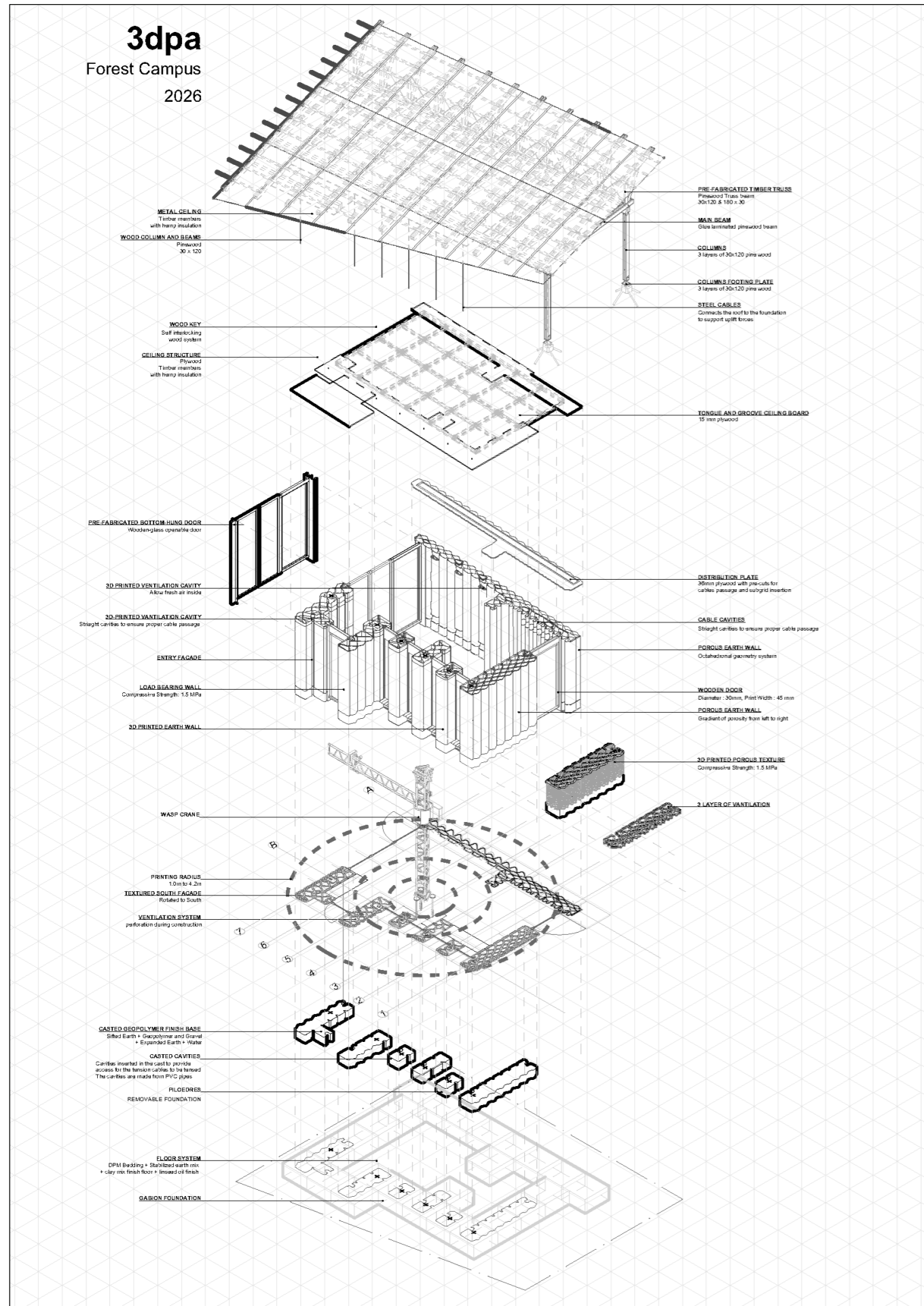
The focus is on how geometry, material behavior, and fabrication logic come together to shape performative walls. Through variations in toolpaths, surface textures, and internal cavity systems, the project investigates how a single printed element can respond to structure, ventilation, and thermal performance at the same time.

Working at full scale also brings attention to the realities of construction, where material preparation, machine constraints, and on-site decisions become part of the design process. In parallel, the project addresses constructive detailing, developing solutions for connections with doors, windows, and other building elements.

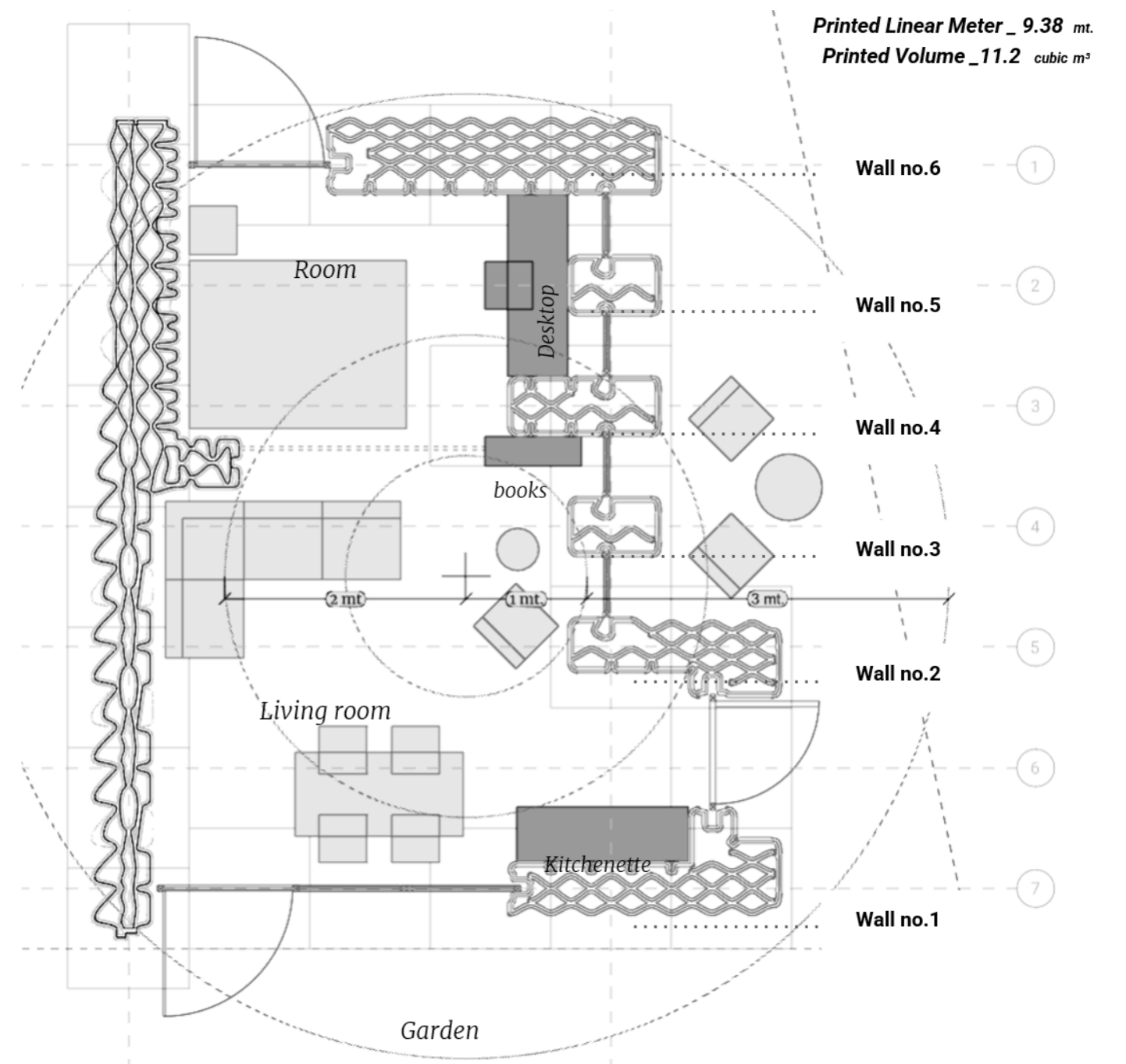
Rather than treating earth as a limitation, the project uses its properties as a driver for form and performance.

The result is a habitable prototype that brings together design, fabrication, and material research into a coherent architectural system.





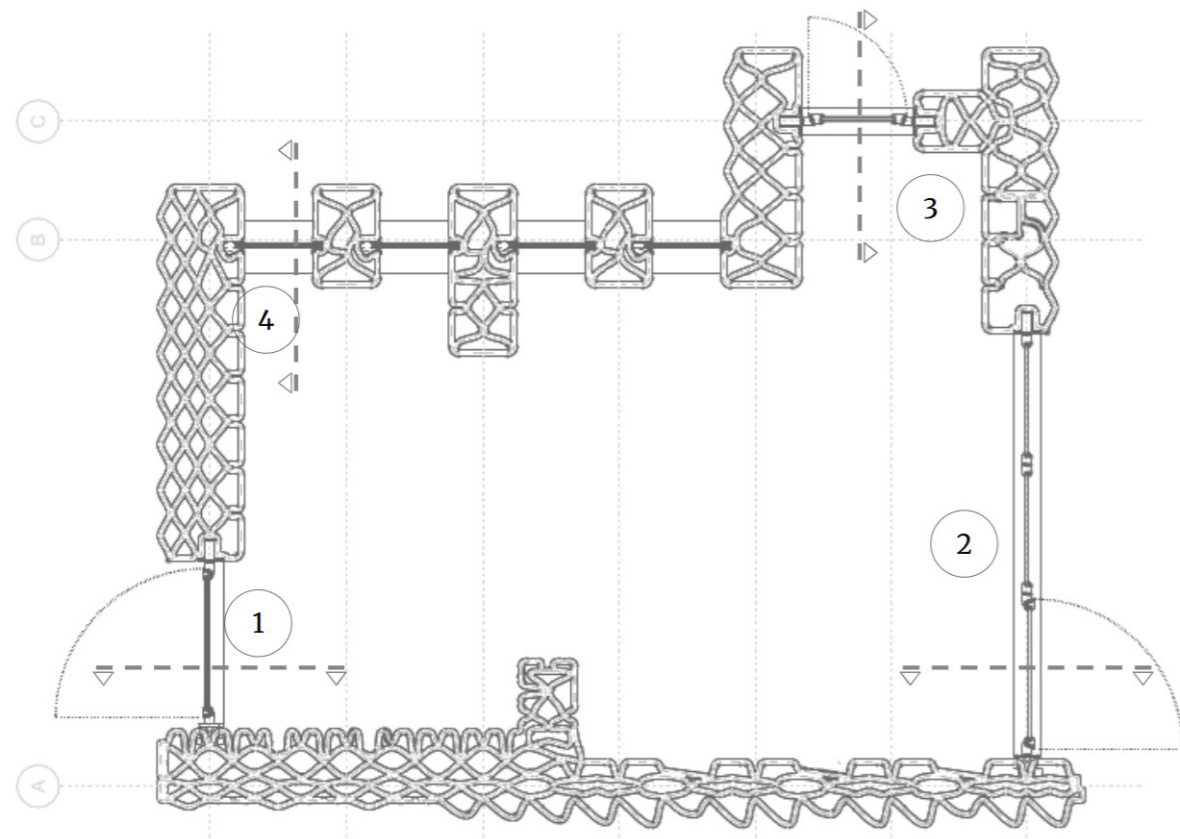
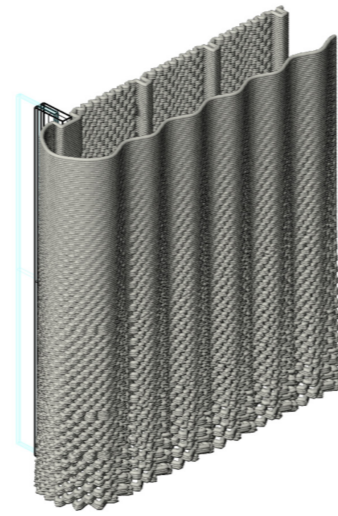
The IAAC prototype brings together the main outcomes of this year's research into a single architectural space. It is designed as a small residential unit, including a bedroom, a living area, and a compact kitchen, all connected within one continuous interior. Building on last year's Helia Wall, the project moves from testing individual walls to creating a complete enclosure. The design is based on a system of 3D-printed earth walls, where each wall explores different ideas—such as geometry, toolpaths, openings, and structure—while still working together as one system. Openings are placed based on orientation and use: larger ones in shared spaces for light and openness, and smaller ones in private areas for more control and privacy. Overall, the prototype works both as a habitable space and as a way to test how 3D-printed earth walls can come together to form a complete and functional building.



The wall geometry combines structure, ventilation, and material behavior into a single system. Surface texture is not only aesthetic, but also helps control stability and drying during printing.

The prototype is made of six wall segments with internal cavities that create a continuous airflow network, improving ventilation and drying performance.

While the system is mainly defined computationally, some adjustments were made on site, balancing digital control and manual flexibility.

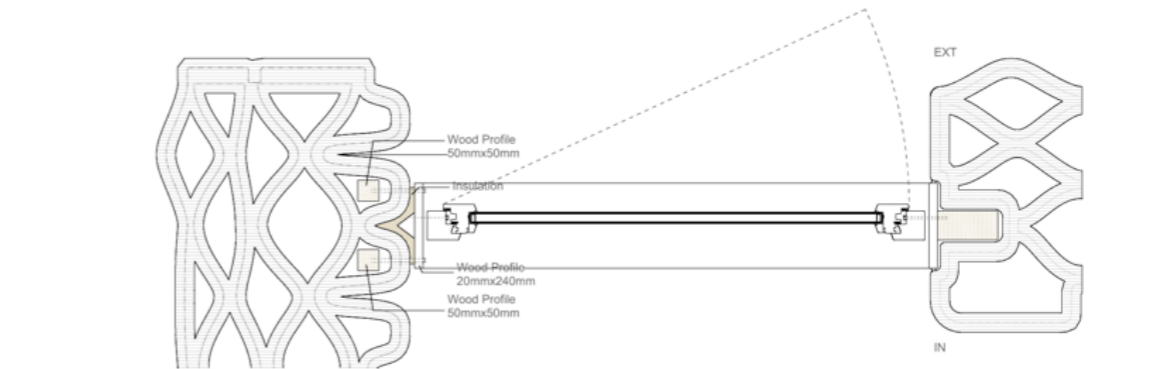


A key challenge was designing robust and climate-efficient connections between the 3D-printed earth walls and other building systems, including the existing HELIA wall.

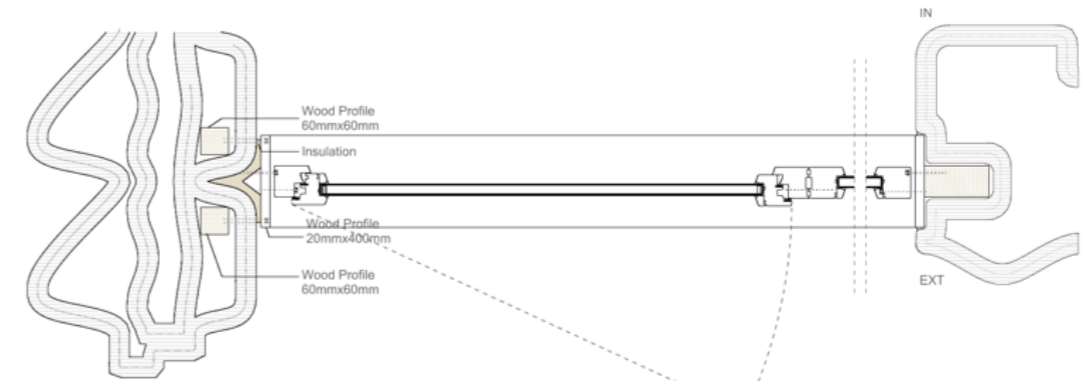
The project focuses on efficient connections between 3D-printed earth walls and other building elements.

Special attention was given to doors and windows, using timber subframes to allow precise installation while adapting to material tolerances and shrinkage.

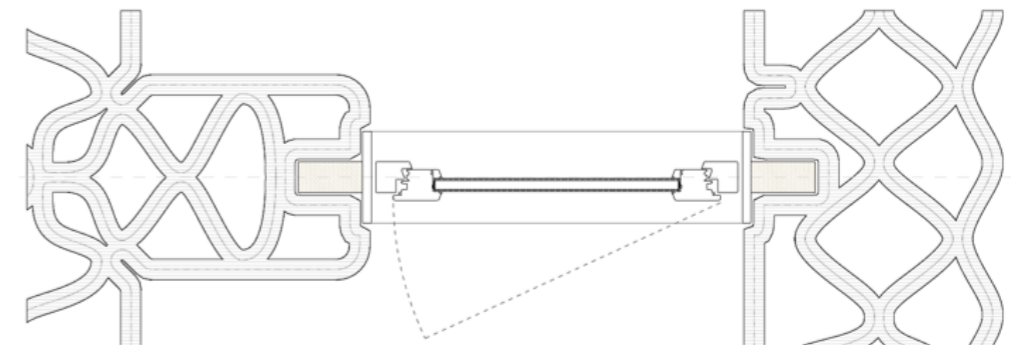
The result is a flexible detailing system that ensures structural continuity, thermal performance, and buildability.



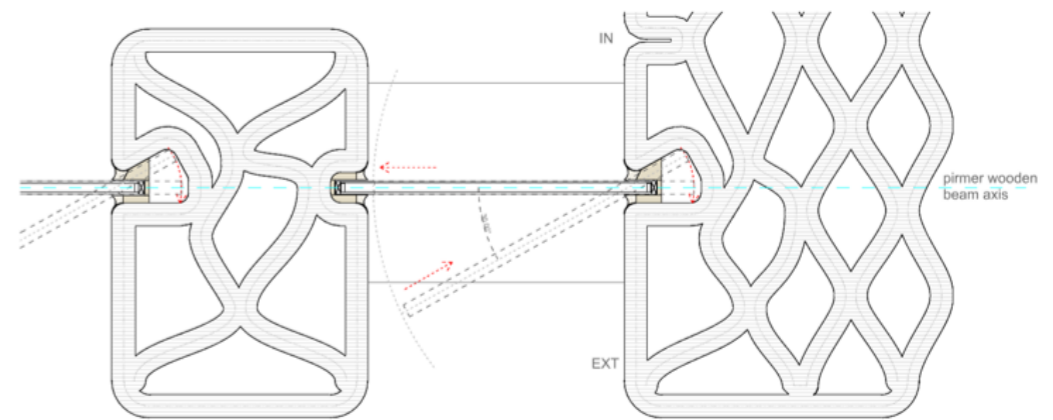
1 Exterior Opening Glass Door Joint Detail
Dry State Assembly /In between Helia and new wall



2 Exterior Opening Glass Door + Fixed Door Joint Detail
Dry State Assembly /In between Helia and new printed wall

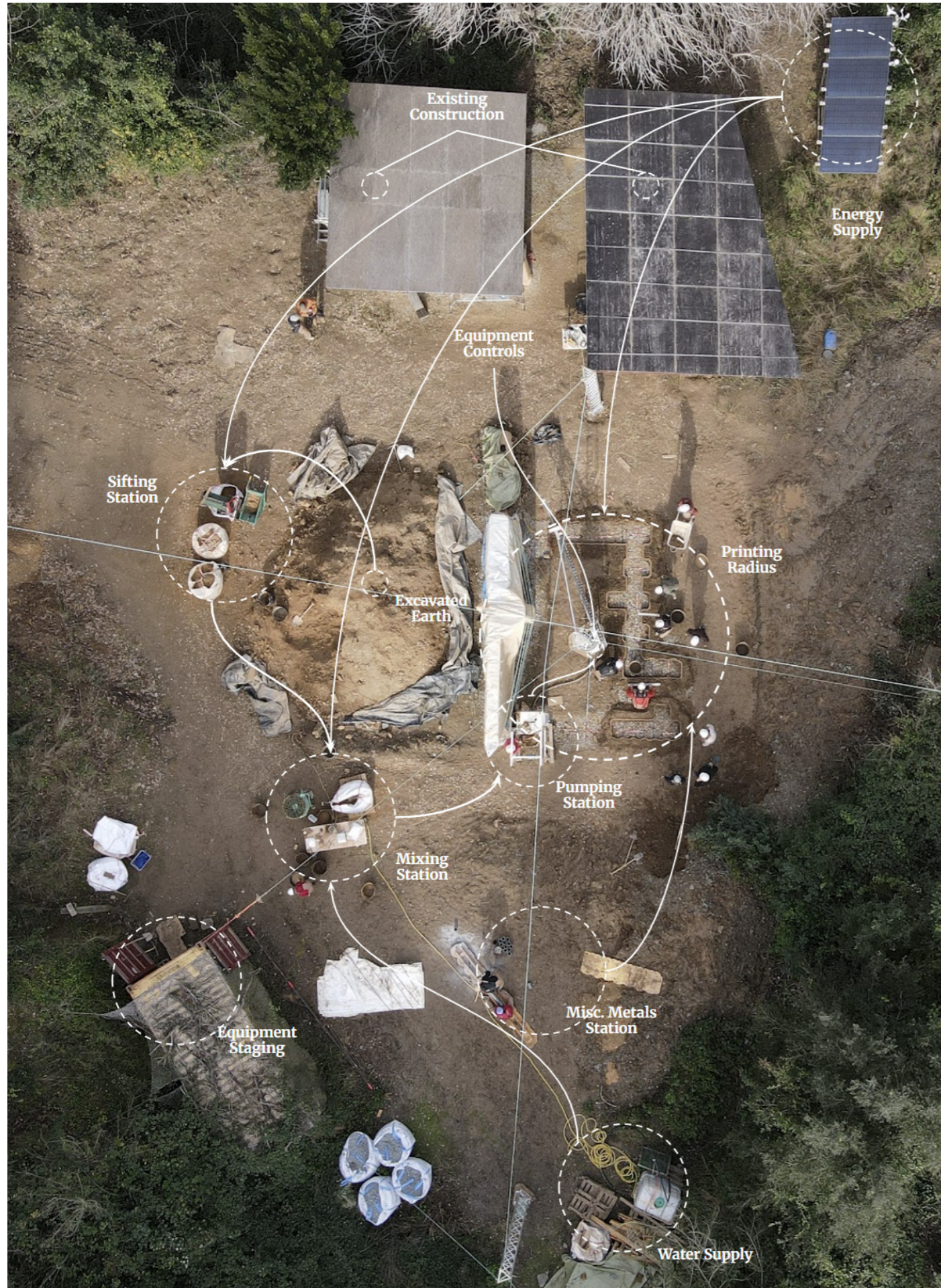


3 Exterior Opening Solid Door Joint Detail
Dry State Assembly /In between new printed walls



4 Fixed Window Joint Detail
Dry State Assembly /In between new printed walls





Process _

Excavation + Gabion Foundation

After defining the layout, we prepared the ground and implemented a gabion foundation system instead of a traditional concrete footing. Gabions—steel cages filled with local stones—provide a stable and evenly distributed base, while allowing water to pass through and reducing pressure under the structure. This solution improves ground stability while reducing the environmental impact by avoiding the use of concrete.



Crane Installation + Tarp Setup

The process begins with the installation of the Printer (Wasp Crane), anchored to steel columns to ensure stability and precise operation across the full printing area. Once assembled, a protective tarp system is installed using the same structure, creating a controlled environment that protects the equipment and material from weather, ensuring consistent printing conditions.



Plinth Printing & Casting

The plinth is built using a hybrid system, where the robot prints a zigzag pattern that acts as formwork for the base.

This geometry provides initial stability to the wet clay, while the internal cavities are filled with gravel to resist pressure during the concrete pour and prevent deformation. The printed lattice also helps distribute loads and maintain the shape during casting.

Once stabilized, the system functions as a mold for the structural base, supporting the load above.

This approach avoids traditional timber formwork, reducing waste while using 3D printing to create a more efficient and adaptable construction process.



The base is completed through a monolithic pour of a stabilized earth-cement mix into the printed formwork, encapsulating both reinforcement and anchor systems. Steel rebars are placed inside the printed channels to provide the tensile strength that raw earth lacks, ensuring structural stability against lateral forces.

At the same time, steel connection plates are embedded to define precise anchor points for the future superstructure.

The plinth also acts as a capillary break, protecting the printed walls from ground moisture and ensuring the long-term durability of the system.

Wall Printing

Sifting

Soil is collected on site and mechanically sieved to remove large particles and impurities, ensuring a clean and consistent material.



Mixing

The soil is combined with water and additives to achieve the right workability, strength, and printability. The result is a homogeneous mix optimized for extrusion.



Pumping

The mixture is pumped to the print head, where flow and pressure are manually controlled to ensure continuous extrusion and accurate layer deposition.





More info here



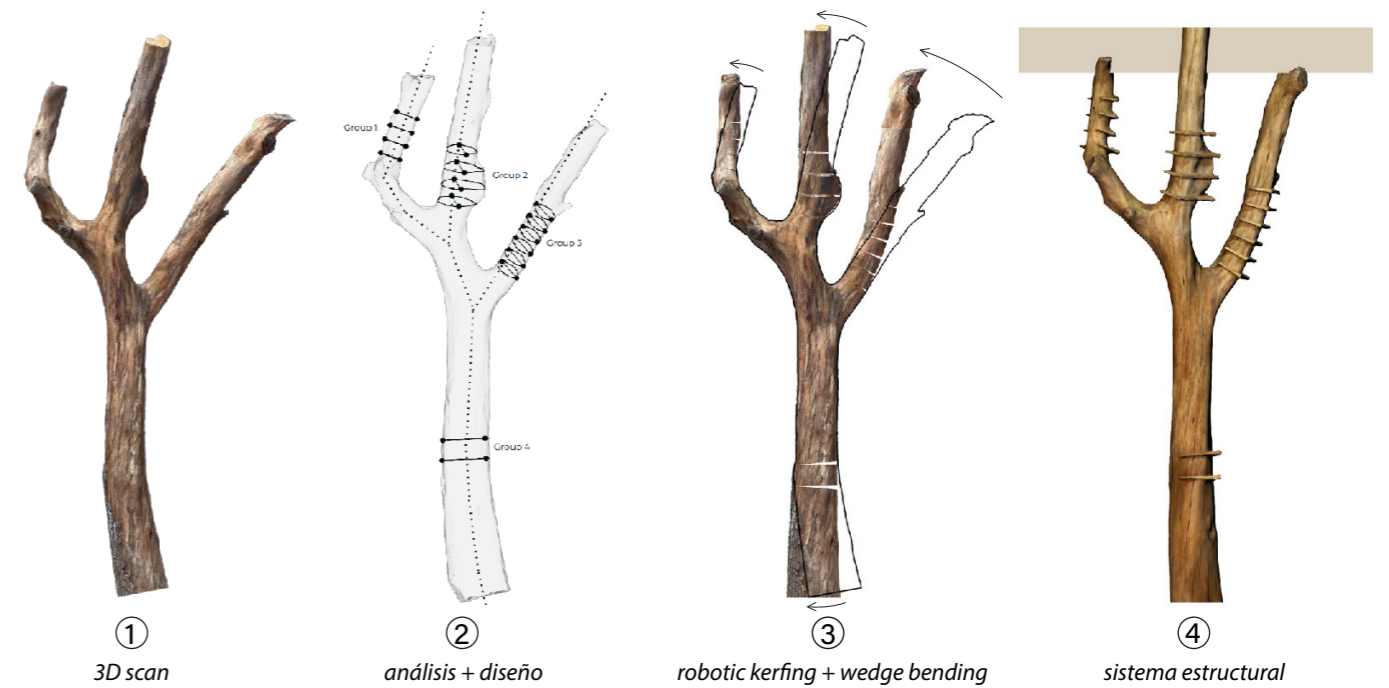
Project Video here



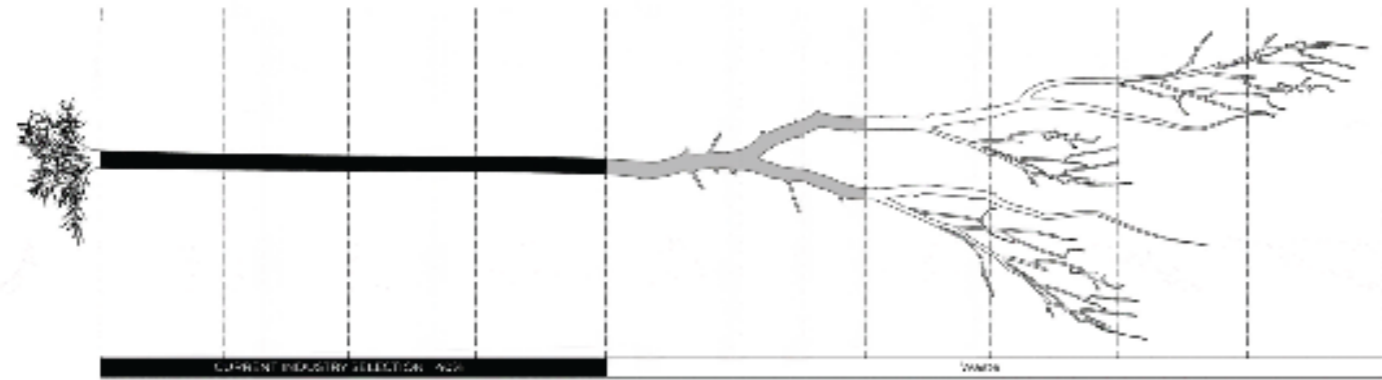
From Organic to Regulated

This project explores how highly irregular tree trunks can be transformed into dimensioned and structured systems. Through strategic cuts and the insertion of wedges, the complex natural geometry of the logs is modified to guide their curvature and direct the branches toward specific load points.

Using 3D scanning, parametric design, and robotic fabrication, we enable a controlled geometric transformation that unlocks the structural potential of the parts of the tree that are often underutilized due to their non-standard shapes, revealing new architectural possibilities for natural timber.



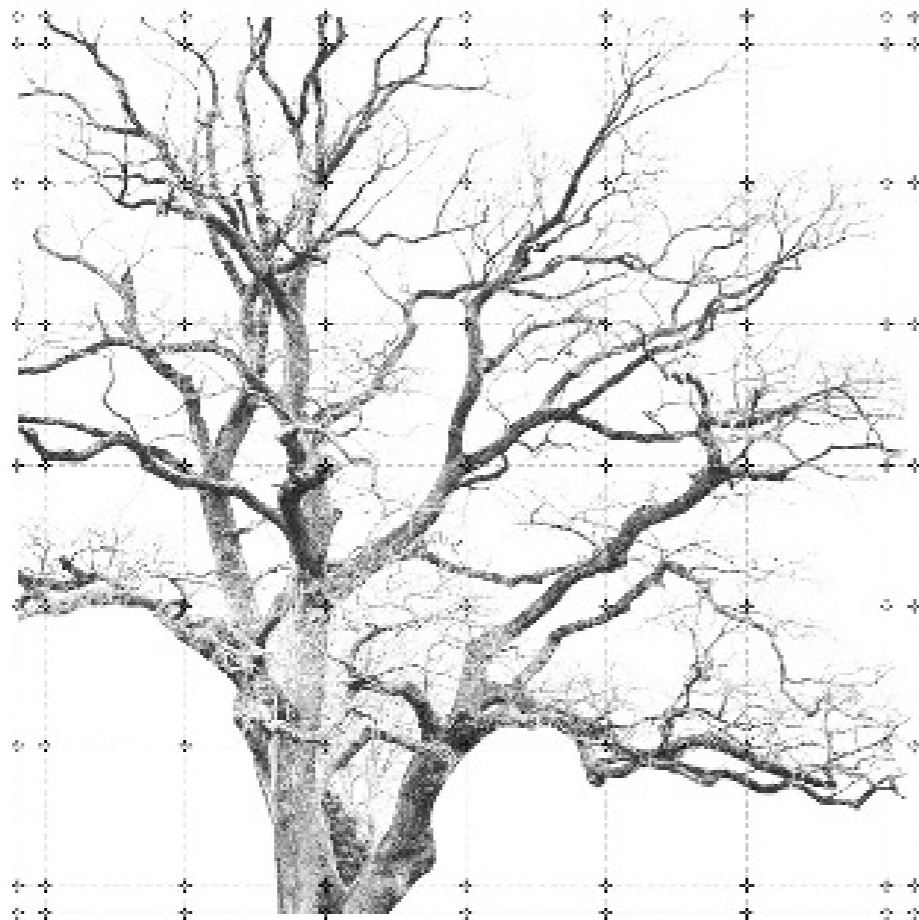
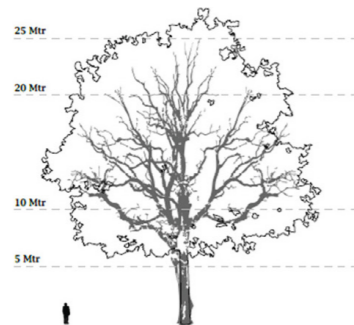
In today's forestry industry, only about 40% of a harvested tree—the straight part of the trunk—is used for construction or high-value products. The remaining 60% is typically discarded or turned into low-value byproducts such as firewood or biomass. This imbalance led us to explore whether this proportion could be changed by focusing on the irregular, twisted, or branching parts of the tree that rarely enter the conventional timber supply chain. Our goal is to increase the usable material from 40% to 60% or more.



In Catalonia, common tree species include pine, beech, holm oak, and oak. While pine dominates the forestry industry due to its straight growth and ease of processing, oak grows in irregular and organic forms, with twisted branches and complex geometries that fall outside standard industrial processing. However, this complexity comes with notable advantages: oak is harder and more resistant than many of its local counterparts.

Oak Technical data

Density . High	670-910 kg/m³
Hardness . High	1.200-1.360 lbf
Elasticity module . Medium	10-12 GPa
Compression resistance . High	46-65 MPa
Durability . High	White Oak more resistance

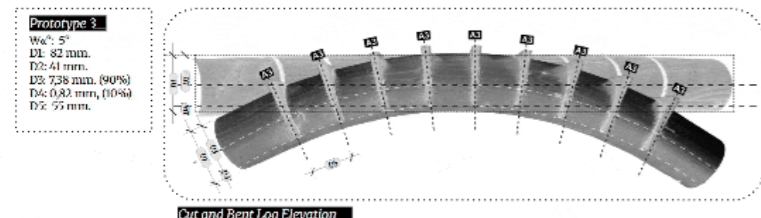
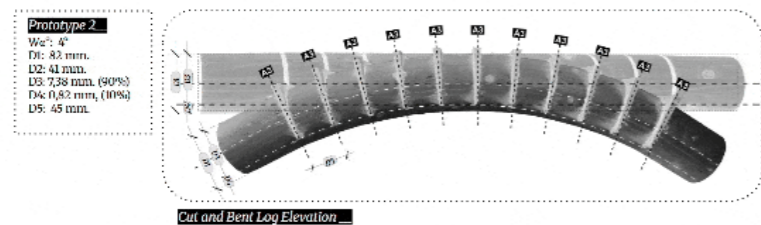
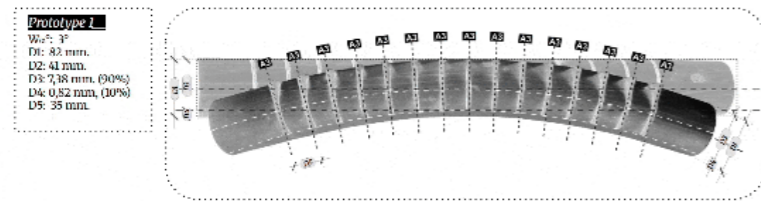
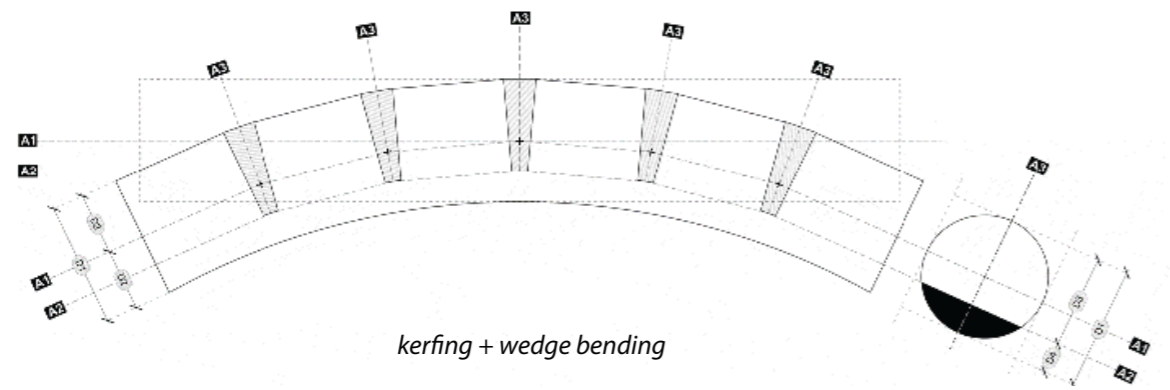
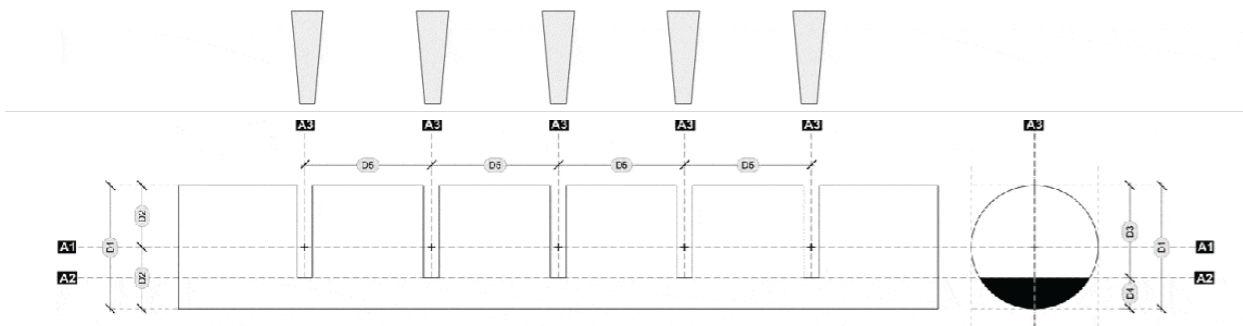


This condition—being both highly capable yet underused—made oak the ideal material for our research. We chose to work with it because of its irregularity, not in spite of it. By doing so, the project explores ways to diversify timber use beyond pine, proposing new structural and aesthetic possibilities from parts of the tree that are currently considered unsuitable for construction.



Bending Control – Wedged Kerfing

To transform the geometry of the tree trunks, we applied the kerfing technique, which consists of To transform the geometry of the tree trunks, we applied kerfing, a technique that uses a series of cuts to locally weaken the wood and allow it to bend without breaking. We used a variation called wedged kerfing, where wedges inserted into the cuts generate lateral forces that bend and reshape the trunk in a controlled way. To study its behavior, we produced prototypes with straight pine posts, testing parameters such as kerf depth, spacing, and wedge angle.

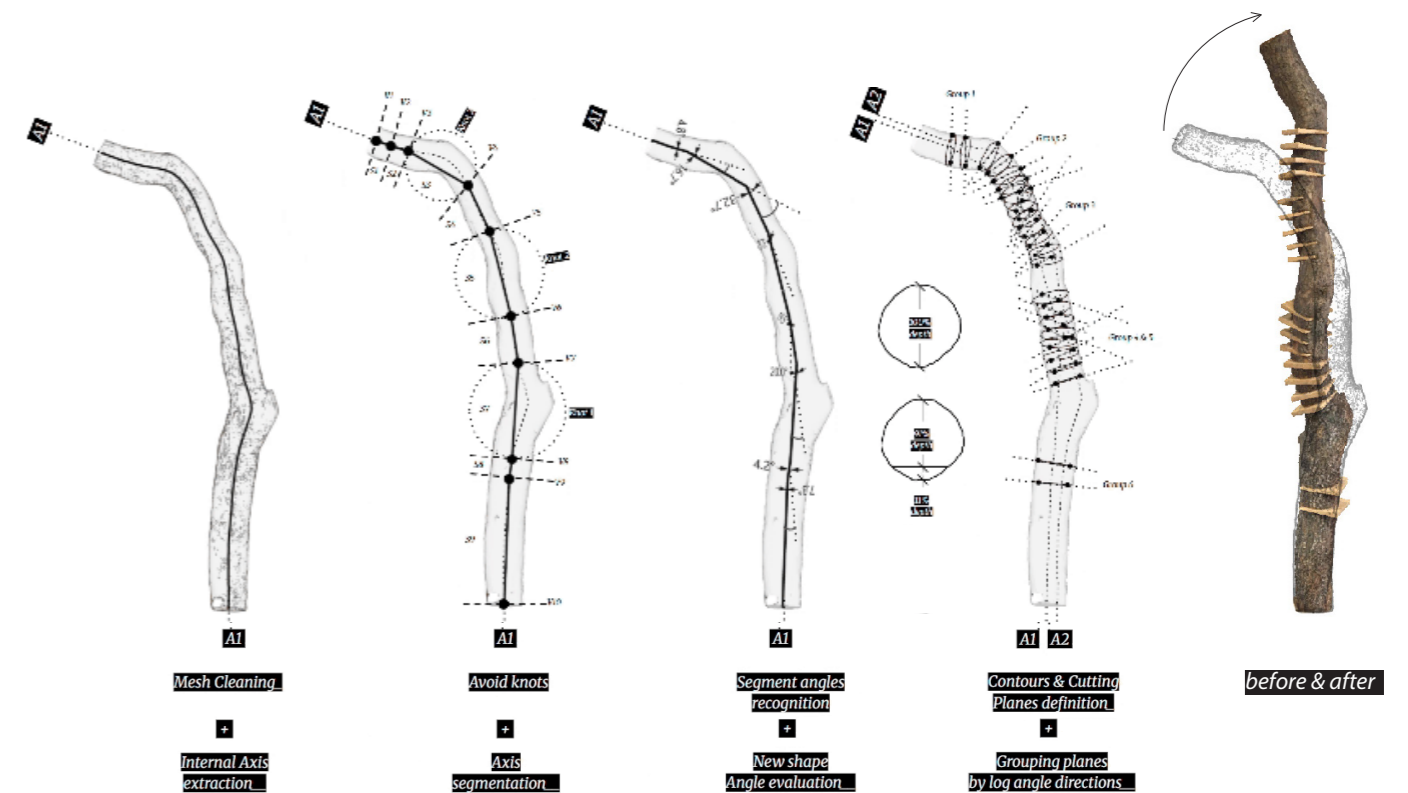


Prototype 1 – To UnLog a Log

Applying kerfing to standardized timber is relatively straightforward, as these elements are straight and homogeneous. After identifying effective kerf and wedge configurations using pine posts, we moved to a more challenging goal: straightening a 1.7-meter irregular oak log.

Natural logs present complex geometries, with varying sections, uneven surfaces, knots, and cracks, making precise cuts difficult with conventional tools.

To address this, we used 3D scanning to capture the exact geometry of the log and a 6-axis industrial robot equipped with a chainsaw to execute the kerfs accurately. This process demonstrates how robot-assisted wedged kerfing can realign irregular timber and unlock new possibilities for non-standard wood in construction.



Prototype 2 - To UnLog a Tree

After testing the method at small scale (pine posts) and medium scale (oak log), we moved to an architectural-scale prototype using a full tree. We selected a 2.8-meter trifurcated oak trunk, found felled and abandoned at Valldaura Labs in Collserola. The goal was to straighten the slightly curved main trunk and align the three branches along a common horizontal line, allowing a beam to rest on them.



Phase 1 - Selection and Scanning

The first step was the digitization of the trunk using Polycam and photogrammetry-based 3D scanning, allowing us to capture its irregular natural geometry. This process generated an accurate digital twin, providing a reliable base for simulation, design, and robotic fabrication.

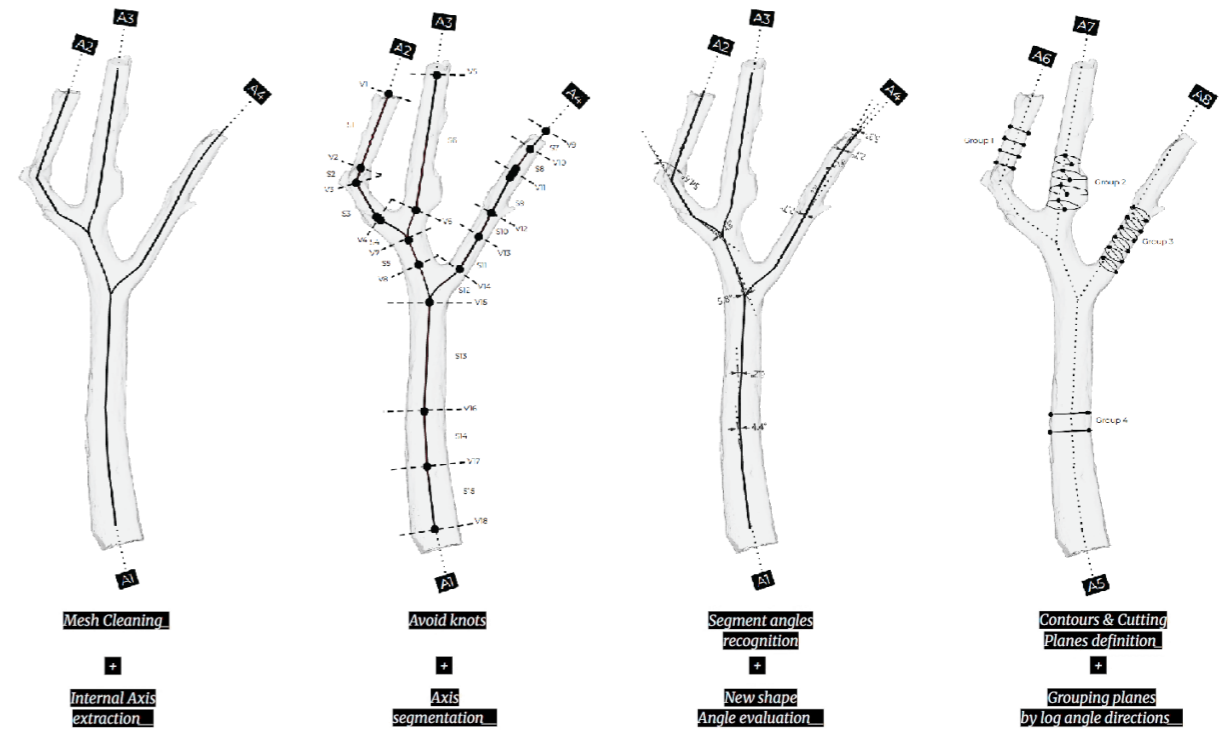


3D scan

Phase 2 - Analysis and Design

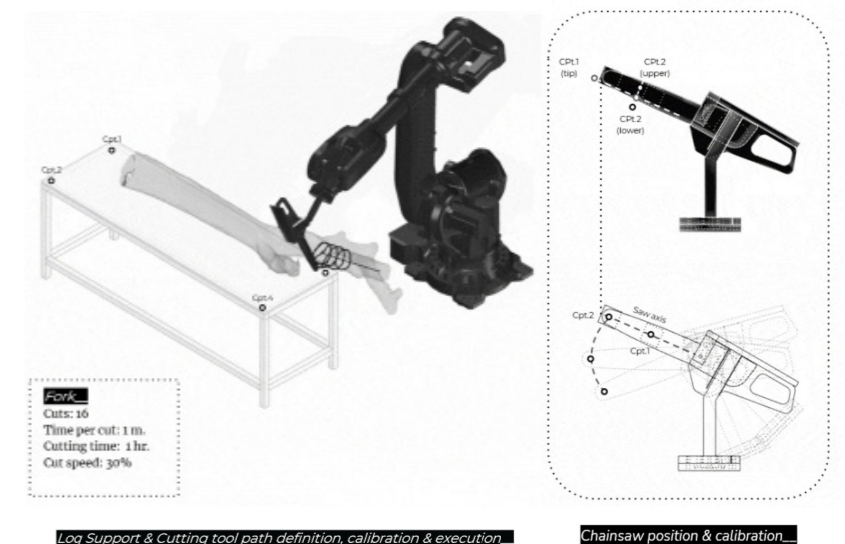
After scanning the trunk, we conducted a series of geometric analyses and design steps: extracting the trunk's central axis, identifying natural nodes and segmentations, and defining the number, position, spacing, and depth of the kerf cuts.

This mapping allowed us to simulate the bending behavior of the trunk before fabrication, ensuring that each transformation aligned with the design and structural intentions



Phase 3 - Robotic Setup and Fabrication

We determined that cutting 85-90% of the trunk's thickness provided the best balance: deep enough to allow bending, but shallow enough to prevent cracks or structural failure. Special attention was given to calibrating the chainsaw mounted on the robotic arm to achieve precise cutting depth, ensuring both structural integrity and controlled deformation of the trunk.



ForK
Cuts: 16
Time per cut: 1 m.
Cutting time: 1 hr.
Cut speed: 30%

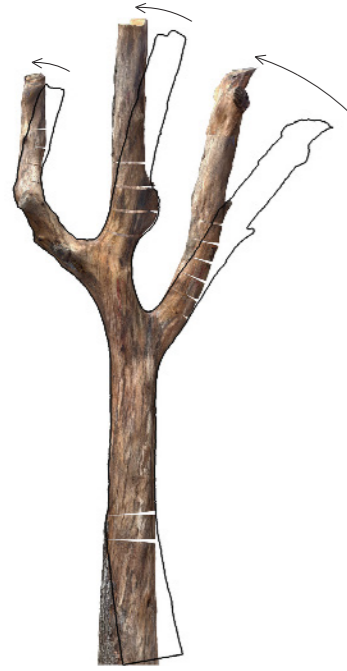
Log Support & Cutting tool path definition, calibration & execution...

Chainsaw position & calibration...

Phase 4 - Wedge Insertion

In the final step, 5° iroko wedges, CNC-milled for precision, were manually inserted into the kerf cuts made by the robot.

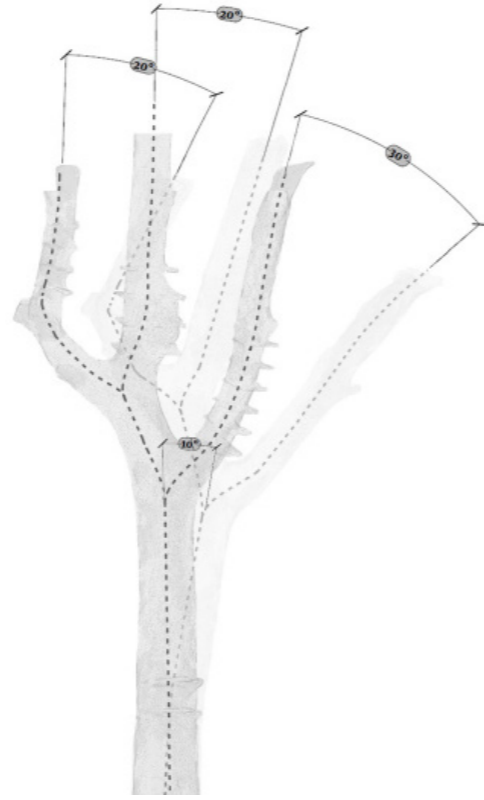
Despite the hardness of the oak, a small team was able to gradually bend and reshape the trunk, transforming its irregular geometry into a controlled structural element.



wedge bending



sistema estructural

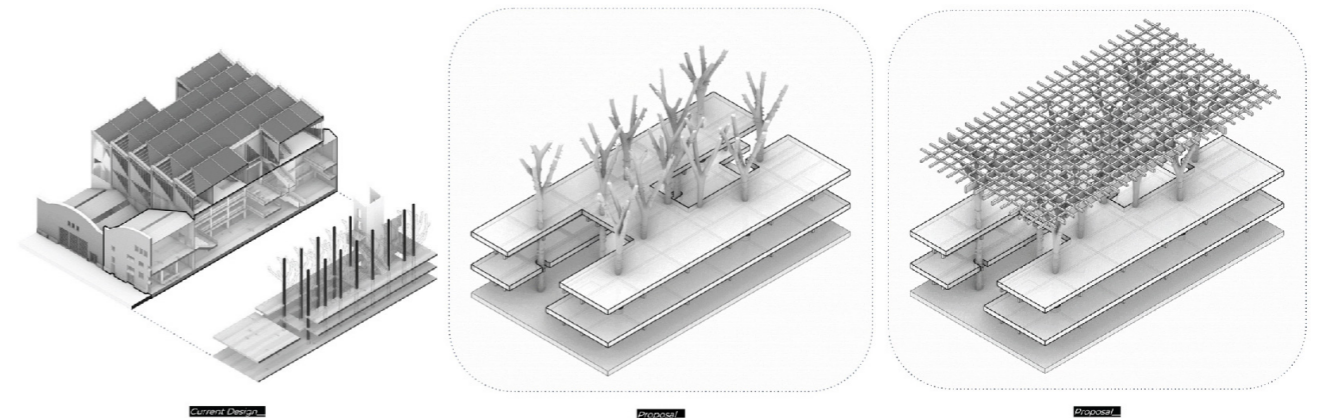


Architectural Application

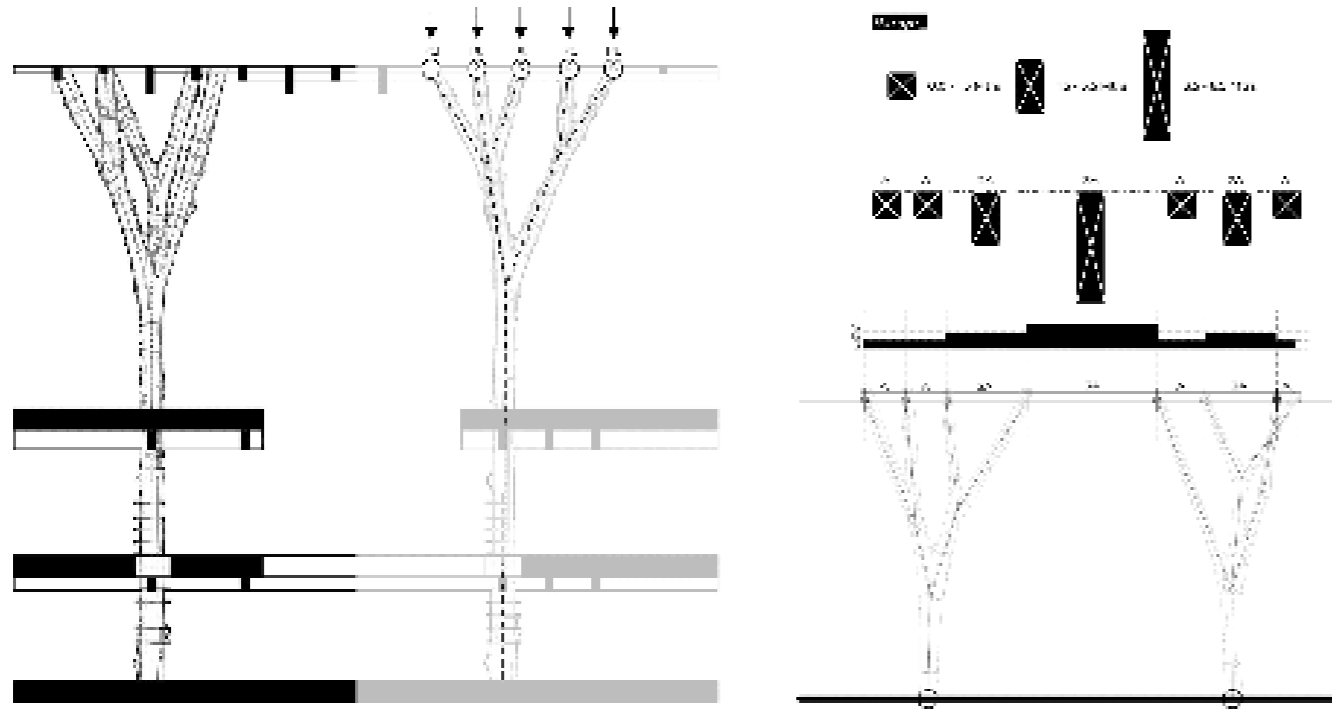
This research explores whether irregular tree trunks can be transformed into unique structural and design elements. Instead of being discarded, the natural geometry of the tree becomes a purposeful, efficient, and expressive structural component. The approach works with the tree's natural form while maintaining the architectural control required to integrate it into a load-bearing structural system.



To demonstrate the research, we developed a speculative architectural intervention within IAAC's new Ávila building, focusing on one of its three-story vertical halls. The proposal introduces a system where reformed tree trunks act as vertical columns, working together with a horizontal structural grid to transfer loads to the ground through the branches and trunk. This intervention illustrates how irregular trees can be realigned and integrated into architectural systems, functioning not just as symbolic elements but as key structural components.



Since the amount of transformation that can be applied to each tree is limited, our design strategy focuses on minimal but targeted interventions. Each tree is modified only as much as needed to connect with specific points of a modular structural grid, which acts both as a load distribution system and as a spatial framework for the design.



By reshaping the trees, we effectively close their geometry, improving their structural performance by increasing compression and reducing tension in the branches and trunk.

While trees are naturally designed to support their own weight, our transformation redirects forces more vertically, enabling them to transfer external loads to the ground more efficiently.



More info here



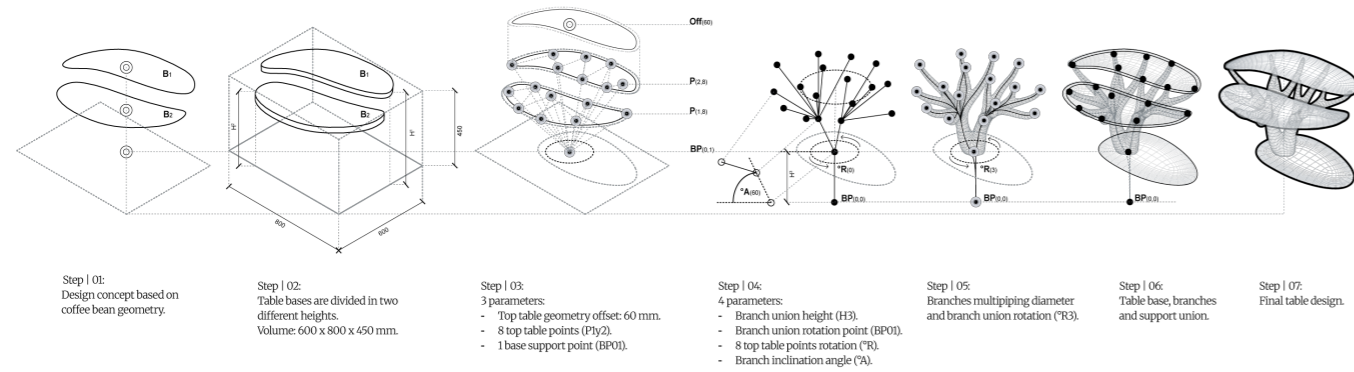
Project Video here



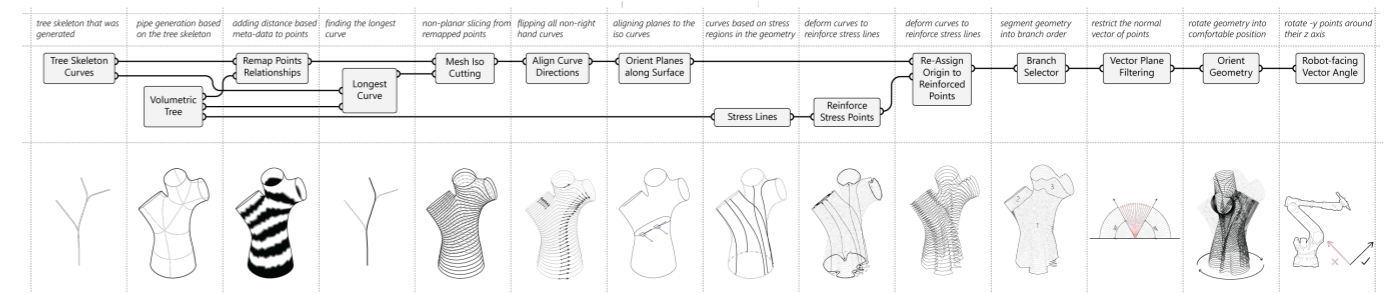
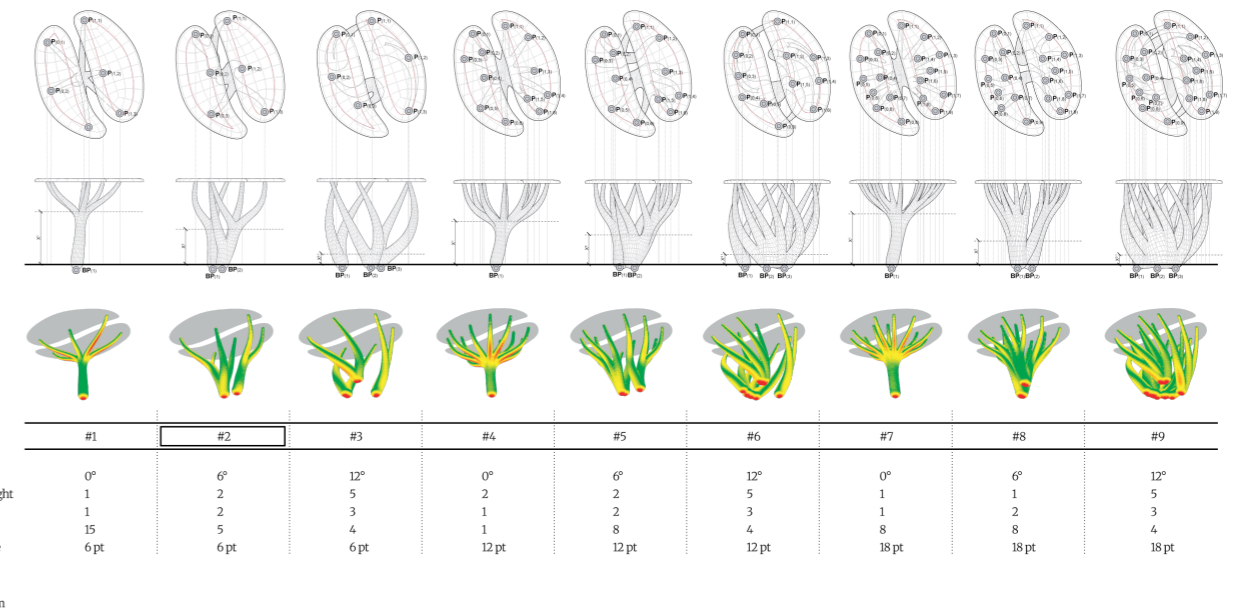
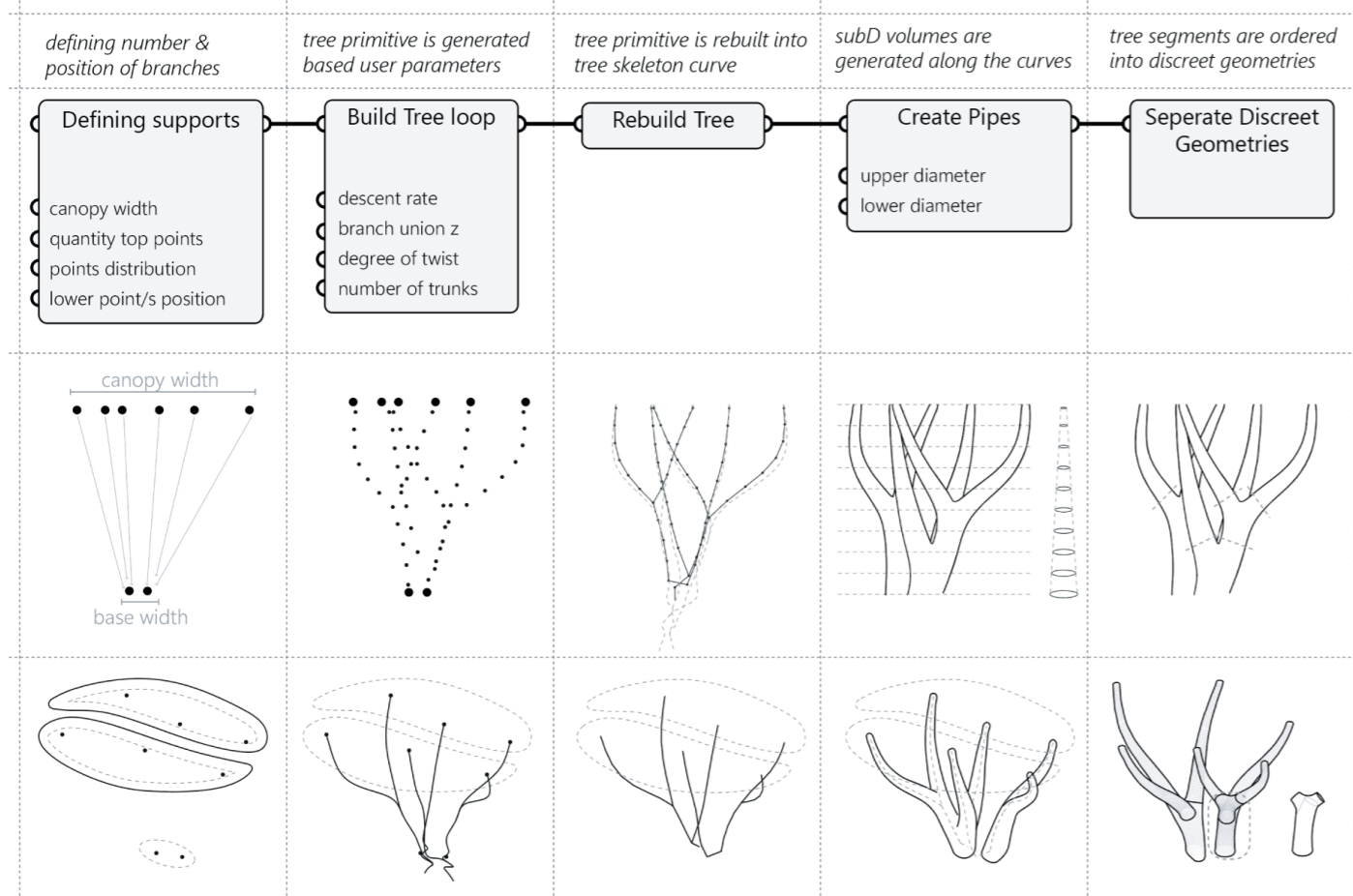
Our investigation takes place against the backdrop of rapidly growing trends towards computational design tools and advanced construction methodologies. This investigation forms part of a 1 week workshop which focusses on additive manufacturing of biomaterials. In particular our investigation builds on the research that was done in April 2024 at laac on non-planar 3D printing of cork. We aim to go further and test the potential of cork for large scale non-planar printing, our goal height being 450mm. Our initial goal was to see if it would be possible to produce a coffee table in this manner.



The mixture consists of aggregate, binders/thickeners, a pH controller, and a solvent. Cork acts as the main structural aggregate. Gelatin, pectin, and xanthan increase viscosity so the paste holds its shape during printing, while pectin helps bond layers. Microbial growth is controlled by adjusting the pH away from neutral using bicarbonate. Distilled water is used as the solvent to avoid mineral interactions.

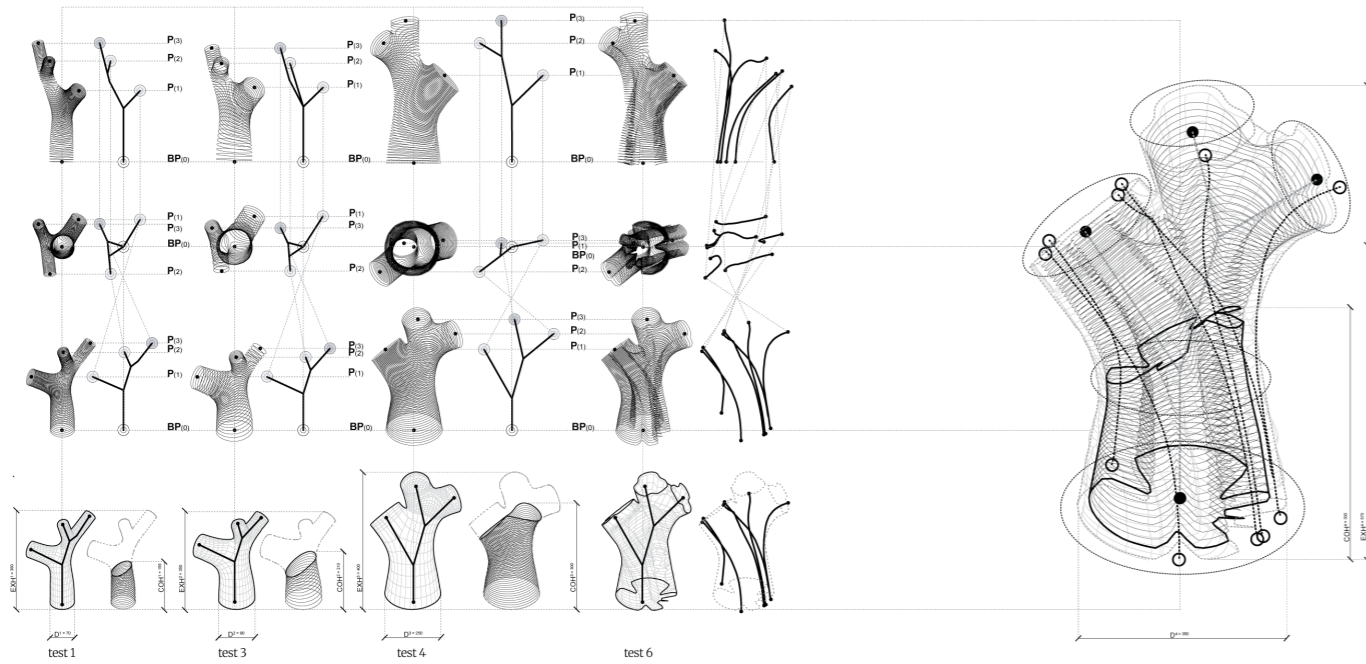


Our design concept plays with the idea of a “coffee table”, taking the shape of a coffee bean as the plan form. Using the natural hemispherical division of the bean, the table was split into two separate tabletops connected to the base through thin, branch-like supports. The geometry was generated from a 3D branching skeleton, from which the final volumetric form was created. Similar to topology optimization, this approach is generative, but it allowed us greater control to align the design with material constraints. This strategy also enabled rapid iteration and prototyping, integrating form generation with the printing and slicing logic.



To define the optimal design, we adopted an iterative strategy, generating nine variations with different controlled parameters and selecting the best-performing option from these iterations. Our slicing and toolpath strategy was directly linked to the branching skeleton curves and the pipe geometry used for form generation. This allowed the toolpaths to adapt dynamically to any changes in the tree structure. Additionally, the toolpath script included three dedicated components designed to create smoother and safer robot movements, helping to reduce collisions between the tool and the robotic arm.





We faced several limitations when using Grasshopper to control the robotic arm, with much of the time spent resolving tool collisions.

While we developed strategies to adjust the toolpath and improve robot movement, these relied on manual parameter adjustments.

Improved robot feedback systems and a smaller extruder could significantly reduce these issues. As a material, cork shows strong potential for 3D printing due to its viscosity and tackiness, which allow steeper printing angles than materials like clay or concrete.

However, its low structural strength in the wet state limited our prints to about 200 mm before deformation. Future research should focus on improving the material's strength during printing and accelerating its drying process.

Overall, cork presents promising opportunities for non-planar 3D printing, with clear potential for further development.



More info here





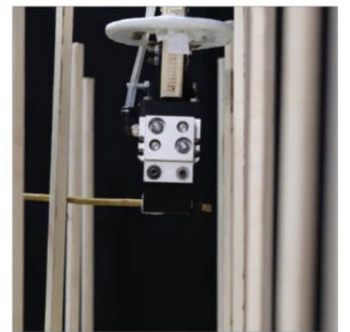
Willow weaving is a construction technique dating back over 14,000 years. Despite its age, it is still practiced today in largely the same way. Recent research at the Karlsruhe Institute of Technology (KIT) has explored its integration into modern construction through composite willow-earth elements fabricated with CNC processes. Building on this work, our research investigates how a 6-axis industrial robotic arm can expand the possibilities of robotic willow weaving and open new directions for architectural fabrication.



Traditional Weaving



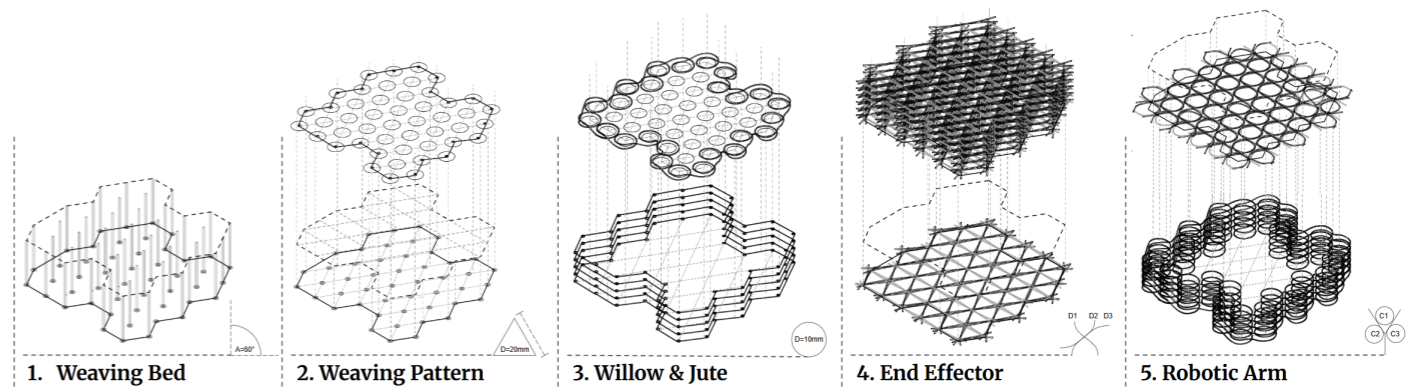
CNC Weaving



Robotic Weaving

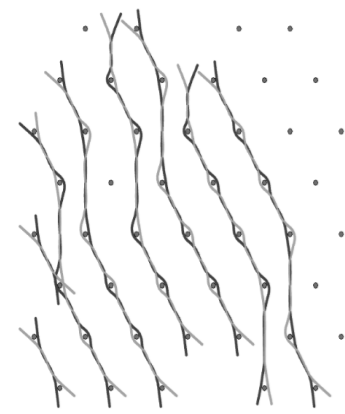
The fabrication of a willow module is defined by five key parameters. The weaving bed acts as the structural grid that constrains and guides the weaving process. The weaving pattern determines the placement of the material and directly influences both the structural performance and the visual character of the module.

The material properties of willow branches and jute yarn also play a key role, particularly the flexibility and bending limits of the branches during weaving. The end-effector is responsible for picking and placing the willow elements and depositing the jute used to secure them. Finally, the 6-axis robotic arm performs the weaving operation, manipulating the materials in space and executing the toolpaths required to assemble the module.

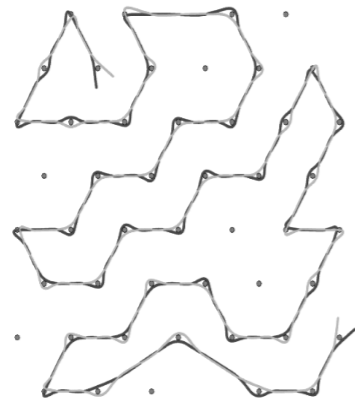


We explored three computational strategies to generate weaving patterns: discrete vectors, Hamiltonian paths, and shortest-path branching systems. The discrete vector approach was selected for its structural potential, but tests revealed that some branches lacked tension, highlighting that stable willow weaving requires three aligned constraint points.

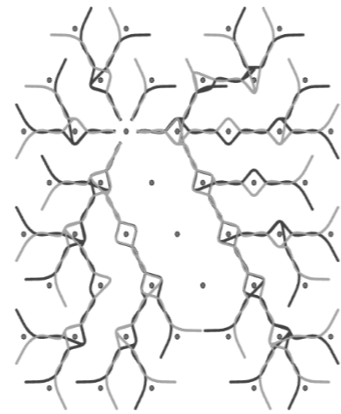
Based on this insight, we developed a manual weaving strategy and generated custom toolpaths that better responded to the grid constraints. This approach produced results that aligned more closely with the simulations and improved the stability of the weave.



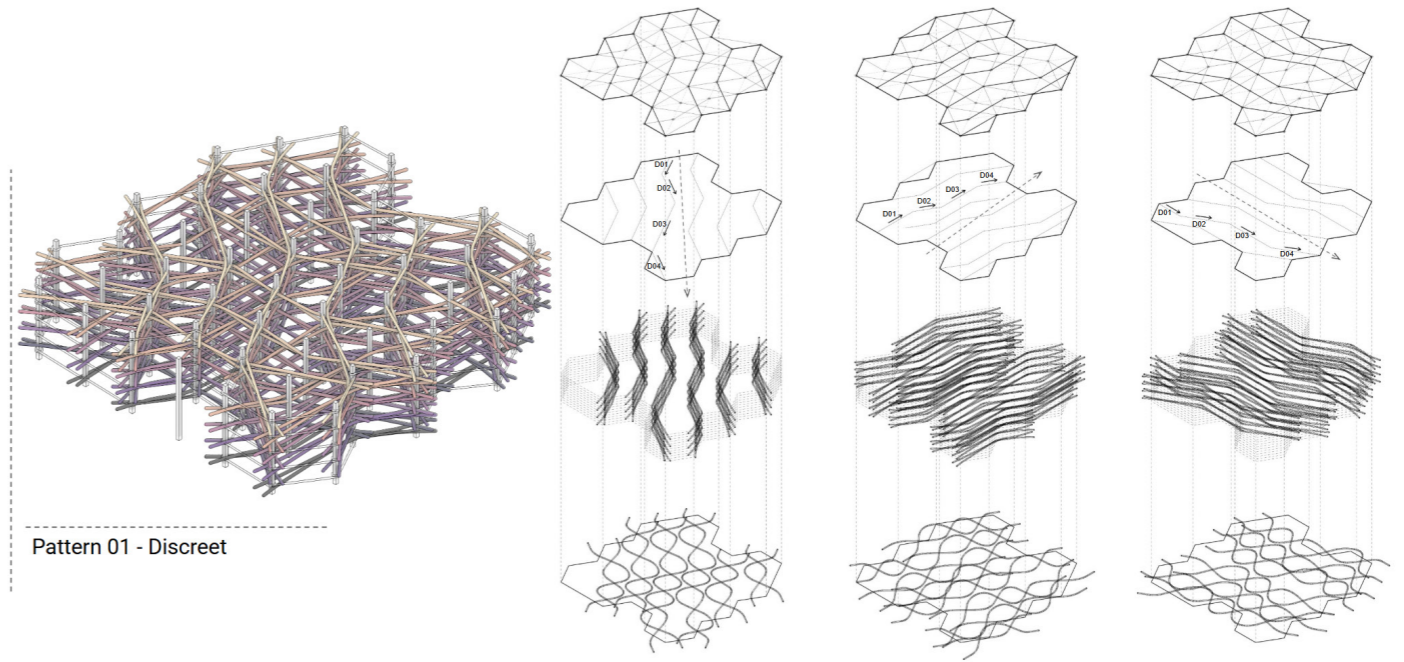
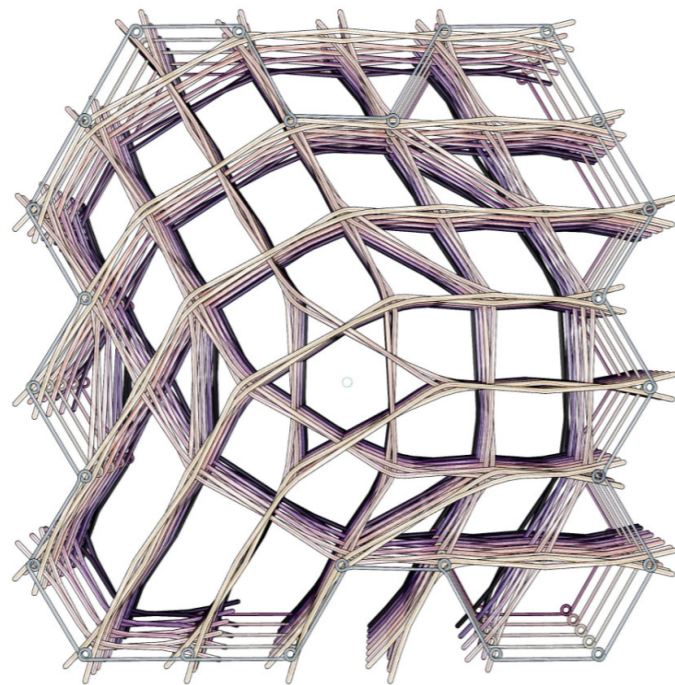
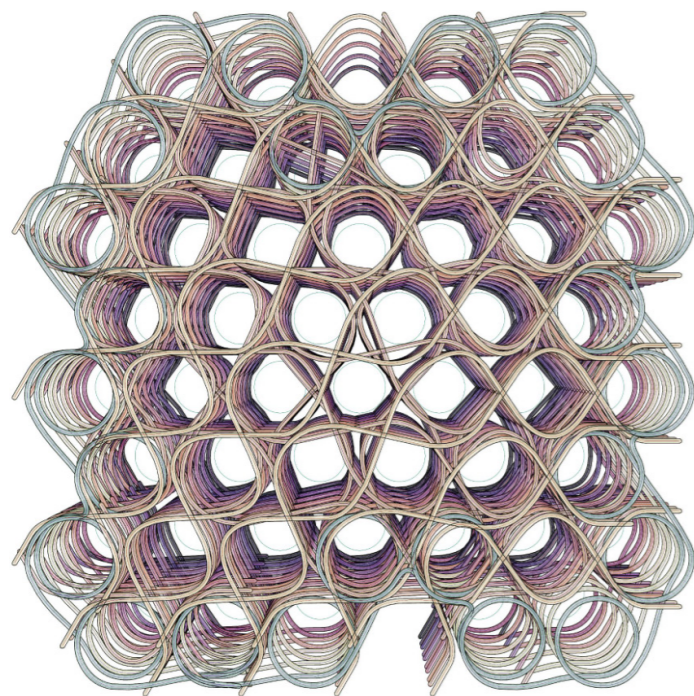
Discreet Vectors



Hamiltonian Path



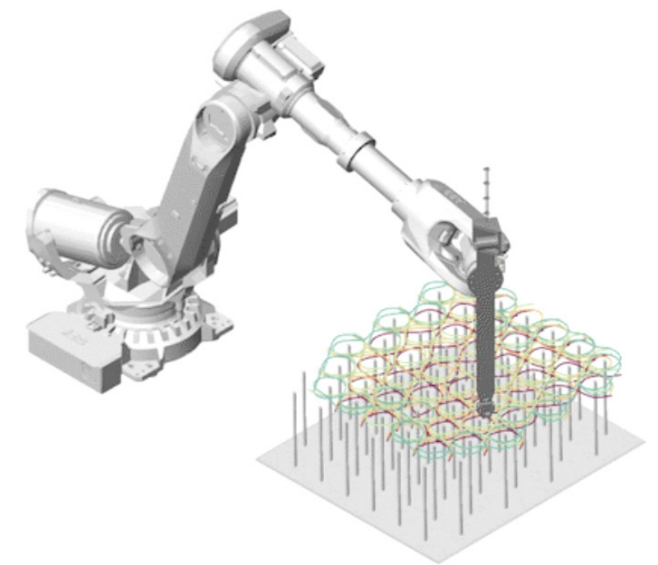
Shortest Path



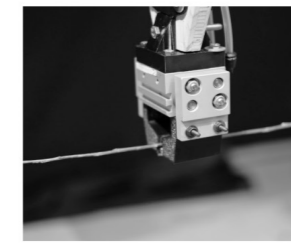
Pattern 01 - Discreet

This simulation illustrates the robot's toolpath and the sequence of layers that form the woven module. Each layer is individually simple, following a defined path across the weaving grid.

When combined, however, these layers interlock to create a dense and structurally coherent lattice. The accumulation of repeated weaving operations generates a complex spatial pattern, where the interaction between layers contributes to both the strength and the overall geometry of the module.



Weaving Bed



Pick & Place Willow



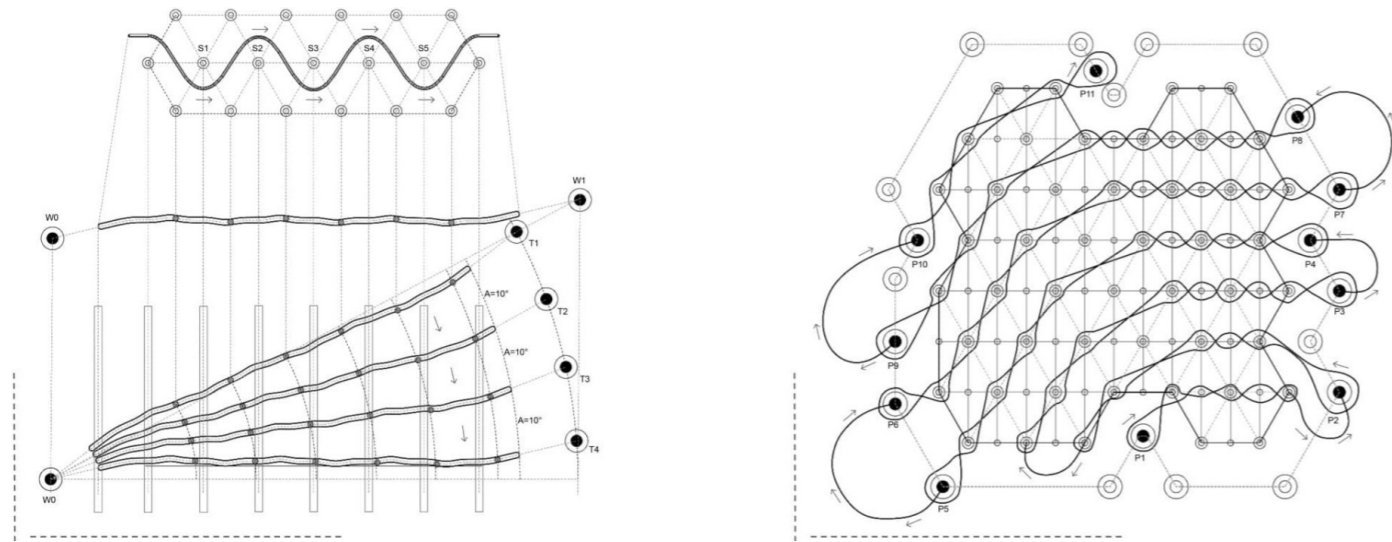
Jute Perimeter



Build Up Multiple Layers

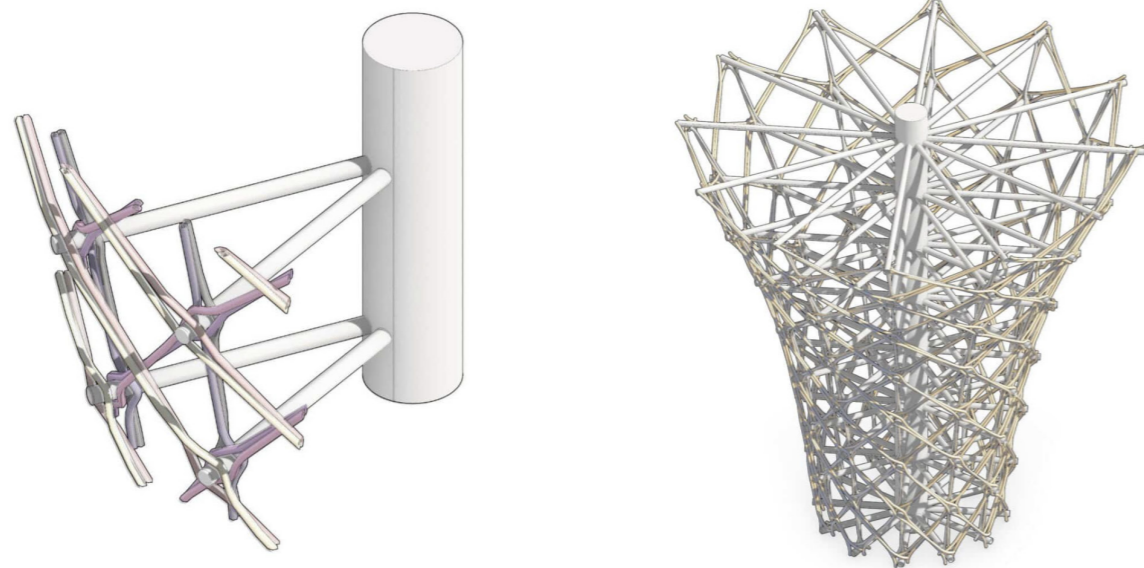
One of the main challenges was designing a toolpath that could weave the willow while minimizing stress on the branches to prevent breakage, while also avoiding collisions with the poles of the weaving grid. This proved difficult to resolve effectively.

In future iterations, a pick-and-place strategy using a swishing motion could be more suitable, allowing the robot to weave the branches around the grid without positioning the end-effector between the poles. This approach could reduce stress on the material and simplify the robotic movement.

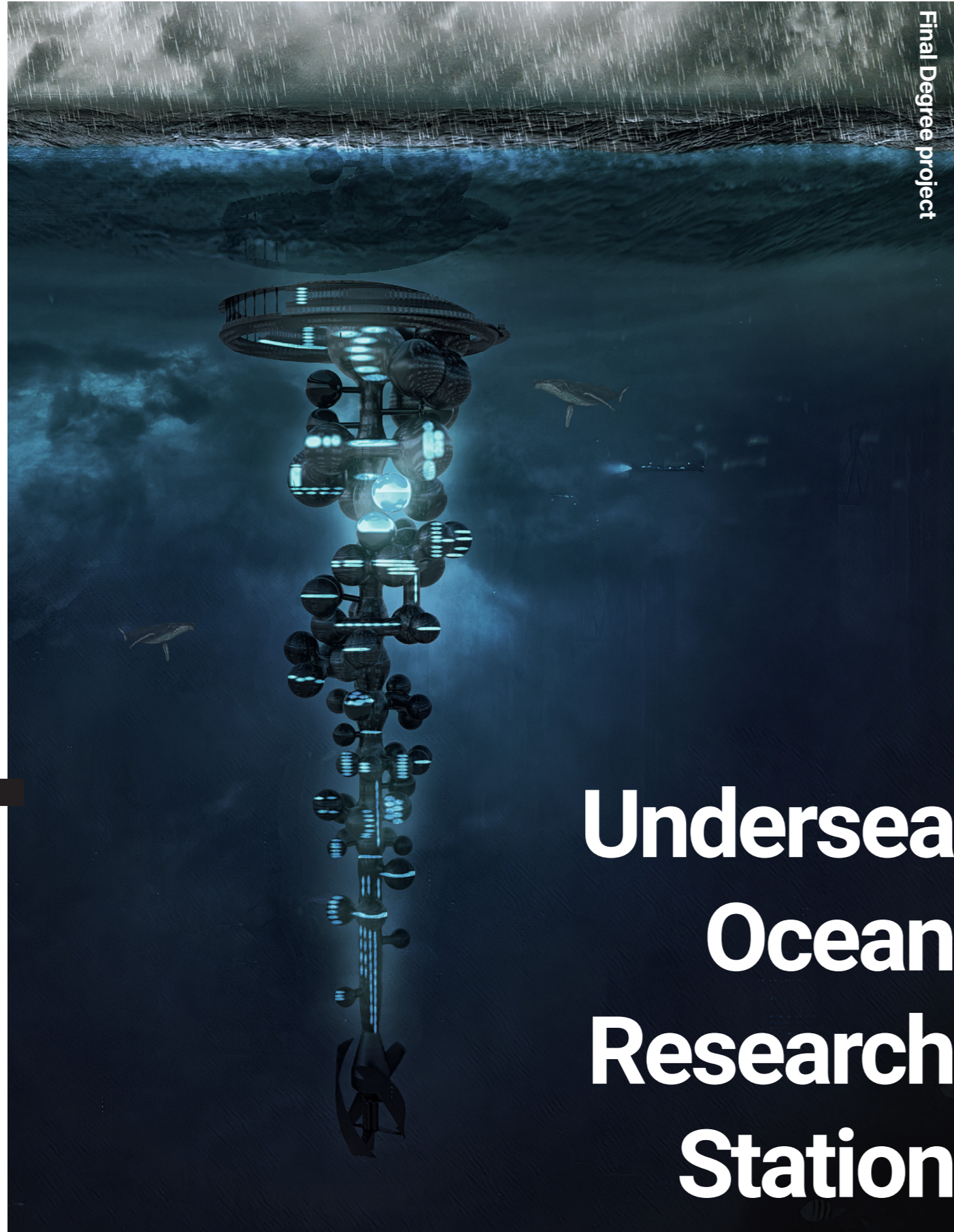


In terms of future applications, we believe robotic willow weaving should take advantage of the six degrees of freedom offered by industrial robotic arms. Rather than replicating planar weaving methods, the technology has the potential to explore non-planar weaving geometries.

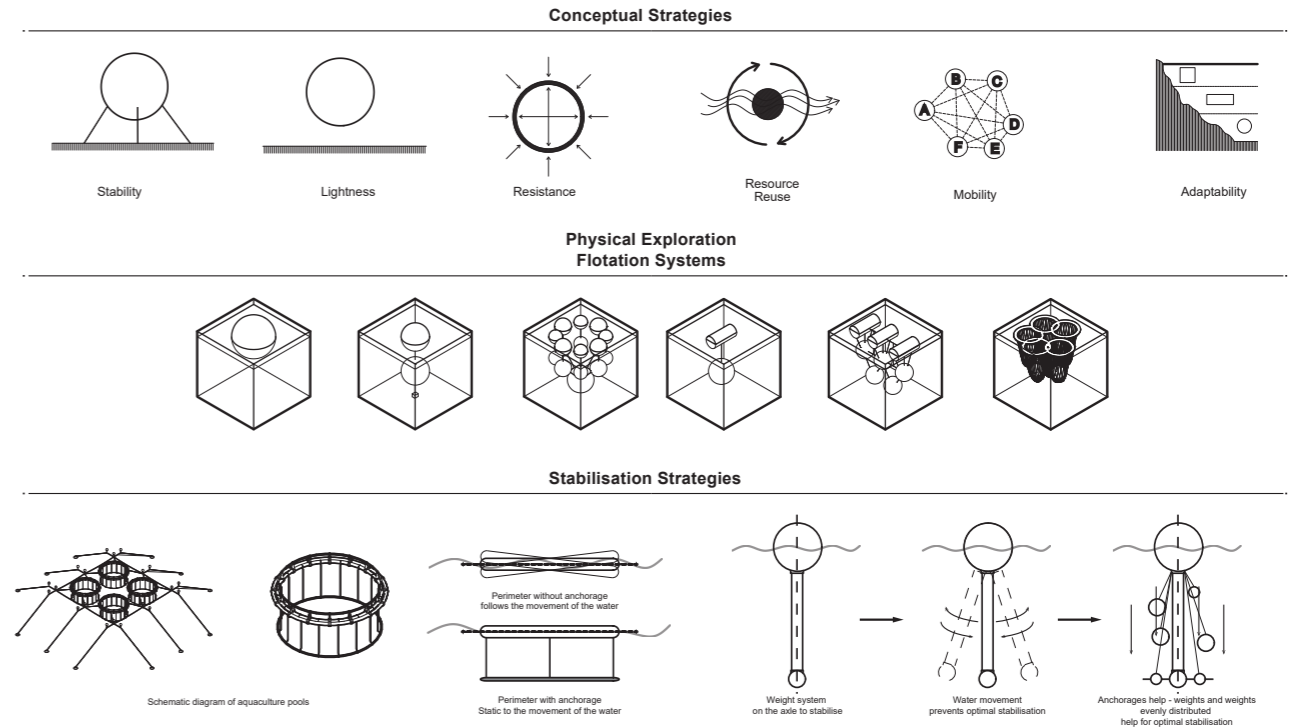
This approach could build on the weaving bed strategy developed by KIT while leveraging the spatial capabilities of robotic fabrication to create more complex woven structures.



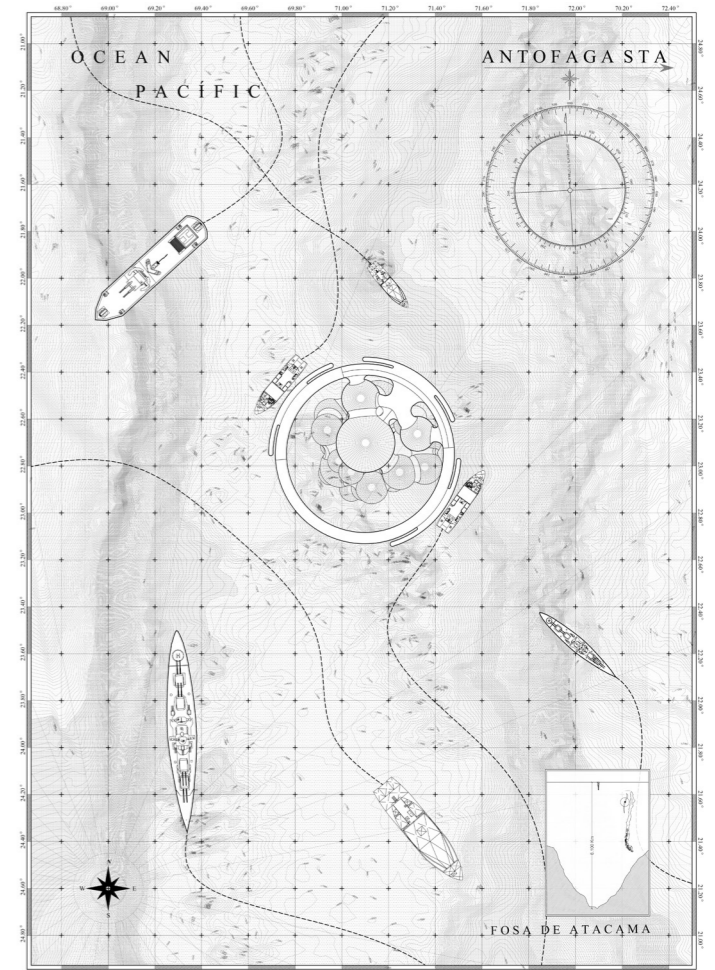
[More info here](#)

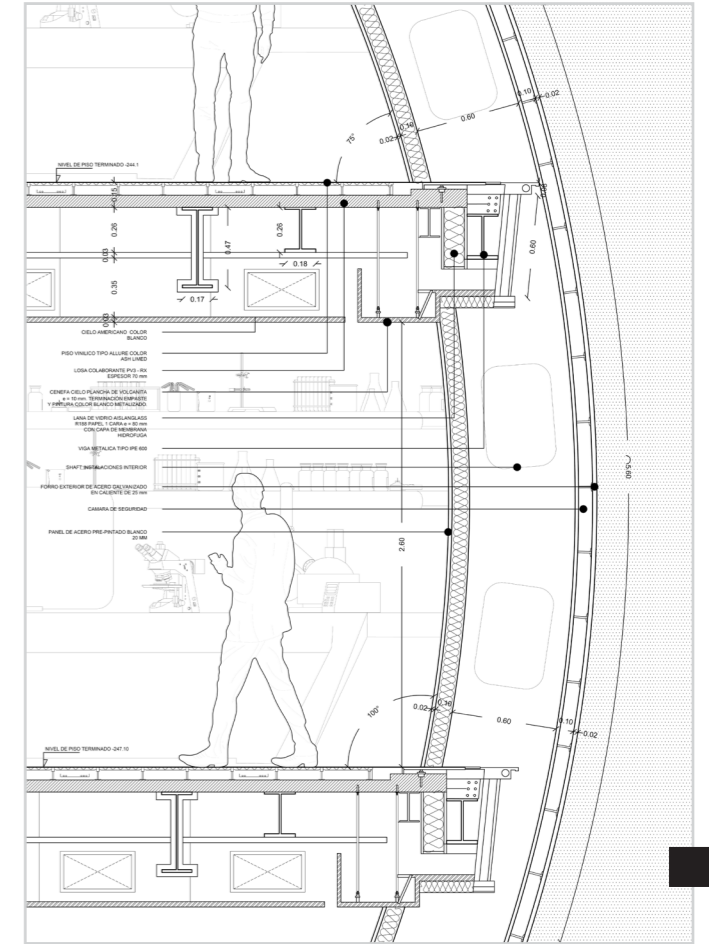
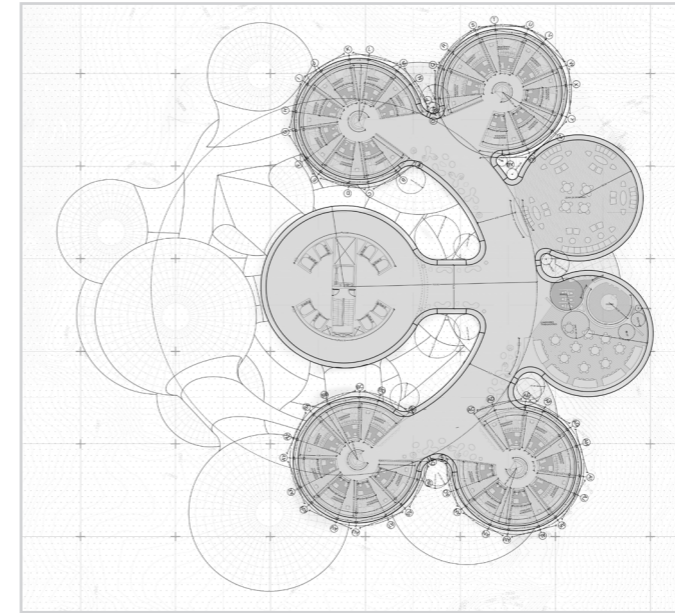
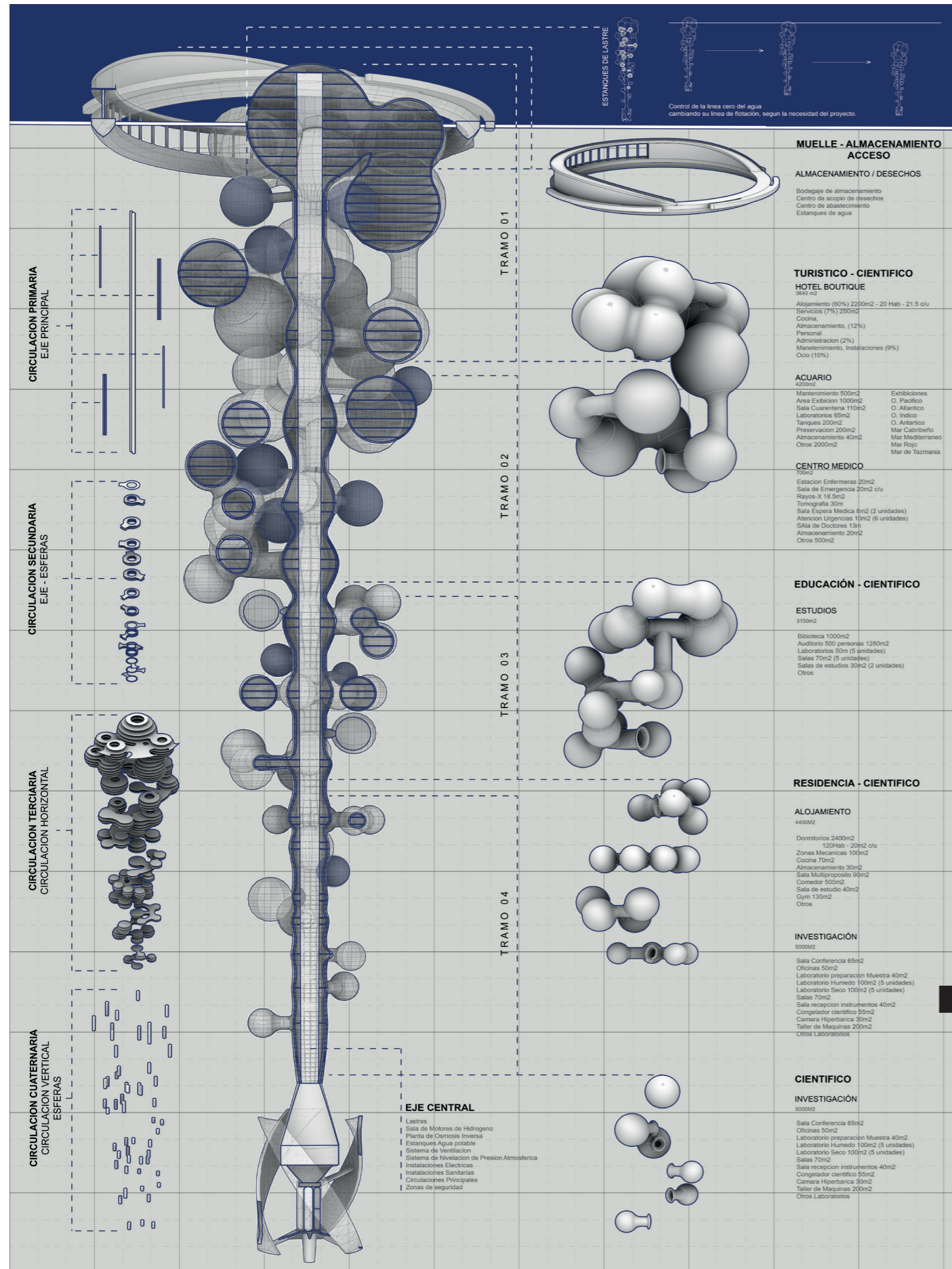


Undersea Ocean Research Station



Is it feasible to live underwater in the ocean? How can architecture contribute to colonising this vast ocean that covers 70% of the Earth? In this project, we explore the possibility of designing architectural structures that allow life in the ocean depths, considering the eventuality of inhabiting the oceans in the future. We only know 5% of the oceans, while we have a more excellent knowledge of the Moon and Mars. Therefore, the project focuses on establishing an underwater research station to study and better understand the ocean and its natural phenomena.





This project is based on detailed studies of architectural forms, anchoring systems, flotation, and other relevant aspects to create a habitable environment in a place where human life would be challenging. We aim to develop a base that prioritizes scientific research but also considers its occupants' comfort and habitability needs. This station will not only serve as a platform for studying the ocean but also as a crucial step towards a deeper understanding of our marine environment and its potential applications for the future of humanity.



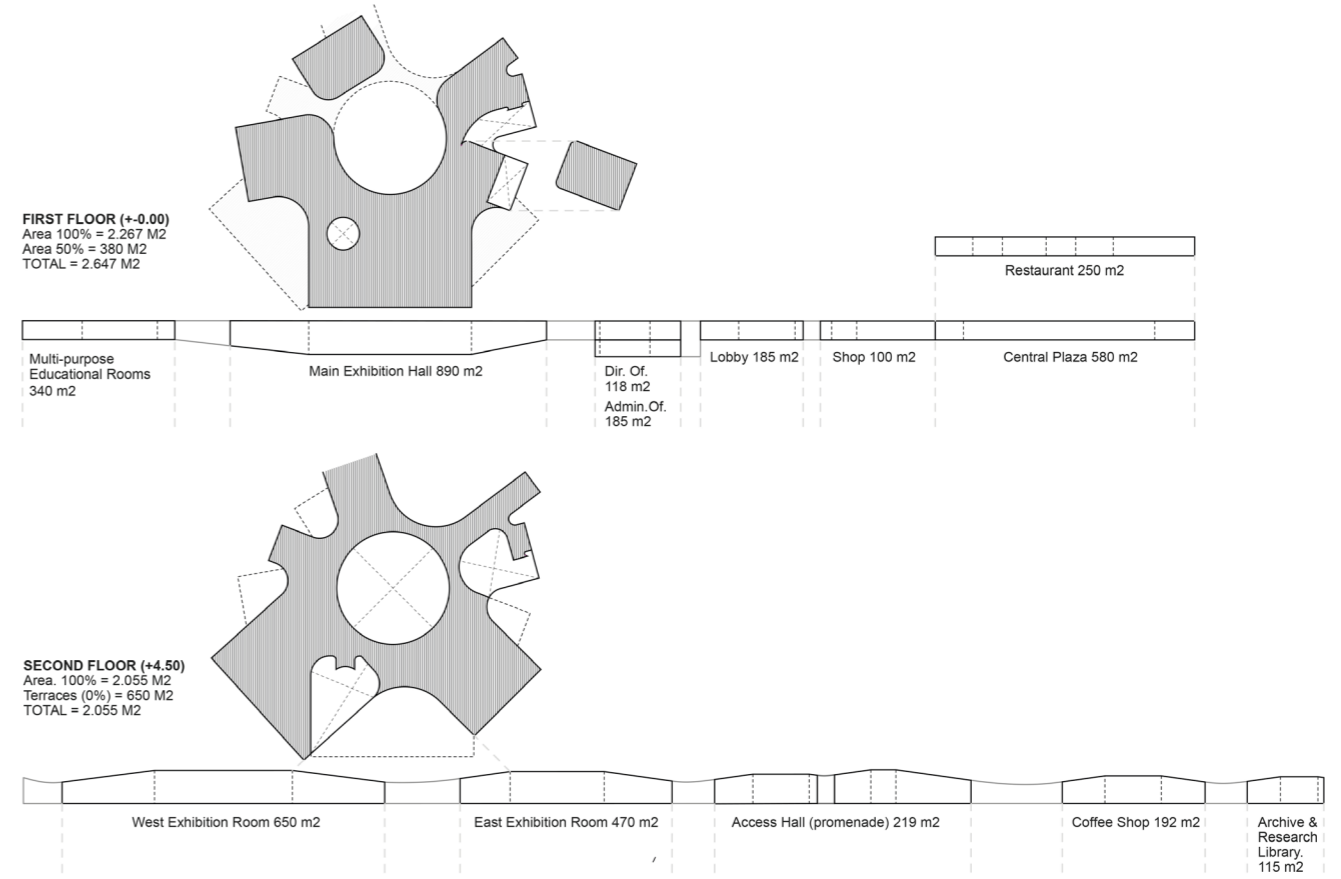
NuMu Vitacura Museum

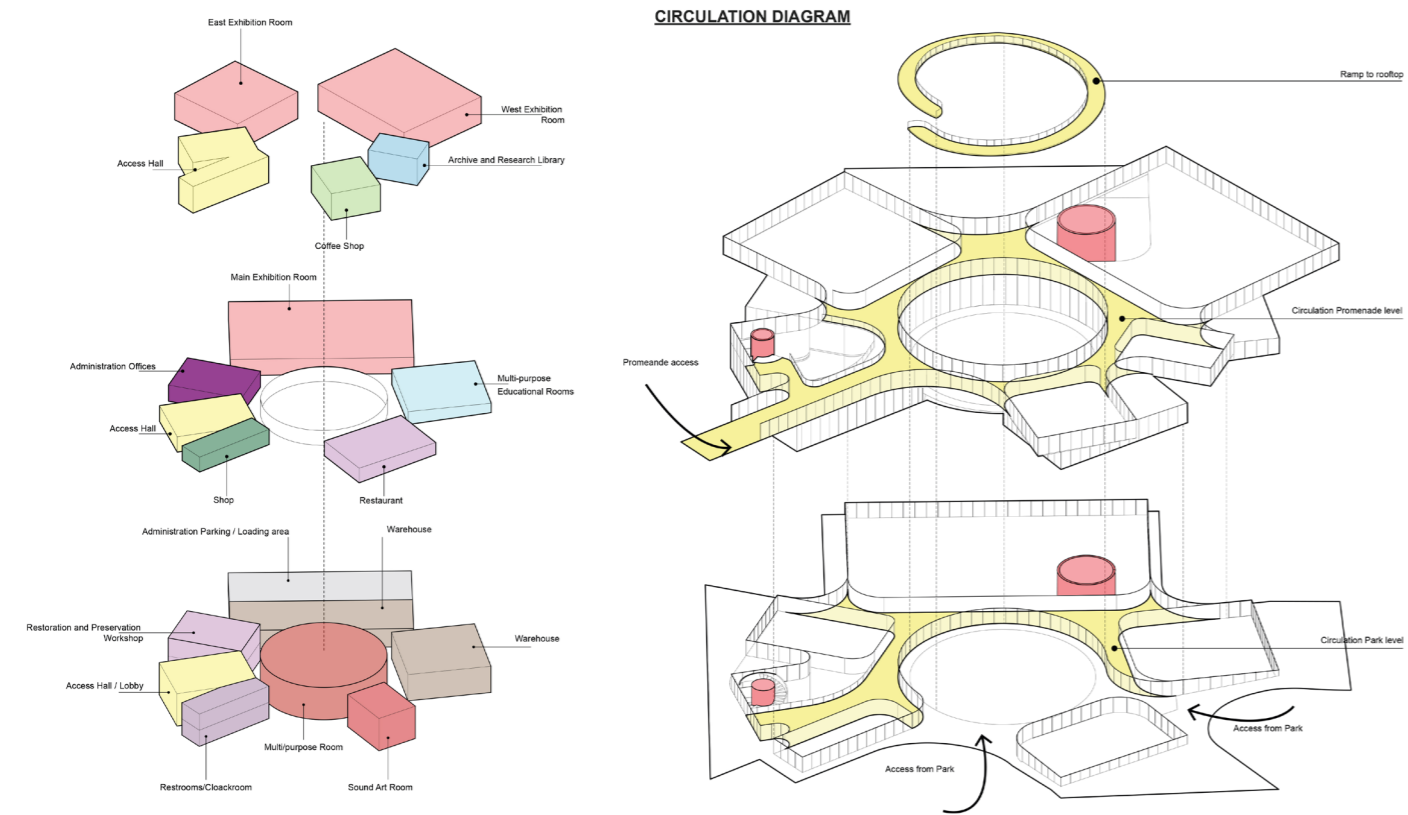
BASE Studio | ValleCornejo Architects

Colaborator Architect

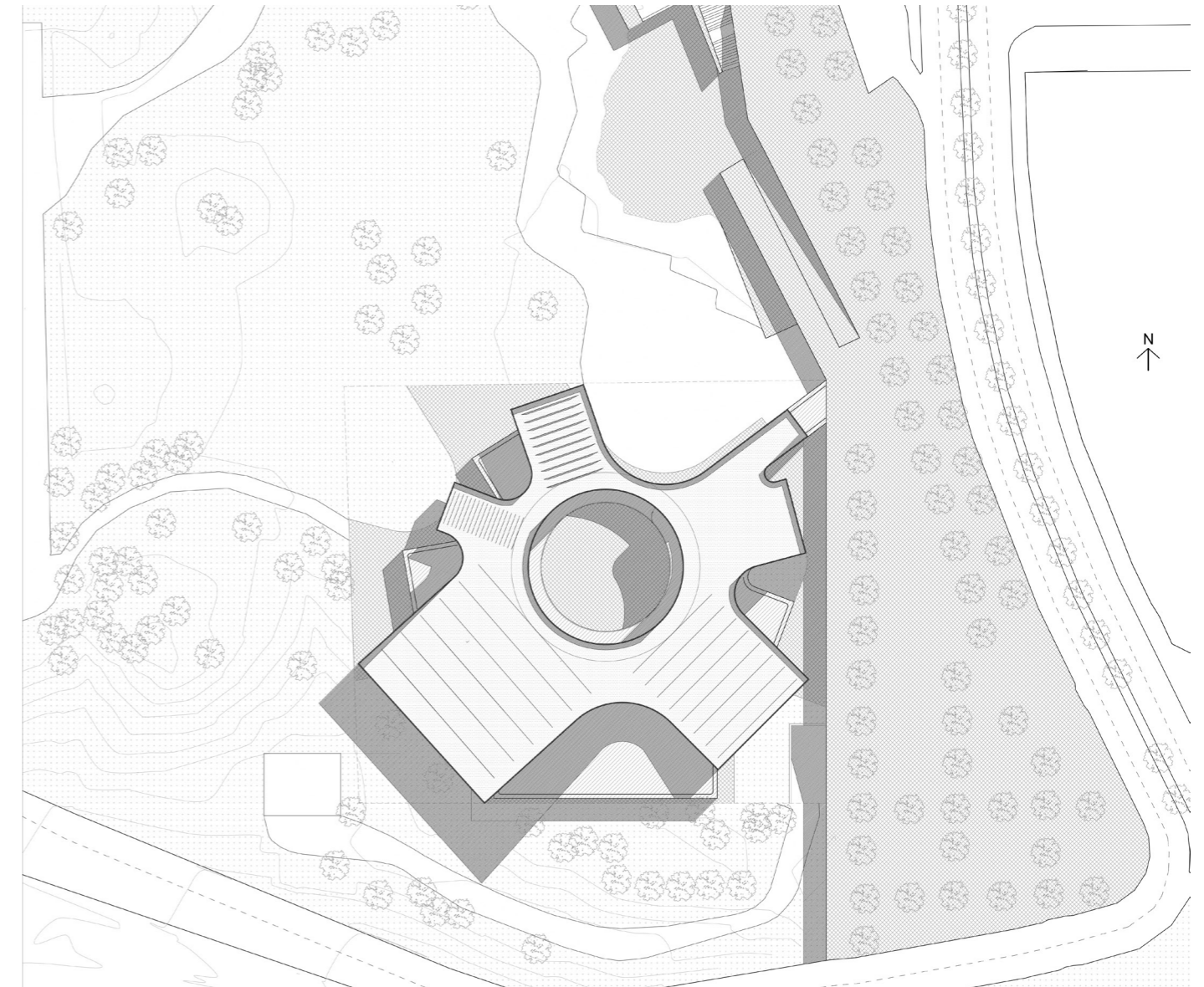
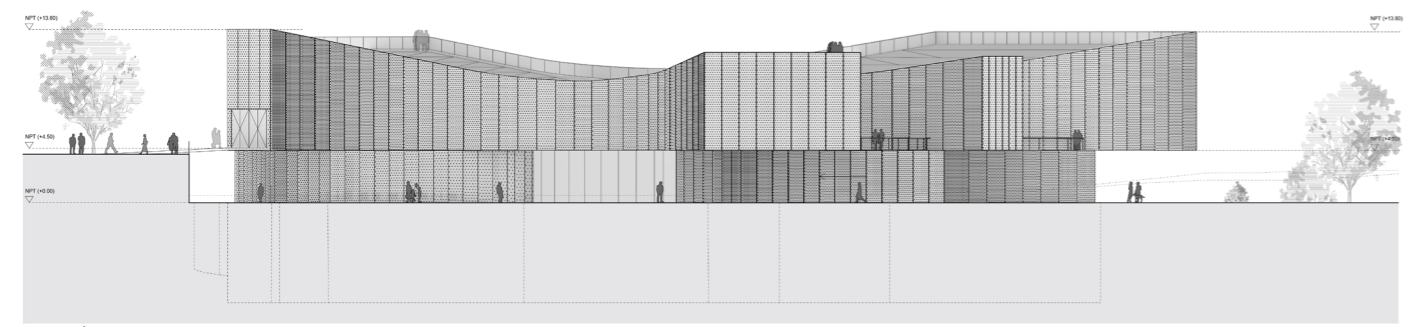
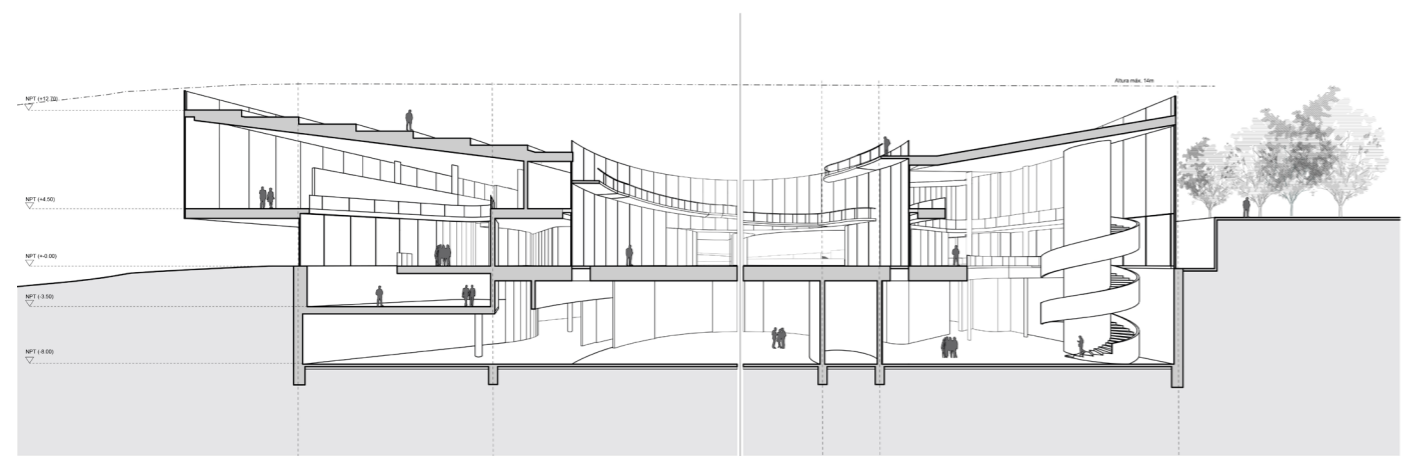
The three-level building is conceptualized as an architectural masterpiece, seamlessly blending practicality with aesthetics to create an environment that transcends mere functionality. Its design ethos revolves around fostering a symbiotic relationship between the various programs housed within and the natural landscape enveloping it. Central to this concept is the strategic placement of a central courtyard, serving as a spatial nucleus and a

conduit for seamlessly integrating the interior spaces with the surrounding environment. This deliberate design choice promotes operational autonomy for each programmatic element. It nurtures a profound connection with the outdoors, affording inhabitants and visitors breathtaking panoramic vistas and direct access to nature's embrace.





The facade is conceived as a dynamic canvas, employing an innovative interplay of translucent and transparent panels to dissolve boundaries between interior and exterior realms. This architectural feature imbues the structure with transparency and openness. It serves as a visual testament to the project's commitment to community engagement and knowledge dissemination.



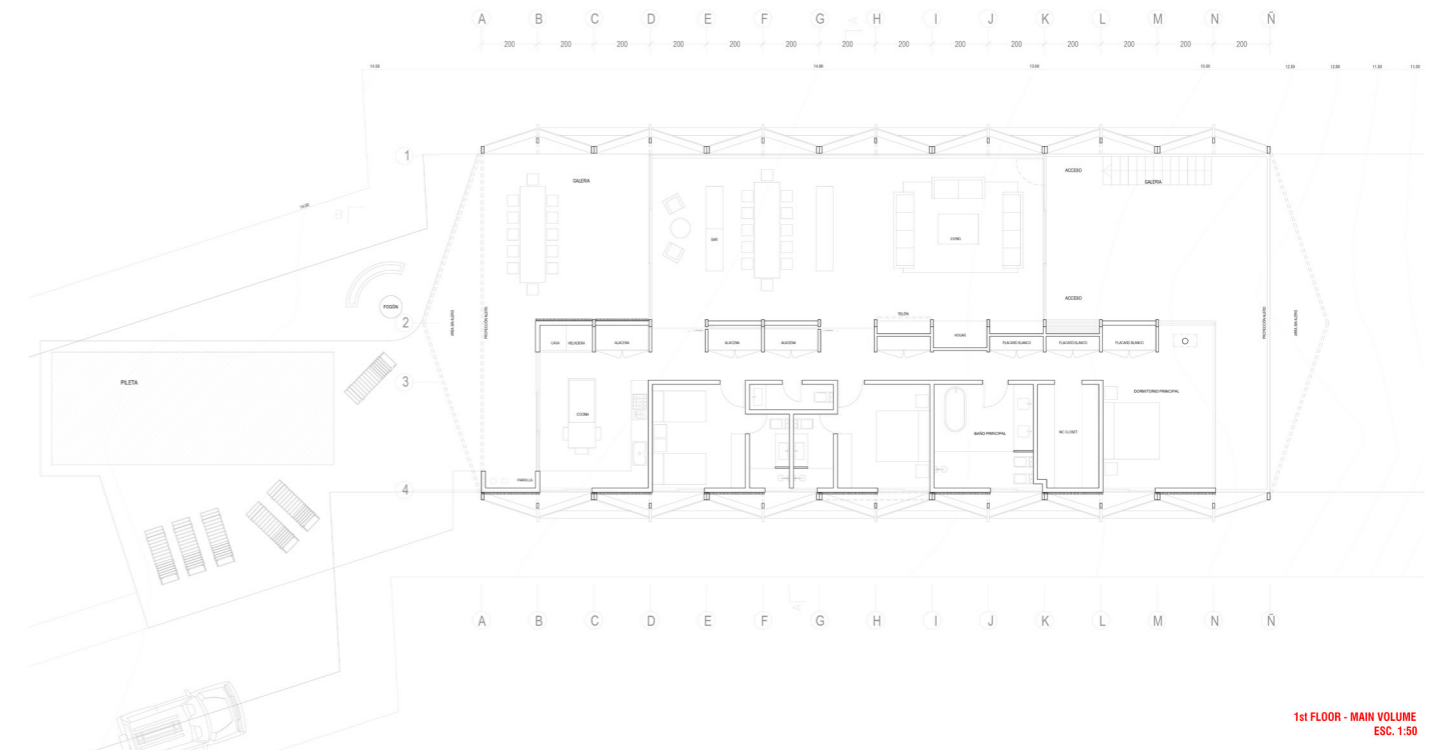
— La Brisa House

Felipe Assadi Architects - Carolina Pedroni Architects
Senior Architect

José Ignacio, Uruguay



Private Project



1st FLOOR - MAIN VOLUME
ESC. 1:50



Construction year - 2022-2023

Located in José Ignacio, Uruguay, this house stands out for its innovative use of wood in its design and construction. Wooden trusses form the roof structure and the walls, providing an efficient and visually distinctive construction system.

This sustainable and creative architectural approach enhances the overall atmosphere of the house by providing a cosy feeling and a connection with the natural environment. Using wood as the primary material ensures environmental responsibility while adding character and charm to the living spaces. The natural textures of the wood create a sense of harmony with the coastal surroundings, offering a serene retreat where one can appreciate the beauty of the marine landscape.

Trilco House

Felipe Assadi Architects
Senior Architect

Trilco, Vichuquen, Chile



Construction year - 2024-2025

The house in Trilco, Vichuquen, unfolds in five wings that open towards the coastal cliffs, maximizing views and natural light. With a transparent design prioritizing natural illumination, a central hearth acts as a focal point and organizing element. A seamless fusion of functionality and connection with nature





— Padre

■ Correa Kitchen remodelling

Lekker Desing and Furniture
Associated Architect - Project Manager

The kitchen remodelling project aims to seamlessly integrate it with the apartment while maximizing natural light through strategically placed mirrors and glass cabinets. The design creates an elegant and understated atmosphere, perfect for bringing cooking enthusiasts together. With a careful selection of materials and details, the project promises to deliver a cosy and sophisticated space for culinary enjoyment.



Thank you.

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