

EPFL IBOIS

studio Weinand 2023-24
Wood as a resource,
from territory to material
ép. I : the round wood



The IBOIS laboratory, directed by Professor Yves Weinand, is dedicated to research into innovation in wood construction. Wood is both a renewable and recyclable resource, and today it plays a major role in the construction sector.

The research carried out by the IBOIS laboratory focuses on two main areas: wood-wood assembly, with minimal use of other materials, and digitization, applied throughout the production chain, from design to completion.

The aim of this research is to use digital tools to develop and deliver innovative and competitive timber construction solutions in the contemporary construction sector.



Theme : wood as a resource, from land to material

By using a renewable and recyclable resource, timber construction has a better energy balance than other materials such as concrete or metal. However, a number of factors influence this calculation, casting doubt on the environmental virtues of contemporary timber construction.

The first issue is the geographical origin and the route taken by the primary resource in supplying the construction sector. In addition to the distance between the place where the tree grows and the place where it is harvested, each transformation involves a displacement that further increases the carbon footprint of the finished product. The entire production and processing chain therefore needs to be examined in order to reduce the environmental impact of timber construction.

The second issue is yield. The industrialization of the timber industry has also had the effect of imposing morphological criteria on timber supply. As a result, by favoring the straightest, largest-diameter trunks, a whole part of forest production whose geometry does not fit in with machining standards is not profitable, as it is often thinned to encourage the growth of the selected elements. What's more, in most felling processes, only a targeted part of the tree is required for the finished product, further increasing the proportion of non-valued wood.

Acting on these different factors requires us to question the geographical origin of the resource, the quality of forestry operations and also the character of the tree itself as an entity. Where does the wood used come from? How far has it travelled from being felled to being used on a building site? What transformations has it undergone?

Once this information has been identified, how can we intervene in the production chain? How can we reduce both the number of interventions and the number of kilometers travelled? What kind of architecture, and to what extent, could use a material that is as close as possible to its raw state?



Image : IBOIS, abbattage en forêt, Rossinière, 2011.

After several years working on the subject of timber plate structures (2005-23), the IBOIS laboratory headed by Professor Yves Weinand now aims to integrate these issues at the highest level by focusing on the specific subject of roundwood, from the extraction of the resource to its integration into the field of architecture.

The first research project, carried out by Petras Vestartas (arch., Phd. EPFL, 2017-2021) on the occasion of his thesis work "Design-to-Fabrication Workflow for Raw-Sawn-Timber using Joinery Solver". Through this work, P. Vestartas examines the possibility of minimizing the transformation of wood through the use of 3D scanning and the capacity of robotics to produce joints in pieces of round wood of variable geometry. Drawing on assembly principles from traditional construction, he proposes and analyses innovative wood-wood assemblies machined from rough timber.

This first milestone marks the start of a larger-scale research project that will continue in 2023 with the work of Damien Gilliard (ing. arch., Phd. Candidate). His thesis, entitled "Scaling Up Timber". Climate change is having an impact on the quantity and quality of the raw material, making it necessary both to anticipate these changes as effectively as possible by informing forestry practices, and to transform the relationship with the material by integrating the concepts of variable production and selective felling. D. Gilliard is going to set up a 3D forest scanning technique with the aim of establishing a new knowledge base of forest dynamics and exploitation scenarios.

While this research addresses certain technical aspects of the wood production circuit in the construction sector, trying to rationalize its use and reduce its environmental impact, it also outlines a change in design that should also be reflected in architecture. By offering an open field for experimentation, the studio can support such innovation.

Image : IBOIS, abattage en forêt, Rossinière, 2011.



Objectives: From precedents (...)

In idealized representations of primitive shelters, such as those by Marc-Antoine Laugier or Claude Perrault in his translation of the Vitruvian treatises, log construction is omnipresent. Wood is represented by all these formal devices, knots and branches representing the natural character of the material. Roundwood, in the form of trunks or simple branches, has been a favorite building material since ancient times: present in many regions, it is a resource that is easy to work with simple hand tools and easy to transport, within certain size limits. From the 19th century onwards, the industrialization of the timber industry and the advent of mechanized tools led to both standardization of the material and a wide diversification of derived products. These changes led to the development of the timber construction sector, but in fact reduced log construction to isolated cases.

Through the experiences they bring together, however, these cases provide lessons that can be analyzed and compiled in the form of a case study. The compilation of this documentation is based on the definition of analysis criteria that cut across all the cases in the corpus, making it possible first to analyze different aspects of each of the projects and then to make comparisons.

The first part of the semester will be devoted to the study of precedents. A body of work, documented as exhaustively as possible, will be the subject of an architectural, constructive and quantitative analysis specific to log construction. For the presentation of this first part, which will be organized in the form of a critique and an exhibition of the work, the following documents will be expected: a complete 3D Rhino model produced according to a predefined model; a physical model of a fragment at 1/10 scale; an exploded isometric representation (scale to be defined); a quantitative analysis according to a given table. The creation of these documents will also provide an opportunity, in the studio, to familiarize oneself with the representation of a material that is not commonly handled. Research and experimentation in 2D, 3D and scale models will be part of this first phase of study on the theme of round wood.



Image : « Public restrooms », Yamashita Sekkei, Tatsudayama Rest Forest, 2021.

Objectives: (...) to mock-up

Resolving construction at the scale of detail is an integral part of the architectural project equation. It involves the precise arrangement of materials in relation to each other, to the building's overall structure, program, volumetry and so on. This material and constructive identity acts directly on the sensory perception of architecture, interacting with our most basic senses. However strong an architecture may be on a spatial or even urban scale, its identity can be contained in the precise, orderly implementation of elements on the scale of detail. The mastery of detailing in architecture requires, first and foremost, a good knowledge of the materials themselves and the related know-how, but also the ability to exchange and communicate in order to develop the project in collaboration with qualified craftsmen.

While drawings remain the most direct and universal medium, a mock-up - a partial 1:1 scale model - can be a very useful validation tool. The difference in scale with the mock-up means that the material or materials and the way they are used have to be transposed to reality, as well as being an exercise in composition:

"A form of proxy architecture, the mock-up is frequently comprised of disparate elements from a single building project. Windows, curtain wall systems or material samples often find themselves coupled together in an assemblage that bears more resemblance to public art installations than to architecture."

The definition of the object as such acts like a totem, bringing together in an imaginary composition the various details of a project in order to understand its articulation and appreciate its material reality. Like an abbreviation of the project, the mock-up constitutes a chimerical artefact, presenting the new construction to come via a skewed, symbolic reality.

David K. Ross et al., *Archetypes - David K. Ross*, A Standpunkte publication (Zurich: Park Books, 2021).



Objectifs : (...) au *mock-up*

The choice to work with a raw material that has an infinite number of different structural and aesthetic qualities influences the project process. This is because log construction does not have a catalogue of standardized norms, elements and implementations that can be arranged to meet a spatial or programmatic ambition; it still has to be composed. By rethinking the design cycle with the aim of integrating the intrinsic parameters of the material from the outset, the Weinand studio is proposing for the 2023 semester to explore the project on the smallest scale, that of detail, via the theoretical concept of the mock-up as a symbolic representation of the project. On the basis of previous studies and the results of the workshop, the studio project consists of creating a technical mock-up of a log architecture. In the manner of a mock-up, which, in the form of an imaginary artefact, brings together the disparate elements of a project, the project consists of a set of details of a hypothetical building. With no more program than "making a home" - providing a floor, a roof, a facade - the mock-up constitutes, in symbolic form, the material and constructive identity of the project.

By comparing one of the fragments analyzed in the case study with the 3D trees obtained during the workshop, the aim of the exercise will be to compose, in the theoretical form of a mock-up, a section of log architecture using innovative details. This composition will be the result of an in-depth study of the different assemblies, but also of a mastery of the overall constitution of the whole created. The assessment criteria will therefore cover both the technical development and the understanding of the symbolic significance of the project. The second part of the project will be presented in the form of a critique and exhibition of all the work produced during the semester. The exhibits will consist of 2D and 3D representations, scale models and, where appropriate, 1/1 scale prototypes.



Mock-up Sitterwerk Saint Gallen, 2017-19
<https://boltshauser.info/>

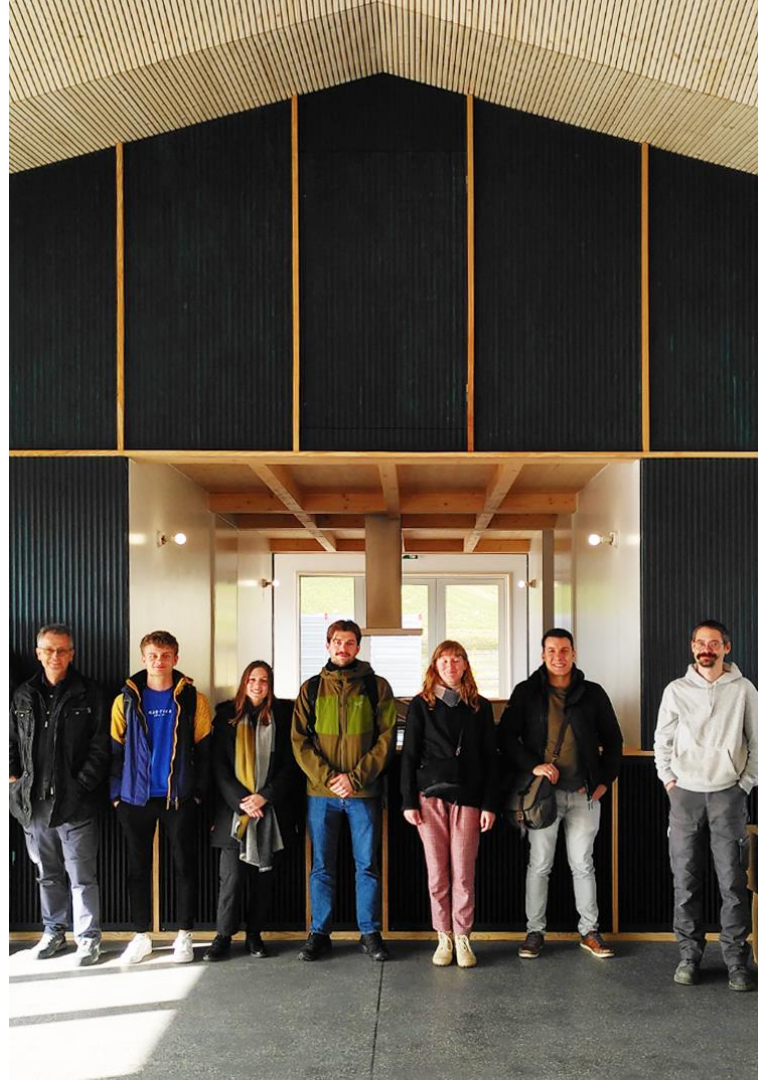
Method: studio - courses/meetings/visits

Studio work is a major part of the semester program, so attendance is required on the days of the week dedicated to this teaching. Professor Yves Weinand and the laboratory team - Damien Gilliard (ing. arch., Phd. Candidate), Agathe Mignon (arch., Phd., scientific collaborator), Andra Settini (arch., Phd. Candidate) and Joseph Tannous (arch., Phd. Candidate) - will provide support throughout the semester to ensure the smooth development of the projects.

Occasionally, meetings will be arranged for interim presentations. Research in the timber construction sector, and even more so in the field of technical and digital innovation, also requires an interest in particular aspects of architecture and building. The semester program aims to provide a dynamic and applied introduction to these issues through a range of talks given by researchers, specialists and professionals. These events will be divided between ex-cathedra lectures, invitations or visits to sites or companies.

Evaluation: continuous assessment and critical appraisal

Evaluation is divided into continuous evaluation (attendance and participation throughout the semester, workshop work) and occasional evaluation during critiques.



19.09	(1)	Presentation of IBOIS research Introduction > precedents	Round table presentation Choice of case studies; formation of groups
25.09 26.09	(2)	Tour de table of selected case studies Review of analysis hypotheses	Primary analysis (context, operating diagram) 3D sketches, drawings and models
02.10 03.10	(3)	Unlearning Center Review of work with prof. Y. Weinand	In-depth analysis (construction and details) 3D sketches, drawings and models
09.10 10.10	(4)	Pre-presentation and validation of productions Introduction to quantitative analysis documents	Development of presentation material Completing analysis documents
16.10	(5)	Critique > precedents (prof. Y. Weinand + guest)	Document archiving > precedents

Programme > *points cloud workshop*

17.10	(5)	Introduction > points cloud workshop	-
23.10 24.10	(6)	(program in progress)	- -
30.10	(7)	Review of work with prof. Y. Weinand	Creation of the database

31.10	(7)	Introduction > mock-up	3D sketches, drawings and models
06.11	(8)	Lecture / conference	Project development
07.11		Studio work / individual critique	3D sketches, drawings and models
13.11	(9)	Studio work / individual critique	Project development
14.11		Review of work with prof. Y. Weinand	3D sketches, drawings and models
20.11	(10)	Lecture / conference	Project development
21.11		Studio work / individual critique	3D sketches, drawings and models
27.11	(11)	Studio work / individual critique	Project development
28.11		Review of work with prof. Y. Weinand	3D sketches, drawings and models
04.12	(12)	Lecture / conference	Project finalization
05.12		Studio work / individual critique	3D sketches, drawings and models
11-15.12	(13)	Pre-presentation and validation of productions	Development of presentation material
18-22.12	(14)	Critique > mock-up (prof. Y. Weinand + guest)	Document archiving > mock-up

