Reflection of Graduation Project

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Studio

Name of Studio: Architectural Engineering Graduation Studio
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Title

Cycling Pavilion for New Brettenzone

Graduation Project Reflection

Research and Design
Complex timber structure in digital fabrication and Cycle pavilion

The design question is to design and materialize the cycle pavilion in long Brettenzone, and the research question is how to realize it by wood and economic digital fabrication. The research has been done in several aspects, including suitable wooden products for CNC mill/router/lazer cut, suitable timber construction system, wood-wood connection in digital fabrication and the specific construction method-joint displacement and etc.

After the research, reciprocal structure system with a great amount of smaller elements and interlocking wood-wood connection was chosen. And for the certain bridge pavilion, the variation of the structural pattern was implied to achieve the span. (Image 1) These principles have been used to guide the design process.
The approach of variation of timber structural pattern to achieve such a big span didn’t work especially in such a big span and the interlocking joint. (Image 2) Concrete is introduced as the basement material due to the big span needed in the typical context and the constraint of reciprocal structure system with wooden connection and the exposed structural elements. Finally, a combination of complex reciprocal timber frames and concrete composes the whole bridge cycle pavilion instead of everything in wood. (Image3)
The approach clearly tells the possibility and constraints of this kind of timber structure. Pure interlocking wood-wood connection is replaced by simple metal jointed interlocking wood-wood connection. By this approach, the benefit of digital fabrication is still kept, which is to precut the wooden elements then use standard metal joint and assemble them by non-skilled labor. (Image 4-5)

The theme of AE studio and the subject study of the graduation project
From technical fascination on wood and digital fabrication to curved cycle pavilion in Brettenzone
Starting from the technique fascination and the certain context, and then specifying the research topic based on the design input is how I understand the theme of AE graduation studio. I have the fascination of materialization of complex geometry architecture. To be more specific, the context of Brettenzone gives me more input like natural environment and the nice continuous cycle track but interrupted at one point. So I decide to bridge this gap by a complex curved bridge which will be totally or partly materialized by wood with digital fabrication.

Approach of AE studio and the method for the graduation project
From design requirement to the research on complex timber structure in digital fabrication then back to the design
The study of complex timber structure is conducted at the very beginning with the help of tutors from architectural design and complex structure, and an extra tutor on digital fabrication. Case study, literature study, research by design were employed in the research process. Physical Models made of wooden elements helped a lot during the research and design process. Finally, a reciprocal structure made of a great amount of small wooden elements precut by CNC mill machine is studied and designed as part of the pavilion. (image 6)

The wider social context and the graduation project
Precut wood by CNC machine and the complex timber structure
Digital fabricated wood has a lot of potential in timber construction, especially for timber structure in complex (curved) geometry. In this graduation project, reciprocal structure is chosen because of its principle which is using lots of small elements supporting each other side by side(not end to end) to have the whole structure. Standard metal joint can be employed because of precutting of wood elements. Then the whole structure can be assembled easily. The study and design of this construction way can be useful in a large group of complex timber structure.