



RETHINKING BAMBOO CONNECTIONS

*THE LINKED BAMBOO

*ALL YOU NEED IS BAMBOO

Designing a simplified system for connecting bamboo in order to develop housing units for a determinate target population in Ecuador.

Date	11-05-2020
Student	Elisa Vintimilla Salas
Student number	4833600
Tutors	Dr. ing. Marcel Bilow Dr. ir. Fred Veer
Delegate examiner	Lei Qu

GRADUATION PROJECT

Research Topic

Re-thinking Bamboo Connections: designing a simplified system for connecting bamboo in order to develop housing units for a determinate target population in Ecuador.

REFLECTION

Reflection

This research is a part of the graduation requirement for the master track of building technology, at the Faculty of Architecture and built environment of the Technical University of Delft, therefore, the methodology and experiments were formulated based on the academic guidelines.

The technical and scientific knowledge learn during the first and second year were important to choose the direction of this research: product development and structures -material science-. With both mentors specializing in the previous mentioned field, the technical scope of the thesis was defined in an early stage as well as the goal of the research, which help me to organize the work flow of the research. The mentors are guiding the steps of the process of the research and design in order to prepare a cohesive design proposal as a result of this thesis.

Research approach

The goal of this study was to develop a simplified system of connecting bamboo for a determinate country and target population in Ecuador that facilities the construction of bamboo houses and therefore increase use of bamboo as a structural element. Most part of the investigation was aimed at the research by design that will be an outcome of the main constraints to design bamboo connections for housing purposes in Pedernales.

The research topics were the base for the problem definition. On the other hand, the methods and reasoning that were applied in the process that go beyond the literature review were categorized in four phases explained below.

The first three phases are directed to the posed problems and the sub questions defined in the previous chapter, they enclosed the learnings of the concrete experience learned from the literature review, the reflective observation of the information and the abstract conceptualization of the design. The last phase was the active experimentation of the results of the previous courses of action, which covered the sizing of elements, testing and structural analysis, the evaluation of the design and lastly the specific learnings from the study.

Challenges during the research process

The first part of the research was kept simple; research of the material, context and connection was done. After this phase, the design began and it was more challenging because of the limited time frame.

A few weeks after the design concepts were realized the University was closed because of the pandemic COVID-19, which resulted two unfortunate situations: in order to validate the prototypes, aid needed to be sought from the civil engineering department and the laboratories for mechanical testing.

Since the laboratories were and still are closed the testing will not be made, which means that important insights, that would have determined the practical applicability of this research will be missed. This affected the productivity of the research as some motivation was lost.

Moreover, it was really hard to concentrate at home, as I normally go to university to work. Spending 100% of the time in a studio apartment can be tiring and I got the feeling that I was not advancing in my thesis although I was working on it.

Setting meeting with tutors helped to keep the focus on what is really important and the project was therefore developed, even though not being able to perform the testing was disappointing.

RELEVANCE

Societal relevance

In most bamboo producing countries, bamboo cannot be used for long-term structures because of the short durability and the construction complications. Bamboo has a great potential for re-urbanizing a site affordable and safely. With proper treatment of the culms, bamboo can increase its durability. Connecting bamboo represent a challenge for bamboo producing countries. Simplifying bamboo joints is the first step towards the standardization of the construction system of the material. Thus, bamboo's full potential can used to solve housing shortage in these regions, increasing its use as a structural element.

Scientific relevance

The results of this research will help to increase the bamboo target audience in order to standardize bamboo structures for housing in bamboo producing countries. A simplified bamboo connection can change the conventional perspective towards this material and will allow to integrate modulation and standardization in bamboo construction system, as a further research. It is planned to generate a construction manual that explains how to build the connection and assembly the bamboo structures for housing purposes, this manual can be shared with in the semi-rural and rural towns of bamboo producing countries making bamboo a self-building material for this communities.

TU Delft-programme relevance

Structural and product design are two lines of work that allow to explore and test alternative materials in order to shape a more sustainable built environment. The possibility of evaluating the results and working on a prototype of the connection allows a practical approach to the research. The results of this study can be the base of other students that want to work with the potential of bamboo. Finally, this research can be integrated with the honors programme research I do, mentored by Dr. ing. Marcel Bilow, about creating a world map of connections. This research focuses developing an on-line system that offers old and new connection concepts trough a categorized data base. Thus, the final connection will be mapped in the website, increasing the target audience of the research.