

## Architectural connectors for bamboo structures

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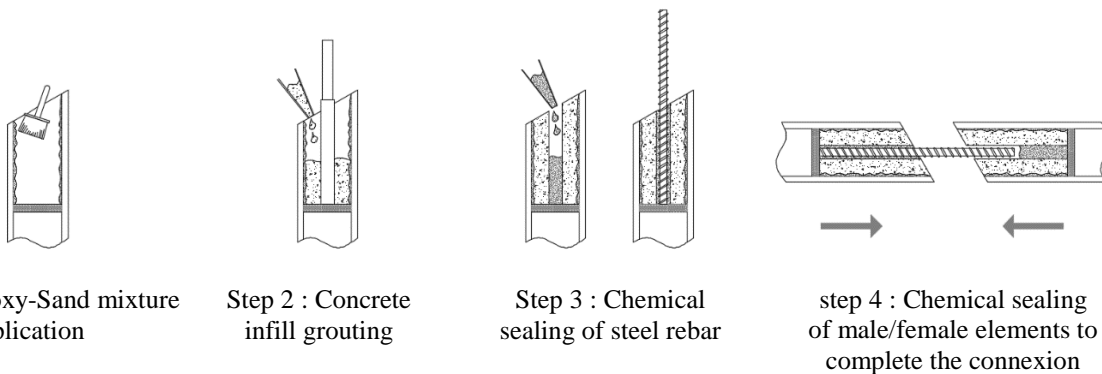
### Abstract

The Bamboo assemblies generally use a variety of materials (ropes, steel, plastic, etc.), often positioned outside the bamboo, as described in [1]. Most of the existing connection designs fail to fulfill at the same time three of the important aspects of the bamboo connection: the adaptability to the varying cane geometry, the measurable and sufficient resistance and the limited visual impact. This shows the need for novel techniques in compliance with today's structural design method and aspirations.

Our study is a continuation - purely theoretical - of projects such as The Land (Basel, 2015) and Do We Dream Under The Same Sky (Arles, 2018) (artist Rirkrit Tiravanija, structures designed by Bollinger+Grohmann). The aim is to build such freestanding 3D structures of bamboo with invisible connections.

The new type of assembly should fulfill the following requirements:

- **Architectural:** The connection must be invisible - only bamboo is visible.
- **Universal:** it must adapt to all geometric configurations.
- **Resistant:** it must be suitable for large structures under high stress, and have a breaking load comparable to the bamboo cane itself.
- **Ecological:** its environmental impact must be limited
- **Efficient:** its implementation must be as fast, simple and economical as possible.



Our proposal is to study mixt steel and concrete connections directly embedded inside the bamboo cane, which is completely hidden at the end of the process. The first elements were tested to verify the breaking modes and especially the interfaces between the different materials. The results are used to anticipate the actual capacity of the connection for further quantification tests, given the material properties of each components.

The results give a good feedback on the most unknown interface – Bamboo and concrete, as the breakage happens between the rebar and the concrete, and help to anticipate the connection capacity as the limiting point is a well know interface. This good behavior also question the use of the epoxy as it is currently quite time consuming, technological and ecologically questionable.

**Keywords:** bamboo, connectors, assemblies, reticulated structures

### References

- [1] K. Dunkelberg, "Bamboo as a Building Material", *IL 31 Bamboo*, Stuttgart, Germany : Institute for Lightweight Structures, 1985.
- [2] C. Berthoux, M. Leyral, K. De Rycke, A. Pierre, « Connecteurs architecturaux pour ossature en bambou », *FabricA*, vol. 13, pp28-49, 2019