



## Topological Optimization of Ecological Tri-composite Floors in Lightweight Structural Wood, Ultra High Performance Concrete and Polymeric Fibres

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Summary:

To minimize the built-in energy of the floor, we need to replace the current system with lighter solutions that retain the key features for robustness and maintenance, and are cost-effective and easy to build (Spadea et al., 2015). This project aims to explore innovative flooring solutions that make up a light wood load-bearing structure reinforced underneath by naturally occurring polymeric fibers (FRP) (Bencardino and Condello 2016), which work well in tension, and above an Ultra-Thin Ultra High Performance Concrete Slab (UHPC) that works exceptionally well in compression. Considering the application of very large floors in multi-storey buildings, the following key questions will be addressed: 1) what form should such a system have, 2) how will this be analyzed, and what mode of failure will be desirable? (3) what practical limitations would be imposed by constructability, (4) what would be the gain on economic cost and environmental impact from a life cycle analysis point of view, and (5) is possible to use biosourced epoxy for connections. The methodology consists of: (i) systems analysis and shape optimization using finite element numerical techniques, (ii) connection shear tests, and (iii) proof of concept on a beam prototype.