Research Reflection

Position of the Graduation Topic in the Studio

The graduation studio of the Building Technology (BT) master track is referred to as “sustainable graduation studio”. Hence, sustainability plays a central role in every course offered within the BT master track. This research has a clear focus on sustainability as it investigates how to optimize the usage of the most consumed material in the built environment: concrete. Given the significant share that concrete has in the building industry, the ability to optimize the composite use represents a global impact in reducing both pressure from the environment and carbon footprint.

A merge between the fields of material science and circularity drive this research. Material science is aknowledge offered within the BT track. On the other hand, education on circularity is not offered widely enough. This has represented a challenge because the knowledge has been new and has to be acquired in a relatively short period. The combination of these two fields results in the understanding of the material properties of concrete and alternatives to fully exploit its potential in a cost-effective and environmentally friendly way. This represents one of the greatest challenges posed to building technology today.

Relation of Research and Design

This research is conducted by experimental design. It investigates the engineering of a prefabricated structural concrete slab that optimizes the composite use in two manners. First, comprises material and structural optimization with the support of digital technologies. Topology optimization will be evaluated to reduce the amount of concrete without affecting the functionality of the slab. Correspondingly, a production system that minimizes material waste, such as formwork, must be considered. Second, the design will foresight multiple lifespans of the concrete slab. This means that it can be efficiently demounted and reused to extend its exploitation life before being remanufactured. The simplicity of connections for rapid and easy assembly/disassembly is important in this framework. This translates into additional savings of energy and CO2 emissions due to a rapid building process. Prototypes of the reusable concrete slab should be fabricated to evaluate this new approach.

Societal Relevance

The success of maintaining the sustainability of our natural environment largely depends on our ability to optimize our resources. This research offers a new approach to the usage optimization of the most globally used building material: concrete. In this exploration the use of concrete is reduced by increasing the life-span of a structural element. The structural element can be reused multiple times. Therefore, it is not necessary to build new elements. This reduces the intensive depletion of raw materials in our natural environment. Furthermore, it offers a shift towards rethinking buildings as material banks to use in the future. The ability to optimize the use of concrete is necessary to maintain and sustain many of the resources that our planet offers. After all, Earth is our only Earth.

Furthermore, this research has also an economic relevance as the monetary costs for producing new buildings would greatly be reduced. Investments for the fabrication of new

components would be avoided, leaving only logistics and transportation expenses.

Scientific Relevance

The information gathered in this research can disclose new ways of constructing our buildings to optimize the use of materials. Design for reuse is a practice that has been recently applied to the built environment. However, its focus has been mainly on façade systems and interior components. The practice has left aside the most expensive, labour intensive and energy consuming segment of the building: the structure. In this sense, every piece of information on how the strategy of design for reuse can be applied to structural concrete elements, with all its advantages, represents a step towards a more sustainable use of our resources.