

Popular science summary of the PhD thesis

PhD student	<u>Sara Sofie Vestergaard</u>
Title of the PhD thesis	<u>A Modifiable Structural System Made of Precast Concrete Wall Elements</u>
PhD school/Department	<u>Department of Civil and Mechanical Engineering</u>

Science summary

In this thesis, a novel and optimized design concept for precast concrete walls is proposed and analyzed. The aim of the new design is to support the circular use of buildings to prolong their lifespan, and to reduce the CO₂ footprint of the structure.

In multistorey buildings, precast concrete walls are often used to carry loads and stabilize the building. Precast concrete walls are efficient to produce and provide several important functions, such as room division, sound insulation and fire protection, areas where concrete has advantageous properties. Furthermore, concrete is a durable material, but its durability is not always fully utilized, since concrete wall structures do not provide much flexibility when a building is modified and new openings for doors or windows are needed in existing stabilizing concrete walls. This could be the case when a residential building is converted into office spaces, hotel rooms into apartments or other types of alterations. This can lead to costly structural strengthening, and in some cases result in the demolition of an entire building.

The novel design, modifiable concrete walls, is similar to conventional concrete walls in outer geometry, but consists of a frame zone and a flexible zone that can be cut out, when an opening is needed. To reduce the CO₂ footprint of the structure, the flexible zone is produced using very low-strength concrete, with a minimal amount of reinforcement, and exhibits the same acoustic and fire insulation properties as standard concrete in uncracked conditions. During the Ph.D. project production methods were tested and numerical and experimental analyses were conducted to optimize the design and investigate its structural properties.