

## Popular science summary of the PhD thesis

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Title of the PhD thesis	<u>Performance Based Structural Optimisation</u>
PhD school/Department	<u>Department of Civil and Mechanical Engineering</u>

### Science summary

\* Please give a short popular summary in Danish or English (approximately half a page) suited for the publication of the title, main content, results and innovations of the PhD thesis also including prospective utilizations hereof. The summary should be written for the general public interested in science and technology:

Reinforced concrete is essential in the modern built environment due to its affordability and versatility. However, currently, concrete contributes to about 8 % of global CO<sub>2</sub> emissions and consumes non-renewable resources like sand, gravel, and limestone. The current prognosis indicates that the demand for concrete will increase with population growth, thus increasing the environmental impact on the world. To address this issue, optimising reinforced concrete structures such that minimum material usage is obtained is a possible way to reduce the impact of concrete consumption and thus help with a more sustainable construction sector.

When designing civil engineering structures, designers must ensure both safety and serviceability, guided by two main criteria: the Ultimate Limit State (ULS; ensuring that the structure can withstand extreme loads without collapse) and the Serviceability Limit State (SLS; ensuring functionality, including limiting cracks and deflections).

Traditional material optimisation methods for reinforced concrete structures have often focused on either the ULS or SLS aspect, but rarely both.

This thesis introduces a novel approach that minimises the material consumption of reinforced concrete structures, considering multiple load cases and criteria related to ULS and SLS and thus producing more robust designs that promote sustainability without compromising structural integrity or longevity.