

Upgrading of the load carrying capacity of concrete structures

Project background

A Danish proof loading project, investigating in-situ test methods on bridges has been finalized recently. Tests simulating the real loading from heavy vehicles were carried out both in the laboratory and on existing bridges. These tests indicated that the load-bearing capacity of concrete slabs is significantly higher than estimated using relevant codes. The tests also indicated that failure of concrete slabs only happen after a significant cracking and deflection of the slab has occurred.

Hypothesis

The following hypotheses have been formulated:

- Existing theoretical methods for the evaluation of concrete slabs underestimate the load carrying capacity of the slab.
- The existing models for the evaluation of the load carrying capacity of concrete slabs are not based on data from experiments that represent the actual traffic loads acting on bridges. Using a more precise model of the actual loads that takes the spatial distribution of the loads into account will lead to a higher load carrying capacity.
- Failure of slabs only occurs after a significant cracking and deflection of the slab has occurred. Hence, it is possible to perform in-situ tests of the load carrying capacity without any significant risk of sudden unwarned failure of the slab.

Expected results

The main results of the project are expected to be:

- To show that concrete slabs have a higher load carrying capacity than the one determined using the computational models given in the relevant codes.
- To identify cracks and/or deflections of concrete slabs prior to failure. This implies that it is possible to perform load tests and monitor the slabs during testing in order to determine if there is a risk of failure of the slab.

These results may also help to significantly reduce costs and CO₂-emissions by reducing the amount of material necessary for the construction of new structures and by prolonging the service life of existing structures.

Execution of the project

The project is carried out by Ph.D.- student Kenneth Dahl Schiøttz Damsgaard in cooperation with supervisors from AAU and COWI.

The project will start up in 2023 and will have a duration of 3 years. During the project Kenneth will cooperate with representatives from the Danish Road Directorate and other researchers at Aalborg University, DTU and TU Delft who are all conducting research in relation to the load carrying capacity of bridges and load tests of bridges.