

Proof load testing of torsion-critical concrete bridges

Developing new methods to safely assess complex bridges using load testing

The challenge of ageing infrastructure

Across the world, the current bridge stock is ageing. Many bridges were designed for different traffic conditions and are repeatedly subjected to increasing traffic loads. Evaluation of older bridges may often be associated with uncertainties and hidden capacities that make them challenging to assess with typical evaluation methods. Consequently, load testing has emerged as a reliable way to directly evaluate the bridge response and to decide whether the existing bridges are still safe for continued service.

An approach for testing complex bridges

By applying controlled representative loads to a bridge combined with monitoring, engineers can evaluate its bridge class. This is a proof load test. In Denmark, this approach has already been implemented, and a national guideline on load testing has been developed. However, some bridges behave in more complex ways.

Bridges affected by torsion have been identified as a next step in expanding proof loading methods. Such bridges are subjected to a twisting effect rather than more familiar exposures such as bending and shear. At present, no validated proof loading procedures exist for how to safely carry out proof load testing, monitor the response, or evaluate the results for such bridges.

The project aims to expand current proof loading practice to torsion-critical concrete bridges. Key activities include identifying relevant bridges, how to test such bridges using controlled vehicle loading, developing monitoring approaches for capturing torsion-related behaviour, and investigating stop criteria that help determine when to terminate a test. A central element of the project is a full-scale in-situ test on an existing bridge, which will provide proof of concept.

The project is carried out within a strong Danish collaboration within bridge assessment, building on long-standing cooperation between consulting engineers, academic partners, and infrastructure owners. While the funded activities are anchored in COWI, the project is closely coordinated with Aalborg University and the Danish Road Directorate to ensure both scientific robustness and practical applicability.

Why this matters

The project will provide new knowledge and initial methods for assessing torsion-critical bridges through load testing, addressing a gap in the current engineering practice. This will support infrastructure owners in making better-informed decisions about existing bridges.

Improved assessment methods can help avoid unnecessary strengthening or replacement of structures that may already have sufficient capacity. This can reduce costs, lower CO₂ emissions from construction activities, and improve the utilisation of the existing infrastructure.