# Heated Reinforced Concrete Slabs Subjected to Static Load: Experimental results and numerical simulations

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*Ferry-free coastal route E39* is a project by the Norwegian Public Roads Administration that aims to design a coastal highway route without ferry connections. Wide and deep fjords along the Norwegian coast make submerged floating tunnels (SFT) an alternative to conventional structures. In the unfortunate situation of accidental events, the SFT reinforced concrete (RC) structure may become damaged, affecting its load carrying capacity. Furthermore, fire condition has become an important issue in the design of tunnels.

A collaboration research project between NTNU and *Politecnico di Milano* has been started to study the behavior of RC elements when exposed to extreme conditions. This project is aimed at assessing the reliability of numerical approach in the prediction of RC 2D structural elements when exposed to the combination of fire and quasi-static loading. An ad hoc experimental campaign has been defined to provide a reliable benchmark. Three different fire load cases have been studied: 0 (reference case), 60 or 120 min fire exposure time. Afterwards, bending tests with a simply supported condition on a circular support have been performed, with a linear circular load applied on a steel ring. Two identical tests have been performed for each load case.

Numerical results have been obtained by reproducing the experiments using Diana FE. Nonlinear heat and structural analyses were performed to study the thermal and mechanical behavior of the slabs. Moreover, material tests were performed to provide accurate temperature-dependent material properties in the simulations. Load-deflection curve, crack pattern and temperature distribution along the slab thickness, were the main variables used to compare the results.

This study aims to develop a better-calibrated model, which will be able to assess the risk analysis of SFT and its feasibility in the *E39* project.

**Keywords:** fire tests, quasi-static tests, reinforced concrete slabs, nonlinear analyses