Heated Reinforced Concrete Slabs Subjected to Blast Load:
Configuring Experiments by Numerical Analyses

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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 between Kristiansand and Trondheim without ferry connections. Wide and deep fjords along the Norwegian coast make submerged floating tunnels (SFT) an alternative to conventional structures, such as large span bridges, significantly reducing the environmental impact to the landscape. This type of structure has, however, never been built before. The evaluation of its feasibility taking into account safety aspects represents, therefore, an engineering challenge.

In the unfortunate situation of accidental events, the SFT reinforced concrete (RC) structure may become damaged, affecting its load carrying capacity. RC shells can be a representative component of the SFT concrete structure and it is relevant to study if the RC shells can carry the combination of fire and blast load. In order to evaluate these two phenomena, a shock tube is a useful equipment to perform experimental tests on heated RC slabs. The number of experiments is usually limited due to the high cost and, therefore, conclusions are generally obtained with the contribution of numerical simulations.

This study presents a preliminary numerical study of RC slabs subjected to fire and blast loads. First, different models (3D solid and shell model) have been developed and compared, in order to find the best strategy in terms of results and computational time. Then, nonlinear analyses for both static and dynamic tests have been performed, in combination with standard fire curve load effects. Temperature-dependent material properties have been used, in order to evaluate the influence of high temperature in the blast load carrying resistance. Load-deflection curve, crack pattern and temperature distribution along the slab thickness, are the main variables used to compare the results.

This study aims to assess future experiments performed on heated RC slabs subjected to blast loading. Determining the most influencing material parameters will define relevant experiments to perform and, therefore, help to develop a better-calibrated numerical model. The numerical simulations will assess the risk analysis of SFT and its feasibility in the *E39* project.

Keywords: high temperature influence, blast loading, reinforced concrete slabs