Strengthening of RC Slabs and T-beams using Ductile Post-tensioned Unbonded CFRP Twin-anchor System

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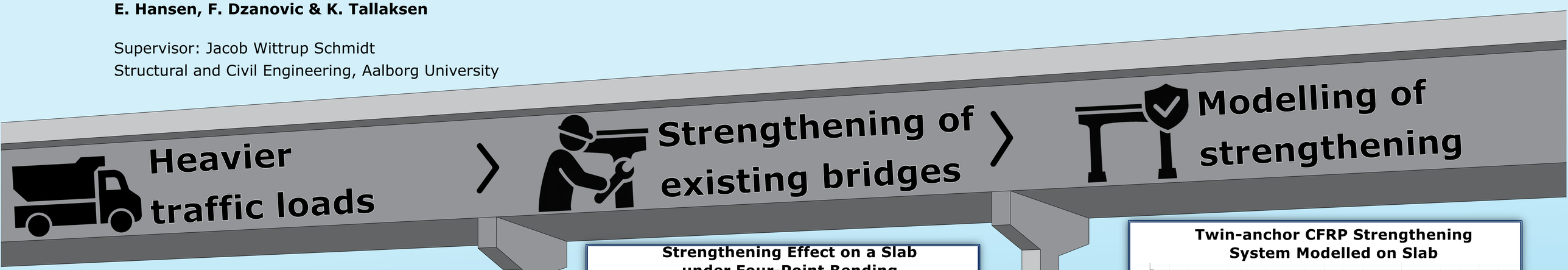
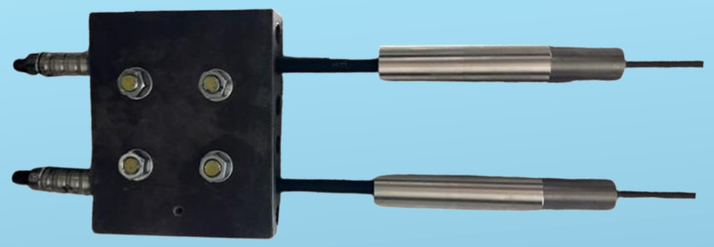


Motivation

With increasing traffic volumes and heavier vehicles, there is a growing demand for bridges with higher load-bearing capacities. Constructing new bridges to meet this demand is costly, time-consuming and environmentally harmful. Therefore, new alternatives are investigated such as strengthening using CFRP systems.



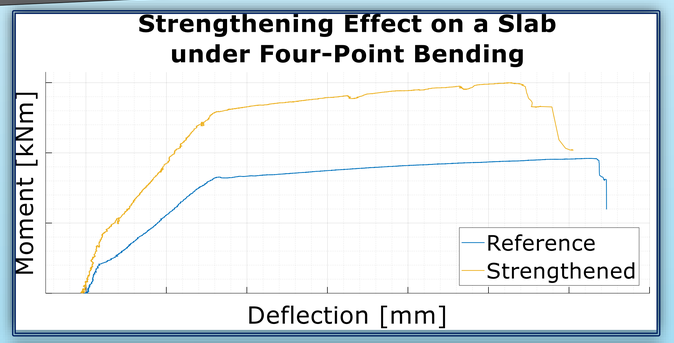
CFRP

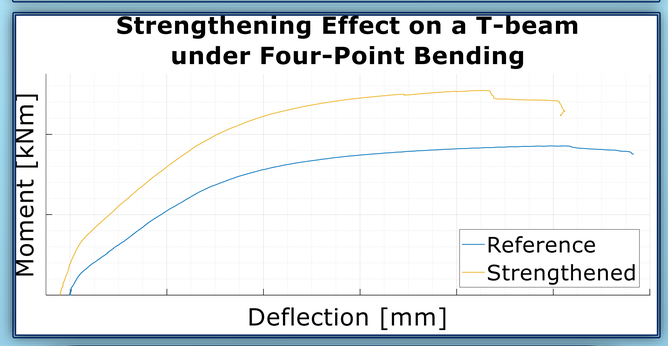
Pros:

- Lightweight (5 x lighter than reinforcement steel)
- High tensile strength (5 x higher than reinforcement steel)
- High corrosion resistance

Cons:

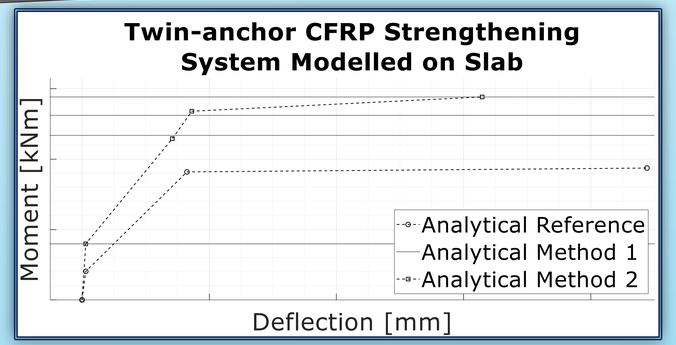
- Brittle
- Anisotropic

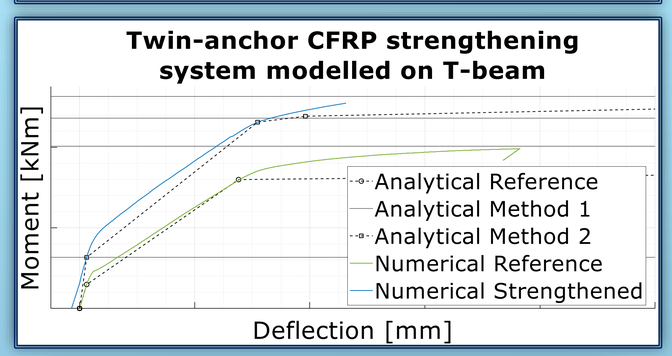




Strengthening Effect

The twin-anchor CFRP strengthening system is mounted onto typical reinforced concrete bridge geometries, i.e. slabs and T-beams. Analysing the first crack, yielding of the reinforcement and the ultimate capacity for the reference and strengthened geometries showed strengthening for all stages. The ultimate capacity was strengthened up to 50 %.





Modelling

Material parameters for steel reinforcement and concrete have been determined experimentally. These are used in modelling of the experiments.

Novel analytical methods have been used to determine the effect of the strengthening system. A numerical model has also been developed to determine the strengthening effect. Both analytical and numerical approaches align with the experiments.