



MASTER THESIS 2018

SUBJECT AREA:	DATE:	NO. OF PAGES:
Concrete Structures	June 11 th 2018	184

TITLE:

Assessment of an existing bridge suffering from Alkali-Silica reaction

Vurdering av en eksisterende bro skadelidende av Alkali-Silikareaksjoner

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SUMMARY:

The first parts of the thesis contain a general literature review about damage mechanisms in concrete and how they affect the structural behavior of concrete structures. The survey is extended with a more in-depth review of damage due to alkali-silica reactions. One of the effects of alkali-silica reactions is the formation of a swelling gel, which in contact with water expands. In statically undetermined bridges, elongation and curvature changes from alkali- expansion could result in additional moments in which these type of bridges not were designed for. Elgeseter bridge in Trondheim is one of those bridges.

Structural assessment of Elgeseter bridge was conducted in the longitudinal direction. The capacity control of the different sections was conducted, not taking into account structural damages or concrete degradation. When including loads due to alkali-silica expansion, the moment capacities were exceeded in the field section between axis 1-2 (15%), the internal field sections (27%) and in the original zero moment sections, 4.5m from the columns (92%).

A more in-depth study was conducted regarding alkali-silica expansion on Elgeseter bridge, making a 2D model (longitudinal direction) and a 3D model of the bridge in the finite element program DIANA. Both models revealed large tensile stresses in the original zero moment sections due to additional moment from the alkali reaction. The crack development on the bridge found by the 2D model seemed to be in good correlation with the field investigations on the bridge which has revealed large cracks occurring at the zero moment spots. With the 3D model, it was also possible to detect shear stresses appearing on the plate due to different strain over the width of the cross-section at the end span.

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