More Realistic Codes for Existing Bridges

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Abstract

Examples are given from comparisons of analyses based on (1) code models, (2) finite element models and (3) full scale tests to failure of three bridges. The analyses based on the code models gave very conservative results, while the finite element models could better predict the real behaviour.

Keywords: Bridges, Assessment, Codes, Full Scale Tests.

1 Introduction

A global engineering challenge is to use our existing structures in an optimal way and not to take them out of service before their true real functionality has come to an end. Codes and standards are - and should be - conservative. However, it is one thing to design a new structure - with all unknowns regarding material properties and workmanship - and another thing to assess an existing structure, where properties and performance can be checked and ascertained. So there is a need for codes for existing structures such as the new Swiss codes, [1].

Unfortunately it is much easier for an infra-structure manager to have a new bridge to oversee than to have to take care of an old bridge. For the old bridge much knowledge and concern is needed to make the right decisions regarding maintenance and upgrading. For that reason bridges are sometimes taken out of service before there really is a need to do so, it is just less trouble for the manager to have it replaced than to have to struggle with it. However, with increased use of Life Cycle Cost Analysis (LCCA) also for maintenance and upgrading work, this practice will hopefully be abandoned and more optimal procedures will be introduced. Examples on how this can be done are given in the recent European projects MAINLINE, 2011-2014 [2] and Sustainable Bridges, 2003-2007 [3].

Tests to failure of existing bridge structures are rare, mainly due to high costs and lack of test objectives. When such an opportunity appears, understanding of existing structures can be gathered, and a proof of design and assessment methods can be obtained.

This paper compiles the experience and results from tests to failure of three different types of bridges. The paper is an update of an earlier paper [4]. The results are presented with focus on a comparison between the tested capacity and existing methods for assessment based on analytical models from standards and codes.

The results show that code models often underestimate the true capacity while non-linear numerical tools might provide more accurate results when combined with results from material testing.

2 The Örnsköldsvik Bridge

2.1 Background

This test was scheduled as part of a demonstration of newly developed or upgraded

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