Anticipation of Repair Need of Bridges Based on Visual Inspections of Finnish Bridges

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Summary

All bridge structures are usually exposed to outdoor climate and are therefore deteriorated by several different degradation mechanisms, whose progress depend on many structural, exposure and material factors. Finnish bridges are very often made of concrete, and the decks of steel bridges are usually of concrete. Under Finnish climatic conditions frost damage to concrete together with corrosion of reinforcing steel constitute the major degradation mechanism that causes the need to repair concrete structures.

The repair need of concrete structures depends on already existing damage in the structure and damage facing it in the near future. Usability of repair techniques depends not only on existing damage but also on the type of structure and service life of repair.

An essential factor in determining the success of systematic bridge management is the detection of damage. Each Finnish bridge managed by the Finnish Road Administration is inspected visually every fifth year. These general inspections have been made for over 20 years. As a result we have an extensive, growing database which can be used for anticipating the repair need of bridge structures.

On the basis of that database deterioration models have been established for every type of structural member of bridges. These models are tools for finding appropriate repair methods for damages and they allow optimal timing of condition investigations and repair work.

Keywords: bridges, degradation mechanisms, maintenance, visual inspection, service life, visual damages, concrete, model, modelling.

1. Introduction

1.1 About bridges in Finland

The Finnish Road Administration manages about 14,300 bridges (clear opening ≥ 2,0 m) in Finland [1]. In different periods several different materials have been used to construct bridges including stone, wood, steel and concrete. Finnish bridges are for the most part quite young – over 95 % have been built after 1950. The largest number of bridges were built in the 1960s and '70s. The most prevalent building material has been concrete. Reinforced and prestressed concrete bridges account for 67 % of the bridge stock [2]. Moreover, the decks and substructures of steel bridges as well as the substructures of wooden bridges are also primarily of concrete which means that concrete structures' share of the structures of the bridge stock is even larger.

Steel culverts constitute a significant 20 % share of Finnish bridges. Steel culverts are typically built across small water bodies and pedestrian and bicycle ways. Due to the large share of concrete structures and the difficulty in detecting damage in them, we shall here concentrate only on damage suffered by concrete structures and the possibility of repairing them.

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