Automation based structural monitoring systems for ordinary bridges

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Summary

Demography of bridge stocks in various organisations and countries show great number of small bridges, making them of special interest in bridge management and life-cycle engineering. Improvements in analysis methods, input reliability or accuracy of bridge management systems will have notable impact to overall life-cycle costs. Recent progress in automation technology has revealed possibility to develop bridge monitoring systems, which by their properties are suitable to widespread usage for ordinary small bridges. In the near future, bridge management systems may consist on two bridge groups for “not instrumented” and “instrumented” bridges. Aim of this paper is to describe one example of implementing automation based bridge monitoring system, and discuss its integration into bridge management. It also addresses some envisaged developments in various disciplines to fully take benefit of the possibilities of the technology.

Keywords: bridges, structural monitoring, bridge management systems, life-cycle engineering, sustainability, automation, information and communication technology.

1. Introduction

A type of bridge monitoring, which is based on measurements with sensors continuously over time, has been used over some decades by researchers and scientist. It has been useful in special cases of technically challenging new bridges or old significant bridges whose safety is doubted. Tender specifications of major new bridges nowadays frequently contain provisions for structural monitoring systems. They are seen as tool to verify design, enhance safety and optimize maintenance efforts. The question how many years, and in which extend, it is useful to operate and maintain the health monitoring systems seems to be open.

Recently, increasing number of bridge experts consider structural monitoring as a standard tool to complement traditional bridge inspections, load testing and evaluation methods [1,2]. One limitation of traditional bridge monitoring systems has been the complexity and price, which have made them reasonable investments only for bridges, whose maintenance costs are high. With new technologies this limitation is subjected to change, and bridge monitoring is about to enter to everyday bridge management of ordinary bridges.

Overall cost of bridge maintenance is increasing in many industrial countries as the main highway network has been built decades ago. Railway bridge stock is typically also old. Some countries have great number of small masonry arch railway bridges in the age 100 years and beyond [3].

Instead of asking more funds to infrastructure maintenance every year, the engineering community needs to develop more advanced tools to reach principles of sustainable development and to constraint owners’ economical efforts. This means that old bridges need to be kept in service for increased axle loads and traffic volume; maintenance should be better optimized; better

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