

Approach for the life-cycle management of structures including durability analysis, shm and maintenance planning

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Summary

A tailor-made model was developed, which utilizes state-of-the-art information from literature as well as VCE's experience gained in the course of performing bridge monitoring and bridge inspection worldwide. This knowledge has been incorporated into the assessment procedure that is described in this paper.

Probabilistic methods are used for the service life calculations of the whole structure as well as for individual structural members. The reason is to cover occurring uncertainties which have to be also implemented into the established maintenance plan in terms of lower & upper bounds of life expectancy. The starting point of the bridge's service life – in terms of the safety level – is according to the initial over design and depends on the applied design code and certain safety consideration in the course of the static calculations.

This paper describes the developed methodology using the example of an urban highway extension project with more than 100 existing and new bridges.

Keywords: Durability analysis, structural health monitoring, life-cycle management, maintenance planning, life-cycle costs.

1. Introduction

The A15 highway is the main connection of the Rotterdam seaport with the industrial area in the Netherlands. At present the A15 suffers from considerable accessibility and safety problems. A major upgrade and extension project has been planned to increase the number of traffic lanes and to switch to a safer and more efficient road design.

The project is implemented by means of a PPP model, where the design, execution, maintenance, operation and financing are placed into the hands of a market party (contractor) for more than 25 years including a construction time of 5 years. The payments to the contractor are conditional on compliance with and verification of the road availability.

The project section of the highway has a length of 37 km and includes more than 100 bridges, viaducts and tunnels. All construction and maintenance works have to be executed under traffic with as little traffic impediment as possible.

As the payment of the contractor is dependent on the availability and the traffic impediment, a well elaborated maintenance concept is of major interest. A Management Information System (MIS) shall be developed and implemented for the optimisation of the condition assessment and the maintenance planning of all engineering structures as well as the road pavement over the whole availability period. This MIS shall collect and analyse all relevant data from visual inspection, structural health monitoring, maintenance measures and the traffic management system. The results will be interpreted and lead to an as-precise-as possible maintenance planning. A continuously working, dynamic updating procedure for the maintenance plan shall be implemented.