

Maintenance of Important Infrastructures – Objectives and Strategies

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Summary

Infrastructures have to meet certain requirements during their service life in order to fulfil particular economical and societal needs. These requirements can be categorized into four groups: proper functioning, economy, society & culture and environment. However, until today investigations on the selection of maintenance strategies are primarily cost-oriented. Maintenance strategies developed on the basis of such investigations do not necessarily lead to an optimal solution with regards to requirements other than economic efficiency. This paper deals with the necessary framework for an appropriate selection of maintenance strategies for infrastructures. A simulation procedure is presented which allows for the development and examination of maintenance strategies with regard to different maintenance objectives. The procedure uses Monte Carlo simulation technique and takes into account data in relation to the structural properties, possible deterioration mechanisms, the effect of maintenance measures and the costs.

Keywords: maintenance strategies, Monte Carlo simulation, bridge engineering, infrastructure

1. Introduction

Infrastructures in terms of structures for fulfilling economical and societal needs have to be maintained and adjusted to future demands. This paper deals with the necessary framework for an appropriate selection of maintenance strategies for important infrastructures.

Usually the selection of maintenance strategies is accomplished with regard to the minimisation of maintenance costs as the primary objective. This approach is helpful for single bridges which are part of a redundant network. However, for large and important infrastructure projects, other objectives can become decisive. For example, in the case of major fixed links or high-speed railway networks a maximisation of the system's availability can outweigh maintenance costs. Furthermore, some structures might require a maximisation of service life even at high maintenance costs; this may be the case with safety-relevant structures for flood control for which reconstruction or rebuild might pose a considerable impact to the environment. A desired maximisation of service life also applies to structures that are sites of historic interest. Especially in environmentally constrained and urbanised areas infrastructures diversely interact with their surroundings and hence it is quite clear that they have to be designed and maintained with respect to many different requirements.

However, until today investigations on the selection of maintenance strategies are primarily cost-oriented (e.g. [1], [2], [3]). Maintenance strategies developed on the basis of such investigations do not necessarily lead to an optimal solution. Generally, maintenance strategies should be selected in view of maintenance objectives that account for the special situation: different situations require different maintenance objectives. The awareness for this principle has risen over the last years and several authors have reported on investigations concerning requirements other than economic aspects ([4], [5], [6], [7]). In this paper a computer-based procedure is presented which allows for the development and examination of maintenance strategies with regard to different maintenance objectives and can be applied to further research in this field.