Methodology to determine financial needs of river structures

Bryan T. ADEY
Professor
ETHZ
Zurich, Switzerland
bryan.adey@ibb.ethz.ch

Bryan Adey, born 1972, received his PhD in civil engineering in 2002 from the Swiss Federal Institute of Technology in Lausanne (EPFL). He is currently the head of the Infrastructure Management Group of the Swiss Federal Institute of Technology in Zurich (ETHZ).

Rade HAJDIN
President
IMC
Zurich, Switzerland
Rade.hajdin@imc-ch.com

Rade Hajdin, born 1961, received his PhD in civil engineering in 1990 from the Swiss Federal Institute of Technology in Zurich (ETHZ). He is currently the president of Infrastructure Management Consultants Ltd. (IMC).

Summary

In this paper a general methodology is given that can be used to determine the lowest cost intervention strategies of river structures with respect to gradual deterioration processes, their financial needs and the consequences if they are not followed. An example is used to illustrate the type of results possible using this methodology with normally existing data. The methodology is similar to those used in state-of-the-art bridge management systems but is adapted to take into consideration special aspects related to river structures, such as that a river section is composed of multiple river structures and that an intervention performed on a river section normally includes interventions on multiple structures within a section.

Keywords: optimal intervention strategies, financial needs, river structures, management systems.

1. Introduction

The structures required to train rivers within cities, e.g. levees, revetments, retaining walls, and sleepers, require substantial financial resources to construct. In the short term, excluding the occurrence of an extreme event, such as a one in a hundred year rainfall, after they are built they require little financial resources, if any, to maintain. In the medium to long term, the financial resources required to maintain them varies considerably depending on the type of construction, the material of construction, the effects of water, and the intervention strategy being followed. For example, one generic intervention strategy is to do nothing to a river structure, except regular maintenance such as controlling the vegetation, until there is an unacceptable risk of failure and then reconstruct it, and another intervention strategy is to perform maintenance interventions, e.g. the repointing of a masonry retaining wall, when the structures fall into a certain condition state, which also ensures that the failure risk under normal conditions remains negligible. Both of these intervention strategies are valid and neither necessarily results in a negative impact to the infrastructure users.

The choice between these intervention strategies, and all others, depends on the type and speed of the deterioration processes affecting the river structure, and the cost and effectiveness of the interventions. Taking these parameters into consideration, it is the task of infrastructure manager to determine and execute the optimal intervention strategies, i.e. the strategies that ensure the functioning of the river structures for the lowest long term costs. It is, however, in some cases desirable to follow strategies that do not result in the lowest long term costs, e.g. when it is known that a re-naturalization of the river will be performed in the near future or during times of exceptionally tight budgets. When the river structures are to be kept in service in the long term, however, any deviation from the optimal intervention strategies results in increased overall expenditures.

Although many infrastructure managers know in general which intervention strategies are optimal in the long term for their structures, the infinite number of exact possibilities renders them unsure

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