Bridge Management in Switzerland

Abstract

Annual spending on transportation infrastructure consumes substantial amounts of public funds in both developed and developing countries. The combination of ageing infrastructure and increasing transportation demand requires ever more funds just to maintain current levels of service for travellers. Transportation authorities have to find an optimum balance between costs and benefits of preservation actions performed on existing transportation infrastructure. In order to cope with this task transportation authorities are engaged in the systematic development of systems that support consistent, unified and comparable decision-making processes for the preservation and modification of bridges as a part of transportation infrastructure. In particular the Swiss Federal Road Office and the Swiss Federal Railways are spearheading this development.

All these systems implement in one way or another following three steps:

1. Condition assessment and condition forecast: Through periodic inspection, damage is classified according to type and extent. This information, together with the forecast of the future development of observed damages, is the basis for planning of interventions.
2. Specification of technically plausible actions: Condition assessment and condition forecasting provide information on current and future deterioration levels. For a given condition there are various technically feasible actions that can restore the bridge to a damage-free condition. These actions and their costs are stored in catalogues.
3. Elaboration of working program: Technically feasible actions are subjected to economic analysis to identify the economically optimum action for a given bridge.

With regard to safety and serviceability it is assumed in all these systems that preventative maintenance is generally more beneficial than corrective maintenance. This is mirrored in the choice of condition states: in condition states 1 to 4 the probability of failure or reduced serviceability is acceptably low. If interventions are performed in these condition states they would be preventative interventions. In condition state 5 where serviceability and safety can be impaired an intervention must be performed. The cost of interventions in condition state 5 takes into account the risk of failure and/or reduced serviceability. This risk is, in monetary terms sufficiently high to prevent intervention strategies that allow bridges to enter condition state 5.

For the National Highway System a computer-aided bridge management system has been developed by Swiss Federal Roads Office. This system called KUBA consists of two principal components, a data collection system (KUBA-DB), and a management system (KUBA-MS) and two additional components, a load rating system (KUBA-ST) and a reporting system (KUBA-RP). These components share a common data base. This paper gives an overview of the important aspects of KUBA, including a discussion of the impact of KUBA on the planning process of the Swiss Federal Roads Authority, namely on 1) the evaluation of financial needs, 2) the general management of structures, including the formulation of inspection and intervention policy, 3) the inspection of structures, and 4) the planning of interventions. In KUBA the assessment units are structural elements. It is therefore necessary to define elements for each structure prior to first inspection. Elements are primarily classified using a catalogue of element types and a catalogue of so-called ‘construction types.’ For example, with a column in reinforced concrete, the ‘column’ is the element type and ‘reinforced concrete’ is the construction type.

Swiss Federal Railways started developing their bridge inventory system in 80’s. Currently they have inventory system and a computer-aided inspection tool. In this system called InfoIb the assessment units are bridges. The bridges are classified based on their structural system and material using a catalogue of bridge types. During the inspection individual damages are recorded, providing the basis for planning of interventions. Recently this system is enhanced with a module, which can estimate financial needs.

Cantonal road authorities are also developing simple tools for their bridge inventory. Since the data collection is rather costly most of these authorities implement systems with bridges as assessment units. Particularly interesting are developments in urban areas, where an effort has been made to consider impact on bridges users during intervention actions.

This paper gives the overview of these efforts.