

Bridge Inspection Decision Making Using Sequential Hypothesis Testing Methods

SAMER M. MADANAT

DAJIE LIN

University of California, Berkeley

ABSTRACT

Bridge Management Systems (BMS) are decision support systems used by highway agencies in selecting appropriate maintenance and rehabilitation (M&R) activities and in allocating available resources effectively among facilities. BMS decision making is based on the condition of bridge components, their predicted deterioration, and the cost and effectiveness of M&R activities. Traditionally, bridge condition assessments have relied mainly on human inspectors; their results have generally been qualitative and subjective. More detailed inspections requiring some degree of destruction to the bridge, like drilling the deck to inspect for chloride contamination, have also been used.

With recent technological developments, methods have been developed to evaluate the condition of bridge structures in a quantitative and objective manner. Associated with the use of these technologies are questions relating to inspection frequency, sample size and the integration of data from the various technologies and human inspections.

This paper presents the application of a statistical decision making method, namely Sequential Hypothesis Testing, for addressing the above questions. The paper includes the mathematical formulation of the Sequential Hypothesis Testing model, the derivation of optimal inspection policies, and the implementation of these policies in the context of bridge component inspection. A parametric analysis illustrates the sensitivity of the method to the cost structure of the problem, the precision of the technologies used, and the historical information or expert judgment regarding the condition of bridge components.

EDITOR'S NOTE

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