Updating Life-Cycle Performance Model of Bridge based on Inspection Data

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Abstract

For the bridge maintenance strategy and planning, prediction of future performance based on the current performance must be required and it is possible more rational decision-making through the higher accuracy of the prediction model. While performing a detailed inspection of the entire bridge can reduce a significant part of the uncertainty, it is impossible to reduce the uncertainty of inspection result and it is always evaluated by probability. In this study, to solve this problem, a Bayesian update method is applied to the optimal maintenance strategy in Bridge Management System (BMS) considering the uncertainty of inspection data. Also, examples of application are presented, showing the effects of inspection and updating on the bridge maintenance strategies. In this study, application possibility and availability of domestic bridge management system are evaluated by referring to the proposed method in the existing trends.

Keywords: bridge; maintenance; decision-making; uncertainty; inspection; bayesian; updating.

1 Introduction

Predicting a performance of structures is important to reduce the costs of maintenance, repair, rehabilitation and replacement of structures. To establish the optimal maintenance strategy and planning, there are needs to consider structural performance history. In this study, life cycle performance models (LCP models) of bridges are developed on the basis of condition index of the bridges by a statistical and probabilistic method. The condition indices resulted from visual inspection and are associated with corrosion, fatigue and crack of the bridges. Factors causing these defects are considered in life cycle performance model.

Also, the predicted performance includes a lot of uncertain factors because the condition indices were observed by person. To reduce the uncertainty of the models, updating method of these models is proposed by using probabilistic method. The probabilistic method is Bayesian theory.

2 Development of Life Cycle Performance Model

To develop life-cycle performance models of the bridges, a multiple regression analysis is carried out on the basis of a database of condition indices and influence factors making the structures deteriorated. A detail procedure is shown in Figure 1. The multiple regression analysis is a statistical process for estimating relationships between a dependent variable and one or more independent variables. Prior to the multiple regression analysis,