Estimating Bridge Deterioration for Small Data Sets Using Regression and Markov Models

Authors : Yina F. Muñoz, Alexander Paz, Hanns De La Fuente-Mella, Joaquin V. Fariña, Guilherme M. Sales

Abstract : The primary approach for estimating bridge deterioration uses Markov-chain models and regression analysis. Traditional Markov models have problems in estimating the required transition probabilities when a small sample size is used. Often, reliable bridge data have not been taken over large periods, thus large data sets may not be available. This study presents an important change to the traditional approach by using the Small Data Method to estimate transition probabilities. The results illustrate that the Small Data Method and traditional approach both provide similar estimates; however, the former method provides results that are more conservative. That is, Small Data Method provided slightly lower than expected bridge condition ratings compared with the traditional approach. Considering that bridges are critical infrastructures, the Small Data Method, which uses more information and provides more conservative estimates, may be more appropriate when the available sample size is small. In addition, regression analysis was used to calculate bridge deterioration. Condition ratings were determined for bridge groups, and the best regression model was selected for each group. The results obtained were very similar to those obtained when using Markov chains; however, it is desirable to use more data for better results.
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