

Statistical Analysis of Bridge Management System Inspection Data

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1 Abstract

Bridge inspection is essential for sustaining safe and well-performing transportation networks. The Ministry of Transportation of Ontario (MTO) bi-yearly inspects over 2800 bridges in Ontario, Canada. Then assigns each bridge a Bridge Condition Index (BCI) representing its performance level and required rehabilitation. As this is a time and resources consuming practice, this study explores the BCI trends which can allow a better control on inspection and maintenance scheduling. First, statistical analysis is conducted to identify the correlation of the bridge parameters with the BCI. The analysis reveals that the main parameters associated with BCI are bridge age, and time since last major and minor maintenances. Then, multivariate regression analysis is performed to establish a BCI prediction equation function of these parameters. The proposed framework can supplement existing practices for smarter inspection and maintenance scheduling.

Keywords: Bridges, inspection, maintenance, Bridge Condition Index.

2 Introduction

Bridges are a vital component of the transportation network in Ontario and Canada. Regular inspection is essential for accurate assessment of bridge performance and its repair needs [1-3]. However, bridge inspection can be costly and time consuming [4-6]. Thus, it is economically beneficial to provide a statistical-based framework that can be used to predict the future condition for bridges. Such framework can serve as guideline for assigning an appropriate inspection and maintenance priority for each bridge. That way, bridges with expected poor or fair performance can be given higher priority allowing for inspection and maintenance prioritization that can save both time and resources [7, 8].

The Ministry of Transportation of Ontario (MTO) [9] conducts detailed maintenance inspections every two years for over 2800 bridges owned by the

Ontario province. First, inspectors evaluate the condition of each bridge element, such as the deck and bearings, then the bridge is assigned a Bridge Condition Index (BCI) score reflecting its performance and maintenance requirements. For example, a BCI score ranging from 70-100 indicates good performance with no required maintenance for the following five years. Bridges with a BCI of 60-70 may need repairs within the next five years. Finally, a score lower than 60 implies the need of repairs within a year. Thus, the purpose of this study is to identify the main parameters affecting the BCI and to understand the BCI trends, allowing for the better control on inspection and maintenance strategies.

The proposed framework is based on the inspection data provided by the MTO which includes the latest records of BCI scores in addition to other valuable information such as construction date, last major or minor rehabilitations dates, construction material,