

ABSTRACT

Taylor, Benjamin R. M.S.C.E., Purdue University, August 2015. An Investigation of the Economic Impact of Implementing Nondestructive Testing Methods for Reinforced Concrete Bridge Decks in Indiana. Major Professor: Mark Bowman.

Bridge decks are among the most expensive components of a bridge over the lifetime of the structure because they frequently require maintenance and rehabilitation. Currently, the Indiana Department of Transportation performs visual inspection as their principal means of determining condition in the deck. This only allows the inspector to truly tell the surface condition and speculate what is occurring below the surface. Because of this lack of quality data, INDOT implements programmatic scheduling of major work actions. Nondestructive testing methods that can locate corrosion and delamination exist, but they are not being utilized.

The primary objective of the study was to investigate the economic viability of using nondestructive testing to evaluate bridge deck condition and manage decisions on major work actions. First, nondestructive tests were evaluated to find out if they are, in fact, better at locating deterioration than current methods. Then, a project level comparison between the NDT methods was performed to show which method and combination of methods were the best from a cost perspective. Using the optimal combination of methods, a project level analysis on 30 bridge decks was performed, and the costs were compared to current programmatic schedules. Finally, this analysis was expanded to the network level, which includes the entire bridge inventory in Indiana.

The results of this study indicate that implementing nondestructive testing methods is financially beneficial. After a thorough literature review and conferring with NDT personnel, it is found that NDT methods are much better at assessing bridge deck

condition than current methods of bridge deck inspection. From a cost perspective and on the project level, infrared thermography was the best individual equipment, while the best combination of NDT methods was chloride ion penetration, ground-coupled ground-penetrating radar, and infrared thermography. Only air-launched horn GPR and IR have highway speed capabilities, so they were the selected NDT combination for network level collection. In-house project level usage of NDT methods were less costly because of the fewer work actions being performed. Similarly, in-house network level usage of NDT methods compared to current methods leads to significant savings. When comparing consultants to in-house NDT use, it can be beneficial to utilize a consultant when their cost per area estimate is below the break-even point.