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Bridge Health Monitoring by Infrared Thermography

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1 Abstract

Condition ratings of bridge components in the Federal Highway Administration (FHWA)'s Structural Inventory and Appraisal database are determined by bridge inspectors in the field, often by visual confirmation or direct-contact sounding techniques. However, the determination of bridge condition ratings is generally subjective depending on individual inspectors' knowledge and experience, as well as varying field conditions. There are also limitations to access, unsafe working conditions, and negative impacts of lane closures to account for. This paper describes an alternative method to obtaining informative and diagnostic inspection data for concrete bridge decks: mobile nondestructive bridge deck evaluation technology. The technology uses high-definition infrared and visual imaging to monitor bridge conditions over long-term (or desired) intervals. This combination of instruments benefits from rapid and large-scale data acquisition capabilities. Through its implementation in Japan over the course of two decades, the technology is opening new possibilities in a field with much untapped potential. Findings and lessons learned from our experience in the states of Virginia and Pennsylvania are described as examples of highway-speed mobile nondestructive evaluation in action. To validate the accuracy of delamination detection by the visual and infrared scanning, findings were proofed by physical sounding of the target deck structures.

Keywords: bridge inspection; concrete bridge deck; nondestructive evaluation; infrared thermography; high speed scanning; mobile scanning; validation.

2 Introduction

Bridge inspectors for both state agencies and engineering contractors use their eyes, hands, and sounding hammers in the field to look for deficiencies such as delamination or the presence of cracking and spalling. This does serve inspectors well in determining the general condition of decks, but a single bridge inspection may be a day to a week-long venture, depending on the structure size, accessibility, and condition. This raises an important question about efficiency, and how to reduce time in the field and impact to the public.

Also, the determination made by the inspector, given the same guidance by reference manuals such as the AASHTO Guide Manual for Bridge Element Inspection [1], may still lead to different conclusions. This level of subjectivity can be concerning to end-users, such as state bridge engineers or project leads, who are not afforded the time to visually look at every single bridge element themselves. But what if they did have the capability to view a

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