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16. Abstract

This report is divided into two volumes. This volume (Volume I) summarizes a structural health monitoring (SHM) system that was developed for the Iowa DOT to remotely and continuously monitor fatigue critical bridges (FCB) to aid in the detection of crack formation. The developed FCB SHM system enables bridge owners to remotely monitor FCB for gradual or sudden damage formation. The SHM system utilizes fiber bragg grating (FBG) fiber optic sensors (FOSs) to measure strains at critical locations. The strain-based SHM system is trained with measured performance data to identify typical bridge response when subjected to ambient traffic loads, and that knowledge is used to evaluate newly collected data. At specified intervals, the SHM system autonomously generates evaluation reports that summarize the current behavior of the bridge. The evaluation reports are collected and distributed to the bridge owner for interpretation and decision making.

Volume II summarizes the development and demonstration of an autonomous, continuous SHM system that can be used to monitor typical girder bridges. The developed SHM system can be grouped into two main categories: an office component and a field component. The office component is a structural analysis software program that can be used to generate thresholds which are used for identifying isolated events. The field component includes hardware and field monitoring software which performs data processing and evaluation. The hardware system consists of sensors, data acquisition equipment, and a communication system backbone. The field monitoring software has been developed such that, once started, it will operate autonomously with minimal user interaction. In general, the SHM system features two key uses. First, the system can be integrated into an active bridge management system that tracks usage and structural changes. Second, the system helps owners to identify damage and deterioration.

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