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Monitoring local damage due to fatigue in plate girder bridge

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Abstract

About 95% of all fatigue damage to plate girder bridges occurs at the front of soleplates, the edge of gusset plates, and the upper end of vertical stiffeners. In the present study, the changes in vibration frequency and main-girder deflection that are generally used as indices to monitor the condition of a bridge were analytically investigated to determine their effectiveness, using a model that considered the influence of the types of fatigue cracks present in a real bridge. The results of a natural vibration analysis and a dynamic analysis that considered a vehicle traveling on the bridge showed that the dynamic deflection response and the vibration characteristics of the bridge changed as damage progressed. It was found to be possible to identify the conditions leading up to serious fracture of the main member and total bridge collapse. However, it was more difficult to detect incipient fatigue cracks and fracture of secondary members.

Keywords: plate girder, fatigue crack, vibration frequency, deflection, bridge monitoring

1. Introduction

As transportation infrastructure ages, it is important to develop effective methods for maintenance of the large number of existing bridges. One approach that is expected to become widespread is the combined use of sensors and information-and-communication technology. To allow long-term

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