



Numerical Examination in Bridge Responses due to Fracture of Truss Member in a Steel Truss Bridge under Vehicle Loadings

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Abstract

This study investigated the bridge responses and modal parameters of a steel truss bridge based on FE analysis considering vehicle loadings and aimed to propose an adjustable damage scenario for a loading test on the target bridge. The idea of this study is that the modal parameters and stress distribution identified under assumed damage scenario can provide useful information to decide artificial truss member cut-off patterns and to ensure the bridge safety in the vehicle loading tests. A three-dimensional FE model is constructed using commercial FE analysis software suite for calculating modal parameters (natural frequencies and mode shapes) and maximum internal member force of the bridges. The eigenvalue analysis and static loading analysis were conducted with intact bridge and damaged bridge whose member fracture is simulated by removing one vertical, diagonal member, or two vertical members, in order to find the most severe condition for cutting locations where largest axial force occurs. Results show that variation in modal frequency and mode shape due to different damage scenario are conspicuous. Effect of cut-off pattern changes of damage scenarios are observable by comparing the analysis results between intact and damaged bridge. Finally, two vertical steel members are determined to be cut off in the field loading test.

Keywords: steel truss bridge model; member fracture; FE analysis; cut-off truss member.