A Novel Approach to Analyze Existing Bridges Efficiently

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Abstract

Analyses of existing bridges are conducted for different reasons such as load rating and retrofit simulations. It is desirable to have full 3D finite element models for analysis purposes; however, development of such models may not be feasible since these 3D models require considerable time, effort and expertise. As a result, AASHTO provides practical methods for the analysis of the bridges. The basic approach which is commonly used by design offices, DOT engineers and other practitioners is the beam line analysis using distribution factors. The recent AASHTO LRFD Bridge Design Specifications provides formulations where span length, beam spacing, beam stiffness and slab thickness are used to obtain girder moment and shear distribution factors. In this study, the writers explore the use of simply measurable quantities to obtain distribution factors more reliably, thus obtain better models that describe the actual condition of bridges. In this paper, the writers present their study to investigate moment and shear distribution factors of simple span T-beam bridges by using frequency "ω_i", flexibility "f_{ii}" and skew "θ" which can be determined by means of simple tests. First, finite element models of 40 bridges are analyzed to obtain frequency and flexibility information. Second, the moment and shear values are collected for all models under HL-20 truck load. Third, a non-linear regression analysis is conducted to generate an appropriate equation which includes frequency, flexibility and skew to determine the distribution factors. Finally, frequency and flexibility and skew information coming from a real life study are used in these equations and the results are compared for verification of the formulation and the approach.