Monitoring-Based Operational Bridge Condition Assessment Using Detrended Measured Girder Distribution Factors

Masoud SANAYEI, Claire WRIGHT, Allen MARR

Long-term operational strain measurements are taken from a 3-span continuous steel girder bridge to estimate girder distribution factors (GDFs) which are used to detect bridge damages. A nonlinear multiple regression model is fitted to the GDFs to study the parameters that affect the GDFs. It revealed that bridge age, temperature, frozen ground, and vehicle travel path can be statistically significant variables. Using the model, the variations due to environmental conditions and traffic events are removed from GDFs, leaving only the live load distribution due to the geometry and material properties. A nonparametric rank-sum test is proposed to detect structural damage using the detrended GDFs. The method is shown to exhibit a high degree of statistical power for detecting damages from detrended GDFs. In damage scenario simulations, the proposed method could detect damage if it existed to issue safety warnings. It would not issue false safety warnings when the damage was not present.