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Evaluation of Commercial Back-analysis Package in Condition Assessment of Railways

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Abstract : Over the years,increased demands on railways, the emergence of high-speed trains and heavy axle loads, ageing, and deterioration of the existing tracks, is imposing costly maintenance actions on the railway sector. The need for developing a fast andcost-efficient non-destructive assessment method for the structural evaluation of railway tracksis therefore critically important. The layer modulus is the main parameter used in the structural design and evaluation of the railway track substructure (foundation). Among many recently developed NDTs, Falling Weight Deflectometer (FWD) test, widely used in pavement evaluation, has shown promising results for railway track substructure monitoring. The surface deflection data collected by FWD are used to estimate the modulus of substructure layers through the back-analysis technique. Although there are different commerciallyavailableback-analysis programs are used for pavement applications, there are onlya limited number of research-based techniques have been so far developed for railway track evaluation. In this paper, the suitability, accuracy, and reliability of the BAKFAAsoftware are investigated. The main rationale for selecting BAKFAA as it has a relatively straightforward user interfacethat is freely available and widely used in highway and airport pavement evaluation. As part of the study, a finite element (FE) model of a railway track section near Leominsterstation, Herefordshire, UK subjected to the FWD test, was developed and validated against available field data. Then, a virtual experimental database (including 218 sets of FWD testing data) was generated using theFE model and employed as the measured database for the BAKFAA software. This database was generated considering various layers' moduli for each layer of track substructure over a predefined range. The BAKFAA predictions were compared against the cone penetration test (CPT) data (available from literature; conducted near to Leominster station same section as the FWD was performed). The results reveal that BAKFAA overestimatesthe layers' moduli of each substructure layer. To adjust the BAKFA with the CPT data, this study introduces a correlation model to make the BAKFAA applicable in railway applications.

Keywords : back-analysis, bakfaa, railway track substructure, falling weight deflectometer (FWD), cone penetration test (CPT)
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