

Determination of dynamic ballast characteristics under transient impact loading

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ABSTRACT: Train-related impact loads acting on a sleeper bottom were directly measured and spectral analysis was performed to determine the dynamic characteristics of ballast layer under traffic impact loads. The results indicate that broadband vibration components act on the ballast layer, which exhibits two different types of behavior depending on dynamic stiffness characteristics. For vibration components over 100 Hz, the layer has high rigidity, resists dynamic loading sufficiently and absorbs impact loading adequately. However, in the low-frequency range, it easily deforms and is hard to absorb load components. FE vibration analysis of ballast aggregate was also performed to examine related characteristics. The mechanisms by which wave propagation velocity inside a ballast layer is reduced and wave motion inside it is greatly reduced were numerically simulated using only elastic body analysis without consideration of material nonlinearity.

Keywords: Ballasted track, Field measurement, Concrete sleeper, Spectral analysis, Finite element analysis