Development of Measurement Techniques for Dynamic Pressure on a Sleeper Bottom and Dynamic Behavior of Ballast Stone Induced by Running Train

Akira AIKAWA Akira NAMURA Akiko KONO Fumihiro URAKAWA

This paper describes a newly developed technique to measure the dynamic pressure on a sleeper bottom induced by a running train with high frequency up to several thousand Hertz using a special sensing sleeper. Attached to the whole undersurface of the sleeper is a solid construction of 75 pieces of thin impact force sensor whose main body is made of piezoelectric film (PVDF), silicone rubber and solid cover plates. The solid cover plates transmit impact force to the sensor and prevent breakage of the sensor itself from impact loads of a running train. Next, the paper also describes newly developed measurement techniques of the three-dimensional (3D) behavior of a ballast stone using a special ballast sensing stone with piezoresistive triaxial acceleration sensors. We examined the performance of sleeper sensor and sensing stone through a full-scale field experiment performed on a railway line. The results verified that the newly developed techniques are effective for measuring the dynamic interaction within the boundary layer between a sleeper and an assemblage of ballast grains of a conventional ballasted track.