

Application of Ground Penetrating Radar and Light Falling Weight Deflectometer in Ballast Quality Assessment

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Abstract : Systematic monitoring of the trackbed is necessary to assure safety and quality of service in the railway system. Moreover, to produce effective management of the maintenance treatments, the assessment of bearing capacity of the railway trackbed must include ballast, sub-ballast and subgrade layers at different depths. Consequently, there is an increasing interest in obtaining a consistent measure of ballast bearing capacity with no destructive tests (NDTs) able to work in the physical and time restrictions of railway tracks in operation. Moreover, in the case of the local railway with reduced gauge, the use of the traditional high-speed track monitoring systems is not feasible. In that framework, this paper presents results from in site investigation carried out on ballast and sleepers with Ground Penetrating Radar (GPR) and Light Falling Weight Deflectometer (LWD). These equipment are currently used in road pavement maintenance where they have shown their reliability and effectiveness. Application of such Non-Destructive Tests in railway maintenance is promising but in the early stage of the investigation. More specifically, LWD was used to estimate the stiffness of ballast and sleeper support, as well. LWD, despite the limited load (6 kN in the trial test) applied directly on the sleeper, was able to detect defects in the bearing capacity at the Sleeper/Ballast interface. A dual frequency GPR was applied to detect the presence of layers' discontinuities at different depths due to fouling phenomena that are the main causes of changing in the layer dielectric proprieties within the ballast thickness. The frequency of 2000Mhz provided high-resolution data to approximately 0.4m depth, while frequency of 600Mhz showed greater depth penetration up to 1.5 m. In the paper literature review and trial in site experience are used to identify Strengths, Weaknesses, Opportunities, and Threats (SWOT analysis) of the application of GPR and LWD for the assessment of bearing capacity of railway track-bed.

Keywords : bearing capacity, GPR, LWD, no destructive test, railway track

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