

Ballast settlement and ballast deformation laws for predicting the railway track degradation

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ABSTRACT

The constant passage of rail traffic causes permanent and gradual settlement of the granular layers of ballasted tracks. The settlement of the ballast layer represents the most significant component of the overall settlement of a railway track.

In the last years, several authors have defined laws and models for the prediction of the permanent settlement and the deformation of the ballast layer [1]. The majority of those models only consider the vertical degradation of the track, disregarding this phenomena in the lateral direction, since the vertical track geometry deteriorates faster than the horizontal one. These laws are usually established through laboratory tests on materials that constitute the ballast layer, field testing or tests at a reduced scale [2].

In this paper a review of the laws to estimate the ballast permanent settlement and the ballast permanent deformation that results from the railway traffic is presented and discussed. Then, two numerical cases are analysed. In the first case, the evolution of the track settlement due to the passage of the dynamic loads on an uneven track is presented. For that, a numerical iterative procedure is used [3]. In the second case the ballast permanent deformation, which is estimated using laws that depend on the number of loading cycles and the stress state the materials are subjected to [4], is incorporated in the numerical model, through an iterative procedure. This methodology enables to simulate the deformed track profile evolution [5].

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