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IMPACT OF DIFFERENT SUBBALLAST SOLUTIONS ON THE SERVICE LIFE OF THE RAILWAY SUBSTRUCTURE

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The use of bituminous materials in railway trackbeds has been pointed out as an interesting alternative to the granular-only subballast design traditionally applied in most European railroad tracks. The present paper focuses on the use of bituminous subballast layers in railway trackbed design and on their potential to protect the substructure over its service life. It describes a suitable methodology to account for the effects of traffic loading and environmental actions in the hydro-thermo-mechanical performance of the subgrade and consequent deformational behaviour over time. Thus, the effect of using bituminous subballast layers instead of the conventional granular-only design may be assessed.

The developed methodology is based on a mechanistic-empirical design approach where railway track finite-element models are developed to perform the mechanistic and hydro-thermic analyses, and empirical equations are applied to relate the computed response to subgrade long-term deterioration. The mechanical design of the railway track considers the elastoplastic behaviour of railway track materials as well as an adequate modelling of the sleeper-ballast interface contact. The hydro-thermic analysis of the railway track, accounts for environmental variables such as hydro-geological conditions (groundwater table) and atmospheric actions (precipitation, temperature, and relative humidity) and models the runoff of superficial rainwater.

Combined with empirical equations, the results from the mechanical and hydro-thermic analysis were used to predict the long-term deformational behaviour of the subgrade. The solutions incorporating bituminous materials showed a better performance than the granular-only design concerning the predicted substructure service life. Furthermore, the phreatic level was found to have great influence on the substructure's deformational behaviour, thus proving the importance of an adequate design of subsurface deep drainage systems.