Study of the behavior of unsaturated fine-grained soils under cyclic loading - Application to the development of a methodology for diagnosis and maintenance of the Trans-Gabon Railway subgrade.

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Context

The repeated moving of trains induces cyclic loading on the railway subgrade soil which, in certain situations (high axle load, adverse environmental context, failure of the drainage system), can lead to a state of failure of the track (photo 1). In the case of the Trans-Gabon Railway line, subgrade instability problems are recorded due to the severe environmental context (high rainfall) and the presence of evolving subgrade soils. At present, the behavior under cyclic loading, in unsaturated condition, of railway subgrade with fine-grained soils is still poorly mastered.

Objectives

▶ To propose a diagnostic methodology to evaluate the in-situ mechanical resistance and the amplitude of plastic strain of the railway subgrade soil, according to the water conditions and the amplitude of cyclic loading applied
▶ To estimate, from in-situ measurements, the characteristics of the subgrade soil (water content, dry density) in order to feed the plastic strain prediction model.

Methods

Mathematical model

The analytical model for the prediction of the strains that we propose to determine will have to take into account the amplitude of the cyclic loading (Δq_{max}) and the degree of saturation of the soil (S_{r}). The model gives the plastic axial strain (\varepsilon_{pa}) such as [3]:

\varepsilon_{pa}(N, S_{r}, Δq_{max}) = t(S_{r}, Δq_{max}) \cdot f(N)

Where f_{pa} is the axial plastic strain according to the number of cycles of the load application to the axle (N) and t(S_{r}, Δq_{max}) is the axial plastic strain depending on the amplitude of loading and the soil moisture status.

Materials

References


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