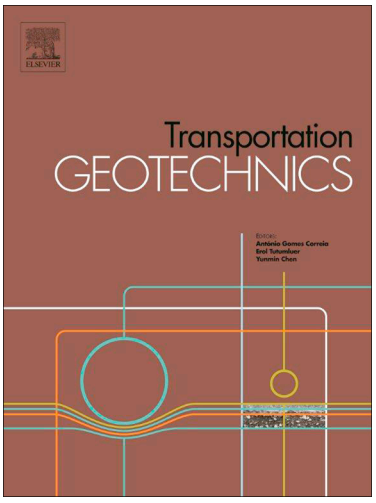

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Modelling the effects of trafficking and tamping on scaled railway ballast in triaxial tests

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Abstract

Most of the world's railways are on ballasted track, which is generally used in preference to slab track because of its lower initial cost and the relative ease with which track geometry can be adjusted. However, the accumulation of track movements as a result of trafficking leads to a gradual deterioration in track line and level, hence the need for periodic corrective maintenance. This is usually by tamping; a process in which the track is lifted and vibrating tines are inserted into the ballast and moved horizontally to raise the ballast surface back to the required level. The period before further maintenance is required decreases with each tamp. This paper investigates one of the reasons for the deterioration in ballast robustness following tamping, with reference to triaxial tests on scaled ballast in which vertical loading cycles and the stress reversal caused below the railseat by tamping were simulated. It is shown that the stress reversal disrupts and loosens the vertical load bearing ballast structure developed during trafficking to support vertical train loads. On re-loading after tamping, the track settles significantly and, as a result of the loss of vertical load-bearing structure, with further load cycles rapidly returns to its reduced height. The implication is that maintenance by tamping is, on its own, disruptive to the structure and resilience of the ballast to vertical cyclic loading, and should be carried out as rarely as possible.