The 2024 World Congress on
Advances in Civil, Environmental, & Materials Research (ACEM24)
19-22, August, 2024, The K hotel, Seoul, Korea

Investigating the Reinforcing Effects of Geogrid in Unbound Granular Materials using the Precision Unbound Material Analyzer (PUMA) and Repeated Load Triaxial (RLT) Tests

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ABSTRACT

Geogrids have been extensively employed to reinforce unbound granular materials (UGMs) for enhancing pavement performance. Although traditional repeated load triaxial (RLT) tests are commonly used to evaluate geogrid effectiveness, they are not able to replicate the soil stress states in pavements. This is because the confining stresses are maintained as a constant value in RLT tests, which could not simulate the residual lateral stresses and strains accumulated in the soil during repeated loadings. Additionally, it is difficult to compare the effectiveness of geogrids with different tensile strengths based solely on the RLT test results. Therefore, in this study, the precision unbound material analyser (PUMA) is adopted to investigate the performance of geogrids in UGMs. PUMA tests are similar to the RLT tests, but they enable repeated load testing under confinement with constant stiffness. The results of PUMA tests, including the horizontal confining stress, resilient modulus, and permanent strains, were analysed to evaluate the effects of geogrids on UGMs. Traditional RLT tests were also conducted, and the results are compared against those of the PUMA tests. While both RLT and PUMA tests yielded consistent trends regarding the reduction in permanent deformation of UGMs, PUMA tests offer a more accurate approach for simulating the interlock effects and quantifying the benefits of geogrids. Furthermore, PUMA tests provide a higher degree of accuracy in simulating field soil stress states through dynamic horizontal confinements. The results of this study also demonstrate the advantages of PUMA tests in terms of repeatability and result consistency compared to RLT tests.

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