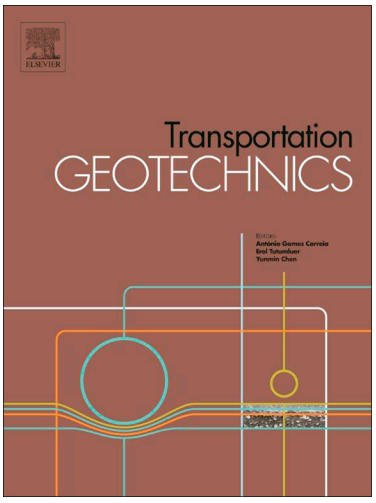

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Drainage Potential of Reservoir Course of Porous Pavement for Various Particle Size Distributions of Aggregate

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Abstract: Porous pavements are constructed to allow surface water to pass freely through the pavement structure and finally to percolate into the underlying soil. The main advantages of these pavements are managing storm water as well as reducing runoff quantity in urban roadways. The reservoir course consisting of coarse aggregate with high values of air void functions as an important layer for proper performance of the porous pavement to provisionally store water and slowly release it into the underlying soil. In the present study, the hydraulic conductivity of reservoir layer is experimentally determined by providing different sieve size ranges of aggregate and considering the non-laminar flow condition. Then, imaging-based analysis of two dimensional (2D) horizontal images captured from tested aggregate specimens is carried out to further illuminate the percentage of pore area between coarse aggregate and drainage potential of the reservoir course with different particle size distributions. Obtained results show that providing smaller-sized gradation of aggregate (especially with lower effective diameter) leads to the reduction of the permeability of reservoir course. Also, consideration of uniform gradation with narrow range of particle sizes results in estimation of higher values of hydraulic conductivity coefficient. Furthermore, analysis of the 2D horizontal images indicates less percentage of pore area for established gradations with broad range of particle sizes and lower values of effective diameter. Generally, an inverse correlation is observed between the estimated pore area as well as the computed volumetric air void content with the experimentally determined hydraulic conductivity.

Keywords: Porous pavement; Reservoir course; Permeability; Gradation; Air void

1. Introduction

The conventional pavement of urban street is constructed to prevent the entry of rainwater and snowmelt into the pavement structure by providing ditches along the two sides of the street. In the recent two decades, porous pavement has been developed in urban areas in which the rain water can freely pass through the pavement structure and can finally penetrate into the underlying soil (Weiss et al. 2017). Permeable pavement surfaced by pervious concrete or porous asphalt mixture, is usually used for parking lots, low traffic urban streets, golf courses, bike trails and sidewalks because of lower load bearing capacity of the permeable pavement (Roseen et al. 2012, Hein and Schaus 2016). Generally, permeable pavement results in reducing the runoff volume in urban areas, recharging local aquifers, removing pollutants from water, reducing the deicing salts, and consequently protecting the natural environment. Also, porous pavement is so advantageous due to increasing the road