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THE EFFECT OF CYCLIC WHEEL LOADING ON RUTTING BEHAVIOUR IN UNPAVED ROADS WITH GEOCELL-REINFORCED BASES

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Geocell concept was originally developed by US army corps of engineers in 1970s. Due to its three Dimensional shape, geocell offers all-round confinement to the soils, which improves the mechanical characteristics of soils. Behaviour of the geocell reinforced soils under the dynamic load such as cyclic plate load testing and wheel loading is not clearly understood yet.

Moghadds Tafreshi et al. (2010, 2015) carried out the cyclic plate load test on geocell-reinforced sand. Madhavi et al. (2010) indicated the benefit of geosynthetics in unpaved roads constructed over weak subgrade. Yang et al. (2012) constructed unpaved road sections with different types of layer profile. They evaluated the results from accelerated pavement testing of unpaved road with geocells-reinforced sand bases. Tabatabaei Aghda et al. (2019) studied on the behaviour of geocell-reinforced dredged sand. They presented the results of full scale wheel and plate load tests. However there is not any study has been done on the behaviour of geocell-reinforced poorly graded gravel under the wheel loading.

This study reviews previous studies related to the geocell-reinforced soil under cyclic loads. Furthermore evaluates the effect of geocell-reinforced poorly graded gravel under the wheel load in unpaved roads with geocell-reinforced bases. Large scale laboratory tests were conducted on the geocell-reinforced and unreinforced GP soil. The rutting of the wheel loading on the soil was measured.

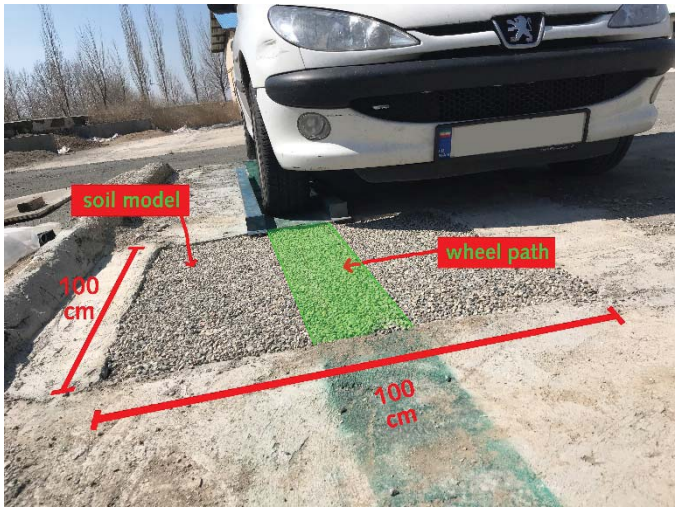

Figure 1. Field test arrangement.

The soil used in this study is classified as GP according to the unified soil classification system. The geocells have 5 cm height and 10×11 cm pocket size. In both reinforced and unreinforced sections, GP aggregate was compacted to 90% of dry density. Loading was performed by the passage of the 3200 N wheel of a car at a constant speed of 5 km/hr. The test pit of this study was constructed in 70 cm depth, 100 cm length and 100 cm width with concrete floor and walls. The field test arrangement presented in Figure 1. Geocell is placed over the GP soil in reinforced section and filled with it. A 5 cm well graded gravel covered the geocell. The geocell-reinforced test pit section is shown in Figure 2-a. The unreinforced section is presented in Figure 2-b. The moving wheel ran back and forward in the sections. Rut depths in the middle of two sections were measured with a reference frame and a laser meter when the number of passes reached 2, 4, 10, 20, 30, 50 and 80.

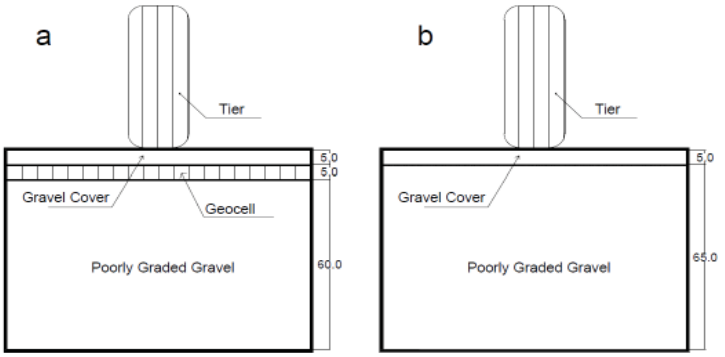

Figure 2. Profile sections: (a) geocell reinforced, (b) unreinforced.

After the large scale tests were conducted, the rut depth with the number of passes graph and cross section profile with horizontal distance were plotted. These graphs show the rut depth development clearly. According to the results, geocell-reinforcement had a significant effect in improving the behaviour of the GP soil. The ratio of maximum rutting in unreinforced section to geocell-reinforced section is 1.48.

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