

BEHAVIOR OF GEOCELL REINFORCED SAND FOUNDATION SYSTEMS UNDER CYCLIC LOADING

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ABSTRACT

Geocell is an efficient type of reinforcement in the soil improvement problems as a result of the lateral confinement it provides for the infill soil. However, its applicability is not well considered in practice due to the lack of a standard design method. In this research, in order to study the monotonic and cyclic behavior of geocell reinforced sand, a reduced scale physical model of foundation on the reinforced soil is developed and pressure-settlement performance of the foundation system is evaluated. Geocells with various heights are made using a woven geotextile which are located in the optimum position in the dense sand bed and the strip foundation model is then situated on the surface of the reinforced soil. The footing is then subjected to a pre-specified static load followed by 1000 cycles of repeated loads with the frequency of 0.5 Hz. The results show that cyclic loading leads to substantial plastic settlement in each cycle which have a decreasing trend by increase in the load cycle number. Depending on the type of reinforcement and the amplitude of the cyclic load there would be footing instability after some load cycles i.e. ratcheting happens or a stable condition in which development of plastic settlement will be ceased by exerting the cyclic load i.e. plastic shakedown occurs. It is concluded that the cellular geotextile improves the performance of the footing much more than the planar geotextile with the same amount of reinforcement. Increasing height of geocell will also result in more improvement factors in reducing the permanent plastic settlements and the amplitude of the cyclic loading and its difference with the ultimate static bearing capacity of the footing makes a significant contribution on the behaviour of the reinforced sand foundations.

INTRODUCTION

In recent years using geosynthetics as soil reinforcements is a very common technique for soil improvement. One of the most effective types of geosynthetics are geocells which have been used as soil reinforcement for embankments, foundations, retaining walls and slopes. Since geocell has a three-dimensional geometry, it provides a great lateral confinement for the infill material without dependence on the friction or interlocking with the infill soil. When they are used under the foundations or embankments, the bearing capacity of subgrade increases and footing settlements decreases much more than the case of using the planar types of reinforcements like geotextiles and geogrids as a result of confinement and distribution of pressure to a wider area in the underlying soil.