Effects of Changing Water Level on Stability of Reinforced Earth Marine Wall

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Abstract

One of applications of reinforced earth is in marine works. In this application a reinforced soil wall may be used as a quay wall, wharf structure or a seawall to protect the coastline against wave action. When a reinforced soil wall is used as a seawall, it must be designed to withstand against the marine environment. Changing water level in front of the wall is one of marine parameters, which could affect the stability of the structure. This paper evaluates the effects of changing water level especially saturation and rapid draw down on stability factors of reinforced soil marine wall. For this purpose a model wall was subjected to different cases of changing water level and the amount of safety factors of the wall were computed by a computer program developed by the author. The study shows that the rapid draw down of water table from top of the wall can increase the tensile force in the reinforcement by three times, which inherently decreases the safety factor of the structure.

Introduction

When a reinforced soil wall is constructed in marine environment, it must be designed to withstand against marine parameters such as submergence, changing water level due to tide, wave forces and ship attack [۲]. One of marine parameters, which may have deleterious effect on stability of the structure, is changing water level, especially in the case of rapid draw down of water table in front of the wall [۴], [۶]. Rapid change of water level in front of the wall is almost occurs in presence of high sea waves. This papers aims to evaluate the effects of changing of water level especially rapid draw down on stability factors of reinforced earth marine wall. To determine this effect, different cases of changing water level may be considered. In the first case, the water table is assumed to be stable and horizontal on the inside and outside of the wall but the different depths (Figure ۱a). This case is suitable for simulating tide effects on the wall behaviour. In the second case, the water level in the backfill of the wall is higher than in the front of the wall, and water seeps out from the backfill (Figure ۱b). This case simulates the rapid draw down of the water table at the front of the wall. In the third case, the water table at front of the wall is higher than in the backfill, and water seeps into the wall. In this case the water pressure acting on the facing panels reduces the tensile forces of the strips and provides more stability for the wall. Since the third case has no deleterious effects on the stability of the structure, only the first two categories studied in this research.

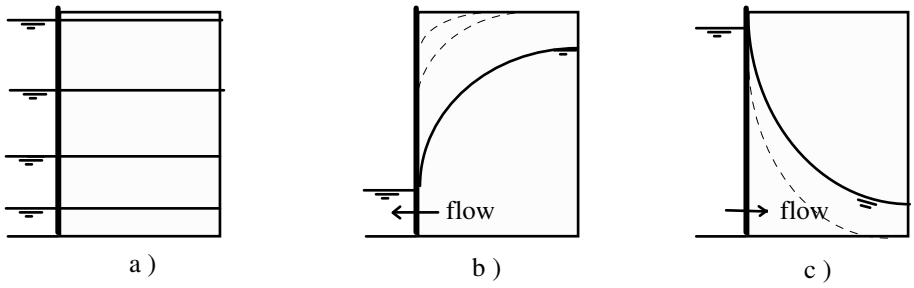

Figure ۱: Different categories of changing water level

This study was done by numerical modelling. The numerical modelling was done using the computer program ADRES, developed by the author. This program is able to carry out seepage computations as well as the internal and external analysis of reinforced earth walls by

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