DESIGN AND USE OF A NOVEL TEST APPARTUS FOR RETENTION OF FINE DREDGED FILL

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INTRODUCTION

This paper will discuss the problem of retaining fine sand in reclamations protected by rubble mounds with geotextile filters. It formed part of a wider study that will be presented at this conference by Dimakopoulos et al., where the hydraulic gradient at the reclamation / landfill (see Figure 1) will affect retention of the sand. In particular, we will describe the design and application of a novel test device to identify sand retention in experiments on an example sand sample and geotextile subject to reversing heads. It also directly follows on from the work by Cantelmo et al 2011 and Polidoro et al 2015, where hydraulic gradients in the core were examined during the assessment of the extent / suitability of the retention method. The paper will summarise numerical modelling to derive appropriate hydraulic gradients (Dimakopoulos et al.), the design of the test device using relatively easily obtained materials, and the use in a forensic failure study.

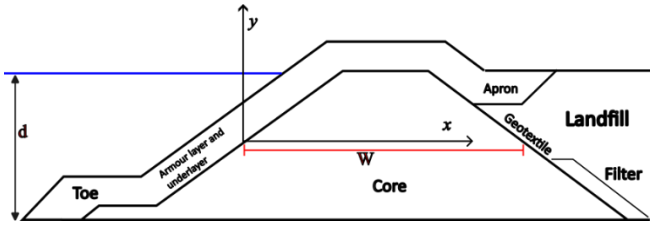

Figure 1: Cross section of a rubble mound retaining a dredged reclamation

METHODOLOGY

There is no generally accepted test on sand-tightness of geotextiles under oscillatory conditions although various ad-hoc tests have been devised over the years (BAW, 1994). These tests suffered a number of weaknesses, mainly in the (wave) periods used. The concept for an oscillatory flow rig was influenced by the Guidelines for Testing Geotextiles BAW (1994). The new device used pneumatic excitation based on knowledge gained by HR Wallingford through the development of our Tsunami Simulators (Rossetto *et al.*, 2011 & McGovern *et al.*, 2018). Sand tightness testing of geotextiles in ASTM D5101 12 (2017) for uni-directional flow conditions was also used in the concept design.

Figure 2: Oscillatory flow test rig, showing the U-tube shape and the sample container in place (clear pipe section)

The novel oscillatory flow rig (see Figure 2) allows samples (both sediment and geotextile) to be subject to oscillatory flow. This flow can be period driven, reversing direction over a given time period, or based on amplitude (head) which mimics a given pressure oscillation at the filter / fill junction (see Figure 3). The paper will describe the baseline testing that was undertaken to validate the rig and then present selected sand-tightness testing undertaken with two different geotextiles. These tests successfully demonstrated the value of assessing sand-tightness under realistic oscillatory flow conditions compared to the standard uni-directional flow conditions.

The paper will conclude with a review of how this work was used within a forensic failure study where it helped inform the fundamental processes that led to the failure.

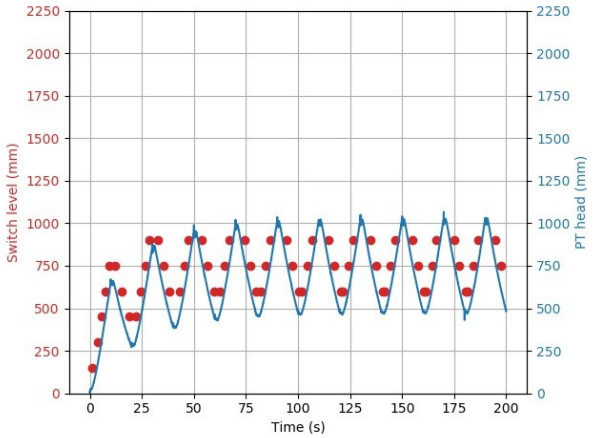

Figure 3: Pressure in the reclamation fill shown against the oscillating head in the apparatus (switch level is a measure of the head of water above the sample tube)

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