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Performance of Pilot Test of Geotextile Tube Filled with Lightly Cemented Clay

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Abstract : In recent years, geotextile tube has been widely used in the hydraulic engineering and dewatering industry. To construct a stable containment bund with geotextile tubes, the sand slurry is always the preference infilling material. However, the shortage of sand supply posts a problem in Singapore to adopt this construction method in the actual construction of long containment bund. Hence, utilizing the soft dredged clay or the excavated soft clay as the infilling material of geotextile tubes has a great economic benefit. There are any technical issues with using this soft clayey material as infilling material, especially on the excessive settlement and stability concerns. To minimize the shape deformation and settlement of geotextile tube associated with the use of this soft clay infilling material, a modified innovative infilling material is proposed – lightly cemented soft clay. The preliminary laboratory studies have shown that the dewatering mechanism via geotextile material of the tube skin, and the introduction of cementitious chemical action of the lightly cemented soft clay will accelerate the consolidation and improve the shear strength of infill material. This study aims to extend the study by conducting a pilot test of the geotextile tube filled with lightly cemented clay. This study consists of testing on a series of miniature geo-tubes and two full-size geotextile tube. In the miniature geo-tube tests, a number of small scaled-down size of geotextile tubes were filled with cemented clay (at water content of 150%) with cement content of 0% to 8% (by weight). The shear strength development of the lightly cemented clay under dewatering mechanism was evaluated using a modified in-situ Cone Penetration Test (CPT) at 0 days, 3 days, 7 days and 28 days after the infilling. The undisturbed soil samples of lightly cemented infilled clay were also extracted at 3-days and 7-days for triaxial tests and evaluation of final water content. The results suggested that the geotextile tubes filled with un-cemented soft clay experienced very significant shape change over the days (as control test). However, geotextile mini-tubes filled with lightly cemented clay experienced only marginal shape changed, even that the strength development of this lightly cemented clay inside the tube may not show significant strength gain at the early stage. The shape stability is believed to be due to the confinement effect of the geotextile tube with clay at non-slurry state. Subsequently, a full-scale instrumented geotextile tube filled with lightly cemented clay was performed. The extensive results of strain gauges and pressure transducers installed on this full-size geotextile tube demonstrated a substantial mobilization of tensile forces on the geotextile skin corresponding to the filling activity and the subsequent dewatering stage. Shape change and the in-fill material strength development was also monitored. In summary, the construction of containment bund with geotextile tube filled with lightly cemented clay is found to be technically feasible and stable with the use of the sufficiently strong (i.e. adequate tensile strength) geotextile tube, the adequate control on the dosage of cement content, and suitable water content of infilling soft clay material.

Keywords : cemented clay, containment bund, dewatering, geotextile tube
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