NON-CONVECTIONAL APPROACH OF DEWATERING HIGHLY SOFT KUMAMOTO CLAY

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1. Introduction:

The present urbanization trend all over the globe, have compelled engineers to build infrastructures on highly slurry clay, even on reclaimed land. The limited space and restriction by government laws regarding where and how to deposit dredge materials have made its more environmentally threaten to man. (Jun Tong, et al, 2012). The aim of this study is to find a remedial way by which this weak soil property can become an engineering enviable resources for embankment work by dewatering process (Shodai Soda, et al, 2015).

Over the years, many approaches have been used in handing this situation but proven uneconomical and environmentally unfriendly, upon this ground this new model whose functionality does not require external factors (energy) rather than itself weight and polyester dewatering materials type was conceived.

2. Material Used:

The soil sample used for this study was obtained from Kumamoto (Aso), Japan. The physical properties of this soil are as follows: initial water content= 185%, liquid limit (LL) = 121.98%, plastic limit=82.12%, plastic index=39.86, organic content=23.4%, and particles density=2.27g/cm3.

3. Laboratory test:

The soil sample was passed through 2mm mesh sieve, with physical properties enumerated above. The test apparatus used in this study are shown in Fig.1 below, illustrating case 1, 2 and 3 of this study. The test apparatus comprises of two polyester materials (A: woven material in thickness of 0.6mm (Tere pack 020)and B: non-woven material in thickness of 2mm (Twin guard TS-20)/ produced by DAIKA industries Co.Ltd, a cylindrical container of 124.64 mm height and 93.4 mm diameters, plastic plate and plastic bag. The sample prepared in 185% of water content was poured into the cases (Case1 –A&B, 2-A&B and 3-A&B), all the case study the significant differences among them is the placement order of the polyester dewatering. Case 1 and 2 polyesters were vertically and horizontally placed respectively, while Case 3 combination of both order of arrangement. After which the cylindrical container housing the plastic bag containing the sample was covered with plastic plate, in order to prevent undue evaporation from the test. This dewatering process lasted for 4, 7 and 14 days periods. In order to monitor the rate of moisture depletion from the test sample, a moisture traducer was planted in case3-A due to effectiveness polyester materials and the case itself in dewatering the clay soil compared to the others as shown in Fig 1 below.

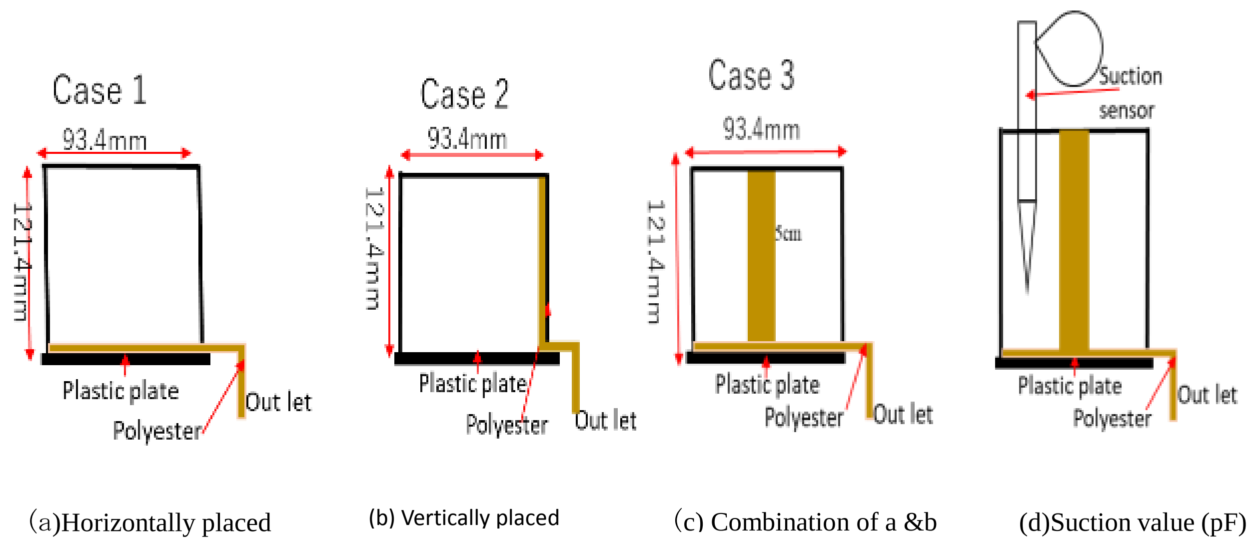


Fig.1. Schematic diagram of dewatering apparatus and suction set up.

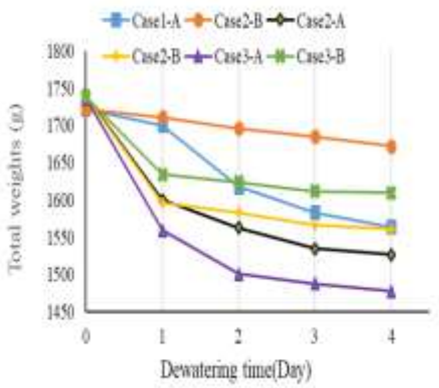


Fig. 2. Dewatering

Table 1. Dewatering ratio.

4Days Dewatering Percentage Ratio.						
	Case 1-A	Case 1-B	Case2-A	Case2-B	Case3-A	Case3-B
Ratio=n%/185%	86%	96%	81%	84%	77%	89%

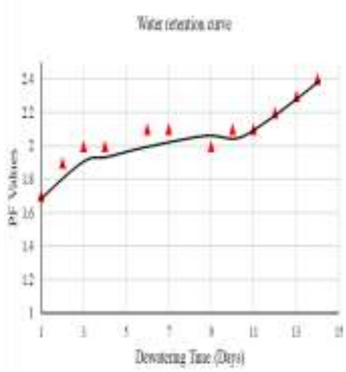
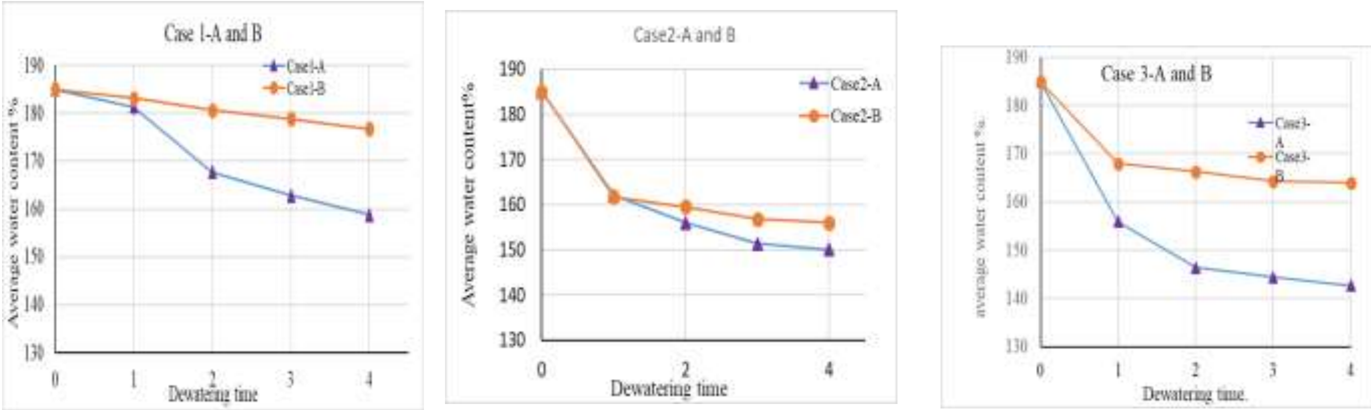


Fig. 4. Suction (pF)



(a) Horizontally placed (b) Vertically placed (c) Combination of both a & b

Fig.3 Change of average water contetn in each case.

4. Results and discussion:

Figures 2 and 3 show the distinctive effectiveness of the dewatering polyesters materials used as well as their order of arrangement effectively dewatered slurry soil at a given period of time. At the initial stage of the experiment much quantity of water deplete from the soil drastically,but the quantity of the dewatering volume began to reduce after passenge of 2days and on through the dewatering period from Fig.4, the pF value was 0 at initial period, untill it get to dewatering period of day 1 and onward, that the suction pressure raises from 0 pF value to 2.4 pF value. This phenomenon behind the dewatering behavoir of the sample (Pham Van et al., 2012) can be attributed to as the process in which the slurry soil began to change to normal Terzergi soil property and the incresement of the pF is an indicator of the reduction of the sample void pore, as illustrated in Fig.4 and Table 1. Furthermore the characteristic differences of the soil behavoir at the initial stage, progressive stage and the final dewatering period considered under this study is that,at initial stage, there is large amount of water contetn which impel the bonding between the soil particles, there by enhances high pore space of the soil and at the progressive stage as well as the final stage of this test,the seperated soil particles, rebuilds their bonds as the soil dehydrate (sedimentation and coagulation took place in the soil test.) ,which in turn increase the pF and the shear strenght of the soil as shown in Figs.3 a), b) and c). From this study, after 7days dewatering period, Case 3-A has 101% water content with a cone index of 134.88kN/m2 from the laboratory test results.

Conclusion: In this experimented work,conclusions can therefore be drawn thus:

- The rate of water depletion from a given slurry soil is proportional to the quality of the dewatering materials used, partern or arrangement and the allowable dewatering time.
- The rise of pF value is determinant of the amount of water present in the soil mass, ie the reduction of the pore space of the soil particles will lead to increase of the soil pF and soil strenght.

References:

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