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Experimental Study on using Broken Tile Waste as a Filler Material in Stone Column

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***Abstract*—Clayey is considered as a weak soil and have very low bearing capacity. In this study an attempt is made to evaluate the suitability of using broken tile waste which is a waste material to act as a substitute material for traditional stone aggregates in a stone column.Tests was performed at varying depths and spacing on single and group piles respectively. Study was also conducted by encasing the piles in a suitable geosynthetic to reduce the bulging effect.**

***Keywords*—Broken Tile Waste; Clay; Stone Column**

I. INTRODUCTION

Soil is one of the most important governing part of design in every construction work.It will be very difficult deal with problematic soils such as weak or soft clays having very high compressibility, loose sand and expansive soils during any construction project. So such soils should be avoided or suitable ground improvement techniques should be applied. Stone column is one such technique. The main aim of inserting a column is to replace a percentage of weak soil with a more stiffer granular material so that it can take up the load from the super structure. But it is applicable and economical only if large gravel, crushed rock or stone aggregate is available abundantly near the construction sites. Now there is a need to upgrade the traditional materials with suitable waste materials.

This paper also focuses on the comparison between ordinary and encased stone column.

I. OBJECTIVES OF THE STUDY

A. To study the effect of depth and spacing on single and group of stone column.
B. To compare between single and group column.
C. To study the effect of encasement.

II. MATERIALS USED

A. Clayey Soil

The soil sample needed for the study was collected from Mancha, Thiruvananthapuram District, Kerala. The clay was sandal yellow in colour.

Fig. 1. Clayey Soil Sample.

A. Broken Tile Waste

Broken tiles was collected from Thirumala, Thiruvananthapuram, Kerala. Tiles was broken and sieved through 10 mm sieve.

Fig. 2. Broken Tile Waste.

B. Geosynthetic

Geosynthetic used in this study was geotextile of 120 GSM.

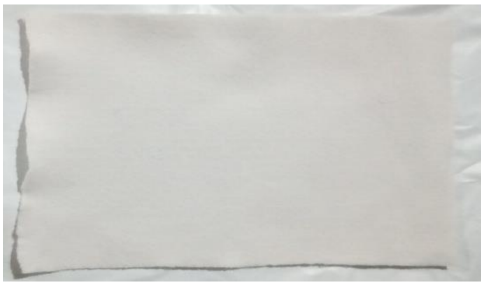


Fig. 3. Geotextile

TABLE 1. PROPERTIES OF CLAYEY SOIL

Sl No.	Property	Value
1	Specific Gravity	2.66
2	Percentage of Clay (%)	57.68
3	Percentage of Silt (%)	42.52
4	Plasticity Index (%)	15.85
5	Soil Classification	CI
6	Maximum Dry Density (kN/M3)	1.58
7	Optimum Moisture Content (%)	20
8	Unconfined Compressive Strength (kN/m2)	20.06

IV. LABORATORY TESTING

The soil was classified as medium plastic clay. Plate load test was conducted on soil. The empty tank was applied with grease around the inner surfaces of test tank to reduce friction between clay and the tank. Soil was mixed with optimum water. Soil was filled in three layers and was compacted to maintain the density. PVC pipe of 40 mm diameter was greased with oil and inserted into the tank. Broken tiles was then charged through the pipe into the tank in layers with proper compaction.

Fig. 4. Single encased column

Fig. 5. Group encased column

V. RESULTS AND DISCUSSION

The load settlement behaviour of ordinary group and encased stone column is shown in figure 4 and 5 respectively. From the graph, single column of 300 mm depth and group column of 90 mm spacing showed a better performance.

Fig. 6. Load settlement curve for ordinary single column

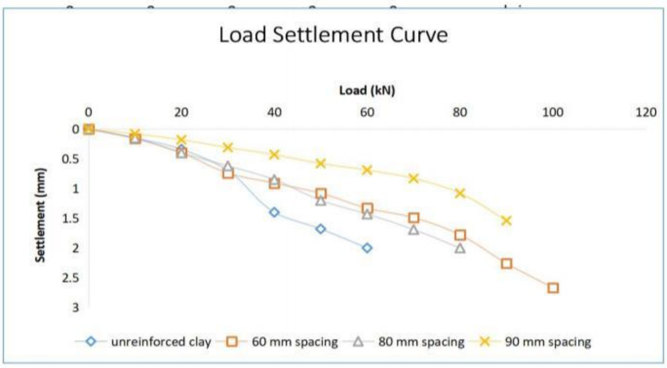


Fig. 7. Load settlement curve for ordinary group column.

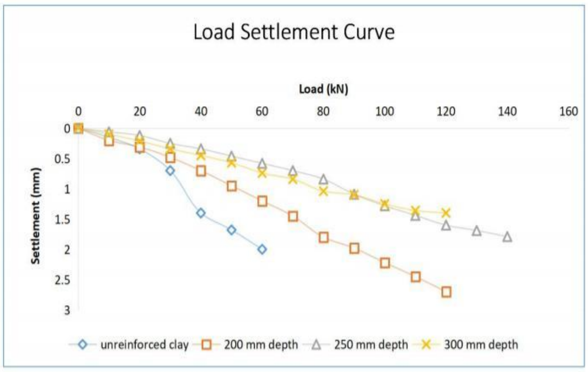
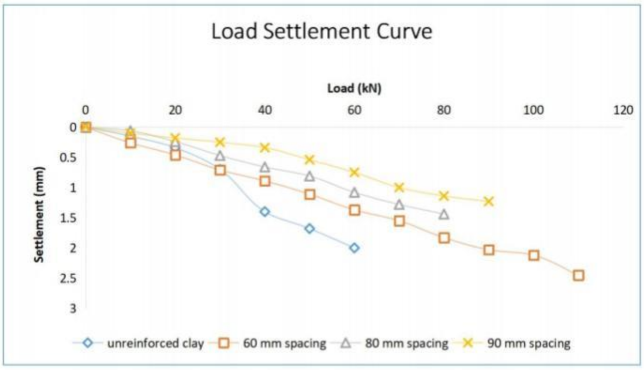


Fig. 8. Load settlement behaviour of encased group column



CONCLUSION

From the overall plate load test result was found that the overall performance increased with an increase in depth. Similarly, performance increased with an increase in spacing for group column. Encasing the column material with geotextile was proved effective to reduce bulging effect at greater depths. Most suitable depth and spacing was found as 300mm and 90 mm respectively. Percentage increase was 50% for ordinary single column and 125 % for encased single column compared to unreinforced soil. Similarly for group piles, the percentage increase was 120% for ordinary group column and 200% for encased group column which shows the effectiveness of encasement. A percentage increase of 80% was clearly observed on encasing the group column in geosynthetic.

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