AN EXPERIMENTAL STUDY ON STABILIZATION TECHNIQUES AT WATER LOGGED AREAS OF PUTTUR, D.K DISTRICT

Project Reference No.: *45S_ BE_3813*

College **:** *Vivekananda College of Engineering and Technology, Puttur, Dakshina Kannada*
Branch **:** *Department of Civil Engineering*
Guide(s) **:** *Dr. Sowmya N J*
Student(s) **:** *Mr. Thushara C*
Ms. Pavithra
Ms. Shravani C
Ms. Shwetha

Keywords:
Stone column, deformation, waterlogged area

Introduction:

Soil is a basic material used for construction. For earth filling in foundation and in subgrade construction the strength of soil is considered. Density of soil is an important parameter for the purpose of construction. The strength of soil depends upon its density. Density is mainly depending on the moisture content present in it. Water logged areas are covered with soft soil deposits having high compressibility and low strength. Among various stabilization methods like vacuum pre-consolidation, soil cement columns and lime treatment, stone column technique is preferred due to the advantage of reduced settlements. Stone columns are vertical columnar elements filled with compacted and un-cemented stone fragments or sands or gravels formed below the ground level. Hence the presence of stone column creates a composite material which is stronger and stiffer than the original soil. Load carrying capacity of a stone column is due to various reasons like frictional properties of granular material filled in the column, cohesion and frictional properties of surrounding soil of the column, characteristics of foundation transmitting stresses and the magnitude of lateral pressure developed in the surrounding soil mass. An additional confinement to the stone column can be achieved by providing geosynthetic encasement to individual stone column. The performance of fill embankment on very soft clay needs to be analysed before construction of structures in waterlogged areas. Hence this study is conducted to know the performance of stone and sand columns in waterlogged area of Puttur Taluk.

Objectives:

1. Understand and select the effective and economical techniques of soil stabilization in waterlogged areas.
2. Evaluating behaviour of the selected stabilization method for the study site soil.
3. Implementing the stabilization technique to resolve the problem of waterlogged area at study stie of Puttur taluk.

Methodology:

Materials: Field soil, coarse aggregates, sand, geosynthetics and PVC pipe.

Methods:

a. Listing the various soil improvements done at different waterlogged sites in India and abroad.

b. Identification of study site at Puttur.

c. Collection of soil sample.
Soil was collected from the selected waterlogged area which is located at Balnadu, Puttur taluk.

d. Determining the properties of the soil.
The index and engineering properties of the field soil was determined by various laboratory tests such as specific gravity test, consistency limit tests, sieve analysis, standard proctor test, unconfined compression test etc.

e. Designing the stone/sand column.
Based on literature survey length to diameter ratio of 2 and c/c spacing of stone/sand columns are also considered as 2 respectively.

f. Preparation of working model.
Field condition is simulated in the laboratory by using the available mould which is having diameter as 277mm and height 233mm. PVC pipe of diameter 60mm is used for the installation of the stone column.

g. Determining the effectiveness of stone/sand column in soil with different spacing and loading.
Tests on soil was conducted for different conditions such as soil alone, soil with single and group of stone/sand columns and soil with geosynthetic encased stone/sand column. In all

the test universal testing machine is used for the application of load. To compare the load bearing capacity of soil in different conditions, deformation is kept constant.

h. Identifying the relevance of stone/sand column at the selected field.
Site condition is analysed and suitability of different test results are evaluated.

Results and Conclusions:

The soil samples collected from waterlogged location are tested and the results are shown in Table 1 and the load carrying capacity of single pile and group of piles are given in Table 2.

Table 1 Properties of soil

Test results			
Field density	1.34gm/cc	Heavy compaction test ODD	1.75 gm/cc
Water content	30.43%	OMC	18.64%
Liquid limit	36.5%	Coefficient of permeability	0.00014 cm/s
Plastic limit	26.9%	Compression strength (UCC)	85 kN/m^2
Shrinkage limit	21.69%	Specific gravity	2.2

Table 2 Test on soil with and without stone/sand column

Deformation (mm)	Compressive Load (kN)						
	Soil alone	Single sand column	Single stone column	Single stone column with geosynthetics	Single sand column with geosynthetics	Group of columns with sand	Group of columns with stone
5	0.4	0.5	0.9	1.2	0.9	1.2	1.6
10	1.1	1.3	1.7	2.2	1.9	2.3	3.1
15	1.8	2.0	2.8	3.8	3.4	3.9	5.0
20	3.2	3.6	4.3	5.6	5.2	5.8	7.8
25	4.1	5.6	7.8	8.3	7.9	8.7	10.9

This work concludes that the load bearing capacity of the soil increases with the installation of stone/sand column. As the number of column increases, the load bearing capacity of the field soil also increases. Moisture content of sand and gravel are measured after 24 hours of the loading and observed increased water content in sand (is 17%) than stone columns (is 4%). It is also found that Geosynthetic material encasement helps to keep the stone/sand column in position. Based on study it is concluded that, sand column method is better technique in water logged areas of Puttur taluk than stone column. At spacing of group columns of 2d, there is no improvement in load carrying capacity of group of sand columns compare to individual.

Scope for future work:

In the present work the field soil is tested with sand/stone column in the laboratory and found that sand column is effective. Therefore, in future sand column can be installed and tested in the field which has water logging problems.