EXPERIMENTAL INVESTIGATION ON RED SOIL BRICK WITH CEMENT AND GRANITE DUST

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Abstract :
Soil supports different types of structures like buildings, roads, railway lines, pipelines etc., Accurate investigation of geotechnical properties can enhance a good design of foundation to support to the structure. This paper explored the results of red soil brick with cement and granite dust. Recycling wastes by utilizing them into building materials is a moderate solution for the pollution issues. A great deal of the prominence is laid on energy saving and economy. This project mainly deals with utilization of red soil brick with cement and granite dust.

***IndexTerms* – Alluvial soil, clayey soil, granite dust, red soil.**

I. INTRODUCTION

The geotechnical properties of soil on which a superstructure is to be constructed must be well understood in order to avoid superstructure and foundation failure one of the most important engineering properties of soil is its ability to resist sliding along internal surfaces with in a mass. The stability of structure built on soil depends on shearing resistance offered by the soil along probable surfaces of slippage. The shear strength of geotechnical property is generally represented by Mohr-Coulomb theory. The angle of shearing resistance represents the interlocking between the soil particles whereas cohesion is mainly due to intermolecular bond between absorbed water surrounding each again. Cohesion has a major role in the design of different geotechnical structures such as foundations, slope, and underground chambers, empirical correlations are widely used in geotechnical Engineering practice as a tool to estimate the engineering properties of soil.

The civil engineering structures like building, bridge, highway, tunnel, dam etc., are founded below or on the surface of the earth. For their suitability, suitable foundation soil is required. To check the stability of soil to be used as foundation or as construction materials, its properties are required to be assessed. As per different assessment of geotechnical properties of subsoil at project is necessary for generating relevant input data for design and construction of foundations for the proposed structures. Proper design and construction of structures prevent an adverse of environmental impact or structural failure or post construction problems.
Information about the surface and subsurface features is essential for design of structures and for planning construction techniques. When the buildings impose very heavy loads and the zone of influence is very deep, it would be desirable to invest some amount on subsurface exploration than to redesign the building make it costlier. For complex projects involving heavy structures such as bridges, dams, multi-storey buildings it is essential to have detail exploration. The purpose of detailed exploration is to determine the engineering properties of soils for the different strata. Plasticity index and liquid limit are the important factors that help an engineer to understand the consistency or plasticity of clay. The shear strength of soils is of special relevance among geotechnical soil properties because it is one of the essential parameters for analyzing and solving stability problems.
The various types of soil availability in Cuddalore District and its statistical report is presented in Table 1 and Fig.1.

Table 1 Cuddalore District Soil Types statistical report

S.No	Type of soil	Locations
1	Red loamy soil	Panruti, Kurinjipadi, Virudhachalam
2	Lateritic soil	Virudhachalam , Thittakudi
3	Black soil	Chidambaram, K.M koil, Cuddalore
4	Sandy alluvium	Cuddalore, Parangipettai, Kurinjipadi

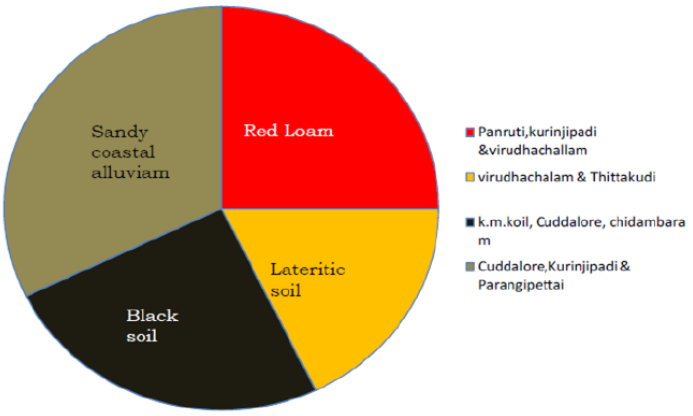

Fig.1 Cuddalore District Soil Types Availability

II. OBJECTIVES OF THE STUDY

This study focused on the following objectives to enumerate the various properties of soil which would help in stability analysis of structures.

- To find the index and engineering properties of soil.
- To know the allowable bearing capacity of foundation for proposed building.
- To know the depth and type of foundation for the proposed building, Highways, Bridges.
- To know the allowable passive resistance for the foundation of proposed building.

III. LITERATURE REVIEW

Venkatasubramanian et al., (2011) proposed a technique to correlate CBR values with the soil parameters of various types of soils taken from the three different districts of Tamil Nadu. A relation was developed with help of Artificial Natural Network System (ANN) & Multiple Regression Analysis (MLR).

Patel et al., (2010) proposed a method for correlating UCC values with liquid limit, plasticity limit and plasticity index, OMC and maximum dry density of cohesive soil of various zone of Surat city of Gujarat State. The results were analyzed statically. A correlation is made between UCC & the soil index properties using linear regression model through excel and SPSS software.

Anandarajah (2003) investigated the various mechanisms of increase in permeability by leaching, when water saturated clayey soil is leached with organic fluid. Based on theoretical & experimental data, it has been shown that the formation of macro cracks is the most possible mechanism of permeability increase.

Vipulanandan (2010) studied laboratory and field compacted soil samples falls in the group CL, CH,SE. The Author concluded that the undrained shear strength had better correlation with the CBR.

Shankar et al (2009) conducted experimental work on laterite soil collected from Dakshina Kannada and Udupi districts. The laterite soil and blended laterite soil are tested for Engineering properties, CBR, UCC. Then these soils are treated with different dosage of Enzyme. Again these soils are tested over different curing periods.

Roy and Dass.G (2014) reported that increase in specific gravity can increase the shear strength parameters (cohesion and angle of shearing resistance). He observed that increase in specific gravity also increases the CBR values.

IV. METHODOLOGY

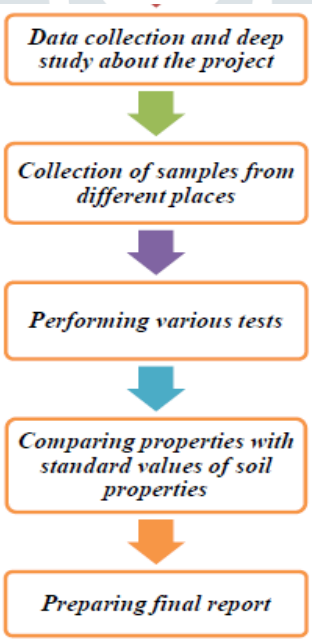

Fig.2 Methodology Flowchart

Types of soil samples consider in this study are presented in Figs. 3 to 5 with their location.

Fig. 3 Location of red soil sample

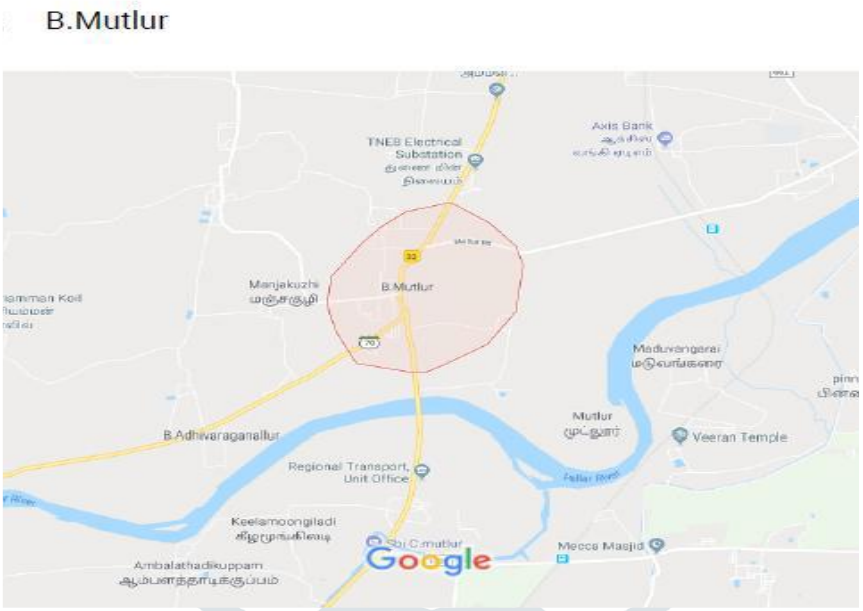

Fig. 4 Location of alluvial soil sample

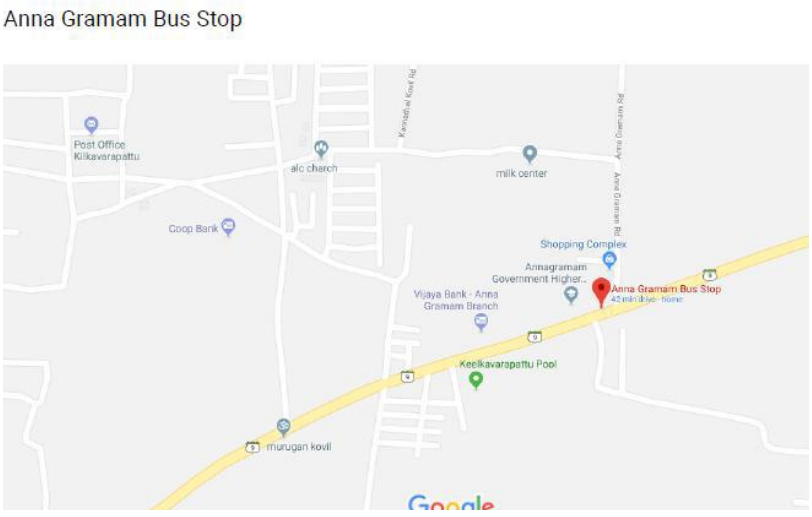

Fig. 5 Location on clayey soil sample

V. RESULTS AND DISCUSSION

Determination of other properties using formula from the laboratory test results is presented in Tables 2 and 3.

Table 2 Properties of soil using formula from the Laboratory test results.

S. No	Values	Types of soil		
		Red soil	Clayey soil	Alluvial soil
1	γs unit wt of solids G.γw	25.3KN/m^3	26.87KN/ m^3	23.156KN/ m^3
2	Void ratio (e) $G.\gamma w\gamma d$ – 1	0.18	0.33	1.43
3	Unit wt of soil (γ) $(G+es)1+e$ γw	2.33 KN / m^3	2.308 KN / m^3	1.56 KN / m^3
4	γsat saturated unit wt of soil $(G+e)1+e$ γw	2.33 KN / m^3	2.31 KN / m^3	1.56 KN / m^3
5	γ' Submerged unit wt of soil $G-1$ $1+e$ γw γsat – γw	1.33 KN / m^3	1.31 KN / m^3	0.56 KN / m^3
6	Saturated wt (wsat) eG	0.069	0.120	0.60
7	Consistency index (Ic)	1.56	1.58	-
8	Liquidity index (IL)	0.56	0.58	-
9	Compression index (Cc) • 0.009 (WL - 10%) • 0.007 (WL -10%)	0.4698 0.3650	0.2835 0.2200	- -
10	Co efficient of permeability K= 100D210	6.76	10.24	4
11	% Finer 100 $GWd(G-1)$	32.6%	31.5%	34.7%
12	Degree of saturation (Sr) wGe	0	91%	58.4%
13	Cohesion $qu2$	0.289	0.0195	-
14	Ultimate Bearing capacity • qult = 4c • qult = 5.5c • qult = 5.14c • qult = 2c	• 1.156 • 1.580 • 1.480 • 0.578	• 0.078 • 0.107 • 0.100 • 0.039	-
15	Terzaghi correction C' = (2/3) C	0.193	0.013	-
16	Porosity (n) = $e1+e$	0.153 15.3%	0.248 24.8%	0.58 58%

Table 3 Properties using formula from the Laboratory test results are mentioned below in the table.

S.No	Tests	Red soil		Alluvial soil		Clayey soil	
		Test	Formula	Test	Formula	Test	Formula
1	Specific gravity	2.58	2.59	2.36	2.35	2.74	2.72
2	Dry density (gm/cc)	2.195	2.186	0.97	0.97	2.045	2.06
3	OMC (%)	10	8.95	18	17.7	11	12
4	Permeability (cm/sec)	2.24 x 10-3	2.27 x 10-3	-	-	2.42 x 10-3	1.08 x 10-3
5	Liquid limit (%)	62.2	63.2	-	-	41.5	41.4
6	Plastic limit (%)	33.3	30.8	-	-	19.37	15.6
7	UCC (kg/cm^2)	0.578	0.578	-	-	0.039	0.039

Nowadays soil investigation is very essential to avoid the foundation failure as well as structural failure. So it has been decided to investigate the index and engineering properties of three major type of soils located in Cuddalore district. The collected disturbed samples at a depth of 2feet were tested for its properties in our department laboratory. Index properties: Specific gravity, Water content, Particle size distribution and Atterberg Indices. Engineering properties: Compaction, Consolidation, Permeability and Shear strength.

IV. CONCLUSIONS

The test results were compared with standard values and found that 95 % of the values obtained are nearer to the standard values. An attempt has been made to determine the other properties of soil by using formulas and also correlation has been established between properties obtained from formula and laboratory test values. UCC value can be used for determining bearing capacity of soil. Based on the values of atterberg limits for clayey soil, we can decide the type of foundation and soil stabilization if needed. By knowing permeability value, we can adopt better method of draining water in underwater construction.

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