



Comparative Analysis Of Lime And Bone Meal Powder As Soil Stabilising Agent

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Abstract: This paper is aimed at achieving effective utilization of Clayey soil as a sustainable building material by improving its strength using two stabilizing agents, lime and Bone Meal Powder (BMD) and also find out the better stabilizing agent. The clayey soil collected are subjected under room drying, sun-drying and oven-drying methods. Different percentages of lime and BMD (2,4,6,8,10%) were added to the soil separately. Samples are tested and find out the strength difference achieved by the use of two stabilization agents through which we can conclude the better stabilizing agent.

Index Terms - Lime, Bone Meal Powder

Introduction

The choice of building materials in society has been influenced by availability and cost. As a result of the high cost of conventional construction materials in most developing countries, owning a house is relatively difficult for the large proportion of low-income citizens. In order to solve this problem, it is necessary to explore new ways of producing building materials from locally available materials at low cost. Over the years, the construction industry has moved from using local building materials to conventional building materials. However, issues of cost and availability have necessitated interest in earth-based materials in recent times. Clayey soil are environmentally friendly materials. Buildings constructed of earth-based materials are the most affordable since earth materials are available and are cheaper.

One of the most notable properties of clay soil is its high shrink-swell potential. This means that the soil can expand and contract significantly with changes in moisture content. This can lead to movement and settling of the building's foundation, resulting in cracking and damage to the structure. The challenge to building a foundation on clay soil is protecting it from the regular expansion and contraction when exposed to moisture. Over time, an unprotected foundation can sustain significant and costly damages. But this doesn't mean you can't build on clay soil or that your project is doomed to suffer irreparable damages. The best way to overcome this is Soil stabilization.

This paper is aimed at achieving effective utilization of Clayey soil in Thrippunithara area as a sustainable building material by improving its strength using two stabilizing agents, lime and Bone Meal Powder (BMD). Lime is an effective soil stabilizing agent for clayey soil because it improves the soil's engineering properties, making it a better construction material. Lime treated soil can develop long-term, permanent strength in reactive soils resulting in soil stabilization. Bone meal powder can be used as a soil stabilizer in clayey soil because it can help bind soil particles together. Bone meal is a low-cost source of calcium phosphate, which can precipitate within soil pores and bind soil particles. This can help increase the unconfined compressive strength (UCS) of the soil.

The clayey soil collected are subjected under room drying, sun-drying and oven-drying methods. Testes for the classification of soils should be done. Different percentages of lime and BMP (2,4,6,8,10%) were added to the soil separately. Samples are tested and find out the strength difference achieved by the use of two stabilization agents through which we can conclude the better stabilizing agent. By find out the Optimum Moisture sample we can applied to the embankment using software Geo -Study and check out the feasibility of the soil sample.

The mechanism used here is Flocculation. Flocculation is the process where individual clay particles are pulled together, create pore space in the soil allowing water movement and air exchange. This is one of the most important keys to healthy soil. Clay particles usually possess net negative charge therefore they attract positively charged ions. In BMD & Lime it contains Ca^{2+} ions, which holds the particles together. The electrostatic charges on the surface of the particles serves as the action mechanism. The process which soil particles come into contact and adhere each other forming clusters, flakes or clumps of larger size.

I. METHODOLOGY

A. GENERAL

The main purpose of this project is to compare the properties of bone meal powder and lime by injecting into the soil. Through the experimental analysis we can find out which is good stabilising agent for soil stabilisation. This chapter deals with the various experimental procedures adopted to conduct the laboratory tests towards the fulfilment of the objectives of the project.

To achieve the objectives of our project work, soil samples which were available on the site were collected. The collected soil sample is air dried. The geotechnical properties of soil sample were tested individually. At first, soil classification is done using 75-micron sieve and 4.75 micron IS sieve. After that mainly four soil tests were conducted, grain sieve analysis, hydrometer analysis, specific gravity, Atterberg's limit. The following tests are needed to be conducted for the determination of clayey soils. The results got analysed and find out the properties of soil. Therefore, our first objective is fulfilled. After the experiments we need to analyse the geotechnical properties of soil by adding the lime with the required proportions. Here we choose different proportions of lime which has been added to the clayey soil to do the same laboratory experiments. Then the results we got from these experiments shall be analysed and compare. Find out whether the properties have been changed or not.

B. MATERIAL SELECTION

- Soil collection

80 Kg of Clayey soil was collected on 30/10/24 from Thrrippunithara.

- Bone Meal powder collection

5Kg of bone meal powder was collected from KGP Factory , Mattoor on 25/09/24.

- Lime collection

5 Kg of lime was collected from agricultural society ,Mattoor on 24/09/24.

C. MIX PROPORTION

The mix proportions basically 5 types of percentage of bone meal powder and lime adding separately for stabilizing the soil and following percentage were used to stabilize the soil (2%,4%,6%,8%,10%) by the weight of the soil

II. EXPERIMENT AND RESULT

a. Soil Classification

TABLE 1 CLASSIFICATION OF SOIL

Specific Gravity	2.5
Uniformity Coefficient	21.44
Coefficient of Curvature	0.55
Liquid Limit	61%
Plastic Limit	33.33
Plasticity Index I_p	27.67
γ_d Theo. Max	2.02 gm/cc
Max. Dry Density	2.02 gm/cc
OMC	20%

b. Soil Stabilization Using Lime

Tests are conducted by adding lime in 0%,2%,4%,6%,8%,10% in soil.

TABLE 2 PROPERTIES OF SOIL USING LIME

% of Lime	Specific Gravity	LL	PL	Plasticity Index	MDD	OMC	Uniformity Coefficient	Coefficient Curvature	qu(KN/m ²)
0%	2.5	41.85	30	11.85	1.67	14.87	21.44	0.55	0.0555
2%	2.034	34.4	26.5	7.9	1.72	13.87	36	0.022	0.0025
4%	2.1	33.5	26.5	7	1.768	12.4	7.082	0.83	0.0025
6%	2	35.8	23.5	12.3	1.8	11.1	8.083	0.93	0.00225
8%	1.8	37.03	27	14.53	1.91	10.9	4.025	0.75	0.0035
10%	1.91	35.52	22.5	13.02	1.89	11.9	3.96	1.92	0.00225

c. Soil Stabilization Using Bone Meal Powder

Tests are conducted by adding Bone Meal Powder in 0%.2%,4%,6%,8%,10% in soil.

TABLE 3 PROPERTIES OF SOIL USING BMP

% of BMP	Specific Gravity	LL	PL	Plasticity Index	MDD	OMC	Uniformity Coefficient	Coefficient Curvature	qu(KN/m ²)
0%	2.5	41.85	30	11.85	1.67	14.87	21.44	0.55	0.055
2%	1.33	36	27	8.5	1.45	21%	39	0.025	0.0059
4%	1.26	35	26	8	1.64	11%	8.083	0.93	0.0062
6%	1.89	34	24.5	7.5	1.56	14%	6.2857	1.0754	0.0076
8%	1.99	38	28	15.5	1.64	11%	3.466	0.678	0.0065
10%	2.02	34	24.5	14.05	1.45	21%	3.96	1.92	0.0053

DISCUSSION

Based on the results from the experiment on soil classification it is determined as clayey soil. Lime and BMP are used as a stabilizer for improving the geotechnical characteristics of the soil. By conducting various experiments results are compared and focused on the strength aspect, Unconfined compression test is determined of soil with lime and bone meal powder. Results gives Bone meal powder attained more strength than Lime. Hence concluded that Bone meal powder is good stabilizing agent than Lime.

III. ACKNOWLEDGMENT

We would like to express gratitude to Adi Shankara Institute of Engineering and Technology for providing the resources and facilities to conduct this study. Special thanks are extended to the faculty and staff of the Civil Department for their support and guidance throughout the project..

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