FINAL YEAR PROJECT PROPOSAL

BY

WUSU, Michael Oladimeji (08/30GB088)
DEPARTMENT OF CIVIL ENGINEERING
UNIVERSITY OF ILORIN, ILORIN, NIGERIA

Project Supervisor: Dr. O.G. Okeola

November 2012

STABILIZATION OF ORGANIC CLAY USING LIME-ADDED SALT IN OKELELE, ILORIN

BY
WUSU, M.O.
Department of Civil Engineering, University of Ilorin, Ilorin, Nigeria.

1.0 INTRODUCTION

The inability of some soils to exhibit certain characteristics in term of strength, texture, size, etc. are some of the challenges faced by engineers in foundation engineering. These problems are easily associated with soil in the soft categories. A typical example of this type of soil is clay, particularly organic clay. Many types of clay have reduced strength due to mechanical disturbance as a result of earth movement. They also tend to have high compressibility. Hence, construction on clay soil may result in bearing capacity failure induced by its low shear strength. Therefore clay has to be improved upon before any engineering work can commence on it (Kassim, 2009).

An important decision as to be made on whether to use the original material on site, or to replace with one of higher quality or, create a new site material that suite the standard requirement by altering the properties of the existing material which is known as 'soil stabilization'. Of all the options listed, stabilization of soil using lime is the least expensive and most widely used. The use of lime as a stabilizer is borne out of its ability to increase shear strength and bearing capacity. The stabilizing effect depends on the reaction between soil mineral and lime.

Lime alone is not an effective stabilizer of clay soil even though lime as been used to stabilize soils for decades. This is because the organic matter present in clay tends to coat soil particles preventing the penetration of lime and reducing the effectiveness of lime stabilization.

This study aims at increasing the strength of organic clay found in Okelele in Ilorin, Kwara State.

2.0 OBJECTIVES

The following are the objectives of the study:

- To ascertain the effectiveness of salt-lime combination for clay soil in comparison with lime–clay soil mixture.
- To determine the percentage increase in strength of clay soil obtained from the two salt mixtures at different concentration.

3.0 LITERATURE REVIEW

Soils which cannot be structurally used for construction purpose without some measure of stabilization are referred to as 'weak soil'. In Nigeria organic clay belong to this category. In-situ derived clays occur in several parts of Ilorin with the largest deposit occurring in the okelele ward in Ilorin East Local Government Area (Ogunsanwo and Agbasi, 1994). Studies carried out previously on the effect of soil organic matter on the geotechnical properties of soil show that the former has a significant effect on the engineering properties of soil.

It has been postulated that if the value of organic content in soils lies between 6 to 20 percent, it affects the properties of soil but the behavior is still like mineral soils: organic silts/clays and if the organic content of soils lies in the range of 21 to 74%, it governs the entire properties of the soil. Study shows that both liquid limit and plastic limit of Illinois soils increase linearly with increase in organic carbon content. The unconfined compressive strength has been found to generally decrease with increase in organic content. A study on the artificially prepared organic soil revealed that its liquid limit and plastic limit linearly increase with organic content. On the other hand, its plastic limit is nearly a linear function of organic carbon content, while its plasticity index is independent of organic carbon content. A recent study carried on organic soil revealed that its specific gravity decreases with increase in organic content (Adeyemo, 2012).

Clay is a weak soil yet cohesive and is found to have it strength varied by decrease in the action of climate and water content of soil. Organic clay is only slightly different from clay with reference to the amount of organic matter it contains, which in turn affects the engineering properties. Hence the bearing capacity and strength of organic clay soil is lower as expected due to its high organic content. Organic clay contains organic matter such as humid acid and humates. The estimate of the organic matter content in organic clay is between 20 to 75 percent (Adeyemo, 2012).

Lime is an excellent choice for short-term *modification* of soil properties. Lime can modify almost all fine-grained soils, but the most dramatic improvement occurs in clay soils of moderate to high plasticity. Modification occurs because calcium cations supplied by the hydrated lime replace the cations normally present on the surface of the clay mineral, promoted by the high pH environment of the lime-water system. Thus, the clay surface mineralogy is altered, producing the following benefits: (National Lime Association).

· Plasticity reduction
· Reduction in moisture-holding capacity (drying)
· Swell reduction
· Improved stability
· The ability to construct a solid working platform

Special stabilization methods have been classified into three namely mechanical, physical and chemical stabilizers. Chemical soil stabilization changes soil-water interaction by surface reactions and therefore modifies the behaviour of organic clay for the intended usage. Chemical methods include the use of bitumen, calcium salt, cement and lime.

Calcium oxide and calcium hydroxide (slaked or hydrated lime) are the types of lime commonly used in soil stabilization. Even though quicklime is effective in some case, hydrated lime is widely used for stabilization. This is because quicklime will corrosively attack equipment and there is also a risk of severe skin burns.

The three major reactions that give lime treated clay great strength are (I) dehydration of soil, (II) ion exchange and flocculation and (III) pozzolanic reaction. The addition of salt is to act as a catalyzer to accelerate as well as help lime to increase the strength of soil. Two types of salt are commonly used are sodium chloride (NaCl) and calcium chloride ($CaCl_2$). The use of salt to accelerate lime–organic clay reaction is because lime has little effect in highly organic soils .

4.0 STUDY AREA

Ilorin lies approximately on longitude 4^{o} 35'E and latitude 8^{o}30' N as shown in Fig. 1.The sampling locality, Okelele is a settlement situated within Ilorin Township in the Ilorin East Local Government area of Kwara State(Fig. 2) and slightly southwest of the Sobi Hills in kwara State. (Fig. 3) The clay horizon is rather thin. As a result, the hand dug pits are soon abandoned and new ones dug. The study area is littered with such pits and in most cases filled with rain water.

FIG 1: Map of Nigeria showing Kwara State.

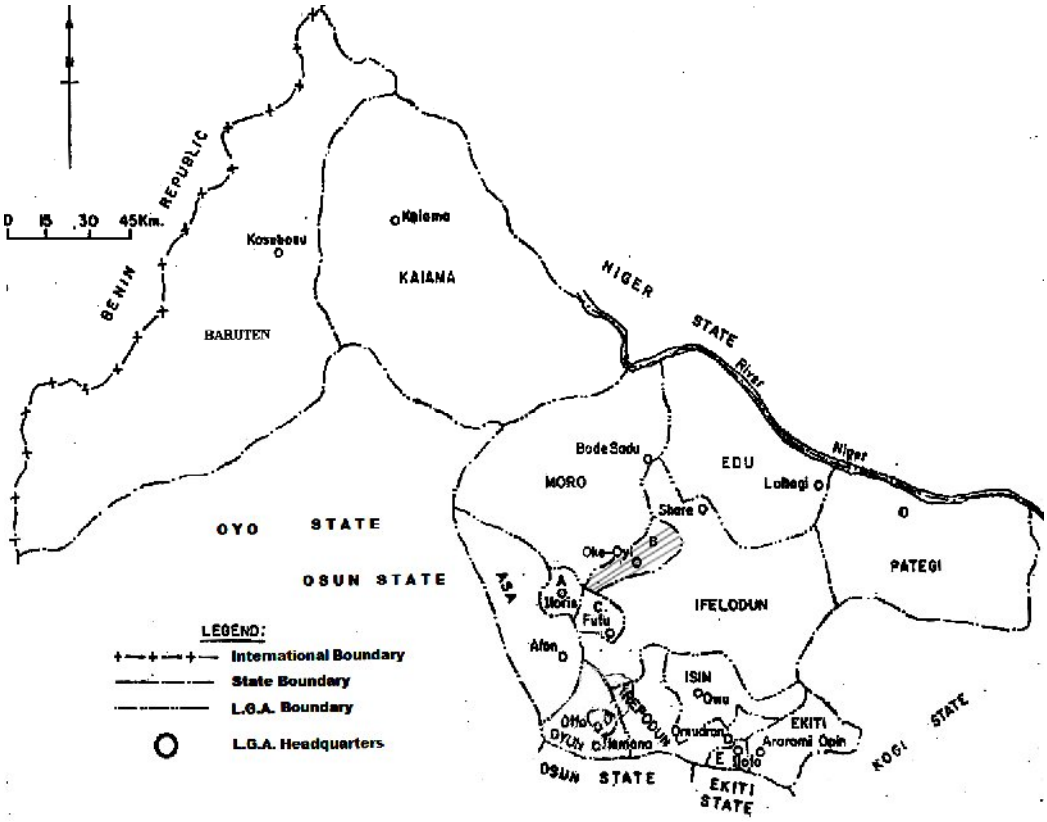


Fig. 2 The Map of Kwara state showing the Ilorin East local Government

FiG 3: Google earth Map showing Okelele,Ilorin

5.0 METHODOLOGY

5.1 Field Work

This include site visits to the area and followed by the collection of sample of organic clay. It is essential to identify accurately materials comprising foundation strata. Soils are identified by visual examination. A description based on visual examination will include color, odor when present, size and shape of grains, gradation, and density and consistency characteristics.

5.2 Laboratory Test

There are some tests to be conducted on soil and lime to ensure that the soil is suitable for stabilization and to determine the amount of lime to be used. Also to be to examined is the influence of soil stablization on additon of salts(NaCl and $CaCl_2$) to lime at different concentration ranging from 2.5–10 percent (Kassim, 2009).

The test is in two folds. The first is done on soil. This includes the specific gravity, particle size distribution (seive analysis), Atterberg limit test (plastic limit, liquid limit, plasticity index) and standard proctor test. The second test will be to determine the appropriate and adequate amount of lime before stabilization commences. Two set of test are performed on lime, these are initial consumption of lime (ICL) and available lime content (ALC) (Kassim, 2009).

6.0 BUDGET

This project is estimated to cost the sum of ₦30, 000

Table 6.0: Project Budget

S/NO	ITEMS	COST (₦)
1	Purchase of Printer	10,000
2	Purchase of Internet Modem	6,000
3	Transportation	3,000
4	Purchase of Lime and Salts	5,000
5	Purchase of printing paper, ink and toner	3,000
6	Other Expenses	3,000
	Total	30,000

7.0 EXPECTED RESULT

The study will aid in ascertaining further geotechnical properties of clay that will be beneficial in engineering work such as in embankment, soil exchange in unstable slopes, backfill for bridge abutments and retaining walls and improvement of soil beneath foundation slab etc.

8.0 PROJECT TIME FRAME

8.1 Project WBS

This project is estimated to take about 5 months to complete. The Project Work Breakdown structure and Gantt chart for the schedule using Microsoft Project are shown in Table 8.1 and Figure 8.1

Table6.1: Project Work Break Down schedule

S/NO	ACTIVITIES	DURATION
1	Sourcing for materials on the project	3 Weeks
2	Reading and Studying of relevant Materials on the Project.	2 Weeks
3	Site Visitation	1 Week
4	Site Reconnaissance	1 Week
5	Collection of Samples	1 Day
6	Physical study of Samples	1 Week
7	Procurement of Lime and Salt	2 Weeks
8	Preparation of Samples	2 Weeks
9	Practical and Laboratory Activities	6 Weeks
10	Compilation of Results and Data	1 Week
	Total	19 weeks

9.0 REFERENCES

- Adeyemo, T.E., (2012). Effect of Organic Content on Compaction and Consolidation Characteristics of Lagos Organic Clay. Paper 184.http://ww.ejge.com/2012/Abs12.184.htm

- Eisazadeh A., Kassim A.K. and Nur H. (2010). Thermal characterization of lime stabilized soils. 19th World Congress of Soil Science, Soil Solutions for a Changing World. 1 – 6 August 2010, Brisbane, Australia.

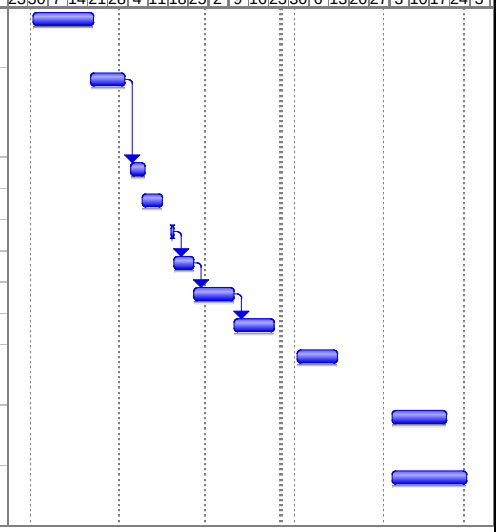
- Kassim, K.A. (2009). The effect of catalyst on Soil Stabilization by appilication of Lime. Researh Vote No: 78104

- National Lime Association (2001). Using Lime for Soil Stabilization and Modification. A Proven Solution. http://www.lime.org (Accessed November 5, 2012).

- Ogunsanwo O., Agbasi U., Mands E. (1994).Geotechnical and geochemical properties of some clays occurring in Ilorin, Nigeria and the environmental implication of their mode of exploitation. Proceedings of Seventh International Congress. International Association of Engineering Geology, Balkema, Rotterdam. Pp 2741-2746

7.2 TIME FRAME

ID	Task Name	Duration	Start	Finish	Predecessors
1	Sourcing for materials on the project	3 wks	Tue 10/2/12	Mon 10/22/12	
2	Reading and Studying of relevant Materials on the projects	2 wks	Mon 10/22/12	Fri 11/2/12	
3	Site Reconnaissance	1 wk	Mon 11/5/12	Fri 11/9/12	2
4	Site Visatation	1 wk	Fri 11/9/12	Thu 11/15/12	
5	Collection of Sample	1 day	Mon 11/19/12	Mon 11/19/12	
6	Physical Study of Sample	1 wk	Tue 11/20/12	Mon 11/26/12	5
7	Procurement of Lime and Salt	2 wks	Tue 11/27/12	Mon 12/10/12	6
8	Preparation of samples	2 wks	Tue 12/11/12	Mon 12/24/12	7
9	Pratical and Labouratory activities	2 wks	Wed 1/2/13	Tue 1/15/13	
10	Pratical and Labouratory activities cont'd	3 wks	Mon 2/4/13	Fri 2/22/13	
11	Compilation of results and data	4 wks	Mon 2/4/13	Fri 3/1/13	



Project: Fig 1
Date: Thu 12/27/12

Task
Split
Progress
Milestone
Summary
Project Summary
External Tasks
External Milestone
Deadline

FiG. 7.2 PROJECT GANTT CHART