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"Soil Stabilization with Lime for Expensive Soil"

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Abstract-The main object of this paper describes an evaluation effectiveness of lime with the soil which are used as pavement of road where load is heavy. Lime use as the ground treatment or ground improvement. the lime treatment is something, that has been quite popular with many of the civil engineers and whenever there is a problem with the soft soil and expansive soils, lime treatment has been given and essentially, to improve the bearing capacity and reduce the settlements. We know that this lime treatment can be affected in the field and various factors that can influence the treatment.

lime can be used for the pavement should be used for improvement of bearing capacity. some typical failure when the expansive soil is subjected to alternate wetting and drying and definitely when some places where it could be more changes then the rest like. the pavement has been damaged beyond any repair, whatever. So, this need to be repaired in the proper way. Also, the way that one should do is, that he should be able to examine why this has occurred what are the issues involved because the material in place of subgrade, sub-base and all that. and one should examine why has occurred. this is another thing that we have like a crack, like pavement.

Key words- lime, expensive soil, sub- base

1. INTRODUCTION

Lime play an important role for stabilization of soil to improve the quality of fine-grained soils. actually, it has been quite effective in all the fine grained. not necessarily expansive soils. what are if the soils are fine-grained which means that the high specific surface, likes say for example, it can be just because of certain ions present in the material or because of water, water present in the materials. so essentially the liquid limit and plasticity characteristics are reflected in higher values, higher is a liquid limit, definitely higher is a specific surface. So, in treating this particularly fine grain soils lime treatment has been very effective.

Another one that one can see particularly the problems. the expansive soil are quite common even the this another case that we see in fact one can measure the failure in fact some are you don't understand the treatment process, say for the example people have been talking about treatments and if the treatment is not correct then even though it could lead to premature failure was like this so important thing in this case would be that you should be able to understand why these failure are occurring, whether it is in the case of a soft soil or an expansive soil, because all these soils are essentially poor in terms of their assigned properties and settlement issues

so, what should be really worried about how to handle this and there should be a systematic way of understanding these techniques otherwise there could be a problem in over it be properly implemented in the field. and finally, it leads to problems

if have the sulphate material in the soil and then try to give a lime treatment to that it cannot be effective. Which means that lime treatment if you want to make it effective. really check-up if the sulphate is there, if it is not, then you go ahead with had with lime treatment and lime treatment is also sometimes need to add some sort of additives like a fly ash, cement depending on the requirements.

2. LITERATURE REVIEW

The first applications in the construction of the highways and air field pavement was introducing in 1956 and 60s with these attempts achieve a success and resultant these technics was extended. So, lime use in large scale for stabilization of soil and improvement of strength and bearing capacity and reduce the settlement of soil

The addition of lime mechanism effects the compressibility, strength and permeability of the soil and clay. these benefits change occurs due to the mixing of lime. So, the reasons on mechanism there are a couple of issues here one when we call it the cation exchange capacity of the cation exchange, we call it flocculation because other one is aggregation so this aggregation is essentially a function of the time and temperature.

Ankit Singh Negi, Devashish Pandey Siddharth (2013) the paper title "Soil stabilization using Lime" 2013[1] observed that the reaction is very quake with lime stabilization of soil the reaction starts within few hours.

Gati sri Utami (2014), in the paper title "Clay soil stabilization with lime effect the CBR and swelling" ,(2014)[2] observed that native land value for liquid limit (67%),plastic index(36.87%)the soil stabilization with lime react within 3 days
M.Adams Joi,A.Maria Rajesh(2015) the paper title "soil stabilization using industrial waste and lime";2015[3] observed that soil stabilization with the lime provide the share strength and the unconfined compressive strength value more than the ordinary method.

Nandan A Patel, Prof. C. B. Mishra, Vasu V Pancholi (2015), in the paper titled "Scientifically Surveying the Usage of Terrasil Chemical for Soil Stabilization",2015 [6] observed that the local soil used with additives is best for construction works. The research was based on engineering properties of soil with and without stabilizers and to find out CBR, degree of permeability. 0.041 % Terrasil by dry aggregate weight of soil was used for soil stabilization. The results show that CBR has increased and geotechnical properties of soil have improved.

3. AIM OF STUDY

3.1 following some point is aim of this study:

1.Structre have a longer service life and cheaper to maintain.

2. delays due to weather condition are reduced.

3. Improve the bearing capacity of the soil and reduce the settlements.

4. Improving the engineering property of soils used for pavement.

5. To increase shear strength

3.2 Mechanism of stabilization

3.2.1 Cation exchange

When trying to deal with soils or particularly clays, the cation exchange is an important aspect like we know that the clays are negative charged surface. and possibilities is that when you add some material like lime something that is replacement of ions.

cation exchange capacity depends on the pH of the soil like water and other thing is that there is a pour water for pour water it has some pH definitely it has a big influence on the cation exchange capacity. and also, the type of the clay's mineral. there are different types of clay mineral and its montmorillonite koalinite and iolite and all that. and the specific surface in the montmorillonite of is very high and because of which say example,

so, some of these things are all well known in geotechnical engineering particularly when you are trying to study the soil behaviour and clays and the quick lime, they are different types of materials here one can add Ca like calcium oxide or calcium hydroxide or even calcium carbonate. this material it leads to is dissociated it water.it increasing the hydration and it increases the electro, electric concentration as well.

3.2.2 Sedimentation

Untreated clay behaves as a polymer because these molecular structures are similar to each other. Then they are sproviding plastic property

3.2.3 Pozzolanic

calcium silicate and calcium aluminate hydrate materials and also changes in the fabric changes so it leads to two compounds like this and it's like and even we understand that the same compounds also exist in cement as well it's like as cementitious material if soil is supposed to be poor[3].

the water presents in by ion exchange and aggregation and other one is in the long run

this cementation materials formation is something that's very important and because of the cementation strength of the soil is much higher.

so essentially the three mechanism as one is the cation exchange second thing is a flocculation, the third one is pozzolanic reaction.

4. MATERIALS AND METHODS

4.1 Hydrated Lime

Lime is made up of $caco_3$ it is quite reactive in nature with the parent material of carbon lime has less embodied energy then cement. free lime absorbs carbon dioxide in setting process of carbonation it is a gentle binding property of lime enable full re-use of other materials

TABLE 1. lime specification

S.N.	Specification	Value
1	Boiling tem.	100 ^{0}c
2	Heat of Fusion	580 ^{0}c
3	Bulk density	500kg/m^3
4	PH	12.4
5	Specific gravity	1.2-1.5

4.2 Subgrade soil

Sub grade soil is a natural undisturbed and native earth materials. It is derived from rock.it is naturally compacted and bear the heavy load.

4.3. Method

Stages of research

a. Preparation research was conducted on the field observation and taking sample in unnao Sample
b. Experiment in the laboratory

4.3.1 Field -mixed and laboratory-mixed specimens

Preparation: First step to prepare the soil by removing unwanted elements and object from the soil which might hinder or ruin the mixture of lime an which is also helped to improve or modify the humidity of the soil and this process is implement by using the ripper or harrow, plough.

Spreading: In this step, the lime is spread by using spreader which is fitted with the weighing machine. The lime is spread pneumatically or uniformly on the subgrade soil which are the basic need for the stabilization of the soil.

Mixing: After spreading the lime on the top of the soil the lime mix with help of mixing instrument like ripper, harrow.

Compaction: Whenthegrading of lime is complete in good manner which decrease the air void ratio and water content in the soil. Compaction provide the share strength, and compressive strength of the soil, this step is done by rolling machine.

5. EXPERIMENTAL METHOD

5.1 Laboratory test

A) Sieve analysis
B) Moisture content test
C) Compaction test (Proctor test)
D) California bearing ratio test
E) Atterberg limit test
F) Liquid limit
G) Specific gravity
H) Plastic limit

6. RESULT AND DISCUSSION

The results of the initial test is shown on the given table 3. The moisture content, Atterberg limit test and some soil and lime test discussed here.

Preliminary test

Let us consider the natural moisture content of samples M, N, O and P are 9.2%, 10%, 7.6% and 10.5% respectively and their dry density are 1.7, 1.75,1.86 and 1.84. These values fall within the range for a clayey soil which is between 2.0 and 3.0 with sample A is the most expensive soil. Sample (N) are honeycomb structure soil in nature while(o) is vermiculite 80% of sample of the soil are clay which are vary from 2.0 to 3.0 more than 20% of the sample pass through 200-micron sieve. Other Result and analysis of this study write in below and represent by the index and figure.

6.1 Index Properties

TABLE 2. Index property of materials

S.N.	Index properties	lime	soil
1.	Moisture content	3%	80%
2.	Particle size	2 microns	0.04mm
3.	Sieve analysis	0.51%	0,53%
4.	Plastic limit	22%	25%
5.	Specific gravity	2.6kg/m^3	2.75 kg/m^3
6.	Shrinkage limit	5.8%	7.3%

6.2 Mechanical properties

6.2.1 standard proctor compaction test

TABLE 3. Standards Proctors Compaction test

Sample	Dry density (g/cc)	Maximum Moisture Content in (%)
Sample-M	1.7	9.2
Sample-N	1.76	10
Sample-O	1.86	7.6
Sample-P	1.84	10.6

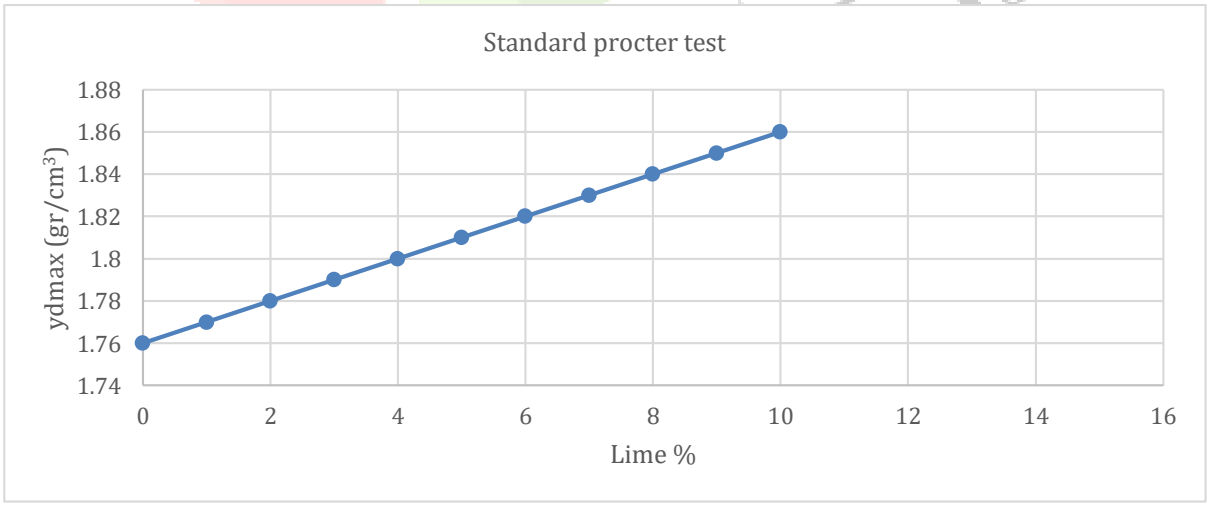

FIGURE 1. Relationship the dry unit weight (yd max) with percentage of lime

6.2.2 Unconfined compressive strength

TABLE 4. Unconfined compressive strength

S. No.	Sample	Unconfined compressive strength (kn/m^3)
1.	Sample-M	65
2.	Sample-N	181
3.	Sample-O	196
4.	Sample-P	153

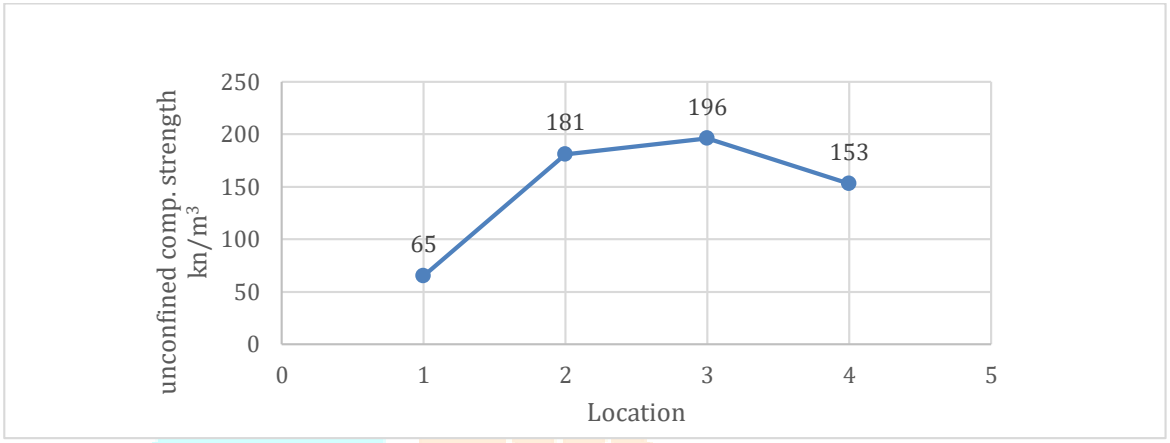

FIGURE 2. Unconfined compressive strength

6.2.3 California bearing ratio test

By the table 5 sample(M) bearing ratio is 24%, sample(N) 32%, sample(O) 16% and sample(P) give a 14%.

TABLE 5. California bearing ratio test

S. N.	Sample	Bearing ratio in %
1.	Sample-M	24
2.	Sample-N	32
3.	Sample-O	16
4.	Sample-P	14

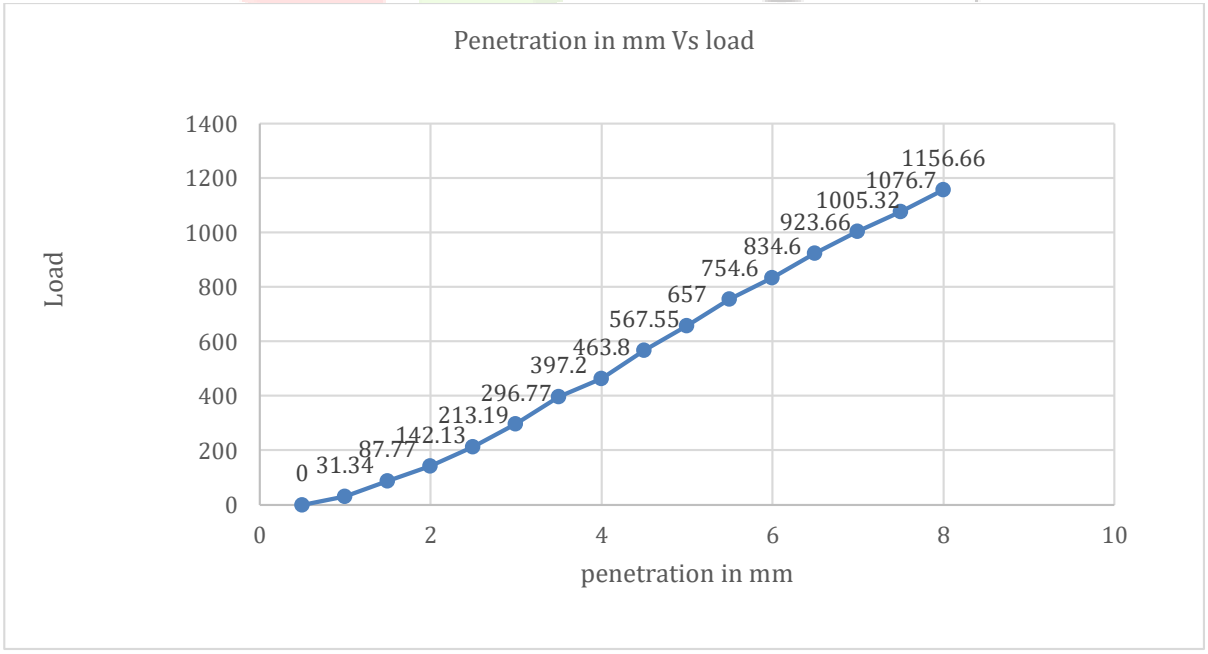

FIGURE 3. Penetration in mm with load

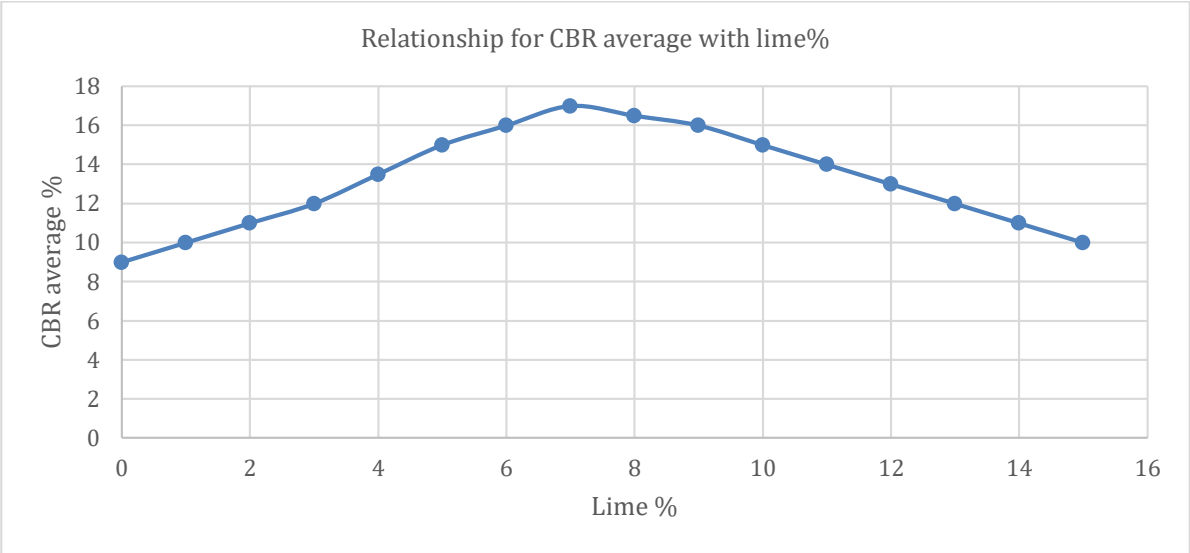

FIGURE 4. The relationship for CBR average with % of lime

7. CONCLUSION

The classical case of the lime treatment itself. Lime treatment is very effective if there is no sulphate in the soil but if sulphate is present in the same expansive soil then it becomes worse. Expansive Soil had great improvement with the lime treatment. after this study we are obtain that by this laboratory test the addition of lime to sub grade soil increase the compressive strength of the soil.in comparison of the ordinary method. for soft soil and expansive soils, lime treatment provided the bearing capacity of the soil and reduce the settlement of the pavement.

The maximum lime contents for a sample A, B, C and D are 8,6.45,7 and 6% respectively. A and B samples are in its natural states which is suitable or consider for sub-grades and these treatments are unsuitable for sub-base courses while sample D is unsuitable.

8. REFRENCE

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