Research Paper Engineering

Comparitive Study Between Soil Stabilisation Using Brunt Brick Dust and Brunt Brick Dust Along With Lime

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ABSTRACT

Soil is the essentially met in every construction. In the direction of improving the properties of soil by soil stabilization is very important in construction activity especially where black cotton soil is met. Therefore authors got inspired to do this work under consideration in order to give a breakthrough in the Civil Engineering domain. Soils are weathered products of rocks which are formed mainly because of the process called weathering. Weathering process introduces physical and chemical changes leading to the formation of coarse and fine grained soils. The former resemble the parent material namely the rock while the latter doesn't. Majority of the clayey soils (fine grained) in the world often pose a problem of swelling and shrinkage to a geotechnical engineer while admitting and loosing water. Hence they are often referred as weak soils or soft soils in the context of their swelling and shrinkage aspects. The main reason behind this quality of clayey soils is because of different clay minerals like smectite, atapulgite, chlorite, hallosite, illite and a chief mineral namely montmorillionite. In the case of foundations the swelling and shrinkage problems induce differential settlements, and in pavements problems like potholes, cracking and undulations are created leading to discomfort for the passengers which in turn lessen the life of vehicle. The quality of clayey soils has been improved substantially with quite a lot of admixtures available either natural or artificial by lot of researchers. This paper discusses the results of the laboratory study conducted on local clayey soil and its improvement by stabilizing it with different admixtures. Very exiting results are obtained with this comparative study and hence the effective method of soil stabilization can be judged and adopted by referring conclusion of this paper.

KEYWORDS : Montmorillionite, Brick dust, Lime, Compaction, Black cotton Soil.

1 INTRODUCTION

Approximately classification of entire soils of the world split into either clay or sandy type of soils. The latter hardly pose any problem due to seepage of water into it, which is mainly because of its formation from the parent material namely rock. Rather the clayey type of soils are formed by chemical weathering which involves chemical reactions constituting hydration, carbonation and leaching. Due to these aspects the clayey soils swell when it comes in contact with water during winter season and shrink when water is lost due to evaporation during summer. A lot of investigation has been carried out by researchers in modifying the swelling and shrinkage properties of clayey so ils. The modification can be brought about by variety of options say by either removing water from those soils in form of de-watering methods, by compacting them,by introducing reinforcements and by additives. The last option is sorted in this study on a multiple basis which is found to be economical in certain aspects when the quantum of soil to be stabilized is larger , especially in the case of laying flexible pavements and before laying very large shallow foundations. Early studies have carried out in stabilizing the clayey soil with a lot of additives say flyash palm oil ash, marble dust, brick kiln dust

Cement ,Bitumen , Egg shell stone dust , Fuel oil Quarry dust etc., and considerable modification was observed. The current study aims to stabilize the soil using different admixtures say brick dust and Brick dust with lime as an additives. Some discussions oriented to flexible pavements are also included in the present study .

2. MATERIALS AND PROPERTIES

The properties of the Black Cotton soil and Lime are presented in Table 1 & 2

Table 1 Properties of soil

Differential Free Swell (%)	
LL (%)	66.3%
PL (%)	31.56%
PI	34.7%

Table 2 Chemical Properties of Lime

Calcium Oxide, CaO (%)	73.22
Phosphorus Oxide, P2O5 (%)	0.08
Calcium Sulphate, CaSO4 (%)	0.12
Ferric Oxide, Fe2O3 (%)	0.17
Aluminium Oxide, (%)	0.11
Magnesium Oxide, MgO (%)	0.74
Loss on Ignition, LOI (%)	24.35

2.2 TESTS

A series of tests were conducted to enhance and ensure the improvement of clayey soil with the above mentioned admixtures in various proportions as listed below.

2.3 ATTERBERG LIMITS

Name of the Test
Atterberg limits (LL & PL)
Modified Proctor Compaction (MPC)
Differential Free Swell (DFS)

The preliminary laboratory tests like specific gravity, grain size distribution confirming to Indian Standards were conducted to optimize the proportioning of different admixtures with the natural soil. The proportions adopted are similar for all the tests conducted in series. The details of the sieve analysis test along with Atterberg limits are furnished below.

1. The liquid limit device shall be inspected to determine that it is clean , dry and in good working order, that the cup falls freely and it does not have too much side play at its hinge. The grooving tool shall also be inspected to determine that it is clean and dry.

2. About 120 gm of the soil sample passing 425-micron sieve shall be mixed thoroughly with distilled water in the evaporating dish or on the flat glass plate to form a uniform paste. The paste shall have a consistency that will requi9ire 30 to 35 drops of the cup to cause the consistency closure of the standard groove. In case of clayey soil , the soil paste shall be left for a sufficient time (24 hours) so as to ensure uniform distribution of moisture throughout the soil mass.

3. 3. Take a portion of the paste in the spatula and place it in the centre of the cup so that it is almost half filled.

Level off the cup surface of the wet soil with the spatula , so that it is parallel to the rubber base and maximum depth of the soil is 1 cm.

4. Cut a groove in the wet soil in the cup by using appropriate grooving tool.

Turn the handle of the apparatus at the rate of 2 revolutions per seconds until the two parts of the soil come in contact with bottom of the groove along the distance 10 mm. record the numbers of blows required to cause the groove close to 10 mm.

Collect the representative slice of soil from cup and put it in a airtight container, determine water content of the sample.

Remove the soil from the cup and mix it with the soil left earlier on the glass plate. Change the consistency of the mix by adding more water or leaving the soil paste dry. repeat the above steps 3,4,5, & 6. Note the numbers of blows to close the groove and keep the soil for water content determination.

Plastic Limit

Take about 120 gm of dry soil passing through the 425 micron IS sieve.

Mix the soil with distilled water on a glass plate to make it plastic enough to shape into a small ball.

Leave the plastic soil mass for some time for maturing. Take about 8 gm of the plastic soil, and roll it with fingers on a glass plate, when a diameter of the thread has decreased 3mm, the specimen is kneaded together and rolled out again. Continue the process until thread just crumbles at 3 mm dia.

Collect the piece of crumbled soil thread in a moisture content container for water content determination.

Repeat the procedure at least the twice more with fresh sample of plastic soil.

The average water content of three soil sample will give plastic limit.

Modified Proctor Test

1. 5 kg of sample is taken
2. Thoroughly mix it with mixing tools.
3. Fill the mixed soil sample into the standard proctor mould into 5 layers with 25 blows per layer.
4. Unmould the soil specimen.
5. Take out very small amount of sample from the centre of the specimen and weight it. Put it into the oven for 24 hours for drying.
6. After completion of time period again weight the sample and note the difference in weight.
7. Repeat whole process until value increase again.
8. Plot the values and get OMC & MDD.
9. proportions of soil ,brick dust and lime
10. The below figure is showing the impact of brick dust on maximum dry density and optimum moisture content. Form the figure it is concluded that with the increasing amount of brick dust with lime by percentage weight of black cotton soil dry density is increasing and optimum moisture content is decreasing.

3. RESULTS AND DISCUSSION

Atterberg's Limits

ATTERBERG LIMITS			
S.No	Soil Composition	LL	PL
1	Black Cotton Soil	66.3%	31.56%
2	Black Cotton Soil + 30 % Brick Dust	45.12%	26.66%
3	Black Cotton Soil + 40 % Brick Dust	43.45%	24.46%
4	Black Cotton Soil + 50 % Brick Dust	39.82%	17.9%
5	Black Cotton Soil + 20 %Brick Dust + 10% Lime	44.56%	25.82%
6	Black Cotton Soil + 25 % Brick Dust + 5% Lime	42.39%	23.24%
7	Black Cotton Soil + 35 % Brick Dust + 5% Lime	40.02%	18.6%

By the replacement of black cotton soil from the burnt brick dust and brunt brick dust with lime it is identified that the values of attereberg's limits are decreasing with increasing the stabilizing content. .

As same reduction is identified liquid limit, plastic limit and plasticity index. Reduction in liquid limit value for 30, 40, 50 % burnt brick dust are respectively 45.12, 43.45, & 39.82 %. Plastic limit values are as for 30, 40, 50 % burnt brick dust are respectively 26.66, 24.46, and 17.9%. As same reduction in plasticity index for 30, 40, 50 % brick dust are respectively 18.46, 18.99, & 21.92 %. Similarly by the replacement of black cotton soil from the burnt brick dust with lime it is identified that the values of attereberg's limits are decreasing with increasing the stabilizing content.

As same reduction is identified liquid limit, plastic limit and plasticity index. Reduction in liquid limit value for 20%BD+10%lime, 25%BD+ 5% lime& 35% BD + 5% lime are respectively 44.56, 42.39, & 40.02 %. Plastic limit values are as for 30, 40, 50 % burnt brick dust are respectively 25.82, 23.24, and 18.6%.

Modified Proctor Test

Modified proctor test values for different mix proportions

MODIFIED PROCTOR COMPACTION TEST			
S.No	Soil Composition	(MDD) g/cc	(OMC) %
1	Black Cotton Soil	1.42	25.33%
2	Black Cotton Soil + 30 % Brick Dust	1.58	22.17%
3	Black Cotton Soil + 40 % Brick Dust	1.66	20.43%
4	Black Cotton Soil + 50 % Brick Dust	1.73	17.02%
5	Black Cotton Soil + 20 %Brick Dust + 10% Lime	1.63	21.3%
6	Black Cotton Soil + 25 % Brick Dust + 5% Lime	1.66	19.3%
7	Black Cotton Soil + 35 % Brick Dust + 5% Lime	1.68	18.2%

The above figure is showing the impact of brick dust and some added quantity of lime on maximum dry density and optimum moisture content. The above figure also states that with the increasing amount of brick dust and lime by percentage weight of black cotton soil dry

density is increasing and optimum moisture content is decreasing.

4.CONCLUSIONS

1] The above figure is showing the impact of brick dust on maximum dry density and optimum moisture content. Form the figure it is concluded that with the increasing amount of brick dust by percentage weight of black cotton soil dry density is increasing and optimum moisture content is decreasing.

2] From the results it is concluded that the impact of brick dust and lime on black cotton soil is positive. By replacing soil by 35% of brick dust and 5% of lime of its dry weight it gives maximum improvement in the engineering properties of black cotton soil. So use of brick dust and lime is preferable for stabilization because it gives positive results as stabilizer and also it is a waste utilization.

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