Bentonite as Cementious (binding) material for improvement of Soil subgrade properties

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ABSTARCT

This research project focused on laboratory testing at Cecos university of engineering and technology peshwar.Bentonite is absorbent aluminium phyllosilicate clay consisting mostly of montmorillonite. The goal of the research was to use Bentonite as cementious material, and to determine subgrade improvement by this local stabilizer feasible within Pakistan or not.

The subgrade soil of Jamalgarhi, Mardan consists when of clayey soil comes under the category of A6 class of AASHTO soil classification. The average natural moisture content of the soil is more than 25% which makes it water logged and problematic for pavement construction.

The performance of stabilizers/Additives was compared with the performance of virgin soil. This comparison allowed for fundamental conclusions and recommendations to be made for soil stabilizers and their abilities to be used for new roads and rehabilitation purposes.

Keywords: subgrade improvement; bentonite clay ,moisture content..

I. INTRODUCTION

Bentonite was named by Wilbur C. Knight. (Al). Bentonite usually forms from weathering of volcanic ash, most often in the presence of water.Bentonite has great water binding ability and consequently very low permeability to water. It has been found, that the permeability of the soil is reduced considerably when substituted by sodium bentonite. Hence, this material is often employed in construction engineering to make a porous medium water-tight. It can be used alone or with some other grouting material. It is also used in drilling muds, decolourizer, foundry sands and cosmetics preparation

II. TESTING PROCEDURE

2.1 Sample collection:

Sample from two sites in mardan.one was collected from Jamalgarhi and other was collected from Qaziabad. According to AASHTO classification both of these soil samples were clayey soil and was expected to lie under the category of A-6 or A-7 soil.

2.1.1Tests on soil sample:

After collection of soil samples, the soil was tested by incorporating bentonite clay with samples containing 5 and 10% bentonite clay. Laboratory tests were conducted for determining, Atterberg's limits, modified proctor test (for OMC and maximum dry density) and California Bearing Ratio (CBR). Data was collected and analysed for developing relations.

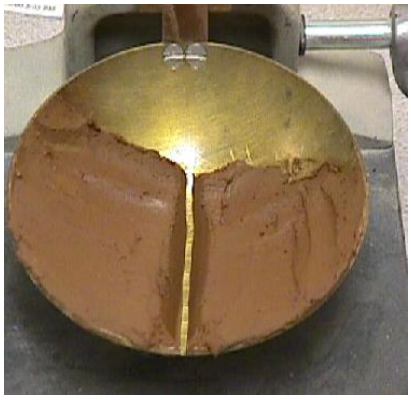

Fig 3.1Groove in the soil sample using grooving tool for mosisture content at Cecos lab

III. RESULTS AND DISCUSSION

After performing the tests different graphs between water content and number of blows for10,30,and 65 values to which bentonite clay was added upto 10% was developed.

Table 3.1 shows CBR test of the soil sample mixed with 5% Bentonite Clay .

MDD from Proctor Test (g/cc)		2.112	
MDD from Proctor(pcf)		131.80	
NO. of Blows	Dry density from CBR(pcf)	%compaction	%CBR
10	102.700	77.928	3.8295
30	112.700	85.516	7.3774
65	113.400	100.000	25.248

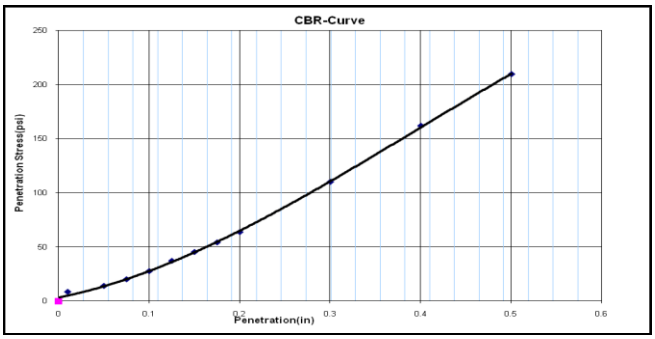

Fig III.2 CBR Curve for Soil with 5% bentonite clay as additive (65 blows)

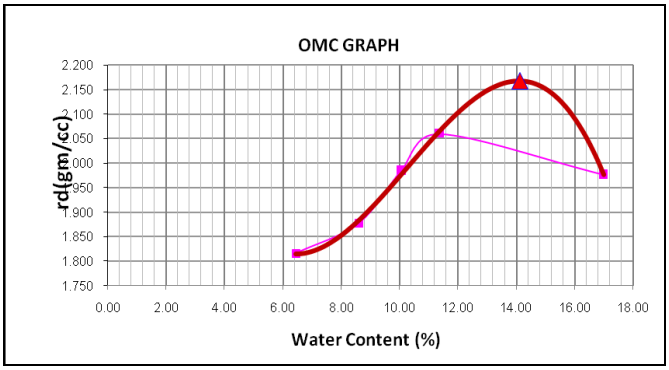

Fig III.3 Graph between maximum dry density and water content for soil having 10% Bentonite clay as additive

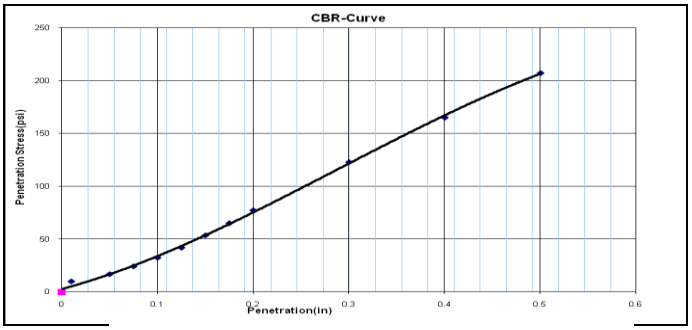

Fig III.4 CBR Curve for Soil with 10% Bentonite Clay as additives (65 blows)

Table 3.2 shows the result for the CBR test of the soil sample mixed with 10% Bentonite Clay

MDD from Proctor Test (g/cc)		2.112	
MDD from Proctor(pcf)		131.80	
NO. of Blows	Dry density from CBR(pcf)	%compaction	%CBR
10	104.700	79.445	8.7645
30	113.000	85.743	3.0661
65	126.900	100.000	25.766

Table 3.3 Results of test performed after adding 10% Bentonite Clay as Additive

Properties	**10% Bentonite clay (as additive)**
OMC	12.22
Max.Dry Density	127.0
Swelling	0.48
CBR	8.8

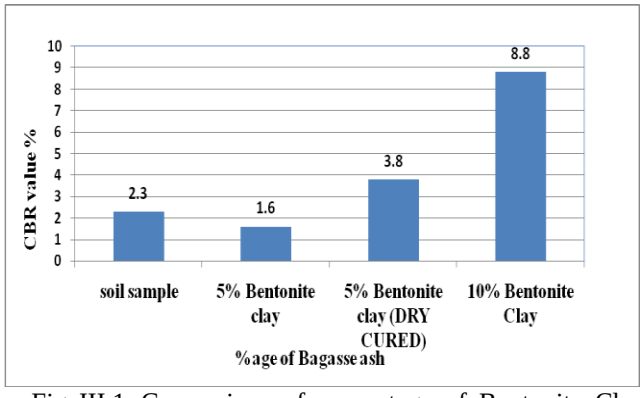

Fig III.1 Comparison of percentage of Bentonite Clay added to soil sample vs CBR value

Conclusion and recommendation

I. The graph shows that the CBR value increase with percentage of bentonite caly.

II. It also appears that the 5% bentonite with dry cured condition has increased CBR value than with normal cured.

III. From the analysis it was observed that weak subgrade materials can be improved sufficiently by adding 10% bentonite clay as additive.

IV. The bentonite clay shows a much high value when dry cured than one with normal curing.

Based upon the results of this research it is recommended that an additional study be conducted in order to more thoroughly evaluate the potential of improvement of the engineering properties of weak subgrade materials by using other additives or combination of two additives.

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