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Stability of Black Cotton Soil Using FeCL3 And Fly Ash.

[1]Prof.Suresh C Jain

[2]Aakash N Patel [3]Hatim A Dhundhiyawala[4]Parth D limbachiya [5]Aliasger H Nalawala

1 Associate professor, civil engineering department, ITM universe, Vadodara, Gujarat, India
2 U.G. student, civil engineering department, ITM universe, Vadodara, Gujarat, India
3 U.G. student, civil engineering department, ITM universe, Vadodara, Gujarat, India
4 U.G. student, civil engineering department, ITM universe, Vadodara, Gujarat, India
5 U.G. student, civil engineering department, ITM universe, Vadodara, Gujarat, india

Abstract : *As the day's advancing so is the technology and with the modernization there is an enhancement in construction and there are several advanced techniques in construction and so are the project acquired in such Dedicated Freight Corridor (DFC) which is a broad gauge freight corridor project under Dedicated Freight Corridor Corporation (DFCC) which works under Indian Railway ministry. As we are conducting a case study of DFC project. We endeavour to improve soil stability & bearing capacity of black cotton soil for railways with help of fly ash and fecl3 . We had study stretch CTP-13 of western corridor right from Vadodara to Sachin, Surat.*

Keywords: *Fly Ash (F.A.), Ferric Chloride (FeCl3), M.D.D., O.M.C., C.B.R.*

1. INTRODUCTION

Black cotton soils is one of the problematic soils that has high potential for Shrinking or swelling due to change of moisture content. These soils have the tendency to increase in volume when water is available and decrease in volume when water is available and decrease in volume when water is removed. These soils covers about 20% of the total area of India. The problem that causes black cotton soils is that deformations are significantly greater. There deformation cannot be predicted movement of soil is usually in an uneven manner & is of such magnitude which causes extensive damage to structures resting on them. Many stabilization techniques are in practice for improving the characteristics of black cotton soil. Additives such as lime, cement, calcium chloride, rice husk, fly ash are also used to alter characteristics of black cotton soil. The effect of additives and the optimum amount of additives to be used depend mainly on the mineralogical composition of soil.

To study the influence of Ferric chloride (FeCl3) and Fly ash on properties of black cotton soil.

2. Materials Used

Black cotton soil :-The black cotton soil for the study has collected from Satara, a village 4 km for Aurangabad city Dist. Aurangabad Maharashtra, INDIA.

The properties of soil are assessed based on relevant I.S. code provisions & are given in Table 1.

Sr. No.	Property	Value
1	Liquid Limit	66%
2	Plastic Limit	24%
3	Plasticity Index	42%
4	Maximum Dry Density	1.465 g/cm3
5	OMC	25.90%
6	California Bearing Ratio	1.75%

Ferric Chloride: - Laboratory grade Ferric Chloride consisting of 96% FeCl3 was used in this work. The amount of Ferric Chloride used was between 0 to 2% by dry weight of soil.

Fly Ash: - Fly ash was collected from Thermal Power Station, wanakbori, Gujarat. Fly ash content was varied from 0 to 12% by dry weight of soil.

3. Laboratory Test

Liquid Limit: - The liquid limit test was conducted on treated & untreated B.C. soil
Using casagrande's liquid limit apparatus as per the procedures laid down in IS: 2720 Part 4 (1970)

Plastic limit: -The plastic limit test was conducted on treated & untreated B.C. Soil as per the specification laid dash in IS: 2720 Part 4 (1970)

Maximum Dry Density & O.M.C.:- This test was conducted on treated & untreated B.C. Soil as per specification laid down by IS: 2720 Part 6 (1974)

California Bearing Ratio: -This test was conducted on treated & untreated B.C. Soil as per specification laid down by IS: 2720 part 16 (1979)

4. Results And Discussion

The effect of adding FeCl3 and Fly Ash on properties of B.C. Soil is presented in Table No. 3.

Table 3: The effect of adding FeCl3 and Fly Ash on properties of B.C. Soil

Soil	FeCl3	Fly Ash	MDD g/cm3	OMC%	CBR%	L. L.	P. L
100.00	0.00	0.00	1.465	25.90	1.75	66.00	24.19
100.00	0.50	0.00	1.469	25.23	2.07	64.00	23.96
100.00	0.50	3.00	1.475	24.75	2.39	63.00	24.18
100.00	0.50	6.00	1.481	24.25	2.55	62.00	24.81
100.00	0.50	9.00	1.486	24.12	2.78	62.00	24.90
100.00	0.50	12.00	1.492	24.01	2.86	61.00	25.10
100.00	1.00	0.00	1.474	25.13	2.47	60.00	25.33
100.00	1.00	3.00	1.481	24.25	2.63	59.00	25.91
100.00	1.00	6.00	1.489	24.21	2.86	58.00	26.14
100.00	1.00	9.00	1.497	23.88	3.34	57.00	26.29
100.00	1.00	12.00	1.503	23.73	3.66	56.00	26.54
100.00	1.50	0.00	1.481	24.25	2.63	58.00	26.08
100.00	1.50	3.00	1.488	23.62	3.02	57.00	26.24
100.00	1.50	6.00	1.497	23.27	3.42	56.00	26.39
100.00	1.50	9.00	1.504	23.04	3.66	55.00	26.75
100.00	1.50	12.00	1.512	22.99	3.98	53.00	26.90
100.00	2.00	0.00	1.489	23.57	3.02	57.00	26.44
100.00	2.00	3.00	1.496	23.31	3.50	57.00	26.64
100.00	2.00	6.00	1.505	22.95	3.82	56.00	26.63
100.00	2.00	9.00	1.512	22.68	4.14	54.00	26.55
100.00	2.00	12.00	1.526	21.88	4.46	53.00	26.70

Effect of FeCl3 & Fly ash on Atterbergs limit: The variation of liquid limit values with different percentage of FeCl3 alone is shown in Fig.1.
It can be observed that there is considerable decrease in liquid limit as the percentage of FeCl3 increases.

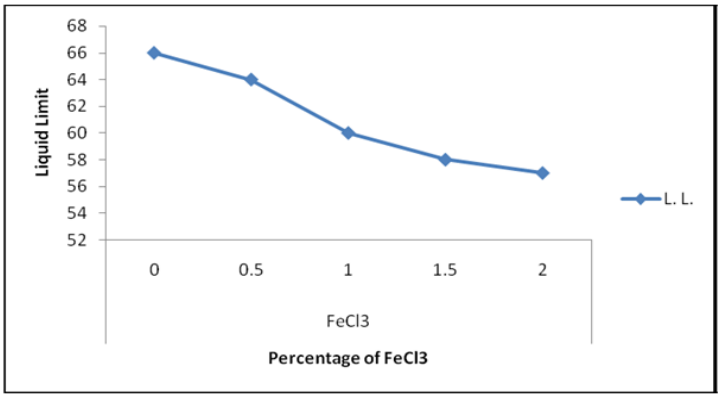

Fig. 1: The variation of liquid limit values with different percentage ofFeCl3

Effect of FeCl3 & Fly ash combination as on maximum dry density & OMC:- From Fig. 2 it can be seen that MDD increases as the percentage of chemical and fly ash increases. MDD increases from 1.465 g/cm3 for raw soil to 1.526 g/cm3 for 2% FeCl3 & 12% Fly ash combination. The increase in MDD indicates the increase in strength of soil. This may be due to formation of Slicacious material & cation exchange reactions. Also it is observed that optimum moisture control decreases with increase in percentage of FeCl3 and Fly ash.

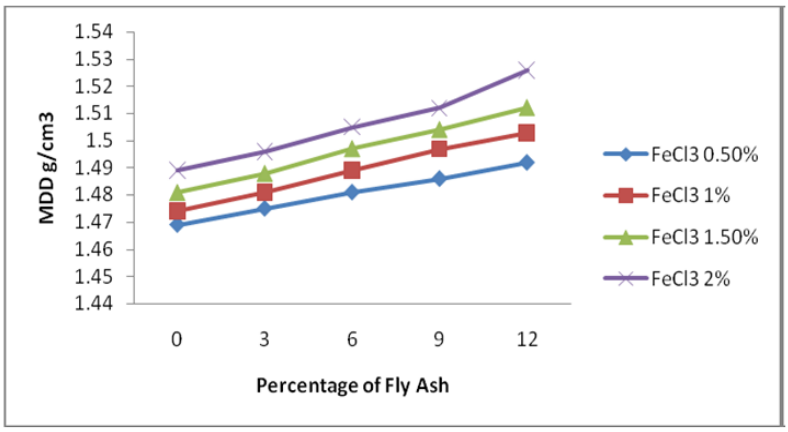

Fig.2Variation of MDD g/cm3

Effect of FeCl3 & Fly ash on C.B.R. The Fig. 3 shows the variation of CBR with of stabilized B.C. soil with addition of different percentage of FeCl3 alone. It is observed that the CBR increase with increased percentage of FeCl3. The increase in value of CBR with 2% of FeCl3 is 72.57%. The value of CBR also increase as the percentage of Fly Ash increases which can be observed from Fig. 6. The max increase in CBR value is 154.85%. It is observed for combination of 2% FeCl3 & 12% fly ahs. The increase in CBR can be attributed cation exchange of FeCl3 and fly ash and soil minerals. Increase in CBR values show the increase in stability of soil and resistance to penetration which helps to decrease the pavement thickness.

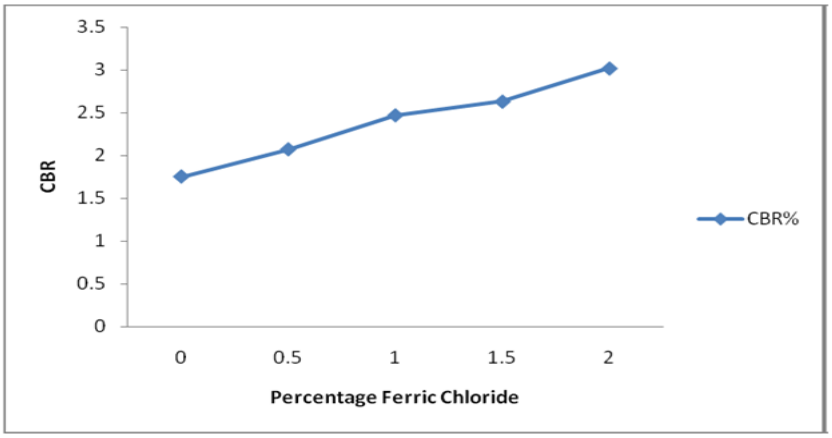

Fig.3Variation of CBR

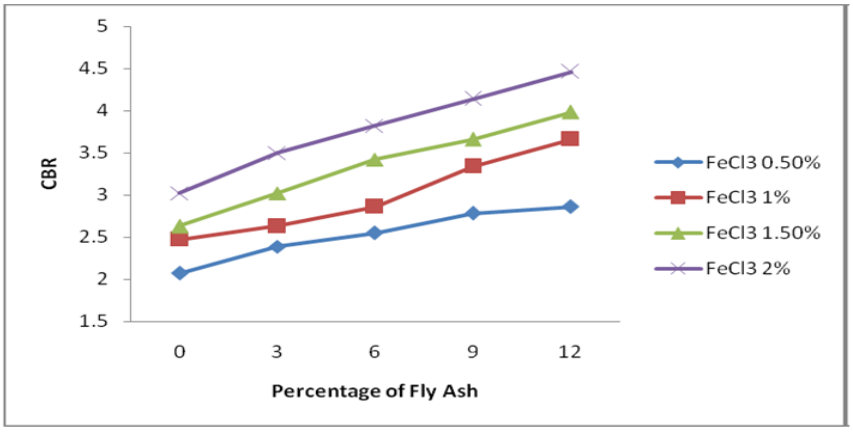

Fig.4Variation of CBR%

5. Conclusion

The following conclusions are drawn on the basis of test results obtained on black cotton soil stabilized with fly ash and FeCl3. 1. It was observed that liquid limit of B.C. Soil has been decreased by 19.69% with addition of 2% FeCl3 of 12% Fly ash. 2. It was observed that plastic limit of black cotton soil has been increased by 10.37% for 2% FeCl3 + 12% Fly ash. 3. It was observed that M.D.D. of B.C. Soil increased from 1.465 g/cm3 to 1.526 g/cm3 for 2% FeCl3 + 12% Fly ash. 4. It was observed that CBR value of B.C. Soil increased to by 155% for 2% FeCl3 + 12% fly ash. Combination of fly ash and ferric chloride can stabilize black cotton soil. The utilization of fly ash is an alternative to reduce construction cost of roads particularly in the area of black cotton soils.

