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Use of Lime and Fly Ash on Strengthening of Sub Grade Soil

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Abstract:
In India there are about 82 thermal power plants, which are currently producing about 100 million tons of fly ash per annum, But the creation of waste from these thermal power plants are not disposed properly. This creates adverse effects on the environment such as air pollution, water pollution, which affect on human health. Hence the proper disposal of such waste becomes necessary for ecosystem and it became challenges for engineers. The aim of this paper is to utilize the Industrial waste such as fly ash & lime for this purpose use of lime and fly ash on strengthening of subgrade soil. In present investigation, black cotton soil is obtained from Almala (Maharashtra). The basic tests like specific gravity, liquid limit, plastic limit, free swell index, standard proctor test, California Bearing Ratio test are carried out on raw black cotton soil and found a soil with low CBR value which is very problematic for civil construction. So it is necessary to increasing CBR value of soil by improving properties of sub grade soil using Lime and Fly ash with different proportions as 2%, 4 %, 6% ,8%,10%,12% and 14% by dry weight of soil.

Keywords: Fly ash, Lime, strength, CBR, MDD, OMC

1. INTRODUCTION

All the centuries are growing so rapidly, this growth will clearly see by the improvement of infrastructural facilities and transportation facilities. Foundation and pavement is very sensitive to the characteristics which provide the support for pavement or structure and problems associated with this further become far more critical, particularly in regions where the black cotton soils are there. All the soils are not expensive soil and expensive soil are not black cotton soil. Black cotton soil is considered as not suitable for construction due to high swelling and shrinkage behaviour of soil. The soil poses problems to the structure founded on them. Very destructive results caused by this type of soil have been reported in many countries. This disadvantage of black cotton soil can be overcome by improving with suitable material and if these materials are of waste from any source then that will help to disposal from the source.

2. MATERIALS

SOIL: The basic material used for experiment is black cotton soils, which are having main characteristics as swelling and shrinkage. They are very sensitive to changes in environment. Mostly such soil is not suitable for construction purpose, following are basic properties of soil which is used for this project.

Table.1. Properties of soil before modification

Sr. No.	Property	Value (%)
1	Specific Gravity	2.13
2	Liquid Limit	66
3	Plastic Limit	27
4	Plasticity Index	39
5	Free Swell Index	23.08
6	Optimum Moisture Content	26.48
7	Maximum Dry Density (g/cm3)	1.447
8	California Bearing Ratio Value	2.39

FLYASH: fly ash is obtained from thermal power plant Parali .maximum dry density, MDD=1.311 g/cc; Optimum moisture content, OMC=29.10%

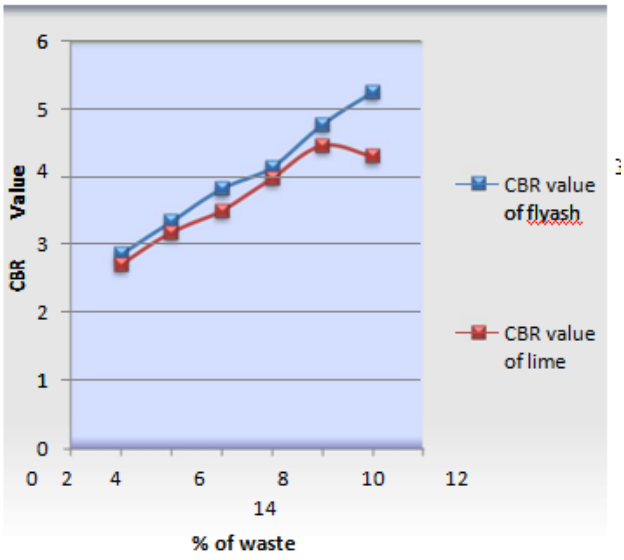
LIME: Commercial grade lime mainly consisting of 58.65%Cao and 7.2%Silica, MDD=1.18g/cc, OMC=30.57%

3. METHODS & RESULTS

The weak subgrade soil is treated with two wastes at 2%, 4%, 6%, 8%, 10%, 12% separately and for each percent CBR test And standard proctor test is carried out the result of this test showed improvement in CBR value with the increase in percentage of waste also the value of MDD will also increase while the value of OMC will reduces with the increase in the percentage of waste.

Table .2. CBR value with different percentage of waste

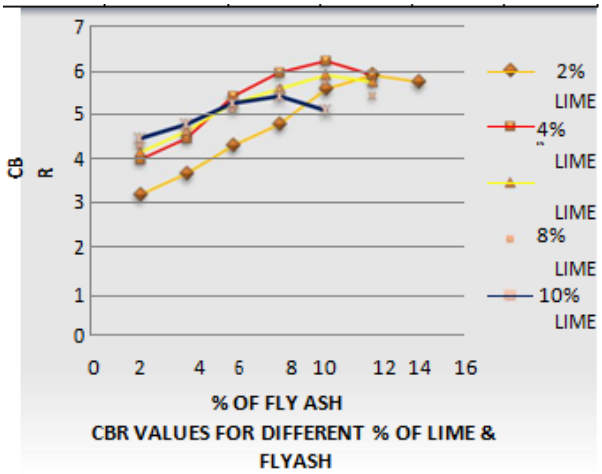
% of waste	CBR value of fly ash	CBR value of lime
2	2.86	2.71
4	3.34	3.18
6	3.82	3.5
8	4.14	3.98
10	4.77	4.46
12	5.25	4.3



Graph.1.Variation of CBR value with different percentage of waste

Table.3. CBR values of different % of fly ash & lime

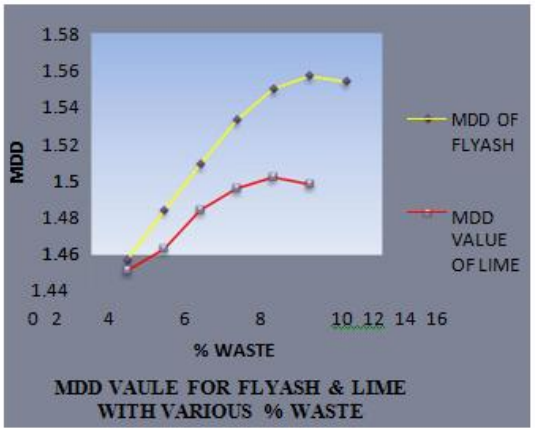
FLY ASH %	2% LIME	4% LIME	6% LIME	8% LIME	10% LIME
2	3.18	3.98	4.14	4.3	4.46
4	3.66	4.46	4.61	4.61	4.77
6	4.3	5.41	5.25	5.09	5.25
8	4.77	5.94	5.57	5.57	5.41
10	5.57	6.21	5.89	5.73	5.09
12	5.89	5.89	5.73	5.41	
14	5.73				



Graph .2. variation of CBR values of different % of fly ash & lime

Table.4. MDD values for % of fly ash & lime

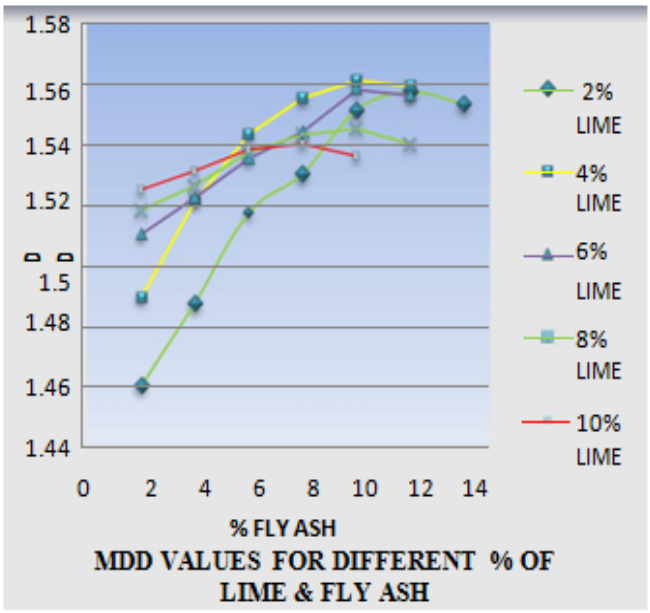
% WASTE	MDD OF FLYASH	MDD VALUE OF LIME
2	1.457	1.451
4	1.484	1.463
6	1.509	1.484
8	1.533	1.496
10	1.55	1.502
12	1.557	1.498
14	1.554	



Graph.3. Variation of MDD values for % of flyash & lime

Table.5. MDD values of various % of flyash & lime

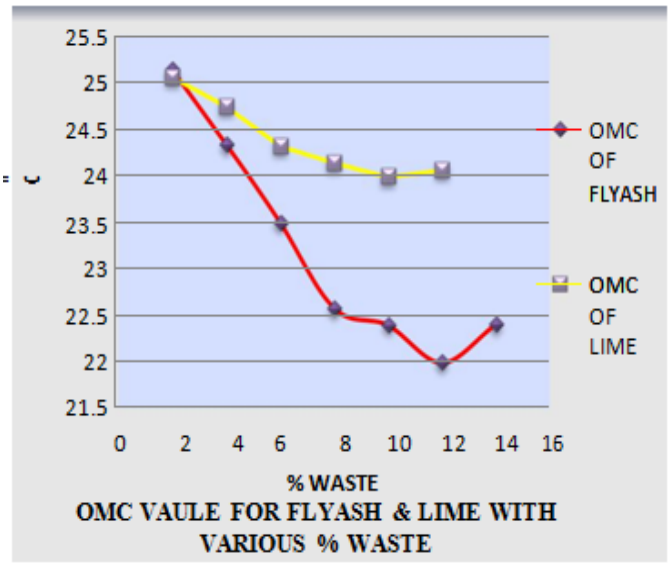
FLY ASH %	2% LIME	4% LIME	6% LIME	8% LIME	10% LIME
2	1.46	1.489	1.51	1.518	1.525
4	1.487	1.521	1.522	1.526	1.531
6	1.517	1.543	1.535	1.537	1.538
8	1.53	1.555	1.544	1.543	1.54
10	1.551	1.561	1.558	1.545	1.536
12	1.557	1.559	1.556	1.54	
14	1.553				



Graph .4. variation of MDD values of various % of fly ash & lime

Table.6. OMC values for % of fly ash & lime

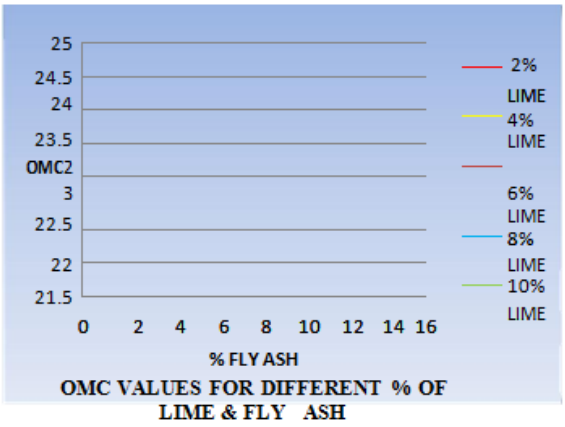
% WASTE	OMC OF FLYASH	OMC OF LIME
2	25.13	25.06
4	24.33	24.74
6	23.49	24.32
8	22.57	24.14
10	22.39	23.99
12	21.99	24.06
14	22.4	



Graph .5. Variation of OMC values for % of fly ash & lime

Table.7. OMC values of various % of fly ash & lime

FLY ASH %	2% LIME	4% LIME	6% LIME	8% LIME	10% LIME
2	24.53	24.13	24.07	23.89	23
4	23.98	23.51	23.69	23.09	22.76
6	23.69	22.93	23.15	22.24	22.54
8	23.05	22.17	22.76	22.01	22.37
10	22.17	21.7	22.14	21.88	21.74
12	21.9	21.9	22.44	22.09	
14	22.03				



Graph .6. Variation of OMC values of various % of fly ash & lime

4. CONCLUSIONS

In India production of large quantity of industrial wastes faces serious problems of handling and disposal. For doing safe disposal of industrial waste without adversely affecting the environment and the large storage area required are major concerns. Hence in our investigation and attempt has been made to utilize certain industrial waste such as fly ash and Lime to stabilize weak subgrade soil. Use of this industrial waste improves the subgrade strength of weak soil. Hence there is a value addition to these industrial wastes serving the three benefits of safe disposal of effluent, using as a stabilizer and return of income on it.

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