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PAVEMENT STABILISATION USING BY GEO TEXTILES

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Abstract:- Soil Reinforcement is one of these techniques in which we enhance the engineering properties of the matter. This process involves the use of natural fibers to strengthen the soil, and this is an ancient concept. Due to this, the unduly distributed soils that are reinforced with fiber have lured the attention of geotechnical engineers for quite some time now.

The pavement performance is a critical aspect in terms of the features of soil upgrade that offers a surface for complete structure of the pavement. This is a matter of great importance, and the strength of pavements gets increased by proper construction & design practices. Tons of fly ash that emerges from hordes of thermal power plants has a low weight, is non-plastic and is extremely fine. This usually gets disposed as a slurry in ponds underlying the area. And if you would have noticed, the ash from these ponds leads to air pollution which is a very serious threat. Since the load-carrying capability of these materials is less, working on their civil engineering properties is quite difficult. However, these material's performance can be enhanced with the use of methods involving soil reinforcement.

Keywords: Reinforcement, Pavement, Flyash, CBR, Geotextile.

INTRODUCTION

One of the major sources of energy is Coal in India and is likely to be so in future as well. The fly as that comes out of the Indian thermal powerplants is estimated to be over 100 million tonnes. However, there are areas such as mine filling, structural filling land reclamation, road construction and several other such areas where this fly ash can be used. This can solve the disposal issue to a great extent. According to Toth et al., who learned using fly as for structural filling, devised that the structural nature of fly ash is quite equivalent to silt and if a structural fill is prepared using the fly ash, this would definitely do much better than the one made of natural materials.

Scholars like Balley and Leonard used non-treated coal as in a pulverized manner and it showed more cementing features when used as a product for filling the structure in order to use it as a foundation support for a brand-new precipitator at a power station located in Indianapolis, USA. Even Sridharan et al. studied the ash ponds in terms of their geotechnical features in India and found this flash ash having very less unit weight, but high properties relating friction, less compressibility and quite good for the structural fill uses. When you strengthen these materials with the use of soil improving methods, they can be used as a base of various physical structures, embankments and subgrades of roads. This process of reinforcing the soil with the help of tension resistance has been inculcated widely in engineering.

Both bound and unbound pavements get hammered by frequent loads that focus with strength on a point. They can lead to aging of precipitate and even rattle the construction of roads. This strengthening of the pavements and the roads and enhance its service life by lowering the fatigue and cracks due to settlement and thermal issues. The stress concentration on these Pavements and Roads gets lessened and distributes evenly. Subgrade is known as a layer that has been compacted, formed of naturally distributed soil, about 300mm thick, lying below the pavement of the crust and offering a suitable pavement base. The embankment subgrade can be compressed in a couple of layers, normally to a much better standard against the embankment's lower part. It is essential to compress the subgrade very well, in embankment or cutting, so as to use the complete ability and lessen the cost of the complete pavement size.

MATERIALS AND METHODS

Materials

The material used in the present research work are:-

- **Fly Ash:-** Flyash is the waste product out form thermal power company. It is found to inorganic in nature and this in the present scenario it is acting as menace for thermal power industry.

- **Geo Textile:-**Geotextile is known as a fibrous material that is used with soil environment and contains non-woven and woven materials with polymers, natural products like jute, fabricated with the use of textile process. Polypropylene: When you polymerize the monomers of propylene with specific catalysts, it gives birth to thermoplastic polypropylene in a crystalline environment.

Methods

- **Sampling:-** Samples of fly ash, soil, geosynthetic material was collected from the different sampling station.
- **Preparation of sample: -** After the collection of samples it was prepared for analysis. It was firstly cleaned and left over night for air dry. Then is was sieve from 4.75 mm sieve as to maintain uniformity in the particle of sample.
- **Characterization of fly ash:-** Analysis of Fly ash was done in two categories namely:-
  - Geotechnical parameter and Chemical and Morphological Parameter
- **Geotechnical analysis of Soil:-** Geotechnical property of the fly ash was analyzed in the Geotechnical Laboratory by performing geotechnical test.
- **Characterization of geotextile:-** the characterization of collected geotextile was done as to analyze the compatibility of it geotextile for reinforcement.

- **Preparation of geotextile Reinforcement:-** After the Analysis of characteristics the reinforcement was prepared. Three types of reinforcement sample were prepared. One sample in which single layer of geotextile was used. Second sample in which double layer of geotextile was used and in third sample four layers of geotextile was used
Reinforcement made was left overnight in order to get air dry in the reinforcement and then it was subjected to analysis.

- **Analysis of Prepared Reinforcement: -** After the making of reinforcement all these reinforcement were subjected to analysis of stability for the use of reinforcement which include California Bearing Ratio Test.

RESULTS
RESULT FOR ANALYSIS OF FLYASH
(a) GEOTECHINICAL ANALYSIS

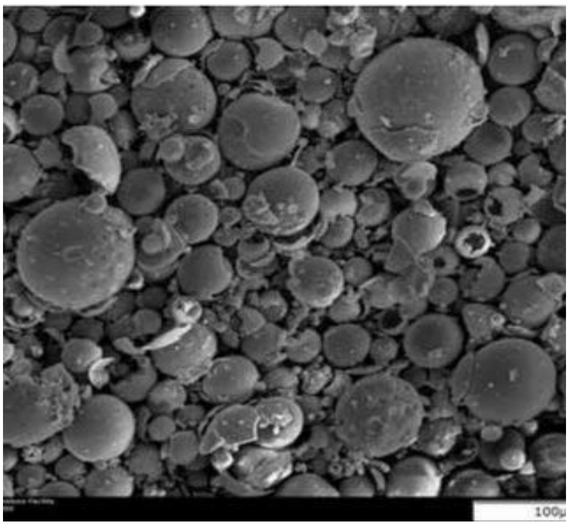
Properties		Value
Specific Gravity		1.28
Bulk Density		1.10
Moisture Content		1.16
Compaction		19.824
Permeability		~5.23× 10^{-4} cm^2
Plastic Limit		16.823
Shrinkage Limit		14.23
Grain Size analysis	D_{10}	0.32
	D_{30}	0.412
	D_{60}	0.57
	Cu	2.33
	Cc	1.009

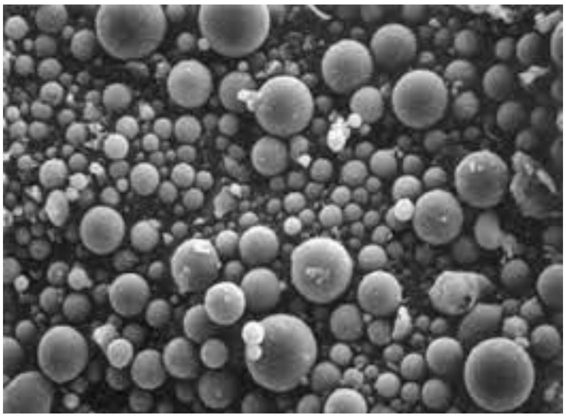
(b) CHEMICAL AND MORPHOLOGICAL ANALYSIS

- **X-Ray Florescence (XRF)**

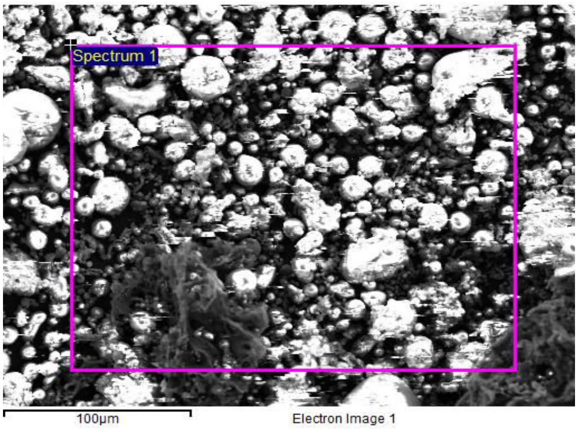
Compound	Percentage (by weight)
SiO_2	50.23
Al_2O_3	24.30
Fe_2O_3	6.31
MgO	0.63
TiO_2	1.86
CaO	0.81
MnO	0.039
Na_2O	0.08
K_2O	1.49
P_2O_5	0.356
Total	86.023

- **FESEM**





- **EDX**



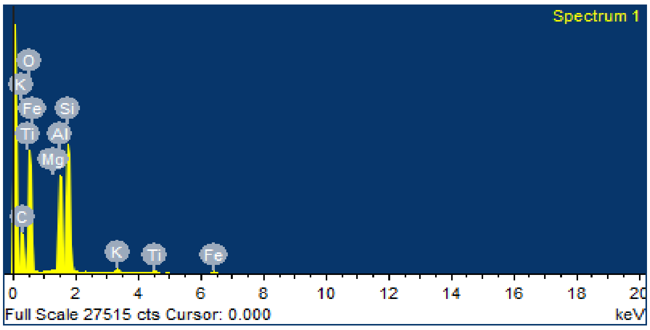


Table 9: EDX Analysis

Element	Weight	Atomic
C	28.86	39.03
O	44.56	44.92
Mg	0.19	0.16
Al	9.02	5.32

Si	14.10	7.98
K	0.84	0.40
Ti	0.89	0.39
Fe	1.67	0.42
Total	100	

- **Atomic Absorption Spectroscopy**

Elements	Concentration (ppb)
Copper	0.62
Cadmium	0.09
Cobalt	0.02
Iron	5.2
Manganese	0.9
Lead	0.04
Nickel	0.4
Zinc	0.7

RESULT FOR ANALYSIS OF SOIL

(a) GEOTECHINICAL ANALYSIS

S. No.	Property	Value
1	Specific Gravity	2.53
2	Bulk Density	1.93
3	Fineness	64.2
4	Moisture Content	15.32
5	Liquid Limit	37.09
6	Plastic Limit	21.85
7	Plastic Index	15.23

8	Gravel	1.7
9	Sand	35.18
10	IS classification	Sandy Silt

CHARACTERISATION OF GEOTEXTILE

S. No.	Property	Value
1	Tensile Strength	6 KN/m
2	Grab Tensile Strength	600 N
3	Roll Width	4 m
4	A.O.S	72 m
5	Trapezoidal Tear Strength	170 N
6	CBR Strength	600

RESULT FOR REINFORCEMENT ANALYSIS

Embedment Ratio	CBR value (%)	Strength Ratio = $\frac{CBR\ (Reinforced)}{CBR\ (Unreinforced)}$
Unreinforced	0.792	-----
0.25	0.868	1.137
0.50	0.956	1.213
0.75	1.051	1.371
1.00	1.159	1.526
1.25	1.127	1.476
1.50	1.079	1.422
1.75	1.046	1.403
2.00	1.38	1.391

No of Geotextile Layer	Embedment Ratio	CBR value	Strength Ratio
0	0	0.78	-
1	0.25	0.87	1.19
2	0.25, 0.50	1.40	3.08
3	0.25, 0.50, 0.75	2.65	3.31
4	0.25, 0.50, 0.75, 1	4.07	5.10
5	0.25, 0.50, 0.75, 1, 1.25	3.72	4.98

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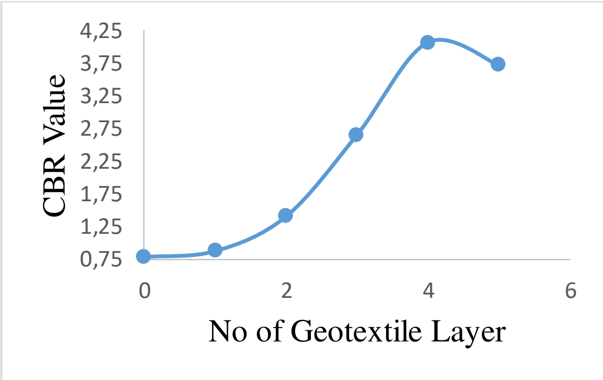

Fig Variation of CBR value with the no of Geotextile layer

CONCLUSION

Based on the testing done and results obtained the followings conclusions were made

- On addition of fly ash in the soil sample increase in the strength were observed.
- On adding the fly ash the difference in the strength were notice by 30% in CBR test.
- In first series of testing done by placing geotextile in single unit the maximum strength ratio that was obtained is 1.76. This was obtained when geotextile was placed just below the middle line of the sample.
- In second series of testing done by placing multiple of geotextile membrane and the maximum strength ratio that was obtained is 5.10 when four layers of geotextile was used in the sample and the strength obtained was far more better than the strength obtained in the first series of testing.
- The value of CBR test for double layer of geotextile was found to be 1.40 which is 44% higher.
- The CBR value for triple layer of geotextile is 2.65 which is 47% higher when compared with single and double layer geotextile.
- The CBR value for four layer of geotextile is 4.07 which is 80% higher when compared with single and double and triple layer geotextile.

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