IMPROVEMENT OF BLACK COTTON SOIL PROPERTIES USING E-WASTE AND LIME

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Abstract: Soil Stabilization is that the development that deals with modifying the properties of soil (Index & Engineering) to boost its performance. Stabilization is getting used for a spread of engineering works either in its natural type or in an exceedingly processed type. Eventually all structures rest on soil foundation wherever the most objective is to extend the strength or stability of soil and to cut back the development price. Currently daily the use of waste product with soil has gained attention because of the increasing issues of waste management. This paper presents the results of Associate in nursing experimental program undertaken to analyze the impact of E-waste with lime at completely different dosages on black cotton soil. Behaviour of soil was observed through various dosages of combination of e-waste and lime. The performance of E-waste and lime stable soil was evaluated victimization physical and strength performance tests namely; Atterberg's limit, relative density, compaction check, unconfined compressive check, California bearing quantitative relation (CBR) and direct shear check. Theses checks were conducted so as to judge the advance within the strength characteristics of the soil. E-waste and Lime treated soil effectively will increase the strength, sturdiness and workability of the soil. Such treatment conjointly improves soil compressibility

Keywords: E-waste, Black cotton soil, Soil stabilization, Recycling, Lime.

1 INTRODUCTION

Clayey soil expands once they are wetted and shrink once dried. These soils are known as expansive soil or swelling soil. Attributable to swelling nature, the BCS is problematic for construction. It swells and shrinks to a fault with the amendment of water content attributable to presence of fine clay particles that swell, once they are available in contact with water, leading to alternate swelling and shrinking of soil attributable to that differential settlement of structure takes place. The black cotton soil cowl the plateaus of geographic region, Saurashtra, Malwa, Madhya Pradesh, Chhattisgarh and extend in South-East direction on Godavari and Krishna valleys in India (approximately 350000 km^2). Within the twentieth Century, the knowledge and communication revolution has brought monumental changes within the manner we have a tendency to organize our lives, our economies, industries and establishments. These spectacular developments in times have beyond question increased the standard of our lives. At an equivalent time, these have LED to manifold issues as well as the matter of huge quantity of unsafe waste and alternative wastes generated from electrical product therefore increasing the number of E-waste day by day. E-Waste successively deals with the disposal techniques. Exercise is one in all the disposal techniques, however if it's not recycled then it's to be land stuffed in an exceedingly close disposal facility. Thus by taking this time in thought we've adopted. The Use of E-Waste‟, for up the steadiness of the soils. In construction of any structure engineering properties of soils is that the necessary issue to be thought of. As soil conjointly incorporates a relation with water and therefore stabilising the soil can increase the speed of tolerance of water into the soil therefore creating it quite ideal for engineering purpose. Soil stabilization might increase the amount of soil which can end in less consolidation. Thus, when addition of E-waste improvement within the soil properties may be seen this ends up in soil stabilization.

2.0 MATERIALS AND METHODS

2.1 Black Cotton Soil

The materials used for the tests embrace the black cotton soil and E-waste. The soil was procured from farm in M.I.D.C area, Yavatmal District. Manual labour was used for the procural of soil. Larger size lumps were countermined with rammers. Then it absolutely was large laboratory drier dried for twenty-four hours at 110 °C to 120 °C.

TABLE 1: PROPERTIES OF BLACK COTTON SOIL.

Sr. No.	PROPERY	VALUE
1.	Dry density (Ɣd)	14.5 kN/m3
2.	Grain Size Distribution (IS 2720: Part 4) Gravel	 0.58%

	Sand Clay	14.22% 88%
3.	Liquid Limit (WL) (IS 2720: Part 5)	81.5%
4.	Plastic Limit (WP) (IS 2720: Part 5)	60.7%
5.	Plasticity Index (IP) (IS 2720: Part 5)	19.23%
6.	IS classification of soil	CH or MH
7.	Specific Gravity	2.38
8.	Compaction (IS 2720: Part 8) Maximum Dry Density Optimum Water Content	 15.8 kN/m3 27%
9.	Direct Shear Test (IS 2720: Part 13) Cohesion (C) Angle of Friction (Φ)	 48 kN/m2 10 degree
10.	Unconfined compressive strength (IS 2720: Part 10)	12.23 kN/m2
11.	California Bearing Ratio CBR (IS 2720: Part 16) Unsoaked	 18.65%
12.	Free Swell Index (IS 2720: Part 40)	72.68%

2.2 E-waste

Electronic waste is also represented because the discarded electronic equipments like mobile phones, computers, social unit appliances that fail or aren't any fitter for its originally meant use. Everyday advancements in technology have resulted in quick growing surplus of electronic waste round the globe. E-waste was collected from dump yard at Yavatmal.

2.3 Water

Water may be a vital ingredient of environmental-friendly brick blocks victimization e- waste because it's involved at intervals the chemical change with cement. Potable water need to be used for mixing the cement, sand and e-waste. It needs to be free from organic matter and additionally the pH value ought to be between 6 and 7.5.

2.4 Lime

Lime could be a calcium-containing inorganic material within which carbonates, oxides and hydroxides predominate. These materials square measure still utilized in massive quantities as building and engineering Materials (including sedimentary rock merchandise, concrete and mortar) and as chemical feedstock's, and sugar processing, among other uses. The rocks and minerals from that these materials square measure derived, usually sedimentary rock or chalk, square measure composed primarily of carbonate. They will be cut, crushed or fine-grained and with chemicals altered. "Burning" and, through resultant addition of water, into the less caustic (but still powerfully alkaline) calcium hydroxide or calcium hydrate (calcium hydroxide, Ca(OH)2), the method of Which is named slaking of lime.

TABLE 2: INDEX PROPERTIES OF LIME

Sr. No.	Properties	Values
1	Specific Gravity (G)	2.8 Kg/m3
2	Liquid Limit (WL)	27 %
3	Plastic Limit (WP)	25 %
4	Shrinkage Limit (WS)	6.5 %
5	Sieve Analysis- Coefficient of curvature (Cc)	0.56

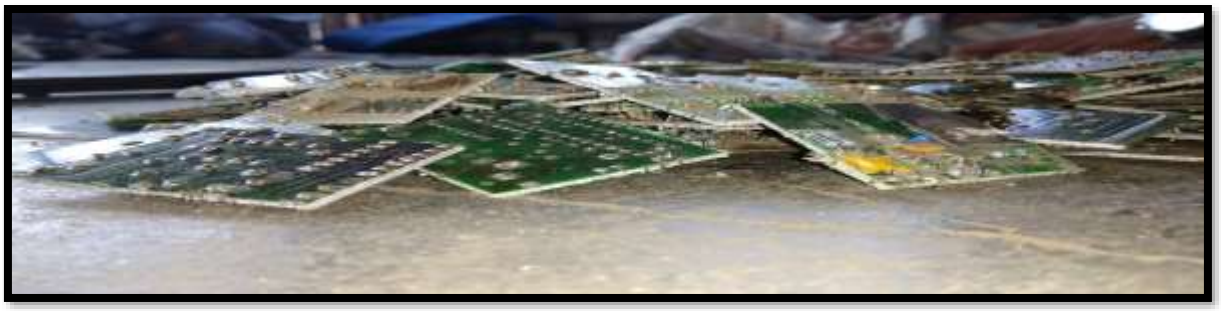

FIG 1: E-WASTE COLLECTED FROM DUMP-YARD USED IN SOIL STABILIZATION.

Laboratory tests were conducted on black cotton soil with and while not E-waste. so as to gauge the development in strength properties, physical and strength performance tests namely; Atterberg's Limit, relative density, Compaction check, Unconfined Compressive check, American state Bearing magnitude relation (CBR) and Direct Shear check were performed.

In this project The project have conducted varied experiment to seek out the stabilisation of the sub base victimisation the economic waste and cement the varied take a look at conducted to seek out the stabilisation of the sub base supported the ASTM procedure area unit listed below:

I. Liquid Limit (ASTM D 4318 – 05)
II. Plastic Limit (ASTM D 4318 – 10e)
III. Sieve Analysis (ASTM D 6913)
IV. Specific Gravity (ASTM D 6473)
V. Standard Proctor Compaction Test (ASTM D 1557)
VI. Unconfined Compressive Strength (ASTM D 2166)
VII. California Bearing Ratio Test (ASTM D 1883)

3.0 RESULT AND DISCUSSION

3.1 Mechanical Properties

3.1.1 Standard Proctor Compaction Test

TABLE 3: STANDARD PROCTOR COMPACTION TEST

Samples	Optimum moisture content in %	Dry density in g/cc
sample 1	9.5	1.732
sample 2	10.7	1.856
sample 3	8.56	1.955
sample 4	12.50	1.865
Sample 5	7.32	1.888

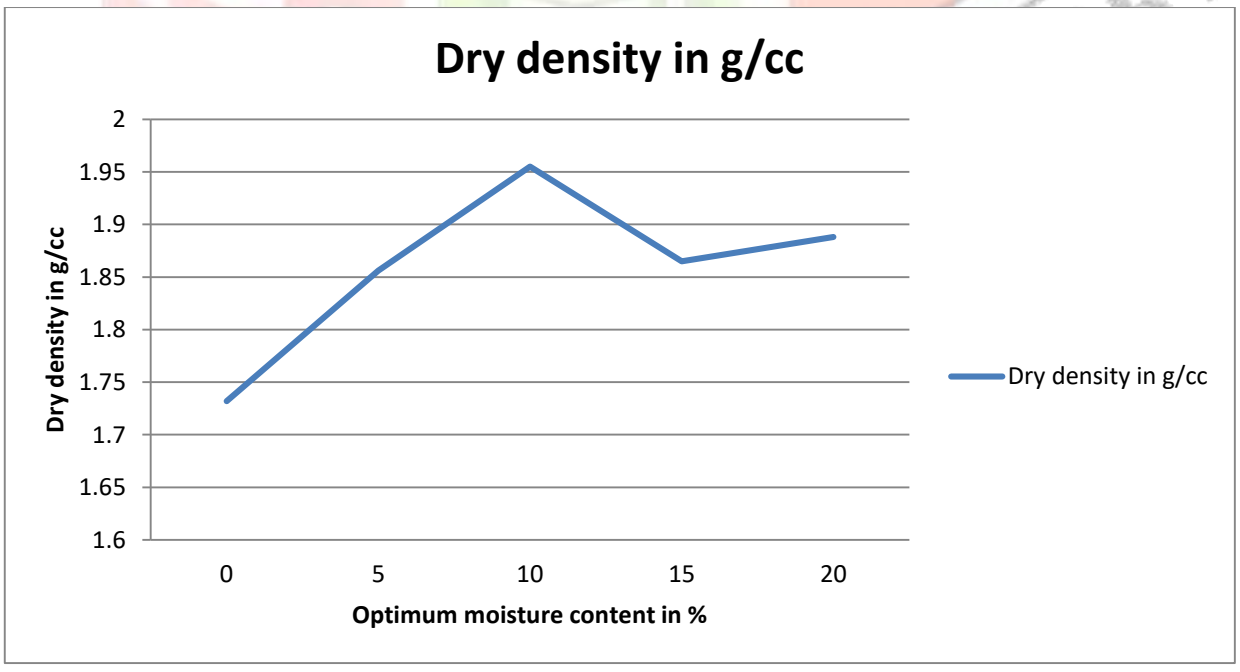

Fig 2 Water content in % Vs Dry density

3.1.1 UNCONFINED COMPRESSIVE STRENGTH

Table 4 Unconfined compressive strength

Location	Unconfined compressive strength in kN/m^2
Location 1	68
Location 2	190
Location 3	205
Location 4	155
Location 5	175

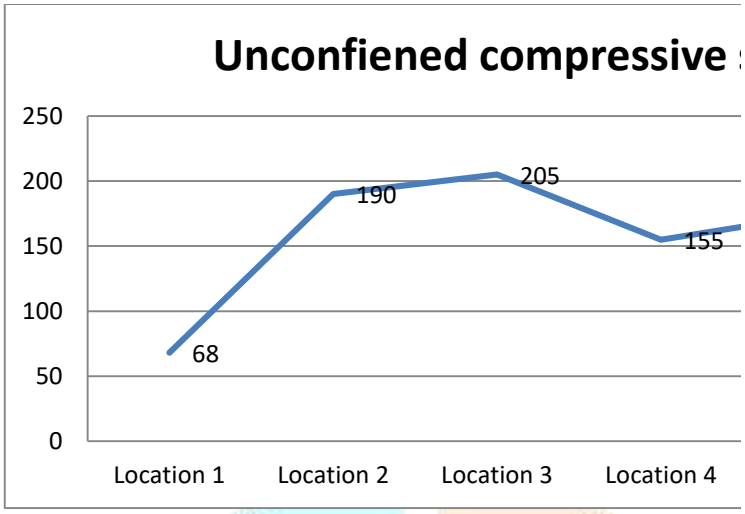

Fig.3 unconfined compressive strength

3.1.2 CALIFORNIA BEARING RATIO TEST

Location	Bearing Ratio in %
Location 1	27
Location 2	38
Location 3	19
Location 4	18
Location 5	28

Table 5 California bearing ratio test

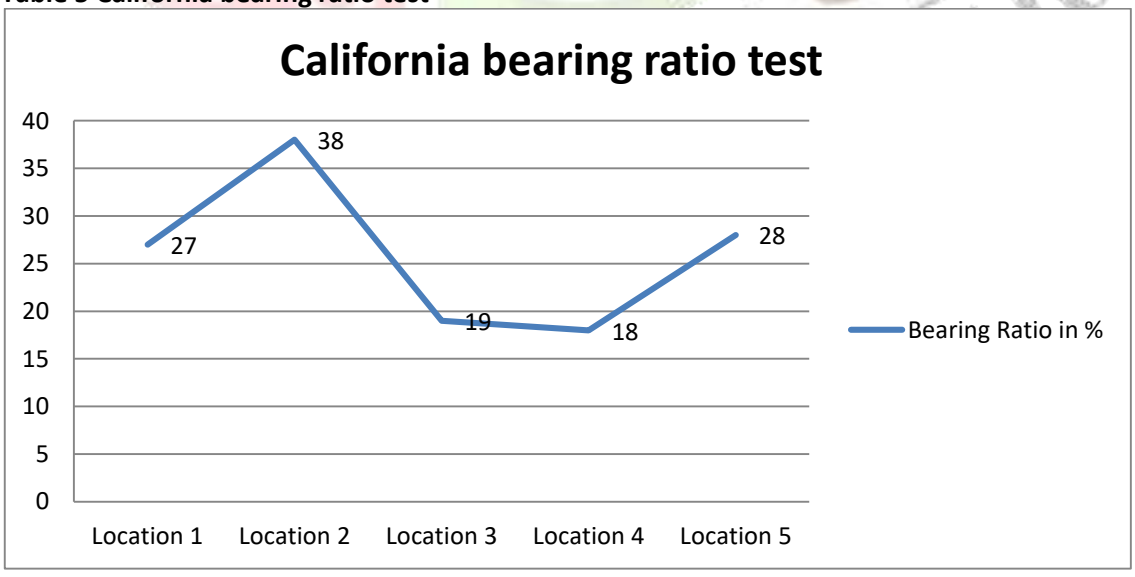

Fig 4 California bearing ratio

Fig 5: soil behaviour before and after addition of e-waste and lime

CONCLUSIONS

Based on the experimental work distributed within the gift study the subsequent conclusions are drawn for investigation of black cotton soil properties.

1. The on top of take a look at results reveals that the Soil with Lime and e-waste is a lot of stable than plain soil. OMC will increase with increase this present day of Lime as Lime absorbs some water at the beginning of reaction. The worth of MDD decreases with increase in Lime disease spirochete age.
2. The on top of take a look at results state that the Soil gains compressive strength on addition of lime and e-waste, however it continues solely up to an exact purpose in time of lime & than starts decreasing like increase this present day of lime reactions b/w soil & lime starts decreasing & one point comes once all the reactions completes of unconfined compression starts decreasing.
3. The cosmic microwave background price goes on increasing with reference to addition of E-waste.
4. it's discovered that free swell index values of the soil have belittled with increase in E-waste.
5. Unconfined strength of soil increases.
6. Bearing ratio increases.

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