International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Articles available online http://www.ijoer.in; editorijoer@gmail.com

Vol.6., Issue.4, 2018
July-Aug.

RESEARCH ARTICLE

ISSN: 2321-7758

STRENGTHENING OF SUBGRADE MATERIAL PROPERTIES BY USING ASPHALT WASTE

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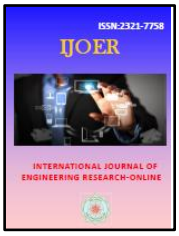


ABSTRACT
With rapid growth of population, fast urbanization and more construction of buildings and other structures has resulted in reduction of good quality of available land. With the increasing of population there will be increase in use of motor vehicles. So there is a necessity of high way development network to reduce the traffic problems. There is no choice for people expect to use soft and weak soils around for construction activities. Such soil possesses poor shear strength and high swelling and shrinkage. Black cotton soil is not suitable for sub grade material for high way development. The mechanical behavior of such nature of soil has to be improved by employing stabilization and reinforcement techniques to make it reliable for construction activities.

Black cotton soils are very weak soils and shows poor values in engineering and index properties (shear strength, compressibility and permeability, shrinking nature). Black cotton soils are one of the waste soils in civil engineering point of view which we have to stabilized (or) replaced before going to take any project. So that's why we called black cotton soils are problematic soils in civil engineering aspect. In my present investigation we are focusing on stabilizing the black cotton soils by using stabilizing techniques. Generally there are number of stabilizing techniques are those mechanical and chemical stabilization. Black cotton soils are comes under category of fine grained soils. Here we are taking lime; plastic waste and asphalt waste are used as stabilizing agents for stabilizing the black cotton soils. Samples of black cotton soil collected from ATHUKURU region in Nellore district in state of Andhra Pradesh in India. The basic properties of soil were determined. Changes in various soil properties like specific gravity, liquid limit, plastic limit, optimum moisture content and maximum dry density, California bearing ratio (CBR) and unconfined compression strength of soil were analyzed. Laboratory tests were conducted on various proportions of stabilizers (lime, plastic waste and asphalt waste) of mixes with soil. So finally to we expecting get better results after stabilizing black cotton soil with asphalt waste and lime plus plastic waste then compare to normal black cotton soil.

Keywords— Geo Technical Properties, Asphalt Waste, Laboratory Tests, etc..

1) INTRODUCTION

Black cotton soils, with high swell and shrink conduct end up being trying for construction and pavement exercises. Black cotton soils will hurl and cause lifting of building or different structures amid high dampness varieties and they endure shrinkage

and can bring about building settlement amid droughts. They additionally apply weight on the vertical face of the establishments, basements and holding dividers bringing about parallel developments. Aside from its consequences for building constructions and establishments, they have serious effect on streets, ground grapples, underground pipelines and other covered structures. Black cotton soils cover right around 20% of India's property cover and around 8% of the world's territory cover. Consequently, they can't be just overlooked of construction and pavement exercises due to their dangerous nature. There are a few strategies accessible for enhancing the qualities of far reaching soil. Be that as it may, a productive and savvy technique with least time is dependably the most welcome.

Past looks into on change of Black cotton soils have turned out with various productive arrangements including concoction adjustment strategies and profound establishment procedures. The most huge among them being the lime adjustment. The essential idea driving compound adjustment for Black cotton soil is that, extension happens as a result of retention water particles in the diffuse twofold layer through three conceivable components, the adjustment chips away at the idea of presenting cation of high valence than that of water, which gets pulled in to the earth minerals and unites dirt minerals. In this examination, an endeavor is made to ponder the saline water as a compelling synthetic stabilizer in extensive soils.

2) BACKGROUND

The need of enhancing the engineering properties of soil has been perceived for whatever length of time that construction has existed. Numerous old culture including the Chinese, Romans and Incas used different procedures to enhance soil reasonableness, some of which were effective to the point that a considerable lot of the buildings and roadways they built still exist today some are still being used.

NEEDS AND ADVANTAGES

Soil properties change an incredible arrangement and construction of structures depends a great deal on the bearing limit of the soil, consequently, we have to balance out the soil which makes it less demanding to anticipate the heap bearing limit of the soil and even enhance the heap bearing limit. The degree of the soil is likewise a vital property to remember while working with soils. The soils might be very much evaluated which is alluring as it has less number of voids or consistently reviewed which however sounds stable yet has more voids. Therefore, it is smarter to combine distinctive sorts of soils to enhance the soil strength properties. It is exceptionally costly to supplant the mediocre soil totally soil and henceforth, soil stabilization is the thing to search for in these cases.

1. It enhances the strength of the soil, in this way, expanding the soil bearing limit.
2. It is more prudent both as far as cost and vitality to expand the bearing limit of the soil instead of diving for deep establishment or pontoon establishment.
3. It is likewise used to give greater solidness to the soil in slants or other such places.
4. Here and there soil stabilization is likewise used to counteract soil disintegration or arrangement of residue, which is exceptionally valuable particularly in dry and dry climate.
5. Stabilization is likewise improved the situation soil water-sealing; this keeps water from going into the soil and subsequently helps the soil from losing its strength.

LITERATURE REVIEW

Jasmin Varghese Kalliyath *et.al.* (2016) studied the effect of plastic fibers. Various tests such as Standard Proctor, UCC were carried out with different samples of silty clay. Authors observed that the replacement of 0.5 % waste plastic fiber to the expansive clayey soil reduce its OMC and increased maximum dry density but UCS of the soil was found to be increased. The test results also showed that with 1% replacement, MDD and UCC were less than the 0.5 % replacement but greater than the untreated soil. Further increase in the plastic replacement showed decrease in the MDD and the UCS. The increase in the MDD of the soil with 1% replacement is due to the decrease in the number of voids with the addition of plastic which leads to effective compaction and also increase in the

cohesion. Thus authors concluded that optimum percentage of plastic was 0.5 % for optimum results.

Mercy Joseph Poweth *et al*. (2014) investigated the effect of plastic granules on weak soil sample with plastic and without plastic granules in varying percentage. The percentage of waste plastic was taken as 0.25%, 0.5 %, 0.75%. Maximum dry density was obtained when 0.25 % plastic was added and OMC was less than the soil without plastic for this percentage of soil. Further CBR value decreases when 0.25 % plastic is added but it was found to be increased for 0.75 % of plastic. Authors also observed that for the same percentage of plastic, shear stress was maximum.

Satyam Tiwari and Nisheet Tiwari (2016) investigated the effect of waste polypropylene fiber on shear strength of unsaturated soil samples. Here, the percentage of specific gravity of the soil increases 0.3% by using 0.5% of fiber (PPF).

S. Ayyappan et al. (2010) a series of laboratory unconfined compression strength tests and California bearing ratio tests were carried. Polypropylene fibers with different fiber length (6mm, 12mm and 24 mm) were used as reinforcement. Soil -fly ash specimens were compacted at maximum dry density with low percentage of reinforcement (0 to 1.50 % of weight). The results of study of a randomly oriented fiber reinforced soil- fly ash mixtures indicted that a maximum performance was achieved with 12 mm fibers in optimum dosage of 1.00 % by dry weight of soil- fly ash mixtures.

Lee et al., (1999) determined the shear strength and stress strain relationship of tyre chip and a mixture of sand and tyre chips. They found out the stiffness and strength properties for tyre sheds and rubber sand mixture.

Rao and Dutta, (2001) conducted studies on sand mixed with rubber chips. Compressibility tests and triaxial tests were conducted. The stress strain relations and strength parameters were studied. It was found that the value of internal friction and effective cohesion of sand increased with increase in percentage of rubber up to 15%.

Ventappa and Dutta (2006) performed a study with objective of determining compressibility and strength characteristics of sand and tire mixtures for suitability of sand tire chip mixture for embankment. they concluded that upto20% compressibility of sand-tire mixture was 1% i.e. in tolerance limit for 10m height of embankment and produced cohesion between 7-17.5 KPa and also internal frictional angle increased from 38 to 40 degree.

METHODOLOGY

The methodology adopted to achieve the required objectives is presented below. In the present work the methodology adopted is as follows:

A. Characterization of materials

B. Scheme of experiments

C. Experimental procedure

A. Characterization of materials: The materials used in the present work are black cotton soil, lime, and plastic waste. Characterization of these materials is as given in the following sections.

Characteristics of Clayey Soil: The soil used in present work is taken from AATHUKURU (Vill), ULAVAPADU (M), PRAKASAM (Dt), designated as soil having liquid limits respectively. The index and engineering properties of the soil used in this work are presented as in Table 1.

Table 1. Geotechnical Properties of Soil

S.NO.	PROPERTY	VALUE
1	LIQUID LIMIT %	45
2	PLASTIC LIMIT %	19.04
3	PLASTICITY INDEX %	25.96
4	O.M.C. %	19
5	M.D.D. g/cm^3	1.75
6	CBR VALUE. %	4.2

Characteristics of Asphalt Waste: The asphalt waste is taken from NH16 road waste near THUMMALAPENTA. Pavement rehabilitation and reconstruction generate a large volume of reclaimed asphalt pavement (RAP) waste. Also, large quantities of crushed concrete waste (CCW) are generated from building demolitions and constitute a principal component of municipal solid waste consisting of concrete, sand, brick, rock, metals, and timber. This paper present the results of a laboratory evaluation of the characteristics of RAPs stabilized using CCW with a view toward determining their suitability for use as flexible pavement material. The mixtures were subjected to British Standard light (standard Proctor) compactive efforts to determine the

compaction characteristics and California bearing ratio (CBR). Test results show that the properties of RAP waste improved with CCW treatment.

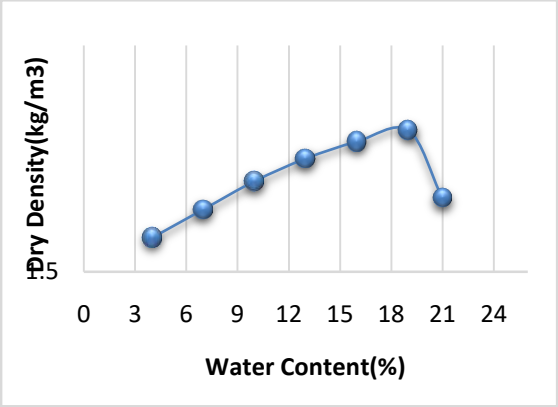
B. Scheme of experiments: The detailed scheme of experiments, formulated to meet the objectives stated in the Chapter-1 is presented in this section. In the first module it is intended to study the Compaction Characteristics of soil treated by varying %dosage of Lime and Plastic Waste. In The second module The series of tests conducted for determination of compaction characteristics (optimum moisture content & maximum dry density) and California bearing ratio as well as direct shear for different proportion of admixtures with the soil as given below:

3) Soil Only
4) Soil + 5% Asphalt Waste
5) Soil + 10% Asphalt Waste

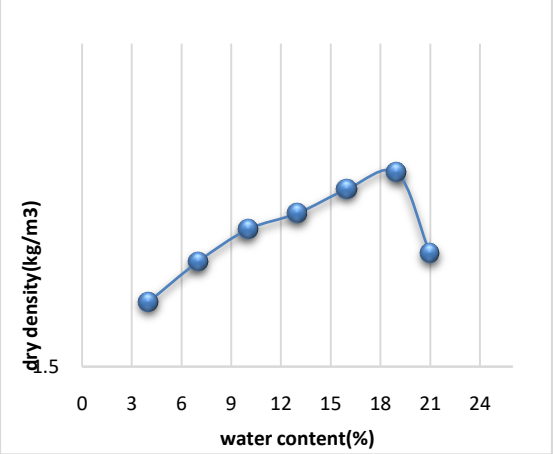
C. Experimental Procedure: The test specimen is prepared as per IS: 2720 (Part16)-1987, with some modifications as per the requirement of the each specimen. The moulding dry density is calculated for each specimen.

RESULTS AND DISCUSSIONS

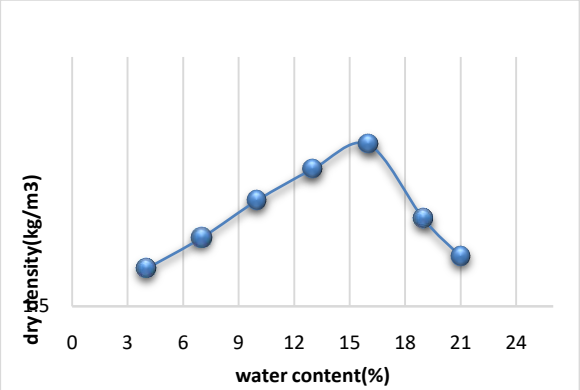
STANDARD PROCTOR TEST



Graph:-1. SPT for Soil

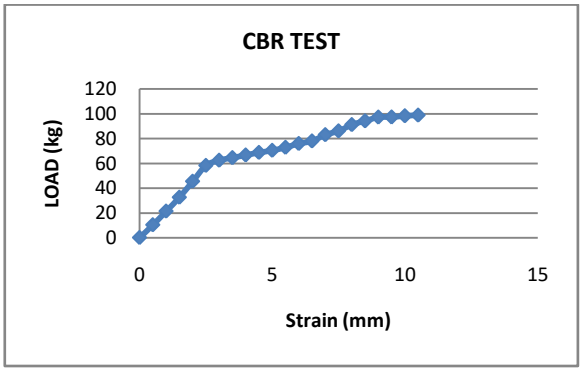


Graph 2- SPT For Soil + 5% Asphalt



Graph 3 -SPT For Soil + 10% Asphalt

CBR TEST



Graph 4. CBR for Soil

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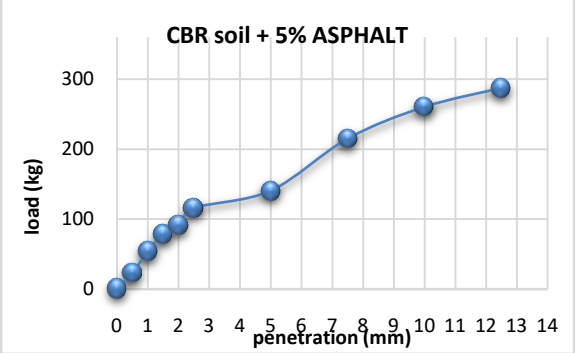
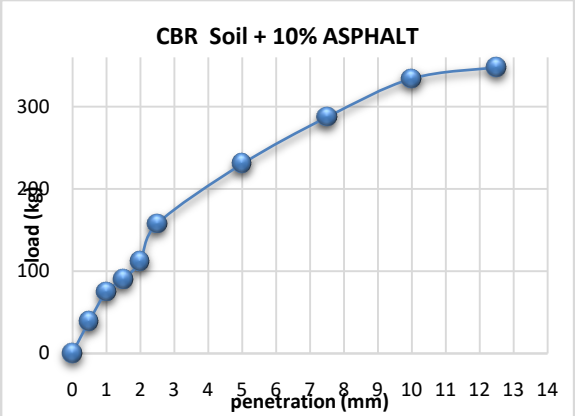
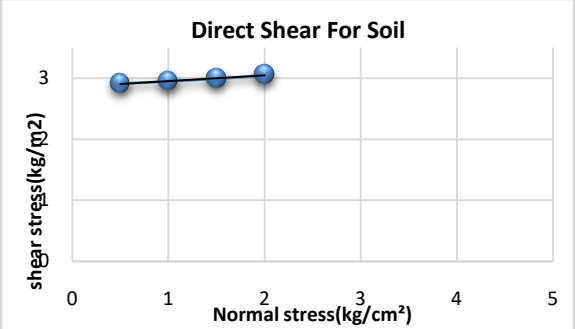


Graph 5. CBR For Soil + 5% Asphalt

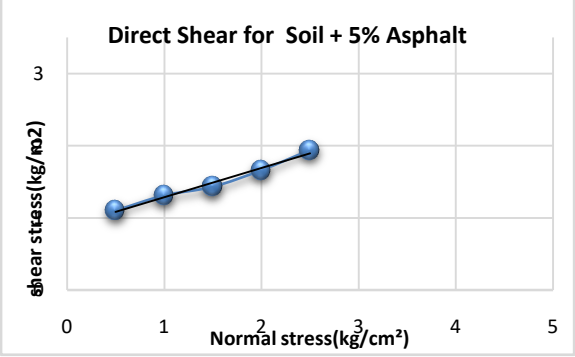


Graph 6. CBR For Soil + 10% Asphalt

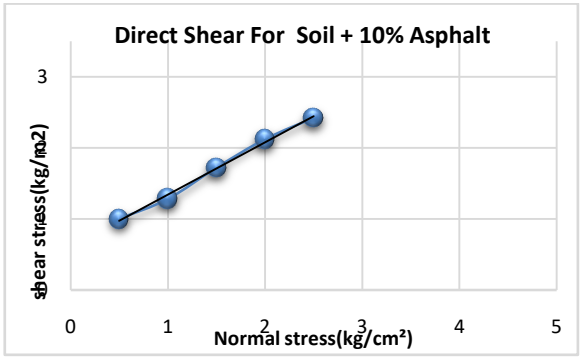
DIRECT SHEAR TEST



Graph 7. Direct Shear For Soil

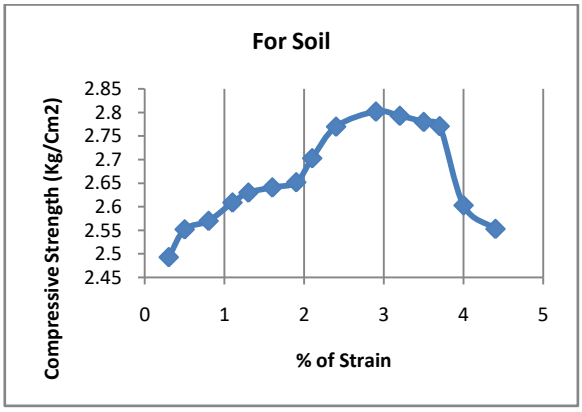


Graph 8. Direct Shear For Soil + 5% Asphalt Waste



Graph 9. Direct Shear For Soil + 10% Asphalt Waste

UCC TEST



Graph 10. UCC For Soil

CONCLUSION

In my present project based on the above laboratory investigation conducted on black-cotton soil and it has shown poor engineering properties, which is not a suitable material for pavement subgrade. So we have added the admixtures (asphalt waste, plastic waste and lime). From the data, we have made the following conclusions.

- Addition of admixtures into the black cotton soil has changed the proctor compaction parameters.
- Addition of asphalt waste into the black cotton soil The OMC of the BCS has decreased from 19% to 16.00% and Maximum dry density (MDD) increased from 1.75g/cm^3 to 1.95g/cm^3.
- There is significant decrease in swelling characteristics of the soil with addition of admixtures. The free swell index values are reduced from 39% to 33%, indicating that the degree of expansiveness has reduced from high to low.
- Unsoaked CBR values have also increased with the replacement of admixtures in soil.

- The replacement of asphalt waste into the black cotton soil, increases the CBR value from 4.2% to 11.49% which can be used for construction of sub grade in pavements.
- The free swell index is decreases compared to normal soil. There increase in the values of Ø on replacement of asphalt waste.
- The usage of asphalt waste as a stabilising agent for black cotton soil will decreases the cohesion value but it increases the Ø value which ultimately increases the SBC of soil from 3.9 t/m² to 9.00 t/m².

Hence, i conclude that asphalt waste can be used as a stabilizing agent for improving the performance of black cotton soil sample taken from athukuru region, so that the soil can be used as construction for sub grade material in the pavement.

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[2]. HARISH AND ASHWINI, H.M. (2016) studied the effect of plastic bottles strips as a stabilizer for two soil samples, red soil and black cotton soil. Red soil consists of 4 % gravel, 88% sand and 8% silt and clay and black cotton soil 2.6% gravel, 15.1 %sand and 82.3 % silt and 0.18 % of clay. They used plastic stripes in making the pavement and it was found that there was an increase in the strength of the soil.

[3]. JASMIN VARGHESE KALLIYATH *ET.AL.* (2016) studied the effect of plastic fibers. Various tests such as Standard Proctor, UCC were carried out with different samples of silty clay. Authors observed that the replacement of 0.5 % waste plastic fiber to the expansive clayey soil reduce its OMC and increased maximum dry density but UCS of the soil was found to be increased. The test results also showed that with 1% replacement, MDD and UCC were less than the 0.5 % replacement but greater than the untreated soil.

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