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STABILIZATOIN OF BLACK COTTON SOIL BY USING GEOTEXTILE MATERIAL IN ROAD CONSRUCTION

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Abstract : Geotextile material a newly emerging field in the civil engineering and other field i.e. road work, river canal work, drainage etc Considerable length of roads planned to be constructed in India under various programmes require construction over poor subgrade soils. The performance of a road largely depends on properties of the subgrade soil. One such subgrade soil often encountered is the black cotton (BC) soil. It is inorganic clay of medium to high compressibility, high shrinkage and swelling property, very hard when dry, but lose its strength completely when in wet condition. As a result of wetting and drying process, vertical movement takes place in the soil mass leading to failure of pavement, in the form of settlement, heavy depression, cracking and unevenness.in order to improve the stabilization of BC soil the geotextile material has a scope as reinforcement. The overview of various synthesis geotextile fibre used in road construction.

Key words:- Geotextile material, black cotton soil, CBR test

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INTRODUCTION

The roads laid on BC soil bases develop undulations at the road surface due to loss of strength of the sub-grade through softening during monsoon. BC soil is a highly clayey soil and problem for highway engineers. In dry state it shrinks and becomes so hard that the clods cannot be easily pulverized for treatment for its use in road construction. However, when it is wet during rains, it swells as well as loses strength and poses serious problem with regard to subsequent performance of the road. All this results cracking in roads and for this is the reason that the road engineers do not prefer to construct roads on BC soil but have no option as black cotton soil is available in about one third part of the country, Geotextiles form one of the largest groups of geosynthetics. One of the most popular applications of Geotextiles is in the construction of pavements and embankments on soft soil. The primary faction is to stronger road construction. The geotextile perform this function by providing a dense mass of fibre at the interface of the two layer. The various types of geotextile, geosynthetic are geogride, geocell, geomembrane, geobages, geotube, geocomposite.

LITERATURE REVIEW

CONSTRUCTION AND RAW MATERIAL OF GEOTEXTILE

Geotextiles are made from polypropylene (PP), polyester (PET), polyethylene (PE), polyamide (nylon), polyvinylidene chloride (PVC), and fiberglass, and their GSM varies from under 40 to over 3000 which are mainly used as landfills. PP and PET are the most widely used. Sewing thread for geotextiles is made from Kevlar or any of the above polymers. Different fabric composition and construction are suitable for different applications. To survive aggressive underground environments, geotextiles must be resistant to various forms of attack, such as mechanical, chemical and biological. Chemical attack may be initiated directly by acidic and alkaline soils or indirectly by the active wastes present in the land fills. Depending on the type of chemical compound, changes in the polymer structure can be brought about by oxidation, chain scission, cross linking, swelling or dissolution of the polymers, volatilization or extraction of ingredients of the polymeric compound, or an increase in the crystallinity of the polymer. In addition the service temperature may accelerate the effects of chemical degradation

DESIRED CHARACHETERISTIC OF GEOTEXTILE MATERIAL

- Ability to resist clogging,
- Excellent elongation at break,

- Excellent water permittivity,
- Good grab tensile strength,
- Good puncture resistance,
- Trapezoidal tear strength,
- UV resistance,
- Very good Mullen burst.

NEED OF THE STUDY

BC soil has very low bearing capacity, high swelling and shrinkage characteristics and it is a very poor subgrade material for road construction. Soaked laboratory CBR values of Black Cotton soil is generally found in the range of 2 to 4 percent. Due to very low CBR values, it results in excessive design thickness of pavement. Under the traffic loads, the soil sub-base is subjected to compression in the vertical direction accompanied by tension in the lateral direction. Also, during dry weather conditions, cracks develop at the soil surface due to tensile stresses induced as a result of drying and shrinkage. During wet weather conditions, water starts to rise in the sub-base by capillary action from soil sub-grade. Materials like polypropylene fibres, polyethylene fibers are needed to improve the compressive as well as the tensile strength and the permeability characteristics of the sub-base for a better performance of the pavements. Now-a-days, geotextiles are widely used in highway engineering, to solve a variety of problems related to drainage, separation and reinforcement of pavement structure. Geotextiles made of artificial fibres such as polypropylene, polyethylene etc., are emerging as alternatives to polymeric geotextiles.

EXPERIMENTAL PROGRAM

CBR TEST:

The B.C. soil sample of unreinforced and reinforced soil for CBR test were prepared as per procedure. The desired amount of oven dried (100-105°c) B.C. soil is be taken and mixed thoroughly with water corresponding to its optimum moisture content in the CBR mould having 150mm dia. And 175mm high with detachable perforated base plate.

The preparation of BC soil sample is reinforced soil the desired amount of fibre is mixed in dry state the fibre contain a dia. 2mm and length is 3mm is used before the addition of water and

then compacted to same procter density. As per same procedure is carried out the strips, and the CBRvalue of all the specimen is calculate corresponding to both 2.5mm&5mm penetration.

This CBR test is carried out following two fibres are used

1)polypropylene fibres & strips

2)polyethylene fibres & strips

Polyethylene fibers (PE)

The feasibility of reinforcing soil with polyethylene (PE) strips and/or fibers has been also investigated to a limited extent [91,115–118]. It has been reported that the presence of a small fraction of high density PE (HDPE) fibers can increase the fracture energy of the soil [119]. Nowadays, GEOFIBERS, typically 1–2 in. long discrete PP and/or PE fibrillated or tape strands, are mixed or blended into sand or clay soils [120,121]. But, it is important to know that some researchers have applied the term ‘‘Geofiber’’ for PP fibers used in soil reinforcement

Polypropylene fibers

The most commonly used synthetic material, polypropylene fiber is used in this study. This material has been chosen due to its low cost and hydrophobic and chemically inert nature which does not absorb or react with soil moisture or leachate. The high melting point of 160°C, low thermal and electrical conductivities, and high ignition point of 590°C are other properties. The Propylene fiber used in this study has physical properties such as specific gravity of 0.91, and an average diameter and length of 0.06 mm and 20 mm respectively

CBR value as per Standard procedure of CBR test comparatively determine the fibres, stips, as per there length and dia. The preparation of BC soil is soacked and unsoaked condition. The BC soil is blended with different percentage of fibres, strips the specification are under

PHYSICAL PROPERTIES OF FIBRES

Component	Weight (%)
Silica	70.74
Aluminium Dioxide	20.67
Ferric Oxide	2.28
Magnesium Oxide	1.57

BC soil with 0% fibres & strips

BC soil with 1% fibres & strips

BC soil with 2% fibres & strips

BC soil with 3% fibres & strips

BC soil with 4% fibres & strips

BC soil with 5% fibres & strips

The soaked and unsoaked CBR value are determine in the laborataory for BC soil mixed with varying percentage of fibres, strips of comparatively study.

CONCLUSION

1. There is a need for improving the engineering characteristics of BC soil for road construction

2.Extensive awareness should be created among the people about the application of geotextile materials.

3.CBR value of Black Cotton soil is maximum with combination of fibre ,strips

There is a need for improving the engineering characteristics of BC soil for road construction

4. Improve the stabilization of BC soil the geotextile material has a scope as reinforcement. The overview of various synthesis geotextile fibre used in road construction.

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