

A Review on Use of Geofibres in The Reconstruction of Road

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ABSTRACT

The study was undertaken to evaluate the effect of geofibres in the reconstruction of Road. Samples of sub-grade soil were collected within the failed section of Road. Geofibres was added to the soil in an increasing order of 5% , 10% , 15% and 20% by weight of the soil in a single and double layered system. The sub- grade soil samples and sample stabilized with geofibres was subjected to laboratory testing. The test conducted were sieve analysis test, specific gravity test, atterberg limit test, compaction test and CBR test. Results obtained from sieve analysis test classified the samples as A- 7- 6 according to AASHTO Soil Classification System and CH (clay of high plasticity) according to Unified Soil Classification System, the specific gravity of the sub- grade soil was 2.66, the liquid limit, plastic limit and plasticity index of the sub- grade soil was 34.8% , 21.5% and 13.3% , the maximum dry unit weight of the sub- grade soil increased from 20.7kN/m³ to 22.67kN/m³ , for the single layered disposition of geofibres while for the double layered disposition of geofibres, the maximum dry unit weight of the sub- grade soil increased from 20.7kN/m³ to 23.2kN/m³ . The CBR of the sub- grade soil increased from 25.8% to 32.6% for the single layered system, 27.4% to 34.8% for the double layered. The study therefore recommends the use of geofibres in road construction as improvement in the strength properties of the sub- grade soil was observed.

Keywords: – Geofibres, Soil

1. INTRODUCTION

Road's infrastructure is the most essential component for socioeconomic development of any country (Mittal and Shukla, 2019). (Burnett, 2011) opined that there are countless advantages associated with the construction of good road networks particularly within the confines of socioeconomic and environmental benefits. Highway pavement is an integrated system comprising of layers of superimposed processed materials above the natural compacted sub- grade soil which function primarily to distribute the wheel load of vehicle to the supporting soil in such a way that the bearing capacity of the supporting soil is not exceeded. Pavement types ranges from flexible to rigid to semi- rigid and composite pavement.

Flexible pavements are multi- layered system consisting sub- grade (pavement foundation), sub- base, base course and wearing course (asphalt concrete). Performance of a flexible pavement during service is significantly influenced by the strength and stiffness of the sub- grade layer as it serves as foundation for the pavement (Kadeyali, 1997). Sub- grade is natural compacted earth composed soils ranging from laterite, clays and there are cases where the sub- grade may contain expansive soils that its strength as strength cannot be guaranteed under applied loads (Osinubi, 2013). In such scenario stabilization of the sub- grade soil become necessary. Soil stabilization involves the placement of a material in a given soil layer where the presence of the material causes a redistribution of stresses and strains in the soil favorable to the purpose at hand (Palmeira, 2014).

Currently, soil stabilization is most commonly performed with geosynthetics, leading to an increase in the strength and a decrease in the compressibility of the composite material. In other words, the addition of geosynthetic reinforcement in regions of tensile strain helps to inhibit the stresses in the soil, thereby increasing the shearing characteristics of the composite material (Jewell, 2012).

1.2 Geofibres of Study

The study is focused basically on promoting the use of geofibres as an additive for strength enhancement of sub-grade soils along road. The geofibre will be added to the sub- grade soils in increasing percentages of 5% in a two layered system by weight of the sub- grade soils. Samples of sub- grade soils and geofibres will be collected and subjected to laboratory testing. The laboratory testing includes: Sieve analysis test, Specific gravity test, Atterberg limit (Liquid and Plastic limit) test, Compaction test and California Bearing Ratio test. The California Bearing

Ratio test will be used as index to evaluate the strength of the sub- grade soil. During the experimental investigation for determination of California Bearing Ratio (CBR) value of the sub- grade soils modified geofibre, single layer and double layer of geofibre will be placed horizontally at varying depth so as to certain the strength of the modified sub- grade soils. Recommendations will be made based on key findings obtained from California Bearing Ratio test.

1.2 Significance of Study

The use of geofibres in the reconstruction of Road will be of immense economic benefits. Some of the conventional practice adopted in strength enhancement of weak sub- grade soils includes: complete excavation and importation of soils with higher strength and density, treatment through stabilization using chemical stabilizers like lime and Portland cement, these are relatively expensive process. Geofibres which are residue obtained during production of plastics will offset the high cost associated with treatment of weak sub- grade soils if incorporated as a component in road construction and reconstruction process. The economic benefits associated with the use of goobers in road construction comes from the fact that goobers are cheap to procure and will also replace relatively expensive additives like Portland cement, lime and stone dust used as a conventional material in strength enhancement of weak sub- grade soils.

Therefore, a considerable cost savings will be fostered should geofibres be used as a material for improvement of bearing strength of weak sub- grade soils.

2. MATERIALS AND METHODS

This section presents the materials and methods used to actualize the research goal. Relevant standards and journals were employed to ascertain how the materials collected be analyzed and also the various laboratory tests to be conducted.

All Tests such as sieve analysis test, specific gravity test, atterberg limit (liquid and plastic limit) test, compaction test and California bearing ratio test were carried out at Civil Engineering Laboratory located in VBKCOE Malkapur

Disturbed sub-grade soil samples were collected from the failed section of a pavement along the road, as they accurately represent in-situ conditions. The soil, lateritic in nature, was gathered using a shovel, stored in empty cement bags, and transported to the laboratory. Upon arrival, the in-situ moisture content was determined before further testing. Geofibers (GF), measuring 12 mm in length and 34 microns in diameter, were procured from plastic industries and mixed with the sub-grade soil in varying proportions ranging from 5% to 20% by weight, applied in both single and double layered systems. The experimental investigation involved a series of laboratory tests conducted at the Civil Engineering Laboratory of VBKCOE, Malkapur. These tests included sieve analysis (particle size distribution), specific gravity test, water absorption test, Atterberg limits (liquid and plastic limits), compaction test, and California Bearing Ratio (CBR) test to evaluate the engineering properties of the natural and modified soils.

3.CONCLUSIONS

- From the findings obtained on the assessment of the effect of geofibres as a material for road construction, the following conclusion can be drawn:
- Evaluation of the particle size distribution of clay shows that the percentage passing sieve No 200 (0.075mm) was 43.7 and as a results, the clay sample was classified as CH (clay of high plasticity) according to Unified Soil Classification System and A- 7- 6 according to AASHTO Soil Classification System.
- The specific gravity, liquid limit, plastic limit and plasticity index of the soil sample were 2.66, 34.8% , 21.5% and 13.3% .
- The maximum dry unit weight of the soil sample was found to increase on consistent addition of geofibres from 5% to 20% for the single layered disposition of geofibre while for the double layered disposition of geofibre, a range of fluctuating values was obtained.

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