International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2022): 7.942

Improvement of Strength of Sub Grade Using Geosynthetic Fiber

Saurabh Shukla[1], Ankit Verma[2]

[1]M. Tech Scholar, Transportation Engineering, Babu Banarasi Das University, Lucknow, India
saurabhshuklaalld[at]bbdu.ac.in

[2]Assistant Professor, Department of Civil Engineering, Babu Banarasi Das University, Lucknow, India
ankit1105verma[at]bbdu.ac.in

Abstract: ***Geosynthetic materials are man made materials used in contact with soil / rock and / or any other geotechanical material. They are made from polypropylene polyethane or polyester. Geosynthetic are used to stabilize, inhance omprove or modify the behaviour of various civil engineering structures likes Dams, canals, roads, retaining walls. They are used for filtration drainage, sepration, reinforcement, protecating sealing and packing. Geosynthetic are avalible in wide range of forms and materials eact to suit slightly different use. These products have wide range application in civil engineering Geotechnical, hydraulics and Transportation engineering. We are using geo synthetic fiber (polypropylene recron 3s) mix with soil check stregth and properties of soil. Soil and fiber mix with each other and enhance properties at certain limit. We use CBR meachine to chech stregth of soil.***

Keywords: Polyester, Polypropylene

1. Introduction

The volume of traffic on road and airport is constantly increasing. The growing need to ability and services coupled with expending trading goods starching out transport infrastructure to its limit clearly taking on co- existing facilities. The traffic load on road and pavement a compounded by daily and annul temperature variations with the resulting failures visibility deformation carks and potholes. The extremely high and permanent loads to asphalt and concrete pavement to expose. They are required to full fill the function to connecting people and supply goods and services. Our roads and airport are subject to continuous process optimization and growing customization.

People have seen that the geo synthetic help in significant saving improved performance and good serviceability both in short and long term. These are very important like saving in one thing then improved performance. Like readability and comfort smoothness and serviceability on the road.

Geo synthetic have made it possible to construct road and pavement in seemingly difficult situations such as soft and organic deposits and in expansive soil areas. Geo synthetic enhance properties of soil. Soil and fiber increase strength of soil and useful in sub grade for better pavement.

2. Literature Review

Jorge G. Zornberg (1)- Geosynthetics have been successfully used to fulfill a number of functions that contribute significantly to the good performance of roadways. They include the functions of separation, filtration, reinforcement, stiffening, drainage, barrier, and protection. One or more of these multiple functions have been used in at least six important roadway applications. The applications include the migration of reflective cracking in asphalt overlays, separation, stabilization of road bases, stabilization of road soft subgrades, and lateral drainage. This paper illustrates the mechanisms as well as key advances in each one of these multiple applications.

Eli Cuelho Steve Perkins Zachary Morris (2)- The results of this study indicate that strength and stiffness of the junctions and tensile members mainly contribute to the performance of geosynthetics when used as subgrade stabilization, and the relative contribution of these material properties depends on the thickness of the base course aggregate layer and the anticipated rut depth. Practitioners who wish to use geosynthetics as subgrade stabilization should consider specifying minimum values for material properties that correlated with good performance of the test sections. These minimum values can be categorized by the severity of the site conditions, ranging from moderate to severe, as demonstrated in the two phases of this project. Further work is necessary to more confidently specify minimum values for geosynthetic material properties associated with good rut performance. The specified properties are mutually important, and products having only one of the specified properties may not perform well. Further research is necessary too determine the combined effect of these properties as they relate to subgrade stabilization of a greater variety of base thicknesses and subgrade strengths. Information from that research could be used to augment or determine specific design parameters for a wider range of subgrade stabilization applications. Despite the fact that the woven and non-woven geotextiles performed well in the field study, it is unknown which material properties are directly responsible for their performance. Intuitively, surface friction properties and tensile strength of the materials plays an important role however, additional work is needed to evaluate the effect individual geotextile properties have on their performance in subgrade stabilization applications

Rudolf Hufenusa, , Rudolf Rueeggerb , Robert Banjacc (3)- A full-scale field test on a geosynthetic reinforced unpaved road was carried out, including compaction and

trafficking, to investigate the bearing capacity and its performance on a soft subgrade. The test track was built with three layers of crushed, recycled fill material. The 1st layer was compacted statically, whereas the 2nd and 3rd were dynamically compacted. The geogrids were instrumented with strain gauges to measure the short- and long-term deformations and the ongoing formation of ruts was assessed from profile measurements. The various geosynthetics used for this reinforced unpaved road were found to have a relevant reinforcing effect only when used under a thin aggregate layer on a soft subgrade. Under such conditions, ruts can form in the subgrade, mobilizing strains and thus tensile forces in the geosynthetic. The achievable degree of reinforcement depends on the stiffness of the geosynthetic and is limited by finite lateral anchoring forces.

Muhammad Nouman Amjad Raja, & Muhammad UmerArifKhan(4) - In the recent times, the use of geosynthetic-reinforced soil (GRS) technology has become popular for constructing safe and sustainable pavement structures. The strength of the subgrade soil is routinely assessed in terms of its California bearing ratio (CBR). However, in the past, no effort was made to develop a method for evaluating the CBR of the reinforced subgrade soil. The main aim of this paper is to explore and appraise the competency of the several intelligent models such as artificial neural network (ANN), least median of squares regression, Gaussian processes regression, elastic net regularization regression, lazy K-star, M-5 model trees, alternating model trees and random forest in estimating the CBR of reinforced soil. For this, all the models were calibrated and validated using the reliable pertinent historical data. The prognostic veracity of all the tools mentioned supra were assessed using the well-established traditional statistical indices, external model evaluation technique, multi-criteria assessment approach and independent experimental dataset. Due to the overall excellent performance of ANN, the model was converted into a trackable functional relationship to estimate the CBR of reinforced soil. Finally, the sensitivity analysis was performed to find the strength and relationship of the used parameters on the CBR value.

3. Material and Method

In this work we use soil and geo synthetic fiber which is called polypropylene fiber (recron 3s). We mix soil and geo synthetic fiber and check CBR value of soil. And we use socked CBR method.

4. Methodology

Collection of material we perform laboratory test. In this test we calculate properties of soil and geo synthetic fiber. For CBR test perform proctor density test and classified soil properties.

GRAIN SIZE ANALYSIS IS2720 PART - 4 – 1985 RA 2006	GRAVEL	3.205
	SAND	29.08
	SILT & CLAY	67.715

Grain size analysis is done by 4-mm sieve, 2-mm sieve, 425-micron sieve and 75-micron sieve. Grain size analysis is also called mechanical analysis.

LIQUID LIMIT (IS 2720 part 5 1985 RA 2006)	26
PLASTIC LIMIT (IS 2720 part 5 1985 RA 2006)	NIL
SPECIFIC GRAVITY (IS 2720 part 17 1986 RA 2002)	2.40
VOID RATIO (IS 2720 part 17 1986 RA 2002)	34.15
SOIL CLASSIFICATION (IS1798 1970 RA 2007)	ML

Liquid limit test is used by Casagrande method. Liquid limit machines use a manually a small motor to lift a brass cup to

a prescribed height and drop in to a hard rubber base. A portion of the soil sample is spread in the brass cup and divided using a grooving tool. The moisture content when the groove closes for 1/2in after 25 drops of the cup is defined as the liquid limit.
In this test liquid limit of soil is26 and plastic limit is NIL.

Specific gravity G = W2-W1 / (W4-W1) – (W3-W2)

Void ratio = Density of soil / Maximum dry density
Soil is silty clay soil (ML)

PROCTOR DENSITY TEST	OMC	13	%
IS 2720 PART – 7 1963 RA 2021	MDD	1.789	g/cc

4.1. SOIL CBR VALUE

CBR VALUE	2.5	3.05	%
IS2720 PART – 16 – 19897 RA-2021	5.0	3.17	%

4.2 CBR value for 0.25% (mix with soil and geo synthetic fiber)

Proctor density test	OMC	14	%
IS 2720 part – 7 1963 RA 2021	MDD	1.814	g/cc
CBR VALUE	2.5	3.89	%
IS 2720 part – 16 – 1987 RA 2021	5.0	4.21	%

4.3 CBR value for 0.50% (mix with soil and geo synthetic fiber)

Proctor density test	OMC	15	%
IS 2720 part – 7 1963 RA 2021	MDD	1.836	g/cc
CBR VALUE	2.5	4.82	%
IS 2720 part – 16 – 1987 RA 2021	5.0	6.93	%

4.4 CBR value for 0.75% (mix with soil and geo synthetic fiber)

Proctor density test	OMC	15	%
IS 2720 part – 7 1963 RA 2021	MDD	1.829	g/cc
CBR VALUE	2.5	2.60	%
IS 2720 part – 16 – 1987 RA 2021	5.0	4.36	%

4.5 CBR value for 1.0% (mix with soil and geo synthetic fiber)

Proctor density test	OMC	17	%
IS 2720 part – 7 1963 RA 2021	MDD	1.824	g/cc
CBR VALUE	2.5	2.38	%
IS 2720 part – 16 – 1987 RA 2021	5.0	3.96	%

5. Result and discussion

As mentioned above that the aim of this study based on CBR machine we found the strength of soil mix with geo synthetic fiber to help in pavements. CBR value increases when we mix0.25% ofgeo synthetic in soil. After that we add 0.50% of geo synthetic in soil CBR value more than 0.25% of soil. After 0.50% we perform another test at 0.75% and increase 0.75% geo synthetic in soil and get result. In 0.75% CBR value is decreases for better result performed one more test at 1.0% and add geo synthetic in soil and get CBR value is decreases more than 0.75%So we get a better result CBR value increases at 0.50% after that it decreases.

6. Conclusion and Future Outlook

This work Present the geo synthetic and soil gain more strength when they mixed use in soil. Mostly we can use in subgrade for better serviceability and comfort in pavement. If geo synthetic Add more in soil they can lose there properties. Geo synthetic reducing the intensity of stress on the subgrade. Preventing subgrade fines from pumping. Reducing the thickness of aggregate required for stabilization of subgrade. And allowing an Increases in strength over time. Reducing differential settlement in roadway and in transition areas from cut to fill. Reducing maintenance and extending the life of the pavement.

References

[1] steven w. Perkins, Barry R. Christopher, Eli L. Cuelho, Inge Hoff, Development of Design method of geosynthetic reinforced flexible pavements DTFH61-01-X-00068.
[2] Muhammad Nouman Amjad Raja, Sanjay Kumar Shukla & Muhammad UmerArifKhanAn intelligent approach for predicting the strength of geosynthetic-reinforced subgrade soil, DOI: 10.1080/10298436.2021.1904237
[3] Eli Cuelho Steve Perkins Zachary Morris, field investigation of geosynthetic used for subgrade stabilization
[4] Rudolf Hufenusa, , Rudolf Rueeggerb , Robert Banjacc , Pierre Mayorc , Sarah M. Springmanc , Rolf Bro¨nnimanndFull-scale field tests on geosynthetic reinforced unpaved roads on soft subgrade
[5] Jorge G. Zornberga,*Functions and applications of geosynthetics in roadways
[6] Eli Cuelho Steve Perkins Zachary MorrisRelative Operational Performance of Geosynthetics Used as Subgrade Stabilization