EFFECT OF GEOSYNTHETIC ON SOFT SUBGRADE –LITERATURE REVIEW

ANITHA J

Department of Infrastructure engineering
PSG College of technology, Coimbatore, India
Email id:anithaj66@gmail.com

Abstract - *The road laid on bases formed of weaker soil leads to large deformations, causing increases in maintenance cost and interruption of traffic service. And if the subgrade layer of pavement consists of expansive soil (black cotton soil), due to its susceptibility to moisture change and results in subsequent high swelling and shrinkage characteristics. These soils possess less strength and bearing capacity and thereby results in increasing the thickness of pavement. There are many stabilization methods available to improve engineering properties of these types of soft subgrade soil. Use of geosynthetics over a soft subgrade (expansive soil) found to be one of the feasible and economic solutions to strengthen road pavement and thereby increasing service life. This study presents the effect of various geosynthetic products on soft subgrade (black cotton soil) in improving strength parameters.*

Key Words: **CBR value, expansive soil, geo-synthetic reinforcement, loads carrying capacity….**

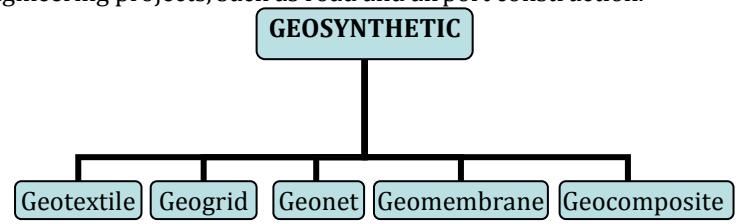
1. INTRODUCTION

India has one of the largest networks of roads in the world. Due to rapid growth in traffic, the existing roads have become structurally inadequate. Traditional design and construction practices do not fulfil construction standards. To overcome these constraints, researchers are forced to seek alternative designs using substandard materials and innovative design practices. Geosynthetics products have helped designers and contractors to solve several types of engineering problems.

Most of the areas in India are occupied by black cotton Soil, which absorbs water, swells and loses its strength. The roads laid on black cotton soil as a subgrade develop undulations at the surface due to loss of strength because of its expansive nature. The black cotton soil (BC soil) contains high percentage of clay and appears in black or blackish grey in colour. Due to low bearing capacity of black cotton soil (BC soil), pavement thickness required is excessive to take up stresses developed in the soil within its permissible limit. Use of geosynthetic on road surface especially on expansive soil subgrade found to be one of feasible and economic solution.

1.1 GEOSYNTHETIC

Geosynthetic is a general term to define a group of polymeric materials which are applied in various civil engineering projects, such as road and airport construction.



Due to its polymeric nature it's suitable for the places where it requires high level of durability. However they can be used in exposed condition because of its proper formulation. Based on function, geosynthetics can be used and the functions are:

- Filtration
- Separation
- Drainage
- Barrier
- Reinforcement
- Protection

1.2 WHY GEOSYNTHETICS?

- Innovative solution to solve difficult problems economically and expediently.
- Enables use of local materials- sustainable solution.
- Use of Unskilled labours.
- Easy installation
- Does not require heavy equipment.
- It reduces maintenance cost and increases life.
- Quality can be controlled since it's factory-made.

1.3 REINFORCED SOIL

Soil + reinforcement = reinforced soil

Soil is strong in compression but weak in tension. Reinforcement which has high tensile strength could be effective in counteracting materials which are weak in tension.

Thus, including layers of reinforcement (geosynthetics) in soil could improve their tensile strength.

The reinforced soil is considered to have a better load carrying capacity and higher tensile strength than non-reinforced soil.

2. REVIEW OF LITERATURE

2.1 P. B. Ullagaddi, T.K.Nagaraj presented an **"Investigation on geosynthetic reinforced two layered soil system"** which says that investigation has been carried out with different thickness configuration of the two soils and three types of woven and non-woven geotextiles, having different physical and mechanical properties. Based on experimental work it infers that there is improvement in CBR Value and therefore increases bearing capacity.Due to increase in bearing capacity, thickness of soil layer can be reduced to serve the same functioning. Based on U.S .corps and IRC method, woven geotextile found to be more effective in increasing CBR value than non-woven geotextile.

2.2 Sarika B. Dhule and S.S.Valunjkar (2011) presented an "**Improvement of flexible pavement with use of geo-grid"** which says that Geogrid +murrum –increase CBR value and factors affecting the compaction characteristics are shear strength and low permeability. CBR value depends upon degree of compaction.

2.3 A.K.Choudhary, K.S.Gill and J.N.Jha (2011) presented on "**Improvement in CBR values of expansive soil sub-grades using geo-synthetics"** which says that expansion ratio decreases when number of reinforcing layer is increased.CBR value increases by increasing number of reinforcing layer. Reinforcing efficiency: Geo-grid better than jute geo-textile.

2.4 K. Rajagopal, S. Chandramouli, Anusha Parayil & K. Iniyan presented a **"Studies on geosynthetic-reinforced road pavement structures"** which says that by using geosynthetic material there is improvement in strength and stiffness and shows better performance under repeated loads(fatigue condition).Under monotonic loading, modulus improvement factor is higher.

2.5 Vaishali S. Gor L. S. Thakur Dr. K.R. Biyani presented a "**Study of typical characteristics of expansive subgrade with geotextiles and cushion materials"** which concludes that by Addition of metakaolin, swelling pressure of black cotton soil reduces but further increment in the amount of metakaolin results in increase in swell pressure.Increase in unconfined compressive strength has been noticed. Stabilised metakaolin expansive soil CBR value is higher compared to expansive soil without metakaolin.

2.6 R. Ziaie Moayed and M. Nazari studied the "**Effect of Utilization of Geosynthetic on Reducing the Required Thickness of Sub base Layer of a Two Layered Soil"** which says that by inclusion of geogrid improves the shear resistance at the interface by offering interlocking resistance and reduce the lateral movement of the soil. It also offers more separating function and prevent the sand layer entering into the underneath layer (clayey soil)

2.7 Ambika Kuitya, Tapas Kumar Roy presented a **"Utilization of geogrid mesh for improving the soft subgrade layer with waste material mix composition"** which says that by insertion of geogrid –provides better resistance against loading and also CBR value increases significantly at soaked condition. Inserting geogrid at one third height found to be optimum height and improves bearing capacity.

2.8 Dr. P .senthil kumar and R .rajkumar studied about "Effect of Geotextile on CBR Strength of Unpaved Road with Soft Subgrade" which concludes that it's more advantageous for unpaved road and provide more resistance at lower penetration. It also enhances CBR value.

3. CONCLUSIONS

Based on performance of reinforced soil, above researches gives a wide variety of results on several issues from which the following conclusions can be drawn:

1. A geosynthetic reinforced soil is stronger and stiffer than soil without reinforcement.
2. Geo-grids improve sub-grade restraint and base reinforcement applications.
3. Inclusion of geosynthetic ensures a long lasting pavement structure by reducing excessive deformation and cracking.
4. Geosynthetic reinforcement improves the service life of pavement.
5. Addition of geosynthetic in form of geotextile, geogrid reduces pavement thickness significantly.
6. Placing of geotextile material in soil improves bearing capacity and therefore implies that geotextiles increase load carrying capacity of soil.
7. Geosynthetics delay the propagation and accumulation of primary micro cracks.
8. Reinforced soil shows better resistance under repeated loads

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