

GEOSYNTHETIC ROAD PAVEMENTS: A WAY FORWARD

JAY NARENDRABHAI PANCHAL¹, PROF. KUMKUM BHATTACHARJEE²

¹M.E. INFRASTRUCTURE ENGINEERING, LDRP-ITR, GNDHINAGAR johnyblazeharjy@gmail.com

²CIVIL ENGINEERING, LDRP-ITR, GANDHINAGAR, kumkum.006@gmail.com

ABSTRACT

Geosynthetics are synthetic products used to stabilize terrain. They are generally polymeric products used to solve civil engineering problems. This includes eight main product categories: geotextiles, geogrids, geonets, geomembranes, geosynthetic clay liners, geofoam, geocells and geocomposites. The primary functions of geosynthetics are separation, filtration, reinforcement, drainage and containment. Generally, road pavements are of two types: 1) Flexible Pavements (Asphalt/ bituminous), 2) Rigid Pavements (R.C.C/ P.C.C). Main use of geosynthetics in road pavements is, in road pavements geosynthetics are used as separation, filtration, drainage, reinforcement, asphalt reinforcement, soil stabilization, erosion control of highway embankments. By which road pavement life can be improvised and strengthening of the road pavement can be done. It provides economic as well as environmental benefits. The cost benefit of using geosynthetics includes tangible benefits in the form of lower capital costs. However the lifetime benefits of the project would essentially result in conserving the environment. Other benefits are cost benefits of using geosynthetics for landfills, cost benefits of using geosynthetics for roads, cost benefits for rural roads(unpaved). IRC (Indian Road Congress), MoT (Ministry of Textiles), MoRTH (Ministry of Road Textiles & Highways), NHDP (National Highway Development Project), PMGSY (Pradhan Mantry Gram Sadak Yojana) in these all government organizations of India have given advantages and uses of geosynthetics in road pavements with their specifications.

Keywords: Geosynthetics, geonet, geogrid, geotextile, geocell, road pavements.

1. INTRODUCTION

The Historical evidence shows that Geotextiles were used in roadways construction in the days of Pharaos to stabilize the right ways of their edges. Babylonians used palm fronds and hemp to strengthen the soil reinforced structures called "Ziggurats" more than 3000 years ago. This shows that mankind has recognized & realized the huge potential of Geotextiles many centuries ago but its true potential have yet not been harnessed fully. The term Geotextiles is not much in use, as most of the time the material used is synthetic material and "Geo-synthetic" is the term commonly used which are used as geo-membrane, geogrids, geonets, etc. In fact it is one of the fastest growing segments in the textile sector. When we talk specifically to road sector, which is now one of the sunrise sectors of the economy, the geotextiles finds applications in subsurface drainage, erosion control, separation of layers, filtration, protection of slopes and embankments in pavement, etc.

It may be of interest that the current Geotextiles market in the country is about Rs.300 crores only. Considering the amount of trillions of investment in the road infrastructure in the country by the Central government and State government organizations, the extent of Geotextiles usage in the road infrastructure sector demands for relook about its usage versus its usage potentiality. Possibly the time has come to blend the tradition and innovation in this important segment which is small but have big impact on the sustainability and cost effectiveness factors. This combination of tradition and innovation can be termed as "Tradonnovation" Such a combination may create avenues for wider application as well as acceptability as use of local available materials & machines to solve local issues & demand with the help of modern scientific instruments and techniques/technology may create a win-win situation for all. It may also help in providing more opportunities for

employment besides increasing level of confidence in the users as well as road developers. The imperative need is for more innovative handling of Geotextiles to make its usage more popular in road sector applications by addressing the issues of strength, durability, economics and technical viability to make its use really preferable at all stages of projects right from conceptualization, designing to execution and maintenance. This may require synergic efforts of all stakeholders, which it is hoped may help in furthering the versatile usage of Geotextiles in the civil engineering applications including the road sector.

2. NEED OF STUDY AND OBJECTIVES

PROBLEM STATEMENT

In the urban areas where the asphalt or bitumen roads are constructed, they are facing frequent damage and need maintenance which results reduction of life of the road. Also resurfacing of the roads is mostly being done in traditional method. And in rural areas which have no good road network provided or any good quality roads are not constructed yet. These all parts of the country need some solutions to tackle this problem and to solve these problems. For the solution, geosynthetics are the best option which should be adopted to construct the roads. Geosynthetics are used mostly in road pavements as their applications are mostly done to provide reinforcement between layers of the road, separation of road layers, filtration, and drainage, slope protection, stabilize the embankment of bridges, etc. The advantages of the geosynthetics are many but still not adopted by the governments compared to NORTH-EAST region of India. There is no guideline provided by government or private organization except Textile Industry. Thus it becomes necessary to study various concepts of geosynthetics and evaluate its impact compared to

traditional pavements. Several studies have been carried out which can help in further research.

OBJECTIVES

- To bring awareness to the various agencies concerned on the optimal and judicious use of geosynthetics and the benefits that accrue from such use.
- To reduce the construction cost of the roads by using geosynthetic material in the road layers.
- To improve the strength and life of the road pavements.
- Thickness of the bitumen or R.C.C. layer can be decreased up to 40% by using geosynthetics in road pavements.

3. LITERATURE

Case study: Road Failure Due To Soft Subsoil

Location: Daund – Gar Dapoli Road (Pune District).

Material Used: Woven Geotextile.

Problem:

The road passes through sugarcane area having black cotton soil as a natural subgrade and has inadequate drainage. The root cause of road failure was attributed to CH type of soil, with low cohesion under saturated and un-drained conditions, reasonably heavy traffic and high axle loads and inadequate drainage arrangement.

Solution

An indigenously designed PP woven slit film Geotextile was introduced along the interface between existing subgrade and granular base over a 2 km long stretch of road along MDR 82 in Daund region of Pune district. This is carried out to enable to compare the performance of reinforced stretch with an unreinforced stretches in adjoin areas.

Case study: Geogrid Reinforced Soil Walls With Segmental Panel Fascia

Location: Vadodara – Bharuch Section of NH-8 in the State of Gujarat

Material Used: Geogrid, Non-woven Geotextile.

Problem:

Area is located, where the black cotton soil is available up to the depth of 3 to 8m. It was difficult to achieve required safe bearing capacity at the depth to 1 to 1.5 meter. Maximum height of the reinforced soil wall is 10 meter as it has to connect the ROB's as well as Flyover's.

Solution:

Detailed soil investigation has been carried out to know the actual extent of black cotton soil. Area, where the depth of soil is up to 2.0 to 2.5 meter has been replaced with good quality granular fill. Other areas, where the depth of black cotton soil is on higher side, it has been replaced up-to 2.5 meter, then provide the plate form with the layers of

geosynthetic material with granular fill with maximum of 500mm to 750mm. Over the plate form levelling pad has been placed for the erection work.



Figure1. RE Wall elevation using Geogrids

4. PROBLEMS IN APPLICATION

Lack of Awareness: The engineers of government & private organizations are not that much aware about geosynthetics, their uses in road pavements and their advantages. Even if some organizations are aware about geosynthetics, they are not ready to use. They have perception that the road material cost will be more increased if they will use geosynthetics.

Lack of Education: There is no specific education provided in the institutes except IITs, NITs and some other well-known institutes. So it becomes necessary to have proper knowledge about geosynthetics.

Traditional & Orthodox Approach: It can be seen that, the government is not ready to use geosynthetics even though they are aware about its advantages.

Soil Characteristics: In India, the characteristics of soil are different compared to other countries of the world. So it may be difficult to use ASTM, AASHTO and other specifications for Indian soil.

Quality Standards: There are no quality standards being provided specifically for Indian soil characteristics. IRC, MoRTH, MoT, ITTA, CRRI have given specifications but they are again mostly from ASTM & AASHTO. So it becomes necessary to create particular Indian Standards relative to soil characteristics.

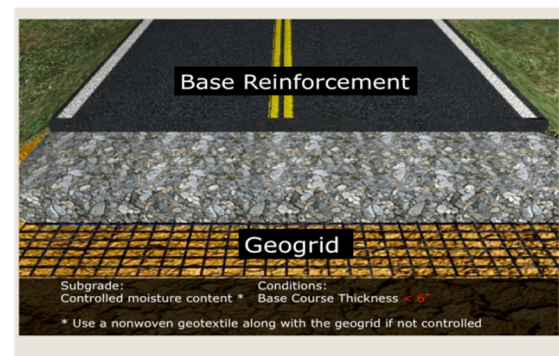


Figure 2. Geogrid used as basal reinforcement

5. CONCLUSION

In current scenario, the usage of geosynthetics in road pavements is at initial stage and will require aggressive approach to make more acceptable. If 5% of usage of geosynthetics may adopt in road infrastructure then it would create Rs. 5000 crores/year, a huge upgrade compared to the current scenario. If a similar trend continues till 2020 (taking the most conservative approach), a huge market for geosynthetics will be created for roads. Thus, there is great scope of improvement of pavement quality of road with help of geosynthetics. And application of geosynthetics is very much wide hence it can be used for further innovations and research works in all civil engineering applications.

6. REFERENCES

- [1] Indian Highways: A Review of Road and Road Transport Development, IRC, Vol. 41, No. 6, June 2013
- [2] Study on Developing Measures to Promote the Use of Geosynthetics in India, Ministry of Textiles, Gov. of India, December 2013.
- [3] Khanna S.K. & Justo C.E.G “Highway engineering equivalent single wheel load (ESWL)” pg no 338, Ninth edition 2010.
- [4] Kadyali L.R and Lal N.B “Principles and practices of Highway engineering including expressway and Airport Engineering” Fifth edition.