

Comparison of Advanced (Geosynthetic) Road Pavement and Conventional (Asphalt/Bitumen) Road Pavement

Innovation in road construction by different methods

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Abstract — Geosynthetics are synthetic and polymeric products used to solve civil engineering problems. Also their advantages are more in all civil engineering works as they can be used in road pavements, embankment protection, ground stabilization, soil erosion control, landfills and waste management etc. So it is advantageous to use geosynthetics in road pavements to improve the life of pavement, to provide more strength and to protect from damage, etc. Here the comparison of conventional (asphalt/bitumen) road pavements and advanced (geosynthetics) road pavement will let us know that how geosynthetics are performing in pavements while it has been applied in different layers of road.

Keywords- Road Pavement, Geosynthetics, Strength, Life of pavement.

I. INTRODUCTION

Geosynthetics are synthetic products and polymeric products used to solve civil engineering problems. The different synthetic products are: geotextiles, geogrids, geonets, geomembranes, geosynthetic clay liners, geofoam, geocells and geocomposites. Geosynthetics reinforcement has a potential in improving the engineering characteristics of the pavement materials as well as layers, which improves the pavement service life, provides strength, protects from frequent damage and decreases frequent maintenance also. So by the case study of geosynthetics used in road pavement will make it more clarify about the advantages of it.

Case Study: Rehabilitation/Repair of Pavement with Geosynthetic

Use of geosynthetic for subgrade stabilization near Power Plant for Internal Road of M/s Balkrishna Tyres, Bhuj, Gujarat.



Fig. Existing Deformed Pavement at BKT Factory, Bhuj



Fig. Laying of Non-woven Geotextile



Fig. Laying of Geogrid

During monsoon season, water percolated through the pores of the existing pavement into the sub grade and thereby reducing the bearing capacity of the sub grade. Hence when the heavy vehicles passed over the prepared pavement, due to the heavy tyre pressure, the soil immediately below the tyre got deformed. The soil on the surrounding sides of the tyre thereby got uplifted. Techfab (India) Industries Ltd submitted a proposal of using Geosynthetics to strengthen the pavement against heavy vehicular impacts & also restrict the percolation of water through existing pavement. M/s TCS has finalized the cross-section, considering the proposal, and based on that high strength woven geotextile has been used. Final crosssection, approved from M/s TCS has attached. Considering site condition and water level, other products (Techgeo PR and TGB) are used.

Concluding Remarks :

From the case study, it was noticed that the paving fabric exhibited critical bitumen retention properties that ensure sound adhesion between the old and new surfacing layers. This encourages bitumen to be drawn up from the tack coat and provides for an easy installation that results in a strong bond being developed between the fabric and underlying surface.

The following recommendations can be drawn on the field trial using geotextile:

1. During the construction of the road pavement, the maximum damage to the fabric occurs due to construction stresses and not due to traffic loads. Therefore, the geotextile selected should meet the minimum physical standards as determined by procedure presented in this paper.
2. It is also observed while using crushed stone metal for construction of pavements, it is recommended that a 5 to 10 cm thick cushioning layer be provided over the geotextile layer, for better performance of the fabric layer.
3. The test specifications with additional subbase thickness behave better than sections with integral subbase layers due to the obvious reasons of higher crust thickness. However, the inclusion of a geotextile certainly improves the load distribution capacity of a road pavement and makes the pavement structurally sound.
4. It looks certain that geotextile does reinforce the pavement by its ability to confine and restrain the movement of the granular structural layer and also to some extent by the so called membrane effect, whereby a fabric that develops high tensile strength under the load can induce a vertical stress upwards, while reducing the magnitude of stress imposed upon the subgrade. However, from this study, it could not be decided that what percentage of pavement thickness could be reduced by the inclusion of a geotextile, without affecting the overall performance of the road pavement. This needs a separate study only for this parameter on a soft subgrade soils with different fabrics.

Cost Comparison:

	Bitumen Road	Geosynthetics Road
Material Used	Bitumen/Asphalt	Non-woven geotextile
Construction Procedure	Traditional Method	Advanced Method
Cost	₹ 3.7 Cr.	₹ 4.05 Cr.
Life Cycle Analysis	Average	Double

- According to comparative analysis bitumen road pavement construction cost ₹ 3.7 Cr/km length and Geosynthetic road pavement construction costs ₹ 4.05 Cr/km length.
- The cost difference between traditional and advanced road pavement is ₹ 35 lakh, which is only 8.7% of per kilometer cost of the road.
- Once geosynthetics used in road pavements, the life of road will almost increase by 1.5 times to double. Even periodic and annual maintenance will be reduced.
- So with 8.7% investment of per kilometer length of road will benefit in terms of less maintenance, longevity, climatic variations compared to bituminous road will impart more structural functionality in terms of durability and strength, which at last will provide future benefit in economizing cost.

Current Statement about Geosynthetics:

Features	Bitumen	Geosynthetics
Awareness	High	Low
Adaptability	Very High	Low
Feasibility	Medium	High
Maintenance	High	Low
Cost Saving	Average	Moderate
Life	Good	High
Weather effect on pavement	Moderate	Moderate

Conclusion:

- Since all the above parameters are measure of the performance and structural capacity of road pavement, the test results clearly indicate that the inclusion of a geotextile improve the structural capacity of the road pavement possibly due to its ability to confine and restrain movement of granular layers into soft subgrade as well as better filtration and drainage capacity.
- The results also indicate that in case of road, where the subgrade remains wet or saturated over a long period of time the geotextile sections performed better than the sections having sand, moorum or stabilized material sub-base. The effect of geotextile is more effective if the subgrade is very soft and saturated.

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