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USE OF GEOTEXTILE MATERIAL IN FLEXIBLE PAVEMENT

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Abstract: a country's economic growth mainly depends on transportation. One of the basic forms of transportation is road transportation. If the quality of roads is good then, it can give boast to transportation and ultimately it will increase the economy of the country. As per our observation, the condition of roads in our country is not much favorable for quick transportation of goods. During monsoon season, the condition of road further deteriorates due to water logging issues. Rutting of roads and formation of potholes takes place due to logging of water on embankments. If we can provide a separation layer between embankment and sub-grade material, then it will provide the stability to embankment as well as hold the sub-grade material in its position. The use of geotextile material is increasing worldwide and we are in a need to implement the use of geotextile. Use of natural fibers like-jute, coir etc can not only increase the stability of roads but also increase the service life of roads as well as decrease the maintenance cost. Coir is prepared from coconut husk (outer shell of coconut) and India, being covered by oceans on three sides, has abundant growth of coconut. So the raw material needed for production of coir is available easily which decrease the cost of import unlike other natural fibers.

Keywords: Geotextile, Flexible Pavement, Natural Fiber, Bitumen

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INTRODUCTION

The development of transportation plays an important role in economic development of the country. A pavement structure can be designed either as a flexible pavement or rigid pavement the flexible pavement is widely preferred in India, due to its advantages over rigid pavement and economy. Flexible pavements have low or negligible flexural strength and are rather flexible in their structural action under higher volume of traffic and load. Fibres are used to improve the performance of asphalt mixtures against permanent deformation and fatigue crack

Figure (1) Flexible Pavement

Figure (2) Rigid Pavment

II OBJECTIVES

- The objective of the present study is to explore the possibility of utilizing coir geotextile for the construction of unpaved roads and embankments.
- To reduce the cost of maintenance required for resurfacing of roads.
- To reduce the amount of bitumen thereby reducing cost of construction.
- To provide stability to embankment material.
- To hold the sub-grade material in position.
- To provide drainage to the water this gets accumulated on road mostly during rainy season.
- To stop the soil erosion from sides of road.
- To decrease maintenance cost of road using this material.
- To increase life year of road

Research problem:

While examining the bituminous mix the different problems meant to be solved are:
Maintaining the problem of thickness of bituminous mix
India is the second largest in terms of the length of the road network. However, these are some facts and comparisons India has a road network of over 5,242,842 kilometres in 2016, the second largest road network in the world. India has less than 5 kilometers of roads per 1000 people. However, the usages of the roads are more on every 1000 peoples in compare to other countries.
According to a survey every year about 29% of the roads need maintenance which costs a lot to government.
However one of the main problems which are faced by government is maintenance problem.Using fibers are always beneficial but it also concerns the environment. One of the

biggest challenges is to make the modification in road pavement with keeping environment in mind. Pot holes are big problem during rainy season. Road is wash out because of heavy rain fall.

III MATERIALS AND METHODS

(1) Bitumen: It is a sticky, black and highly viscous liquid or semi-solid form of petroleum. It may be found in natural deposits or may be a refined product; it is a substance classed as a pitchBitumen has excellent adhesive qualities provided the conditions are favorable. However in presence of water the adhesion does create some problems. Most of the aggregates used in road construction possess a weak negative charge on the surface. The bitumen aggregate bond is because of a weak dispersion force. Water is highly polar and hence it gets strongly attached to the aggregate displacing the bituminous coating. When temperatures are raised, as well as when a load is applied to bitumen, the bitumen will flow, but will not return to its original position when load is removed. This condition is referred to as plastic behaviour

Fig: Bitumen

(2) Geotextile: Coir fibre: Coir Geotextile is natural fiber. This is used in construction of road as polymer for increasing strength of or road pavement. We used this material in road construction to decrease potholes in roads and increase a road life. Also coir is available in abundance in India and hence the cost of obtaining the raw material and processing it for industrial use will be viable Coir fibre is natural fibre is use for bituminous concrete samples exhibits superior performance compared to other fibre reinforced samples. Natural coir fibre decreases penetration and ductility of modified bitumen while the softening point value is increased compared unmodified bitumen specimen. Natural coir fibres are preferred due to their low-cost and good consistency with bituminous pavement.

Coir natural fibre is absorbing water easily and protect pavement from damage. Easily transverse water from pavement

- Coir fibbers in bituminous concrete improved the mixtures performance against the anticipated major pavement distresses like permanent deformation, fatigue cracking and thermal cracking.
- Not pot holes created because of rain.
- And another advantage is it is easily available

Fig (3) Coir fibbers

- Aggregate tests:
- Los Angeles test
- Impact test
- Bitumen test :
- Marshall test
- Penetration test
- Ductility test
- Marshall stability test

Test result

Sr no	Test name	Result
1	Los Angeles test	13.54%
2	Impact test	14.866 %
4	Penetration test	53.33
5	Ductility test	44

Table (1) Test result for aggregate & bitumen

	sample 1
weight of aggregates	1200
Weight of bitumen in added gms	65
Weight of specimen 'Wa'	1263
Weight submerged 'Ww'	720
Volume (V of specimen) cm3	530
Density of compacted mixture 'd' = g/cm3	2.23
Specific gravity of mixture = $\frac{100}{(\%\ of\ bitumen \div sp\ GR.of\ bitumen) + (\%of\ aggregate \div SP.GR.of\ aggregate)}$	2.35

Volume of bitumen VB = $\frac{\text{bitument content} \times \text{density}}{\text{sp.gr.of aggregates}}$ = %	5.72
Volume of aggregates VA= $\frac{(100-\text{bitumen content}) \times \text{density}}{\text{sp.gr.of aggregates}}$ %	10.72
Voids in mineral aggregates V.M.A=100-VA	16.456
Voids filled with bitumen = V.F.B = 100* VB / VMA	63.52
Measured stability in Newton	1600
Flow value in mm.	3.2

Table (2) Test Result for Marsall test

▶ Variation of Marshall Properties of SMA with different % of fibres as additive

Coir fibre	0.1	8.19	3.14	2.609	4.14	2.318	18.935	78.135
	0.2	10.073	3.05	3.303	4.31	2.315	19.039	77.363
	0.3	**12.68**	**2.83**	**4.445**	**4.46**	**2.308**	**19.284**	**76.872**
	0.4	7.936	2.72	2.918	4.64	2.298	19.634	76.368

Table (3) Variation property of SMA with different % of coir fibre

Outcome

The variations of indirect tensile strength of Stone Matrix Asphalt mixtures with different percentages of fibre contents are given. The tensile strength of SMA mix with fibre additive shows increasing trend up to 0.3% and it is found to be decreasing at 0.4% fibre content. This behaviour is because, the tensile strength is related primarily to a function of the binder properties, and its stiffness influences the tensile strength. Presence of fibre in the mixture makes it stiffer. The addition of fibre beyond a certain level can increase the viscosity of binder, which results from the effects of increase in volume of fibre particles due to the absorption of binder. Therefore, this increase in viscosity inhibits the ability of the binder to coat adequately on the surface of aggregates, thereby lead to the potential loss of bonds between the fibre, binder and the aggregate.

Additive	%	ITS, Unconditioned (MPa)	ITS, Conditioned (MPa)	%TSR (MPa)
Coir fibre	0.1	0.851	0.709	83.31
	0.2	1.0983	1.059	96.42
	0.3	**1.1242**	**1.1048**	**98.27**
	0.4	1.0831	1.0521	97.14

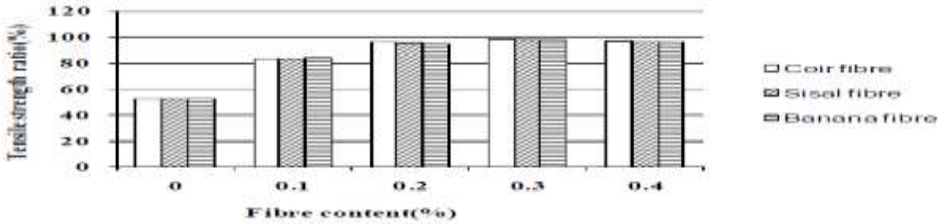
Table (4) Data of various percentage of coir added to bitumen

IV RESULT AND DISCUSSION

- After research of many papers and tests conducted by us, we have found that addition of coir fibre to bitumen in proper amount increases the strength of bitumen mix thereby

increasing its binding property. Coir fibre when added in 3% to the weight of bitumen, can increase the tensile strength considerably and when the the quantity is increased from 3%, tensile strength starts decreasing.

- We have done the tests adding different amount of fibre, and when the percentage was increased from 3%, the binding property of bitumen degraded considerably and the mould deformed very quickly.
- Hence, we concluded that coir fibre when added in 3% proportion to the weight of bitumen, will give maximum tensile strength the binding property of bitumen will be maximum at this percentage.
- We have also compared results of our tests with tests conducted with addition of different fibres and we concluded that coir fibre gives maximum tensile strength compared to all fibres.



Hence, the final conclusion is coir fibre increases the tensile strength of bitumen and is also viable for use in commercial projects

REFERENCE

1. AASHTO T 245 (1997), “Standard Method of Test for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus”, American Association of State Highway and Transportation Officials, Washington DC.

2. Al- Hadidy , AI. And Yi- qiu, Tan. (2008), “Evaluation of pyrolisis low density polyethylene modified asphalt paving materials”, Construction and Building materials,Volume: 23, Issue number 3, 1456 – 1464.

3. ASTM D 1559 (2004), “Standard Test Method for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus”, American Society for Testing and Materials, Philadelphia.

4. ASTM D 2041(1995), “Standard Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Materials”, American Society for Testing and Materials, Philadelphia.

5. Aggarwal, P. And Sharma, B., —Application of Jute Fiber in the Improvement of Subgrade Characteristics‖. International Journal on Transportation and Urban Development.

6. Behbahani, S., Nowbakht, H., Fazaeli and Rahmani, J. (2009), “Effects of Fiber Type and Content on the Rutting Performance of Stone Matrix Asphalt”, Journal of Applied Sciences, 9: 1980-1984.

7. Chen and Wu (2009) Experimental Study of Fibbers in Stabilizing and Reinforcing Asphalt Binder. Fuel, China.

8. Data Book on Jute, 1st edition., Edited by Mitra B.C., (National Institute of Research on Jute and Allied Fibre Technology), Kolkata .

9. Huang H, White TD (2001). Dynamic properties of fiber-modified overlay mixture. Transport Res. Rec., 1545: 98–104.) Hogue M.Z., An introduction to jute /allied fibres properties and processing, International Jute Organization, IJSG (1992)
10. Hogue M.Z., An introduction to jute /allied fibres properties and processing, International Jute Organization, IJSG (1992).
11. Ibrahim, K. (2000), "The Tensile Characteristics of Fibre Reinforced Bituminous Mixtures", PLATFORM. Volume 1 Number 2,17-24

- **Websites**

1. http://www.basiccivilengineering.com/2015/04/comparison-betweenflexiblepavement.html
2. http://en.wikipedia.org/wiki/E-jute