

DEVELOPMENT OF JUTE-BASED ASPHALT OVERLAY FABRIC

by

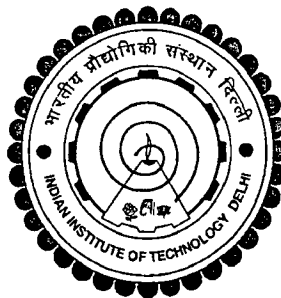
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Submitted

in fulfillment of the requirements of the degree of Doctor of Philosophy

to the



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- ① Textile fibres - Jute
- ② Transport engineering
- ③ Bituminous road construction (Asphalt)

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Dedicated

to

My Parents, Husband and Son


CERTIFICATE

This is to certify that the thesis entitled, "**Development of Jute-based Asphalt Overlay Fabric**" being submitted by **Ms. Mahuya Ghosh** to the Indian Institute of Technology, Delhi, for the award of the degree of **Doctor of Philosophy** in the Department of Textile Technology, is a bona fide research work carried out by her. Ms. Mahuya Ghosh worked under our joint guidance and supervision and fulfilled the requirements for submission of the thesis.

The results contained in this thesis have not been submitted, in part or in full, to any other University or Institute for the award of any degree or diploma.



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ABSTRACT

A reasonably high modulus and strength, very low extension at break, low cost, eco-friendliness and a renewable and abundant source characterize jute as a potentially useful raw material for certain class of geotextile applications, the scope of which can be enlarged by systematic studies of its in-situ behaviour. In order to explore the suitability of jute as asphalt overlay fabric that strengthens distressed asphaltic pavements, both jute and asphalt in isolation as also in composite forms were subjected to suitable tensile, thermal, spectroscopy and X-ray investigations for establishing the compatibility of jute with asphalt as also its durability under hygral and enzymatic loads. It was found that although the strength of jute deteriorates by about 10 % in hot asphalt, the physical and chemical bonds between the two results in a very durable composite that withstands hygral and enzymatic loads remarkably well. Accordingly a grid-like jute fabric based on leno construction was developed for reinforcing suitably notched asphalt concrete beams. Such beams, some of which were also hygrally loaded, were subjected to accelerated cyclic mechanical loading simulating vehicular traffic. A comparison of crack propagation vis-à-vis control beams, namely unreinforced ones as also those reinforced with other commercial geotextiles, established the efficacy of the jute fabric. An analysis of the fabrics exhumed from the tested asphalt concrete beams led to the development of a model for guiding overlay fabric designing by relating grid size to those of aggregate and voids. The proposed model assigns considerable importance to the bulk characteristics of the asphalt concrete. The void fraction and the void size distribution of the old pavement surface (assumed to follow normal distribution in the present case) as also the size of the largest void are key inputs in designing the fabric.

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