STUDIES ON A BRAIDED PREFABRICATED VERTICAL DRAIN

by

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Drainage and fibres

CERTIFICATE

This is to certify that the thesis entitled "STUDIES ON A BRAIDED PREFABRICATED VERTICAL DRAIN" submitted by Mr. Sampath Kumar P. Jinka, 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 record of the bonafide research work carried out by him. Mr. J.P.Sampath Kumar has worked under our guidance and supervision and has fulfilled the requirements for the 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

Prefabricated vertical drains (PVDs) are used in soft cohesive soils to accelerate the consolidation process by shortening the drainage path. In general, these PVDs made of either polyester or polypropylene are 100 mm wide and about 4-6 mm thick consisting of a core enclosed by a non-woven sheath. In the early 90^s, PVDs were developed using natural materials like jute and coir taking into account the eco-friendliness as well as the availability of these materials. However, the production process of all these PVDs involves different kinds of machines.

In this experiment, braiding technology was employed to produce a PVD in a single operation using natural fibers like jute and coir. A triaxially braided jute sheath comprising of braiding and axial yarns was developed enclosing core yarns made of coir. The dimensional, tensile and structural properties of all the samples were analyzed and later related to the input variables like machine and materials.

Few samples were then selected and evaluated for performance properties, namely pore size distribution, permeability and discharge capacity. These properties were also compared with those of two commercial drains, one made of synthetic material while the other is from natural fibers. The results of the performance properties were then related to the structural variables of the samples. After analyzing the data obtained from the experiments conducted and the relations developed, a designing methodology was developed, which can help in producing a braided drain of desired qualities.

The results of dimensional properties showed that the width, thickness and linear weight of the PVD depends on the count and number of braiding, axial and core yarns used for a machine of known particulars. Around 80% contribution to the tensile strength of the braided PVD is by the jute axial yarns and the rest is by the core coir yarns.

From the results of the experiments on the discharge capacity it was concluded that the discharge capacity of a PVD can be improved, if fine capillaries in large number oriented in the direction of the flow are allowed to develop along the sheath as also along the interface between core and the sheath. These capillaries moreover should remain relatively unaffected by lateral pressure. The discharge capacity of the braided drain was found to depend on the count and number of core, axial and braiding yarns. The braided sheath contributes to a larger extent to the discharge capacity of the drain as compared to the core. It was also expected that finer core yarns in larger number in conjunction with a thin braided sheath would yield higher discharge. This indicates the desirability of the use of finest available yarns of jute and coir for the preparation of a drain sample. Even the braided drains made of relatively thicker jute and coir yarns have performed well in comparison to another commercial natural fiber drain and a synthetic drain.

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