

**STUDIES ON A BRAIDED
PREFABRICATED VERTICAL DRAIN**

by

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DEPARTMENT OF TEXTILE TECHNOLOGY

Submitted

in fulfilment of the requirements of the degree of

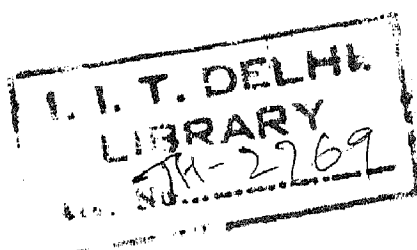
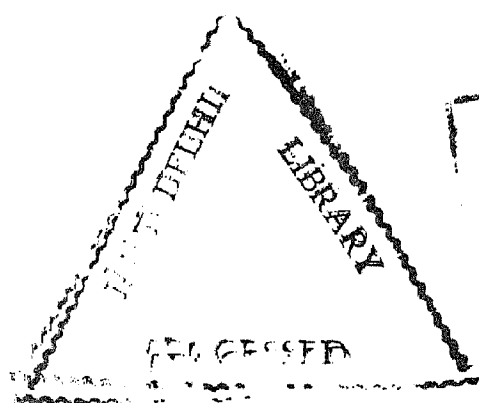
DOCTOR OF PHILOSOPHY

to the



INDIAN INSTITUTE OF TECHNOLOGY, DELHI

JULY 2000



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Drainage and fibres

by

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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ACKNOWLEDGEMENTS

I wish to express my sincere thanks and heartiest regards to my supervisor Prof. P.K.BANERJEE, for his excellent and valuable guidance, encouragement and inspiration throughout the course of this research work.

I wish to express my heartiest regards to my supervisor Prof. G.VENKATAPPA RAO, for his excellent and valuable guidance, in spite of his busy schedule as Dean of students, throughout the course of this research work.

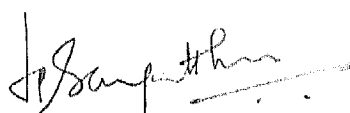
My sincere thanks are due to the Heads of Department of Textile Technology, Prof. K.R. Salhotra and Prof. R.B. Chavan for their cooperation rendered throughout my course of this research work.

My sincere thanks are due to the staff of Department of Textile Technology, the staff of Soil Mechanics Laboratory and the Civil Engineering Workshop of IIT, Delhi, Mr. Ashok Kumar as well as Mr. Rajkumar Tejanian of Computer Laboratory for their immense help, cooperation and cordial behaviour during the period of my research.

I am grateful to my fellow research scholars, especially, Dr. Prabir Kar, Mr. Santhosh Rao, Mr. C.S. Gokhale, Mr. T.V. Sree Kumar, Mr. K. Murugesh Babu, Mr. M.V. Mahendra Gowda, Mr. S.B. Muttagi, Mr. P. Bhat, Mr. M.P. Mani, and Mrs. Devika for their help, suggestions and cooperation.

I offer my heartiest thanks to my wife Kusuma and daughter Swathi for their cooperation and patience rendered to me throughout the period of my research work. At the end, I thank my mother and my relatives for their understanding, encouragement and necessary financial cooperation rendered to me throughout the period of this research.

Dated : July , 2000


(JINKA. P. SAMPATH KUMAR)

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.

CONTENTS

CERTIFICATE	i
ACKNOWLEDGEMENTS	ii
ABSTRACT	iv
LIST OF FIGURES	xi
LIST OF TABLES	xv
 CHAPTER 1 INTRODUCTION	
1.1 INTRODUCTION	1
1.2 SCOPE	3
1.3 OBJECTIVES OF THE PRESENT WORK	4
1.4 SUMMARY OF PRESENTATION	4
 CHAPTER 2 LITERATURE REVIEW	
2.1 INTRODUCTION	6
2.2 MATERIALS	6
2.2.1 Jute	6
2.2.2 Coir	8
2.2.3 Properties of jute and coir	8
2.3 PVD	10
2.3.1 Consolidation of Soft Soils	10
2.3.2 Role of VD in Consolidation	10
2.3.3 Types of VD	13
2.3.4 Materials Used for PVDs	14
2.3.5 Manufacturing methods of PVDs	17
2.3.6 Installation of PVDs	19
2.3.7 Field Trials of Some PVDs	20
2.3.8 Drain Parameters	20
2.3.9 Summary of PVD	39
2.4 BRAIDING	41
2.4.1 Introduction	41
2.4.2 Definitions	41
2.4.3 Principle of Braiding	42
2.4.4 Types of Braid	42

2.4.5	Methods of interlacing	44
2.4.6	Structure of a braid	46
2.4.7	Braid repeat	48
2.4.8	A typical braiding machine	48
2.4.9	Important braid relationships	50

CHAPTER 3 PRELIMINARY EXPERIMENTS

3.1	INTRODUCTION	52
3.2	RAW MATERIALS SELECTED	52
3.3	PREPARATION OF SAMPLES	52
3.4	TESTING OF SAMPLES	55
3.4.1	Dimensional Properties	58
3.4.2	Tensile Properties	59
3.4.3	Structural Characteristics	63

CHAPTER 4 RESULTS OF PRELIMINARY EXPERIMENTS

4.1	PROFILE OF THE SAMPLES	66
4.2	DIMENSIONAL PROPERTIES	68
4.2.1	Effect of Number of Braiding Yarns in the Strand	71
4.2.2	Effect of Count of Braiding Yarns	73
4.2.3	Effect of Number of Core Yarns	73
4.2.4	Effect of Axial Yarns	73
4.2.5	Effect of Spring Tension	74
4.2.6	Effect of Mandrel	74
4.2.7	Effect of Braid Structure	74
4.3	TENSILE PROPERTIES	75
4.4	STRUCTURAL PROPERTIES	81

CHAPTER 5 RELATION BETWEEN INPUT VARIABLES AND STRUCTURAL, DIMENSIONAL AS WELL AS TENSILE PROPERTIES OF THE DRAIN

5.1	INTRODUCTION	84
5.2	NOTATIONS	84

5.3	RELATION BETWEEN INPUT VARIABLES AND THE STRUCTURAL CHARACTERISTICS OF THE DRAIN	85
5.3.1	Braiding Angle and Plait Height	85
5.3.2	Modular Length of Braiding Yarn	89
5.4	RELATION BETWEEN BRAIDING VARIABLES AND PHYSICAL CHARACTERISTICS OF THE DRAIN	91
5.4.1	Expression for Weight Per Linear Meter (g)	91
5.4.2	Expression for Width	94
5.4.3	Expression for Thickness	94
5.5	RELATION BETWEEN BRAIDING VARIABLES AND TENSILE PROPERTIES OF THE DRAIN	99
5.6	SUMMARY OF RELEVANT EXPRESSIONS	100
 CHAPTER 6 TESTING REGIME		
6.1	INTRODUCTION	101
6.2	MATERIALS SELECTED	101
6.2.1	Selection of Test Specimens	101
6.2.2	Sand and Glass Beads Used	102
6.2.3	Water Used	103
6.2.4	Clay Used	105
6.3	THICKNESS	105
6.4	TENSILE TESTING	107
6.5	PORE SIZE DISTRIBUTION	107
6.5.1	Dry Sieving Test	107
6.5.2	Hydrodynamic Sieving Test	109
6.6	PERMITTIVITY TEST	113
6.6.1	The Apparatus	114
6.6.2	Testing Procedure for Samples Under Stress	114
6.6.3	Testing Under zero load	118
6.7	DISCHARGE CAPACITY TEST	118
6.7.1	The Apparatus	118
6.7.2	Mounting of the sample	123
6.7.3	Testing Procedure	125

6.7.4	Testing Procedure for Specimens in Kinked Condition	126
6.8	MODEL TANK STUDIES	126
6.8.1	The Tank	126
6.8.2	Testing Procedure	128
6.9	DURABILITY TESTS	129
6.9.1	Testing Procedure	130
6.10	SUMMARY	130
 CHAPTER 7 RESULTS AND DISCUSSION		
7.1	INTRODUCTION	132
7.2	THICKNESS	132
7.3	TENSILE STRENGTH AND ELONGATION	135
7.4	PORE SIZE DISTRIBUTION	137
7.4.1	Dry Sieving Test	137
7.4.2	Hydrodynamic Sieving Test	139
7.5	PERMITTIVITY TEST	142
7.5.1	Results of Permeability under Stress	142
7.5.2	Results of Permeability under zero load	174
7.6	DISCHARGE CAPACITY	145
7.7	MODEL TANK STUDIES	152
7.8	DURABILITY TESTS	158
 CHAPTER 8 RELATION BETWEEN STRUCTURAL VARIABLES AND PERFORMANCE OF THE DRAIN		
8.1	INTRODUCTION	162
8.2	EXPRESSION FOR PORE SIZE	162
8.3	DISCHARGE CAPACITY	165
8.4	SUMMARY	168
 CHAPTER 9 DESIGN GUIDELINES		

9.1	INTRODUCTION	169
9.2	DESIGN GUIDELINES	169
9.2.1	Case 1	169
9.2.2	Case 2	173
9.2.3	Illustration 1	174
9.2.4	Illustration 2	177
CHAPTER 10	SUMMARY AND CONCLUSIONS	181
CHAPTER 11	SCOPE FOR FUTURE STUDIES	185
REFERENCES		186
PUBLICATIONS / COMMUNICATIONS		xvii
CURRICULUM VITAE		xviii