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Behaviours of Different Types of Sand Mixing With Natural Sugarcane Fiber

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ABSTRACT:
For the extension of land transportation system in India huge number of road construction is being prepared through different Government schemes. Such constructions need enormous amount of good quality brickbats for construction of sub base as per conventional method. Agricultural lands, which contribute soil for brick manufacturing is becoming scarce in India and also burning of brick consumed large energy, while conservation of energy is given utmost importance in India. In view of this Government of India is highlighting on use of alternate material to substitute brickbats for construction of subbase. On the other hand, use of natural fiber materials, such as sugarcane, jute, etc. as additive materials in soil is recognized for their use as soil reinforcement. The main benefit of these materials is that they are very cheap, eco-friendly and are also easily available in plenty in India. They can be used as additive material in the sub base course using sand to improve strength and decreased deformability.
In this study an experimental program has been undertaken with different sand-sugarcane fiber composites. Standard Proctor tests were carried out on mixing natural sugarcane fiber in various proportions and various lengths with three different types of sand to find optimum moisture content (OMC) and maximum dry density (MDD) of each case. California Bearing Ratio (CBR) tests were conducted at optimum moisture content in each case.
KEY WORDS:
Natural fibers, Sugarcane fiber, Eco-friendly, deformability, California Bearing Ratio.

I. INTRODUCTION:

In the sub-base construction of flexible pavements, huge amount of conventional brick bats are used. Due to large scale increase of construction of roads, enormous quantity of bricks is needed to meet the demand. However, the making of bricks needs soils of special quality mostly from agricultural lands. Further for burning bricks, large amount of energy is consumed. In view of this, there is great demand of searching some alternate suitable materials which may replace brickbats for the construction of subbase of roads. Sand is being used extensively in many rural road, as a good drainage layer but it also being thought for ideal subbase material as it could be capable of producing comparable CBR as required for subbase layer. It had shown that Ganga and Chopan sands could be conveniently used as material for subbase (Singh and Prasad, 2004). They stated that the use of these sands would be economical for road construction.

Therefore, reinforcing sand with randomly distributed fiber can be employed in the case of embankments, subgrades etc. Glass fiber (Pazare et.al 2002), Nylon fiber (Jain et al, 2003), synthetic fiber like polypropylene fibers (Consoli et.al, 1998), Polyester fiber (Kaniraj et.al, 2001), fragmented rubber shredded tyre (Lindh & Mattsson 2004) etc. are being studied elsewhere as additive materials with soils. But as the synthetic fibers are much costlier than natural fibers, affect the cost effectiveness of the project. To make it cost-effective, locally available natural fibers like sugarcane, coir, jute etc. could be used as strengthening material with soil for low traffic unpaved roads. .

II. TEST PROGRAMME:

In the present investigation, the efficacy of using natural sugarcane fiber with locally available sands has been investigated. A series of Standard Proctor test and CBR test of locally available different types of sands has been done mixed with natural sugarcane fiber of various length of 5mm, 10mm and 20mm and different proportion of 0.5%, 1%, 1.5% and 2% to find their compaction characteristics and strength properties.

III. MATERIALS:

A. SUGARCANE FIBER

Natural sugarcane fibers were processed in the laboratory purchasing from local market. The fibers were then separated and dried in sun for several days. After that the sugarcane fibers were cleaned and cut into small pieces of length 5mm, 10mm and 20mm for use as fiber material. Sugarcane fibers were randomly mixed in different types of sand to form homogeneous mixture.

B. SAND

Locally available Fine sand, Medium sand, and Silver sand were used in this experimental study for their easy availability in many parts of the country for possible use in practice. The summary of the physical properties of sands are given in Table 1.

Table 1: Summary of Physical Properties of Sands

Properties	Fine Sand	Medium Sand	Silver sand
Classification (IS)	SP	SP	SM
Specific gravity	2.62	2.63	2.52
Maximum dry density (gm/cc)	1.62	1.63	1.59
Optimum moisture content (%)	15.3	14.5	15.5
California bearing ratio (%)	8.4	9.1	7.2

IV. METHODOLOGY:

To investigate the effect of inclusion of natural sugarcane fibers of various lengths and proportion, in different sands, (i.e. Fine sand, Medium sand, and Silver sand), a series of Standard Proctor tests and unsoaked CBR tests has been conducted as per I.S. codal provision. Natural sugarcane fiber of various length of 5mm, 10mm and 20mm and different proportion of 0.5%, 1%, 1.5% and 2% have been studied to find the compaction characteristics and strength properties of different types of sands. The mixing of sugarcane fibers and sand was done manually with proper care for preparing homogeneous mixture at each stage of mixing. It was found that the sugarcane fibers could be mixed with sand more effectively in the moist state than in the dry state.

V. RESULTS AND DISCUSSIONS:

From Standard Proctor tests, the OMC and corresponding MDD for each mix were determined. For each case unsoaked CBR tests were conducted at OMC. The results of these tests are given in the table 2.

Table 2: Summary of Results of Standard Proctor and Unsoaked CBR tests

Fiber length	**% OF Fiber**	**Fine sand**			**Medium sand**			**Silver sand**		
		MDD	**OMC**	**CBR**	**MDD**	**OMC**	**CBR**	**MDD**	**OMC**	**CBR**
	0.0%	1.603	14.2	6.4	1.615	13.5	7.1	1.578	14.6	5.2
Sugarcane **0.5cm**	0.5%	1.588	14.4	8.6	1.613	13.7	8.1	1.574	14.8	8.9
	1.0%	1.579	14.5	10.1	1.610	13.9	8.6	1.571	14.9	10.1
	1.5%	1.568	14.7	10.6	1.605	14.2	7.8	1.566	15.2	10.5
	2.0%	1.556	15.0	9.1	1.599	14.4	7.2	1.557	15.4	8.6
Sugarcane **1.0cm**	0.5%	1.578	14.4	8.1	1.61	13.9	7.8	1.570	14.9	7.7
	1.0%	1.572	14.6	9.0	1.606	14.2	8.4	1.568	15.1	8.2
	1.5%	1.558	14.9	9.6	1.598	14.5	7.9	1.558	15.5	8.3
	2.0%	1.548	14.3	8.6	1.592	14.8	6.8	1.552	15.7	7.3
	0.5%	1.570	14.6	7.7	1.605	13.9	7.5	1.568	15.0	6.9

Sugarcane **2cm**	1.0%	1.561	15.0	8.6	1.596	14.4	8.0	1.562	15.2	8.0
	1.5%	1.554	15.2	9.2	1.588	14.7	7.5	1.554	15.6	8.2
	2.0%	1.545	15.5	8.2	1.580	14.9	6.6	1.548	15.9	7.0

(A) STANDARD PROCTOR TEST:

The value of MDD and OMC obtained from the laboratory tests are given in Table 2 for all the three types of sands.

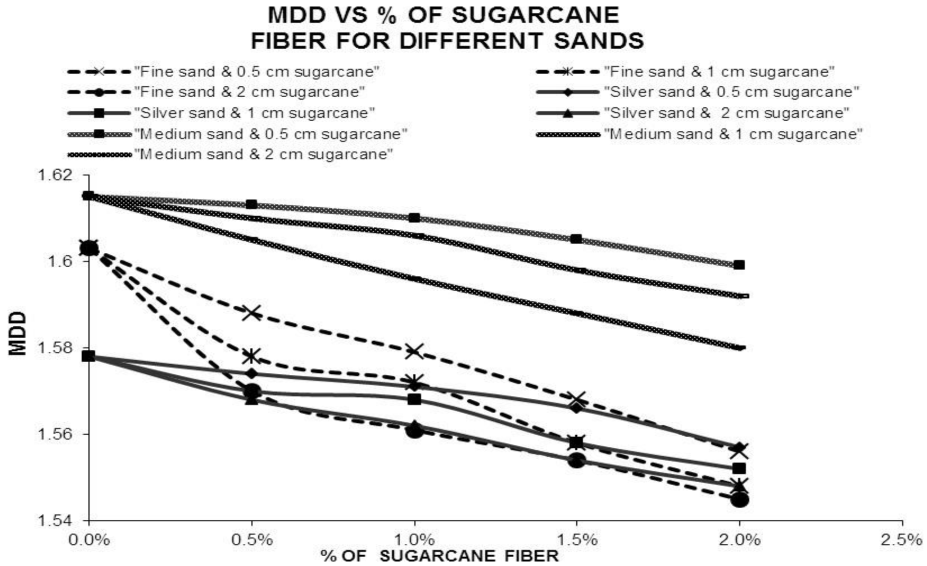

Fig. 1: Effect of sugarcane fiber content on MDD for different types of sand

(I) EFFECT OF SUGARCANE FIBER ON MDD FOR DIFFERENT TYPES OF SANDS:

The variation in MDD with Fiber content are plotted for different types of sand mixed with various percentage of natural sugarcane fiber of varying length are shown in Fig. 1. The results show that as the sugarcane fiber content increases, the MDD decreases for all the three types of sand. The decrease of MDD with mixing of sugarcane fiber is probably due to the lower unit weight of the sugarcane fiber.

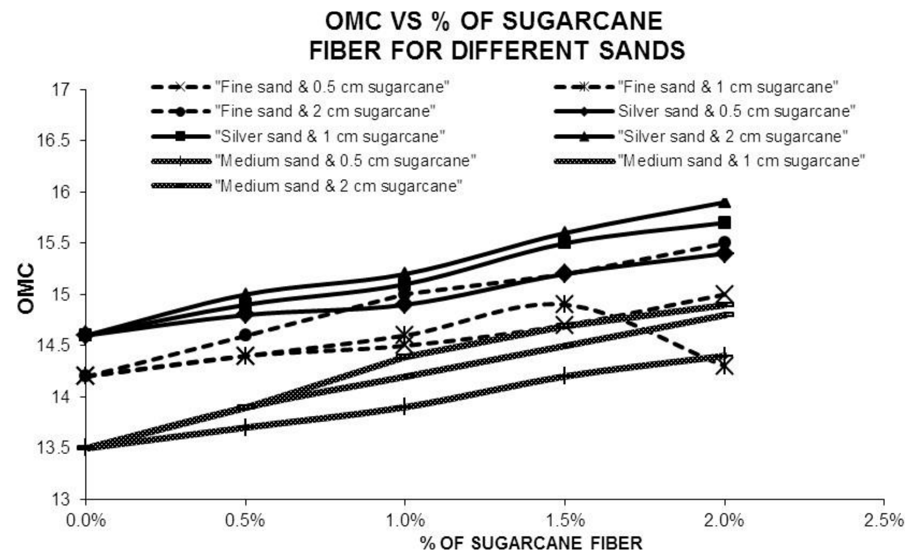

Figure 2: Effect of sugarcane fiber content on OMC for different types of sand

(II) **EFFECT OF SUGARCANE FIBER ON OMC FOR DIFFERENT TYPES OF SANDS:**

The variation of OMC with fiber content are plotted for different types of sand mixed with various percentage of natural sugarcane fiber of varying length are shown in Fig. 2. The results show that as the sugarcane fiber content increases, the OMC increases for all the three types of sand. Sugarcane fibers soak water and this yields an increase in OMC with increase of fiber content.

(B) UNSOAKED CBR TEST:

The values of unsoaked CBR obtained from laboratory tests are given in Table 2.

EFFECT OF SUGARCANE FIBER ON UNSOAKED CBR FOR DIFFERENT TYPES OF SANDS:

The Unsoaked CBR vs fiber content curve for different types of sand mixed with various percentage of natural sugarcane fiber of varying lengths are shown in Fig.3. From the CBR test results, it is observed that the Unsoaked CBR value increases with increase in fiber content (%) up to a certain maximum limit in each case and beyond the limit it decreases for all types of sand. Unsoaked CBR value is maximum for 1.5% of sugarcane fiber content for all the three types of sand. The limit may be taken as optimum fiber content. The probable cause of the reduction of CBR is due to less contact between fiber and sand when the percentage of sugarcane fiber increased beyond the optimum,

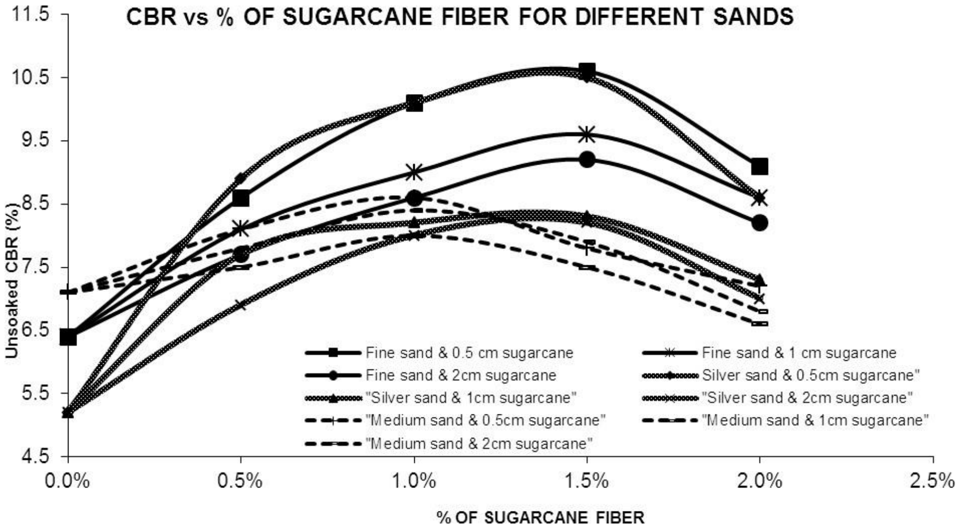

Figure 3: Effect of sugarcane fiber content on CBR for different types of sand

VI. CONCLUSIONS:

The following conclusions may be drawn from the present study.

1. For the all types of sands used, MDD decreases and OMC increases with the increase of randomly mixing Sugarcane fiber within the range of different parameters studied.
2. There is a considerable increase in the Unsoaked CBR value for the all types sands used i.e. Fine sand, Medium sand, and Silver sand when mixing with randomly distributed natural sugarcane fiber, initially upto 1 to 1.5%, where after the CBR value decreases.
3. Unsoaked CBR value is maximum for fiber length of 5mm for sugarcane fibers independent of types of sand used and optimum fiber inclusion is 1.5% of the dry weight of sand for sugarcane fiber beyond which CBR value decreases.

REFERENCES:

[1]. Consoli N.C., Prietto P.D.M. and Ulbrich L.A. (1998): Influence of Fiber and Cement Addition on Behavior of Sandy Soil, Journal of Geotechnical and Geoenvironmental Engineering, ASCE, Vol.124, no.12, pp. 1211-1214.

[2]. IS 2720 (Part VII) -1980, Determination of Water content – dry density relation using light compaction.

[3]. Bureau of Indian Standards, New Delhi, India.

[4]. IS 2720 (Part XVI) -1987, Laboratory determination of California Bearing Ratio. Bureau of Indian Standards, New Delhi, India.

[5]. Jain, P.K., Jain, R. and Kumar, R. (2003) "Behaviour of expansive black cotton soil mixed with nylon fibre", Proc. Indian Geotechnical Conference, Roorkee, Vol- 1, pp. 389-392.

[6]. Kaniraj, S. R. and Havanagi, V. G. (2001) "Behavior of cement-stabilization fiber-reinforced fly ash-soil mixtures. Journal of Geotechnical and Geoenvironmental Engineering, ASCE, Vol. 127, no. 7, pp. 574- 584.
[7]. Lindh and Mattsson, Nina (2004) "Composite soil made of rubber waste and cement stabilized soil", 5th international conference of Ground Improvement Techniques, Malaysia, pp.195-202.
[8]. Pazare, K.S., Chatterjee, P. (2002) "Behaviour of silty soil reinforced with randomly distributed fibers". Proceedings of National seminar on Road Transportation in India: Emerging Trends and Techniques, September, 12-13, 2002, IIT, Kharagpur, pp. 3.41-3.48.
[9]. Singh, V. and Prasad, H.S. (2004) "Use of sand layer as subbase materials in road construction on alluvial soil", Proc. Indian Geotechnical Conference on Ground Engineering: Emerging Techniques, Warangal Vol 1, pp. 494-496.