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UTILIZATION OF BAMBOO CHIPS AS AN ECO-FRIENDLY MATERIAL IN RURAL ROAD CONSTRUCTION

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***Abstract*—**The roads in rural areas does not have good durability and serviceability due to low fundings provided for rural road construction. In this project we have partially replaced coarse aggregate with bamboo chips by 10%, 15% and 20% of its weight and have prepared cubes, cylinders and beams to obtain the optimum dosage which gives good compressive strength. After the study, test results with partial replacement of 15% bamboo chips with coarse aggregates achieves desirable strength and has possessed low weight compared to conventional concrete. The Comparative study was also carried out with Conventional rigid pavement construction for a stretch of 1 km with 15% bamboo chips replaced pavement and was estimated with the difference of Rs.54,810 per km**.**

***Keywords*—Bamboo**

I. INTRODUCTION

Nearly millions of Indians live in villages scattered throughout the country. Access roads provide a means of connecting rural people to the big city. Despite the efforts made, over the years, at the Government and Central levels, through various programs, about 40% of the country's settlements are not connected to all the roads of the season. The biggest problem with rural and developing roads is that the budget remains very low. To address all of these problems, bamboo is one of the best alternatives to concrete reinforcement for low cost construction. Bamboo is natural, cheap, widely available and most importantly strong in both thickness and pressure. Bamboo is a multi-purpose store divided by a large amount of strength and weight and its ease of operation with simple tools. It is one of the fastest growing and most accessible nature reserves in your area. Bamboo was used in construction even in antiquity. It can be used as a technical and non-technical means. Bamboo fibers have a more flexible modulus than any other natural material. When long strands are high it gives strength. The addition of bamboo fibers to concrete raises mechanical strength and durability. It has a relatively low specific weight as well.

II. METHODOLOGY

2.1 Materials

Cement

The IS 2720 compliant cement is used. In this experiment we used PPC grade 43 cement as a binding Portland pozzolana cement is obtained by grinding fly ash with Portland cement clinker n material other than gypsum or water or both will be added and the following cement features.

Fine Aggregates

Good standards compliant with IS 383-2016, river sand located in the Belagavi zone is used for this project. Sand over 600 micron.

Coarse Aggregate

The rough scales associated with IS 2386 used for this project are brought to the stone quarry in the Hirebagewadi, Belagavi region. A coarse aggregate of 20mm is used.

Bamboo

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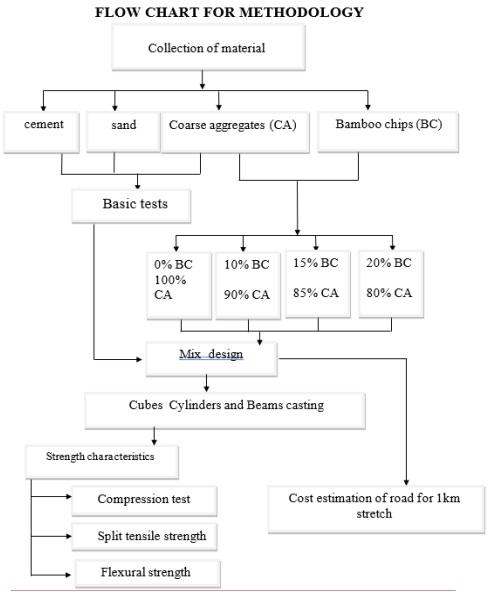
Bamboo is a type of grass with a strong, sturdy, hollow stem. Bamboo is superior to wood and steel to withstand strong strength. The bamboo used in this project comes from the Dandeli forests.



Sl no.	Tests	Results	Reference
1.	Specific gravity	2.88	IS 2720 Part 3
2.	Normal consistency	34%	IS 4031
3.	Initial setting time of cement	30 mins	IS 4031 Part 5
4.	Final setting time of cement	600 mins	IS 4031 Part 5

Sl.no.	Tests	Results	Reference
1	Specific gravity	2.55	IS 2386 Part 3
2	Fineness modulus	3.1295	IS 2386

Sl.no	Tests	Result	Reference
1.	Impact test	11.11%	IS 2386 Part 4
2.	Bulk density	1.763 gm/cc	IS 2386 Part 3

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3.	Specific gravity	2.75	IS 2386 Part 3
4.	Water absorption	0.99%	IS 2386 Part 6
5.	Colour of aggregates	Grey	IS 2386
6.	Shape of aggregates	Angular	IS 2386 Part 1

III. RESULT AND DISCUSSION

Density of Concrete

Particular	Cube density KN/m3		Cylinder density KN/m3		Beam density KN/m3	
	7 days	28 days	7 days	28 days	7 days	28 days
1	23.3	23.5	20.7	21.8	15.1	15.6
2	22.1	22.6	19.5	20.17	14.8	15.29
3	21.8	22.38	19.5	19.30	14.2	15.03
4	20.9	21.21	20.3	20.38	13.75	14.6

Cost Estimation For 1Km stretch Road

Total cost for building 1 km road with 15% bamboo chips replacement

Cement =17,15,280Rs
Sand =1,86,480Rs
Coarse aggregate =3,10,440Rs
Steel=17,14,832 Rs
Total cost =39,27,032

Total cost for building 1 km road without any replacement

Cement =17,15,280Rs
Sand =1,86,480Rs
Coarse aggregate =3,65,250Rs
Steel=17,14,832 Rs
Total cost =39,81,842/- Rs

The cost difference is 54,810/- rupees

Compressive strength results

Sl.no	Particular	C/S area mm2	Load (KN)		Compressive strength (N/mm2)	
			7 days	28 days	7 days	28 days
1	Fresh concrete(S0)	22500	500	625	23.3	29.7

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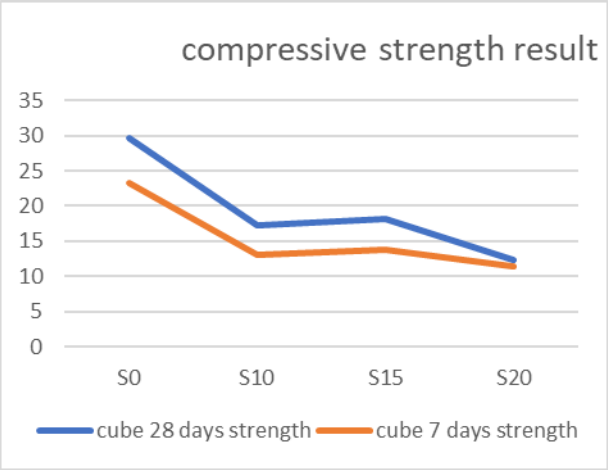
2	10% bamboo chips(S10)	22500	310	386.6	13	17.6
3	15% bamboo chips(S15)	22500	292	408.3	13.7	18.1
4	20% bamboo chips(S20)	22500	260	280	11.5	12.4



The compressive strength of cube of partial replacement of bamboo chips by 15 % shows greater strength as compared to other two percentages, 10% and 20%

Split Tensile strength result

Sl.no	Particular	C/S area mm2	Load KN		Split tensile strength (N/mm2)	
			7 days	28 days	7 days	28 days
1	Fresh concrete(S0)	17671.4	200	240	11.3	13.5
2	10% Bamboo chips(S10)	17671.4	84	110	4.8	6.2
3	15% Bamboo chips(S15)	17671.4	90	143.3	5	8.13
4	20% Bamboo chips(S20)	17671.4	65	83.33	3.6	4.7

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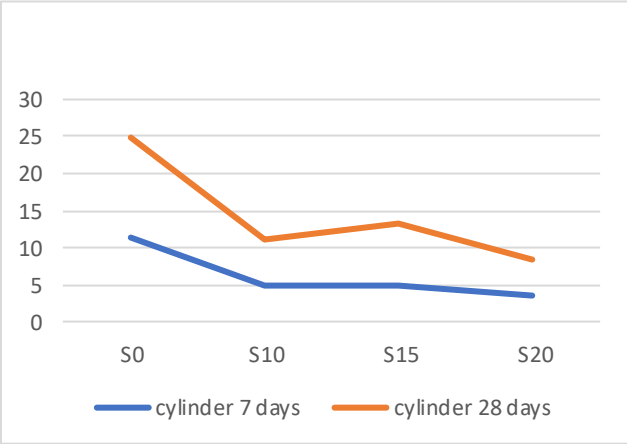
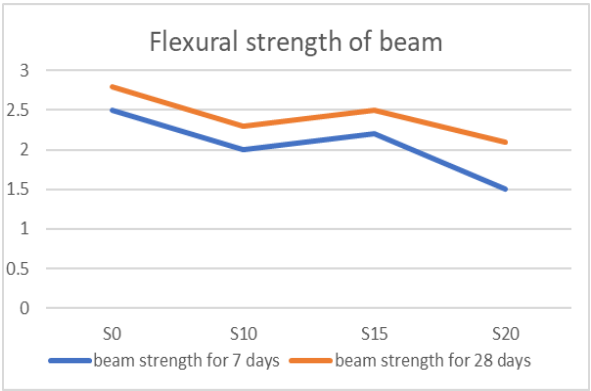


The split tensile strength of cylinder of partial replacement of bamboo chips by 15 % shows greater strength as compared to other two percentages, 10% and 20%.

Flexural strength results

Sl.no	Particular	C/S area mm2	Load (KN)		Flexural strength (N/mm2)	
			7 days	28 days	7 days	28 days
1	Fresh concrete(S0)	103500	151	138	3.4	4.3
2	10% Bamboo chips(S10)	103500	93	110	2.0	2.3
3	15% Bamboo chips(S15)	103500	102	105	2.2	2.5
4	20% Bamboo chips(S20)	103500	70	97	1.5	2.1



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The flexural strength of beam of partial replacement of bamboo chips by 10% after 28 days of curing shows greater strength than other two percentages.

IV.CONCLUSION

1. The density of partially replaced concrete by bamboo chips differs by 5 to 10 % for 10%, 15% , and 20% for 7 and 28 days of curing and also light weight concrete can be achieved.
2. The cost estimation carried out for 1km stretch of concrete road with partial replacement of bamboo chips by 15% of coarse aggregate reduces the construction cost of rupees 54,810/-
3. The partial replacement of 15% bamboo chips for coarse aggregates shows greater strength than other percentages.
4. Bamboo is an efficient alternative material for different types of construction.

Bamboo chips replaced as aggregate to concrete mix

Prepared moulds of concrete mix with partial replacement

Failed cubes after testing

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Failed cylinders after testing

Failed beam after testing

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