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TO STUDY THE EFFECT OF BAMBOO PIECES ON THE PROPERTIES OF PAVEMENT QUALITY CONCRETE BY PARTIAL REPLCMENT OF COARSE AGGREGATES

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ABSTRACT
Pavement is usually defined as a structure consisting of layers and their key purpose is to share out the applied load to the sub grade. Rigid pavements have usually three layers namely sub grade, base layer and top most layers known as concrete slab. This concrete slab should be of above M35 grade of concrete as per IS recommendations. The most common size of coarse aggregates to be used in the rigid pavements should be of 20 mm and fine aggregates should be of zone II. As for as flexible pavements are concerned concrete pavements are more durable, while requiring a lesser amount of preservation and having longer life. This report discusses about the settlement of rigid pavements utilizing bamboo pieces. The study aims to examine the practicability of using bamboo pieces in pavement quality concrete with 0.38 water/binder ratios. This report presents the detailed amount of bamboo pieces used ranging from 0 to 1.5% with a variation of 0.5% on trial basis.
Adding bamboo pieces up to 0.5% the compressive strength gets increased and beyond 0.5% of bamboo pieces' addition the strength starts decreasing and as we keep on mounting the bamboo pieces percentage up to 1.5% the flexural strength also rises.

Keywords: pavement, durable, bamboo pieces, admixtures, permeability, strength.

INTRODUCTION
1.1 GENERAL
Pavement is usually defined as an arrangement of layers and their prime function is to distribute the practical load to the sub grade. Rigid pavements have usually three layers namely sub grade, base layer and top most layers known as concrete slab. This concrete slab should be of above M35 grade of concrete as per IS recommendations and is called as paving quality concrete. Pavements are of two types namely flexible pavements and rigid pavements.

Flexible pavements
Since asphalt has the capability of twisting, deforms a little and returns to its unique position that is why it has got the name "flexible". These pavements are planned for the expected life period of 20 to 30 years and the thickness of flexible pavement is decided on the basis of material used, degree, and number of repetitions of traffic, environmental conditions and the desired service life of pavements.

Rigid pavements
Rigid pavements also known as concrete pavements are used mostly for constructing major highways and airports. The volume of traffic on these pavements remains high and these pavements are usually designed for high strengths and the grade of concrete should be above M35 only then a designer can achieve the feat of high strength. The following points highlight the assortment of bamboo as reinforcement in concrete structures:
1. The plant should be three years of age at least having brown colour.
2. Culms with largest diameter should be preferred.

1.2 Properties of Bamboo [Priyadarshee et al. (2014)]

1.2.1 Physical Structure of Bamboo

This material has got the resemblance with wood because of its comparable chemical structure. However physical structure separates it from wood. Wood carries grains oriented within the identical direction in the course of the entire arrangement. On the outside periphery of every knot, twigs form special kinds of grass looking leaf structures. Bamboo consists of matching fibres that are armoured along the axial route of the Culm.

1.2.2 Shrinkage and Swelling

Gaining or losing moisture leads to the changes in the dimensions of bamboo. Since bamboo readily takes moisture from the surroundings, for that reason the dampness adjustments with the modifications within the relative wetness and temperature of the encompassing surroundings.

1.2.3 Bending

This factor decides the feasibility of bamboo as a building material, because of the bending skill of bamboo; it is supposed to be the best alternative to the steel in building structures.

1.2.4 Elasticity

Since the bamboo possesses excessive suppleness which makes it a unique construction material for earthquake threatened areas. Any other gain of bamboo is its low weight; it could be lifted and operated with an ease, hence eliminating the use of cranes and other hefty equipments.

OBJECTIVE AND SCOPE

2.1 Objectives

1. The objective of this study is to examine the feasibility of using bamboo pieces in pavement quality concrete and to check the strength of concrete.
2. To see the outcome of mineral admixture on the potency of concrete.
3. To make the concrete economical.
4. To conclude the research in a good manner.

LITERATURE REVIEW

Before starting any project work one is supposed to go through the previous research works so that a basic idea can be achieved regarding the project, for that we need to consult more research papers.

3.1 Workability

Vignesh et al. (2016) Studied about the flexural strength of Steel fibre concrete. It is obvious that using fibres in the concrete leads to the early accomplishments of compressive strength but on the other hand using bamboo pieces in the concrete decreases workability to a greater amount so the use of chemical admixtures is highly recommended.

3.2 Compressive strength

Vignesh et al. (2016) Studied about the experimental study on flexural strength of Steel fibre concrete. As we know that the fibres help to transfer loads at internal micro cracks and we call that fibre reinforced concrete. Using bamboo pieces in concrete leads to early accomplishment of compressive, tensile and flexural strengths of concrete which had been practically investigated. However the research conducted shows that using bamboo pieces in concrete workability decreases to a greater amount which demands a use of chemical admixtures and since bamboo with high amount of sugar (4.92%) having retarding effects on setting and strength developments can only be counteracted by the addition of chemical admixtures.

METHODOLOGY

This chapter draws the basic procedures regarding the study. This chapter basically helps us in getting a proper idea about the research and finally leads us to finish our work. The path followed so as to make this research successful is highlighted below:

1. Studying about pavement quality concrete and its design.
2. Studying of research and review papers to get the basic idea.
3. Collection of all the materials so as to know their properties before starting the work.
4. To prepare the design mix and to get the accurate quantity of materials.
5. To make the perfect use of both the mineral and chemical admixtures.
6. Preparing controlled concrete so as to get the target mean strength.
7. Preparing of concrete to get the required strength as per grade of concrete.
8. Casting of the specimens.
9. Tests on hardened concrete.
10. Analysis and conclusion about the project.

RESULTS AND DISCUSSION

This part of research almost draws the half conclusion on the research as it includes all the test results. The portion includes all the 7 days and 28 days' test results for both the compressive strength and flexural strength and apart from that it includes all the properties of materials used in the project.

5.1 Tests on fresh concrete

5.1.1 Slump test

This test helps us in determining the ease of concrete to flow. To achieve the desired slump value for M40 grade of concrete, different percentages of super plasticizers were used. The amount of chemical admixture should be such that there should not be any effect on the strength of concrete. With the increase in percentage of super plasticizer the workability increases but after exceeding the limit the concrete starts to collapse as a result the strength decreases by a greater amount. Initially before directly using certain percentage of super plasticizer to get the required slump value it takes too many trials to achieve the feat. Before starting the project work the slump of controlled concrete was checked and different percentages of super plasticizers were used and the super plasticizer used was Aura mix 400. After getting the slump for controlled concrete the specimens were casted and tested after respective days of curing. Now, problem that usually arises while using bamboo pieces in concrete is that the workability of concrete decreases and for that high range water reducers are used, so the super plasticizer used earlier got replaced by Poly carboxylic ether and after taking too many trials on Poly carboxylic ether the suitable one was using 0.6% and there was no effect on the strength parameters.

5.2 Mechanical properties

5.2.1 Compressive strength test

To check the required potency for M40 grade of concrete cubes of size 150mm*150mm*150mm have been casted and were kept in curing tanks for 7 days and 28 days of age. To check the strength an average of three cubes were taken. Three different percentages of bamboo pieces were taken and results were compared with the controlled concrete. A total of 24 specimens were casted out of which 12 specimens were casted for 7 days of curing and remaining 12 specimens were casted for 28 days of curing. After testing the specimens the test results showed that with the increase in bamboo pieces percentage up to 0.5% the strength keeps on increasing but after increasing the percentage of bamboo pieces beyond 0.5% the strength starts decreasing.

DISCUSSION

As we noticed that with the rise in proportion of bamboo pieces up to 0.5% the strength keeps on increasing compared to that of controlled concrete but after the further adding up of bamboo pieces to the concrete the strength gets decreased, it is because, since the dimensions of the specimens are lesser to accommodate the extra bamboo pieces and restricts the bamboo pieces from spreading uniformly which then forms clumps and is not allowing the aggregates to make a proper bond in between.

4.4.2 Flexural strength test

To check the bending ability of beams usually flexural strength test machine is used but here slabs were casted so the flexural strength was checked on universal test machine using three point loading. A total of two supports were provided and a point load was applied on the slab apart from this two strain gauges were fixed on the opposite corners of slab and moreover slabs were kept diagonally on the supports. The two strain gauges providing the deflection and the two supports provided help the slab in bending. The dimensions of the slabs were 600mm*500mm*75mm and total of sixteen slabs were casted for 7 days and 28 days of curing including four extra slabs with steel reinforcement, the test results showed that with the enhance in bamboo pieces percentage up to 1.5 % the flexural strength keeps on increasing and after that the results were compared with the steel reinforced slabs.

DISCUSSION

As the compressive strength decreases with the increase in bamboo pieces percentage the reason being lesser dimensions of the specimens which is not allowing the extra fibre to get mixed properly along with the other materials present in the mix, but in case of slabs the flexural strength keeps on increasing with the increase in bamboo pieces percentage. Since the dimensions of the slabs are larger it helps the bamboo pieces in spreading uniformly and the fibre gets a chance of forming a proper bond in between the aggregates as a result it increases the bending ability of specimens.

Figure 4.5: 7 and 28 days flexural strength results

Table 5.7: Average 7 days and 28 days flexural strength of slabs with steel reinforcement

Size of the specimens = 600mm*500mm*75mm,Minimum area = 0.12% of b*d Dia. Of bars = 8mm								
Age of days	Gauge A		Gauge B		Time (min)	Load KN	Displacement (mm)	Flexural strength N/mm^2
	Initial	Final	Initial	Final				
7 days	0	0.8mm	0	0.6mm	3	65	0.1	1.73
28 days	0	0.4mm	0	0.1mm	13	96	0.1	2.56

Table 4.8: Durability test results for compressive strength.

Percentage of bamboo pieces	28 days compressive strength of normal water curing (N/mm^2)	28 days compressive strength of sodium hydroxide solution based water (N/mm^2).	28 days compressive strength of sodium hydroxide solution based water (N/mm^2).	56 days compressive strength of sodium hydroxide solution based water (N/mm^2).	56 days compressive strength of normal water curing (N/mm^2).
0%		40.08			
0.5 %	42.75		(880/150*150)*1000 = 39.1	36.08	44.2

CONCLUSION

- After designing the proper mix for M40 grade of concrete, the percentage of super plasticizer fixed to get the required slump for controlled concrete was changed as the bamboo pieces was added to the concrete. Since the bamboo pieces absorbs too much moisture and for high grades of concrete like M40 we are supposed to reduce the quantity of water to get the desired strength so adding bamboo pieces to the concrete decreases the workability. To make the concrete workable the percentage of super plasticizer was increased. So with the increasing bamboo pieces percentage the slump value decreases but lies within the range.
- To get the required 28 days strength for M40 grade of concrete it usually takes too many trials to achieve the feat. Initially the strength of controlled concrete was achieved after almost taking 6 trials, but the target was getting the strength of bamboo pieces reinforced concrete. Since the bamboo pieces absorbs moisture

that makes concrete more permeable this in turn decreases the strength so the use of mineral admixture is recommended. Using 0.6% of poly carboxylic ether and 3% of silica fume the compressive strength for both the controlled and silica fume based concrete is satisfied.

- Since the dimensions of cubes are lesser this does not allow extra quantity of bamboo pieces to get mixed properly so the strength decreases after increasing the percentage of bamboo pieces. That is why earlier accomplishment of strengths was seen with the increase in bamboo pieces percentage up to 0.5%.
- Beyond 0.5% of bamboo pieces the strength started decreasing as the extra bamboo pieces could not make the proper bond in between the aggregates.
- As we keep on increasing the percentage of fibre the flexural strength keeps on increasing and the chances of resisting bending also increases. This is due to the reason that the dimensions of slabs are larger which helps the bamboo pieces in spreading uniformly and the bamboo pieces gets a chance of forming a proper bond in between the aggregates as a result it increases the bending ability of specimens.
- Up to 1.5% of bamboo pieces addition the flexural strength gets close to that of steel with the minimum reinforcement of 0.12% of b*d and of dia. 8mm.

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REFERENCES

1. Agarwal, A., and Maity, D., (2011) “Experimental Investigation On Behaviour Of Bamboo Reinforced Concrete Members”. 16th International Conference on Composite Structures ICCS 16.De Souza Neto, E. A.; Peric, D.; Owen, D. R. I. 2008.
2. Amada, S., and Untao, S., (2001) “Fracture Properties of Bamboo” composite part B, vol. 32 , pp 451-459.
3. Achilleos, Constantia, et al. "Proportioning of steel fibre reinforced concrete mixes for pavement construction and their impact on environment and cost."Sustainability 3.7 (2011): 965-983.
4. K. Ghavami, “Ultimate Load Behavior of Bamboo-Reinforced Lightweight Concrete Beams, ” Cement & Concrete Composites, Vol.17, pp 281-288, 1995.

DECLARATION

I therefore proclaim that the proposal titled **"TO STUDY THE EFFECT OF BAMBOO PIECES ON THE PROPERTIES OF PAVEMENT QUALITY CONCRETE BY PARTIAL REPLACEMENT OF CORASE AGGREGATES "** is a record of work completed by **SUHAIL GOWHER KHANDAY** bearing Rollno.**19M-CE-1169** in complete satisfaction of the necessity for the level of Masters of Technology in Civil Engineering with specialization in **Highway and Transportation Engineering,** Department of Civil Engineering, Rimt University,Sirhind punjab, India. I have delighted every one of the necessities for the accommodation of this venture report, which nearly has added a decent standard as far as anyone is concerned. This report has not been submitted somewhere else for the honour of some other degree

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