An Experimental Project On 100 % Replacement of Steel Reinforcement with Bamboo

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Abstract *:- Bamboo strengthened cement is a composite material comprising of concrete, sand, total, water and bamboo. Right now, bamboo sticks are circulated all through the solid. The social proficiency of this composite material is extremely better than that of fortified concrete and numerous other development materials of equivalent expense. Because of this advantage, the utilization of BRC has expanded during the most recent 10 years and its present field of use incorporates: safe and light weight structures, and so on.*

Concrete has found to have phenomenal compressive quality however poor in elasticity, to deal with the ductile anxieties steel is ordinarily utilized as fortifying material in concrete. Creation of steel is an exorbitant business and its utilization in concrete as strengthening material expands the expense of development by numerous folds. Likewise, creation of steel discharges a lot of ozone depleting substances causing impressive crumbling of the earth. It is here that built bamboo can be of extraordinary incentive to Civil Engineers owning to its few net commendable highlights.

Utilization of bamboo as a reinforcing material in solid development and its broad use in the substitution with steel as support in solid burden bearing individuals. . Study results will be utilized for the finding of a technique for the substitution of bamboo as reinforcing material in the perfect sum and the right extent and the most ideal situation instead of steel as well as with steel

Introduction :-

Bamboo has wide use since old occasions as ease material for lodging and bridges. In current days it is utilized as planning material for ground surface and rooftop and panels. Bamboo is inexhaustible and adaptable asset portrayed by high quality and low weight. It is assessed that there are 1200 species developing in 14.5 million hectors areas. Bamboo is world quickest developing woody plant, it is a 4.5 to 40 cm daily.

Concrete cement has been concentrated widely by the national and worldwide establishments. Bamboo has been utilized as a structure material all around by the human progress since an exceptionally extensive stretch of time however after the examination, its utilization as support has increased little consideration.

Problem Identification:-

Before selection of this topic we have finalized 4 topics I.e. use of plastic as a soil stabilizer, low cost roofing tiles, analysis of seismic load on building, Rain water harvesting. But these 4 topics covers single topics but our bamboo topic covers 2-3 points.

Scope of work:-

The scope of work is for buildings beam, column, slab this work consists of preparing concrete with using bamboo sticks to achieve nearly equal strength as steel. To minimization of cost and time of the construction of buildings. To increase knowledge about designing method by using bamboo.

Concept of BRC:-

Bamboo as reinforcements in Portland or other concrete. Bamboo was given recent consideration for use as reinforcements in soil-cement pavement slabs in which the slab behave inelastically even under the light loads. Bamboo structure is more durable and more usable in terms of building material. Bamboo abundantly available in large yield at low for more economical

Need of Study

For constructing structures which are light weight we want to achieve nearly equal strength of steel reinforcement. So it comes with the effort of designing of reinforcement, placing of reinforcement and many other things. So we can reduce the

quantity of reinforcement with using of bamboo reinforced concrete. But in India BRC is not commonly used product or some people are don't know about the concept therefore we want to study on this topic

Benefits of BRC

1. To reduce the green house gases immission.
2. Achieve good fire resistance.
3. To reduce cost of construction.
4. Reduce steel reinforcement requirements.

Experimental Setup

We have done an experimental study on the Steel reinforced concrete with bamboo reinforced concrete. Here we replace the steel by bamboo as reinforcement in concrete. Thus it reveals about the strength of bamboo reinforced concrete.

Material Collection

Materials were collected for both Steel Reinforced and Bamboo Reinforced concrete. Materials needed for Reinforcement cement concrete are cement, fine aggregate, coarse aggregate, steel rod, bamboo and water.

1. Cement:-

Cement is one of the binding material in the construction work. In this project we used 53 grade Ordinary Portland Cement (OPC) From the IS: 8112 – 1989

2. Natural Course Aggregate. :-

It is most important construction material in the concrete which interconnect to each other. The aggregate which retains on the 4.75 mm sieve is known as Natural Course Aggregate.

3. Crushed Sand : *-*

The aggregate which is passes through the 4.75 mm sieve it is called as fine aggregate.

4. Water:-

Water is an important ingredient of concrete as it actively participates in the chemical reaction with cement. Since it helps to form the strength giving cement gel, the quantity and quality of water is required to be looked into very carefully.

5. Steel:

Steel is a combination of iron with commonly a couple of percent of carbon to improve its strength and break opposition contrasted with iron. Numerous other extra components might be available or included. Hardened steels that are consumption and oxidation safe need ordinarily an extra 11% chromium.

6. Bamboo:

Bamboos are evergreen perpetual blossoming plants in the subfamily Bambusoideae of the grass family Poaceae. The root of "bamboo" is questionable, however it most likely originates from the Dutch or Portuguese language, which initially obtained it from Malay or Kannada.

Preparing concrete mix design:

Preparation of concrete mix design, we decide to use or make M-20 grade concrete using 20 mm size aggregate and using crushed sand. With referring IS 456-2000 we made the concrete mix design for M-20 grade concrete having proportion ***1:1.5:3****which is having W/C ratio 0.50. With respect to calculated concrete mix design that we decide to cast 6 beam, 3 beams for 7 days and other is for 28 days.*

Methodology 1

We decide to add 4 nos. of 25mm width bamboo sticks as main bars. And W/C ration of 0.50. In this methodology we decide to add the stirrups of 20 mm thickness.

1. *First we take the amount of required water for concreting as per 0.50 W/C ration then make bamboo reinforcement of required dimension.*
2. *Then add water in 2 to 3 parts in the concrete mix.*
3. *Then add all water and mix it well.*
4. *After mixing it and tamp it well till the concrete get spread overall in beam mold.*
5. *Prepare all 6 beams.*

Fig: Bamboo Reinforcement

Fig: Oiled Mould

Fig: After Casting of BRC

Difficulties in Methodology 1:

A. *While making bamboo reinforcement it is very difficult to attach bamboo to each other using steel binding wires.*
B. *It is hard to connect bamboo strongly.*
C. *While pouring the concrete in mold it is very difficult to spread and tamp the concert overall the mold.*

Testing

Due to replacement of steel into bamboo for the purpose we have comparative of those two material test like Tensile, Double Shear and Flexural Strength.

a)Tensile Test

Tensile test of bamboo is carried for to find the Limit of proportionality, Yield strength, Young's modulus of elasticity and elongation in the rod steel, as the test is used for the bamboo for reinforcement.

Table 1: Tensile Strength of Specimen

Sl. No	*Specimen Type*	*Breaking Load in KN*	*Tensile Stress in N/mm2*
1	*Steel*	*57.35*	*507.08*
2	*Bamboo*	*29.76*	*266.5*

b) Flexural Strength

All the beams are tested into Flexural Strength by the Universal testing machine with a capacity of 1000KN. The beams where supported by Simply Supported over a span of 700mm.

Fig: Testing on UTM

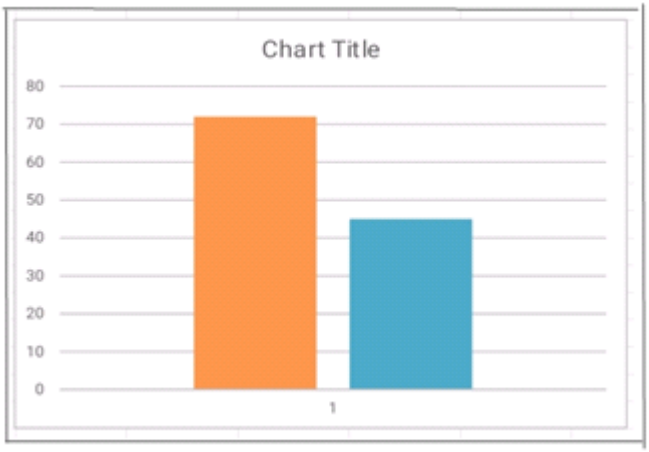
The load application continued until the deflection became excessive and readings were noted at first crack point and the ultimate load. While testing it was noted that Bamboo reinforced beams produced initial cracks without any cracking noise and their crack widths were small when compared to the steel reinforced beams.

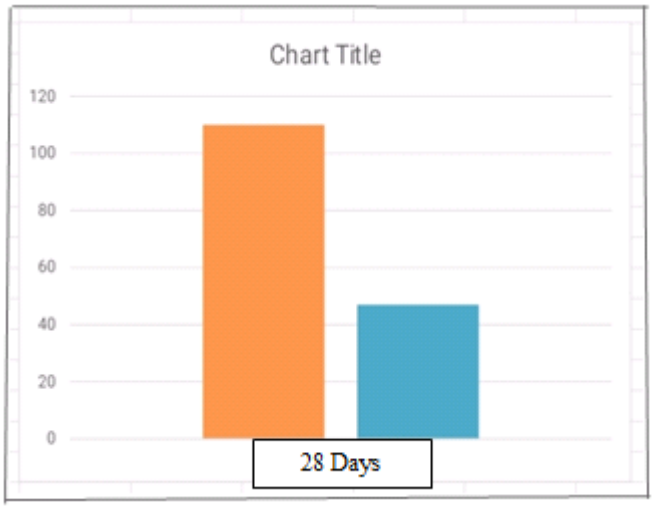
Table 2: Crack Load for 7 Days

Sl. No	Specimen Type	Identification Mark	Breaking Load in KN	Average in KN
1.	Steel Reinforced Beam	B1. 1	73	
		B1. 2	68	72
		B1. 3	72	
2.	Bamboo Reinforced Beam	B2. 1	47	
		B2. 2	45	44
		B2. 3	42	

Table 3: Crack Load for 28 Days

Sl. No	Specimen Type	Identification Mark	Breaking Load in KN	Average in KN
1.	Steel Reinforced Beam	B1. 1	108	
		B1. 2	106	109
		B1. 3	109	
2.	Bamboo Reinforced Beam	B2. 1	45	
		B2. 2	47	45
		B2. 3	43	





Results and discussion

As per the test results, it is inferred that

Compared to steel, tensile results were equal for bamboo (almost 99%).

Bamboo reinforced concrete has attained flexural strength almost on par with steel reinforced concrete.

When compared to steel, bamboo had high flexibility in nature and it deflection more.

Conclusion

Bamboo, on using as reinforcement in concrete deflects more due to low density; but 100 % replacement does not attain enough flexural strength.

Hence it cannot be used in important member in structure but taking less load such as roof it can be used. Slabs of parking area, public toilets, watchman cabins and sunshades.

It also helps in cost effectiveness and reduces environmental effects that are cost by steel production.

References

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