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A Comparative Performance Study on Bamboo Reinforced Concrete Slab

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Abstract

The most important intend of this work is to evaluate Epoxy resin-coated Bamboo sticks to conventional reinforcement. In process of steel, manufacturing will make more environmental impacts. To reduce the use of steel in construction this project concentrate on the alternate of steel reinforcement to bamboo reinforcement. Even improve the tensile of concrete the bamboo fibers also added in concrete with manifold bamboo string, since of its low down cost, and mass. From this project work, three bamboo reinforced polymers merged are arranged with the make use of epoxy and durable. In the experimental outcome, it was discovered by bamboo combinations comprise elevated yielding potency amongst others. Concurrently the straps of bamboo resistant in cement concrete slabs as an alternative to steel rods through usual dimension. Steel bar resistant Slab of 2mx2m be somewhat high when compared to bamboo reinforcement. At the equivalent point in deflection time of mutually slabs are the similar at 45.8 KN load. Therefore the bamboo strap reinforcement is an acceptable alternative for Slab.

Keywords: conventional reinforcement, polymers, bamboo strap

Preface

Usually, steel bar is old to concrete reinforcement. Steel bar has many demerits resembling its rust, far above the ground rate, and also the manufacture of steel go-ahead to liberate CO2 in the environment. At present, steel manufacturing is amid the three major creators of carbon dioxide, even as the manufacturing is producing more solid waste. Industries of various productions processes which inequity the ecology and a source of unfavorable circumstances like changes of climate, global warming, earthquake, tsunami, etc. This examination has an advance to decrease the carbon footprint in the construction field from steel and cement manufacturing the production of 1 ton of steel will make the emission of around 2 tonnes of carbon dioxide. (Suresh et al., 2008) in their research, they concluded the footprint in an atmosphere the earth's warmth is rising every year. The same condition is sustained, subsequently, it will origin to the critical environment for humans and all other living organisms on earth, and sustainability of existence will be a question. Consequently present is a required to cover an alternate and eco-friendly material in construction that will not harm the ambiance and which can make a reimbursement towards sustainable development. Bamboo is one such material employing bamboo as reinforcement the strength and recital of construction resolution are comparable to steel reinforced concrete (Ajinkya et al., 2013). Other than the previous to employing bamboo as reinforcement it must be suitably chosen, weathered, and treated with epoxy resin to attain the most excellent results, create sociable with concrete, and rise over several drawbacks (Anurag et al., 2018).

Preparation Of Specimens

With the purpose of comparison of steel and bamboo reinforcement, two different slabs were cast and determined the strength using various experimental test

Reinforcement of Slab by a steel bar

Using 8mm diameter bars for the slab reinforcement with the center to center span of 150mm on both sides. Reinforcement details have shown in fig 1

Fig 1: Steel Bar Reinforcement For Slab

Bamboo Strips Reinforcement

After seasoning of bamboo was converted like straight strips and it is connected like steel reinforcement which one mentioned above with the closer spacing of 50mm center to center each side. To improve the durability of bamboo is coated with synthetic resin. The details of bamboo reinforcement have shown in fig 2.

Fig 2: Bamboo Strips Reinforcement for Slab

3.1 Sem Analysıs Of Normal Bamboo And Epoxy Coated Bamboo

The normal bamboo surfaces are micro-level cracks and honeycombs are present and also the surface has more smooth as found by Scanning electron microscopy (SEM) is shown in fig3.

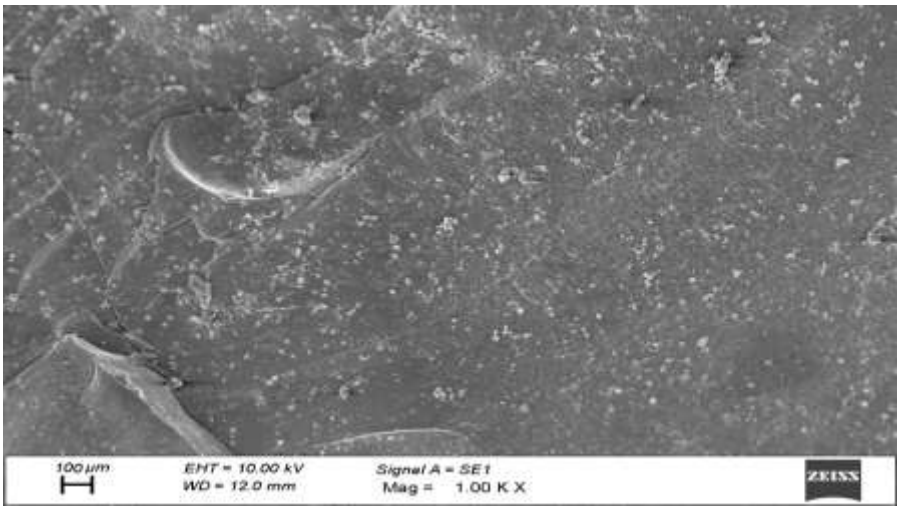

Fig 3. SEM image of Normal Bamboo

After epoxy coated and sprayed Msand to control the micro cracks and to create roughness of the bamboo surface is shown fig 4.

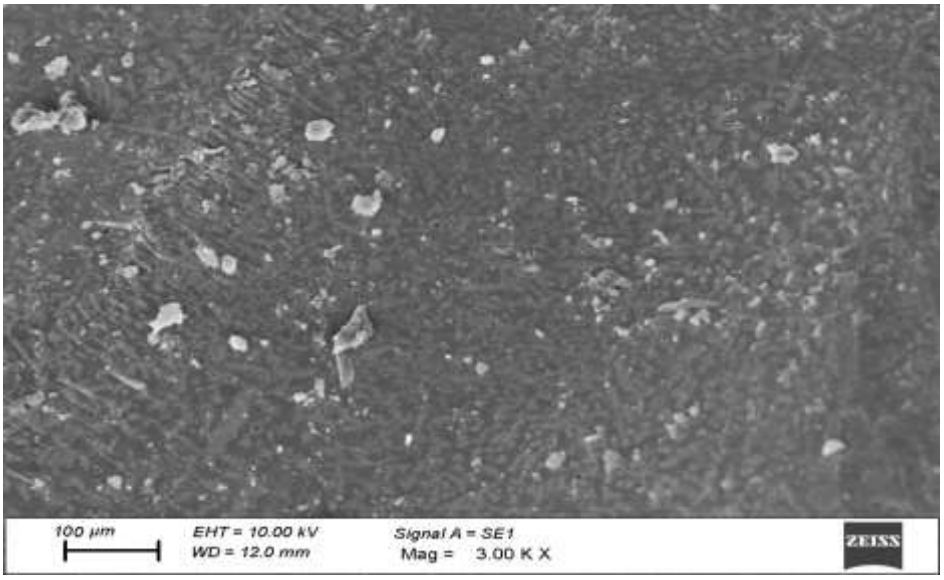

Fig 4. SEM image of Epoxy Coated Bamboo

3.1 Slab Panel

Research about Concrete adding together: total amount of cement and Msand necessary also unite the Msand along with cement equally awaiting the combine has a matched color.with a void inside the center, regularly include modest water annulled, along with humidify fraction of the combine adding up trivial water with self-effacing till the absolute wet combine, in non-natural consistency. The mixture is supposed to have a stiff, stage manifestation and in addition, it is supposed to take a seat on a trowel. Later than actual integration, the Steel bar & bamboo strap reinforced mat is positioned 20mm in excess of beginning the features of the concrete base plane. subsequent to insertion with concrete combination 1: 2: 4 (Cement: Msand: Aggregate) be a supplementary in the

direction of the reinforced mat along with the concrete is powerfully force to tauten the CA (Course Aggregate).

Following by settle present, a compound effect sandwiched among these two component consequences within the surroundings and progressive consolidate in concrete as in Figure 3. designed for receiving the strongest probable concrete, curing for 28 days.

Bamboo sticks of 20 mm width and 10mm thickness were worn as reinforcement in concrete. Bamboo sticks were originally encrusted through Epoxy resin to build water resistance. Then sand-blasting was finished on Epoxy resin-coated sticks utilizing M-sand granule fleeting all the way through 4.75 mm Indian Standard through a sieve and keep hold off in 2.36 mm Indian Standard sieve, in tidy to include improved acquaintance among bamboo sticks and the neighboring concrete. Then the seasoned sticks are reserved in the atmosphere for drying up to 48 hours earlier than employing as bamboo reinforcement in concrete. The belongings to the straps bamboo are prearranged in Table 2.

Sticks are spread at an equivalent spacing of 100mm in both directions. Demonstrate the characteristic understanding of bamboo sticks.

Table 2 bamboo straps Properties

Bamboo Properties	Mean value	Standard deviation
Ultimate tensile strength	130MPa	29 MPa
Compressive strength	42MPa	6 MPa
Modulus of elasticity	7.26 x10^4 MPa	0.26 x10^4 MPa

Cost Analysis

The two-layer of bamboo mat with 100mm both side spacings was adopted. Steel bar 8mm diameter bar with the spacing of 150mm was adopted. A comparative cost analysis of steel bar and bamboo sticks is given below table3 and 4.

Table 3 Rate of steel bar for 2mX2m slab panel

S.No	Weight of steel bar for slab (m)	Weight of steel in kg	Rate of Steel bar in Rs	No of Bars	Total cost (Rs)
1	2m of the X direction	0.78kg	46.8	14	655.20
2	2m of the Y direction	0.78 kg	46.8	14	655.20
Total (Rs)					1310.40

Table 3 Rate of the Bamboo bar for 2mX2m slab panel

S.No	Weight of Bamboo bar for slab (m)	Weight of bamboo stick in kg	Rate of Steel bar in Rs	No of Bars	Total cost (Rs)
1	2m of X direction	0.28kg	16.85	20	337.00
2	2m of Y direction	0.28 kg	16.85	20	337.00

Total (Rs)	674.00

Result and Discussion

The three diverse samples are experienced in the testing apparatus and to find the tensile potency. The bamboo reinforcement strength assessment quantity is shown in fig 3.

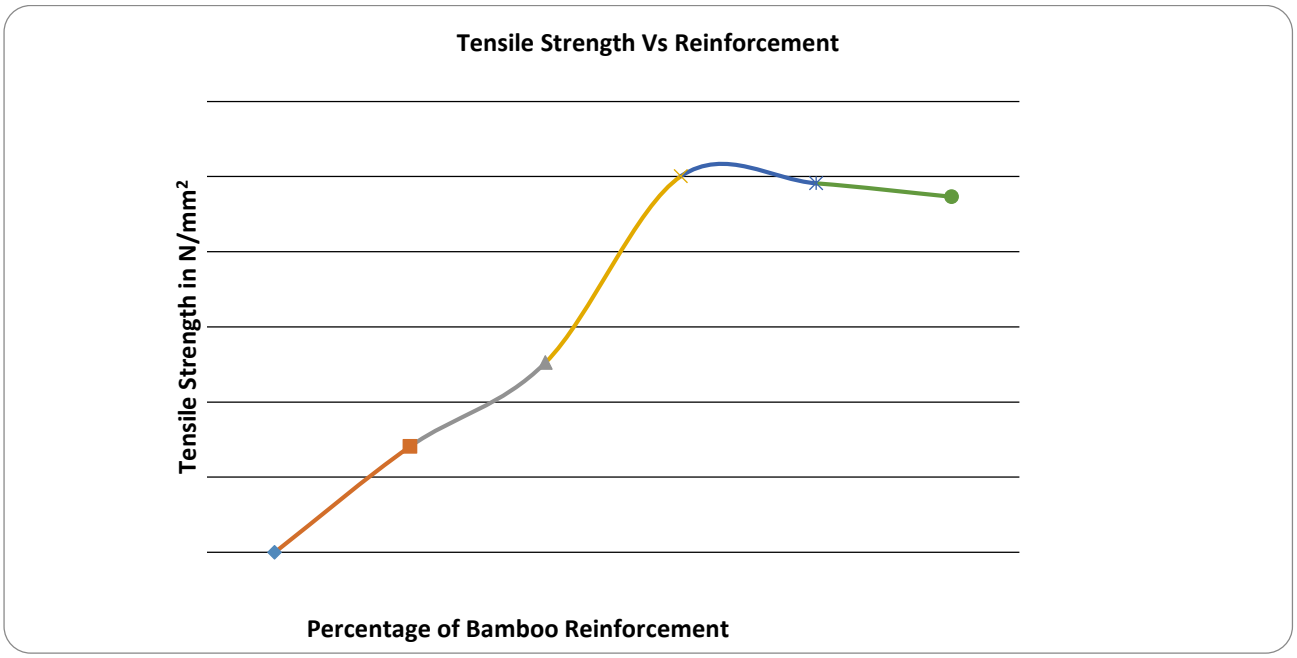

Figure 5 Tensile strength of different composition

Concurrently the experiment of compressive be completed to the bamboo plus steel toughened slabs through exhausting a compressive machine. from morals of the load and deflection endure ability established and exposed in Figure 4.

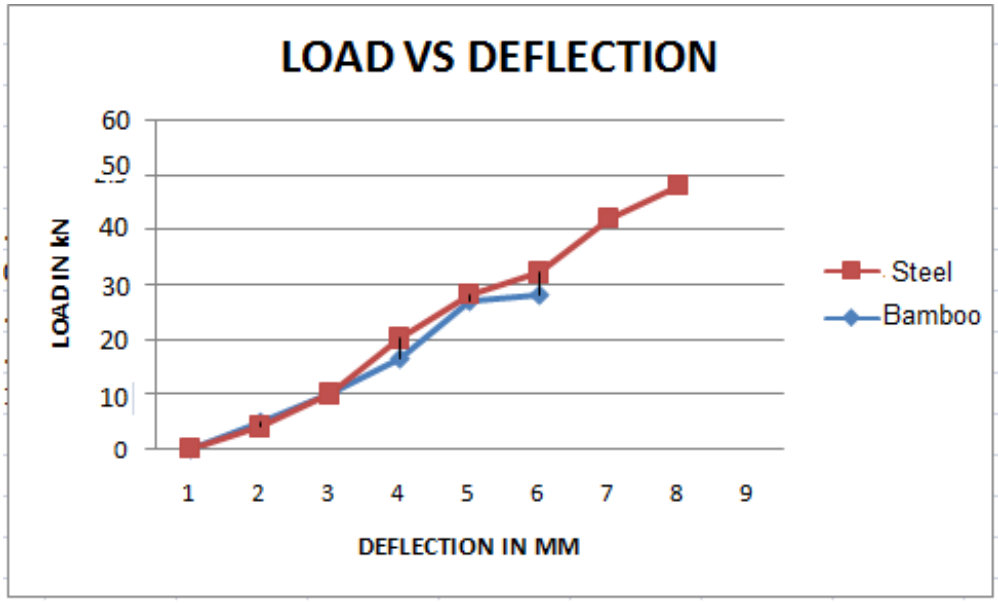

Fig 4. Deflection of bamboo and steel bar reinforced slab

According to imposed test results, the steel-reinforced slab can carry a maximum 25 kN load at the center and failure occur at 1.9 mm deflection at the center of the slab specimen. But for the same

condition when the slab was reinforced with two layers of bamboo mat reinforcements it got 12% more strength and failure occur at deflection of 3.5 mm. When using three bamboo reinforcements, it got 80% more strength. It is previously studied that cost of the bamboo reinforced slab is relatively low as per strength requirements with comparing plain cement concrete beam with small span. Steel reinforced concrete slab is superior to others in terms of strength but, when low cost and low self-weight construction are needed, it reminds bamboo reinforced construction. The failure mode of specimens is shown in Figure 5 and figure 6.

Fig 5. Pattern of crack in Steel Reinforced concrete slab

Fig 6. Pattern of crack in Bamboo Reinforced concrete slab

Conclusion

- Accordingly, bamboo is capable of potential substitution of reinforced steel bar in the current trade construction.
- The influence tensile of bamboo straps is comparatively elevated to create bamboo straps is a smart substitute in tensile consignment submission. The strap reinforced slab (44KN) has taken away weight resist capability compare to the steel bar used concrete slab (62KN).
- Strap reinforced concrete slab is also a low-cost construction one it is around 54% less compared to steel reinforcement.

Next to the identical moment of deflection of the mutual slabs are simply equivalent at 45.8 KN load.

Therefore steel reinforcement is a substitute employing bamboo for nominal structural purposes.

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