



“Bamboo as Green Alternative to Steel for Reinforced Concrete Elements of Low Cost Construction”

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Abstract: The following project report could be a theoretical demonstration of the great use of bamboo as a reinforcing material in concrete construction and its intensive use within the substitution with steel as reinforcement in concrete load bearing members. The report has been derived with the assistance of conclusions and results of the previous reports of varied conducted experiments for crucial the mechanical properties of bamboo and its use as a cloth in construction. The development principles concerned within the coming up with of bamboo bolstered members and structures has been mentioned during this document, the utilization of bamboo within the place of steel as a full yet like steel is shown to confirm the weight reduction, economic blessings with its strength compromised to a small and safe level. Varies researches and study results are used for the deduction of a way best suited for the replacement of bamboo as reinforcing material within the correct quantity and also the right proportion and also the very best placement in situ of steel and or with steel. A way that will not compromise with the issue of safety of the structure needs to be shown within the report.

I. INTRODUCTION

The use of bamboo as reinforcement in cement concrete has been studied. Extensively by the Clemson Agricultural school. Bamboo has been used as a building Material globally by the human civilization since a long amount of your time however once the Clemson’s study, its use as reinforcement has gained very little attention. A study of the feasibility of victimization bamboo because the reinforcing material informed concrete components was conducted at the U. S. technologist Waterways Experiment Station in 1964. Final strength style procedures changed to require into consideration the characteristics of the bamboo reinforcement were accustomed estimate the last word load-carrying capability of the formed concrete components with bamboo reinforcing. This study has been taken as a reference within the study conducted hence forward. The investigation of the employment of bamboo as a complementary material with steel in RCC construction has been shown during this study with the economy, safety, convenience, and sturdiness of application of the actual plan. Since the employment of bamboo in times of yore for housing functions, it’s been decreasing in our world within the kind of artifact despite its wealthy properties, strength, and economical benefits. There are many ways bestowed and deduced by universities and also the U.S navy and has verified the validity of the employment of bamboo in structural members like columns and girders. Thus during this report, the ways are bestowed by the members of this cluster for the higher strength and a lot of applicable ways with the smallest amount compromise in strength. Ways that are place forth during this report don’t seem to be sure to have the simplest outcomes or with any assurance of the most strength of a structure, the styles being bestowed are those that are tested on software system simulation for safe operating load and failure analysis. This might be terribly useful and have an smart breakthrough within the field of concrete coming up with outstanding economical advantages over steel (being used with it) and its Benefits associated with the reduction of carbon emission within the atmosphere, if ways like these are applied extensively and studies for the event of a code referring to concrete design with bamboo reinforcements are brought forward for a higher future of economical and eco-friendly RCC construction.

II. METHODOLOGY

Bamboo reinforcement concrete construction follows the same style, combine with proportions and construction techniques as used for steel bolster. Simply steel reinforcement is replaced with bamboo reinforcement. Properties of bamboo reinforcement, combine the proportion of concrete, style, and construction technique with bamboo ferroconcrete is mentioned during this article. Nature’s material, bamboo has been widely used for several functions. In the main as a strength-bearing material. It’s used for building shelters from Associate in a Nursing earlier time. Bamboo has used for system works, formwork supporting stands, and plenty of in-building construction works. These area units are restricted to medium-large comes. Although existence of bamboo has been found for centuries, bamboo as a reinforcement material



is an Associate in nursing innovation within the engineering science construction field. This innovation was supported Clemson's study that has been conducted within the Clemson Agricultural School. Bamboo may be perishable and renewable in nature. It's energy economical because it is of natural origin and environmentally property in nature. These properties have been forced to use this within the construction field for hundreds of years Steel as a reinforcing material may be a demand that's increasing day by day in most developing countries. There are things once the assembly isn't found enough to face the steel demand. Therefore it's essential to possess another that's price compared to steel. Bamboo is found in plethoric, they're resilient and therefore these will face the demand as a reinforcing material and become a perfect replacement for steel. The strength property is that the main demand for a reinforcing material is seen considerable for bamboo, compared with different materials together with steel. The structure of bamboo from its origin offers this property. The hollow tabular structure has high resistance against wind forces once it's in natural environs. Functioning on the weak points of bamboo Associate in nursing citing an innovation of bamboo as a steel replacement would be an excellent different.

III. LITERATURE SURVEY

GENERAL STUDY

Building with bamboo appearance back on associate ancient tradition within the region during which plant grows in abundance, like South America & Africa. Bamboo is one of the oldest construction materials. There have been loads of construction activity within the developing world, especially India & China, for the last one and a decade. Though in some way the visible construction industry is one of the foremost polluting industries within the world. Production of each concrete and steel causes substantial deterioration of atmosphere. "BAMBOO AS inexperienced various TO CONCRETE AND STEEL FOR MODERN STRUCTURES" BY- Suresh Bhalla (International Organisation of Environmental analysis, Goa, 18-20 Dec. 2008). Despite the long tradition of building with bamboo, the fabric isn't used oftentimes in trendy building construction. Bamboo may be an ideal various for steel within the gift and also the future, because it possesses all the desired mechanical properties, and might dead replace steel, counting on the situation and also the application.

ANALYTICAL STUDIES AND ANALYSIS

Tjerk Reijenga "Role of bamboo in inexperienced Building design". During this project we tend to area unit comparing steel reinforcement with bamboo reinforcement, its structural price and techniques of replacement of steel with bamboo whereas reinforcing. U.S. armed service technology Laboratory (1966) reportable a study providing a set of directions on a way to properly construct a range of structures victimization Bamboo. It was counseled within the report that the number of Bamboo reinforcement in concrete be 3 to 4-dimensional of the concrete's cross-sectional space because of the optimum quantity. Mardjono (1998) provided analysis with the trouble to allow some style of organization of a system to put together with Bamboo between cultures, species, and countries having varied designs. Janseen (2000) conducted her study on building with Bamboo. It provides calculations to indicate to show why it's economically competitive, mechanical properties, its several uses, its natural sturdiness, and also the preservation of the Bamboo. The America armed service Corps is that the leading institute in analysis for bamboo reinforcement techniques and it's developed some tables and graphs.

III. RESULTS

In this article, the results of all the conducted experiments and STAAD.pro is noncommissioned and mentioned for any analysis of the induction of the hypothesis which can follow for the conclusion of the project. Theoretical results and STAAD.pro results for single members with hundreds imparted upon them noncommissioned with style strategies used parameters and all of the outcomes whether or not appropriate or not for to any extent further style are mentioned.

Theoretical Results

These results show that the realm of bamboo needed is high if the member needs to sustain the masses born by a steel bolstered structure. The instant of resistance for them on an individual basis bolstered beam is a pair of 0.25×10^3 N-m. Following square measure, the results that square measure obtained by all the bamboo bolstered members for the theoretical on the paper style of individual structural members.

1. Most bending moment of bamboo bolstered beam, $M=37962.902$ N-m
2. Maximum shear at the support of bamboo bolstered beam, $V=62.27$ KN
3. Calculate shear of bamboo reinforced beam, $V'=47.151 \times 10^3$ N
4. Style load of on an individual basis bolstered beam= 11.25 KN/m
5. Most bending moment of the on an individual basis bolstered beam, $M=2.025 \times 10^6$ N-m
6. The minimum space of bamboo of the on an individual basis bolstered beam, $AS = 1367.4$ mm²



- 7. Moment of resistance of on an individual basis bolstered beam, M.O.R = 71.29KN-m
- 8. Bending moment thanks to self-weight of a beam in doubly bolstered =16.87 KN-m
- 9. Moment of resistance of doubly bolstered beam, M.O.R = 90.28 KN-m

STAAD.PRO results

All the results obtained by the tests and simulations underneath completely different conditions that were Applied on STAAD.PRO for the planning of the complete structure bolstered with bamboo and Steel along are shown during this article. The members that were tested beforehand and the members substituted within the structure also will be detailed for his or her style results and their several properties allotted. All the masses that are placed on the structure and the individual members that square measure to blame for the displacements, bending moments, and shear reactions have all been shown before severally within the article a pair of.1.2.3. Now the results for the individual members and also the steel bolstered and also the steel and bamboo coupled structures would be delineated. Results for the steel and bamboo coupled bolstered concrete beam is shown as follows:



Figure. Bamboo and steel coupled section of the beam

Shown higher than is that the valid style of a beam bolstered with the coupling of bamboo and steel within the compressive zone of the beam. The planning diagram as shown by STAAD.PRO will depict the no. of bars that square measure employed in the beam and also the spacing that needs to be placed between the bars. Now, the results for the steel bolstered G+2 structure are shown in the form of graphs for specific members.

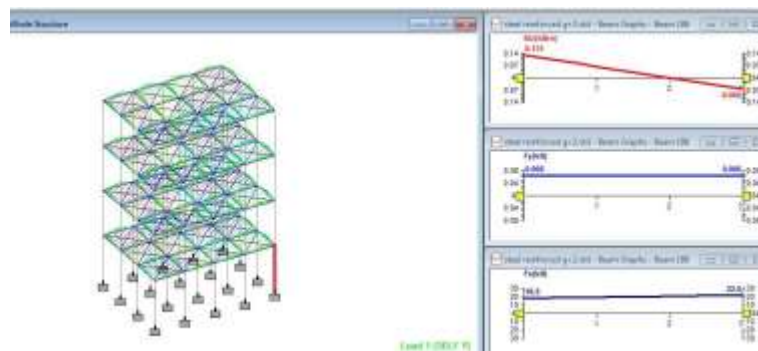


Figure. Graph for lowest column (steel bolstered structure)

Graph result for the identical member is shown below for steel and bamboo coupled reinforcement within the compressive zones of all the members of the structure.

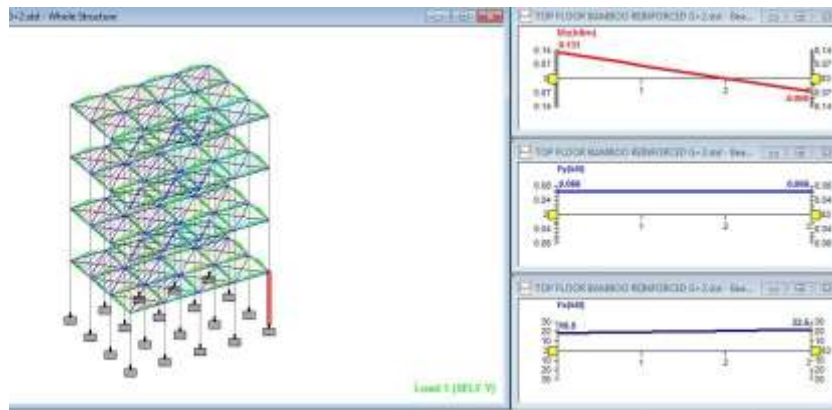


Figure. Graph for lowest column (steel-bamboo bolstered structure)

Graph results for beams for steel bolstered structure and also the bamboo and steel coupled reinforced structure is shown below respectively:

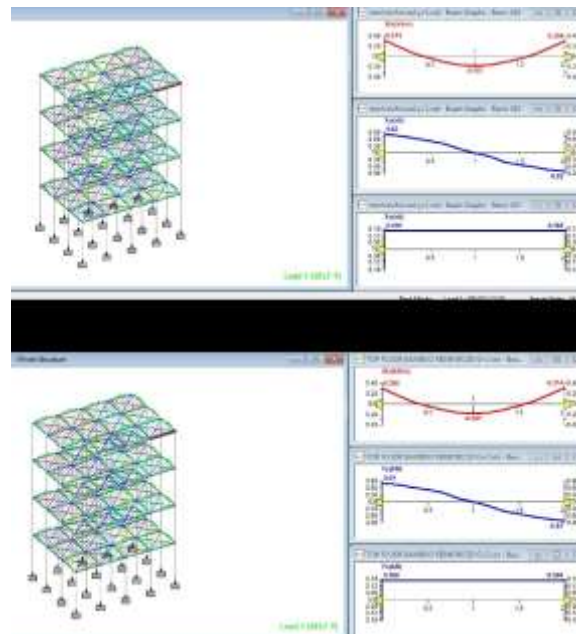


Figure. Graph for roof beam (steel reinforced structure).
Graph result for roof beam (steel-bamboo reinforced structure)

IV. CONCLUSION

Bamboo has been used for many years since the traditional times as an artifact however has gained a lot of attention within the spotlight since the Clemson study. However, there's no such methodology that may be relied upon for the right construction of any structure that's reinforced with bamboo. The property of bamboo is that the reason that it was selected as the material for reinforcing beams and columns. It's a positive certainty that the structural member that has been bolstered with bamboo can lose its strength up to a major limit, so this project report has centered on providing a technique by that steel and bamboo will be used along so the strength of the member and so the structure isn't compromised with observance a discount in self-weight and creating the structure economically. During this report, STAAD.PRO has been used because the machine that was accustomed confirms that the structure is often safe and every one of the members of the structure can pass with a change within the material that's being employed within the reinforcement. Thus it's been concluded that structures are often bolstered with bamboo within the zones wherever compression has to be tackled. Steel and bamboo are used along with where needed and less than twenty-fifth of steel during a member are often replaced whereas within the whole structure, less that 40% ought to get replaced. Bamboo as reinforcement will solely be utilized in structures wherever light masses square measure being imparted. Bamboo may also be used as reinforcing the partition walls, but not like all the load-bearing members, 100 percent of steel are often replaced which can prove to be higher than steel as in unstable proofing and forestall the walls from losing integrity by the nature of its stiffness. The G+2



structure that was used for confirming the validity of the strength of the structure with the modified properties of reinforcement is often used conventionally for the appliance in world structures or the structure bolstered totally with steel are often bolstered with bamboo and diameters of the bars within the zones it's being used are often exaggerated to keep up the strength issue. A discount of 716 kilos was determined when the structure with modified properties was accustomed to reinforce bamboo on paper. The structure bolstered totally with steel needed AN approx. total of Rs.121011 was spent on reinforcement whereas the structure bolstered with bamboo and steel price Rs.65950 for the reinforcement. Within the third structure, a complete of Rs.107877 was spent on the reinforcement and saved an addition of Rs.13134. The results for structure 3 aren't the maximum amount as much as desired by a construction professional but can be of huge application when the construction is on a large scale. Therefore it can be concluded that the method presented in this report has structural applications better than the conventional ones and can be used for all the aspects of Civil Engineering on an advantageous note i.e. economy, safety, and eco-friendly construction. This study can also be used to further amend the statistics for the development of a code reinforcing steel and bamboo together in conventional concrete construction.

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