

Bamboo as Reinforcement in Concrete for Low Cost Housing

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Abstract— This paper presents the disclosures of an assessment concerning the display of bamboo fortified strong shafts in flexure. Bamboo has social, monetary and social significance and is used comprehensively for building materials close by thousands livelihoods. It is significantly versatile rough material for different works. “The bamboo is light weight, versatile, extraordinary, high manageable, unassuming material than the other structure materials like steel.” Bamboo can be used in various structure works. Bamboo structures are versatile, tremor sheltered, light weight and humble. Bamboo can be used as fortress in various helper people. “Bamboo is a green material for acceptable unforeseen development and has diverse central focuses. Usage of bamboo may be progressed for green structures and reasonable unforeseen development.” The improvement business is the essential purchaser of imperativeness and materials in numerous countries.” The “journey for reasonable unforeseen development, defined as progress that tends to the issues of the present without dealing the limit of individuals later on to address their own issues has become a noteworthy issue when endeavoring to address the troubles in giving suitable housing to the routinely extending all out people. To manufacture the proportion of information concerning bamboo a couple of viable investigation programs have been done since 1979 at PUC-Rio and in Brazil. Vegetable fibres can be used either alone or as help in different sorts of systems, for instance, soil and solid composites.

Keywords: Bamboo, Cement, Sand, Water Curing, Lodings

I. INTRODUCTION

In Nigeria, as other making countries and moreover in part in industrialized ones, the housing need issue is expecting growing estimation with consistent addition in the cost of building materials. Particularly impacted is the insignificant exertion dwelling division. Concrete, by and large used for advancement work is weak in pressure anyway strong in pressure. Its inflexibility is about 10% of its compressive quality. Exactly when strong structures are abused manageable nerves, support is given in kind of steel, made and glass fibers to withstand the weights. All things considered, in making countries particularly in Nigeria, steel reinforcement is customarily embedded in concrete to take the malleable tensions which plain concrete is unequipped for confronting. Consistently, the expense of steel has been extending to the Extent that the material isn't, now moderate to individuals in low and medium pay social affairs. Bamboo is a wood-like plant that is a bit of the grass family, containing a round and empty void shoot, or Culm.

This Culm is guaranteed about with a waxy surface, which fights tenacity from getting off. At expands, the Culm has raised edges called center centers, from which branches will branch. The plant grows up from a multitude of underground stems and roots, called rhizomes. A few

creature courses of action can make to a stature of up to 30.5 m, with an estimation as astounding as 305 mm. Bamboo is a brand name resource with quick authenticity. In all honesty, bamboo can have a high movement rate, with unequivocal species growing up to 600 mm for dependably. Regardless, it paying little heed to everything takes four to five years for the bast strands, or indicated wood fibers to make.

A. Bamboo Is An Engineering Material:

In result of the buyers picking industrialized things, among various effects, practices are smothered in natural zones or even in unassuming networks, and maintainable materials are wasted and causing invariable pollution. In this sense, it becomes clear that natural materials satisfy such fundamental essentials, using plant results, for instance, rice husk, coconut fibres, sisal and bamboo and henceforth constraining essentialness use, apportioning non-boundless basic resources, reducing sullyng and keeping up a strong space.

B. Basic Characteristics of Bamboo

Bamboos are goliath grasses and not trees as customarily recognized. They have a spot with the social affair of the Bambusoideae. The bamboo culm, as a rule, is a barrel shaped shell, which is segregated by cross stomachs at the middle focuses. Bamboo shells are orthotropic materials with high gauge toward the path identifying with the fibres and low quality opposite to the fibres only. Bamboo is a composite material containing long and equal cellulose fibres implanted in a ligneous framework. The thickness of the fibres in the cross-region of a bamboo shell shifts along its thickness. This presents an in every practical sense inclination material, advanced by the condition of weight dissipating in its standard condition.

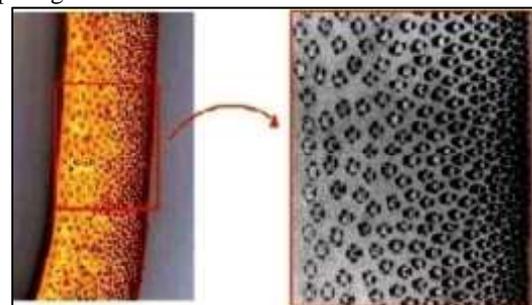


Fig. 1.3.1: Uniform fibers of bamboo

C. Corrosion of Bamboo

The volume of bamboo is extended to retain the water in the Concrete. Likewise, the volume of bamboo psychologists to lose the water as indicated by the drying of cement. Since the shrinkage of bamboo is so bigger than that of cement and its speed is additionally quicker, the bamboo installed in solid will be presented to development and constriction over and again.

D. Physical and Mechanical Properties

The bamboo is made out of various center points having traverse stomach between two centers. The nodal length of bamboo Culm has mannerism in estimation and height bamboo. Bamboo test was assembled from the farm and the estimation study was finished. The culms were separate from base to polish off with numerical in climbing demand. The length of full bamboo was assessed. The length of each center was recorded. The estimations were recorded with least check of 1mm. It is revealed that the length of center is humbler at base and keeps growing at focus bit and again decreases in top part.

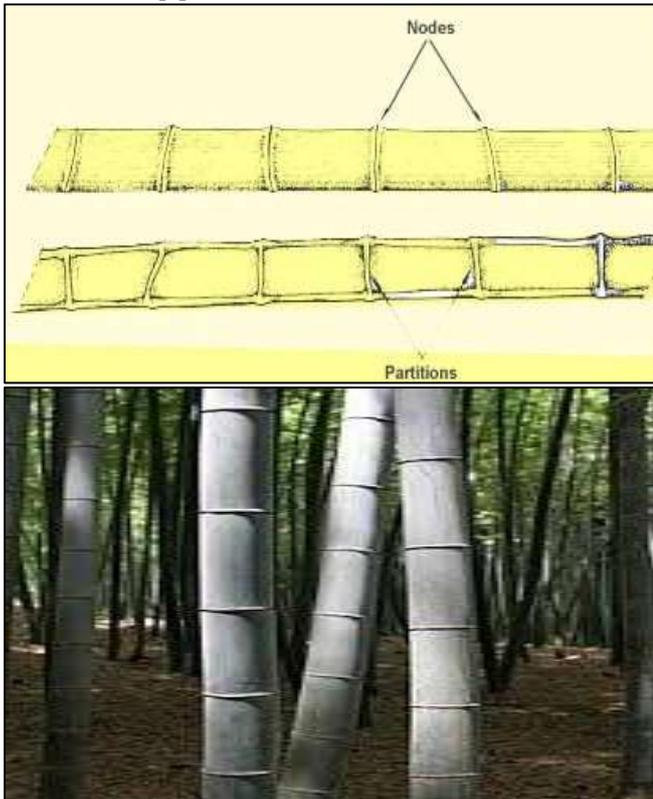


Fig. 1.5.1: Internal portions and nodes of bamboo

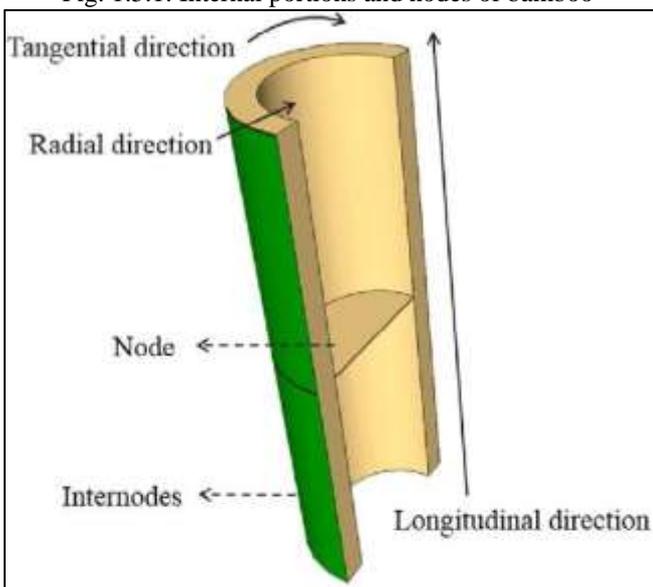


Fig. 1.5.2: Measurement of nodal length of bamboo

E. Mechanical Properties of Bamboo:

1) Compression Test:

Bamboo case of 50 mm length was cut from the full bamboo. Model from the inside fragment of bamboo was picked for pressure test. The inside and outer breadths at top and base piece of the models were taken.



Fig. 1.6.1: Compression Test of bamboo

2) Water Absorption Test:

Water maintenance is used to choose the proportion of water acclimatized under demonstrated conditions. Components impacting water ingestion include: sort of plastic, included substances used, temperature and length of presentation. The results data uncovers knowledge into the introduction of bamboo materials in water or wet conditions.

Percent Water Absorption = [(Wet weight - Dry weight) / Dry weight] x 100



Fig. 1.6.2: Water Absorption test

F. Improving of Bond Strength of Bamboo by Using Synthetic Resins:

It is eminent that bamboo embedded in concrete ingests the water contained in the strong. Thusly, bamboo goes over the loosening up and the advancement of volume, the bond between bamboo bars and the incorporating concrete is diminished. Besides, as the purpose behind bamboo loses its quality in strong, it is in like manner understood that the dissolvable portion in the strong decay the fat substance of bamboo. In this assessment, a built pitch and produced flexible is used for waterproofing on bamboo surface. As opposed to exorbitant and phenomenal materials, as an immediately available, a made flexible showed up in Figure 8 (c) and a designed gum showed up in Figure 8 (a, b) have been tried.



(a) Synthetic resin brush (b) synthetic spray (c) synthetic spray

Fig. 1.9.1: Materials for surface treatment

G. Objective of the Paper

The goals of this examination are

- 1) To analyze the flexural qualities of solid which is strengthened with bamboo supports, steel fortified concrete and plain cement beams (without fortification).
- 2) To apply surface treatment to the bamboo supports and assess its impact on the quality of the pillars.
- 3) To look at the conduct of supports in concrete with age.

II. LITERATURE REVIEW

A Literature review or record study is somewhat review article. A composing review is a scholarly paper which fuses the current data including extensive revelations, similarly as speculative and methodological duties to a particular subject. Composing reviews are discretionary sources and don't report new or exceptional exploratory work. Composing reviews are explanation behind exploration in pretty much every educational field. A tight augmentation composing review may be consolidated as a bit of a buddy explored journal article presenting new assessment, serving to mastermind the current examination with the collection of significant composition and to offer setting to the peruser. Conveying a composing overview may in like manner be a bit of graduate and post graduate understudy work, recalling for arranging of recommendation, paper, or a journal article. Composing studies are similarly customary in an investigation recommendation or plan.

III. EXPERIMENTAL STUDY

A. Materials Used

The materials used in this investigation are Fine Aggregate, Coarse Aggregate, Cement, Bamboo sticks, NaOH (sodium hydroxide), Acetone and Zinc acetate dehydrate.

1) Cement:

Concrete is a coupling material having solid and paste properties, which makes it capable to join the unmistakable

improvement materials and structure the compacted assembling the creation of cement is decreasing wherever all through the world considering reputation blended cement by goodness of lower imperativeness use, normal defilement, money related and other specific reasons.

Thermopile Applications:

B. Aggregates:

In a strong mix, sums have between 75 to 80% of total volume. The properties aggregates extraordinarily sway the new and hardened properties of concrete.

The sums are appointed two particular sorts

- 1) Fine sums
- 2) Coarse sums

1) Sand:

Locally available stream sand in dry condition was used as a fine absolute all through the assessment. Stream sand having atom size under 4.75mm and experiencing 4.75mm was used. Sand used in this examination changed in accordance with Zone-2 of Indian standard subtleties IS 383-1970.

2) Coarse Aggregate

Crushed stone stones of size 20mm and 10mm of coarse all out are used. The mass express gravity in grill dry condition and water osmosis of the coarse absolute 20mm and 10mm as indicated by IS code were 2.58 and 0.3% respectively.

C. Water:

Clean consumable water was used for making concrete. Water used for mixing should be freed from destructive proportions of oils, acids, dissolvable bases, salts, sugar and other characteristic pollutions. Water fit for drinking is normally seen as fit for making concrete. Water has two limits in strong mix. At first it reacts with the solid paste has cemented. Additionally, it fills in as a vehicle or oil in the mix of fine aggregate and cement.

D. Sodium Hydroxide (NaOH) Solution:

The sodium hydroxide was taken as pellets with 97%-98% flawlessness was purchased from close by supplier. The sodium hydroxide course of action with required obsession was set up by dissolving the figured proportion of sodium hydroxide pellets in refined water.

E. Acetone:

$(CH_3)_2CO$ is the normal compound with the condition $(CH_3)_2CO$. it is a dry, unique, burnable liquid and is commonly clear and most diminutive ketone. $(CH_3)_2CO$ is miscible with water and fills in as a fundamental dissolvable in its own right.

F. Zinc acetate dehydrate:

Zinc acidic ruinous enlistment is a salt with condition $Zn(CH_3CO_2)_2 \cdot 2H_2O$. both the hydrate and hydrous structures are dead solids that are commonly used in planned mix, ZnO is recorded as ordinarily saw as guaranteed by the U.S. Food and Drug Administration. In our past investigates, we sifted through an adaptable catalyst of cross related ZnO nanowalls ensured about on bamboo substrate for the photo synergist application under UV light lighting up. We other than present a methodology to pass on bamboo surfaces super amphiphobic by joining control of ZnO nanostructures and fluoro polymer affirmation while

keeping up their utilization impediment. In like manner, bamboo with multi limits related with water-safe, UV-safe, and fire safe properties was viably made by ZnO nano sheet structures verbalization, followed by fluorination treatment.

G. Bamboo Sticks



Fig. 3.7.1: Selection of Bamboo

Sticks Stick width is 18mm and length is 550mm and shading is light tanish shading And then sticks are treated with synthetic substances.

Water Absorption Test

Without chemical treatment: percentage of water absorption after 24 hours Wet

weight of bamboo (w_1)= 180

Dry weight of bamboo (w_2)=140

$$((w_1-w_2)/w_2) * 100 = ((180-140)/140) * 100 = 28.5\%$$

With chemical treatment: $w_1 = 150$

$w_2 = 140$

Percentage of absorption = 7.14%.

H. Durability Test for bamboo:

Compensated with oil – restoring to improve the quality. The oil directing system for bamboo is finished with electrical oil restoring machine, palm oil is utilized for this structure. First oil is gotten changed in accordance with temperature 60°C. By then bamboo tests are set stuck oil by utilizing metallic scrape. Besides, the models are taken out at three stretches 140°C, 180°C, and 220°C. At each stretch 30 min, 60 min, 90 min presentation respects are noted.

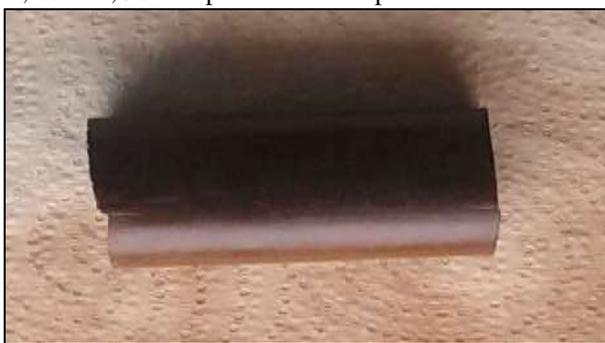


Fig. 3.9.1: Oil Treated Bamboo

I. Mix Design:

In this study, we M30 grade for both ordinary Portland cement concrete (OPC) and, the mix proportions are as follows:

Mix	Proportion	Cement (kg/m ³)	Fine aggregate (kg/m ³)	Coarse aggregate (kg/m ³)	Water (liters)
M30	1:0.45:2.6:1.5	438.9kg/m ³	673.2kg/m ³	1164.4kg/m ³	197.16lit/m ³

Table 3.10.1 Mix proportions of M30 grade concrete (OPC) w/c=0.45

J. Mixing Procedure for ordinary Portland cement concrete:

- 1) Weight the sums required for the mix i.e, solid, sand, coarse aggregate.
- 2) Mix the sums by hand mix or factory administrator completely.
- 3) Add water as indicated by proposed water/concrete ratio=0.4.
- 4) Mix it out and out again.
- 5) The standard Portland solid mix is masterminded and a short time later it is placed in molds.

K. Casting:

For testing of compressive quality and flexural nature of both standard Portland solid concrete. Here using 150mmx150mmx150mm size 3D squares are casted for testing of compressive quality and 600mmx150mmx150mm size precious stones are casted for testing the flexural quality.

L. Casting of cubes:

All out 3 solid shapes were given a role as appeared in fig 3.13.1 are set up with standard Portland concrete



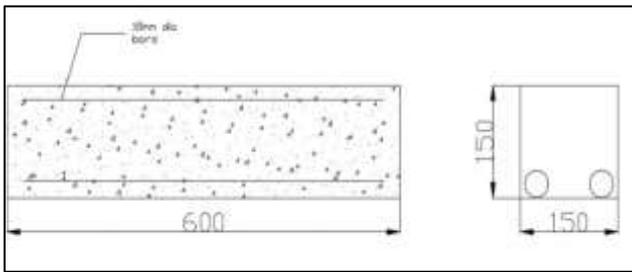
Fig. 3.13.1 Casting of Cubes



Fig. 3.13.2 Unmoulded Cubes

M. Casting of Prisms:

Hard and fast 12 precious stones were casted. 4 were set up with plain strong, 4 were set up with invigorated bars of 8mm separation across and 4 were set up with bamboo sticks as reinforced bars of 18mm estimation.



All dimensions are in mm
Fig. 3.14.1: Shows the Reinforcement Details

N. Curing:

Cement concrete cubes and beams are placed in water for 7 days and 28 days.



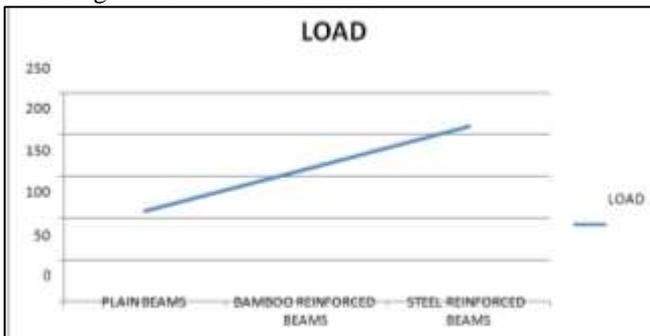
Fig. 3.15.1: Curing of Cubes



Fig. 3.15.2: Curing of Beams

IV. TEST RESULTS & DISCUSSION

Tests on blocks and bars: The 3D shapes and bars were tried for compressive quality and flexural quality separately according to Indian standard code.



Graph 4.1: comparison of loads of three different types of beams

V. ANALYTICAL RESULTS

A. STAAD ANALYSIS:

By utilizing staad star we can make the examination for this bar, we can take the trial esteems what are acquired from the test study, load esteems are taken UTM testing machine and we can utilize the bamboo yield quality for solid structure of the bar.

1) Loadings:

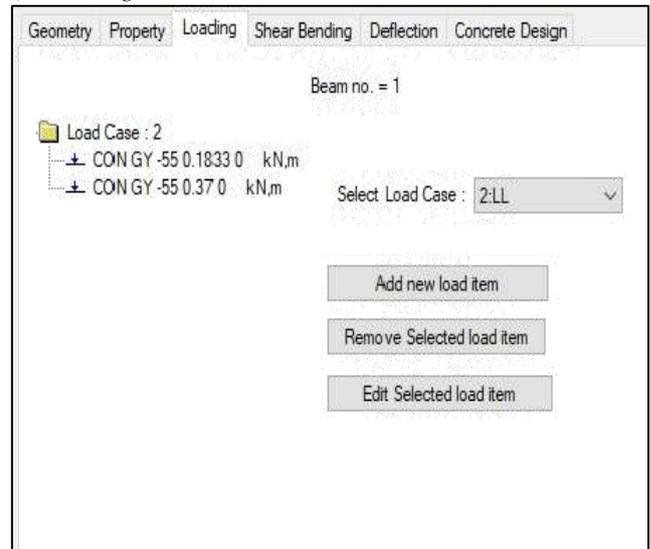


Fig. 5.1.1: Shows the loadings applied in beam

2) Shear Bending:

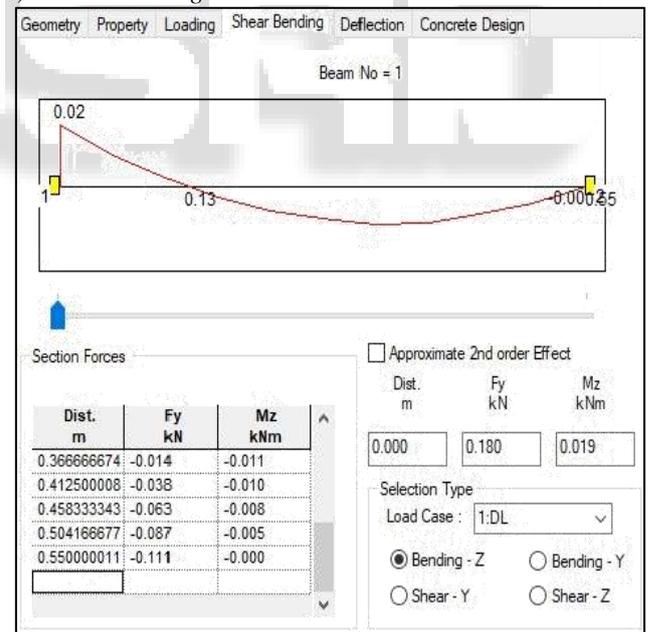


Fig. 5.1.2: Shows the shear bending of the beam

3) Deflection:

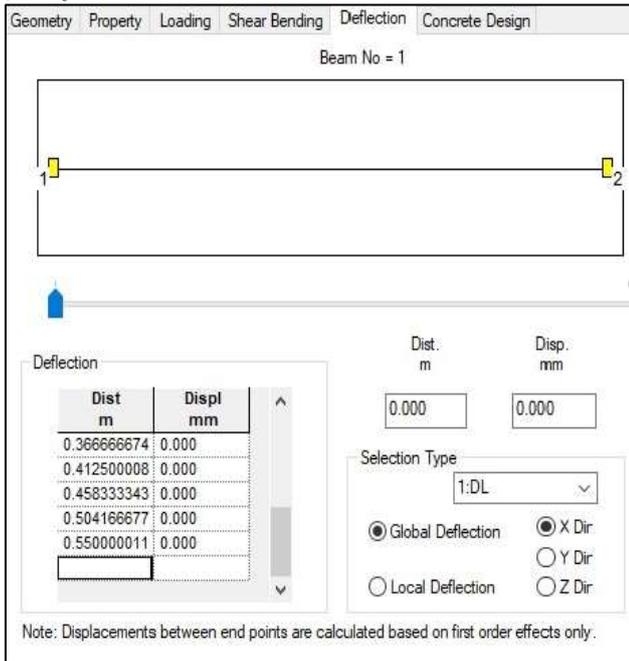


Fig. 5.1.3: Shows the deflection of the beam

B. Frame Analysis:

We can also make analysis on frame, these are the beam values

1) Shear Bending:

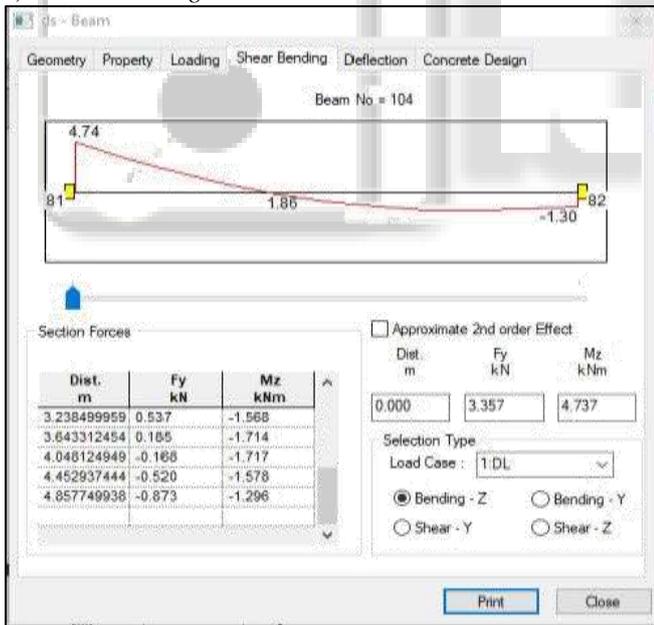


Fig. 5.2.1: Shows the shear bending of the beam

2) Deflection:

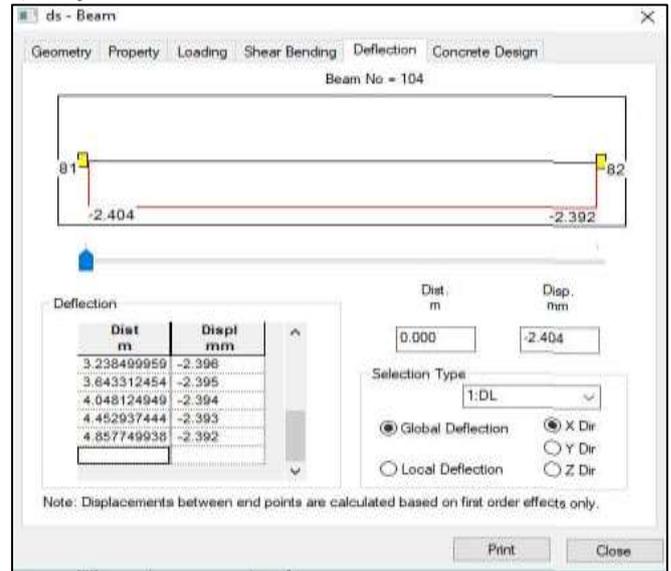


Fig. 5.2.2: Shows the deflection of the beam

3) Concrete Design

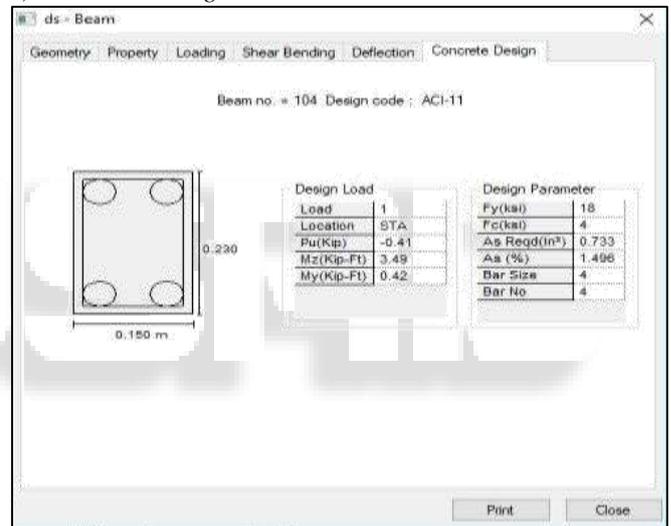


Fig. 5.2.3: Shows the concrete design of the beam

4) Shear Bending:

Column values

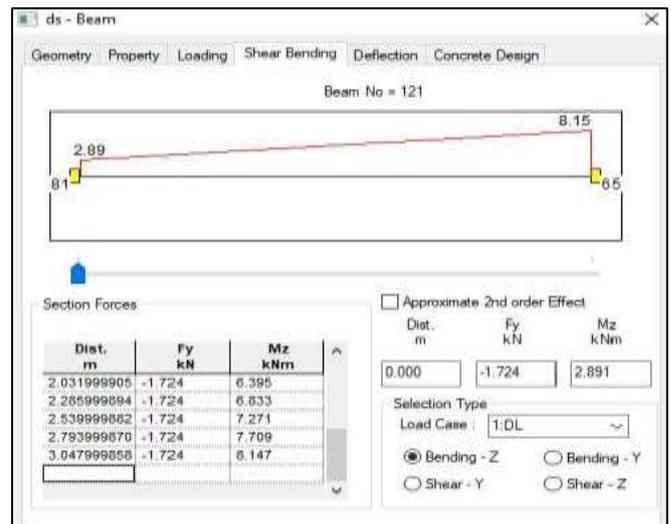


Fig. 5.2.4: Shows the shear bending of the column

5) Deflection:

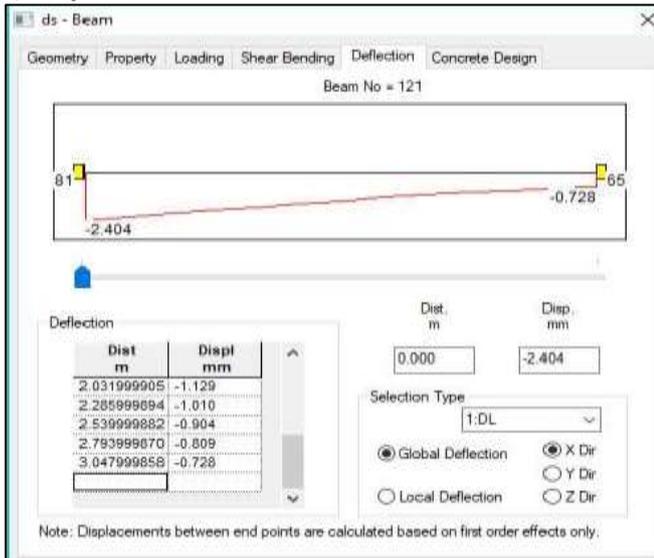


Fig. 5.2.5: Shows the deflection of the column

6) Concrete Design:

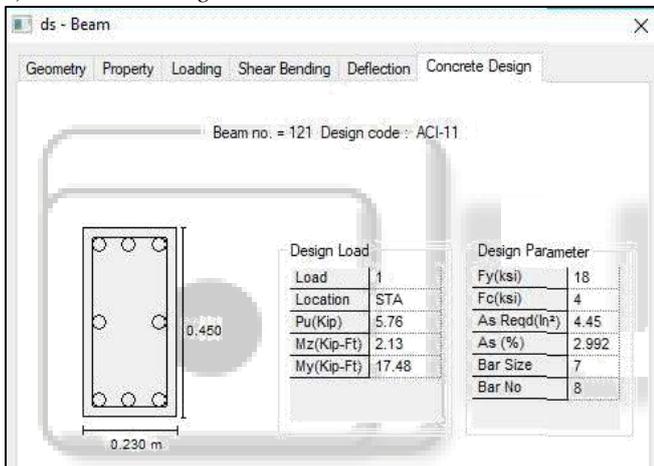


Fig. 5.2.6: Shows the concrete design of the column

VI. CONCLUSIONS

- 1) The consolidation of bamboo bolsters in strong columns can construct the store passing on breaking point of the poles when differentiated and plain bars.
- 2) In column bamboo as fortress can diminish the sudden breakdown. Bamboo strengthened bars can give a ramifications when breakdown is happened.
- 3) Bamboo backings offered present parting quality on strong bars.
- 4) Bamboo help disintegrated in concrete with age. Usage of invulnerable surface covering with manufactured inventions can makes it more impenetrable to rot.
- 5) Treatment with engineered substances can diminish water ingestion up to 74% and assemble the bond quality among bamboo and concrete.
- 6) Strength was seen to improved by up to half over the nature of Unreinforced bars at 28-day reestablishing for 0.023% help volume division.
- 7) The nature of bamboo strengthened bars is agreeable for negligible exertion dwelling adventures yet further work ought to be done before unmistakable

recommendation on the usage of bamboo as help in concrete can be made.

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