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Longitudinal Tensile Test of Bamboo Lamination (Dendrocalamus asper and Gigantochloa apus) for Gligen Part (Anco/Lift Net Fishing Tools)

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***Abstract*—A study on assessing the tensile test of bamboo lamination using Dendrocalamus asper and Gigantochloa apus. Focus in this research is strength of Gligen (part of Anco/liftnet). Here we use bamboo laminate products with special adhesive materials. The basis for making a bamboo lamination model with the ability and function of bamboo as a reinforcing structure. The technique is destructive test for specimen. For this experiment a specimen is placed on the hold of tensile machine. Preliminary initial results show that there is an approximate ...**

Keywords—fishing gear, anco, bamboo, material flexibility

I. INTRODUCTION

Mechanical properties of materials are the ability of the material to hold the loads imposed on it (static and dynamic). Anco is a fishing net in the form of lift nets that gets weight/weight from fish catches. Good anco construction is to hold loads from fish catches. Anco is shown in Fig. 1.

Fig.1. Anco/lift net.

The application of the use of bamboo as a mixture component between bamboo components and thermoplastic and polymer chemicals has been investigated previously for construction structures. Using a resin with a pressing treatment, the comparison of the strength of the adhesive and without adhesives can show results where the bamboo can be used as a component in a construction structure, with a value of about 100 MPa [1].

Generally, adhesives that are often used are types of commercial adhesives, including: epoxsi adhesive, polyvinyl acetate, rubber based adhesive. In the gluing process, the term glue spread is used, namely the amount of adhesive that is bonded per unit surface area of the adhesive area. The concentration of the use of the adhesive that is bonded illustrates the amount of adhesive that is anchored to achieve a strong solid adhesive line. The broad unit used refers to the English unit of 1000 square feet with the abbreviation MSGL which is expressed in units of pounds (lbs). If both surfaces are grounded, it is called MDGL or two-sided resurfacing called double spread. Converted adhesive units to be simpler called GPU (Gram Pick Up), determined by Eq. 1:

$$GPU = \frac{S \times A}{2048.2} \quad (1)$$

Where: GPU = gram pick up (gram), S = The amount of adhesive that is laced in pound/MSGL, A = glued area (cm^2) [2].

When a load works on a bamboo composite material it can be a solution for using bamboo as a product that can be applied to a bamboo laminate. For the benefit of a construction structure, the bamboo laminate modulus results in the strength of 610 MPa and Modulus 46 GPa [3].

The design of laminated beams using a solid beam model that is loaded with static transverse forces will generate internal stresses and strains, as a form of beam resistance behavior [4]. In laminated beams with loading conditions as shown in Fig. 2., tension acting in the cross section is the shear force and bending moment. The magnitude of the shear

force and bending moment can be calculated by the principle of static equilibrium.

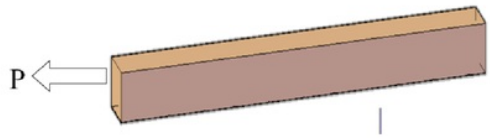

Fig. 2. Model loading on bamboo laminate.

The stress-strain relationship to the beam behavior is burdened by the transverse direction of the longitudinal utility obtaining Eq. 2:

$$\sigma = \frac{M \times y}{I} \qquad (2)$$

The critical limit length of the laminated beam is obtained from the magnitude of the load which causes bending and bending failure simultaneously based on the distance between the loads and the length of the span in this study using Eq. 3:

$$L_{cr} = \frac{4.64 \times \sigma \times h}{8\tau} \qquad (3)$$

Where: σ = bending stress, h = cross section height (cm), τ = shear stress.

II. METHOD

In this study, bamboo laminate are first obtained by processing entire bamboo culms. The experiment here is to use a lamination bamboo that is material for replacing bamboo in Gligen part (show in Fig. 3). This bamboo laminate is a vertical and horizontal bamboo laminating system that produces laminated beams.

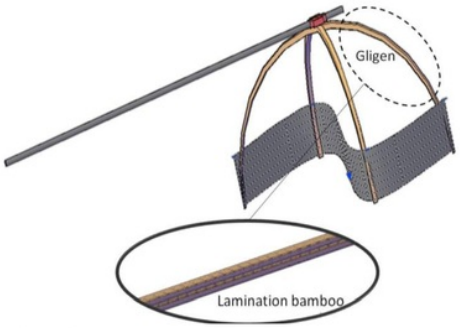

Fig. 1. Illustration of this research that Gligen by bamboo replaced with lamination bamboo.

A. Horizontal Laminate Bamboo

Bamboo pieces are arranged horizontally into laminated bamboo (shown in Fig. 4).

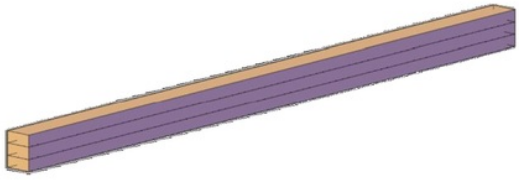

Fig.4. Laminated bamboo arranged horizontally.

B. Vertical Laminate Bamboo

Bamboo pieces are arranged vertically into laminated bamboo (shown in Fig. 5).

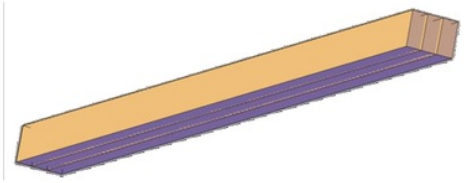

Fig.5.Laminated bamboo arranged vertically.

C. Laminated Beams

Laminated bamboo is horizontally and vertically arranged into laminated beams. Beam is laminated to 4-5 layers mixing Dendrocalamus asper and Gigantochloa apus (shown in Fig. 6).

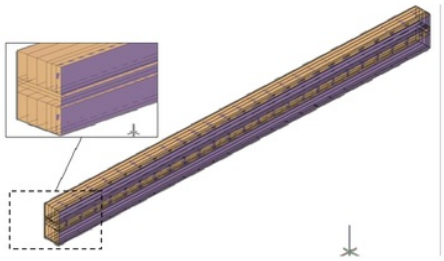

Fig.6.Laminated beams for replacement material in the Gligen section.

D. Tensile Test

Tensile test is a method used to test the strength of a material by giving a load of style that is as pleasing [5]. Tensile testing is carried out to complete the basic design information of the strength of a material and as supporting data for material specifications [6]. In the tensile test, specimen is given the load of the axis of attraction which increases continuously, along with the observation of the extension experienced by the test object [7].

Beam modeling and simulation using computer (shown in Fig. 7).

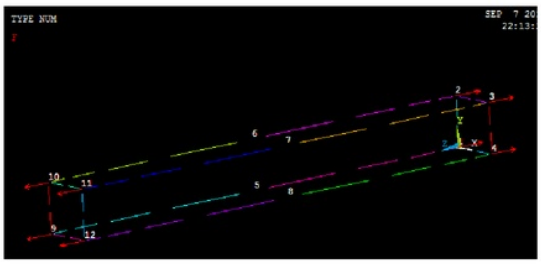

Fig.7.Laminated beams in computer simulation.

Size of the model specimen is 100 mm x 100 mm x 1000 mm. The design of the model uses the MOE value (Modulus of Elasticity) of bamboo lamination in accordance is 117110 N/mm^2 [8]. The design is planned to use 200 number of meshing, see Fig. 8.

Fig.8.Meshing of specimen

III. Results and Discussions

Beam laminate analyses using computer simulation. In this study we will get the value of the ultimate stress on bamboo laminate. Where the results obtained are in Table 1.

TABLE I. AVERAGE RESULT TENSILE TEST

Result	Value
Ultimate load (N)	6000
Ultimate stress (N/mm^2)	4.5

For the maximum deformation testing received by the test specimen in computer simulation, there is a picture in Fig. 9. As for the maximum received stress at a value of 4.5 KN/mm^2.

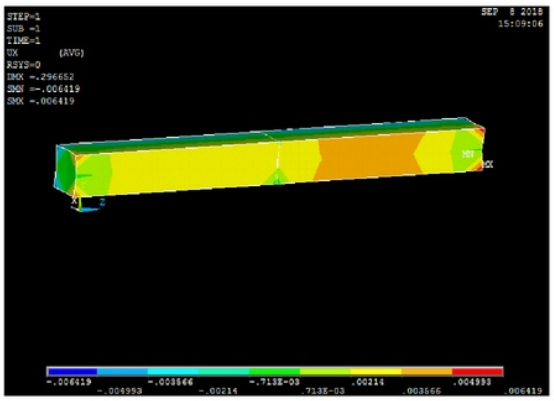

Fig.9.Result of simulation.

IV. Conclusion

Beam laminate from bamboo are very effective and can be applied to the Gligen part of Anco, where the method of formation requires special expertise for the pressing process to get the best beam laminate. Results of the tensile test of beam laminate are still eligible for the bamboo lamination ultimate load where the average taken is 6000 N, shown Table 1. So that mechanically it can still be sucked and is useful as an alternative ingredient in the gligen part of the elevator net. Of course in the process of maintenance and use, look again at efforts to make this laminated material more durable.

Acknowledgment

The authors would like to thank the Directorate of Research and Community Service (DRPM), Ministry of Research, Technology and Higher Education of the Republic of Indonesia for financial support.

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Fig. 1. Anco/lift net.

TABLE II. AVERAGE RESULT TENSILE TEST

Result	Value
Ultimate load (N)	6000
Ultimate stress (N/mm²)	4.5

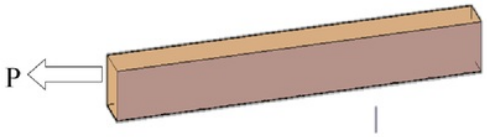

Fig. 2. Model loading on bamboo laminate.

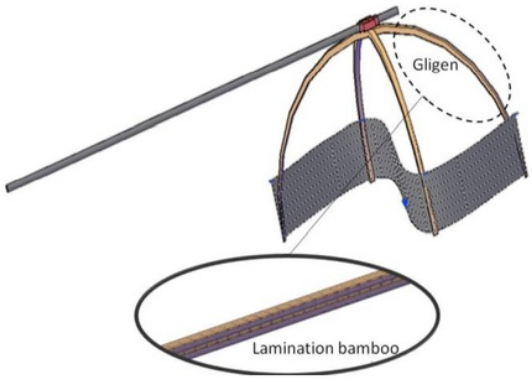

Fig. 3. Illustration of this research that Gligen by bamboo replaced with lamination bamboo.

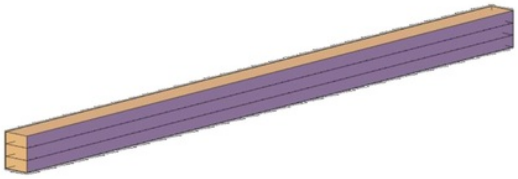

Fig. 4. Laminated bamboo arranged horizontally.

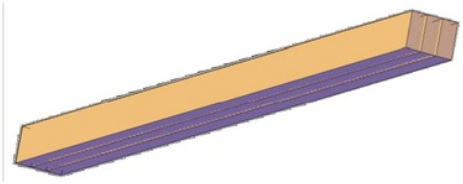

Fig. 5. Laminated bamboo arranged vertically.

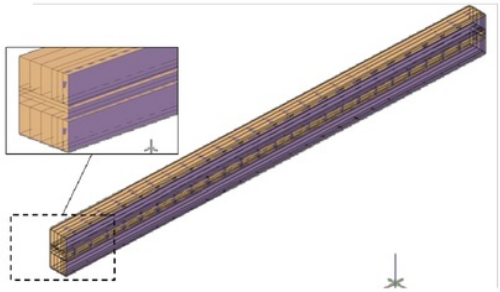

Fig. 6. Laminated beams for replacement material in the Gligen section.

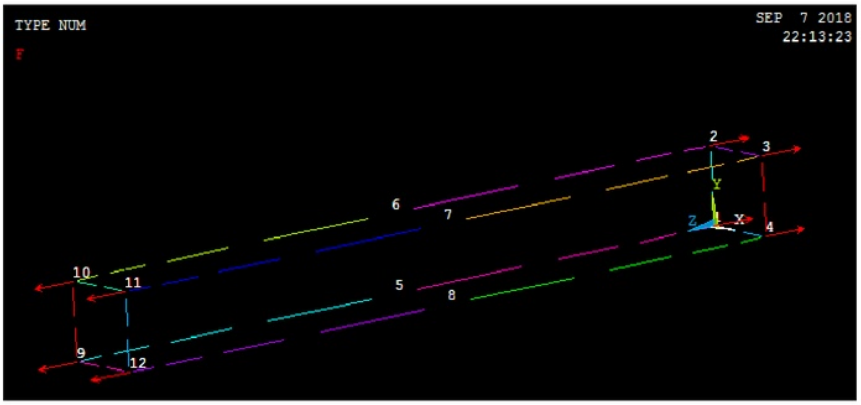

Fig. 7. Laminated beams in computer simulation.

Fig. 8. Meshing of specimen.

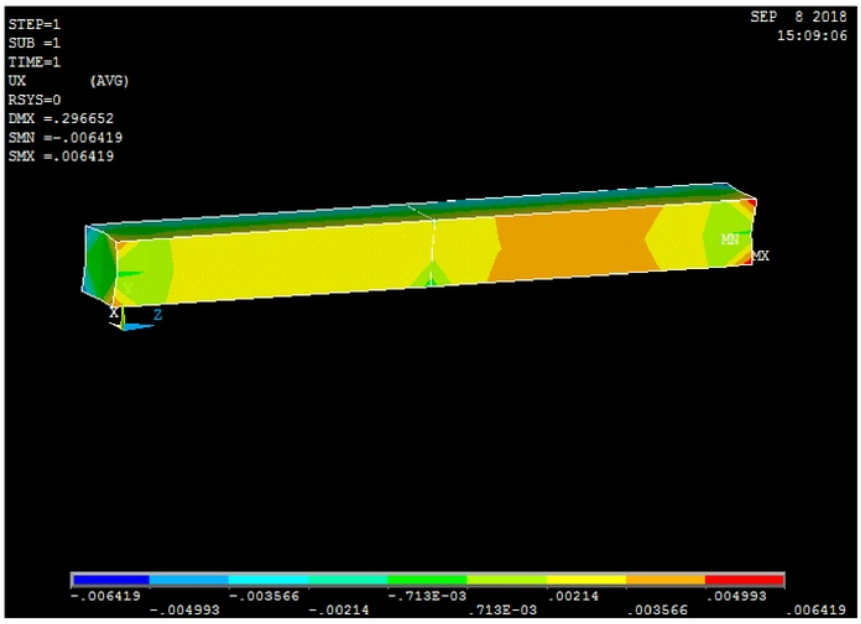

Fig. 9. Result of simulation.

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