

# The Influence of Lateral Stress Variation to Shear Strenght Bamboo Lamination Block

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**Abstract**—The use of bamboo lamination substitute wood for structural beams. Damage of glue-line bamboo lamination beam before collapsing to influence of flexural strength. The aim of this study to know the effect of shear connector PVAc resin to the shear strength bamboo lamination. Shear connector with incising method on bamboo blade. The bamboo used in this work belongs to the species of *Bambusa Dendrocalamus asper* (local name: bambu Petung) and PVAC adhesives used.

The variation of compression strength on lateral stresses were 1.5 MPa, 2 MPa and 2.5 MPa. The shape an dimensions of the shear strength test specimens by standard ISO 2004. The mechanical properties testing conducted correlation with statistical analysis. The phenomenon of glue-line damage were analyzed by Scanning Electron Microscopy.

**Keywords**—Lateral stress, shear stress, bamboo lamination

## I. BACKGROUND

Bamboo grows fast, easy to grow and does not require special maintenance. Bamboo with good quality can be harvested at the age ranges (3-5) years [4]. Bamboo with good quality can be harvested at the age ranges (3-4) years [7].

Bamboo fiber has a high tensile strength [2]. Tensile strength bamboo fiber ranging between (150 ~ 320) MPa, greater than the tensile strength of wood fibers ranges (34 ~ 220) MPa [3]. Parenchyma sell structures more dense with age bamboo, the bamboo optimum density occurs in 4-year-old [10].

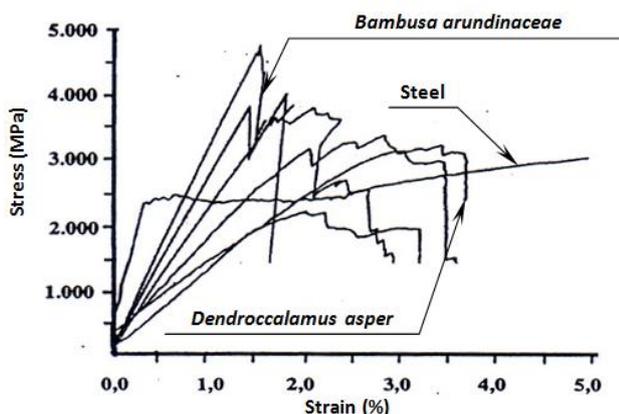


Figure 1. Bamboo stress-strain (Morisco, 1999)

Reference [9], describes the use of bamboo which is divided into a traditional bamboo (conventional) and bamboo engineering (experience the manufacturing process). Bamboo laminated are building materials that have a character like wood. This materials are a very popular building material developed and researched in recent years, as it has many advantages. The three main aspects that affect the quality of the final result in the manufacture of laminated bamboo is bamboo materials, adhesives and gluing technology [7].

The study was conducted to determine the effect of lateral stress on shear strength bamboo lamination block. Lateral stress with compression variations on 1.5 MPa, 2 MPa and 2.5 MPa.

## II. LITERATUR REVIEW

Varma and Chariar (2012), conducted research mechanical strength of bamboo laminates using epoxy resin and pattern collapse was observed microscopically. Most (2010), examined the effect of age on the shear strength of bamboo laminated bamboo Petung beams. Reference [6], examined the effect of age on the flexural strength bamboo laminated bamboo beams Petung. Reference [9], examined the influence of the width of the lamina on the bending strength of laminated bamboo beams Petung.

Effect of pressure on the shear strength of the beam clamp horizontally laminated bamboo Petung has been investigated [6]. Reference [4], conducted research on the effect of compression force MoR Petung Bamboo laminated beams vertically. MOR maximum value obtained in advance of 1.3 MPa compression force  $s/d$  1.6 MPa. Likewise, the influence of pressure on the shear strength of the beam clamp horizontally laminated bamboo Ampel has been investigated by Amirullah [1].

## III. PROBLEM IDENTIFICATION

The advantages of laminated bamboo, among others, can be formed in a variety of sizes, better mechanical properties than the base material type of bamboo used. Damage to the line resulting adhesive laminated bamboo laminated bamboo beams damaged before its power reaches the maximum value. Bamboo planks in laminated bamboo beams are experiencing compression estimated damage to the fiber and therefore contributes to the strength and power of the beam line adhesive laminated bamboo.

IV. OBJECTIVES

The objectives of this research are to get compression on lateral stress optimum value. The result on bamboo block lamination be made structural beam. The study was conducted to determine the effect of lateral stress on shear strength bamboo lamination block. Lateral stress with compression variations on 1.5 MPa, 2 MPa and 2.5 MPa.

V. METHODOLOGY

The raw material is Bambusa Dendrocalamus asper. Making the preliminary test specimen to test the properties of physics and mechanics according to ISO and ASTM D143-2008. Glued of bamboo block lamination were Polivinyll acetate (PVAc) glued.

Testing of the shear strength laminated bamboo blocks there are each using lateral stress pressure variation (1.5 MPa, 2 MPa and 2.5 MPa).

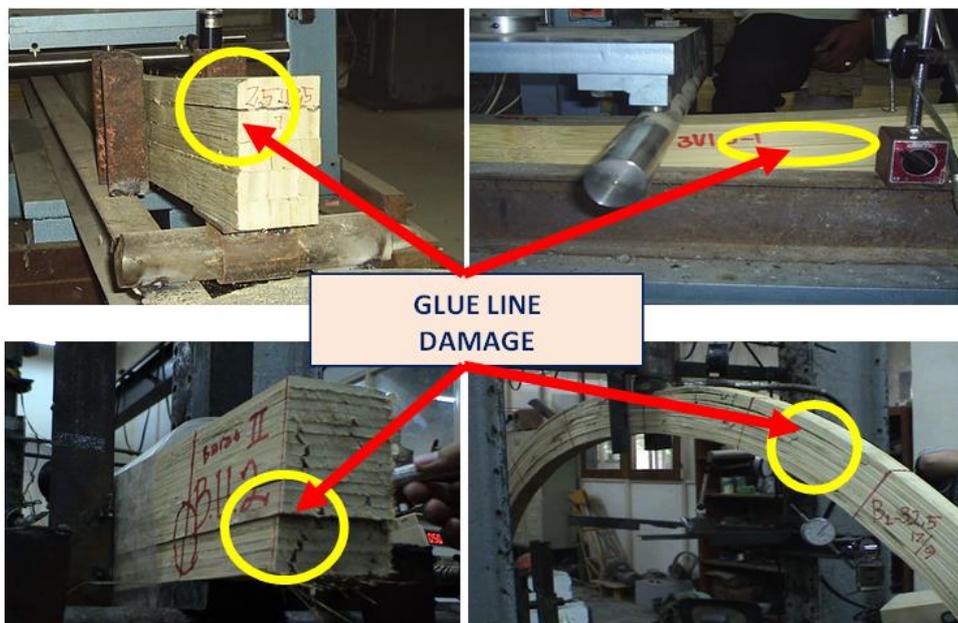


Figure 2. Glue-line damage before laminated bamboo beam cracking (Andreas, 2005)

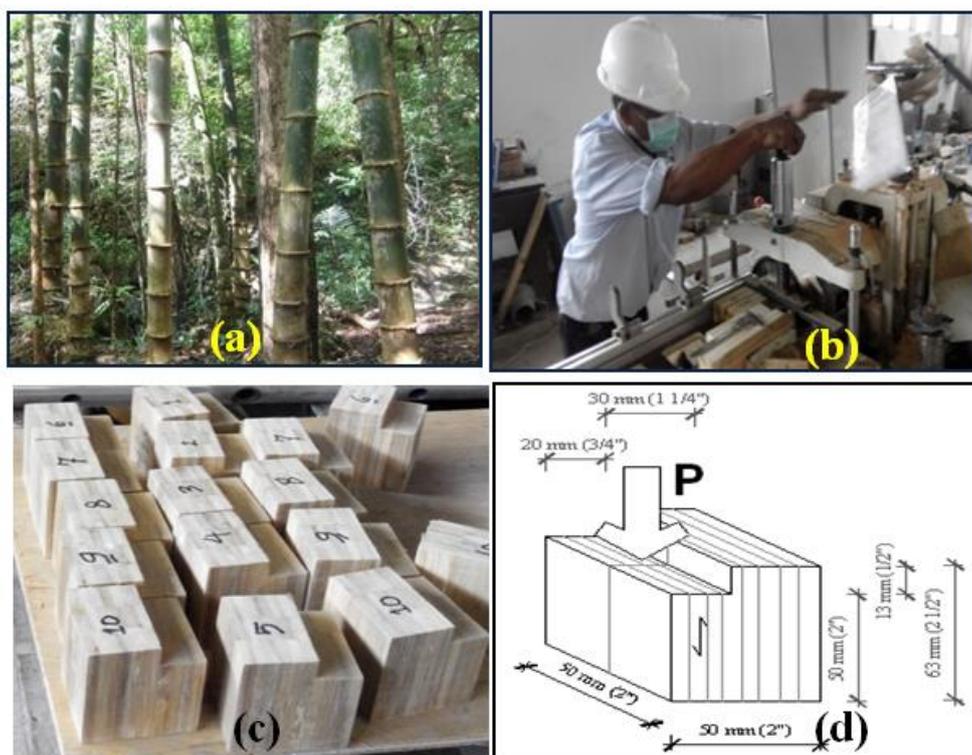


Figure 3. (a) Petung Bamboo (*Bambusa Dendrocalamus asper*), (b) manufacturer of shear strength specimens, (c) Shear strength bamboo block lamination, (d) ASTM D143-2008 standar

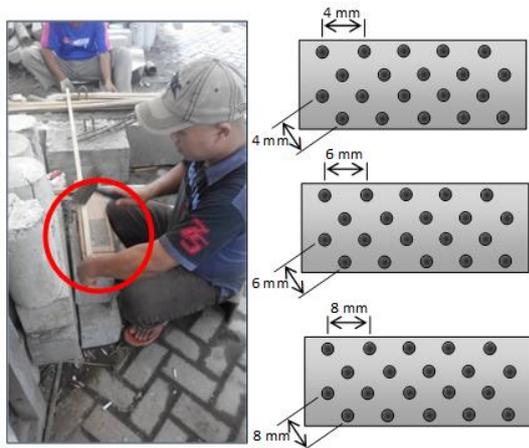


Figure 4. Incising properties



Figure 5. Shear strength bamboo block lamination testing setting-up

## VI. RESULT AND DISCUSSION

The water content of at pressure of 1.5 MPa is an average of 12.81%. The average of moisture in the pressure of 2 MPa is an average of 12.52%. The water content in the pressure of 2.5 MPa is average 12.43%. Density at a pressure of 1.5 MPa was an average density of 0.73 g/cm<sup>3</sup>. Density values with 2 MPa is an average of 0.75 g/cm<sup>3</sup>. At a pressure of 2.5 MPa average of 0.78 g/cm<sup>3</sup>.

Shear strength bamboo block lamination with lateral stress 1,5 MPa to have average value were 3,737 MPa. Shear strength bamboo block lamination with lateral stress 2 MPa to have average value were 5,389 MPa. Shear strength bamboo block lamination with lateral stress 2,5 MPa to have average value were 4,995 MPa.

## VII. CONCLUSION

1. The water content of at pressure of 1.5 MPa is an average of 12.81%. The average of moisture in the pressure of 2 MPa is an average of 12.52%. The water content in the pressure of 2.5 MPa is average 12.43%.
2. Density at a pressure of 1.5 MPa was an average density of 0.73 g/cm<sup>3</sup>. Density values with 2 MPa is an average of 0.75 g/cm<sup>3</sup>. At a pressure of 2.5 MPa average of 0.78 g/cm<sup>3</sup>.
3. Shear strength bamboo block lamination with lateral stress 1.5 MPa to have average value were 3.737 MPa.
4. Shear strength bamboo block lamination with lateral stress 2 MPa to have average value were 5.389 MPa.
5. Shear strength bamboo block lamination with lateral stress 2.5 MPa to have average value were 4.995 MPa.

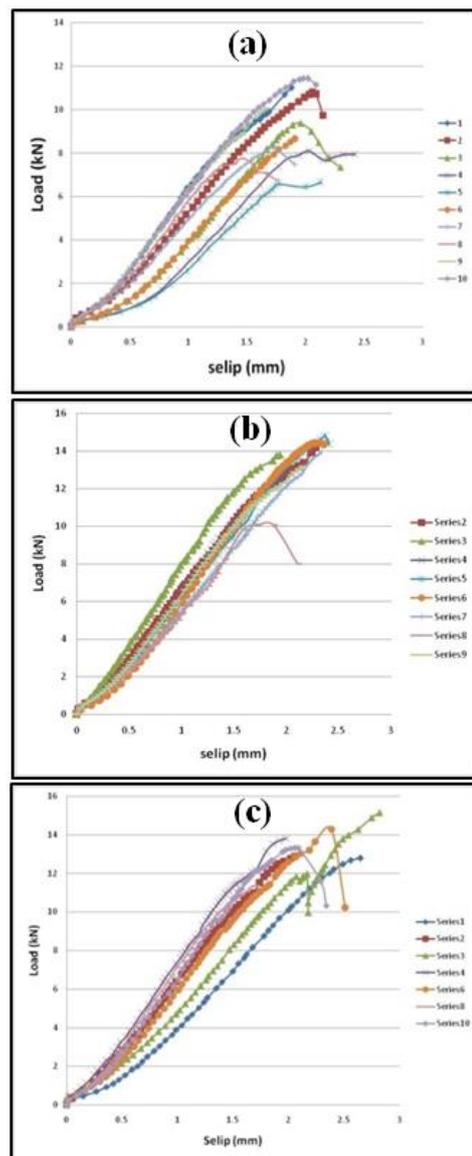


Figure 6. Load-Slip curve : (a) Lateral stress 1.5 MPa, (b) Lateral stress 2 MPa, (c) Lateral stress 2.5 MPa.

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