KAMPER WOOD CONNECTION LAMINA AN ALTERNATIVE STIFFNESS AND WOOD SOLID COLLAPSE

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ABSTRACT

In order to meet the availability of structural components with dimensions that do not depend on the diameter of the timber , it is developing structure form instead of solid wood but laminate components are made by gluing or commonly referred to as laminated beams or Glulam (Glued Laminated) . The purpose of this study is : Knowing the physical properties and mechanical properties of wood laminated limestone ; Analyzing stiffness (MOE) and collapse (MOR) .The materials used in this penelititan ie from lime wood aged less than 25 years from Muara Wahau East Kutai Regency of East Kalimantan Province . Adhesives used are synthetic wood finishes and andhesives Synteko 1909 and 1999 with the hardener composition ratio 100/15 % . This study used a test machine brands Amsler scale were made in Western Germany with a capacity of 100 kN up to the ultimate limit . The size of the test sample 6 cm x 6 cm x 6 cm , 6 cm x 6 cm x 76 cm with a thickness of each lamina 2 cm adhesive to both surfaces given 200-220/m2 resurfacing and each treatment was made three replications . Research findings indicate that the value of the initial moisture content of 12 % on average , the value of density from 0.58 to 0.63 kg/cm^3 , the value of the MOE 8971 to 9895 N/mm^2 , MOR values 54.78 to 70,12 N/mm2 , the results of the analysis of the pattern of wood lamina connections to do is no difference between the treatment , whereas there was no difference in effect between treatments .This study suggests that the adhesive and hardener Synteko can be used as an alternative connection material . Given the weakness can determine the efficiency of a connection on the wood and construction adhesives have high efficiency .

Keywords: Water Content , Density , MOE , MOR.

INTRODUCTION

A. Background

Indonesia is one country that has a high biodiversity , especially in wet tropical forests and Kalimantan in particular . Forest damage occurred as a result of illegal logging , forest fires , mining , land-use violations of forest area and forest land use implementation distorted . This situation resulted in a reduction in timber production from natural forests , resulting in limited availability of large diameter wood . On the other hand , with the increasing needs of a growing population of timber for various purposes is also increasing . Pertambanhan This requirement led to good quality wood , large diameter and high into existence scarce .

Laminate design principle is to maximize the dimensions by minimizing material . If these principles can be carried out simultaneously then the intended use of the laminate can be achieved to the maximum , so that the laminate is an economical design while meeting the structural principle (Bodig and Jayne , 2003) . Moody et al . , 1999 indicated that the product is engineered glulam voltage regulation (stress -rated product) consisting of two or more layers of wood are glued to each other together with the longitudinal direction of fibers throughout layer called the lamina , parallel to its length . Moody et al . 1999 also states that the glulam is a material made of layers of wood choices .

Intact wooden beams with wood defects , resulting in the capacity to bear the burden becomes smaller , with cutting into several thinner layers and then glue the wood back by eliminating defects or defective timber to position precisely the mechanical properties will increase . Expressed by Berglund and Rowell (2005) , that the greatest advantage of the use is to produce glulam beams can be created from wood with a small-diameter logs , wood with low quality , as well as the thin wood can be dried more quickly than wood with large dimensions .

The adhesive is a material with properties different from the wood . The presence of the adhesive layer between the glulam timber , allowing a change in the mechanical properties of glulam , such as stiffness and strength . With the cross-sectional dimensions of the same glulam , can be prepared a number of horizontally laminated .

B. Purpose

The purpose of this research is :
1 . Knowing the physical properties and mechanical properties of wood laminated limestone
2 . Analyzing stiffness (MOE) and Destruction (MOR)

C. Benefits

This study is expected to provide benefits that knowledge of physical properties , mechanical properties , analysis of MOE and MOR lime wood , as well as useful in the process of further research.

LITERATURE REVIEW

A. Description of the Kamper Tree (Dryobalanops aromatica)

Kamper Wood has great size and height . Trunk diameter reaches 70 cm to 150 cm even with trees reaching 60 meters high . Bark is brown and reddish brown in the area . In the trunk will issue a lime scent when cut . Kamper Wood in Borneo is also known as Ampadu , Amplang , Lime , Kayatan , Keladan , Melangit , Mengkayat , Mohoi , Muri , and Sintok . In addition to so-called Cretaceous Sumatra or Barus plant is named Haburuan or Kaberun . In addition to produce camphor , Kamper Wood can also be used as a wood building materials , shipping , walls , and floors because it has a pretty good quality wood .

B. Physical Properties and Nature of Mechanics.

1 . Nature of Physics: Important physical properties of wood is its density , because the measurement and its relationship with other traits are emphasized . Kayubadalah strength properties is important when wood is used as a building material or construction (Haygreen and Bowyer , 2003) .

a. Water Content: Wood moisture content , the water is contained in a piece of wood . All the physical properties of wood is strongly influenced by changes in the moisture content of wood . The amount of moisture content of wood varies depending on the type of wood . Variation of moisture content of wood from the tree of life ranging from 30 % to 300 % by weight expressed as a percentage of dry kiln , kiln dry weight is used as the basis for this weight is the number of instructions solids (Tsoumis , 1991) .

b . Density: The density of a material is the ratio of mass to volume . Increased water content will increase the density of the wood , which can far exceed the density of the density of dry kiln . Density is very important , especially in terms of quality wood . Density affects the

properties of hygroscopicity , shrinkage and expansion , mechanical properties , thermal , acoustic properties , electrical . And others associated with the subsequent processing (processing , drying , etc.) (Tsoumis , 1991) .

2 . Nature of Mechanics.

Static Bending Strength : According Dumanauw (2001) , bending strength or flexural strength of wood is to resist the forces trying to bend the wood . In a simple beam subjected to load then the bottom will experience tension and upper experiencing maximum compressive stress . This voltage is gradually decreased toward the center and becomes zero at the neutral axis . The flexural strength of wood is usually expressed with a broken modulus .Of testing flexural strength values obtained in the limit of the proportion of wood strength and maximum strength of the timber . Below the proportion of straight-line relationship exists between the amount of stress and strain , where the value of the ratio between strain and stress is called the modulus of elasticity (MOE) . The maximum bending strength(MOR) is calculated using the same test to determine the MOE Haygreen and Bowyer, 2003)

METHODS

A. Time and Place Research: This study was carried out from start to completion of Research Preparation approximately six (6) months at the Laboratory of Physics and Mechanics Faculty of Forestry, University of Mulawarman Samarinda in East Kalimantan.

B. Materials and Devices Research: The materials used in this penelititan ie from lime wood aged less than 25 years from Muara Wahau East Kutai Regency of East Kalimantan Province . Adhesives used are synthetic wood finishes and andhesives Synteko 1909 and 1999 with the hardener composition ratio 100/15 % .

The tools used include Straighten Machine Tools , Machine Cut , brand Adventuren OHUS Scales , Pressure Equipment , Equipment Oven , Urges Strength Test , test machine is used to determine the strength of a strong urge insisted that the wood used . In this study, the test machine was a strong urge scale Amsler brands made in Western Germany with a capacity of 100 kN .

C. Research Methods

1 . Sampling Test: Test samples taken from the wood logs with diameter attention to each part (base , middle , end) . Before the first test sample was made made boards that continued dry conditions have been conditioned to 12 % moisture content . Test sampling for testing physical properties and mechanical properties of wood selected from defect-free wood.

2 . Creation Sample Test: Preparation of test sample was formed in accordance with the provisions of ASTM standard D 143-05 (ASTM , 2005) on Methods of Testing Small Clear Specimen of Timber . Tests were conducted for physical properties , namely water content , density . As for testing mechanical properties ie flexural strength . The shape and size of the sample is as follows :

a) Test Sample Water Content

The test sample made size 6 cm x 6 cm x 6 cm

b) Test sample Density

Test samples were made as test sample moisture content .

c) Bending Strength Sample (Static Bending)

The test sample made size 6 cm x 6 cm x 76 cm

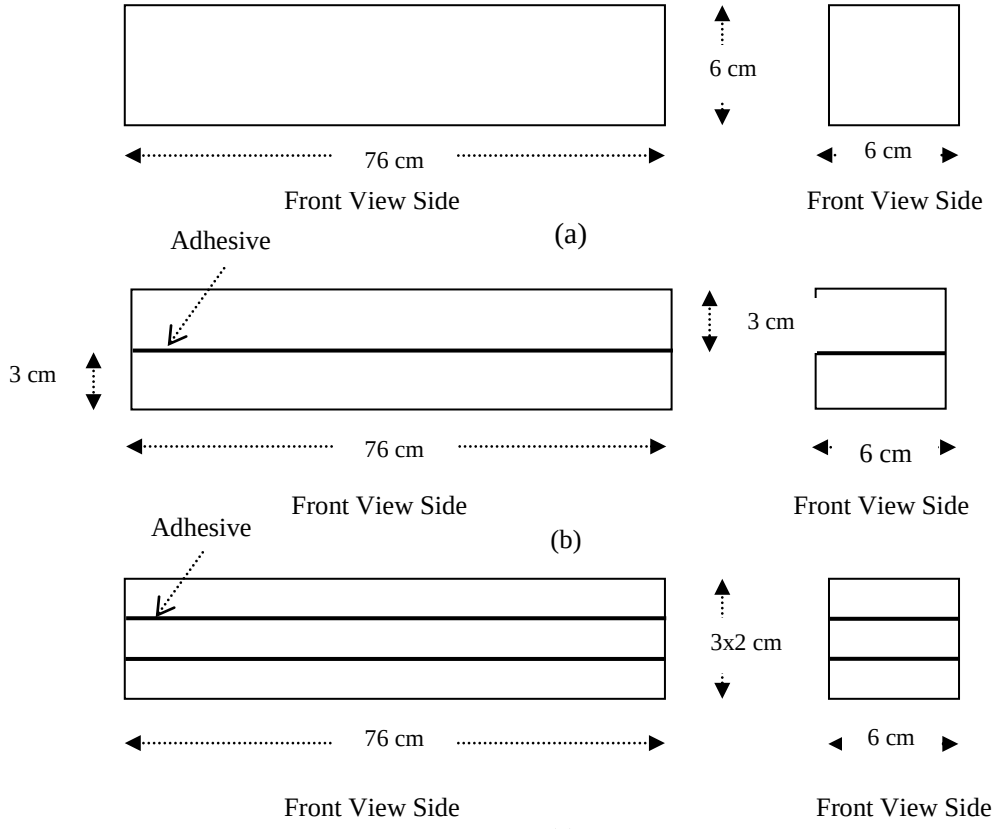

Figure 1. Samples Bending Strength Test 1
(a) Solid Wood (b) Two-Layer Laminated Wood
(c) Three-layer laminated wood

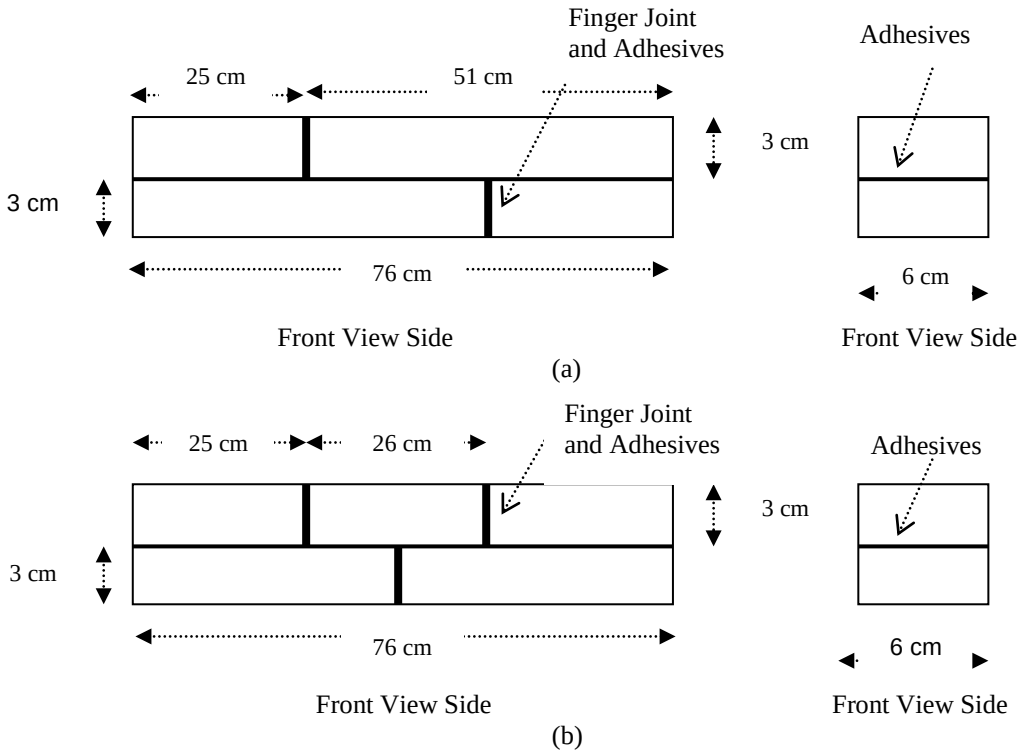

Figure 2. Samples Bending Strength Test 2
(a) Two-Layer Laminated Wood Pattern Connection 1
(b) Two-Layer Laminated Wood Pattern Connection 2

3. Sampel Test Process

a) Water Content

$$\mu = \frac{m_u - m_0}{m_0} x100\% \ (Ka) \quad \text{..... (1)}$$

b) Density

$$\rho_n = \frac{m_0}{V_0} \left(\frac{gr}{cm^3}\right) \quad \text{..... (2)}$$

c) Static Bending Strength

$$MOE = \frac{L^3.\Delta F}{4.a^3.b.\Delta f} \left(\frac{gr}{mm^2}\right) \quad \text{..... (3)}$$

$$MOR = \frac{3\ F_{mak}.L}{2.b.a^2} \left(\frac{gr}{mm^2}\right) \quad \text{..... (4)}$$

D. The Design of Experiments

In this study, the experimental design used was a randomized block design (RAK) two factors, the type of treatment that layer (3 type = A = α_i) consists of a layer 1, layer 2, layer 3 and the connection patterns of the lamina (2 type = B = β_j) consists of line 1, line 2. thing each factor total 3 pieces. Data processing is performed using IBM SPSS and EXCEL programs. A general model of the design of this experiment are:

$$Y_{ijk} = \mu + \alpha_i + \beta_j + (\alpha\beta)_{ij} + \rho_k + \varepsilon_{ijk} \quad \text{..... (5)}$$

RESULTS AND DISCUSSION

A. Physical Properties of Kamper Wood

1 . Levels of Water

All wood physical properties , mechanical properties are determined amount of water content in the wood . Determination of water content in air-dry condition is a condition that is most desired in the use of wood . Water content of air-dried wood depends on the local climate . In this study, the initial moisture content of all samples the average value of the test was 12 % and the final water content of between 11.5 % to 13 % .

2 . Density

Density greatly affect the properties of hygroscopicity , shrinkage and expansion , mechanical properties , acoustic properties , electrical and other costs associated with the next timber (processing and drying) (Tsoumis , 1991). From the research , the highest density value of 0.63 and a density value of 0.59. According Oey (1964) the higher the density value , generally the stronger and heavier wood .Added weight of wood by substances contained in wood mechanics are hardly menininggkan strength .

B. Nature of Mechanics

1 . Static Bending Strength MOE

The results of the test sample with a static bending strength.

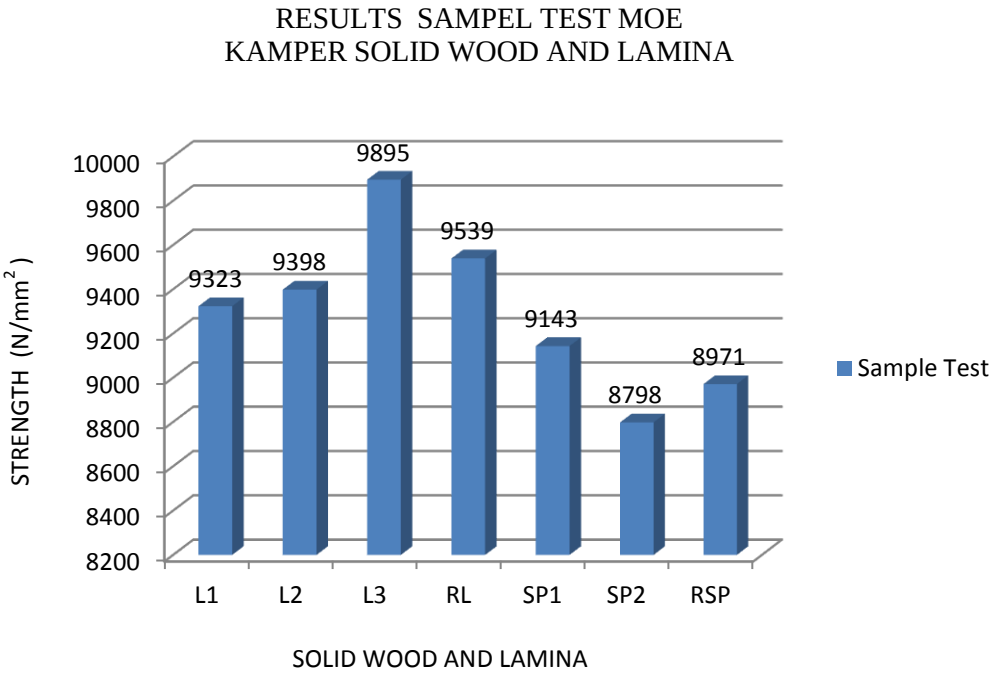

Figure 4 . Results Sample Test MOE Kamper Solid Wood and Lamina

The average value of Kamper wood MOE FACTOR A consists of Layer 1 , Layer 2 and layer 3 ; FACTOR B consists of Lamina Connection Layer 2 Position 1 , Position 2 Lamina Layer 2 connection is shown in Figure above .

2 . Analysis MO

Table 1. Analysis MOE Solid Wood and Lamina Cretaceous synthetic adhesives .

Tests of Between-Subjects Effects

Dependent Variable: RESULTS

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	422608,725[a]	7	60372,675	635,072	,000
Intercept	1474162116,287	1	1474162116,287	15507009,068	,000
GROUP	95,064	2	47,532	,500	,621
FAKTOR_A	284589,525	2	142294,762	1496,827	,000
FAKTOR_B	133070,820	1	133070,820	1399,799	,000
FAKTOR_A * FAKTOR_B	63,331	2	31,665	,333	,724
Error	950,642	10	95,064		
Total	1542158479,868	18			
Corrected Total	423559,368	17			

a. R Squared = ,998 (Adjusted R Squared = ,996)

The results of the analysis of the above table can be summarized as follows : due to sig . to FACTOR A ; FACTOR B < 0.05 , then H_1 is accepted and H_0 is rejected . It is no difference between the treatment FACTOR A ; FACTOR B tested . Especially for interaction FACTOR

FACTOR A * B > 0.05, H_0 is rejected and H_1 is accepted . It is no difference between treatment interaction FACTOR FACTOR A * B is tested.

3. Static Bending Strength MOR
The results of the test sample with a static bending strength.

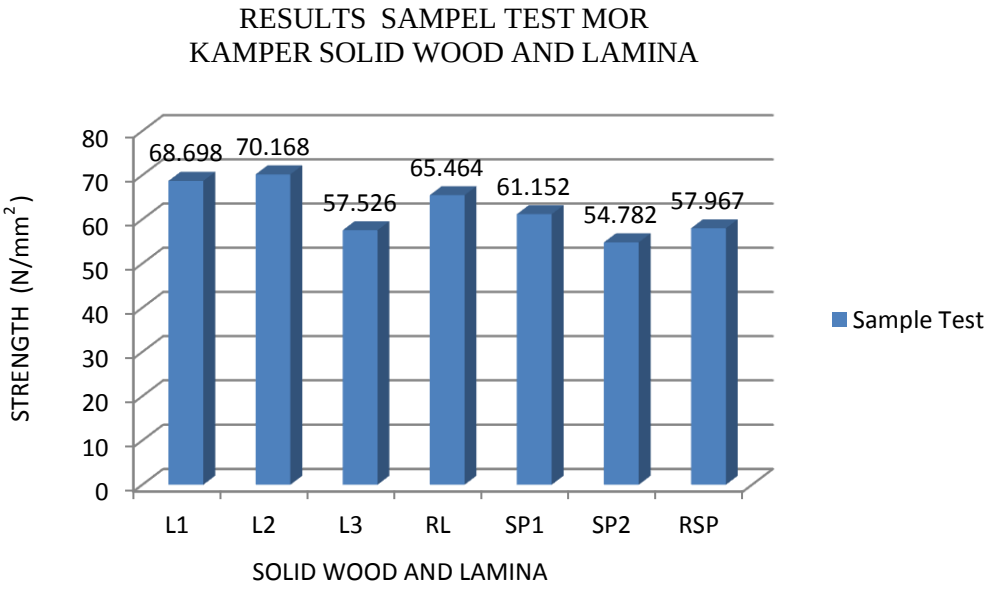

Figure 5 . Results Sample Test MOR Kamper Solid Wood and Lamina

The average value of Kamper wood MOR FACTOR A consists of Layer 1 , Layer 2 and layer 3 ; FACTOR B consists of Lamina Connection Layer 2 Position 1 , Position 2 Lamina Layer 2 connection is shown in Figure above .

4. Analysis MOR

Table 2 . Analysis MOR Solid Wood and Lamina Cretaceous synthetic adhesives .

Tests of Between-Subjects Effects

Dependent Variable: RESULTS

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	179,337[a]	7	25,620	30,936	,000
Intercept	62239,793	1	62239,793	75156,807	,000
GROUP	1,271	2	,636	,768	,490
FAKTOR_A	143,991	2	71,996	86,937	,000
FAKTOR_B	39,481	1	39,481	47,675	,000
FAKTOR_A * FAKTOR_B	,144	2	,072	,087	,917
Error	8,281	10	,828		
Total	68785,698	18			
Corrected Total	187,618	17			

a. R Squared = ,956 (Adjusted R Squared = ,925)

The results of the analysis of the above table can be summarized as follows : due to sig . to FACTOR A ; FACTOR B < 0.05 , then H_1 is accepted and H_0 is rejected . It is no difference between the treatment FACTOR A ; FACTOR B tested . Especially for interaction FACTOR

FACTOR A * B > 0.05, H_0 is rejected and H_1 is accepted . It is no difference between treatment interaction FACTOR FACTOR A * B is tested .

CONCLUSIONS AND RECOMMENDATIONS

From the results and the above discussion we can conclude some of the following :

A. Conclusions.

1. Levels of water all test samples lime wood has met the applicable requirements of 12% .
2. Value for wood density chalk meet the Indonesian National Standard .
3. Adhesives is an alternative as a material weakening of the connection has an efficiency of 100 % .
4. Analysis of laminated wood MOE relationship with lamina connections no difference between treatments . As for the effect there is no difference between treatments .
5. Analysis MOR relationships and influence at the MOE .
6. Timber lamina is an alternative piece of wood to get the desired size .

B. Recommendations

1. Further research should be conducted with many kinds of patterns of connections .
2. Composition mix , resurfacing and capacity of different brands of adhesive production .

3. Implementation of the required accuracy in testing samples from preparation materials , resurfacing , compression , until readiness for the samples tested.

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