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Experimental Investigations of Flexural Strength of Wooden Beam

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ABSTRACT: Several studies have been conducted on the use of compression tests to determine the bending and tensile properties of wood. Teak, Mango, Jackfruit, Element, and Aquasia wood were used in this project. Each specimen sample was tested for flexural strength, compressive strength, and tensile strength. A correlation study was performed on each specimen sample using Microsoft Excel to determine the link between the bending and tensile properties of timber from compression tests. Wood has a number of distinct, independent mechanical properties. The physical and mechanical properties of wood have a wide range of values that are influenced by a large number of variables. Because of environmental factors during growth, these timber qualities vary from species to species and even within species. According to the experimental results, wood now has a higher load capacity and is stronger and more rigid. Because of its cellular structure and how these cells are arranged, the strength of the wood product is primarily determined by the direction of any loading. The experiment and analysis results were then compared.

KEYWORDS: Differentgradeofwood, Strengthening, analysis, graphs.

I. INTRODUCTION

Residential homes with older timber buildings in particular have a few defects that require specific interventions to repair in preparation for remodelling. They require innovative technologies to boost the load-carrying capability of the members for cutting-edge housing circumstances, including reinforcement or repair owing to prior overloading, insect and fungal assault. They are built for reduced living loads as defined in performance and design standards. Often, detrimental interventions are carried out because neither decision-makers nor building builders have the essential knowledge of appropriate strengthening measures. In order to restore and strengthen existing timber floors under bending stresses, a research of reinforcement techniques has been conducted.

In the past, some species supplied a variety of needs, but other, less common or desirable species met just one or two. For instance, white oak is widely desired for use in flooring, barn timbers, cooperage, railroad crossties, farm equipment, and shipbuilding because it is hardy, sturdy, and long-lasting. The majority of the furniture and cabinetry were made out of woods like black walnut and cherry. Black locust was appreciated for its use as barn timbers, whereas hickory was used to make robust, strong, resilient striking-tool handles. It was widely believed that wood from trees that had grown in specific environments was stronger, more resilient, easier to work with tools, or finer grained than wood from trees that had grown in other environments. Wood characteristics are substantially influenced by location and growth conditions, according to recent studies.

One of the earliest known building materials is timber, and through the ages, expertise in its usage and knowledge of its nature have provided numerous successful solutions to structural issues. We are utilising UTM to perform a flexural strength test on wooden samples in order to analyse various aspects of their qualities. Additionally, various woods have various strengths and characteristics. Five different types of wood are being tested to learn more about that: 1.Mango wood, 2.Element wood, 3.Teak wood, 4.Jack fruit wood, 5.Aquasia wood.

II.METHODOLOGY

Four-point flexural test in the following manner:

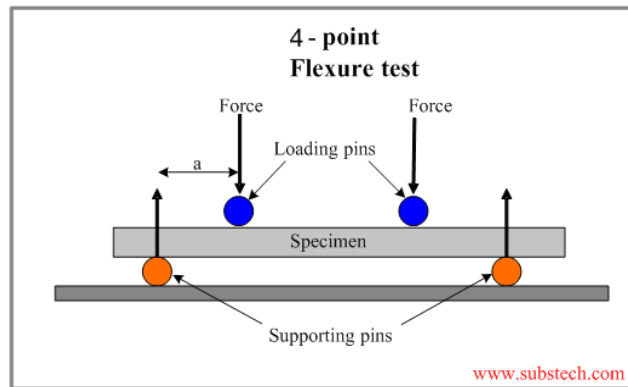


Figure 1: 4-point flexure test.

Measurements:

Dimension of wood block = $L*B*H = 700 \times 150 \times 150$ mm

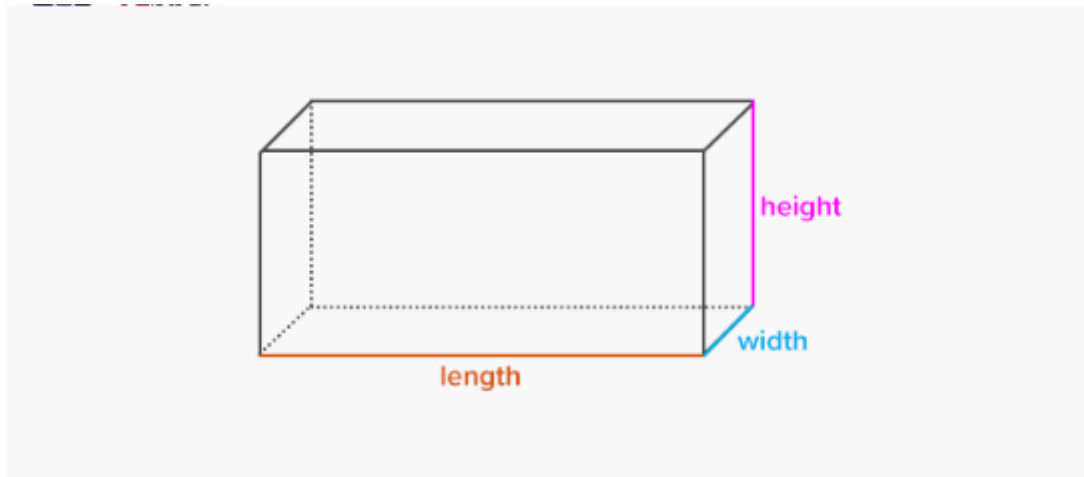


Figure2 :Dimension of the specimen

Test Procedure:

- Insert the bending tool into the UTM.
- Measure the width and depth of the wooden beam.
- Adjust the height of the support and clamp it to the bottom table.
- Attach the transverse test pan to the bottom side of the lower cross head.
- After fixing the beam to the rollers of the transverse test brackets with the load coming from the centre, measure the length of the beam's span between the supports for central loading.
- Raise the lower table to zero the load pointer. The UTM's vernier scale is used to calculate the deflection corresponding to each load as it is applied.
- Record the maximum load and deflection.

Equipment Required:

- Universal Testing Machine.
- Deflection Gauges.
- Wooden Beam.
- Measuring Tape.

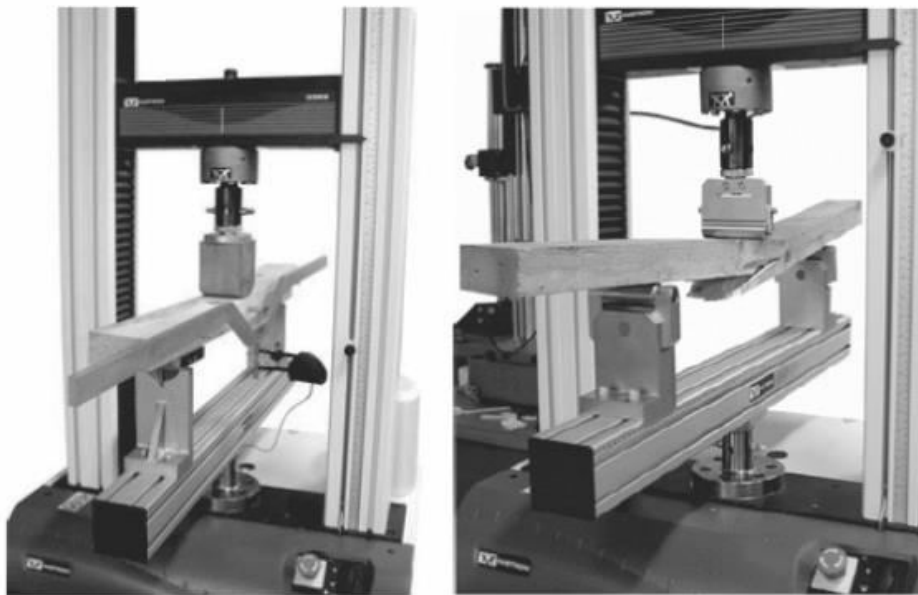


Figure3: Wooden beam while loading and after failure.

Test Precautions:

- Gradually apply the stresses to enable easy reading of the deflection against each reading.
- To prevent damage, remove the gauges before the failure load occurs.
- Stay away from the machine while the load is applied because the particles could harm you.

Calculation:

Formula to calculate Residual flexural tensile strength:

$$F_{Ri} = \frac{3F_{Ri}L}{2bh_{sp}^2}$$

b = Width of the specimen (mm).

H_{SP} = distance between the tip of notch and top of cross section (mm).

L = Specimen length (mm).

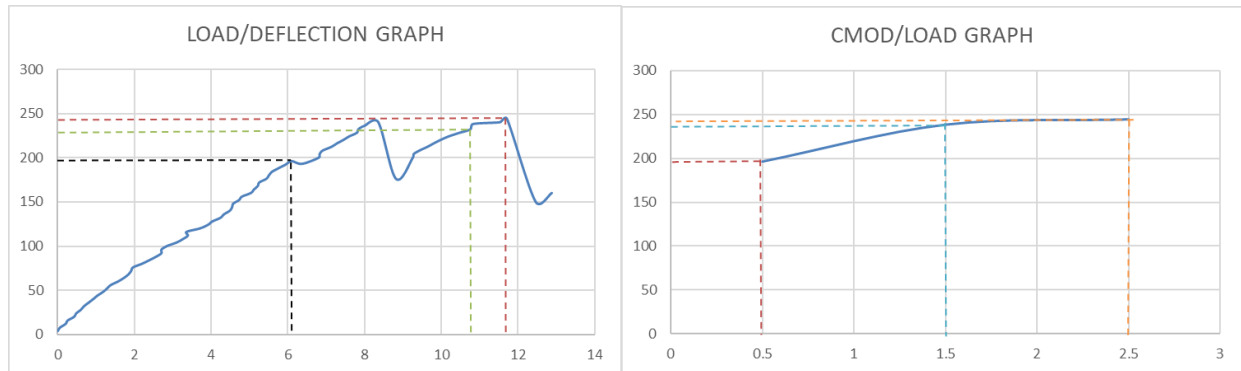
F_{Ri} = CMOD load recorded.

III. RESULT AND DISCUSSION

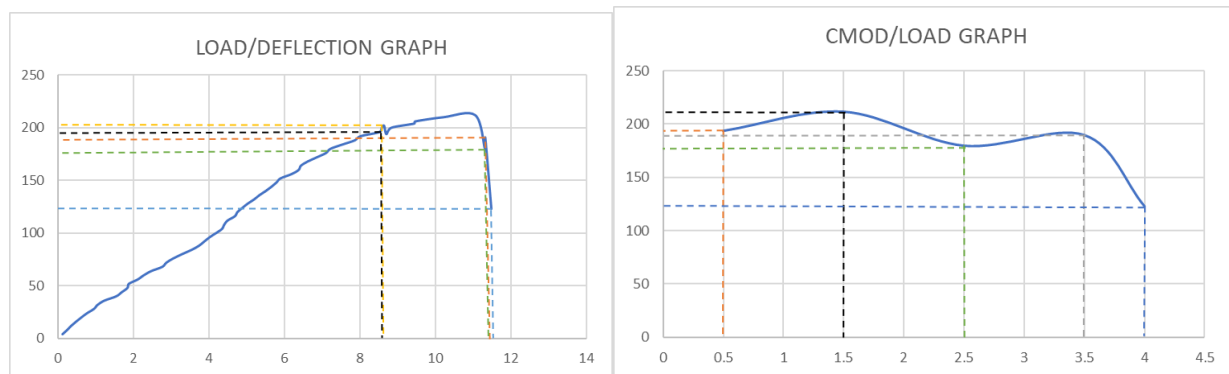
Specimen	Average Residual flexural tensile strength
Mango wood	237.94
Element wood	927.84
Teak wood	200.52
Jack fruit wood	351.15
Aquasia wood	781.74

Graph Analysis:

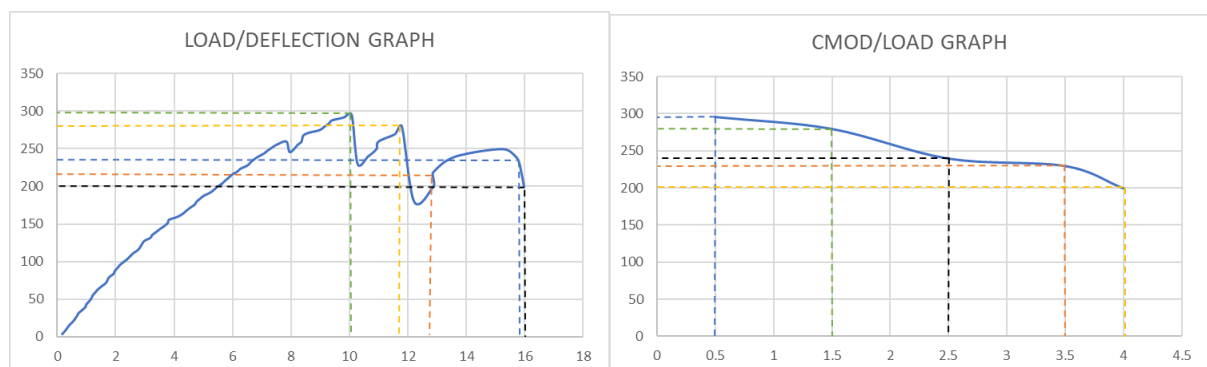
1. Teak wood.



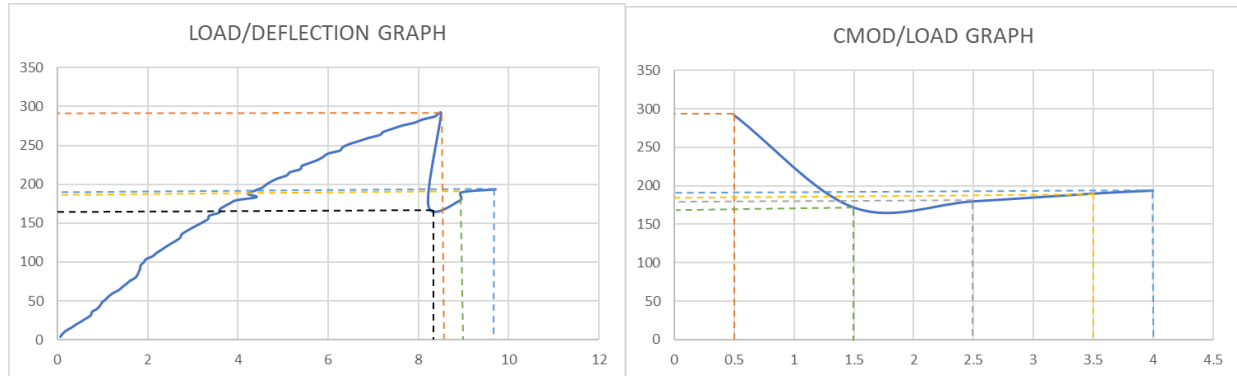
2. Mango wood.



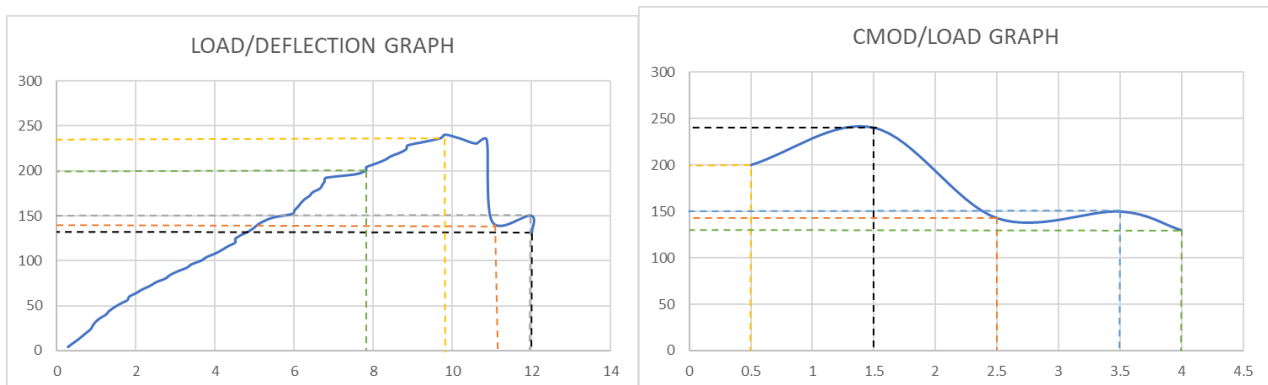
3. Element wood.



4. Jack fruit wood.



5. Aquasia wood.



IV. CONCLUSION

Mechanical tests on unreinforced wood demonstrated. Overall, the experimental results revealed an intriguing change in the strength, stiffness, and failure behaviour of the unreinforced specimens. The experimental results were almost identical to and comparable to those obtained from numerical analyses. As a result, there would be a reliable method of calculating the strength of wood members to obtain the most efficient un-reinforcement of structural size, in which the failure of wood is tabulated and the graph is analysed at the end.

ACKNOWLEDGMENTS

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