

**TO INVESTIGATE THE
MECHANICAL PROPERTIES OF
DIFFERENT TREE SPECIES USED
FOR CONSTRUCTION.**

BY

NAWEGULO EUNICE

REG.NO. BU/UP/2018/3500

**THIRD YEAR PROJECT REPORT SUBMITTED TO THE FACULTY OF SCIENCE AND
EDUCATION IN PARTIAL FULFILLMENT FOR THE AWARD OF A BACHELORS
DEGREE IN SCIENCE AND EDUCATION OF BUSITEMA UNIVERSITY.**

MAY 2022

DECLARATION

I **Nawegulo Eunice** hereby declare that this work is an output of my effort and has not been submitted to any institution of higher learning for the award of a degree.

Sign:

Date:

APPROVAL

I affirm to the best of my knowledge that **Nawegulo Eunice** Registration number ***BU/UP/2018/3500*** has tirelessly compiled this project report under my supervision, and it can be submitted to the management for academic award.

Signature:

Date:

DR. ANDIMA GEOFFREY
DEPARTMENT OF PHYSICS
BUSITEMA UNIVERSITY

DEDICATION

I dedicate this work to my family and friends for their love, support and encouragement.

ACKNOWLEDGEMENT

I extend my sincere gratitude and thanks to the almighty GOD, who gave me the knowledge, kept me healthy and protected me in all ways that I have managed to come up with this research however much it was challenging.

My humble appreciation also goes to my supervisor **Dr. Andima Geoffrey** for his support he has tirelessly rendered to me during research work.

I extend further appreciation to my fellow students of physics for the encouragement and help in the literature searching over the internet, their prayers and comfort that I got from them especially Mr. Kitemu Julius.

I finally thank my family for the support they have given me during this time of project; their prayers and encouragement are invaluable may the almighty GOD reward them abundantly.

TABLE OF CONTENTS

DECLARATION	i
APPROVAL	ii
DEDICATION	iii
ACKNOWLEDGEMENT	iv
LIST OF FIGURES	vii
LIST OF TABLES	viii
LIST OF ACRONYMS	ix
ABSTRACT.....	x
CHAPTER ONE	1
1.1 BACKGROUND OF THE STUDY	1
1.2 STATEMENT OF THE PROBLEM	3
1.3 JUSTIFICATION	3
1.4. Main objective	4
1.4.1 The study was guided by the following objectives	4
1.5 SCOPE OF THE STUDY	4
CHAPTER TWO: LITERATURE REVIEW	5
2.1 WOOD	5
2.2 TYPES OF WOOD.....	5
2.2.1 EUCALYPTUSGRANDIS (EG) (Kalitunsi Caribbean pine; Pitch pine)	5
2.2.2 PINUSOOCARPA, POO (Ocote pine, Nicaraguan pitch pine).....	5
2.2.3 PINUSCARIBAEA var. HONDURENSIS (PCH) (Caribbean pine; Pitch pine).	6
2.2.4 MAESOPSIS EMINII (MUZ) Musizi.....	6
2.2.5 CUPRESSUSLUSITANICA (Cupressaceous Cypress; Mexican Cypress; Portuguese	6
2.2.6 OTHER SPECIES	7
2.3 CHARACTERISTICS OF WOOD	7
2.4 COMPOSITION OF WOOD	8
2.4.1 Moisture in Wood	8
2.4.2 The Strength of Wood	8
2.5 CLASSIFICATION OF WOOD	9
2.5.1 Hardwoods.....	9
2.5.2 Soft Wood.....	10
2.7 WOOD DEFECTS FROM CONVERSION	10
2.7.1 Chip mark	10

2.7.2 Diagonal grain.....	11
2.7.3 Torn grain.....	11
2.7.4 Wane	11
2.7.5 Machine burn	11
2.7.6 Machine bite	11
2.7.7 Machine gouge.....	11
2.8 WOOD DEFECTS FROM SEASONING	11
2.8.1 Bowing	12
2.9 NATURAL WOOD DEFECTS	12
2.9.1 Bark pockets	12
2.9.2 Bird pecks.....	12
2.9.3 Burls.....	12
2.9.4 Coarse grain.....	13
2.10 INSECT DEFECTS	13
2.11 DUCTILITY	13
2.12 HOOKE’S LAW.....	13
2.13 YOUNG’S MODULUS.....	14
2.14 LINEAR ELASTICITY	14
CHAPTER THREE: METHODOLOGY	15
3.1 DATA/SAMPLE COLLECTION	15
3.1.1 Sampling Strategies.....	15
3.2 RESEARCH DESIGN	15
3.2.1 Procedure.....	15
3.3 MEASUREMENTS.....	16
CHAPTER FOUR: RESEARCH FINDINGS	17
4.1 RESULTS.....	17
CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS	19
5.1 CONCLUSION	19
5.2 RECOMMENDATIONS	19
5.3 SUGGESTIONS FOR FURTHER RESEARCH.	19
REFERENCES.....	20

LIST OF FIGURES

Figure 3.1 Diagram of the experimental setup.	15
--	----

LIST OF TABLES

Table 4.1 Table of results	17
----------------------------------	----

LIST OF ACRONYMS

EG	–	Eucalyptusgrandis
PCH	–	Pinuscaribaea Var. Hondurensis
MUZ	–	Maesopsis Eminii
CFR	–	Central Forest Reserve
GPA	–	Giga-Pascals

ABSTRACT

The construction industry around Nagongera town council uses wood as one of the main construction material. Different wood species have different mechanical properties which affect the strength of the buildings some of which have collapsed. In this study, the mechanical properties of different wood species used in construction were investigated. Three tree species were investigated and categorized into soft and hard wood. The results showed that the species which had small deflection had a relatively high young's modulus and was categorized as hard wood and that with high deflection had relatively low young's modulus and categorized as soft wood. A recommendation was made that since hard wood is too heavy, it is not suitable for roofing which gives high weight to the wall and substructure leading to low strength of the building.

CHAPTER ONE

1.1 BACKGROUND OF THE STUDY

Wood (Timber) as a natural material has been valued and processed for many centuries as a building material. It is characterized by a warm and friendly nature combined with a brilliant behavior in the view of sustainability compared with other building materials. Wood (timber) has been one of the most important shaping materials of the human history for thousands of years. Wood has been used by humans in various ways like making electric poles, fencing, making home furniture, windows and doors. However, timber (wood) has been also used by humans as a construction material in building. Wood is often categorized as a load bearing material only used for small buildings such as single family houses. This has not always been the case before the invention of steel and reinforced concrete, wood was one of the few materials able to carry tensile loads. This made it a prominent material for bridges and horizontal structure in buildings. The type of wood to be used will depend on the project. Some wood is more suitable than others for building construction, while other types are popular for making instruments or novelty. The wood at the center of a tree is in compression; therefore, it is weaker than the wood from the outer layers which are in tension. In general there are two main types of wood with the main difference being the way trees reproduce⁵.

Hardwood trees are angiosperms that reproduce from seed that are covered in some way, such as fruit, nuts or acorns which must be removed before the seed begins growth. Most hardwood trees lose their leaves in the fall for example Mvule tree. Softwood trees are gymnosperms, which reproduce from uncovered seed. Pines and other conifers are examples of softwood trees that depend on the wind to carry the lightweight seed across distances⁶.

Before choosing wood for any building or construction project it pays to know the characteristics of the wood you are considering. Spending time to investigate how easy it is to work with, how strong is the deformation or elastic to hold up during construction can save time and money. The nature of wood use has, of course, varied from region to region and changed with time.

From 1850s, the invention of cheap steel producing methods and reinforced concrete revolutionized the building industry. Higher and larger buildings were able to be constructed at fewer costs. Around the same time, the invention of modern saw mills led to the price dropping of timber (sawn wood and the products manufactured from it)⁷.

Coming into the 20th century timber was only suited for small or middle height building because the size was limited by a number of factors and the connection technology was undeveloped. Also fire safety in timber buildings of the era limited use in densely populated area.

REFERENCES

1. Eva Frühwald *Analysis of structural failures in timber structures: Typical causes for failure and failure modes* Publication in Lund University research portal 2011
2. A. Zziwa, Y. N. Ziraba & J. A. Mwakali; *Timber use practices in Uganda's building construction industry: current situation and future prospects*. International Wood Products Journal 2013
3. David W. Green, Jerrold E. Winandy, and David E. Kretschmann; *Mechanical Properties of Wood*, Macgrow Hill 2002
4. Samuel J. Record. *The Mechanical Properties of Wood Including a Discussion of the Factors Affecting the Mechanical Properties, and Methods of Timber Testing* Open Knowledge Foundation Network, India: Open Education Project Yale Forest School, 1914.
5. https://www.researchgate.net/publication/316923927_Material_since_Ages_Wood
6. www.differen.com/difference/hardwood-vs-softwood
7. T D G Canisius et.al.2011
8. <https://www.merriam-webster.com/dictionary/wood>
9. spgs.mwe.go.ug
10. www.differen.com/difference/hardwood_vs_softwood
11. (<https://www.britannica.com/science/Hookes-law>)
12. https://en.wikipedia.org/wiki/Young%27s_modulus
13. <https://en.wikipedia.org/wiki/Nagongera>
14. https://en.wikipedia.org/wiki/Tororo_District
15. physics.stackexchange.com
16. <https://caribteak.com/wood-defects/wood-defects-glossary/>)