

DESIGN AND CONSTRUCTION OF A STRUCTURE

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## DECLARATION

I Twebaze Christopher, hereby declare that this report titled "Design and construction of a structure" is my original work and has never been submitted to any University for any award

**SIGNATURE:**

A handwritten signature in black ink, appearing to read 'Christopher Twebaze', written over a dotted line.

**DATE:** 09/06/2019

## **Approval**

This project report titled "Design and construction of a structure" was developed under my guidance and supervision

**NAME:** MR. HABAK WIHI VIANNEY

**SIGNATURE:**

A handwritten signature in blue ink, appearing to be 'HABAK', written over a horizontal dotted line.

**DATE:** 11/06/2019

## **DEDICATION**

I dedicate this work to my beloved father Mr. Kayangire Richard, my wife Kesafaari Jenester,.....ii

APPROVAL Turyahikayo Julius, Muhungirehe Sebastian, Turyagyenda James, Kamugisha Marius and..... iii

DEDICATION Mugabirwe Zepher who helped me for my Education career..... iv

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# CHAPTER ONE

## INTRODUCTION

### 1.0 Introduction

This project includes; the back ground of the project, statement of the problem, aims of the project, objectives of the project, scope, and the significance of the project.

### 1.1 Back ground

The Uganda government white paper on Education (1992) highlights the potential role of Science and Technology in enhancing development. Science and technology advancement is used to ease the work which can only be achieved through student centered practical learning.

The challenges that we do face in teaching and learning through learner centered is lack of apparatus to use in practical lessons (hands on and minds on) and motivation, this lead to poor performance of students in physics. Lack of practical skills can be improved by improvisation of teachers.

Lack of motivation to both teachers and students can be improved by requesting the administrators to provide some little amount to buy instructional materials to use in practical and learners are motivated by teaching concepts which are abstract to real that is practical lessons.

The above challenges lead to fake engineers or scientists by constructing structures which are weak. This can be achieved by constructing of vertical beam which is reinforced to support the ties and struts of structures.

This improvisation skill may lead learners getting the interest in the subject from Ordinary Level to University/ other institutions thus having many engineers.

Therefore learning and teaching of Structures enables one to know about tension and compression forces.

Therefore Structure design is a methodical investigation of stability, strength and rigidity of structure. The basic objectives in structural analysis and design are to produce structure capable of resisting all applied loads without failure during its intended life. The primary purpose of a structure is to transmit or support loads. If the structure is improperly designed or fabricated or if the actual applied or exceed the design specifications, the device will probably fail to perform its intended function, with possible serious consequences .A well - engineered structure greatly minimize the possibility of costly failures.

## 1.2 Problem Statement

Since independence the country has largely promoted Art subjects producing large number of "white collar" workers such as economists, lawyers, office attendants and administrators which explain the shortage of engineers, doctors, among others (Wamboga, 2005). The above can be achieved through student centered practical learning since every few secondary school laboratories are well equipped and most of teachers lack enough improvisational skills to solve the problem. This has led to the theoretical teaching of science disciplines in Uganda thus rendering physics an abstract subject which could not be the case. Therefore this was intended to design and construct a structure so that the learning and teaching of this concept in physics will become easy.

## 1.3. Objectives.

### 1.3.1 General Objective.

The aim of the project was to design and construct a structure.

### 1.3.2 Specific Objectives.

- To design and construct a structure.
- To identify ties and struts.

To ease teaching/learning process

## 1.4 Significance of the project.

The following are benefits of this project.

- Physics teachers will be motivated to improve on practical skills in the lesson and real life situations.
- Students will be motivated to like the subject since some concepts of physics which are abstract will involve hands on experiment.
- The project will help students improve on practical skills which will contribute to their performance in physics.

## 1.5 Scope of the Project

This includes the time scope and academic scope.

### 1.5.1 Time Scope

This project took about five months to be completed.

### 1.5.2 Academic Scope

This project was about designing and constructing a structure to aid in teaching and learning of the concept of ties and struts in S.3.



## CHAPTER TWO

### THEORY

#### 2.0 Introduction

This chapter presents the theory and literature about design and construction of a structure.

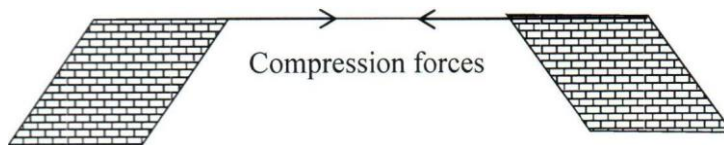
#### 2.1 The construction of a structure

In any structure there are forces that act on it. These are compression and tension forces.

##### Compression Forces

Compression force is that one that acts on the structure in the same direction. With this force, the structure results from particles of a beam to be pressed more closely and its length decreases but thickness of the beam increases

The diagram below shows how compression force acts on a structure.

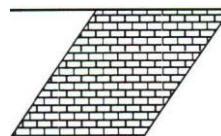


In the diagram above when the grinder is removed, the structure buckles inwards and it is destroyed hence not effective in construction of water dams.

##### Tension Forces

Tension force is the force that pulls a structure in opposite direction resulting to the particles of the beam to be pulled further apart from one another causing its length to increase and the thickness to decrease. (Semu Joseph 2017)

This is shown below



When the grinder is removed in the above, the structure remains. This is best in the construction of water dams.

A structure is said to be rigid when it is able to withstand forces acting on it without collapsing. Experiments with structure of different geometrical shapes have shown that triangular shapes

constructed with beams are best rigid structure. Tension and compression are key forces explaining how structures stay up and why they fall down. A good structure is a cheap one that uses as few girders as possible. They are two different girders used in the construction of structure. They include ties and struts (Obina Johnson and Prof. Elidad J.KB. Banda, 2009)

Ties are girders which are under tension or are a structural member that is stretched so that it cannot buckle that is can be long since they will not buckle. Ties can be replaced by ropes in some cases since they resist tension that will coil under compression.

Struts are a girder under compression or a structural membrane that will tend to buckle under compression.

Ties and struts on structures are applied in roof supports, support for water tanks, wooden door and window reinforcement, radio masts, electric pole supports and pylons (A.Atkinson and H.Sinuff, 1985).

## 2.2 Identifying ties and struts on a structure.

In order identify tie and struts in any rigid structure there are three ways of doing it:-

- Load the structure and watch which girders buckle. If it is buckles it is a strut and if it resists buckling it is a tie.
- Replace unknown girders with a string of appropriate length, if the string tightens it is a tie and if it coils it is a strut.
- Remove the girder and see what happens to the space it was occupying. If the space widens under the forces acting on it, then the girder is a tie and if the space narrows under the forces acting, then the girder is a strut.(Wabwire. H.C,Sekkoba.A.S,Kasirye Simon and G.W .Ssemivure,2010)

## CHAPTER THREE

### MATERIALS AND METHODS

#### 3.1 Materials

Materials used include:-

**Woods.** They are used to be fixed together to form a structure.

**Nails.** These fix the wooden materials together and provides the design of a structure. **Tape**

**Measure.** For measuring the length of the girders.

**Pencil.** This is used to locate the marking points after measuring using a tape measure so that a nail is fixed.

**Hammer.** For hitting the nail so that they get fixed in the structure.

**Load /weight.** It helps in strengthening the girders.

#### 3.2 Methods

Timber are bought and cut to different sizes using hand saw. A tape measure is also used to get the required length of the girder. In case size of the material is needed to be reduced in size, a panga is used.

#### 3.3 Designed and constructed structure

##### 3.3.1 Design

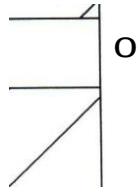
The phase involves a detailed consideration of the alternative solutions defined in the planning phase and results in the determination of the most suitable proportions, dimensions and details of the structural elements and connections for constructing each alternative structural arrangement being considered.

##### 3.3.2 Construction

This involves mobilization of personnel, procurement of materials and equipment including their transportation to the actual place. During this phase, some redesign may be required if unforeseen difficulties occur such as unavailability of specified materials.

**A**

o



o

**C**

o



**D**

o

**Load/ Weight**



Figure 3.1 **Diagram of a structure**

## CHAPTER FOUR

### RESULTS AND DISCUSSION

#### 4.1 Results

After removing the girder which is a tie, the structure buckles outwards and the space widens under the force acting on it. But when the girder is a strut, the structure buckles inwards and the space narrows under the force acting on it.

From the diagram when girders AB and BD are removed, the in between widens

And the structure buckles outwards. Therefore AB and BD are ties. On the other hand when girders BC and CD are removed, the space in between comes together (narrows) and the structure buckles inwards. Thus BC and CD are struts.

When a structure is built by engineers with the beam which is weak, under the forces of tension and compression, the structure buckles and falls down claiming the lives of those staying there and wasting the amount used to buy the materials. The engineers are supposed to do what is in the discussion below.

#### 4.2 Discussion

- When a structure is under tension force, the beam can be replaced by a single string; this becomes cheap in terms of cost.
- The girders used as struts should be as short as possible to reduce the tendency of buckling; and if they are long, they must be made from thicker material which will be heavier and more expensive.
- The structures should be oiled or painted to reduce the chance of the beetles (insects) destroying or weakening them.
- Girders used for the construction of structures should be made of hollow metals then fixed with screws and nuts to make them very strong.

## **CHAPTER FIVE**

### **CONCLUSION AND RECOMMENDATIONS**

#### **5.1 Conclusion.**

A structure was designed and constructed and ties and struts were identified.  
The designed structure can be an efficient improvised aid in teaching and learning of ties and struts.

#### **5.2 Recommendations**

Physics teachers should be motivated by providing science allowances and little amount of money to buy materials to use in practicals so as to involve learners on hands and on minds on experiments.

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