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**DEPARTMENT OF MINING AND WATER RESOURCES ENGINEERING**

**FINAL YEAR RESEARCH PROJECT**

**INVESTIGATION OF THE CAUSES OF FLY ROCKS.**

**Case Study: TORORO LIMESTONE QUARRY.**

**BY**

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## **ABSTRACT**

Fly rock are mainly rocks that are propelled beyond the blast area by the force of an explosion. Comprising of hard soil or stones from the exploding blast holes. When the uncontrolled material fragments are thrown beyond the allowable limits, they result in human injuries, fatalities and structure damages.

In most pits, including the intended direction of throw is horizontal. If too little confinement is provided in the horizontal direction the blast "blows out", causing fly rock to be thrown at a low angle above horizontal, in most open pit mines, any fly rock will be propelled by the relative amount of confinement in the lateral direction as compared to the vertical. The result of too much lateral confinement is the tendency for blow-outs in the vertical direction.

The blasting operations done in the quarry by contracted company (HM Company) by Tororo cement industry is the one of the greatest causes of fly rocks in the quarry since blasting has unavoidable mainly due to the increasing demand for blasted outputs like aggregates for civil and construction purposes, limestone for cement milling at the plants, making fly rock remain to be a serious threat to both surrounding community, quarry personnel and the environment.


This project encompassed detailed assessment of geological rock properties for both structural and rock properties that had great influence to the study investigations, rock characterization for different geo-mechanicals rock properties and blasting techniques parameters that are being in the quarry, their potential impacts to both blasting results and fly rocks were identified, discussed in the report including the rock laboratory tests that were carried out in the characterization and quantifying of rock samples. The rock powder factor used in the blasting operations, the rock fissures, fractures, joints, weathering extent, orientations of the different parameters and the rock discontinuities have been identified, measured and discussed in great details, And finally, by the end of this study, the causes of fly rocks in the Tororo limestone quarry have been investigated and achieved.

## **DEDICATION**

I dedicate this project report to my family especially to my Brother Ochwo John Steven. A and to Aunt Abbo. Beatrice and all my siblings.

**DECLARATION**

I OWOR LABAN hereby declare to the best of my knowledge that this is my true and Original piece of work and has never been submitted to any university or institution of higher Learning by anybody for any academic award.

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**APPROVAL**

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## CHAPTER ONE

### 1.0 Introduction.

This chapter elucidates the background of the study that leads to the problem statement. It also covers the main and specific objectives of the research project, the justification (significances), scope, time period and the purpose as to why the study was carried out.

### 1.1 Background of the study.

During surface blasting process, some stone can get torn and travel to very large distances in addition to this desirable displacement of rock fragments, which is termed as 'fly rock'. This unanticipated fly rock is hazardous to men and machineries which are employed in the mine and also to the surrounding environment, therefore, the blasting engineer should take appropriate measures to control them on the field, (Lundborg et. al., 1975).

In general, there are two kinds of movements associated with bench blasting in open cast mines. Initially, there is forward movement of entire rock mass in the horizontal direction which depends on specific charge and secondly on fly rock (Bhandari, 1984), Mishra and Gupta, (2002) and (Bajpayee et. al., 2004). Fly rock is a rock or stone that is propelled beyond the blast area by the force of explosion. A study of blasting accidents has revealed that more than 40% of fatal and 20% of serious accidents resulting from blasting occur due to fly rock, Mishra, (2003) These fly rock impacts cause craters or blown outs on the surface of bench. The direction of fly is difficult to predict and depends on local conditions and blasting parameters.

In July 5, 1990, a blaster standing on the top of a 200-ft high wall about 505 ft from the blast site was fatally injured by fly rock [MSHA, 1990a]. On October 12, 1990, a visitor and miner were also fatally injured by fly rock [MSHA, 1990b]. On December 21, 1999, an equipment operator in a pickup truck was guarding an access road to the blast site [MSHA, 1999]. The pickup truck was about 800 ft from the blast site.

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