BUSITEMA UNIVERSITY
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FACULTY OF ENGINEERING

DEPARTMENT OF MINING AND WATER RESOURCES ENGINEERING

BLAST OPTIMIZATION AT TORORO CEMENT QUARRY

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A final year project report submitted to the department of mining and water resources engineering in partial fulfillment of the requirement for the award of a degree in Bachelor of Science in mining engineering.

2016.

ABSTRACT

The research study was conducted to devise measures for achieving optimal quarry blasts associated with reduced secondary blasting costs, maximization of profits, increased safety, and environmental protection. Blasting is the most recognized and applied technique. During blasting, energy transformation takes place in the explosive. Rock breakage is associated with generation of dust, air blats, noise, ground vibrations fly rocks etc. Blast optimization is concerned with efficient utilization of explosive energy during the rock fragmentation. The major objectives being desired fragmentation size, safety and environmental protection, presents a necessity for properly designed blasts.

Though numerous studies have been conducted in trying to minimize these blasting effects, a lot of monitoring is required for fly rocks since the direction of throw of material cannot be predicted easily. In this study, focus was put on blast design parameters; geological and human aspects. Human aspects entail the explosive properties, and initiation systems, bench, drill hole, cost of the explosive among others. The geological aspects are; rock properties, ground water conditions.

Today optimization of blasts is achieved through conducting trial blasts. This is an inefficient tool/measure as it is a trial and error technique. In this particular paper, an application tool to integrate the blasting parameters has been developed to eliminate the rudimentary trial blasts. Thus deductions such as qualitative and quantitative results from optimized blasts can be drawn with a right tool with the aim of assessing, monitoring and controlling field blasts which are aspects of a good blasting practice. The results of this practice are minimized cost, profit maximization and safety and environment protection.

DECLARATION

I Nasinza Mariam declare that this report is the outcome of my tireless efforts and it has not been presented in any institution of learning for the award of any form, therefore with all confidence I submit it for the award of a Bachelor's degree in Mining.

SIGNATURE: .... DATE 24th/05/2016

DEDICATION

I dedicate this project to my dearest family for their moral and financial support throughout these four years. It has been quite a long journey which could have been much harder if it were not for their endless efforts.

APPROVAL

This project proposal has been submitted to the faculty of Engineering for examination with approval of my supervisor mentioned below;

SUPERVISOR: Mr. TUGUME WYCLIFFE

Signature... Date.......................................

ACKNWOLEDGEMENTS

I am indeed grateful to the almighty God who has seen me through this incredible experience towards achieving my bachelor's degree.

I wish to recognize the valuable assistance extended to me at all the stages in accomplishment of this project by my beloved Lecturers, Mr. Tugume, Mr. Nasasira, and Mr. Joseph Ddumba.

Not forgetting my classmates, roommates and everyone who have been of a great deal in this accomplishment am forever indebted.

Special thanks to Tororo cement plant for the unlimited permission granted to me towards accessing the quarry for research.

ACRONYMS

ANFO	Ammonium nitrate + Fuel oil
BIMS	Blasting Information Management System
GPS	Global Positioning Satellite
GSI	Geological System Index
RAM	Random Access Memory
RMR	Rock Mass Rating
RQD	Rock Quality Designation
RWS	Relative weight strength
VOD	Velocity of Detonation
UCS	Uniaxial compressive strength
Is	Point load index
kN	kilo Newton
SR	Stiffness ratio
BH	Bench height
K_d	Correction based on rock deposition
K_s	Correction factor based on rock structure
Pf	Powder factor

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CHAPTER ONE: INTRODUCTION

1.1 Background

On rock blasting, chemical reactions occur converting the explosive energy into shock energy and gas energy. It is demonstrated that about 20% of this energy goes to rock breakage and the rest certifies itself in the form of undesirable energy. The undesirable energy is in form of seismic energy, air blast, heat and light. Blasting is accompanied by propagation of the dust, fumes, and fly rocks. It's further, accompanied by back breaks, cracks and misfires (misfire; partial detonation or failure of explosive to detonate). Blast optimization entails efficient utilization of explosive energy during rock fragmentation process, hence less throw of material reducing on fly rocks, less vibrations, back breaks and misfires, reducing blasting costs at large through less explosive consumption, less wastage of explosive energy. For optimal fragmentation, rock displacement and minimal undesirable side effects from blasting, perfect choice of explosives, proper selection of blast design parameters, initiation system and sequence and the delay time should have a common relationship.

Today blasting is conducted in the vicinity of cities, villages and dwellings, as it is for Tororo cement quarry .The blasting effects have had a negative impact on residents near Tororo cement quarry, and the company.

Constantly complaints arising from residents neighboring Tororo quarry concerning the cracks developed in their buildings due to vibrations, and annoyance due to the noise generated from the blasting operation.

The impacts of blasting include injuries to persons and instability of the walls of the quarry which may lead to fatalities.

Therefore, blast optimization is highly desirable to mitigate afore mentioned problems.

1.1.1 Air blast

Air blast is a transient impulse that travels through the atmosphere. Much of the air overpressure produced by blasting has a frequency below the audible limit of 20 Hz. Air overpressure, both audible and inaudible, can cause a structure to vibrate in the same way as ground vibrations.

Causes of air blast

5.3 REFERENCES

Blair, A. C. (2015). A novel powder factor based bench blast design method for large surface coal mines.

Bowa, V. M. (2015). Optimization Of Blasting Design Parameters On Open Pit Bench A Case Study Of Nchanga Open Pits, *4*(09).

Keaton, J. R. (2007). Rock Slope Engineering: Civil and Mining, 4th Edition. *Environmental and Engineering Geoscience*, *13*(4), 369–370. http://doi.org/10.2113/gseegeosci.13.4.369

Mishra, A. (2009). DESIGN OF SURFACE BLASTS- A COMPUTATIONAL APPROACH Department of Mining Engineering National Institute of Technology DESIGN OF SURFACE BLASTS- A COMPUTATIONAL APPROACH Under the Guidance of Dr . KAUSHIK DEY Department of Mining Engineering National Instit. *Mining Engineering*.

Pradhan, M., Balakrishnan, V., & Pradhan, G. K. (2015). Use of Discarded Water Bottles in Blasting- An Innovative Enviro-Friendly Technique, *3*(1), 51–56.

Submitted, A. T., Partial, I. N., Of, F., For, R., Degree, T. H. E., Technology, B. O. F., … Parida, C. K. (2007). OPTIMIZATION OF BLASTING PARAMETERS IN OPENCAST MINES OPTIMIZATION OF BLASTING PARAMETERS IN OPENCAST MINES.

Venkatesh, M. (2010). LIMESTONE ROCK FRAGMENTATION ANALYSIS USING WipFrag LIMESTONE ROCK FRAGMENTATION ANALYSIS USING. *Dept. of Mining Engineering, National Institute of Technology Rourkela*, *1*(1), 3–6.

Highway, F. (1991). Rock Blasting and Overbreak Control, (132).

Iiuterimatioimal, F., & On, S. (2015). FIRST IIUTERIMATIOIMAL SYMPOSIUM ON ROCK FRAGMENTATION BY BLASTING Symposia publication, (1).

Office, G. E. (n.d.). GUIDE TO ROCK AND SOIL DESCRIPTIONS GUIDE TO DESCRIPTIONS.

Rock Mass Rating.pdf. (n.d.).

Santi, P. M. (2006). Field Methods for Characterizing Weak Rock for Engineering, XII(1), 1–11.

Vergne, J. De. (n.d.). Hard Rock Miner ' s Handbook.