



**BUSITEMA  
UNIVERSITY**  
*Pursuing Excellence*

## **FACULTY OF ENGINEERING**

**DEPARTMENT OF MINING AND WATER RESOURCES**

**ENGINEERING**

**FINAL YEAR PROJECT REPORT**

**Investigate and Establish Bench Parameters for Re- Design  
of Tororo Limestone Quarry**

**By**

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*^ proposition submitted in partial fulfillment of the requirements for a  
bachelor's degree of science in Mining Engineering*

*May 2016*

## ABSTRACT

This final year research project aimed at investigating and establishing bench parameters for re-design of Tororo limestone quarry. Design of open pit slope angles is more important as the depths of open pits continuously increases. Small changes in the overall pit slope angles have large consequences on the overall economy of the mining operation.

Tororo quarry has comparable geological formations along the carbonatite complex, for this reason detailed fieldwork was performed to determine the properties (spacing, roughness, weathering, karst etc.) of the discontinuities of the rock slope in the study area. The uniaxial compressive strength (UCS) of rock samples obtained from the study area were tested in the laboratory.

The stability of the slope was assessed using orientation-independent slope stability probability classification (SSPC) system in order to determine maximum slope height. The re- design geotechnical parameters were determined using both empirical mathematical equations and the existing equipment in Tororo quarry.

The research also gives the logical conclusion inferred from the research activities and goes ahead to give recommendations based observations, empirical and analytical data.

## DECLARATION

I OGALA OSCAR, declare that this final year project is my own original work and that it has not been presented to any other University for a similar or any other degree award. I take full responsibility over it and any other person mention here is not responsible.

Student's name OGALA OSCAR

Signature [Handwritten Signature]



## **DEDICATION**

This report is dedicated to my parents Mr. Ekitwi Romano and Mrs. Titin Margaret, and above all to the whole family for the assistance rendered to me throughout my life of education ever since I joined school up to today at university may God bless them all for their support and reward them abundantly.

## APPROVAL

This final year research project report presented to my office has been compiled, read, understood and produced under my full guidance and supervision with all my concentration and passion.

**Signature**.....

**Date**.....

**Supervisor:** Ms Nangendo Jacqueline

## ACKNOWLEDGEMENTS

I would like to express my gratitude to Busitema University Mining and Water Resources Engineering Department for helping me get to this point in my academic career. I am very grateful for all the support given to me by the department through my time at Busitema University.

I am sincerely in debt to Ms. Nangendo Jacqueline, my advisor, for all of her assistance and guidance through the course of this research project as well as my academic career. I would also like to thank the other members of department, Mr. Ddumba Joseph Lwanyaga, Ms. Egole Marion, Mr. Mugisha Moses, Mr. Mukiibi Ivan, Mr. Tugume Wycliffe and Mr. Nasasira Hillary for their expertise and help. I am thankful to have had the full support of this commission.

I would also like to recognize and thank Tororo Cement Factory Limited for their support of this project from a research standpoint. Specifically, I would like to recognize Eng. Jayeshalem Yesu for his time, suggestions, and assistance throughout this project.

Finally, thank you to my family and friends who have enabled me to reach this point. Without their encouragement, I would not be in the position I am currently.

## LIST OF ABBREVIATIONS

**MEMD** – Ministry of Energy and Mineral Development

**ISRM** – International Society of Rock Mechanics

**UCI** – Uganda Cement Industry

**UDC** – Uganda Development Corporation

**TCL** – Tororo Cement Limited

**RQD** – Rock Quality Designation index

**TC** – Condition factor

**CD** – Condition of the discontinuities

**DS** – Average spacing's of the joint sets

**IRA** – Inter Ramp Angle

**BSA** – Bench Stack Angle

**OSA** – Overall Slope Angle

**IOSA** – Indicative Overall Slope Angle

**ROFRAQ** – Rock fall Risk Assessment for Quarries

**UCS** – Uniaxial Compressive Strength

**SPA** – Spacing Parameter

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either mining of dimension stone or aggregate (Morrison and Russell, 1973). It is preferable, however, to restrict this term to production of dimension stone only (Hartman and Britton, 1992). The products of quarries are prismatic blocks of rock such as marble, granite, limestone, sandstone, slate, etc.,

Open pit or open cast mining is used to exploit a deposit near the earth's surface that has a relatively low stripping ratio, is preferably large in extent, and is reasonably uniform in value (Hartman and Britton, 1992).

### 1.1.2 Mine Design

At the preliminary design stage, decisions are made about general quarry slope alignments and the likely working sequence. Geological and geotechnical data will be required since these may affect considerations. The alignments and position of final quarry slopes may be determined by other constraints on development however (e.g. available land, topography etc)(Jarvis *et al.*, 2014).

The principal aim of the preliminary design is to select a working method that minimise geotechnical hazards whilst maintaining an economic and efficient operations. Several alternative methods and slop alignments should be considered and the geotechnical and operational implications of each assessed. A useful method is the preparation of a geotechnical hazard plan in which the potential mode of failure, likelihood of failure and operational implications of failure are used to classify slopes. Such plans should also be prepared for development issues to be made (Ruth *et al.*, 2014).

In order to maximise production in quarries and to minimise the overall stripping ratio, the steepest feasible overall slopes are generally required. The first step in the design of such slopes is to identify the maximum overall slope for the depth of operation projected. All materials that that are to be excavated must be considered.

Most quarry slopes are benched and the overall slope depends on the relationship between width, height and face angle of the benches. The stability of benches with different combinations of height, width and face angle should be analysed for each material and each geotechnical setting identified and in combinations that do not exceed the maximum allowable overall slope angle. Bench considerations will depend on both operational and stability considerations (Ruth *et al.*, 2014).

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