BUSITEMA UNIVERSITY
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Faculty of Engineering

Department of Mining and Water Resources Engineering

ANALYSIS OF SHOVEL-TRUCK SYSTEM FOR OPTIMAL SELECTION AT TORORO CEMENT QUARRY

By

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ABSTRACT

This project report entails the analysis of shovel-truck system for optimal selection at Tororo Cement Limited Quarry, in Tororo-Uganda, with the basic aim of optimizing cycle time, material size, loading distance through and cost of shovel-truck system.

This is justified by the fact that, Material handling account for 60% of the total operating cost of the mines, so it is desirable to maintain an efficient material handling system. This is due to the facts that as the size of fleet being used increases, shovel productivity increases but truck productivity decreases, so an effective fleet size must be chosen that utilize all equipment.(May et al. 2012)

This was done by thoroughly reviewing literatures of shovel-truck productivity, cost of handling material, effects of field parameters and application of models that optimize the time parameter and general impact on a company's productivity at the quarry.

Shovel-truck system operational data from the quarry was analyzed and applied to a multi-channel queuing model representative of the loading process of the haul cycle. The outputs of the model was compared with actual data to evaluate the validity of the queuing model used.(May et al. 2012)

The end aim of project is to optimize the time to ensure that the practices is conducted in the fastest means possible with maximum utilization of the availed equipment for output and profit maximization.

DECLARATION

I **LOKWE EMMANUEL, BU/UG/2012/1803,** Pursuing a Bachelor of Science in Mining Engineering do hereby declare that, this project report has been compiled by me and has not been presented to any University or other institution of higher learning for any academic award.

Signature..................................

Date. 30th/05/2016

APPROVAL

This piece of work has been endorsed by:-

Signature: ------------------------------------ Date: ------------------------------------

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ABBREVIATIONS AND ACRONYMS

TCL- Tororo cement limited

M/M/c- Kendall notation

GDP- Growth Domestic Product

LSM -Large-Scale Mining

Kms – kilometers

UCI - Uganda cement industry

UDC- Uganda Development Corporation

BCY - Bank cubic yard

UDC Uganda Development Corporation

CHAPTER ONE

1.0. INTRODUCTION

This chapter contains, TCL background information, Problem statement describing the context for the study and the purpose statement to provide a specific and accurate synopsis of the overall purpose of the study, and the significance indicating how this project will refine, revise, and extend the existing knowledge on Shovel-truck systems to Tororo cement limited (TCL) Quarry. It further incorporates the scope, justification and limitations of the proposed research project.

1.1. BACKGROUND OF TCL

1.1.1. Location and address

TCL is located in the Eastern part of Uganda about 230Kms from the Capital city Kampala. It is 10Kms before the Uganda/Kenya border town of Malaba. Access from Kampala is by an all-weather tarmac road. The coordinates of the main factory are 00 39 36N, 34 09 18E (Longitude: 0.6600; latitude: 34.1550).

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1.1.2. Geology of Tororo rock suite

Rocks of the Tororo Suite occupy the eastern segment of the WTT, underlying a surface of ca. 3,000 km^2. Tororo Suite granitoids are typically biotite bearing and composed of several sub-facies including gneissic granite and granodiorite, hornblende-bearing granodiorite, granite and diorite, porphyritic granite, biotite granite, medium-grained granite with pegmatite and the dated Kisoko granite (~2.664 Ga). A special facies of Tororo Suite rocks is formed by Na-K metasomatic halos surrounding the Neogene carbonatite plugs of the alkaline Elgon Complex. Regionally, the contours of the Tororo Suite can be distinguished from the surrounding rock units by their high

REFERENCES

Bazzaz, A.A., Osanloo, andM., Karimi, B. (2008). Mine Planning and Equipment selection. In *Optimal Open Pit Mining Equipment SelectionUsing Fuzzy Multiple Attribute Decision Making Approach* (pp. p.253-268.). China .

Alkass, S., El-Moslmani, K., & AlHussein, M. (2003). *A Computer Model for Selecting Equipment for Earthmoving Operations Using Queuing Theory.* Montreal, Canada:: Concordia University.

Amirkhanian, S.A., Baker, N.J. (1992). Expert System for Equipment Selection for Earthmoving Operations. *Journal of Construction Engineering and Management, Vol. 118, No. 2*, p.318 - 331.

Bandopadhyay, S., Venkatasubramanian, P. (1987). Expert systems as decision aid in surface mine equipment selection . *Journal of Mining, Reclamation and Environment*, p.159-165.

Bascetin A. (2003). A Decision Support System for Optimal Equipment Selection in Open Pit Mining. *Analytical HierarchyProcess, Istanbul Tech University journal of Geoscience,* , vol.16, p.1-11.

Bascetin A., Oztas, O., and Kanli, A.I. (2006). EQS: Computer Software Using FUZZY Logic for Equipment Selection in Mining Engineering. *TheJournal of The South African Institute of Mining and Metallurgy*, Vol.106, p.63-70.

Bonates, E.j.l. (1992). *The development of assignment for semi-automated truck- shovel system Evolutionary Water Cooled Reactors* . Monteral: University of McGill.

Bozorgebrahimi, E., Hall, R. A., and Blackwell, G. H. (2003). Sizing equipment for open pitmining –a review ofcritical parameters Mining Technology. In E. H. Bozorgebrahimi, *Sizing equipment for open pitmining –a review ofcritical parameters Mining Technology,* (pp. Vol. 112, p.A171-A179).

Caterpillar. (2012). improving efficiency underground. *A challege work trucking*, VIEWPOINT,7,2.

Çelebi, N. (1998). An equipment selection and cost analysis system for openpit coal mines. *International Journal of Mining, Reclamation and Environment,12:4*, p.181-187.

Clement, G. K. (Director). (1980). *Capital and operating Cost Estimating System Manual for mining and beneficiation of metallic and non-metallic minerals except fossil fuels in the United States and Canada* [Motion Picture].

Denby, B. and Schofield, D. (1990). Applications of expert systems in equipment selection for surface mine design. *International Journal of Mining, Reclamation and Environment*, p.165-171.

E. P. Pfleide. (1973). Surface haulage and storage. In E. P. Pfleide, *SME mining engineering handbook, volume 2,* .

Ercelebi, S. G., & Bascetin, A. (2009). Optimization of shovel-Truck system for Surface Mining. *The Journal of The Southern African Institute of Mining and Metallurgy*, 433-439.

Erdem, B., Çelebi, N., and Pasamehmetoglu, A.G. (1998). Optimum dragline selection for strip coal mines. *Min. Industry*, pp. p.A13-A24.

Fytas, K., Collins, J.L., Flament, F., Galibois, A., and Singhal, R. (1988). Potential applications of knowledge-based systems in mining. *CIM Bulletin*, pp. p.38- 43.

Ganguli, R. B. (2002). Expert System for Equipment Selection. *InternationalJournal of Mining, Reclamationand Environment, 16:3*, p.163-170.

Gentry D. W and O'Neil T. J. (1984). Mine investment analysis. In G. D. J, *SME* .

Gross, D., & Harris, C. M. (1998). *Fundamentals of Queueing Theory.* New York: John Wiley & Sons, Inc.

Haidar, A., Naoum, S., Howes, R., and Tah, J. (1999). Genetic Algorithm Application and Testing quipment Selection. *journal of Construction Engineering and Management, Vol. 125, No. 1January/ February,*, p.32-38.

Hartman, H. L., & Mutmansky, J. M. (2002). *Introductory Mining Engineering.* Hoboken, NJ:: John Wiley & Sons, Inc.

May, Meredith Augusta. (2012, december 19). *Applications of Queuing Theory for Open-Pit Truck/Shovel Haulage Systems.* Blacksburg, VA: Faculty of the Virginia Polytechnic Institute and State University. Retrieved september 6, 2015

Najor, J., & Hagan, P. (2004). *Mine Production Scheduling within Capacity Constraints.* Sydney, Australia: The University of New South Wales.

Pfleider, E. P. (1973). Surface haulage and storage, . In E. P. Pfleider, *SME mining engineering handbook,* , (p. volume 2).

Samanta, B., Sarkar, B., and Mukherjee, S. K. (2002). Metall. Sect. A: Min. Technology. *Selection of opencast mining equipment by a multi-criteria decision-making process, Trans. Instn Min,* p.A136-A142.

Tayeb, S., Ahcene, B., Jerome, P., Omar, S., and Mouloud, B.K. (2007). Equipment Selection by Numerical Resolution of the Hessian Matrix and TOPSIS Algorithm. *Asian Journal of Information Technology*, Vol.6(1), p.81-88.