
FACULTY OF ENGINEERING
DEPARTMENT OF MINING ENGINEERING
MATLAB-BASED OPTIMIZATION OF TRUCK-LOADER FLEET FOR
UNDERGROUND MINES

Case study: WAGAGAI MINING COMPANY (U) LTD

FINAL YEAR PROJECT REPORT

By

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A Research report to be submitted to the Department of Mining Engineering in partial fulfilment of the requirement for the award of the Bachelor of Science in Mining Engineering of Busitema University

Abstract

The determination of optimal fleet is key activity in mining operation as loading and haulage account to more than 60% of total operation cost. One of the major costs in mine is related to the purchase and application of equipment. Proper fleet selection, in a way that secures the production needs of a mine as well as minimizing the cost of production, is one of the main challenges of mine planners. The equipment selection process can be classified into three phases i.e. type of fleet, size of equipment, and calculation of required numbers. This study focuses on the proper placement of the passing bays in an underground tunnel that optimizes production efficiency, and meets the desired output from the available working-time which can also be referred to as the time factor. This is achieved by helping in the determination of a satisfactory cycle time that will conform with the continuous functioning of the loader, which leads to the design of a fleet system that will be perfect for a shovel from the inequality $CYT_{MIN} \leq NT (T_l + T_s)$. This implies that the circle time must be less than or equal to the number of trucks multiplied by the summation of the loading time and the spotting time. This also means that the loader should at no time during the loading and haulage operation await other trucks. When selection of equipment is not properly done it results into over trucking or under-trucking. In many underground mines, haulage vehicles carry ore from underground loading stations to the surface. Vehicles travel in narrow tunnels with occasional passing bays that allow descending empty vehicles to pull off the main path and wait for ascending laden vehicles to pass. The number of passing bays and their locations influence the delays to descending vehicles, and hence the haulage productivity of the mine. formulate and solve a mixed integer programming (MIP) model to determine the optimal locations of passing bays to maximize haulage productivity for given numbers of vehicles and passing bays. The loading and hauling system at Wagagai mine need to be evaluated since the operations are expanding and new equipment (trucks and shovels) has been introduced. With the increase in the number of units for both excavation and transportation, the mine aims to operate at maximum efficiency. The key contribution of this paper is to find the optimal locations of passing bays and the associated vehicle schedule to maximize tonnes hauled per shift in an underground mine.

Approval

I present this research report to Department of Mining Busitema University which has been under the supervision of the following supervisors:

Supervisor

Name: MR. NUWAREEBA EDISON

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

Supervisor

Name: MR. KIDEGA RICHARD

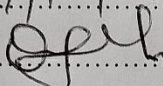
Signature.....Date.....

DECLARATION

I ONGULA MAXWEL, hereby declare that this document was written by me and is a true reflection of what transpired during the project development time. I therefore affirm that the research conducted for this report was carried out diligently, employing reliable sources and appropriate methodologies. An external source used have been appropriately cited, referenced and credited

This report has not been utilized in the acquisition of an academic award by any individual or any learning institution

Date.....17/10/2024.....

Signature..........

DEDICATION

I would like to dedicate this report to my family members, friends and relatives. And anyone who took part in this part of my education physically, emotionally, financially, and spiritually. May Almighty God bless and reward you abundantly.

ACKNOWLEDGEMENT

I take this opportunity to thank the almighty GOD for granting me life, good health and the ability to research and gather information that is integrated in this report

I am deeply indebted to my dear supervisors: NUWAREEBA EDSON and MR KIDEGA RICHARD for the time, support, guidance, knowledge, and advice provided to me during the preparation of this research proposal. May the almighty reward you abundantly

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5.3.2 Areas for further research

- The research aimed at reducing the waiting time for the fleet in an underground mine. Further research can be done to control vehicle collision in underground mines.
- The research was based on mixed integer linear programming using MATLAB. Further research can be done using the Monte-Carlo simulation method.

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