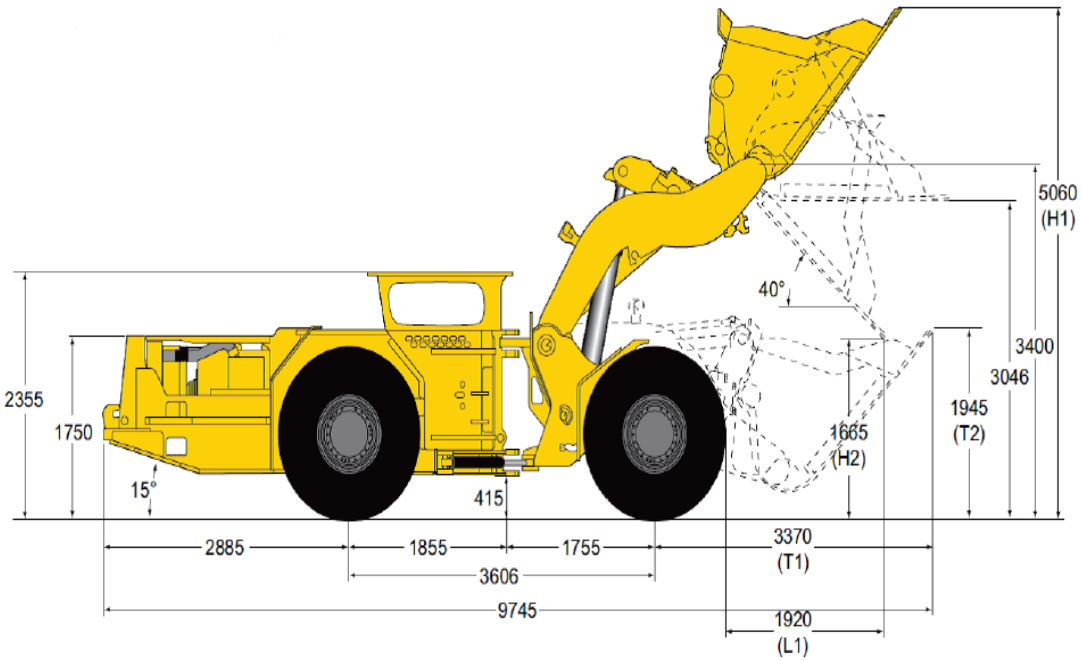
TECHNICAL REPORT

Future Loading System at Kiirunavaara Underground Mine



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PREFACE

The research work presented in this report was performed at the Division of Mining and Geotechnical Engineering, Luleå University of Technology. This work is the part of the I² Mine work package 2 (Novel Mining and Underground Processing Methods), subtask 2.1.1. We would like to thank the EU 7th framework program for the financial support they provided during the time of this work. Loussavaara- Kiirunavaara Aktiebolag (LKAB) is greatly acknowledged for providing the opportunity to perform the study.

ABSTRACT

Diesel-powered equipment has for many years been utilized for loading and hauling in underground mining operations. Normally, these machines work in combination with other ore-handling components such as orepasses. The availability of other loading options such as electric machines, Häggloaders, and wheel loaders makes the selection of the loading equipment crucial for achieving higher throughput and an effective choice is an important factor in mine production optimization. Improper selection could increase the operating costs and generate lower production rates. This study is conducted at Kiirunavaara underground mine aiming at providing guidelines for selecting the future loading system by comparing different loading equipment alternatives for the possible future conditions. The study is made using different simulation software, AutoMod and SimMine. Various scenarios in terms of loading equipment fleet were simulated, all aiming for a fixed production target. The result shows that the current loading operation which consists of one 25 tonnes electric and one 21 tonnes diesel machines produces the average daily production of 6035 tonnes which is 60% of the daily future planned production. Among all simulated scenarios, it is shown that the use of two electric LHD machines from 6:00 a.m in the morning until 00:30 a.m before blasting and either one or none of the electric LHD machine after blast are the favoured options towards achieving the daily planned target. The analysis show that, when increasing mining depth, minimizing the usage of diesel machines and increasingly using electric units has great impact towards cost reductions, which is particularly important when mining depth increases since the heat emission factor also increase the cost to ventilate the mine. Further, statistical analysis shows that both AutoMod and SimMine tools produces relevant results compared to each other.

Keywords: *Loading system, equipment selection, Ore pass system, Gas emission, Discrete Event Simulation, increasing mining depth*