

PROJECT DESCRIPTION

LKAB

Malmberget Mine, Sweden



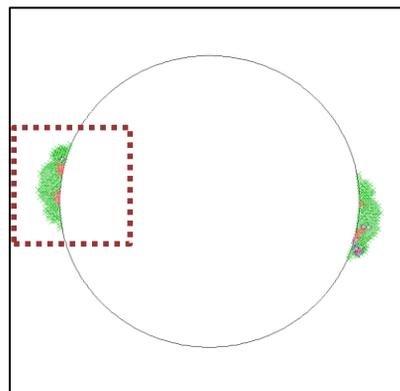
The LKAB mining company is currently carrying out investigations for a potential continued mining at depth in the Malmberget mine. Part of this work involves design of ore passes. The ore passes are a vital part of the transportation chain, and has, historically, been subject to extensive instabilities leading to closing and re-development of ore passes. The objective of this project was to: (i) validate rock mass strength and stress state, and (ii) determine the optimal orientation and location of ore passes with respect to the effects of wear (geometrical changes) and stress-induced failures in the ore pass walls.

ITASCA'S ROLE

Itasca conducted a numerical modeling study using *FLAC* in which modelling results were compared with observed fallouts in ore passes and ventilation shafts. A brittle (cohesion-weakening, friction-strengthening) material model was used, and representative material strengths determined. Following this, a large number of alternative scenarios were explored in which ore pass orientation and location were varied. Ore pass wear was simulated by creating a groove at the bottom of the ore pass. Progressive spalling (stress-induced) failure was modelled in selected cases, by removing rock that was encapsulated by a contiguous shear band and the ore pass wall in an iterative manner.

PROJECT RESULTS

An example of calibrated spalling failure is shown below. The brittle material model was found to successfully replicated observed fall-outs. Analysis of future ore passes showed that material strength and local geology were more critical than location and orientation of the ore passes. The results are currently used in the design process for new ore passes.



Observed spalling failure in the ventilation shaft (left) and *FLAC* modeling results (right)