Simulation of 3-D Pore-Pressure Distributions for Slope Stability Analysis

CIVIL • ENVIRONMENTAL • MANUFACTURING • **MINING** • OIL & GAS • POWER GENERATION

PROJECT DESCRIPTION

Codelco

Chile

This project involved the simulation of pore-pressure distributions at the Chuquicamata open-pit mine slope in Chile, which is the largest copper mine by excavated volume.

ITASCA'S ROLE

A three-dimensional (3-D) groundwater flow model was constructed using MINEDW. Three main factors required the implementation of a 3-D model: 1) discrete zones of recharge in the gravel zone lead to a non-uniform flow field; 2) the low permeability west fault and shear zones maintain the non-hydrostatic pore-pressure distributions with depth during mining; and 3) the drainage gallery causes localized depressurization. In addition, the development of the zone of relaxation (ZOR), according to the mining schedule, is simulated. The model was calibrated against measured water levels, pore pressures, drains, and seepage rates.

PROJECT RESULTS

The calibrated model was used for the prediction of pore-pressure distributions in the pit walls for different time periods. The model was able to capture the non-hydrostatic, transient nature of the pore pressures with depth in the granodiorite west of the shear zone, in the shear zone, and along the west fault. The exported pore-pressure distributions were used as an input to the 3DEC slope-stability analyses.

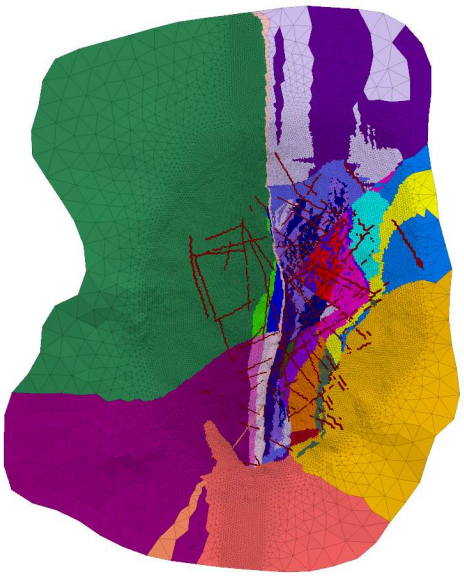

Figure 1. Plan View of Model Grid and Simulated Geologic Units

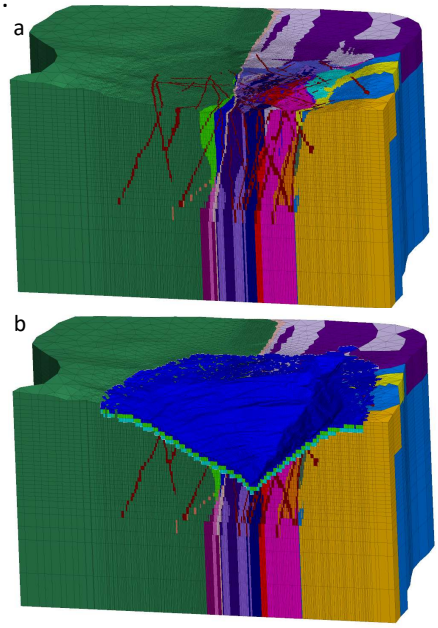

Figure 2. Cross-sections a) Before Mining, b) During Mining (with ZOR)

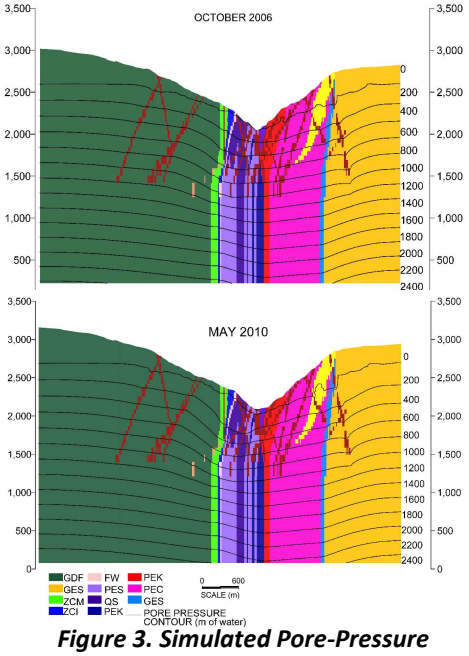

Figure 3. Simulated Pore-Pressure Distributions

REFERENCES

Liu, H., F. Duran del Valle, J. Xiang, and B. Şener Kaya. 2012. Simulation of three-dimensional pore-pressure distribution for slope-stability analysis, 46th US Rock Mechanics/Geomechanics Symposium, Chicago, IL, USA, 24-27 June.

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