Jessa Vatcher

Senior Engineer

Expertise	Mining Engineering, Rock Mechanics, Numerical Modelling
Education	Doctor of Philosophy (Rock Mechanics), 2017 Luleå University of Technology, Luleå, Sweden
	Licentiate of Engineering (Rock Mechanics), 2015 Luleå University of Technology, Luleå, Sweden
	M.A.Sc. Mining Engineering (Rock Mechanics), 2012 Queen's University, Kingston, Canada

Professional Experience

2017 – Present	*Itasca Consultants AB, Luleå, Sweden* *Rock Mechanics Consultant*
2013 – 2017	*Itasca Consultants AB, Luleå, Sweden* *Rock Mechanics Consultant, Part-time*
2012 – 2017	*Luleå University of Technology, Luleå, Sweden* *Doctoral Student, Division of Mining and Geotechncial Engineering*
2007 – 2011	*Queen's University, Kingston, Canada* *Teaching Assistant, Robert M. Buchan Department of Mining*
2008	*Stantec, North Bay, Canada* *Engineering Intern*
2007	*Vale, Sudbury, Canada* *Engineering Intern, Creighton Mine*

Project Experience

<u>*Mining:*</u>

Evaluation of inclined caving mining method for a pre-feasibility study for a deep Australian mine from a rock mechanics perspective. 3D numerical modelling used to assess potential stability issues.

Literature review and analysis of InSAR data concerning surface deformation after discontinued mining.

Statistical simulations of hydraulic fracturing for a mine using full hydraulic-mechanical coupling with discrete fracture networks (DFN). The purpose of this analysis was to provide recommendations as to alternative hydraulic fracturing intervals with the given knowledge of the geomechanical environment.

Evaluation of production associated risk factors of seismicity in LKAB's Kiirunavaara Mine. A three-dimensional numerical analysis that evaluated the influence of different realisations of production and unplanned remnants by including all production fans in the analysis volume.

Three-dimensional continuum analysis of LKAB's Kiirunavaara Mine (sublevel caving) as part of the permit application submitted to the Environmental Court of Sweden (Mark- och miljödomstol). The purpose of the analysis was to 1) evaluate correlations between vibrations on the ground surface, mining induced seismicity, and production, and 2) use these correlations to evaluate if ground vibrations are expected to be different with continued production to Level 1365 m.

Three-dimensional continuum analysis of the LKAB's Malmberget Mine (sublevel caving), to evaluate the influence of alternative mining sequences on cavity growth and seismicity for a specific set of orebodies.

Three-dimensional continuum analysis for the prefeasibility study for a potential underground mine. The purpose of the analysis was to evaluate mine scale stress fields and likely behaviour with production alternatives.

Recommendation of suitable mining methods for a potential underground mine as part of a prefeasibility study.

Two-dimensional continuum analysis to evaluate if a potential discontinuity contributed to observed deformations on the ground surface above and underground mine.

Infrastructure & power generation:

Evaluation of the long-term stability of a historic nuclear power station. Techniques used included a literature review, a site visit, and empirical calculations.

Probabilistic analysis of spalling location and depth around deposition tunnels for Sweden's planned spent nuclear fuel repository.

Three-dimensional continuum analysis of the planned bus terminal which will be located in the rock slope at Slussen in Stockholm. The purpose of the analyses included: sensitivity of planned geometry to variation in the stress field, stability analysis of a planned tunnel under pre-exiting tunnels with sequenced installation of concrete liner, stability analysis of a planned thin pillar, and stress analysis for a stretch of tunnel with complex support design.

Three-dimensional continuum analysis of planned additional tunnels to a subway station in Stockholm. The purpose of the analysis was to evaluate stability and expected displacement of the excavations with consideration of the shallow rock cover in some areas, variation in the stress field, and loads on the ground surface from buildings and roads.

Three-dimensional continuum analysis of the planned building construction above pre-existing road tunnels at Årstastråket in Stockholm. The purpose of this analysis was to evaluate the potential influence of the buildings and their complex foundations on the pre-existing tunnels.

Research:

Automation of model runs to evaluate probability of failure using Itasca's *FLAC3D* using the Accelerated Weight Histogram (AWH) method. Automation accomplished using a combination of *Python* and *Itasca's* built-in scripting language, *FISH*.

Exploration of the rock damage process using Itasca's *PFC* particle code with spheres and rigid blocks (BBM). Voronoi formed and tetrahedral rigid blocks were used. Materials were calibrated to Lac du Bonnet granite laboratory tests, and the Mine-By Experiment was simulated in 3D with realistic stress path (coupled *FLAC3D-PFC*).

Exploration of the rock damage process using Bonded Block Modelling (BBM) in Itasca's *3DEC* code. Particular focus was given to spalling behaviour and expanding our fundamental understanding of BBM application and techniques. Calibration of parameters was achieved through BBM representations of laboratory testing and then applied to theoretical mining and tunneling problems.

Teaching and academic experience:

Supervisor to Aris Skarvelas Master's thesis (2021) at Luleå University of Technology.

Assisted in creation and teaching of *FLAC3D* (2019) via TEKNA in Trondheim, Norway.

Assisted in developing and training of numerical modelling using *FLAC* (2016, 2017, 2018, 2021) at Luleå University of Technology.

Assisted in training on mining methods at the Sandvik International Mining School (2014).