

Fredrik Perman

Principal Rock Mechanics Engineer

Expertise Rock Mechanics, Mining Engineering, Numerical Modeling

Education M.Sc. Civil Engineering (Rock Mechanics), 2003
Luleå University of Technology, Luleå, Sweden

Professional Experience

2018 – Present *Itasca Consultants AB, Luleå, Sweden*
Principal Rock Mechanics Engineer

2011 – 2018 *Itasca Consultants AB, Luleå, Sweden*
Rock Mechanics Consultant

2006 – 2011 *Vattenfall Power Consultant AB, Luleå, Sweden*
Rock Mechanics Consultant

2003 – 2006 *SwedPower AB, Luleå, Sweden*
Rock Mechanics Consultant

2001 *Luleå University of Technology, Dept. Rock Mechanics, Luleå, Sweden*
Intern

2000 *Boliden Mineral AB, Aitik, Gällivare, Sweden*
Trainee

1997 *SEI Datasvar, Sveg, Sweden*
Computer Support Specialist

1996 – 1997 *Vattenfall Training Centre, Jokkmokk, Sweden*
Civil Servant - Waterpower Production Assistant

Project Experience

Infrastructure (Tunneling):

Responsible rock mechanic engineer for the design work and construction of the Korsvägen part at the West Link Project (Västlänken) in Gothenburg. The rock mechanic work including one new underground 4-track railway station with low rock cover and huge span, access tunnels and connecting tunnels.

Involved in rock mechanics analysis of a pilot storage for gas, in the form of an underground lined cavern.

Design work for the extension of the Stockholm metro involving new underground stations, and deep tunnels, for two of the planned three metro lines.

Geometry setup for numerical modelling of the stress field in the Stockholm area, including large-scale structures and topography.

Geometry setup for numerical modelling of the Follobanen high-speed railway tunnel in Oslo.

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 analysis was to verify constructability in the developed layout. Also, a detailed analysis of a horizontal raise bore tunnel was made, with installed rock bolts and lining.

As part of the planning for the highway tunnels in the Bypass Stockholm project, numerical analysis of a tunnel intersection was performed. The model included intersections with large roof spans between the main tunnel and caverns and shafts for air exchange. A three-dimensional model in *3DEC* was constructed, including a fault zone and one joint group. The purpose of the model was to verify constructability in the developed layout.

Detailed design work for the Citybanan (City Link) commuter-train tunnel project in Stockholm. Three-dimensional continuum- and discontinuum analyses of the crossing between Citybanan City Station and Blue Subway Station. Design and analysis of tunnel intersections between Citybanan and pre-existing energy tunnels, including three-dimensional continuum analyses.

Evaluation, interpretation, and analysis of all rock stress measurements in the Stockholm area to obtain design data for the Citybanan project. Rock stress measurements for the Citybanan project in different locations, participated as field engineer, interpretation, and reporting.

Rock mechanics analysis of bridge foundation over open-mine stopes for a new railroad in Kiruna. Numerical analysis of shotcrete reinforcement in rock tunnels, using two- and three-dimensional models, with the objective of developing guidelines for simulation and evaluation of shotcrete in tunnel design work.

Participated in developing design guidelines for railroad tunnels in rock for Banverket (the Swedish Railroad Administration).

Slope inspection of road cuts.

Hydropower:

Investigation of the stability of the rock foundation of one of the largest hydropower dams in Sweden. The aim was to clarify whether the rock foundation can be a problem for the dam safety. The work started with analysis of existing documentation, and identifying issues concerning the bedrock that may affect the dam's function. Increase knowledge of local conditions and thus reduce the remaining uncertainties regarding the rock foundation. Investigate identified potential problems and develop a knowledge model and a survey and monitoring program for rock foundation.

Nuclear Waste Disposal:

Analysis and interpretation of rock stress data for the Forsmark site, including regional stress data, to assess the confidence of measured stresses with different methods and to provide input to stress modeling and detailed site characterization. The work included analysis and evaluation of earlier rock stress measurements.

Interpretation of overcoring data using transient analysis of old measurements.

Rock stress measurements with overcoring method for SKB (Swedish Nuclear Fuel and Waste Management Company) in Forsmark and Oskarshamn, and for Posiva (Nuclear waste management company in Finland) in Olkiluoto.

Stress Measurements:

Project manager and responsible field engineer for rock stress measurements using overcoring method in various projects both in Sweden and international, including both shallow and deep boreholes.

Evaluation, interpretation and reporting of rock stress measurements using overcoring.

Investigation of core diking and overcoring rock stress measurements in high-stress environments through field testing (drilling and overcoring) and analyses.

Development of quality operation procedures and manuals for rock stress measurements using overcoring with the *Borre*-method, and hydraulic fracturing (HF) and hydraulic tests on pre-existing fractures (HTPF) methods.

Mining:

Rock mechanics and mining selection feasibility study for a sublevel-stoping mine in the Skellefteå area, Boliden. Conducted work included geomechanical model, analysis of suitable dimensions of stopes, sill pillars etc. using empirical methods and numerical analysis and recommendations for reinforcement of stopes and drifts.

Update of geomechanical design parameters for Kaunis iron's Taupuli open pit mine. Conducted work included: core logging, updated geomechanical model, recommendations of design parameters (heights, width and angles) for benches, inter ramp slopes and overall slope, and recommendations for monitoring of slope stability.

Geomechanical study of crown pillar extraction at the Kemi Mine. The work includes data compilation for the rock mass at the mine, numerical stress analysis of the crown pillar mining to assess influence on pit walls and surface deformation.

Continuum and discontinuum numerical analysis for Boliden Tara Mines with the aim of assessing the consequences of mining the crown pillar, with focus on the surface impact, in addition to determining the influence of the existing faults on the crown pillar extraction.

Geometry setup for a numerical model of the Rana Gruber sublevel caving mine

Assessment of caving and surface deformations resulting from underground sublevel cave mining using numerical modeling.

Rock mechanics pre-feasibility study for an open pit in the Malmberget area. Including core logging, borehole video interpretation, geomechanical model, design domains, properties and slope design.

Rock mechanics pre-feasibility studies for several deep orebodies within the Skellefteå mining district.

Numerical modeling using *FLAC3D* of the Malmberget mine.

Numerical modeling using *3DEC* focusing on the potential for fault-slip seismic events for different mining scenarios. Scenario description of caving and crown-pillar stability comprised of data compilation, analysis of seismicity data and empirical assessment of stope stability and caveability.

Three-dimensional forensic numerical modeling using *3DEC* for a rockburst fatality. Three dimensional discontinuum analyses of an area in the Kiirunavaara mine where a major seismic event occurred.

Numerical analysis of the Malmberget mine comprising several orebodies.

Evaluation of shaft stability in the LKAB Kiirunavaara sublevel caving mine.

Numerical analysis of stresses in pillars for a new sublevel layout at the LKAB Kiirunavaara sublevel caving mine. Study of the parameters (distance, rock parameters, etc.) that control if two shafts will affect each other via numerical analysis.

Analysis of rock mechanical consequences of mining near the main haulage level at the LKAB Kiirunavaara sublevel caving mine.

Analysis of optimal tunnel geometry for the new main level KUJ1365 for the Kiirunavaara mine.
Numerical analysis of rock stresses around drifts and main gallery at the LKAB Kiirunavaara sublevel caving mine.

Project manager for pit slope design for an open pit, collecting data according to proposed survey program. Rock mechanical core logging (RQD-, RMR-, and Q-characterization).

Developing a survey program to get new data.

Develop preliminary slope angle for an open pit, based on available data.

Trainee for seven-month on the mine planning office. Measurements with total station and GPS, charging, blasting, planning and follow-up.