

# Mining Rock Mechanics



Open pit and underground mines provide unique technical challenges. Each deposit possesses distinct characteristics, requiring a tailored approach to maximize ore extraction while maintaining worker safety and a reliable production profile. This delicate balance necessitates a focused, multi-disciplinary strategy that leverages expertise across various engineering domains.

Knight Piésold applies sound rock mechanics engineering principles to deliver safe, practical, and cost-effective solutions to our clients. Our comprehensive suite of rock mechanics engineering services spans the entire lifecycle of both open pit and underground mines, from initial engineering studies through to construction and operations, to eventual closure and rehabilitation.

Knight Piésold's team of highly qualified and experienced engineers brings a wealth of global expertise to every project. Having successfully supported hundreds of mining development projects and operating mines across diverse geological and geographical settings, our professionals possess the knowledge and skills to tackle the most complex geotechnical challenges.



Site Investigations  
and Rock Mass  
Characterization



Legacy Mine  
Hazard  
Management and  
Rehabilitation



Open Pit Mining



Underground  
Mining





Our commitment to an integrated approach has fostered long-term partnerships with numerous mining operations worldwide, often extending beyond a decade. We provide tailored, ongoing rock mechanics support that evolves with each mine's unique needs and challenges. This support includes regular site visits and inspections, comprehensive training programs, staff secondment, as well as site characterization and analyses. Furthermore, our expertise extends to conducting corporate assurance and due diligence reviews, to assist our clients in maintaining best practices and regulatory compliance in an ever-changing industry landscape.

### Site Investigations and Rock Mass Characterization

Understanding the characteristics of the rock masses in the open pit slopes or underground excavations is fundamental to the mine design process. We design and implement geomechanical and hydrogeological site investigations, including core orientation, geomechanical logging, mapping, in-situ testing, instrumentation, geophysics, and laboratory strength testing. Our experienced team has worked in some of the most challenging conditions on Earth, including deserts, mountain tops, underground development kilometers below surface, and the arctic tundra. We offer on-site training to enhance client staff capabilities. Ultimately, the data obtained are analyzed and grouped into geomechanical domains that reflect the deposit geology and can be practically applied in the mine design process.

### Open Pit Mining

We have extensive experience in the design and management of open pit slopes and employ a wide range of advanced analysis methods, including kinematic, limit-equilibrium, and 2D/3D numerical analyses to assess achievable slope geometries. We evaluate and design comprehensive pit dewatering and slope depressurization strategies to effectively manage groundwater and to enhance slope stability. Our team excels in designing, managing, and interpreting slope monitoring and instrumentation programs, as well as assessing and mitigating slope instabilities and rockfall hazards.

### Underground Mining

We offer specialized rock mechanics services for a wide range of rock mass conditions and underground mining methods, including cut and fill, open stoping, and caving. Our team routinely provides guidance on crucial inputs such as stope dimensions, overbreak estimates, pillar dimensions, extraction sequencing, ground support standards, and instrumentation programs. We specialize in the assessment and management of mine-induced seismicity and rock burst hazards, as well as the monitoring of cave propagation.

### Legacy Mine Hazard Management and Rehabilitation

The management of geomechanical hazards at legacy mine sites is an increasing challenge within the industry. These hazards include unstable slopes, crown pillars, shafts, and adits. We offer a comprehensive range of services to identify, characterize, and manage these hazards over time, with the ultimate goal of rehabilitation and final closure. Our approach combines reviews of historical records, site investigation programs, and the construction of 3D mine geometry models to identify and prioritize hazards. We conduct stability analyses and risk assessments to evaluate whether further mitigation is required and identify the most suitable mitigation methods for each site. Our team has extensive experience in designing and managing monitoring programs for legacy sites, utilizing both in-situ instrumentation and cutting-edge remote sensing techniques to maintain long-term safety and environmental compliance.