AECOM

Rock Engineering

Statement of Qualifications

Delivering a better world

AECOM is delighted to present this Qualifications Statement, outlining our specialized geotechnical and geological services. Our commitment to advancing mining and civil infrastructure has made us a leader in rock mechanics, providing state-of-the-art consultation with cutting-edge software packages to our valued clients. Central to our company is a profound commitment to client satisfaction, where the dedication and expertise of our staff play a pivotal role in delivering exceptional results.

Our team of engineers and engineering geologists excel in providing innovative and pragmatic solutions across diverse industries such as mining, water resources, civil construction, renewable energy, and transportation. With a focus on delivering superior results, we skillfully leverage both company and client resources to effectively meet project requirements in a budget-conscious approach.

The AECOM Rock Engineering Team is composed of specialized professionals in rock engineering and engineering geology located in The United States and Canada, enabling us to tackle even the most complex and diverse projects on a global scale.

Within this Statement of Qualifications, we offer an insight into our areas of expertise and present a comprehensive record of our service to a wide array of clients, encompassing mining companies, state and federal transportation departments, international contractors, developers, and foreign federal agencies.

We sincerely appreciate your interest in our Rock Engineering Team. Should you have any inquiries, please feel free to reach out to us via our website.

Sincerely,
AECOM Technical Services, Inc.

AECOM around the globe

51K
AECOM employees worldwide

7
Continents

16B
FY'24 revenue

120+
Years of mining experience

Our markets

At AECOM, a fully integrated infrastructure support service firm, we serve clients across the Government, Environmental, Water, Transport, Energy, Mining and Metals, Oil and Gas, High Rise Buildings and Industrial market sectors. By working with you to understanding your needs, we deliver cost effective solutions to your operational and strategic goals. Solutions that positively impact lives, transform communities and make the world a better place.

Our services

Blending our global reach with local knowledge, innovation and technical excellence, we provide you with the level of resources that you need, when and where you need them. From bespoke design elements to complete turnkey solutions, we will be there with you every step of the way.

Rock Slope Engineering

Engineering Geology

- Surface topography and InSAR data interpretation
- Sirovision 3-D slope and rock mass modeling
- Geologic modeling using Seequent's Leapfrog Works
- Surface and downhole geophysical characterization
- Rock mass mapping for deterministic and probabilistic data collection
- In-situ field testing of intact rock strength, joint strength and stress
- Various rock mass classifications (Q, RMR, Q-Slope, SMR, GSI)
- Multiple geotechnical drilling methods including limited access using helicopters and barges
- Oriented structural diamond core logging
- Geophysical surveys
- Geotechnical instrumentation-slopes and underground structures

Rock Slope Engineering Design

- Limit equilibrium modeling
- Numerical modeling (finite element analysis, finite difference analysis, distinct element analysis)
- Kinematic stereo net analysis
- Rockfall analysis
- Rockfall protection
- Rock scour & rock erodibility
- Rock stabilization slope reinforcement and stabilization
- Slope monitoring and instrumentation

Rock excavations for highways, rail, electrical transmission facilities and corridors, open pit quarries, mines, and dams necessitate a high level of reliability to ensure public safety.

AECOM boasts a specialized team of experts in rock slope engineering. Our geological/geotechnical engineers and engineering geologists have provided valuable assistance to clients on numerous projects involving rock slopes of varying heights, ranging from tens to hundreds of feet, and extending up to thousands of feet.

AECOM collaborates closely with a diverse range of clients ,often addressing engineering problems with limited data under challenging access conditions. Our personnel have successfully collaborated with large and mid size mining companies internationally, large international contractors, federal agencies, state and federal departments of transportation, foreign federal government agencies, municipalities, and confidential mining companies.

Furthermore, members of the AECOM Rock Engineering Team have actively co-authored published papers and attended "Rock Slope Engineering" training seminars for many years, such as Pipeline Geotechnique, Grout in Rock, and rocscience technical courses, etc."

Many of these highly regarded short courses have been hosted by national and sectional chapters of the Association of Engineering Geologists, the American Society of Civil Engineers, and the Canadian Geotechnical Society.

Surface and Underground Mining

Prefeasibility/Feasibility Studies

- Open pit mining
- Mine waste facilities
- Utility Corridors
- Foundations
- Geologic Hazard Evaluations
- Field program management

Construction Observation Services

- Foundation excavation
- Deep foundations
- Rock slopes
- Blasting and blasting design
- Material quality and borrow investigation
- Rock reinforcement quality assurance

Surface & Underground Mine Design

- Open pit design
- Subsidence characterization
- Rock slope for haul and access roads
- Remediation and mine closure
- Hydrogeologic studies
- Instrumentation design and automation
- Ground control planning
- Rock reinforcement design

Geotechnical and geologic site characterization is of utmost importance in the planning and successful development of both surface and underground mines.

AECOM specializes in all aspects of rock characterization for mine development studies and fully understands the commitment required to complete mining studies effectively under challenging time and financial constraints. Our services include planning and managing field drilling programs, conducting geotechnical mapping, and providing comprehensive rock mass characterizations for the design of large surface rock excavations and safe underground openings.

Our mining clientele primarily consist of mining engineers, mine planners, and owners. Over the years, we have successfully completed geotechnical rock characterization and geologic studies for mining applications all over the world. The AECOM Rock Engineering Team utilizes the most up-to-date design tools for geotechnical mining applications. These tools include empirical methods like RMR, Q, and CMRR rating systems, limit equilibrium analysis, as well as advanced finite and discrete element computer modeling techniques.

Foundation Engineering

Foundation Design

- Dams
- Shallow and deep foundations for bridges and transmission towers
- Rock anchor design
- Slope stability
- Deformation analysis
- Monitoring
- Rock characterization (deformation moduli, discontinuity shear strength, rock mass strength)
- Numerical modeling

Foundation Construction Observation

- Quality assurance monitoring
- Field engineering during construction
- Rock anchor design and testing
- Verification of slope conditions
- Verification of design and rock mass assumptions

Foundation Characterization

- Geological mapping
- Kinematic stereonet evaluation
- In-situ stress evaluation
- Downhole geophysics
- Diamond rock core logging
- Soil SPT test and sampling
- Surface geophysics surveys for P-S w

Structures such as bridges, wind turbines, and transmission towers are primarily founded on elevated rock and rock slopes. Foundations such as these require a comprehensive understanding of the in-situ stress conditions and other factors, such as earthquake and wind loading to ensure stability.

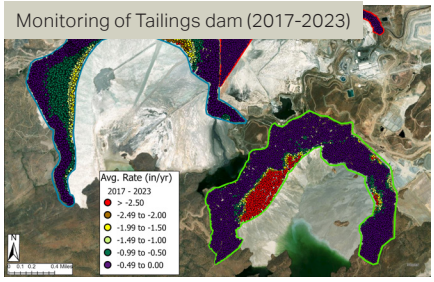
The AECOM Rock Engineering Team specializes in providing geotechnical design assistance to civil/structural engineers and contractors for foundations that support buildings, bridges, wind turbines, transmission towers, and dams. Our expertise covers both shallow and deep foundations on both rock and soil, utilizing state-of-the-art analysis tools, including empirical design criteria, limit equilibrium, and advanced finite and discrete element computer modeling programs.

We offer investigative services, including siting studies and geologic and geotechnical site characterization. Our methods of characterization encompass detailed geologic and structural rock mapping, geophysical surveys, and diamond core drilling with structural oriented core logging. AECOM handles all aspects of geotechnical work and design for foundations on rock, including slope stability and rock scour investigations. Additionally, we provide construction monitoring, for tensioned anchor testing, load testing, and foundation subgrade surveys to ensure the utmost quality and safety in foundation design and construction.

The AECOM Rock Engineering Team supports a qualified team of professionals. Our clients include geotechnical engineering firms, state departments of transportation, and mining companies. The team has managed site characterization projects and designs throughout North and South America, Europe, and Africa. Additionally, we are well experienced in coordinating and executing difficult logistical projects in remote and rugged terrain within various climates, elevations and seasons and executing designs with limited subsurface information.

Photo by Crux (www.cruxsub.com)

InSAR Evaluation



Monitoring of Tailings dam (2017-2023)

Mining Operations

- Ground subsidence/movements
  - detection
  - monitoring
  - quantification
- Monitoring of tailings facilities
- Open pit stability assessments and monitoring
- Infrastructure and asset planning and risk assessments
- Waste dump/leach dump subsidence
- Surface impact of underground mining
- Preparation of land subsidence monitoring reports
- Monitoring access roads, pipeline corridors and rock slopes
- Correlation and interpretation of conventional and space-borne ground deformation data.

Mining Exploration

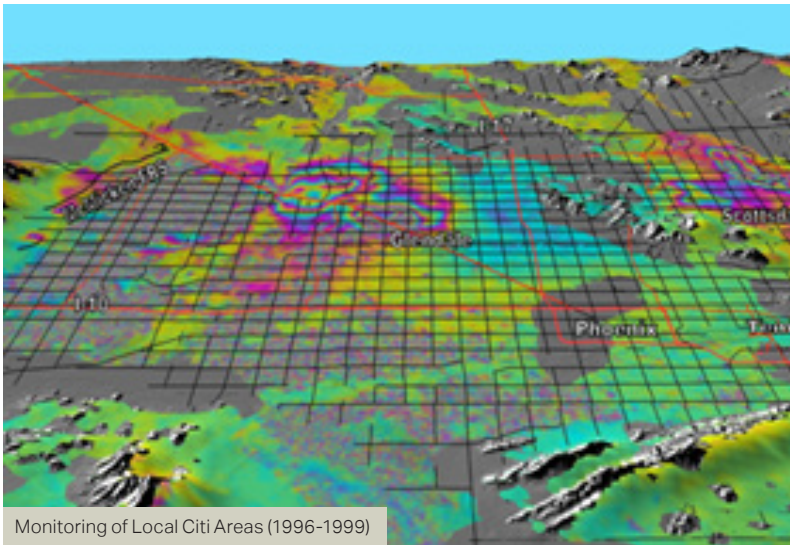
- Preliminary Digital Elevation Model (DEM)
- Land cover/ forest cover mapping and classification
- Past ground subsidence measurement

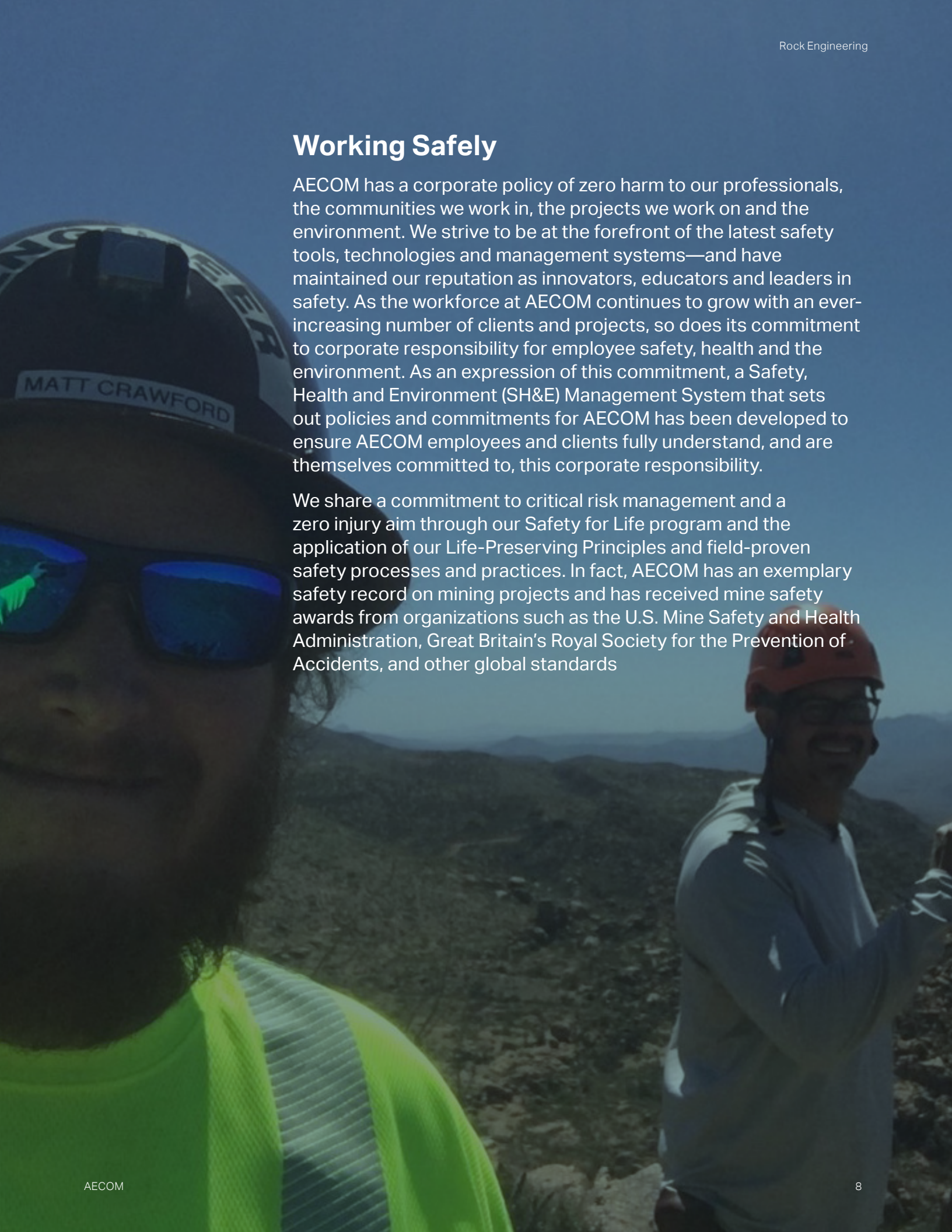
Mining Closure

- Baseline digital elevation model
- Landcover classification
- Monitoring and mapping vegetation growth
- Monitoring annual ground subsidence
- Monitoring abandoned mines

AECOM employs a powerful mapping tool, interferometric synthetic aperture radar (InSAR), which is being used to quantify the rate and distribution of active ground subsidence.

Accurately quantifying the deformation process is often the key to our understanding and subsequent mitigation of the damaging effects of geologic processes such as landslides, regional ground subsidence due to fluid withdrawal, consolidation of the weak soil due to foundation load, and mining-induced ground collapse. InSAR relies upon repeat imaging of an area from the same vantage point in space to measure changes in the distance between the radar antenna and the ground. InSAR has the capability to detect and quantify minute changes in terrain elevation by comparing phase variances of satellite-based side-looking radar data between satellite orbits of a similar trajectory. InSAR data can detect relative terrain elevation changes to a resolution of a few millimeters. High-resolution radar instruments can be used to identify the areas that are subsiding most rapidly and can also identify slow subsiding or deforming structures. These technologies come hand-in-hand with professional Geologists, Hydrogeologists, Geohydrologists, GIS Professionals, and Climatologists for our mining clients. This interdisciplinary approach distinguishes AECOM as the turn-key InSAR solution provider for the mining industry. The AECOM team expert on InSAR has successfully used this technology in the past to model and predict ground subsidence and earth fissuring for a number of projects related to the repair and monitoring of earth dams, waste piles and tailings dams, mine dewatering impacts, settlement of power plant structures, and design of highways and highspeed rail.


Monitoring of Local Citi Areas (1996-1999)



Working Safely

AECOM has a corporate policy of zero harm to our professionals, the communities we work in, the projects we work on and the environment. We strive to be at the forefront of the latest safety tools, technologies and management systems—and have maintained our reputation as innovators, educators and leaders in safety. As the workforce at AECOM continues to grow with an ever-increasing number of clients and projects, so does its commitment to corporate responsibility for employee safety, health and the environment. As an expression of this commitment, a Safety, Health and Environment (SH&E) Management System that sets out policies and commitments for AECOM has been developed to ensure AECOM employees and clients fully understand, and are themselves committed to, this corporate responsibility.

We share a commitment to critical risk management and a zero injury aim through our Safety for Life program and the application of our Life-Preserving Principles and field-proven safety processes and practices. In fact, AECOM has an exemplary safety record on mining projects and has received mine safety awards from organizations such as the U.S. Mine Safety and Health Administration, Great Britain's Royal Society for the Prevention of Accidents, and other global standards

About AECOM

AECOM is the global infrastructure leader, committed to delivering a better world. As a trusted professional services firm powered by deep technical abilities, we solve our clients' complex challenges in water, environment, energy, transportation and buildings. Our teams partner with public- and private-sector clients to create innovative, sustainable and resilient solutions throughout the project lifecycle – from advisory, planning, design and engineering to program and construction management. AECOM is a Fortune 500 firm that had revenue of $16.1 billion in fiscal year 2024. Learn more at aecom.com.

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