

SLOPE PERFORMANCE MONITORING

Self-paced & online course
starting March 30 2027



COLLEGE OF ENGINEERING

School of Mining
Engineering & Mineral
Resources

Brought to you by the Geotechnical Center of Excellence at the University of Arizona, this online, asynchronous, professional development course is designed for self-paced learning on your schedule. The course includes 20 hours of pre-recorded content developed by the GCE and industry subject matter experts. Upon course completion a professional development certificate is provided.

This course, developed and facilitated by the Geotechnical Center of Excellence and underwritten by the Large Open Pit (LOP) Project, provides comprehensive coverage of all aspects of slope performance monitoring. Based on the LOP Guidelines for Slope Performance Monitoring text, the course offers practical insights and best practices for geotechnical professionals. Course access begins March 30, 2027, and content is available until March 30 2028. Registration for the course is open until January 30, 2028.

Topics covered:

- Movement detection
- Displacement monitoring
- Subsurface deformation monitoring
- Water monitoring
- Geophysical monitoring
- Slope monitoring case studies
- System design, support, and operations
- Data acquisition and management
- Data analysis, utilization, and communication

This course is for:

- Engineers, geologists, and other mining professionals working with monitoring equipment or interested in doing so in the future.
- Geotechnical consultants who interpret monitoring data or integrate data into engineering analysis.
- Anyone looking to strengthen their understanding of slope monitoring!

\$999 USD

Discounts for GCE members, groups, and students.

REGISTER



<https://cvent.me/DAvmdR>

Developed with support from



Large Open Pit
Project

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Questions?

Contact gce-courses@arizona.edu
or visit mining.arizona.edu/gce

CONTENT OUTLINE

SECTION 1

Module 1: Overview of Slope Monitoring

Introduction / Why We Monitor Pit Slopes • Intro-duction To Slope Performance Monitoring • Potential Failure Modes • Time Dependent Behavior of Rock Slopes • History of Pit Slope Monitoring • Current Status of Slope Monitoring • Case Study: Freeport McMoran - Integrated Monitoring Program

SECTION 2

Module 2: Movement Detection

Investigative, Predictive and Observational Monitoring • Crackmeters • Wireline Extensometers • Precise Levelling • Laser Distance Measuring • Tiltmeters • Case Study: Point Measurements - Debswana

Module 3: Displacement Monitoring • Point Measurements

Manual and Robotic Total Stations • GPS and GNSS • Application: Point Measurement

SECTION 3

Module 4: Displacement Monitoring • Full-Spatial Measurements

Ground-Based Radar (SAR and RAR) • Ground-Based Laser Scanners (LIDAR) • Digital Photogrammetry • Drone Photogrammetry For Deformation and Displacement Monitoring • Application: Utilizing Terrestrial Laser Scanners (TLS) For Slope Performance Monitoring • Case Study: Ground-Based Radar For Slope Monitoring

Module 5: Displacement Monitoring. Site-Wide Measurements

Crewed and Uncrewed Aerial Vehicles • Satellite Radar • INSAR as an Application of SAR • INSAR In The Context of Mining • Case Study: Back Analysis of an Unexpected Slope Failure In an Open-Pit Mine • Case Study: INSAR - Jagersfontein

SECTION 4

Module 6: Subsurface Deformation Monitoring

Time Domain Reflectometry • Inclinometers • Shape Array Accelerometers • Smart Markers

Module 7: Water Monitoring and Management

Meteorological Monitoring and Surface Monitoring • Ground-water Monitoring • Hydrological Monitoring of Waste Dumps • Hydrological Monitoring During Open-Pit Closure • Case Study: Water Monitoring and Management - Highland Valley Copper

SECTION 5

Module 8: Geophysical Monitoring

Microseismic Monitoring • Case Study: Microseismic - Sunrise Dam Gold Mine • Blast Performance Monitoring

Module 9: Monitoring and System Design Considerations

System Design Considerations • Risk-Based Slope Monitoring Considerations • Strategic vs. Tactical Monitoring • Integrated Slope Monitoring • Capabilities and Limitations of Slope Movement Monitoring Systems

SECTION 6

Module 10: System Support and Operation. Practical Aspects

Mine Operational Considerations • Equipment Protection and Reliability • Program Staffing and Organization • Communications • Case Study: The Leo Slide - Rio Tinto • Case Study: Slope Monitoring System Operation - Nevada Gold Mines • Case Study: Rapid and Small-Scale Slope Failures

Module 11. Data Acquisition, Transmittal, Validation and Management

Data Communications • Data Management and Handling • Data Validation and Reliability • Case Study: Data Management and Communication - Venetia Mine • Case Study: Data Management and Communication - Planar Failure In Australia

SECTION 7

Module 12. Data Analysis and Utilization

Data Visualization • Integrated Monitoring • Trend Analysis • Utilization of Monitoring Data • Combining Monitoring Data With Numerical Modeling • Case Study: Combining Monitoring Data With Numerical Modeling • Case Study: Data Analysis and Utilization

Module 13. Data Utilization and Communications

Mine Plan Stability Evaluation • Observational Mining • Alarming Instabilities and Failures • Practical Aspects of Alarm Management and Response • Reporting Process and Duty of Care

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