

# SLOPE PERFORMANCE MONITORING

Course begins  
February 18, 2025



THE UNIVERSITY OF ARIZONA

School of Mining  
& Mineral Resources

Offered by the **Geotechnical Center of Excellence**, this 14-week professional development course is asynchronous, featuring approximately 21 hours of pre-recorded content. It includes live, virtual panel discussions with subject matter experts and remains accessible for a full year after the live component concludes.

**T**his 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 begins February 18, 2025, with a 14-week live component and year-long access.**

## 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!

## LEAD TECHNICAL ADVISORS



**Bob Sharon**

Managing Director,  
Sharon Geotechnical



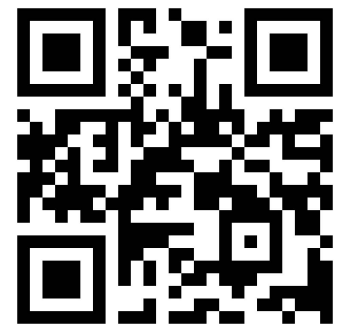
**Erik Eberhardt**

Director of Geological  
Engineering, University  
of British Columbia

**\$899 USD**

Discounts for GCE members, groups, and students.

REGISTER



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Developed with support from



Large Open Pit  
Project

## Questions?

Contact [gce@arizona.edu](mailto:gce@arizona.edu) or  
visit [mining.arizona.edu/gce](https://mining.arizona.edu/gce)

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## CURRICULUM OUTLINE

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### RELEASE 1

#### **Module 1: Overview of Slope Monitoring**

Section 1 Introduction / Why We Monitor Pit Slopes • Introduction 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

### RELEASE 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

### RELEASE 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

### RELEASE 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

### RELEASE 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

### RELEASE 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

### RELEASE 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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