

# **42nd International Conference on Ground Control in Mining (ICGCM 2023)**

Canonsburg, Pennsylvania, USA  
24-27 July 2023

## **Editors:**

**Ted Klemetti  
Ihsan B. Tulu  
Heather Lawson**

**Michael Murphy  
Kyle Perry**

ISBN: 978-1-7138-9841-2

**Printed from e-media with permission by:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571



**Some format issues inherent in the e-media version may also appear in this print version.**

Copyright© (2023) by Society for Mining, Metallurgy and Exploration (SME)  
All rights reserved.

Printed with permission by Curran Associates, Inc. (2024)

For permission requests, please contact Society for Mining, Metallurgy and Exploration  
at the address below.

Society for Mining, Metallurgy and Exploration Inc.  
12999 East Adam Aircraft Circle  
Englewood, CO 80112-4167

Phone: (303) 948-4200  
Fax: (303) 973-3845

[cs@smenet.org](mailto:cs@smenet.org)

**Additional copies of this publication are available from:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: 845-758-0400  
Fax: 845-758-2633  
Email: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

## Design Tools and Guidelines

Load Capacity and Stiffness Characteristics of Pumpable Standing Support System Used in Underground Coal Mines	1
<i>Batchler, T.J., Klemetti, T., Matthews, T.J., McElhinney, D.J.</i>	
NIOSH Gas Well Stability Research: Research to Practice	14
<i>Su, D., Zhang, P., Khademian, Z., Kim, B.</i>	
The Road to Zero: The Fifty-Year Effort to Eliminate Roof Fall Fatalities from U.S. Underground Coal Mines	26
<i>Mark, C.</i>	
Using UT3PC and LaModel to Aid the Mine Engineer in Evaluating Mine Layout Design	47
<i>Larson, M.K., Kim, B.H.</i>	

## Mine Case Studies

Automation of Roof Bolting in Underground Coal Mines Through Electro-Hydraulic Control	66
<i>Willaman, P., Saeler, K.</i>	
Design Methodology of Pumpable J-Crib Stopping Wall and Jenmar High-Strength Stopping Panel Wall	76
<i>Li, X., Mirabile, B., Adasiak, R.</i>	
Effect of Casing Cementing Alternative on Shale Gas Well Casing Deformations Induced by Longwall Mining	94
<i>Zhang, D., Su, D., Kim, B.H.</i>	
Field Instrumentation and Data Analysis of Ground Movement and Pillar Performance at the Maple Eagle Mine in Southern West Virginia	112
<i>McElhinney, M., Compton, C., Mazzella, M., Minoski, T., Sears, M., Morris, M. Bright, J.</i>	
Geotechnical and Hydrogeological Data Collection for the Mining Industry—Tales from the Field	126
<i>Andrews, K., Stansfield, S., Keim, S.</i>	
A Novel Hybrid Cementitious Material for Pumpable Roof Supports: From Laboratory-Scale Investigation to Full-Scale Production	133
<i>Nikvar-Hassani, A., Zhang, L.</i>	
Pillar Recovery in the Illinois Basin	142
<i>Mark, C., Gardner, T.D.</i>	
Recovering an Isolated Coal Panel Under Surface Buildings Using L-Shaped Interval Cemented Paste Backfilling	152
<i>Guo, M., Guo, W., Zhang, H.</i>	

## Mining Induced Seismicity

Control of High-Order Seismicity in Deep Western United States Mines Through Structural Mine Designs	166
<i>Maleki, H.</i>	
Examination of Coal Burst Mechanics and Control Measures in Major United States Coalfields	181
<i>Maleki, H.</i>	

Longwall Mining Generated Seismic Activity Buchanan County, Virginia	198
<hr/>	
<i>Scovazzo, V.A.</i>	
Seismic Energy and Energy Released Due to Strata Failure During Longwall Caving Operations	212
<hr/>	
<i>Gerwig, C., Wickline, J.R., Agioutantis, Z.</i>	

## Numerical Modeling Applications in Ground Control

Coal Pillar Rib Stability: A Regression Model Based on Distinct Element Method	232
<hr/>	
<i>Mohamed, K., Sears, M., Guner, D., Nowak, S., Kirmaci, A., Sherizadeh, T.</i>	
Gate Road Layout for Deep Cover, Steeply Dipping Longwall Mining:A Case Study in the Western United States	247
<hr/>	
<i>Newman, C., Newman, D.</i>	
Technical System of Intelligent Ground Control in Close-Multiple Coal Seams	259
<hr/>	
<i>Li, Y., Wang, N. Wang, J.</i>	
A New Strain-Softening Anisotropic Constitutive Model for Coal Mine Roof Simulation	267
<hr/>	
<i>Sherizadeh, T., Guner, D., Karadeniz, K.E., Nowak, S.,Kirmaci, A.</i>	
Surface and Highway Subsidence Characteristics Due to Longwall Mining Based on a Long-Term Field Monitoring	282
<hr/>	
<i>Guo, W., Hu, Y., Zhao, G., Li, J., Li, L.</i>	
Stability Analysis of Underground Excavations in Limestone Under Dynamic Loadings	296
<hr/>	
<i>Kim, B.H., Larson, M.K.</i>	
Stress Distribution in Pillars as a Function of Opening and Pillar Geometry and Material Properties	309
<hr/>	
<i>Agioutantis, Z., Wedding, Z.E.</i>	
A Study of the Leading Factors Associated with a Massive Ground Collapse in an Underground Limestone Mine in Southwestern Pennsylvania	327
<hr/>	
<i>Rashed, G., Evaneck, N., Van Dyke, M., Mazzella, M., Slaker, B.</i>	

## Tools for Monitoring of Deterioration and Subsidence

Empirical Correlation of Geotechnical and Hydrogeological Characteristics of Overburden Rock in Stream Valleys Overlying Central Appalachian Underground Coal Mines	341
<hr/>	
<i>Afrouz, .G., Andrews, K.</i>	
Lineament Analysis of Shuttle Radar Topography Mission (SRTM) Images for Fracture System Identification	352
<hr/>	
<i>Phillipson, S.E.</i>	
Prediction of Dynamic Subsidence in the Proximity of Longwall Panel Boundaries—the Influence of the Edge Effect Offset	363
<hr/>	
<i>Agioutantis, Z., Romero, J., Maldonado, E.</i>	
Use of Structure from Motion Photogrammetry for Monitoring of Underground Storage Facilities	375
<hr/>	
<i>Gurgel, M.J.M., Preusse, A.</i>	