ITGAUM

INTERSTATE TECHNICAL GROUP ON ABANDONED UNDERGROUND MINES

Ninth Workshop

November 9, 2011

11:00 a.m. – 3:00 p.m. Eastern Time

The Interstate Technical Group on Abandoned Underground Mines (ITGAUM) with assistance from the Federal Highway Administration (FHWA) Central Federal Lands and the National Highway Institute (NHI) is conducting its Ninth Workshop on October 9, 2011. The workshop will be conducted using the web conferencing services of the NHI. There is no charge to participate in this workshop.

This workshop will focus on the effects of mine development on highway planning, design, construction and maintenance as well as other infrastructure development. Related topics pertaining to subsurface exploration and geophysical testing to identify potential hazards associated with underground mines will be discussed. The workshop will consist of four presentations with discussion following each presentation and one-half hour discussion on the use of geophysics for mine investigation and monitoring.

Agenda

11:00 – 11:40	**Geotechnical Evaluation incorporating LiDAR Scanning for the Morenci Tunnel, Arizona SR 191 MP 169, Graham County,** *Nick M. Priznar, Arizona Department of Transportation, Robert Cummings, P.E., Saguaro GeoServices, Inc.*
11:40 – 12:40	**Investigation for Remediation of Gypsum Mines Under State Route 2**, *Patrick Gallagher, CTL Engineering*
12:40 – 1:00	**Break**
1:00 – 1:40	**Something's Got To Give: Developing An Undermined Area,** Donald V. Gaffney, Michael Baker Jr., Inc.
1:40 – 2:20	**Assessment Of Mine Subsidence In An Area With A Major Pillar Crushing Event, Newcastle, Australia**, *Arthur Love, David Knott, and Simon Baker, Coffey Geotechnics and Steve Ditton, Ditton Geotechnical Services*
2:20 – 3:00	**Geophysics Discussion**

Workshop Access

You can access the workshop at: http://fhwa.adobeconnect.com/mines/

You will need a computer with an internet connection to view the slide presentations. The audio portion of the presentations can be received via telephone or VOIP. In order to participate in the discussions, you will need a microphone connected to your computer if you are using VOIP or you can use a telephone.

Here is the information for access via telephone: Dial-in Number: 877-691-6033, Participant passcode: 4698861

FHWA's account was upgraded to Adobe Connect 8 on November 19th. The upgrade will require attendees to install the latest version of Flash Player 10.1.

To test your system, please copy and paste the following link into your browser:

http://admin.acrobat.com/common/help/en/support/meeting_test.htm

To ensure your system is properly configured, please contact your local IT Support for additional assistance.

Tutorials for the use of Adobe Connect 8 are available at:
http://tv.adobe.com/show/learn-adobe-connect-8/

Abstracts

Geotechnical Evaluation incorporating LiDAR Scanning for the Morenci Tunnel, Arizona SR 191 MP 169, Graham County, *Nick M. Priznar, Arizona Department of Transportation, Robert Cummings, P.E., Saguaro GeoServices, Inc.*

Conventional and innovative (LiDAR supported) geotechnical techniques were used to evaluate the stability and state of internal support for the Morenci Tunnel in eastern Arizona.

The Morenci Tunnel was originally constructed by drill and blast techniques in 1949, as a safety improvement to eliminate a hazardous blind curve in mountainous terrain for what was then a county highway. Prior to 1980 the tunnel was unsupported. Areas of crown deterioration prompted the installation of rock bolts, chain link fabric and steel arches in the 1980s.

Detachment of several blocks around the north tunnel portal entrance raised concern that the stability of the rock mass may have declined and the previous structural reinforcement would need to be augmented. A systematic inspection of the tunnel structure was conducted in 2007 to assess the stability of the rock cuts in the approaches to the portals, and to assess the effectiveness of the tunnel interior reinforcement.

ADOT employed LiDAR scanning of the interior tunnel surfaces as part of a more conventional geotechnical assessment involving geologic mapping, photo mosaics, and kinematics. The goals of the LiDAR were (1) create a three dimensional model of the tunnel geometry with which future changes could be compared; (2) depict the geologic structure for future analysis; and (3) inventory the existing reinforcement elements.

A systematic assessment of every reinforcement element was conducted, including the steel arches and over 2,000 rock bolts. Preliminary analyses of the tunnel and portal stability were based on the inventory created by the scanning, and were supplemented with detailed geotechnical field examination. LiDAR proved very useful in the inventory of reinforcement elements and the general depiction of the tunnel perimeter, but interference from the chain link and shadowing due to tunnel wall irregularity hindered the interpretation of planar geostructural features from the LiDAR scans alone. Future subsurface application of LiDAR could be valuable with site specific deployment of the scanning apparatus to locally optimize point cloud and photo mosaic coverage.

Investigation for Remediation of Gypsum Mines Under State Route 2, *Patrick Gallagher, CTL Engineering*

Ohio Department of Transportation (ODOT) is investigating solutions to the potential risk of mine collapse along SR-2 in Ottawa County, which overlies abandoned gypsum mines. Investigation of the extent and condition of the mines included completion of a geophysical investigation, drilling boreholes, laboratory testing, mapping of mine voids using sonar technology, and a review of historical information. The data and information collected was used to approximate the mine boundaries and develop and evaluate conceptual alternatives to minimize the risk of a mine collapse adversely affecting SR-2.

Something's Got To Give: Developing An Undermined Area, Donald V. Gaffney, Michael Baker Jr., Inc.

Development west of Pittsburgh, PA, has been tied to extension of the roadway network in the area. In particular, over time the historic US 22 and US 30 routes coming out of Pittsburgh have been upgraded and partially replaced with roads meeting interstate criteria. Prior to this roadway improvement and associated development, however, the area was extensively mined for coal.

As the intersection of US 22 /US 30 and PA Route 60 grew from an at-grade, two-lane intersection to a full interchange of I-376 with US 22 / US 30 and PA Route 60, the surrounding area transformed from rural farmland, to a business and industrial center, and now to a business/industrial/retail complex. The interchange is situated at the top of a plateau that has been undermined for coal from hillside drift entries.

Initially, public and private construction in the area did not address the presence of abandoned underground mines. Before development, local subsidence features were visible in some area fields, but were not considered a problem. First local land use other than farming involved development of trailer parks along strip mine benches. Subsidence problems first appeared during development of commercial properties surrounding the interchange. Various alternatives were used to address subsidence during property development above the mine, but these were typically applied to only the buildings involved. During one rehabilitation cycle for the interchange bridge, the mine area below the foundations was grouted. Other major retail development in the area was primarily below the elevation of the coal, but removed and exposed more of the old workings. The interchange and surrounding roads and bridges are in various stages of design and construction to meet increased local demands as a result of the development, with mine issues still being addressed.

This case history demonstrates the symbiotic relationship between roadways and development, and how that relationship can become complex with the introduction of abandoned underground mines.

Assessment Of Mine Subsidence In An Area With A Major Pillar Crushing Event, Newcastle, Australia, *Arthur Love, David Knott, and Simon Baker, Coffey Geotechnics and Steve Ditton, Ditton Geotechnical Services*

Historical and "new" information was used to develop a model for pillar strength and subsidence analyses using empirical and numerical methods. The subsidence assessment was for a 12 ac multi-storey redevelopment site on reclaimed land along Newcastle Harbor.

The 20.3 ft thick Borehole Coal Seam was mined approximately 230 ft beneath the harbor using the room and pillar method in the 1880's and 1890's. The mined height was approximately 16.4 ft and the pillars were approximately 16 ft wide; thus, resulting in marginally stable pillars. Soon after mining was completed in one area, pillar failure occurred, probably due to the fall of the 4 ft thick roof coal which had been left in place, further increasing the height of the pillars. A 62 ac trough with up to 4 ft of subsidence resulted. Mining continued until the colliery closed and flooded.

The site is within a Mine Subsidence Board district. Approval for development is based on their assessment of risk.

Boreholes targeted pillars to assess their condition and coal thickness, allowing the extent of crushing to be assessed. A downhole geophysical survey was performed to confirm the coal thickness.

The subsidence associated with the crush was modelled (Lamodel and SDPS) and then used to assess potential subsidence in areas with standing or partially crushed pillars.

Potential subsidence contours were estimated by subtracting the subsidence associated with the initial crush event from the worst-case future crushing scenario.

The stability of pillars was assessed using numerical (FLAC-2D) models of existing and grout-confined pillars. The models were calibrated with borehole data and historical records.

To lessen potential subsidence impacts, grouting is planned between groups of pillars while leaving some rooms ungrouted to reduce the amount of potential trough subsidence by reducing the width of the mined area. This approach uses less grout and thereby reduces costs compared to conventional saturation grouting.