Eighth Biennial Workshop

April 5, 2011
11:00 a.m. – 1:30 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 Eighth Biennial Workshop on April 5, 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 of general discussion on topics of interest to ITGAUM members.

Agenda

11:00 – 11:30	**Illustrative Examples of Australian Practice Dealing with Abandoned Coal Mines**, *Scott Mackenzie and David Knott, Coffey Geotechnics*
11:30 – 12:00	**Design and Construction of Interstate 435 Improvements over Formerly Mined Land**, *John Szturo and Jamie Martens, HNTB Corporation*
12:00 – 12:30	**Missouri's Experience with Long-Term Void Monitoring**, *George Davis, Missouri Department of Transportation*
12:30 – 1:00	**Mine Remediation Options for a New Highway Corridor**, *Kirk Beach, Ohio Department of Transportation*
1:00 – 1:30	**General Discussion**

Registration

Please register for the workshop using the following URL:
http://www.nhi.fhwa.dot.gov/resources/webconference/web_conf_learner_reg.aspx?webconfid=22810

You will receive a confirmation e-mail with information for how to connect to the workshop including pass codes.

You will need a telephone to receive the audio portion of the presentations and a computer with an internet connection to view the slide presentations.

Abstracts

Illustrative Examples of Australian Practice Dealing with Abandoned Coal Mines
Scott Mackenzie and David Knott, Coffey Geotechnics

Examples of Australian practice dealing with abandoned coal mines and comments on differences with American practice are presented. Coal mining started in Australia in about 1800 using convict miners. Subsidence is a legacy of the mining.

In portions of Australia, approval for development over mined areas is regulated by the Mine Subsidence Board (MSB), a state agency responsible for repairing structures damaged by subsidence. The MSB approves investigation, mitigation, and development to limit its exposure to claims, a process that helps standardize these activities. In the US, development is regulated by municipality planning commissions. The level of sophistication with subsidence of the commissions varies and largely depends on the expertise of the Municipal Engineer and the project engineer; therefore, the level of investigation, analysis, and mitigation varies greatly.

Examples include:

1. Eight storey condominium – Advanced modelling of 100 year old flooded mine workings at 210 foot depth was performed after an investigation indicated that 13 ft high pillars were subjected to abutment loading conditions due to an adjacent retreat mined area.

2. 30 lot Housing Development – Mitigation of 1870s mining included over-excavation and grouting where the workings had <30 ft of cover and structures were designed for sinkhole subsidence at >30 ft of cover. Capping of shafts and mitigation of sinkholes was also preformed.

3. Ipswich Commercial Development – A development planned in a non MSB area with multiple seam mining from the 1890s to the 1950s. The site was also impacted by faulting. An investigation indicated that the site is subject to sinkhole

and trough subsidence. Mitigation includes moving buildings to lower impact areas.

4. Ten Storey Commercial Development – The site was near an area where a major pillar crushing event occurred in the 1890s. The workings were approximately 16 ft high, 230 ft deep, and flooded. Analyses indicted that grouting the rooms to about 70% of the pillar height increased the strength of the pillars to lessen potential subsidence.

Design and Construction of Interstate 435 Improvements over Formerly Mined Land
John Szturo and Jamie Martens, HNTB Corporation

The Missouri Department of Transportation plans to modify the I-70 and I-435 interchange in Kansas City. The modification involved acquiring additional right of way and constructing travel lanes over areas of both abandoned and developed underground limestone mines. An existing rail line also traverses the interstate through the mine.

Mine remediation design involved review of historic mine maps and records as well as subsurface exploration utilizing coring and down hole video. Ground based lidar was also used to map the accessible adjacent mine space areas deemed too dangerous for entry.

A risk based approach was undertaken to develop mine remediation that satisfied protecting the new highway improvements while minimally disturbing the developed mine space operator. Remediation will take place from both the surface and within the mine and included grouting with low and high mobility grout, roof mine bolts and shotcrete.

Missouri's Experience with Long-Term Mine Void Monitoring
George Davis, Missouri Department of Transportation

US Route 24 crosses abandoned underground mines in the area of Huntsville, Randolph County, Missouri. These mines were first encountered during construction of the interchange for that town and were periodically assessed for subsidence potential for over 20 years in a program fulfilling the need for due diligence by the Missouri Department of Transportation (MoDOT). After construction was completed on the interchange at Huntsville twelve cased access holes were drilled into former mine voids to assess the condition of the mines on a regular basis. A photographic system using a 35mm SLR camera was developed to take pictures of the underground voids and assess change in the voids which might be a sign of impending catastrophic collapse. In addition, a second system was used that employed inexpensive 'fish-finder' sonar to determine the size of water-filled voids.

Unlike other states which possess detailed mine maps of the subsurface, Missouri's early coal mines were largely family operations which possessed a single entry and used room-and-pillar methods of mining. Maps were neither used nor made. Mine locations were originally dictated by the presence of nearby railroad lines which needed coal for locomotives. We did manage to procure several previously unknown maps during our investigation from the Audrain County clerk's office in Huntsville; Copies were made and sent to the general mine map repository for Missouri in Rolla at the Division of Geological Survey, Missouri Department of Natural Resources.

MINE REMEDIATION OPTIONS FOR A NEW HIGHWAY CORRIDOR

Kirk Beach, Ohio Department of Transportation

The City of Nelsonville in southeastern Ohio is surrounded by rugged Appalachian foothills where coal and clay were previously mined. Planning for a Nelsonville bypass started in the mid 1990's and Construction of the four-lane highway began in 2007 with a projected completion date of 2014. The planning process evaluated multiple corridors through or around the town. Eventually, two corridors remained as possible alignment alternatives. At this point, preliminary drilling of the corridors was conducted to help characterize the limits of major geologic hazards (e.g., underground mines) which would help in the selection of a preferred alignment. Subsequently, the upper end of the estimated cost for remediation of underground mines along the new alignment rose to an estimated $50M to $75M. During the detailed design phase, the cost to stabilize nearly 8.5 miles of the main line was reduced to $30M through a detailed risk assessment. The mine remediation costs, which involved drilling into and grouting the mine voids, remained high initiating additional efforts to reduce costs. One of the principle components of the high costs was the use of cementation grout. An alternative solution was proposed utilizing barrier grouting and foam sand infilling. Although this method had merit, it was rejected. Eventually, the project moved into the bidding phase and another opportunity for alternative solutions arose. The bidding process allows contractors the option to submit Value Engineering solutions as alternatives to the proposed methods and materials. As such, ODOT received several alternative solutions with recommendations to: 1) excavate enough of the mine's overburden to utilize an implosion and, dynamic compaction procedure and 2) completely dig out and backfill an abandoned mine location. The first proposal was rejected when the Wayne National Forest which owns much of the land the bypass is located on raised the concern of the imploded material causing an increase in acid mine drainage. The second proposal has received preliminary approval. This project resulted in a significant impact to ODOT's business processes involving geotechnical issues. When dealing with underground mines, priority is given to avoidance followed by minimizing exposure, and, lastly, mitigation of the potential threat to the traveling public.