The Nelsonville Bypass:
A Hitchhiker’s Journey through the Galaxy of Mine Hazards

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Agenda

I. Project
   Introduction/Background
II. Exploration of Geohazards
III. Results of Exploration
IV. Mitigation of Geohazards
V. Questions/Answers
I. Project
Introduction/Background

Nelsonville, Ohio
General Project Information

- **Owner**: ODOT
- **Designer**: District 10
- **County**: Athens/Hocking
- **Limited Access Highway from Columbus, Ohio to Charleston, WV**
Bypass Alignment

Dorr Run Interchange

Approximate Alignment

8.5 Miles Long

10 Bridges Along Alignment

Happy Hollow Interchange
Project Challenges

- Large-scale roadway project with tight schedule
- Appalachian terrain meaning deep cuts and fills
- Alignment underlain by abandoned coal mines
- Roughly half of the alignment on Wayne National Forest property
Geohazards

- Abandoned Underground Mines
  - Mine Water Quantity/Quality
  - Subsidence
  - Drift Entries, Shafts

- Abandoned Surface Mines
  - Mine Spoil
  - Highwalls
  - Mine Sediment Ponds

- Uncontrolled Man-Made Fills

- Landslide-Prone Soils and Bedrock

- Soft Foundation Soils
Mining History

- Started Mid-1800’s in Nelsonville
- Both Surface and Underground
- No. 7 (Upper Freeport) Coal
- No. 6 (Middle Kittanning) Coal
- Lower Kittanning Coal/Clay
Ohio Coal Mining

- **Coal Production Since 1800:**
  - 1.4 billion tons from surface mines
  - 2.2 billion tons from underground mines

- **Principal Means of Coal Mining**
  - 1800-1948: Underground Mining
  - 1948-1995: Surface Mining
  - 1995-present: Underground Mining
Mapped Mines in Project Vicinity

Proposed Alignment

Existing Alignment

State of Ohio - Abandoned Underground Mine Locator (ODNR)
Typical Profile of Mining Geohazards

- Upper Freeport No. 7 Coal
- Middle Kittanning No. 6a Coal
- Lower Kittanning No. 6 Coal/Clay
- Mine Spoil Pile
- Proposed Roadway Grade
- Strip Mine Highwall/Bench

State of Ohio Department of Transportation
Fuller Meacham Scott & May
II. Exploration of Geohazards
Exploration Planning

- Geologic Mapping Review
  - Bedrock Geology
  - Soil Survey
- Abandoned Mine Mapping Review
  - Review of abandoned mine quadrangle
  - Review of individual mine maps
  - Superimposed mine maps on roadway plans
- Use Preliminary Exploration Results
- Prepare Final Boring Plan
Mine Maps Superimposed on Roadway Plans
Sample/Core Borings

- Three Stages of Drilling
- Approximately 265 Borings
- Over 22,000 Feet of Drilling
- Average Depth per Boring About 80 Feet
Geophysical Testing

- Grumann Exploration
- Relative
- Electromagnetic Terrain Conductivity

- In-Phase Response Contour Diagrams
Borehole Camera
III. Results of Exploration
Example 1 – Mine Void Exposed in Cut Slope
Exploration Results

Example 2 – Mine Void Well Below Proposed Grade
Exploration Results

Example 3 – Mine Void Near Proposed Grade
IV. Mitigation of Mining Geohazards
Abandoned Mine Mitigation: Three Primary Concepts/Options

- **Undercut and Replace Concept**
  - Generally if proposed grade is less than about 40 feet above the mine void

- **Grouting Program Concept**
  - Generally if proposed grade is greater than about 40 feet above the mine void

- **Do Nothing Concept**
  - With high quality roof rock and proposed grade is greater than about 100 feet above the mine void
Undercut and Replace

Existing Grade

Proposed Grade

Assumed Angle of Draw = 30°

Limits of Undercut

Mine Void
Typical Grouting Program

12.5’ Spacing (Typ.)

Roadway Centerline

25’ Spacing (Typ.)

Barrier Grout Holes (Typ.)
Pneumatic Backstowing

- Existing Grade
- Bench at Mine Elevation
- Backstow Stone
- Proposed Grade

20’ Min.
V. Questions/Answers