Abandoned Underground Mines Affecting Indiana Highways

"Member presentation" for Interstate Technical Group on Abandoned Underground Mines - 2002 Workshop, May 1-3, 2002, in Davenport Iowa

Abandoned Underground Mines Affecting Indiana Highways

- The purpose of this presentation is to discuss the problem of Abandoned Underground Mines affecting the highways in Indiana.

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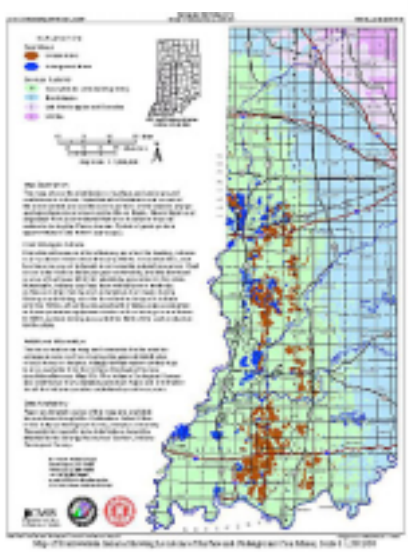
- Materials and Tests Division
- Geotechnical Section

Topics of Discussion

- 1. The main ideas I'll be talking about is *where* mine subsidence affects our highways, and I'll give one specific example.
- 2. Another topic is the question of: Are some Bridges at a greater risk from subsidence problems due to seismic activity?

SW Indiana Coal Mine Geologic Map by IGS



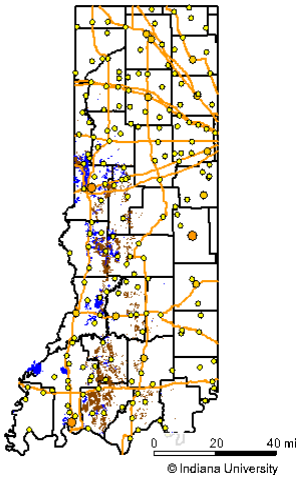
Index map of Indiana showing the coal-bearing rocks of the Pennsylvanian System in green, underground coal mines in blue, and surface coal mines in brown.

SW Indiana Coal Mines Map

- IGS website interactive coal map
- will zoom to 10 scales.

Legend:

- < 10,000
- 10,001 - 50,000
- > 50,001
- Highways
- Underground Mines
- Counties



Map Showing town of Linton. Underground Mines are in Blue, highways in orange, at zoom scale = 7

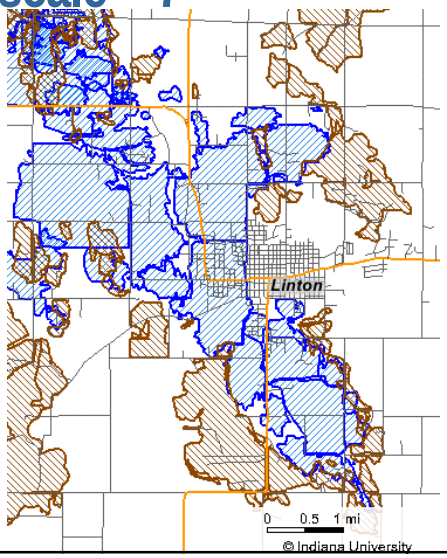


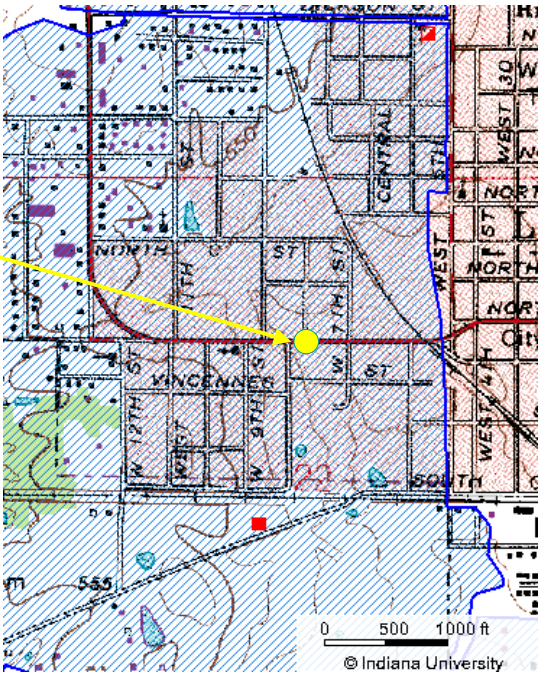
Photo example of subsidence in the town of Linton, Indiana, November, 1998, on SR 54.

- Temporary wedge and level with 2' crushed stone

A 10'x4' concrete culvert crosses near site

SR 54 at 8th St NW, in Linton, Indiana site.

At maximum zoom scale



How this example of mine subsidence affected our highway.

- This ***subsidence*** caused hazardous abrupt grade changes requiring temporary road closure, and emergency temporary repairs, and temporary reduced speed limits.
- We found supporting information from Photos, maps, plans, history from local residents, core sample drilling.
- This problem inconvenienced the public in terms of safety of driving, inconvenience of detours, and tax money for investigation and repairs, and lower speed limits.

Some factors causing or affecting mine subsidence

- There is a slight possibility of problems with crushed stone mines and maybe even other types of mines, like clay mines, but most are coal mines.
- We usually think of 5 typical common factors: 1.Time elapsed since mining. 2. Depth of the mine. 3. Water conditions of the mine. 4. Type and thickness of rock and sediment overlying the mine. 5. Method of mining and plan shape of the mine. *Also*, there are some *special* factors of importance for transportation agencies: Since the driving force for subsidence is gravity, 1. Added weight of fill, especially at bridge approaches, could accelerate subsidence. 2. Acceleration and Amplification of Gravity forces from Earthquakes could accelerate subsidence that would be a problem at the most inopportune time of emergency transportation needs.
- For supporting information and examples see Earthquake Soil Amplification/Liquifaction maps, and EQ Hazard Maps, from USGS and CUSEC.

Real Life

- The Linton subsidence problem was a relatively easy problem to fix by itself, but it could get difficult if there were many others to deal with at same time.
- There may be some added risk of subsidence for folks that live in Earthquake zones like West Kentucky or Southeastern Missouri, or Northeast Arkansas, or Southern Illinois, or Southwest Indiana

What This Means

- Subsidence has the potential to cause big problems with a few bridges and drainage structures.
- A closer look at bridge structure locations over mines may be needed in areas of possible underground coal mines, for consideration of preemptive work such as grouting of mine voids at piers and end bents, especially in Earthquake prone areas.

Map of Mew Madrid Seismic Zone showing where a hypothetical magnitude 8(VIII) earthquake would be felt and at what magnitude in that area. From CUSEC