Division of Structural Design
Geotechnical Branch
Geohazards 2014

Presented By:
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Geohazards – from wikipedia

A **geohazard** is a geological state that may lead to widespread damage or risk. [1]

Geohazards are geological and environmental conditions and involve long-term or short-term geological processes. Geohazards can be relatively small features, but they can also attain huge dimensions (e.g., submarine or surface **landslide**) and affect local and regional socio-economy to a large extent (e.g., **tsunamis**).
Physiographic Regions

Kentucky has a diverse topography that demands in-depth investigations.
• From the Geohazards 14th Technical Forum Call for Abstracts:

This year’s technical sessions will focus on the following major topics:

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Scour, Scour Mitigation, and Stream Restoration

Scour is the driving force behind foundation selection for many structures!

KYTC generally does not use spread footings on soil at wet crossings for bridges.

Lewis Co. KY
Bullitt County KY
KY 1494 over Long Lick Creek
Replaced bridge and installed Tieback wall to correct landslide caused by scour
Currently, the Dawkins Line Rail Trail is 18 miles long. When the second phase of the trail is completed, it will be 36 miles.

The first 18-mile leg of the trail, from Hagerhill in Johnson County to Royalton in Magoffin County, was opened to hikers, cyclists and horseback riders on June 15, 2013. This 18-mile section features 24 trestles and the Gun Creek Tunnel, which is 662 feet long. The trail follows the old Dawkins Line railroad bed that runs from Hagerhill to Evanston. The Dawkins Line Rail Trail is the largest rail-to-trail in the state.
Gun Creek Tunnel is not the same as Carver Tunnel
Car Fire, Lagging Fire, Coal Fire, Multiple collapses, inaccessible

Investigation ongoing
LSIORB East End Tunnel under the Drumanard Historical Property

Public Private Partnership with construction oversight administered by Indiana
Extensive investigation without the customary expensive pilot bore

• Vertical Borings
• Inclined borings
• Geophysical Methods
• Down hole testing
• Video logging
• Etc
• Horizontal borings
Extensive investigation without the customary expensive pilot bore

- Horizontal borings
- Gold Fields
- Couldn’t get a drill!!!
Currently under construction!
Karst
Large Sinkhole in Cut Section Prior to Slope Stabilization
Down-hole camera - the Geotechnical Branch has 3 down-hole cameras. We put them in our core holes to look at karst features, etc.

• A picture is worth a thousand words.
Barren Co.
I-65 over 31W

Over 30 foot void
Terrestrial
Underground
Readout
Device
Instrumentation

- Piezometers
- Slope Inclinometers
- Tilt Meters
- Mounted Survey Prisms
- Crack Meter
- etc
US 460 over US 23 in Pike Co. KY

- Micropile foundation through a rock fill
- Some piers leaning?
- Moving?
- Instrument!
Installed Slope Inclinometers
Installed 4 sets of tilt meters
Seismic Impacting Infrastructure Design

KY Lake and Lake Barkley Bridges
High Seismic Zone – New Madrid Seismic Zone
Delta Mariner
Lots of additional testing for a site specific seismic design. KYTC worked closely with Terracon and ICA Engineering.
• Crosshole Logging on land to determine Shear Wave Velocities
PS Suspension Logging on water to determine Shear Wave Velocities

KY Lake under construction!!!
**Problem:** Bridge pier may be tilting causing displacement in the bearing device atop pier #5

**Objective:** Monitor movement and separation of pier #5 and span #4

**Scanner:** Optech Illris 3D

**Notes:** Scan taken from west side of pier #5

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![Image of bridge pier and scan data]

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**Markland Bridge**
Sometimes we employ highly specialized equipment:
Cone Penetration Equipment

APPLICATIONS
Continuous Profile of Soil Layers
Soil Properties
  Type (sand, silt clay, gravel)
  Stress History
  Shear Strength
  Density
Seismic Analysis
Pile Behavior
Unknown pile (foundation) lengths
- Resistivity
- Microgravity
- GPR
• Drainage Pipe under Nicholasville Rd. Outlet end buried and flooding Fayette Mall Parking lot

• District and Central Office forces conducted extensive investigations to find the outlet pipe (including geophysical methods such as ground penetrating radar). Geotech was called in and deployed yet another of our highly technical and specialized devices....
• Dowsing Rods
Dig out and replace
Drilled in Recycled Railroad Rail Retaining wall with recycled Guardrail Lagging
Rockfalls
Hydrogeology
Impacts of Mining
(let's throw in remote sensing too)
Audubon Parkway in Henderson Co.
(That's just east of Utopia Road)
LIDAR

Drawn By: Levi McIntosh
Scan Date: 6/19/2014 and 6/30/14

Problem: A section of Audubon Parkway has began to settle.
Objective: Monitor the elevation changes of the different areas.

Vertical Exaggeration: 10x / All dims shown in ft.
Scanner: Optech Illris 3D

Notes: Cross section and profile data was collected. The data shows a minimal elevation difference.

Audubon Pkwy
What's Happening?
Still studying on that.
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- Tunneling
- Karst
- Instrumentation
- Seismic Impacting Infrastructure Design
- Remote Sensing
- Innovative Landslide Mitigation & Correction
- Rockfalls
- Hydrogeology
- Impacts of Mining

• Yep covered that…
I will hang around for Questions.