Real Time Monitoring of Subsidence I-70, Muskingum County, Ohio

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Geohazards Impacting Transportation in the Appalachia Region
Columbus August 2010
Site Location and Conditions
“to old mine mouth”
subsidence

Long Mine
TDR Principle, HDD Drilling, and Cable Installation
Cables can be grouted into boreholes or trenches to monitor deformation.
TDR Cable Tester

Modem

Programmable Data Logger

Coaxial Multiplexer
System Calibration
EBPA

Distance along cable, ft

Reflection Magnitude, \( \rho \)

end of cable at 1760 ft


8/20/2010
Findings

- Predominately hard drilling in rock
- Compacted fill at east and west portions of site as anticipated
- Located one “soft zone” that can be further investigated using borings and geophysics
124+00
131+00
131+00
148+00

DAS at 138+00
Soft zone
Action Plan

- At preset times or whenever a user wishes, the TDR cables are interrogated and the data is compared to a baseline that is stored in the data logger.

- At any location where the difference between the baseline and the current reading exceeds a predetermined magnitude an entry is made in an activity log.
EB Passing Lane Trench B

Reflection Coefficient, $\rho$

Distance, m

Baseline

Current

Difference

8/20/2010

GeoTDR Inc.
The Activity Log file of each cable will be a running list of cable deflection events that exceed the magnitude criterion.

The TDR system will send out a Notification of Alert when it has detected cable deflection that meets alert levels based on criteria programmed in the data logger.

Alerts will be in the form of emails.
Action Plan (cont)

- Criteria for Levels of Alert will be based on the amount of deflection, and the rate of change of deflection when assigning an alert level.

- The Ohio DOT will develop action plans (response, remediation, and further investigation) based on the level of alert, on-site evaluation and log file evaluation.
Real Time Monitoring with Time Domain Reflectometry (TDR)

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Typical Costs

- MTDR unit $3,600
- Cable on Spool $1/ft
- Remote DAS $10,000

INSTALLED CABLE COST

- Trench $7/ft
- Vertical hole $15-$25 /ft
- Angled hole $30-$45 / ft
- Inside inclinometer casing $3-$5 /ft