Emergency Response to Rockfall on Tennessee’s Interstate 75

Presentation By: J. Reid Bailey, PE
GeoStabilization International
reid@gsi.us

Martin J. Woodard, PhD PG PE
GeoStabilization International
marty@gsi.us

Bob Lyne,
GeoBrugg
Bob.Lyne@geobrugg.com
I-75 MP 142.5 prior to February 26, 2016
Failure onto I-75
Geology

- Coal Bearing Region
  - Hance Formation
  - Interbedded *shale*, sandstone, siltstone, *underclay*, coal
  - Strong Units
    - Sandstones
    - Limestones
  - Weak Units
    - Shale, underclay
Geologic Structure Control vs.
Differential Weathering Control
Geologic Structure in Appalachian Coal Region

- Discontinuities
  - Geologic Breaks in the rock
- Bedding Plane
  (generally horizontal)
- Tectonic Joints
- Valley Stress Relief Joint
Tectonic Joints are compressional joints; just like a compression test in concrete.

60 and 120 degree angles
Tectonic Joints in Coal Region

Compression caused by plates colliding, compression lateral
Creates “Saw-tooth” appearance
Valley Stress Relief Joint

Valley Stress Relief Joints
Valley Stress Relief Joints

- Overburden Rock is removed
- Stress is Relieved
- Relaxation of the rock mass causes joints
- Characterized as
  - Nearly vertical
  - Continuous throughout slope
  - Parallel to valley (commonly rivers)
Local Failures with Valley Stress Relief Joints

Less durable units can erode quicker than more durable units creating overhangs. As erosion continues towards the VSRJ rockfalls can occur.
Large Failures Caused By Valley Stress Relief Joints (VSRJ)

Some slopes can fail along the VSRJ if undercutting or pressures are high enough.
I-75 Failure

Vertical Fractures (Related to Valley Stress Relief Joints)

Seep Zones

Weak Zones such as a claystone or underclay
Emergency Response Requirements

• Repair the slope working in conjunction with TDOT and Blalock

• Open Southbound lanes to traffic within 7 days

• Open Northbound lanes to traffic within 21 days
Construction Plan

- **Above Failure**
  - Lay back to a 1H: 1V
  - Pinned Mesh System

- **Near Failure Plane**
  - Develop a mid-slope Bench

- **Below failure plane**
  - Approximate 3H: 1V
  - Need to move fast with road opening requirements
Blasting
(attempt to make things faster)

- Have to blast upper section to 1H: 1V Slope
- Remove high hazard to southbound lanes to open up lanes
- Remove failed material to prepare to stabilize
- Attempt to do all in ONE step
Results of Blasting

- Top section 1H: 1V slope developed
- Rocks falling only onto Northbound Lanes
- Safe to open Southbound lanes to traffic in less than 1 week
Excavation Coordination with Blalock Construction
Excavation of Failed material after blasting

- During excavation vertical structure noticed in middle of slope
- All failed material in front
- Can’t continue 1H: 1V slope
- Valley Stress Relief Joint
Excavation and Preparation of Vertical Feature
Slope Protection

• Left with a vertical feature with a 1H:1V Slope above
• GeoBrugg Tecco G65 3mm - Pinned Mesh on 1H:1V Slope above
• Vertical Cut - Shotcrete Surface Protection – VSRJ Area
The TECCO® System

1. High-tensile steel wire TECCO® meshes
2. TECCO® system spike plates
3. Anchors
4. RUVOLUM Dimensioning Concept
Cost Optimization

- Conventional flexible systems
- TECCO® G65/2
- TECCO® G65/3
- TECCO® G65/4
Staging Work

• Working on Upper pinned mesh slope area
• Working on VSRJ area
• Required to stage work so one worker isn’t working directly below another worker
Staging Work
Working in Stages
Night Work
Pinned Mesh Area (top of slope)
Pinned Mesh/Shotcrete Area
Thank You