South Penn Railroad & the Pennsylvania Turnpike

- South Penn Railroad alignment abandoned in 1885
- Right of way sold to Penn Turnpike Commission in 1938
- 160 mile Turnpike opened in 1940
Impact on New Baltimore Community

- Original Turnpike bisected New Baltimore community from St. John’s Church
- Relocation of a cemetery of Carmelite Priests
- Construction of steps
  *(PTC has prohibited their use since 1977)*
westbound milepost

98.0  Contact: Catskill-Chemung (pic. 13A). Close to the bridge over the Turnpike at the Carmelite Mission, The Chemung consists of interbedded olive-color, shale and platy, chocolate red sandstone. Fossils found include Productella speciosa and Productella lachrymosa.

98.0-102.9  Catskill interbedded red and green shale and red sandstone, thickness approximately 2,011 feet. The strata in this interval dip westward from 5° to 18°. Occasional Ostracoderm (armor-plated fish) plates are found, especially at WB 98.9-99.1 (EB 60.9-61.1), the New Baltimore Slide. This slide, a combination slump rock-slip has given constant trouble. It involves rock throughout the entire length of the cut and 1,250 feet back from the Turnpike. Many thousands of cubic yards of rock have been removed from this area. Note ripple marks on red sandstone, Plate 11B.

102.9  Contact: Pocono-Catskill (Hampshire of Darton).

eastbound milepost

62.0

57.1
View of Slide Area from New Baltimore

• Original alignment revised (vertically and horizontally) = minimized impact on slide

• Original survey records taken during construction showed movements of up to 13 ft/year (1938 - 1940)

• Over the last 20 years, movements are closer to 8”/yr. (avg.) - raising the Eastbound shoulder pavement approximately 6”/yr. (avg.)
Observations & Early Investigation(s)

- Planer or Translational failure
- Scarps as high as 80’ recorded
- Slope “monitored” by some method since 1940
- Deformation of eastbound shoulder and right lane
- Movement generally occurs in the Spring
- PTC aware of this issue prior to the original construction
- A bench cut into the lower portion of the slope and slope flattened in 1950
- First geotechnical investigation done in 1999 (inclinometers, piezometers, time domain reflectometry, surface monuments)

*Long term maintenance was more cost effective than remediation until........*
The MP 124 to MP 133.5 Total Reconstruction & Widening Project

**Preliminary design began 2005**

- Replaced all overhead bridges
- Remediated NBS
- Corrected all substandard curves
- Added a 6th lane (widened and reconstructed portions from 124-129)

**Final design began 2010**

**Construction Manager (Stahl Sheaffer Engineering, LLC) came onboard Nov. 2012**
Test Blasting Program

- Dec. 6-11, 2010
- Performed by DBA Consulting Inc. as part of design
- Test blasting was performed by Wampum Hardware
Geotechnical Investigations from 1999 through Blasting Program

- Geotechnical Borings (past and current)
- Surface Monuments
- In-Place Inclinometers
- In-Place Piezometers
- TDR Cable Locations
- Preliminary and/Final Blast Study Locations
New Monitoring Program Implemented

- Laser surveying system & prisms used in addition to geotechnical investigations and blasting study

- Allowable rates of movement during construction were developed (including a Warning System based on Maximum Levels of movement)
PRISMS

- 4 Baseline
- 17 Original
- 80 Total (including the 17 original)
Project area covers approximately 125 acres
The New Baltimore Slide may be the focus area, but there’s also the Four Degree Curve

- 1.6 M CY of material (not including a swell factor)
- Top-down excavation (not an active slide)

- Existing Curve = 4 degrees
- “New” Curve = 3 degrees
  (which meets PTC criteria)
New Baltimore Slide Remediation

- 2.1 M CY of material (not including a swell factor)
- Top-down (limited width excavation)
- Phased E&S
- Experienced geologist required to be supplied by the contractor
- Rock blanket “benched” into material below the excavated failure plane
Contract Awarded

- Notice-to-Proceed Date – 01-22-15
- Completion Date: 06-23-17
- Original Contract Amount: $33,296,249.49
- Total Approved Change Orders (4): ($365,745.81)
- Current Contract Amount: $32,930,503.68
- Amount Earned to Date (03/20/16): $28,439,511.03 – or 86%
Drilling & Blasting

- Two (2) Truck Drills
- Two (2) Track Drills
- Lifting 40K to 50K CY per shot
- Moving 150K CY per week
- 37 Production Blasts to date
Moving the Dirt

Hitachi 1900 excavator (14 yd³ bucket)  Five (5) caterpillar 777 trucks (100 tons)
Moving the Dirt

Komatsu 1250 excavator (11 yd³ bucket) and five (5) Caterpillar 775 trucks (65 tons)

• Two (2) 350 Caterpillar Excavator
• One (1) D10 Caterpillar Dozers
• Two (2) D9 Caterpillar Dozers
• Three (3) D8 Caterpillar Dozers
• One (1) D7 Caterpillar Dozers
• Two (2) Caterpillar Compactors
The “Workhorses”: Hitachi 1900 on the left; Komatsu 1250 on the right
In Search of ....... the Failure Plane
(The Holy Grail)
Failed Material on Top of Slide Plane
Sandstone Directly Under Slide Material
Verifying Slide Plane Elevation
Slide Material Removed, “Interrupting” the Slide Plane Prior to Placing Embankment Material
The Team

L – R: Deb Benczo, Zach Varga, Matt McCahan, Chuck Medlen, Albert Mabus, Mark Welker, Justin Fox, Joe Neubert, Randy Wadding, Bill Clark, Carol Will, Jeremy Polter, Craig Knarr, Joan Hawk, Tony Colella, & Doug Thomas

L – R: Kami Corden, Dave Bradley