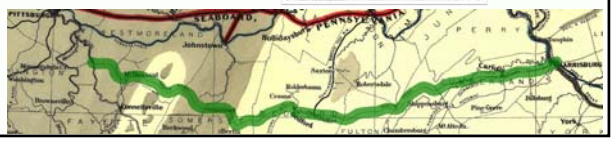
STAHL SHEAFFER ENGINEERING
PENNA TURN PIKE
NEW BALTIMORE SLIDE REMEDIATION PROJECT
ASHE Harrisburg | PENNDOT Engineering District 8-0 |
Pennsylvania Turnpike Commission | 12th Annual Joint Conference
2016

South Penn Railroad & the Pennsylvania Turnpike

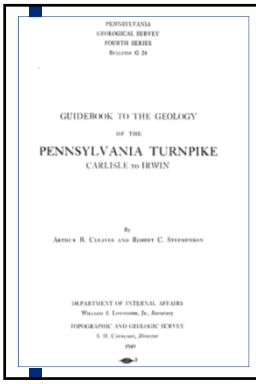
- South Penn Railroad alignment abandoned in 1885
- Right of way sold to Penn Turnpike Commission in 1938
- 160 mile Turnpike opened in 1940



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)



PENNSYLVANIA
GEOLOGICAL SURVEY
FOURTH SERIES
BULLETIN G 24

GUIDEBOOK TO THE GEOLOGY
OF THE
PENNSYLVANIA TURNPIKE
CARLISLE TO IRWIN

By
ARTHUR B. CLEAVES AND ROBERT C. STEPHENSON

DEPARTMENT OF INTERNAL AFFAIRS
WILLIAM S. LIVSEY, JR., SECRETARY
TOPOGRAPHIC AND GEOLOGIC SURVEY
S. H. CHANCE, DIRECTOR
1949

westbound milepost		eastbound 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*.	62.0
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.**	62.0-57.1
102.9	Contact: Pocono-Catskill (Hampshire of Darton).	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……**

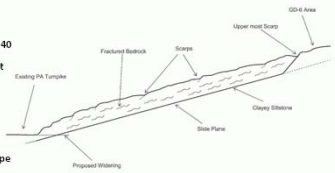


Figure ES-1: Schematic view of the failure mechanism

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

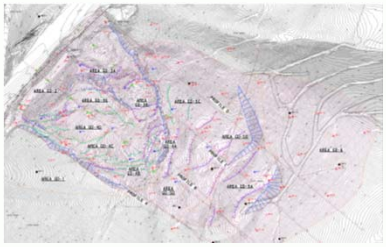
Construction Manager (Stahl Sheaffer Engineering, LLC) came onboard Nov. 2012

Test Blasting Program

- Dec. 6-11, 2010
- Performed by DBA Consulting Inc.
- As part of design
- Test blasting was performed by Wampum Hardware

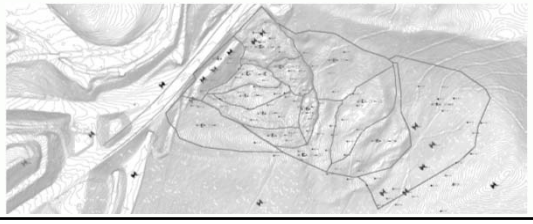
Geotechnical Investigations from 1999 through Blasting Program

- 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)*

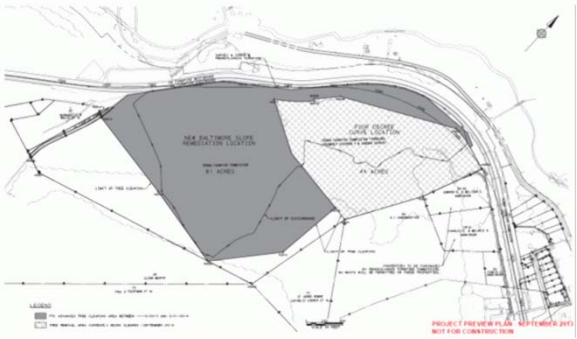


PRISMS

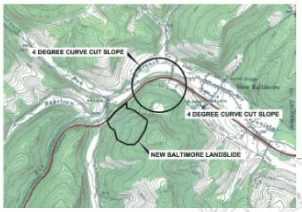
- **4 Baseline**
- **17 Original**
- **80 Current** (includes 17 original)

7 MPT Stages in this Project

- **Stage I** – Construct Outside Shoulders
- **Stage II** – Median Construction
- **Stage III** – Extend Temporary Eastbound Pavement
- **Stage IV** – NBS Remediation Stage (Mass Earthwork)***
- **Stage V** – Restore Eastbound Lanes
- **Stage VI** – Restore Median
- **Stage VII** - Milling of Shoulders to Original Conditions



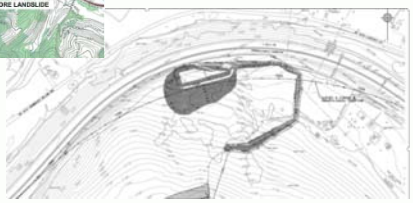
Project area covers approximately 125 acres



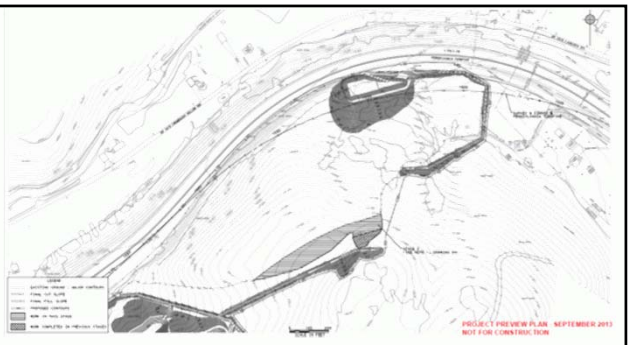
The New Baltimore Slide may be the focus area, but there's also the

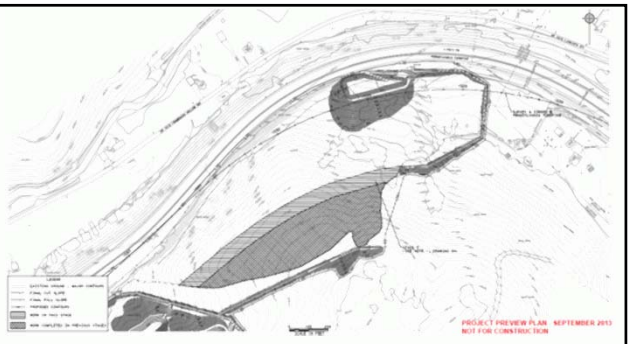
Four Degree Curve

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



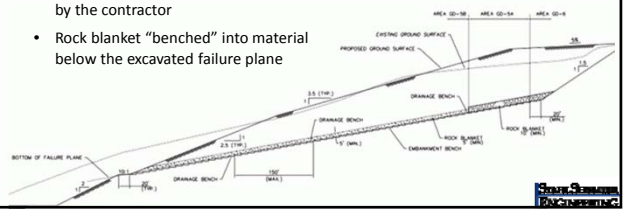
- **Existing Curve = 4 degrees**
- **"New" Curve = 3 degrees**
  (which meets PTC criteria)

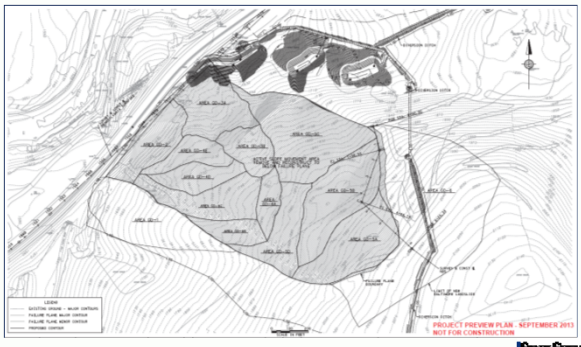


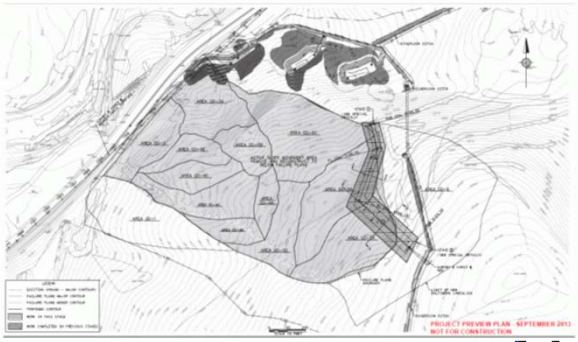


New Baltimore Slide Remediation

- 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






PROJECT PREVIEW PLAN - SEPTEMBER 2013
NOT FOR CONSTRUCTION

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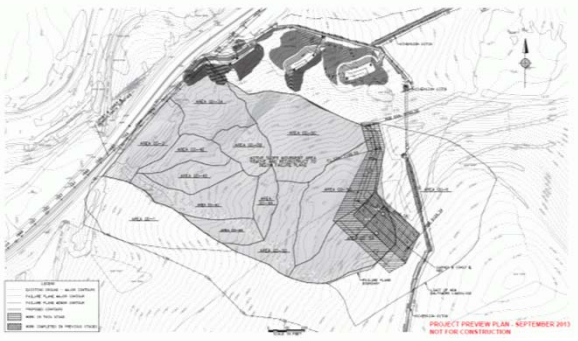
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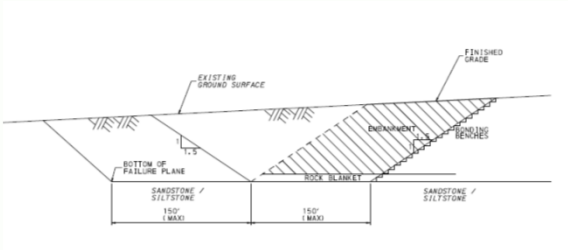
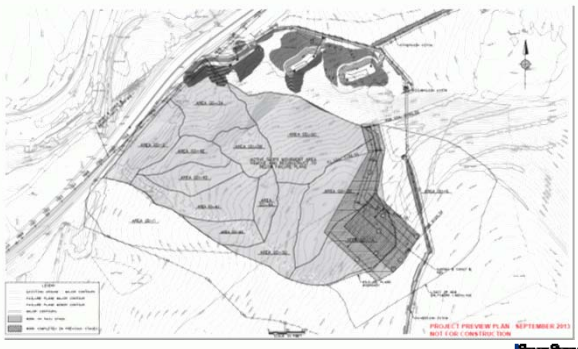

FINISHED GRADE
EXISTING GROUND SURFACE
EMBANKMENT
BENDING BENCHES
1
1.5
BOTTOM OF FAILURE PLANE
ROCK BLANKET
SANDSTONE / SILTSTONE
150' (MAX)
150' (MAX)
SANDSTONE / SILTSTONE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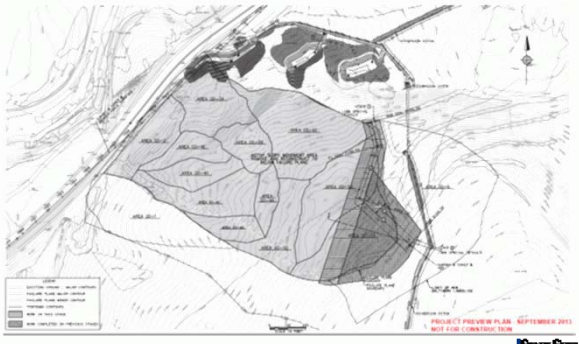
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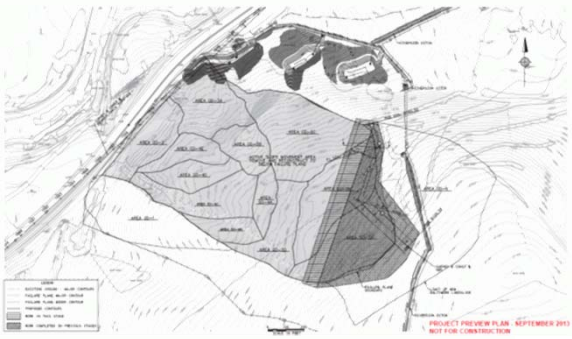
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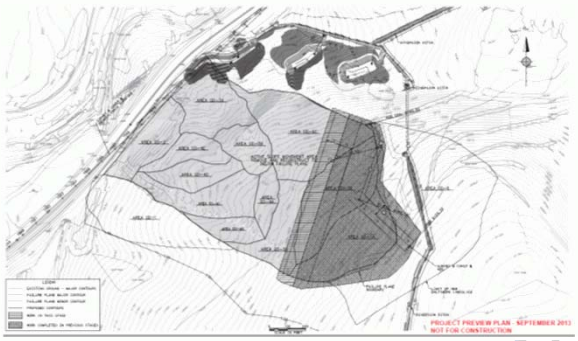
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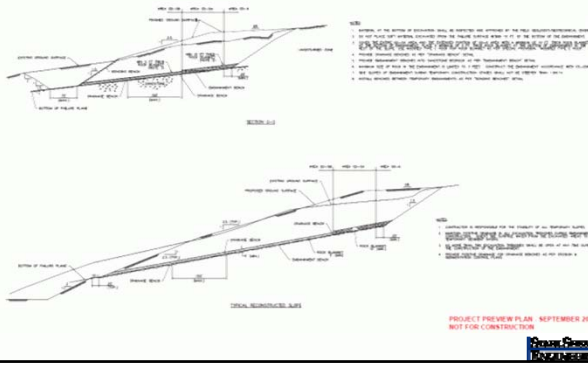

PROJECT PREVIEW PLAN - SEPTEMBER 2013
NOT FOR CONSTRUCTION

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 (3) - **$23,848.16**
- Current Contract Amount - **$33,320,097.65**
- Amount Earned to Date (03/20/16) - **$20,625,967.91 – or 62%**

INDEPENDENCE EXCAVATING
Full service site development and demolition

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

WAMPUM HARDWARE CO.
SINCE 1904

Test Blast

Four Degree Curve

Blasting

Moving the Dirt

Hitachi 1900 excavator (14 yd^3 bucket)

Five (5) caterpillar 777 trucks (100 tons)

Moving the Dirt

Komatsu 1250 excavator (11 yd^3 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

Four Degree Curve
Excavation & Slope Grading

Four Degree Curve
Seeded Finished Slope

Four Degree Curve

Excavation November 2015

White dots in foreground = Prisms being monitored on slide

New Baltimore Slide

Backfilling in Section A & B

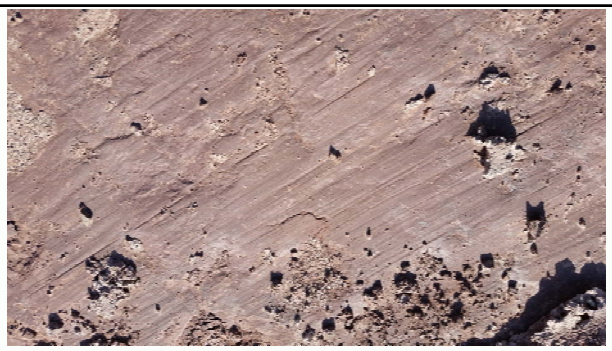
In Search of ……. the Failure Plane

(The Holy Grail)

Failed Material on Top of Slide Plane

Sandstone Directly Under Slide Material

Verifying Slide Plane Elevation



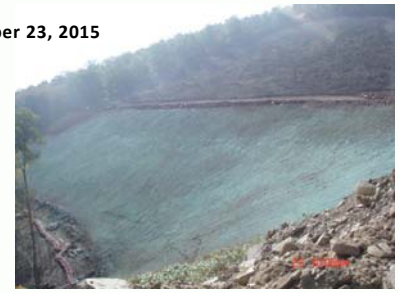
Slide Material Removed, "Interrupting" the Slide Plane Prior to Placing Embankment Material

Independence's Waste Area Behind St. John's Church

August 31, 2015

Independence's Waste Area Behind St. John's Church

October 23, 2015



Independence's Waste Area Behind St. John's Church

November 3, 2015

Independence's Waste Area Behind St. John's Church

April 14, 2016

Issues to Date:

- **Dust** – Independence has increased their dust control efforts. Complaints have virtually ceased. There really is no answer to the dust created from blasting.
- **Runoff** – We're working closely with the Somerset Conservation District and have implemented measures to reduce the problem.
- **Waste Material** – Independence's original waste area was designed for **1.2M CY** to the tree line. If the material is placed as high as possible, this area will accommodate, approximately, an additional **500K CY** if necessary (for a total of **1.7M CY**). Independence submitted a request to use some additional Commission property and St. John's Church property for additional **250K CY** of waste. **The two (2) waste areas will handle approximately 2.0M CY.**

The Team

L – R: Kami Corden, Dave Bradley

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

Questions?