# TDOT SR-108 Landslide

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DAN BROWN ASSOCIATES STGEC 2022 Southeastern Transportation Geotechnical Engineering Conference



#### Acknowledgments

TDOT – Robert Jowers and Travis Smith
TDOT Region – Sammy Bahnam
EGSci – Kal Vencil and Shane Hickman

•DBA

- Ali Day
- David Graham
- Ben Turner
- John Turner

#### Agenda

#### **Project Information**

- Timeline
- Location and History
- Geology
- Field Exploration

Design

# Project Information

## Timeline

TDOT requested services on September 23, 2020

Initial Site Meeting with TDOT

Secondary Exploration with TDOT Drill Crews and Geophysical Investigation by EGSci



#### Location















#### 2007 Drainage "Fix"











1973 geologic map shows landslides in the area

1992 the roadway alignment was shifted closer to the uphill cut

2007 mitigation to delay major repair consisting primarily of reworking drainage



Pra – Raccoon Mountain Formation
 Sandstone

Sandstone

Siltstone

• Shale

Pwp – Warren Point SandstoneSandstone

Mississippian-age Pennington – Formation (Mg)

Pennsylvanian-age Gizzard Group (Pg)

Shale, siltstone, sandstone, limestone, and dolomite.



#### Warren Point Sandstone Formation





# Initial Investigation Plan 14 Borings 21 Borings 7 Piezometers 5 Piezometers 8 Inclinometers 28 Inclinometers

#### **TDOT Drill Crews**



#### CME 550 ATV

### **TDOT Drill Crews**



## TDOT Drill Crews

#### Acker Rebel Track Mounted



# Drilling Methods

#### Hollow Stem Auger

#### **Casing Advancer**

DBA Field Log: SANDSTONE; brown with black mottling, coarse-grained, moderately weathered, very hard to extremely hard, moderately fractured

#### 2- 3 4 5 NYLON 6 7 8 9 2F 1 25

#### SANDSTONE

DBA Field Log: SHALE; gray, slightly weathered to fresh, moderately soft to moderately hard, moderately to intensely fractured

#### SHALE



DBA Field Log: SILTSTONE; grayish-red, moderately weathered, moderately hard to hard, moderately fractured

#### SILTSTONE



DBA Field Log: LIMESTONE; light gray, slightly weathered, very hard, slightly fractured

#### LIMESTONE



# **Geophysical Testing**



- Multi-Channel Analysis of Surface Waves (MASW)
- Seismic Refraction Tomography (SRT)
- Electrical Resistivity Imaging (ERI)







2

-3

100

0

1

Profile Change in Inches

130296-00 B-4 A

130296-00 B-4 B

#### Inclinometers

100

0

2

Profile Change in Inches

3

#### Groundwater Readings







#### **Geophysical Results**



### Slide Analysis



# Anchored Soldier Pile Wall

#### Soldier Piles

- HP 18x135 Soldier Pile Section <u>(Modeled using DFI Guidance</u> <u>Report)</u>
- Soldier Pile spacing (horizontal) of 10 ft.

#### Anchors:

- Typical total anchor length of 75 ft and Bond Lengths of 30 ft.
- Anchor tendons: 5 strands-15 mm diameter
- Three rows of anchors at a vertical spacing of 8 ft from station 12+00 to 20+00; five rows of anchors at a vertical spacing of 8 ft from station 20+00 to 24+00; four rows of anchors at a vertical spacing of 8 ft. from station 24+00 to 27+00.
- 15 deg anchor inclination



Guidance for Factoring Deep Foundation Structural Resistance for Landslide Stabilization and Excavation Support

**Final Report** 

December 10, 2021

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### ASP Wall Typical



#### ASP Wall Global Stability



# Downhill Stability



# Wall Profile

Wall Divided into 3 Sections:

- Station 12+00 to 20+00
  - Height 20 ft.
  - 3 rows of anchors
- Station 20+00 to 24+00
  - Height 40 ft.
  - 5 rows of anchors
- Station 24+00 to 27+00
  - Height 30 ft.
  - 4 rows of anchors





PROFILE VIEW - RETAINING WALL





PROFILE VIEW - RETAINING WALL



## **Typical Cross Section**



#### Where are we now?

- The Final Geotechnical Report has been submitted
  Continued Design work by the Structural Engineering Team
- •Letting will be later this year.
- •More to come....

# Questions