Using a Bridge for Emergency Slide Repair

US 231 near Laceys Spring, Morgan County, AL
DBA Design and Construction Timeline

- Feb 12/13 – Slide Occurs
- Feb 14 – Get the Call
- Feb 17 – ALDOT mobilizes drills (State Holiday)
- Feb 18-20 – Visit Site, ALDOT drilling
- Mar 5 – Meet w/Director – Bridge is a GO
- Mar 9 – Excavation Underway
- Mar 11 – Bridge Limits Set by DBA/Design Begins
- Apr 15 – Foundation Design Report Delivered
- Apr 20 – Plans Issued
- May 8 – Project Letting and Award
- June 1 12:00am – Begin Construction
- Sep 28 – Bridge Open to Traffic (7.5 months!)
- Mid Oct – Post-Construction Instrumentation Installation
- Dec – Collection of instrument readings via remote begins
Geologic map of the Laceys Spring area, Morgan County, showing the location of the landslide area on US-231 at MP 301.7 (Dodson, Chester L., and Harris, Jr., Wiley F., 1963, Geologic Map of Morgan County, Alabama: Geological Survey of Alabama Map 23).
STA 893+25 Analysis Section – 03/02/20 (Day 16)

Slip Plane Elev.,
B-1: 1092
B-2: 1084
B-3: 1089
INCL B-6: 1052

INCL B-6 (Proj)

Projected slip surface = elev 1115 at NB CL

INCL C-2 (2/28/20)
A+ = Elev 1132ft
B+ = Elev 1100ft

Resistivity (Ohm-m)

Interbedded Sand/Clay
Interbedded Sandstone/Clay
Interbedded Limestone/Clay

RMS = 3.6%
L2 = 0.80

Inclinometer B-2
US-231 MP 301.7

Cumulative Movement (ft)

99th Percentile
for 2010-2020
• 1 boring per abutment/bent during grading – used for design and in report
• 1 boring each bent shaft (not abutments) between grading and start of bridge to finalize Top of Rock, shaft tips, grade beam elevations
NB Bent 3

**NB3 Center**
- GS EL = +1158.60 ft
- Depth to Top of Rock = 49.6 ft
- Top of Rock Elevation = +1109.00 ft

**NB3 Downhill**
- GS EL = +1130.271 ft
- Depth to Top of Rock = 24.0 ft
- Top of Rock Elevation = +1106.271 ft

**NB3 Uphill**
- GS EL = +1140.012 ft
- Depth to Top of Rock = 10.2 ft
- Top of Rock Elevation = +1129.812 ft
NB Bent 4

NB4 Downhill
GS EL = +1125.333 ft
Depth to Top of Rock = 25.0 ft
Top of Rock Elevation = +1100.333 ft

NB4 Center
GS EL = +1142.82 ft
Depth to Top of Rock = 33.7 ft
Top of Rock Elevation = +1109.12 ft

NB4 Uphill
GS EL = +1131.760 ft
Depth to Top of Rock = 31.0 ft
Top of Rock Elevation = +1100.76 ft
SB Bent 7

SB7 Downhill
GS EL = +1090.454 ft
Depth to Top of Rock = 17.5 ft
Top of Rock Elevation = +1073.0 ft

SB7 Center
GS EL = +1105.8 ft
Depth to Top of Rock = 33.4 ft
Top of Rock Elevation = +1072.4 ft

SB7 Uphill
GS EL = +1090.777 ft
Depth to Top of Rock = 17.9 ft
Top of Rock Elevation = +1072.9 ft
Questions to Answer:
Where is Top of Rock?
Where is Bottom of Grade Beam?

- Many iterations with ALDOT Bridge Design
- Varying shaft diameter, length, 2 or 3 shafts
- Varying rock strength, soil strength (slope)
Drilled Shaft and Grade Beam Design

- 9ft Dia Rock Socket
- 8ft x 1.5in Structural pipe
- 28 - #18 bars, 75ksi
- 9.5ft x 5/8in Permanent Casing
- 8ft x 1.5in Structural pipe
- Stem wall for selected bents

SAAV Conduit – 2 per shaft
Preliminary Grading Plan to begin work – March 6, 2020
• 220,000 cubic yards removed prior to bridge construction
• Additional excavation at each bent for grade beams

For later:
NB7 Inclinometer and VW Piezometer
Bent 7 NB Shaft 2 (uphill)
8ft x 1.5in pipe

9.5ft perm casing

NUCOR SKYLINE

FAVORSTEEL & FABRICATING
205.426.3288 favorsteel.com

SSAB
• 2 slick lines delivered concrete between Casing and Structural Pipe
• Pump boom or free fall inside Structural Pipe
• All shafts in the dry
• Specified maximum differential of concrete in/out of Structural Pipe
Post-Construction Instrumentation

To allow load in the shafts to be characterized, should ground movement occur, so that the condition of the bridge foundations, and their suitability to resist additional movement, can be established at any given time

• DETAILS:
  • Monitor slope movement and water pressures, deflection of the drilled shafts.
  • Comparison of the measured responses with predicted values.
  • Assess risk of damage of the bridge in near real-time, at least qualitatively.

Challenges with Instrumentation Plan and Installation

• Time
• Access
  • Completion of grading NOT part of incentive – delayed access for free-field locations
  • Incentive/Disincentive contract – Additional steps out of the norm for bridge construction had potential for delays
  • Details of getting components to talk to each other, for hubs to talk to cloud, etc.
Installation Plan

As of 01/12/21:
All 24 Shaft ShapeArrays installed
All NB free-field instruments installed (1 SA, 3 INC, 3 VWP)
SB free-field ShapeArrays installed
Utilizing 2 existing upslope and 2 downslope inclinometers from construction
Inclinometer and Vibrating Wire Piezometer (Construction)
Free Field Shape Array Installation
What’s Next?...or....The Story Continues......

- All installed instruments are gathering data and we can download it!
- Installation of Southbound Free-Field Instruments (INC, VWP)
- Installation of Downslope Instruments (INC, VWP)
- ALDOT reads Inclinometers every week to two weeks
- Analysis of data – slope movements, groundwater, shaft movements, estimating loads in the shafts
- Establish protocol for comparing measured to design
- Draft Action Levels Plan submitted to ALDOT for review
- DBA monitor for first year (or so), develop training for ALDOT Geotechnical Section for future
Thanks For Listening!!!