

Using a Bridge for Emergency Slide Repair

US 231 near Laceys Spring, Morgan County, AL



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- Large landslide occurred on US-231 near Lacey's Springs in February 2020
- Heavily used corridor for Huntsville commuters
- Roadway was closed in both directions with detours adding 30 – 60 minutes to commutes



- Feb 12/13 Slide Occurs
- Feb 14 Get the Call
- Feb 17 ALDOT begins drilling
- Mar 5 Meet w/Director Bridge is a GO
- Mar 9 Excavation Underway
- Apr 15 Foundation Design Report Delivered
- May 8 Project Letting and Award
- June 1 12:00am Begin Construction
- Sep 28 Bridge Open to Traffic (7.5 months!)
- Mid Oct Begin Instrumentation
- Dec Begin Remote Collection











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).

Site History

- Original unimproved SR-38 constructed on ancient slide and colluvium
- SB roadway constructed as original SR-53 in ~1947
 - Loose sliding material noted on upslope side of roadway
- Roadway designated US-231 in 1953
- NB lanes constructed in ~1970 to create 4-lane roadway
 - SB & NB embankments constructed of waste material from cuts









STA 893+25 Analysis Section – 03/02/20 (Day 16)



Projected slip surface = elev 1115 at NB CL

INCL











NB Bent 3

NB3 Center Top of Rock Elevation = +1129.812 GS EL = +1158.60 ft P 10.0 DHOR 2' FI = 1129.8' Depth to Top of Rock = 49.6 ft Top of Rock Elevation = +1109.00 ft D=32.6' EL=1126.0' C/AY (114'2' FI =1124.8' LAVERS ->> 20.2" . D=42.6' EL=1116.0' 10=75 2' FI=1114 8' D=49.6' EL=1109.0' SPACER SPACER

NB3 Uphill

GS EL = +1140.012 ft

Depth to Top of Rock = 10.2 ft

SPACER

SPACED

SPACED

D=30.2' EL=1109.8'

BTM 30.2 1

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



NB Bent 4

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

BOTTOM date D=12' EL=1078.5 D=14' EL=1076.5'D=17.5' EL=1073.0' MUDSTONE LAYER D=18' EL=1074.5' HAI D=20' EL=1072.5' . =77 E = 1068D=24' EL=1066.5' D=26' EI = 1064.5'Real and a second D=28' EL=1062.5' ¥ 3.00 D=30' EL=1060.5' AV P D=32' EL=1058.

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 = 17.9ft Top of Rock Elevation = +1072.9 ft





D=32.9' EL=1057.9







NOT TO SCALE



Preliminary Grading Plan to begin work – March 6, 2020







For later: NB7 Inclinometer and VW Piezometer

Bent 7 NB Shaft 2 (uphill)

- 220,000 cubic yards removed prior to bridge construction
- Additional excavation at each bent for grade beams



8ft x 1.5in pipe











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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







BRASFIELD GORRIE GENERAL CONTRACTORS







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.









Vibrating Wire Piezometer

Free Field Shape Array

Shaft Shape Array



Star Hub and Solar Panel



Completed Shaft Install





Free Field Shape Array Installation



What's Next?...or....The Story Continues.....

- All instruments are gathering data and we can download it!
- 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 Reports/Documents Submitted to ALDOT
 - Action Levels Plan
 - Instrument Installation
 - Data Monitoring ("Baseline")
- DBA monitor for first year (or so), develop training for ALDOT Geotechnical Section for future

Thanks For Listening!!!



If you're ever sad, just remember the world is 4.543 billion years old and you somehow managed to exist at the same time as Guy Fieri

Thanks to Kaye Davis, Renardo Dorsey, and everyone at ALDOT