December 2015 Flooding In Alabama

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December 2015

Recurrence Interval is between 100 year and 200 year
Structure History & Details

- Year Built: 1952
- Drainage Area = ~32 mi²
- Interior Supports
  - Bents #2 - #6: 3-pile 10 x 42 HP
  - Bents #7 & #8: 4-pile 10 x 42 HP
  - Cross Bracing at bents #2, #3, #7, & #8
2008 Site Inspection

2009 Scour Evaluation
- Item 113 coded “Scour Critical = 3”
  - Based off calculated scour
  - Potential for Pushover Failure
  - If the groundline reached a distance of 20’ from the top of the rail at bents #2 - #6, the structure would need to be closed
- Countermeasures: In lieu of additional monitoring, place 2’ thick layer of Class 2 Riprap with Filter Fabric from abutment #1 to 16’ past bent #6.

Flood Event Information
- County closed the structure and contacted the BSS on 12/29/2015 due to increased unbraced length
- BSS performed a site inspection on 12/30/2015
- Most significant damage occurred at bents #5 and #6 where the groundline scoured as much as 12.5’.
  - Bent #5: 21’ of unbraced length
  - Bent #6: 23’ of unbraced length

Upstream Side

Bent 5

Bent 6
Bent 5

Bent 6

2016 Stability Analysis

- BSS performed a new stability analysis and re-evaluated the structure for scour
- Bents #7 and #8 stable for Max Scour Event Q500
- Bents #2 and #3 unstable for Pushover for flood events greater than the Q100
- Bents #4 unstable for Pushover for flood events less than the Q25
- Bents #5 and #6 currently unstable for Pushover
  - Bent #5: 5.5' past the pushover limit (UBL = 21')
  - Bent #6: 7.5' past the pushover limit (UBL = 23')
- Due to unbraced length and span length, "Longitudinal Buckling" is a factor
2016 Stability Analysis

- Repair options:
  - Option #1: Backfill and protect with minimum 2’ thick layer of Class 2 Riprap and Filter Fabric.
  - Option #2: Drive Steel H-piles through the deck and increase the number of piles in bents #5 - #6 and protect the area with minimum 2’ thick layer of Class 2 Riprap and Filter Fabric.

Option #2

December 2015 Flood Event
Structure History & Details

- Year Built: 1962
- DA = 6730 mi²
- Structure originally supported by
  - Piles at the abutments
  - Concrete columns with footings at Bent #2
  - Concrete columns with pile footings at Bents #3 - #9

Scour Timeline

- Scour first discovered at Bent #6 in 1971
  - 9-15' of piling exposed below the footing
  - Riprap was placed by divers to the top of the footing

- 1991 Scour Action Plan Team Evaluation
  - No significant changes
  - Concerns of corrosion and section loss of the exposed piling
    - Piling exposed for almost 20 years

- 1993 Underwater Inspection
  - Divers removed some riprap to check for section loss
  - Average section loss 17-20%

- 1995 the Division requested a stability analysis due to 15' of scour at Bent #6

- 1999 Underwater Inspection
  - Section loss has increased by 13% at Bent #6
  - Riprap is very unstable

- 2000 Inspection
  - 25' of exposed piling with 12' of remaining embedment at Bent #6
  - Riprap was installed to temporarily stabilize the support

- 2002 Countermeasure/retrofit was designed
  - Drilled shafts to replace the pile footings at Bent #6

- 2005 the drilled shaft retrofit was completed
• The Bridge Scour Section was contacted by the Region on 11/2016 due to significant scour that occurred at Bent #7 causing the pile footing to become exposed and undermined as much as 6’.

• Countermeasures for Bent #7 were developed and turned over to the Region on 12/2016.

• The structure is being monitored until the countermeasures are completed.
Preliminary Analysis

- Looks like Class III works for 4.5 to 5 fps at the depths and slopes per the 2015 flood event - ALDOT divers confirmed Class III has not moved
- Possibly put Class III on top of Class II used to fill void space
- Approximately 3,800 tons at 8360 sq ft

Limits of Req'd Countermeasures

- 8360 sq ft

Upstream

- APPROX 3FT THICK CLASS II RRRAAP
- 5'
- EL 158.42'
- CLASS II RRRAAP
- APPROX 3FT THICK CLASS II RRRAAP
- FILTER BLANKET

December 2015 Flood Event
Morgan County BIN 4410

Structure History & Details

- Year Built: 1952
- Drainage Area = ~44.4 mi² (Design)
  ~51.5 mi² (USGS)
- Interior Supports
  - Bents 2 - 4 & 7 - 8: 4-pile 10 x 42 HP Fully Encased
  - Bents 5 & 6: 4-pile 10 x 42 HP Cross Braced with Partial Encasements
- Original Scour Evaluation Performed by BSS in 1996
  - Determined to be stable by assessment, coded 8A

Flood Event Information

- The Region contacted the BSS on 1/13/2016 due scour and migration of the channel
- BSS performed a site inspection on 1/27/2016
- Underwater inspection performed on 3/1/2016
- BSS performed a new stability analysis and re-evaluated the structure

- Most significant damage occurred between Bents #4 and #7 where the channel experienced minor vertical scour but significant lateral scour causing the channel to migrate south toward bent #4
- Minor undermining of the encasements occurred at B-6

2016 Stability Analysis

- Bents #5 and #6 very close to being unstable for Buckling
  - Bent #5: 2' from the buckling limit
  - Bent #6: 2.5' from the buckling limit
- The structure was to be inspected every 30 days as well as monitored during any significant rainfall (5 inches in 24 hr period) until the countermeasures were installed

2016 Stability Analysis

- Buckling Limit
- Graph showing stability analysis with critical points marked
2016 Stability Analysis

- Required Countermeasures:
  - Exposed piles/voids under the encasements at bent #6 be filled/protected with grout bags by underwater divers
  - A minimum 2’ thick layer of Class II riprap with filter fabric be placed a minimum of 15’ south of bent #4 to 15’ north of bent #7 extending a minimum of 15’ from each face of the bridge on max slope of 1.5:1

Countermeasures

- The BSS was notified on 5/4/2016 that the countermeasures were installed as specified.
- The monitoring frequency was returned to the normal 24 month frequency.

December 2015 Flood Event
December 2015 Flood Event

Blount County

Blount County BIN 12849

Upstream Side

Downstream Side
Pipe Issues
Barbour County - SR239

Scour caused by the flood event resulted in undermining along the entire face of the culvert on the downstream side as much as 5' that extends under the structure. It also caused the loss of bank material from behind the wingwalls. The flow line of the culvert is currently approximately 6' above the stabilized streambed on the downstream side.
Debris on the caps and on the deck of the abandoned truss bridge indicate how high the water was during the flood event.

Macon County - Calebee Creek

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