Deep Creek Canyon – US Highway 12

ABC Techniques in Rural Montana

Jim Scoles – Morrison-Maierle
Location

• Deep Creek Canyon
• US Highway 12
• Helena National Forest
Project Background

• 11-mile corridor
• 7 bridges built in 1930’s (20-40 ft spans)
• Flood in 2011 – scour and damage
• Bridges at the end of useful life/ yearly risk of losing a bridge
Proposed Improvements

- New bridges
- Rock slope modifications
- Stream & riparian repairs/ enhancements
- Culvert repairs & replacements
- Guardrail installation
- Mill & overlay pavement
- Project split into three segments
Broadwater County

- RP 11.7: Replace Bridge with Culvert
- RP 12.2: Raise Roadway Grade
- RP 13.4: Reconstruct Horizontal Curve

Meagher County

- RP 14.8: Realign Approach & Construct New Bridge (Cabin Gulch)
- RP 15.1: Construct New Bridge
- RP 16.4: Rip Rap & Cutoff Wall
- RP 19.6 & 19.8: Construct New Bridges
- RP 20.8: Mitigate Rock Fall Hazard

Locations:
- Little Deep Creek Rd
- Ridge Rd
- To White Sulphur Springs
- N Fork Rd
- Ross Gulch Rd
- → To Townsend
- To Townsend
- Grassy Mountain Rd
Route Use

- Two hour detour
- 800 ADT
- Weekday commuters
- Recreational users
- Emergency services
Construction Options

Close Roadway

Detour Road & Bridge

Phased Bridge Construction

Accelerated Bridge Construction
Initial Detour Challenges

• Roadway pressed between rock hillsides and creek
• No room for staging
• Phased placement of riprap
• Remove mature growth
• Environmental impacts
Detour Construction Option

- Construction duration 6-10 mo.
  - Short-term traffic delays
  - One lane traffic day & night
  - Equipment close to traffic
- Cost of detour ≈ cost of new bridge
Accelerated Bridge Construction (ABC) Option

- Reduce bridge construction duration and road closure
  - Precast elements
  - SPMT move bridge into place
  - Bridge slides
  - Deck panels
- Precast system preferred
Preferred ABC Approach

- Perform as much work offline as possible under traffic
- Utilize precast concrete bridge members
- 2-3 day weekend road closure to construct one bridge
## Construction Comparison

<table>
<thead>
<tr>
<th></th>
<th>Temp Detour Bridge</th>
<th>ABC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Segment A Estimated Bridge Cost</td>
<td>2X</td>
<td>1X</td>
</tr>
<tr>
<td>Environmental Impacts</td>
<td>More</td>
<td>Less</td>
</tr>
<tr>
<td>Construction Duration (mo.)</td>
<td>6-10</td>
<td>3-4</td>
</tr>
<tr>
<td>One Lane Traffic</td>
<td>Day &amp; Night</td>
<td>Day Only</td>
</tr>
<tr>
<td>Equipment Near Road</td>
<td>More</td>
<td>Less</td>
</tr>
<tr>
<td>Congestion in Canyon</td>
<td>More</td>
<td>Less</td>
</tr>
<tr>
<td>Short Term Traffic Delays</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Scheduled Road Closure</td>
<td>None</td>
<td>1 Weekend/Bridge</td>
</tr>
</tbody>
</table>

Public and various agencies support for ABC
Final Design...

- Committed to 2-3 day (weekend) closure per bridge
- Foundation construction off alignment before closure
- 24 hours assumed for bridge removal and steam work
- Precast concrete modular bridge design to allow construction within 24 hours
Segment A and B Systems

• Superstructure
  – Tri-deck Superstructure for Segment A
  – Voided Slab Superstructure for Segment B
    (shallower structure depth, larger span capability, accommodates large cross slope)

• Substructure
  – Segment A – drilled shaft foundation
  – Segment B - pile foundation
    • Depth of bedrock required alternate approach
ABC Modular System – Segment A

- Precast concrete grade beam
- Grouted & pinned drilled shaft connection
- Precast concrete tri-deck
Drilled Shaft Pin Connection – Segment A

- 3/8" Shim
- Drilled shaft below
- Full width keyway below
- 10" Dia. open hole in grade beam
- DSBW #9 dowels
- 10" Dia. open hole formed with galvanized corrugated steel pipe. Place plumb in final position.
- Precast concrete grade beam
- 3/4" Shim
- 1 1/2" x 1 1/2" keyway
- Drilled shaft reinforcing not shown
ABC Modular System – Segment B

- Precast concrete grade beam
- Blind-grouted pile connections
- Precast concrete voided slab
Grouting Pile Blockouts – Segment B

3" Ø grout/air outlet on fill face of grade beam and high side of blockout.

2" Ø grout/air outlet on rear face of grade beam and high side of blockout.

3" Ø grout inlet on fill face of grade beam and low side of blockout.
Grouted Pile Blockouts – Trial Mockup
Deck Profiling

- Vary deck thickness to match roadway grade
- Eliminated asphalt wearing surface
  - Reduced schedule
  - Lower maintenance
  - Could add wearing surface to Segment C work if needed
Shop Dry-Fit

- Required trial fit-up
- Minimized MDT / public / contractor risk
- Most bridges require some adjustments
  - Bearings, anchor bolts and bearing seats
Site Constraints and Staging Limitations
Stream & Environmental Work
Precast Grade Beam
Setting Beams
Precast Wingwall
Moisture Barrier
Finished Bridge
Removal 2-6 hours

Bridge Construction 20-24 hours

Stream Work 10-18 hours

Backfill and Approach 6-18 hours

Total Road Closure 30-66 hours
Time Lapse Video
Project Awards

• American’s Transportation Award – 2015 Best Use of Innovation Regional Award (co-sponsored by AASHTO, AAA and US Chamber of Commerce)
• APWA Rocky Mountain Chapter – 2014 Project of the Year
• ACEC Montana – 2015 Transportation category Deep Creek, Segment A
• ACEC Montana – 2016 Environmental category Deep Creek, Segment B
Lessons Learned

• Early public involvement key
• Weekend closures/night work tough on MDT and contractor
• Increase coordination with contractor, fabricator, designer, and MDT
• Traffic control communication/ signage
Thanks!

• Thanks to all MDT staff that made this project a huge success.
Questions?

Special Thanks