Counterweight Trunnion Bearing Rehabilitation for CSXT Bascule Bridge over Buffalo River

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Project Location
Strauss Bascule

- Counterweight
- Truss
- Span Truss
- Trunnion Bearing
- Counterweight Tower
Trunnion Bearing

Gusset Plate

Sleeve

Pin & Pin Nut

Sleeve Stud

Bushing

Bearing Base
Trunnion Deficiencies
Minimize Disruption to Train Traffic

- Bridge to remain open to rail traffic except:
  (3) 24-hour Sundays

  Work Window 1 – remove pin, sleeve, bushing
  Work Window 2 – install new bushing, sleeve
  Work Window 3 – install new pin
Temporary Jacking System

• Jack from the existing tower
• No external supports
• 800 ton CW
• 700 ton resultant @ each bearing
• 20° from vertical
• Fully detailed on plans
Temporary Jacking System

$$\frac{\text{Temp. Steel}}{\text{Lifted Weight}} = 0.01$$

Horizontal Jacking System

Vertical Jacking System
Vertical Jacking System

- Rivets swapped for A490 bolts
- Vertical jacking force 612 Ton
Vertical Jacking System
Vertical Jacking System

Bronze / Stainless Sliding Surface
Horizontal Jacking System

- A354 Gr. BD Bearing Base anchor bolts
- Stainless to bronze sliding surface
- Horiz. jacking force 254 Ton
Horizontal Jacking System
Jacking Considerations

• Design load increase 40% to account for unknowns
• Instrumentation of gusset plate rotations
• Post-jacking - 48 hrs. & 5 train observation period
• Gusset plates continuously braced
• Temp. pin for live train traffic
• Slow order while on jacks
• Limit transverse jacking
Construction Sequence

Pre-Work Window #1
Construction Sequence
Construction Sequence

Work Window #1
Construction Sequence

Work Window #1
Construction Sequence

Work Window #1
Construction Sequence

Work Window #1
Construction Sequence

Work Window #1
Pin Removal

Work Window #1
Sleeve & Bushing Removal

Work Window #1
Braces & Plastic Sleeve Installed

Work Window #1
Temporary Pin Installed
Construction Sequence

Work Window #2
Construction Sequence
Construction Sequence

End Work Window #2
Bushing Installed

Work Window #2
New Sleeve
Sleeve and Shims Installed

Work Window #2
Temporary Pin

End Work Window #2
Line Boring
Construction Sequence

Work Window #3
Construction Sequence

End Work Window #3
Pin Installation

- Pin oversized 0.005” vs. bore (ANSI FN1 fit)
- Initially cooled in dry ice
- Liquid nitrogen bath to -130° F
- Clearance of 0.013”
- Practiced installation
- Installed in < 3 min
Pin Installation

Work Window #3
Pin Installation

Work Window #3
Construction Sequence
Completed Repair

• Operational testing
• Friction decreased 14%
• Eliminated noises and vibration from bearing
Why so successful?

- High level of planning
- Fully detailed procedure
- Collaboration between owner, engineer & contractor
- Hourly construction schedule during work windows
- “Practice Runs” of pin installation procedure
Questions ?