Gilmerton Vertical Lift Bridge

A Presentation to The AASHTO Technical Subcommittee for Movable Bridges

By: Kevin Johns, PE | Movable Bridge Business Unit Director
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Acknowledgments

- **Owner:** City of Chesapeake
- **Administrator:** VDOT
- **Lift Span EOR:** Modjeski and Masters
- **Approach Span EOR:** Gannett Fleming
- **Contractor:** PCL
- **CEI:** Parsons Brinckerhoff & Hardesty and Hanover
Project Location

- Located on Rte. 13 Military Highway
- Crosses the Southern Branch of the Elizabeth River
Project Site

Rte 13 Military Hwy
Structural Statistics

- New bridge length: 1,908 ft
- Lift Span length: 250 ft
- Towers: 207 ft tall
- Vert. Clear: Open 135 ft, Closed 35 ft clearance
- Hor. Clear: 150 ft Min
- Six Lane Cross Section. 85’-4” out-to-out of Deck
- Trusses 89 ft CL-to-CL
Structural Statistics

- Weights:
  - 7.1 Million Pounds Structural Steel
  - Lift Span Weight: 5 Million Pounds
  - Reaction at Tower Base: 4.4 Million Pounds/Tower Leg
  - Counterweight pockets sized to accommodate FWS
Electrical System

- Drive Motor: 2 - 200hp Flux Vector Drive per tower
- 30hp auxiliary drive gearmotor in each tower for emergency operation
- CCTV monitoring the roadway and waterway & marine radar monitoring of the waterway
Mechanical Statistics

- 2¼ in Dia. Ropes
- Sheaves: 15 ft Dia., 12 Ropes each, 4 per Tower
- Transverse centering through guide rollers
- One main differential gear reducer driving
  - Two secondary differential gear reducers
    - Driving two drive pinions each
    - Engaging Four Ring Gears on Sheaves
Problem/Solution

• Problem: Build new bridge on same alignment with minimal disruption

• Solution: Straddle it.
Construction Over Existing Bridge

- Existing bridge carries vehicular traffic
- Able to open for marine traffic
Problem/Solution

- Problem: Build a new bridge 20ft from active RR Bridge
- Solution: Instrument it.
Problem/Solution

• Problem: Support 15 Million pounds of reaction in the Great Dismal Swamp

• Solution: 12ft diameter drilled shafts
12ft Diameter Drilled Shafts

• 12 ft Dia Drilled Shaft Oscillator
• Shafts founded in soil, not rock

• #18 Longitudinal Bars
• #8 Hoop Bars
Installation Challenges

• Picking casing for 12ft drilled shaft from under the railroad bridge
Problem/Solution

• Problem: Settlement of shafts founded in soil

• Solution: Jacking brackets
Jacking Brackets

• Ability to correct for settlement at any column bearing
Problem/Solution

- Problem: Drilled shaft installation procedure inconsistent with design

- Solution: Redesign during construction
Drilled Shaft Redesign

• Original Design
  • 183ft long full depth casing difficult to install

• Installed Design
  • Redesign with 123ft shaft with 78ft of casing
Problem/Solution

• Problem: Support the truss with top of foundation 25ft below truss bearings

• Solution: Integrated shelf on tower column
Lift Span Support Shelf

• Shelf on tower leg to support lift span
  – Reaction for live load
  – Reaction for counterweight supported
Problem/Solution

• Problem: Bottom bay of bracing interferes with existing roadway

• Solution: Moment connection in tower and bearing
Moment Resisting Connections

- Transverse Floorbeams Fixed End Connection to Tower Legs
Moment Resisting Connections

- Anchor Bolts Post-Tensioned for Fixed Connection to Drilled Shaft. 180,000 pounds per anchor bolt
Problem/Solution

- Problem: Protect bridge from large ocean vessel collision
- Solution: 7 – Dolphins and a new fender system
Vessel Collision Potential

Barge Approaching

Barge Positioned to Pass
Dolphins

• Dolphin Installation
  – Dolphins range from 35ft to 45ft diameter
  – Sheet Pile ring with H-Pile king posts attached
  – Tip elevations from -86.0 to -116.0
Problem/Solution

- Problem: Ordnance found in Bascule Counterweight
- Solution: Call the Navy
Construction
Construction Photos July, 2010

Existing Bascules

Work Trestle
Construction Photos Oct., 2010

Drilled Shaft Oscillator

Drilled Shaft Oscillator
Construction Photos Oct., 2011

Traffic Under Tower

New Tower w/ Bascule Up
Construction Photos Dec., 2011

New Tower

Aerial View
Construction Photos Dec., 2011

Aerial View at Site

Aerial View Lift Span
Construction Photos Jan., 2012

Aerial View at Site

Aerial View at Site
Construction Photos May, 2012

Aerial View at Site

Aerial View at Site
Construction Photos May, 2012

Aerial View at Site

Aerial View Lift Span
Construction Photos July, 2012

Aerial View at Site

Aerial View Lift Span
Construction Photos Aug, 2012

Aerial View at Site

Aerial View Lift Span
Construction Photos Jan, 2013

Remove Existing Span

Cutting Girders
Construction Photos Jan, 2013

Existing Bridge Removed

New Bridge Positioned
Construction Photos Jan, 2013

Almost In

Final Position
Construction Photos Jan, 2013

Jubilation!

Pride!
Questions,
Thank you.