Rt. 15/29 (SBL) Bridge Superstructure Replacement and Roadway Widening

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Prior to Construction

West side view of SBL bridge prior to construction

East side view of SBL bridge prior to construction
Project Information

- **Location:** The Route 15/29 (SBL) Bridge Superstructure Replacement and Roadway Widening Project over Broad Run is located in Prince William County, 0.55 Mile North of Route 215.
- **Scope:** Work includes replace and widen existing bridge superstructures with offsite-fabricated superstructure segments, substructure concrete widening and repairs, re-alignment and approach work.
- **Superstructure:** 3-Span, Concrete T beam, Simply Supported
- **Substructure:** Wall type piers and abutments
- **Year Built:** 1952
- **ADT:** 25,000
- **Condition:** Structurally deficient and functionally obsolete.
Project Limits

Project limits within the Buckland Historical District and the Mosby Heritage Area
Construction Concept
Typical Sections

Existing Bridge

- 2 Lanes @ 12'-0" + 2 Shoulders @ 2'-0"
- Widen 5'-4"
- 3'-2 ½"
- 8'-10"
- 9'-0"
- 8'-10"
- 3'-2 ½"

Proposed Modular Bridge

- 36'-0" Roadway
- 12' Lane
- 12' Lane
- 8'-0" Shoulder
- 4'-0" Shoulder
- 7'-10"
- 8'-9"
- 9'-0"
- 12'-11"
Proposed Modular Structure

- **Module Configuration:**
  - Each Module Consists of a Prefabricated Conc. Deck on Two Steel Beams
  - Module Width Arrangement in Transverse Section: (7’-10”) (8’- 9”) (9’-0”)(12’- 11”)
  - Module Length = Span Length (~ 44’)
  - Max. Module Weight = ~35 tons (~30 tons w/ Lightweight Concrete)

- **Longitudinal Joints between Modules:**
  - Grouted/Waterproofed Keyways

- **Diaphragms between Modules:**
  - Field Installed Steel Diaphragms

- **Deck Parapets:**
  - Plant Cast Concrete

- **Asphalt Overlay:**
  - 3” Thick with Waterproof Membrane
Proposed Sequence of Construction

Span A  Span B  Span C

Stage I

Stage II

Stage III

Stage IV

[Median]
Extending Pier with External PT

[Median]

~ 11’

Corbel (Cast-in-Place, or Prefabricated, Match Cast)

~ 6’
~36’

External Post-Tensioning

Legend:
- Existing Structure
- Proposed Structure

Grouted Dowel Typ.
Extending Abutment A (Typical)

Legend:
- Existing Structure
- Proposed Structure

Concrete Removal
Grouted Dowel, Typ.
Proposed Construction
Stage I at Night: 9 p.m. to 5 a.m.

[Diagram showing proposed construction details with measurements and notes on lane widths, transport lane, and construction stages.]
James River Bridge

Transport lane to haul away existing segment and install new module

Two cranes lift a pre-constructed unit into place on the James River Bridge in Richmond, VA. (Photo: URS Corporation)
 Proposed Construction
Stage I Night

NOTE: Stages III and IV similar
Stage II MOT for Nighttime Construction

1. Close the SB bridge to traffic from 9 p.m. to 5 a.m.
2. Route the SB traffic on NB via the crossover 300’ north of the bridge.
3. Route the SB traffic back on SB via the crossover 400’ south of the bridge.
4. Maintain both lanes of traffic on SB bridge from 5 a.m. to 9 p.m.
Proposed Construction

Stage II at Night: 9 p.m. to 5 a.m.
Proposed Construction

Stage II at Night

- Span A
- Span B
- Span C
- Transport Lane

Remove/Replace Superstructure

Stage II Construction
Stage I Construction
Completed Structure

Span A

Span B

Span C

1'-3"

8'-0"

Shoulder

12' Lane

12' Lane

4'-0"

Shoulder

36'-0"

Roadway

8'-9"

9'-0"

4'-0"

7'-10"

12'-11"

Railing

[Median]
Construction Phase
Existing Bridge Elevation

Span A: 44'-2"
Span B: 42'-6"
Span C: 44'-2"
Initial Construction

Abutment B

East side Pier 1, Pier 2

Under bridge view of Abutment B
Conflicts with Beams

- Existing beam seat conditions justified the weekend closure to enable total replacement.
Beam Seat Construction Issues

*In conflict with existing beams*
High Water

Before and after photos of high water after heavy rains (10’) in May 2008
High Water

Damages caused by heavy rain after installation of cofferdam (port-a-dam)
Cofferdams

Installation of an additional Cofferdam at Pier 1 needed as a result of high water to complete formwork and concrete pour
Initial Progress
Abutment A

East side Abutment A, Pier 1 and Pier 2
Environmental
Demolition Shield

Installation of demolition shield
Weight Limitations

Hand Rails Removed

Removal of existing handrails to reduce weight during the removal of segments
Steel Beams – Galvanization and Shipping

Steel beams after galvanizing and shipment to Coastal Precast Systems, Inc.
Coastal Prefabricating Modular Deck Units
Revised Construction Sequence
Revised MOT Plan for Weekend Closures
Revised Construction of Span A

- Span A
- Span B
- Span C

Detour SB Traffic During Weekend

Remove/Replace Superstructure
Revised Construction of Span B

Span A  Span B  Span C

Remove/Replace Superstructure

[Median]

Detour SB Traffic During Weekend
Revised Construction of Span C

Detour SB Traffic During Weekend

Remove/Replace Superstructure

[Median]
Completed Structure

Span A  Span B  Span C

36'-0" Roadway  1'-3"  1'-3"

8'-0" 8'-9" 9'-0" 12'-11"

Shoulder  Lane  Shoulder

Span A  Railing  Span C

[Median]

1'-3"  36'-0" Roadway  1'-3"

12' Lane  12' Lane

8'-0" Shoulder  4'-0" Shoulder

7'-10"  8'-9"  9'-0"  12'-11"
Lessons Learned

Conflicts With Beams

- Encourage full detailed survey/as-built investigation during Preliminary Engineering Phase.
- Design should use maximum tolerances to allow for field adjustments.
- Designers need to insure all specified materials are readily available (standard typical beam sizes).

![Diagram of Existing and New Bridge with dimensions and overlap issues](image-url)
Lessons Learned (Continued)

Crane Issues

• Larger crane required
• Limited work area
Placing Asphalt at the Abutment and Sealing Deck Joints
Completed Structure with Asphalt Overlay