Project Background

Location

Concept Development
- Public Involvement
- Aesthetics

Final Bridge Design
- Substructure
- Superstructure

Construction
- Conclusion

Substructure

Superstructure

Conclusion
Project Background

Existing Bridge
- 10 Spans – 120’ Steel Plate Girders
- 3 Traffic Lanes (1 NBL & 2 SBL)
- Functionally Obsolete
- Spans Mill St., Parking Lot & Occoquan River

Concept Development

Proposed Bridge Requirements
- 7 Traffic Lanes (3 NBL, 3 SBL & 1 SBL Turn)
- Appropriate Shoulder Widths for Safety
- Pedestrian Walkway
- Raise Profile of the Roadway and Bridge
- Use Existing Bridge Alignment & ROW
- Parking Area during and after construction
- Functional and Economical Bridge Solution
- Approval of Bridge Concept by Town

Concept Development

Concept Study

Public Involvement
- Bridge Selection Committee
- Citizens and Elected Officials from Town of Occoquan, Fairfax and Prince William Counties
- Provide community input into the bridge selection process
Concept Development

Public Involvement
- Education
- Bridge Types
- Purpose & Applications
- Cost

Legends:
- Very Good
- Good
- Acceptable
- Poor
- Very Poor

Evaluation Summary

Public Involvement
- Approved Bridge Concept

Rte. 123 Bridge over the Occoquan River
Virginia Concrete Conference 2007
Concept Development

Public Involvement

- Brickwork Formliners
  - Bases of Pier Columns
  - Base of Abutment A MSE Wall

Virginia Concrete Conference 2007

Rte. 123 Bridge over the Occoquan River
Concept Development

- Fractured Rib Formliners
  - Faces of Pier Columns
  - Faces of MSE Wall Panels

Concept Development

- Pedestrian Walkway
  - Recessed Panels
  - Pedestals with Lighting
  - FRP Railing Panels

Final Bridge Design

Sequence of Construction

Stage I Construction

Stage II Construction
Final Bridge Design

Summary of Concrete Strengths

- Beams and Beam Segments: 55 MPa (8,000 psi)
- Deck Slab: 40 MPa (5,800 psi)
- Parapets, Medians & Railing Pedestals: 35 MPa (5,100 psi)
- Pier Caps & Columns: 35 MPa (5,100 psi)
- Pier Footings: 25 MPa (3,600 psi)
- Abutments & MSE walls: 25 MPa (3,600 psi)

Summary of Reinforcing Steel

- All mild reinforcing steel – ASTM A615 Gr. 60:
  - 420 MPa (60 ksi)
- MMFX 2 (Stage II Deck Slab Only) – ASTM A615 Gr. 75:
  - 520 MPa (75 ksi)
- Prestressing Steel - 0.6” Ø, Low-Relaxation – ASTM A416 Gr. 270:
  - 1860 MPa (270 ksi)
- Post-tensioning Steel - 0.6” Ø, Low-Relaxation – ASTM A416 Gr. 270:
  - 1860 MPa (270 ksi)

Abutments

- Single Row of Steel Piles
- Socketed into Rock
- MSE Walls
**Final Bridge Design**

**MSE Walls**
- Support of Abutment Fills
- Retaining Wall for SBL Approach
- Support for Roadway Fill
  - (Rte 123 & Rte 722)
- Reduced ROW
- Greater than 350' long (107 m)
- Maximum Height of 43.5' (13.25 m)

**Final Bridge Design**

**Piers**
Final Bridge Design

Deck Slab
- 8.5" (220mm) Slab Thickness
- Epoxy Coated Reinforcing Steel (SBL)
- MMFX 2 Reinforcing Steel (NBL)

Approach Spans – (144'-4" Each)
- 4 Simple Spans – 140' (42.7m) each
- Made Continuous for Live Load

Main Span Unit – (180'-240'-180')
- 2 End Segments – 128' (39m) each
- 2 Haunch Segments – 98' (30m) each
- 1 Drop-In Segment – 137' (41.8m)
Final Bridge Design
Analysis and Design Software
- Consplice PT by LEAP Software
- Girder Line Analysis
- Time Dependent Analysis

Girder Section
- Approach Spans
  - Standard VDOT 77” Bulb-T (PCBT-77)
- Main Span Unit
  - Modified PCBT-77
    - 2” added to top flange thickness
      (from 4” to 6” thick)
    - 2” added to overall section width
      (from 7” web to 9” web)

Post-Tensioning Tendons
- 3 Tendons (T1, T2 & T3)
- 12 – 0.6” Diameter Strands Per Tendon
Final Bridge Design

Post-Tensioning Ducts
- 3" Diameter HDPE Round Ducts
- 6" (150mm) Vertical Duct Spacing

Final Bridge Design

End Segment End Block

End Block Elevation

Final Bridge Design

Haunch Segments
- Variable Web Depth
- Constant Bottom Bulb Thickness
- Overall Depth Varies from 6.58' (2007mm) to 12.5' (3810mm)
**Final Bridge Design**

Girder Splices
- 2' (600mm) Splice Length
- Lapped & Interlocking Reinforcing Steel
- Welded Steel Plates

**Erection Sequence**
Final Bridge Design

Erection Sequence

Construction

- Sequence of Construction
  - Eliminate Stage I Demolition of Existing Fascia Girder
  - Non-Parallel Bridges

Construction

- Transverse Deck Cracking
  - Full Depth Shrinkage Cracks
  - Full Width Cracks Spaced at 3'-10'
  - Extent of Cracking Varies with Span Location
Construction
Web Cracking of Beam Segments – Casting Yard

Construction
Web Cracking of Beam Segments - Testing

Construction
Web Cracking of Beam Segments – Impact of Duct Size
Construction

Web Cracking of Beam Segments – Re-Cast

Construction

Web Cracking of Approach Girders

Conclusion

Notable and Innovative Features
- High Strength Concrete in Superstructure
- Spliced and Post-tensioned Bulb-T Girder Segments
- MMFX2 Reinforcing Steel (NBL Deck)
- FRP Railings
- Public Involvement
- Cost Effective Aesthetic Features
  - Formliners for Rustication
  - Recessed Panels
  - Stamped Concrete
Conclusion

Application of state-of-the-art technology with cost effective architectural enhancements to provide a bridge structure that meets requirements of function and overall aesthetic goals.