VDOT DESIGN & CONSTRUCTION GUIDELINES
RECENT UPDATES – BRIDGE SPECIFICATIONS
VIRGINIA CONCRETE CONFERENCE 2019

Kendal R. Walus, PE
State Structure and Bridge Engineer

February 28, 2019
2018 National Steel Bridge Alliance Award

- 2018 NSBA Prize Bridge Award
  - Short Span Category
- 1st Bridge in USA to Use 50CR for:
  - Tapered Girder Webs
  - Cross Frames
  - Stainless Steel High Strength Bolts

Route 340 over South River – Waynesboro, Virginia
Staunton District
2018 PCA Bridge Design Award of Excellence

- 2018 PCA Concrete Bridge Award
  - 1 of 8 Winners in USA
  - Recognition of Creativity and Imagination in the Structural, Functional, Aesthetic, Sustainable and Economic Design
- 1st Bridge in USA to Use CFRP for:
  - All Reinforcement in Bulb-T Beams

Route 49 over Aaron’s Creek – Halifax County, Virginia
Lynchburg District
Roads & Bridges 2018 Top 10 Bridges - 6th Place

- 2018 Roads & Bridges Top 10 Bridges
  - Longest Steel Jointless Bridge in VA
  - Use of Virginia Abutment
  - Use of Low Shrinkage Concrete (before 2016 Specs)
  - Alternate Foundation Design
  - Innovative Construction Details

Route 340 over South Fork Shenandoah River - Front Royal, Virginia
Staunton District
2018 ACI Excellence in Concrete Construction

- Won in Both the Category “Infrastructure” as well as the Commonwealth Award
- First Bridge in Commonwealth to use the New Adjacent Member Connection Detail
- Innovative Connection that Effectively Transfers the Loads Transversely
- Filling Material, Very High Performance Concrete (VHPC)
- Significantly Reduces the Lap Splice Length for the Steel Reinforcement

Route 744 over Bluestone River - Tazewell County, Virginia
Bristol District
2019 ACEC Virginia’s Engineering Excellence Awards

• 2019 Honor Award Category
  • Context Sensitive Design
  • Diverging Diamond Interchange
  • Architectural Treatment
  • Successful Incorporation of Concrete Bridge Panel

Southgate Drive over Route 460 – Blacksburg, Virginia
Salem District
Structure and Bridge Division

- **Assistant S&B Engineers**
  - Project Delivery – Prasad Nallapaneni
  - Engineering Services – Junyi Meng
  - Maintenance – Adam Matteo
  - Safety Inspection – Chris Williams

- **District Bridge Engineers:**
  - Bristol – Gary Lester
  - Culpeper – Teresa Gothard
  - Fredericksburg – Annette Adams
  - Hampton Roads – Mohamed Ali
  - Lynchburg – Frank Lukanich
  - Northern Virginia – Gary Runco
  - Richmond – Jeff Hill
  - Salem – Dean Hackett
  - Staunton – Rex Pearce

**S&B Strength:**
- Admin/Program Management/Design = 145
- Safety Inspection = 127
- Bridge Maintenance = 291
- Grand Total = 563
PERFORMANCE MEASURES

• VDOT’s Bridge Performance Measure
  
  • Total Number of Non-SD NBI and All Structures > 95.5%
  
  • 0.5% Condition Improvement of Bridge Joints in Condition States 1 & 2
  
  • 0.5% Reduction in the Number of NBI and All Structures with a Minimum General Condition Rating 5 (Fair) by July 1, 2019
  
  • 15% Reduction in the Number of Fracture Critical Structures
  
  • FHWA - % Deck Area of SD (Poor) NBI NHS Structures < 10.0%; VDOT Goal = 3.0%
  
  • FHWA - % Deck Area of Good (GCR =>7) NBI NHS Structures; VDOT Goal = 33.0%

• VDOT is Undergoing a Comprehensive Review of Performance Measures – July 2019
Continual Improvement – Non-SD Structures Trend

Chart 2 - Percentage of Non-SD Structures Statewide by Count and Deck Area (Nine Year Trend)

Based on FY2018 Data
VA Responsible Structures
Continual Improvement – SD Structures Trend

Based on FY2018 Data
VA Responsible Structures
Continual Improvement – Non-SD Structures Trend

Percentage of Non-Deficient Structures
Graph of Recent Progress

December 31, 2018 - 95.5%
Statewide Target for All Bridges & Culverts, and NBI Structures

Based on January, 2019 Data
VA Responsible Structures
Maintenance and Bridge Management

• 2018 Bridge Crew Accomplishments
  • Performed Preventative Maintenance on over 3,473 Bridges
  • Rehabilitated 84 Structurally Deficient Bridges
  • Replaced 83 Structurally Deficient Bridges
Aesthetics and Concrete Are Excellent Partners
Minimize Long Term Maintenance Costs

- Implementation of New Technologies:
  - Continuous Spans for New Bridges – 1970’s
  - Latex Modified Concrete Deck Overlays – 1970’s
  - Three Coat Zinc Based Paints – 1982
  - High Performance Concrete in All Bridge Elements - 2003
  - Corrosion Resistant Reinforcing Steel – 2008
  - Jointless Bridge Technology – 2011
  - Self Consolidating Concrete for Drilled Shafts - 2015
  - Low Shrinkage Concrete in Bridge Decks – 2015
  - Latex Modified Overlays Using Hydro Demolition – 2015
  - Carbon Fiber and Stainless Steel Prestressing Strands in Piles – 2017
  - Inverted Tee Beam - 2017
  - Corrosion Resistant Structural Steel (Grade 50CR) – 2018
  - Elastomeric Concrete Plug Joints - 2018
  - Engineered Cementitious Concrete for Steel Culvert Repairs - 2018
Minimize Long Term Maintenance Costs

- Design
  - Jointless Design
  - Use Virginia Abutment and Pier Details
- Eliminate Joints Where Possible
  - Closures
  - Deck Extensions
- Corrosion Resistant Reinforcing Steel
- Low Shrinkage Concrete in Bridge Decks
Minimize Long Term Maintenance Costs

- Closure Pours and Overlays

I-64 Over Dunlap Creek – Staunton District
Minimize Long Term Maintenance Costs

- Overlays
Minimize Long Term Maintenance Costs

• Prestressed Concrete Piles and Adjacent Box Beam Changes
  • New Prestressed Concrete Pile Standards using Stainless Steel and Carbon Fiber Strands
  • New Virginia Adjacent Member Connections (VAMC) for Prestressed Concrete Slabs
Minimize Long Term Maintenance Costs

- Carbon Fiber/Stainless Steel Prestressing Strands

Nimmo Parkway – 18 Piles Virginia Beach, Virginia
Hampton Roads District
Minimize Long Term Maintenance Costs

- Carbon Fiber Prestressing Strands for Bulb Tee Beams

Route 49 over Aaron’s Creek - Lynchburg District
Minimize Long Term Maintenance Costs

- Elastomeric Concrete Plug Joints
Minimize Long Term Maintenance Costs

• Inverted Tee Beam Standard
  • Up to 45 Feet
  • Improved Constructability
Minimize Long Term Maintenance Costs

- Concrete Slab Solutions
Minimize Long Term Maintenance Costs

• Rolled Beam Timber Deck Replacement

Route 654 over Maxey Mill Creek
Lynchburg District
Minimize Long Term Maintenance Costs

- Rolled Beam Timber Deck Replacement
Being Cost Effective – Stretching Tax Dollars

• Pipe Liners
Being Cost Effective – Stretching Tax Dollars

- Engineered Cementitious Concrete Culvert Repair
Being Cost Effective – Stretching Tax Dollars

• Steel Beam End Repairs
Being Cost Effective – Stretching Tax Dollars

- Substructure Surface Repairs
 Updates to Design Guidelines & Bridge Specifications

• Updates:
  • Chapter 7 - Reinforcing Steel
    • Development and Lap Lengths using AASHTO LRFD Bridge Design Specifications 8th Edition

• New Barrier Rail – CPSR (Concrete Parapet Steel Rail) Series
  • Replaces BR27 Series
  • MASH Crash Tested
  • Test Level 4

• Precast Concrete Beam Standards
  • Added Design Camber at Erection Requirements
  • Recognized and Incorporated Industry Guidance

• IIM S&B 80.6 – VDOT Modifications to AASHTO Update
  • AASHTO LRFD Bridge Design Specifications 8th Edition
  • Design yield strength of 75 ksi for all types of CRR when Used in Box Culverts and Rigid Frames
Updates to Design Guidelines & Bridge Specifications

- Chapter 8 – Bridge Layout:
  - Use of Centerline of Bearings
  - Reference Working Line When Chord is Not Appropriate
  - Provides Numerous Curved Bridge Layout Examples
  - Updates Substructure Layout Examples
  - Updates Slope Protection Details
Updates to Design Guidelines & Bridge Specifications

• Chapter 14 – Joints:
  • Class I, II and III Adhesive Based Joint Sealer
  • Elastomeric Expansion Dam – Conformance with Industry Standard
  • Asphalt Plug Joint
  • Flexible Concrete Plug Joint
• Remember – No Joint is the Best Joint!
Updates to Design Guidelines & Bridge Specifications

- IIM S&B 96 – Lead Exposure Safety Directive:
  - VDOT’s Lead Exposure Control Program Manual – September 2018
Updates to Design Guidelines & Bridge Specifications

- Upcoming Items Heading Your Way:
  - Single Slope Concrete Parapet (SSCP) Standard
    - MASH Crash Tested
  - Guidance on Box Culvert Wingwalls
  - Guidance on Climate Change for Bridge Design
  - Updating Special Provisions on ECC and VHPC
    - To Include Bagged Materials
  - Special Provision for Superstructure Erection Stability
    - Concrete and Steel Main Members
  - IIM to Designers on Superstructure Erection Stability
Culvert Wingwall Problems

Wingwall Collapse

Wingwall Sliding

Undermining
Culvert Wingwall Problems

Wingwall Rotation

Settlement Failure
Culvert Wingwall Problems

Wingwall Failures
Culvert Wingwall Problems

Wingwall Failures
Culvert Wingwalls

- Why is this Occurring?
- Who is Responsible?
- What can we do to Prevent this from Happening?
- What is VDOT’s Plan?
  - Reviewing Current Practice
  - Reviewing Standard Requirements
  - Reviewing Design Specification Requirements
  - Working with District and Central Office Engineers
  - Working with Industry
Summary

• Wingwall Designs Must be Engineered Correctly

• VDOT is Implementing New Technologies in Bridge and Culvert Design

• It is Important to Stay Informed with these Changes

• We Expect You to Incorporate the Guidance into Plan Sets

• VDOT is Focused on Minimizing Long Term Maintenance Costs

• Thank You for Your Cooperation!
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