

I-95 HOV/HOT Lanes Project

Exhibit C

Technical Requirements

Attachment 3.15b

Structural Design Criteria

Types of Structures

Bridges, toll gantries, overhead span sign structures, cantilever sign structures, butterfly sign structures, LUMS structures, high mast lighting structures, offset lighting poles, conventional lighting poles, camera poles, traffic signal structures, Bridge Class Culverts, retaining walls, MSE walls, sound barrier walls and standard structures

Specifications/Standards/Guides

- A. Construction Period Activities: The standards, special provisions and reference guides applicable for the Construction Period shall be the version of those documents as noted herein below or those in effect as of August 15, 2011, including all supplements, errata, revisions and interims.
- B. Operating Period Activities: Following the Work period, all subsequent design and construction must meet the standards current at the time the Work is performed.

1 Bridge Criteria

1.1 Live Load Capacity

HL-93 as outlined in AASHTO LRFD Bridge Design Specification.

1.2 Load Rating

See Section 6 below.

1.3 Bridge Width and Length

Bridge width and length shall be determined by the functional classification of roadway(s) being considered and the facility or item being crossed. The Manuals of Structure and Bridge Division – Volume V, Part 2 provide geometric requirements. Precautions shall be taken in the initial design so that any future widenings of the structure, or the object being crossed, does not violate any minimum vertical and horizontal clearances for either structure.

1.4 Future Wearing Surface Load

A minimum future wearing surface load of 15 psf shall be applied to the deck areas of the composite section.

1.5 Construction Tolerance Load

A minimum construction tolerance load of 20 psf shall be applied to the non-composite sections of beam/girder spans having cast-in-place slabs.

1.6 Aesthetic/Architectural Treatment

Aesthetic/architectural treatment shall be in accordance with Attachment 3.11 of the Technical Requirements.

1.7 Additional Bridge Specific Criteria

- A. Bridge “type” decisions shall be based on reducing long term maintenance costs for VDOT.
- B. All beam/girder systems with a cast-in-place deck shall be designed as composite.
- C. No bridge shall be designed as fracture critical, unless otherwise approved by the Department.
- D. The use of HPS (high performance steel) 70 ksi will be permitted. Use of 100 ksi may be considered but will require a submittal regarding

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fabrication techniques and subsequent approval by the State Structure and Bridge Engineer.

- E. The use of HPC (high performance concrete) for prestressed concrete beams in excess of 8,000 psi will be considered but will require approval of the State Structure and Bridge Engineer. Prestressed beams shall be the approved VDOT Bulb-Ts, AASHTO shapes will not be permitted.
- F. If structural steel beams/girders are selected, the material shall be weathering steel if the conditions meet the requirements of FHWA (Federal Highway Administration) Technical Advisory “Uncoated Weathering Steel in Structures” T5140.22.
- G. Fatigue prone details shall be minimized and/or not used (e.g. cover plates on continuous rolled beam sections in the negative moment areas are not acceptable, longitudinal stiffeners are not acceptable, etc.).
- H. No field welding to structural steel members, primary or secondary, shall be permitted except as allowed in the Manuals of Structure and Bridge Division – Volume V Series.
- I. To the maximum extent possible expansion joints in deck slabs should be minimized. The use of continuous span units and jointless bridge design technologies, as outlined in the Manuals of Structure and Bridge Division Volume V-Part 2, shall be used in determining the bridge type.
- J. Structural approach slabs, including sleeper pads, will be required for all bridges. Approach slabs shall conform to the requirements of the Manuals of Structure and Bridge Division Volume V-Part 2 and 3 or as modified in the Technical Requirements.
- K. Piers used for all bridges shall be limited to the following types: hammerhead piers with rectangular columns, multi column piers with square columns, wall piers, circular columns for straddle piers, and dual circular columns for integral columns as detailed in the Technical Requirements Attachments 3.11 & 3.15a.
- L. The following note shall be added to the GENERAL NOTES shown on the title sheet of bridge plans if the project has steel beams/girders: “The spacing and height of stud shear connectors shall be shown on the shop plans (working drawings)”.
- M. Painting of ASTM A709 Grade 50W structural steel for jointless bridges will not be required. This includes jointless bridges with fully-

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integral, semi-integral, deck slab extensions and alternate backwall abutments.

2 Toll Gantries, Signs, Lighting, and Traffic Signals Criteria

- A. Structural design of toll gantries shall be in accordance with the Road and Bridge Specifications Section 700 for overhead sign structures.

3 Culverts, Retaining Walls, MSE Walls, Sound Barrier Walls and Standard Structures Criteria

3.1 General

Items intended to be included in this criteria include: retaining walls (including their foundations) not attached to bridge structures, MSE walls, sound barrier walls, culverts, buried structures, soil-corrugated metal structure interaction systems, soil-reinforced concrete structure interaction systems, soil-thermoplastic pipe interaction systems.

3.2 Live Load Capacity, if applicable

HL-93 as outlined in AASHTO LRFD *Bridge Design Specification*.

3.3 Unbraced Length of Sound Barrier Wall Posts

Sound barrier wall post shall be designed such that the minimum unbraced length used in the design is not less than the full height of the post, measured from the top of foundation to free end of post.

3.4 Combination Sound Barrier Wall / Soldier Pile Retaining Wall Systems

Splicing of sound wall posts to soldier piles of retaining wall will not be permitted. Sound barrier wall post shall be continuous with the retaining wall pile.

3.5 Load Rating

See Section 6 below

3.6 Future Wearing Surface Load, applied where applicable

A minimum future wearing surface load of 15 psf shall be applied to the deck areas of the composite section.

3.7 Construction Tolerance Load, applied where applicable

A minimum construction tolerance load of 20 psf shall be applied to the non-composite sections of beam/girder spans having cast-in-place slabs.

4 Additional Design Constraints for Bridges, Toll Gantries, Over Head Sign Structures, Cantilever Sign Structures, Butterfly Sign Structures, High Mast Light Poles, Light Poles, Camera Poles, Traffic Signal Structures, Bridge Class Culverts, Retaining Walls, MSE Walls, Sound Barrier Walls and Standard Structures

4.1 Corrosion Resistant Reinforcement

- A. Epoxy coated reinforcing steel may be used in lieu of corrosion resistant reinforcing steel where required in accordance with S&B IIM 81-Corrosion Resistant Reinforcing Steels (CRR).
- B. Plain deformed reinforcing bars shall conform to ASTM A615 Grade 60.
- C. No timber elements will be acceptable.

5 Minimum Plan Requirements for Bridges and Other Similar Structures

5.1 Plan numbers will be assigned by Central Office Structure and Bridge.

5.2 Plan sets should contain sheets which are arranged and detailed as outlined in the Manuals of Structure and Bridge Division – Volume V Part 2.

5.3 A summary table of moments, shears, reactions and stresses for primary load carrying members shall be included on the plans.

5.4 Additional Minimum Plan Requirements for Bridges

- A. Dead load deflections shall be computed and shown on the drawings.
- B. Camber diagram shall be shown on the drawings.
- C. The sequence of concrete deck placement operations for beams or girder construction shall be given for continuous structures and all erection stress shall be computed where necessary for design.

6 Load Ratings

All new and modified bridges and Bridge Class Culverts shall be “load rated” in accordance with draft IIM S&B 86-Load Rating and Posting of Structures (Bridges and Culverts) as outlined in the Technical Requirements Attachment 1.5a.

7 Units

U.S. Customary Units

8 Standard Details

Standard details are available on the S&B website