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**I-95/I-395 HOV/HOT Lanes –
Fredericksburg Extension (Fred Ex) Project**

Exhibit C-5

Technical Requirements

Attachment 1.5a

Standards and Specifications

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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 final issuance of RFP, including all supplements, errata, revisions and interims. Following the Work period, all subsequent design and construction must meet the standards current at the time the Work is performed. Groupings of standards are for ease of reference only and certain reference documents have been included. It is the responsibility of the Design-Builder to ensure that all relevant standards and specifications have been applied.

The Design-Builder must verify and use the latest version of the documents listed herein. The Design-Builder shall meet or exceed the minimum design standards and criteria.

A. Standards and Reference Documents

General

1. AASHTO Guide Specifications for Highway Construction, 9th Edition
2. VDOT Materials Approved Lists
3. VDOT Construction Manual May 2016
4. VDOT Post Construction Manual (December 2016)
5. VDOT Construction Inspection Manual (January 2017)
6. VDOT's Minimum Requirements for Quality Assurance & Quality Control on Design-Build & Public-Private Transportation Act Projects, July 2018
7. VDOT Traffic Engineering Design Manual (2014)
8. VDOT Right of Way Manual of Instructions, Third Edition (May 11, 2016; Revised October 13, 2017)
9. VDOT Utility Manual of Instructions – Utility Relocation Policies and Procedures, Eleventh Edition (October 1, 2016; Revised August 14, 2017)
10. VDOT Land Use Permit Regulations Guidance Manual (May 20, 2013)
11. VDOT Land Use Permit Regulations 24 VAC 30-151 (3/17/2010)
12. VDOT Policy Manual for Public Participation in Transportation Projects Nov 2016
13. VDOT Instructional & Information Memorandums (IIM) – All Divisions (as of date of RFP)
14. VDOT Road and Bridge Standards, Vol. 1 and Vol. 2 (2016), including all revisions as of the date of the RFP
15. VDOT Road and Bridge Specifications (2016) (Divisions II – VIII only)
16. VDOT 2018 Supplement to the 2016 Road and Bridge Specifications
17. VDOT Virginia Work Area Protection Manual (2011) (Revised April 2015)
18. FHWA 23CFR30 Subpart J Workzone Safety and Mobility
19. 2010 ADA Standards for Accessible Design

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20. Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way, dated July 26, 2011
21. Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities dated July 23, 2004 and amended May 7, 2014
22. VDOT Policy for Integrating Bicycle and Pedestrian Accommodations, adopted March 18, 2004 by the CTB
23. Transportation Research Board Highway Capacity Manual (2010)
24. VDOT Manual of Instruction for Material Division (2016) to include all associated memoranda
25. VDOT CADD Manual (Issued 2012, Revised June 2017)
26. VDOT Highway Traffic Noise Impact Analysis Guidance Manual (July 14, 2015)
27. ISO 9001 Quality Management Systems (September 2015)
28. AASHTO Guide for Park-and-Ride Facilities, 2nd Edition October 2004
29. Virginia Uniform Statewide Building Code 2012 (Effective July 14, 2014)
30. Uniform Relocation Assistance and Real Property Act of 1970, as amended (as of date of RFP)
31. 1950 Code of Virginia, Titles 25.1 and 33.2, as amended (as of date of RFP)
32. Traffic Operations Analysis Tool Guidebook Version 1.0 (2015)
33. VDOT Asbestos Project Monitoring and Clearance Air Monitoring Procedures
34. VDOT Guidelines for Management of Contaminated Soils Associated with Utility Installation And Maintenance Activities
35. VA Statewide Fire Prevention Code
36. Virginia Occupational Safety and Health Standards

Roadway Design

1. VDOT State Bicycling Policy Plan (September 2011)
2. VDOT Road Design Manual (Issued January 2005, Revised July 2017)
3. AASHTO – A Policy on Geometric Design of Highways and Streets, 6th Edition (2011)
4. AASHTO – Roadside Design Guide, Fourth Edition, October 2011 (updated Chapter 6)
5. AASHTO – A Policy on Design Standards Interstate System, 5th Edition (January 2005)
6. AASHTO – Guide for High-Occupancy Vehicle (HOV) Facilities, 3rd Edition (2004)
7. AASHTO – Guide for the Development of Bicycle Facilities, 4th Edition (2012)
8. AASHTO – Guide for the Planning, Design, and Operation of Pedestrian Facilities, July 2004

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9. AASHTO – Update to the Guide for the Planning, Design, and Operation of Pedestrian Facilities, October 2010

Geotechnical and Pavement Design

1. VDOT Soil Design Parameters for Sound Barrier Walls, Retaining Walls and Non-Critical Slopes – April 14, 2011
2. AASHTO Guide for Design of Pavement Structures (Rigid Pavement and Flexible Pavement) (1993 Edition and subsequent revisions)
3. AASHTO Manual on Subsurface Investigations (1988)
4. VDOT Pavement Design Guide for Subdivision and Secondary Roads, 2014
5. VDOT Manual of Instruction for Material Division
6. VDOT Manual of Structure and Bridge Division, Part 11 Geotechnical Manual for Structures
7. FHWA 23CFR626 - Part 626 Pavement Policy – April 7, 2011
8. Development and Implementation of Pavement Condition Indices for the Virginia Department of Transportation: Phase I – Flexible Pavements – September 2002

Structures

1. VDOT Manual of Structure and Bridge Division, Parts 1 through 12 (as of date of RFP)
2. AASHTO Guide Specification for LRFD Seismic Bridge Design, 2nd Edition, 2012; 2014 and 2015 Interim Revisions
3. AASHTO LRFD Bridge Design Specifications, 7th Edition, 2014; and VDOT Modifications
4. AASHTO Standard Specifications for the Design of Highway Bridges, 16th Edition, 1996; 1997 and 1998 Interim Specifications; and VDOT Modifications
5. AASHTO Construction Handbook for Bridge Temporary Works, 2nd Edition, 2017
6. AASHTO Guide Design Specifications for Bridge Temporary Works, 2nd Edition, 2017
7. AASHTO Manual for Bridge Evaluation, 2nd Edition, 2011, 2013, 2014, 2015 and 2016 Interim Revisions
8. AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, 1994 Edition
9. AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, 6th Edition, 2013 with 2015 Interim.
10. AASHTO Guide Specifications for Structural Design of Sound Barriers – current edition

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11. FHWA Guidelines for the Installation, Inspection, Maintenance and Repair of Structural Supports for Highway Signs, Luminaires, and Traffic Signals (March 2005), FHWA NHI 05-036
12. FHWA Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges, December 1995, including Errata sheets and Revisions
13. FHWA 23CFR625 – Design Standards for Highways (December 1995, including Errata sheets and Revisions)
14. FHWA 23CFR630 Subpart B – Plans, Specifications, and Estimates
15. FHWA 23CFR650 - Subpart C – National Bridge Inspection Standards (“NBIS”)
16. Stage I - Plan Review Check List – August 2011 Draft
17. VDOT Structure and Bridge Stage I Report Summary Form
18. VDOT Structure and Bridge Division Stage I - Report Template – January 7, 2004 Draft
19. Stage II - Plan Review Check List – July 1, 2011 Draft
20. AASHTO LRFD Guide Specifications for Design of Pedestrian Bridges, 2nd Edition with 2015 Interim Revisions; and VDOT Modifications
21. AASHTO LRFD Bridge Construction Specifications, 3rd Edition, with 2010, 2011, 2012, 2014, 2015, and 2016 Interim Revisions
22. AASHTO Guide for Protective Screening of Overpass Structures, 1990
23. AASHTO Guide Specifications for Seismic Isolation Design, 4th Edition
24. AASHTO Guide Specifications for Highway Bridge Fabrication with HPS 70W (HPS 485W) Steel, 3rd Edition, 2011.
25. AASHTO Manual for Bridge Element Inspection, 1st Edition, with 2015 Interim Revisions
26. AASHTO Guide Specifications - Thermal Effects in Concrete Bridge Superstructure, 1st Edition, 1989
27. AASHTO/AWS D1.5M/D1.5: 2010 Bridge Welding Code, 6th Edition, with 2011 and 2012 AASHTO Interim Revisions
28. AASHTO/NSBA Steel Bridge Collaboration Shop Detail Drawing Presentation Guidelines, G1.3 - 2002
29. ANSI/AWS D1.2/D1.2M: Structural Welding Code - Aluminum, current edition
30. ANSI/AWS D1.1/D1.1M: Structural Welding Code - Steel, current edition
31. gINT Manual
32. NCHRP Report 350 Recommended Procedures for the Safety Performance Evaluation of Highway Features
33. AASHTO Manual for Assessing Safety Hardware, 2nd Edition, 2016

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34. AASHTO/FHWA Joint Implementation Plan for the AASHTO Manual for Assessing Safety Hardware, 2009
35. NFPA 70 National Electrical Code, 2011 Edition
36. NFPA 502, Standard for Road Tunnels, Bridges, and other Limited Access Highways, 2011 Edition
37. VDOT Supplement to the AASHTO Manual for Bridge Element Inspection, 2016
38. VDOT Memorandum – Asbestos Containing Materials on Bridges – October 23, 2009
39. Virginia Department of Transportation Asbestos Inspection Procedures, dated May 14, 2004
40. PCI Recommended Practice for Lateral Stability of Precast, Prestressed Concrete Bridge Girders, 1st Edition, 2016, CB-02-16
41. FHWA Engineering for Structural Stability in Bridge Construction, 2015, FHWA-NHI-15-044
42. AASHTO Guide Specifications for Wind Loads on Bridges During Construction, 1st Edition, 2017
43. AASHTO/NSBA Steel Bridge collaboration S10.1-2014 Steel Bridge Erection Guide Specification

Drainage

1. VDOT 2002 Drainage Manual (including current Errata Sheets) and revisions (Revised 5/2017)
2. Virginia Stormwater Management Handbook, Volume I & Volume II, (First Edition – 1999), Virginia Department of Conservation and Recreation [now Virginia Department of Environmental Quality]
3. 2013 Virginia Stormwater Management Handbook, Second Edition, Virginia Department of Environmental Quality
4. 2013 BMP Standards and Specifications, Virginia Department of Environmental Quality
5. Virginia Erosion and Sediment Control Handbook (Third Edition – 1992), Virginia Department of Conservation and Recreation [now Virginia Department of Environmental Quality]
6. FHWA Hydraulic Design Series Number 5 (HDS-5), Hydraulic Design of Highway Culverts, 2012
7. FHWA Hydraulic Design Series Number 6 (HDS-6), River Engineering for Highway Encroachments, 2001
8. FHWA Hydraulic Design Series Number 7 (HDS-7), Hydraulic Design of Safe Bridges, April 2012
9. FHWA Hydraulic Engineering Circular Number 9 (HEC-9), Debris Control Structures – Evaluation and Counter Measures, 2005

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10. FHWA Hydraulic Engineering Circular Number 15 (HEC-15), Design of Roadside Channels with Flexible linings, Third Edition, 2005
11. FHWA Hydraulic Engineering Circular Number 14 (HEC-14), Hydraulic Design of Energy Dissipaters for Culverts and Channels, 2006
12. FHWA Hydraulic Engineering Circular Number 17 (HEC-17), Highways in the River Environment- Floodplains, Extreme Events, Risk, and Resilience, June 2016
13. FHWA Hydraulic Engineering Circular Number 18 (HEC-18), Evaluating Scour at Bridges, 2012
14. FHWA Hydraulic Engineering Circular Number 20 (HEC-20) Stream Stability at Highways, 2012
15. FHWA Hydraulic Engineering Circular Number 21 (HEC-21), Design of Bridge Deck Drainage Systems, 1993
16. FHWA Hydraulic Engineering Circular Number 22 (HEC-22), Urban Drainage Design Manual, 2009, Revised August 2013
17. FHWA Hydraulic Engineering Circular Number 23 (HEC-23), Bridge Scour and Stream Instability Countermeasures – Experience, Selection and Design Guidance, Third Edition, Volumes 1 and 2, 2009
18. FHWA Culvert Design for Aquatic Organism Passage (HEC-26), 2010
19. FHWA Culvert Inspection Manual, 1986
20. US Army COE, Hydrologic Modeling System (HEC HMS) Version 4.2
21. Virginia, Erosion and Sediment Control Law and Regulations,
22. FEMA National Flood Insurance Program Regulations
23. US Army COE, River Analysis System (HEC RAS), Version 5.0.1
24. The Virginia SWM Law dated 2015 (as listed in the Code of Virginia)
25. The Virginia SWM Regulations dated 2015 (as listed in the Virginia Administrative Code)

Traffic Control Devices and Lighting

1. USDOT FHWA Standard Highway Signs
2. 2009 Manual of Uniform Traffic Control Devices (MUTCD), Revisions 1 and 2 (May 2012) and 2011 Virginia Supplement to MUTCD, Revision 1 (September 2013)
3. AASHTO Roadway Lighting Design Guide (2005)
4. ANSI/IESNA RP-8-14 Roadway Lighting
5. National Fire Protection Association NEC Standards, 2017
6. Virginia Standard Highway Signs, Revision 1, March 2015
7. VDOT Traffic and Ancillary Structures Inventory and Inspection Manual 2014

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8. Traffic Operations and Safety Analysis Manual (TOSAM), Version 1.0, November 2015
9. VDOT Traffic Engineering Division Numbered Memoranda (Traffic Engineering (TE) and Mobility Management (MM)) including announcements from the Northern Region of the Virginia Department of Transportation

Miscellaneous

1. VDOT Survey Manual
2. VDOT Guardrail Installation Training Manual (GRIT), Revised August 2017
3. VDOT Public Involvement Manual, November, 2016

ITS

1. Institute of Electrical and Electronics Engineer (IEEE) 802.3 Local and Metropolitan Area Networks
2. National Electric Manufacturers Association (NEMA) TS-4 Hardware Standards for Dynamic Message Signs (DMS) with NTCIP Requirements
3. IEEE 1512-2006 - IEEE Standard for Common Incident Management Message Sets for Use by Emergency Management Centers, IEEE 1512.1-2006 – IEEE Standard for Common Traffic Incident Management Message Sets for Use by Emergency Management Centers
4. National Transportation Communications for ITS Protocol (NTCIP)
5. VDOT Northern Region Operations ITS Architecture
6. I-95 and I-495 Express Lanes Tolling and Traffic Management System (TTMS) Project TMS Interface Control Document (ICD), Version: 1.5 – December 16, 2015
7. National Electrical Manufacturers Association (NEMA) Standards
8. Telecommunications Industry Association (TIA) and Electronic Industries Alliance (EIA) Standards and Specifications
9. Underwriters Laboratories (UL) Standards

B. Special Provision Copied Notes, Special Provisions, and Supplemental Sections

1. VDOT 2016 Road and Bridge Specifications - Special Provision Copied Notes, Special Provisions and Supplemental Specifications. Updated as of June 2018:
 - a. Division II – Materials
 - b. Division III – Roadway Construction
 - c. Division IV – Bridges and Structures
 - d. Division V – Incidental Construction

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- e. Division VI – Roadside Development
 - f. Division VII – Traffic Control Devices
 - g. Division VIII – Intelligent Transportation Systems
2. VDOT Special Provision for Design-Build Tracking Numbers –June 4, 2015
 3. VDOT Special Provision for Lime Modification of Soils, revised November 23, 2009
 4. VDOT Special Provision for Lightweight Aggregate, October 26, 2009
 5. VDOT Special Provision for Hydraulic Cement Concrete Operations for Massive Construction, March 3, 2014
 6. VDOT Special Provision for Rideability for Design Build Projects – November 16, 2016
 7. VDOT Special Provision for Turbidity Curtain – December 15, 2016
 8. VDOT Special Provision for Elastic Inclusion for Design Build and PPTA Projects – February 27, 2017
 9. VDOT Special Provision for Powder Coated Galvanized Material for Design-Build and PPTA Projects - June 23, 2016
 10. VDOT Special Provision for Quality Assurance/Quality Control (QA/QC) for the Construction of Deep Foundation Systems for Design-Build and PPTA Contracts – July 29, 2016
 11. VDOT Special Provision for Drilled Shafts Using Self-Consolidating Concrete for Design-Build and PPTA Contracts, April 15, 2013.
 12. VDOT Special Provision for Dynamic Pile Testing for End Bearing Piles for LRFD for Design-Build and PPTA Projects, February 7, 2014
 13. VDOT Special Provision for Micropiles for Design-Build and PPTA Projects, January 20, 2010
 14. VDOT Special Provision for Soldier Pile Retaining Walls for Design-Build and PPTA Projects– July 6, 2016
 15. VDOT Special Provision for Secant Pile or Tangent Pile (Drilled Shaft) Walls – June 8, 2011
 16. VDOT Special Provision for Permanent Soil Nail Wall for Design Build and PPTA Projects – June 7, 2011
 17. VDOT Special Provision for Reinforced Earth Walls with Low Density Cementitious Fill (LDCF) for Design-Build and PPTA Projects, June 24, 2011
 18. VDOT Special Provision for T-Wall Retaining Wall System for Design-Build and PPTA Contracts, December 10, 2009
 19. VDOT Special Provision for Mechanically Stabilized Earth Walls (Segmental Block Facing) for Design-Build and PPTA Contracts – September 30, 2015
 20. VDOT Special Provision for Mechanically Stabilized Earth Walls (Concrete Panel Facing) for Design-Build and PPTA Contracts – April 8, 2016

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21. VDOT Special Provision for MSE Walls (Modular Cantilever Facing), December 10, 2009
22. VDOT Special Provision for Densified Aggregate Piers for Foundation Reinforcement –June 24, 2011
23. VDOT Special Provision for Monitoring of Existing Adjacent Structures During Construction - June 8, 2018
24. VDOT Special Provision Copied Note for Dismantling and Removing Existing Structures or Removing Portions of Existing Structures, January 9, 2017
25. VDOT Special Provision for Asbestos Removal and NESHAP-Related Demolition Requirements for Structures On Design-Build Projects, June 22, 2009
26. VDOT Special Provision for Asbestos Project Monitoring and Clearance Air Monitoring Procedures on Design Build Projects, May 14, 2004
27. VDOT Special Provision for Asbestos Containing Soil, February 2, 2000
28. VDOT Special Provision for Phase I and Phase II Environmental Site Assessments for Design-Build Projects – June 25, 2013
29. VDOT Special Provision Copied Note for Demolition Notification for Structures not Requiring Asbestos Removal – June 25, 2009
30. VDOT Special Provision for Nesting Migratory Birds on Bridges for Design Build Projects, April 26, 2017
31. VDOT Special Provision for Limitation of Operations Protection of Bats on Bridges for Design Build Projects, June 2, 2016
32. VDOT Special Provision for Tree Removal Time of Year Restriction for Design Build Contracts, November 30, 2016
33. VDOT Special Provision for Architecture Treatment and Concrete Surface Color Coating for Design Build Projects, February 27, 2018
34. VDOT Special Provision for Sound Barrier Walls, May 22, 2018
35. VDOT Special Provision for Uninterruptible Power Supply, January 12, 2016

C. Additional Reference Documents

1. FHWA Geotechnical Engineering Circular No. 2 - Earth Retaining Systems, FHWA-SA-96-038 – Feb 1997
2. FHWA Geotechnical Engineering Circular No. 4 - Ground Anchors and Anchored Systems, FHWA-IF-99-015, 1999
3. FHWA Geotechnical Engineering Circular No. 7 - Soil Nail Walls – Reference Manual, FHWA-NHI-14-007 – February 2015
4. FHWA Permanent Ground Anchors, Volume 1, Final Report, FHWA-DP-90-068 – April 1990

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5. FHWA Permanent Ground Anchors, Volume 2, Field Demonstration Project Summaries, FHWA-DP-90-068, April 1990
6. FHWA Geotechnical Engineering Circular No. 6, Shallow Foundations, September 2002, FHWA-SA-02-054
7. FHWA Manual of Subsurface Investigations, May 2002, FHWA NHI-01-031
8. FHWA Design and Construction of Mechanically Stabilized Earth Walls and Reinforced Soil Slopes Volumes I & II, November 2009, FHWA-NHI-10-024 & 024
9. FHWA Geotechnical Engineering Circular No. 10 - Drilled Shafts Construction Procedures and LRFD Design Methods, May 2010, FHWA NHI-10-016
10. FHWA Soil Nailing Field Inspectors Manual-Soil Nail Walls, FHWA-SA-93-068 – April 1994
11. FHWA The Osterberg Cell for Load Testing Drilled Shafts and Driven Piles, FHWA-SA-94-035, 1994
12. Load and Resistance Factor Design (LRFD) For Highway Bridge Superstructures (July 2015), FHWA-NHI-15-047
13. Load and Resistance Factor Design (LRFD) for Highway Bridge Substructures (May 2001), FHWA-NHI-08-036
14. Load and Resistance Factor Design (LRFD) For Highway Bridge Superstructures - Examples (August 2015), FHWA-NHI-15-058
15. LRFD for Highway Bridge Substructures and Earth Retaining Structures (Jan 2007), FHWA-NHI-05-095
16. Ground Improvements Reference Manual Volume I, FHWA-NHI-06-019 (as of date of RFP)
17. Ground Improvements Reference Manual Volume II, FHWA-NHI-06-020 (as of date of RFP)
18. Earth Retaining Structures (RM), FHWA-NHI-07-071, June 2008
19. Micropile Design and Construction Reference Manual (December 2005), FHWA-NHI-05-039
20. VDOT NRO Change and Clearance Interval Data Collection Processing Best Practices – July 17, 2015
21. VDOT NRO TEP – Clearance Intervals – February 28, 2013
22. VDOT Preliminary Sub Example (as of date of RFP)
23. VDOT NRO TEP – Pedestrian Timing at Traffic Signals, December 8, 2011
24. VDOT NRO TEP – Pedestrians Accommodations at Traffic Signals, August 7, 2014
25. VDOT Traffic Calming Guide for Local Residential Streets, 2002 (Revised July, 2008)
26. VDOT Detector Placement, January 13, 2005
27. VDOT NRO TEP – Pavement Marking at Intersections, July 20, 2012

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28. VDOT NRO TEP – Hatch Marks on Non-Limited-Access Roadways, April 17, 2015
29. VDOT NRO TEP – Yellow Change and Red Clearance Intervals, January 7, 2013
30. VDOT NRO – 2015 Bicycle Marking Reference Guide (as of date of RFP)
31. American Water Works Association Standards (as of date of RFP)
32. FHWA Hydrology Design Series No. 2, Highway Hydrology, October 2002
33. FHWA Hydraulic Design Series No. 3, Design Charts for Open Channel Flow, August 1961
34. FHWA Hydraulic Design Series No. 4, Introduction to Highway Hydraulics, June 2008
35. FHWA Hydraulic Design Series No. 5, Hydraulic Design of Highway Culverts June 2012
36. FHWA Hydraulic Engineering Circular No. 11, Design of Riprap Revetment, March 1989
37. USDA, NRCS, Urban Hydrology for Small Watersheds, TR-55, June 1986
38. FHWA - A Guide for HOT Lane Development, March 2003
39. ITE TMDD - Traffic Management Data Dictionary and Message Sets for External TMC Communication (TMDD and MS/ETMCC) (as of date of RFP)
40. VDOT DBE Program, July 2016
41. Virginia Department of Transportation CII/SSI Policy Guide for Employees, Vendors, Contractor or other Persons Accessing VDOT's CII/SSI – March, 2006 (Interim Revision November, 2009)
42. DMS Upgrade and Expansion Program *Concept of Operations*, February 25, 2008
43. VDOT NRO Vehicle Detector Master Plan, June 13, 2008
44. VDOT NRO CCTV Master Plan, June 2008
45. VDOT NRO CCTV Concept of Operations, June 2008
46. VDOT NRO Vehicle Detector Concept of Operations, May 14, 2008
47. FHWA 23 CFR PART 940—Intelligent Transportation System Architecture and Standards – January 8, 2001
48. VDOT ITS Projects – Systems Engineering and Architecture Compliance (Rule 940) Checklist (as of date of RFP)
49. Virginia Megaprojects Program Lane Closure Policy and Procedures, June 2009 Revised April 23, 2012