ROAD DESIGN MANUAL REVISIONS
January, 2018

CHAPTER 1B

- Page 1B-8 **–** Added the following definition**;** ***"DESIGN VEHICLE*** *- A design vehicle is a selected motor vehicle whose weight, dimensions and operating characteristics are used to establish highway design.."*

CHAPTER 2A

- Page 2A-9 – Revised the following language in the fifth sentence under "PROJECTING VERTICAL ALIGNMENTS" from; *Therefore, when the "K" Value for a sag vertical curve does not meet the VDOT Road Design Manual minimum, same as the AASHTO minimum, it shall be submitted as a design waiver and shown as "Other" on the LD-448 Waiver Form.* To; Therefore, when the "K" Value for a sag vertical curve does not meet the VDOT Road Design Manual minimum, same as the AASHTO minimum "*and lighting is not provided,"* it shall be submitted as a design waiver and shown as "Other" on the LD-448 Waiver Form.

CHAPTER 2D

- Page 2D-23 – Revised the following language in the third paragraph from; *"The minimum entrance radii outlined in Appendix "F" should be adhered to in the design of* ***ALL*** *entrances. For Commercial Entrances where a high percentage of trucks are anticipated, consideration should be given to increasing the entrance radii to accommodate the turning requirements of those vehicles."* To; The minimum entrance radii outlined in Appendix "F" "*shall"* be adhered to in the design of **ALL** entrances. For Commercial Entrances where a high percentage of trucks are anticipated, consideration "*shall"* be given to increasing the entrance radii to accommodate the turning requirements of those vehicles.

CHAPTER 2E

- Page 2E-8 – Revised the following language under "Curb and Gutter" from; *(Also see "Mountable Curb and Curb and Gutter, page 2E-32")* To; (Also see "Mountable Curb and Curb and Gutter", "*page 2E-35"*).

  Revised the following language at the end of item #7 from; *"Fills may need to be widened if guardrail is required. (See Appendix I)"* To; Fills may need to be widened if guardrail is required. *"(See Appendix J)"*

- Page 2E-15 – Added the following language after the second paragraph under "FENCE"; "*Proposed fence or fenced limited access lines, where they deviate from proposed right of way lines, are denoted by a dashed line with "X"s between dashes, in a heavier line than existing fence."*

  Revised the following language in the first sentence in the fourth paragraph; "*Normally, chain link fence is used within municipalities or other urbanized areas and farm fence is used in rural areas."* To; Normally, chain link fence "*(Standard FE-Cl Chain Link)"* is used within municipalities or other urbanized areas and *"woven wire fence, also known as"* farm fence "*(Standard FE-W1)"* is used in rural areas.

  Added the following language after the fifth paragraph under "FENCE"; "*Vinyl coated fence (Standard FE-CL Vinyl Coated) may also be used in lieu of chain link fence (Standard FE-CL Chain Link) in urbanized areas."*

  Deleted the following language under "FENCE"; "*Existing fence replacement is normally covered in right of way agreements and is not a contract item except in rare instances. Proposed fence or fenced limited access lines, where they deviate from proposed right of way lines, are denoted by a dashed line with "X"s between dashes, in a somewhat heavier line than existing fence*."

  Added the following language after the eighth paragraph under "FENCE"; "*When it is recommended **not** to fence limited access lines, each such location is to be thoroughly reviewed and discussed by the project development team at the project Field Inspection. The Project Manager is to request approval for any such exemptions from the State Location and Design Engineer, or his or her designee."*

- Page 2E-51 – Revised the following language in the last sentence of the first paragraph under "LIMITED ACCESS FENCING" from; "*For additional information see AASHTO "An Informational Guide on Fencing Controlled Access Highways"*. To; For additional information see *"FENCE" in this chapter."*

- Page 2E-61 – Revised the following in the fourth sentence in the last paragraph from; *"The stations and length used on the plans for culverts measuring over 20 feet shall be based on the distance between the back of the outside walls, not on the distance…"* To; The stations and length used on the plans for culverts measuring over 20 feet shall be based on the distance between the back of the outside walls *"along the construction baseline"*, not on the distance…

CHAPTER 2G

- Page 2G-36 – Revised the following language under "As-Built Plans" from; "*The Area Construction Engineer shall forward all "As-Built" plan information not captured through the formal plan revision process developed during construction to the District Location and Design Engineer. It is assumed that significant right of way and design changes made during construction would be captured through the formal revision process. The District Location and Design Engineer or Design Engineer shall send the electronic "As-Built" plan assembly to CADD Support with a request that the plans be stored in Falcon."* To; "***Right of way and design changes made during construction should be captured through the formal revision process.*** *However, if design changes made during construction (that do* ***not*** *impact right of way) are* ***not*** *captured through the formal revision process, the Area Construction Engineer shall send all "As-Built" plans to the District Location and Design Engineer. The naming convention of the plan file name is to add "ab" following the plan sheet number. For example, plan sheet number 03 would be renamed 03ab. The District Location and Design Engineer or Design Engineer shall send the electronic "As-Built" plans in pdf format (only the plan sheet(s) revised and not captured through the formal plan revision process developed during construction) to the C.O. CADD Support Section with a request that the plans be stored in Falcon."*

APPENDIX A

- Page A-8 – Added the following language;
  "DESIGN VEHICLE
  The type of vehicle that makes frequent turns without encroaching into the adjacent lane when making turns. The tracking of the design vehicle is an important determinant of corner radii at intersections. When the design vehicle traverses an intersection, the design vehicle shall be able to turn from one street to another without deviating from the near travel lane and impeding other traffic flow. Therefore, the design vehicle determines the elements of design such as turning radius and lane width. The design vehicle is to be determined based on the LD-104 Request for Traffic Data and discussed at the Project Scoping Meeting and recorded on the Scoping Worksheet - Roadway Design.

  The WB-67 shall be the design vehicle used for intersections of freeway ramp terminals with other arterial crossroads and for other intersections on state highways and industrialized streets that carry high volumes of traffic or that provide local access for large trucks."

- Page A-11 – Revised the following language in the second paragraph under "LANE/SHOULDER/PAVEMENT TRANSITIONS, MERGING TAPERS & SPEED CHANGE LENGTHS from; *"For Temporary Merging, Shifting and Shoulder Tapers see 2009 MUTCD, Section 6, Table 6C-3 and 6C-4."* To; For Temporary Merging, "*Temporary*" Shifting and "*Temporary*" Shoulder Tapers see 2009 *MUTCD*, Section 6, Table 6C-3 and 6C-4.

- Page A-12 – Revised the following language in FIGURE A-1-1 GEOMETRIC DESIGN STANDARDS FOR RURAL PRINCIPAL ARTERIAL SYSTEM (GS-1) under "Minimum Width of Ditch Front Slope" to add *"@ 6:1"*.

  Revised the following language under "FOOTNOTE #3" from; *"Ditch slopes to be 6:1 - 10' and 12' widths and 4:1 - 6' width. A hydraulic analysis is necessary to determine actual depth requirement."* To; *"A hydraulic analysis is necessary to determine actual depth requirement."*

- Page A-13 – Revised the following language in FIGURE A-1-2 GEOMETRIC DESIGN STANDARDS FOR RURAL MINOR ARTERIAL SYSTEM (GS-2) under "Minimum Width of Ditch Front Slope" to add *"@ 6:1"*.

  Revised the following language at the end of the seventh paragraph "GENERAL NOTES" from; *"… see AASHTO Green Book, Chapter 7, Section 7.3.2, page 7-29, Table 7-2."* To; … see AASHTO Green Book, Chapter 7, Section 7.3.2, page 7-29, Table 7-*"4"*.

  Revised the following language under "FOOTNOTE #5" from; *"Ditch slopes to be 6:1 - 10' and 12' widths and 4:1 - 6' width. A hydraulic analysis is necessary to determine actual depth requirement."* To; *"A hydraulic analysis is necessary to determine actual depth requirement."*

- Page A-14 – Revised the following language in FIGURE A-1-3 GEOMETRIC DESIGN STANDARDS FOR RURAL COLLECTOR ROAD SYSTEM (GS-3) under "Minimum Width of Ditch Front Slope" to add *"@ 6:1"*.

  Revised the following language at the end of the tenth paragraph under "GENERAL NOTES" from; *"… see AASHTO Green Book, Chapter 6, Section 6.2.1, page 6.2, Table 6-2."* To; … see AASHTO Green Book, Chapter 6, Section 6.2.1, page 6.*"3"*, Table 6-2.

  Revised the following language at the end of "FOOTNOTE #3" from; *"For additional guidance on shoulder widths, see AASHTO Green Book, Chapter 6, Section 6.2.2, page 6-5."* To; For additional guidance on shoulder widths, see AASHTO Green Book, Chapter 6, Section 6.2.2, page 6-*"6"*.

  Revised the following language under "FOOTNOTE #5" from; *"Ditch slopes to be 6:1 - 10' and 12' widths and 4:1 - 6' width. A hydraulic analysis is necessary to determine actual depth requirement."* To; *"A hydraulic analysis is necessary to determine actual depth requirement."*

  Revised the following language under "FOOTNOTE #8" from; *"…see AASHTO Green Book, Chapter 3, Section 3.2.2, page 3-3, Table 3-2."* To; …see AASHTO Green Book, Chapter 3, Section 3.2.2, page 3-*"2"*, Table 3-2.

- Page A-15 – Revised the following language in FIGURE A-1-4 GEOMETRIC DESIGN STANDARDS FOR RURAL LOCAL ROAD SYSTEM (GS-4) under "Minimum Width of Ditch Front Slope" to add *"@ 6:1"*.

  Revised the following language at the end of "FOOTNOTE #5" from; *"For additional guidance on shoulder widths, see AASHTO Green Book, Chapter 5, Section 5.2.2, page 5-5."* To; For additional guidance on shoulder widths, see AASHTO Green Book, Chapter 5, Section 5.2.2, page 5-*"6"*.

  Revised the following language under "FOOTNOTE #6" from; *"Ditch slopes to be 6:1 - 10' and 12' widths and 4:1 - 6' width. A hydraulic analysis is necessary to determine actual depth requirement."* To; *"A hydraulic analysis is necessary to determine actual depth requirement."*

  Revised the following language under "FOOTNOTE #9" from; *"…see AASHTO Green Book, Chapter 3, Section 3.2.2, page 3-3, Table 3-2."* To; …see AASHTO Green Book, Chapter 3, Section 3.2.2, page 3-*"2"*, Table 3-2.

- Page A-16 – Revised the following language in FIGURE A-1-5 GEOMETRIC DESIGN STANDARDS FOR URBAN PRINCIPAL ARTERIAL SYSTEM (GS-5) under "Minimum Width of Ditch Front Slope" to add *"@ 6:1"* on Interstates, Freeways and 60 mph Other Principal Arterial with Shoulders and *"@ 4:1"* on the rest of the Other Principal Arterial with Shoulders and *"@ 3½:1"* on Other Principal Arterial with Curb and Gutter.

  Revised the following language at the end of the ninth paragraph under "GENERAL NOTES" from; *"…see Chapter 8, Section 8.2.1, page 8-4, Table 8-1."* To; …see Chapter 8, Section 8.2.*"7"*, page 8-4, Table 8-1.

  Revised the following language under "FOOTNOTE #3" from; *"Ditch slopes to be 6:1 - 10' and 12' widths and 4:1 - 6' width. A hydraulic analysis is necessary to determine actual depth requirement."* To; *"A hydraulic analysis is necessary to determine actual depth requirement."*

  Revised the following language under "FOOTNOTE #13" from; *"…see AASHTO Green Book, Section 3.2.2, page 3-3, Table 3-2. For Intersection sight distance requirements see Append. F, Table 2-5."* To; …see AASHTO Green Book, Section 3.2.2, page 3-*"2"*, Table 3-2. For Intersection sight distance requirements see Append. F, Table 2-5.

- Page A-17 – Revised the following language in FIGURE A-1-6 GEOMETRIC DESIGN STANDARDS FOR URBAN MINOR ARTERIAL STREET SYSTEM (GS-6) under "Minimum Width of Ditch Front Slope" to add *"@ 6:1"* on Streets with Shoulder Design with a 60 mph design speed and *"@ 4:1"* on the rest of the Streets with Shoulder Design.

  Revised the following language at the end of the eighth paragraph under "GENERAL NOTES" from; *"…see Chapter 7, Section 7.3.3, page 7-29, Table 7-4."* To; … see Chapter 7, Section 7.3.*"2"*, page 7-29, Table 7-4.

Revised the following language under "FOOTNOTE #9" from; *"Ditch slopes to be 6:1 - 10' and 12' widths and 4:1 - 6' width. A hydraulic analysis is necessary to determine actual depth requirement."* To; *"A hydraulic analysis is necessary to determine actual depth requirement."*

Revised the following language under "FOOTNOTE #12" from; *"…see AASHTO Green Book, Chapter 3, Section 3.2.2, page 3-3, Table 3-2."* To; …see AASHTO Green Book, Chapter 3, Section 3.2.2, page 3-*"2"*, Table 3-2.

- Page A-18 – Revised the following language in FIGURE A-1-7 GEOMETRIC DESIGN STANDARDS FOR URBAN COLLECTOR STREET SYSTEM (GS-7) under "Minimum Width of Ditch Front Slope" to add *"@ 4:1"* on Streets with Shoulder Design with a 40 to 50 mph design speed and *"@ 3:1"* with a 30 or 35 mph design speed.

  Revised the following language at the end of "FOOTNOTE #1" from; *"… see AASHTO Green Book, Chapter 6, Section 6.2 and 6.3.2, page 6-6, Table 6-6."* To; … see AASHTO Green Book, Chapter 6, Section 6.2 and 6.3.2, page 6-*"5"*, Table 6-*"5"*.

  Revised the following language under "FOOTNOTE #6" from; *"Ditch slopes to be 6:1 - 10' and 12' widths and 4:1 - 6' width. A hydraulic analysis is necessary to determine actual depth requirement."* To; *"A hydraulic analysis is necessary to determine actual depth requirement."*

  Revised the following language under "FOOTNOTE #11" from; *"Where shoulders are provided, roadway widths in accordance with Table 6-5 should be considered."* To; Where shoulders are provided, roadway widths in accordance with Table 6-5, *"page 6-6"* should be considered.

- Page A-19 – Revised the following language in FIGURE A-1-8 GEOMETRIC DESIGN STANDARDS FOR URBAN LOCAL STREET SYSTEM (GS-8) under "Minimum Width of Ditch Front Slope" to add *"@ 3:1"* on Streets with Shoulder Design.

  Revised the following language at the end of "FOOTNOTE #1" from; *"… see AASHTO Green Book, Chapter 5, Section 5.2.1, page 5-5, Table 5-4."* To; … see AASHTO Green Book, Chapter 5, Section 5.2.1, page 5-*"3"*, Table 5-*"2"*.

  Revised the following language under "FOOTNOTE #8" from; *"Ditch slopes to be 3:1 - 4' width. A hydraulic analysis is necessary to determine actual depth requirement."* To; *"A hydraulic analysis is necessary to determine actual depth requirement."*

  Revised the following language under "FOOTNOTE #10" from; *"…see AASHTO Green Book, Chapter 3, Section 3.2.2, page 3-3, Table 3-2."* To; …see AASHTO Green Book, Chapter 3, Section 3.2.2, page 3-*"2"*, Table 3-2.

- Page A-20 – Revised the following language in FIGURE A-1-9 GEOMETRIC DESIGN STANDARDS FOR SERVICE ROADS (GS-9) under "Minimum Width of Ditch Front Slope" to add *"@ 3:1"*.

  Revised the following language under "FOOTNOTE #3" from; *"Ditch slopes to be 3:1. A hydraulic analysis is necessary to determine actual depth requirement."* To; *"A hydraulic analysis is necessary to determine actual depth requirement."*

- Page A-21 – Revised the following language in FIGURE A-1-10 GEOMETRIC DESIGN STANDARDS FOR INTERCHANGE RAMPS (GS-R) under "Minimum Width of Ditch Front Slope" to add *"@ 6:1"*.

  Revised the following language under "FOOTNOTE #5" from; *"Ditch slopes to be 6:1. A hydraulic analysis is necessary to determine actual depth requirement."* To; *"A hydraulic analysis is necessary to determine actual depth requirement."*

  Revised the following language under "FOOTNOTE #6" from; *"…see AASHTO Green Book, Chapter 3, Section 3.2.2, page 3-3, Table 3-2."* To; …see AASHTO Green Book, Chapter 3, Section 3.2.2, page 3-*"2"*, Table 3-2.

  Revised the following language under "FOOTNOTE #8" from; "S*ee 2011 AASHTO Green Book, Chapter 10, Section 10.9.5 for further guidance on Auxiliary Lanes."* To; See 2011 AASHTO Green Book, Chapter 10, Section 10.9.5, *"page 10-76"* for further guidance on Auxiliary Lanes.

- Page A-27 – Revised the following language in the first and second sentences in the fifth paragraph under "ROADWAYS WITH CURB" from; *"When a vertical drop-off or other hazard (see Section I-3, Guardrail Warrants) is located within 6' of the face of curb, guardrail should be considered. For instructions on the placement of guardrail adjacent to curb, see Section I-3, Guardrail Installation in Urban Settings.*" To; When a vertical drop-off or other hazard (see *"Appendixes I & J,"* Section I-3 *"& J-3"*, Guardrail Warrants) is located within 6' of the face of curb, guardrail should be considered. For instructions on the placement of guardrail adjacent to curb, see *"Appendixes I & J,"* Section I-3 *"& J-3"*, Guardrail Installation in Urban Settings.

- Page A-46 – Added the following language after the third paragraph under "ROUNDABOUTS"; *"VDOT has adopted the NCHRP Report 672 Roundabouts: An Informational Guide, 2nd Edition as our design guide. However, design criteria mentioned in this Manual takes precedence over NCHRP Report 672."*

- Page A-54 – Added the following language at the beginning of the page;
  - *Entry and Exit Design*

    The entry curb radius is an important factor in determining the operation of a roundabout because it affects both capacity and safety. The entry curb radius, in conjunction with the entry width, the circulatory roadway width, and the central island geometry, controls the amount of deflection imposed on a vehicle's entry path and speed. See NCHRP Report 672, Chapter 6, Section 6.4.5.

    - *Entry angle, Phi, is not discussed in NCHRP Report 672, but additional information can be found in the Wisconsin Department of Transportation Facilities Development Manual, Chapter 11, Roundabouts Section 26-30.5.23. This angle is not a controlling design parameter, but instead a gauge of sight to the left and ease of entry to the right. This affects both capacity and safety at the intersection.*

    The exit curb radii are usually larger than the entry radii in order to minimize the likelihood of congestion and crashes at the exits. This, however, is balanced by the need to maintain slow speeds through the pedestrian crossing on exit. The exit design is also influenced by the design environment (urban vs. rural), pedestrian demand, the design vehicle, and physical constraints. See NCHRP Report 672, Chapter 6, Section 6.4.6.

- Page A-107 – Added the following language after the sixth paragraph; *"In March 2016, ITE released Recommended Design Guidelines to Accommodate Pedestrians and Bicycles at Interchanges: An ITE Recommended Practice."*

- Page A-108 – Added the following language at the end of the first paragraph; *"In August 2016, ITE released an ITE Application Supplement to the NACTO Transit Street Design Guide to provide insight on how the Guide fits with other accepted practices that currently exist within the industry, addresses key application issues including traffic signals, use of street space, analysis techniques/performance measures, and provides case studies."*

  Added the following language after the third paragraph; *"In July 2017, ITE released Protected Bikeways Practitioners Guide to provide transportation professionals with an easy-to-navigate document for planning, designing, operating, and implementing protected bikeways in the United States and Canada."*

- Page A-109 – Added the following language after the first paragraph; *"In August 2017, ITE released the Protected Bikeways Practitioners Guide, developed by the ITE Complete Street Council with support from ITE Technical Programs Division staff. The Guide is intended to provide transportation professionals with an easy to navigate document for planning, operating and implementing protected bikeways in the United States and Canada. The Guide also provides references to the critical design standards and guidelines that direct the geometric and operational design of protected bikeways, including international best practices and research and fills current design gaps in guidance based on best practice example.*

  In August 2017, the Federal Transit Administration (FTA) released the Manual on Pedestrian and Bicycle Connections to Transit, which provides a compendium of best practices to assist transportation professions improve pedestrian and bicycle safety and access to transit, including information on evaluating, planning for, and implementing improvements to pedestrian and bicycle access to transit.

  In October 2017, FHWA released Accessible Shared Streets: Notable Practices and Considerations for Accommodating Pedestrians with Vision Disabilities.

- Page A-110 – Added the following language at the be top of the page; "*This Document captures the national state of the practice for accommodating pedestrians with vision disabilities on shared streets, helps State and local partners meet Americans with Disabilities Act (ADA) obligations, and serves as a model for engaging people with disabilities in the planning process. This document focuses on accessibility, specifically on streets where pedestrians, bicyclists, and motor vehicles are intended to mix in the same space rather than streets that lack curbs but are not intended to encourage this mixing, such as curbless streets.*

  On November 14, 2017, the Pedestrian and Bicycle Information Center (PBIC) updated the Design Resource Index that identifies the specific location of information in key national design manuals for various pedestrian and bicycle design treatments. The Design Resource Index aims to help practitioners quickly access resources and reduce the amount of time for design guide searches. Resource: The PBIC Messenger, which is maintained by the University of North Carolina.

  On November 29, 2017, ITE released Implementing Context Sensitive Design on Multimodal Corridors: A Practitioner's Handbook. This informational report was developed through an external contract with the FHWA Office of Human Environment, supported by ITE Technical Programs Division staff, which complements ITE's 2010 "Designing Walkable Urban Thoroughfares" recommended practice. It is geared towards practitioners facing safety and mobility challenges in urban and suburban spaces. It distills the latest research, evidence, and case studies that practitioners need to advance their projects and focuses upon thoroughfares, or arterial and collector roadways, which are often the most challenging streets to redesign."

- Page A-121 – Added the following language under "Note 2"; *"Shared Lane Markings shall not be used on shoulders."*

- Page A-138 – Revised the following language after the first paragraph from; "Path Roadway Intersections" To; *"Shared Use"* Path *"and"* Roadway *"or Entrance"* Intersections.

  Revised the following language in the first paragraph under Shared Use Path and Roadway or Entrance Intersections from; *"Intersections between paths and roadways are often the most critical issue in shared use path design. Due to the potential conflicts at these junctions, careful design is of paramount importance to the safety of path users and motorists. Solutions are provided in the AASHTO guide and should be considered as guidelines, and not as absolutes. Each intersection is unique, and will require sound engineering judgment on the part of the designer as to the appropriate solution. Shared use paths shall cross roadways as close to an intersecting road as practical, however, in no case should the crossing be closer than 5 feet from the edge of the parallel travelway. As the Path approaches the crossing it should be aligned with the destination of the crossing on the other side of the road. CG-12 Curb should be appropriately aligned and be the same width as the path. The crossing should also be perpendicular (or nearly so) to the road being crossed. Normally, two CG-12 curb are recommended at each corner where a path crosses an intersection. Sight distance should be evaluated and sound engineering judgment must be used in locating crossings. There may be situations, such as low traffic volumes where the crossing should be located further from the intersection."* To; Intersections between *"shared use"* paths and roadways are often the most critical issue in shared use path design. Due to the potential conflicts at these junctions, careful design is of paramount importance to the safety of path users and motorists. Each intersection is unique, and will require sound engineering judgment on the part of the designer as to the appropriate solution. Shared use paths shall cross roadways as close to an intersecting road as practical, however, in no case *"shall"* the crossing be closer than 5 feet from the edge of the parallel *"roadway"*. As the *"shared use"* path approaches the crossing it should be aligned with the destination of the crossing on the other side of the road. The *"path"* crossing should also be perpendicular (or nearly so) to the "road*way or entrance"* being crossed. Sight distance should be evaluated and sound engineering judgment must be used in locating *"the shared use path"* crossings. There may be situations, such as low traffic volumes where the *"shared use path"* crossing should be located further from the intersection.

  Revised the following language in the second paragraph under Shared Use Path and Roadway or Entrance Intersections from; *"When a Shared Use Path intersects a road, with no sidewalk, the path should slope to a relatively level (1%+ slope) area at the road elevation and the curb opening shall be the same width as the path. The level area shall have a Detectable Warning Surface extending the full width of the path and shall be labeled on the plans as Detectable Warning Surface Required. If a sidewalk intersects a Shared Use Path, then the sidewalk must also slope to the same relatively level area as the Shared Use Path."* To; When a shared use path intersects a "road*way or entrance on a shoulder and ditch typical section,"* the *"shared use"* path should slope to a relatively level (1%+ slope) area *"to"* the "road*way or entrance"* elevation The level area shall have a Detectable Warning Surface extending the full width of the *"shared us"* path and shall be labeled on the plans as Detectable Warning Surface Required. *"See Figure A-5-9 below for a shoulder and ditch typical section."*

Added the following language after the third paragraph under "Shared Use Path and Roadway or Entrance Intersections"; *"When a shared use path intersects a roadway or entrance on a curb and gutter or curb only typical section a St'd CG-12 Type B shall be called out where the shared use path intersects the roadway or entrance. See Figure A(1)-1-10 below for a curb and gutter or curb typical section."*

- Page A-139 – Added the following "Figures"; "*Figure A-5-9 Detectable Warning Surface For Shared-Use Path With Shoulder"* and *"Figure A-5-10 St'd. CG-12 Type B for Shared-Use Path With Curb & Gutter."*

- Page A-140 –Revised the following language in the first from; *"If a sidewalk intersects a Shared Use Path, then the sidewalk must also slope to the same relatively level area as the Shared Use Path."*
  To; If a sidewalk intersects a shared use path, then the sidewalk "*shall*" also slope to the same relatively level area "*in order to tie in to"* the shared use path.

  Revised the following language in the second paragraph from; "*Where a Shared Use Path cross an unpaved road or driveway, the road or driveway shall be paved a minimum of 20 feet on each side of the Shared-Use Path to reduce the amount of gravel scattered onto or along the path by motor vehicles. The pavement structure at the crossing shall be adequate to sustain the expected loading at that location. At a minimum, the pavement structure shall be the same as the Shared Use Path pavement structure."* To; Where a shared use path crosses an **unpaved** road"*way"* or "*entrance"*, the "*unpaved"* road"*way"* or "*entrance"* shall be paved a minimum of 20 feet on each side of the shared-use path to reduce the amount of gravel scattered onto or along the "*shared use"* path by motor vehicles. The pavement structure "*of the shared use path"* at the crossing shall be adequate to "*support"* the expected "*vehicle"* loading at that location. At a minimum, the pavement structure "*at the crossing"* shall be the same as the shared use path pavement structure.

- Page A-144 – Revised language in FIGURE A-5-9 SHARED USE PATH TRANSITION FROM ROADWAY ONTO BRIDGE FOR DESIGN SPEEDS >45 MPH from; *"3" Max. Asphalt Pavement"* To; *"2" Max. Asphalt Pavement"* to detail Section B-B, C-C, D-D and F-F.

- Page A-179 – Revised language in FIGURE A-5-24 SIDEWALK TRANSITION FROM ROADWAY ONTO BRIDGE FOR DESIGN SPEEDS >45 MPH from; *"3" Max. Asphalt Pavement"* To; *"2" Max. Asphalt Pavement"* to detail Section B-B, C-C, D-D and F-F.

- Page A-197 – Revised the following language from; *"This project is to be constructed in accordance with the Department's Road and Bridge Specifications dated 2007, Road and Bridge Standards dated December, 2008, Work Area Protection Manual dated May 2005 and as amended by contract provisions and the complete plan assembly."* To;
  This project is to be constructed in accordance with the Department's Road and Bridge Specifications dated 20*16*, Road and Bridge Standards dated *July, 2016*, Work Area Protection Manual dated May 20*11* and as amended by contract provisions and the complete plan assembly.

APPENDIX B(1)

- Page B(1)-21 Revised the following language in the first paragraph under "C. PARALLEL PARKING LANE WIDTHS" from; *"Parallel parking is the preferred arrangement for on-street parking. Provisions for on-street parallel parking are allowed on roadways where the posted speed limit is 35 mph or less."* To; Parallel parking is the preferred arrangement for on-street parking. Provisions for on-street parallel parking are allowed on roadways "*functionally classified as collectors or locals"* where the posted speed limit is 35 mph or less. "*See Secondary Street Acceptance Requirements (SSAR) 24 VAC 30-92-120 Design and agreement Requirements."*

APPENDIX C

- Page C-23 – Replaced detail for "Elements and Dimensions Associated with (Transit) Stops"

APPENDIX F

- Page F-2 - Added the following definition**;** ***"DESIGN VEHICLE*** *- A design vehicle is a selected motor vehicle whose weight, dimensions and operating characteristics are used to establish highway design.."*

- Page F-57 – Added the following language in FIGURE 3-3 WARRANTS FOR LEFT TURN STORAGE LANES ON FOUR-LANE HIGHWAYS detail; "*Note: S=100' Min. (See Figure 3-1)"*.

- Page F-81 – Revised the following language in the paragraph under "Acceleration/Deceleration Lanes" from; "*Acceleration lanes shall be considered on high speed roadways (Design Speed 50 mph and greater) where WB 62 vehicles will be entering the roadway."* To; Acceleration lanes shall be considered on high speed roadways (Design Speed 50 mph and greater) where WB "*67"* vehicles will be entering the roadway.

- Page F-92 – Added the following language after the first sentence under "Entrance Width"; "*Note: The width of the entrance shall be wide enough so that the design vehicle does not encroach into the opposing lane when entering the entrance."*

  Added the following language after "Entrance Width"; "*Design Vehicle: The type of vehicle that makes frequent turns without encroaching into the adjacent lane when making turns. The tracking of the design vehicle is an important determinant of corner radii at intersections. When the design vehicle traverses an intersection, the design vehicle shall be able to turn from one street to another without deviating from the near travel lane and impeding other traffic flow. Therefore, the design vehicle determines the elements of design such as turning radius and lane width. The design vehicle is to be determined based on the*

LD-104 Request for Traffic Data and discussed at the Project Scoping Meeting and recorded on the Scoping Worksheet - Roadway Design.

The WB-67 shall be the design vehicle used for intersections of freeway ramp terminals with other arterial crossroads and for other intersections on state highways and industrialized streets that carry high volumes of traffic or that provide local access for large trucks."

- Page F-93 – Revised language in "TABLE 4-3 DESIGN VEHICLE AND TURNING RADIUS BY LAND USE" under "Radius" to include the word "Minimum" to the column as well as to increase the minimum radii.

APPENDIX I

- Page I-1 – Revised the following language in the second paragraph under "INTRODUCTION" from; "When guardrail is wholly or partially within the project limits for any construction project, including heavy maintenance and RRR projects, all existing substandard guardrail systems and components including terminals shall be upgraded to the latest standard in accordance with current VDOT Road and Bridge Standards for the following situations:" To; *"When guardrail is wholly or partially within the project limits for any construction project, including heavy maintenance and RRR projects, the engineer shall perform a guardrail assessment on all existing guardrail systems and components including terminals. Refer to Traffic Engineering Division IIM-TE-366 for upgrade warrants. If warranted by IIM-TE-366, the existing guardrail shall be upgraded to the latest standard in accordance with the current VDOT Road and Bridge Standards for the following situations:"*

APPENDIX J

- Page J-1 – Revised the following language in the second paragraph under "INTRODUCTION" from; "When guardrail is wholly or partially within the project limits for any construction project, including heavy maintenance and RRR projects, Traffic Engineering Division shall perform a guardrail assessment on all existing guardrail systems and components including terminals. Refer to Traffic Engineering Division IIM-TE-366 and IIM-TE-367. Unless Traffic Engineering Division determines that the guardrail can be eliminated, the guardrail shall be upgraded to the latest standard in accordance with current VDOT Road and Bridge Standards for the following situations:" To; *"When guardrail is wholly or partially within the project limits for any construction project, including heavy maintenance and RRR projects, the engineer shall perform a guardrail assessment on all existing guardrail systems and components including terminals. Refer to Traffic Engineering Division IIM-TE-366 for upgrade warrants. If warranted by IIM-TE-366, the existing guardrail shall be upgraded to the latest standard in accordance with the current VDOT Road and Bridge Standards for the following situations:"*

- Page J-2 – Deleted the following language under "W-BEAM GUARDRAIL GENERAL CRITERIA; "*During NEW CONSTRUCTION, always install to the current VDOT Standards."*

  Revised the following language in the new first paragraph under "W-BEAM GUARDRAIL GENERAL CRITERIA from; "*New and existing guardrail within the project limits must meet MASH requirements…"* To; New guardrail "*installations must"* meet MASH requirements…

  Deleted the following language under "W-BEAM GUARDRAIL GENERAL CRITERIA; "*All guardrail shall be replaced or upgraded in accordance with Section J-1."*

- Page J-3 – Revised the following language in the third sentence from; "*An appropriate height transition is required when…"* To; An appropriate transition is required when… and relocated the language to page J-4.

  Revised the following language in the first sentence under "GR-MGS4 STRONG POST TRANSITION FROM MGS1 TO GR-2 W-BEAM GUARDRAIL" from; "*GR-MGS4 is the transition used where existing GR-2 will remain in place and a new installation of GR-MGS1 will tie into the existing rail."* To; GR-MGS4 is the transition used where existing GR-2 will remain in place and a new installation of "*a GR-MGS system"* will tie into the existing rail.

  Added the following language after "GR-MGS4 STRONG POST TRANSITION FROM MGS1 TO GR-2 W-BEAM GUARDRAIL";
  "GR-9
  Only the GR-9 to terminate MB-3, such as a CAT-350, is allowed until a MASH equivalent is developed and approved.

  GR-10
  This system to span low fill culverts is allowed until a MASH equivalent is developed and approved with the following requirements. For Types I & II, raise the rail to 31" to match the MGS System height. For Type III, the height will remain the same, but GR-MGS4 transitions will be required on each side. Refer to Appendix I for additional guidance.

  MB-3
  This 2-sided strong post system is allowed until a MASH equivalent is developed and approved with the following requirements. The height will remain the same. If the MB-3 splits to tie into 2 MGS Systems, GR-MGS4 transitions will be required. Refer to Appendix I for additional guidance."

  Revised the following language under "HIGH TENSION CABLE" from; "*There are currently no VDOT approved MASH high tension cable systems. Refer to Appendix I for guidelines."* To; "*There is no standard for high tension cable since each available proprietary system is unique. Therefore, a Special Provision is needed when used on a project. Drawings of the proposed system must be submitted for approval prior to installation."*

- Page J-4 – Revised the following language to the last sentence in the first paragraph under "BARRIER TERMINALS GENERAL CRITERIA" from; "*The termini of guardrail/barrier must be designed and located so there are no exposed blunt ends within the clear zone which a vehicle could impact."* To; The termini of guardrail/barrier must be designed and located so there are no exposed blunt ends "*that"* a vehicle could impact.

  Revised the following language in the second paragraph under "BARRIER TERMINALS GENERAL CRITERIA" from; "New and existing terminals within the project limits must meet MASH requirements. Those that are not within project limits but are part of a length of barrier that has 60% within the project limits (see **Section J-1**) must also meet MASH requirements. All terminals shall be installed as they were tested in accordance with MASH. Lapping of guardrail terminals must be in accordance with the Standards." To; "*New terminals must meet MASH requirements and be on the MASH approved products list. The Engineer shall perform as assessment of existing guardrail terminals within the project limits using the most current IIM-TE-366. All terminals shall be installed per the manufacturer's instructions and the Road and Bridge Standards."*

  Revised the the following language in the second sentence in the third paragraph under "BARRIER TERMINALS GENERAL CRITERIA" from; "*For gaps between two runs of guardrail ≤ 200'+, closing the gap…"* To; For gaps between two runs of guardrail "*approximately 200' or less,*" closing the gap

  Added the following language after the sixth paragraph under "BARRIER TERMINALS GENERAL CRITERIA"; "*An appropriate transition is required when used with an existing NCHRP 350 system that is not being upgraded to MASH."*

  Added the following language after the seventh paragraph under "BARRIER TERMINALS GENERAL CRITERIA";
  "*GR-6*
  This buried in the back slope NCHRP 350 terminal is allowed until a MASH equivalent is developed and approved. A GR-MGS4 transition will be required. Refer to Appendix I for additional guidance."

- Page J-6 – Revised the following language in 'TABLE J-3-2 TYPICAL FIXED AND HAZARDOUS OBJECTS WITHIN THE CLEAR ZONE" from; *"Guardrail Required"* To; *"Barrier Required"*.

  Revised the following language in "Note (a)" in 'TABLE J-3-2 TYPICAL FIXED AND HAZARDOUS OBJECTS WITHIN THE CLEAR ZONE" from; *"Multiple post installations where the spacing between posts is less than the minimum spacing required for breakaway shall be replaced or shielded by guardrail."* To; Multiple post installations where the spacing between posts is less than the minimum spacing required for breakaway shall be replaced or shielded by *"barrier"*.

  Revised the following language in "Note (c)" in 'TABLE J-3-2 TYPICAL FIXED AND HAZARDOUS OBJECTS WITHIN THE CLEAR ZONE" from; *"Where these devices exist and cannot be converted to breakaway, relocated or removed, the choice of guardrail should be in accordance…"* To; Where these devices exist and cannot be converted to breakaway, relocated or removed, the choice of *"barrier"* should be in accordance…

  Revised the following language in "Note (e)" in 'TABLE J-3-2 TYPICAL FIXED AND HAZARDOUS OBJECTS WITHIN THE CLEAR ZONE" from; *"Every effort should be made to remove the tree rather than shield it with guardrail."* To; Every effort should be made to remove the tree rather than shield it with *"barrier"*.

  Revised the following language in "Note (f)" in 'TABLE J-3-2 TYPICAL FIXED AND HAZARDOUS OBJECTS WITHIN THE CLEAR ZONE" from; *"Guardrail will not normally be used to shield a line of utility poles. However, where guardrails are used in front of utility poles for other reasons, the choice of guardrail should be in accordance with the deflection shown in* ***Table J-3-3****."* To; *"Barrier"* will not normally be used to shield a line of utility poles. However, where *"barriers"* are used in front of utility poles for other reasons, the choice of *"barrier"* should be in accordance with the deflection shown in **Table J-3-3**

  Revised the following language in "Note (h)" in 'TABLE J-3-2 TYPICAL FIXED AND HAZARDOUS OBJECTS WITHIN THE CLEAR ZONE" from; *"A field review and evaluation should be made to determine if guardrail is suitable for protecting motorists from these roadside hazards."* To; A field review and evaluation should be made to determine if *"barrier"* is suitable for protecting motorists from these roadside hazards.

  Added the following language in 'TABLE J-3-2 TYPICAL FIXED AND HAZARDOUS OBJECTS WITHIN THE CLEAR ZONE"; *"(j) When a barrier is required for a retaining wall or a culvert headwall over 23' in length, a cast-in-place concrete parapet is to be used. Depending on the wall design, the parapet can be integrated into the wall or cast with a moment slab to resist overturning."*

- Page J-7 – Deleted the following language in the first paragraph under 'FIXED OBJECTS WITHIN DEFLECTION AREA"; *"Additionally, the deflection zone must be free of breakaway signs, signals, and luminaire supports since their performance when struck by deflecting guardrail is unknown and untested."*

  Revised the following language in the first sentence in the last paragraph under 'BARRIER TYPE SELECTION" from; *"In taking all eight items into account, the deflection, strength, and safety requirements should never be compromised."* To; In taking all eight items into account, the deflection, strength, and safety requirements "*must"* never be compromised.

- Page J-8 – Revised the following language to TABLE J-3-3 from; *"TABLE J-3-3 TYPICAL BARRIER SELECTION AND PLACEMENT"* To; TABLE J-3-3 TYPICAL "*MASH"* BARRIER SELECTION AND PLACEMENT

- Page J-11 – Revised the following language in the first sentence under ASPHALT CURBS from; *"Standard MC-3B Asphalt curb is to be used, where necessary, in conjunction with paving under guardrail on high fills to provide a means of erosion control to preserve the slopes."* To; Standard MC-3B Asphalt curb is to be used, where necessary, in conjunction with "*MC-4"* paving under guardrail on high fills to provide a means of erosion control to preserve the slopes.

- Page J-12 – Revised language in FIGURE J-3-2 TYPICAL OFFSET LAYOUT FOR A TANGENT MGS GUARDRAIL TERMINAL from; *"3" Max. Asphalt Pavement"* To: "*2" Max. Asphalt Pavement"* to detail Section B-B, C-C and D-D.

- Page J-13 – Revised language in FIGURE J-3-3 TYPICAL CURB OFFSET LAYOUT FOR A TANGENT MGS GUARDRAIL TERMINAL AT A BRIDGE WITH A SIDEWALK from; *"3" Max. Asphalt Pavement"* To; *"2" Max. Asphalt Pavement"* to detail Section B-B, C-C, D-D and F-F.

- Page J-14 – Revised language in FIGURE J-3-4 TYPICAL CURB OFFSET LAYOUT FOR A TANGENT MGS GUARDRAIL TERMINAL AT A BRIDGE WITH A SHARED-USE PATH from; *"3" Max. Asphalt Pavement"* To; *"2" Max. Asphalt Pavement"* to detail Section B-B, C-C, D-D and F-F.