<u>IMPERIAL</u> ROAD DESIGN MANUAL
REVISIONS January, 2012

CHAPTER 1B

- Page 1B-3 – Added the following language to the "ABBREVIATIONS";
  "MASH - AASHTO Manual for Assessing Safety Hardware (2009)".

CHAPTER 2B

- Page 2B-4 – Added the following language; "OPERATIONAL /" to "CAPACITY ANALYSIS" now the subsection is named "*OPERATIONAL / CAPACITY ANALYSIS*".

  Added the following language under "OPERATIONAL /CAPACITY ANALYSIS";
  "A review of the volume and types of traffic and the physical characteristics of the roadway that includes capacity analysis or traffic flow simulation and considers potential roadway or traffic control improvement to improve traffic flow through the intersection(s) and along other sections of the roadway."

  Added the following language at the bottom of the page; *"SAFETY ANALYSIS"*
  A review of crash data and the physical characteristics of the roadway that includes an evaluation of potential engineering countermeasures (physical roadway improvements and/or use of traffic control devises) to reduce the potential for crashes at intersections and along other sections of the roadway.

  Deleted the following language under "OPERATIONAL /CAPACITY ANALYSIS"; "*All capacity checks shall be reviewed with the Transportation & Mobility Planning Division and shall be documented in project files.*"

- Page 2B-7 – Revised the following language in the third sentence under "REQUEST FOR APPROPRIATE ENVIRONMENTAL DOCUMENT" <u>from</u>; "Copies of this memorandum should go to the District Administrator, District Construction Engineer and Residency Administrator and other…" <u>to</u>; "*Copies of this memorandum should go to the District Administrator, District Construction Engineer and other…"*

- Page 2B-12 – Revised the following language in the last paragraph under "VALUE ENGINEERING" <u>from</u>; "The analysis is to be performed promptly by the team and is to provide the appropriate Administrator including the Residency Administrator and appropriate…" <u>to</u>; "*The analysis is to be performed promptly by the team and is to provide the appropriate Administrator and appropriate…*"

CHAPTER 2C

- Page 2C-12 – Added the following language; "OPERATIONAL /" to "CAPACITY ANALYSIS" now the subsection is named "*OPERATIONAL / CAPACITY ANALYSIS*".

  Deleted the following language under "*OPERATIONAL /* CAPACITY ANALYSIS"; "*All capacity checks shall be reviewed with the Transportation & Mobility Planning Division and shall be documented in project files.*"

CHAPTER 2D

- Page 2D-9 – Added the following language; "OPERATIONAL /" to "CAPACITY ANALYSIS" now the subsection is named "*OPERATIONAL / CAPACITY ANALYSIS*".

  Deleted the following language under "OPERATIONAL / CAPACITY ANALYSIS";
  In addition, the designer should review the following:

  Major At-grade intersection capacity checks:

  1. *Overall intersection level of service*
  2. *Level of service for each approach*
  3. *Number and length of turning lanes*
  4. *Pedestrian and bicycle influence*

  Interchange capacity checks:

  1. *Basic ramp level of service*
  2. *Ramp Termini level of service*
  3. *Entrance - Exit levels of service*
  4. *Weave - merge lane lengths and widths*
  5. *Acceleration - deceleration lane lengths*

All capacity checks shall be reviewed with the Transportation & Mobility Planning Division and shall be documented in project files.

CHAPTER 2E

- Page 2E-21 – Revised language in the first sentence of this page from; "Recommended by the Field Inspection Report, the Residency Administrator or the city/county…" to; "*Recommended by the Field Inspection Report or the city/county…*"

- Page 2E-39 & 40 – Added the following language;
  Temporary Construction Easements

  Requirements for Temporary Construction Easements (TCE) around Entrances

  All TCE shall be labeled on the plans for there specific intended use such as: cut/fill slopes, drainage, detours and entrances). For example: (Prop. Temporary Construction Easement (TCE) for Entrance).

  ALL TCE for Entrances shall be summarized separately on the Right of Way Data Sheet from all other TCE such as cut/fill slopes, drainage and detours. The Right of Way Data Sheet has been revised to add a column for Temporary (Entrances) and is in the CADD Cell Library.

  All TCE for Entrances shall be computed for each parcel (if applicable) and summarized on the Plat in the Areas of Easements Table. See VDOT's Survey Manual, Chapter 12, Figure 12-D for a Sample Right of Way Acquisition Plat.

  Temporary Construction Easement (TCE) Requirements

  In many instances the proposed replacement entrance construction will extend beyond the proposed roadway right of way and/or proposed temporary construction easement being acquired for roadway grading. As some extend only a small distance beyond those points different proposed rights are applicable.

a) Minor Construction

1. Urban and Suburban

Whenever the elevation change between the proposed roadway features (edge of pavement or back of sidewalk) and the existing entrance is minimal (less than 1 foot) ***and*** *the entrance re-construction will tie-in by the end of the curb radius or within twenty five (25) feet of the edge of the pavement of the proposed roadway, the entrance construction is considered minor. In these cases it will not be necessary for the plans to denote a temporary construction easement for the work, as VDOT will construct the minor tie in as required by the statutory provisions.*

2. Rural

Whenever the elevation change between the proposed edge of pavement and the existing entrance is minimal (less than 2 feet) ***and*** *the entrance re-construction will tie-in within fifty feet (50') of the edge of the pavement of the proposed roadway, the entrance construction is considered minor. In these cases it will not be necessary for the plans to denote a temporary construction easement for the work, as VDOT will construct the minor tie-in as required by the statutory provisions.*

b) Substantial Construction Work

Whenever the proposed entrance replacement construction is not minor, as defined herein, the plans shall include Proposed Temporary Construction Easement (TCE) limits to facilitate the proposed work. Temporary Construction Easements for Entrance shall be clearly labeled for that purpose (Prop. Temporary Construction Easement (TCE) for Entrance) and will have a different duration from other temporary construction easements for other purposes such as cut/fill slopes, drainage and detours.

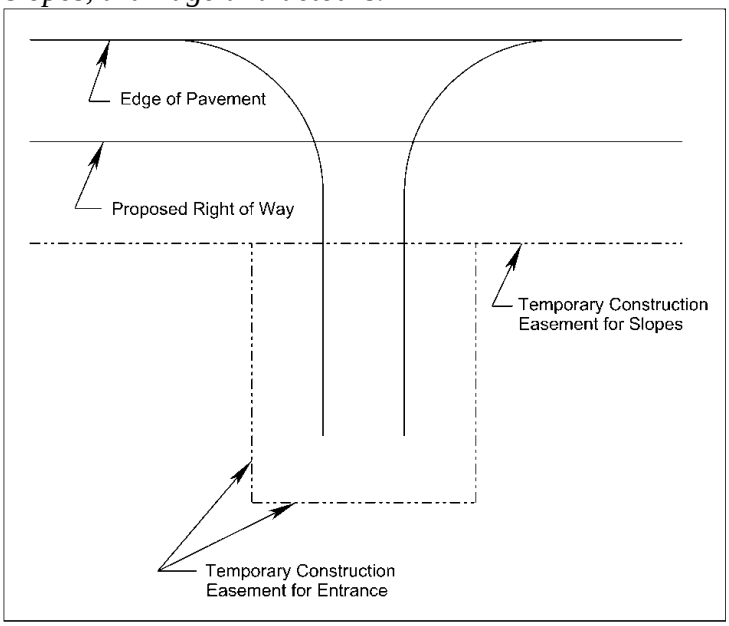


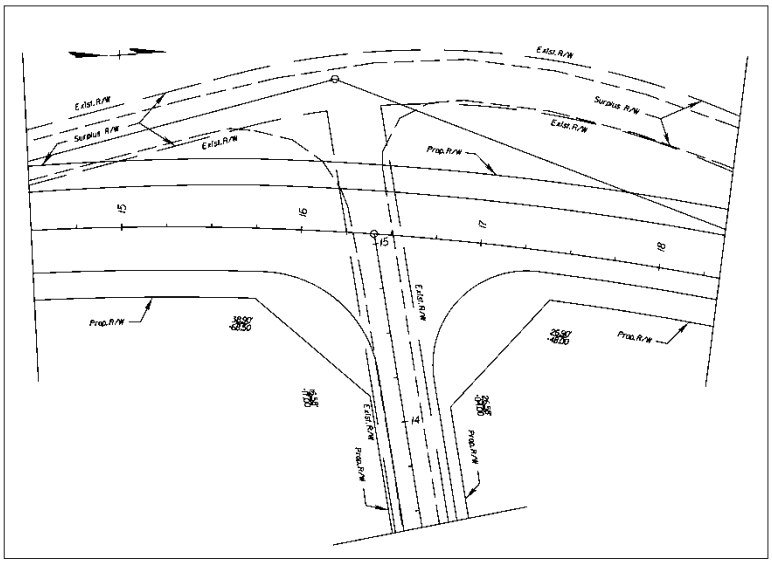
FIGURE 2E-8.2 DEPICTING TEMPORARY CONSTRUCTION EASEMENT FOR ENTRANCES

- Page 2E-44 – Revised language in the first sentence of the fourth paragraph under "LIMITED ACCESS LINES" from; "*At interchanges, the limited access lines are to encompass the entire periphery of the interchanges and should extend beyond the ramp terminals a minimum of 100 feet (30 m) in urban areas and 300 feet (90 m) in rural areas. (See Figure 2E-9). These distances usually satisfy any congestion concerns. However, in areas where the potential for development exists which would create traffic problems, it may be appropriate to consider longer lengths of access control.*" to;

"At interchanges, the limited access lines are to encompass the entire periphery of the interchanges and *shall* extend beyond the ramp terminals *to meet the Access Management Standards (Appendix F) for minimum spacing standards for entrances and intersections from interchange ramps."*

- Page 2E-46 – Added the following information on "Surplus Right of Way";
  DETERMINING SURPLUS RIGHT OF WAY

  Prior to presenting the plans for public hearing the designer shall designate (with the Residencies concurrence) all areas on the project that are currently existing right of way that can be designated "Surplus Right of Way". By labeling the surplus in this manner, the surplus property has been established and will be included in the Right of Way Division's "Residue Parcels Inventory" for disposal purposes.



- Page 2E-48 – Revised "FIGURE 2E-9 DEPICTING LIMITED ACCESS RIGHT OF WAY" detail to refer to Appendix F for spacing standards.

- Page 2E-49 – Replaced "FIGURE 2E-10 DEPICTING LIMITED ACCESS RIGHT OF WAY".

- Pages 2E-50 thru 2E-52 – Replaced the Title Sheet examples with new examples of Tier 1 and Tier 2 projects, page numbers now 2E-50 thru 2E-55.

- Page 2E-72 – Replaced "FIGURE 2E-17 SAMPLE RIGHT OF WAY DATA SHEET to reflect change to add easements for entrances.

CHAPTER 2F

- Page 2F-8 – Revised language in the third paragraph from; "Time Frame for Submission - immediately after the Environmental Document has been approved by the FHWA. The Project Manager is responsible for submitting plans to the Programming Division thirty days prior to the scheduled turn in date for Right of Way approval." to; "Time Frame for Submission - After the Environmental Document has been approved by the FHWA *and Design Approval has been granted* the Project Manager is responsible for submitting plans to the Programming Division thirty days prior to the scheduled turn in date for Right of Way *submission*."

APPENDIX "A"

- Page A-6 – Revised language under "PAVEMENT TRANSITION" to include the following; "*LANE/* PAVEMENT TRANSITION".

- Page A-17 – Added "Figure A-1-11 Geometric Design Standards For Temporary Detours (GS-10)."

- Page A-18 – Added "Figure A-1-12 Geometric Design Standards For Shoulder Design (GS-11)."

- Page A-19 – Added "Figure A-1-13 Geometric Design Standards For Shoulder Design For Local Road And Streets (GS-12)."

- Page A-20 – Added "Figure A-1-14 Geometric Design Standards For Graded Median Design (GS-13)."

- Page A-22 – Revised language in the last sentence on the page from; "See Figure A-2-1, Case 3." to; "See Figure A-2-1, Case *4."*

  Added the following information at the bottom of the page; "*When obstructions exist behind curbs, a minimum lateral offset of 3 feet should be provided beyond the face of curb to the obstruction at intersections and driveway openings. This offset provides sufficient clearance to keep the overhang of a truck from striking an object."*

- Page A-23 – Revised Table A-2-1 CLEAR ZONE DISTANCE for design speeds 40 mph or less with design ADT of 750 and higher.

  Revised language in footnote "a." and "b." and added the following footnotes;

  c. For roadways with low volumes it may not be practical to apply even the minimum values found in Table A-2-1. Refer to Chapter 12 for additional considerations for low volume roadways and Chapter 10 for additional guidance for urban applications in AASHTO Roadside Design Guide.

  d. When design speeds are greater than the values provided, the designer may provide clear zone distances greater than those shown in Table A-2-1.

- Page A-26 – Revised language in the second sentence of the first paragraph from; *Refer to AASHTO's Roadside Design Guide, Appendix A, for "A Cost-Effective Selection Procedure".* to; Refer to AASHTO's Roadside Design Guide, *Chapter 2, for "Economic Evaluation of Roadside Safety".*

  Deleted the following language at the end of the page; *"Another cost effectiveness selection procedure is to utilize the Roadside Safety Analysis Program (RSAP) mentioned in Appendix A of the Roadside Design Guide (CD included with guide)."*

- Page A-28 – Revised language in the second paragraph under "HORIZONTAL CURVE ADJUSTMENTS" as follows; "These modifications are normally considered where *crash* histories indicate *such* a need, *when* a specific site investigation shows a definitive *crash* potential *that* could be significantly lessened by increasing the clear zone width, and *when* such increases are cost effective."

  Revised "Table A-2-2 showing horizontal curve adjustment factors to agree with The 2011 AASHTO Roadside Design Guide.

- Page A-35 – Added the following language to this page;
  Roadside safety hardware not accepted prior to the adoption of AASHTO's Manual For Assessing Safety Hardware (MASH) must meet the requirements of MASH.

  Roadside safety hardware accepted prior to the adoption of AASHTO's Manual For Assessing Safety Hardware (MASH) must meet the requirements of The National Cooperative Highway Research Program (NCHRP) Report 350.

- Page A-36 – Revised language in Note (L) from; *Vertical Height Tolerance for new installations, +/-1".* to; *Vertical Height Tolerance for new installations, +1".*

- Page A-37 – Revised language in the third and forth sentence in the first paragraph under "GUARDRAIL INSTALLATION IN URBAN SETTINGS" from;
  For design speeds greater than 45 mph, use Standard GR-2A or optional stiffening methods which are of nested rail or additional w-beam rail on back of post. This decreases the possibility of an errant vehicle striking the curb before impacting the guardrail or snagging the guardrail posts and is applicable to all design speeds.
  to;
  For design speeds greater than 45 mph, use Standard GR-2A or optional stiffening methods which *use* nested rail or additional w-beam rail on back of post. This decreases the possibility of an errant vehicle striking the curb before impacting the guardrail or snagging the guardrail posts.

  Revised language in the second and third sentence in the second paragraph under "GUARDRAIL INSTALLATION IN URBAN SETTINGS" from; "*For low-speed roadways (45 mph or less) the guardrail shall be offset a minimum of 6' behind the face of curb. For high-speed roadways (50 mph or greater) the guardrail shall be offset a minimum of 11' behind the face of curb.*"
  to;
  "For low-speed roadways (45 mph or less) the guardrail shall be offset a minimum of *8'* behind the face of curb. For high-speed roadways (50 mph or greater) the guardrail shall be offset a minimum of *13'* behind the face of curb. *When using CG-2 or CG-6 (6" barrier curb) guardrail shall be offset a minimum of 8' behind the face to curb for low-speed roadways.*"

  Revised language in the second sentence of the third paragraph under "GUARDRAIL INSTALLATION IN URBAN SETTINGS" from; "the guardrail should be placed 1' behind the sidewalk (or sidewalk space)." to; "the guardrail *shall* be placed 1' behind the sidewalk (or sidewalk space) *provided that minimum offset requirements are met.*"

- Page A-39 – Revised Table A-3-3 DESIGN PARAMETERS FOR ROADSIDE BARRIER LAYOUT to revise "Shy Line" offsets to agree with The 2011 AASHTO Roadside Design Guide.

- Page A-45 – Deleted the following language under "IMPACT ATTENUATORS (CRASH CUSHION); *"In 1993 the National Cooperative Highway Research Program (NCHRP) published NCHRP Report 350. As a result of that report the FHWA issued a requirement that all permanent safety hardware systems included in Federal Aid projects after August 1998 meet NCHRP 350. VDOT extended that requirement to include state funded projects as well."*

  Revised the following language in the third and fourth paragraph under "IMPACT ATTENUATORS (CRASH CUSHION) from;
  Devices subjected to traffic speeds greater than 45 mph must meet NCHRP 350 Test Level 3.

  Devices subjected to traffic speeds of 45 mph and less must meet NCHRP 350 Test Level 2.
  to;
  Devices subjected to traffic speeds greater than 45 mph must meet Test Level 3 *requirements per NCHRP 350 or AASHTO's MASH as appropriate.*

  Devices subjected to traffic speeds of 45 mph and less must meet Test Level 2 *requirements per NCHRP 350 or AASHTO's MASH as appropriate.*

- Page A-46 – Revised following language; *"Source: The errata August 2001-February 2003 of the 2002 AASHTO Roadside Design Guide."* to; *"Source: The 2011 AASHTO Roadside Design Guide.*"

- Page A-52 – Revised language in the second paragraph under "ACCIDENT RECORDS" to remove the following; *"The Residency Administrator or"*.

  Deleted the following language under **"**BRIDGE REHABILITATION OR REPLACEMENT SELECTION POLICY";
  Existing bridges shall be evaluated and the necessary work shall be determined in accordance with the following provisions:

  Bridges with overall deck area exceeding 20,000 square feet shall be evaluated and any necessary work shall be determined by the Structure and Bridge Engineer on a case-by-case basis.

  All other bridges shall be replaced, rehabilitated, or allowed to remain in existing condition in accordance with the following:

(1) Bridges shall be replaced under any one or more of the following conditions unless otherwise approved by the Structure and Bridge Engineer. The new replacement structure shall meet the current requirements of the Virginia Department of Transportation's Road and Bridge Standards.

RRR guidelines may only be used for the total replacement of a bridge when the 15-year traffic projection is 750 vehicles per day or less.

a. If the estimated cost for rehabilitating the existing structure exceeds 65% of the estimated cost of a new structure.

b. If the existing or rehabilitated structure is overstressed under the loading specified in the AASHTO Manual for Maintenance Inspection of Bridges (i.e., if the bridge is to be posted for less than the legal load).

c. If the usable width of the existing or the rehabilitated bridge will be less than the minimum acceptable values for usable width of bridges on RRR projects shown in the table below, and it is not economically feasible to provide that width.

(2) Bridges shall be rehabilitated as required or remain in the existing condition, if conditions in A, B, or C above do not prevail. The usable width of the existing or the rehabilitated bridge shall meet or exceed the minimum acceptable values for usable width of bridges on RRR projects shown in the Table hereinafter.

MINIMUM BRIDGE WIDTHS ON RRR PROJECTS SHALL BE AS FOLLOWS:
(If bridge is less than 100 feet long)

DESIGN YEAR VOLUME ADT	✸ ***USABLE BRIDGE WIDTH (FACE-TO-FACE OF CURB) FT.***
0 - 750	*WIDTH OF APPROACH LANES*
751 - 2000	*WIDTH OF APPROACH LANES + 2 FT*
2001 - 4000	*WIDTH OF APPROACH LANES + 4 FT*
OVER 4000	*WIDTH OF APPROACH LANES + 6 FT*

Source: See Transportation Research Board (TRB) "Practices for Resurfacing, Restoration and Rehabilitation - Special Report 214.

NOTE: See DRAINAGE DESIGN ELEMENTS Bridge Restoration and Bridge Rehabilitation for hydraulic conditions that are to be evaluated.

✸ *If lane widening is planned as part of the RRR project, the usable bridge width should be compared with the planned width of the approaches after they are widened.*

Replaced the above with; "*See VOLUME V – PART 2 DESIGN AIDS AND TYPICAL DETAILS, Chapter 6 – Geometrics, which can be accessed at http://www.extranet.vdot.state.va.us/locdes/electronic%20pubs/Bridge%20Manuals/Volume V-Part2/Chapter6.pdf*"

- Page A-80 – Added the following language to the end of the second bullet at the bottom of the page; "*Also see Table A-5-1 through A-5-6 for design treatments for various traffic operations and design factors.*"

- Page A-104 – Revised "FIGURE A-5-9 SHARED USE PATH TRANSITION FROM ROADWAY ONTO BRIDGE FOR DESIGN SPEEDS >45 MPH" detail to reduce distance from beginning taper to GR-9 (75' to 50') to agree with IIM-220.

- Page A-122 – Revised "FIGURE A-5-12 SIDEWALK TRANSITION FROM ROADWAY ONTO BRIDGE FOR DESIGN SPEEDS >45 MPH" detail to reduce distance from beginning taper to GR-9 (75' to 50') to agree with IIM-220.

APPENDIX "B"

Page B-41 – Revised language in the thirteenth bullet under "The submittal should contain and depict the following criteria:" from; VISSIM and SIDRA Analysis…, to; VISSIM *or* SIDRA Analysis…

APPENDIX "B(1)"

- Page B(1)-2 – Added the following language; "OPERATIONAL /" to "PROJECTED TRAFFIC / CAPACITY ANALYSIS" now the subsection is named "*PROJECTED TRAFFIC / OPERATIONAL / CAPACITY ANALYSIS"*.

- Page B(1)-6 – Deleted the following language under "TRANSITIONS AND TURN LANES";

  1. *Left or right turn lanes should be provided at intersections when the Department or locality determines that projected turning movements or safety warrants their installation. These facilities shall be designed in accordance with the appropriate provisions of Appendix F of the Department's Road Design Manual or other traffic impact tools specifically approved for use by the District Administrator. Where necessary, additional right-of-way width shall be provided to accommodate these facilities.*

  2. *Normally where roadway section widths change, the centerline should not be offset. The length of the transition should be calculated using the following formula for design speeds less than 45 mph.*

  $L = S^2W \div 60$
  L = length of transition
  S = Design Speed
  W = Width of offset on each side

  Ex. Road narrows from 36' to 30'. Design speed is 25 mph.
  625 (3) ÷ 60= 31.25 ft

  Replaced the above language with the following;
  TURN LANES
  See Appendix "F"

  TRANSITIONS, MERGING TAPERS AND SPEED CHANGE LENGTHS
  See Appendix "F"

- Page B(1)-8 – Added the following language to Note 11; For 0-400 ADT *and "No Parking"* ONLY minimum pavement width may be reduced from 24 feet to 18 feet *and shoulder width may be reduced in accordance with Note 8 above.*

- Page B(1)-19 – Added the following language at the bottom of the page; "*For more information on Sight Distances see Appendix "F"."*

- Page B(1)-20 – Revised language at the bottom of the page to add the following; AASHTO's A Policy on Geometric Design of Highways and Streets, "*Chapter 9"*

- Page B(1)-44 – Revised the detail showing the landscape placement within intersection sight distance.

- Page B(1)-51 – Deleted the following language in the third bullet under "The submittal should contain and depict the following criteria:"; *"WB-50 or"*.

  Revised language in the thirteenth bullet under "The submittal should contain and depict the following criteria:" from; VISSIM and SIDRA Analysis…, to; VISSIM *or* SIDRA Analysis…

- Page B(1)-52 – Replaced "Minimum Dimensions for Roundabouts and Circular Island" information with the following language; *"All Roundabouts shall be designed in accordance with NCHRP Report 672 Roundabouts; An Informational Guide, Second Edition."*

APPENDIX "F"

- Page F-1 – Revised the definition for "Commercial Entrance" as follows; "*Any entrance serving land uses that generate more than 50 vehicular trips per day or the trip generation equivalent of more than five individual private residences or lots for individual private residences using the methodology in the Institute of Transportation Engineers Trip Generation."*

- Page F-3 – Added the following definition; "***Low Volume Commercial Entrance:*** *Any entrance, other than a private entrance, serving five or fewer individual residences or lots for individual residences on a privately owned and maintained road or land uses that generate 50 or fewer vehicular trips per day using the methodology in the Institute of Transportation Engineers Trip Generation."*

- Page F-5 – Added the following definition; "***Rural Area:*** *The areas outside the boundaries of urbanized areas and urban places (see Urban Area)."*

- Page F-6 – Added the following definition; "***Urban Area:*** *An urbanized area (population of 50,000 and over), or an urban place as designated by the Bureau of the Census (population of 5,000 or more) and not within any urbanized area, with boundaries fixed by State and local officials and approved by the Federal Highway Administration."*

- Page F-8 – Revised language under "Functional Classification" from; "*Functional classification defines the nature of this channelization process by defining the part that any particular road should play in serving the flow of trips through a highway network. An illustration of a functionally classified roadway network is presented below.*

  Since cities and larger towns generate and attract a large proportion of the relatively longer trips, the arterial highways generally provide direct service for such travel. In Rural areas the intermediate functional category, the collectors, serves small towns directly, connects them to the arterial network, and collects traffic from the bottom-level system of local roads, which serves individual farms and other rural land uses.

  The same basic concepts apply in urban areas as well. A similar hierarchy of systems can be defined; however, because of the high intensity of land use and travel throughout an urban area, specific travel generation centers are more difficult to identify. In urban areas additional considerations, such as spacing, become more important in defining a logical and efficient network.

  Allied to the idea of traffic channelization is the dual role the highway network plays in providing (1) access to property, and (2) travel mobility. Access is a fixed requirement, necessary at both ends of any trip. Mobility, along the path of such trips, can be provided at varying levels, usually referred to as "level of service." It can incorporate a wide range of elements (e.g., riding comfort and freedom from speed changes) but the most basic is operating speed or trip travel time." to;

  Functional classification defines the nature of this channelization process by defining the part that any particular road should play in serving the flow of trips through a highway network. Allied to the idea of traffic channelization is the dual role the highway network plays in providing (1) access to property, and (2) travel mobility. Mobility can be provided at varying levels, usually referred to as "level of service." It can incorporate a wide range of elements (e.g., riding comfort and freedom from speed changes) but the most basic is operating speed or trip travel time. The four major functional classifications are:

  - *Principal arterial is a major highway intended to serve through traffic where access is carefully controlled, generally highways of regional importance, with moderate to high volumes of traffic traveling relatively long distances and at higher speeds.*

  - *Minor arterials are highways that interconnect with and augment the principal arterial system. Minor arterials distribute traffic to smaller geographic areas providing service between and within communities.*

  - *Collector is a highway that provides land access service and traffic circulation within residential, commercial, and industrial areas. The collector system distributes trips from principal and minor arterials through the area to the ultimate destination. Conversely, collectors also collect traffic from local streets in residential neighborhoods and channel it into the arterial system.*

- *Local streets/roads comprise all facilities that are not collectors or arterials. Local streets serve primarily to provide direct access to abutting land and to other streets.*

- Page F-10 – Deleted "Urban and Rural Area Definitions" from this page and added this information at the beginning of this appendix under "Definitions".

- Page F-11 – Deleted "Functional System Characteristics" information from this page. This information has been included on page 8 of this appendix.

- Page F-22 – Deleted the following language under "General Intersection and Entrance Spacing Criteria";

  5. Rural vs. urban areas

  Rural: Greater spacing due to lower density, larger parcel size, and higher speed limits. Distances between destinations are longer requiring greater mobility.

  Urban: Shorter spacing due to higher land use density, smaller parcels with less road frontage, slower traffic speeds, and greater need to accommodate pedestrians/bicyclists. Distances between destinations tend to be shorter so a lower level of mobility may be acceptable.

- Page F-23 – Revised the following; "*Table 2-2 Minimum Spacing Standards for Commercial Entrances, Intersections, and Crossovers"* to reduce the table from 7 rows to 4 rows to eliminate the different spacing requirements between Urban and Rural classifications.

  Added the following language to the notes; "***F. Right Turn Lanes -*** *When a right turn lane will be installed at an entrance, the length of the turn lane needs to be considered when locating the entrance."*

- Page F-24 – Revised the following language to "Footnotes to Table 2-2" <u>from</u>;
  *① **Legal Speed Limit** – Use legal speed limit unless the design speed is available and approved for use by VDOT*

  *② **Signalized Intersection/Crossover Spacing** –Spacing is allocated in fractions of a mile: (1/2 mile, 2,640 ft); (1/3 mile, 1,760 ft); (1/4 mile, 1,320 ft); (1/5 mile, 1,050 ft); (1/6 mile, 880 ft), (1/8 mile, 660 ft). It is based on (i) the Signalized Intersection Spacing section and Table 2-1 and (ii) Transportation and Land Development by Vergil Stover and Frank Koepke, Institute of Transportation Engineers: "Traffic signal control applied in a sequential pattern according to specific spacing criteria optimize traffic efficiency" …"to reduce fuel consumption, reduce delay, reduce vehicular emissions and improve safety." <u>Undivided collector spacing</u> is based on stopping sight distance to assure motorists have sufficient distance to see/react to a vehicle exiting an entrance or to a vehicle slowing down to turn into an entrance and stop in time to avoid a collision.*

③ ***Unsignalized Intersection/Crossover and Full Access Entrance Spacing*** *–These operate in a similar manner so the spacing standards can apply to these intersections/entrances equally. Spacing is allocated in fractions of a mile (see Footnote 2) or the length of a right auxiliary turn lane needed for a safe deceleration to turn into an entrance from Geometric Design of Highways and Streets 2004, AASHTO, pages 713 to 716. Undivided collector spacing is based on stopping sight distance (see Footnote 2).*

④ ***Partial Access One or Two Way Entrance Spacing*** *– Left turn movements are limited (right in/right out with or without left in movement). Spacing is based on sufficient stopping sight distance for motorists to be able to see/react to a vehicle slowing down to turn into an entrance or a vehicle exiting an entrance and stop in time to avoid a collision. See Figure 4-5 for illustrations of commercial entrance channelization island options for creating a partial access entrance on highways without a restrictive non-traversable median. Also see "Restricting Left Turn Movements at Commercial Entrances" for additional information.*

⑤ ***Urban Minor Arterials and Collectors***– *"Urban" is an abbreviation of "urban area" as defined in the Introduction to this document.*

⑥ ***Rural Minor Arterials and Collectors***– *"Rural" is an abbreviation for "rural area" as defined in the Introduction to this document. Rural minor arterial and collector spacing standards are greater than their urban counterparts. Rural areas generally have lower land use density, larger parcel sizes, and higher speed limits. Distances between destinations are longer requiring greater mobility.*

⑦ ***Divided and Undivided Collectors*** *– Spacing between intersections is greater on median divided multi-lane collectors because they carry higher traffic volumes, offer opportunities for greater mobility, and as a result are more likely to evolve to minor arterial status.*

⑧ ***Local Street Spacing*** *– For commercial entrances on local streets (not individual private entrance driveways to homes), a spacing distance of 50 ft between entrance radii is specified to assure a minimum separation between such entrances (illustrated in Figure 4-11).*

⑨ ***Corner Clearance -*** *Corner clearance is the minimum distance entrances on a minor side street need to be separated from an intersection to prevent queued vehicles from backing up into the highway or blocking entrances near the intersection. This separation protects the functional area of the intersection. The corner clearance distance will apply where it is greater than the Table 2-2 spacing standard. See the Corner Clearance in Section 4 for more information.*

to;

① ***Legal Speed Limit*** *– The speed limit set forth on signs lawfully posted on a highway or in the absence of such signs the speed limit established by Article 8 (§46.2-870 et seq.) of Chapter 8 of Title 46.2 of the Code of Virginia.*

② ***Signalized Intersection/Crossover Spacing*** *– Spacing is allocated in fractions of a mile: (1/2 mile, 2,640 ft); (1/3 mile, 1,760 ft); (1/4 mile, 1,320 ft); (1/5 mile, 1,050 ft); (1/6 mile, 880 ft), (1/8 mile, 660 ft). It is based on (i) the Signalized Intersection Spacing section and Table 2-1 and (ii) Transportation and Land Development by Vergil Stover and Frank Koepke, Institute of Transportation Engineers: "Traffic signal control applied in a sequential pattern according to specific spacing criteria optimize traffic efficiency" …"to reduce fuel consumption, reduce delay, reduce vehicular emissions and improve safety."*

③ ***Unsignalized Intersection/Crossover*** *– Intersections and crossovers need ample spacing to accommodate the complex situations faced by motorists from vehicular deceleration, acceleration, and numerous conflict points associated with vehicular crossing and left and right turning movements. At a four way intersection, these traffic movements' creates 32 conflict (collision) points (see Figure 2-1). Intersections and crossovers also may become signalized over time. Spacing is allocated in fractions of a mile (see footnote 2).*

④ ***Full Access Entrance Spacing –*** *Spacing can be less than unsignalized intersection and crossover spacing as there are fewer turning movements and potential conflict points (no entrance on the opposite side of the road so no crossing movements). However, studies have demonstrated that the majority of access related vehicular crashes involve left turns. The spacing is based on intersection sight distance for both four and two lane highways to assure that motorists approaching an entrance and those turning out of the entrance have sufficient time to react to highway and entrance traffic and to merge safely when making right and left turns. Again the purpose is to maintain the capacity and safety of the highway.*

⑤ ***Partial Access One or Two Way Entrance Spacing*** *– Left turn movements are limited (right in/right out with or without left in movement). The focus is on making sure motorists have sufficient time to be able to see/react to a vehicle slowing down to turn into the entrance or to a vehicle exiting the entrance, and stop in time to avoid a collision. Stopping sight distance can be used for this purpose. See Figure 4-5 for illustrations of commercial entrance channelization island options for creating a partial access entrance on highways without a restrictive non-traversable median. Also see "Restricting Left Turn Movements at Commercial Entrances" for additional information.*

⑥ ***Local Street Spacing*** *– For commercial entrances on local streets (not individual private entrance driveways to homes), a spacing distance of 50 ft between entrance radii is specified to assure a minimum separation between such entrances (illustrated in Figure 4-11).*

⑦ ***Corner Clearance -*** *Corner clearance is the minimum distance entrances on a minor side street need to be separated from an intersection to prevent queued vehicles from backing up into the highway or blocking entrances near the intersection. This separation protects the functional area of the intersection. The corner clearance distance will apply where it is greater than the Table 2-2 spacing standard. See the Corner Clearance in Section 4 for more information.*

- Page F-25 – Revised "FIGURE 2-8.1 ILLUSTRATION OF THE RELATIONSHIP BETWEEN SPACING STANDARDS" detail to agree with information in "*Table 2-2 Minimum Spacing Standards for Commercial Entrances, Intersections, and Crossovers"*.

- Page F-26 – Revised "TABLE 2-3 MINIMUM SPACING STANDARDS FOR COMMERCIAL ENTRANCES AND INTERSECTIONS NEAR INTERCHANGE AREAS ON MULTILANE CROSSROADS" by eliminating rural area types and reducing the spacing in the "Y" and "Z" columns and provided the source of this information.

- Page F-27 – Revised "TABLE 2-4 MINIMUM SPACING STANDARDS FOR COMMERCIAL ENTRANCES AND INTERSECTIONS NEAR INTERCHANGE AREAS ON TWO-LANE CROSSROADS" by eliminating rural area types and provided the source of this information.

- Page F-29 – Deleted the following language in the second paragraph under "Private Section Crossover Requests"; "*If an exception to the spacing standards is approved, the Regional Traffic Engineer will determine whether the request complies with the sight distance requirements and other engineering standards in Appendix F. See the "Exceptions/Waivers to the Design Standards" section above for information on the forms and review process.*" Highlighted several portions of the remaining language under "Private Section Crossover Requests" to help illustrate on what each paragraph is focused on.

- Page F-34 – Revised ***SDL**: 6 Lane Major Road (Divided – 18' Median)* and ***SDL**: (Where left turns are physically restricted)* information in "TABLE 2-7 INTERSECTION SIGHT DISTANCE".

- Page F-44 – Revised language in the thirteenth bullet under "The submittal should contain and depict the following criteria:" from; VISSIM and SIDRA Analysis…, to; VISSIM *or* SIDRA Analysis…

- Page F-43 – Replaced "Minimum Dimensions for Roundabouts and Circular Island" information with the following language; "*All Roundabouts shall be designed in accordance with NCHRP Report 672 Roundabouts; An Informational Guide, Second Edition."*

- Page F-52 – Added the following language;
  TRANSITIONS, MERGING TAPERS AND SPEED CHANGE LENGTHS

  Pavement transitions typically occur where new or reconstructed roadways tie-in to existing roadways. This transition of pavement width shall meet the minimum length provided by the following equations:

Less than 45 mph	45 mph and greater
$L = S^2W \div 60$	$L = W \times S$

  L = length of transition
  S = Design Speed
  W = Width of offset on each side

  Transition length area shall include all roadside safety apparatus, if required.

- Page F-80 – Revised language in heading from; "PRIVATE ENTRANCES" to; "PRIVATE *AND LOW VOLUME COMMERCIAL* ENTRANCES*"*.
  Added the following language at the beginning of the page;
  1. Low Volume Commercial Entrance
  Except for the sight distance provision in item 4, the private entrance design standards below and in Figure 4-1 apply to low volume commercial entrances. Low volume commercial entrances shall be placed at locations that provide adequate stopping sight distance as shown in Table 2-6.

- Page F-85 – Revised "Low Volume Entrance" label to read "*Moderate Volume Entrance*".

- Page F-89 – Revised the second sentence in the first paragraph under "Corner Clearance on a Minor Side Street" to remove the following language; *(excluding local streets).* The sentence now reads *"The major roadway will have the higher functional classification or if the same classification will have the higher traffic volume."* And added the third sentence; "*Corner clearance does not apply to the intersection of two functionally classified local streets."*

- Page F-105 – Revised "FIGURE 4-15 LOW VOLUME COMMERCIAL ENTRANCE…" detail and renamed it *"FIGURE 4-15 MODERATE VOLUME COMMERCIAL ENTRANCE…"*

APPENDIX "H"

- Page H-1 – Replaced the following language; *"Concurrent Engineering Process"* with; *"Project Development Process"*.

- Page H-2 – Added the following language at the beginning of the page; "*Alternate Project Delivery Project Manager (PM-APD) – APD representative who leads the contract document development from project inception to completion. This individual shall interact extensively with the PM-D and CO POC's. The CM-APD is responsible for procurement of the Design-Build contract.*"