

IMPERIAL ROAD DESIGN MANUAL
REVISIONS July 2008

CHAPTER 1D

- Page 1D-1 – Revised language to link from “Project Management Manual” to “Project Management Online Guide”.

CHAPTER 2A

- Page 2A-3 – Revised language to link from “Project Management Office Team Site” to “Project Management Online Guide”.
- Page 2A-8 – Revised language to link from “Project Management Office Team Site” to “Project Management Online Guide”.
- Page 2A-11 – Revised language to link from “Project Management Office Team Site” to “Project Management Online Guide”.

CHAPTER 2B

- Page 2B-8 – Included the following under “REQUEST FOR COST ESTIMATES FROM OTHER DIVISIONS”; “PMO-Form-05” this will replaces the old LD-419.
- Page 2B-10 - Added the following language under “PRELIMINARY FIELD INSPECTION”; *The following notes are to be added to all plan and profile sheets including the title and detail sheets; “PRELIMINARY F. I. PLANS” and “THESE PLANS ARE UNFINISHED AND UNAPPROVED AND ARE NOT TO BE USED FOR ANY TYPE OF CONSTRUCTION OR THE ACQUISITION OF RIGHT OF WAY.”*

Included the following under “AVAILABILITY OF PLANS”; “PMO-Form-06 or 07” this will replaces the old LD-320.

CHAPTER 2C

- Page 2C-10 - Added the following language;
Horizontal Alignment and Vertical Control Data
 - A Survey Alignment Data Sheet containing the project horizontal survey alignment and vertical controls, along with corresponding reference data, is furnished along with the project survey plan sheets by the Survey Section (See attached example). The Survey Alignment Data Sheet eliminates the need to show reference points and bench marks on the plan and profile sheets.
 - A Horizontal Construction Alignment Data Sheet, plotted from the alignment data files, will be utilized on all projects.
 - The sheet(s) will be made a part of the plan assembly in accordance with the guidelines contained in the Road Design Manual (Preparation of Supplemental Sheets – Index, Section 2E-56).
 - The Survey Alignment Data as furnished by the Survey Section will accompany any requests for additional survey.
 - Projects not requiring Alignment Data include No Plan, Landscape, Signal, Maintenance and projects without surveys.

CHAPTER 2D

- Page 2D-4 - Added the following language under “DATA REQUIRED FROM PROJECT MANAGER”; The following notes are to be added to all plan and profile sheets including the title and detail sheets; “*PUBLIC HEARING PLANS*”, “*ADDITIONAL EASEMENTS FOR UTILITY RELOCATIONS MAY BE REQUIRED BEYOND THE PROPOSED RIGHT OF WAY SHOWN ON THESE PLANS*”, “*PRELIMINARY EASEMENT FOR UTILITY RELOCATIONS ARE APPROXIMATE ONLY AND SUBJECT TO CHANCE AS PROJECT DESIGN IS FINALIZED*” and “*THESE PLANS ARE UNFINISHED AND UNAPPROVED AND ARE NOT TO BE USED FOR ANY TYPE OF CONSTRUCTION OR THE ACQUISITION OF RIGHT OF WAY.*”
- Page 2D-22 – Revised language in the second sentence in the first paragraph as follows; However, “*this exception requires a Design Waiver which shall be approved by*” the District Location and Design Engineer.

- Page 2D-23 - Added the following language under “DETERMINING PROJECT LIMITS”; “*Any deviation from the sketch in Figure 2D – 6 (there may be many) should be discussed at the Preliminary Field Inspection.*”

Revised title of the third paragraph from “SETTING PROJECT TERMINI” to “DETERMINING RIGHT OF WAY AND UTILITY LIMITS”. Also added “Preliminary” to Field Inspection in the last sentence.

- Page 2D-24 – Revised Figure 2D-6 to replace “Begin/End Temporary Connection” with “Begin/End Construction”. Also added “Preliminary” to “Field Inspection” in the last paragraph on this page.
- Page 2D-26 – Included the following under “BRIDGE DESIGN”; “PMO-Form-04” this will replaces the old LD-430. Also included the following under “PUBLIC HEARING DATA”; “PMO-Form-05” this will replaces the old LD-419.
- Page 2D-29 – Added “PMO-Form-15” in the first sentence of the second paragraph this will replaces the old LD-441.
- Page 2D-31 - Included the following in two locations under “DESIGN APPROVAL”; “PMO-Form-15” this will replaces the old LD-441. Also added “the Project Manager will” in the fifth sentence.

CHAPTER 2E

- Page 2E-13 – Included the following under “CURB AND GUTTER”; “PMO-Form-04” this will replaces the old LD-430.
- Page 2E-22 – Deleted the following language in item 4 under “RETAINING WALLS”; “*as denoted in IIM-197*”.
- Page 2E-23 thru 2E-26 – Added the following language;

RETAINING WALL EXCAVATION

POLICY

- *Retaining Wall Excavation shall consist of the removal of material necessary to accommodate the structure shown on the plans in accordance with Section 401 of the Road and Bridge Specifications.*
- *Retaining Wall Excavation will be paid for in Cubic Yards based on plan quantities.*

- *Retaining Wall Excavation is applicable for all types of Retaining Walls.*

DEFINITIONS

- *Neat Line – a line defining the proposed or specified limits of a structure.*
- *Weep hole – a hole designed to drain off accumulated water from behind a structure.*

METHOD OF MEASUREMENT

- *Theoretical volume (in cubic yards) of material removed from within the limits of vertical planes up to 18” outside the neat lines of the footings, measured from the surface of the original ground or proposed roadway to the bottom of the foundation shown on the plans.*
- *See Section 401.04 of the Road and Bridge Specifications for further details.*

EXAMPLES

SUMMARY

- *Retaining Walls are summarized on the Incidental Summary; therefore, Retaining Wall Excavation should also be summarized on the Incidental Summary, and paid for as Cu. Yds. of Retaining Wall Excavation.*
- *Retaining Wall Excavation should denote the symbol (⊗) for payment on basis of plan quantity as per IIM-LD-135.*

Porous backfill is included in the price bid for Retaining Wall Excavation if only required within an 18” cube for drainage behind the weephole as required in Section 401.11 of the Road and Bridge Specifications.

SPECIAL PROVISION

- *A Specification is available for applicable projects as follows:*
- *<http://virginiadot.org/business/const/spec-default.asp>*

CONSTRUCTION OF CONCRETE BARRIER & RETAINING WALLS ON SUPERS

POLICY

- *Concrete Barriers on roadway approaches should be designed with the same shape (K type) and angle of inclination as the parapet face and concrete median barriers on the bridge.*

- *The Standard GS-11 has a 7% algebraic difference for the shoulder break on the outside of a superelevated section. The bridge deck has a straight super between parapet walls making it necessary to spline the shoulder grade of the roadway to match the bridge deck slope. Under normal conditions, this can be accomplished by a 200' transition.*

The same principle would apply to the low side of the roadway. Should the superelevation of the bridge deck be less than the slope of the inside shoulder, then it would be necessary to spline the shoulder grade to match the bridge deck. The length of transition is to be obtained by using sound engineering practices.

PLANS

- *When concrete barriers are tied into the bridge parapets and median, a general note will need to be included in the plans specifying:*

“The Contractor is to transition the Concrete Barrier so that the face will align with the face of the bridge parapets and median.”

- *The roadway development is to be closely coordinated with bridge design in the approach area.*

EXAMPLES

- *Bridge geometrics for concrete median barrier and parapet of the same shape (K Type) may be constructed:*

- 1) *Vertically, or*
- 2) *Perpendicular to the superelevated pavement*

- *The barrier should be oriented vertically when the barrier is in front of a retaining wall, as illustrated below:*

- Page 2E-33 – Replaced language for “Mountable Curb” with the following;

Mountable Type Curb

Curb and/or curb and gutter should be utilized in special situations ONLY on highways with design speeds of 50 mph or greater. These situations may include, but are not limited to, drainage considerations, access control and right of way restrictions. Whenever necessary to utilize curb and/or curb and gutter on a highway with a design speed of 50 mph or greater, mountable type curb (Standard CG-3 / CG-7) shall be used. Because Urban Principal Arterial highways are typically free-flowing with higher operating speeds, mountable type curb (Standard CG-3 / CG-7) shall be used with design speeds of 45 mph or greater. (See AASHTO Green Book, Chapter 4)

Barrier Type Curb

The use of barrier type curb (standard cg-2 / cg-6) is limited to low-speed highways (design speeds 45 mph or less) with the exception of urban principal arterials mentioned above. The same standard entrance gutter, street connection, median strip, etc. Is used for standard cg-3 / cg-7 and standard cg-2 / cg-6.

- Page 2E-36 – Added “preliminary” to field inspection in the third sentence of the last paragraph.
- Page 2E-37 – Added “Preliminary” to Field Inspection in the second sentence of the first paragraph under “DETERMINING SLOPE EASEMENTS”.
- Page 2E-39 – Added “preliminary” to field inspection in the first sentence of the second paragraph under “UTILITY EASEMENTS”.
- Page 2E-58 - Added the following language;

Project Section Numbers

Project section numbers (PE, RW and C or M) are to be shown as follows; Preliminary Engineering (PE-) number will to be shown only on the title sheet (for example see sheet 2E-49) and the first and last plan and profile sheets identifying the project termini’s (for example see sheet 2D-24).

Right of Way numbers (RW-) are to be shown in the upper right hand corner on all plans, profiles, detail sheets and cross sections.

Construction or Minimum Plan numbers (C- or M-) are to be shown in the upper right hand corner on all plans, profiles, detail sheets and cross sections.

- Page 2E-61 - Added the following language; “*Pavement Marking and Marker Plans comes next*” and “*Landscape Plans are number next*”.
- Page 2E-63 – Replaced “Figure 2E-15 Index of Sheets” with updated example.
- Page 2E-74 - Added the following language under “DESIGN FEATURES NOTE”;
ADDITIONAL NOTES

The following notes are to be added to all plan and profile sheets including the title and detail sheets; “F. I. PLANS” and “THESE PLANS ARE UNFINISHED AND UNAPPROVED AND ARE NOT TO BE USED FOR ANY TYPE OF CONSTRUCTION OR THE ACQUISITION OF RIGHT OF WAY.”

- Page 2E-77 – Revised language to link from “Project Management Office Team Site” to “Project Management Online Guide”.
- Page 2E-79 – Revised language to link from “Project Management Office Team Site” to “Project Management Online Guide”.

CHAPTER 2F

- Page 2F-1 – Added the following language under “CHECK FOR ACCURACY AND COMPLETENESS”; “*The following note is to be added all plan and profile sheets including the title and detail sheets; “THESE PLANS ARE UNFINISHED AND ARE NOT TO BE USED FOR ANY TYPE OF CONSTRUCTION.”*”.
- Page 2F-5 - Included the following under “INTEGRATED PROJECT MANAGER (CERTIFICATION ACCEPTANCE)”; “PMO-Form-05” this will replace the old LD-419.

CHAPTER 2G

- Page 2G-3 – Replaced “Project Manager” with “Lead Design Engineer” in the second sentence of the forth paragraph.
- Page 2G-17 – Revised language to link from “Project Management Office Team Site” to “Project Management Online Guide”.
- Page 2G-18 – Revised language to links from “Project Management Office Team Site” to “Project Management Online Guide” under PREPARATION OF PLANS FOR CONSTRUCTION and DATA REQUIRED FOR PLAN COORDINATION REVIEW.
- Page 2G-21 – Revised language to link from “Project Management Office Team Site” to “Project Management Online Guide”.

APPENDIX “A”

- Page A-9 – Included the following language in the forth paragraph under “GENERAL NOTES”; “*is to be used for all*”.

Deleted the following language at the end of the seventh paragraph under “GENERAL NOTES”; “*(45mph = 7° maximum)*”.

- Page A-10 - Deleted the following language at the end of the forth paragraph under “GENERAL NOTES”; “*(45mph = 7° maximum)*”.

- Page A-11 - Deleted the following language at the end of the fourth paragraph under “GENERAL NOTES”; “(45mph = 7° maximum)”.
- Page A-12 - Deleted the following language at the end of the fifth paragraph under “GENERAL NOTES”; “(45mph = 7° maximum)”.
- Page A-15 & 16 – Rewritten “CLEAR ZONE GUIDELINES” as follows;
The term “clear zone” is used to describe the unobstructed, traversable area provided beyond the edge of the traveled way for the recovery of an errant vehicle. The clear zone includes shoulders, bike lanes, parking lanes and auxiliary lanes (except those auxiliary lanes that function like through lanes). Clear zone distances are based upon traffic volume, speed, and embankment slopes.
Source: Draft revision to 2010 AASHTO “Green Book”.

A recoverable area is to be provided that is clear of all unyielding obstacles such as trees, sign supports, utility poles, light poles, or any other fixed objects that might severely damage an out-of-control vehicle (See 2004 AASHTO A Policy on Geometric Design of Highways and Streets, Chapter 5). Determining a practical clear zone often involves a series of compromises between absolute safety, engineering judgment, environmental and economic constraints. Additional information is available in AASHTO’s Roadside Design Guide.

ROADWAYS WITH SHOULDERS

For all Freeways and Arterials, and for Collectors with design speeds ≥ 50 mph, clear zone widths are to be determined from AASHTO’s Roadside Design Guide, Chapter 3. For an example, see Figure A-2-1, Case 1.

For all Rural Local Roads, Urban Streets with paved shoulders and Collectors with design speeds ≤ 45 mph, as much clear zone as practical should be provided, with a minimum of 10’ beyond the traveled way. (See 2004 AASHTO A Policy on Geometric Design of Highways and Streets, Chapters 4 and 5). For an example, see Figure A-2-1, Case 2.

On projects such as RRR, intersection improvements, etc. recoverable areas are not always practical due to the intent of the project to provide minimal improvements, and extend the service life of the existing roadway, for a fraction of the costs of reconstruction. However, as much clear zone as practical should be provided.

Source: TRB Special Report 214, Designing Safer Roads

Whenever adequate right of way is available, urban projects should be designed with shoulders in lieu of curbs (unless city ordinances require otherwise) and clear zone widths should be consistent with the requirements for roadways with shoulders. (See 2004 AASHTO “A Policy on Geometric Design of Highways and Streets”, Chapter 7). The justification for providing a curb is to be documented

in the project file (e.g. Preliminary Field Inspection Report, recommendation from Right of Way and Utilities Division, etc.).

ROADWAYS WITH CURB

High-Speed Roadways with curb

For roadways with design speeds of ≥ 50 mph, curb should ONLY be utilized in special situations. These situations may include, but are not limited to the following:

- *Drainage considerations*
- *Need for access control*
- *Right of way restrictions*

Source: AASHTO Green Book, Chapter 4

When necessary to utilize curb on a roadway with a design speed ≥ 50 mph for one of the situations listed above, a clear zone distance commensurate with prevailing traffic volumes and vehicle speeds is to be provided. (See AASHTO's Roadside Design Guide, Chapter 3).

In situations where these clear zone widths are not practical, the greatest practical values should always be utilized. The lateral offset shall extend a minimum of 8' from the face of curb, or beyond the back of the sidewalk, whichever is greater (See Figure A-2-1, Case 3). Source: Draft revision to 2010 AASHTO "Green Book".

Low-Speed Roadways with curb

When curb is utilized on urban roadways with design speeds of ≤ 45 mph, the greatest practical lateral offset is to be provided, and shall extend a minimum of 8' from the face of curb, or beyond the back of the sidewalk, whichever is greater. See Figure A-2-1, Case 3. (Source: Draft revision to 2010 AASHTO "Green Book")

In situations where space is restricted, the lateral offset distance may be reduced to an absolute minimum of 1.5' beyond the face of the curb, with wider distances provided where practical. See Figure A-2-1, Case 4. (Source: AASHTO Roadside Design Guide, Chapter 3 and 2004 AASHTO "Green Book", Chapters 4 and 5) The justification for not providing a minimum 8' lateral offset beyond the face of curb (or to the back of sidewalk) is to be documented in the project file (e.g. Preliminary Field Inspection Report, recommendation from Right of Way and Utilities Division, etc.).

- Page 18 & 19 – Replaced typical section examples.

- Page A-20 – Included the following under “CLEAR ZONE COST-EFFECTIVENESS ANALYSIS”; “PMO-Form-04” this will replaces the old LD-430.
- Page A-22 – Added the following language under “HORIZONTAL CURVE ADJUSTMENTS”; “*The distances in TABLE A-2-1 may be increased on horizontal curves by the values shown in TABLE A-2-2. See the AASHTO Roadside Design Guide, Chapter 3 for further instructions*”. Also added source for Table A-2-2.
- Page A-27 – Added source for diagram for Alternate Design To Reduce Total Clearance Requirement.
- Page A-32 - Deleted the following language under “GUARDRAIL INSTALLATION IN URBAN SETTINS” in the first paragraph; “*Even when CG-3 or CG-7 (4" high mountable curb) is used*”.

Replaced the following language to the second paragraph; “*If possible, to provide maximum offset, the guardrail should be placed 11’ or more behind the curb for high speed (50 mph or more) roadways and 6’ or more behind the curb for low speed (45 mph or less) roadways.*” with “*When the guardrail is to be aligned with the face of the curb, only GR-2 (Strong Post) and CG-3 or CG-7 (4” high curb) is to be used regardless of the design speed. If the guardrail is not to be aligned with the face of the curb or if CG-2 or CG-6 (6” high curb) is being used, then provide maximum offset where possible by placing the guardrail 11’ or more behind the face of curb for high speed (50mph or more) roadways and 6’ or more behind the face of curb for low speed (45mph or less) roadways.*”. Also replaced “*asphalt or concrete*” with “any”.

- Page A-51 & A-52 – The following language was added;

BACKGROUND

- *All roadways are classified as to how the facility functions in accordance with Federal guidelines.*
- *The Geometric Design Standards in Appendix A of VDOT’s Road Design Manual are divided by Functional Classification (FC).*
- *The terms “Urban” and “Rural” used in the FC do not necessarily coincide with the terms as applied to highway systems in Virginia.*

Urban - Urbanized areas within set boundaries having a population of 5,000 or more. This may include areas outside of incorporated cities and towns.

Rural - Areas not designated as Urban. Includes incorporated cities and towns with populations less than 5,000.

VIRGINIA HIGHWAY SYSTEMS

Urban - Roadways within the boundaries of incorporated towns and cities with a population of 3,500 or more plus eight other designated urbanized areas (Bridgewater, Chase City, Elkton, Grottoes, Narrows, Pearisburg, Saltville and Woodstock). The urban program is administered by the Local Assistance Division.

Primary - Primary Roadways

Secondary – All secondary roadways except those in Arlington and Henrico Counties. Projects are administered by the Local Assistance Division.

- *A project classified as Urban in FC may be part of the Interstate, Arterial, Primary, or Secondary System and will be administered as such. This applies also to projects classified as Rural.*
- *The Functional Classification block on the title sheet is to show the Geometric Design Standard used.*

If more than one standard is used in the design, it will be necessary to set up two Functional Classification blocks since in most cases there would be a change in traffic volumes and scope of work.

EXAMPLE

- *When the Functional Classification for a project would normally warrant either Geometric Design Standard GS-1, GS-2, GS-3, or GS-4 and Geometric Design Standard GS-5, GS-6, GS-7 or GS-8, respectively, is used then it will be necessary to show the standard used in the design on the title sheet under the Functional Classification.*
- *If the normal Geometric standard would be GS-3 and Geometric Standard GS-7 is used, the title sheet is to show:*

RURAL COLLECTOR-ROLLING-DIVIDED (Urban St'd. GS-7 was used)

- Page A-89 – Replaced the following language in the second paragraph; *“On curb or curb and gutter roadways, when the distance between the travel way (edge of pavement) and the shared use path is less than 5 feet (7 feet recommended for new construction), a suitable physical barrier is recommended.”* with *“For curb and/or curb and gutter streets, the shared use path shall be a minimum of 5.5 feet from the face of the curb”*.
- Page A-90 – Replaced *“desirable”* with *“required”* in the last paragraph, and added the following language; *“Depending on the height of embankment and condition at the bottom, a physical barrier, such as dense shrubbery, railing or chain link fence, may need to be provided.”*
- Page A-91 – Added the following paragraph at the top of the page; *“The vertical clearance to obstructions should be a minimum of 8 feet. However, vertical clearance may need to be greater to permit passage of maintenance and emergency vehicles. In undercrossings and tunnels, 10 feet is required for adequate vertical shy distance.”*
- Page A-112 – Revised the second sentence under *“PLAN PREPARATION”* as follows; *“For the current version of the “No Plan” title sheet, see the CADD No Plan Directory, which is in Falcon under Engineering Services (eng-ser). “Minimum Plan” title sheet shall include all the information as that shown on a “Construction Plan” title sheet.*
- Pages 135 thru 156 – Added the following language to the beginning of the introduction; *“Transportation Management Plans (TMP) are required on all Category 1, 2 and 3 projects. TMP’s consist of the following strategies (or plans): Temporary Traffic Control, Public Communication and Transportation Operations. Refer to LD-IIM-241 for guidance”*. And replaced *“maintenance of traffic”* with *“temporary traffic control plans”* in numerous locations

APPENDIX “B”

- Page B-20 – Deleted the following language under section 3a; “*When used along rural highways, CG-6 shall be limited to design speeds not greater than 40 mph.*”

Deleted the following language under section 3b; “*40 mph in rural settings and*”.

- Page B-25 – Revised the last sentence in the second paragraph under “Shared use paths” as follows; “*For curb and/or curb and gutter streets, the shared use path shall be a minimum of 5.5 feet from the face of the curb.*” Also included the following language in the last paragraph; “*a minimum 5 feet separation from the edge of the path pavement to the top of slope is required. Depending on the height of embankment and condition at the bottom, a physical barrier, such as dense shrubbery, railing or chain link fence, may need to be provided. The vertical clearance to obstructions should be a minimum of 8 feet. However, vertical clearance may need to be greater to permit passage of maintenance and emergency vehicles. In undercrossings and tunnels, 10 feet is required for adequate vertical shy distance.*”
- Page B-40 – Deleted the following language under “ROUNDABOUTS”; “*Operational and safety characteristics of roundabouts should be compared with those of signalized and unsignalized intersections on all projects and be used if deemed appropriate*”. And added the following language; “*VDOT recognizes that Roundabouts are frequently able to address safety and operational objectives better than other types of intersections. Therefore, it is VDOT policy that Roundabouts be considered when a project includes reconstructing or constructing new intersection(s), signalized or unsignalized. The Engineer shall provide an analysis of each intersection to determine if a Roundabout is a feasible alternative based on site constraints, including right of way, environmental factors and other design constraints. The advantages and disadvantages of constructing a Roundabout shall be documented for each intersection. When the analysis shows that a Roundabout is a feasible alternative, it should be considered the Department’s preferred alternative due to the proven substantial safety and operational benefits.*” and “*The maximum daily service volume of a single-lane roundabout varies between 20,000 and 26,000 vehicles per day (2,000 -2,600 peak hour volume), depending on the left-turn percentages and the distribution of traffic between the major and minor roads.*”

Exceptions to this requirement include, but are not limited to, the following:

- *Where adequate horizontal and/or vertical approach sight distances cannot be met.*
- *When there are signalized intersections in close proximity to the proposed roundabout.*
- *Where high volume entrances are in close proximity (within 100’) to the outer edge of the inscribed diameter.*
- *Where left turns are not the predominant turning movement.*
- *Has been deemed unsuitable by the District or Central Roundabout Review Committee.*

- Page B-41 – Added the following language; *Example Plan Sheets for Typical Single Lane Roundabouts can be accessed at: <https://www.nysdot.gov/portal/page/portal/main/roundabouts/guide-engineers/examples>*

APPENDIX “C”

- Page C-4 – Revised language under “LEFT-TURN LANES” as follows;
As a general policy, left-turn lanes are to be provided for traffic in both directions in the design of all median crossovers on non-access controlled “*four-lane or greater*” divided highways using controls as shown in Figure C-1-1 “*and adjusted upward as determined by Figure C-1-1.1 or by capacity analysis for left-turn storage.*” Left-turn lanes should also be established on two-lane “undivided” highways where needed for storage of left-turn vehicles and/or prevention of thru-traffic delay “*as shown in Figure C-1-1 and adjusted upward as determined by Table C-1-2 and Figure C-1-1.2 through C-1-1.19 or by capacity analysis for left-turn storage. See Table C-1-2.1 for TRUCK ADJUSTMENTS.*”
- Page C-5 – Added the following note under FIGURE C-1-1 “*(To be used for divided and undivided highways) (However, VDOT minimum standards for storage length (45 mph) is 100 feet.)*”.

Added language to the following note: *Dimension "L" to be adjusted upward as determined by Figure C-1-1.1 or by capacity analysis for left-turn storage “*lanes on four-lane or greater (divided) highways.*”

Added the following note: “*Dimension “L” to be adjusted upward as determined by Table C-1-2 and Figures C-1-1.2 through C-1-1.19 or by capacity analysis for left-turn storage lanes on two-lane (undivided) highways.”

- Page C-6 – Added the following reference and note under FIGURE C-1-1.1 “*Figure C-1-1.1 was derived from Highway Research Report No. 211. (However, VDOT minimum standard for storage length (45mph or less) is 100 feet.)*”
- Page C-7 – Revised note to add the following language to agree with the note on page C-18: “**DESIGN SPEED IS THE PREFERRED CRITERIA, BUT OPERATING SPEED OR**” SPEED LIMIT MAY BE USED IF APPLICABLE, I.E. ADDING LANES TO EXISTING FACILITIES.
- Page C-8 – Added the following language to the end of the first paragraph: “*These figures were derived from Highway Research Report No. 211. This study was undertaken to provide consistent volume warrants for left-turn storage lanes at unsignalized intersections.*”

- Page C-18 – Added “Channelizing” to the existing references and added a second reference as follows: “AASHTO Green Book, Chapter 9 (For turning lane tapers).”

- Pages C-23 and 24 – Added the following language:

“INTERSECTION DESIGN

Highway crossings may be grade-separated or at-grade (signalized or unsignalized). Grade-separated crossings do not provide access between the crossing highways unless an interchange is constructed. The decision whether to provide an at-grade or a grade-separated highway crossing is a trade-off between providing optimal service to through traffic on one or both highways and providing access to surrounding land uses and should be based on the highway functional classification and operational and safety considerations. The type of crossing selected should meet capacity, safety and mobility needs. Chapter 10 of the AASHTO A Policy on Geometric Design of Highways and Streets, provides guidance on the selection of a type of crossing.

Design of intersections should be consistent with the design considerations and recommendations contained in Chapter 9 of the AASHTO A Policy on Geometric Design of Highways and Streets. Operational considerations for selecting an intersection type and layout include design hour volumes and predominant movements, vehicles types and distribution, pedestrians, bicyclists, approach speeds, number of approaches and safety.

General safety and operational objectives for intersection design are:

- *To provide adequate sight distances*
- *To minimize points of conflict*
- *To simplify conflict areas*
- *To limit conflict frequency*
- *To minimize severity of conflicts*
- *To minimize delay*
- *To provide acceptable capacity for the design year volume*

VDOT recognizes that Roundabouts are frequently able to address the above safety and operational objectives better than other types of intersections in both urban and rural environments and on high-speed and low-speed highways. Therefore, it is VDOT policy that Roundabouts be considered when a project includes reconstructing or constructing new intersection(s), signalized or unsignalized. The Engineer shall provide an analysis of each intersection to determine if a Roundabout is a feasible alternative based on site constraints, including right of way, environmental factors and other design constraints. The advantages and disadvantages of constructing a Roundabout shall be documented for each intersection. When the analysis shows that a Roundabout is a feasible alternative, it should be considered the Department’s preferred alternative due to the proven substantial safety and operational benefits.

The documentation shall include, at a minimum, the criteria outlined in this chapter. If Roundabouts are not being considered than documentation shall be provided on the LD-430 Scoping Report.

The maximum daily service volume of a single-lane roundabout varies between 20,000 and 26,000 vehicles per day (2,000 -2,600 peak hour volume), depending on the left-turn percentages and the distribution of traffic between the major and minor roads.

Exceptions to this requirement include, but are not limited to, the following:

- *Where adequate horizontal and/or vertical approach sight distances cannot be met.*
- *When there are signalized intersections in close proximity to the proposed roundabout.*
- *Where high volume entrances are in close proximity (within 100') to the outer edge of the inscribed diameter.*
- *Where left turns are not the predominant turning movement.*
- *Has been deemed unsuitable by the District or Central Roundabout Review Committee.”*

Roundabout designs should be based on Federal Highway Administration Publication Number FHWA-RD-00-067, Roundabouts: An Informational Guide at <http://www.tfsrc.gov/safety/00068/htm> and <http://www.tfsrc.gov/safety/00068.pdf> . Additional information can also be found in VDOT’s Roundabout Brochure at <http://www.virginiadot.org/programs/faq-roundabouts.asp>. See Figure C-1-2.2 for Roundabout Details. When roundabout design is proposed, the Residency Administrator should consult the District Location & Design Engineer.

“Common characteristics of acceptable roundabouts include (a) a domed center that is sufficiently clear to not compromise sight distance and (b) a paved traversable apron not less than 4 feet in width, the radius of which is sufficient to serve the turning radius of school buses and single unit design vehicles. If the percentage of trucks anticipated to use the road exceeds 5%, that radius should be sufficient to serve those vehicles.

Example Plan Sheets for Typical Single Lane Roundabouts can be accessed at: <https://www.nysdot.gov/portal/page/portal/main/roundabouts/guide-engineers/examples>.”

- Page C-51 – Added the following language in “SECTION 3 RIGHT OF WAY” **POLICY**

The type of Right of Way Monuments to be used will be determined at the Field Inspection.

The District Engineer’s Field Inspection Report will indicate whether concrete Right of Way Monuments, Std. RM-1, or steel pin Right of Way Monuments, St’d. RM-2, are to be used.

When both types are recommended, the location of each type will be specified.

ST'D RM-1

The St'd. Right of Way Monument, St'd. RM-1, is concrete and will be used at locations as recommended by the District Administrator at the Field Inspection.

St'd RM-1 monuments shall be set by the contractor.

ST'D RM-2

The St'd. Right of Way Monument, St'd. RM-2 uses a steel pin with cap and locator post.

The St'd. RM-2 monument is not a replacement for the concrete monument (St'd. RM-1), but will be used at locations as recommended by the District Administrator at the Field Inspection.

St'd. RM-2 monuments will be set by the Contractor when Construction Surveying is to be performed by contract.

St'd. RM-2 monuments will be set by the State Survey Party only after approval by the State Location and Design Engineer, in accordance with IIM-LD-152.

GENERAL NOTES

General Notes are to be shown in accordance with IIM-LD-110.

PLANS

Projects containing both types of monuments should have each type clearly noted.

APPENDIX "D"

- Page D-1 thru D-15 – Revised "Culvert Outlet Protection" tables to include additional qualities.

APPENDIX "F" Access Management, Design Standards for Entrance and Intersections has been added to the Road Design Manual. These standards are to be incorporated in all projects that have not been to public hearing.