METRIC ROAD DESIGN MANUAL
REVISIONS JULY 2008

Note:
Volume 2 Metric no longer exists. All information related to metric projects can now be found in Volume 1.

APPENDIX "A" METRIC

- Page A-9 - Deleted the following language at the end of the seventh paragraph under "GENERAL NOTES"; "*(70km/h = 211m minimum radius)"*.

- Page A-10 - Deleted the following language at the end of the forth paragraph under "GENERAL NOTES"; "*(70km/h = 211m minimum radius)"*.

  Revised GS-6M chart to indicate that CG-7 is to be used with design speeds of 80km/h and higher.

- Page A-11 - Deleted the following language at the end of the forth paragraph under "GENERAL NOTES"; "*(70km/h = 211m minimum radius)"*.

- Page A-12 - Deleted the following language at the end of the fifth paragraph under "GENERAL NOTES"; "*(70km/h = 211m minimum radius)"*.

- Page A-15 & A-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 ≥ 80 km/h, 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 ≤ 70km/h, as much clear zone as practical should be provided, with a minimum of 3.0 m 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 ≥ 80 km/h, 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 ≥ 80 km/h 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 2.4 m 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".

Roadways with curb outside of shoulder

In situations where space for clear zone is restricted, and curb is provided outside of the shoulder, the lateral offset distance may be reduced to an absolute minimum of 0.5 m beyond the face of the curb, provided the lateral offset extends a minimum of 2.4 m from the edge of the traveled way. See Figure A-2-1, Case 5 (Source: AASHTO's Roadside Design Guide, Chapter 3 and 2004 AASHTO "Green Book", Chapter 4). The justification for not providing a clear zone distance commensurate with prevailing traffic volumes and vehicle speeds is to be documented in the project file (e.g. Preliminary Field Inspection Report, recommendation from Right of Way and Utilities Division, etc.).

Low-Speed Roadways with curb

When curb is utilized on urban roadways with design speeds of ≤ 70km/h, the greatest practical lateral offset is to be provided, and shall extend a minimum of 2.4m 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 0.5 m 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 2.4 m 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 A-18 & A-19 – Replaced typical section examples.

- Page A-20 – Included the following under "CLEAR ZONE COST-EFFCTIVENESS ANALYSIS"; "PMO-Form-04" this will replaces the old LD-430.

- Pages A-80 thru A-101 – 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 "C" METRIC

- 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 (70km/h) is 30 m.)"*.

  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 (70km/h or less) is 30 m.)"*

- 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-19 – 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 30 m) 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.tfhrc.gov/safety/00068/htm and http://www.tfhrc.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 1.2 m 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."