

Background on the Revisions to VDOT's Access Management Spacing Standards

Spacing Standards for Commercial Entrances, Signals, Intersections, and Crossovers

The spacing standards were located in the Road Design Manual instead of the Access Management Regulations so they could be reviewed periodically and adjusted as necessary.

During the three years (principal arterials) and two years (other highways) the standards have been in effect the Central Office has received copies of 60+ approved spacing exceptions from the Districts – and at least half as many more have been approved. District staff and transportation consultants have also offered a number of comments and suggestions on the spacing standards over the past several years.

An evaluation of this information indicates the need to address the following items:

OVERALL REDUCTION IN SPACING STANDARDS – The number of exceptions indicates that a reasonable reduction in the spacing distances would be in order. The proposed changes should lower the number of exception requests and therefore support residential and business development in Virginia while assuring sufficient spacing to protect the public and maintain highway capacity.

SIGNAL SPACING – ½ mile signal spacing on principal arterials is specified for essentially all three speed limits: over 50, 35-45, and under 30mph. The source for this standard is a 26 year old study from Colorado. Since then computer software has evolved to enable signal timing to be more easily synchronized in a coordinated signal system to produce an orderly progression of traffic.

As a result, signal spacing can be less on highways with speeds below 50mph and still achieve operational efficiency. ½ mile signal spacing, though, is important for 55+ mph principal arterials, the statewide roadway network for through traffic.

URBAN – RURAL CRITERIA - This distinction was based on the premise that parcel size and road frontages are greater in rural areas so entrance spacing could be greater, too. Comments received over the past few years along with the fact that half of the approved exceptions were on rural highways indicates that rural road frontage, as in urban areas, is kept to a minimum to maximize the value of land for development. This is particularly true near interchange ramps.

Removing this distinction simplifies the spacing tables (Tables 2-2, 2-3, and 2-4) and eliminates the need for a developer and District staff to have figure out whether a highway is in an urban or rural area.

SEPARATE SPACING FOR CROSSOVERS/INTERSECTIONS VS. FULL ENTRANCES – Spacing for unsignalized crossovers/intersections and full access entrances are currently treated the same. Yet four-way intersections and crossovers require greater separation to accommodate the complex situations faced by motorists due to vehicular deceleration, acceleration, and numerous conflict points associated with vehicles crossing the highway combined with left and right turning movements. Intersections and crossovers also may become signalized over time.

SIGHT DISTANCE – Since the standards were produced in 2007/2008 a wide range of *intersection sight distance* (ISD) values have been established for two and multi-lane highways. ISD can offer good criteria for developing spacing for intersections, crossovers, and full access entrances. Using the length of a right turn lane for entrance spacing becomes problematic when entrances do not meet turn lane warrants. Spacing can be based on ISD for both four and two lane highways to assure that motorists have sufficient time to react to intersection/entrance traffic and right and left turning movements.

Because left turn movements are restricted at **partial access entrances** (usually right in/right out) the focus should be 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.

Entrance/Intersection Spacing Near Interchange Ramps

When the interchange access spacing standards in Tables 2-3 and 2-4 were prepared in 2007, the only study on the topic was a 1996 Oregon DOT research report.

In 2008, the Virginia Transportation Research Council released an 80 page report on the results of a five year study of 2,277 crashes near 186 interchange ramp locations in Virginia by researchers in the VA Tech Department of Statistics, Department of Civil/ Environmental Engineering, and Transportation Institute. The findings demonstrated that the traffic crash rate declined significantly at entrances/intersections located 750 ft and 990 ft from the ramps, with virtually no crashes at a distance of 1,320 ft or greater from the ramp.

These more recent research findings are applied to the Tables 2-3 and 2-4 spacing standards for entrances and intersections near interchange ramps.

Minimum Spacing Standards for Commercial Entrances, Intersections, and Crossovers: *New Spacing in Blue Italic*

Highway Functional Classification	Legal Speed Limit (mph) ^①	Centerline to Centerline Spacing in Feet						
		Signalized Intersections/ Crossovers ^②		Unsignalized Intersections/ Crossovers & Full Access Entrances ^③			Partial Access One or Two Way Entrances ^④	
Urban Principal Arterial	≤ 30 mph	1,760	<i>1,050</i>	<i>Xover</i>	Both	<i>Entrance</i>	270	<i>250</i>
	35 to 45 mph	2,640	<i>1,320</i>	<i>880</i>	1,050	<i>440</i>	325	<i>305</i>
	≥ 50 mph	2,640		<i>1,050</i>	1,320	<i>565</i>	510	<i>495</i>
Urban Minor Arterial	≤ 30 mph		880	<i>Xover</i>	Both	<i>Entrance</i>	270	<i>200</i>
	35 to 45 mph		1,050	<i>660</i>	660	<i>355</i>	305	<i>250</i>
	≥ 50 mph		1,320	<i>660</i>	660	<i>470</i>	425	<i>425</i>
Urban Collector	≤ 30 mph	660	425	<i>Xover</i>		<i>Entrance</i>	155	<i>200</i>
	35 to 45 mph	660	<i>425</i>	440		200 <i>225</i>	250	
	≥ 50 mph	1,050	<i>495</i>	440		305 <i>335</i>	360	
Rural Principal Arterial	≤ 30 mph	2,640	<i>1,050</i>	<i>Xover</i>	Both	<i>Entrance</i>	270	<i>250</i>
	35 to 45 mph	2,640	<i>1,320</i>	<i>880</i>	1,320	<i>440</i>	440	<i>305</i>
	≥ 50 mph	2,640		<i>1,050</i>	1,320	<i>565</i>	585	<i>495</i>
Rural Minor Arterial	≤ 30 mph	1,050	<i>880</i>	<i>Xover</i>	Both	<i>Entrance</i>	270	<i>200</i>
	35 to 45 mph	1,320	<i>1,050</i>	<i>660</i>	880	<i>355</i>	360	<i>250</i>
	≥ 50 mph	1,760	<i>1,320</i>	<i>660</i>	1,050	<i>470</i>	495	<i>425</i>
Rural Collector	≤ 30 mph	880	660	<i>Xover</i>		<i>Entrance</i>	200	
	35 to 45 mph	1,050	<i>660</i>	660	<i>440</i>	305 <i>225</i>	305	<i>250</i>
	≥ 50 mph	1,320	<i>1,050</i>	660	<i>440</i>	425 <i>335</i>	425	<i>360</i>
Local Street ^⑧	Commercial entrance spacing: See Figure 4-11.							

TABLE 2-2 MINIMUM SPACING STANDARDS FOR COMMERCIAL ENTRANCES, INTERSECTIONS AND CROSSOVERS ^⑨

Minimum Spacing Standards for Commercial Entrances, Intersections, and Crossovers

Highway Functional Classification	Legal Speed Limit (mph) ^①	Centerline to Centerline Spacing in Feet			
		Signalized Intersections/ Crossovers ^②	Unsignalized Intersections/ Crossovers ^③	Full Access Entrances ^④	Partial Access One or Two Way Entrances ^⑤
Principal Arterial	≤ 30 mph	1,050	880	440	250
	35 to 45 mph	1,320	1,050	565	305
	≥ 50 mph	2,640	1,320	750	495
Minor Arterial	≤ 30 mph	880	660	355	200
	35 to 45 mph	1,050	660	470	250
	≥ 50 mph	1,320	1,050	555	425
Collector	≤ 30 mph	660	440	225	200
	35 to 45 mph	660	440	335	250
	≥ 50 mph	1,050	660	445	360
Local Street ^⑥	Commercial entrance spacing: See Figure 4-11.				

TABLE 2-2 MINIMUM SPACING STANDARDS FOR COMMERCIAL ENTRANCES, INTERSECTIONS AND CROSSOVERS ^⑦

Notes: **A. Divided/undivided highway** - Spacing distances apply to both divided and undivided highways.

B. Crossovers - A proposed intersection that will require a new or closing an existing crossover on a divided highway must also be approved in accordance with the Crossover Location Approval Process Section.

C. Relationship between spacing standards - Signalized intersection spacing applies to other signals. The unsignalized intersection spacing is the minimum distance between such intersections and between unsignalized and signalized intersections. The partial entrance spacing separates such entrances from each other and from intersections.

D. Roundabouts - Roundabouts are separated from other intersections by the unsignalized intersection spacing standard; from other roundabouts by the partial access entrance spacing.

E. Spacing standards exceptions - See “exceptions to the spacing standards” presented later in this section.

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.

Footnotes to Table 2-2

- 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 on the minor intersecting road where the distance is greater than the Table 2-2 spacing standard. See Corner Clearance in Section 4 for more information.

Revisions in Blue

Spacing Standards for Commercial Entrances/Intersections Near Interchange Ramps

The spacing standards near interchange ramps focus on safe ramp exit and entry movements. Greater separation between ramp terminals and entrances and intersections is necessary for multilane versus two-lane highways because the motorist's maneuvers at multilane roads are more complex, such as crossing through lanes to reach a left turn lane at an intersection. Functional classification is not applied because arterials may be two lane or multilane. Note: If the off and/or on ramp has a full auxiliary lane, the spacing would be determined as if there were a ramp taper.

Minimum Spacing Standards for Commercial Entrances and Intersections Near Interchange Areas on Multilane Crossroads				
Type of Area	Spacing Dimension			
	X	Y	Z	M
Urban	750'	1320' 2640'	750' 990'	990'
Rural	1320'	2640'	1320'	1320'

Minimum Spacing Standards for Commercial Entrances and Intersections Near Interchange Areas on Multilane Crossroads			
X	Y	Z	M
750'	1320'	750'	990'

TABLE 2-3 MINIMUM SPACING STANDARDS FOR COMMERCIAL ENTRANCES AND INTERSECTIONS NEAR INTERCHANGE AREAS ON MULTILANE CROSSROADS

Source: [Access Control Design on Highway Interchanges, 2008](#).
 H. Rakha, A. M. Flintsch, M. Arafeh, G. Abdel-Salam, D. Dua, and M. Abbas.
 Virginia Tech Transportation Institute, Blacksburg, VA

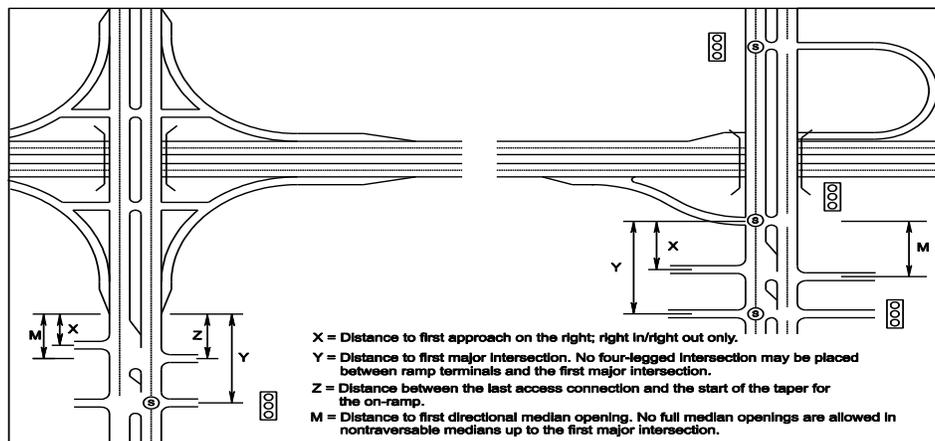


FIGURE 2-9 ACCESS CONTROL ON MULTI LANE HIGHWAYS AT INTERCHANGES

Minimum Spacing Standards for Commercial Entrances and Intersections Near Interchange Areas on Two-Lane Crossroads		
Type of Area	X or Z	Y
Urban	750'	1320'
Rural	1320'	1320'

Minimum Spacing Standards for Commercial Entrances and Intersections Near Interchange Areas on Two-Lane Crossroads	
X or Z	Y
750'	1320'

TABLE 2-4 MINIMUM SPACING STANDARDS FOR COMMERCIAL ENTRANCES AND INTERSECTIONS NEAR INTERCHANGE AREAS ON TWO-LANE CROSSROADS

Source: *Access Control Design on Highway Interchanges, 2008.*
 H. Rakha, A. M. Flintsch, M. Arafah, G. Abdel-Salam, D. Dua, and M. Abbas.
 Virginia Tech Transportation Institute, Blacksburg, VA

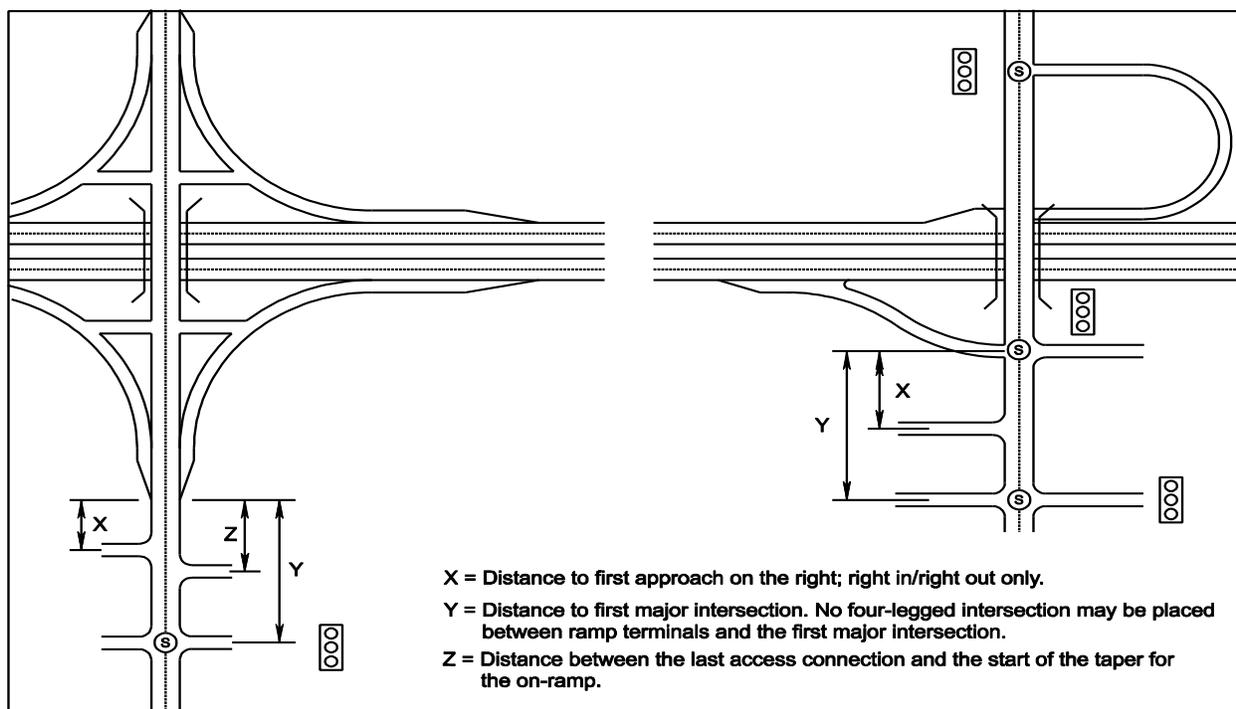


FIGURE 2-10 ACCESS CONTROL ON TWO LANE HIGHWAYS AT INTERCHANGES