MISSOURI DEPARTMENT OF TRANSPORTATION
ACCESS MANAGEMENT
GUIDELINES

2006

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1.0 ANALYSIS OF RETROFIT AND PERMIT APPLICATIONS

Where access is being managed on an existing roadway (a retrofit or permit project), it is often not possible to incorporate and attain all of the access management criteria due to economic, physical or other constraints. Care must be taken to balance economic interests with transportation needs. Economic impacts to business must be carefully considered and efforts must be made to mitigate those impacts. Collaboration with property owners and other stakeholders is the most effective method to achieve improvements that satisfy both operational and economic needs.

The collaboration process should begin in the early stages of the project. MoDOT staff should discuss the fundamentals and benefits of managed access with the stakeholders. Emphasis should be placed on safety and operational benefits and how those benefits can have a positive impact on property values and the business climate. Most stakeholders are more receptive after they gain an understanding of the concepts.

Understanding the concepts may not completely alleviate concerns. Adjoining property owners can remain hesitant to application of the principles on their individual properties. Personal meetings with each property owner to discuss and mitigate the needs of their site are often the best way to alleviate the concerns. Multiple meetings with some individuals may be necessary as proposals are discussed and their impacts are assessed. The resulting design may not be entirely satisfactory to either party. Instead the goal of the process should be to produce acceptable operational and safety impacts, while gaining consent of the stakeholders.

In cases where the access management criteria cannot be met, a detailed analysis should be performed to determine the optimum solution. This solution should strive to improve safety and operations along the roadway, and maintain uninterrupted flow on the transportation system and adequate access to the adjoining properties. Flexibility, good judgment, negotiation and compromise will be necessary to determine the right solution for each particular location.

While Highway Capacity Manual procedures can provide quick and reliable results for predicting whether or not a facility will be operating at or below capacity, they are generally limited in their ability to evaluate systems effects, queues and the effects of queues, and over saturated conditions. Additionally, there are several gaps in the Highway Capacity Manual procedures, such as roadways with the following:

- closely spaced traffic signals
- two-way left turn lanes
- roundabouts
- tight diamond interchanges
- freeway weaves
- other unique scenarios

In cases where Highway Capacity Manual procedures will not adequately analyze the roadway improvements, a microsimulation analysis may be appropriate. The VISSIM software package has been identified as the most capable of analyzing the limitations and gaps of the Highway Capacity Manual. In regards to roundabouts, the Highway

Capacity Manual may be used as a primary check of a roundabout's capacity, but additional operational analyses should use either the SIDRA or VISSIM software package.

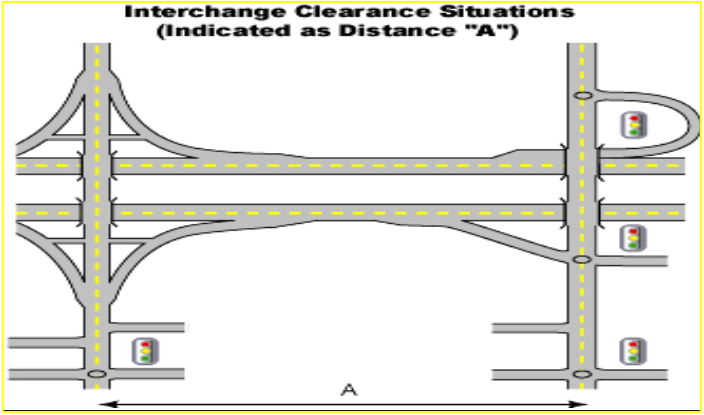
2.0 SPACING BETWEEN INTERCHANGES

What This Guideline Means

Adequate spacing is needed between grade-separated interchanges on high-speed roads to allow for safe and efficient weaving or changing of lanes for traffic that is entering and exiting. Generally, speeds are higher in rural areas; therefore, interchanges must be spaced farther apart there than in urban areas.

Interchange spacing decisions should be supported by an operational and level of traffic service analysis. Connectivity, speed, and safety should also be considered. In highly dense urban central city areas, the configuration of the local street system may require a closer interchange spacing to maintain connections and mobility.

Diagram



Guideline

Roadway Classification	In Current and Projected Urban Areas	In Rural Areas
Major	2– 3 miles *	2 – 5 miles
Minor	Generally Not Applicable	Generally Not Applicable

* Spacing less than two miles in urban areas may be considered, when analysis indicates the lesser spacing is acceptable. However, all other options should be considered, before spacing is reduced.

Spacing greater than the distances shown is advantageous for safety and operations. Distances shown are between the centers of interchanges.

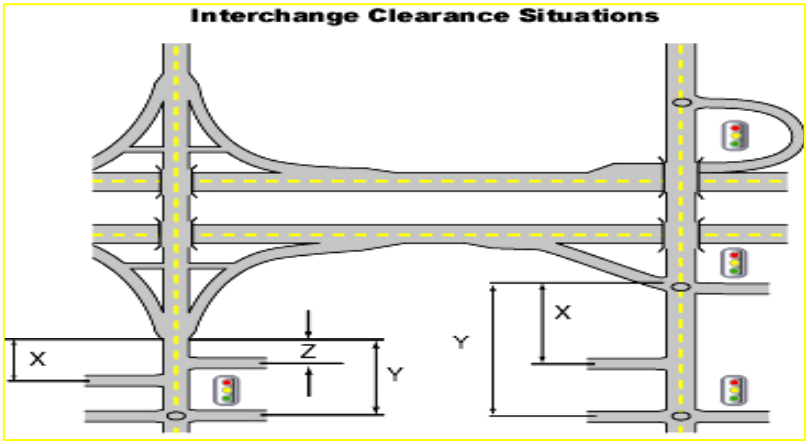
3.0 CLEARANCE OF FUNCTIONAL AREAS OF INTERCHANGES

What This Guideline Means

Adequate space is needed for traffic to make the transition from a road with interchanges to a road with at-grade access points. The functional area of the interchange is the area in which merging and diverging of traffic takes place. Drivers must travel along an exit ramp, find acceptable gaps, change lanes (weave), and merge within this distance.

A safe distance for this activity to occur should be provided from the end of the off ramp to the first driveway, median opening, or intersection with a public road. (This is measured from the point of intersection of the ramp baseline and roadway centerline.) When only right turns into or out of driveways or public roads are involved, a shorter clearance area may be used. These guidelines also apply to on-ramps and off ramps not associated with an interchange.

Diagram



X = Distance from baseline off-ramp to first right-in, right-out driveway/public road intersection.

Y = Distance from baseline off-ramp to first major public road intersection, full median opening, or left-turn opportunity.

Z = Distance from last right-in, right-out opportunity to baseline on-ramp.

Spacing greater than the distances shown is advantageous for safety and operations.

Guidelines for Interchange Area Clearance

Type of Area	Distance from Ramp to Right-In, Right-Out Driveway (X)	Distance to First Major Public Road Intersection, Full Median Opening, Or Left-Turn Opportunity (Y)*
Major	750 feet – 1,320 feet	1,320 feet – 2,640 feet
Minor	Generally Not Applicable	Generally Not Applicable

*Left turns should not be allowed in this section of roadway. The public road intersection is likely to become a signalized intersection as the interchange area develops. Right –in, right –out driveways configuration should include a non-traversable median.

Note: All ramp measurements are taken to or from baseline ramp.

Any clearance of less than the range contained in the above table should be supported by a study of alternatives to ensure safety and traffic flow. All reasonable alternatives, including relocating the interchange to a different location should be considered. Other alternatives to be examined may include installation of raised medians, construction of a single point urban interchange, the use of roundabouts at the ramp and or outer road intersections, or alternative access ways such as frontage and backage roads.

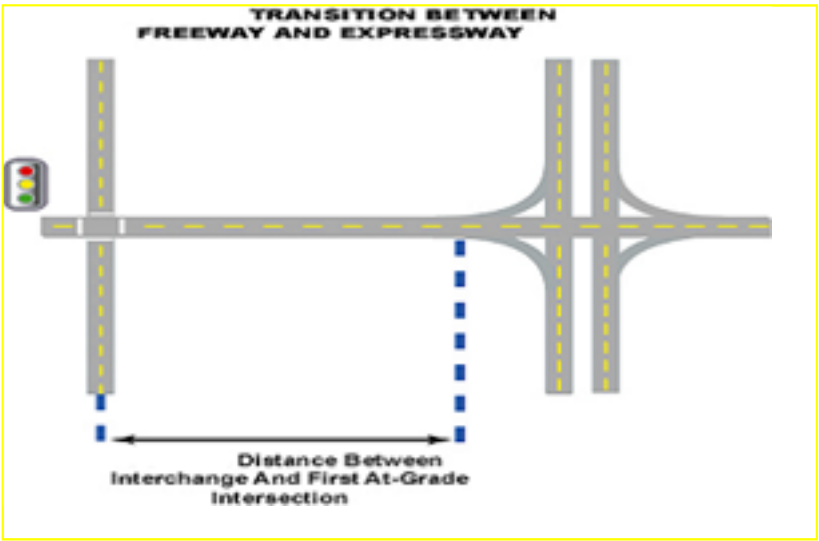
4.0 FREEWAY AND EXPRESSWAY TRANSITION

What This Guideline Means

Some major roads will consist of a mixture of freeway (with grade-separated interchanges and no driveway accesses) and expressways (with at-grade public road intersections and driveways). The transition between freeway and expressway must be carefully planned so drivers are well aware that a change in the access character of the roadway has occurred. This guideline does not apply to minor roads.

The following distances should be provided between the taper of the final ramp on a freeway cross section to the first at-grade intersection (and potentially the first traffic signal) on an expressway cross-section on the same facility.

Diagram



Guideline

Roadway Classification	In Current and Projected Urban Areas	In Rural Areas
Major - Freeway	No at-grade intersections	No at-grade intersections
Major - non Freeway	½ mile (2,640 feet) – 1 mile (5,280 feet)	1 mile (5,280 feet)
Minor	Generally Not Applicable	Generally Not Applicable

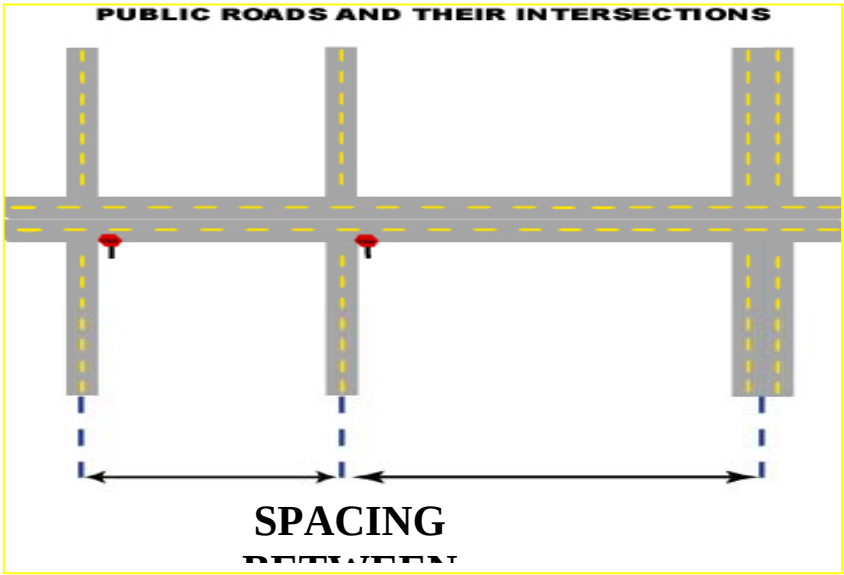
Spacing greater than the distances shown is advantageous for safety and operations.

5.0 AT-GRADE INTERSECTIONS SPACING

What This Guideline Means

This guideline provides for adequate spacing between intersections. Major roadways are mainly intended to serve through traffic and should have intersections that are spaced the farthest apart. Minor roadways provide some service to through traffic but also provide direct access to property; therefore, they can be placed closer together.

Diagram



Guideline

Roadway Classification	In Current and Projected Urban Areas	In Rural Areas
Major - Freeway	No at grade intersections	No at grade intersections
Major – Non Freeway	½ mile (2,640 feet) – 1 mile (5,280 feet)	> 1 mile (5,280 feet)
Minor	⅛mile (660 feet) - ¼ mile (1,320 feet)	¼ mile (1,320 feet) - ½ mile (2,640 feet)

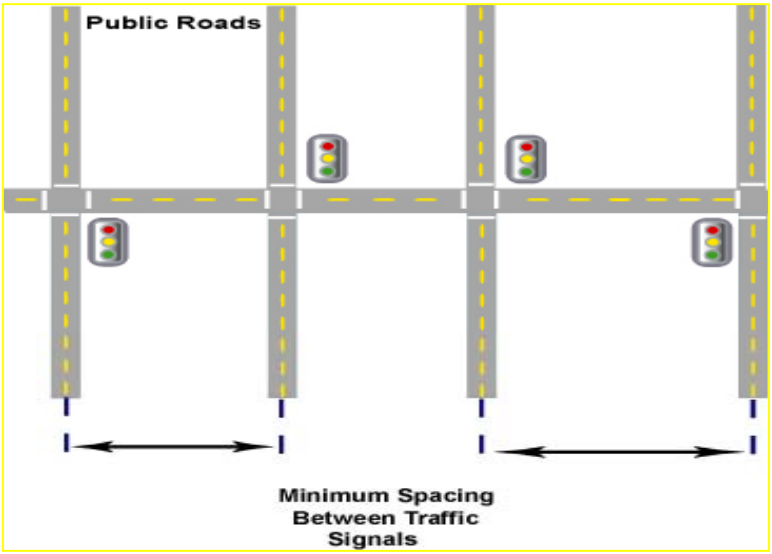
Spacing greater than the distances shown is advantageous for safety and operations.

6.0 TRAFFIC SIGNAL SPACING

What This Guideline Means

Appropriate signal spacing is needed to preserve efficient traffic flow and progression on urban arterial roadways; for instance, a quarter- or half-mile spacing allows traffic signals to be effectively interconnected and synchronized. Adequate spacing will also tend to reduce rear-end collisions and “stop and go” driving that increases congestion, delay, and air pollution. In urban areas, these guidelines were developed to allow for smooth operations given a 90-second total traffic signal cycle length.

Diagram



Minimum Guideline

Roadway Classification	In Current and Projected Urban Areas	In Rural Areas
Major - Freeway	Traffic signals not allowed	Traffic signals not allowed
Major – Non Freeway	½ mile (2,640 feet) to 1 mile (5,280)	See note below *
Minor	¼ mile (1320) to ½ mile (2,640 feet)	See note below *

* Rural traffic signals are generally isolated signals rather than signals placed in a progression along a route. Signals should be placed at least one mile (5,280 feet) apart because of high operating speeds in rural areas.

7.0 MEDIAN OPENING SPACING

What This Guideline Means

Openings in raised medians should only be provided to accommodate turning traffic in locations where this can be safely done. Where openings are provided, an adequate spacing between them is necessary to allow for weaving of traffic to preserve traffic flow and provide for safe lane changes and turns.

A full opening allows turns to be made in both directions; a directional opening allows turns to be made in only one direction. An example of a directional median would be one that allows left turns into a driveway but does not allow left turns to be made out.

Median openings should not be allowed under the following circumstances:

- On interstates or other freeways
- Within the functional area of an interchange
- Within the functional area of an intersection between two public roads
- At locations that have high accident rates

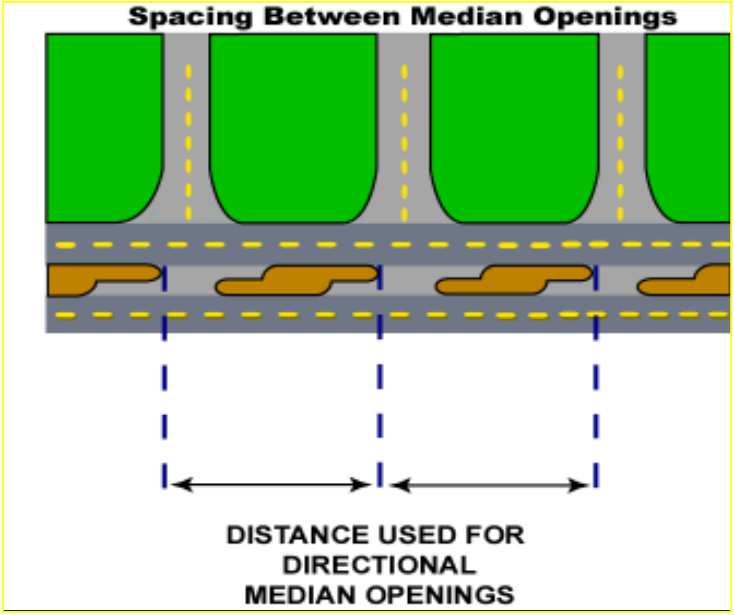
Under conditions of inadequate sight distance, median openings *shall not* be allowed.

Traffic studies should support the required length of queue storage for major traffic generators such as a shopping mall or industrial plant. For additional guidance on left turn queue storage see

Accommodating Safe U-Turns

In cases where left turns are restricted by lack of median openings, care must be taken to allow for U-turns to be made in a safe manner. U-turns can be safely accommodated through a variety of means, including signal phasing and timing, widening, and including physical design features such as turning lanes and “jug handles.” Where U-turns cannot be made safely, they should be explicitly prohibited. U-turn opportunities should be designed with an appropriate typical design vehicle.

Diagram



Minimum Guideline

Roadway Classification	In Current and Projected Urban Areas	In Rural Areas
Major - Freeway	No median openings allowed	No median openings allowed
Major – Non Freeway	1,320 to 2,640 feet (full) 660 to 1320 feet (directional)	1320 to 2640 feet (spacing should increase with higher posted speed)
Minor	1,320 feet (full) 660 feet (directional)	Generally not applicable

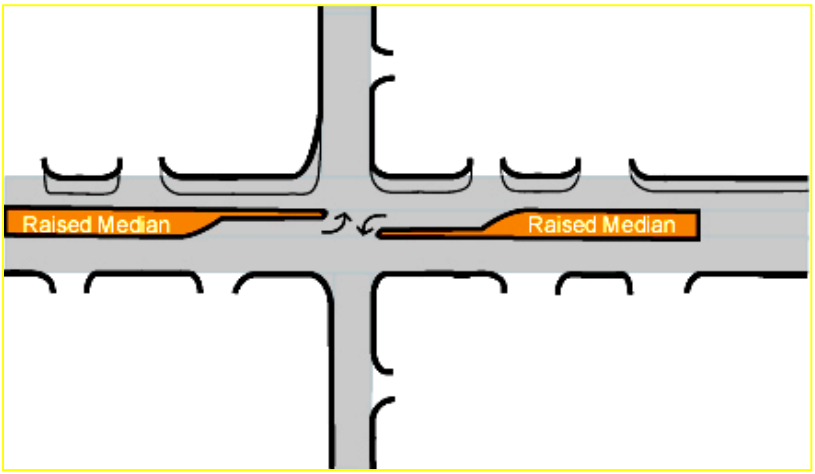
8.0 RAISED MEDIANS

What This Guideline Means

Raised medians are the most effective access management strategy on high-volume urban routes. Roadways with raised medians are at least 25 percent safer than multi-lane undivided sections and 15 percent safer than two-way left-turn lane cross sections in such high traffic situations.

In general, use of raised medians is recommended where current and projected traffic volume is greater than 28,000 average annual daily traffic (AADT). Raised medians are especially recommended in corridors where the traffic volume is high, the density of commercial driveways is high (over 20 -30 per mile in both directions), and other access management strategies such as driveway consolidation and corner clearance are not practical. Raised medians should be used on arterial facilities with three or more through traffic lanes in each direction.

Diagram



Guideline

Roadway Classification	In Current and Projected Urban Areas	In Rural Areas
Major - Freeway	Not applicable	Not applicable
Major – Non Freeway	Raised median when current and projected traffic exceeds 28,000 AADT	flush median
Minor	Raised median when current and projected traffic exceeds 28,000 AADT	flush median

9.0 AUXILIARY ACCELERATION AND TURNING LANES

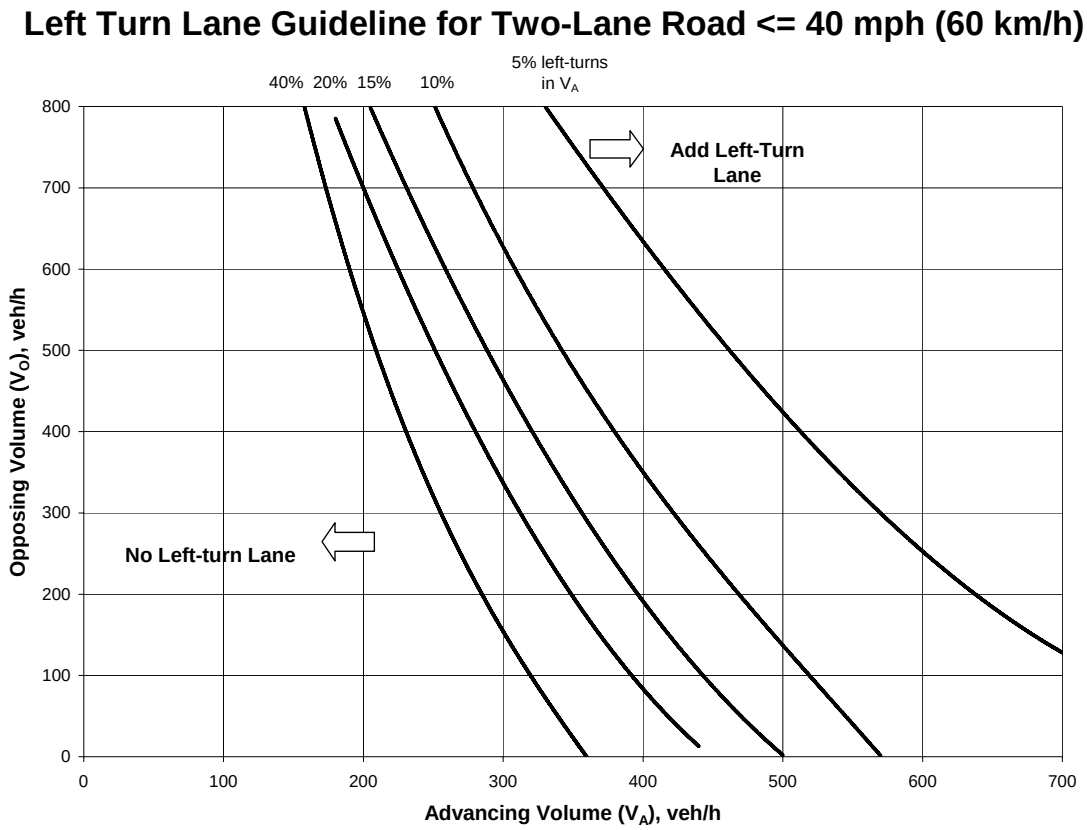
What This Guideline Means

Dedicated left- and right-turn lanes should be provided in situations where traffic volumes and speeds are relatively high and conflicts are likely to develop at public road intersections and driveways between through and turning traffic. Auxiliary lanes are an asset in promoting safety and improved traffic flow in such situations. Some major applications for and considerations for the design of auxiliary lanes are as follows:

- Installing a right-turn acceleration lane. These lanes allow entering vehicles (those that have turned right from a driveway or minor public road onto the major route) to accelerate before entering the through-traffic flow. Acceleration lanes should be considered on roadway segments, intersections and driveways with high traffic volumes where speed differential could result in unacceptable conflicts and/or delay. Acceleration lanes may also be appropriate where crash experience indicates a problem with right-turning, entering vehicles. The right-turn acceleration lane should be of a sufficient length to allow safe and efficient merge maneuvers. The design length, tapers, and other features of right-turn acceleration lanes should be guided by a traffic study.

- Installing auxiliary left-turn lanes. Such lanes, installed in the roadway center, are intended to remove turning vehicles from the through traffic flow. This should reduce the frequency of rear-end collisions at locations where there is considerable left-turn ingress activity, such as major driveways and minor public road intersections. Left-turn lane warrants are shown in the following figures. To use the figures, peak hour traffic counts, including directional splits, will be required, which may be obtained from District Traffic Staff. In addition, the ITE Trip Generation Manual may be used as an estimate for peak hour traffic counts. For design year analyses, appropriate growth rates will be required, which may be obtained from Planning Staff.

- The use and design of auxiliary left-turn lanes should be guided by a traffic study. In general, auxiliary left-turn lanes must be long enough to accommodate a safe deceleration distance and to provide adequate storage of a queue for expected peak hour turning traffic. The Engineering Policy Guide should be consulted for appropriate storage and deceleration lengths.

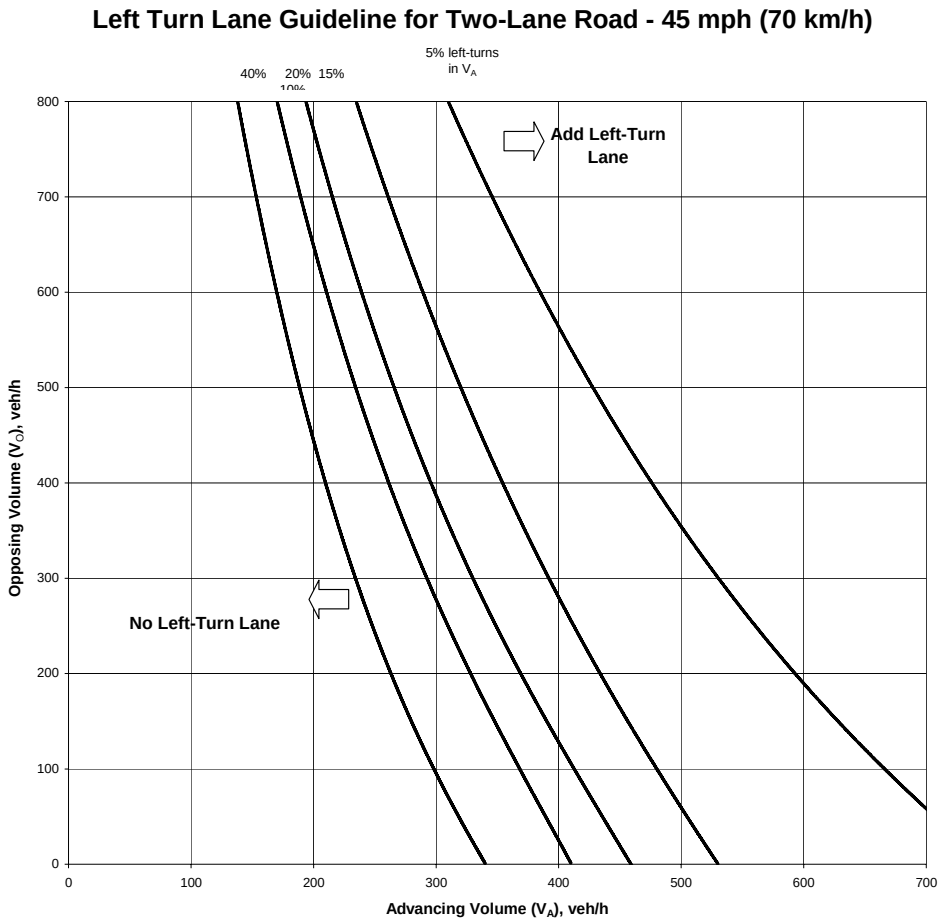


The following data are required:

1. Opposing Volume (veh/hr) - V_O - The opposing volume should include only the right-turn and through movements in the opposite direction of the left turning vehicle.
2. Advancing Volume (veh/hr) - V_A - The advancing volume should include the right-turn, left-turn and through movements in the same direction as the left turning vehicle.
3. Operating Speed (mph) - The greater of design or posted speed.
4. Percentage of left turns in V_A

Left turn lane is not needed for left turn volume less than 10 vph. However, criteria other than volume, such as crash experience, may be used to justify a left turn lane.

The appropriate trend line is identified on the basis of the percentage of left-turns in the advancing volume, rounded up to the nearest percentage trend line. If the advancing and opposing volume combination intersects above or to the right of this trend line, a left-turn lane is appropriate.



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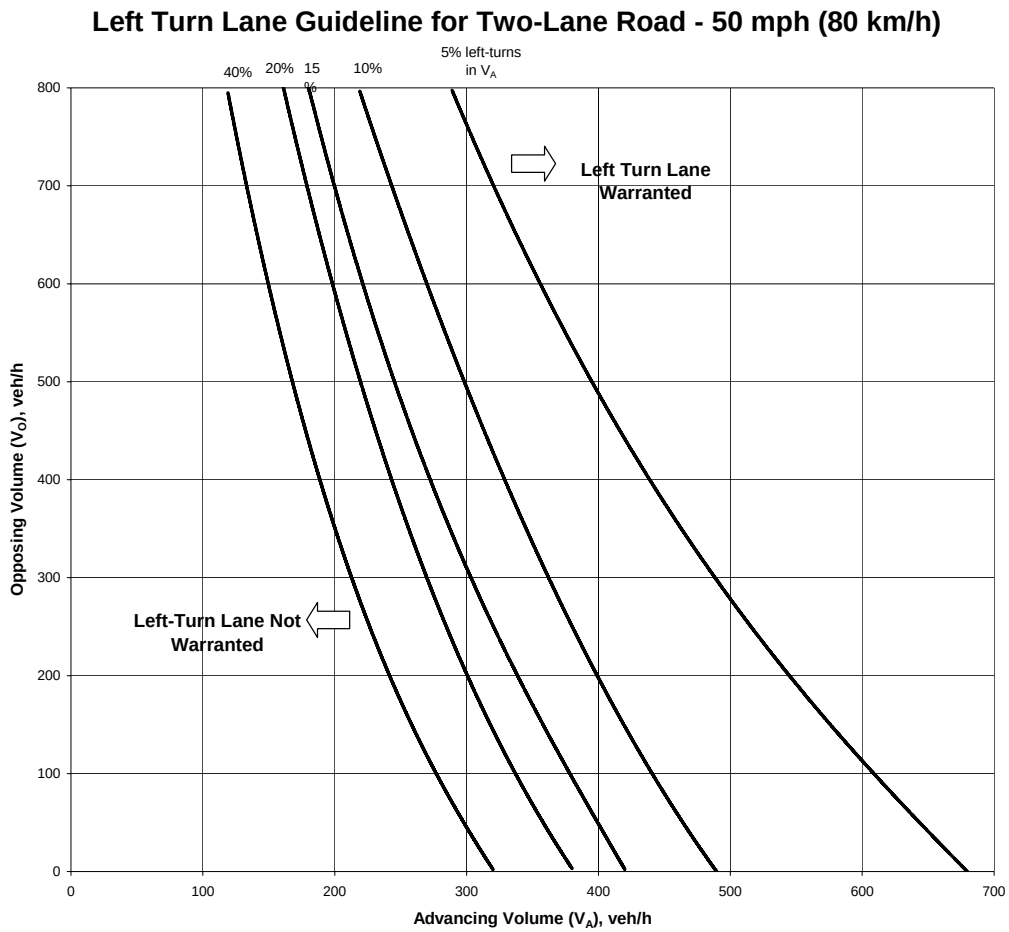

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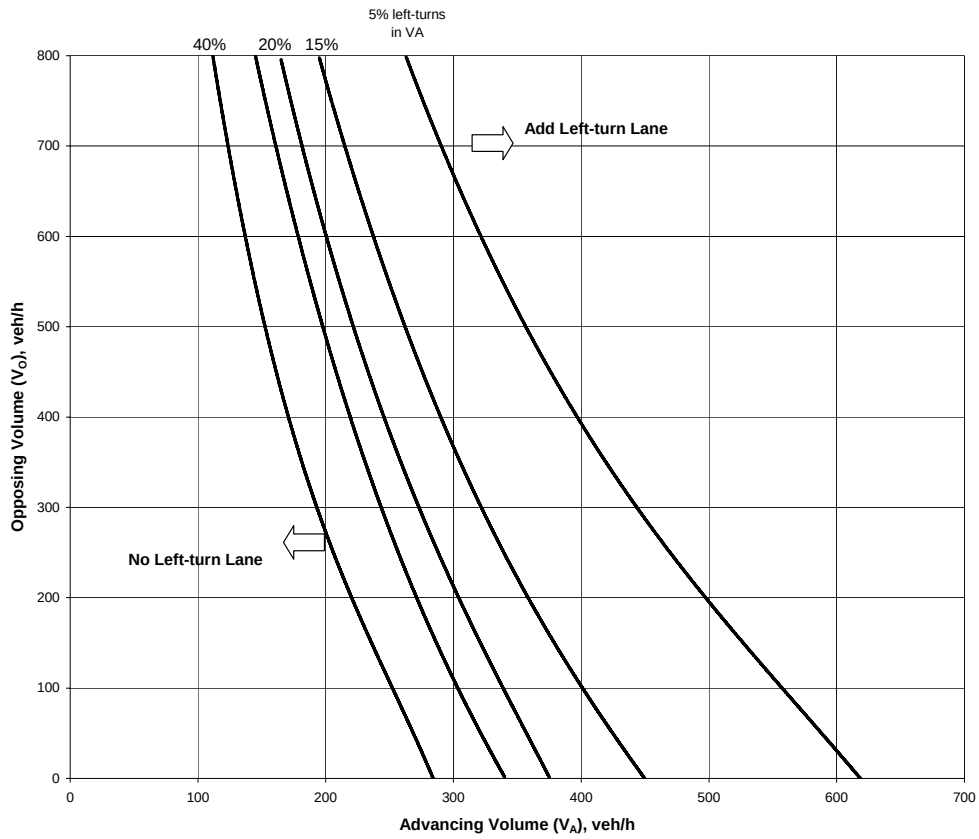
Left Turn Lane Guideline for Two-Lane Road - 55 mph (90 km/h)



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2. Advancing Volume (veh/hr) - V_A - The advancing volume should include the right-turn, left-turn and through movements in the same direction as the left turning vehicle.
3. Operating Speed (mph) - The greater of design or posted speed.
4. Percentage of left turns in V_A

Left turn lane is not needed for left turn volume less than 10 vph. However, criteria other than volume, such as crash experience, may be used to justify a left turn lane.

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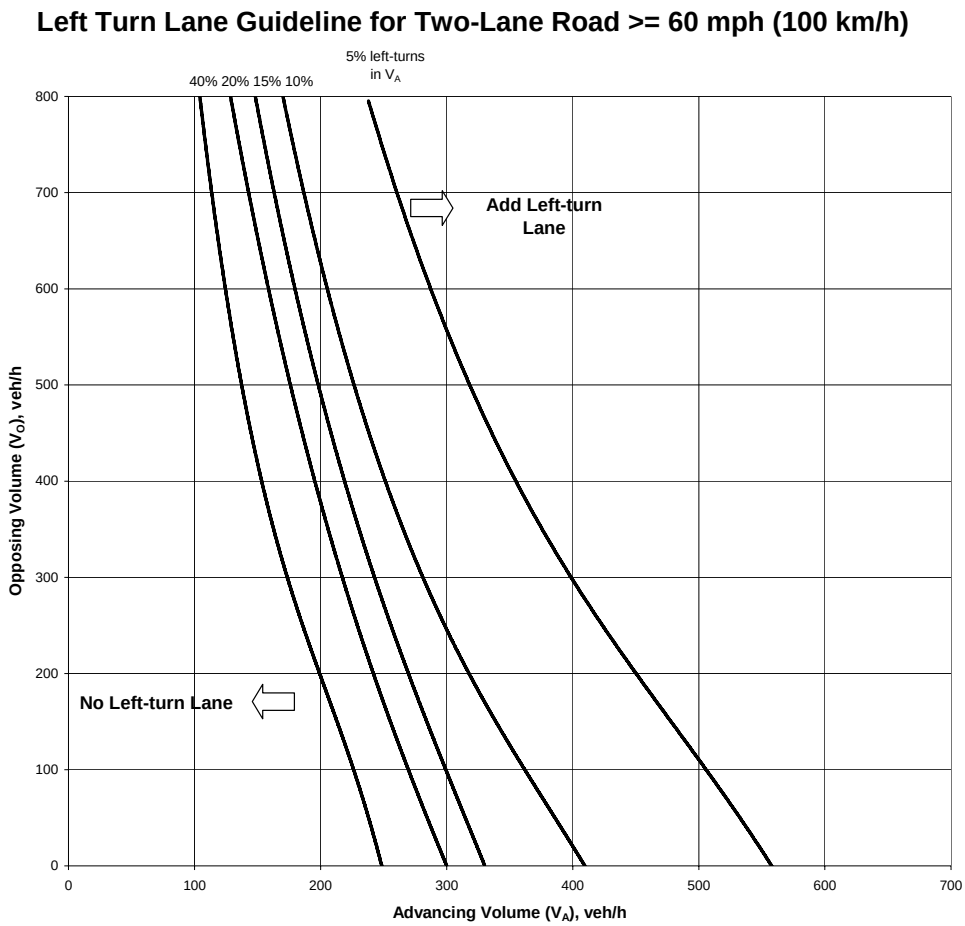

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2. Advancing Volume (veh/hr) - V_A - The advancing volume should include the right-turn, left-turn and through movements in the same direction as the left turning vehicle.
3. Operating Speed (mph) - The greater of design or posted speed.
4. Percentage of left turns in V_A

Left turn lane is not needed for left turn volume less than 10 vph. However, criteria other than volume, such as crash experience, may be used to justify a left turn lane.

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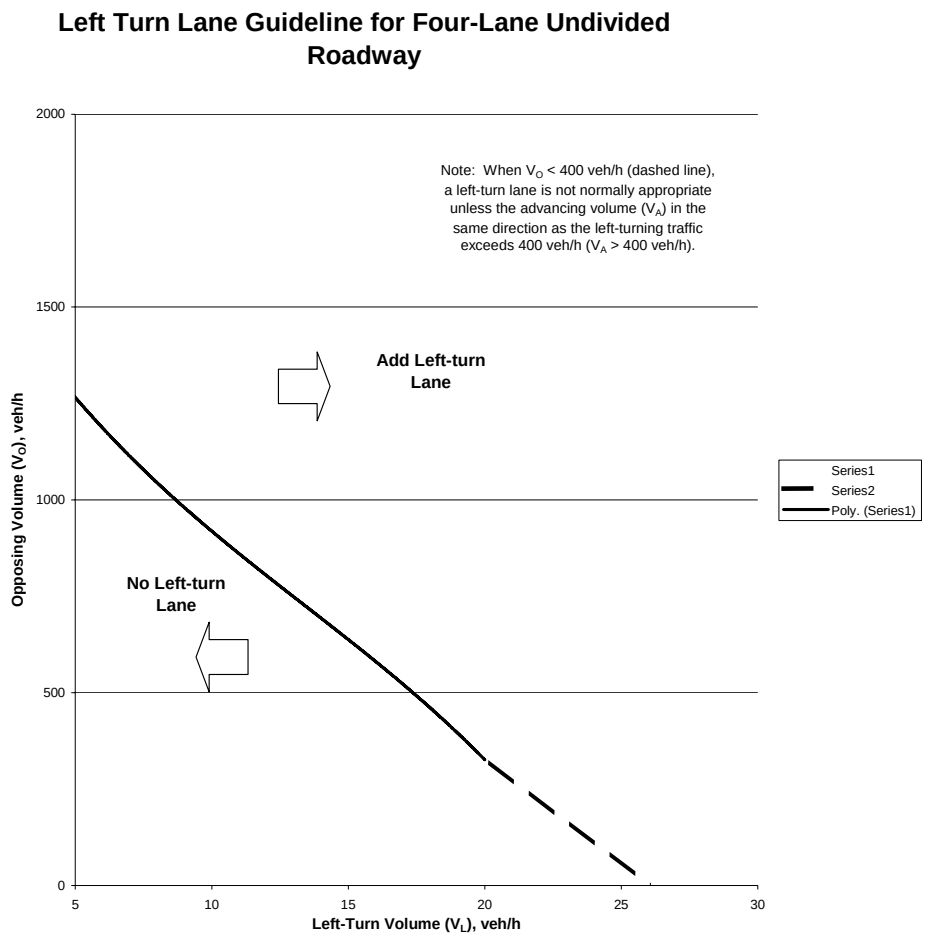


The following data are required:

1. Opposing Volume (veh/hr) - V_O - The opposing volume should include only the right-turn and through movements in the opposite direction of the left turning vehicle.
2. Left-Turn Volume – V_L

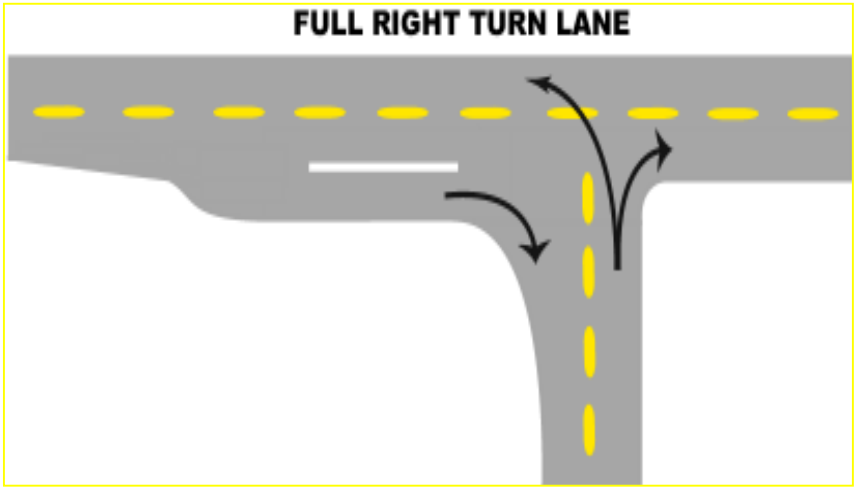
If the opposing and left-turn volume combination intersects above or to the right of the trend line, a left-turn lane is appropriate.

- Installing auxiliary right-turn lanes. The use of dedicated right-turn lanes should also be guided by a traffic study. In general, dedicated right-turn lanes should be provided in both rural and urban areas on two lane routes as shown in the figures below. Right-turn lane warrants are shown in the following figures. To use the figures, peak hour traffic counts, including directional splits, will be required, which may be obtained from District Traffic Staff. In addition, the ITE Trip Generation Manual may be used as an estimate for peak hour traffic counts. For design year analyses, appropriate growth rates will be required, which may be obtained from Planning Staff.

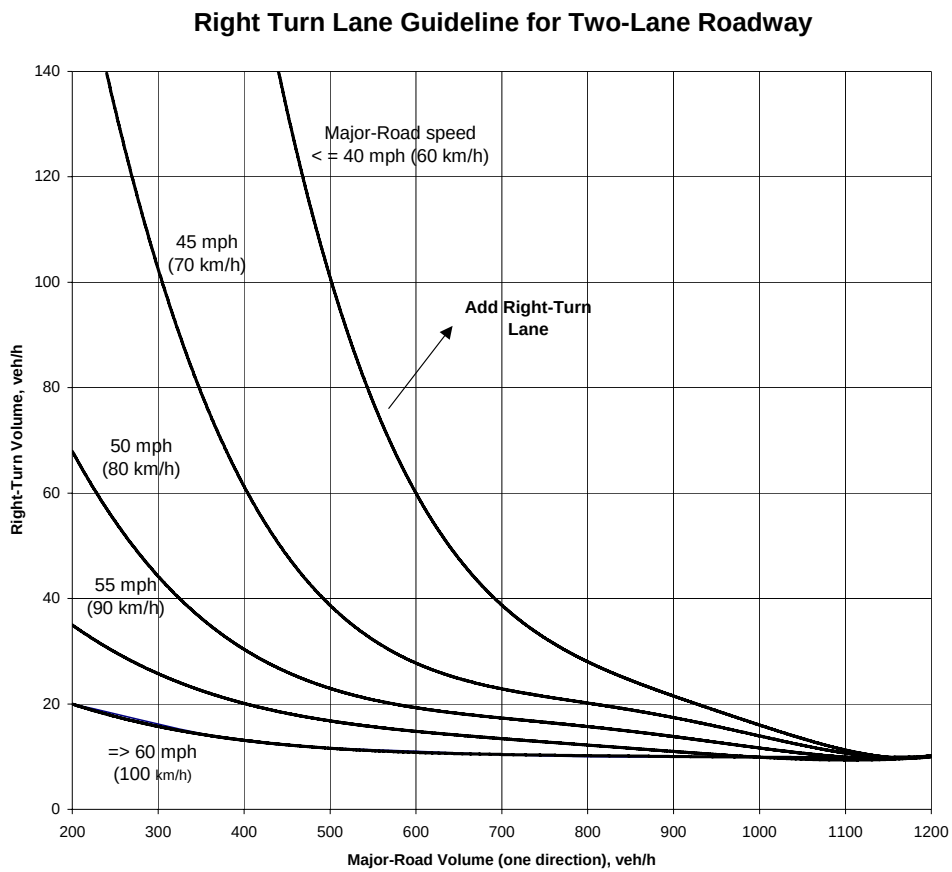
Dedicated right turn lanes should also be strongly considered in situations where:

- Poor internal site design and circulation leads to backups on the mainline. Auto-oriented businesses with short drive-through lanes or poorly-designed parking lots would be prime examples of this situation.
- The peak hour turning traffic activity is unusually high (e.g. greater than 10 percent of the daily total.)
- Operating speeds on the mainline route are very high (greater than 60 miles per hour) and right turns would generally not be expected by drivers.
- The driveway or minor public road intersection is difficult for drivers to see.
- The driveway entrance is gated or otherwise must be entered very slowly.
- Right turning traffic consists of an unusually high number of trailers or other large vehicles.
- The intersection or driveway angle is highly skewed.
- Rear end collision experience is unusually high at a location.

Diagram



As with any auxiliary turning lane, dedicated right-turn lanes should be designed based on the results of a traffic study.

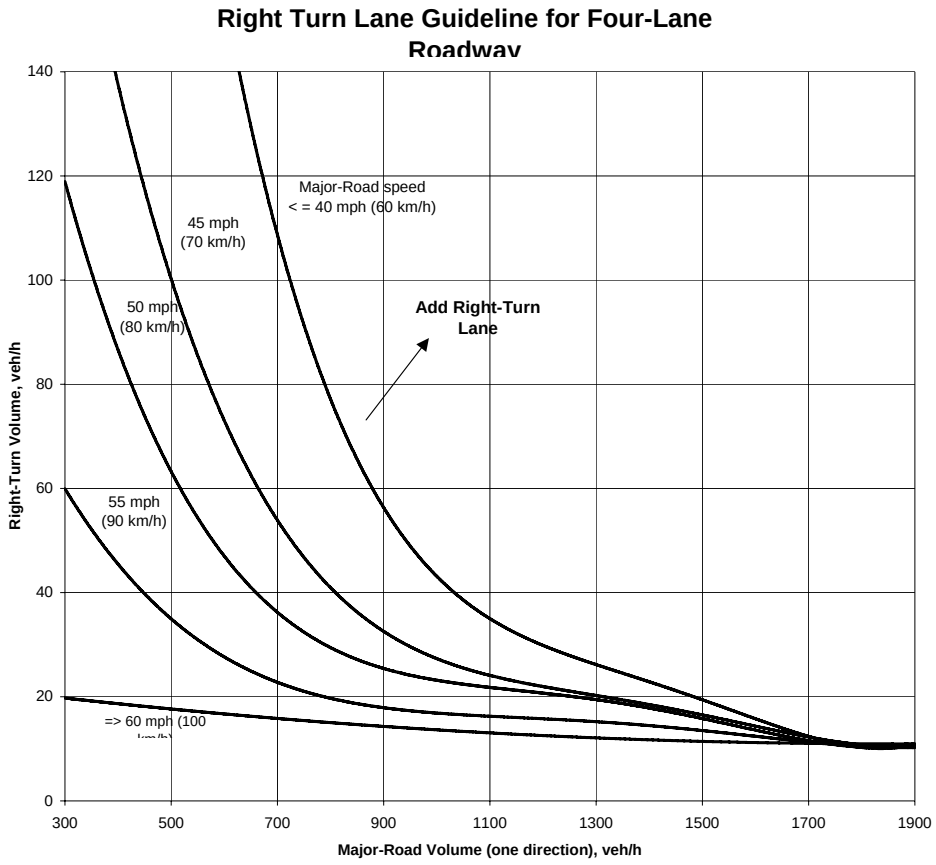


The following data are required:

1. Advancing Volume (veh/hr) - The advancing volume should include the right-turn, left-turn and through movements in the same direction as the right turning vehicle.
2. Right Turning Volume (veh/hr) - The right turning volume is the number of advancing vehicles turning right.
3. Operating Speed (mph) - The greater of design or posted speed.

Note: Right turn lane is not needed for right turn volume less than 10 vph. However, criteria other than volume, e.g. crash experience, may be used to justify a right turn lane.

If the combination of major-road approach volume and right-turn volume intersects above or to the right of the speed trend line corresponding the major road operating speed, then a right-turn lane is appropriate.



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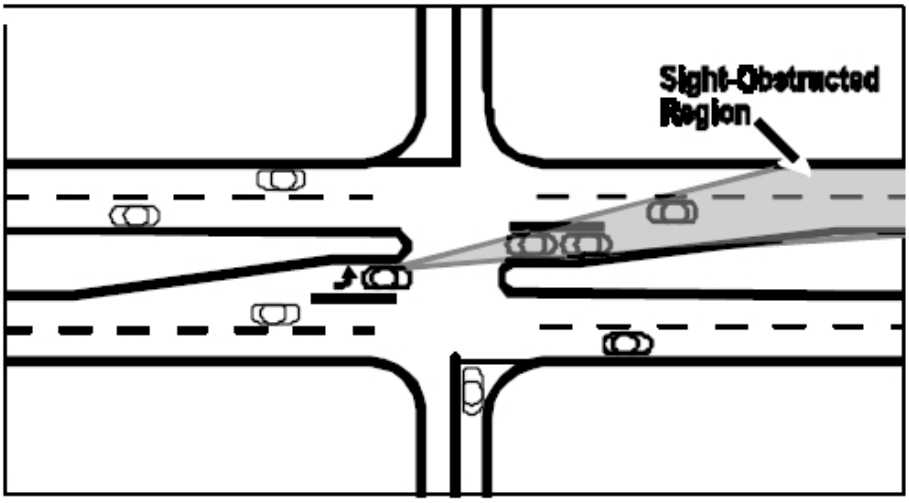
3. Operating Speed (mph) - The greater of design or posted speed.

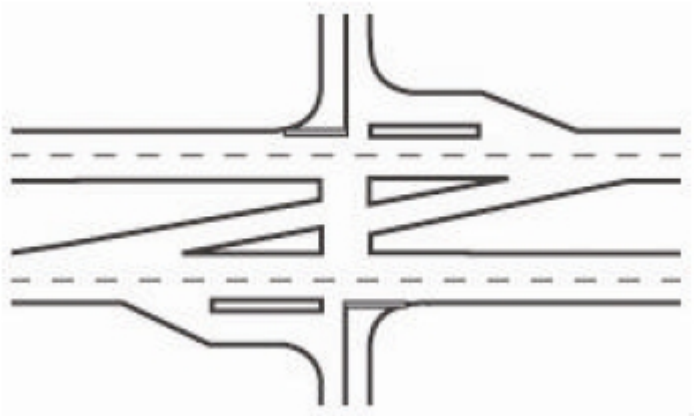
Note: Right turn lane not warranted for right turn volume less than 10 vph. However, criteria other than volume, e.g. crash experience, may be used to justify a right turn lane.

If the combination of major-road approach volume and right-turn volume intersects above or to the right of the speed trend line corresponding the major road operating speed, then a right-turn lane is appropriate.

- **Offset Right- and Left- Turn Lanes**

Vehicles in the right-turn lane tend to obstruct the vision of drivers waiting at the stop bar of the minor roadway. One way to reduce the obstruction of the minor roadway drivers' view is to offset the right-hand turning bay to the right. Similarly, vehicles in the opposing left-turn lane block the views of left-turning vehicles from the opposite direction, as shown in the figure below. An example intersection with offset right- and left-turn lanes is shown below. Offsetting left-turn lanes to the left as far as practical improves the visibility of opposing traffic. By improving the visibility of opposing traffic, drivers can more effectively use available gaps. Offsetting right-turn lanes to the right gives drivers on the minor approach (at the stop bar) an unobstructed view of oncoming traffic in the near expressway lanes, which allows for more effective use of gaps.





Rural Expressway Intersection Synthesis of Practice and Crash Analysis
Center for Transportation Research and Education – October 2004

Consideration should be given to offset right- and left-turn lanes lane in locations with high mainline operating speeds, large percentage of turning trucks, unique sight distance issues, or crash experience where investigation of crash diagrams indicates a safety benefit may be obtained from an offset turn lane. Care should be taken when implementing offset auxiliary turn lanes to ensue the horizontal geometry of the roadway does not negate the line-of-sight improvement.

10.0 TWO-WAY LEFT-TURN LANES ("Five-Lane" Facilities)

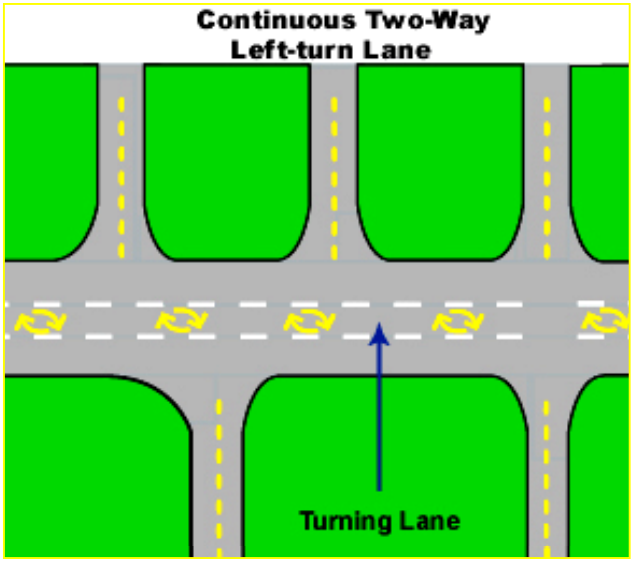
What This Guideline Means

Two-way left-turn lanes may be effective as an access management tool when used in conjunction with other techniques such as driveway consolidation and corner clearance. TWLTL cross sections work best in situations where traffic volume and the density of driveways is relatively low, and the proportion of left-turning vehicles is relatively high. TWLTL's are recommended in places where commercial driveways make up a substantial portion of total driveways and where the percentage of vehicles turning left at peak hour is approximately 20 percent or greater.

TWLTL's may be inappropriate where the commercial driveway density is above the driveway spacing guideline. Research indicates that when commercial driveway density is over 24 per mile (12 per mile in each direction), crash rates increase significantly. This roughly equates to an average driveway spacing of 440 feet. TWLTL configurations should generally be avoided unless driveway density can be kept at that level or below, or other viable alternatives do not exist.

TWLTL configurations are not recommended along high traffic volume (over 28,000 AADT) urban routes; in such situations raised medians are at least 25 percent safer than multilane undivided sections and 15 percent safer than TWLTL cross sections. TWLTL configurations should not be used on facilities with more than four through-traffic lanes, e.g., to create a "seven lane" facility. Crash experience with such large roadway cross sections is poor.

Diagram



Guideline

Roadway Classification	In Current and Projected Urban Areas	In Rural Areas
Major - Freeway	Not applicable	Not applicable
Major – Non Freeway	May be used when appropriate if AADT in design year is less than 28,000; otherwise use a raised median	Not recommended
Minor	May be used when appropriate if AADT in design year is less than 28,000; otherwise use a raised median	Not recommended

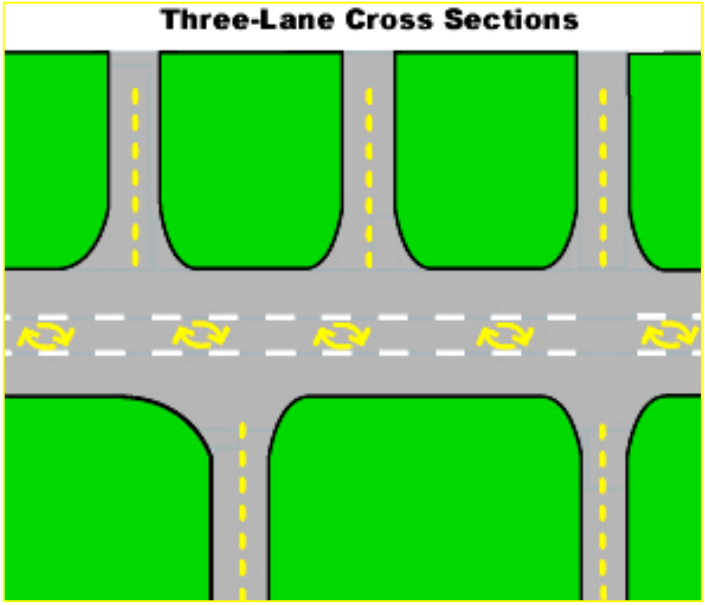
11.0 THREE-LANE CROSS SECTIONS

What This Guideline Means

Three-lane cross sections (two through lanes with a TWLTL in the center) are approximatelyt 25 percent safer than an undivided four-lane road and can provide comparable capacity provided that intersections are well designed. They work best in situations where traffic volumes are moderate and where the proportion of vehicles turning left is high. The use of TWLTL's should be discouraged in rural areas, as their use in high speed, low volume situations can lead to increase in head on crashes. They should also be avoided in urban areas where the design year traffic is expected to grow beyond 17,500 AADT. TWLTL's are best used in situations where driveway density is low to moderate (e.g., below 24 commercial driveways per mile, which equates to a spacing of about 440 feet between driveways).

This guideline does not refer to third lanes used as passing, turning, or climbing lanes in rural areas.

Diagram



Guidelines

Roadway Classification	In Current and Projected Urban Areas	In Rural Areas
Major - Freeway	Not applicable	Not applicable
Major – Non Freeway	May be used when appropriate and where AADT in design year is less than 17,500	Not recommended
Minor	May be used when appropriate and where AADT in design year is less than 17,500	Not recommended

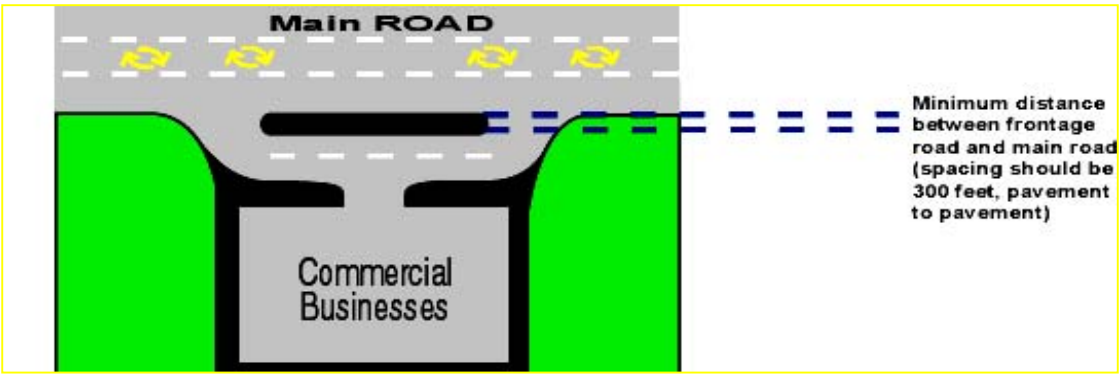
12.0 FRONTAGE AND BACKAGE ROADS

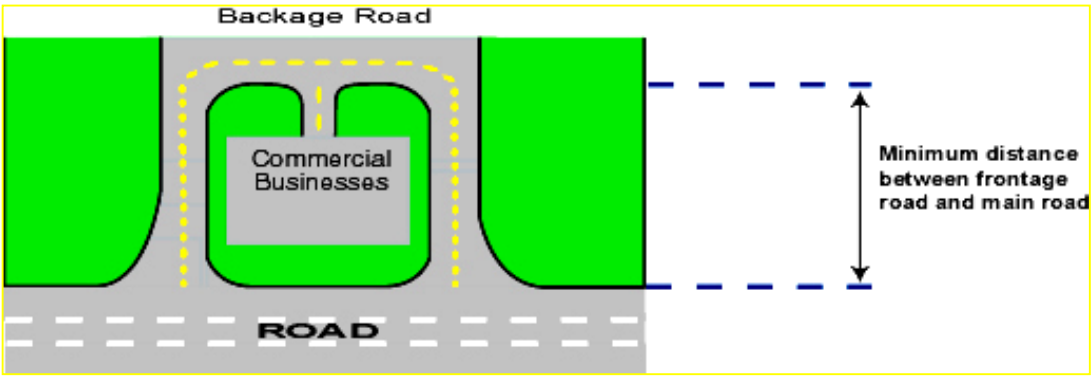
What This Guideline Means

Frontage and backage roads provide alternative access to property and help remove turning traffic from the through traffic on a mainline route. A frontage road provides alternative access at the front of properties while a backage road provides alternative access at the rear of properties.

Frontage and backage roads can dramatically improve safety and operations. However, a common mistake involves placing frontage or backage roads in close proximity to the mainline. Placing frontage roads very close to mainline roads can create additional opportunities for delay, congestion, and crashes because insufficient storage ("throat length") is provided for entering and exiting vehicles.

Diagrams





Guideline

Backage roads should be spaced approximately 300 feet or more from the mainline route. Measurements should be taken from pavement edge to pavement edge. Backage roads are more advantageous than frontage roads because they minimize visual distractions and headlight glare on both the mainline and backage road. The backage configuration is particularly conducive to ownership by other governmental entities. Frontage roads may be more appropriate on freeways, especially those where MoDOT will maintain and operate the outer road system. See "Clearance at Functional Area of Interchanges" for further spacing recommendations.

13.0 DRIVEWAY SPACING

What This Guideline Means

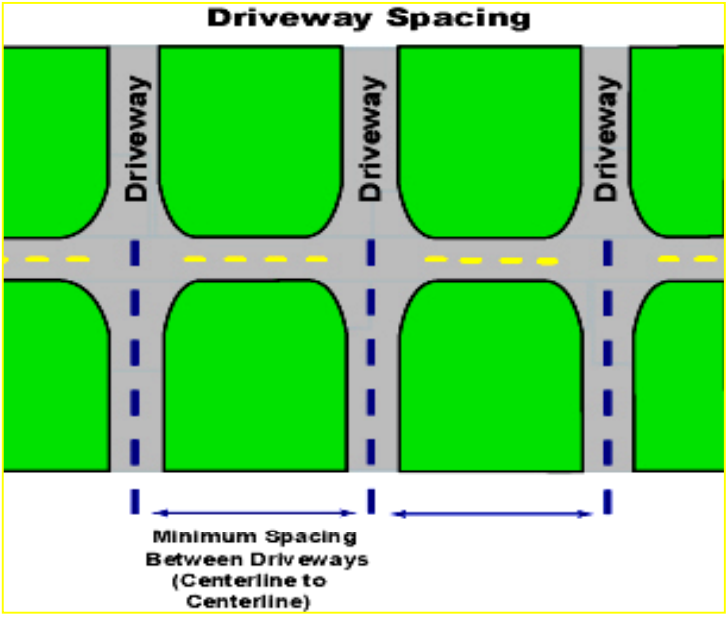
This guideline describes the recommended spacing between private driveways necessary to preserve both safety and traffic flow. Spacing between driveways must be longer on higher speed routes in rural areas than in urban areas. In urban areas, these guidelines allow for about one driveway per city block face on non freeway- major roadways and two driveways per block face on minor roadways.

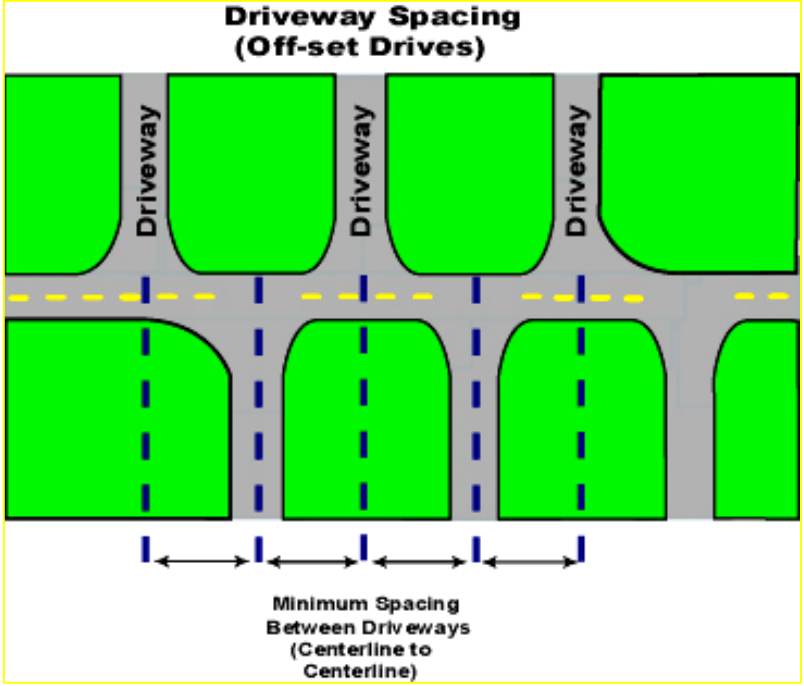
In order to preserve spacing, direct access should be moved to local streets (not arterials) where possible. In particular, access for corner lots should be moved to a lower traffic side street whenever possible. Access can often be better accomplished on major streets through such means as frontage and backage roads, joint access, cross access, and shared driveways. This guideline only applies where sight distance allows. Driveways should *not* be allowed where sight distance is inadequate even if the driveway spacing guideline would allow them.

Driveway accesses should be provided on local and collector streets ("side streets") rather than arterials wherever possible. Driveways should also be lined up across the public roadway from each other whenever possible. When driveways are not lined up, the spacing should be measured from the closest driveway on either side of the road, except where a non-traversable (e.g., raised) median exists.

On urban routes where non-traversable medians exist, shorter driveway spacing may be acceptable for right-in, right-out driveways only.

Diagrams





Guideline

Roadway Classification	In Current and Projected Urban Areas	In Rural Areas
Major - Freeway	No driveways	No driveways
Major – Non Freeway	440 to 660 feet	660 to 1,320 feet *
Minor	220 to 330 feet	330 to 440 feet *

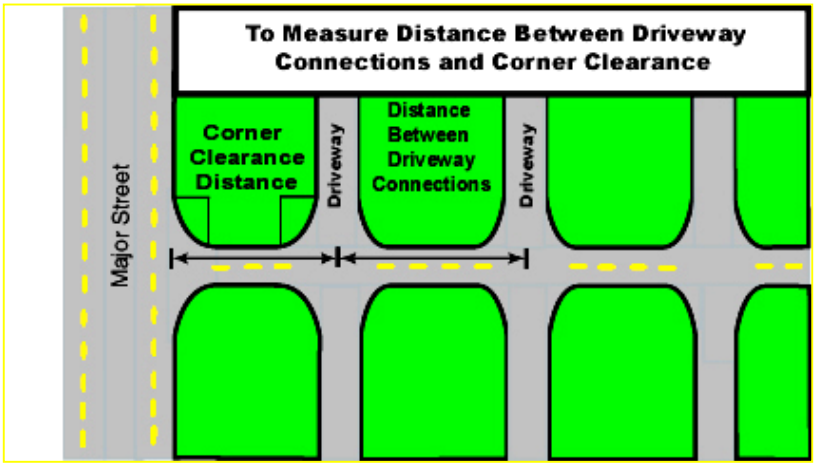
* The urban guideline may be applied in developed areas that are not urban, for example, cities with populations under 5,000. On collectors in cities with population under 5,000, the guideline is 220 feet (same as the urban guideline).

14.0 DRIVEWAY CORNER CLEARANCE

What This Guideline Means

Corner clearance represents the distance between the corner of the intersection of two public roadways and the next private driveway. It is important to provide enough distance between the corner and the first driveway to effectively separate conflict points and to allow drivers enough time to make safe maneuvers. When corners are not adequately cleared, crash rates and delay increase. These guidelines correspond to the driveway spacing guidelines for the same roadway classification. However, maintaining adequate corner clearance is more critical for safety and operations than mid block driveway spacing. *This guideline only applies where the sight distance guideline allows.*

Diagram



Guideline

Roadway Classification	In Current and Projected Urban Areas	In Rural Areas
Major - Freeway	No driveways	No driveways
Major – Non Freeway	440 to 660 feet	660 to 1,320 feet *
Minor	220 to 330 feet	330 to 440 feet *

* The urban guideline may be applied in developed areas that are not urban, for example, cities with populations under 5,000. On collectors in cities with population under 5,000, the guideline is 220 feet (same as the urban guideline).

15.0 SPACING / CLEARANCE FOR RIGHT-IN, RIGHT-OUT DRIVEWAYS

What This Guideline Means

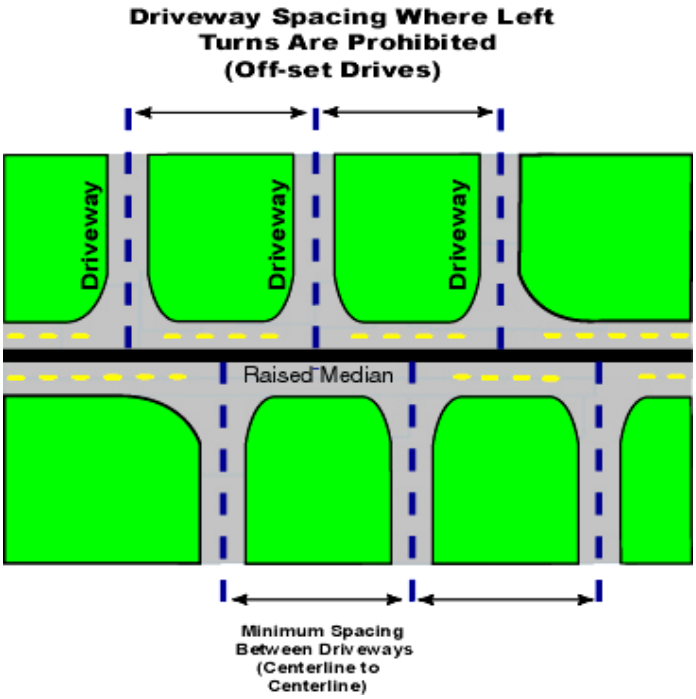
This guideline describes the recommended spacing and corner clearance for driveways along roadways in urban areas that have a non-traversable median and speed limits at or below 45 miles per hour. A non-traversable median restricts left-turn movements into and out of driveways. Adequate spacing between driveways and corner clearance are both important to maintain safety and traffic flow. Spacing between driveways should be greater on higher speed routes and in rural areas than in urban areas because of higher posted speed limits.

Research and experience in other states indicates that on urban routes *where non-traversable medians exist*, shorter driveway spacing and corner clearance upstream from an intersection is acceptable for right-in, right-out driveways. This guideline provides for double the number of right-in, right-out driveway access points compared to situations where left turns into and out of driveways are permitted. It also provides for a shorter clearance distance from corners to the last driveway upstream from the corner. For safety reasons, the downstream corner clearance similar to situations where no non-traversable median is present. This shorter guideline for right-in right-out driveways *should not* be used where a non-traversable median does not exist (e.g., where there is a continuous left-turn lane.) The shorter spacing is also not recommended in rural areas, where higher operating speeds prevail.

Experience has shown that a shorter guideline for right-in, right-out drives is appropriate where there is a physical barrier that prevents left turns (e.g., a non-traversable median). Regulatory restrictions on left turns (e.g., “No Left Turn” signs) and small traffic islands do not prevent left turns.

Direct access should be moved to local streets (not arterials and collectors) where possible. Access can be better accomplished on major roadways through techniques such as frontage and backage roads, joint access, cross access, and shared driveways. These guidelines only apply where sight distance allows. *Driveways should not be allowed where sight distance is inadequate even if the spacing guideline would allow them.*

Diagram



Guidelines, in Urban Areas *

Roadway Classification	Spacing between Right-In, Right-Out Driveways on Roadway with a Restrictive Median	Upstream Corner Clearance for Right-In, Right-Out Driveways on Roadway with a Restrictive Median**
Major - Freeway	No driveways	No driveways
Major – Non Freeway	220 to 330 feet	220 to 330 feet
Minor	110 to 165 feet	110 to 165 feet

* The urban guideline may be applied in rural but developed areas that are not urban, for example, cities with populations under 5,000. On collectors in cities with population under 5,000, the recommended spacing is 110 feet (same as the urban guideline).

** Downstream corner clearance guidelines should be similar to the main corner clearance guideline even when a non-traversable median exists.

16.0 DRIVEWAY GEOMETRICS

The design of driveways affects the speed of traffic turning into and out of driveways and in turn the speed differential between through traffic and turning traffic. Large speed differentials are associated with higher crash rates and diminished traffic operations.

Driveway designs should always be based on the results of a study of the traffic likely to use them; these guidelines are presented to illustrate good practices for driveway designs.

Lining Up Driveways Across Roadways

Driveways should be as closely lined up with driveways across roadways without non-traversable medians to the maximum extent possible even if less spacing between driveways is the result.

Angle of Intersection to the Public Roadway

- Driveways that serve two-way traffic should have angles of intersection with the public road of 90 degrees or very near 90 degrees. Two-way traffic driveways with skews greater than 20 degrees should be discouraged.

- One-way traffic driveways should have skews between 0 and 30 degrees.

Right-Turn (Approach) Radius

Approach radii should be large enough to allow entering vehicles to do so at a reasonable rate of speed. The following are suggested as acceptable approach radii and are measured from the edge of the driving surface of the roadway. Any maximum approach radius is allowable for driveways.

Right-Turn Radius for Driveways	Urban Areas (At or below 45 mph Posted Speed)	Rural Areas (Greater than 45 mph Posted Speed)
Residential Driveways	10 feet	25 feet
Commercial Driveways	25 feet	50 feet
Industrial Driveways	Design to handle typical large truck that uses the driveway	Design to handle typical large truck that uses the driveway

Inside radii should be determined on a case-by-case basis given driveway angle, traffic volume, and other relevant factors. Sites that generate substantial large truck traffic need inside larger radii to accommodate the wheel path of the turning trucks.

Driveway Width

No driveways should have widths less than 20 feet. Driveways of greater than 54 feet should be strongly discouraged unless they contain a raised median to separate traffic lanes. Driveways that serve one-way traffic should be from 20 to 30 feet wide. Driveway widths should be measured from the face of curb to the face of curb at the point of tangency. Any medians contained in the driveway are above and beyond the widths in the table. Appropriate widths for various levels of traffic and directions of access are shown in the table below:

Driveway Traffic Category	Average Daily Traffic Using Driveway	Peak Hour Traffic Using Driveway	With Two-Way Access	With One-Way Access
Residential	0 – 100	0 – 10	20* feet - 30** feet	NA
Low Volume Commercial/Industrial	< 1500	< 150	28 feet** - 42 feet***	20 feet*
Medium Volume Commercial/Industrial	1,500 – 4,000	150 – 400	42 feet*** - 54 feet****	20 feet* - 30 feet**
High Volume Commercial/Industrial	> 4000	> 400	Determined through a traffic study - normally 42 feet or greater	Generally not applicable

* One-lane driveways.
** Driveway striped for two lanes.
*** Driveway striped for three lanes.
**** Driveway striped for four lanes.

All commercial and industrial driveways should be curbed on approach.

Driveways and Accommodation of Pedestrians

In current and future urban places, all driveways should adequately accommodate pedestrians using sidewalks or paths. The least practical width should be used to accommodate pedestrians. Medians should be considered on driveways, four lanes or wider, to provide a refuge for pedestrians.

Driveways and Accommodation of Bicycles

Where a driveway crosses a bicycle, the driveway and the bicycle facility should be designed so as to accommodate the safe crossing of bicyclists.

Tapers

The distance between the entrance and exit tapers of adjacent driveways should be 50 feet or greater. If not, the tapers should be eliminated and the shoulder paved to form a turn lane.

Driveway Throat Length

The throat length is the distance between the street and the parking lot served by a driveway. An adequate throat length helps to keep traffic conflicts within a parking lot to an acceptable level and provides space on the driveway for incoming and outbound traffic. The following throat-length guidelines are suggested:

- For low traffic volume commercial and industrial driveways (below 150 peak hour vehicles in both directions), the shortest desirable driveway throat length is 20 feet (about one 20-foot car length).

- For medium traffic volume commercial and industrial driveways (150 – 400 peak hour vehicles in both directions), the shortest desirable driveway throat length is 60 feet (about three 20-foot car lengths).

- For high-volume driveways (over 400 peak hour vehicles in both directions) such as a shopping center entrance, the adequate throat length should be determined by the results of a traffic study.

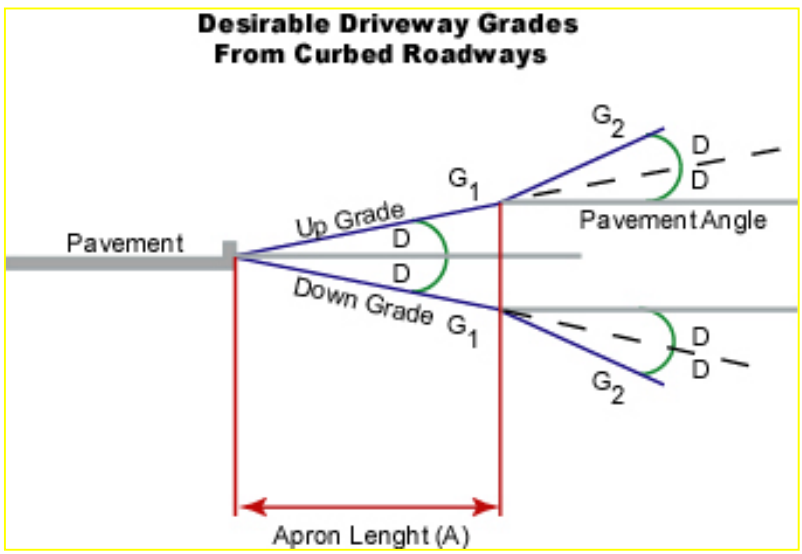
Vertical Geometrics (Driveway Grade Change)

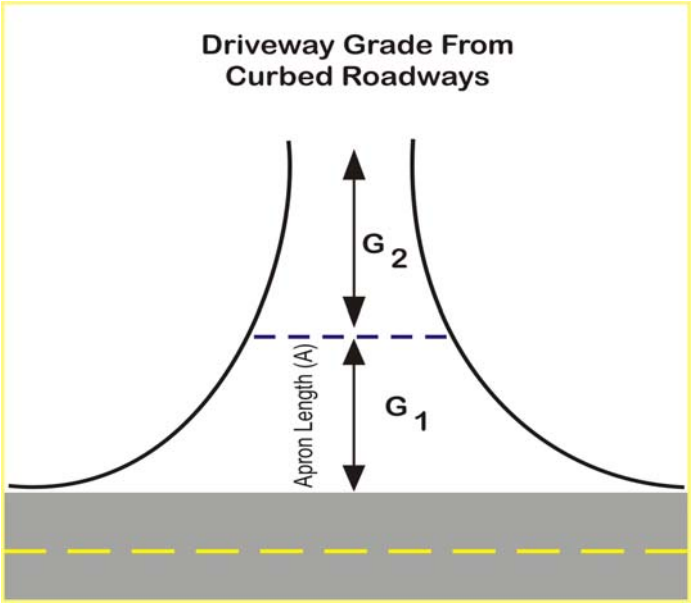
Access driveways on arterial roadways should be designed to allow vehicles to proceed into or out of the driveway at a speed that will prevent large speed differentials between turning and through traffic. Required apron lengths, desirable grade changes and maximum allowable grade changes are shown in the table below. The apron is a relatively flat area where the driveway meets the public roadway. These guidelines apply to all types of driveways, including for residential, commercial and industrial uses. Driveways should have a minimum grade change of approximately 1 percent to provide for adequate drainage. Either an upgrade or downgrade can be used.

Roadway Classification	Apron Length ("A" in the Diagram)	Desirable Grade Change, ("D" in the Diagram) Urban	Desirable Grade Change, ("D" in the Diagram) Rural
Major - Freeway	No driveways	No driveways	No driveways
Principal Arterial	25-30 feet	1%-4%	1%-3%
Minor Arterial	15-20 feet	1%-5%	1%-4%

Notes: The Apron Length is shown as "A" and grade change as "D" on the diagram below. The grade may change along the course of the driveway, as indicated by G_1 and G_2. In such cases, it is very important to ensure that the minimum apron length is maintained.

Diagrams





Driveway Surfacing
Required driveway surfaces depend on the roadway they are entering:

Roadway Classification	In Current and Projected Urban Areas	In Rural Areas
Major - Freeway	No driveways	No driveways
Major- Non Freeway	Paved	Paved, except for residential and field entrances
Minor Arterial	Paved	Paved, except for residential and field entrances. Unpaved driveways are acceptable on collectors

Having paved driveways is most critical on major roadways to keep the speed differential between through and turning traffic as low as possible. As noted before, all commercial and industrial driveways should be curbed on approach.

17.0 PARKING ON FACILITIES

What This Guideline Means

Parking should not be allowed on highway facilities that are primarily intended to serve through-traffic movement (major roadways). On-facility parking should not generally be allowed along minor roadways in rural areas since these roadways allow for high travel speeds. Parking may be allowed on urban minor roadways, if an engineering study indicates that it is safe to do so and that the parking will not hinder traffic operations.

Normally, only parallel parking should be allowed. Angle parking may be used in a central business district to promote a "walkable community".

Local governments have the ability to prohibit or restrict parking within their jurisdiction.

Recommended Guideline

Roadway Classification	In Current and Projected Urban Areas	In Rural Areas
Major	No parking	No parking
Minor	Parking should be studied but may be allowed when appropriate.	No parking*

* The urban guideline may be applied on minor roadways in developed areas that are not urban, for example, cities with populations under 5,000.