Road Adequacy & Access Technical Guidance

Please contact the Capital Projects & Engineering Department for clarification or assistance.

Road adequacy standards must be met to ensure an adequate roadway network to support the increased demands on a system created by new development.

1 Rough Proportionality

If an applicant for concept plan or plat approval disagrees with the roughly proportionate nature of the apportionment at any time in the concept plan's or plat's review process, he should so advise the city engineer in writing prior to approval of the concept plan or plat. The city engineer or other professional engineer who holds license issued under Chapter 1001, Texas Occupation Code, retained by the city shall prepare a roughly proportionate analysis prior to consideration of the concept plan or plat by the Planning and Zoning Commission. If the city or retained engineer's analysis shows the apportionment of the municipal infrastructure costs to the applicant's development do not exceed the amount that is roughly proportionate to the development's impact and the Local Government Code Section 212.904.

2 Street Requirements

2.1 Cross-Sections

Roadway cross sections shall be consistent with the approved Master Thoroughfare Plan and include the following elements:

Table 1. Street Design Standards

Street Classification	Parkway	Major Arterial	Arterial – Rural	Arterial – Urban	Major Collector	Downtown Approach	Collector	Local/ Residential
Typical ADT	-	-	-	-	-	-	<3,000	<1,000
Right-of-way (min)	180'	120'	120'	90'	80'	70'	60'	50'
Curb & Gutter	2'	2'	2'	2'	2'	2'	2'	2'
Pavement Width (min)	76'	72'	70'	58'	58'	38'	36'	30'
Median (min)	20'	20'	-	16'	-	-	-	-
Shoulder (min)	3'	-	-	-	-	-	-	-
Sidewalk (min)	12'/12'	12'/5'	5'/5'	5'/5'	5'/5'	5'/5'	10'/5'	4'/4'
Minimum Grade	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%
Maximum Grade	5%	5%	5%	5%	5-8%*	5-8%*	5-8%*	5-10%*
Centerline Radius (min)	1,200'	1,200'	770'	770'	770'	340'	340'	200'
Design Speed	45 mph	45 mph	40 mph	40 mph	40 mph	30 mph	30 mph	25 mph

*5% maximum grade preferred

A. Pavement Cross Slope – All streets shall have a maximum cross-slope of 2%. The cross-slope can vary where there is a transition into or out of a maximum 2% straight grade across the entire street width or street intersections. When super-elevation is approved, the maximum allowable slope is 6%. Super-elevation must be designed in accordance with the latest edition of *A Policy on Geometric Design of Highways and Streets*.
B. Curb and Gutter – All urban streets shall be designed with standard 2' curb and gutter. The gutter is not included in the pavement, lane, and bike lane widths but is a portion of the parking lane. A standard curb without gutter may be used with a median when stormwater is draining away from the curb.
C. Pavement Widths – Pavement widths are based on the street classification, number of lanes, lane widths, and shoulder widths. Additional pavement width may be necessary to accommodate turn lanes, parking, on-street bike lanes, marked buffers, and shoulders.
D. Lane Widths – Lane widths should be 12' for Parkways, Major Arterials, and Collectors and 11' for Arterials – Rural, Arterials – Urban, and Major Collectors. For Downtown Approach Streets, lane widths from 10-12' should be used based on the adjacent land use and parking activity. Lane widths may be required to be increased due to adjacent land use and anticipated large vehicles such as trucks and buses.
E. Median Widths – Medians are required for Parkways, Major Arterials, and Arterials - Urban and are measured from the face of curb to face of curb. Medians may also be provided to restrict access or channelize traffic.
F. Shoulder Widths – Shoulder widths are measured from the outside travel lane to edge of pavement. Additional shoulder width may be required for rural streets, medians and roadsides without curb, and accommodations for bicycles.
G. Centerline Radius – Minimum centerline radius is a function of design speed, superelevation, and the vehicle side friction factor, measured in accordance with the latest edition of *A Policy on Geometric Design of Highways and Streets*. The minimum horizontal radii are in accordance with the latest edition of *A Policy on Geometric Design of Highways and Streets.*
H. Two-Way Left-Turn Lanes - Two-way left-turn lanes are typically used for low speed, low volume roadways with closely spaced driveways. The minimum standard width for a two-way left-turn lane shall be designed in accordance with the latest version of TxDOT's *Roadway Design Manual*.

2.2 Vertical Curves

The minimum and maximum allowable street grades for the City of Seguin are shown in Table 1. Vertical curves are utilized in roadway design to affect gradual change between tangent grades and will result in a design which is safe, comfortable in operation, pleasing in appearance, and adequate for drainage. Vertical curve alignment shall also provide stopping sight distance (SSD) in all cases. SSD is a function of design speed, perception-reaction time, and deceleration rate. The latest edition of *A Policy on Geometric Design of Highways and Streets* shall be used to calculate SSD.

A vertical curve is required when two longitudinal street grades intersect at a point of vertical intersection and the algebraic difference between those two grades is greater than 1%. Where the algebraic difference is less than or equal to 1% for local/residential streets and alleys and less than or equal to 1% for all other roadway classifications, vertical curves are not required. The latest edition of *A Policy on Geometric Design of Highways and Streets* shall be used to determine the minimum acceptable length of crest and sag curves.

The use of multiple, vertical grade deflections to create a vertical curve or to avoid design of a vertical curve when the algebraic grade difference exceeds 1% will not be accepted.

A minimum of 10-ft. vertical clearance shall be provided for all roadway crossings over pedestrian and bicycle facilities.

All divided streets shall be profiled such that the ultimate median curb lines have a maximum elevation differential of 3 in. per 20 ft. of median width. This is necessary to accommodate the installation of future median openings and turn lanes. Spot elevations and pavement cross-slope transitions for future lanes shall be included in the plans to verify median cross-slopes. In areas where there is no future need for a median opening, the Engineer may justify the use of a greater differential between median curb elevations.

2.3 Adequate Streets

All developed lots within the city limits shall have access to an adequate street. An adequate street is one that has a minimum road width consistent with the surrounding street network and a pavement structure that meets the City's minimum pavement design requirements listed in the Technical Manual. Alleys shall have a minimum width of 20 ft. and local streets shall not be less than 24 ft. to be considered adequate. When a substandard street is present, the property owner(s) of the developed lot(s) shall be responsible for constructing an adequate street to the boundary of the developed lot(s).

2.4 Adequate Streets for Subdivisions

All subdivisions shall have access to an adequate boundary or approach street. An adequate boundary or approach street is one that has a minimum road width consistent with the needs generated by the proposed development, not less than 24 ft., and a pavement structure that meets the City's minimum pavement design requirements listed in the Technical Manual. When a substandard street is present, the Developer shall be responsible for reconstructing and/or widening the existing pavement.

The limits of the reconstruction and/or widening shall be based on a traffic impact analysis (TIA) submitted by the Developer. The TIA shall include construction traffic and the ultimate traffic volumes of the development. If the City determines that the Developer needs to reconstruct or widen existing roadways outside of the area being developed, the City shall inform the Developer of these limits.

The City shall determine Overall Condition Index (OCI) score of each existing roadway. If the estimated OCI score is less than 50, the Developer shall be required to reconstruct the existing roadway section to the minimum required pavement width as approved. The Developer will prepare and submit a geotechnical report from a licensed geotechnical engineer that is in accordance with general engineering standards.

If the estimated OCI score is equal to or greater than 50, the Developer shall be required to prepare a geotechnical report from a licensed geotechnical engineer which evaluates the existing roadway to determine if there are any areas of pavement distress in the existing pavement section. The geotechnical report shall provide a recommended pavement repair section, if applicable, and a recommended pavement widening section to be approved by the City. The Developer shall be required to make pavement repairs, widen the existing roadway, and resurface the entire pavement width.

The pavement transitions at the beginning and ending of any proposed widening shall follow the lengths shown in Table 2. The Developer shall remove a minimum of 2 ft. (2’) of the existing pavement from the pavement edge for construction of the widened pavement section. If the existing roadway to be widened has a parabolic cross slope (or varied cross slopes) or the cross slope is nonexistent, the developer shall ensure the new cross slope of the widened section meets a minimum of 2% but does not exceed a maximum of 4% cross slope. If widening an existing pavement section to one side creates two different cross slopes, the maximum algebraic difference between these two cross slopes is 1%. If this difference is greater than 1%, additional level-up or reconstruction of the existing roadway section will need to ensue to minimize this difference. Pavement improvements which would result in a reverse crown or ponding of runoff in the roadway are not allowed.

Table 2. Minimum Transition Lengths

Posted Speed (mph)	**Formula**	**Minimum Transition Lengths (L)**								
(S)		W = 2’	W = 3’	W = 4’	W = 5’	W = 6’	W = 7’	W = 8’	W = 9’	W = 10’
30	$L = \frac{WS^2}{60}$	30’	45’	60’	75’	90’	105’	120’	135’	150’
35		41’	61’	82’	102’	123’	143’	163’	184’	204’
40		53’	80’	107’	133’	160’	187’	213’	240’	267’
45	$L = WS$	90’	135’	180’	225’	270’	315’	360’	405’	450’
50		100’	150’	200’	250’	300’	350’	400’	450’	500’
55		110’	165’	220’	275’	330’	385’	440’	495’	550’
60		120’	180’	240’	300’	360’	420’	480’	540’	600’

3 Traffic Impact Analysis

3.1 Report Content

All Traffic Impact Analysis (TIA) reports shall be signed and sealed by a professional engineer, registered to practice in the state of Texas and shall include the following minimum information:

A. Impact area
   1. Land use, site, and study boundaries (provide map).
   2. Existing and proposed site uses.
   3. Existing and proposed land uses on both sides of boundary streets for all parcels within the study area (provide map).
   4. Existing and proposed roadways and intersections of boundary streets within the study area of the subject property, including traffic conditions (provide map).
   5. All major driveways and intersecting streets adjacent to the property will be illustrated in detail sufficient to serve the purposes of illustrating traffic function; this may include showing lane widths, traffic islands, medians, sidewalks, curbs, and traffic control devices (e.g., traffic signs, signals, pavement markings, etc.).

6. A general description of the existing pavement condition for boundary streets.
7. Photographs of boundary streets of the development and an aerial photograph showing the study area.

B. Trip generation and design hour volumes
    1. A trip generation summary table listing each type of proposed land use, the building size assumed, the average trip generation rates used (total daily traffic and AM/PM/weekend street peaks), and the resultant total trips generated shall be provided.
    2. Generated vehicular trip estimates may be discounted in recognition of other reasonable and applicable modes (e.g., transit, pedestrian, bicycles, etc.). Furthermore, trip generation estimates may also be discounted through the recognition of pass by trips and internal site trip satisfaction.

C. Trip distribution. Provide the estimates of percentage distribution of trips by turning movements to and from the proposed development by site access location (provide table and figure).

D. Trip assignment. Provide the direction of approach and departure of site traffic via the area's street system (provide figure by site entrance and boundary street).

E. Projected traffic volumes. Provide a figure for each item listed below:
    1. Peak hour site traffic (including turning movements) for the two highest peak hour times (AM, PM, or weekend).
    2. Peak hour total traffic including site-generated traffic and projected traffic (including turning movements) for the two highest peak hour times (AM, PM, or weekend).
    3. For special situations where peak traffic typically occurs at non-traditional times, e.g., major sporting venues, schools, large industrial employers, etc., any other peak hour necessary for complete analysis (including turning movements).
    4. Total daily existing traffic for street system in study area.
    5. Total daily existing traffic for street system in study area and traffic generated by proposed development for all phases of development.
    6. Total daily existing traffic for street system in study area, traffic generated by proposed development, and projected traffic from build-out of study area land uses for all phases of development.

F. Capacity analyses
    1. A capacity analysis shall be conducted for all public street intersections and junctions of major driveways with public streets which are significantly impacted within the study area boundary as defined in this section as agreed to by the developer's engineer and the city engineer. A capacity analysis is required as shown below in Table 3.

Table 3. Capacity analysis requirements

Volumes with and without site traffic	**Boundary Street**	**Non-Boundary Street within Impact Area**
Existing Conditions	Required	Required
First Phase	Required	Not required
Intermediate Phase(s)	Required	Not required
Final Phase	Required	Required

2. Capacity analyses will follow the principles established in the latest edition of the Transportation Research Board's Highway Capacity Manual (HCM), unless otherwise directed by the city engineer. Capacity will be reported in quantitative terms as expressed in the HCM and in terms of traffic level of service based on control delay by movement or lane group.
3. Capacity analyses will include traffic queuing estimates for all critical applications where the length of queues is a design parameter (e.g., auxiliary turn lanes, at traffic gates, etc.).

G. Neighborhood traffic analysis. If the TIA calculations show that a proposed development increases traffic on a collector or local/residential street by at least ten (10) percent, a neighborhood traffic analysis shall be performed. This analysis will include an evaluation of existing and projected traffic on the affected roadways. Where the projected traffic exceeds the limits of the existing collector or local/residential street mitigation may be required to lower this traffic.

H. Sight distance. Sight distance (both stopping sight distance and intersection sight distance) and shall be considered, as appropriate. The latest edition of *A Policy on Geometric Design of Highways and Streets* shall be used to calculate stopping sight distance and intersection sight distance. Traffic control shall not be installed on new streets for the sole purpose of not meeting necessary sight distance.

I. Conclusions and requirements. Provide a narrative detailing:
   1. Mitigation measures coordinated with phasing.
   2. Conclusions.
   3. Recommendations consistent with this section.

Any previous traffic study relating to a development that is more than 2 years old may be required to be updated unless the city engineer determines the conditions have not changed significantly.

3.2 Implementation

For phased construction projects, implementation of required traffic improvements for mitigation of impacts of the development must be accomplished no later than the completion of the project phase for which the capacity analyses show they are required. Plats for project phases subsequent to a phase for which a traffic improvement is required may be approved only if the traffic improvements are completed or secured as approved by the city engineer.

3.3 Traffic signal warrant analysis

A TIA that contains a traffic impact mitigation for installation of a new traffic signal location shall include a traffic signal warrants analysis satisfying the requirements of the Texas Manual on Uniform Traffic Control Devices.

3.4 Turn lane requirements

Turn lanes are exclusive deceleration and storage lanes that allow for vehicles to turn left and right at intersections outside the through lane. Design of deceleration lanes shall be in accordance with the latest version of TxDOT's *Roadway Design Manual*.

A. Left and right turn lanes shall be required:
   1. At all driveway or street intersections with a daily entering traffic volume of 500 vehicle trips or 50 vehicle peak hour trips;
   2. At all driveway or street intersections on the state highway system at the direction of TxDOT; or
   3. Based on other factors such as street classification, travel speeds, sight distance, truck traffic, crash history, and other site conditions.
B. The design of turn lanes shall be based on the existing centerline of the roadway. The existing and new pavement for turn lane improvements shall be designed based on the development traffic loads and may include rehabilitation. At a minimum, a surface course treatment is required for the full improvements including taper and pavement marking area.
C. Left turn lanes
   1. Storage length. Left turn storage lengths shall be sized to store the number of vehicles expected to queue in the lane during an average peak period. Left turn storage length shall be designed in accordance with the latest version of TxDOT's *Roadway Design Manual*. Additional length may be required based on traffic volumes or TIA storage requirements.
   2. Width. Left turn lanes on arterials and larger classifications shall be 12 ft. in width. All other left turn lanes should be 12 ft. in width, with 10 ft. allowed when constraints are present.
   3. Cross-slope. The cross slope of left turn lanes shall match the cross slope of the adjacent through lane.
   4. Taper lengths. Single left turn lane taper lengths shall be designed in accordance with the latest version of TxDOT's *Roadway Design Manual*. Left turn lane tapers shall be designed using either:
      a. Symmetrical reverse curves of at least 250 ft. minimum radius; or
      b. Asymmetrical reverse curves where the leading reverse curve is twice the radius of the following reverse curve and the leading reverse curve has a minimum radius of at least 300 ft.
   5. Median openings may be provided at intersections or at intervals for major developed areas. Spacing between median openings must be adequate to allow for the introduction of left-turn lanes and signal detection loops to operate without false calls.
D. Right turn lanes
   1. Placement
      a. Upstream right turn lanes. A minimum tangent section of 30 ft. shall be provided between the preceding driveway or cross-street curb return and the taper of a right turn lane.
      b. Continuous right turn lanes. The use of continuous right turn lanes is discouraged. Where several successive driveways require exclusive right-turn lanes, and the driveway spacing is not adequate to avoid encroachment of the right-turn lane on another driveway, a continuous right turn lane shall be used.
      c. Functional area of intersections. Right turn lanes are considered part of the functional area of an intersection, as defined by AASHTO in *A Policy on Geometric*

Design of Highways and Streets. To reduce potential conflict and enhance intersection safety, driveways are not allowed within the functional area of an intersection.

2. Storage length. Right turn storage lengths shall be sized to store the number of vehicles expected to queue in the lane during an average peak period. Right turn storage length shall be designed in accordance with the latest version of TxDOT's *Roadway Design Manual*. Additional length may be required based on traffic volumes or TIA storage requirements.
3. Width. Right turn lanes on arterials and larger classifications shall be 12 ft. in width. All other right turn lanes should be 12 ft. in width, with 10 ft. allowed when constraints are present.
4. Taper lengths. Single right turn lane taper lengths shall be designed in accordance with the latest version of TxDOT's *Roadway Design Manual*. Right turn lane tapers shall be designed using either:
    a. Symmetrical reverse curves of at least 250 ft. minimum radius; or
    b. Asymmetrical reverse curves where the leading reverse curve is twice the radius of the following reverse curve and the leading reverse curve has a minimum radius of at least 300 ft.

4 Access management

The TIA should consider the access to the existing street system as well as internal street connections, including intersection and driveway spacing and median openings. The tables and figures below provide guidelines for new or modified street and access connections. When determining access spacing near an intersection of streets of different classification, and unless specified circumstances exist, the greater distance shall apply.

Table 4. Minimum Street and Access Connection Spacing

Street Classification	Design Speed	Number of Through Lanes	A Access Spacing	S Signalized Intersection Spacing	C Street Spacing	M Median Opening Spacing
Parkway	45 mph	4 to 6	250'	1,320'	1,000'-1,320'	500'-800'
Major Arterial	45 mph	4 to 6	250'	1,000'-1,320'	1,000'-1,320'	500'-800'
Arterial – Rural	40 mph	4	250'	1,320'	1,000'-1,320'	-
Arterial – Urban	40 mph	4	200'	1,000'	1,000'	500'-800'
Major Collector	40 mph	4	150'	600'-1,000'	500'	-
Downtown Approach	30 mph	2	100'	600'-1,000'	500'	-
Collector[a]	30 mph	2	100'[b]	-	200'	-
Local/Residential[a]	25 mph	2	25'[b]	-	175'	-

[a]Values shown are for guidance only; closer access spacing may be permitted at the discretion of the city engineer.
[b]Does not apply to residential driveways. Residential driveways must be spaced 20' apart and 40' from an intersection.

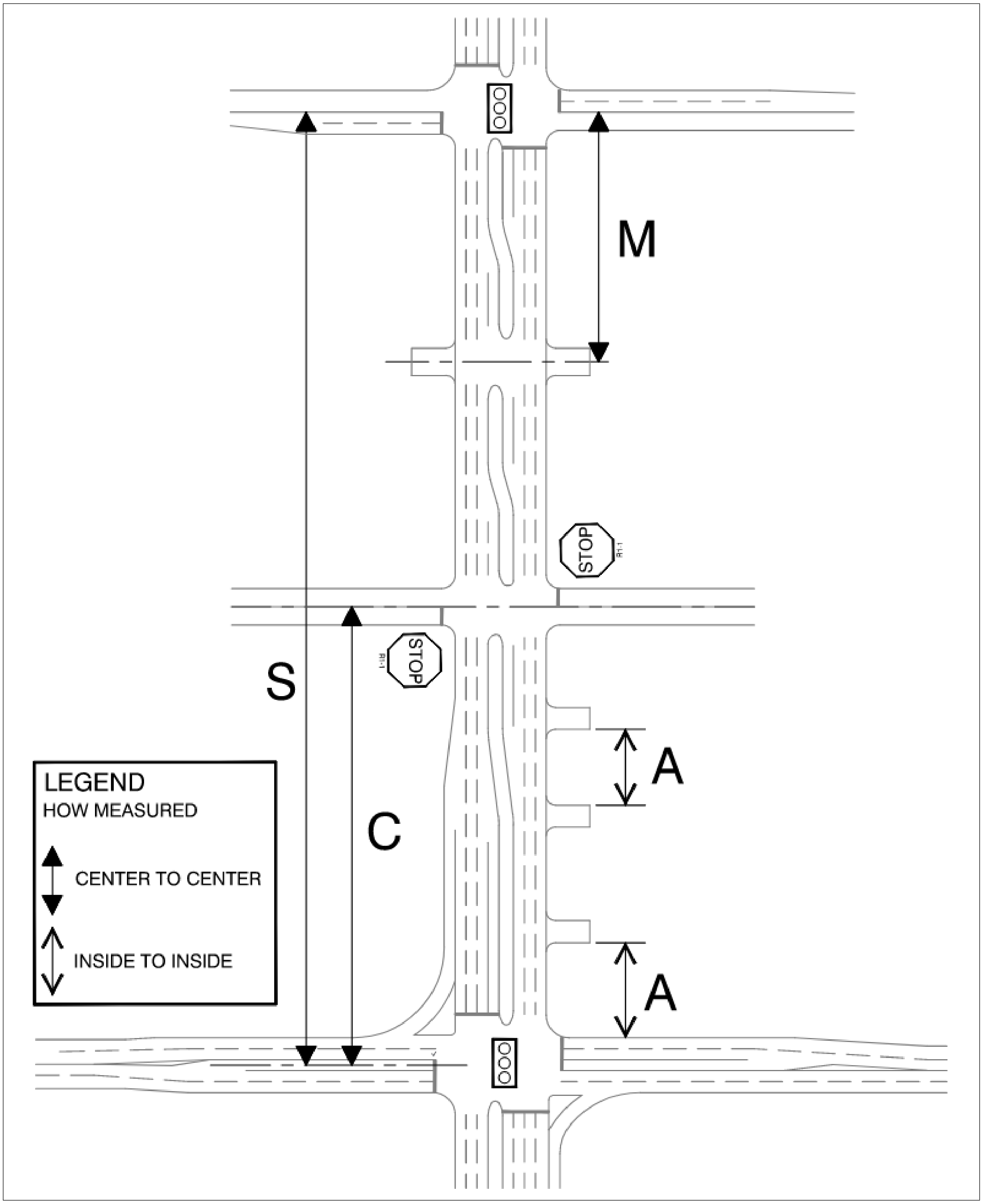

Figure 1. Minimum Street and Access Connection Spacing

Median openings are designed to allow one or more left-turn movements across a restrictive median. They can be full-access openings or directional openings. Median openings must conform to the connection spacing and traffic signal spacing requirements outlined in Figure 1. The spacing must account for expected future connections and traffic signals.

Median openings must only be allowed where they meet the minimum connection spacing requirements, provide adequate sight distance, provide adequate left-turn storage and deceleration length, and meet any other necessary design requirements or guidelines. An engineering study must be provided to support the location of a new or modified median opening. If the median spacing guidelines cannot be achieved, the engineering study must justify the proposed spacing, including documenting that the requested median opening will not degrade traffic conditions (current or future operations and safety) below acceptable levels. The primary metric for this evaluation must be a comparison of 95th percentile peak hour queue length and the available queue storage, demonstrating that the median opening will not impact upstream and downstream intersections or signals.

Where a property at a corner does not have the necessary frontage to accommodate the required spacing from the intersection, or an interior property does not have adequate width to meet the spacing requirements from an existing driveway on an adjacent property, a common access easement with an adjacent property may be utilized to obtain the necessary spacing. Where site limitations preclude such common access easements, or where cooperation of adjacent property owners cannot be obtained, the city engineer may authorize a non-compliant driveway, which should be spaced as far from the intersection as practical, provided that the applicant can demonstrate that the proposed drive would not result in a traffic safety hazard. In cases where non-compliant driveways are authorized, additional safety measures may be required (e.g., right-in, right-out only, channelization, additional signs, etc.).

Access to arterial and parkway streets should be limited to protect the flow of traffic from the lots. A one foot (1’) non-access easement shall be provided along arterial and parkway streets when lots have access to another public right-of-way.

Table 5. Minimum Street and Access Connection Spacing for Single-Lane Roundabouts

Street Classification	**Design Speed**	**A** **Access Spacing**	**R** **Roundabout - Roundabout Spacing**	**C** **Street Spacing**	**SR** **Signal - Roundabout Spacing**
Collector[a]	30 mph	100’	250’	150’	250’
Local/Residential[a]	25 mph	40’	250’	100’	250’

[a]Values shown are for guidance only; closer access spacing may be permitted at the discretion of the city engineer.

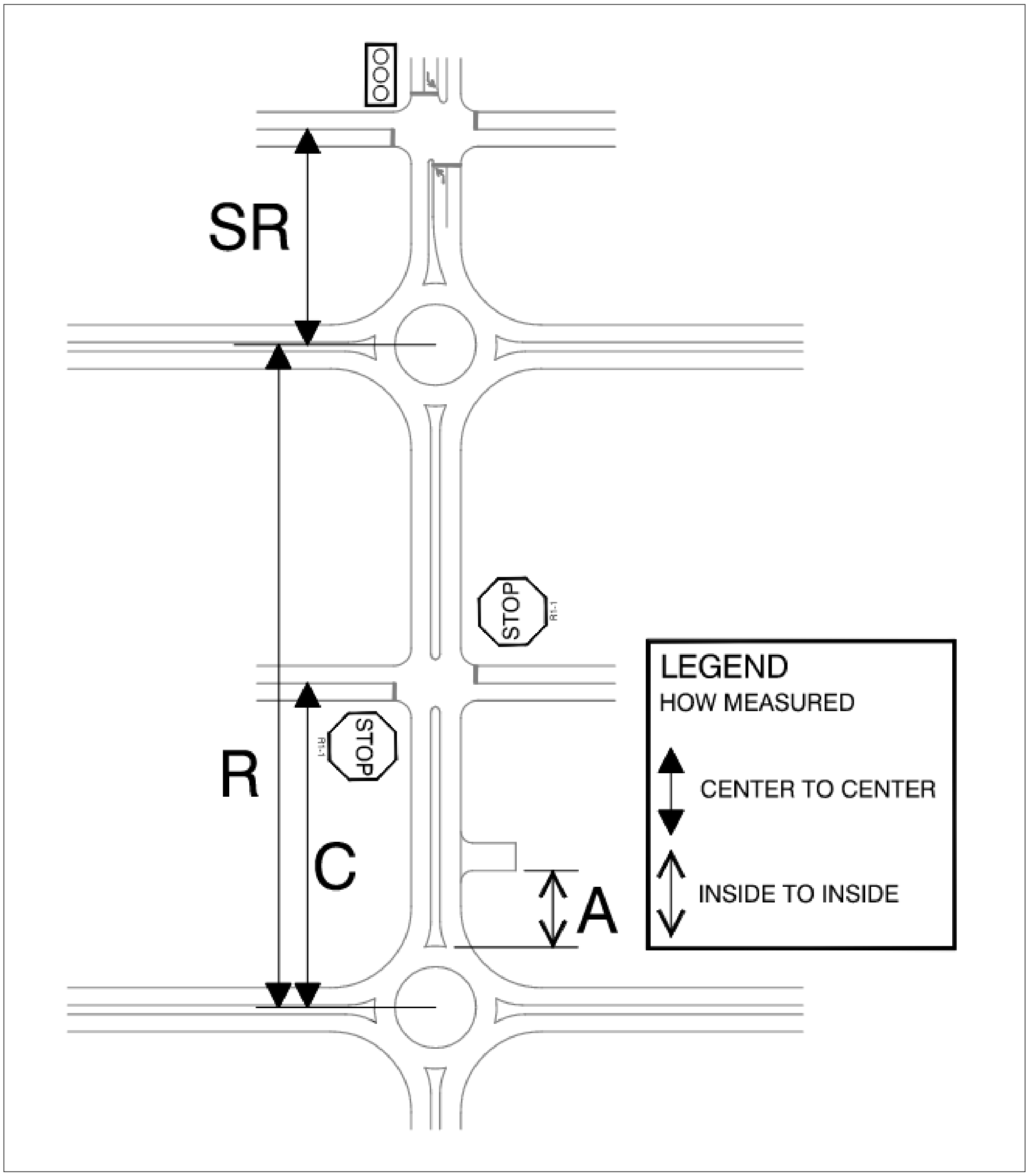

Figure 2. Minimum Street and Access Connection Spacing for Single-Lane Roundabouts

4.1 Throat length

Driveway throat length is important for safe and efficient traffic operations on site and the adjacent street. The throat length needs to be of sufficient length so that vehicles may enter, exit, and circulate on site without interference of traffic on the street.

A. Driveway throat length is measured from the nearest edge of right-of-way to the first conflict point in the driveway.

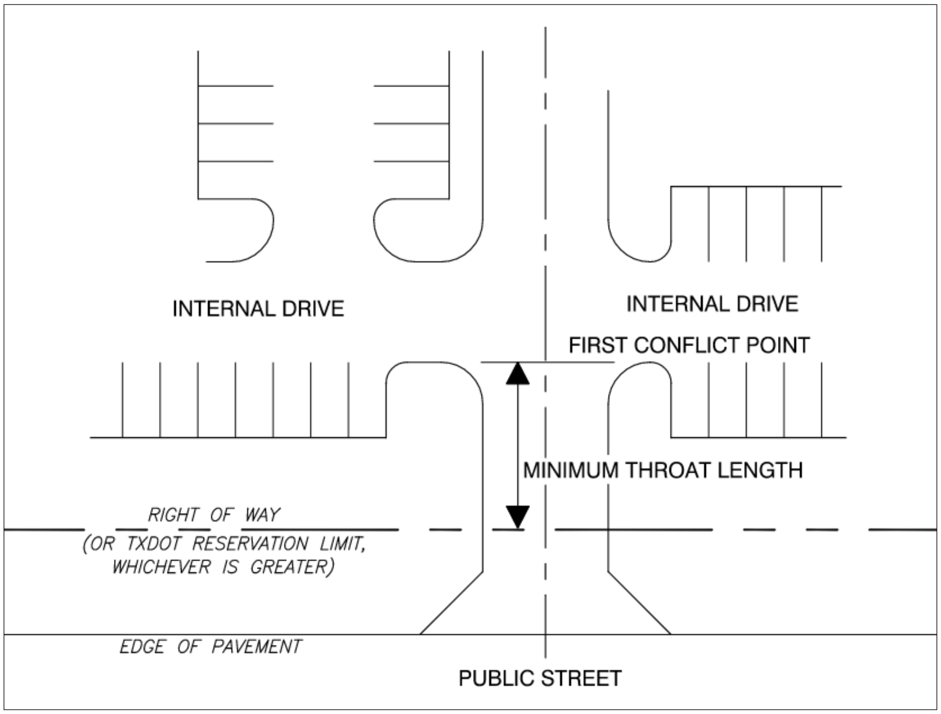

Figure 3. Throat length

B. The minimum throat length is shown in Table 6. All throat lengths for driveways on TxDOT roadways shall meet TxDOT requirements.

Table 6. Minimum Driveway Throat Length

Street Classification	Throat Length
Parkway	100’
Major Arterial	100’
Arterial – Rural	100’
Arterial – Urban	100’
Major Collector	75’
Downtown Approach	50’
Collector	50’
Local/Residential	50’

C. For driveways serving between 100 and 400 vehicles in the peak hour (two-way traffic volumes) the driveways must provide at least 150 feet of throat length.

D. For driveways serving over 400 vehicles in the peak hour (two-way traffic volume) and for all driveways controlled by a traffic signal, adequate throat length must be determined by a TIA.

E. The required throat length can be modified by the city engineer based on the results of an engineering analysis, considering the ultimate public street section anticipated and ultimate buildout of the adjacent land.

4.2 Intersections

The main objective in the design of an intersection is to facilitate the safety, convenience, and efficiency of all transportation system users. In this portion of the technical manual, intersections include public roadways, private roadways, and non-residential driveways.

A. Accommodations should be made for all existing and future pedestrian, bicycle, and public transportation movements.
B. Drainage inlets shall be installed to capture stormwater prior to entering all intersections with a collector or higher classification roadway.
C. All streets shall intersect at a 90-degree angle. Deviations up to 10 degrees may be considered by the city engineer on a case-by-case basis where existing conditions will not permit.
D. Offset intersections shall be avoided unless necessitated by topography or traffic circulation conditions. When an offset intersection is necessary, the following minimum centerline offsets shall be required (subject to approval by the city engineer, the Planning & Zoning Commission and City Council):
    1. Arterial and parkway streets 300-foot offset, centerline to centerline;
    2. Major collector and collector streets 150-foot offset, centerline to centerline;
    3. Local street 125-foot offset, centerline to centerline.

    When the offset intersections involve streets of different classification, and unless specified circumstances exist, the greater distance shall apply.

E. The practice of constructing short-radius horizontal curves on approaches to achieve right-angle intersections should be avoided whenever practical. The intersection and traffic control devices at the intersection may be located outside the driver's line of sight, resulting in the need to install advanced signing. Sharp curves may also result in increased lane encroachments.