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OVERVIEW

The purpose of this Manual is to provide minimum guidelines for the design and construction of transportation infrastructure within the City of Denton, Texas and its extraterritorial jurisdictions using the complete street and context sensitive solution approach. The goal is to create safer, more livable places that are consistent with their social, environmental, and economic values.

Complete streets are transportation facilities that are planned, designed, operated, and maintained to provide safe mobility for all users, including bicyclists, pedestrians, transit vehicles, truckers, and motorist, appropriate to the function and context of the facility. Context sensitive solutions formulate a complete street design considering contextual applications. Contextual applications can be of geographical nature such as Urban Core, General Urban, Suburban, University Core, and other typical service areas that require unique components to address the overall transportation facilities.

The criteria established in this Manual have been developed from a review of various TxDOT and American Association of State Highway and Transportation Officials (AASHTO) publications, City of Denton Mobility Plan, North Central Texas Council of Governments Public Works Construction Standards (NCTCOG), other City Transportation Manuals from various cities in the surrounding area, regulatory requirements, and City of Denton offices which oversee the design, construction, and maintenance of public transportation infrastructure.

This Manual is not intended to be a complete design criterion for all circumstances and conditions. Other design criteria may be warranted from applicable resources. The Federal Government, the State of Texas, NCTCOG, Denton County, Denton County Transit Authority (DCTA) and other related organizations and resources shall be consulted for additional criteria as may be deemed necessary.

This Manual is to be used by design engineers in the City of Denton Capital Project Engineering Division, consulting engineers employed by the City and engineers of subdivisions and land development infrastructure projects proposed for construction and acceptance by the City within the City and within its extraterritorial jurisdictions. The criteria established in this Design Manual provide basic guidance. However, full responsibility and liability for proper design remains with the design engineer. Users of this Manual should be knowledgeable and experienced in the theory and application of transportation engineering. The City Engineer or his elected representative must approve any deviation from criteria established in this Manual.

Along with this Design Manual, the Denton Development Code (DDC) shall be consulted for additional guidance. The criteria established in this Manual do not supersede the policies contained in the DDC. Any revision to the DDC supersedes the criteria in this Manual.

1. Street Design

The user should be aware of and utilize the City of Denton Development Code Subchapter 20 - Transportation in conjunction with this Manual.

1.1 Street Classification

The City of Denton Development Code (DDC) provide definitions for the street classifications. These street classifications apply to developments and/or street improvements within the City of Denton and are to be used for design purposes. These classifications are established based upon expected fully developed traffic volumes.

a. Alley

An alley (residential or commercial) is a private street designed to provide access to the rear of or side of a lot including solid waste and fire access. Alleys are required for all residential lots fronting on a residential street prohibiting on street parking, on collector streets, and in nonresidential zoning districts where necessary to provide for adequate access for service vehicles, off-street loading or unloading, access for emergency vehicles, fire access or similar reasons consistent with the intent of the DDC.

All alleys shall have at least two (2) direct access point to public streets and are subject to the block length criteria included in this manual.

b. Flag Drive

A flag drive is a private road within a private access easement, which may serve up to 3 residential dwelling units. Flag drives shall have direct access to a public street other than an alley, however shall not provide direct access to an arterial street.

c. Residential Street

A residential street is a public street associated with residential development within an urban environment. The residential street may require parking or prohibit parking dependent on use. Alleys will be required for residential streets prohibiting on street parking. Alleys are permitted for residential streets requiring on street parking.

d. Rural Street

A rural street is a street which serves no more than 20 single family residential lots.

e. Cul-De-Sac

A Cul-De-Sac is a dead end street that has a fire accessible turn around at the end of the street. A Half Cul-De-Sac is a street bend at 90 +/- 5 degrees for residential and collector streets.

f. Collector

A collector street is a street that collects associated traffic from residential and rural streets, commercial streets, or industrial streets as designated on the City Mobility Plan or as designated by the City Traffic Engineer. Collector streets can have residential, commercial, industrial, or mixed uses.

g. Arterial

Arterial streets are streets that serve major routes into and through the City of Denton. Arterial streets are shown on the City Mobility Plan or as designated by the City Traffic Engineer. These street types are to have limited access as defined in the access management section of the manual.

h. Freeway

Freeways are streets that intend to move traffic through and around the City. Two examples are IH 35 and Loop 288. These street types are to have limited access as defined in the access management section of the manual.

1.2 City of Denton Mobility Plan

The City of Denton Mobility Plan which includes the thoroughfare plan should be reviewed relative to any proposed development. Refer to the following link to the City of Denton Website:

<https://www.cityofdenton.com/CoD/media/City-of-Denton/Business/Development%20Review/Denton-Mobility-Plan.pdf>

It should be noted that the City of Denton Mobility Plan is a living document and is periodically updated to reflect the changes in the characteristics of anticipated traffic flow within the City.

1.3 Geometric Standards

1.3.1 Section Standards

Street section standards are provided in this section of the manual. Options are provided for residential, collector, and arterial streets dependent upon treatment utilization within the street section. Besides defined lanes, other treatments that can be utilized within the street sections include on street parking, bike lanes, multi-use paths, and transit facilities. The intent is to provide options in order to develop a “complete street” and “context sensitive” design. Table 1.3.1 provides the street standards including options. Right of Way requirements may vary at intersections based upon turning movement requirements.

Minimum and maximum street grades are also shown on Table 1.3.1. In general street grades shall follow the natural contour of the property and be below the existing grade so that the parkway drains towards the street. Excessive cuts and fills solely for the purpose of balancing earthwork are not permitted.

TABLE 1.3.1 GEOMETRIC STREET STANDARDS

Roadway Class	No. of Lanes	Min Row (Ft)	Min ⁽⁹⁾ B-B Width (Ft)	Design Speed (MPH)	Min ⁽⁶⁾ Center Line Radius (Ft)	Min Horz. Curve Separation (Ft)	Min Grade %	Max Grade %	Parking	Side walk Width (Ft)
Alley Residential	1	25	15 ⁽¹⁾	15	100	0	0.5	8	Prohibited	N/A
Alley Commercial	1	30	20 ⁽¹⁾	15	100	0	0.5	8	Prohibited	N/A
Residential Lane ⁽²⁾	2	55	33/ 31 ⁽³⁾	30	200	0	0.5	10	Prohibited	5
Residential	2	55	33/ 31 ⁽³⁾	30	200	0	0.5	10	Permitted	5
Collector	2 ⁽⁵⁾	65	39	35	400	100	0.5	7	Permitted ⁽⁸⁾	8
Collector	4 ⁽⁵⁾	110	70/ 80 ⁽⁴⁾	35	575	100	0.5	7	Prohibited	8
Arterial	4	110	70/ 80 ⁽⁴⁾	40	575	100	0.5	7	Prohibited	5
Arterial	6	135	90/ 104 ⁽⁴⁾	45	750	100	0.5	7	Prohibited	5

(1) Alleys are edge of pavement to edge of pavement

(2) Alleys and sufficient off street parking required with Residential Lanes. Curb line to be marked with No Parking marking.

(3) Back of curb to back of curb width may be reduced if surmountable curbs are utilized.

(4) Width dependent upon whether a stripped continuous left turn lane is used or a raised median

(5) Number of travel lanes dependent upon TIA and/or City of Denton Traffic Engineer recommendations

(6) Minimum center line radius based upon cross slope of minus two percent (-2%)

- (7) Maximum grade within 60 feet of an intersection measured from the intersection curb is 2% or less
- (8) Parking permitted for residential collector only.
- (9) See Table 1.4.3.1 for additional right-of-way requirements at intersections with turn lanes.

OPTIONS FOR COMPLETE STREETS AND CONTEXT SENSITIVE:

Within the geometric standards are options that relate to developing a complete street that accounts for all transportation facilities within the context of the associate area. Connectivity and context sensitive solutions are essential to meeting the goals of the standards. Typical options are shown in the following as well as typical street sections.

BIKE LANES – Bike lanes shall be 6 feet wide unless otherwise approved by the City Traffic Engineer. Bike lanes shall be provided according to the Pedestrian and Bike Lane component of the Mobility Plan or as required by the City of Denton for connectivity to other facilities.

OFF STREET MULTI-USE PATH – Some development areas will warrant the use of off street multi-use paths for pedestrian and bicycle traffic connectivity to other facilities as identified by the City of Denton. Multi-use paths shall be 10 feet wide unless otherwise approved by the City of Denton Traffic Engineer.

TRANSIT – Bus stop locations may be required by the City of Denton for connectivity of the transit system. See Section 5 of this manual for details.

MEDIAN VS. CONTINUOUS LEFT TURN LANE – Selection of a median or continuous left turn lane shall be based upon the TIA, connectivity, adjacent uses, and other factors required by the City Traffic Engineer. Medians shall be 24 feet back of curb to back of curb. Continuous left turn lanes shall be 14 feet wide.

MODIFICATIONS TO STANDARDS – Modifications to the standards in some instances may have to be considered based upon context sensitive use. An example of context sensitive use which may require the standards to be modified is a roadway corridor restriction that creates limitations that cannot be altered. An example of a roadway corridor restrictions would be existing infrastructure and/or buildings that must remain. Modifications to the standards based upon context sensitive use shall be at the sole discretion of the City Engineer.

The complete street design is based upon using the above options in conjunction with the other geometric features of the street in order to accommodate adjacent uses and promote connectivity. During the Pre-Development meeting and/or the TIA review meeting options for Collectors and Arterials for development shall be designated.

The following figures highlight the options for Collector and Arterial Streets:

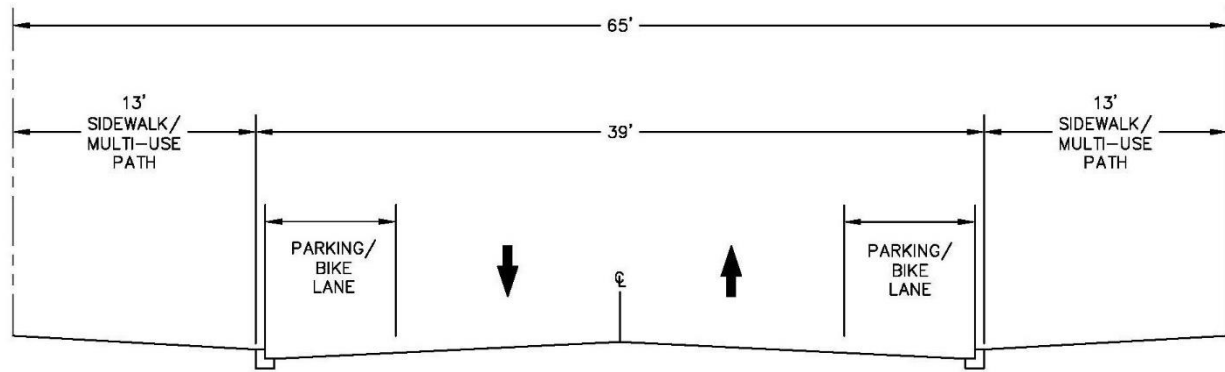


Figure 1.3.1 Two Lane Collector

- 1) Parking for residential collector only

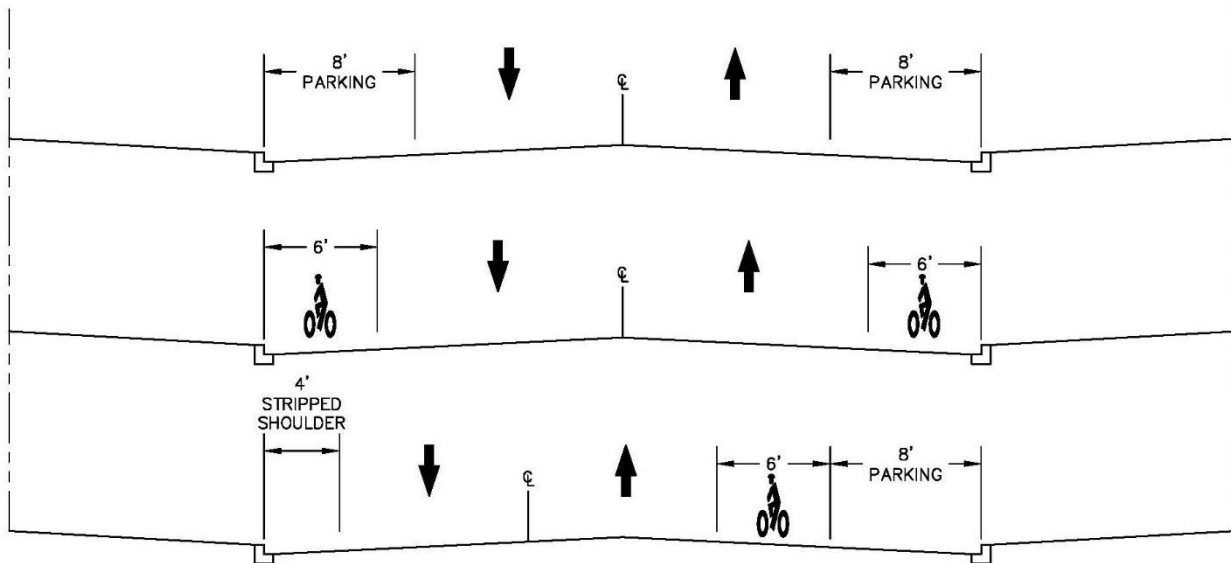


Figure 1.3.2 Two Lane Collector Options

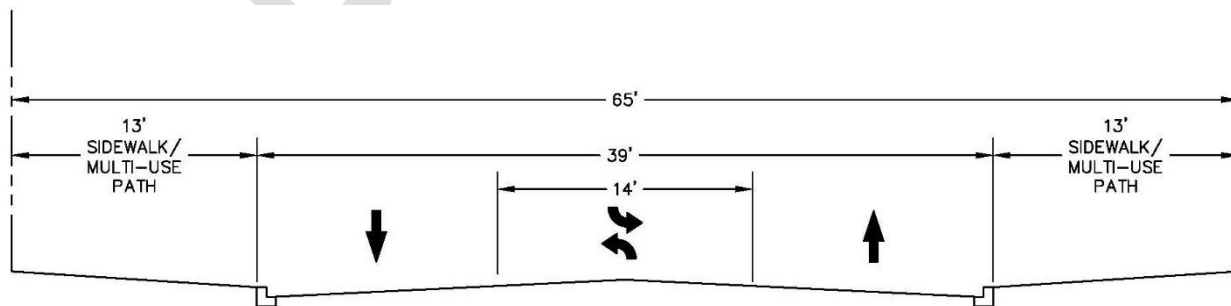


Figure 1.3.3 Two Lane Collector with Continuous Left Turn Lane

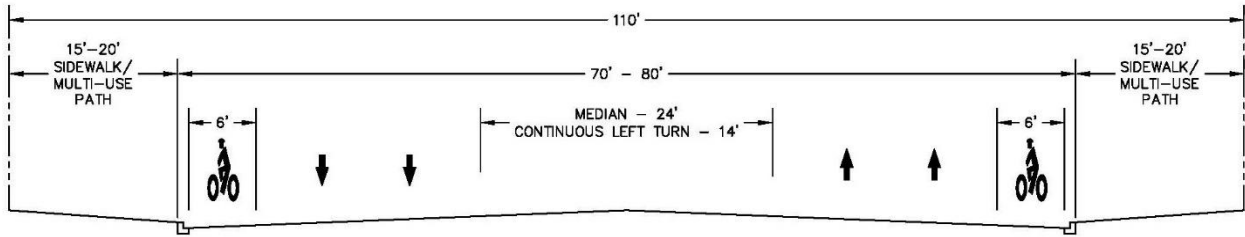


Figure 1.3.4 Four Lane Collector

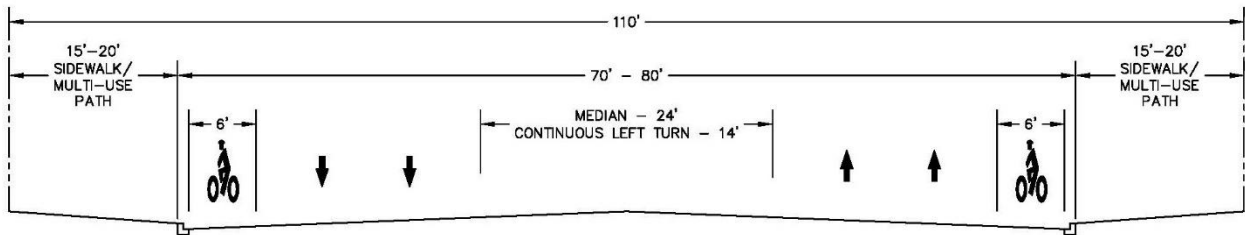


Figure 1.3.5 Four Lane Arterial

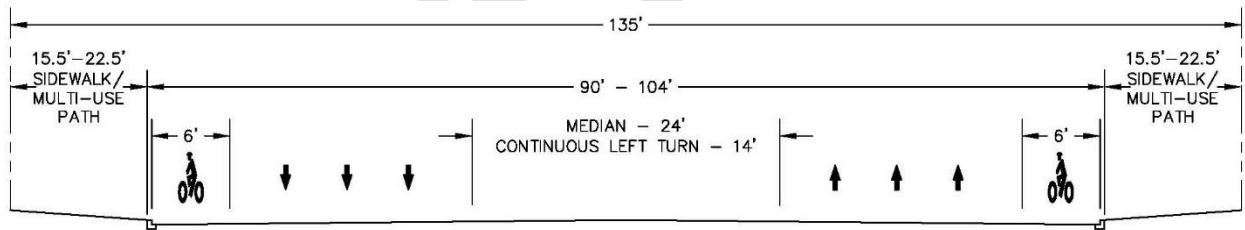


Figure 1.3.6 Six Lane Arterial

1.3.2 Vertical Curve Standards

Vertical curves are required when two street grades intersect at a point of vertical intersection greater than 1 percent. Minimum vertical lengths for both crests or sags shall be defined by the design speed for the street and the associated stopping sight distance and minimum K value.

Table 1.3.2. shows the minimum K value for various design speeds.

TABLE 1.3.2 MINIMUM 'K' VALUES FOR VERTICAL CURVES

Design Speed (MPH)	Stopping Sight Distance (Ft)	Crest Vertical Curve (K min)	SAG Vertical Curve (K min)
30	200	19	37
35	250	29	49
40	305	44	64
45	360	61	79

$L = KA$ L = Vertical Curve Length
 A = Algebraic Difference in Grade

1. No vertical curve required for "A" equal to or less than 1%
2. Minimum spacing between successive vertical curves shall be 50 feet for residential and 100 feet for collectors and arterials
3. Unless otherwise approved by the City of Denton, resultant vertical curve grade shall be no less than 0.3 percent (0.3%) for concrete pavement and no less than 0.5 percent (0.5%) for asphalt pavement.
4. For drainage purposes, 50 foot vertical curves are required when "A" is greater than 1% and less than or equal to 1.2%. Otherwise minimum vertical curve length is 100 feet.
5. Stopping sight distances and K values are from AASHTO Geometric Design of Highways and Streets

1.3.3 Cul-de-sac Standards

a. Cul-de-sacs

Maximum length of a Cul-de-sacs shall be 600 feet measured from the centerline of the intersecting street to the Cul-de-sac radius point and perpendicular to the intersecting street centerline. Minimum length of a Cul-de-sac shall meet Fire Code requirements. Residential Cul-de-sacs shall not have more than 29 residential lots. The center radius of the Cul-de-sac shall be a minimum of 50 feet for residential developments and 60 foot for commercial and industrial developments measured from the center point to the face of curb or edge of pavement where there is no curb. The Cul-de-sac return radius shall be 30 foot. Cul-de-sac minimum street grades shall be as shown on Figure 1.3.3.1 for downward gradient and as shown on Figure 1.3.3.2 for upward gradient.

b. Offset Cul-de-sacs

Offset Cul-de-sacs shall have the same radius and return radius as the standard Cul-de-sac. The length of the offset Cul-de-sac shall be measured from the centerline of the intersecting street to the Cul-de-sac radius point, perpendicular to the intersecting street centerline.

c. Temporary Turn-Around

A temporary turn-around shall be limited to approved phase developments where the street will be extended in the future. A temporary turn-around shall meet the requirements of a standard Cul-de-sac for radius and return radius size. The length of street associated with the turn-around shall not be any greater than 600 feet nor less than Fire Code requirements. If the length of street

will be greater than 600 feet then the next block length of street and intersecting streets shall be constructed in order to provide looped traffic flow for emergency vehicles. The turn-around section shall be constructed to the same structural section as the street section less curb and gutter requirements unless drainage requirements warrant curb and gutter.

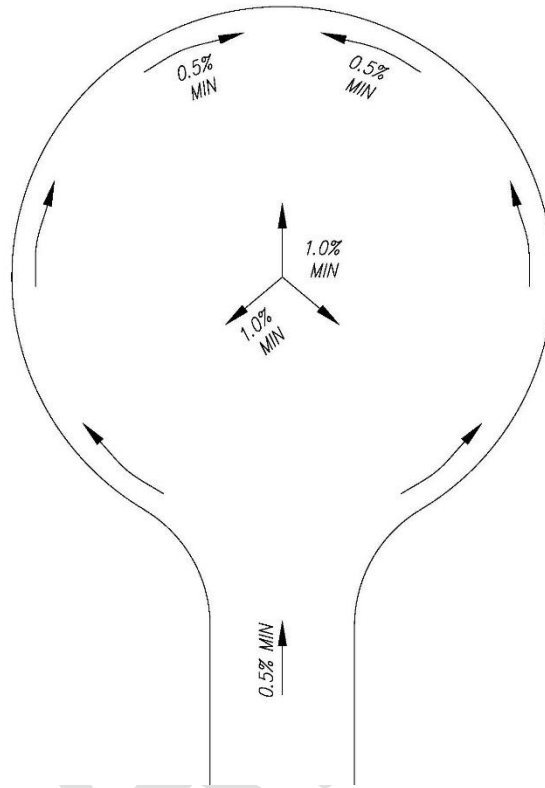


Figure 1.3.3.1, Downward Gradient, Cul-de-Sac, Minimum Slopes

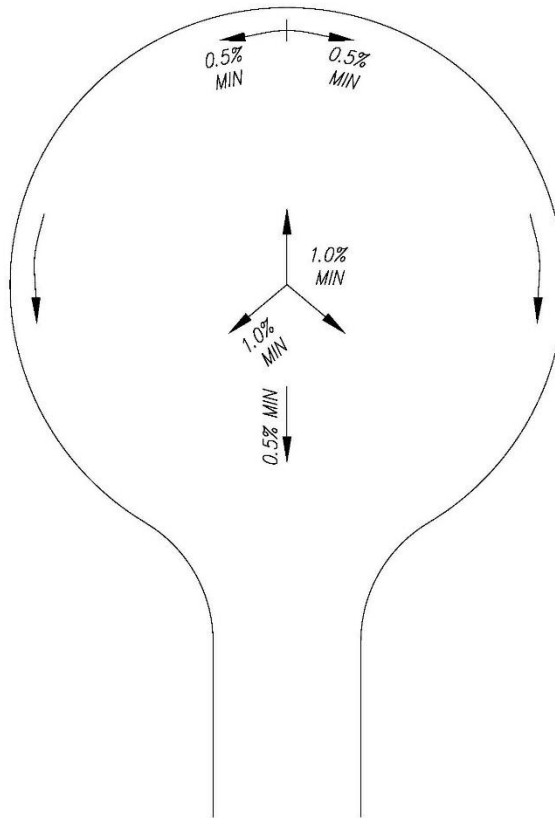


Figure 1.3.3.2, Upward Gradient, Cul-de-Sac, Minimum Slopes

1.3.4 Ride Quality

Ride quality is an essential part of maintaining anticipated traffic flow patterns for street design. If the ride quality is poor, traffic flow patterns can be impacted causing unnecessary traffic congestion or unsafe conditions. As a part of public street design, ride quality shall be incorporated into the technical specifications and general notes for the street improvements. Testing for ride quality shall be in accordance with TxDOT Item 585 Ride Quality for Pavement Surfaces. Surface Test Type A shall be used for short in-fill street improvements (typically less than a 1000 continuous feet) as required by the City Engineer. Surface Test Type B shall be used for long street improvements (typically greater than or equal to 1000 continuous feet) and/ or new subdivision street improvements as required by the City Engineer.

1.4 Intersections

Three components of intersections are addressed in this section of the manual; intersection geometry, visibility standards, and turning movement standards. These standards are to work in concert with the TIA requirements of this manual. Additionally, the Pedestrian and Bicycle Facility Design, Transit Facility Design and the City of Denton Standard drawings for accessibility should be reviewed for additional design requirements.

1.4.1 Intersection Geometry

Street intersections should be designed to be perpendicular. Table 1.4.1.1 provides tolerances that are acceptable for types of intersections based upon street classification. All streets as far as practical shall be aligned with any existing streets by continuation of the centerline thereof. The staggering of street alignment resulting in "I" intersections shall leave a minimum distance of one hundred fifty (150) feet between the centerlines of residential streets and two hundred (250) feet between the centerline of collector streets.

Table 1.4.1.1 also provides required right-of-way corner clip requirements and curb return radius requirements for intersections. These standards provide minimum vision clearance areas. Additional sight clearance evaluation should be performed as necessary according to Section 1.4.2.

Table 1.4.1.1, Intersection Geometry

Type	Intersection Angle (Degrees)	Right of Way Corner Clip	Curb Return Radius
Alley/Alley	90+/-15	5 feet	10 feet
Alley/Neighborhood	90+/-10	5 feet	10 feet
Alley/Collector	90+/-10	5 feet	20 feet
Flag Drive/Neighborhood	90+/-15	5 feet	10 feet
Flag Drive/Collector	90+/-10	5 feet	20 feet
Neighborhood/Neighborhood	90+/-10	10 feet	20 feet
Neighborhood/Collector	90+/-10	15 feet	20 feet
Neighborhood/Arterial	90+/-5	15 feet	30 feet
Collector/Collector	90+/-5	15 feet	30 feet
Collector/Arterial	90+/-5	20 feet	30 feet
Arterial/Arterial	90+/-5	30 feet	30 feet

- Fences must provide a 5-foot corner clip adjacent to driveways

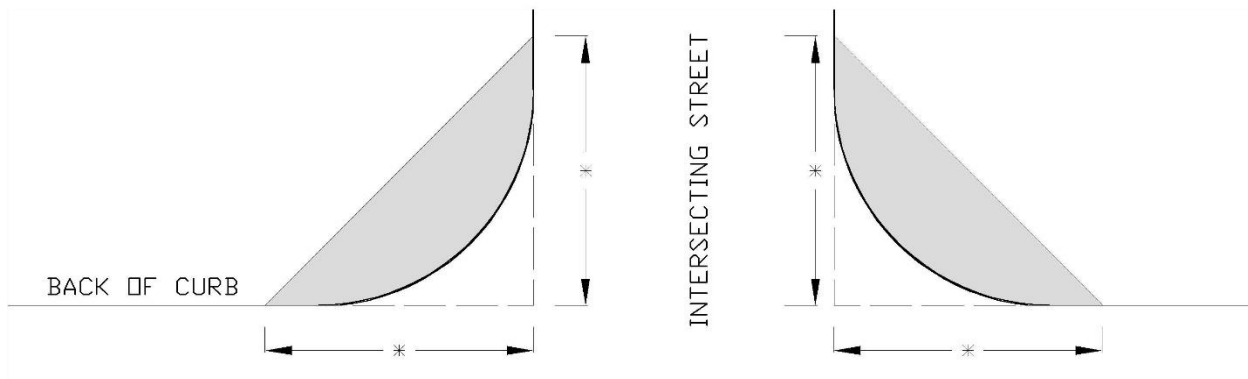


Figure 1.4.1.1, Vision Clearance Area

1.4.2 Visibility Standards

Table 1.4.2.1 and Figure 1.4.2.1 shall be used to evaluate the unobstructed view for motorist for the intersection design and are based upon the design speed outside of the intersection. Design speeds are based upon the street classification unless otherwise approved by the City of Denton Traffic Engineer. The values shown in the table are minimum standards. Within the sight line area, no obstruction shall be allowed that will obstruct the view of motorist. A sight visibility easement shall be dedicated to protect and maintain sight visibility.

TABLE 1.4.2.1 SIGHT VISIBILITY

Design Speed (MPH)	Intersection Sight Distance Near Side (Ft)	Intersection Sight Distance Far Side (Ft)
30	290	335
35	335	390
40	385	445
45	430	500

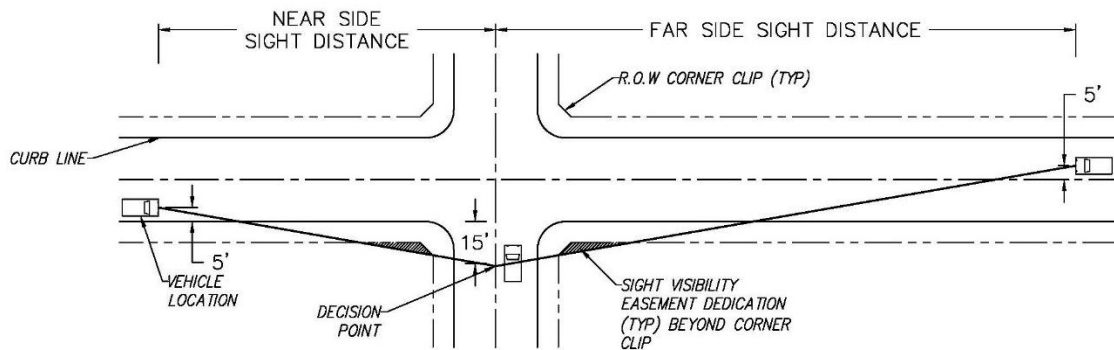


Figure 1.4.2.1, Visibility Standards

1. Table 1.4.2.1 is based upon passenger car right turn and left turn from stop. Refer to ASHTO Geometric Design of Highways and Streets for Single-unit truck and combination truck design requirements, Case B1 and Case B2 where truck traffic warrants additional sight distance.
2. Refer to ASHTO Geometric Design of Highways and Streets for multi-lane considerations.
3. Lines of sight distance at all intersections shall be clear at an elevation between 3 feet and 9 feet above the gutter elevation.

1.4.3 Turn Lane Standards

Turning movement requirements shall be based upon an approved TIA, and/or the requirements of the City of Denton Traffic Engineer, and the figures and tables within this section. When a turn lane movement is required, Table 1.4.3.1 and Figures 1.4.3.1 and 1.4.3.2 shall be used as a minimum for the turn lane geometry. Additional consideration shall be given for unique traffic movement such as excessive tractor trailer utilization, extended length transport vehicle movement, etc. See Section 1.4.4 for additional geometry standards for Collectors and Arterials.

TABLE 1.4.3.1 MINIMUM TURN LANE GEOMETRY

LEFT TURN LANE

Intersection Type	Lane Width (Ft)	Min Storage (Ft)	Min Taper (Ft)	Additional ⁽⁶⁾ R.O.W. Req'd (Ft)
Residential Collector	11	60	100	15
Commercial/Industrial Collector	11	150	100	15
Secondary Arterial	11	150	100	15
Primary Arterial	11	200	100	15

RIGHT TURN LANE

Intersection Type	Lane Width (Ft)	Min Storage (Ft)	Min Taper (Ft)	Additional R.O.W. Req'd (Ft)
Residential Collector	11	100	100	15
Commercial/Industrial Collector	11	150	150	15
Secondary Arterial	11	150	200	15
Primary Arterial	11	200	200	15

- 1) Required turn lane storage may be greater dependent upon the Traffic Impact Analysis
- 2) The Pedestrian Path shall be taken into account for access across the median by utilizing a leave out or ramp in accordance with accessibility standards described in this manual.
- 3) Cross slope of median openings or turn bays shall not be more than 2 percent or less than 1 percent.
- 4) On TxDot Roadways TxDOT standards shall supersede City of Denton Standards.
- 5) Taper Radius shall be 200 feet minimum.
- 6) Additional right-of-way required per turn lane bay.

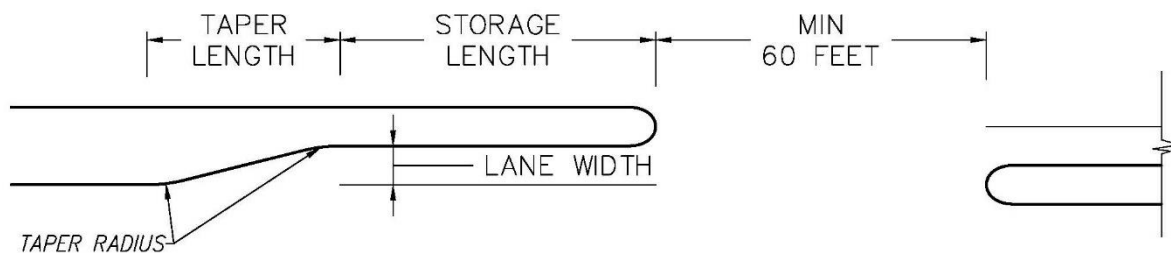


Figure 1.4.3.1, Left Turn Lane

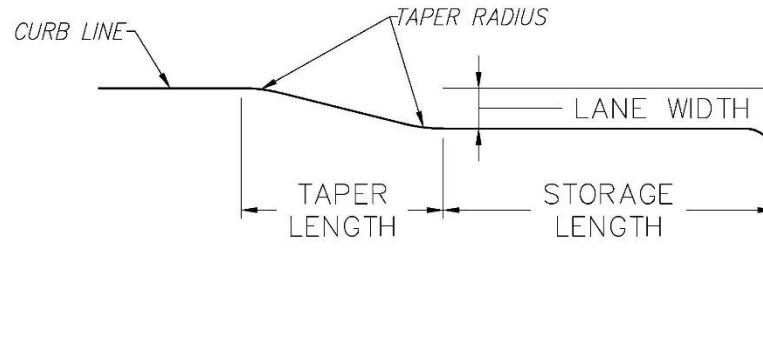


Figure 1.4.3.2, Right Turn Lane

1.4.4 Intersection Diagram for Collectors and Arterials

Figure 1.4.4.1 provides median location details and specific turn lane radius requirements. Also refer to median details shown in the City of Denton Standard drawings

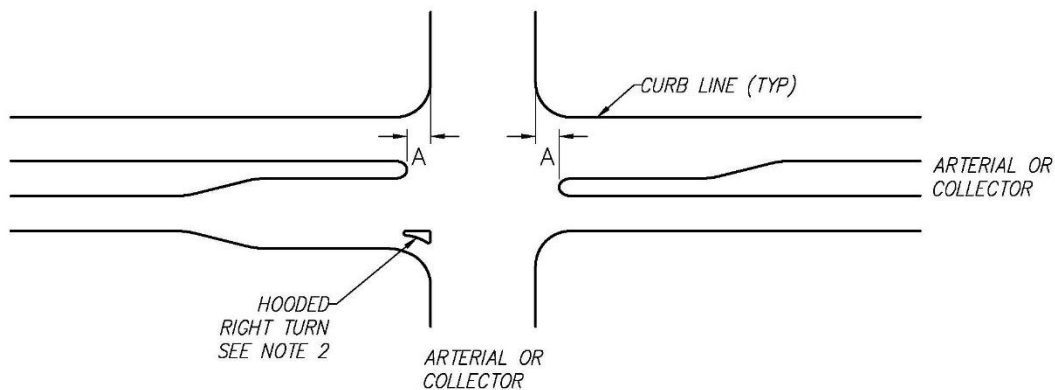


Figure 1.4.4.1, Intersection Detail

1. For collector and arterial streets $A = 15$ feet minimum.
2. Depending upon traffic flow requirements the right turn may require a hooded right turn.

1.4.5 Intersection Spacing/ Maximum Block Length

Table 1.4.5.1, Min. Intersection Spacing

	Alley	Flag Drive	Residential	Collector	Arterial
Alley	100 feet	N/A	100 feet	100 feet	N/A
Flag drive	N/A	N/A	75 feet	75 feet	N/A
Residential	100 feet	75 feet	*200 feet	*200 feet	400 feet
Collector	100 feet	75 feet	*200 feet	*200 feet	400 feet
Arterial	N/A	N/A	400 feet	400 feet	1200 feet

* 100-foot minimum to the first intersection for entrances to subdivisions off of an arterial where lots back up to the arterial. This is measured between right of way lines.

Table 1.4.5.2, Max Block Lengths

Land Use	Max Block Length
Single family/duplex Residential, Multi Family, Commercial/Retail, Industrial	1200 feet

- Lot width is measured at the right of way line
- Block length is measured between right of way lines and on both sides of the street
- Alley or Flag Drive intersections are not considered in block length calculations
- Max Block Length does not apply to blocks that back up to developed properties where redevelopment is not expected in the near term, floodplains, railroads or freeways without frontage roads

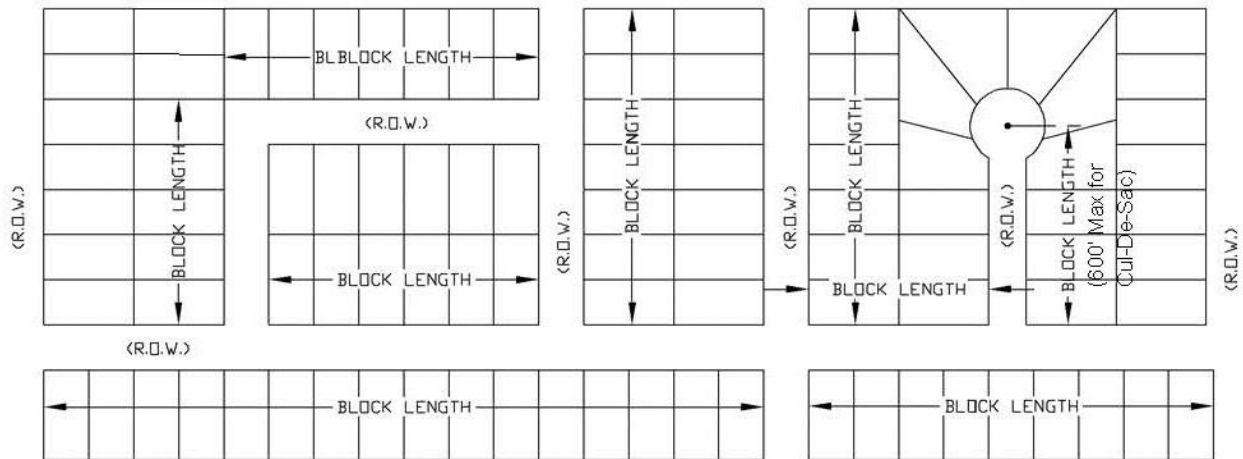


Figure 1.4.5.1, Block Length Measurements

1.4.6 Median Openings

Median openings for collectors and arterials shall be as designated by the City Transportation Engineer. Median opening allowance first shall consider the safety and effective flow of traffic within the collector or arterial street, then secondarily the effective movement of traffic to and from the development. Whether a median opening is allowed will be solely up to the City Transportation Engineer. The width of a median opening shall be 60 feet unless otherwise designated by the City Transportation Engineer. Median openings shall center on the intersecting drive. Median opening noses shall be as shown on the City of Denton Standard drawings.

1.4.7 Roundabouts

Roundabouts are circular intersections that create counterclockwise traffic movements around a central island with entering traffic yielding to circulating traffic. Every roundabout is unique but usually contain the following features shown on Figure 1.4.7.1 and Figure 1.4.7.2:

Central Island – The central island is the raised area in the center of the roundabout around which traffic circulates.

Splitter Island – The splitter island is a raised or painted area on an approach used to separate entering traffic from exiting traffic, to deflect and slow entering traffic, and to allow pedestrians to cross the road in two stages.

Circulatory Roadway – The circulatory roadway is the roadway that follows the traffic path adjacent to the Central Island. Flow of traffic in the circulatory roadway is counterclockwise.

Apron – An apron is the traversable portion of the central island adjacent to the circulatory roadway that may be needed to accommodate the wheel tracking of longer vehicles. The curb line is surmountable and the apron is typically reinforced stamped colored concrete.

Entrance Lane – The entrance lane is the point of entry from connecting roadways to the circulatory roadway. Entrance lane traffic must yield to circulatory roadway traffic coming from the left.

Accessible Pedestrian Crossing – In general, pedestrian crossings at roundabouts are discouraged unless otherwise approved by the City Engineer. If pedestrian crossings are allowed, the crossing will use a two step approach utilizing a splitter island. The crossing shall be setback from the entrance line and utilize an opening in the splitter island. The crossing must meet accessibility standards.

Landscaping Strip – A landscaping strip between the back of curb and the sidewalk shall be provided. The landscaping strip shall include a two foot wide colored stamped reinforced

concrete mow strip adjacent to the curb and a six feet minimum wide landscape strip. The curb and gutter within the roundabout shall be surmountable.

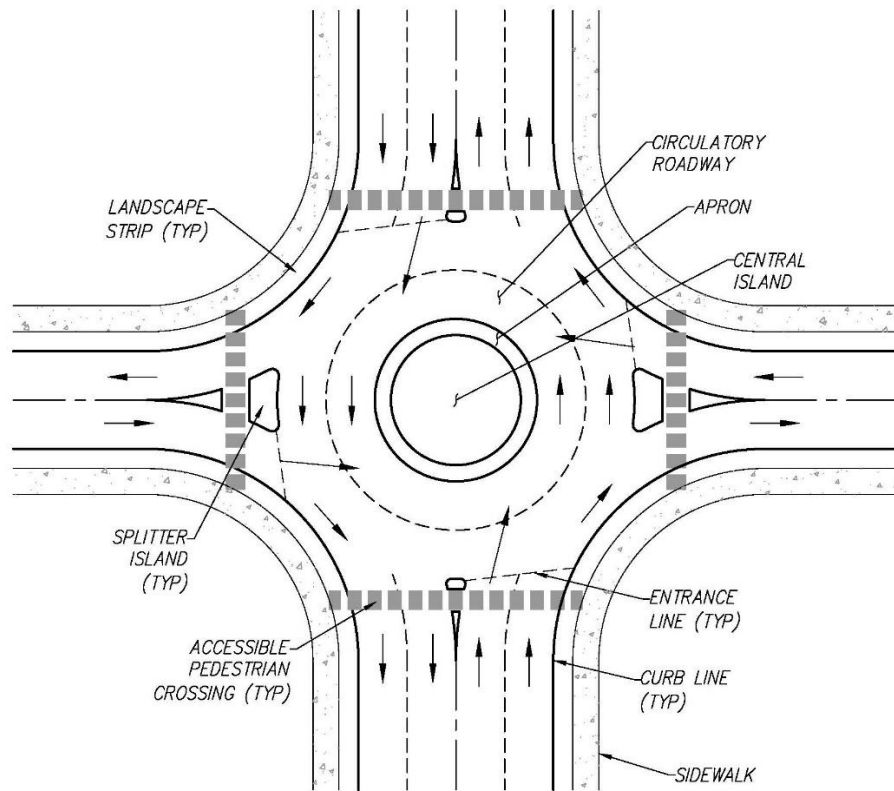


Figure 1.4.7.1 Four Lane Roundabout

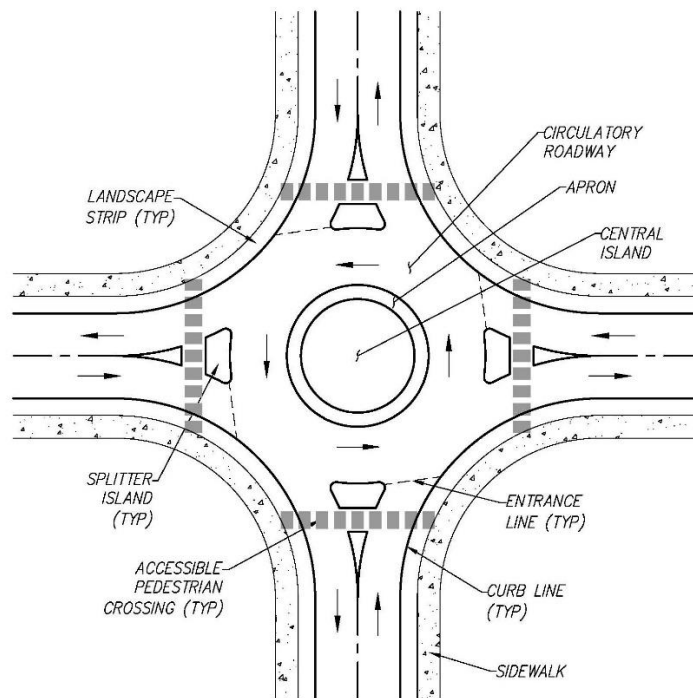


Figure 1.4.7.2 Two Lane Roundabout

1.4.7.1 Roundabout Design

The design of a roundabout is an iterative process taking into account multiple objectives and design elements including safety, operations, cost, uses, right of way, traffic volumes and other such items. Normally each roundabout will be unique in some way so a standard roundabout is not included in the manual. Also the various analysis and design considerations are beyond the scope of this manual. The resources shown in this section should be used when designing a roundabout. In addition to the resources shown, the roundabout design shall include the following design review process with the City Engineer and City Staff:

- 1) Have a Pre-Development meeting on the project.
- 2) Have a Traffic Impact Analysis review meeting with City Traffic Engineer. See section on TIA requirements.
- 3) Develop Preliminary layout of roundabout considering TIA and Pre-Development meetings.
- 4) Preliminary Design review meeting with City Engineer.
- 5) Develop roundabout design based up comments from the City Engineer.
- 6) Submit roundabout design through the Development Review Process (DRC).

Resources:

- National Cooperative Highway Research Program Report (NCHRP) 672 Roundabouts: An Information Guide, Second Edition
<https://nacto.org/docs/usdg/nchrprpt672.pdf>
- Federal Highway Administration Roundabouts, An Information Guide
<https://www.fhwa.dot.gov/publications/research/safety/00067/00067.pdf>
- Federal Highway Administration Roundabouts, Technical Summary
<https://safety.fhwa.dot.gov/intersection/innovative/roundabouts/fhwasa10006/fhwasa10006.pdf>

Another helpful resource is the Kansas DOT guideline for roundabouts.

https://www.ksdot.org/Assets/wwwksdotorg/bureaus/burtrafficeng/Roundabouts/Roundabout_Guide/KansasRoundaboutGuideSecondEdition.pdf

1.5 Traffic Calming

- Traffic calming devices are permitted and required only on residential and residential collector streets. Traffic calming devices are required at a minimum of two block intervals (generally 1200 foot maximum spacing) but no less than 200 feet apart on residential streets and residential collector streets.
- Appropriate signage and pavement markings are to be provided along with all traffic calming devices and are not necessarily included in the figures below.
- Additional right of way may need to be dedicated in order to accomplish traffic calming.

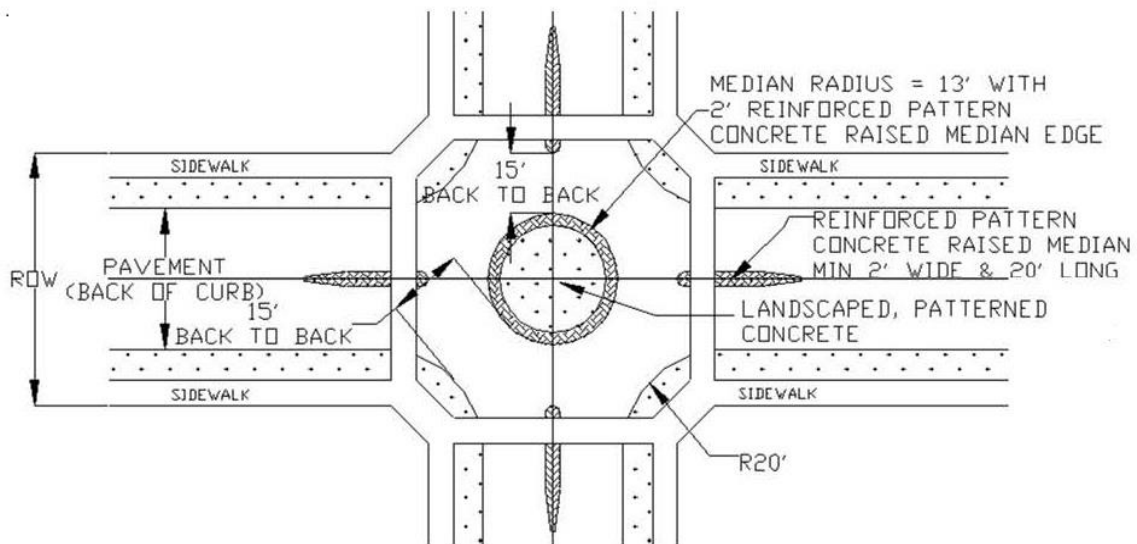


Figure 1.5.1, Traffic Circle

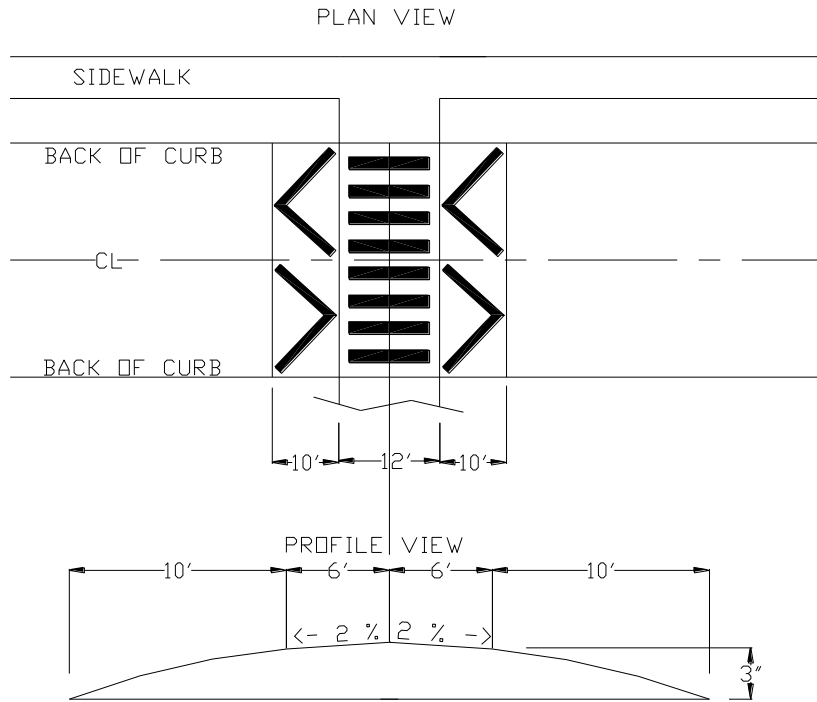


Figure 1.5.2, Raised Crosswalks

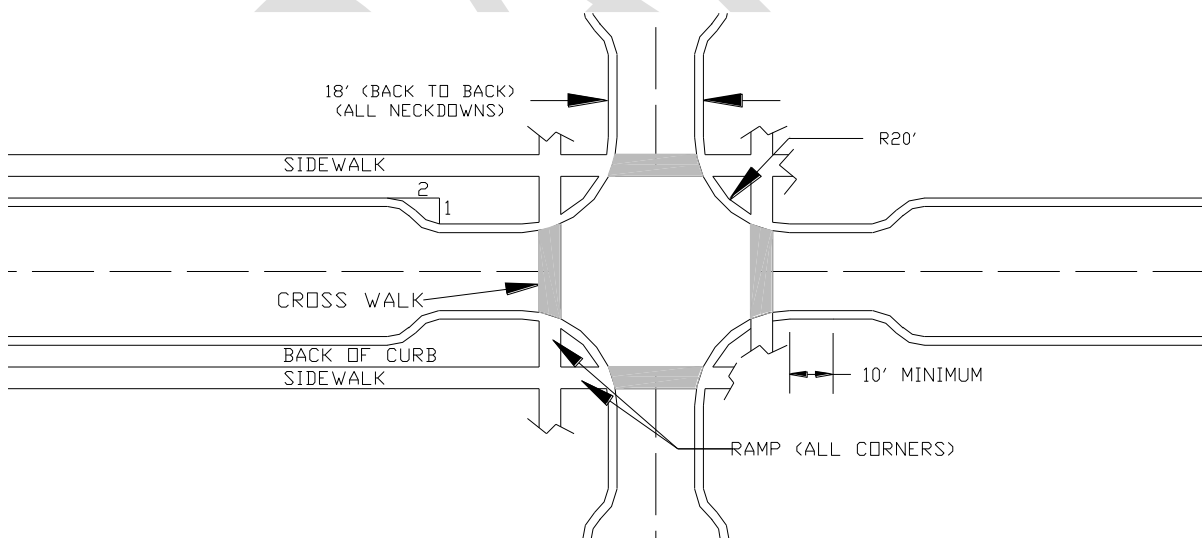


Figure 1.5.3, Neck Downs

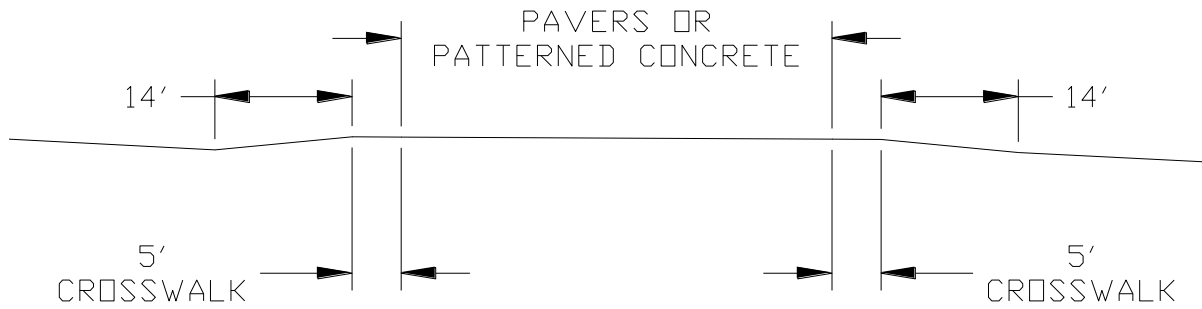


Figure 1.5.6, Raised Intersection Profile View

1.6 On Street Parking

On street parking is permitted for residential streets and residential collector streets. On street parking for proposed commercial/industrial collectors or arterials is not allowed. Where on street parking is designated, one on street parking space for each single family unit on a block is required on the frontage street within that block. Areas in front of or within 10 feet of a driveway, within 20 feet of a street intersection or within 5 feet of a fire hydrant shall not be counted toward the required on street parking. When determining the required off street parking for multi-family development, the on street parking shall not be considered in the required amount of parking needed for the development.

Figures 1.6.1 through 1.6.5 show the acceptable parking configurations for on street parking.

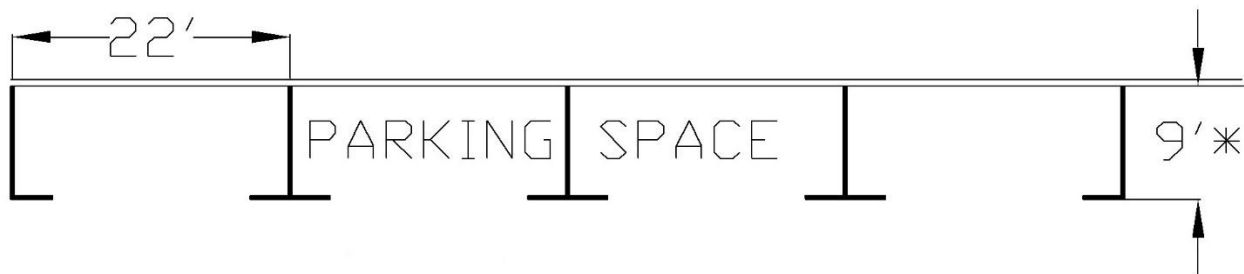
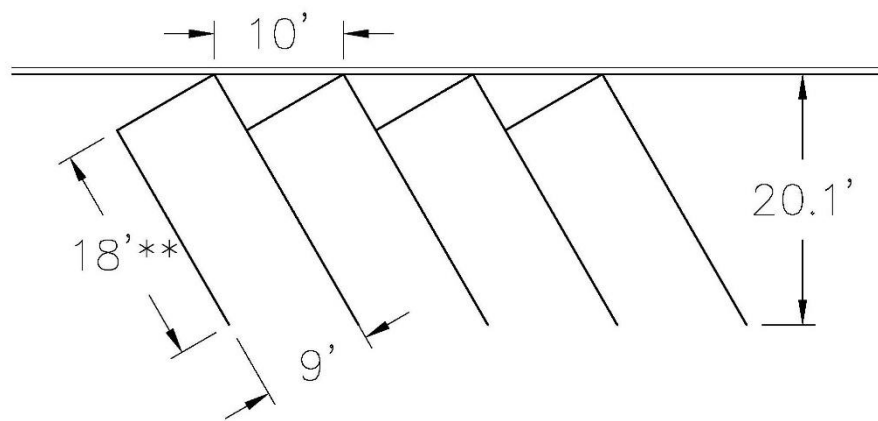
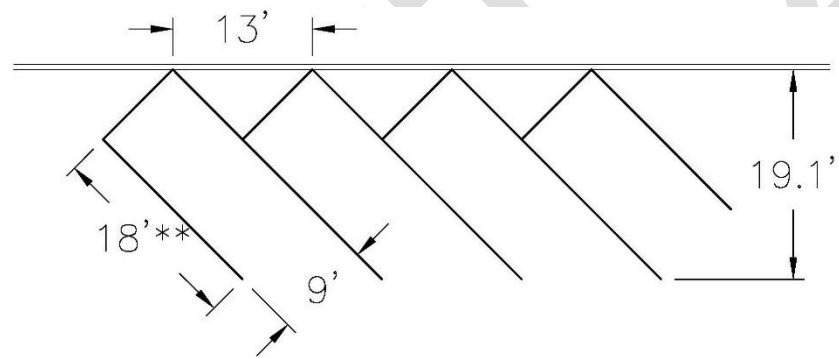
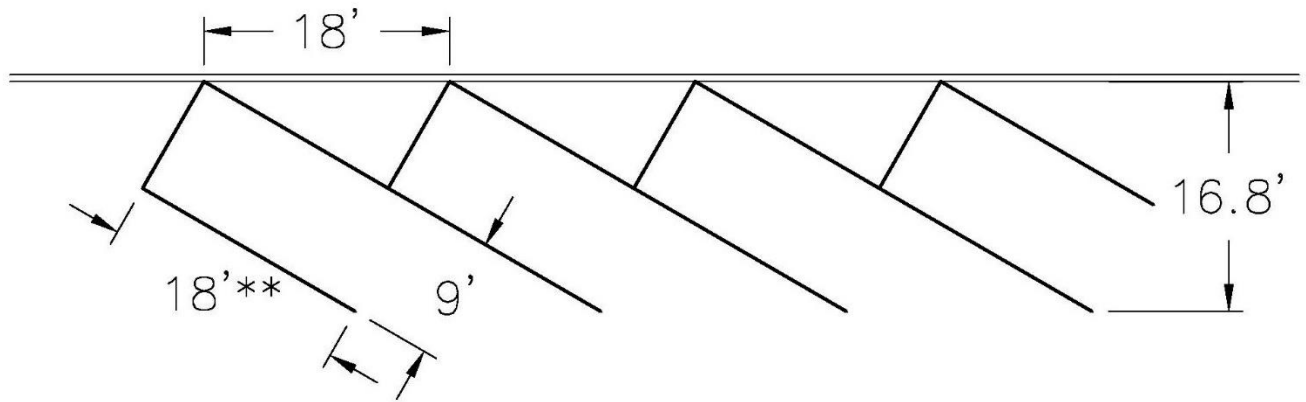


Figure 1.6.1, Parallel Parking



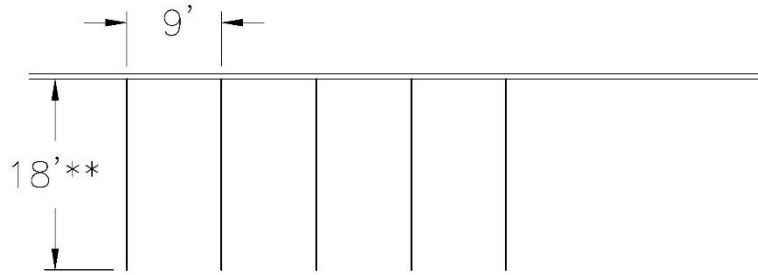


Figure 1.6.5, 90 Degree Angle

* When permitted, the minimum parking space may be 8-feet in width for residential streets and residential collectors.

** Wheel stops will be required to prevent vehicle overhang into adjacent property, right-of-way, structures, landscaping or sidewalk.

- Parking spaces may be reduced to 16.5-feet in length if overhang is allowed.
- All standard parking space stripping shall be white in color.
- All handicap parking spaces shall be installed in accordance with the City of Denton standard details.

1.7 Signage and Pavement Markings

Signage and pavement markings shall be as shown on the City of Denton M & S Drawings and in accordance with the Manual of Uniform Traffic Control Devices.

1.8 Guidelines for Perimeter Street Improvements

1.8.1 Summary

These are guidelines for perimeter street improvement requirements for proposed developments under the Roadway Impact Fee Ordinance. These guidelines are intended to be general in nature, and in the event that these guidelines conflict with provisions of the Denton Development Code (“DDC”) or the Roadway Impact Fee Ordinance No. 2016-189 (the “Ordinance”), the provisions in the DDC and Ordinance will prevail over these guidelines.

1.8.2 Guidelines

1.8.2.1 Level of Service

For any proposed development that would generate enough traffic to reduce the Level of Service below LOS D⁵ on an affected street, the development will be required to construct street capacity enhancements proportionate to the development’s impact. The Denton Development Code currently has a requirement for developments that generate 1,000 vehicle trips per day or 100 trips in a peak hour to submit a traffic study. Developments with this requirement will be required to evaluate the Level of Service for all affected streets to determine the development’s impact. If a development does not generate enough traffic to require a traffic study, then the existing traffic counts plus estimated trips from the current Trip Generation Manual will be used to determine the LOS impact. LOS is to be determined by the proposed development, with verification by the City Engineer.

1.8.2.2 Safety

1.8.2.2.1 For any proposed development that is adjacent to an affected perimeter street where the pavement width is less than 22 feet in width, the development will be required

to widen the street to at least 25 feet in width (with a 2 in. minimum Type C asphaltic concrete overlay for asphalt pavements and without an overlay for concrete pavements) with appropriate transitions to the existing pavement; or

- 1.8.2.2.2** If the adjacent affected perimeter street has a pavement width that is less than 22 feet wide and has an Overall Condition Index (OCI) of below 40, and the street is not scheduled to be reconstructed by the City's current Capital Improvements Program, then the development will be required to reconstruct the entire 25 foot. width of the perimeter street to current City standards, which includes curb and gutter, in the ultimate location with appropriate transitions to the existing pavement. If the development is located adjacent to an affected perimeter street that would, in the City Engineer's opinion and discretion, be sufficient with reconstruction of a 24 foot width with no curb and gutter, then the development may be allowed to pursue this alternative standard

-
- ¹ Some smaller developments are exempt from roadway impact fees. The exemption in Sec. 12.B of the roadway impact fee ordinance states, "[a] change in use that generates less than 10 times the number of Service Units attributable to the immediately preceding use is exempt from the payment of Impact Fees." These developments will also be exempt from these perimeter street paving guidelines.
- ² If the development has 100 feet or less of frontage on the perimeter street, the development will not be required to improve the street. See DDC Sec. 35.20.2. L.4.
- ³ The fee is assessed and "locked in" at the time of the final plat recordation. The fee will not change unless there is an increase in service units. The fee is collected at the time the building permit is pulled.
- ⁴ Credits are given for facilities identified in the roadway impact fee Capital Improvements Plan, and for facilities (streets classified as a collector or above) that qualify to be included in the Mobility Plan, even if not currently depicted on the Mobility Plan map, where the City has entered into a Credit Agreement.
- ⁵ If the LOS is already below D, the development must improve the LOS to at least level D.

1.8.2.3 Adjacent Curb and Gutter Improvements

For any proposed development that has an affected perimeter street which is improved to City standards with curb and gutter across from or immediately adjacent to the development, the development is required to construct the perimeter street improvements according to Subchapter 20 of the Denton Development Code by adding curb and gutter improvements and a maximum of 25 feet. width of additional pavement.

1.8.2.4 Alternate and Interim Roadway Sections

The City Engineer may allow an alternate or interim pavement section (including pavement type, width and thickness), based on the anticipated schedule for reconstruction of a roadway section, differences between existing and future roadway elevations, and other design factors applicable to the Perimeter Street segment.

1.8.3 City Participation

The City reserves the right to participate in the costs of improving the remainder of a perimeter street, if applicable, within its discretion, in accordance with the law, and in the event that adequate funding exists for such contribution.

1.8.4 Credits

Pursuant to Ordinance No. 2016-189, Section 14, the City may credit the contribution of land, improvements or funding for construction of any System Facility (collector street and above), required or agreed to by the City, toward the Roadway Impact Fees due for a development. Such credits are limited to the provisions of said Section 14 and the following guidelines:

1.8.4.1 For Right-of-Way

Right-of-way will be credited, at the Denton County Appraisal District appraised value prior to the beginning of the development process for the property, for only the area of right-of-way provided beyond the current maintained right-of-way limits and excluding right-of-way required for any development site-related improvements.

1.8.4.2 For Street Construction

Construction value will be credited at the total cost of the construction of the roadway and related appurtenances, based on competitive bids and less sidewalks and development site-related roadway or facility improvement, e.g., turn-lanes, acceleration/ deceleration lanes, etc. serving the development. The construction costs for the System Facilities must also be comparable to the costs of roadway improvements within the development and agreed on by the City Engineer. System Facilities may include perimeter or off-site roadway improvements.

1.8.4.3 Development Agreements Required

Any Credits allowed against Roadway Impact Fees for a development are to be included in a Development Agreement between the developer and City, with identification of "... the basis for and the method for computing and the amount of the Credit due and any reduction in Credits attributable to consumption of road capacity for developed lots or tracts served by the Roadway Capital Improvements." City participation in the costs of Perimeter Street Paving improvements requires approval of a Development Agreement between the developer and City by the City Council.

1.8.5 Appeal

An appeal to the City Council of City staff's determination of requirements for Perimeter Street Paving and related off- site roadway improvements may be filed by a property owner or the permit applicant, in accordance with the Denton Development Code, Section 35.3.12.E. An appeal of City Staff's determination of Credits may be filed by the property owner or applicant in accordance with Ordinance No. 101.

1.8.6 Perimeter Street Transition

Table 1.8.6.1, Pavement Transition Lengths

Type of Street	Length of Transition Per offset distance (ratio)
Neighborhood	5
Collector	10
Secondary Arterial	15
Primary Arterial	20

1.9 Traffic Impact Analysis

The purpose of the traffic impact analysis (TIA) is to assess the impacts of development on the existing roadway system within the study area of the development, and to assess the traffic flow needs within the development. The thoroughfare plan and the City of Denton traffic model are the base conditions for assessing the impacts. The current traffic model and the assessment is based on a Level of Service D.

1.9.1 Definitions

Existing Traffic - Existing traffic conditions based on the City of Denton traffic model and / or known existing traffic conditions. Existing traffic conditions do not include the traffic created or associated with the development.

Proposed Traffic Volumes – The number of vehicles per day and per hour projected to be generated by the development.

20 Year Horizon – The estimated traffic volume for the study area based on a 20 year growth period.

Projected Growth Rate – The estimated growth rate per year for the study area based upon the location within the Road Impact Fee Service Area Map and Rate Table.

Study area – The boundaries of the assessment area as determined by the City of Denton Traffic Engineer.

Traffic Queue – Vehicles within a storage queue awaiting traffic movement.

Trip Distribution – Estimates of trip distribution by turning movements from the proposed development.

1.9.2 When a Traffic Analysis is Required

The need for a TIA shall be determined by the City of Denton Traffic Engineer based upon the information provided at the Preliminary Trip Generation Assessment meeting and/or meeting scheduled with the Traffic Engineer for the purpose of determining the TIA requirements. Unless otherwise directed by the City of Denton Traffic Engineer, a TIA will be required for the following conditions:

- Development will generate equal to or more than 100 Peak Hour Trips (PHT)
- Development will generate equal to or more than 1,000 vehicle trips per day (VPD)
- Project area to be developed is equal to or more than 100 acres
- Changes or alterations to the City Thoroughfare plan will be requested
- Access is taken from a TxDOT roadway
- Zoning changes that will negatively increase estimated traffic volumes above the current zoning estimated traffic volumes
- Access is taken from an existing roadway with current traffic flow congestion based upon observed conditions

1.9.3 Traffic Impact Analysis Requirements

1.9.3.1 TIA Criteria

Table 1.9.3.1 shows the number of analysis periods and study area limits for the TIA. Prior to beginning developing the TIA a Preliminary Trip Generation Assessment shall be developed and reviewed with the City of Denton Traffic Engineer to verify the number of analysis periods and the study area requirements. See Section 1.9.4 Submission and Review Procedures.

TABLE 1.9.3.1: Criteria for Study Requirements

<u>Analysis Category</u>	<u>Site Trips Generated at Full Build-Out</u>	<u>TIA Analysis Periods⁽¹⁾</u>	<u>Minimum Study Area⁽³⁾</u>
I	>50 peak hour driveway trips; or 100-500 total peak hour trips	1. Existing year 2. Opening year ⁽²⁾ 3. Five years after opening	1. All site access drives. 2. All signalized intersections and/or major unsignalized intersections within 0.5 mile to 1 mile of site boundary, depending on total peak hour trips.
II	>500 total peak hour trips	1. Existing year 2. Opening year of each phase 3. Five years after initial opening 4. Twenty years after final opening with full build-out	1. All site access drives 2. All signalized intersections and/or major unsignalized intersections within 1.5 miles of site boundary

1. Analysis periods shall include build and no-build scenarios. Assume full occupancy when each phase opens.
2. Assume full build-out.
3. For certain projects, the City may require an enlarged study area. Land uses within the study area should include recently approved or pending development adjacent to the site.

1.9.3.2 Specific Requirements of the TIA Report

At a minimum the TIA report will include the following items:

- Introduction that describes the project and traffic generating modes
- Traffic Analysis Map
 - Existing and Proposed Land use within Study Area
 - Study Area Boundary
 - Existing and Proposed Roadways
 - Designation of Traffic movement elements
 - Thoroughfare Plan Elements within Study Area
- Trip Generation Calculations
 - Daily and Peak Hourly Trip Generation for fully developed project conditions. Include both AM and PM Peak Hour. Provide Summary table and backup tables for calculation methods.
 - Discount assumptions based upon City of Denton Transportation Engineer approval.
- Trip Distribution and Assignment Tables and Figures

- For Entrance/ Exit from the development
- For boundary streets within study area
- Existing and Projected Traffic Volumes for Study based upon Table 1.9.3.1 Criteria
 - Average Daily
 - Peak Hourly AM and PM
- Traffic Volume Analysis
 - Level of Service Evaluation for Peak Hour AM and PM
 - Turn Lane Evaluation for project site and study area. The extent of evaluation to be determined by the City of Denton Traffic Engineer.
 - Signalization Evaluation for project site and study area. The extent of the evaluation to be determined by the City of Denton Traffic Engineer.
 - Identification of all thoroughfares, driveways, intersections, and individual movements that do not meet LOS D.
- Recommendations
 - Proposed recommendations to mitigate impacts to transportation system within the study area.
- Document Requirements.

The following provides a general outline for the TIA report:

Executive Summary

- 1 Introduction
 - a. Purpose
 - b. Methodology
- 2 Existing and Proposed Land Use
- 3 Site Traffic Generation
- 4 Existing and Proposed Traffic Flow
 - a. Transportation System
 - b. Transportation Volumes
- 5 Traffic Analysis
 - a. Level of Service Evaluation
 - b. Turning Movement Evaluation
 - c. Signalization Evaluation (If needed)
- 6 Mitigation
- 7 Conclusions and Recommendations
- Additional Requirements

Dependent up the site characteristics, the City of Denton Transportation Engineer may require additional information to be included within the TIA.

1.9.4 Submission and Review Procedures

- A Preliminary Trip Generation Assessment of the proposed development shall be conducted to determine the TIA requirements such as limits of study area, need and type of turning movement evaluation, need for signalization evaluation, discount assumptions that can apply, and criteria to be used. Sufficient base information shall be submitted to the City of Denton Traffic Engineer in order to provide proper guidance on TIA requirements for the report. Subsequent to the submittal of the preliminary trip generation assessment, a meeting with the City of Denton Traffic Engineer should be scheduled to discuss the specific requirements for the TIA.
- Upon completion of the TIA report, two (2) copies of the report shall be submitted to the City of Denton Traffic Engineer for review.
- After a TIA is approved, and if the development proposed land use and/ or proposed traffic generation characteristics change, the TIA shall be updated and re-submitted to the City for approval.

2 Drive Approach Design

The user should be aware of and utilize the City of Denton Development Code Subchapter 20-Transportation in conjunction with this Manual.

2.1 Drive Approach Type

The following provides the types of drive approaches considered within the manual:

- Single family residential – A drive approach to a single family residential lot or one lot duplex.
- Multi-family residential – A drive approach to a multi-family lot such as triplexes, fourplexes, and multi-complexes. The drive approach can be either the main entrance approach or the secondary entrance approach. Each type has specific design requirements.
- Commercial – A drive approach to a commercial development. The drive approach can be either the main entrance approach or the secondary entrance approach. Each type has specific design requirements.
- Industrial – A drive approach to an industrial development. The drive approach can be either the main entrance approach or the secondary entrance approach. Each type has specific design requirements.
- Mix use approach – A drive approach that is a mix use shall consider the more stringent criteria for the approach design.

2.2 Geometric Standards

The following standards generally apply to all developments. However, there may be unique situations for which these standards may be impractical. In these situations, the City Engineer and/or his/her representative will work with the developer to develop a mutually agreeable solution. In the event that a mutually agreeable solution is not reached, the developer may apply to the Planning and Zoning Commission for consideration of the issue.

A “Driveway” is located entirely on private property. It is only for a single family or a duplex property. It connects a drive approach to a garage, “car” port, parking pad or the like.

A “Drive Aisle” is located entirely on private property. It is for every other condition other than for a single family or a duplex property. It connects a drive approach to an area(s) that is to be accessed on the site such as, but not limited to: parking space(s); loading dock(s); loading area(s) (marked or implied - for passengers and/or goods); porte cochere(s), and/or the like. It can also be a fire lane (in and of itself or in conjunction with other access use[s]). It can also be an access to an adjoin property (in and of itself or in conjunction with other access use[s]).

A “Drive Approach” is located in the ROW and connects a street (City, public or private) or highway (TxDOT) with a driveway or a drive isle. Some features of the drive approach may extend into and be a part of the driveway or drive aisle.

2.2.1 Drive Approach Dimensions

Table 2.2.1.1, Driveway Dimensions

Use	Drive Approach Widths	Radius
Single Family and Duplex Residential *	Min. Width = 12 feet Max Width = 20 feet **	5 feet
Multi-Family Residential	Min. Width = 24 feet Max Width = 38 feet	10 to 20 feet
Commercial	Min. Width = 30 feet Max Width = 38 feet***	20 to 25 feet
Industrial	Min. Width = 30 feet Max Width = 38 feet***	20 to 25 feet

- Refer to Figures 2.2.1.1 through 2.2.1.5
- Add 5 feet to maximum radius for significant truck traffic
- For shared drive approaches, no lot shall contain less than 9 feet of the drive approach and driveway or drive aisle (as may apply). Drive approach shall be centered on lot line such that maximum drive approach width equals 30 feet.
- Maximum drive approach width is a function of traffic volume. Refer to Figures 2.2.1.1 through 2.2.1.4.

* For infill situations:

-A one single family residential or a two-family residential lot accessing a collector may be permitted to have 1 full width or circular drive approach when alleys are not practical.

-Adjacent two single family residential or two two-family residential lots accessing a collector may be permitted to have 1 shared full width or circular drive approach when alleys are not practical.

-Contiguous three or more single family residential or three or more contiguous two-family residential lots accessing a collector will be required to enter the collector by an alley, flag drive, or residential street.

-For one single-family residential or one two-family residential lot accessing an arterial, an on-site facility will be required to allow entrance into the arterial in a forward manner.

** For homes with a three or more car garage, where the garage door faces the street and the garage door is less than 40 feet from the back of curb, the maximum drive approach width is 30 feet.

*** Drive approaches with a median installed in lieu of the double yellow marking may exceed the maximum drive approach width by the width of the median only. Drive approaches with significant truck traffic may install surmountable curb with textured and colored pavement in the parkway with a depth equal to or greater than the drive approach pavement requirement.

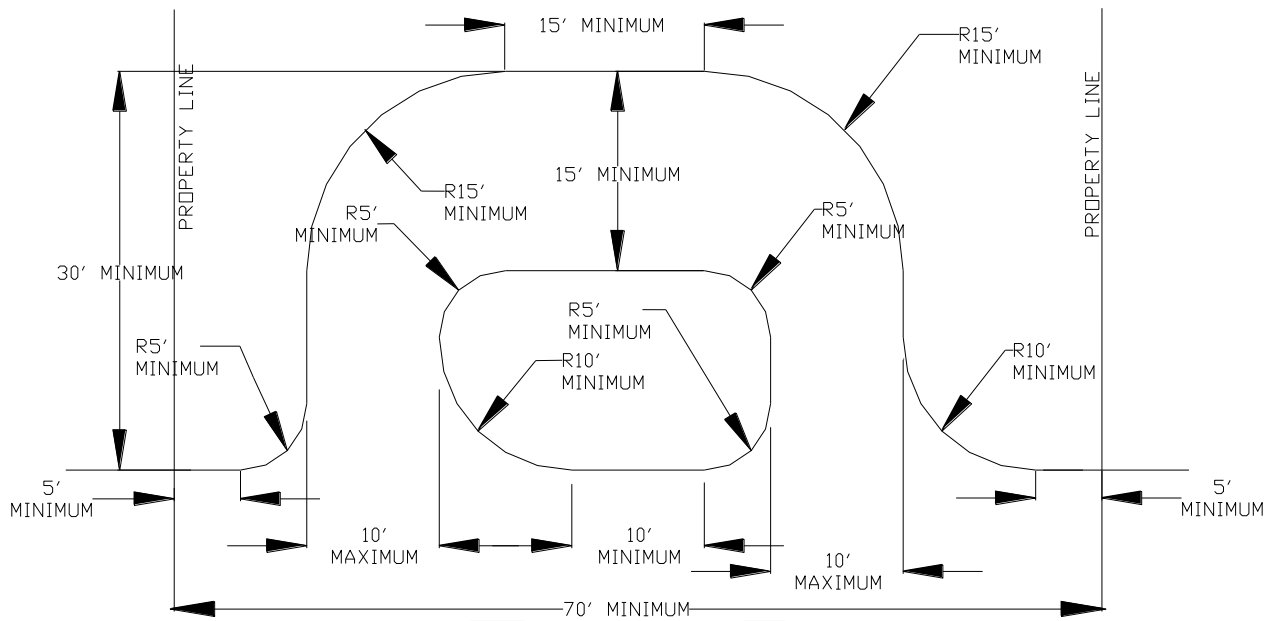


Figure 2.2.1.1, Residential Circular Drives

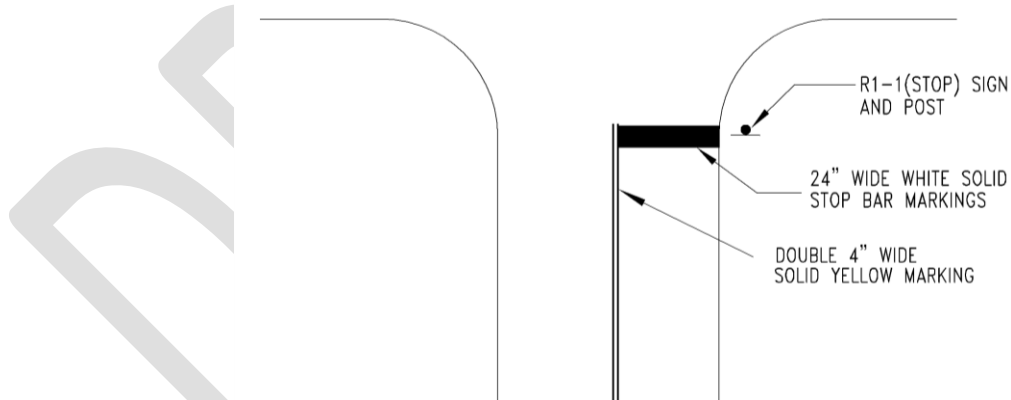


Figure 2.2.1.2, Single Lane Egress, Single Lane Ingress

Commercial Drive Approach

- The stop bar and stop sign shall be on private property as well as upstream of any pedestrian facility crossing the drive approach and/or the drive aisle.
- The outbound (towards the street) lane shall be 10 feet wide until at such time as the width of the driveway is greater than 28 feet and then the inbound (onto the site) lane shall be a minimum of 18 feet wide.

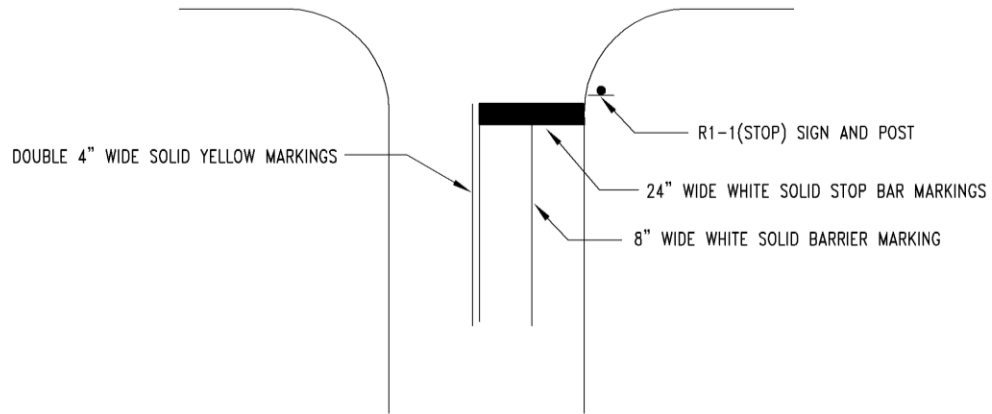


Figure 2.2.1.3, Dual Lane Egress, Single Lane Ingress

Commercial Drive Approach

- The stop bar and stop sign shall be on private property as well as upstream of any pedestrian facility crossing the drive approach and/or the drive aisle.
- The two outbound (towards the street) lanes shall each be 10 feet wide until at such time as the width of the driveway is greater than 38 feet and then the inbound (onto the site) lane shall be a minimum of 18 feet wide.

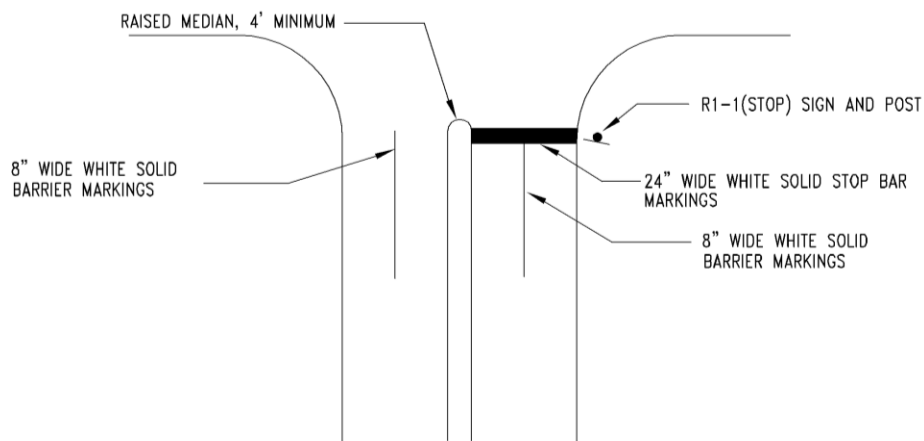


Figure 2.2.1.4, Multiple Lane Egress, Multiple Lane Ingress

With Median Commercial Drive Approach

- The stop bar and stop sign shall be on private property as well as upstream of any pedestrian facility crossing the drive approach and/or the drive aisle.
- The two outbound (towards the street) lanes shall each be 10-12 feet wide the two inbound (onto the site) shall each be 10-12 feet wide.
- Median shall accommodate any pedestrian facility across the drive approach and/or drive aisle as projected from both sides thereof.
- Only allowed when dual left turn lanes into the site or opposing street/driveway has two or more lanes of which two are designated as being through lanes.

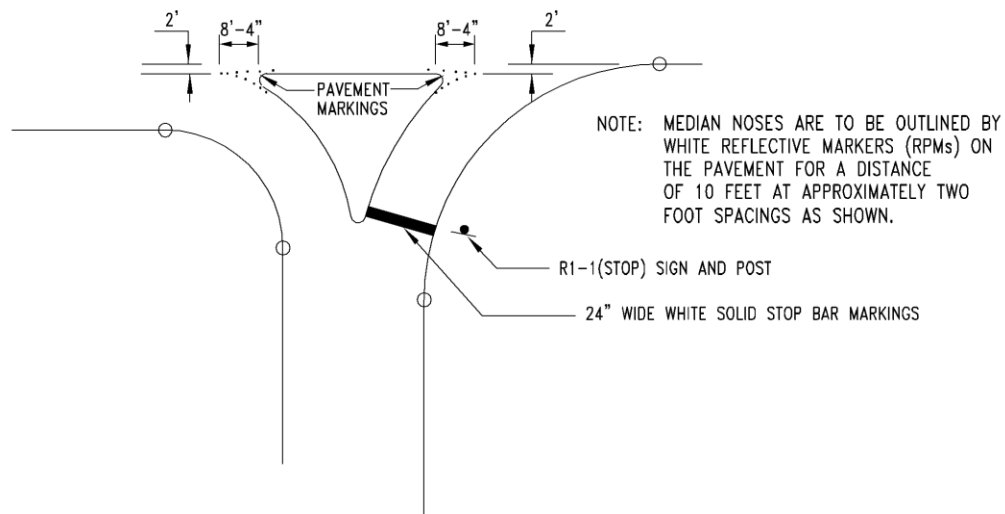


Figure 2.2.1.5, Right in /Right out Commercial Drive Approach

- The stop bar and stop sign shall be on private property as well as upstream of any pedestrian facility crossing the drive approach and/or the drive aisle.
- The minimum width of the drive approach/drive aisle prior to the island, as well as each lane (inbound and outbound) at the island and the applicable radii shall be determined by the engineer of record and based upon the type(s) of vehicles expected to use it as well as an auto-turn analysis provided to the City for review and approval.
- Median/island shall accommodate any pedestrian facility across the drive approach and/or drive aisle as projected from both sides thereof.
- For “one way in” or “one way out” driveways, the geometry shall be as shown in the figure above for the respective side.

2.2.2 Drive Approach Spacing

- Drive Approach spacing (same side of street)

Table 2.2.2.1, Minimum Drive Approach Spacing

Street Classification	Min. Drive Approach Spacing
Alley	10 feet
Flag Drive	10 feet
Residential	10 feet if permitted
Collector	100 feet if permitted
Secondary Arterial	150 feet if permitted
Primary Arterial	200 feet if permitted

- Driveway spacing is measured between the closest edges of each drive approach not including the radius.

- b. Drive Approach spacing adjacent to street intersections

Table 2.2.2.2, Minimum Drive Approach Spacing at Intersections

Type of Intersection	Approaching the Intersection	Departing the Intersection
Alley/Alley	10 feet both streets	10 feet both streets
Alley/Residential	20 feet on alley, 50 feet on residential if permitted	20 feet on alley, 50 feet on residential if permitted
Alley/Collector	20 feet on alley, 75 feet on collector if permitted	20 feet on alley, 100 feet on collector if permitted
Flag Drive/Residential	20 feet on flag drive, 50 feet on residential if permitted	20 feet on flag drive, 50 feet on residential if permitted
Flag Drive/Collector	20 feet on flag drive, 75 feet on collector if permitted	20 feet on flag drive, 100 feet on collector if permitted
Residential/Residential	50 feet both streets	50 feet both streets
Residential/Collector	50 feet residential, 75 feet collector	50 feet residential, 100 feet collector
Residential/Arterial	50 feet residential, 150 feet arterial if permitted	50 feet residential, 200 feet arterial if permitted
Collector/Collector	75 feet both streets	100 feet both streets
Collector/Arterial	75 feet collector, 150 feet arterial if permitted	100 feet collector, 200 feet arterial if permitted
Arterial/Arterial	150 feet both streets if permitted	200 feet both streets if permitted

- Corner clearance is measured between the right of way line of the intersecting street and the nearest edge of the drive approach not including the drive approach radius. See figure 2.2.2.1.

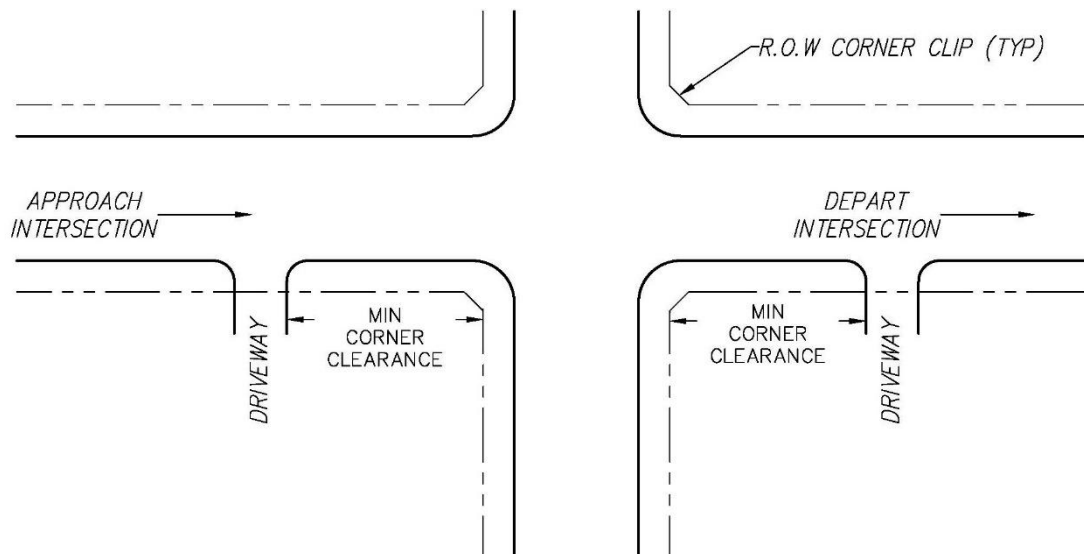


Figure 2.2.2.1, Drive Approach Spacing at Intersections

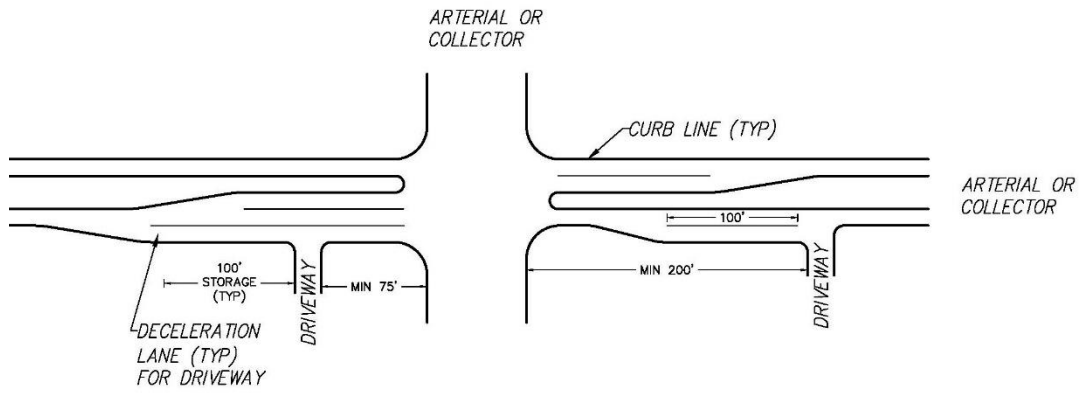


Figure 2.2.2.2, Drive Approach Near Turning Movements

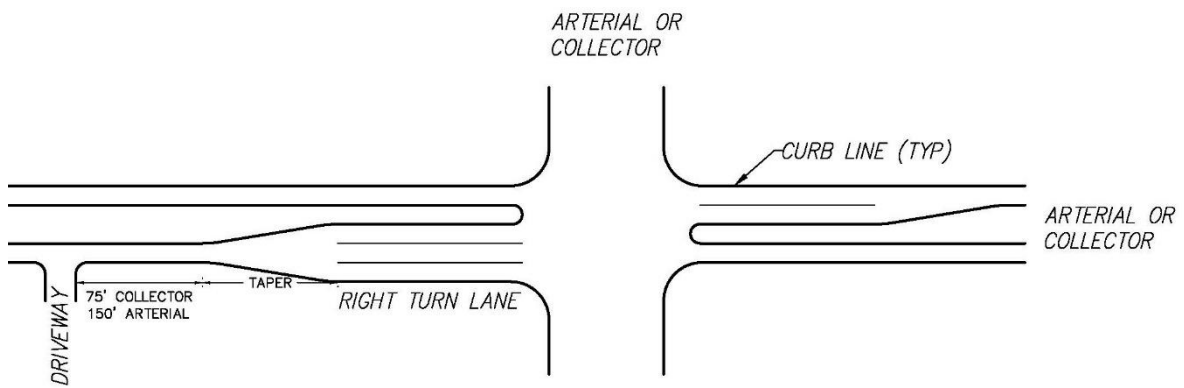


Figure 2.2.2.3, Drive Approach Near Turning Movements

c. Drive approach offset/relationship to median openings

- For collector streets, drive approaches that do not align across the street from each other must be offset by a minimum of 75 feet between nearest tangent edge to nearest tangent edge.
- For Arterial Streets without medians, drive approaches must align across the street from each other and be positioned as is reasonable and practical given property line location and time of development of the site. When this is not physically possible or practical, based on the opinion of the City Engineer, drive approaches that do not align must be offset across the street from each other by a minimum of 150 feet between nearest tangent edge to nearest tangent edge.
- For Arterial Streets with medians, drive approaches must align with existing or proposed median openings. Where this is not possible or practical as determined by the City Engineer, drive approaches must be placed as far away from the existing or proposed median opening as is reasonably possible.

2.2.3 Driveway Throat Length Requirements

Table 2.2.3.1, Minimum Throat Length

Number of Parking Spaces	Min. Throat for Primary Drive Aisle	Minimum Throat for Secondary Drive Aisle
0 to 100	20 feet	20 feet
101 to 250	40 feet	20 feet
251 to 500	60 feet	40 feet
501 to 1000	80 feet	60 feet
1001 and over	Queuing Analysis Required	Queuing Analysis Required

- All drive approaches that access an arterial shall be classified as a primary drive approach. If no drive approaches access an arterial, then the drive approach expected to receive the most traffic is considered to be the primary drive approach.
- The throat length is measured between the first parking space or drive aisle and the property line.
- Parking lots with 10 or less parking spaces may use a minimum throat length of 10 feet for drive approaches accessing a residential street or collector street.

2.3 Drive Approach Grades

2.3.1 Minimum Drive Approach Slope

The minimum drive approach slope shall be determined by: $S = (6 + [0.02 \times W \times 12]) / (W \times 12)$ where W = the width of the parkway in feet as shown on the City of Denton Standard drawings.

2.3.2 Maximum Drive Approach Slope

Unless otherwise approved by the City Engineer, maximum drive approach slope shall be 8 percent.

2.3.3 Sidewalks in Drive Approach

Maximum sidewalk cross slope within the limits of the drive approach shall be 2 percent.

2.3.4 Sidewalk Easement Requirement

Where the parkway width is insufficient to provide appropriate drive approach slope, a sidewalk easement will be required equal to the balance of the sidewalk width needed outside the right of way plus 2 feet. The additional 2 feet requirement is for sidewalk installation and maintenance. The balance of the sidewalk width needed is based upon using the minimum drive approach slope calculated within Section 2.3.1. See Figure 2.3.4.1

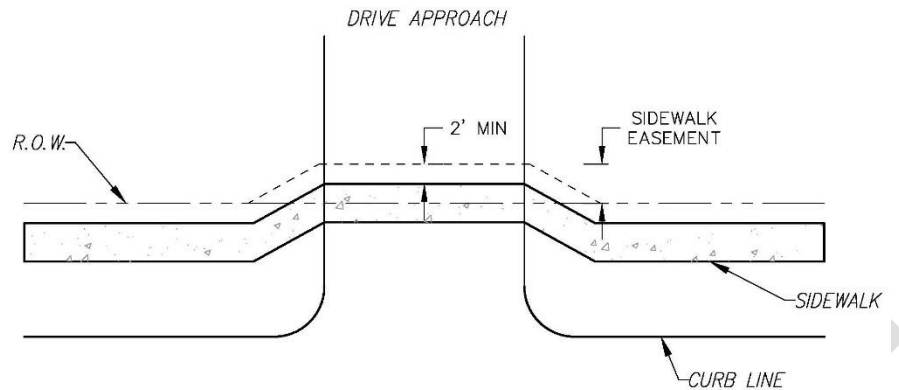


Figure 2.3.4.1, Sidewalk Easement to Meet Drive Approach Slope

2.3.5 Driveway/Drive Aisle Consideration

The drive approach slope from the bottom of the gutter to the nearest edge of the sidewalk (within the limits of the right of way) shall not exceed the driveway/drive aisle slope beginning at the furthest edge of the sidewalk. Also it shall not be less than the minimum slope nor be greater than the maximum slope as noted herein. See Figure 2.3.5.1

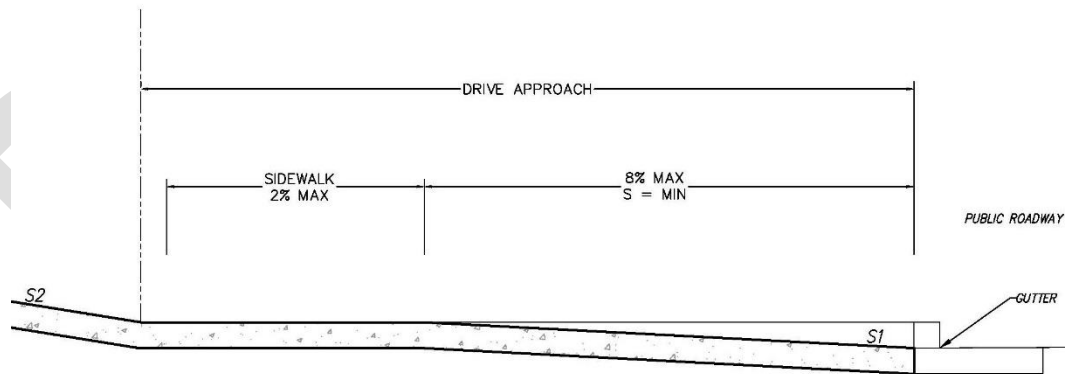


Figure 2.3.5.1, Driveway/Drive Aisle Section

1. $S_1 \leq S_2$
2. $S = (6 + [0.02 * W * 12]) / (W * 12)$
W = Width of the Parkway

2.4 Off Street Storage

At a minimum off street storage shall be provided as shown in Section 2.2.3. Additional storage capacity may be required based upon the types of vehicular traffic anticipated.

2.5 On Street Storage

On street storage if required shall be developed using appropriately sized turn lanes based upon full build out traffic volumes. On street storage requirements shall be included within the TIA if required.

2.6 Access Management

2.6.1 Purpose

The purpose of the access management plan is to promote the health, safety, and general welfare of the present and future residents of the city through managing traffic flow and promoting traffic safety.

2.6.2 Access Standards

a. Definitions

1. Driveway means the portion of the travel lane of a lot that opens onto a public street
2. Permit means a City of Denton curb cut permit
3. TxDOT Highways are state operated highways that include Farm to Market (FM) roadways, State Highways (SH), Interstate Highway (IH), IH Frontage Roads, and United States (US) Highways.

b. Compliance

No person shall construct, reconstruct, replace, relocate, alter, enlarge, improve or perform any work on or make use of any driveway for any property within the City or the Extraterritorial Jurisdiction, except in accordance with the Access Management Plan and this Manual or TxDOT Access Management Manual when applicable. All driveways shall be designed, installed, located and constructed in accordance with the approved specifications, plans, conditions and requirements of the permit issued for the property and the requirements of this Manual. No certificate of occupancy shall be issued for any building on any property for which a permit is required, until the construction, improvements, alterations or other work covered by the permit is completed in accordance with the permit issued, the requirements of this Manual or the provisions of any other applicable ordinance. Where no building permit was required in connection with the requested permit, no driveway on the property for which the permit was issued shall be used until and unless the work is completed in accordance with the permit and this Manual.

c. Closing of Driveways

Where the closing or relocating of one (1) or more existing driveways or portions thereof is necessary to comply with this Manual or a curb cut permit issued, access shall be closed by the removal of the existing driveway approach and the installation of curb and gutter along the gutter line of the street, all in accordance with City or if applicable, TxDOT specifications. If there is no existing curb and gutter on the street, the driveway shall be closed in the manner specified by the City Engineer.

d. Access to Freeways

Access to freeways shall only be provided at entrance ramps. Access to frontage roads may be provided in accordance with the standards for access to arterial streets set forth in this Manual with the following exceptions.

1. No access is allowed in areas where TxDOT owns the Control of Access. Such Control of Access may be found on current TxDOT right-of-way maps.
2. No access is allowed within a paved gore area or 250 feet past painted gore of an exit ramp. Similarly, no access is allowed within a paved gore area or 200 feet upstream of the painted gore of an entrance ramp.

e. Access to Arterial Streets

Access to an arterial street shall not be permitted unless there is no other reasonable means of providing safe access to the property. Unless designated as a freeway, all TxDOT Highways shall be considered arterials. Additionally, the geometric, hydraulic and pavement designs of all access driveways to TxDOT roadways must be reviewed by TxDOT to assure compliance with their standards.

1. No development shall be allowed access to an arterial street if property excluded from the development could have been used to provide reasonable access to a lesser classified street or if the property has been previously subdivided in violation of state law or Denton City Code if access could have been provided to a lesser street except for such unapproved subdivision of the property.
2. Existing commercial or industrial lots created prior to adoption of The Denton Development Code by legal subdivision procedures with exclusive frontage on an arterial street may take access to the arterial in accordance with the access standards in this Manual.
3. Existing single family and two family lots created prior to adoption of The Denton Development Code by legal subdivision procedures with exclusive frontage on an arterial street may be developed with a circular drive. Such driveway shall be designed and constructed in accordance with standards for circular drives provided in this Manual.
4. When driveway access to an arterial street is the only reasonable means of providing safe and adequate access to the property as determined by the City Engineer, the driveway design, number of driveways, location and construction shall be in accordance with this Manual.
5. Driveways on an arterial shall align with existing median openings, other driveways, and "T" intersections or be offset in accordance with this Manual.

f. Access to Collector Streets

1. Access to collector streets for commercial, office, or industrial development is required and shall be designed and constructed in accordance with the standards provided in this Manual.
2. No single or two family lots shall be designed such that there is no other means of access other than a collector street.
3. Existing single family and two family lots developed prior to approval of the Denton Development Code with exclusive frontage on a collector street and no alley may be developed with a circular drive. Such driveways shall be designed and constructed in accordance with the standards for circular drives provided in this Manual.
4. Driveways on a collector street shall align with existing driveways and "T" intersections on the opposite side of the street, or shall be offset in accordance with this Manual.

g. Driveway Separation

Unless located on a TxDOT roadway, driveways shall be separated in accordance with this Manual to ensure that all driveways are separated by sufficient distance so as to avoid interfering with the safe movement of traffic. In interpreting and applying the separation requirements, the following shall apply:

1. The separation requirements shall be determined in reference to any proposed or existing driveways on or off the property. Where applied to a property, which is located adjacent to an undeveloped tract, the separation requirements shall account for the placement of future driveways on the adjacent undeveloped property.
2. The minimum separation specified may be reduced for currently developed property if the amount of street frontage for the property is insufficient to allow for one (1) driveway access that would have the necessary separation from an existing driveway on adjacent property and joint access with adjacent properties is not physically possible as

determined by the City Engineer. If a reduction in the minimum separation specified is allowed, the separation shall be reduced only to the degree necessary to allow for the single driveway.

3. The separation distances specified shall be measured from the nearest edge of each driveway at the right-of-way line.

h. Corner Clearance Standards

Corner clearance standards shall be applied in accordance with this Manual to ensure that the traffic movements from driveways do not unduly conflict with the movement of traffic on intersecting public streets. In interpreting and applying the standards the following shall apply:

1. A reduced requirement may only be used if absolutely necessary to provide driveway access to property where no other means of access meeting the corner clearance requirement is reasonably possible and joint access with adjacent properties is not physically possible as determined by the City Engineer. If a reduction in the minimum corner clearance specified is allowed, the corner clearance shall be reduced only to the degree necessary to allow for the single driveway.
2. The specified distances shall be measured at the right-of-way line from the edge of the driveway nearest the intersecting street to the right-of-way line of the intersecting street. Where right of way corner clips exists or are proposed, the specified distance shall be measured from the edge of the driveway nearest the intersecting street and the end of the corner clip nearest to the subject driveway.

i. Driveway Widths and Grades

Unless located on a TxDOT roadway, driveway widths and grades shall be in accordance with this Manual. Driveways connecting to TxDOT roadways shall meet TxDOT standards.

j. Medians

1. When any development is required to provide more than one-half of any arterial street, a median shall be provided in accordance with this Manual.
2. Median Openings
 - Median openings shall be a minimum of 400 feet apart measured from the nose of median to nose of median.
 - Whenever a median opening is constructed, the associated left turn lane serving the development must be constructed at the same time. In the event that there is an existing intersecting street on the opposite side of the street, the new development constructing the median opening shall be required to install both left turn lanes.
 - Patterned and colored median noses shall be as shown on the City of Denton Standard Drawings.

k. Right and Left Turn Lanes

- Development expected to generate at least 100 but less than 1000 vehicle trips per day and less than 100 vehicle trips per hour at full development may be required to provide right turn lanes into each entrance and left turn lanes into each entrance that left turns are possible.
- Developments expected to generate at least 1000 vehicle trips per day or at least 100 vehicle trips per hour at full development shall be required to provide right turn lanes into each entrance and left turn lanes if a left turn is possible in accordance with an approved traffic impact analysis.
- Right and left turn lanes may be required based upon the traffic impact study for the study area.

2.6.3 Variance Procedure

- a. If an access related variance is not associated with the subdivision of property, the variance will be submitted to the Traffic Safety Commission for consideration.
- b. If an access related variance is associated with the subdivision of property, the variance will be submitted to the Planning & Zoning Commission.
- c. Driveway related variances are considered Hardship Variances. The proposed Hardship Variance is appropriate based on a finding that unreasonable hardships or difficulties may result from strict compliance with the subdivision regulations or the purposes of the regulations may be served to a greater extent by an alternative proposal. A variance may be approved so that substantial justice may be done and the public interest secured; provided that the variance shall not have the effect of nullifying the intent and purpose of these regulations; and further provided the Planning and Zoning Commission shall not approve variances unless it shall make findings based upon the evidence presented to it in each specific case that:
 1. The granting of the variance will not be detrimental to the public safety, health, or welfare or injurious to other property;
 2. The conditions upon which the request for a variance is based are unique to the property for which the variance is sought and are not applicable generally to other property;
 3. Because of the particular physical surroundings, shape or topographical conditions of the specific property involved, a particular hardship to the owner would result, as distinguished from a mere inconvenience, if the strict letter of the subdivision regulations is carried out;
 4. The variance will not in any manner vary the provisions of The Denton Plan, the Development Code, and the Denton Mobility Plan, except that those documents may be amended in the manner prescribed by law; and
 5. The special or peculiar conditions upon which the request is based did not result from or were not created by the act or commission of the owner or any prior owner, subsequent to the date of creation of the requirement from which a variance is sought.
- d. The Traffic Safety Commission decision on a hardship variance may be appealed to the Planning & Zoning Commission by a written request by the applicant.
- e. The Planning and Zoning Commission decision on a Hardship Variance may be appealed to the City Council by a written request by the applicant.
- f. If the variance involves a driveway on a TxDOT operated and maintained roadway, City Staff may choose to meet with TxDOT prior to consideration of any variance to receive technical input, which may have a bearing on the staff recommendation.
- g. Suspension and Revocation of a Variance
 1. When the City determines there is a failure to comply with any term, condition, or requirement made a condition of the approval of a variance, the City Council may direct the Building Official, City Engineer or Director, as appropriate, to suspend the variance compliance with the terms, conditions, or requirements under which the variance was approved.
 2. Notice of suspension or revocation of a variance shall be sent by certified mail, return receipt requested.
 3. The body granting the variance shall hold a public hearing no later than 45 days after notification. If the body granting the variance determines there is a failure to comply with any term, condition, or requirement made a condition of the variance, the body may revoke

the variance or special exception or take such action, as it considers necessary to ensure compliance.

4. A decision to revoke a variance is effective immediately. Notice of the decision by the body shall be sent by certified mail.

2.7 Signage and Pavement Markings

See Section 2.2.1 figures.

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3 Pavement Standards

The user should be aware of and utilize the City of Denton Development Code Subchapter 20 - Transportation in conjunction with this Manual.

3.1 Streets

This section covers the minimum pavement structural sections required for each classification of roadway. The pavement structural section requirements are based upon a Geotechnical and Pavement Design Consultation performed by CTL Thompson Texas, LLC in 2010. The design life assumed in the consultation was 40 years for jointed reinforced concrete pavement and 20 years for asphalt concrete pavement. Table 3.1.1 reflect the recommendations shown in the report.

An additional report was generated for reinforced concrete in 2017 by Teague Nall & Perkins, Inc. which provided minimum guidelines for reinforcement for concrete pavement. These recommendations area also reflected in Table 3.1.1.

Refer to the City of Denton Standard Drawings for additional requirements.

TABLE 3.1.1 PAVEMENT STRUCTUAL SECTION

REINFORCED CONCRETE PAVEMENT:

Pavement Section	Arterial	Commercial	Residential Collector	All Other Residential
Joint Reinforced Pavement Depth (Inches)	11	10	8	7
Stabilized ¹ Subgrade Depth (Inches)	12	12	8	8
Minimum Continuous Reinforcing Steel	#4 at 18" on center both ways	#4 at 18" on center both Ways	#3 at 18" on center both ways	#3 at 18" on center both ways

ASPHALT CONCRETE PAVEMENT:

Pavement Section	Arterial	Commercial	Residential Collector	All Other Residential
Asphalt Surface Course (inches)	3	3	3	2
Asphalt Base Course (inches)	9	9	6	6
Stabilized ^(D) Subgrade Depth (inches)	12	12	12	12

- A. Depths provided are minimum City requirements. Engineer of Record is responsible for ensuring these minimums meet design requirements for the specific project and may require additional analysis depending on local soil and moisture conditions as well as higher than expected traffic volumes and/or truck traffic.

- B. Soil conditions shall dictate what type of subgrade stabilization is required; either lime or cement. Geotechnical report(s) shall be prepared to identify which method is appropriate for the types of soils encountered. If cement stabilization is recommended, micro-fracturing according to TxDOT standards will be required.
- C. At a minimum, the subgrade shall be treated with 7% of the subgrade treatment to be used.
- D. TxDOT Flex-base may be used as an option for subgrade treatment. Depth of flex-base required shall be based upon a geotechnical report for the street improvements based upon ultimate traffic conditions. The section shall include filter fabric overlaid upon geo-grid. The geo-grid shall be in addition to the flex-base required by the geotechnical report. The flex-base shall be in accordance to TxDOT specifications Item 247 and shall be Type A Grade 1 material. The geogrid shall be Tensar TX-5 Triaxial Geogrid or approved equal. The geotextile filter fabric shall be Mirafi 500x or approved equal.

3.1.1 Geotechnical Report

At a minimum, a geotechnical report shall be prepared to identify the soil characteristics to be encountered for street improvements including recommendations for the type of subgrade stabilization treatment. If a different pavement structural section will be proposed, a geotechnical report shall be prepared with sufficient detail to justify the proposed structural section. The design criteria shown in the 2010 Geotechnical and Pavement Design Consultation report shall be used at a minimum. Additional requirements may be warranted by the City Engineer based upon the anticipated vehicular loading and traffic volumes anticipated.

3.2 Drive Approach

Refer to the City of Denton Standard Drawing for drive approach structure section requirements.

4 Pedestrian and Bicycle Facility Design

The user should be aware of and utilize the City of Denton Development Code Subchapter 20 - Transportation in conjunction with this Manual.

4.1 Geometric Standards

Table 1.3.1 shows the standard with of sidewalks and bike lanes for the various street classifications. Refer to the City of Denton Standard drawings for the locations of sidewalks and bike lanes within the street right-of-way.

4.1.1 Sidewalk Easements

Where a sidewalk easement is required the easement shall extend 2 feet passed the edge of the sidewalk. Any portion of the sidewalk extending passed the right-of-way shall be contained within a sidewalk easement.

4.2 Mobility Plan Component

The City of Denton Mobility Plan which includes a pedestrian and bike component should be reviewed relative to any proposed development. Refer to the following link to the City of Denton Website:

https://www.cityofdenton.com/CoD/media/City-of-Denton/Residents/Getting%20Around%20Denton/Pedestrian_and_Bicycle_Linkage_Component_Plan.pdf

It should be noted that the City of Denton Mobility Plan is a living document and is periodically updated to reflect the changes in the characteristics of anticipated traffic flow within the City.

4.3 Accessibility Standards

The City of Denton considers sidewalks to be accessible routes according to Section 4.3 of Texas Accessibility Standards (TAS) and considers a public sidewalk a “facility”. Sidewalks, landings, ramps, and flares shall comply with the latest TAS, the latest Department of Justice ADA Standards for Accessible Design, and the Public Right of Way Accessibility Guidelines (PROWAG). Also sidewalks, landings, ramps, and flares are subject to the requirements of the Texas Department of Licensing and Registration (TDLR) for inspection purposes unless otherwise exempted by the City Engineer. Prior to construction of sidewalks where the total cost of the public improvements will exceed \$50,000.00, the Engineer of Record must show proof of Texas Department of Licensing review and approval for accessibility. Compliance with the regulations shall be the responsibility of the Engineer of Record for the project. Refer to the City of Denton Standard drawings for additional requirements.

4.4 Intersections

4.4.1 Curb Ramps

The continuation of accessible routes through intersections shall use approved curb ramps that meet accessibility standards. Refer to the City of Denton Standard drawings for Type 1A and Type 1B curb ramps at intersections. Crosswalks through the intersections shall meet accessibility standards.

4.4.2 Bike Lanes

Bike lanes at intersections shall consider other traffic movements and facilities such as turn lane movements, transit facilities, parking, and stop bar locations. The current Urban Intersection Design Guide by TxDOT can be used for bike lane design at intersections. The bike lane design at intersections require the approval of the City Transportation Engineer.

4.5 Pedestrian TIA Requirements

If a development is proposed within ½ mile of a public elementary or secondary school, a pedestrian traffic impact analysis will be required to determine the appropriate size and location of sidewalks and bicycle facilities to serve those uses.

4.6 Signage and Pavement Markings

Signage and pavement markings shall be as shown on the City of Denton M & S Drawings and in accordance with the accessibility standards.

4.7 Amenities

4.7.1 Bicycle Parking

- a.** Refer to the City of Denton Development Code for applicability and required number of bicycle parking. Refer to Bicycle Parking Guideline 2nd Edition by the Association of Pedestrian and Bicycle Professionals (APBP) for general guidelines and resources.
- b.** All bicycle parking facilities/devices shall be constructed to meet commercial grade structural standards.
- c.** Location Standard:
 1. Bicycle parking must be on the same lot as the principle use.
 2. Bicycle parking must be located in highly visible and well-lit areas.
 3. Bicycle parking must not interfere with accessible paths of travel or accessible parking as required by the accessibility standards.
 4. Bicycle parking must be located within 50 feet of a main building entrance. In multiple building locations, bicycle parking must be distributed in a manner that serves all entrances.
- d.** Layout and Design:
 1. Bicycle rack design
 - Support the bicycle in at least two places
 - Enable the frame and at least one wheel to be secured
 - Designed to accommodate “U” shape locking devices
 - Installed to manufacturer’s specifications
 - Each bike rack must be designed to accommodate at least two bike parking
 2. Bicycle parking space
 - Concrete pad built to City of Denton sidewalk standards
 - Must provide clearance of at least 2 feet from closest wall
 - Must provide clearance of at least 3 feet between bike racks
 - Must not interfere with pedestrian pathway

4.7.2 Benches

All benches shall be constructed to meet commercial grade structural standards. Benches shall be secured to prevent displacement. Benches shall not project into any accessible route or alter an accessible route such that it will not meet the accessible route standards.

4.7.3 Lighting and Enclosures

Lighting standards and above ground enclosures shall not extend into any accessible route or alter an accessible route such that it will not meet the accessible route standards.

4.7.4 Sidewalk on Bridges

Sidewalk widths on bridges shall be a minimum of 6 feet or wider as required by the street classification. Unless otherwise approved by the City Engineer, all street bridges shall have sidewalks on both sides of the bridge. Dependent upon vehicular and pedestrian traffic considerations a parapet wall may be required to separate the sidewalk from the travel lane. Parapet walls shall be constructed to TxDOT standards. A pedestrian bridge rail shall be constructed on the outside of the bridge to protect sidewalk traffic. Both bridge rails and parapet wall shall meet accessibility standards.

4.7.5 Sidewalks on Drainage Crossings

Sidewalk widths at drainage crossings shall be a minimum of 6 feet or wider as required by the street classification. Unless otherwise approved by the City Engineer, sidewalk railing shall be provided to protect the sidewalk traffic from the outside edge of the drainage crossing. Dependent upon vehicular and pedestrian traffic considerations a parapet wall may be required to separate the sidewalk from the travel lane. Parapet walls shall be constructed to TxDOT standards. Railing and parapet walls shall meet accessibility standards.

4.7.6 Sidewalks Adjacent to Screen Walls

A minimum of 2 feet additional width of sidewalk shall be required beyond the standard width of sidewalk for sidewalks adjacent to screen walls.

5 Transit Facility Design

The user should be aware of and utilize the City of Denton Development Code Subchapter 20 - Transportation in conjunction with this Manual.

Bus stops shall meet at a minimum the design standards of the Denton County Transit Authority (DCTA), and the accessibility standards of TAS, PROWAG, and Department of Justice ADA Standards for Accessible Design.

Figure 5.1 show a general layout of a bus stop at an intersection. Bus stops shall be located on the departing side of a street intersection. A pull out lane will be required in conjunction with any bus stop along a street where the posted speed limit is more than 40 miles per hour.

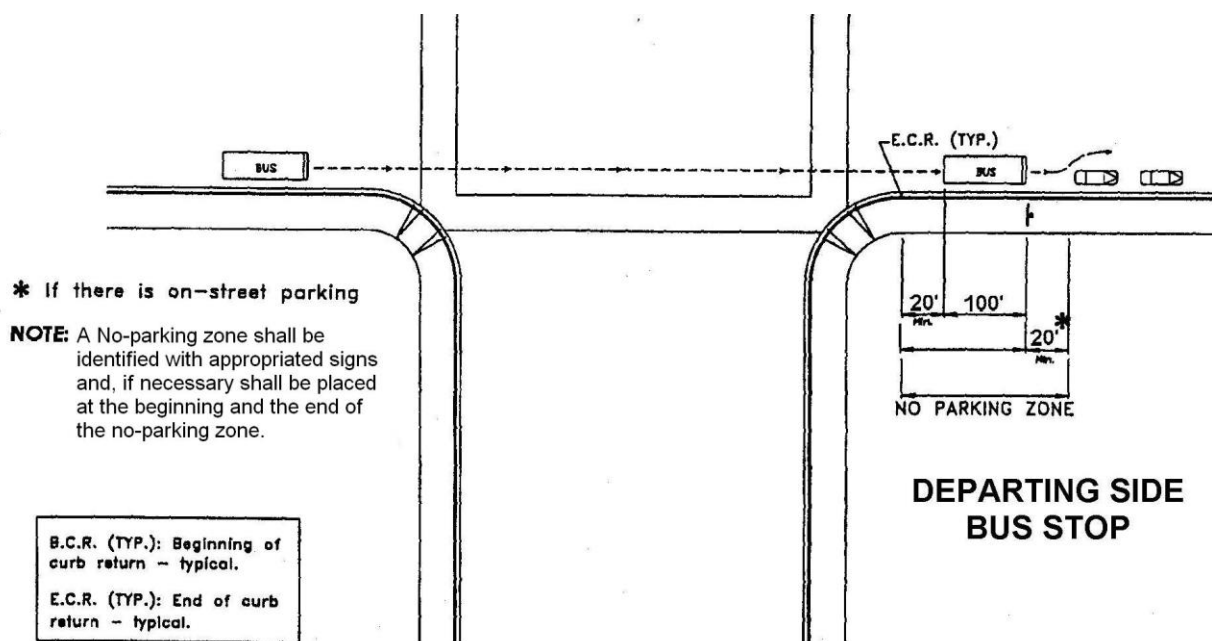


Figure 5-1, Standard Bus Stop Location at Unsignalized Intersection

Note: For signalized intersections an Approach side Bus Stop is preferred

5.1 Bus Stop Placement

Bus stop placement should consider the need for the bus stop, traffic operation concerns, and passenger accessibility. A bus stop should be placed within an area that allows bus stop amenities to be located in the public right of way and where the ingress and egress of the bus does not overly impede the flow of traffic. The warrant for a bus stop shall be as required by the City of Denton in conjunction with DCTA. Elements to consider for bus stop placement include the follow:

- Within Public Right of Way
- Proximity to major trip generators such as malls, student housing areas, retail commercial zones, park and rides, destination areas, etc.
- Pedestrian facilities such as sidewalks or multi-use paths, marked cross walks, space provisions for accessibility standards, and curb ramps should be available at the location for a proposed bus stop.
- Convenient passenger transfers to other routes
- Open and visible location for personal security and passenger visibility
- Acceptable street illumination or proposed street illumination with placement

- Ability to have restrictive parking in bus zone
- Adequate space for bus zone
- Gentle street grades at bus zone
- Return to traffic without overly hindering traffic flow
- No interference from driveways

5.2 Bus Stop Amenities

The following are bus stop amenities that shall be consider during the process of design:

- Accessibility compliant loading area. All bus stops shall have accessibility compliant loading and offloading area. This area shall be integral to the sidewalk pathway, bench area, and shelter are if provided. The loading area shall be constructed of reinforced concrete with the same thickness as the adjacent sidewalk.
- Bench and trash receptacle may be warranted based upon Table 5.2.1. Bench and trash receptacle type and installation shall be as required by the City of Denton.
- A shelter may be warranted based upon Table 5.2.1. The shelter type and installation shall be as required by the City of Denton and DCTA. Shelters shall provide space to meet accessibility standards.
- Illumination shall be provided if illumination is not provided at the street corner adjacent to the bus stop or if in the opinion of the City Engineer the existing illumination is inadequate.

Table 5.2.1 Bus Stop Amenities Warrant

Bus Stops that accumulate 10 points or more may be considered for shelter placement. Bus Stops that accumulate 6 points or greater may warrant a bench and trash receptacle.

6 points	25 people per day boarding
4 points	Special needs, i.e., Senior Center, Medical Complex, libraries, high accessibility standard usage such as group residences.
4 points	High use location, i.e., Student housing area, schools, hospitals, mall.
2 points	Request for improvements by citizens, i.e., multiple requests over a one year time period.
6 points	15 people per day or greater boarding
4 points	Adjacent to an arterial roadway.

5.3 Bus Stop Signage and Stripping

Bus stop signage and stripping shall be according to the City of Denton and DCTA. Signage shall include a “No Parking Zone” sign and a DCTA bus stop sign.