Attachment D

TRANSPORTATION DESIGN STANDARDS FOR TYSONS CORNER URBAN CENTER

VIRGINIA DEPARTMENT OF TRANSPORTATION
IN PARTNERSHIP WITH THE
FAIRFAX COUNTY DEPARTMENT OF TRANSPORTATION

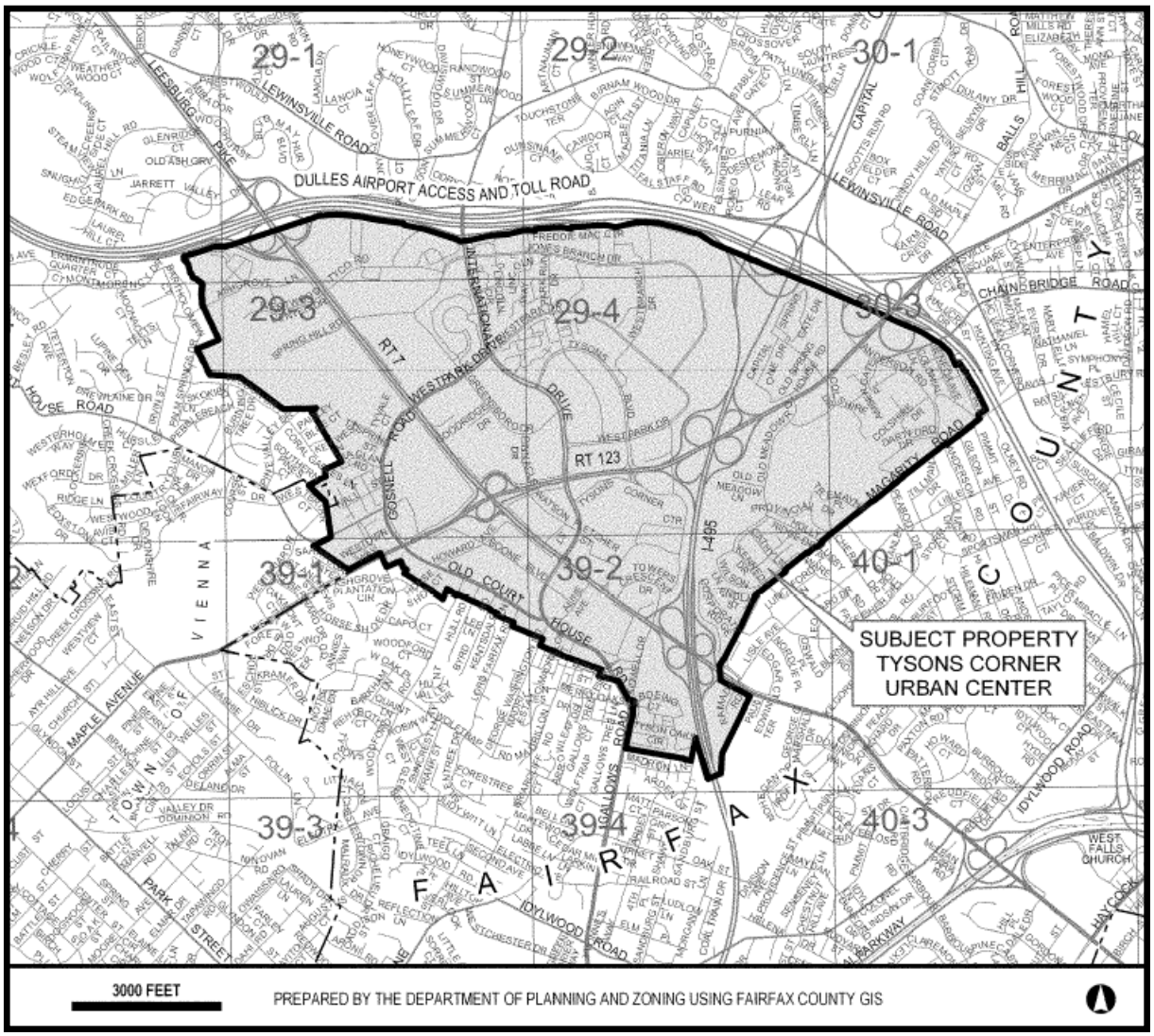

Figure 1 – Tysons Corner Urban Center Boundary

As contained in the Fairfax County Comprehensive Plan

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Table 1 Recommended Functional Classifications and Right-of-Way Limits

Recommended Functional Classification	Tysons Corner Comprehensive Plan Functional Classification	ITE Functional Classification	VDOT/Federal Highway Function Classification
Low Speed Boulevard	Boulevard	Low Speed Boulevard	Principal Arterial
Avenue	Avenue	Avenue	Minor Arterial or Collector
Collector	Collector	N/A	Collector or Local
Local Street	Local Street	Local	Local
Service Street	Service Street	Alley/Rear Lane	N/A

Table Notes:

A. This table contains a matrix of functional classifications defined by VDOT/Federal Highway Administration, the Institute of Transportation Engineers, and Fairfax County.

B. Routes 7 and 123 are classified as Low Speed Boulevards. They are also classified by VDOT as Primary Streets, and are classified by the Federal Highway Administration as National Highway System routes (NHS).

C. All other Avenue and Collector Streets in Tysons Corner are classified as Secondary Streets, and are not currently part of the NHS routes.

D. Unless otherwise agreed, all Local Streets are classified as Secondary Streets.

E. Service Streets are classified as private streets.

F. The Recommended Functional Classifications in this table correspond with Figure 2 (Map 7 of the Tysons Corner Urban Center Comprehensive Plan). That map is conceptual in nature, and it is expected that functional classifications may be amended to fit changing conditions in the Tysons Corner land-use area.

G. The Functional Classifications in this table will be used for the application of design standards in the Tysons Corner Urban Center.

H. The right-of-way for Primary Streets, Low Speed Boulevards shall be placed at a minimum, 18 inches behind the face of curb, and shall be dedicated in fee simple to Fairfax County, with ultimate conveyance to VDOT. In addition, a contiguous right-of-way for the Streetscape Zone shall be dedicated in fee simple to Fairfax County Board, and shall extend at a minimum to the back of sidewalk (See Figure 9).

I. The right-of-way for Secondary Streets, Avenues, Collectors, and Local Streets shall be placed at a minimum at the back of the sidewalk, and shall be dedicated in fee simple to Fairfax County (See Figure 9).

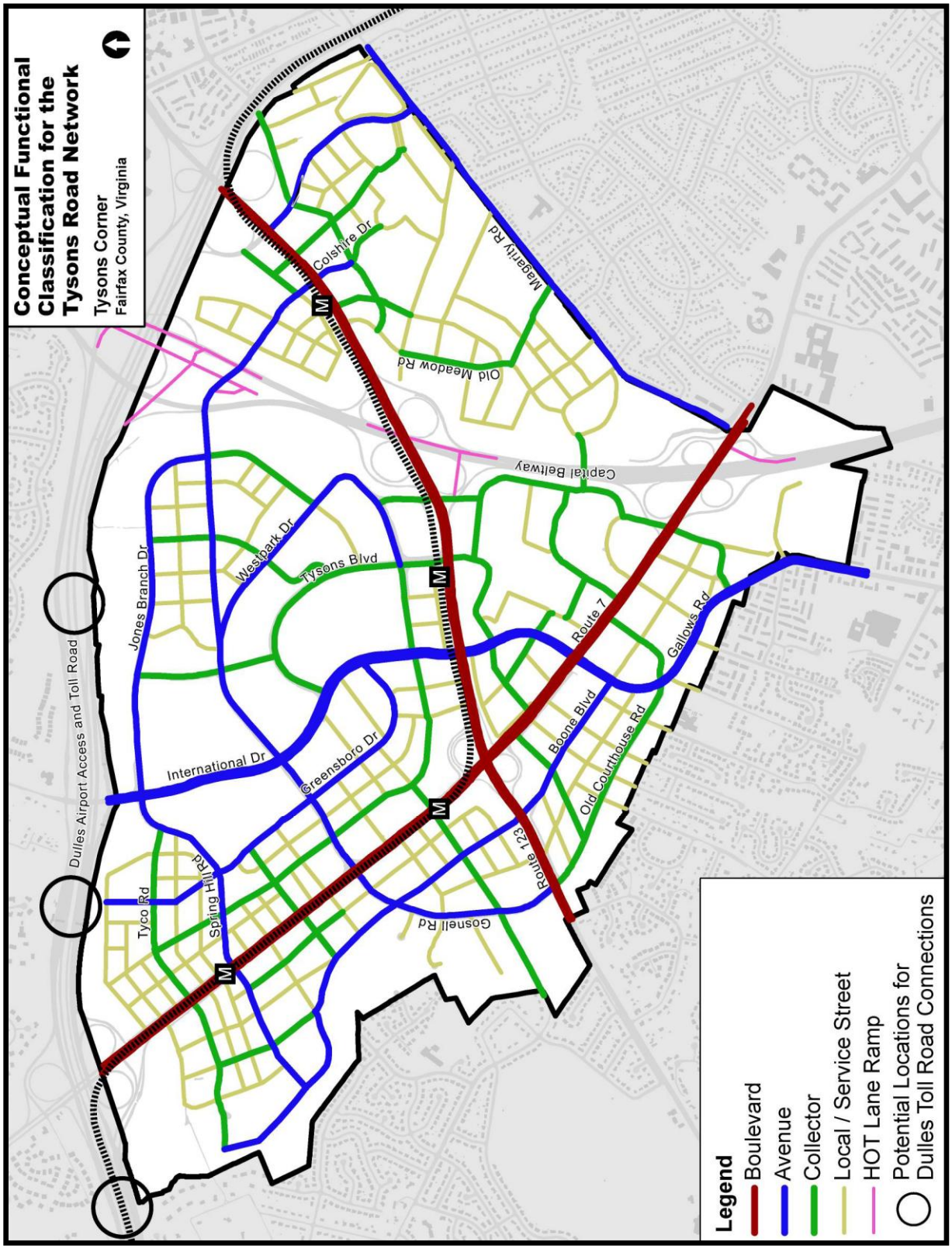

Figure 2 – Tysons Corner Conceptual Functional Classifications

Tysons Corner Urban Center Comprehensive Plan, Map 7

Table 2 Level of Service Standards

Recommended Functional Classification	Level of Service Standards
Low Speed Boulevard	D/E [(1)]
Avenue	E [(2)]
Collector	E [(2)]
Local Street	E [(2)]
Service Street	N/A

References:

i. U.S. Department of Transportation, Federal Highway Administration, United States Code (U.S.C.) 23 part 109, Level of Service Design Criteria Requirements for projects on the National Highway System (NHS); reference to document listed in 23 CFR 625.4, AASHTO, A Policy on Geometric Design of Highways and Streets, 2004.

ii. Tysons Corner Urban Center Comprehensive Plan.

Table Notes:

A. The vehicular Level of Service (LOS) standards need to be balanced with a high level of service for walkability, cycling, transit, and other multi-modal users within the Tysons Corner Urban Center. In addition, the LOS needs to be balanced with the economic development objectives of the Tysons Urban Center Comprehensive Plan (see Figures 3 and 4).

B. Applying the vehicular LOS requires a high degree of professional discretion on the part of VDOT and Fairfax County, and in many instances policy input. Factors such as queue spill back that might disrupt pedestrian and vehicle movement, safety, potential for gridlock, and backups onto Low Speed Boulevards will be taken into consideration.

C. Along Low Speed Boulevards it will be important to maintain vehicular progression, limit queuing and spill back issues that will deteriorate vehicular progression, and maintain ingress and egress to the grid of streets within the Tysons Corner Urban Center.

D. To provide the balance described in Section A, it is necessary to apply the tiered approach as stipulated in Sections I and J below, to intersections and other locations where the results from any applicable Operational Analysis indicates that said intersections and locations do not meet the LOS standards.

E. When applying the LOS as part of a development application, such as a zoning request, the following important factors must be considered:

1. Development potential in the vicinity of the project;
2. Background traffic growth rates within the affected network area;
3. The level of improvement that is necessary to provide an acceptable LOS and vehicular mobility, while at the same time promoting pedestrian, cycling, transit, and other multi-modal mobility;

4. The likely extent of pedestrian activity in the vicinity of the project, particularly with respect to movement of pedestrians to and from rail or transit stations; and

5. Evaluation of the development in context of the tiered approach discussed in the Tysons Corner Comprehensive Plan.

F. An Operational Analysis, where required, may include a traffic analysis, safety analysis, or preliminary or conceptual site engineering of an individual or isolated intersection, a corridor, or a network of streets and intersections within a defined area.

G. A traditional or consolidated Traffic Impact Analysis (TIA or CTIA) for development purposes may suffice to meet the requirements of an Operational Analysis.

H. The scope and depth of the Operational Analysis will be determined by a joint consultation with VDOT and Fairfax County, and in discussion with the applicant.

I. Where an Operational Analysis is being considered as part of a development application, such as a zoning request, a tiered approach as follows shall be applied to mitigate problem locations:

1. Analyze the problem areas not meeting the LOS standards within the affected network area to determine whether the LOS standards can be obtained without widening the streets or providing left or right-turn lanes.

2. Reanalyze the streets by providing aggressive, measurable TDM mitigation measures over those already accounted for in Table 5 of the Tysons Corner Comprehensive Plan, or by providing additional transit services, pedestrian improvements, or bicycle improvements that improve LOS.

3. Evaluate whether additional grid links, including offsite grid links can be constructed to create diversionary paths for vehicles, and in doing so decrease the traffic volumes at problem areas, improve the LOS and traffic circulation, and improve pedestrian, cycling, transit, and other multi-modal mobility.

4. At the discretion of VDOT and Fairfax County, temporary traffic mitigation measures can be evaluated and considered, such as interim capacity improvements that can be easily constructed within the standard street cross-section and not require additional right-of-way, and that can be removed or modified once certain specified grid links, TDMs, transit, or vehicle capacity projects are constructed that directly mitigate traffic impacts within the affected network area.

5. At the discretion of VDOT and Fairfax County, permanent traffic mitigation measures can be evaluated and considered that are ultimately required to be in place once build-out of the grid system is completed within a specified area.

6. After all of the above options have been applied, a determination must be made as to whether an acceptable balance has been achieved between LOS and pedestrian, cycling, transit, and other multi-modal mobility. If an acceptable balance has not been achieved, then the following additional mitigation measures may be considered:

i. Phase the development to coincide with future built or implemented transportation improvements, including TDM, transit, and vehicle capacity projects that will directly mitigate traffic impacts within the affected network area.

ii. Make adjustments to the land-use mix that will decrease single-occupant vehicle trips and/or increase modal split.

iii. As determined by VDOT and Fairfax County, provide financial contributions to Fairfax County that are committed to mitigating deficiencies in the Tysons area.

7. After all of the above options have been applied, a second determination must be made as to whether an acceptable balance has been achieved between LOS and pedestrian, cycling, transit, and other multi-modal mobility. If an acceptable balance has not been achieved, then the following additional mitigation measures may be considered at the discretion of VDOT and Fairfax County:

    i. Evaluate other traffic mitigation measures.

    ii. Analyze whether certain through, left, or right-turn lane improvements can be constructed that will benefit traffic circulation and improve the LOS without seriously compromising pedestrian, bicycle, and transit mobility. In particular, it will be important to evaluate the impact that turn lanes will have on pedestrian safety and mobility.

8. There may remain circumstances after application of the tiered approach above that the LOS Standard cannot be met, and that other alternative criteria may be considered at the discretion of VDOT and Fairfax County. When making this consideration, VDOT and Fairfax County will take into account the existing LOS of the street or intersection.

J. Where an Operational Analysis is not being considered as part of a development application, a tiered approach as follows shall be applied to mitigate problem locations:

1. Analyze the problem areas not meeting the LOS standards within the affected network area to determine whether the LOS standards can be obtained without widening the streets or providing left or right-turn lanes.

2. Evaluate whether additional grid links, including offsite grid links can be constructed to create diversionary paths for vehicles, and in doing so decrease the traffic volumes at problem areas, improve the LOS and traffic circulation, and improve pedestrian, cycling, transit, and other multi-modal mobility.

3. At the discretion of VDOT and Fairfax County, temporary traffic mitigation measures can be evaluated and considered, such as interim capacity improvements that can be easily constructed within the standard street cross-section and not require additional right-of-way, and that can be removed or modified once certain specified grid links, TDMs, transit, or vehicle capacity projects are constructed that directly mitigate traffic impacts within the affected network area.

4. At the discretion of VDOT and Fairfax County, permanent traffic mitigation measures can be evaluated and considered that are ultimately required to be in place once build-out of the grid system is completed within a specified area.

5. After all of the above options have been applied, a determination must be made as to whether an acceptable balance has been achieved between LOS and pedestrian, cycling, transit, and other multi-modal mobility. If an acceptable balance has not been achieved, then the following additional mitigation measures may be considered at the discretion of VDOT and Fairfax County:

    i. Evaluate other traffic mitigation measures.

    ii. Analyze whether certain through, left, or right-turn lane improvements can be constructed that will benefit traffic circulation and improve the LOS without seriously compromising pedestrian, bicycle, and transit mobility. In particular, it will be important to evaluate the impact that turn lanes will have on pedestrian safety and mobility.

6. There may remain circumstances after application of the tiered approach above that the LOS Standard cannot be met, and that other alternative criteria may be considered at the discretion of VDOT and Fairfax County. When making this consideration, VDOT and Fairfax County will take into account the existing LOS of the street or intersection.

K. Except as otherwise noted, and where a Design Exception/Waiver is required, any Design Exception/Waiver shall be submitted to the Fairfax County Department of Transportation for their concurrent review and approval with VDOT.

Footnotes:

(1) The minimum recommended standard for National Highway System (NHS) designated streets is LOS 'D', while the target standard recommended in the Tysons Corner Urban Center Comprehensive Plan is LOS 'E'. However, the VDOT District Administrator may accept a lower standard for NHS routes upon review of an Operational Analysis. Where the LOS 'D/E' standard cannot be achieved, mitigation measures must be considered in accordance with Sections I and J above. A Level of Service (LOS) Waiver for NHS routes is required, and is administered by the VDOT District Administrator at the district level. When considering the waiver, VDOT will take into account the existing LOS of the street or intersection.

(2) Where the LOS 'E' standard cannot be achieved, mitigation measures must be considered in accordance with Sections I and J above. These streets are not part of the NHS routes, and a Level of Service (LOS) Waiver is not required.

Figure 3 – Illustration of Typical Context Sensitive Thoroughfare

An ITE Recommended Practice – Designing Walkable Urban Thoroughfares:
A Context Sensitive Approach, 2010

Figure 4 – Illustration of Typical Context Sensitive Thoroughfare

An ITE Recommended Practice – Designing Walkable Urban Thoroughfares:
A Context Sensitive Approach, 2010

Table 3 Design and Operating Speed

Recommended Functional Classification	Number of Through Lanes	Design Speed [(1)] (mph)	Operating Speed [(2)] (mph)
Low Speed Boulevard	4-8	40	35
Avenue	4-6	30-35	25-30
Collector	2-4	25-30	25-30
Local Street	2	25	25
Service Street	2	≤ 25	≤ 25

References:

i. An ITE Recommended Practice – Designing Walkable Urban Thoroughfares: A Context Sensitive Approach, 2010.

ii. Tysons Corner Urban Center Comprehensive Plan.

Table Notes:

A. Except as otherwise noted, and where a Design Exception/Waiver is required, any Design Exception/Waiver shall be submitted to the Fairfax County Department of Transportation for their concurrent review and approval with VDOT.

Footnotes:

(1) The Design Speed, if available is the primary control for determining minimum intersection sight distance, minimum sight distance on horizontal and vertical curves, and horizontal and vertical curvature. If not available then the operating speed or 85th percentile speed may be used.

(2) The Operating Speed should be achieved through a combination of measures that include one or more of the following, depending on the classification of the street:

a. Setting an appropriate and realistic speed limit;
b. Providing narrower travel lanes;
c. Including physical measures such as curb extensions and medians to narrow the traveled way;
d. Including design elements such as on-street parking to create side friction;
e. Eliminating superelevated curves;
f. Using smaller curb return radii at intersections;
g. Minimizing the use of high-speed channelized right-turn lanes; and
h. Setting signal timing for moderate progressive speeds.

Table 4 Access Management

Recommended Functional Classification	Access Management	Operational Analysis [1]	Signalized Intersection Spacing	Unsignalized Intersection Spacing (full access)	Unsignalized Intersection Spacing (partial access) [7]	Driveway Spacing
Low Speed Boulevard	Moderate	Required	Operational Analysis [2][3]	Operational Analysis [2][3]	325'-660'	Restricted Access
Avenue	Low	Discretionary	525'-660' [4]	200'-660' [6]	200'-660'	200'
Collector	Low	Discretionary	425'-660' [4]	200'-660' [6]	155'-660'	155'
Local Street	Very Low	N/A	325'-660' [5]	100'-660'	N/A	50'
Service Street	N/A	N/A	N/A	N/A	N/A	N/A

References:

i. An ITE Recommended Practice – Designing Walkable Urban Thoroughfares: A Context Sensitive Approach, 2010.

ii. VDOT Access Management Design Standards for Entrances and Intersections.

iii. Tysons Corner Urban Center Comprehensive Plan.

Table Notes:

A. Design of new intersections must be done with consideration for vehicular and pedestrian safety, intersection sight distance, the functional operating area of the intersection, and operation of upstream and downstream intersections.

B. Existing intersections are exempt from the Access Management standards except as necessary to mitigate a safety or Level of Service (LOS) deficiency. See Table 2 for LOS criteria.

C. Intersection Functional Operating Area Definition: The area beyond the physical intersection that comprises decision and maneuver distance, plus any required vehicle storage length, and is protected through corner clearance standards and connection spacing standards.

D. Intersection spacing needs to balance vehicle capacity with the walkability objectives of the Tysons Corner Urban Center Comprehensive Plan, and must allow for development of a highly-connected, multi-modal circulation network.

E. Intersection spacing in this table represents a minimum and maximum range in order to implement the street grid policies in the Tysons Corner Comprehensive Plan.

F. With the exception of Unsignalized Avenues and Collectors as further defined in Footnote [5], the intersection spacing shall not be less than the minimum unless a Design Exception/Waiver is requested from VDOT. The intersection spacing shall also not exceed the maximum unless a waiver is granted by the Fairfax County Department of Transportation. Said waiver will only be approved on certain rare and limited occurrences for severe hardships created by topographic or redevelopment constraints, and not due to any cost of construction or right-of-way acquisition, for example, in limited instances where a site may be constrained by circumstances such as the retention of existing buildings and/or topography. A Design Exception/Waiver is not required.

G. Consideration should be given to providing a marked midblock crossing when intersections are spaced greater than 600 feet apart. The target spacing for pedestrian crossings in more intensive urban areas is every 200 to 300 feet. Consideration must be given for pedestrian safety.

H. Except as otherwise noted, and where a Design Exception/Waiver is required, any Design Exception/Waiver shall be submitted to the Fairfax County Department of Transportation for their concurrent review and approval with VDOT.

Footnotes:

(1) See Table 2 for procedures and standards pertaining to the Operational Analysis.

(2) The spacing of new signalized or full access unsignalized intersections along a Low Speed Boulevard must be demonstrated through an Operational Analysis. As a general guideline, a spacing pattern of between 880 to 1,320 feet should be considered in the analysis. See Table 2 for procedures and standards pertaining to the Operational Analysis. Preparation of an Operational Analysis does not guarantee approval of a new access to a Low Speed Boulevard.

(3) The spacing standards of new intersections and driveways along a Low Speed Boulevard that are near interchange ramps should focus on safe ramp exit and entry movements onto the Low Speed Boulevard. This would be demonstrated through an Operational Analysis of the intersections pursuant to VDOT and FHWA requirements. See Table 2 for procedures and standards pertaining to the Operational Analysis.

(4) An Operational Analysis is required for new signalized intersections located on an Avenue or Collector that are within 660 feet of a Low Speed Boulevard. Preparation of an Operational Analysis does not guarantee approval of a new signalized access within 660 feet of a Low Speed Boulevard.

(5) Traffic signals on local streets, if warranted, may be necessary on occasion to accommodate heavier traffic conditions. However, consideration must first be given to alternate traffic control techniques, such as multi-way stops and roundabouts where applicable.

(6) The Tysons Corner Urban Center Comprehensive Plan establishes a preferred block spacing of between 400 to 600 feet. To allow for redevelopment of properties, and to account for existing topographical and boundary line constraints, a shorter spacing of less than 400 feet, but no less than 200 feet per VDOT standards, may be allowed if demonstrated through an Operational Analysis. See Table 2 for procedures and standards pertaining to the Operational Analysis. A Design Exception/Waiver is not required.

(7) Partial Access Definition: Entrance with movements limited to right-in or right-out or both, with or without left-in movements. Commercial entrance channelization islands are discouraged as they can hinder safe pedestrian movement, and utilization of appropriate median treatments should be considered to control movements.

Table 5 Lane Widths and On-Street Parking

Recommended Functional Classification	Lane Width [1][2]	On-Street Parking [4][5][6][7]	On-Street Parking Width [10]
Low Speed Boulevard	11’	Restricted	N/A
Avenue	10’-11’ [3]	Required	8’
Collector	10’-11’ [3]	Required	8’
Local Street	10’	Required [8]	7’-8’ [11]
Service Street	10’	Restricted [9]	N/A

References:

i. An ITE Recommended Practice – Designing Walkable Urban Thoroughfares: A Context Sensitive Approach, 2010.

ii. Tysons Corner Urban Center Comprehensive Plan.

Table Notes:

A. All signs within VDOT right-of-way must meet VDOT, AASHTO and MUTCD standards.

B. Except as otherwise noted, and where a Design Exception/Waiver is required, any Design Exception/Waiver shall be submitted to the Fairfax County Department of Transportation for their concurrent review and approval with VDOT.

Footnotes:

[1] Lane width does not include shy distance from barrier curb. Shy distance is 1 foot for an inside median or island curb, and 2 feet from an outside curb and gutter section where the travel lane is adjacent to the curb, and there is no bike lane or on-street parking buffer.

[2] Fire apparatus streets shall have an unobstructed width of not less than 20 feet (6096mm), exclusive of shoulders, except for approved security gates in accordance with Section 503.6, and an unobstructed vertical clearance of not less than 13 feet 6 inches (4115mm). The Fire Marshal shall have the authority to require an increase in the minimum access widths where they are inadequate for fire or rescue operations. Source: Sections 503.2.1-2, Statewide Fire Prevention Code, incorporating the International Fire Code; 2009 edition.

[3] The 10-foot Lane Width is recommended for streets that are residential in character and do not carry a significant number of commercial trucks or transit vehicles, whereas the 11-foot width is intended for streets that are commercial or mixed-use in character.

[4] On-street parking must comply with recommended guidelines for ADA accessibility within public right-of-ways. At least one accessible parking space must be provided for every 25 at grade parking spaces, or at least one accessible parking space must be provided for a full square city block (typically 400’-600’ in length), even if there are fewer than 25 parking spaces on that square block.

[5] Parking may be restricted in areas where there are conflicts with traffic operations that create extraordinary safety or capacity constraints. Parking may also be restricted in the vicinity of street intersections and major driveways if there are concerns with sight distance triangles or traffic operations, including circulator routes.

(6) Parking lanes may be time restricted during certain peak conditions to allow for through traffic and/or right-turn movements. Conversely, outside travel lanes may be used for on-street parking during non peak conditions. Approval for parking lane conversion will be done on a case-by-case basis.

(7) On-street loading and maneuvering areas may be allowed within the curb parking area in commercial zones or mixed-use zones with street level commercial activity.

(8) Commercial driveways and loading areas adjacent to local streets may require commercial vehicles to maneuver within the street area.

(9) Some limited parking for utility and service vehicles may be allowed on a case-by-case basis provided the parking does not interfere with emergency vehicle access.

(10) On-Street Parking Width includes the gutter pan width.

(11) The 7-foot On-Street Parking Width is recommended for streets that are residential in character, whereas the 8-foot width is intended for streets that are commercial or mixed-use in character.

Table 6 Median Islands and Turn Lanes

Recommended Functional Classification	Raised/Landscaped Median [1]	Median Width [3][4] (with circulator)	Left and Right Turn Lanes	Left and Right Turn Lane Widths [7]
Low Speed Boulevard	Required	16'-20'	Optional [5]	11'
Avenue	Optional [2]	16'-20' (24'-36')	Optional [6]	10'-11' [8]
Collector	Optional [2]	4'-8' (24'-36')	Optional [6]	10'-11' [8]
Local Street	N/A	N/A	Optional [6]	10'
Service Street	N/A	N/A	N/A	N/A

References:

i. An ITE Recommended Practice – Designing Walkable Urban Thoroughfares: A Context Sensitive Approach, 2010.

ii. Tysons Corner Urban Center Comprehensive Plan.

Table Notes:

A. Except as otherwise noted, and where a Design Exception/Waiver is required, any Design Exception/Waiver shall be submitted to the Fairfax County Department of Transportation for their concurrent review and approval with VDOT.

Footnotes:

[1] See Table 12 for planting requirements within the sight distance triangle.

[2] Raised/landscaped medians are discouraged, but may be evaluated on a case-by-case basis, and should only be considered in areas where there is a need to channelize traffic, restrict left-turn movements, or provide for pedestrian refuge areas. Raised/landscaped medians for 2-lane streets are restricted due to width constraints for emergency vehicles. See Table 6 for median widths.

[3] A 4-foot wide median island is the minimum width for control of left-turn movements. A 6-foot wide median is the minimum width for provision of a pedestrian refuge, and 8 feet should be used as a minimum on higher volume and higher speed streets where pedestrians are likely to cross the street in multiple signal phases.

[4] The minimum planting width for street trees is 8 feet.

[5] Right-turn lanes are discouraged on Low Speed Boulevards, but are recognized as more of a necessity due to the importance of maintaining vehicle progression and access and ingress to the Tysons Corner Urban Center. Right-turn lanes on Low Speed Boulevards must be justified through an Operational Analysis. See Table 2 for procedures and standards pertaining to the Operational Analysis. The warrant or determination for installation of a left or right-turn lane shall be based on capacity and Level of Service (LOS), as determined through an Operational Analysis, not speed based or turning volume ratio based nomographs. See Table 2 for LOS criteria. If justified, the length of storage will be determined by the Operational Analysis. Left and right turn deceleration, acceleration, and continuous center or right turn lanes are restricted.

(6) Left-turn, and in particular right-turn lanes are discouraged, except where the need for the same are justified through an Operational Analysis. See Table 2 for procedures and standards pertaining to the Operational Analysis. The warrant or determination for installation of a left or right-turn lane shall be based on capacity and Level of Service (LOS), as determined through an Operational Analysis, not speed based or turning volume ratio based nomographs. See Table 2 for LOS criteria. If justified, the length of storage will be determined by the Operational Analysis. Left and right turn deceleration, acceleration, and continuous center or right turn lanes are restricted.

(7) Turn lane width does not include shy distance from barrier curb. Shy distance is 1 foot for an inside median or island curb, and 2 feet from an outside curb and gutter section where the turn lane is adjacent to the curb.

(8) The 10-foot Turn Lane Width is recommended for streets that are residential in character, and do not carry a significant number of commercial trucks or transit vehicles, whereas the 11-foot width is intended for streets that are commercial or mixed-use in character.

Table 7 Turn Lane Lengths

Design Speed (mph)	Minimum Taper Length Ratio [1]	Minimum Deceleration Length [2] Percent Slope (road gradient)				
		-5% to -6%	-3% to -4%	Level	+3% to +4%	+5% to +6%
20	1:5	0’	0’	0’	0’	0’
25	1:5	7’	6’	5’	5’	4’
30	1:5	47’	42’	35’	32’	28’
35	1:5	101’	90’	75’	68’	60’
40	1:8	169’	150’	125’	113’	100’

Reference:

i. Design of Turn Lane Guidelines, Minnesota Department of Transportation Research Services, Office of Policy Analysis, Research and Innovation, July 2010, Prepared by Howard Preston, P.E., CH2M Hill, Final Report #2010-25.

Table Notes:

A. Left Turn or Right Turn Lane Length (ft) = Storage (ft) + Min. Taper (ft) + Min. Deceleration (ft).

B. The length of storage will be determined by the Operational Analysis. See Table 2 for procedures and standards pertaining to the Operational Analysis. The minimum storage length for a left turn lane is 60 feet, and for a right turn lane is 40 feet.

C. The taper, storage and deceleration lengths may be reduced to match location constraints and to provide corridor consistency. For example where the block lengths are short, i.e. 300 to 400 feet.

Footnotes:

[1] Length (ft) = Width of Offset (ft) x Ratio. The Maximum length is 100 feet for a single turn lane, and 150 feet for a dual turn lane.

[2] Assumes a 10 mph deceleration in the through lane to a speed of 15 mph. The turn lane may need to be adjusted to reflect stopping conditions.

Table 8 Horizontal Radius

Design Speed (mph)	Minimum Radius (standard crown)	Minimum Radius e_{max} = 0.02 (superelevation)
20	107’	92’
25	198’	183’
30	333’	273’
35	N/A	408’
40	N/A	593’

Reference:

i. AASHTO, A Policy on Geometric Design of Highways and Streets, Chapter 3, 2004; Side Friction Factors Assumed for Design – Low Speed Urban Streets.

Table Notes:

A. A standard crown road section is recommended for all urban street designs up to 30 mph. However, in certain circumstances, and due to topographical or redevelopment constrains, it may be necessary to provide a maximum superelevation rate of up to 4 percent.

B. Except as otherwise noted, and where a Design Exception/Waiver is required, any Design Exception/Waiver shall be submitted to the Fairfax County Department of Transportation for their concurrent review and approval with VDOT.

Table 9 Length of Vertical Curvature

Design Speed (mph)	Minimum Rate of Curvature (K)	
	Crest Vertical Curves	Sag Vertical Curves
20	7	17
25	12	26
30	19	37
35	29	49
40	44	64

Reference:

i. AASHTO, A Policy on Geometric Design of Highways and Streets, 2004.

Table Notes:

A. Vertical curvature shall meet minimum stopping sight distance per AASHTO recommended guidelines.

B. Length of Vertical Curve (ft) = K x A, where K = Rate of Curvature from table, and A = Algebraic Grade Difference (percent). A = g2 – g1, where g1 = percent of tangent grade entering the vertical curve (-downgrade, +upgrade), and g2 = percent of tangent grade leaving the vertical curve (-downgrade, +upgrade).

C. Except as otherwise noted, and where a Design Exception/Waiver is required, any Design Exception/Waiver shall be submitted to the Fairfax County Department of Transportation for their concurrent review and approval with VDOT.

D. The minimum length of vertical curve should be no less than 50 feet.

Table 10 Design and Control Vehicles for Designing Street Intersections

Recommended Functional Classification	Low Speed Boulevard		Avenue		Collector		Local Street		Service Street	
	DV	CV	DV	CV	DV	CV	DV	CV	DV	CV
Low Speed Boulevard	WB-62	WB-62								
Avenue	CITY-BUS	WB-50	CITY-BUS	WB-50						
Collector	CITY-BUS	WB-50	CITY-BUS	WB-50	CITY-BUS	WB-50				
Local Street	SU	WB-50	SU	WB-50	SU	WB-50	P	WB-50		
Service Street	SU	WB-50	SU	WB-50	SU	WB-50	P	WB-50	P	WB-50

References:

i. Wadell, E., Gingrich, M.A., Lenters, M. (February 2009). Trucks in Roundabouts: Pitfalls in Design and Operations, ITE Journal (volume 79), pages 40–45.

ii. Olson, D., Schroedel, C. (Manual Managers). (2009). Washington State Department of Transportation Design Manual, Chapter 910. Washington State Department of Transportation: Design Office, Engineering and Regional Operations Division.

iii. Choosing the Right Design Vehicle for Urban Roundabouts, Abstract by Victor Salemann, PE, and Scott Soiseth, PE.

Table Notes:

A. Consideration must be given to the trade-offs between the traffic safety and operational effects of infrequent large vehicles, and the safety of pedestrians.

B. DV represents the Design Vehicle, and CV represents the Control Vehicle.

C. WB-50 or WB-62 represents a semi-trailer, either 50 feet or 62 feet in length; CITY-BUS represents an intercity transit vehicle; SU represents a single-unit truck, typically 30-feet in length, and P represents a passenger car.

D. Consideration must be given to both the Design Vehicle and Control Vehicle:

   1. The Design Vehicle is one that must be accommodated without encroachment into the opposing traffic lanes.

   2. The Control Vehicle is one that is infrequent but must be accommodated by allowing either encroachment into opposing traffic lanes if there is no raised median, minor encroachment into the streetside area if it does not impact critical infrastructure such as traffic signal poles, or as a last option, multiple-point turns of the vehicle.

E. For a dual turn-lane lane condition, the Design Vehicle shall be used turning simultaneously with a Passenger Car.

F. For a U-Turn condition where there is no raised median, use a Passenger Car for both the Design Vehicle and Control Vehicle. Where there is a raised median, use a Passenger Car for the Design Vehicle only.

G. A minimum Actual curb return radius of 10 to 15 feet should be used where most, if not all of the following conditions occur (See Figure 5):

1. High pedestrian volumes are present or reasonably anticipated;
2. Volumes of turning vehicles are relatively low;
3. The width of the receiving intersection approach can accommodate a turning passenger vehicle without encroachment into the opposing lane;
4. Passenger vehicles constitute the majority of turning vehicles;
5. Bicycle lanes and parking lanes may create additional space to accommodate the effective turning radius of vehicles (see Figure 5). A shy distance of 1 to 2 feet should be retained from the face of curb;
6. Low turning speeds are required or desired; and
7. Occasional encroachment of turning school bus, moving van, fire truck, or oversized deliver truck into an opposing lane is acceptable.

H. Where the minimum Actual curb return radius must exceed 15 feet, compound curves or curve taper combinations are required in order to reduce pedestrian crossing distances. Three-centered symmetric or asymmetric compound curves are preferred. An intersection diagram utilizing Auto Turn or AASHTO vehicle turning templates will be required with all submissions.

I. Except as otherwise noted, and where a Design Exception/Waiver is required, any Design Exception/Waiver shall be submitted to the Fairfax County Department of Transportation for their concurrent review and approval with VDOT.

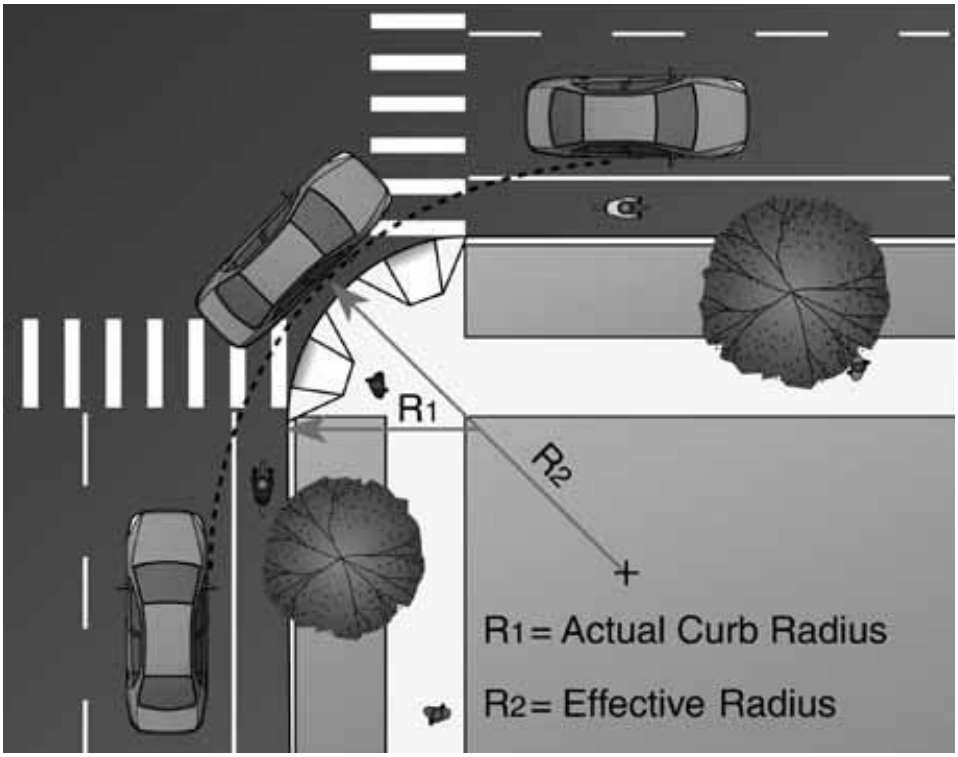

Figure 5 – Effective Turning Radius

Source: An ITE Recommended Practice – Designing Walkable Urban Thoroughfares: A Context Sensitive Approach, 2010

Table 11 Driveway Widths

Driveway Type	Maximum Driveway Width
Two-Way	24’
One-Way	14’

Reference:

i. An ITE Recommended Practice – Designing Walkable Urban Thoroughfares: A Context Sensitive Approach, 2010.

Table Notes:

A. Driveway widths shown are pavement/lane widths, and do not include curb transition panels or curb returns.

B. To promote pedestrian safety and mobility, urban drop or flared driveway transitions (CG-13) shall be used except in conditions where heavy vehicular and/or commercial truck access may require installation of a radius curb-return driveway transition (CG-11).

C. Driveways that carry more than 500 directional peak hour trips may be widened to allow for an additional reversible, or an additional ingress or egress lane. Added lanes should range from 10 to 11 feet in width depending on whether their composition is mostly passenger cars or commercial truck traffic. .

D. Driveways that carry frequent commercial truck traffic may require either widening to a maximum width of 30 feet, or require entrance curb returns. Where the minimum curb return radius exceeds 15 feet, then compound curves or curve taper combinations are required in order to reduce pedestrian crossing distances.

E. A maximum width of 20 feet is applicable to narrow service streets.

F. Except as otherwise noted, and where a Design Exception/Waiver is required, any Design Exception/Waiver shall be submitted to the Fairfax County Department of Transportation for their concurrent review and approval with VDOT.

Table 12 Intersection Sight Distance

Design Speed (mph)	Minimum Intersection Sight Distance Road Gradient (percent slope)						
	-9%	-6%	-3%	Level	+3%	+6%	+9%
20	130’	120’	120’	115’	110’	110’	105’
25	175’	165’	160’	155’	150’	145’	140’
30	230’	215’	205’	200’	200’	185’	180’
35	290’	275’	260’	250’	240’	230’	225’
40	385’ (355’ SSD)	385’ (335’ SSD)	385’ (315’ SSD)	385’ (305’ SSD)	385’ (290’ SSD)	385’ (280’ SSD)	385’ (270’ SSD)

Reference:

i. AASHTO formulas, A Policy on Geometric Design of Highways and Streets, 2004.

ii. 2006 FDOT Design Standards, Index No. 546, Florida Department of Transportation.

Table Notes:

A. Minimum Intersection Sight Distance is used to establish sight distance triangles at intersections or major commercial driveways, for the purpose of maintaining a clear driver field of vision for both other vehicles and pedestrians (see Figure 6).

B. For streets with a design speed of 35 mph or less, the intersection sight distance will be based on AASHTO Minimum Stopping Sight Distance (SSD) criteria, with provision taken into account for road gradient. Unless otherwise approved, for Low Speed Boulevards and streets with a design speed greater than 35 mph, the intersection sight distance will be based on AASHTO Decision Sight Distance as follows:

1. Unsignalized Intersections – Case B2 avoidance maneuver, Right-Turn from the Minor Road, Intersections with Stop Control on the Minor Road; and

2. Signalized Intersections – Case D, Intersections with Traffic Signal Control, which do not require approach or departure sight triangles per AASHTO, should provide Case B2 avoidance maneuver Decision Sight Distance for pedestrian and permissive right-turning vehicle visibility.

C. Intersection sight distances are measured along the center of the approaching travel lanes, is observed from a point 14.5 feet back from the edge of the traveled way, and is measured from an eye height of 3.5 feet, to an object height of 3.5 feet.

D. In order to facilitate redevelopment in more challenging situations, intersection skews up to 30° may be allowed provided that minimum intersection sight distance can be achieved.

E. Planting material within the sight distance triangle shall be limited as follows:

1. Ground Covers – Plant selection of low growing vegetation which at maturity does not attain a height greater than 18 inches below the sight line datum (See Figure 7).

2. Trunked Plants – Plant selection of mature single or multi-stemmed trunk diameter, with each individual trunk up to 4 inches, measured at 6 inches above the ground. Canopy or high borne foliage shall not be lower than 5 feet above the sight line datum (See Figure 7). These selections shall be spaced no closer than 20 feet apart.

3. Trees – Plant selection of mature single trunk diameter between 4 inches and 11 inches, measured 6 inches above the ground. Canopy or high borne foliage shall not be lower than 5 feet above the sight line datum (See Figure 7). These selections shall be spaced no closer than 22 feet for design speeds up to 30 mph, no closer than 27 feet for design speeds up to 35 mph, and no closer than 33 feet for design speeds up to 40 mph. If the design speeds is not available then the operating speed or 85th percentile speed may be used. Plant selection shall not cast greater than a 6-foot wide shadow band on a vehicle entering the intersection (See Figure 8). Preliminary or conceptual site engineering of individual or isolated intersections may be required to verify the maximum allowable shadow band.

F. If in the Engineer's judgment, landscaping or other objects interfere with the line of sight corridor prescribed in these standards; the Engineer may rearrange, relocate, or eliminate plantings or other objects.

G. Except as otherwise noted, and where a Design Exception/Waiver is required, any Design Exception/Waiver shall be submitted to the Fairfax County Department of Transportation for their concurrent review and approval with VDOT.

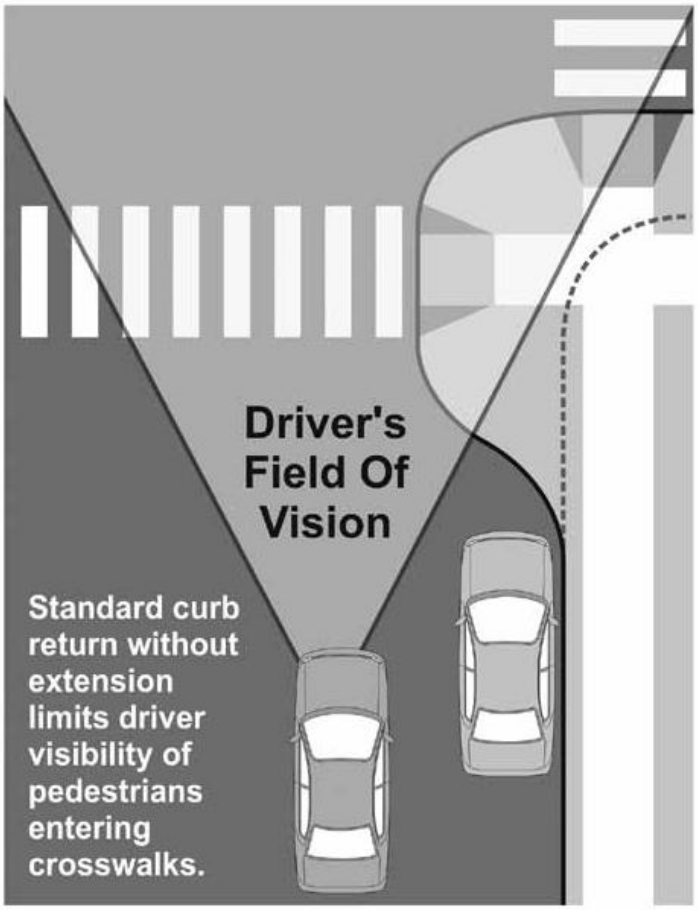

Figure 6 – Driver Field of Vision and Pedestrian Visibility

An ITE Recommended Practice – Designing Walkable Urban Thoroughfares:
A Context Sensitive Approach, 2010

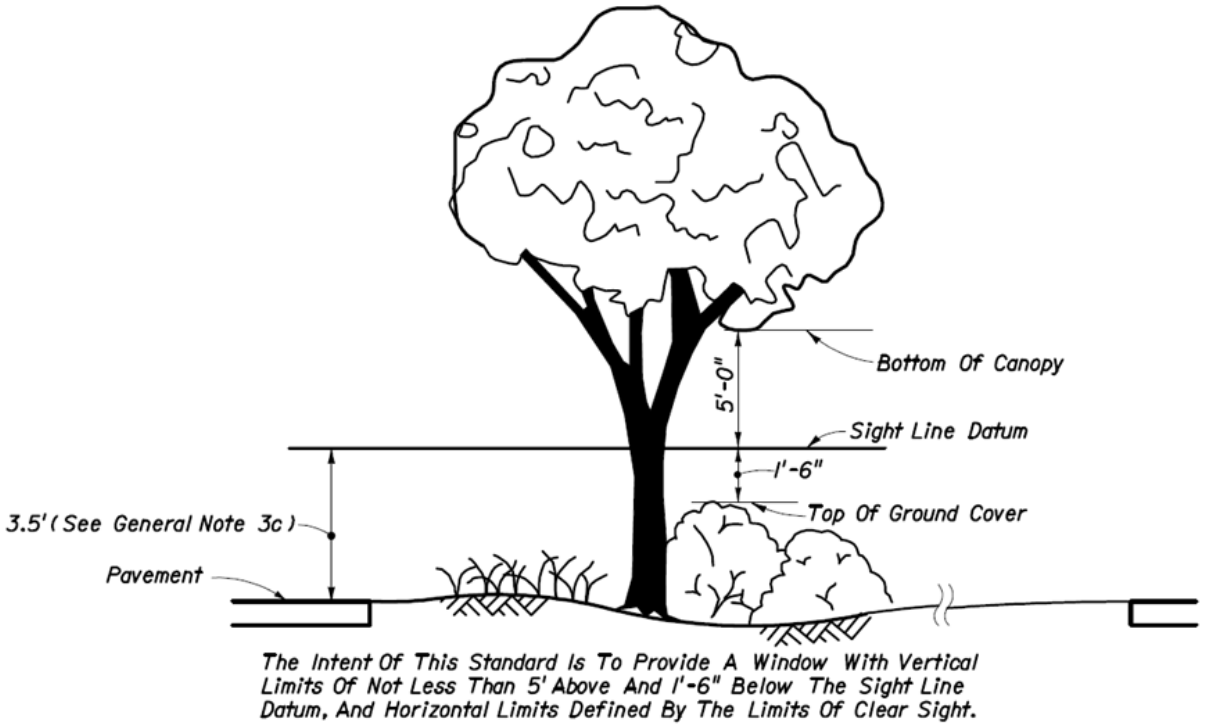

Figure 7 – Sight Line Datum Window

2006 FDOT Design Standards, Florida Department of Transportation

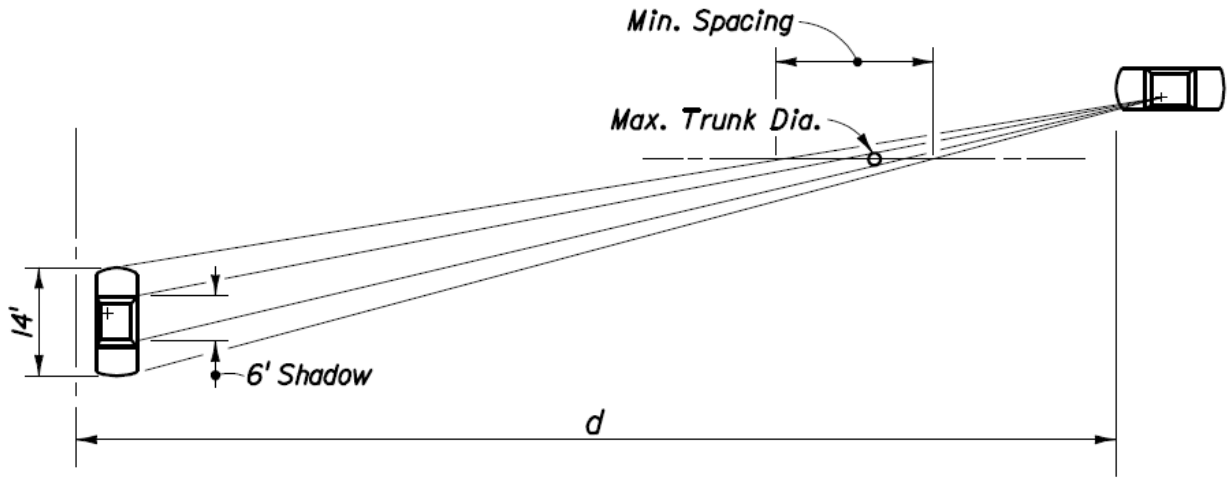

Figure 8 – Shadow Band Diagram

2006 FDOT Design Standards, Florida Department of Transportation

Table 13 Multi-Modal Design Characteristics

Recommended Functional Classification	Circulator Route [1]	Transit Service	Freight Movement
Low Speed Boulevard	N/A	Express and Local	Regional and Local Truck Routes
Avenue	Yes (select routes)	Local	Local Deliveries
Collector	Yes (select routes)	Local	Local Deliveries
Local Street	N/A [2]	Local	Local Deliveries
Service Street	N/A	N/A	Local Deliveries

References:

i. An ITE Recommended Practice – Designing Walkable Urban Thoroughfares: A Context Sensitive Approach, 2010.

ii. Tysons Corner Urban Center Comprehensive Plan.

Footnotes:

[1] The Tysons Corner Urban Center Comprehensive Plan identifies a system of circulator routes to connect most of Tysons Corner. The first phase serving the Metrorail stations after opening will be bus service operating with existing traffic in existing right-of-ways. Over time, the system is envisioned to convert to a fixed guideway or light rail (street car) system operating in exclusive right-of-ways. The Comprehensive Plan is conceptual, and final location of the circulator will be established by more detailed engineering and service demand studies.

[2] Circulator routes may be accommodated on local streets under special circumstances in order to provide for efficient circulation and connectivity.

Table 14 Pedestrian Facilities

Recommended Functional Classification	Streetscape Zone Width [1][2]	Min/Max Building Zone Width	Minimum Sidewalk Width	Minimum Landscape Amenity Panel Width [3][4]
Low Speed Boulevard	33'	15'	10'	8'
Avenue	20'-28'	4' – 12'	8'	8'
Collector	20'-28'	4' – 12'	8'	8'
Local Street	16'-24'	4' – 12'	6'	6'
Service Street	N/A	N/A	5'	N/A

References:

i. An ITE Recommended Practice – Designing Walkable Urban Thoroughfares: A Context Sensitive Approach, 2010.

ii. Tysons Corner Urban Center Comprehensive Plan.

Table Notes:

A. Except as otherwise noted, and where a Design Exception/Waiver is required, any Design Exception/Waiver shall be submitted to the Fairfax County Department of Transportation for their concurrent review and approval with VDOT.

Footnotes:

(1) The Streetscape Zone is comprised of the following (see Figure 9):

a. Building Zone;
b. Sidewalk; and
c. Landscape Amenity Panel, including Lateral Offset (horizontal clearance).

The Building Zone is the space between the Sidewalk and the building face. The Sidewalk is the area in which pedestrians travel. The Landscape Amenity Panel is a multi-purpose area that serves as a buffer between the Sidewalk and vehicular area, and provides space for streetside appurtenances such as street trees, street furniture, and bus shelters. The Lateral Offset is an 18 inch space behind the face of curb, and is incorporated within the Landscape Amenity Panel. The Lateral Offset provides space for door swing from parked vehicles, or a recovery area for vehicles that run up against the barrier curb.

(2) It is expected that sites will be designed in such a manner as to provide the Streetscape Zone Width specified in the chart and that modifications to the width shall generally not apply to sites that will be redeveloped. Modifications to the Streetscape Zone Width may be permitted only in circumstances where topography, the presence of existing buildings that will be retained and/or other conditions preclude the provision of the specified width as determined by Fairfax County. In such instances, the reduction in the streetscape width shall be the minimum necessary, and shall be taken first from the building zone.

(3) Above ground utilities and streetside appurtenances should be placed no closer than 18 inches from the face of curb.

(4) See Table 12 for planting requirements within the sight distance triangle.

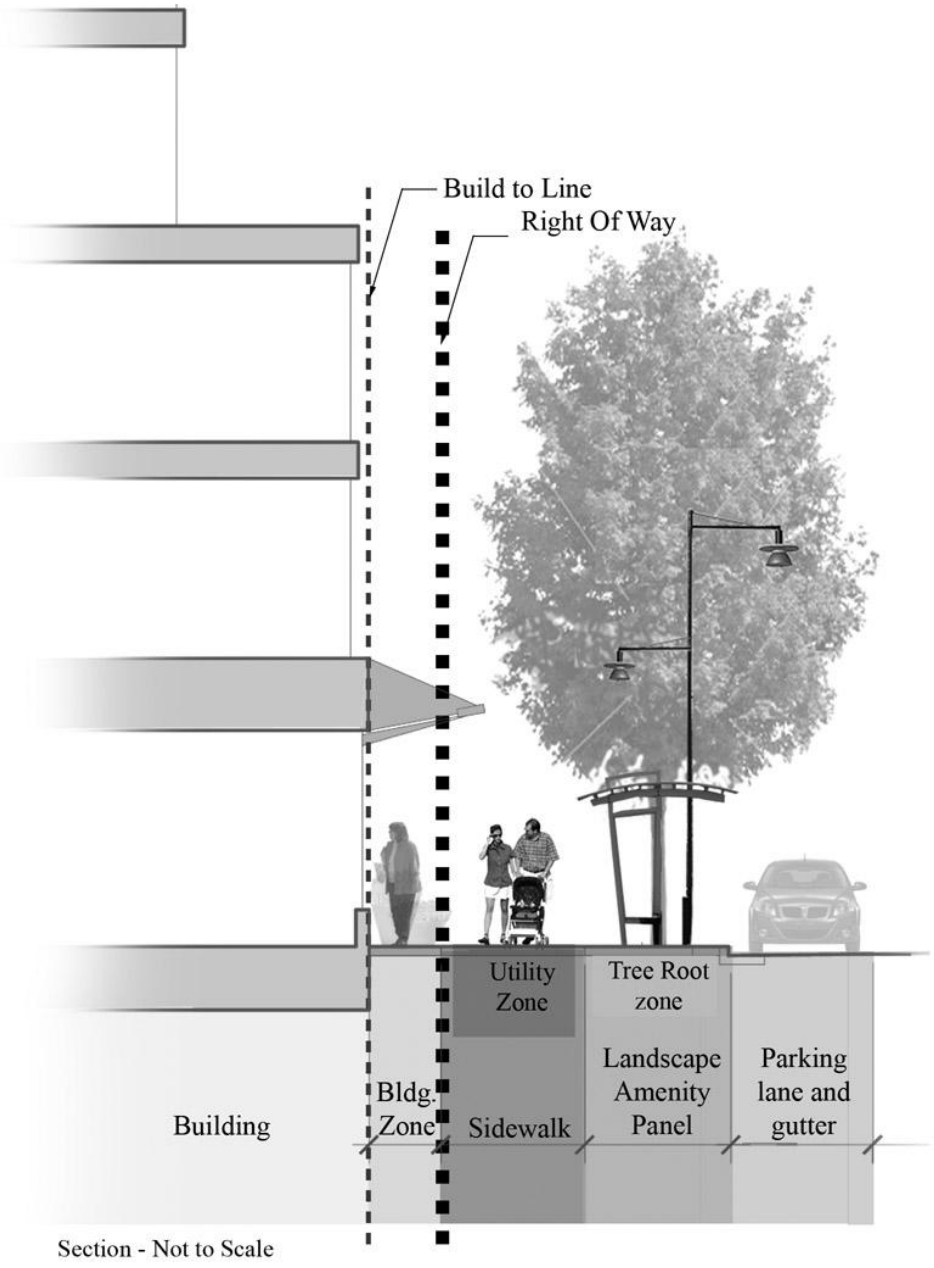

Figure 9 – Streetscape Zone Diagram

Tysons Corner Urban Center Comprehensive Plan

Table 15 Bicycle Facilities

Recommended Functional Classification	Bicycle Facilities [(1)(2)]	Bike Lane Width Adjacent to Curb [(3)]	Bike Lane Width Adjacent to Right-Turn Lane	Bike Lane Width Adjacent to Parking Lane
Low Speed Boulevard	N/A	N/A	N/A	N/A
Avenue	On-Street Bike Lane	4’	5’	5’-6’ [(4)(5)]
Collector	On-Street Bike Lane	4’	5’	5’-6’ [(4)(5)]
Local Street	N/A	N/A	N/A	N/A
Service Street	N/A	N/A	N/A	N/A

References:

i. An ITE Recommended Practice – Designing Walkable Urban Thoroughfares: A Context Sensitive Approach, 2010.

ii. Tysons Corner Urban Center Comprehensive Plan.

Table Notes:

A. Except as otherwise noted, and where a Design Exception/Waiver is required, any Design Exception/Waiver shall be submitted to the Fairfax County Department of Transportation for their concurrent review and approval with VDOT.

Footnotes:

(1) Fairfax County has an updated Bicycle Master Plan for the Tysons Corner Urban Center. The new plan replaces the Conceptual Bicycle Facilities Map in the Comprehensive Plan, and serves as the basis for where, and what type of bicycle facilities are to be placed on each street in Tysons Corner.

(2) A wider bicycle lane is more beneficial on uphill steep grades.

(3) The width of the bike lane is measured from the lip of gutter to the center of the edge line. Where there is no gutter pan, the width of the bike lane is 5 feet as measured from the face of curb to the center of the edge line.

(4) The bike lane width shall be 6 feet minimum when adjacent to a 7 foot on-street parking lane, and may be 5 feet when adjacent to an 8 foot on-street parking lane.

(5) In constrained topographical or redevelopment situations, an absolute minimum bike lane width of 5 feet may be allowed.

Table 16 Utility Placement

Utility	Location			
	Streetscape Zone	Curb Zone	Parking Lane	Travel Lane [4]
Storm Drainage		✓	✓	✓
Sanitary Sewer				✓
Water				✓
Natural Gas [1]			✓	✓
Electrical [2][3]	✓		✓	
Telecommunications [3]	✓		✓	

Table Notes:

A. Utilities should be placed underground, and should be coordinated with future street improvements and sidewalks to foster a pedestrian-friendly environment. To achieve this goal, detailed site analysis should take place early in the development process to avoid conflicts between utilities and proposed street tree locations and root zone cell structures.

B. Underground transformers and switch gear may be placed within the public right-of-way provided these features do not conflict with root zone cell structures, or restrict safety and mobility of the traveling public.

C. Installation of utilities may also include placement of blank conduits and vaults that will be used with future developments.

D. Utility vaults or manholes placed within the street or parking lane must be installed with traffic rated lids.

E. Utility vaults and manholes should be placed outside of the sidewalk area to minimize slipping and tripping hazards. When placed anywhere within the Streetscape Zone where there are hard walking surfaces, the utility vault lids must be installed with ADA compliant non-slip surfaces.

F. Consideration should be given to placement of alternative storm water management facilities within the right-of-way, such as underground storage vaults and mechanical treatment units.

Footnotes:

[1] Can be located anywhere within the roadway area.

[2] Larger transmission lines, such as 230-kv lines are allowed within the travel lane area.

[3] Can be placed within the Streetscape Zone only if there is no parking lane.

[4] The utility should be located within the center of the travel lane so that manholes and valve covers are not within the wheel path area.