

CITY OF RALEIGH

STREET DESIGN MANUAL

UPDATE



July 1, 2018

RESOLUTION NO. 2013 – 851

A RESOLUTION TO ADOPT THE RALEIGH STREET DESIGN MANUAL AND REPEAL THE STREETS, SIDEWALKS AND DRIVEWAY ACCESS HANDBOOK

WHEREAS, the Raleigh Street Design Manual is an adjunct to the recently adopted Unified Development Ordinance; and
WHEREAS, the Manual provides technical specifications used in construction of public improvements; and
WHEREAS, many of the technical specifications are engineering based standards that are not appropriate for inclusion in the Unified Development Ordinance; and
WHEREAS, the Manual will replace the existing Streets, Sidewalks and Driveway Access Handbook; and
WHEREAS, these enhancements were reviewed and discussed with public input.

NOW, THEREFORE, BE IT RESOLVED BY THE CITY COUNCIL OF RALEIGH, NORTH CAROLINA:

1. The Raleigh Street Design Manual dated November 6, 2013 together with the Planning Commission recommendations dated August 13, 2013 contained in certified recommendation number CR-11547, are hereby adopted.
2. The Raleigh Street Design Manual shall be effective five days after the adoption of this resolution.
3. The Streets, Sidewalk and Driveway Access Handbook is hereby repealed coincident with the adoption of the Raleigh Street Design Manual.
4. The Raleigh Street Design Manual is incorporated by the Unified Development Ordinance, Part 10A of the City Code.
5. Except as otherwise authorized in this section, changes to the Raleigh Street Design Manual shall be approved by the City Council after a public hearing. The following changes may be made by staff without need for a City Council public hearing:
 - a. Technical corrections to illustrations where standards are not altered;
 - b. Correction of typographical errors, erroneous information or the addition of or alteration to references to external forms, applications or other governmental information;
 - c. Updates that are a result of recently adopted reference manuals required by Federal or State law;
 - d. The addition of any City Council-adopted alternative street cross section or public improvement related to specific capital improvement projects or streetscape plans projects. This shall include street right-of-way width, location and dimension of all components contained within the right-of-way, street furniture elements, pavement treatment, pedestrian lighting, tree lawn and sidewalks;
 - e. Formatting and publication of the document where content is not altered.

Adopted: November 19, 2013

Effective: November 24, 2013

Revised: July 1, 2018

Distribution: Planning –Bowers, Crane, Daniel

Transportation –Kallam, McGee, Lamb

INTRODUCTION

Raleigh's [*Unified Development Ordinance*](#) (UDO hereby), sets forth many street typologies to work with various streetscapes and frontage types. While the UDO establishes the appropriate street type, this manual assists with specific design details related to the engineering aspects of the various street typologies.

It is the responsibility of the developer to take future roadway plans of the City and NCDOT into consideration when developing a site plan for a future development. In addition, character and circulation patterns of developments in the immediate vicinity should also be taken into consideration to address existing development patterns and context Sources of information include, but are not limited to:

- A. The Arterials, Thoroughfares, and Collector Plan the [*Street Plan Map*](#) in the Transportation Element of Raleigh's Comprehensive Plan
- B. [*NCDOT Transportation Improvement Program*](#)
- C. [*Capital Improvement Program*](#)
- D. [*City of Raleigh and Wake County Short and Long Range Transit Plans*](#)
- E. [*Capital Area Metropolitan Planning Organization*](#)
- F. [*City Council authorized Street and Sidewalk Projects*](#)
- G. [*2030 Comprehensive Plan*](#)
- H. [*American Association of State and Highway and Transportation Officials \(AASHTO\)*](#)
- I. [*Manual on Uniform Traffic Control Devices \(MUTCD\)*](#)
- J. [*Public Right of Way Advisory Group \(PROWAG\)*](#)
- K. [*American with Disability Accessible Design Requirements*](#)
- L. [*NCDOT Policy on Street and Driveway Access To North Carolina Highways Manual*](#)

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CHAPTER 1 STREETS FOR ALL USERS

Article 1.1 Purpose and Scope

This Manual has been developed in conjunction with the Unified Development Ordinance, which recognizes the critical link between land use and transportation, insuring that both work together to preserve and create great places within the City of Raleigh.

Articles of the Unified Development Ordinance have been included in this Manual. The Articles and Sections in this Manual that are included from the UDO will be have a cross reference. In the case where any requirement in the City of Raleigh Code conflicts with any regulation or standard presented in this manual, the City of Raleigh Code shall control.

The design guidelines contained in this Manual are intended to provide for adequate and coordinated development with necessary facilities to serve and protect all users of Raleigh's transportation system.

Staff will apply fundamental engineering principles and practices in the evaluation of the design and construction plans in review.

It is recognized that certain improvements financed wholly or in part with State and Federal funds are subject to the regulations and standards prescribed by those agencies. Such regulations and standards may be different than those of the City and may take priority over City regulations and standards presented in this manual. The guidance presented herein is based on nationally-accepted design parameters, including AASHTO's A Policy on the Geometric Design of Highways and Streets and Flexibility in Highway Design, and supplemented by context-specific guidance such as that contained in the joint ITE/CNU Designing Walkable Urban Thoroughfares: A Context Sensitive Approach, and context-specific guidance for design and installation of green stormwater infrastructure (GSI).

The Public Works Director, or his/her designee thereafter referred to as the Public Works Director, in consultation with other City departments and state agencies, may in accordance with Section 10.2.18 of the [Unified Development Ordinance](#), approve design adjustments for identified regulations established in Chapter 8 of the Unified Development Ordinance.

Article 1.2 Complete and Context Sensitive Streets

In 2009, NCDOT adopted a Complete Streets Policy. The Policy Statement is cited for reference below:

Transportation, quality of life, and economic development are all undeniably connected through well-planned, well-designed, and context sensitive transportation solutions. To NCDOT, the designations "well-planned", "well designed" and "context-sensitive" imply that transportation is an integral part of a comprehensive network that safely supports the needs of the communities and the traveling public that are served.

This policy requires that NCDOT's planners and designers will consider and incorporate multimodal alternatives in the design and improvement of all appropriate transportation projects within a growth area of a town or city unless exceptional circumstances exist. Routine maintenance projects may be excluded from this requirement; if an appropriate source of funding is not available.

Similarly, in 2015, the City of Raleigh amended the Comprehensive Plan to include Policy T 3.1 Complete Streets Implementation, stating:

For all street projects and improvements affecting the public right-of-way, consider and incorporate Complete Street principles and design standards that provide mobility for all types of transportation modes (pedestrian, bicycle, auto, transit, freight) and support mutually-reinforcing land use and transportation decisions. Work with NCDOT to implement these design standards for state-maintained roads within the City's jurisdiction.

The City of Raleigh is dedicated to improving the lives, health, and well-being of our residents and visitors, regardless of age, income, health, or mode of transport. A network of Complete Streets across the City contributes to both livability and sustainability in that it provides safe and equitable mobility choices, recognizes all users regardless of physical ability or mode of travel, provides amenities and infrastructure for all modes, and complements adjoining architectural, economic, community, and land use patterns. With a Complete Streets Policy, the City recognizes that all streets, public and private, are different and that the needs of various users must be balanced. Such a network will be accessible to users of all ages and ability—including bicyclists, pedestrians, transit users, motorists, freight providers, and municipal and emergency service providers—and ensure that all users experience a functional and visually attractive environment.

The City of Raleigh supports that complete streets as an important aspect of the quality of life in the City, and has therefore developed a palette of street typologies that accommodate all users within the context of the UDO. While the street typologies adhere to the principles of Complete Streets, some place more emphasis on moving vehicular traffic than others. Complete street designs should be context-sensitive, consider local needs, and incorporate up-to-date design standards appropriate for the project setting. Each project must be considered both individually and as part of a connected network. Design should consider such elements as natural features, adjacent land uses, input from local stakeholders and merchants, community values, and future development patterns as outlined in the City's Future Land Use Map, Comprehensive Plan, and adopted studies. When determining the community context and the feasibility of implementing Complete Streets concepts, there should be a balance between the safety of all users, the roadway's vehicular level-of-service, and the multimodal quality-of-service.

City streets are a primary source of current and future stormwater runoff. For more sustainable stormwater management the City of Raleigh also supports the use of context-sensitive GSI within certain street typologies. The City of Raleigh's Comprehensive Plan includes a number of policies encouraging use of green stormwater infrastructure, including but not limited to Policy EP 2.1 Green Infrastructure, EP 3.1 Water Quality BMPs; EP 3.8 Low Impact Development; PU Sustainable Stormwater Management; and PU 5.4 Discharge Control Methods. The City of Raleigh has determined that numerous street typologies in the UDO offer opportunities for using GSI while providing multiple community benefits. Guidance is provided herein on appropriate standard design details and planting features that can allow effective use of GSI in these right-of-way areas while meeting other Complete Street goals and design needs. Implementation of GSI elements can be approached by evaluating opportunities and constraints within each zone of the right-of-way and considering potential benefits, risks, and technical design factors.

While the sections contained herein were developed with City's and NCDOT's Complete Streets Policy and the City's GSI policy; some sections may vary somewhat from the NCDOT standards in order to be consistent with a certain land use or development type context.

Article 1.3 Process of Street Design

Streets shall be designed to be consistent with the City's Complete Streets Implementation Policy and GSI-related policies and supportive of their contexts. The goals shall be to serve all modes of mobility which occur within those contexts in a safe and efficient manner and manage stormwater in ways that are sustainable and multi-functional.

The street typologies, their primary functions and elements are defined herein. Typical cross-sections are depicted with the acknowledgement that appropriate modifications to the preferred cross-sections and dimensions may be approved. Any deviations from the specified dimensions must be approved by the Public Works Director as a Design Adjustment.

These street typologies are set forth in the [Unified Development Ordinance, Article 8.4](#); however, this Manual provides the typologies with additional and more detailed engineering and technical specification.

CHAPTER 2 STREET ELEMENT OVERVIEW

Within the public right-of-way, the two primary zones are the **Streetscape** and the **Travelway**.

Article 2.1 Streetscape

The Streetscape is located on both sides of the Travelway. The Streetscape is the primary pedestrian realm, accommodating people walking, stopping, and sitting, and also functions as the transitional area between moving traffic and land uses. The streetscape is also the place where transitions between the pedestrian mode and other modes of transportation occur, and thus its design characteristics including landscaping, aesthetics, multimodal accessibility to support desired development patterns. Sidewalks, the planting area, and the maintenance strip behind the sidewalk are conducive to the use of GSI within the streetscape in certain street typologies. Applicable GSI practices include permeable pavement, curbside bioretention/planters, tree wells/planter boxes, rain barrels, and flow-through stormwater planters.

Article 2.2. Travelway

The Travelway refers to the paved width of a street between curbs that accommodates moving and stationary vehicles in a variety of modes. On wider street cross-sections, additional landscaping such as medians may be present to provide safe havens for pedestrian crossing, traffic separation and calming, restrictions of dangerous turn movements, drainage, and other beneficial functions. The Travelway may include the following elements:

- A. General Travel Lane - General travel lanes accommodate vehicles of all types. The design and control for the general travel lane determine the width of the lane(s) and the street, as well as other geometrics such as curb radii. The width of the travel lane directly corresponds with the operating speed of the street and the level of mobility and access.
- B. Bicycle Facility - Bicycles may be accommodated in their own space or in a shared lane with other vehicles in the ROW.
- C. Transit Facility - Buses, streetcars, taxis, and other mass transit vehicles may be accommodated in their own space or in a shared lane with other vehicles in the ROW.
- D. On-Street Parking - Parking within the ROW, typically adjacent to a curb, accommodates automobiles, bicycles or other vehicles. Parallel orientation is most common, though angled (head in and back in) parking may be used to provide additional spaces where sufficient ROW exists and off-street parking capacity is very limited. The presence of on-street parking encourages lower vehicular travel speeds on streets and buffers pedestrians from moving traffic. In certain street typologies, permeable pavement can be incorporated into street parking areas, and bioretention can be incorporated into corner bulb-outs at intersections and curbside extensions/bump-outs.
- E. Gutter and/or Shoulder - The choice between gutter and shoulder for transitioning from Travelway to Streetscape depends primarily on area drainage characteristics, environmental sensitivity, land use intensity, and aesthetic intent. For most street typologies, a cross-section supporting more urban development involves the use of curb and gutter. Variations on traditional gutter and/or shoulder designs can be used to incorporate GSI elements. See Section 12.4, Curb and Gutter, for more detail on curb and gutter design. Applicable GSI practices include curb extensions/bump-outs and intersection bulb-outs, which are incorporated into the gutter,

shoulder, or other transition, and bioswales, which can take the place of traditional curb and gutter in some applications. Permeable pavement also can be appropriate for use in the shoulder.

- F. Median - Medians can range in width depending on street type and context. They may accommodate integrated turn lanes, pedestrian refuges at cross-streets and mid-block, drainage swales, shade trees, promenades, transit lines and stations. If space permits, landscaped medians provide a beneficial aesthetic and street narrowing effect in almost any context. Medians are conducive to the use of GSI elements that can offer several benefits. Depressed medians can be designed as bioretention islands or vegetated/bioswales that incorporate curb cuts to allow runoff to pass from gutters or other conveyance to these depressions. Alternatively, rock swales can be incorporated in medians where growth and/or maintenance of vegetation may be difficult. Permeable pavement also can be installed in medians as an alternative to conventional, impervious pavement, where the use of vegetation is not suitable.
- G. Turn Lane - Turn lanes may be continuous, integrated with spot medians, or installed at intersections with high vehicular turning volume. Where center left turn lanes are provided on streets with four or more general travel lanes, medians with a pedestrian refuge shall be added to aid in safe crossing as well as more efficient traffic signal phasing.

Article 2.3 Roadway Classification Design Vehicle Type

The [Design Vehicle](#) Table lays out the vehicle types have been used in the engineering specifications for each street type. Every street type shall appropriately accommodate emergency vehicles.

Table 1 Design Vehicle Table

| Street Type | Design Vehicle |
|--------------------------------|--|
| Sensitive Area Street | Single Unit Truck (SU-30) Interstate Semi-Trailer (WB-62) |
| Local Streets | Passenger Car (P) Single Unit Truck (SU-30) |
| Mixed Use Streets | Single Unit Truck (SU-30) |
| Major Streets | Intermediate Semi-Trailer (WB-40) Interstate Semi-Trailer (WB-62) |
| Industrial and Service Streets | Interstate Semi-Trailer (WB-62) |
| Accessways | Single Unit Truck (SU-30), Person |
| Alley | Single Unit Truck (SU-30) |

CHAPTER 3 STREET TYPES

Article 3.1 New Streets

This Chapter describes guidelines for the construction of new streets throughout the City and is intended to provide a catalog of pre-approved street types that are appropriate to use. Additional information can be found in [Article 8.4 of the Unified Development Ordinance](#).

Article 3.2 Street Types Overview

This list provides the new Street Types in the City of Raleigh and ETJ. The schematic and required dimensions along with Engineering Specifications are laid out in the article for each type. Cross sections of each can be found in the [City of Raleigh Standard Details](#).

Section 3.2.1 Sensitive Area Streets

- A. Sensitive Area Parkway
- B. Sensitive Area Avenue
- C. Sensitive Area Residential Street

Section 3.2.2 Local Streets

- A. Neighborhood Yield
- B. Neighborhood Local
- C. Neighborhood Street
- D. Multifamily Street

Section 3.2.3 Mixed Use Streets

- A. Avenue 2-Lane, Undivided or Divided
- B. Avenue 3-Lane, Parallel Parking
- C. Main Street, Parallel or Angular Parking

Section 3.2.4 Major Streets

- A. Avenue 4-Lane, Parallel Parking
- B. Avenue 4-Lane and 6-Lane, Divided
- C. Multi Way Boulevard, Parallel Parking or Angular Parking

Section 3.2.5 Industrial and Service Streets

- A. Industrial Street
- B. Alley, Residential
- C. Alley, Mixed Use

Section 3.2.6 Accessways

- A. Primary Internal Access Drive
- B. Pedestrian Passage

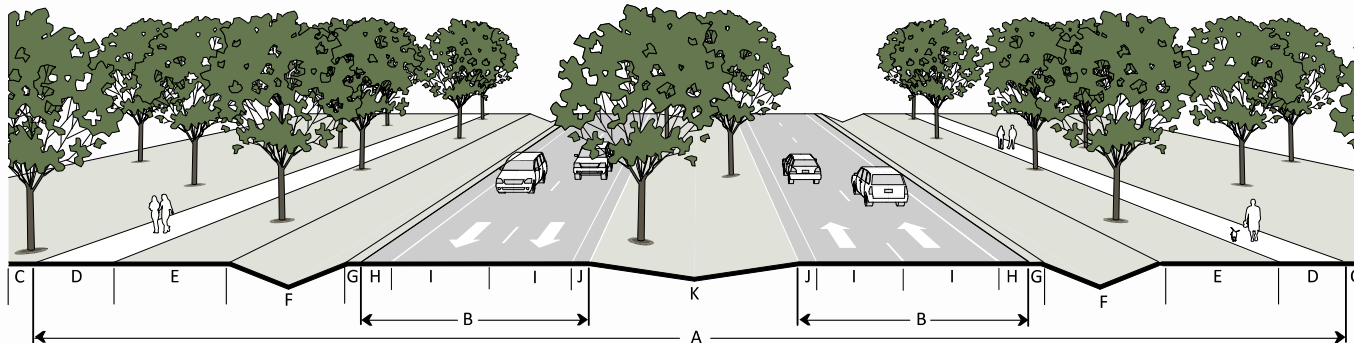
Section 3.2.1 Sensitive Area Streets

In areas of Raleigh where stormwater does not drain into pipe systems, other forms of drainage must be provided. Along encompassed streets, open channel drainage ditches are typical and must be accommodated within special cross-sections. The following roadway cross-sections are intended for use in these “Sensitive” areas.

- A. **Sensitive Area Parkways** are semi-limited access corridors, and are often used to preserve scenic views. They are intended primarily to support regional travel. Medians are a standard feature of parkways in almost every case, except where a narrower cross-section is needed to minimize right-of-way and environmental impact.
- B. **Sensitive Area Avenues** are for use in low-intensity areas that do not have sewer provisions. They have relatively narrow paved widths, which includes shoulders for bicycle and pedestrian uses in retrofit situations lacking sidewalks.
- C. **Sensitive Area Residential Streets** are appropriate in rural conditions with large lot homes, without water and sewer provisions.

3.2.1 A - Sensitive Area Parkway

A Sensitive Area Parkway would be most appropriate as a high volume regional connector road where surroundings are primarily conservation or agricultural land. Multiuse trails on both sides of the street is a preferred way to accommodate pedestrians and cyclists. Ideally, both trails and shoulders are installed. Express transit service may be implemented on Sensitive Area Parkways. Sensitive Area Parkways are conducive to the use of GSI practices. Per UDO Article 9.5, where development impervious cover is more than 24% in any Secondary Water Supply Watershed Protection Area, the first inch of rainfall from the streets must be managed with use of GSI, unless a design exception is approved by the City. In these Protection Areas, permeable pavement may be appropriate for multiuse trails, bioswales and bioretention areas may be appropriate as alternatives to conventional drainage ditches, and combinations of trees and native vegetation may be appropriate as an alternative to conventional tree lawns.

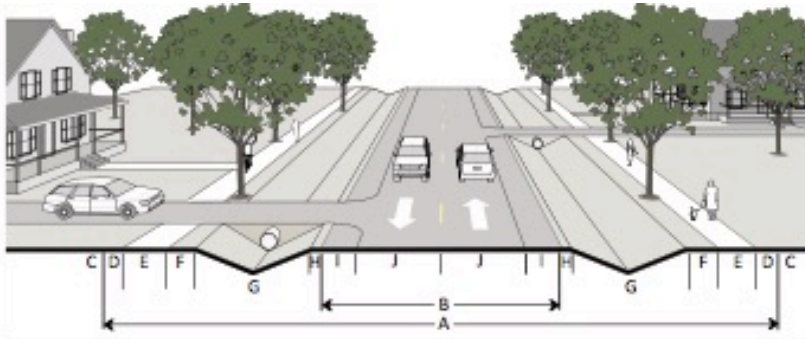


| Width | |
|-------------------------------|----------------|
| A Right-of-way width | 154' |
| B Pavement width | 32' |
| Streetscape | |
| C Maintenance strip (min) | 2' |
| D Multi-use trail (min) | 10' |
| E Planting area (min) | 6' |
| F Drainage (min) | 10' |
| Travelway | |
| G Grassed shoulder | 2' |
| H Paved shoulder/bicycle lane | 8' |
| I Travel lane | 11' |
| J Paved shoulder | 2' |
| K Median (min) | 30' |
| General | |
| Walkway type | Multi-use path |
| Planting type | Tree lawn |
| Tree spacing | 50' o.c. avg |

| Engineering Specifications | |
|---------------------------------|---|
| Design Speed (mph) | 50 mph |
| Design Vehicle | WB-62 |
| Signalized Intersection Density | As warranted |
| Driveway Spacing | 1/4 mile, min |
| Median Opening Distance | At signals or 2 miles apart, minimum |
| Partial Medians/Island | Yes |
| Curb Radii | 25' + |
| Lighting | Required on all public streets for new development, pedestrian scale optional and responsibility of developer |
| Permitted Furniture | Transit stop or trail amenities |

3.2.1 B - Sensitive Area Avenue

A Sensitive Area Avenue is used in rural conditions where it provides important connectivity for multiple travel modes. It should not be used in a completely residential setting (see “Sensitive Area Residential Street” instead.) The Sensitive Area Avenue type provides great flexibility in accommodating future growth, and can be reconfigured to a “Main Street” cross-section within targeted development nodes if drainage facilities were upgraded. Sidewalk is required on both sides of the street. Sensitive Area Avenues are conducive to the use of GSI practices. Per UDO Article 9.5, where development impervious cover is more than 24% in any Secondary Water Supply Watershed Protection Area, the first inch of rainfall from the streets must be managed with use of GSI, unless a design exception is approved by the City. In these Protection Areas, permeable pavement may be appropriate for multiuse trails, bioswales and bioretention areas may be appropriate as alternatives to conventional drainage ditches, and combinations of trees and native vegetation may be appropriate as an alternative to conventional tree lawns.

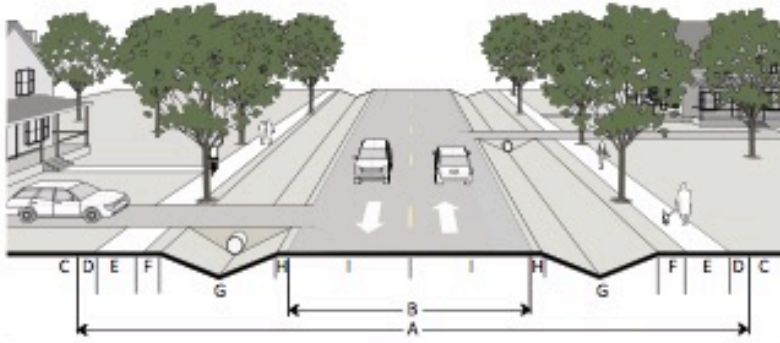


| Width | |
|-------------------------------------|--------------|
| A Right-of-way width | 80' |
| B Pavement width | 30' |
| Streetscape | |
| C Utility placement, easement (min) | 5' |
| D Maintenance strip (min) | 2' |
| E Sidewalk (min) | 5' |
| F Planting area (min) | 6' |
| G Drainage (min) | 10' |
| Travelway | |
| H Grassed Shoulder | 2' |
| I Paved Shoulder | 4' |
| J Travel lane | 11' |
| General | |
| Walkway type | Sidewalk |
| Planting type | Tree lawn |
| Tree spacing | 50' o.c. avg |
| Tree spacing | 50' o.c. avg |

| Engineering Specifications | |
|---------------------------------|---|
| Design Speed (mph) | 40 mph |
| Design Vehicle | SU-30 |
| Signalized Intersection Density | As warranted |
| Driveway Spacing | As needed |
| Median Opening Distance | At intersections |
| Partial Medians/Island | No |
| Curb Radii | 15' |
| Lighting | Required on all public streets for new development, pedestrian scale optional and responsibility of developer |
| Permitted Furniture | As needed |

3.2.1 C - Sensitive Area Residential Street

Sensitive Area Residential Streets are installed in places where natural runoff water drainage is preferred, and traffic volume is relatively low. Typically, this type would be used in an agricultural or primarily low-density residential setting. Sidewalk is required on both sides of the street. Sensitive Area Residential Streets are conducive to the use of GSI practices. Per UDO Article 9.5, where development impervious cover is more than 24% in any Secondary Water Supply Watershed Protection Area, the first inch of rainfall from the streets must be managed with use of GSI, unless a design exception is approved by the City. In these Protection Areas, permeable pavement may be appropriate for multiuse trails, bioswales and bioretention areas may be appropriate as alternatives to conventional drainage ditches, and combinations of trees and native vegetation may be appropriate as an alternative to conventional tree lawns.



| Width | |
|-------------------------------|--------------|
| A Right-of-way width | 70' |
| B Pavement width | 20' |
| Streetscape | |
| C Utility placement, easement | 5' |
| D Maintenance strip (min) | 2' |
| E Sidewalk (min) | 5' |
| F Planting area (min) | 6' |
| G Drainage (min) | 10' |
| Travelway | |
| H Grassed Shoulder | 2' |
| I Travel lane | 10' |
| General | |
| Walkway type | Sidewalk |
| Planting type | Tree lawn |
| Tree spacing | 50' o.c. avg |

| Engineering Specifications | |
|---------------------------------|---|
| Design Speed (mph) | 25 mph |
| Design Vehicle | Passenger Vehicle |
| Signalized Intersection Density | As warranted |
| Driveway Spacing | As needed |
| Median Opening Distance | N/A |
| Partial Medians/Island | No |
| Curb Radii | 5-10' |
| Lighting | Required on all public streets for new development, pedestrian scale optional and responsibility of developer |
| Permitted Furniture | As needed |

Section 3.2.2 Local Streets

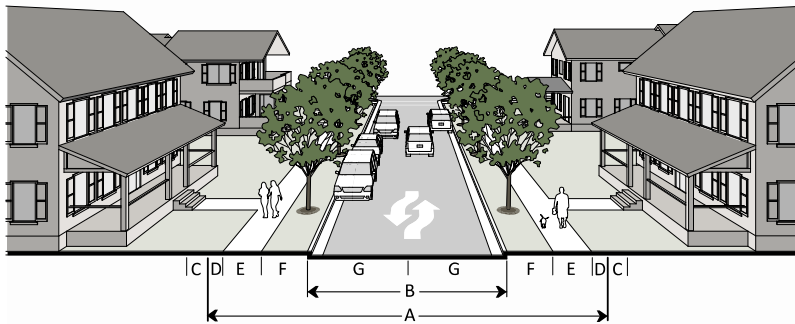
Local Streets provide access to individual lots, accommodate pedestrians and serve as low speed bicycle and vehicle routes. Local streets should be relatively short in total distance and used less frequently compared to other street typologies. [Table 2 Unit Specifications for Local Street Types](#) specifies the number of units per street type.

Table 2 Unit Specifications for Local Street Types

| Street Specification | Units |
|-------------------------|--------------------------|
| A - Neighborhood Yield | Up to 40 units |
| B - Neighborhood Local | 41 – 150 units |
| C - Neighborhood Street | 151 – 350 units |
| D - Multifamily Street | Apartments and Townhomes |

3.2.2 A - Neighborhood Yield

Neighborhood Yield is an unstriped two-way street accommodating parallel parking on one side. Neighborhood Yield streets operate best under low speed and volume conditions, giving opposing vehicle drivers the time and space necessary to successfully negotiate potential conflicting movements and serving no more than 40 units and no longer than ½ mile. Sidewalks are required on both sides of the street. Items in the amenities zone such as streetlights and trees should be installed at a pedestrian scale so as to provide a high level of comfort for residents and non-motorized street users. Neighborhood Yield is conducive to the use of GSI practices including curbside bioretention and permeable pavement in sidewalks.

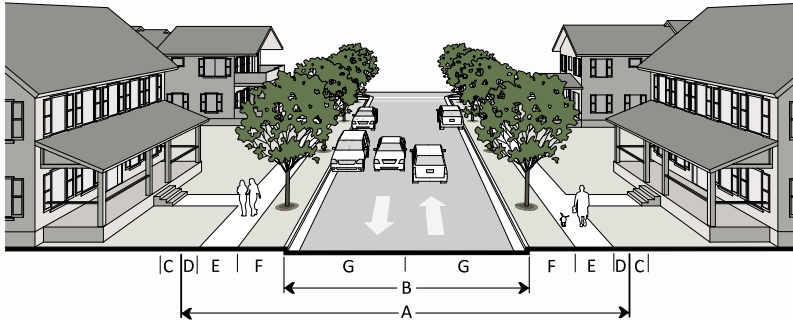


| Width | |
|-------------------------------------|--------------|
| A Right-of-way width | 55' |
| B Back-of-curb to back-of-curb | 27' |
| Streetscape | |
| C Utility placement, easement (min) | 5' |
| D Maintenance strip (min) | 2' |
| E Sidewalk (min) | 6' |
| F Planting area (min) | 6' |
| Travelway | |
| G Parallel parking/travel lane | 13.5' |
| General | |
| Walkway type | Sidewalk |
| Planting type | Tree lawn |
| Tree spacing | 40' o.c. avg |
| Parking type | Parallel |

| Engineering Specifications | |
|---------------------------------|---|
| Design Speed (mph) | 25 mph |
| Design Vehicle | Passenger Vehicle |
| Signalized Intersection Density | As warranted |
| Driveway Spacing | As needed |
| Median Opening Distance | N/A |
| Partial Medians/Island | No |
| Curb Radii | 5-10' |
| Lighting | Required on all public streets for new development, pedestrian scale optional and responsibility of developer |
| Permitted Furniture | As needed |

3.2.2 B - Neighborhood Local

Neighborhood Local Streets are used in primarily residential developments serving from 41 and up to 150 residential units and no longer than ½ mile. They accommodate on-street parallel parking on both sides and feature two general travel lanes for vehicular use, including automobiles, bicycles, and occasional local transit or freight vehicles. Sidewalks are required on both sides of the street. Traffic calming design elements such as intersection bulb-outs and curb extensions/bump-outs can help moderate vehicle speeds on Neighborhood Locals, which are conducive to use of GSI practices including curbside bioretention, bioretention in bulb-outs and/or curb extensions, and permeable pavement sidewalks.

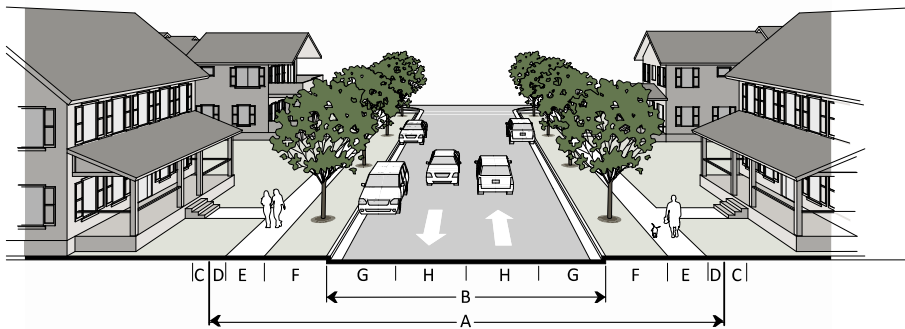


| | |
|-------------------------------------|--------------|
| Width | |
| A Right-of-way width | 59' |
| B Back-of-curb to back-of-curb | 31' |
| Streetscape | |
| C Utility placement, easement (min) | 5' |
| D Maintenance strip (min) | 2' |
| E Sidewalk (min) | 6' |
| F Planting area (min) | 6' |
| Travelway | |
| G Parallel parking/travel lane | 15.5' |
| General | |
| Walkway type | Sidewalk |
| Planting type | Tree lawn |
| Tree spacing | 40' o.c. avg |
| Parking type | Parallel |

| Engineering Specifications | |
|---------------------------------|---|
| Design Speed (mph) | 25 mph |
| Design Vehicle | Passenger Vehicle |
| Signalized Intersection Density | As warranted |
| Driveway Spacing | As needed |
| Median Opening Distance | N/A |
| Partial Medians/Island | No |
| Curb Radii | 5-10' |
| Lighting | Required on all public streets for new development, pedestrian scale optional and responsibility of developer |
| Permitted Furniture | As needed |

3.2.2 C - Neighborhood Street

Neighborhood Streets are used primarily in areas serving between 151 and up to 350 residential units, and where residential uses may be compatible with non-residential uses in a mixed-use context. They accommodate on-street parallel parking on both sides and feature two general travel lanes for vehicular use, including automobiles, bicycles, and occasional local transit or freight vehicles. Sidewalks are required on both sides of the street. Traffic calming design elements such as intersection bulb-outs can help to moderate vehicle speeds on Neighborhood Streets. Traffic calming design elements such as intersection bulb-outs and curb extensions/bump-outs can help moderate vehicle speeds on Neighborhood Streets, which are conducive to use of GSI practices including curbside bioretention, bioretention in bulb-outs and/or curb extensions, and permeable pavement sidewalks.

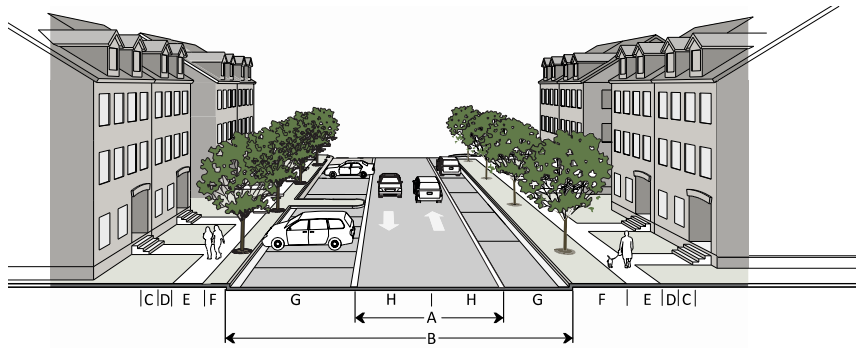


| Width | |
|--------------------------------|--------------|
| A Right-of-way width | 64' |
| B Back-of-curb to back-of-curb | 36' |
| Streetscape | |
| C Utility placement, easement | 5' |
| D Maintenance strip (min) | 2' |
| E Sidewalk (min) | 6' |
| F Planting area (min) | 6' |
| Travelway | |
| G Parallel parking lane | 8' |
| H Travel lane | 10' |
| General | |
| Walkway type | Sidewalk |
| Planting type | Tree lawn |
| Tree spacing | 40' o.c. avg |
| Parking type | Parallel |

| Engineering Specifications | |
|---------------------------------|---|
| Design Speed (mph) | 35 mph |
| Design Vehicle | Passenger Vehicle |
| Signalized Intersection Density | As warranted |
| Driveway Spacing | As needed |
| Median Opening Distance | N/A |
| Partial Medians/Island | No |
| Curb Radii | 5-10' |
| Lighting | Required on all public streets for new development, pedestrian scale optional and responsibility of developer |
| Permitted Furniture | Bicycle racks, benches, parking meters |

3.2.2 D - Multifamily Street

Multi-Family Local Streets are intended to provide direct lot access and a relatively high level of on-street parking capacity in residential settings (Apartments and Townhomes). Two general travel lanes are present along with the allowance of a row of parking on each side in a parallel, perpendicular or angled configuration. Multi-family streets are to be used exclusively for residential developments built under the apartment or townhouse building types defined in the Unified Development Ordinance. Sidewalks are required on both sides of the street in a public easement. In these sections, the parking is not in the right of way, and the use of permeable pavement can be used in on-street parking areas. Multifamily Streets also are conducive to use of GSI practices including curbside bioretention, bioretention in bulb-outs and/or curb extensions, and permeable pavement sidewalks.



Width

| | |
|--------------------------------|-----|
| A Right-of-way width | 22' |
| B Back-of-curb to back-of-curb | 49' |

Streetscape

| | |
|-------------------------------------|----|
| C Utility placement, easement (min) | 5' |
| D Maintenance strip, easement | 2' |
| E Sidewalk, easement (min) | 6' |
| F Planting area (min) | 6' |

Travelway

| | |
|-------------------------|-----|
| G Parking lane | |
| Parallel (either side) | 8' |
| Head-in (either side) | 18' |
| 60° angle (either side) | 20' |
| H Travel lane | 11' |

General

| | |
|---------------|--------------------------------------|
| Walkway type | Sidewalk |
| Planting type | Tree lawn |
| Tree spacing | 40' o.c. avg |
| Parking type | Parallel, head-in, 60 degree angular |

Engineering Specifications

| | |
|---------------------------------|---|
| Design Speed (mph) | 25 mph |
| Design Vehicle | Passenger Vehicle |
| Signalized Intersection Density | As warranted |
| Driveway Spacing | As needed |
| Median Opening Distance | N/A |
| Partial Medians/Island | No |
| Curb Radii | 5-10' |
| Lighting | Required on all public streets for new development, pedestrian scale optional and responsibility of developer |
| Permitted Furniture | Bicycle racks, benches, parking meters |

Section 3.2.3 Mixed-Use Streets

The two general street types that are classified as “Mixed-use Streets” and **Avenues** and **Main Streets**.

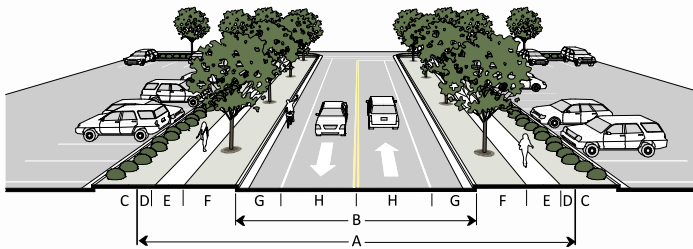
- A. Avenue 2-Lane, Undivided or Divided**
- B. Avenue 3-lane, Parallel Parking**
- C. Main Street, Parallel or Angular Parking**

Avenues are walkable, low-speed streets, generally shorter in length than boulevards. They provide access to abutting commercial and mixed land uses as well as multi-unit residential development. They serve as primary bicycle and pedestrian routes, and may accommodate local transit vehicles. Avenues may feature a median and on-street parking.

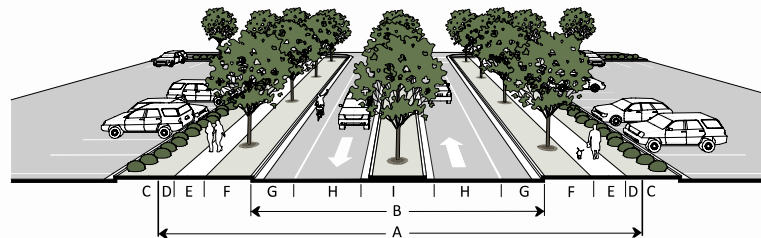
Main Streets are designed to provide connections between neighborhoods and districts, as well as providing access to Avenues and Boulevards from local streets. Main Streets are highly walkable and may serve as the primary street for commercial or mixed-use centers. On-street parking is typically provided.

3.2.3 A - Avenue 2-Lane, Undivided or Divided

This type is intended primarily for use in situations on roads directly adjacent to the Streetscape. The existing context may include any land use, but is often characterized by architecture such as strip malls, internally oriented subdivisions serving > 350 dwelling units with a middle turn lane, or detached development with large setbacks. In recognition of the fact that this type of facility often plays a significant role in local multimodal mobility, the cross-section provides distinct general travel and bicycle lanes. Sidewalks are required on both sides of the street. Where the travel lanes are divided by a median, the use of GSI practices are encouraged for stormwater management; bioretention is encouraged in depressed medians and permeable pavement is encouraged in raised medians.



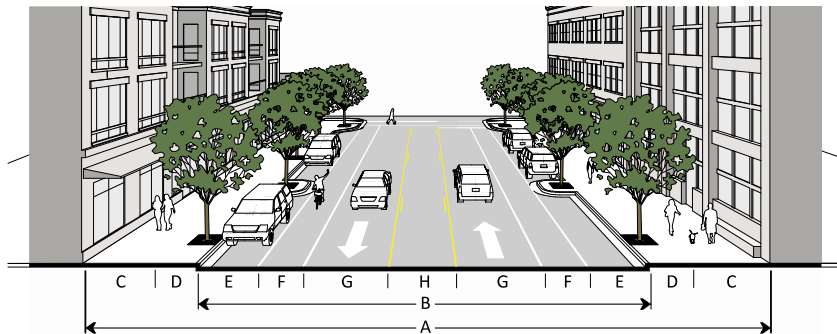
| | Undivided | Divided |
|--------------------------------|--------------|--------------|
| Width | | |
| A Right-of-way width | 64' | -- |
| With center turn lane | -- | 75' |
| With median | -- | 79' |
| B Back-of-curb to back-of-curb | 36' | -- |
| With center turn lane | -- | 48' |
| With median | -- | 52' |
| Streetscape | | |
| C Utility placement, easement | 5' | 5' |
| D Maintenance strip (min) | 2' | 2' |
| E Sidewalk (min) | 6' | 6' |
| F Planting area (min) | 6' | 6' |
| Travelway | | |
| G Bike lane | 7' | 7.5' |
| H Travel lane | 11' | 11' |
| I Center lane | | |
| Striped turn lane | -- | 11' |
| Median | -- | 15' |
| General | | |
| Walkway type | Sidewalk | Sidewalk |
| Planting type | Tree lawn | Tree lawn |
| Tree spacing | 40' o.c. avg | 40' o.c. avg |



| Engineering Specifications | |
|-----------------------------------|---|
| Design Speed (mph) | 30 mph (Undivided) 35 mph (Divided) |
| Design Vehicle | WB-40 |
| Signalized Intersection Density | As warranted |
| Driveway Spacing | > 100' apart |
| Median Opening Distance | > 200' apart |
| Partial Medians/Island | No |
| Curb Radii | 15' |
| Lighting | Required on all public streets for new development, pedestrian scale optional and responsibility of developer |
| Permitted Furniture | Bicycle racks, benches, parking meters, shelters |

Section 3.2.3 - B Avenue 3-Lane, Parallel Parking

A Three-lane Avenue with on-street parking and bike lanes offers significant flexibility. The cross-section is ideal to use in a context featuring residential uses with some ground floor commercial uses or in areas with a mixture of uses. This type provides significant multimodal accessibility and mobility, yet maintains lower speeds and an appealing character, particularly when the center lane includes some landscaped median features. Sidewalks are required on both sides of the street. Use of GSI practices may be desirable with Three-lane Avenues, including permeable pavement for sidewalks and on-street parking areas and bioretention within medians. In addition, Three-lane Avenues also are conducive to use of curbside bioretention and bioretention in curb extensions/bump-outs, stormwater planter boxes, and stormwater street trees (also referred to as tree boxes) as alternatives to tree grates.



Width

| | |
|--------------------------------|-----|
| A Right-of-way width | |
| With center turn lane | 90' |
| With median | 94' |
| B Back-of-curb to back-of-curb | |
| With center turn lane | 62' |
| With median | 66' |

Streetscape

| | |
|-----------------------|----|
| C Sidewalk (min) | 8' |
| D Planting area (min) | 6' |

Travelway

| | |
|-------------------------|------|
| E Parallel parking lane | 8.5' |
| F Bike lane | 6' |
| G Travel lane | 11' |
| H Center lane | |
| Striped turn lane | 11' |
| Median | 15' |

General

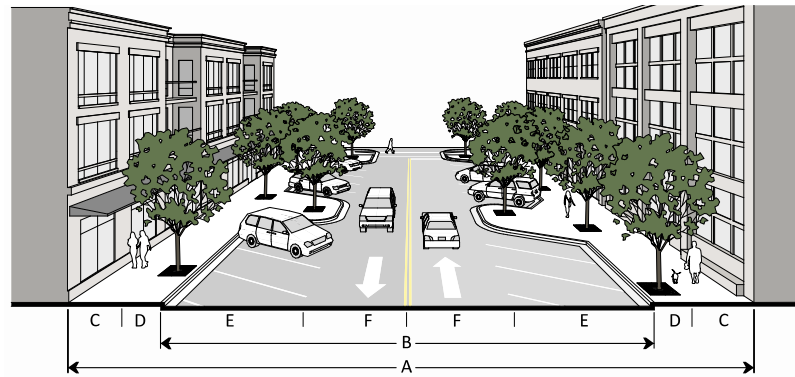
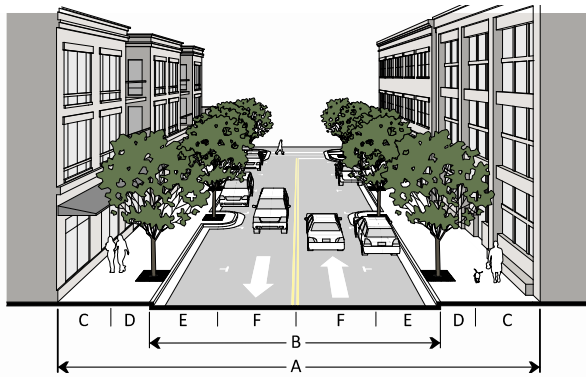
| | |
|---------------|-------------------|
| Walkway type | Sidewalk |
| Planting type | Tree grate / lawn |
| Tree spacing | 40' o.c. avg |
| Parking type | Parallel |

Engineering Specifications

| | |
|---------------------------------|---|
| Design Speed (mph) | 40 mph |
| Design Vehicle | WB-40 |
| Signalized Intersection Density | As warranted |
| Driveway Spacing | > 100' apart |
| Median Opening Distance | > 200' apart |
| Partial Medians/Island | Yes |
| Curb Radii | 10' |
| Lighting | Required on all public streets for new development, pedestrian scale optional and responsibility of developer |
| Permitted Furniture | Bicycle racks, benches, parking meters, shelters, |

Section 3.2.3 - C Main Street, Parallel or Angular Parking

The Main Street type is most appropriate where active frontage and mixed commercial uses exist. On-street parking can be installed in parallel or angled fashion, depending on need and available right-of-way. Due to high anticipated pedestrian activity, design speeds are kept low. This condition also allows bicycles to share space with automobiles in general travel lanes, negating the need for distinct bike lanes. Main Streets are primary candidates for “festival” treatments, in which a portion of the street may be temporarily restricted to non-motorized traffic only for special events. Additional landscaping and traffic calming techniques that are well-suited for Main Streets include street trees in grated wells, bioretention areas/planters, curb bulb-outs with or without bioretention, and a relatively high density of street furniture and public art. Main Streets also are conducive to the use of permeable pavement in on-street parking areas and for sidewalks. Pedestrian-scale street lighting should be installed, and utilities should be located underground, in alleys or other streets to the greatest extent possible. Sidewalks are required on both sides of the street.



| | Parallel Parking | Angular Parking |
|--------------------------------|------------------|-----------------|
| Width | | |
| A Right-of-way width | 73' | 96' |
| B Back-of-curb to back-of-curb | 41' | 64' |
| Streetscape | | |
| C Sidewalk (min) | 10' | 10' |
| D Planting area (min) | 6' | 6' |
| Travelway | | |
| E Parking lane | 8.5' | 20' |
| F Travel lane | 12' | 12' |
| General | | |
| Walkway type | Sidewalk | Sidewalk |
| Planting type | Tree grate | Tree grate |
| Tree spacing | 40' o.c. avg | 40' o.c. avg |
| Parking type | Parallel | 60° angle |

| | |
|-----------------------------------|---|
| Engineering Specifications | |
| Design Speed (mph) | 30 mph |
| Design Vehicle | WB-40 |
| Signalized Intersection Density | As warranted |
| Driveway Spacing | > 100' apart |
| Median Opening Distance | > 200' apart |
| Partial Medians/Island | No |
| Curb Radii | 10' |
| Lighting | Required on all public streets for new development, pedestrian scale optional and responsibility of developer |
| Permitted Furniture | Bicycle racks, benches, parking meters, shelters, |

Section 3.2.4 Major Streets

The categories of streets classified as “Major Streets” are Avenues with four or more lanes and Boulevards.

- A. Avenue 4-Lane, Parallel Parking**
- B. Avenue 4-Lane and 6-Lane, Divided**
- C. Multi Way Boulevard, Parallel Parking or Angular Parking**

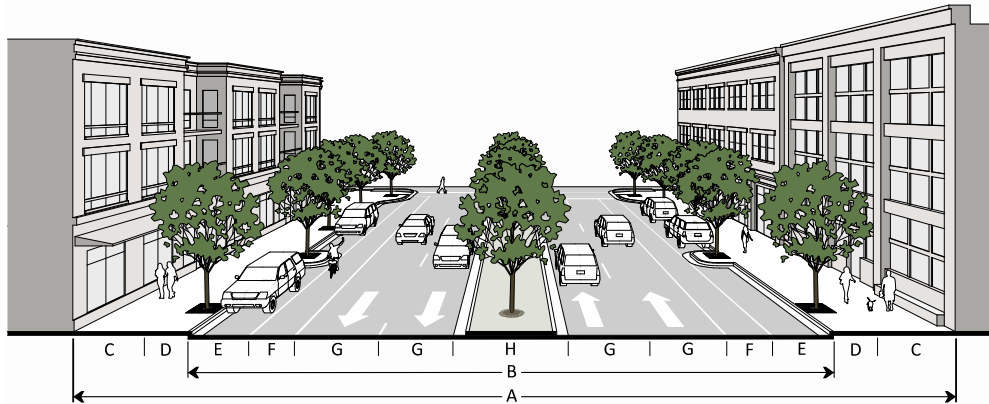
Four- and Six-Lane Avenues have a similar purpose to two- and three-lane Avenues but apply to thoroughfare and arterial streets that require four or more lanes to accommodate traffic demand. Avenues with four or more lanes always feature medians. Signalized intersections are spaced further apart on major streets to better facilitate vehicular mobility. Midblock pedestrian crossings shall be installed on long blocks to maintain walkability in areas where pedestrian usage could be heavy. Major transit routes are often found on these corridors.

Boulevards are designed to support multiple travel modes, including automobiles, freight movers, transit vehicles, pedestrians and bicyclists. Boulevards balance high vehicular capacity with high pedestrian and vehicular accessibility to adjoining urban land uses. Landscaped medians, including those incorporating GSI practices, separate and buffer through traffic from a local access are that accommodate parking, low-speed vehicular traffic, bicyclists and pedestrians.

There are two typical multi-way boulevard configurations: parallel and angled parking where a center median exists with two additional side medians and accessways. Multi-Way configurations are intended to fully support multiple travel modes, providing a high level of mobility and access. They have high vehicular capacity and side accessways provide additional options for right turns, allowing intersections to operate more efficiently.

3.2.4 A - Avenue 4-Lane, Parallel Parking

The Four-lane Avenue provides a good level of mobility for all street users, and is a preferred street type for urban contexts where transit vehicles and cyclists are part of the traffic mix. Medians provide refuge for crossing pedestrians. For more pedestrian-intensive contexts, the width of the Streetscape may be expanded. Curb parking provides vehicular access to adjoining land uses and buffers pedestrians from moving traffic. Sidewalks are required on both sides of the street. Four-lane Avenues are conducive to use of GSI practices including street trees in grated wells, curbside bioretention and/or bioretention in curb extensions/bump-outs, and bioretention in medians. Permeable pavement may be desirable within on-street parking areas and for sidewalks.

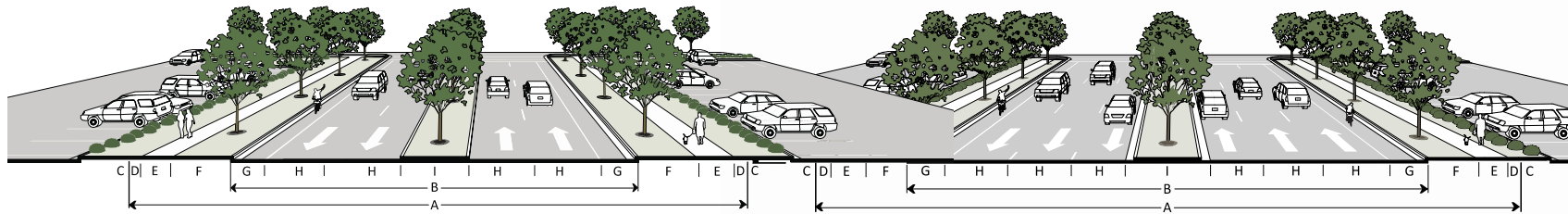


| Width | |
|--------------------------------|-------------------|
| A Right-of-way width | 122' |
| B Back-of-curb to back-of-curb | 90' |
| Streetscape | |
| C Sidewalk (min) | 10' |
| D Planting area (min) | 6' |
| Travelway | |
| E Parallel parking lane | 8.5' |
| F Bike lane | 6' |
| G Travel lane | 11' |
| H Median | 17' |
| General | |
| Walkway type | Sidewalk |
| Planting type | Tree grate / lawn |
| Tree spacing | 40' o.c. avg |
| Parking type | Parallel |

| Engineering Specifications | |
|---------------------------------|--|
| Design Speed (mph) | 40 mph |
| Design Vehicle | WB-40 |
| Signalized Intersection Density | As warranted |
| Driveway Spacing | 200' min |
| Median Opening Distance | 200' min. (may be increased to accommodate a turn lane providing necessary storage length and appropriate taper) |
| Partial Medians/Island | Yes |
| Curb Radii | 15' |
| Lighting | Required on all public streets for new development, pedestrian scale optional and responsibility of developer |
| Permitted Furniture | Bicycle racks, benches, parking meters, shelters, |

3.2.4 B - Avenue 4-Lane and 6-Lane, Divided

This cross-section features four or six general travel lanes, bike lanes, and buffered sidewalks on both sides of the street. Due to the emphasis on through vehicle mobility, it is not conducive to on-street parking; however, the outside general travel and bike lane could be reconfigured to be a transit / bike / right-turn only lane if warranted by context and placed within the multimodal transportation network. Four- and Six-lane Divided are conducive to use of GSI practices including street trees in grated wells, curbside bioretention and/or bioretention in curb extensions/bump-outs, and bioretention in medians. Permeable pavement may be desirable within on-street parking areas and for sidewalks.

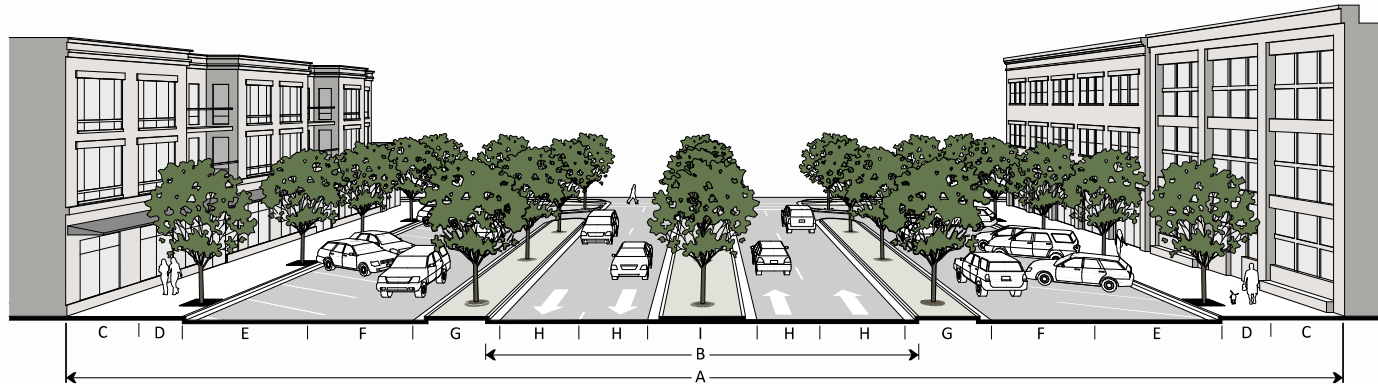


| | 4-Lane | 6-Lane |
|--------------------------------|-------------------|-------------------|
| Width | | |
| A Right-of-way width | 104' | 126' |
| B Back-of-curb to back-of-curb | 76' | 98' |
| Streetscape | | |
| C Utility placement, easement | 5' | 5' |
| D Maintenance strip (min) | 2' | 2' |
| E Sidewalk (min) | 6' | 6' |
| F Planting area (min) | 6' | 6' |
| Travelway | | |
| G Bike lane | 7.5' | 7.5' |
| H Travel lane | 11' | 11' |
| I Median | 17' | 17' |
| General | | |
| Walkway type | Sidewalk | Sidewalk |
| Planting type | Tree grate / lawn | Tree grate / lawn |
| Tree spacing | 40' o.c. avg | 40' o.c. avg |

| | |
|-----------------------------------|---|
| Engineering Specifications | |
| Design Speed (mph) | 40 mph (4 Lane), 50 mph (6 Lane) |
| Design Vehicle | WB-40 |
| Signalized Intersection Density | As warranted |
| Driveway Spacing | > 200' |
| Median Opening Distance | Only at intersections |
| Partial Medians/Island | Yes |
| Curb Radii | 20' |
| Lighting | Required on all public streets for new development, pedestrian scale optional and responsibility of developer |
| Permitted Furniture | Benches, shelters, |

3.2.4 C - Multi-Way Boulevard, Parallel or Angular Parking

A Multi-Way Boulevard is used to provide a high level of both access and mobility. These boulevards consist of general travel lanes separated from side accessways with raised center and side medians, which contain landscape features, transit shelters, or other items. On-street parking is placed within accessways, either in parallel or angled fashion. Bicyclists are expected to use accessway lanes rather than general travel lanes for mobility. Sidewalks are required on both sides of the street. Multi-Way Boulevards are conducive to use of GSI practices including street trees in grated wells, curbside bioretention and/or bioretention in curb extensions/bump-outs, and bioretention in medians. Permeable pavement may be desirable within on-street parking areas and for sidewalks.



| | Parallel Parking | Angular Parking |
|--------------------------------|----------------------------|----------------------------|
| Width | | |
| A Right-of-way width | 154' | 177' |
| B Back-of-curb to back-of-curb | 66' | 66' |
| Streetscape | | |
| C Sidewalk (min) | 10' | 10' |
| D Planting area (min) | 6' | 6' |
| Access Lane | | |
| E Parking lane | 8.5' | 20' |
| F Access lane | 11' | 11' |
| G Median | 11' | 11' |
| Travelway | | |
| H Travel lane | 11' | 11' |
| I Median | 17' | 17' |
| General | | |
| Walkway type | Sidewalk | Sidewalk |
| Planting type | Tree grate / lawn | Tree grate / lawn |
| Tree spacing | 40' o.c. avg | 40' o.c. avg |
| Parking type | Parallel in access lane | 60°angle in access lane |

| | |
|-----------------------------------|---|
| Engineering Specifications | |
| Design Speed (mph) | 40 mph in general lanes |
| Design Vehicle | WB-40 (General Lanes), SU-30 (Accessways) |
| Signalized Intersection Density | As warranted |
| Driveway Spacing | > 200' |
| Median Opening Distance | Only at intersections |
| Partial Medians/Island | Yes |
| Curb Radii | 20' |
| Lighting | Required on all public streets for new development, pedestrian scale optional and responsibility of developer |
| Permitted Furniture | Benches, shelters, |

Section 3.2.5 Industrial (Commercial) and Service Streets

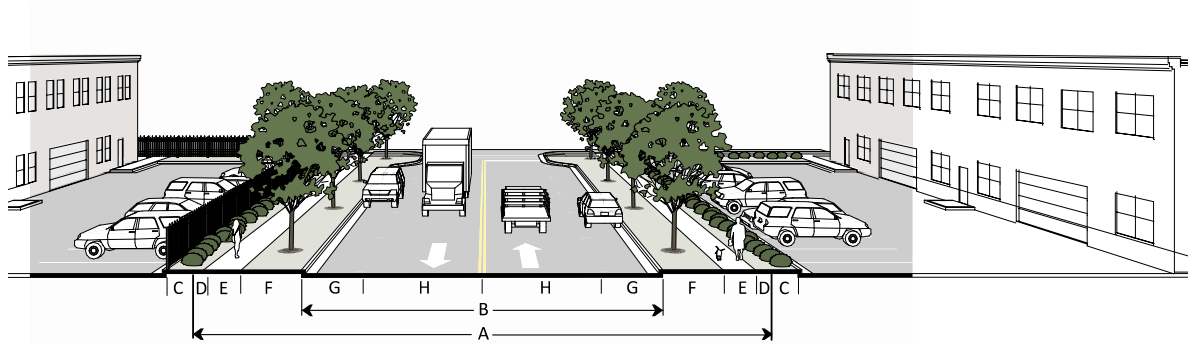
- A. Industrial Street**
- B. Alley, Residential (Private)**
- C. Alley, Mixed Use (Private)**

Streets within industrial and service areas typically carry lower traffic volumes but accommodate a higher proportion of truck traffic. Pedestrian facilities do not need to be as generous as in mixed-use areas, and separate bicycle facilities are not provided for. This street section represents the minimum standard for commercial property for the calculation of facility fees and reimbursements.

A related type is the alley, defined as a narrow low-speed road behind buildings that provides access to parking, service areas and rear uses such as accessory structures. It may also accommodate utilities, in shoulders or easements. Some informal pedestrian and bicycle use is to be expected on alleys, but these activities can share space with motorized vehicles due to land constraints, general lack of amenities, and low traffic volume. Sidewalks are required on both sides of the street.

3.2.5 A - Industrial Street

Industrial Streets are conducive to use of GSI practices including curbside bioretention, bioretention in curb extensions/bump-outs, and permeable pavement for sidewalks.

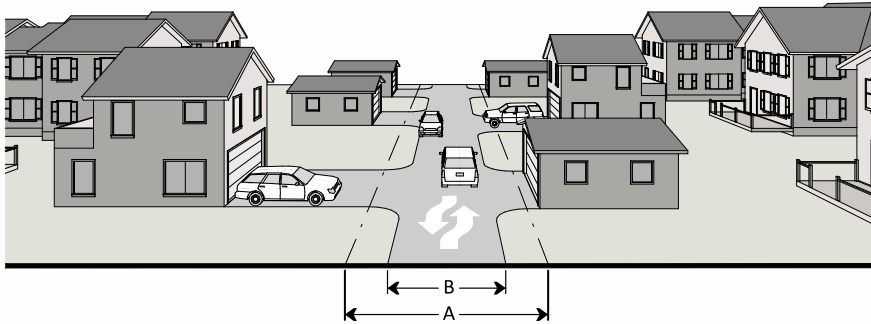


| Width | |
|--------------------------------|--------------|
| A Right-of-way width | 69' |
| B Back-of-curb to back-of-curb | 41' |
| Streetscape | |
| C Utility placement, easement | 5' |
| D Maintenance strip (min) | 2' |
| E Sidewalk (min) | 6' |
| F Planting area (min) | 6' |
| Travelway | |
| G Parallel parking lane | 8.5' |
| H Travel lane | 12' |
| General | |
| Walkway type | Sidewalk |
| Planting type | Tree lawn |
| Tree spacing | 40' o.c. avg |
| Parking type | Parallel |

| Engineering Specifications | |
|---------------------------------|---|
| Design Speed (mph) | 35 mph |
| Design Vehicle | WB-62 |
| Signalized Intersection Density | As warranted |
| Driveway Spacing | As needed |
| Median Opening Distance | N/A |
| Partial Medians/Island | No |
| Curb Radii | 25' + |
| Lighting | Required on all public streets for new development, pedestrian scale optional and responsibility of developer |
| Permitted Furniture | As needed |

3.2.5 B - Alley, Residential (Private)

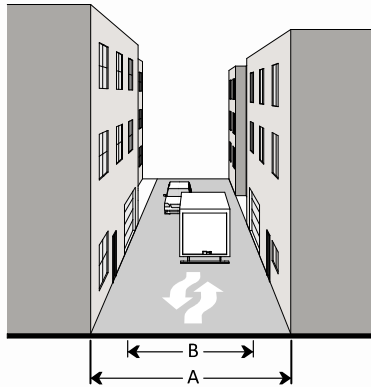
Residential alleys can provide access to accessory housing units and rear-entry parking, as well as provide a location for utilities and services such as garbage removal if built to street standards to support those types of vehicles. They vary in total width from 16 to 20 feet. Alleys can also provide shortcuts for pedestrians and cyclists. Because of their relatively low traffic volumes and vehicle loads, Residential Alleys often can accommodate GSI practices such as permeable pavement and alternative curb systems.



| Width | | |
|-----------|---------------------------------|-------------|
| A | Easement width | 20' |
| Travelway | | |
| B | Travel lane | 16' minimum |
| B | Travel lane, fire service route | 20' |

3.2.5 C - Alley, Mixed-Use (Private)

Mixed Use Alleys provide access to service entrances, loading docks and garages as well as providing a location for utilities and garbage. They vary in width from 20 to 24 feet, depending on whether they are one-way or two-way. Due to their relatively low traffic volumes and vehicle loads, Mixed-Use Alleys often can accommodate GSI practices such as permeable pavement and alternative curb systems.



Width

| | |
|------------------|-----|
| A Easement width | 24' |
|------------------|-----|

Travelway

| | |
|---------------|-------------|
| B Travel lane | 20' minimum |
|---------------|-------------|

Section 3.2.6 Accessways

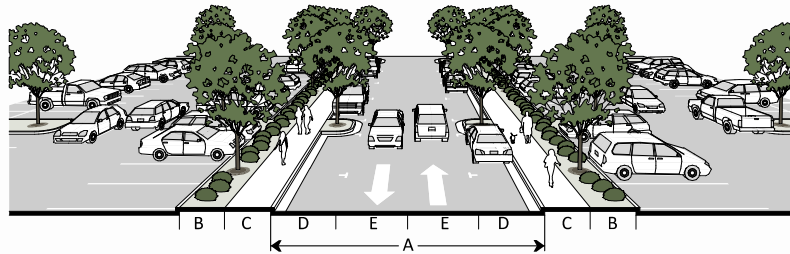
Accessways are used to provide a formal travel path within a block for pedestrians and/or vehicles.

A. Primary Internal Access Drive

B. Pedestrian Passage

3.2.6 A - Primary Internal Access Drive

The primary internal access drive type can be applied to the main entrances of major developments set back from roads such as malls, corporate offices, and high-volume strip centers. It provides pedestrian and vehicular access as well as design flexibility for future retrofits (such as infill development adjacent to this street). This type is typically applied to a private easement within a property, though may be converted to future public use as part of a grid-reliant infill and redevelopment opportunity. Sidewalks are required on both sides of the street. Primary Internal Access Drives are conducive to use of GSI practices including street trees in grated wells and curbside bioretention, bioretention in curb extensions/bump-outs, and permeable pavement for sidewalks and in parking areas that are not part of the travel lanes.

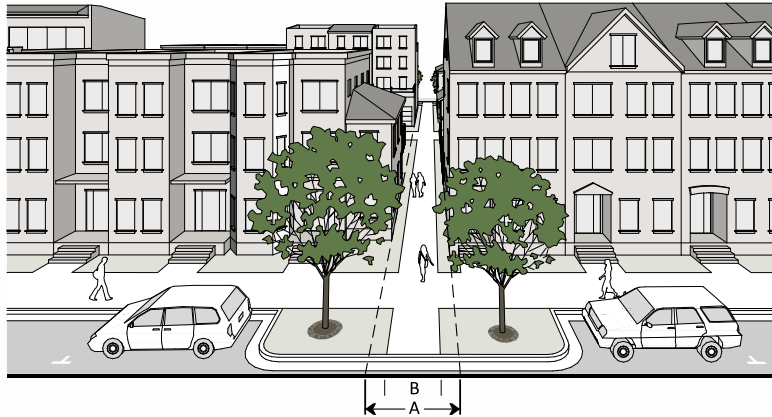


| Width | |
|--------------------------------|----------|
| A Back-of-curb to back-of-curb | 36' |
| Streetscape | |
| B Planting strip (min) | 5' |
| C Sidewalk (min) | 6' |
| Travelway | |
| D Parallel parking lane | 8' |
| E Travel lane | 10' |
| General | |
| Walkway type | Sidewalk |
| Parking type | Parallel |

| Engineering Specifications | |
|---------------------------------|---|
| Design Speed (mph) | 25 mph |
| Design Vehicle | SU-30 |
| Signalized Intersection Density | N/A |
| Driveway Spacing | As needed |
| Median Opening Distance | N/A |
| Partial Medians/Island | No |
| Curb Radii | 5-10' |
| Lighting | Required on all public streets for new development, pedestrian scale optional and responsibility of developer |
| Permitted Furniture | As needed |

3.2.6 B Pedestrian Passage

Pedestrian Passageways are off-limits to motorized vehicles and provide additional pedestrian and bicycle connectivity through medium and large blocks. They may be used in any context. The type may also be applied to standalone greenways and shall be constructed of a durable material to facilitate pedestrian movements and are dedicated as public access easements. The addition of a pedestrian passage permits an increase in minimum block perimeter as per [Section 8.3.2 B 3 of the UDO](#). Pedestrian Passageways are well-suited for incorporating permeable pavement as a GSI practice.



| Width | |
|--------------------------------|----------|
| A Public access easement (min) | 20' |
| Travelway | |
| B Paved area (min) | 10' |
| General | |
| Walkway type | Sidewalk |

| Engineering Specifications | |
|---------------------------------|---|
| Design Speed (mph) | 25 mph |
| Design Vehicle | SU-30 |
| Signalized Intersection Density | N/A |
| Driveway Spacing | As needed |
| Median Opening Distance | N/A |
| Partial Medians/Island | No |
| Curb Radii | 5-10' |
| Lighting | Required on all public streets for new development, pedestrian scale optional and responsibility of developer |
| Permitted Furniture | As needed |

Article 3.3 Existing Streets

This Article describes guidelines for the construction of street improvements and streetscapes for existing streets throughout the City. It is intended to address when street and streetscape improvements are appropriate through the application of the pre-approved street types in this chapter. This information can be found in [Article 7.2](#) and [Article 8.5 of the UDO](#).

Article 3.4 Existing Private Streets

Information for existing private streets can be found [Section 8.5.4 of the UDO](#).

General

- A. No new private streets are allowed.
- B. All existing private streets must remain under maintenance of the homeowners' association and must be maintained to equivalent public street standards.
- C. Private alleys must be constructed to the standards in Sec. 8.4.7. of the UDO and the construction standards specified in the Raleigh Street Design Manual.
- D. Private alleys are not dedicated to the public and shall not be publicly maintained.

Maintenance

The final plat shall be conditioned as follows:

- A. Require perpetual maintenance of private streets by a homeowners' association to the same standards as connecting public streets for the safe use of persons using the streets; and
- B. State that the City has absolutely no obligation or intention to ever accept such streets as public right-of-way.

CHAPTER 4 PLAN AND PERMITTING REQUIREMENTS

Article 4.1 Right-of-Way Permits

For all permit submittal requirements, permit issuance, and fees, please see the Development Services – Customer Service Center and the current [Development Fee Schedule](#). Some projects may require additional processes based on the impact to the public right-of-way.

- A. **Site Final** - The inspector will check the condition of the existing and new infrastructure improvements, and site related items.
- B. **Driveway/Sidewalk** - When new curb cut construction is proposed, this permit will be required. When new sidewalk construction is proposed, not related to Infrastructure Construction Drawings, a permit will be required.
- C. **Permitting obstructions and work in the Public Right of Way** - When utility contractors are doing work in the public right of way, or occupying lane(s) and/or sidewalk, a permit will be required

Article 4.2 Encroachments

The Encroachment approval is a process by which private property owners, firms or corporations may request use of the Public Right of Way for private purposes, such as landscaping, structures or outdoor dining. This review process is intended to ensure the health and safety of the public, as well as protection against potential damage to the streetscape, trees and vegetation, sidewalks, streets, and other publicly owned amenities.

Major Encroachments are permanent structures for private use in the public right-of-way in any part of the City. City Council reviews and approves major encroachments following City staff reviews.

Minor Encroachments are temporary items for private use in the public right-of-way. Examples include outdoor dining tables, awnings and street vending carts. Requests for minor encroachments are reviewed and approved by City staff.

Article 4.3 Travel Lane and Sidewalk Closures

- A. All sidewalk, traffic lane, and on street parking closures must allow for safe vehicular traffic flow and pedestrian access around the construction site
- B. Sidewalk closures result in re-routing pedestrian traffic and must be reviewed for the safe movement of pedestrians and meet [American with Disability Accessible Design Requirements](#), and the [Public Right of Way Advisory Group \(PROWAG\)](#) guidelines during construction.
- C. Travel lanes and parking lanes must meet [Manual on Uniform Traffic Control Devices \(MUTCD\)](#) standards.

Extra planning and design must be considered to provide for safe movement of vehicular and pedestrian traffic in areas where pedestrian activity is a priority such as Pedestrian Business Overlay Districts (PBOD's), where the DX district is mapped, or where SF, UG or UL frontages are mapped. Right-of-way plan elements for temporary street/sidewalk closures must include the following at a minimum:

1. Location of the building or job area
2. Location of the sidewalk
3. Location of on-street parking
4. Location of any transit facilities
5. Direction of travel lanes
6. Location of any streetscape item (utilities, street furniture, trees, signs)
7. Location of transit stops
8. Description of same improvements 100 feet to either side of the site
9. Location of eight foot chain link fence
10. Location of covered sidewalk and details of construction in accordance with the NC State Building Code, Chapter 33
11. Site accessibility/ADA requirements in accordance with the NC Building Code
12. Compliance with Site Access as required in Section 8.3.5 of the UDO
13. Type and Location of barricades
14. Location of traffic merge cones
15. Location of businesses affected by barricades and/or fences
16. Estimated timeframe for project
17. Any items that will be affected by the closure
18. Logistics and construction phasing from the contractor
19. [Traffic Control Plan and Pedestrian Notes](#)

Article 4.4 NCDOT Coordination

- A. Any time a project has the potential to impact a State-maintained roadway, all efforts should be made to coordinate with the North Carolina Department of Transportation (NCDOT). Therefore, a joint meeting between the applicant, NCDOT and the City is often recommended early in the process to discuss project specifics. They include, but are not limited to, access location and types, potential roadway improvements, necessary Right of Way dedication and a project timeline.
- B. Within the City of Raleigh's jurisdiction, the City has site plan approval for developments; however, on State-maintained roadways the NCDOT has the ultimate authority for any work in the Right-of-Way. It is the sole responsibility of the requesting party to determine if a street is State-maintained or not.
- C. It is common for a project to involve both the NCDOT and the City of Raleigh. Plan submittals, review and approvals should be coordinated concurrently with both agencies to avoid conflicting requirements. In situations where an agency's regulation differs from that of the other agency, the more restrictive of the two shall govern.
- D. Applicant is encouraged to coordinate early and often with the two agencies, because NCDOT's review process does not always coincide with the City's, the Notification of any changes to a project's plan based on review comments or requirements is essential to avoiding delays in the approval process.
- E. The NCDOT's Street and Driveway Access Permit Application requires a Local Governmental Authority's approval prior to submission to NCDOT.
- F. As a project moves forward into the construction phase, both the NCDOT and the City of Raleigh have enforcement authority to ensure safety in the Right-of-Way is not being compromised. Both agencies have the ability to affect a project's progress if there is reason to believe proper construction practices are not being adhered to and/or if unsuitable materials are being used in the Right of Way. Failure to comply with permits and the approved plans may result in revocation of permits.
- G. The City of Raleigh has the authority to withhold the issuance of a Certificate of Occupancy until all work is completed and in compliance with the approved permits.
- H. For additional information regarding the coordination between NCDOT and the City of Raleigh please see [NCDOT Policy on Street and Driveway Access To North Carolina Highways Manual](#) Chapter 2, Section A."

Article 4.6 Plot Plan Information for Residential Curb Cuts and Driveways

Section 4.6.1 Plot Plan Requirements

1. Plans shall bear the Note: "ALL DRIVEWAY AND RIGHT-OF-WAY CONSTRUCTION SHALL BE PER CITY OF RALEIGH AND/OR NCDOT STANDARDS AND SPECIFICATIONS."
2. Show the property lines and dimension the subject lot.
3. Show location of residential structure.
4. Show and dimension any existing curb and gutter, and existing sidewalk.
5. Show recorded sight distance triangles or sight easements across the property frontage.
6. Locate and dimension all existing and proposed driveways, and their radii.
7. Residential driveways dimensions are required to be per [Table 7 Driveway Dimensions](#) and perpendicular to the street within the right-of-way.
8. The driveway must be a minimum 18 feet in length as measured from the right-of-way line to the face of the garage or structure.
9. Label street name and dimension street right-of-way(s) width(s).
10. Non-alley loaded driveways may intersect a street no closer than 20 feet from the intersection of two street rights-of-way. The minimum corner clearance from the curb line or edge of pavement of intersecting streets shall be at least twenty (20) feet from the point of tangency of the radius curvature, or twenty (20) feet from the intersection of right-of-way lines, whichever is greater. The radius of the driveway shall not encroach on the minimum corner clearance.
11. Driveways must be located a minimum of 3.5 feet from the side lot line, however, a driveway may be located on the lot line closer than 3.5 feet if it is shared with an adjacent lot.
12. No residential lot may have more than two driveways on the same street.
13. Driveways may be no closer than 40 feet from any other driveway (measured from inside edge to inside edge of proposed driveway).

CHAPTER 5 ADMINISTRATIVE REQUIREMENTS

Article 5.1 Design Adjustments

- A. The purpose of a Design Adjustment is to allow a developer to seek variance from specific elements of the Unified Development Ordinance. All Design Adjustments shall be reviewed in accordance with the provisions of [Section 10.2.18](#) of the [Unified Development Ordinance](#) and the applicable Design Adjustment findings.
- B. A request for Design Adjustment may be submitted at the time of application for a preliminary subdivision plan, site plan or plot plan. A Design Adjustment may also be requested by staff during plan review if it is deemed necessary. The application cannot be processed until a plan is in review. The Design Adjustment must be approved prior to any plan approval.
- C. Further information about Design Adjustments can be found in the [Design Adjustments Article](#)

Section 5.1.1 Design Adjustment Procedure per the UDO

This Information can be found in [Section 10.2.18](#) of the [Unified Development Ordinance](#)

Applicability

- A. The Public Works Director has the authority to approve a request for a design adjustment set forth in this UDO. All design Adjustments shall be reviewed in accordance with the provisions of this section and the applicable design adjustment findings.

Application Requirements

- A. An application for a design adjustment shall be submitted in accordance with Sec. 10.2.1.B. A request for a design adjustment must be submitted at the time of application for a preliminary subdivision plan, plot plan or site plan or at such time the design adjustment is proposed in conjunction with the review of infrastructure construction plans, a plot plan or site plan.
- B. An application for a design adjustment must be signed and notarized by the property owner in order to initiate a request for an adjustment.
- C. The applicant shall submit pertinent material necessary for review; in addition to the submittal material required for a subdivision, plot plan or site plan. This may include detailed landscape plans, roadway cross-sections, site or subdivision layout or other project-specific information.

Public Works Director Action

- A. In reviewing the design adjustment, the Public Works Director shall consult with the heads of the departments of Planning, Public Utilities, Transportation, Parks and Recreation, Inspections and the Fire Department to check the proposed request against the requirements of this UDO and other applicable technical requirements of the City.
- B. The Public Works Director shall consider the applicable intent statements and design adjustment findings for the request and either approve, approve with conditions or deny the request within 60 days of the receipt of a completed application.
- C. Additional review time may be necessary when the design adjustment involves review by another municipal or state entity or when detailed engineering studies are submitted to or required by the Public Works Director.

- D. The reasons for such approval or disapproval shall be stated in writing. In accordance with [Section 10.2.1 C 6](#), notice of the decision shall be provided to the applicant and the property owner (if the property owner is not the applicant) and to each person who has filed a written request for notice with the Public Works Director prior to their decision.
- E. Within 30 days from the date the application was decided, an appeal of the Public Works Director's action may be made to the Board of Adjustment in accordance with [Section 10.2.11](#).

Article 5.2 Fees-in-Lieu for Infrastructure and Streetscape

Where the Public Works Director determines that construction of public improvements would not be feasible, a fee in lieu may be permitted. In this instance, right-of-way dedication and all necessary easements shall be dedicated to the City. Engineering drawings may be required to determine the extent of public improvements and easements.

The installation of the designated streetscape is part of the construction of public improvements and shall be subject to a fee in lieu when the street is not to be constructed. In the event the streetscape is not installed, a fee shall apply based on each tree required or tree grate that is installed.

Please refer to the [Development Fee Schedule](#).

Section 5.2.1 Exemptions to Fee-in-lieu and Pavement Construction

- A. Streets with curb and gutter, other than Thoroughfare or Major Street system roadways, which were built pursuant to earlier City or State paving standards, do not have to be widened unless such widening is needed to alleviate safety problems or increased traffic congestion. Sidewalk construction, curb and gutter improvements, right-of-way dedication, required in this chapter shall not be exempted by this provision.
- B. Exemptions for construction shall be provided for existing single-family lots, single-family subdivisions which have all lots fronting on existing streets, and multi-unit conversions of existing single-family homes, except when construction is needed to extend adjacent street and sidewalk facilities.
- C. Exemptions for construction and fee-in-lieu payment for curb and gutter and sidewalk shall be provided for frontage on roadways that are exempt from curb and gutter requirements, such as streets within a Watershed Protection Overlay District. Construction or fee-in-lieu payment for additional pavement widths to provide sufficient travel lane or shoulder widths per minimum City or State standards may still be required.
- D. Exemptions for construction may be provided for frontage along future thoroughfares when construction as part of the development is not required in the plan approval process.
- E. Exemptions for construction and fee-in-lieu payment may be provided for frontage along streets approved for construction funding by the State Transportation Improvement Program or other State funding programs, provided that the NCDOT Board of Transportation has authorized the project for public bid or for right-of-way acquisition. The City's street improvement assessment policies may be applicable in these cases, as directed by the City Council.
- F. Exemptions may be provided for frontage along streets approved for construction funding in the City's Capital Improvement Program, provided that the City Council has authorized the project for public bid or for right-of-way acquisition. The City's normal street improvement assessment policies will be applicable in these cases, as directed by the City Council.
- G. Exemptions for street construction and fee-in-lieu payment may be provided for frontage along existing or planned future roadways having full control of access (i.e., no direct access from the property to the roadway is permitted)

- H. Exemptions for construction may be provided where the City for the same improvements or on a property where assessments for same street improvements by the City were previously levied has received a previous fee-in- lieu payment. In certain cases, the City may elect to refund a previous fee-in- lieu payment if the Public Works Director determines that construction of frontage improvements would be more appropriate.

Article 5.3 Surety

Sureties are required for all public improvements. For information about the process, see [Surety for Infrastructure Improvements webpage](#). This information can be found in [Section 8.1.3 of the UDO](#).

Construction Surety

- A. If all development-related improvements and installations are not completed and accepted by the City prior to a request to record all or a part of any subdivision or issuance of a building permit for any site plan, whichever first occurs, a security instrument shall be posted, in lieu of completion of the work, in an amount of 125% of the estimated construction cost of the development related improvements which remain incomplete and with surety and conditions satisfactory to the City, providing for and securing to the City the actual construction and installation of improvements.
- B. All development-related improvements that are secured by a surety shall be installed prior to the issuance of the first certificate of occupancy within the subdivision phase or prior to the issuance of the first certificate of occupancy for the site plan, whichever event first occurs on the property. Except the final coat of asphalt for street improvements and the installation of permitted street furniture or sidewalks may at the option of the applicant be installed within 24 months following the issuance of the first certificate of occupancy provided surety in the amount of 125% of these improvements are first provided to the City. Where improvements are required on a State-maintained road, a 100% construction surety is required. In this instance, proof of bond or surety with the State must be supplied to the City.
- C. Where the Public Works Director determines that landscaping in the public right-of- way cannot be installed due to inclement weather conditions, a surety in the amount of 125% of the value of the landscaping shall be provided to the City, in accordance with Sec. 8.5.1.B. The landscaping improvements shall be installed within 12 months of issuance of the conditional letter of acceptance.

Acceptance

- A. Any development-related improvements shall not be officially accepted until the improvements have been inspected by the City, corrections are made in the field and on the approved infrastructure construction plans, a reproducible copy of the as-built drawings is provided to the Public Works Department and the warranty required in the following section is provided to the City.

Warranty

- A. All development-related improvements must have a warranty guaranteeing the work against defects for a period of 2 years from the date of final acceptance of construction.
- B. If the development-related improvements are constructed at different times, then the guarantee shall continue until 2 years from the date of final acceptance of the improvement last completed.
- C. The warranty shall list the City as a beneficiary.

- D. A warranty surety shall be provided in an amount of 15% of the estimated value of the warranted development-related improvements. The surety shall expire 6 months after the expiration of the warranty period.

Article 5.4 Reimbursements

Reimbursements can be requested for public improvements. The [Reimbursement Zone Map](#) lays out the areas where each reimbursement applies to. See the [Infrastructure Reimbursements Article](#) for additional information and a [Sample Reimbursement Application Packet](#). This information can be found in [Section 8.6.3 of the UDO](#).

Improvements Eligible for Reimbursement

- A. The City will pay to the developer unit costs in the Development Fee Schedule for development-related improvements over and above the unit costs for applicable streets.
- B. The following installations are eligible for reimbursement:
 - a. Any street construction in excess of the minimum standard needed to serve the development;
 - b. Any right-of-way dedication in excess of the minimum standard needed to serve the development;
 - c. Right-of-way for controlled-access freeways;
 - d. Stormwater infrastructure: In accordance with UDO Section 8.6.5, the City may reimburse a developer for stormwater infrastructure
- C. Improvements that are over and above improvements needed for the development to comply with any ordinance or regulation. The following
- D. Improvements may be eligible for reimbursement:
 - a. Stormwater treatment practices, including GSI practices, for treating stormwater otherwise conveyed within the street rights-of-way; and
 - b. Stormwater conveyances, including pipes, culverts, ditches, swales, and channels, associated with and needed for such stormwater treatment practices.
- E. Eligibility for reimbursement shall be subject to availability of funds and to prior determination of eligibility for reimbursement by the Engineering Services Director or a designee. The obligations of the parties and reimbursement schedule shall be established in a written agreement between the developer and the City.
- F. Reimbursements are subject to availability of funds and eligibility for reimbursement through the City's facility fee program.

Method and Conditions of Reimbursement

- A. All general and development-related improvement costs shall be based on the Development Fee Schedule, provided that the City Council shall grant alternative mitigation when the total expenditures for both the thoroughfare facility fees and road improvement costs in excess of the applicable street improvements exceed the costs attributable to the development for Thoroughfare construction within the benefit area as indicated in [Article 8.9 Facility Fees](#).
- B. Current reimbursement fees are listed in the Development Fee Schedule, kept on file by the Planning and Development Officer and are updated and adopted by the City Council.

- C. No monetary payments will be allowed if the developer utilizes the dedicated right-of-way for impervious surface coverage in the -FWPOD, -SWPOD or -UWPOD.
- D. The dedicators shall waive their statutory right to withdraw dedications prior to receiving any payment.
- E. Reimbursements shall be paid at the rate in effect when dedication occurs or construction costs are incurred.
- F. The City shall pay such other costs incidental to the development of the general area which, in the opinion of the City Council, should properly be borne by the City. The City Council shall set forth the terms of such payment.

Expiration of Reimbursement

- A. Any request for reimbursement for street, greenway, utility, or stormwater infrastructure installation must be submitted to the City within years of completion and final acceptance by the City or State, whichever is applicable.

CHAPTER 6 INFRASTRUCTURE REQUIREMENTS

Article 6.1 Infrastructure Sufficiency

- A. Every Subdivision or Site Plan shall be subject to a determination of the infrastructure sufficiency, to lessen congestion in the streets, to facilitate the efficient and adequate provision of transportation, water and sewage, and to secure safety from fire.
- B. Infrastructure shall be considered sufficient where it is demonstrated to have available capacity to accommodate the demand generated by the proposed development as well as other approved developments and PD Master Plans.
- C. In order to avoid undue hardship, the applicant may propose to construct or secure sufficient funding for the facilities necessary to provide capacity to accommodate the proposed development at the adopted level of service. The commitment for construction or advancement of necessary facilities shall be included as a condition of development. More information can be found in [Article 8.2 of the UDO](#).

Section 6.1.1 Roadway Construction Through- and Adjoining Developments

- A. All public roadways inside the corporate limits of the City shall be constructed in conformance with City standards and specifications; however, if the roadway is maintained by NCDOT, then the roadway shall be constructed in conformance with either City or NCDOT standards and specifications, whichever is more stringent.
- B. All public roadways that are outside the corporate limits of the City and when water or sewer is connected to the City utility system, or made available within one (1) year after approval of a development plan, shall be constructed in conformance with either City or NCDOT standards and specifications, whichever is more stringent.
- C. Roadways that are outside the Corporate limits of the City and where neither City water nor sewer are available or made available within one (1) year after approval of a site plan, shall be constructed in conformance with NCDOT standards and specifications. The City of Raleigh Public Works Department will not require any exactions above and beyond NCDOT requirements.
- D. Roadways that are within a Watershed Protection Area Overlay District or classified as a sensitive area thoroughfare, shall be constructed in conformance with either City or NCDOT standards and specifications, whichever is more stringent.
- E. The minimum design cross-section for roadways constructed to City standards are illustrated in City of Raleigh Standard Details. Consult NCDOT for minimum design cross-sections for roadways that require their approval.

Section 6.1.2 Minimum Paving Construction

- A. The developer shall be responsible for the cost and installation of the applicable width and pavement design requirements. Frontage improvements shall be installed for roadways in accordance with adopted City or State standards and specifications. The developer shall make off site street improvements constructed to minimum street pavement standards in accordance with this section.
- B. Minimum street pavement standards shall be twenty feet (20 feet) from edge of pavement to edge of pavement for two way streets. The street width may be increased at the discretion of the City, if required to mitigate safety problems or expected increases in traffic congestion.

- C. The developer shall also provide additional pavement surfaces for turning movements to serve the development where prescribed by a traffic impact analysis or as specified elsewhere in this chapter. Street improvements required in excess of minimum paving construction standards associated with a site plan may be eligible for reimbursements per [Section 8.6.3 of the UDO](#). Additional pavement surfaces required to accommodate turning movements generated by the development are not eligible for reimbursement.
- D. The City may elect to require payment of a fee-in-lieu of installation to the applicable minimum paving construction standards as outlined in this section. Methodology for requiring fee-in-lieu payments is specified in the City's administrative regulation for "Fee-in-lieu of Determination and Administration.
- E. An exemption from paving construction requirements shall not relieve the developer of a payment in-lieu of construction unless otherwise specified.

Section 6.1.3 Minimum Stormwater Infrastructure Requirements

- A. The developer shall be responsible for all applicable stormwater drainage and treatment practices as required in Article 9 of the Unified Development Ordinance and the City Stormwater Design Manual.
- B. Use of multi-functional stormwater control measures is expressly allowed and encouraged in the ROW, including streetscape landscape bioretention areas and stormwater planters, stormwater street trees, curb bulb-outs and medians with bioretention, and vegetated swales. Such stormwater control measures may receive stormwater credit for managing stormwater from the adjacent right-of-way area of the development site if part of an approved stormwater management plan and with a long-term maintenance agreement.

CHAPTER 7 TRAFFIC IMPACT ANALYSIS

Article 7.1 Traffic Studies

Section 7.1.1 Purpose of Traffic Studies

- A. In order to better serve the public, the City of Raleigh has adopted a set of minimum standards for traffic studies. This document provides guidance to ensure consistency, to make findings more accurate and to maximize confidence in the results. Deviation from these practices requires justification. By reviewing reports, plans, and submittals, the City of Raleigh in no way relieves the traffic engineer of possible claims or additional work resulting from errors or omissions.
- B. The purpose of a Traffic Study is:
 - a. To provide reliable guidance on short- and long-range planning of site access and off-site improvements;
 - b. To assist developers and property owners in making critical land use decisions regarding traffic and other modal needs;
 - c. To provide government review agencies with recommendations for achieving responsive and consistent transportation and access policies.
- C. Development plans and rezoning cases have a burden to prove that the expected increase in trips will not create unsafe or inefficient traffic conditions. If the expected increase in trips does create unsafe or inefficient traffic conditions, the developer must mitigate the traffic impacts. The standard to provide mitigation is when overall intersection or approach level-of-service degrades from LOS-E to LOS-F. Another standard to provide mitigation is when arterial level-of-service degrades from LOS-E to LOS-F. Mitigation may involve changes to signal timings, constructing additional lanes, restricting access, prohibiting left turns or other measures.

Guidance: City staff, in consultation the traffic engineer, will determine the magnitude of mitigation measures on a case-by-case basis.

Section 7.1.2 Initiating Traffic Studies

In considering the transportation aspects of land development, it is important to determine early in the process if and when a traffic study is needed. Not all land development projects warrant a traffic impact analysis; City staff shall determine when trip generation, traffic assessment or traffic impact analysis reports are required.

Section 7.1.3 Criteria requiring Traffic Studies

Traffic studies are required for development projects based on four criteria, outlined here.

- A. **Land Uses:** Traffic impact analyses shall be required for the following land uses
- a. Single Family Residential Developments ≥ 150 Dwellings
 - b. Apartment Developments ≥ 240 Dwellings
 - c. Residential Condo/Townhome Developments ≥ 300 Dwellings
 - d. General Office Buildings $\geq 64,000$ sq.ft.
 - e. Medical Office Buildings $\geq 47,000$ sq.ft.
 - f. Shopping Centers $\geq 23,000$ sq.ft.
 - g. Supermarkets $\geq 20,000$ sq.ft.
 - h. Convenience Market w/ Gas Pumps: 6 or more Fueling Positions*
 - i. Pharmacy w/ Drive-Thru $\geq 29,000$ sq.ft.
 - j. Drive-In Bank $\geq 11,500$ sq.ft.
 - k. Fast-Food Restaurant w/ Drive-Thru $\geq 6,000$ sq.ft.

* Fueling positions are defined as the maximum number of vehicles that can be fueled simultaneously.

Guidance: The land use sizes listed in Section 7.1.3.A are consistent with the estimated volume of new trips on the public street system in Section 7.1.3.B after deduction for pass-by trips.

- B. **Trip Generation:** Traffic impact analyses shall be required for the following trip generation volumes:
- a. Peak Hour Trips ≥ 150 veh/hour
 - b. Peak Hour Trips ≥ 100 veh/hour if primary access is on a 2-lane road
 - c. More than 100 veh/hour trips in the peak direction
 - d. Daily Trips $\geq 3,000$ veh/day
 - e. Enrollment increases at public or private schools

Guidance: The volumes listed in Section 7.1.3 B are for new trips on the public street system after deductions for pass-by trips and for mixed-use developments, internal capture trips.

- C. **Site Context:** Traffic impact analyses shall be required when the following conditions exist in the vicinity of the development site:
- a. Affects a location with a high crash history [Severity Index ≥ 8.4 or a fatal crash within the past three years]
 - b. Takes place at a highly congested location [volume-to-capacity ratio ≥ 1.0 on both major street approaches]
 - c. Creates a fourth leg at an existing signalized intersection
 - d. Exacerbates an already difficult situation such as a RR Crossing, Fire Station Access, School Access, etc.

- e. Access is to/from a major arterial roadway such as a Parkway, Multi-Way Boulevard or Multi-Lane Avenue
- f. Proposed access is within 1,000 feet of an interchange
- g. Involves an existing or proposed median crossover
- h. Involves an active roadway construction project
- i. Involves a break in controlled access along a corridor

D. Miscellaneous Applications: Traffic impact analyses shall be required:

- a. Planned Development Districts
- b. In response to Raleigh Planning Commission or Raleigh City Council concerns

Guidance: *For rezoning applications, the basis of comparison for trip generation thresholds will be the difference between the maximum allowable land use intensity under current zoning compared to the maximum land use intensity under the proposed zoning. For site plans and subdivisions, the basis of comparison for trip generation thresholds should be the difference between trips generated by the site at the time of preliminary plan submittal versus the expected increase in roadway trips upon development of the site.*

Section 7.1.4 Study Area

The extent of a traffic study depends on the location and size of the proposed development and the conditions prevailing in the surrounding area. It is recognized that an excessively large study area may unnecessarily increase costs, time and effort for the developer, the traffic engineer and City staff. Alternatively, an inappropriately small traffic study area may fail to include roadway segments and/or intersections that would need to be improved to accommodate the trips generated by a proposed development.

Section 7.1.5 Access Points and Intersections

Any traffic study that analyzes off-site impacts shall include all site access points and major intersections (signalized and unsignalized) adjacent to the site.

Guidance: *City staff (with input from the developer's traffic engineer) will determine any additional areas to be included based on local or site-specific conditions, development size or neighborhood sensitivities. The study area boundaries may also be influenced by impacts other than pure capacity issues such as neighborhood cut-thru trips, known congestion issues, accident history, temporary anomalies in the existing roadway system that would influence travel patterns, long-range transportation planning goals, etc.*

Section 7.1.6 Traffic Study Scope

It is critical that all parties discuss the traffic study early in the planning process. An understanding as to the level of detail and the assumptions required for analysis will be determined at that time. In addition to learning the study issues, coverage and level of detail, the traffic engineer must obtain and verify the following information:

- a) Available traffic counts
- b) Information about available transit, bicycle and pedestrian facilities
- c) Committed and planned roadway improvements and the schedule for those improvements
- d) Approved development and background traffic data
- e) Applicable agency codes and policies
- f) Existing congestion locations within the study area
- g) Crash data for all intersections and/or street segments within the study area
- h) Traffic signal timings
- i) Committed and planned signal system improvements
- j) Neighborhood sensitivities
- k) Other traffic-related issues determined by City staff

Guidance: *City staff will assist the traffic engineer in obtaining all information needed to initiate and complete the traffic study.*

- A. **Existing Conditions:** Once all information listed in the study scope has been obtained, it is used to create an existing conditions traffic model. The existing conditions model will be used to create a foundation for assessing the land use and traffic impact changes over time. Thus it is critical that the existing conditions model be as accurate as possible.

Traffic volumes shall reflect normal weekday and/or peak hour traffic conditions. When submitting a traffic study document for review, the traffic counts used for capacity analysis purposes shall have been taken no more than one year prior to the submittal date of the document. Exceptions to this standard can be approved on a case-by-case basis. In some cases, it is necessary to conduct new traffic counts. Counts shall not be taken on holidays, when school is not in session, during adverse weather or when special events occur. The existing conditions model shall accurately reflect the current street and traffic control environment including, but not limited to:

- a. Road geometry
- b. Number and type of travel lanes
- c. Auxiliary turning lanes, storage lengths and tapers
- d. Medians and two-way left turn lanes
- e. Traffic volumes, including heavy vehicles and pedestrians
- f. Transit stops, exclusive bicycle lanes and on-street parking (when applicable)
- g. Cycle length, signal offsets, splits and phase sequence
- h. Detector layout and detector settings
- i. Phase settings such as recall mode, volume-density settings, minimum green, maximum green and clearance times
- j. Two-way and all-way stop control
- k. Roundabouts and other unconventional intersections

Guidance: *City staff will assist the traffic engineer in obtaining turning movement counts, existing signal plans and current signal timings from City of Raleigh archives.*

- B. **Non-Site Traffic Forecast:** Estimates of non-site traffic are required to complete the analysis of horizon year conditions. Non-site traffic volumes, when added to existing volumes, are typically known as Background Traffic. These estimates characterize the “base” conditions, i.e., traffic conditions prior to a site being redeveloped. Non-site traffic consists of two components: existing traffic volumes projected forward to the horizon year using an annual grow rate and trips generated by approved developments within or adjacent to the study area. Projections of existing traffic volumes to the horizon year are dependent on an assumed annual growth rate. City staff (with input from the developer’s traffic engineer) will determine the appropriate growth rate based on information such as the Triangle Regional Traffic model, historical daily traffic volumes obtained from NCDOT, existing turning movement counts, previous traffic studies or other sources.

Guidance: *City staff will provide any necessary information on approved development trips within the study area.*

- C. **Site Traffic Generation:** The ITE *Trip Generation Manual* (latest edition) shall be used to compute Daily, AM peak and PM peak period vehicle trips for each land use. At the discretion of City staff, locally obtained trip generation data can be substituted. The ITE *Trip Generation Handbook* (latest edition) method shall be used to select between trip generation average rates and equations. Trip generation for individual outparcels shall be calculated separately from the remainder of the development. Some land uses require additional justification or local studies. For example, the use of Specialty Retail shall include definite plans for the specific retail that will be in place.
- D. **Internal Capture Trips:** Internal capture calculations shall be used cautiously. The internal capture calculations shall utilize the percentages from the ITE *Trip Generation Handbook* (latest edition) to estimate the internal capture reduction percentage. Alternatively, the National Cooperative Highway Research Program Report 684 *Enhancing Internal Trip Capture Estimates for Mixed-Use Developments* can be used with concurrence of City staff. Reductions for internal capture shall be applied to multi- or mixed-use sites only, but may not be applied to retail-only sites. Internal capture shall not be taken for AM peak hours or from lodging land uses without prior approval by city staff. The internal capture reduction shall be applied before the pass-by trips are calculated.
- E. **Pass-by Trips:** Pass-by percentages shall be obtained from the ITE *Trip Generation Handbook* (latest edition). Pass-by percentages shall only be applied to land uses numbered in the 800s and 900s. For multi-use developments, pass-by percentages shall be applied to the retail component only. Pass-by trips shall not exceed 10% of the total volume on the adjacent street.
- F. **Alternative Mode Trips:** Increasingly, site trips are made by alternative modes such as transit, bikes and walking; City staff recognizes this trend. Reductions in passenger car trips due to alternative modes will be considered, case-by-case, provided that the rationale behind the reduction is clearly stated and evidence or data to support the reduction is reviewed and approved by City staff.

- G. **Site Traffic Distribution and Assignment:** The expected volume of trips generated by a development must be distributed and assigned to the roadway network so that traffic impacts on intersections and street segments can be analyzed and quantified. Site traffic distribution shall be based on clearly stated assumptions and the rationale behind those assumptions. Primary trip distribution shall be based on a gravity model. Pass-by trips shall follow the existing volume distribution of the primary access road.

Guidance: All efforts should be made to ensure that upstream and downstream traffic volumes along corridors balance and maintain continuity. If balanced volumes are not attainable, explanation must be provided. Documentation regarding the balancing methodology must be provided in the technical appendices.

- H. **Crash History:** The traffic study report shall include a section on the accident history of study area intersections and/or street segments. It must assess the number and types of accidents that have occurred in the past three years; it must evaluate the accident severity. If any of the study intersections have a high Severity Index, i.e., greater than 8.40, the report shall discuss possible countermeasures. The North Carolina Department of Transportation maintains a database of all reported accidents that occur within the state. NCDOT has developed special software known as TEAAS¹ to analyze and report on crashes that occur on roadway segments. TEAAS reports shall be included in the technical appendices. City staff will assist the traffic engineer in obtaining TEAAS reports from NCDOT.

¹ Traffic Engineering Accident Analysis Software

Section 7.1.7 Traffic Analysis

Preferred Analysis Programs: Except for very simple cases, all traffic analyses shall be produced with special software programs that are designed specifically for traffic model applications. For software to be acceptable it must be based on the most current Highway Capacity Manual methods.

Table 7.1

| | |
|------------|---------------------------------------|
| Synchro | Signalized intersection delay |
| | Unsignalized intersection delay |
| SimTraffic | Queuing and blocking |
| | Roundabouts |
| | Simulation |
| | Actuated signal cycle variables |
| | Arterial delay |
| | Arterial travel time |
| | Arterial speed and Level-of-Service |
| | Network total stops |
| | Network stops per vehicle |
| | Network fuel consumed |
| | Network air quality/vehicle emissions |
| Artplan | Multimodal Level-of-Service |

Guidance: Use of alternate analysis software must be approved by City staff; however, the above software is not specifically endorsed by City staff. Other traffic analysis tools and programs will be considered on a case-by-case basis. City staff shall determine the appropriateness of the alternative models.

Measures of Effectiveness: When performing analyses, providing overall intersection Level-of-Service alone is not sufficient. Items such as queuing, approach level of service, and volume-to-capacity ratio for example shall also be evaluated. The measures of effectiveness listed in Table 2 shall be used for all traffic studies unless waived by City staff.

Table 7.2 Intersection, Arterial, and Network Measures Effectiveness

| | |
|---------------------------|--|
| Signalized intersection | Intersection average delay per vehicle |
| | Intersection level-of-service |
| | Approach average delay per vehicle |
| | Approach level-of-service |
| | Movement volume |
| | Percent of cycles maxed out (by phase) |
| | Maximum observed queue length |
| | Average queue length |
| | Upstream block time (%) |
| | Storage block time (%) |
| | Volume-to-capacity ratio (by phase) |
| | Intersection vehicle hours of delay |
| Unsignalized intersection | Movement delay |
| | Movement level-of-service |
| | Movement maximum queue length |
| Arterial | Delay |
| | Travel time |
| | Speed |
| | Level-of-Service |
| Network | Stops per vehicle |
| | Fuel consumed |
| | Overall delay |
| | Air quality/vehicle emissions |
| | Multimodal Level-of-Service |

Guidance: Measures of effectiveness for isolated intersections, all intersections along a particular road or all intersections within a roadway network can provide important information when evaluating transportation and land use alternatives. Network and Arterial MOEs are not appropriate for every study. City staff will determine the appropriate measures of effectiveness for each traffic study on a case-by-case basis.

Scenarios: Analyses shall be submitted for each of the following scenarios:

Table 7.3 Analysis Scenarios

| Scenario | Rezoning | Site Plan/ Other |
|------------------------------------|----------|---------------------|
| Existing Year | Yes | Yes |
| Background/Horizon Year | Yes | Yes |
| Build-out under current zoning | Yes | Yes |
| Build-out under proposed zoning | Yes | No |
| Build-out in phases | No | Yes |
| Build-out with proposed mitigation | No | Yes |

Traffic Analysis Default Values: The existing cycle length, signal offsets, splits and phasing scheme for all traffic signals within the study area shall be maintained for all analysis scenarios. Traffic models shall match the signal plans with respect to detector size, detector location and all other detector settings unless it can be demonstrated that the detectors have been field adjusted to other values. All nodes and links within the traffic models shall be accurately located based on NC Grid Coordinates.

Microsimulation programs, such as SimTraffic, shall use a seed time of 10 - 15 minutes and a recording time of 60 minutes. The resulting performance measures shall be averaged over at least 10 simulation runs.

Under Options>Intervals and Volumes set the SimTraffic Parameters as follows:

Table 7.4 Simulation Settings

| <i>Intervals</i> | <i>0</i> | <i>1</i> | <i>2</i> | <i>3</i> | <i>4</i> |
|----------------------|----------|----------|----------|-----------|----------|
| Interval Name | Seeding | Grow | Peak | Stabilize | Recover |
| Duration (minutes) | 10 - 15 | 15 | 15 | 15 | 15 |
| Record Statistics | No | Yes | Yes | Yes | Yes |
| Growth Factor Adjust | No | No | No | No | No |
| PHF Adjust | No | No | Yes | No | No |
| Anti-PHF Adjust | No | Yes | No | Yes | Yes |

The Base Saturation Flow Rate shall be used in accordance with the Highway Capacity Manual (latest edition). Lane Utilization Factors shall be used in accordance with the Highway Capacity Manual (latest edition). A Peak Hour Factor (PHF) of 0.90 shall be used. If traffic counts have been acquired, the resulting PHF may be used for existing and projected conditions. Where schools are present, a PHF of 0.50 shall be used for the AM peak period.

Under the traffic model's simulation settings change **Enter Blocked Intersections** to Yes for the major street approaches to all unsignalized intersections.

Guidance: *The seeding interval should be set to a minimum of 10 minutes or the length of time required for a vehicle to traverse the entire network (including stop time) whichever is greater.*

Traffic Impact Mitigation Measures: If a proposed mitigation involves changing the cycle length, phase duration, phase sequence, splits or offsets of any traffic signal then the traffic engineer will be required to meet personally with Public Works staff in the Raleigh Traffic Control Center. The traffic engineer must demonstrate to Public Works staff's satisfaction that their proposed signal changes will not have unacceptable adverse impacts on other intersections or signals. Public Works staff will determine the area to be considered and the extent of the signal network to be studied. Public Works staff will determine the quality and quantity of information necessary to evaluate the proposed signal timing plan. Once Public Works staff has met with the developer's traffic engineer, staff will have five business days to decide if they will accept or not accept the proposed signal changes. City staff will reply to the traffic engineer in writing and either state explicitly that the proposed changes are acceptable or explain why the proposed signal changes were rejected.

Recommended storage lane lengths shall be provided for all exclusive turn lanes. The 95th percentile queue from a deterministic model or the maximum observed queue from a simulation (whichever is larger) shall be used to determine the storage lane length. Queuing shall not exceed the storage capacity of the approach. Full storage for queue lengths shall be rounded up to the nearest 25 feet with a minimum of 100 feet for both right-turn and left-turn lanes. A default taper length of 100 feet shall be modeled for all added lanes unless specific taper lengths are known.

Multimodal Analysis: All traffic studies shall include a section on Multimodal Level of Service (MMLOS). City Staff will provide information on obtaining software to automate the MMLOS analysis. The traffic engineer will provide an assessment and discussion of current MMLOS conditions in the body of the report as well as a description of how the proposed development will advance Multimodal Level of Service.

Section 7.1.8 Traffic Study Report

- A. The traffic study report is to be an objective, technical summary of the analysis process. The submitted traffic analysis document shall include, but is not limited to: a summary of the analysis and results, site plans, traffic counts and forecasts, volume generation, any assumptions used in the analysis, and any variations from these guidelines. It shall be signed and sealed by a Professional Engineer who is licensed to practice engineering in North Carolina. To facilitate examination by City staff and other interested parties, a one- or two-page executive summary that concisely summarizes the study purpose, findings and conclusions shall be provided.

- B. The traffic study report shall include all current signal timing and signal offset data, obtained from the Raleigh Traffic Operations Center or NCDOT, in the technical appendices.
- C. The traffic study report shall show a side-by-side comparison of background traffic performance measures at the network, arterial, intersection and approach levels to build-out performance measures. The report shall quantify and qualify the changes in magnitude. It will identify which traffic impacts are directly attributable to the development and discuss them in the body of the report.
- D. The analyses shall be presented in a straightforward and logical sequence. The analyses shall lead the reader step-by-step through the various stages of the process to the resulting conclusion and recommendations. Sufficient detail shall be included so that City staff will be able to follow the rationale and methodology of the analysis.
- E. Whenever possible, data should be presented in tables, graphs, maps and diagrams rather than narrative text. When appropriate, schematics drawings of roadway improvements, such as intersection reconfigurations, may be included and described in the text. Since the report may be read by nontechnical decision-makers and interested citizens, it should be as concise as possible with a minimum of jargon.

Section 7.1.9 Traffic Study Conclusion and Recommendations

- A. The traffic study report is to be an objective, technical analysis. All conclusions and recommendations shall be based solely on information contained within the report; all findings shall be clearly documented. It is acceptable to cite publications within the public realm such as the Manual on Uniform Traffic Control Devices, the AASHTO Highway Safety Manual, Federal Highway Administration reports, etc. in order to provide supporting evidence or to articulate key points provided that the citation includes the title, section/chapter and page number of the reference source.
- B. Recommendations where mitigation or improvements are identified “by others” shall clarify which parties are to provide the additional improvements. The traffic study report shall provide documentation that those parties have agreed to construct the additional improvements. The study shall not use planned, but unfunded improvements, by government agencies as a means of mitigation.
- C. The traffic study report shall not include political views or statements, nor shall it take an advocacy position.

Guidance: City staff reserves the right to impose additional conditions and to ask for additional information during the course of the review if warranted by obvious concerns over possible traffic impacts on adjacent properties, roads or intersections. Inadequate reports will be returned to the traffic engineer for completion or modification. In such cases, City staff will state in writing the report's deficiencies and will provide direction for addressing those deficiencies.

Section 7.1.10 Traffic Study Submittal Requirements

Submit all traffic model data files, a pdf file of the traffic study report [including appendices] and two bound copies of the traffic study report directly to:

City of Raleigh, Office of Transportation Planning
Raleigh Municipal Building, Suite 400
Raleigh, NC 27601

City staff will acknowledge receipt of the report via email within 24 hours. Until acknowledged by City staff, the report has not been officially received.

Guidance: Staff's preference is that one hard copy contains the body of the report and the second hard copy contains both the body and the technical appendix.

CHAPTER 8 RIGHT-OF-WAY CONVEYANCE AND EASEMENTS

Article 8.1 Right-of-Way Dedication

All Public roadways, exclusive of slope easements, shall be platted and dedicated in conformance with the [Street Plan Map](#) and the Table of Right-of-Way requirements. It is the responsibility of the Developer to take future roadway plans of the City and NCDOT into account when laying out a development plan. Extra right-of-way dedication can be required for additional pavement to accommodate turning movements.

Section 8.1.1 Reservation Periods for Public Land

Where a proposed park, greenway, open space, school, fire station or other public use shown in the Comprehensive Plan is located in whole or in part in a development, the City Council may require the reservation of the land for future use.

The reservation shall continue in effect for a period of not more than 1 year from the date of approval of the preliminary plan or site plan. This reservation period may be extended for an additional year upon submission of a letter to the City Council of intent to purchase by the appropriate governmental agency. Further extensions may be permitted upon mutual agreement between the land owner and the City Council, each of which shall not exceed 2 years.

Section 8.1.2 Adjustments to required Right-of-Way widths

The Public Works Director may reduce the required minimum right-of-way width due to the location of an existing building or use in the proposed new right-of-way. A Design Adjustment shall be required for any exemption.

Table 3 Right-of-Way Width requirements

| Street Classifications | Minimum Right-of-way width (feet) | Public or Private |
|--|-------------------------------------|-------------------------------------|
| Sensitive Area Streets | | |
| 1. Sensitive Area Parkway | 154 | Public |
| 2. Sensitive Area Avenue | 80 | Public |
| 3. Sensitive Area Residential Street | 70 | Public |
| Local Streets | | |
| 1. Neighborhood Yield | 55 | Public |
| 2. Neighborhood Local | 59 | Public |
| 3. Neighborhood Street (Collector) | 64 | Public |
| 4. Multifamily Street | 22 | Public |
| Mixed Use Streets | | |
| 1. Avenue 2-Lane Undivided | 64 | Public |
| 2. Avenue 2-Lane Divided | 75 with center turn, 80 with median | Public |
| 3. Avenue 3-Lane Parallel Parking | 90 with center turn, 94 with median | Public |
| 4. Main Street Parallel Parking | 73 | Public |
| 5. Main Street Angular Parking | 96 | Public |
| Major Streets | | |
| 1. Avenue 4-Lane, Parallel Parking | 122 | Public |
| 2. Avenue 4-Lane, Divided | 104 | Public |
| 3. Avenue 6-Lane Divided | 126 | Public |
| 4. Multi-Way Boulevard, Parallel Parking | 154 | Public |
| 5. Multi-Way Boulevard, Angular Parking | 177 | Public |
| Industrial and Service Streets | | |
| 1. Industrial Street | 69 | Public |
| 2. Alley, Residential | 20' Easement | Private |
| 3. Alley, Mixed Use | 24' Easement | Private |
| Accessways | | |
| 1. Primary Internal Access Drive | 36' Private (BoC - BoC) | Private with Public Access easement |
| 2. Pedestrian passage | 20' | Private with Public Access easement |

Article 8.2 Slope Easements

- A. A slope easement of 20 feet in width shall be required adjoining each side of a street right-of-way. The City may reduce or increase the slope easement width if due to terrain.
- B. If a property owner submits to the City sufficient information to show that improvements to be located in the slope easement do not interfere with the right of the public to construct within the adjoining right-of-way, streets, sidewalks, or both, then the City shall allow the proposed improvement.

CHAPTER 9 BLOCKS AND ACCESS REQUIREMENTS

- A. The intent of the maximum block perimeter and connectivity regulations is to provide a well-connected street network.
- B. Large blocks with limited connectivity discourage walking, contribute to street congestion and add driving distance that can negatively impact emergency services. New streets should be designed to consider future development.
- C. The access regulations are intended to provide safe and convenient vehicular and pedestrian access within developments and between adjacent developments and to lessen traffic congestion. Pedestrian, bike and vehicular access should be safe, direct and convenient.
- D. Design adjustments to the requirements of this Article may be appropriate where topographic changes are too steep, where existing buildings, streams or other natural or man-made obstructions or site layout of developed properties prevent cross access, where adjoining uses are incompatible or where strict compliance with the UDO would pose a safety hazard.

Article 9.1 Blocks

- A. Every lot shall have frontage on a public street, except those developments which were approved for private streets prior to the effective date of this UDO. Except as otherwise stated in this UDO, all lots must front on a street that has a pavement width of at least 20 feet.
- B. The intent of the maximum block perimeter and connectivity regulations is to provide a well-connected street network. Large blocks with limited connectivity discourage walking, contribute to street congestion and add driving distance that can negatively impact emergency services. New streets should be designed to consider future development.
- C. Design adjustments to the requirements of this Article may be appropriate where topographic changes are too steep, where existing buildings, streams or other natural or man-made obstructions or site layout of developed properties prevent cross access, where adjoining uses are incompatible or where strict compliance with this UDO would pose a safety hazard.

Section 9.1.1 Block Perimeter

The block perimeter standards apply to preliminary subdivision plans, final plats and site plans submitted in accordance with [Section 10.2.5](#) and [Section 10.2.18 of the UDO](#).

A. Block Standards

Residential blocks must have sufficient width to provide for 2 tiers of residential lots, except where single tier lots are required to accommodate single-loaded streets where across from a public park or open space, to allow for unusual topographical conditions or when adjacent to the outer perimeter of a subdivision.

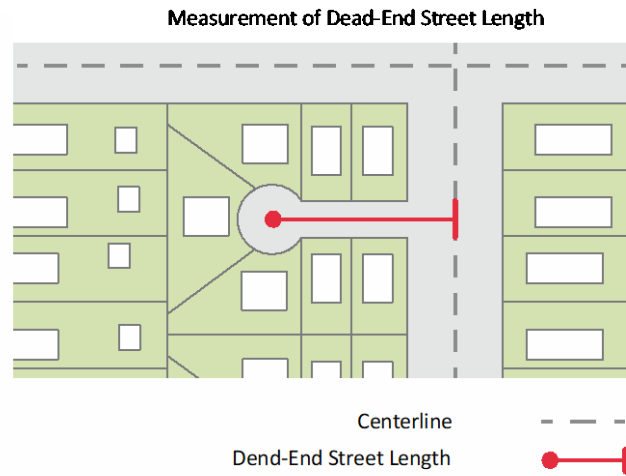
Table 4 Block Perimeter and Dead-End Streets shows the maximum block perimeter and maximum length for a dead-end street by zoning district. In the event that a single block contains more than 1 zoning district, the most restrictive requirement applies

Table 4 Block Perimeter and Dead-End Streets

| | Block Perimeter (max.) | Dead End Street (max.) |
|--|--------------------------------|------------------------------|
| R-1, R-2, R-4, R-6: Average Lot Size on Block | | |
| 40,000+ sf | 8,000' | 1,000' |
| 20,000 - 39,999 sf | 6,000' | 750' |
| 10,000 - 19,999 sf | 5,000' | 600' |
| 6,000 - 9,999 sf | 4,500' | 550' |
| up to 5,999 sf | 3,000' | 400' |
| R-10: By District | | |
| R-10 | 2,500' | 300' |
| Mixed Use Districts | | |
| DX-, -TOD | 2,000' | Not allowed |
| RX-, NX-, CX-, OX-: 3 or 4 Stories | 3,000' | 400' |
| RX-, NX-, CX-, OX-: 5 Stories | 2,500' | 300' |
| OP-, IX-, | 4,000' | 500' |
| Special Districts | | |
| CM, AP | n/a | n/a |
| IH | 6,000' | 400' |
| MH | 3,000' | 400' |
| CMP, PD | 4,000' or based on master plan | 400' or based on master plan |

The Dead-end Street length is measured per the following graphic:

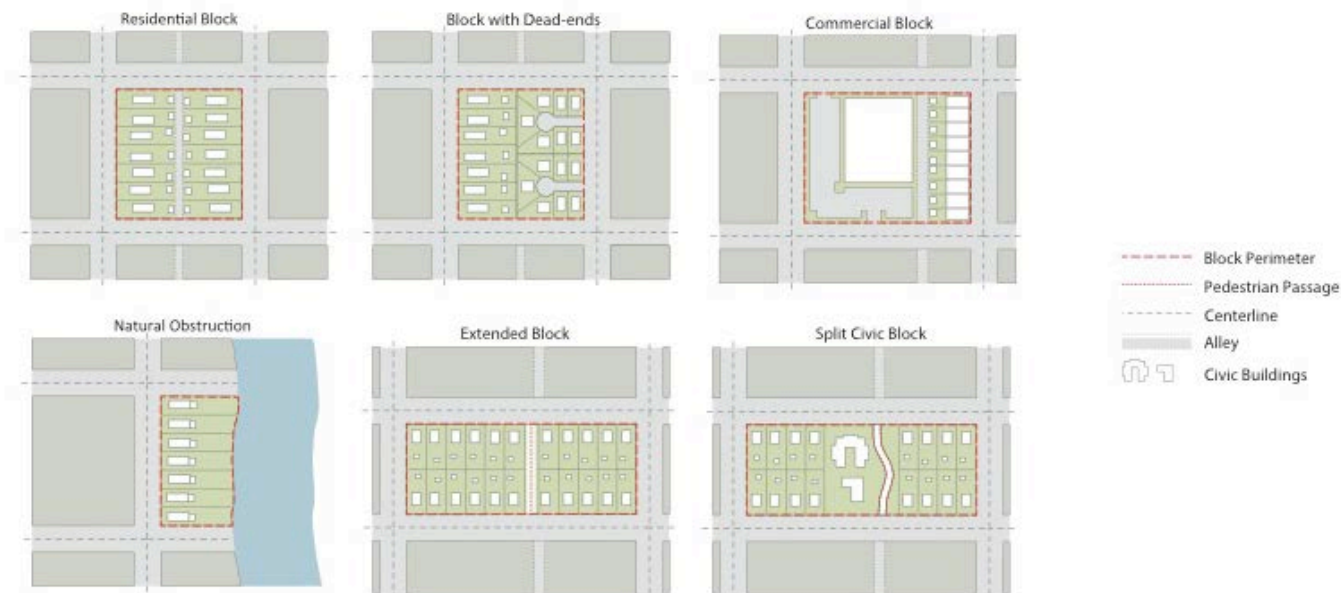
Figure 1 Measurement of Dead-End Street Length



B. Block Measurement

- a) A block is bounded by a public right-of-way (not including an alley). All public rights-of-way proposed as part of a development must be improved with a street.
- b) Block perimeter is measured along the edge of the property adjoining the public right-of-way, except for the measurement of dead-end streets, which are measured from intersecting centerline.
- c) The maximum block perimeter may be extended by 50% where the block includes a pedestrian passage or an alley that connects the 2 streets on opposing block faces. Pedestrian passages and alleys may connect dead-end streets.
- d) A block may be broken by a civic building or open lot, provided the lot is at least 50 feet wide and deep and provides a pedestrian passage that directly connects the 2 streets on each block face.
- e) Within a single phase of any subdivision or development, individual block perimeters may exceed the maximum by 25% provided that the average of all block perimeters in the phase does not exceed the maximum.
- f) The Public Works Director may waive the block perimeter requirements or maximum dead-end street length, when steep slopes in excess of 25%, freeways, waterways, railroad lines, preexisting development, tree conservation areas, stream buffers, cemeteries, open space or easements would make the provision of a complete block infeasible or does not advance the intent of this Article.
- g) Where the block pattern is interrupted by public parkland, including greenways, that is open and accessible to the public, pedestrian access points shall be provided with a minimum spacing equal to $\frac{1}{2}$ of the maximum block perimeter.

Figure 2 Residential Block Measurement Methods



Article 9.2 Residential Access System

Table 5 Unit Specifications for Local Street Types+

| Street Specification | Units |
|-------------------------|---|
| A - Neighborhood Yield | Up to 40 units |
| B - Neighborhood Local | 41 – 150 units |
| C - Neighborhood Street | 151 – 350 units |
| D - Multifamily Street | Apartments and Townhomes (150 units or less) |

Table 6 Access Point requirement per unit count

| Access Points | Units |
|-----------------|---------|
| 1 Access point | 0-150 |
| 2 Access points | 151-300 |
| 3 Access points | 301-450 |

Article 9.3 Subdivision Access

Open Access

- A. Subdivisions must provide roadways that remain permanently open to the public and provide community-wide access as part of an overall connected street network.

Connectivity Required

- A. Proposed streets must be interconnected and must connect with adjacent streets external to the subdivision in order to provide multiple routes for pedestrian and vehicle trips from, to and within the subdivision.

Stub Streets

- A. Where a development adjoins unsubdivided land, stub streets within the new subdivision shall be extended to the meet maximum block perimeter standards of Section 9.1.1 of this Manual.
- B. The stub street must be extended to the boundary of the abutting property to the point where the connection to the anticipated street is expected.
- C. Stub streets must be located so that the portion of the block perimeter located on the subject property does not exceed 50% of the applicable block perimeter maximum.
- D. If a stub street exists on an abutting property, the street system of any new subdivision must connect to the stub street to form a through street.
- E. When the entirety of a creek crossing is in the subdivision, the crossing must be in a single phase in its entirety.
- F. When stubbing to the edge of the site, the stub street will be built to the furthest point possible without NCDWQ approval and a fee in lieu of construction is paid for the remainder. Any right-of-way and slope easements needed to build the connection shall be dedicated.
- G. Where a stub street is provided, a barricade using a design approved by the Public Works Director must be constructed at the end of the stub street, pending the extension of the street into abutting property. A sign noting the future street extension shall be posted at the applicant's expense.
- H. The Public Works Director may eliminate the requirement for a stub street when:
 - a) Steep slopes in excess of 25%; freeways, waterways, railroad lines, preexisting development, tree conservation areas, stream buffers,
 - b) Cemeteries, open space or easements would make the provision of a stub street infeasible; or
 - c) A high intensity nonresidential use is located adjacent to a proposed residential subdivision.

Article 9.4 Site Access

A. General Access Requirements

- a) All existing and proposed development must provide a satisfactory means of vehicular, pedestrian, and bicycle ingress and egress to and from a street or an abutting site.
- b) All on-site parking areas must have vehicular access from a street, an alley, a drive aisle, or a cross-access easement.
- c) All on-site parking areas must be designed to allow vehicles to enter and exit the parking area in a forward motion, unless otherwise approved by the Public Works Director. An improved alley may be used as maneuvering space for access to on-site parking areas.
- d) For any development, the number of driveway access points may be restricted where it is necessary for the purpose of decreasing traffic congestion or hazards. These restrictions may include required common access points.
- e) Nothing in this Article shall prevent site access to any property.

B. Pedestrian Access

1. Pedestrian access shall consist of an accessible, easily-discernible and ADA compliant walkway or multi-use path with a minimum width of 5 feet.
2. The pedestrian access surface located on private property shall be constructed of concrete, asphalt or other fixed, firm and nonslip material as approved by the Public Works Director.
3. Pedestrian access routes between buildings and public rights-of-way shall be physically separated from vehicular surface areas, except where required to cross a drive aisle; such crossings shall be perpendicular wherever practicable. If the pedestrian access is immediately adjacent to a drive aisle or vehicular surface area, it shall be raised.
4. Site plans containing multiple principal buildings shall submit a phasing plan. The phasing plan shall include all necessary elements to address phasing of walkway construction for the existing principal buildings and uses on the site as new buildings and building expansion occurs in the future.
5. All existing and proposed development must provide safe, direct, and convenient pedestrian access connecting main entrances of buildings, establishments, or uses on a site that allows for public access, with all other such entrances and with available access points including parking, all public streets, sidewalks, and transit stops with the exception of the following uses which are exempt.
 - a) Single- or two-unit living;
 - b) Multi-unit living with 6 or fewer dwelling units;
 - c) Agricultural use;
 - d) Parks, open space and greenways;
 - e) Cemetery;
 - f) Telecommunication tower;
 - g) Off-premise sign;
 - h) Minor utilities; and
 - i) Other uses not containing a principal building on the premise (with the exception of a parking facility)

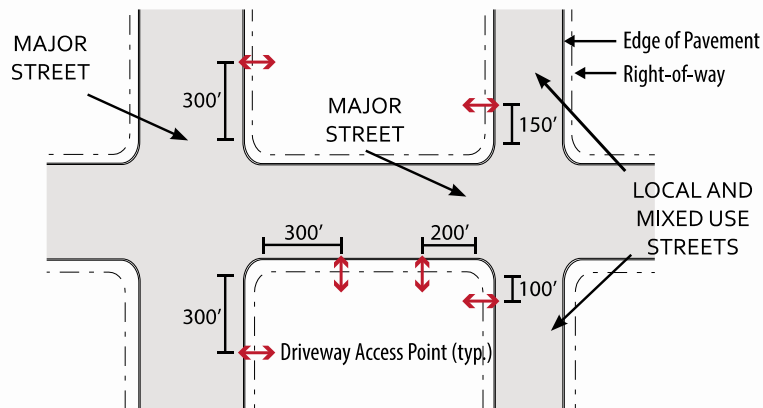
Article 9.5 Driveways and Cross Access

- a) All driveway design and construction must comply with the City of Raleigh Standard Details or the Fire Code when conflict exists.
- b) Commercial Driveway Access to and from streets shall be constructed with the standards and specifications provided in the manual “Policy on Street and Driveway Access to North Carolina Highways” as adopted and amended by NCDOT.
- c) The standard commercial driveway access for the city shall be the “street” type driveway section.
- d) Driveway dimensions measured at the street right-of-way shall be in accordance with **Table 7 Driveway Dimensions**
- e) The Public Works Director may require wider driveways where unusual traffic, grade, or site conditions exist
- f) The Fire Department and Solid Waste Services may require larger radii at entrances to accommodate larger vehicles

Table 7 Driveway Dimensions

| | Width (min) | Width (max) | Radius (max) |
|---------------------------------|-------------|-------------|--------------|
| Residential up to 6 spaces | 10' | 18' | 10' |
| Residential 7+ spaces (one way) | 12' | 16' | 10' |
| Residential 7+ spaces (two-way) | 20' | 24' | 10' |
| Mixed Use/Commercial (one-way) | 12' | 18' | 10' |
| Mixed Use/Commercial (two-way) | 20' | 32' | 15' |
| Industrial/Service | 30' | 40' | 30' |

Driveway access points shall be located according to the diagram below:



Section 9.5.1 Driveways for Residential Uses

- a) When an improved alley with a width of at least 20 feet is provided, all vehicular access shall take place from the alley. Access may be taken from the side street on corner lots.
- b) Except for townhouse lots, all lots 40 feet or less in width platted after the effective date of this UDO are required to take vehicular access from an alley.
- c) No residential lot may have more than 2 driveways on the same street. Multiple driveways that service one lot may be no closer than 40 feet to each other.
- d) Non-alley loaded driveways may intersect a street no closer than 20 feet from the intersection of two street rights-of-way.
- e) Driveways must be located a minimum of 3.5 feet from the side lot line. However, a driveway may be located on the lot line closer than 3.5 feet if it is shared with an adjacent lot.
- f) Parking and driveway areas shall not constitute more than 40% of the area between the front building line and the front property line.
- g) The standard residential driveway access shall be the “ramp” type driveway section per the City of Raleigh Standard Details Manual.
- h) Residential driveway access alignment and grades shall comply with City of Raleigh Standard Details.

Section 9.5.2 Driveways for Mixed and Non-residential Uses

- a) If on-site parking areas can be accessed from an improved alley with a right-of-way of at least 24 feet in width, access from the alley is required and new curb cuts along the public right-of-way are not allowed.
- b) Driveways are allowed based on the property frontage of any street. Additional driveways require approval from the Public Works Director.
- c) Driveways accessing up to 80-foot wide street rights-of-way must be spaced 200 feet apart centerline to centerline and driveways accessing more than an 80-foot wide street right-of-way must be spaced 300 feet apart centerline to centerline.
- d) A driveway serving any non-residential use or multi-unit living shall not be permitted to access neighborhood yield or neighborhood local streets unless the proposed access point is the lesser of 300' from an avenue, boulevard or parkway, or the intersection of another public street.
- e) Offers of cross-access shall be prohibited where a proposed nonresidential use or multi-unit living may potentially obtain access from a neighborhood or residential street, unless the resulting access meets the provisions of subsection d above.
- f) Driveways may intersect a street no closer than 50 feet from the intersection of 2 street rights-of-way, not including an alley.

Section 9.5.3 Cross-access

A. All lots abutting a street other than a local street shall comply with the following standards:

- a) Internal vehicular circulation areas shall be designed and installed to allow for cross-access between abutting lots;
- b) When an abutting owner refuses in writing to allow construction of the internal vehicular circulation on their property, a stub for future cross-access shall be provided as close as possible to the common property line.
- c) When cross-access is waived by the Public Works Director in accordance with [Section 8.6.3 of the UDO](#), bicycle and pedestrian connections shall be provided between abutting properties except where there is a perennial wet stream crossing greater than 15 feet in width that interferes with such access.
- d) Rights of vehicular and pedestrian access shall be granted to all abutting properties contemporaneously with the recording of the final subdivision plat or prior to issuance of a building permit for an approved site plan, whichever event first occurs on the property after September 1, 2013. This right of cross-access shall be recorded by plat in the register of deeds office in the county where the property is located. By the end of the next business day following the recordation, the applicant shall provide to Planning and Development evidence of recordation of the cross-access agreement. No building permit will be issued until evidence of recordation of the cross-access agreement is provided to the City.

B. The content of the cross-access agreement required by the City shall be as follows:

- a) Pedestrian and vehicular access is granted to all properties on the same block face as the property owner establishing the cross-access. The owner may make the pedestrian and vehicular access contingent upon the granting of reciprocal vehicular and pedestrian access right to the granting property.
- b) The location of the pedestrian and vehicular access is described over all sidewalks, vehicular drives and driveways located on the property or by specific metes and bounds.
- c) The beneficiaries granted access rights include the lot owners, their successors, heirs and assigns, tenants and subtenants, lenders, employees, customers and guests.
- d) Each lot owner is required to maintain the vehicular and pedestrian access areas on their lot. Maintenance shall include, but not be limited to repair, fixing potholes and repaving.
- e) All lot owners and tenants granted vehicular and pedestrian access rights shall have the right together with their contractors, but not obligation, to maintain all portions of pedestrian vehicular and access ways. If such owners, tenants and their contractors engage in any maintenance activities off their lot, they shall have the right of contribution to be reimbursed for their actual expenses from the defaulting lot owner, provided at least 30 days prior written notice is first provided to the defaulting lot owner.
- f) A temporary construction easement is granted to the abutting lot owner and tenants and their contractors to enter the adjoining property to install connecting internal drives not previously extended to the property line.
- g) A notice provision explaining how and where to send written notice.
- h) A provision prohibiting the erection of fences walls and other obstructions that prevent the use of vehicular and pedestrian access ways.
- i) A statement that the cross-access agreement runs with the land and it is binding on all successors, heirs and assigns and that the easement rights are perpetual.
- j) A statement that the cross-access agreement is a requirement of the Raleigh City Code and that it may not be terminated or amended in violation of the Raleigh City Code and such amendments and terminations are void ab initio.

- k) The cross-access agreement shall be signed by all of owners of the granting property.
- l) All lenders and their trustees with interests in the granting property shall subordinate their security interests to the cross-access agreement.

CHAPTER 10 PARKING AREAS

Article 10.1 Parking lot Design and Layout (On-site Parking)

- A. Parking lots should be designed to provide for safe pedestrian and vehicular circulation.
- B. Pedestrian flow should provide for as few conflicts with vehicle traffic as possible.
- C. Required parking spaces shall be arranged and sized in accordance with [Figure 3 On-Site Parking Layout Table 8 Regular](#) Parking Space Parking Area Design and [Table 9 Compact Space Parking Area Design](#) schedules shown in the following graphic. Stall depths and module widths shall be measured to the back of curb or to the edge of pavement if curbing is not used.
- D. Handicap parking spaces shall be designed and delineated in accordance with the Means of Egress and Accessibility standards outlined in the current [North Carolina Building Code](#). Parking lots should also be signed and maintained with appropriate traffic control devices and pavement markings so as to regulate the safe movement of vehicles and pedestrians within the parking area.
- E. Direct accessible routes within the site shall be provided from public transportation stops, accessible parking, accessible passenger loading zones and all public streets or sidewalk to the accessible building entrance served. See [Section 7.1.6 of the UDO](#) for additional information for parking location and layout.

Figure 3 On-Site Parking Layout

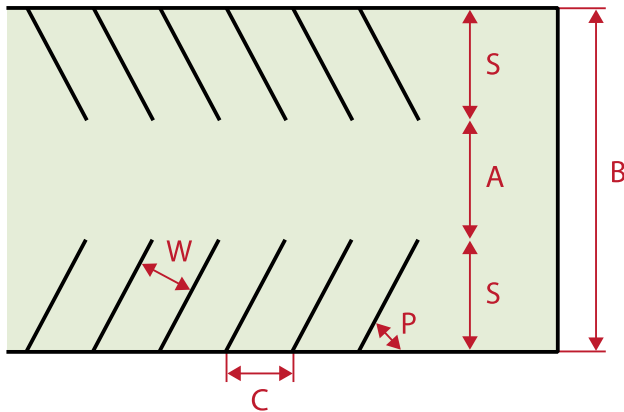


Table 8 Regular Parking Space Parking Area Design

Note: The dimension for Stall Depth (S) is measured to the back of curb.

| Parking Angle(P) | Curb Width (C) | Stall Depth (S) | Stall Width (W) | Aisle Width (A) | Module Width (B) |
|------------------|----------------|-----------------|-----------------|-----------------|------------------|
| 90 | 8.5 | 18.0 | 8.5 | 22.0 | 60.0 |
| 60 | 9.8 | 19.8 | 8.5 | 14.5 | 54.1 |
| 45 | 12.0 | 18.7 | 8.5 | 12.0 | 49.4 |
| 30 | 17.0 | 16.4 | 8.5 | 12.0 | 44.8 |
| 0 | 22.0 | 8.0 | 8.5 | 12.0 | 28.0 |

Table 9 Compact Space Parking Area Design

| Parking Angle(P) | Curb Width (C) | Stall Depth (S) | Stall Width (W) | Aisle Width (A) | (Module Width (B)) |
|-------------------------|-----------------------|------------------------|------------------------|------------------------|---------------------------|
| 90 | 7.5 | 15.0 | 7.5 | 22.0 | 52.0 |
| 60 | 8.7 | 16.8 | 7.5 | 14.5 | 48.1 |
| 45 | 10.6 | 15.9 | 7.5 | 12.0 | 43.8 |
| 30 | 15.0 | 14.0 | 7.5 | 12.0 | 40.0 |
| 0 | 19.0 | 7.5 | 7.5 | 12.0 | 27.0 |

Note: The dimension for Stall Depth (S) is measured to the back of curb.

Modifications to the On-Site Parking Lot Layout graphic may be made in accordance with the following:

- a) A reduction in aisle width in parking decks and other structures if there is a compensating increase in the stall width.
- b) Reductions in aisle width, the utilization of stacked parking stalls, or other changes to access or dimension of parking areas if parking is performed on a continuing basis by paid employee attendants.
- c) Allowance of stacked parking stalls, where each stall does not have access to an aisle or street, if the parking area is specifically designed and designated in the field to serve a particular dwelling unit in a planned development. The parking stall may be located in a garage, carport, or other enclosed space.

Article 10.2 On-Street Parking in the Public Right-of-Way

- A. On-street parking shall consist of parallel, angular (60 degree) or perpendicular spaces only in accordance with the chart below.
- B. On-street parking cannot be utilized to meet to meet on-site parking requirements for any development.

Table 10 On-Street Parking Area Design

| Parking Angle(P) | Curb Width (C) | Stall Depth (S) | Stall Width (W) |
|------------------|----------------|-----------------|-----------------|
| 90 | 8.5 | 18.0 | 8.5 |
| 60 | 9.8 | 19.8 | 8.5 |
| 0 | 22.0 | 8.0 | 8.0 |

Note: The dimension for Stall Depth (S) is measured to the back of curb.

CHAPTER 11 STREETSCAPE DESIGN AND OPERATION

The streetscape is the area that falls into the public right of way which is measured from the back of curb to the right-of-way line along with the General Utility Placement Easement behind the right-of-way line. Considerations in Streetscape design include sidewalk width, slope, furniture, pedestrian accommodation, utilities, landscaping, building access, and stormwater management.

Primary guidance on best practices in this chapter is drawn from multiple guidelines:

- a) [*ITE Manual on Designing Walkable Urban Thoroughfares*](#)
- b) [*Raleigh City Tree and Landscape Guide*](#)
- c) [*Section 8.5.2 of the UDO, Streetscape Types*](#)
- d) [*Public Right of Way Advisory Group \(PROWAG\)*](#)
- e) [*American with Disability Accessible Design Requirements*](#)
- f) [*City of Raleigh Stormwater Management Design Manual*](#)

Article 11.1 Streetscape Types

- A. The required streetscape type is determined by the zoning district or by the designated frontage. Where there is a conflict between a designated frontage and the zoning district, the designated frontage standard applies. If more than one streetscape can be used, the Planning and Development Officer shall make the final determination.
- B. Any Major or Minor Encroachment (See Article 4.1 in this Manual) in the Streetscape area within the Public right-of-way requires approval by Staff or City Council prior to any building permit approval.
- C. A variation to the Streetscape may require a Design Adjustment by the Public Works Director. See the [*Design Adjustments Article on www.raleighnc.gov*](#).
- D. In accordance with UDO Section 8.5.2, the required streetscape type is determined by the zoning district or by the designated frontage. Where there is a conflict between a designated frontage and the zoning district, the designated frontage standard applies. Dimensional standards for planting area, tree spacing, and utility placement and the planting type may be varied to accommodate GSI practices. The Planning and Development Officer and the Urban Forester shall make the final determination. Design specifications for streetscape improvements can be found in this Street Design Manual, the City Tree Manual, and the City Stormwater Design Manual.

The following Streetscape types are found in [Section 8.5.2 of the UDO](#):

- a) Main Street
- b) Mixed Use
- c) Commercial
- d) Residential
- e) Multi-Way
- f) Parking
- g) Sidewalk and Tree Lawn

Section 11.1.1 Adopted Streetscape Plans

The City of Raleigh has additional [Streetscape and Parking Standards](#), and [Streetscape Capital Programs](#) that vary from the standard Streetscape Types found in *Section 8.5.2 of the UDO*.

- A. In the event an adopted streetscape plan regulates streetscape improvements, the adopted Plan shall control.
- B. The requirements of this Chapter are intended to serve as minimum standards. Where a streetscape plan adopted before the effective date of the UDO sets a lower standard, the standard in this Chapter shall prevail.
- C. The City Council may modify an adopted Streetscape Plan following written notice to property owners along the street.
- D. When a streetscape along an existing street is constrained by an existing building, the Public Works Director may adjust the streetscape standards to the minimum extent necessary to accommodate the existing area between the face of the building and back of curb. Modifications shall conform to standards laid out in [Section 8.5.3 B of the UDO](#).

Article 11.2 Streetscape Elements

The Streetscape is made up of multiple elements which differ depending on the street type and frontage.

Section 11.2.1 General Utility Placement Easement

- a) The utility placement easement is the area behind the right-of-way line on private property where any utilities including, but not limited to, Fiber optics, Power poles, Power lines, Telephone, Cable and Telecommunication should be installed.
- b) The easement measures a minimum of five feet behind the required right-of-way line.

Section 11.2.2 Sidewalk in the Public Right-of-way

- a) All public roadways inside the corporate limits of the City and outside the City when water or sewer is connected to the City utility system shall be constructed with sidewalks installed on both sides of any new street per [Table 11 Minimum Sidewalk Width and Location](#)
- b) Additional right-of-way or easements may be required if sidewalk is located outside the existing right-of-way.
- c) Sidewalks shall be required in areas served by any street. Sidewalks shall provide general pedestrian access within the development served and shall connect with all public sidewalks, public streets, and greenway access points. Each block, or each building in the case of multi-unit living, shall be served by a connection to the pedestrian access system.
- d) Except for alleyways, in no case is it allowable to construct a transportation facility of any type expressed in this manual without distinct and accessible pedestrian accommodations.
- e) The minimum sidewalk dimension is a clear width requirement which cannot contain obstacles and shall allow for the minimum ADA required width.

Table 11 Minimum Sidewalk Width and Location

| Street Classifications | Both Sides | Type | Min. width |
|--|------------|------------------------|----------------------------|
| Sensitive Area Streets | | | |
| 1. Sensitive Area Parkway | X | Multi-use Trail | 10' |
| 2. Sensitive Area Avenue | X | Sidewalk | 5' |
| 3. Sensitive Area Residential Street | X | Sidewalk | 5' |
| Local Street | | | |
| 1. Neighborhood Yield | X | Sidewalk | 6' |
| 2. Neighborhood Local | X | Sidewalk | 6' |
| 3. Neighborhood Street (Collector) | X | Sidewalk | 6' |
| 4. Multifamily Street | X | Sidewalk (Easement) | 6' |
| Mixed Use Streets | | | |
| 1. Avenue 2-Lane Undivided | X | Sidewalk | 6' |
| 2. Avenue 2-Lane Divided | X | Sidewalk | 6' |
| 3. Avenue 3-Lane Parallel Parking | X | Sidewalk | 8' |
| 4. Main Street Parallel Parking | X | Sidewalk | 10' |
| 5. Main Street Angular Parking | X | Sidewalk | 10' |
| Major Streets | | | |
| 1. Avenue 4-Lane, Parallel Parking | X | Sidewalk | 10' |
| 2. Avenue 4-Lane, Divided | X | Sidewalk | 6' |
| 3. Avenue 6-Lane Divided | X | Sidewalk | 6' |
| 4. Multi-Way Boulevard, Parallel Parking | X | Sidewalk | 10' |
| 5. Multi-Way Boulevard, Angular Parking | X | Sidewalk | 10' |
| Industrial and Service Streets | | | |
| 1. Industrial Street | X | Sidewalk | 6' |
| 2. Alley, Residential | | Travel Lane | 20' Easement width |
| 3. Alley, Mixed Use | | Travel Lane | 24' easement width |
| Accessways | | | |
| 1. Primary Internal Access Drive | X | 6' | Sidewalk |
| 2. Pedestrian passage | X | Sidewalk | 20' Public Access Easement |

Section 11.2.4 Sidewalk Access Ramps

Sidewalk access ramps shall be provided at all intersections where curb and gutter are provided and where sidewalks and/or greenway trails intersect any street.

Sidewalk access ramps shall be constructed per City of Raleigh [Standard Details](#) (See transportation Details T-20.01.1 through 20.04.5) and/or current [Public Right of Way Advisory Group \(PROWAG\)](#) standards.

Section 11.2.5 Planting Area

The following can be found in Articles [7.2](#), [8.4](#), and [8.5](#) of the UDO.

Tree Planting

- A. All required street trees shall be installed in the planting area per City of Raleigh Standards and the [City Tree Manual](#).
- B. Unless otherwise noted below, all trees planted in accordance with Article 8.2 of the UDO must be shade trees.
- C. Where overhead utilities exist, 1 understory tree shall be planted every 20 feet on center, on average. Required understory trees may be installed within GSI practices. Up to 20% of required understory trees may be offset by installing vegetated GSI practices, such as stormwater planter boxes. A maintenance plan must be approved for the GSI practice according to Section 9.2.2.D.
- D. All required street trees must meet the design and installation requirements of [Section 7.2.7 of the UDO](#). If a GSI practice is part of an approved stormwater management plan for the site, required street trees may be installed within the GSI practice. A maintenance plan must be approved for the GSI practice according to Section 9.2.2.D.

Planting for Development Abutting NCDOT Streets

- A. Where development abuts a street controlled by the North Carolina Department of Transportation as shown on the [Raleigh Powell Bill Map](#), street trees may not be required in the right-of-way, at the discretion of the North Carolina Department of Transportation. In this instance, a Type C2 street protective yard is required in accordance with [Section 7.2.4 of the UDO](#). See the [Guidelines for Planting within Highway Right-of-Way](#) on NCDOT maintained roads for guidance.
- B. Unless otherwise noted below, all trees planted in accordance with this Article must be shade trees.
- C. In accordance with Section 7.2.4.B.4. of the UDO, GSI practices shall be allowed in Street Protective Yard Type C2. In order to accommodate GSI practices, the number of shrubs may be reduced in these protective yards by ten (10) percent.
- D. In accordance with UDO Section 7.2.7.C.4.a., in protective yards, 50% of required trees shall be locally-adaptive evergreen species, except where an approved GSI practice is in a protective yard.
- E. In accordance with UDO Section 7.2.7.C.5.b.vi., to accommodate multi-functional GSI practices as part of an approved stormwater management plan, the number of shrubs may be reduced in Protective Yards by 10%, non-evergreen species may be used in lieu of up to 35% evergreen shrubs, and all shrubs may be 24 inches when planted. Also see the [Guidelines for Planting within Highway Right-of-Way](#) on NCDOT maintained roads for guidance.
- F. Where the planting area is to be used for stormwater management, vegetation shall adhere to recommended plant species in the [NC DEQ Stormwater Design Manual](#).

Section 11.2.6 Street Furniture

The following types of street furniture can be provided for certain frontages and may be at the owner's expense. Any street furniture must be approved through the Encroachment process by City Council.

- a) Bicycle Racks
- b) Benches
- c) Parking Meters
- d) Bus Shelters
- e) Pedestrian Lighting
- f) Planters and/or Flower boxes
- g) Trash Receptacles
- h) Stormwater flow-through planters
- i) Rain barrels

Section 11.2.7 Drainage and Green Stormwater Infrastructure

Drainage of stormwater runoff away from the streetscape is necessary to retain the function of travel and pedestrian areas as well as for purposes of maintaining integrity of streetscape infrastructure. The location and type(s) of storm drainage features vary by street type; the choice between curb/gutter and shoulder depends primarily on area drainage characteristics (per Article 2.2). Stormwater drainage devices (e.g., pipes, catch basins) are required in streetscapes with curb and gutter treatments. Drainage swales/ditches are typically used to provide drainage in areas where storm sewers are not present, except in secondary Water Supply Watershed Protection Areas. On wider street cross-sections, drainage may occur in medians and/or behind the curb.

GSI practices are allowed in the streetscape in accordance with the City's standard details. Installation of GSI practices must not negatively impact existing street drainage patterns. Curb extension/bump-out and median design must maintain drainage of stormwater and not cause ponding within travel or pedestrian areas.

Section 11.2.8 Street Lights

- A. The City of Raleigh has a streetlight program that strives to provide lighting for all public roads inside the corporate city limits. The standards for streetlight design are dictated by the roadway type. For roads that are City maintained the requirements are dictated by the [Guide for Street Lighting and Developers Requirements](#) . For roads that fall on the State Highway System, lighting standards must adhere to NCDOT's standards. Private property developers must adhere to the site lighting standards laid out in [Article 7.4 of the UDO](#).
- a) Streetlights within the City of Raleigh are leased from local energy providers. Standard installation includes an energy efficient Light-Emitting Diode (LED) fixture mounted on a 30' wood pole.
 - b) Certain roadway improvement projects may include the installation of streetlights on gray fiberglass poles at city expense.
 - c) No decorative or pedestrian scale streetlight posts or fixtures are leased by the City of Raleigh outside of City initiated streetscape projects.
 - d) Decorative or pedestrian scale lighting is optional on City of Raleigh public streets, and will not be paid for by the City unless it is a City driven project. The developer and/or property owner will be completely responsible for up-front and ongoing costs of pedestrian scale lights on all non-City projects. The different styles of approved products are available from the local energy providers.
 - e) Energy provider leased Light-Emitting Diode (LED) streetlight fixtures must be used on public right-of-way if they are to be added to the City account. The energy provider will conduct all troubleshooting, repairs, and maintenance.
 - f) The energy provider must develop a lighting plan meeting or exceeding the City of Raleigh lighting standards as stated in Sec. 10-3059 of the City Code of Ordinances. This plan must be approved by Transportation Operations staff before the energy provider is authorized to install.
 - g) The energy provider generally determines the type (wattage) of LED streetlight fixture to be used along each public roadway and the associated pole spacing to meet the City's lighting standards. This can be modified by City staff if need be, and must be approved by staff before installation begins.
 - h) All streetlights must be underground fed, unless overhead infrastructure already exists where streetlights will be placed.
 - i) Underground facility installation and any abnormal costs (trenching, boring, reseeding, rock removal, etc.) associated with streetlight installation must be paid for by the developer, per the [Street Lighting Developer Requirements](#).
 - j) In order for the streetlights to be added to the City account, they must be installed on 30' wood or gray fiberglass poles. If gray fiberglass is used, a \$250/pole buy down can be paid to the City in order to have the streetlights added to our account. This buy down must be paid before City staff will authorize the installation of gray fiberglass poles.
 - k) If the developer uses any type of black poles, post-top lamp streetlights, or pedestrian scale lighting the streetlights cannot be added to the City's streetlight account. These must remain on a private account. If a state registered non-profit owner's association exists for the development, an agreement can be drafted to allow for the annual reimbursement of city standard lighting costs to the association.
- B. The developer, when installing underground electrical and telephone service shall also install at his expense underground terminal facilities for street lighting along public streets according to the standards required by the Illuminating Engineering Society publication Road Lighting; provided however, that the average maintained foot-candle (fc) level for outlying and rural roads as defined in said publication shall be no less than three-tenths (0.3) and the uniformity ratio shall be no greater than sixty-four (64). The City will not take responsibility for any street lighting system until it meets the above standards.

- a) The developer is responsible for installation of streetlights on all local access system roadways (residential and commercial), which will be built or improved as part of their development project. (.4 fc and 6:1 uniformity).
 - b) The developer is responsible for installation of streetlights on all collector system roadways (residential and commercial), which will be built or improved as part of their development project. (.6 fc and 4:1 uniformity)
 - c) The developer is responsible for installation of streetlights on all minor thoroughfare system roadways, which will be built or improved as part of their development project (.9 fc and 4:1 uniformity). If the roadway is built to State standards the street lighting is subject to State lighting requirements.
 - d) The developer is responsible for installation of streetlights on all major system roadways, which will be built or improved as part of their development project (1.2 fc and 4:1 uniformity). If the roadway is built to State standards the street lighting is subject to State lighting requirements.
 - e) The developer is responsible for installation of streetlights on all secondary system roadways, which will be built or improved as part of his development project. If the roadway is built to State standards, the street lighting is subject to State lighting requirements. The City may opt to participate in streetlight installations that would close any gaps in the streetlight system created by this requirement.
- C. Decorative or pedestrian scale lighting is optional on City of Raleigh public streets, and will not be paid for by the City unless it is a City driven project. The developer and/or property owner will be completely responsible for up-front and ongoing costs of decorative or pedestrian lighting on all non-City projects.
- D. The following street lighting fixtures are approved for use on City of Raleigh public streets at the owner's expense.



Mitchell Top Hat LED



Black LED roadway fixture

Table 12 Lighting Design for City Maintained Streets

| Street Classifications | Maintained Foot Candle (avg.) | Uniformity |
|--|-------------------------------|------------|
| Sensitive Area Streets | 0.9 | 4:1 |
| 1. Sensitive Area Parkway | 0.6 | 4:1 |
| 2. Sensitive Area Avenue | 0.4 | 6:1 |
| 3. Sensitive Area Residential Street | | |
| Local Street | 0.4 | 6:1 |
| 1. Neighborhood Yield | 0.4 | 6:1 |
| 2. Neighborhood Local | 0.6 | 4:1 |
| 3. Neighborhood Street (Collector) | 0.6 | 4:1 |
| 4. Multifamily Street | | |
| Mixed Use Streets | 0.9 | 4:1 |
| 1. Avenue 2-Lane Undivided | 0.9 | 4:1 |
| 2. Avenue 2-Lane Divided | 0.9 | 4:1 |
| 3. Avenue 3-Lane Parallel Parking | 0.9 | 4:1 |
| 4. Main Street Parallel Parking | 0.9 | 4:1 |
| 5. Main Street Angular Parking | | |
| Major Streets | 1.2 | 4:1 |
| 1. Avenue 4-Lane, Parallel Parking | 1.2 | 4:1 |
| 2. Avenue 4-Lane, Divided | 1.2 | 4:1 |
| 3. Avenue 6-Lane Divided | 1.2 | 4:1 |
| 4. Multi-Way Boulevard, Parallel Parking | 1.2 | 4:1 |
| 5. Multi-Way Boulevard, Angular Parking | | |
| Industrial and Service Streets | 0.6 | 4:1 |
| 1. Industrial Street | 0.4 | 6:1 |
| 2. Alley, Residential | 0.4 | 6:1 |
| 3. Alley, Mixed Use | | |
| Accessways | 0.4 | 6:1 |
| 1. Primary Internal Access Drive | 0.4 | 6:1 |
| 2. Pedestrian passage | 0.4 | 6:1 |

Section 11.2.9 Bicycle Rack Installation Standards

A. Standard U-Rack Design

A popular type of bike rack is the simple inverted-U design. Each inverted-U rack element accommodates two bikes, one on each side, and allows both wheels and the frame to be secured to the rack simultaneously.

Distance to other Racks:

- a) Racks aligned parallel to each other (side by side) must be at least 36 inches (3ft) apart.
- b) Rack units aligned end to end must be at least 96 inches (8ft) apart.

Distance from a Curb:

- a) Rack units placed perpendicular to the curb must be at least 48 inches (4ft) from the curb to the nearest vertical component of the rack.
- b) Rack units placed parallel to the curb must be at least 24 (2ft) inches from the curb.

Distance from Wall:

- a) Rack units placed perpendicular to a wall must be at least 48 inches (4ft) from the wall to the nearest vertical component of the rack.
- b) Rack units placed parallel to a wall must be at least 36 inches (3ft) from the rack to the wall.

Other Distances:

- a) Allow at least 72 inches (6ft) for safe pedestrian clearance
- b) Racks should be placed at least 6 inches off of brick pavers
- c) Racks should be placed at least 48 inches (4ft) from tree grates
- d) Racks should line up with existing infrastructure (tree grates, existing racks, benches, etc)

Refer to [Standard Detail B.20.03](#) in the [City of Raleigh Standard Details](#) .

On Street Bike Corral

On-street Bicycle Parking Corrals are bicycle racks placed in the parking lane on the roadway where short-term demand for bike parking is high. Corrals typically have 6 to 12 bicycle racks in a row and can park 10 to 20 bicycles. This uses space otherwise occupied by one car.

Installation Standards

- a) Bike corrals should be at street corners, upstream of the intersection.
- b) Two reflective wheel stops should be placed at least 24 inches (2ft) from the rack.
- c) The wheel stop located next to existing on-street parking should be placed 36 inches (3ft) from the parking tick mark.
- d) The rack should be placed thirty-three inches from the face of curb.
- e) A four inch solid white thermoplastic strip should be placed between the wheel stops and three inches from the parking tick mark.

Refer to [Standard Detail B.20.03](#) in the [City of Raleigh Standard Details](#).

CHAPTER 12 ROADWAY, INTERSECTION, AND TURN LANE DESIGN

Article 12.1 Roadway Design

- A. Complete Roadway Improvements, in conformance with the minimum roadway design cross-sections shall be made by developments along all frontages of the property or properties involved.
- B. Roadway improvements may include construction, fee-in-lieu, or combination of the two, which will be determined by staff, or off-site improvements.
- C. When a development is required to improve roadways, the developer shall be required to install pavement markings on the surface per approved plans.
- D. All pavement marking plans and installation shall be in conformance with [MUTCD](#) standards and specifications.
- E. Consideration of GSI practices is encouraged in roadway improvement projects.

Section 12.1.1 Horizontal Street Design

- A. Design criteria for design speed, centerline radius, reverse curve tangent distance and maximum superelevation rates for streets are summarized in [Table 13 Horizontal and Vertical Alignment Design Criteria](#). Superelevation rates, minimum runoff lengths and methods of distribution should be in accordance with [AASHTO](#) standards and specifications.
- B. The minimum tangent length of an approaching intersection should be 50 feet for local access system streets. All higher system streets shall have a tangent section no less than 100 feet approaching the intersection. Tangent lengths shall be measured from the intersection of the two rights-of-way.

Section 12.1.2 Vertical Street Design

- A. Wherever practical, streets should follow the existing contours of a site so as to avoid excessive grading and removal of existing vegetation. Street grades shall not be less than 0.75%. Standards for vertical street design are listed in [Table 13 Horizontal and Vertical Alignment Design Criteria](#).
- B. At signalized intersections, the maximum grade approaching the intersection should not exceed two percent and extend a minimum distance of 200 feet in each direction measured from the outside edge of travel way of the intersecting street.
- C. For intersections not controlled by a traffic signal, the maximum grade approaching the intersection should not exceed five percent and extend a minimum distance of 100 feet in each direction.

Table 13 Horizontal and Vertical Alignment Design Criteria

| New Street Classifications | Design Speed (mph) | Min. centerline Radius (feet) | Max. Rate of Superelevation for Min. CL Radius (ft per ft) | Min. tangent b/w reverse curves (feet) | Maximum Gradient * (%) | Min. Vertical Curve Length ** (feet) | Minimum rate of vertical curvature, K (LF per % of A ***) | |
|--|--------------------|-------------------------------|--|--|------------------------|--------------------------------------|---|-----|
| | | | | | | | Crest | Sag |
| Sensitive Area Streets | | | | | | | | |
| 1. Sensitive Area Parkway | 50 | 930 | 0.04 | 400 | 7 | 150 | 84 | 96 |
| 2. Sensitive Area Avenue | 40 | 535 | 0.04 | 250 | 8 | 125 | 44 | 64 |
| 3. Sensitive Area Residential Street Collector | 35 | 375 | 0.04 | 200 | 9 | 100 | 29 | 49 |
| 4. Sensitive Area Residential Street Local | 25 | 150 | NA | 0 | 12 | 50 | 12 | 26 |
| Local Street | | | | | | | | |
| 1. Neighborhood Yield | 25 | 150 | NA | 0 | 12 | 50 | 12 | 26 |
| 2. Neighborhood Local | 25 | 150 | NA | 0 | 12 | 50 | 12 | 26 |
| 3. Neighborhood Street (Collector) | 35 | 375 | 0.04 | 200 | 9 | 100 | 30 | 50 |
| 4. Multifamily Street | 25 | 150 | NA | 0 | 12 | 50 | 12 | 26 |
| Mixed Use Streets | | | | | | | | |
| 1. Avenue 2-Lane Undivided | 30 | 250 | 0.04 | 150 | 9 | 100 | 19 | 37 |
| 2. Avenue 2-Lane Divided | 35 | 375 | 0.04 | 200 | 8 | 100 | 30 | 50 |
| 3. Avenue 3-Lane Parallel Parking | 40 | 535 | 0.04 | 250 | 8 | 125 | 44 | 64 |
| 4. Main Street Parallel Parking | 30 | 250 | 0.04 | 150 | 9 | 100 | 19 | 37 |
| 5. Main Street Angular Parking | 30 | 250 | 0.04 | 150 | 9 | 100 | 19 | 37 |
| Major Streets | | | | | | | | |
| 1. Avenue 4-Lane, Parallel Parking | 40 | 535 | 0.04 | 250 | 8 | 125 | 44 | 64 |
| 2. Avenue 4-Lane, Divided | 40 | 535 | 0.04 | 250 | 8 | 125 | 44 | 64 |
| 3. Avenue 6-Lane Divided | 50 | 930 | 0.04 | 400 | 7 | 150 | 84 | 96 |
| 4. Multi-Way Boulevard, Parallel Parking | 40 | 535 | 0.04 | 250 | 8 | 125 | 44 | 64 |
| 5. Multi-Way Boulevard, Angular Parking | 40 | 535 | 0.04 | 250 | 8 | 125 | 44 | 64 |
| Industrial and Service Streets | | | | | | | | |
| 1. Industrial Street | 35 | 375 | 0.04 | 200 | 9 | 100 | 29 | 49 |
| 2. Alley, Residential | 20 | 75 | NA | 0 | 12 | 50 | 12 | 26 |
| 3. Alley, Mixed Use | 20 | 75 | NA | 0 | 12 | 50 | 12 | 26 |
| Accessways | | | | | | | | |
| 1. Primary Internal Access Drive | 25 | 150 | NA | 0 | 12 | 50 | 12 | 26 |

Note: * The minimum gradient on streets shall be at least 0.75%.

** All vertical curves must be symmetrical parabolic curves.

*** A=the algebraic difference in vertical curve grades

Section 12.1.3 Cul-de-sac Design

- A. Minimum dimensions for circular cul-de-sac streets are shown in the City of Raleigh Standard Details Manual. Alternative turnaround designs on residential streets serving six dwelling units or less may be considered for alternate designs. Alternative designs must readily accommodate emergency vehicles and Solid Waste Trucks.
- B. Medians may be permitted where the cul-de-sac radius is increased and it can be demonstrated that emergency vehicles and sanitation trucks can be accommodated. The City will not maintain landscaped medians and a private maintenance agreement for the median shall be required to be approved by the City Attorney through the Encroachment Process.

Section 12.1.4 Intersection Design

Streets should intersect at or as near 90 degrees as possible, but no less than 75 degrees. Intersections with more than four legs should be avoided whenever possible. The following table describes optimal street spacing specifications. To achieve the optimal level of connectivity and street spacing shown in the following table, a variety of street network patterns can be implemented.

Table 14 Optimal Street Spacing requirements

| Street Type | Optimal Street type Spacing | Optimal Cross-Street Spacing |
|--|-----------------------------|------------------------------|
| Parkway (4-6 lane), Multi-Way Boulevard (6 lane) | 4-6 miles | 1/2 mile |
| Parkway (4 lane), Multi-Way Boulevard (4-6 lane), Avenue (6 lane) | 4-6 miles | 1/2 mile |
| Avenue (6 lane), Avenue (4 lane, no parking) | 1 mile | 1/4 mile |
| Avenue (3-4 lane), Main Street (2-3 lane) | 1 mile | 300 - 600' |
| Avenue (2-lane), Main Street (2-3 lane), Industrial Street, Local Streets (Mixed) | 1/4 mile (1200') | 300 - 600' |
| Local Streets (Residential) | 150 - 600' | 150 - 600' |

Section 12.1.5 Traffic Control Devices

All traffic control devices should be designed in accordance with the standards and specifications as published in the latest [Manual on Uniform Traffic Control Devices \(MUTCD\)](#). The typical intersection control shall be two-way stop control, which provides stop control on the side-street intersection approaches and free flow on the main street.

All-way stop control may be provided at intersections where traffic volumes or other conditions are consistent with the warrants set forth in the MUTCD. Signal control may only be provided at intersections where vehicle or pedestrian volumes meet the thresholds set forth for new signals in the MUTCD.

A roundabout may be constructed at any intersection location where it may be desired in order to enhance intersection capacity, reduce vehicle speeds along a corridor, or enhance intersection aesthetics. Roundabouts shall be designed in accordance with the criteria set forth in [Roundabouts, An Informational Guide, Second Edition](#). Care should be taken in order to ensure roundabouts are not located in close proximity to adjacent stop or signal controlled intersections where long queues may back up into the roundabout.

Section 12.1.6 Roadway Transition

When constructing a street that will directly connect with an existing street of different width, it is necessary to install a transition taper between the two. The length of taper depends upon the offset differences between the outside traveled edge of the two sections and the design speed of the roadway. When tapers are located on a curve, the separate halves of the roadway should be designed with different curves to create the taper without any angle points in the curvature.

Formulas for determining transition taper lengths are shown below:

Street Width Transition Tapers

For speeds ≤ 40 mph

$$L = \frac{W * S^2}{60}$$

For speeds > 40 mph

$$L = W * S$$

Where,

L = transition taper length

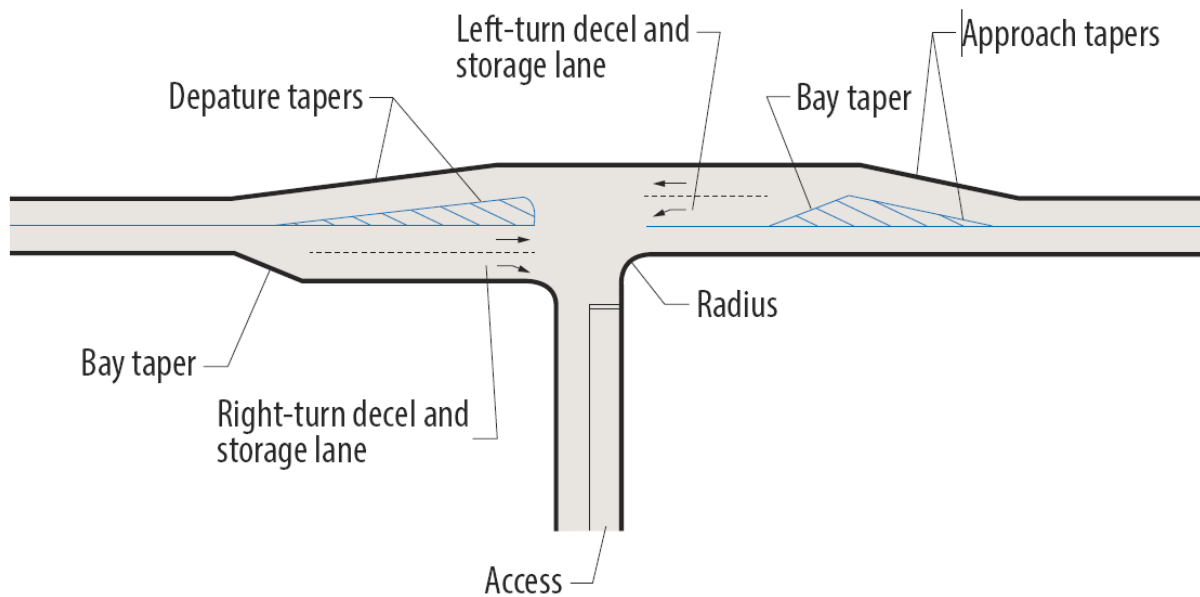
W = width of pavement offset (feet)

S = roadway design speed (mph)

Article 12.2 Turn Lanes

It may be necessary to construct turning lanes for right and left turns into a driveway or street for safety and capacity reasons or where roadway speeds and traffic volumes are high or if there are substantial turning volumes. The purpose of a separate turning lane is to expedite the movement of through traffic, increase roadway capacity, permit the controlled movement of turning traffic, and promote the safety of all traffic. Design elements, which make up a turning lane, are shown in the **Turn Lane Design Elements Table**. Turn lanes should be 12 feet in width; however, the lane width may be reduced to be compatible with the adjacent roadway lane width. In no event shall the turn lane width be less than ten feet.

Turn Lane Design Elements



Section 12.2.1 Turn Lane Warrants

Additional pavement surfaces to accommodate movements shall be required and constructed at intersections to the standards specified in [Table 15 Left Turn Lane Warrants for Two-Lane Roads](#) and [Figure 4 Right Turn/Deceleration Warrants](#) under the following conditions:

1. Left Turn Lane – Signalized Intersections

- a) Where fully protected left-turn phasing is provided; or,
- b) Where peak hour left-turn volume exceeds 100 vph; or,
- c) Where delay caused by left turning vehicles blocking through vehicles would reduce the operating capacity of the intersection below level service “D” (LOS-D), as defined in the latest [Highway Capacity Manual](#).

2. Right Turn lane – Signalized Intersections

An exclusive right-turn lane shall be provided where the right turning volumes exceeds 300 vph and the adjacent through lane volume also exceed vph per lane. When calculating the adjacent through lane volume, it should be assumed that all through lanes have equal volumes.

3. Left Turn Lane – Unsignalized Intersection

A separate left turn lane shall be provided on a two lane roadway, depending on the percent of left turning vehicles in the advancing volume against opposing volume.

For four lane roadways or greater in width, a separate left turn lane should be provided when delay caused by the left turning vehicles blocking through vehicles, would reduce operating capacity of the intersection below level of service “D” (LOS-D), as defined in the latest [Highway Capacity Manual](#).

4. Right Turn – Deceleration Lane, Unsignalized Intersection

A separate turn / deceleration lane shall be provided depending on the roadway’s single lane volume, the volume of the right turning vehicles and the posted speed of the roadway.

5. Additional Turn Lanes

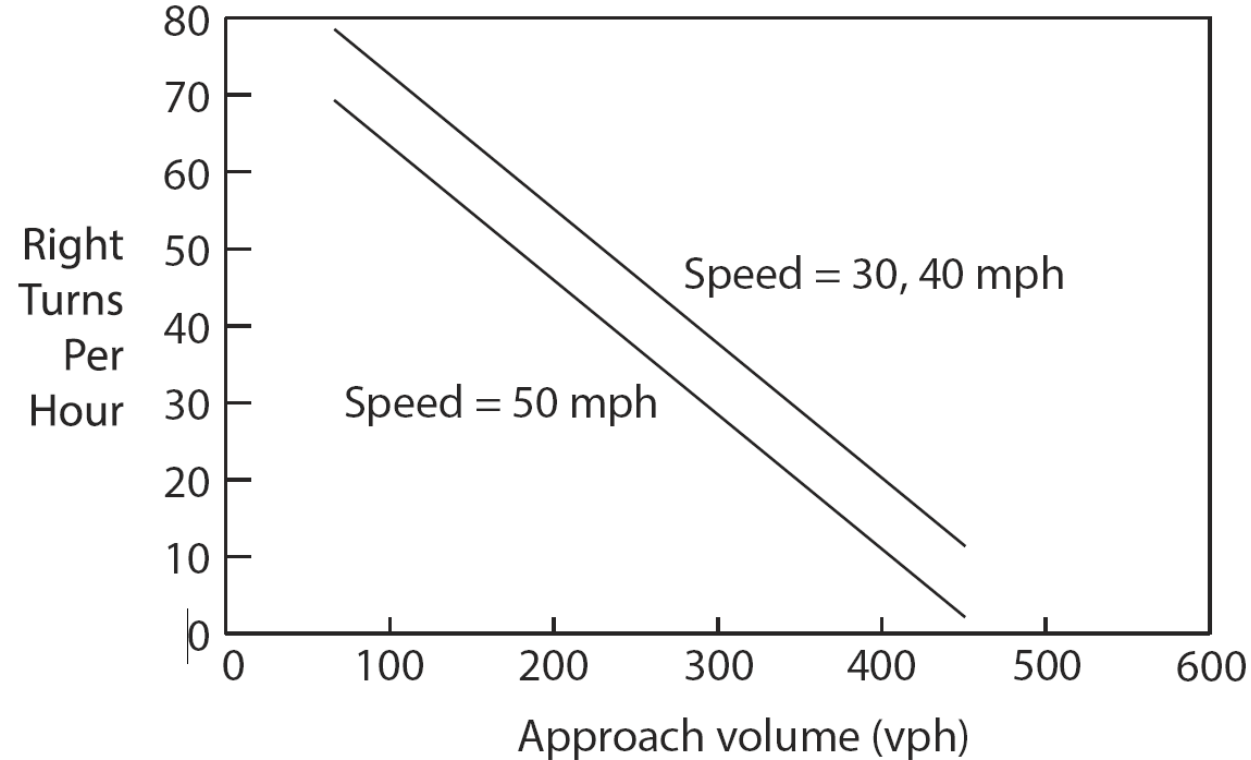
The City may require additional turning lanes and tapers or other improvements when it believes that the absence of such improvement will create an unsafe condition or would reduce the operating capacity of the intersection below level of service “D” (LOS-D), as defined in the latest [Highway Capacity Manual](#).

Table 15 Left Turn Lane Warrants for Two-Lane Roads

| OPPOSING VOLUME (veh./hr.) | ADVANCING VOLUME (veh./hr.) | | | |
|-------------------------------|-----------------------------|-------------------|-------------------|-------------------|
| | 5% Left Turns | 10% Left Turns | 20% Left Turns | 30% Left Turns |
| 40-mph Operating Speed | | | | |
| 800 | 330 | 240 | 180 | 160 |
| 600 | 410 | 305 | 225 | 200 |
| 400 | 510 | 380 | 275 | 245 |
| 200 | 640 | 470 | 350 | 305 |
| 100 | 720 | 515 | 390 | 340 |
| 50-mph Operating Speed | | | | |
| 800 | 280 | 210 | 165 | 135 |
| 600 | 350 | 260 | 195 | 170 |
| 400 | 430 | 320 | 240 | 210 |
| 200 | 550 | 400 | 300 | 270 |
| 100 | 615 | 445 | 335 | 295 |
| 60-mph Operating Speed | | | | |
| 800 | 230 | 170 | 125 | 115 |
| 600 | 290 | 210 | 160 | 140 |
| 400 | 365 | 270 | 200 | 175 |
| 200 | 450 | 330 | 250 | 215 |
| 100 | 505 | 370 | 275 | 240 |

Note: For operating speeds not shown, interpret between given values

Figure 4 Right Turn/Deceleration Warrants



Section 12.2.2 Total Turn Lane Length

A separate turning-lane consists of a taper plus a full width turn lane. The design of the lane is based primarily on the speed at which drivers will turn into the lane, the speed to which drivers must reduce in order to turn into the driveway or side street after traversing the deceleration lane, and the amount of vehicular storage that will be required.

The total length of the turning lane and taper should be determined by either:

- a) The combination of turn lane or through lane queue storage plus the bay taper, or
- b) Right turn / deceleration requirements, whichever is greater.

Section 12.2.3 Turn Lane Storage

A. Signalized Intersection

Where traffic is to be controlled by a traffic signal, the turn lane should be of sufficient length to store the turning vehicles and clear the equivalent lane volume of all other traffic on the approach, whichever is the longest. This length is necessary to ensure that full use of the separate turn lane will be achieved and that the queue of the other vehicles on the approach will not block vehicles from the turn lane.

The storage requirements for turn lanes should be based upon the peak 15-min. flow rates of turning traffic. The average number of turns per cycle can then be multiplied by a factor to account for random variations in arrivals.

The length of turn lane can be estimated by the following formula:

$$L = \frac{V * K * 25 * (1 + p)}{N}$$

Where,

L = storage length of turn lane (feet)

V = peak 15 minute flow rate of turning volume (vph)

K = constant to reflect random arrivals

K = 2.0 for 95% probability of storing all vehicles

K = 1.5 for 90% probability of storing all vehicles

25 = approximate length of vehicle (feet per vehicle)

N = number of cycles for hour

The storage requirement for a separate turn lane is also based on the amount of queue length necessary to accommodate other vehicles arriving on the approach during the red phase of the cycle.

The “red time” formula for estimating the storage length for other vehicles is as follows:

$$L = \frac{V * K * 25 * (1 - g/c)}{(N * I)}$$

Where,

L = storage length of turn lane (feet)

V = peak 15 minute flow rate of turning volume (vph)

K = constant to reflect random arrivals

K = 2.0 for 95% probability of storing all vehicles

K = 1.5 for 90% probability of storing all vehicles

25 = approximate length of vehicle (feet per vehicle)

G = green time (seconds)

C = cycle length (seconds)

N = number of cycles for hour

I = number of approaching vehicle lanes

B. Unsignalized Intersection

The storage length for turning vehicles at intersections not controlled by a traffic signal should be determined by using the formulas for signalized intersections as outlined above. Storage requirements should be based on an assumed minimum cycle length of 90 seconds.

C. Right Turn/Deceleration Lengths

The lengths required to come to a stop from either the design speed or an average running speed of a roadway, are indicated in the following table. The lengths assume the roadway is on a two percent or less vertical grade. The desirable deceleration lengths should be used on new roadways and the minimum may be used along existing roadways. Longer deceleration lengths may be required on downgrades greater than two percent.

Table 16 Right Turn/Deceleration Lengths Table

| Design Speed (mph) | Right Turn/Deceleration Length (feet) | |
|--------------------|---------------------------------------|-------------|
| | Desirable (1) | Minimum (2) |
| 30 | 235 | 185 |
| 35 | 270 | 240 |
| 40 | 315 | 295 |
| 45 | 375 | 350 |
| 50 | 435 | 405 |
| 55 | 480 | 450 |

(1) Assumes stop condition

(2) Assumes 15 mph speed differential

Section 12.2.4 Approach, Departure and Bay Taper

Approach, Departure and Bay Taper length for separate turn lanes shall be based on the following formulas:

Approach and Departure Taper for
Speeds <= 40 mph

$$L = \frac{W * S^2}{60}$$

Approach and Departure Taper for
Speeds > 40 mph

$$L = \frac{W * S}{3}$$

Where,

L = taper length, (feet)

W = width of offset, (feet)

S = design speed, (mph)

Article 12.3 On-Road Bicycle Facilities

A. Bike Lane

Bicycle Lanes are along portions of the roadway that has been designated by pavement markings for the preferential and exclusive use of bicyclists. Bicycle Lanes are always located on both sides of the roadway and carry bicyclists in the same direction as motor vehicle traffic.

Design Standards:

- a) The minimum width for a bicycle lane is four feet.
- b) Bike Lanes shall be the minimum prescribed for each cross section for new streets
- c) Symbols should be placed on the far side of every intersection, or at every decision point.
- d) Minimum width of a bike lane next to on-street parking is six feet.
- e) Bike lane should be dropped 100 feet from stop bar at intersection with a shared right/through lane condition.
- f) Mini skips should be placed whenever a bike lane is dropped; skips should be a 50ft in length.
- g) Bike lane should be placed between the through lane and a dedicated right turn lane.
- h) Bike lane should break for residential street or major driveway (more than 2 lanes).

Refer to Standard Detail [B-10.01](#), [B-10.02](#), and [B-10.04](#) in the [City of Raleigh Standard Details](#).

B. Shared Lane (Sharrow) Markings

Design Standards:

- a) Sharrows should be placed after every decision point or at intervals of 250-feet
- b) When parking is prohibited and travel lane width is greater than or equal to 13 feet, place Sharrow 48 inches from face of curb.
- c) When parking is prohibited and travel lane width is less than 13 feet, place Sharrow in center of travel lane.
- d) When parking is present and travel lane width is greater than or equal to 15-feet, place Sharrow 13 feet from face of curb.
- e) When parking is present and travel lane width is less than 15 feet, place Sharrow in center of travel lane.

Refer to Standard Detail [B-10.03](#) in the [City of Raleigh Standard Details](#).

Article 12.4 Drainage, Curb, and Gutter Design

Drainage of stormwater runoff from travel lanes, and parking spaces in the Travelway and from pedestrian sidewalks and other hardened infrastructure in the Streetscape is essential for safe and functional use of these areas. Although drainage is most conventionally accomplished through surface runoff to concentrated conveyances such as curb and gutter systems and then to drainage pipes for ultimate discharge outside of the right-of-way, an alternative means of providing street drainage is the use of non-paved areas for stormwater storage and infiltration using GSI practices.

All public roadways inside the corporate limits of the City, and outside the City where water or sewer is connected to the City utility system, shall be constructed with standard curb and gutter or an alternative curb system to accommodate GSI stormwater management. Alternative curb systems include flat curb, standard curb with openings, and other curb systems approved by the Engineering Services Director or a designee. Details for curb and gutter installations can be viewed in the [City of Raleigh Standard Details](#). See Detail [T-10.26.1](#) for standard curb and gutter installation. See Detail [T-10-26.2](#) for alternative curb installation.

Section 12.4.1 Curb Installation requirements

1. Standard curb and gutter can be used on all streets.
2. Granite curb shall be required when it previously existed or a streetscape plan recommends the use.
3. Valley-type curbs are permitted for Neighborhood Yield and Neighborhood Local, if all the following are met:
 - a) Where any existing street containing a standard curb and gutter is to be extended, the curb and gutter shall be extended to at least the next intersection.
 - b) Curb treatments shall be the same on both sides of a street, but a different treatment may be used adjoining a median.
 - c) At the interface of differing curb or shoulder treatments, drainage structures are to be installed to assure uninterrupted flow of storm water between the two drainage systems.
4. Curb openings may be used where drainage conveyance from one side of the curb to another is needed to accommodate the use of GSI practices.

A. Curb and gutter is not required on the following streets:

- a) Sensitive area thoroughfares or roadways located within a Reservoir Watershed Protection Area Overlay District. Curb and gutter may be required where right-of-way is restricted or where needed to control stormwater erosion and sedimentation.
- b) Roadways other than thoroughfare system roadways that were inside the City limits and paved prior to 1950.
- c) Where curb and gutter is not planned to be installed in the future as part of design plans on street improvements, or where none is required as part of a City Council approved Neighborhood Plan.

B. Alternative curb systems, such as no-elevation curb, curb openings, flat curb, and other alternative systems, may be allowed in place of standard curb and gutter systems as described in Section 12.4.1, subject to:

- a. Stormwater control measures shown on the stormwater control master plan for a new development or expansion of existing development must control stormwater on a runoff volume basis in accordance with UDO Section 9.2.2.B.1.c.; and
- b. Approval by the Engineering Services Director or a designee after considering situation-specific factors including, but not necessarily limited to, pedestrian safety, vehicular safety, historic preservation, streetscape aesthetics, and management of stormwater collection and conveyance outside the Travelway without resulting in soil erosion or otherwise impacting the integrity of the drainage system.

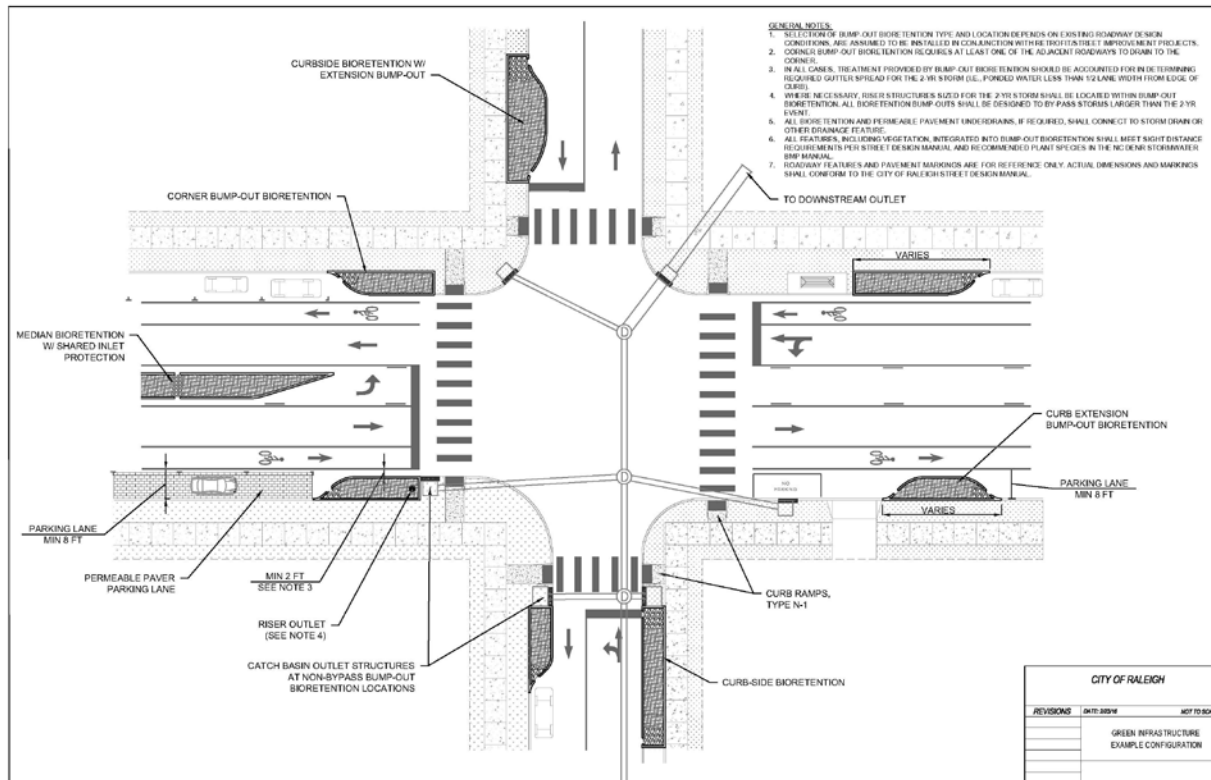
Section 12.4.2 Curb Return Radii

- A. Public street Intersections shall provide appropriate curb radii using the [Table 1 Design Vehicle Table](#) in order to allow the design vehicle to safely complete a turn without encroaching on adjacent Streetscape elements, including sidewalks and landscaping.
- B. Designers should take into account bicycle lane width and parking lane width when designing curb radii, as the travel lane offset allows for a larger effective radius for large vehicles. When a design vehicle larger than a Passenger Vehicle (P) is used and there are multiple receiving lanes, the design should account for the ability of the turning vehicle to use all receiving lanes.
- C. Where on-street parking lanes are provided, curb extensions (bulb-outs) may be considered, reducing the effective crosswalk width for pedestrians. This may have an effect of increasing the required curb radius however, so care should be taken to account for the relevant design vehicle.
- D. Where intersection radii larger than 25 feet are required in order to accommodate large vehicles, designers should consider incorporating mountable curbs, truck aprons, or channelized turn lanes in order to minimize the impact to intersection width for pedestrians.
- E. Every intersection shall appropriately accommodate Emergency Vehicles:

Section 12.4.3 Drainage and Green Stormwater Infrastructure

- A. The use of GSI practices for managing stormwater within the right-of-way is encouraged. GSI practices typically are installed behind the curb either outside of the Travelway or in a median or curb bump-out. [Figure 5](#) shows example placement of GSI devices and additional information for several GSI practices that can be found in the City of Raleigh Standard Details.

Figure 5 Example Green Stormwater Infrastructure elements near a street intersection



Article 12.6 Sight Distance

- A. Sight distance is the length of roadway ahead visible to the driver. The minimum sight distance available on the roadway should be sufficiently long to enable a vehicle traveling at or near the design speed to stop before reaching a stationary object in its path.
- B. Minimum stopping sight distances shall be provided in both the horizontal and vertical planes for planned roadways as related to assumed driver's eye height and position.
- C. Adequate sight distance should be provided at all driveway access points and shall be in accordance with the standards provided in this Manual.
- D. Sight triangles easements shall be shown on all NCDOT maintained roadways for any driveway access according to the manual "Policy on Street and Driveway Access to North Carolina Highways," as adopted and amended by NCDOT.
- E. This note must be placed on all plans: "Within the area of above defined sight triangle, there shall be no sight obstructing or partly obstructing wall, fence, sign, foliage, berms, or parked vehicles between the heights of 24 inches and eight feet above the curb line elevation or the nearest traveled way if no curbing exists."
- F. Objects that can be permitted in the sight distance triangle are utilities such as hydrants, utility poles, utility boxes, GSI practices, and traffic control devices. Those objects must be located to minimize visual obstruction.

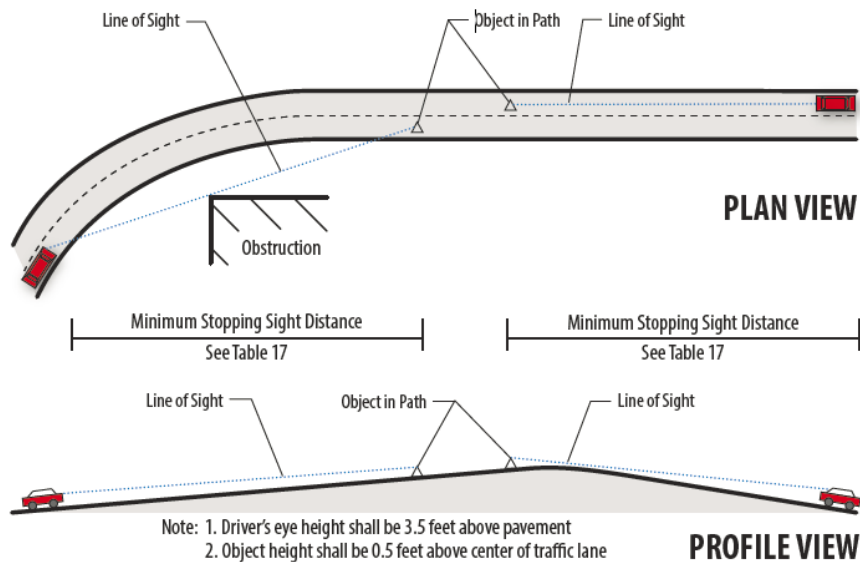
Section 12.6.1 Stopping Sight Distance

Where there are sight obstructions (such as walls, cut slopes, buildings and other hazards) on the inside of curves, changes in roadway alignment may be required to obtain adequate stopping sight distance if the sight obstruction cannot be removed.

Table 17 Stopping Sight Distance

| | Minimum stopping sight distance (in feet), Street grade in percent | | | | | | |
|-------------------|--|-----|-----|------|------------|-----|-----|
| Speed limit (mph) | Upgrades | | | Flat | Downgrades | | |
| | 9% | 6% | 3% | 0% | -3% | -6% | -9% |
| 25 | 140 | 145 | 150 | 150 | 155 | 165 | 175 |
| 30 | 180 | 185 | 200 | 200 | 210 | 215 | 230 |
| 35 | 225 | 230 | 240 | 250 | 265 | 275 | 290 |
| 40 | 270 | 280 | 290 | 305 | 315 | 335 | 355 |
| 45 | 320 | 330 | 345 | 360 | 380 | 400 | 430 |
| 50 | 375 | 390 | 405 | 425 | 450 | 475 | 510 |

Figure 6 Sight Distance Measurement



Section 12.6.2 Intersection Sight Distance

- A. Intersections should be planned and located to provide as much sight distance as possible. A basic requirement for all controlled intersections is that drivers must be able to see the control device well in advance of performing the required action. Stopping sight distance on all approaches is needed as a minimum. Obstruction-free sight triangles shall be provided in both the
 - B. horizontal and vertical planes, as related to assumed driver's eye height and position.
- At any intersection of two roadways, a sight triangle shall be provided for an unobstructed path of sight. The sight distance triangle can be defined by connecting a point that is along the minor street's edge of pavement and 15 feet from the edge of pavement of the major street, with a point that is distance (L) along the major street's edge of pavement.

Figure 7 Sight Distance Depiction

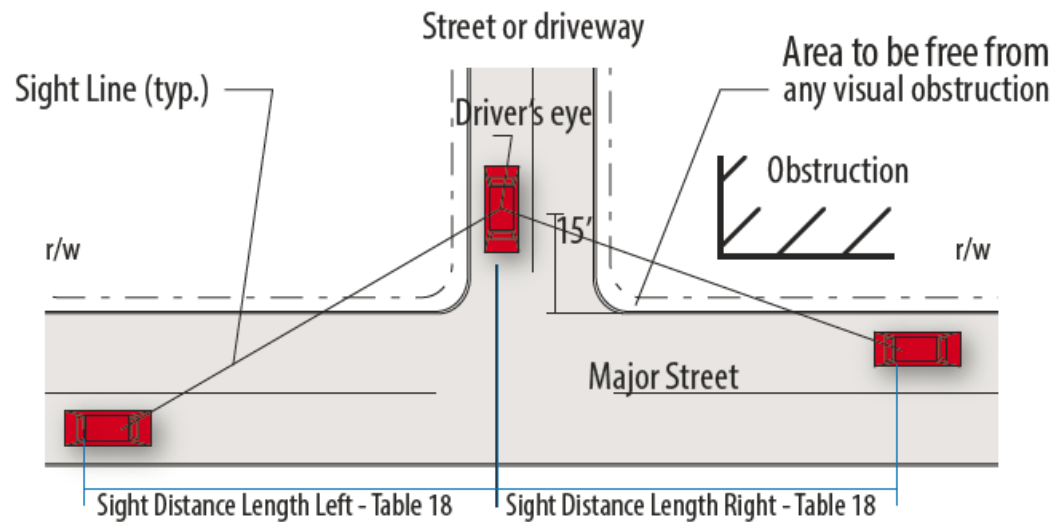


Table 18 Intersection Stopping Sight Distance summarizes the required sight distance (L) along the road for a stopped vehicle to cross the street. If a roadway is divided with a median width of 20 feet or more for passenger vehicle crossings, or 40 feet or more for truck crossings, the required sight distance may be based on a two-stop crossing and consideration given to the width of each one-way pavement at a time.

Table 18 Intersection Stopping Sight Distance

| Speed limit (mph) | Minimum Intersection Sight Distance (ft) | | | | | | | |
|-------------------|--|---------------|--|---------------|------------------|---------------|--|---------------|
| | 2 Lane Undivided | | 3 Lane Undivided or 2 Lane Divided w/ 12' median | | 4 Lane Undivided | | 5 Lane Undivided or 4 Lane Divided w/ 12' median | |
| | LEFT TURN | RIGHT TURN | LEFT TURN | RIGHT TURN | LEFT TURN | RIGHT TURN | LEFT TURN | RIGHT TURN |
| 20 | 230 | 200 | 240 | 200 | 250 | 200 | 270 | 200 |
| 25 | 280 | 240 | 300 | 240 | 320 | 240 | 340 | 240 |
| 30 | 340 | 290 | 360 | 290 | 380 | 290 | 400 | 290 |
| 35 | 390 | 340 | 420 | 340 | 440 | 340 | 470 | 340 |
| 40 | 450 | 390 | 480 | 390 | 500 | 390 | 530 | 390 |
| 45 | 500 | 430 | 530 | 430 | 570 | 430 | 600 | 430 |
| 50 | 560 | 480 | 590 | 480 | 630 | 480 | 670 | 480 |
| 55 | 610 | 530 | 650 | 530 | 690 | 530 | 730 | 530 |

Notes: The sight distances shown in this chart shall be considered approximate only for a passenger car to turn onto the major street from a side street grade of 3% or less.

The distances from this chart are measured along the CL of the roadway (Sight Distance Length L from illustration).

The sight line (or resulting sight distance easement line if outside r/w) shall begin at the driver's eye approximately 15 feet from EP and end at the center of the closest oncoming lane.

Depending on specific site conditions additional adjustments may be required to sight distances. These factors may include, but are not limited to, side street approach grades greater than 3%, median widths of the crossing street, skewed intersections, or other variables that would affect sight distances.

Any adjustments to the above sight distances shall be in accordance with section "Intersection Control" of the latest edition of the AASHTO Manual.

GLOSSARY

AASHTO - American Association of State Highway Transportation Officials.

Access Point - A point of ingress and/or egress, which connects a development to a public or private street.

Approach - The portion of an intersection leg which is used by traffic approaching the intersection.

Bicycle Lanes - A portion of the roadway that has been designated by pavement markings for the preferential and exclusive use of bicyclists.

Capacity - The maximum sustainable hourly rate at which persons or vehicles can reasonably be expected to traverse a point or uniform segment of a lane or roadway during a given time period under prevailing traffic, roadway and control conditions.

City - The City of Raleigh, North Carolina.

City Code - The Charter and Code of Ordinances of the City of Raleigh, North Carolina.

City Council - The governing body for the City of Raleigh, North Carolina.

City Standards and Specifications - Those standards prescribed for construction set out in this Manual and the City Code.

Commercial Driveway Access - Any driveway access point that does not meet the definition of residential driveway access.

Comprehensive Plan - The “Raleigh Comprehensive Plan” was adopted by the City Council as a guide for the development of the City and territory surrounding the City, consisting of maps, charts and text.

Connective Street - A street within a development, other than a cul-de-sac street or loop street, which will allow vehicular and pedestrian circulation to adjoining developments; thereby providing for community-wide circulation.

Coordination (signal) - Maintaining a predictable time relationship between the operation of a traffic signal relative to the operation of other signals in a group or system.

Curb cut - The entrance (apron) to connect the driveway to the street

Cycle - A complete sequence of traffic signal indications.

Cycle Length - The time elapsed between the endings of two sequential terminations of a given interval. For coordinated signals, this is measured by using the coordinated phase green interval.

Design Adjustment – A request for an alternate design. Submittal shall occur in accordance with Section 10.2.18 of the UDO and meet all criteria as outlined in the UDO and this Manual. A Design Adjust does not allow for a waiver from fees.

Design Speed - Usually up to five miles per hour above the expected operating speed of the facility under design.

Design Vehicle - Motor, non-motor vehicles and pedestrians with representative weight, dimensions, and operating characteristics that are used to establish street design controls and standards

Development or Development Plan - Any site plan, subdivision, or plot plan

Detector - A device used to sense the presence or absence of vehicles or pedestrians in the vicinity of a signalized intersection.

Detector Settings - Controls used to affect the operation of a detector.

Developer - A site planner, landowner or subdivider.

Development/Development Plan - Any site plan, subdivision plan, or plot plan.

Driveway Access Point - A point of ingress and egress, or both, which is considered a private driveway. It can be either a residential access point or a commercial driveway access point.

Driveway Width - The narrowest width of driveway measured parallel with the edge of street.

Facility – Any Infrastructure on or with which transportation occurs

Frontage - The distance along a property (additional sidewalk or shoulder width) required between the pedestrian traveler and adjacent building or environmental features to maintain comfort.

Green Interval - The duration of the green indication for a given movement at a signalized intersection.

Green stormwater infrastructure (GSI) – Any of a number of practices that, used individually or collectively, contribute to managing, treating, and reducing stormwater runoff from a development or redevelopment site, as close as possible to the runoff's source, by preserving natural landscape features (such as vegetation, soils, hydrology, and natural processes) and/or by mimicking natural processes through installation and maintenance of structurally engineered devices (such as bioretention cells, bioswales, permeable paving/pavers, green roofs, stormwater street trees, and cisterns). In addition to contributing to stormwater management, GSI practices can enhance site aesthetics, improve air quality, reduce urban heat island impacts, provide shading, create wildlife habitat, reduce energy consumption, reduce infrastructure costs, and increase property values.

Internal Capture Trip - A trip made within the confines of a Mixed-use development that does not use the off-site street system.

ITE - Institute of Transportation Engineers

Level-of-Service (LOS) - A quantitative stratification of a performance measure or measures that represent quality of service, measured on an A – F scale, with LOS A representing the best operating conditions from the traveler's perspective and LOS F the worst.

Loop Street - A street which is designed to discourage through traffic from other areas and both ends of the loop street connect with the same intersecting street.

Measures of effectiveness (MOEs) - Measurable quantities and characteristics used to compare traffic impacts from various alternatives.

Measures of effectiveness quantify traffic impacts and allow for an objective examination of the results. Traffic impacts can be quantified in a variety of ways such as delay, queuing or average speed and at different scales. In many instances, the specific quantity for a given MOE is not as significant as the relative change of in MOE quantity between different alternatives. “Scale” refers to impacts for a specific area under review: an isolated intersection, all intersections along a particular road or all intersections within a roadway network.

Median - That portion of a divided roadway separating the traveled ways for traffic in opposite directions.

Mitigation - Alleviation, reduction, abatement or diminution of traffic impacts created by a development.

Mixed Use Development - A single real estate project that consists of two or more land use classifications between which trips can be made without using the offsite street system.

Multimodal - Being used by more than one travel mode such as motor vehicles, pedestrians and bicycles.

Multimodal Level-of-Service (MMLOS) - A type of analysis where the level-of service of each travel mode on a facility is evaluated simultaneously.

NCDOT - North Carolina Department of Transportation

Offset - The time that the reference phase of a traffic signal begins (or ends) relative to the system master time zero.

On-Street Bike Corral - On-street Bicycle Parking Corrals are bicycle racks placed in the parking lane on the roadway.

Pass-by Trip - A trip made as an intermediate stop from an origin to a destination that does not require a route diversion.

Phase (signal) - The part of the signal cycle allocated to any combination of traffic movements receiving the right-of-way simultaneously during one or more intervals. A phase includes the green, yellow change, and red clearance intervals.

Phase Sequence - The sequence of service provided to each traffic movement, or a description of the order in which left-turn movements are served relative to the through movements.

Phase Settings - Controls used to influence the start, duration and ending of a signal phase.

Primary Trip - A trip made for the specific purpose of visiting a destination. Stopping at the destination is the primary reason for the trip.

Pavement Markings - All lines, words or symbols, except signs officially placed within the roadway or parking area to regulate, warn or guide traffic.

Peak-Hour Volume - Hourly traffic volume used for roadway design and capacity analysis, usually occurring during one or more peak travel hours during a 24 hour period.

Public Works Director - The Department Head of the City of Raleigh Public Works Department.

Reference Phase - One of the two coordinated phases of a traffic signal.

Residential Driveway Access - A driveway access point serving a single family dwelling, mobile home, detached townhouse, two attached townhouses, duplex, multi-unit supportive housing residence, supportive housing residence which is required to provide no more than two (2) off-street parking spaces, or a driveway serving a nonresidential use if the daily volume of two-way driveway traffic is expected to be less than fifty (50) vehicles.

Right-of-Way - An interest in land to the City which provides for the perpetual right and privilege of the City and its agents, franchise holders, successors, and assigns to construct, install, improve, repair, maintain, and use a public street, including related and customary uses of street rights-of-way such as sidewalk, bike path, landscaping, traffic control devices and signage, sanitary sewer, stormwater drainage devices, water supply, cable television, electric power, gas, and telephone transmission and related purposes in, upon, over, below, and across the rights-of-way. The City is authorized to remove, and keep removed from the rights-of-way all trees, vegetation, and other obstructions as is determined to be necessary by the City to maintain, repair, and protect facilities located in the right-of-way

Right-of-Way Centerline -

- a) The right-of-way centerline of a two-way street shall be a point equidistant between the inside edges of the innermost through travel lane in each direction of travel.
- b) The right-of-way centerline of a one-way street shall be a point equidistant between the outside edges of the outermost through travel lanes in the direction of travel.
- c) Where the alignment of an existing street is to be altered or changed, the right-of-way centerline shall be determined in accordance with the new realignment plan, provided the City and/or NCDOT have approved the plan.
- d) In special cases where non-symmetrical street widening, narrowing, re-striping, or other unique situations has occurred, the right-of-way centerline shall be defined by the Public Works Director.

Roadway - See definition of street.

Roundabout - An unsignalized intersection with a generally circular shape, characterized by yield on entry and circulation around a central island.

Shall - When used in the context of this Manual and its contents, shall indicates a mandatory action, procedure or practice.

Shared Lane (Sharrows) Markings - Shared lane markings are used on roadways where dedicated bicycle lanes are desirable but not possible due to physical or other constraints.

Should - As used in the context of traffic studies, should indicates a mandatory action, procedure or practice that City staff is empowered to waive.

Slope Easement - An easement, which is reasonably necessary and incidental to the construction within the adjoining right-of-way of public street or sidewalk, or both, by the City, state, or their contractors. The purposes to which the easement area may be used include cutting, sloping, filling, installation of stormwater drain pipes or other drainage facilities, grading or otherwise changing the natural contour of the easement area in order to support and to accommodate the development of the adjacent street right-of-way, in accord with generally accepted engineering practices. Following the construction of the adjacent street or sidewalk, or both, the area subject to this easement will be graded, stabilized, and restored using conventional engineering and landscaping methods. Thereafter, the landowners with the underlying fee interest may make and enjoy all lawful uses of the property subject to this easement, provided there be no damage to the lateral and subjacent support of the public street, sidewalk, or both or to any stormwater drainage facility.

Split - The segment of the cycle length allocated to each phase or interval that may occur. In an actuated controller unit, split is the time in the cycle allocated to a phase – the sum of the green, yellow change, and red clearance intervals for a phase.

Street - A general term for denoting a public way for purposes of pedestrian, bike and vehicular travel, including the entire area within the right-of-way.

Streetscape - The streetscape is the area that falls into the public right of way which is measured from the back of curb to the right-of-way line along with the General Utility Placement Easement behind the right-of-way line. Considerations in Streetscape design include sidewalk width, slope, furniture, pedestrian accommodation, utilities, landscaping, and building access.

Street Furniture - Items that are placed in the public right-of-way along the frontage of a development. Items include:

- a) Bicycle Racks
- b) Benches
- c) Parking Meters
- d) Bus Shelters
- e) Pedestrian Lighting
- f) Planters and/or Flower boxes
- g) Trash Receptacles
- h) Stormwater flow-through planters
- i) Rain barrels

Traffic Engineer - A professional engineer who is licensed by the North Carolina Board of Examiners for Engineers and Land Surveyors to practice engineering and who has special knowledge of traffic engineering principles through a combination of education, training and experience.

Traffic Engineering - The application of scientific and mathematical principles to facilitate the safe and efficient movement of people, goods and information.

Traffic Impact - A measurable, quantifiable or qualified effect on one or more traffic performance measures. Traffic impacts can be beneficial or detrimental.

Traffic Performance Measures - Synonymous with Measures of Effectiveness.

Traffic Sign - A device mounted on a fixed or movable support, conveying a message or symbol to regulate, warn or guide traffic.

Traffic Study - A collective term for Trip Generation Reports, Traffic Assessment

Report or Traffic Impact Analysis Reports (see below) -

- a) Trip Generation Report: Calculates the expected number of new trips that a development will generate during the AM and PM peak periods. Trip generation reports are required for all rezoning cases. Exceptions can be made for rezoning cases that do not affect the trip generation characteristics of the property such as tree conservation areas, stormwater retention, location and size of building signs, etc.
- b) Traffic Assessment (TA) Report: Calculates the expected number of new trips and calculates the current amount of delay, queuing and traffic capacity available at the nearest intersection(s). If existing delays and volume-to capacity ratios are low, City staff may conclude that the adjacent roadway network can absorb new trips without becoming congested. In that case, no further study is needed.
- c) Traffic Impact Analysis (TIA) Report: Calculates the expected number of new trips and calculates the current amount of delay, queuing and traffic capacity available at the nearest intersections. TIAs calculate the amount of delay, queuing and volume-to-capacity ratio and other variables both before and after a development is built. City staff will then use engineering judgment to determine if the developers should mitigate some of the traffic impacts from their development by adding a new turn lane or installing some other improvement. If mitigation is recommended, the TIA shall recalculate the traffic impacts after the mitigation measures have been installed. It will quantify those impacts that can be directly attributed to the new development and the effect of any mitigation.

Travelway - The travelway refers to the paved width of a street between curbs accommodates moving and stationary vehicles in a variety of modes.

Trip - Travel between an origin and a destination.

Traffic Volume - The number of vehicles passing a given point during a specified period of time

Street Design Manual Updates

Effective July 1, 2018

The Street Design Manual is a support document to the Unified Development Ordinance (UDO) that assists with specific design details related to the engineering aspects of the street types and transportation specific requirements for the right-of-way and land uses. The original document was adopted by Council November 19, 2013.

| Page | Reference | Text |
|------|--------------|--|
| 1 | Introduction | It is recognized that certain improvements financed wholly or in part with State and Federal funds are subject to the regulations and standards prescribed by those agencies. Such regulations and standards may be different than those of the City and may take priority over City regulations and standards presented in this manual. The guidance presented herein is based on nationally-accepted design parameters, including AASHTO's A Policy on the Geometric Design of Highways and Streets and Flexibility in Highway Design, and supplemented by context-specific guidance such as that contained in the joint ITE/CNU Designing Walkable Urban Thoroughfares: A Context Sensitive Approach, and context-specific guidance for design and installation of green stormwater infrastructure (GSI). |

| Page | Reference | Text |
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| 2 | Introduction | <p>City streets are a primary source of current and future stormwater runoff. For more sustainable stormwater management the City of Raleigh also supports the use of context-sensitive GSI within certain street typologies. The City of Raleigh’s Comprehensive Plan includes a number of policies encouraging use of green stormwater infrastructure, including but not limited to Policy EP 2.1 Green Infrastructure, EP 3.1 Water Quality BMPs; EP 3.8 Low Impact Development; PU Sustainable Stormwater Management; and PU 5.4 Discharge Control Methods. The City of Raleigh has determined that numerous street typologies in the UDO offer opportunities for using GSI while providing multiple community benefits. Guidance is provided herein on appropriate standard design details and planting features that can allow effective use of GSI in these right-of-way areas while meeting other Complete Street goals and design needs. Implementation of GSI elements can be approached by evaluating opportunities and constraints within each zone of the right-of-way and considering potential benefits, risks, and technical design factors. While the sections contained herein were developed with City’s and NCDOT’s Complete Streets Policy and the City’s GSI policy; some sections may vary somewhat from the NCDOT standards in order to be consistent with a certain land use or development type context.</p> |
| 3 | Article 1.3 Process of Street Design | <p>Streets shall be designed to be consistent with the City’s Complete Streets Implementation Policy and GSI-related policies and supportive of their contexts. The goals shall be to serve all modes of mobility which occur within those contexts in a safe and efficient manner and manage stormwater in ways that are sustainable and multi-functional.</p> |
| 4 | Article 2.1 Streetscape | <p>The Streetscape is located on both sides of the Travelway. The Streetscape is the primary pedestrian realm, accommodating people walking, stopping, and sitting, and also functions as the transitional area between moving traffic and land uses. The streetscape is also the place where transitions between the pedestrian mode and other modes of transportation occur, and thus its design characteristics including landscaping, aesthetics, multimodal accessibility to support desired development patterns. Sidewalks, the planting area, and the maintenance strip behind the sidewalk are conducive to the use of GSI within the streetscape in certain street typologies. Applicable GSI practices include permeable pavement, curbside bioretention/planters, tree wells/planter boxes, rain barrels, and flow-through stormwater planters.</p> |

| Page | Reference | Text |
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| 5 | Article 2.2 Travelway | A. On-Street Parking - Parking within the ROW, typically adjacent to a curb, accommodates automobiles, bicycles or other vehicles. Parallel orientation is most common, though angled (head in and back in) parking may be used to provide additional spaces where sufficient ROW exists and off-street parking capacity is very limited. The presence of on-street parking encourages lower vehicular travel speeds on streets and buffers pedestrians from moving traffic. In certain street typologies, permeable pavement can be incorporated into street parking areas, and bioretention can be incorporated into corner bulb-outs at intersections and curbside extensions/bump-outs. |
| | Article 2.2 Travelway | B. Gutter and/or Shoulder - The choice between gutter and shoulder for transitioning from Travelway to Streetscape depends primarily on area drainage characteristics, environmental sensitivity, land use intensity, and aesthetic intent. For most street typologies, a cross-section supporting more urban development involves the use of curb and gutter. Variations on traditional gutter and/or shoulder designs can be used to incorporate GSI elements. See Section 12.4, Curb and Gutter, for more detail on curb and gutter design. Applicable GSI practices include curb extensions/bump-outs and intersection bulb-outs, which are incorporated into the gutter, shoulder, or other transition, and bioswales, which can take the place of traditional curb and gutter in some applications. Permeable pavement also can be appropriate for use in the shoulder. |
| | Article 2.2 Travelway | C. Median - Medians can range in width depending on street type and context. They may accommodate integrated turn lanes, pedestrian refuges at cross-streets and mid-block, drainage swales, shade trees, promenades, transit lines and stations. If space permits, landscaped medians provide a beneficial aesthetic and street narrowing effect in almost any context. Medians are conducive to the use of GSI elements that can offer several benefits. Depressed medians can be designed as bioretention islands or vegetated/bioswales that incorporate curb cuts to allow runoff to pass from gutters or other conveyance to these depressions. Alternatively, rock swales can be incorporated in medians where growth and/or maintenance of vegetation may be difficult. Permeable pavement also can be installed in medians as an alternative to conventional, impervious pavement, where the use of vegetation is not suitable. |
| 8 | Section 3.2.1 Sensitive Area Streets | In areas of Raleigh where stormwater does not drain into pipe systems , other forms of drainage must be provided. |

| Page | Reference | Text |
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| 9 | 3.2.1 A - Sensitive Area Parkway | <p>A Sensitive Area Parkway would be most appropriate as a high volume regional connector road where surroundings are primarily conservation or agricultural land. Multiuse trails on both sides of the street is a preferred way to accommodate pedestrians and cyclists. Ideally, both trails and shoulders are installed. Express transit service may be implemented on Sensitive Area Parkways.</p> <p>Sensitive Area Parkways are conducive to the use of GSI practices. Per UDO Article 9.5, where development impervious cover is more than 24% in any Secondary Water Supply Watershed Protection Area, the first inch of rainfall from the streets must be managed with use of GSI, unless a design exception is approved by the City. In these Protection Areas, permeable pavement may be appropriate for multiuse trails, bioswales and bioretention areas may be appropriate as alternatives to conventional drainage ditches, and combinations of trees and native vegetation may be appropriate as an alternative to conventional tree lawns.</p> |
| 10 | 3.2.1 B - Sensitive Area Avenue | <p>A Sensitive Area Avenue is used in rural conditions where it provides important connectivity for multiple travel modes. It should not be used in a completely residential setting (see “Sensitive Area Residential Street” instead.) The Sensitive Area Avenue type provides great flexibility in accommodating future growth, and can be reconfigured to a “Main Street” cross-section within targeted development nodes if drainage facilities were upgraded. Sidewalk is required on both sides of the street.</p> <p>Sensitive Area Avenues are conducive to the use of GSI practices. Per UDO Article 9.5, where development impervious cover is more than 24% in any Secondary Water Supply Watershed Protection Area, the first inch of rainfall from the streets must be managed with use of GSI, unless a design exception is approved by the City. In these Protection Areas, permeable pavement may be appropriate for multiuse trails, bioswales and bioretention areas may be appropriate as alternatives to conventional drainage ditches, and combinations of trees and native vegetation may be appropriate as an alternative to conventional tree lawns.</p> |

| Page | Reference | Text |
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| 11 | 3.2.1 C - Sensitive Area Residential Street | <p>Sensitive Area Residential Streets are installed in places where natural runoff water drainage is preferred, and traffic volume is relatively low. Typically, this type would be used in an agricultural or primarily low-density residential setting. Sidewalk is required on both sides of the street.</p> <p>Sensitive Area Residential Streets are conducive to the use of GSI practices. Per UDO Article 9.5, where development impervious cover is more than 24% in any Secondary Water Supply Watershed Protection Area, the first inch of rainfall from the streets must be managed with use of GSI, unless a design exception is approved by the City. In these Protection Areas, permeable pavement may be appropriate for multiuse trails, bioswales and bioretention areas may be appropriate as alternatives to conventional drainage ditches, and combinations of trees and native vegetation may be appropriate as an alternative to conventional tree lawns.</p> |
| 13 | 3.2.2 A - Neighborhood Yield | <p>Neighborhood Yield is an unstriped two-way street accommodating parallel parking on one side. Neighborhood Yield streets operate best under low speed and volume conditions, giving opposing vehicle drivers the time and space necessary to successfully negotiate potential conflicting movements and serving no more than 40 units and no longer than ½ mile. Sidewalks are required on both sides of the street. Items in the amenities zone such as streetlights and trees should be installed at a pedestrian scale so as to provide a high level of comfort for residents and non-motorized street users. Neighborhood Yield is conducive to the use of GSI practices including curbside bioretention and permeable pavement in sidewalks.</p> |
| 14 | 3.2.2 B - Neighborhood Local | <p>Neighborhood Local Streets are used in primarily residential developments serving from 41 and up to 150 residential units and no longer than ½ mile. They accommodate on-street parallel parking on both sides and feature two general travel lanes for vehicular use, including automobiles, bicycles, and occasional local transit or freight vehicles. Sidewalks are required on both sides of the street. Traffic calming design elements such as intersection bulb-outs and curb extensions/bump-outs can help moderate vehicle speeds on Neighborhood Locals, which are conducive to use of GSI practices including curbside bioretention, bioretention in bulb-outs and/or curb extensions, and permeable pavement sidewalks.</p> |

| Page | Reference | Text |
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| 15 | 3.2.2 C - Neighborhood Street | Neighborhood Streets are used primarily in areas serving between 151 and up to 350 residential units, and where residential uses may be compatible with non-residential uses in a mixed-use context. They accommodate on-street parallel parking on both sides and feature two general travel lanes for vehicular use, including automobiles, bicycles, and occasional local transit or freight vehicles. Sidewalks are required on both sides of the street. Traffic calming design elements such as intersection bulb-outs can help to moderate vehicle speeds on Neighborhood Streets. Traffic calming design elements such as intersection bulb-outs and curb extensions/bump-outs can help moderate vehicle speeds on Neighborhood Streets, which are conducive to use of GSI practices including curbside bioretention, bioretention in bulb-outs and/or curb extensions, and permeable pavement sidewalks. |
| 16 | 3.2.2 D - Multifamily Street | Multi-Family Local Streets are intended to provide direct lot access and a relatively high level of on-street parking capacity in residential settings (Apartments and Townhomes). Two general travel lanes are present along with the allowance of a row of parking on each side in a parallel, perpendicular or angled configuration. Multi-family streets are to be used exclusively for residential developments built under the apartment or townhouse building types defined in the Unified Development Ordinance. Sidewalks are required on both sides of the street in a public easement. In these sections, the parking is not in the right of way, and the use of permeable pavement can be used in on-street parking areas. Multifamily Streets also are conducive to use of GSI practices including curbside bioretention, bioretention in bulb-outs and/or curb extensions, and permeable pavement sidewalks. |
| 18 | 3.2.3 A - Avenue 2-Lane, Undivided or Divided | This type is intended primarily for use in situations on roads directly adjacent to the Streetscape. The existing context may include any land use, but is often characterized by architecture such as strip malls, internally oriented subdivisions serving > 350 dwelling units with a middle turn lane, or detached development with large setbacks. In recognition of the fact that this type of facility often plays a significant role in local multimodal mobility, the cross-section provides distinct general travel and bicycle lanes. Sidewalks are required on both sides of the street. Where the travel lanes are divided by a median, the use of GSI practices are encouraged for stormwater management; bioretention is encouraged in depressed medians and permeable pavement is encouraged in raised medians. |

| Page | Reference | Text |
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| 19 | Section 3.2.3 - B Avenue 3-Lane, Parallel Parking | <p>A Three-lane Avenue with on-street parking and bike lanes offers significant flexibility. The cross-section is ideal to use in a context featuring residential uses with some ground floor commercial uses or in areas with a mixture of uses. This type provides significant multimodal accessibility and mobility, yet maintains lower speeds and an appealing character, particularly when the center lane includes some landscaped median features. Sidewalks are required on both sides of the street. Use of GSI practices may be desirable with Three-lane Avenues, including permeable pavement for sidewalks and on-street parking areas and bioretention within medians. In addition, Three-lane Avenues also are conducive to use of curbside bioretention and bioretention in curb extensions/bump-outs, stormwater planter boxes, and stormwater street trees (also referred to as tree boxes) as alternatives to tree grates.</p> |
| 20 | Section 3.2.3 - C Main Street, Parallel or Angular Parking | <p>The Main Street type is most appropriate where active frontage and mixed commercial uses exist. On-street parking can be installed in parallel or angled fashion, depending on need and available right-of-way. Due to high anticipated pedestrian activity, design speeds are kept low. This condition also allows bicycles to share space with automobiles in general travel lanes, negating the need for distinct bike lanes. Main Streets are primary candidates for “festival” treatments, in which a portion of the street may be temporarily restricted to non-motorized traffic only for special events. Additional landscaping and traffic calming techniques that are well-suited for Main Streets include street trees in grated wells, bioretention areas/planters, curb bulb-outs with or without bioretention, and a relatively high density of street furniture and public art. Main Streets also are conducive to the use of permeable pavement in on-street parking areas and for sidewalks. Pedestrian-scale street lighting should be installed, and utilities should be located underground, in alleys or other streets to the greatest extent possible. Sidewalks are required on both sides of the street.</p> |
| 21 | Section 3.2.4 Major Streets | <p>Boulevards are designed to support multiple travel modes, including automobiles, freight movers, transit vehicles, pedestrians and bicyclists. Boulevards balance high vehicular capacity with high pedestrian and vehicular accessibility to adjoining urban land uses. Landscaped medians, including those incorporating GSI practices, separate and buffer through traffic from a local access are that accommodate parking, low-speed vehicular traffic, bicyclists and pedestrians.</p> |

| Page | Reference | Text |
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| 22 | 3.2.4 A - Avenue 4-Lane, Parallel Parking | The Four-lane Avenue provides a good level of mobility for all street users, and is a preferred street type for urban contexts where transit vehicles and cyclists are part of the traffic mix. Medians provide refuge for crossing pedestrians. For more pedestrian-intensive contexts, the width of the Streetscape may be expanded. Curb parking provides vehicular access to adjoining land uses and buffers pedestrians from moving traffic. Sidewalks are required on both sides of the street. Four-lane Avenues are conducive to use of GSI practices including street trees in grated wells, curbside bioretention and/or bioretention in curb extensions/bump-outs, and bioretention in medians. Permeable pavement may be desirable within on-street parking areas and for sidewalks. |
| 23 | 3.2.4 B - Avenue 4-Lane and 6-Lane, Divided | This cross-section features four or six general travel lanes, bike lanes, and buffered sidewalks on both sides of the street. Due to the emphasis on through vehicle mobility, it is not conducive to on-street parking; however, the outside general travel and bike lane could be reconfigured to be a transit / bike / right-turn only lane if warranted by context and placed within the multimodal transportation network. Four- and Six-lane Divided are conducive to use of GSI practices including street trees in grated wells, curbside bioretention and/or bioretention in curb extensions/bump-outs, and bioretention in medians. Permeable pavement may be desirable within on-street parking areas and for sidewalks. |
| 24 | 3.2.4 C - Multi-Way Boulevard, Parallel or Angular Parking | A Multi-Way Boulevard is used to provide a high level of both access and mobility. These boulevards consist of general travel lanes separated from side accessways with raised center and side medians, which contain landscape features, transit shelters, or other items. On-street parking is placed within accessways, either in parallel or angled fashion. Bicyclists are expected to use accessway lanes rather than general travel lanes for mobility. Sidewalks are required on both sides of the street. Multi-Way Boulevards are conducive to use of GSI practices including street trees in grated wells, curbside bioretention and/or bioretention in curb extensions/bump-outs, and bioretention in medians. Permeable pavement may be desirable within on-street parking areas and for sidewalks. |
| 26 | 3.2.5 A - Industrial Street | Industrial Streets are conducive to use of GSI practices including curbside bioretention, bioretention in curb extensions/bump-outs, and permeable pavement for sidewalks. |

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| 27 | 3.2.5 B - Alley, Residential (Private) | Residential alleys can provide access to accessory housing units and rear-entry parking, as well as provide a location for utilities and services such as garbage removal if built to street standards to support those types of vehicles. They vary in total width from 16 to 20 feet. Alleys can also provide shortcuts for pedestrians and cyclists. Because of their relatively low traffic volumes and vehicle loads, Residential Alleys often can accommodate GSI practices such as permeable pavement and alternative curb systems. |
| 28 | 3.2.5 C - Alley, Mixed-Use (Private) | Mixed Use Alleys provide access to service entrances, loading docks and garages as well as providing a location for utilities and garbage. They vary in width from 20 to 24 feet, depending on whether they are one-way or two-way. Due to their relatively low traffic volumes and vehicle loads, Mixed-Use Alleys often can accommodate GSI practices such as permeable pavement and alternative curb systems. |
| 30 | 3.2.6 A - Primary Internal Access Drive | The primary internal access drive type can be applied to the main entrances of major developments set back from roads such as malls, corporate offices, and high-volume strip centers. It provides pedestrian and vehicular access as well as design flexibility for future retrofits (such as infill development adjacent to this street). This type is typically applied to a private easement within a property, though may be converted to future public use as part of a grid-reliant infill and redevelopment opportunity. Sidewalks are required on both sides of the street. Primary Internal Access Drives are conducive to use of GSI practices including street trees in grated wells and curbside bioretention, bioretention in curb extensions/bump-outs, and permeable pavement for sidewalks and in parking areas that are not part of the travel lanes. |
| 31 | 3.2.6 B Pedestrian Passage | Pedestrian Passageways are off-limits to motorized vehicles and provide additional pedestrian and bicycle connectivity through medium and large blocks. They may be used in any context. The type may also be applied to standalone greenways and shall be constructed of a durable material to facilitate pedestrian movements and are dedicated as public access easements. The addition of a pedestrian passage permits an increase in minimum block perimeter as per Section 8.3.2 B 3 of the UDO. Pedestrian Passageways are well-suited for incorporating permeable pavement as a GSI practice. |
| 40 | Article 5.4 Reimbursements - Improvements Eligible for Reimbursements | Stormwater infrastructure: In accordance with UDO Section 8.6.5, the City may reimburse a developer for stormwater infrastructure C. Improvements that are over and above improvements needed for the development to comply with any ordinance or regulation. The following D. Improvements may be eligible for reimbursement: |

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| | | <p>a. Stormwater treatment practices, including GSI practices, for treating stormwater otherwise conveyed within the street rights-of-way; and</p> <p>b. Stormwater conveyances, including pipes, culverts, ditches, swales, and channels, associated with and needed for such stormwater treatment practices.</p> <p>E. Eligibility for reimbursement shall be subject to availability of funds and to prior determination of eligibility for reimbursement by the Engineering Services Director or a designee. The obligations of</p> |
| 41 | Article 5.4 Reimbursements - Expiration of Reimbursements | <p>A. Any request for reimbursement for street, greenway, utility, or stormwater infrastructure installation must be submitted to the City within years of completion and final acceptance by the City or State, whichever is applicable.</p> |
| 43 | Section 6.1.3 Minimum Stormwater Infrastructure Requirements | <p>A. The developer shall be responsible for all applicable stormwater drainage and treatment practices as required in Article 9 of the Unified Development Ordinance and the City Stormwater Design Manual.</p> <p>B. Use of multi-functional stormwater control measures is expressly allowed and encouraged in the ROW, including streetscape landscape bioretention areas and stormwater planters, stormwater street trees, curb bulbouts and medians with bioretention, and vegetated swales. Such stormwater control measures may receive stormwater credit for managing stormwater from the adjacent right-of-way area of the development site if part of an approved stormwater management plan and with a long-term maintenance agreement.</p> |
| 74 | Article 11.1 Streetscape Types | <p>D. In accordance with UDO Section 8.5.2, the required streetscape type is determined by the zoning district or by the designated frontage. Where there is a conflict between a designated frontage and the zoning district, the designated frontage standard applies. Dimensional standards for planting area, tree spacing, and utility placement and the planting type may be varied to accommodate GSI practices. The Planning and Development Officer and the Urban Forester shall make the final determination. Design specifications for streetscape improvements can be found in this Street Design Manual, the City Tree Manual, and the City Stormwater Design Manual .</p> |

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| 78 | Section 11.2.5 Planting Area | <p>Tree Planting All required street trees shall be installed in the planting area per City of Raleigh Standards and the City Tree Manual. A. Unless otherwise noted below, all trees planted in accordance with Article 8.2 of the UDO must be shade trees. B. Where overhead utilities exist, 1 understory tree shall be planted every 20 feet on center, on average. Required understory trees may be installed within GSI practices. Up to 20% of required understory trees may be offset by installing vegetated GSI practices, such as stormwater planter boxes. A maintenance plan must be approved for the GSI practice according to Section 9.2.2.D.</p> <p>C. All required street trees must meet the design and installation requirements of Section 7.2.7 of the UDO. If a GSI practice is part of an approved stormwater management plan for the site, required street trees may be installed within the GSI practice. A maintenance plan must be approved for the GSI practice according to Section 9.2.2.D.</p> |

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| | Section 11.2.5 Planting Area Planting for Development Abutting NCDOT Streets | <p>A. Where development abuts a street controlled by the North Carolina Department of Transportation as shown on the <i>Raleigh Powell Bill Map</i> , street trees may not be required in the right-of-way, at the discretion of the North Carolina Department of Transportation. In this instance, a Type C2 street protective yard is required in accordance with <i>Section 7.2.4 of the UDO</i> . See the <i>Guidelines for Planting within Highway Right-of-Way on NCDOT maintained roads for guidance</i>.</p> <p>B. Unless otherwise noted below, all trees planted in accordance with this Article must be shade trees.</p> <p>C. In accordance with Section 7.2.4.B.4. of the UDO, GSI practices shall be allowed in Street Protective Yard Type C2. In order to accommodate GSI practices, the number of shrubs may be reduced in these protective yards by ten (10) percent.</p> <p>D. In accordance with UDO Section 7.2.7.C.4.a., in protective yards, 50% of required trees shall be locally-adaptive evergreen species, except where an approved GSI practice is in a protective yard.</p> <p>E. In accordance with UDO Section 7.2.7.C.5.b.vi., to accommodate multi-functional GSI practices as part of an approved stormwater management plan, the number of shrubs may be reduced in Protective Yards by 10%, non-evergreen species may be used in lieu of up to 35% evergreen shrubs, and all shrubs may be 24 inches when planted. Also see the <i>Guidelines for Planting within Highway Right-of-Way on NCDOT maintained roads for guidance</i>.</p> <p>F. Where the planting area is to be used for stormwater management, vegetation shall adhere to recommended plant species in the NC DEQ Stormwater Design Manual.</p> |
| 79 | Section 11.2.6 Street Furniture | h) Stormwater flow-through planters i) Rain barrels |

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| 79 | Section 11.2.7 Drainage and Green Stormwater Infrastructure | Drainage of stormwater runoff away from the streetscape is necessary to retain the function of travel and pedestrian areas as well as for purposes of maintaining integrity of streetscape infrastructure. The location and type(s) of storm drainage features vary by street type; the choice between curb/gutter and shoulder depends primarily on area drainage characteristics (per Article 2.2). Stormwater drainage devices (e.g., pipes, catch basins) are required in streetscapes with curb and gutter treatments. Drainage swales/ditches are typically used to provide drainage in areas where storm sewers are not present, except in secondary Water Supply Watershed Protection Areas. On wider street cross-sections, drainage may occur in medians and/or behind the curb. GSI practices are allowed in the streetscape in accordance with the City's standard details. Installation of GSI practices must not negatively impact existing street drainage patterns. Curb extension/bump-out and median design must maintain drainage of stormwater and not cause ponding within travel or pedestrian areas. |
| 85 | Article 12.1 | E. Consideration of GSI practices is encouraged in roadway improvement projects. |
| 97 | Article 12.4 Drainage, Curb, and Gutter Design | Drainage of stormwater runoff from travel lanes, and parking spaces in the Travelway and from pedestrian sidewalks and other hardened infrastructure in the Streetscape is essential for safe and functional use of these areas. Although drainage is most conventionally accomplished through surface runoff to concentrated conveyances such as curb and gutter systems and then to drainage pipes for ultimate discharge outside of the right-of-way, an alternative means of providing street drainage is the use of non-paved areas for stormwater storage and infiltration using GSI practices. |
| | | All public roadways inside the corporate limits of the City, and outside the City where water or sewer is connected to the City utility system, shall be constructed with standard curb and gutter or an alternative curb system to accommodate GSI stormwater management. Alternative curb systems include flat curb, standard curb with openings, and other curb systems approved by the Engineering Services Director or a designee. Details for curb and gutter installations can be viewed in the <i>City of Raleigh Standard Details</i> . See Detail T-10.26.1 for standard curb and gutter installation. See Detail T-10-26.2 for alternative curb installation. |
| 97 | Section 12.4.1 Curb Installation requirements | 4. Curb openings may be used where drainage conveyance from one side of the curb to another is needed to accommodate the use of GSI practices. |

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| 98 | Section 12.4.1 Curb Installation requirements | <p>B. Alternative curb systems, such as no-elevation curb, curb openings, flat curb, and other alternative systems, may be allowed in place of standard curb and gutter systems as described in Section 12.4.1, subject to:</p> <ul style="list-style-type: none"> a. Stormwater control measures shown on the stormwater control master plan for a new development or expansion of existing development must control stormwater on a runoff volume basis in accordance with UDO Section 9.2.2.B.1.c.; and b. Approval by the Engineering Services Director or a designee after considering situation-specific factors including, but not necessarily limited to, pedestrian safety, vehicular safety, historic preservation, streetscape aesthetics, and management of stormwater collection and conveyance outside the Travelway without resulting in soil erosion or otherwise impacting the integrity of the drainage system. |
| 99 | Section 12.4.3 Drainage and Green Stormwater Infrastructure | <p>A. The use of GSI practices for managing stormwater within the right-of-way is encouraged. GSI practices typically are installed behind the curb either outside of the Travelway or in a median or curb bump-out. Figure 5 shows example placement of GSI devices and additional information for several GSI practices that can be found in the City of Raleigh Standard Details .</p> |
| 100 | Figure 5 Example Green Stormwater Infrastructure elements near a street intersection | New Detail |