

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 The Streets, Sidewalk and Driveway Access Handbook is hereby repealed coincident with the adoption of the Raleigh Street Design Manual.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

Purpose and Scope

This Manual has been developed in conjunction with the Unified Development Ordinance (UDO hereby), 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 **Development Services Director**, or his/her designee thereafter referred to as the **Development Services 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.

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.

Raleigh's Unified Development Ordinance sets forth many street typologies to work with various streetscapes and frontage types. While the UDO establishes the appropriate street type, this Street Design Manual assists with specific design details related to the engineering aspects of the various street typologies. 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. 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:

- **The Arterials, Thoroughfares, and Collector Plan the Street Plan Map in the Transportation Element of Raleigh's Comprehensive Plan;**
- **NCDOT Transportation Improvement Program;**
- **Capital Improvement Program;**
- **City of Raleigh and Wake County Short and Long-Range Transit Plans;**
- **Capital Area Metropolitan Planning Organization;**
- **City Council authorized Street and Sidewalk Projects;**
- **2030 Comprehensive Plan;**
- **American Association of State and Highway and Transportation Officials (AASHTO);**
- **Manual on Uniform Traffic Control Devices (MUTCD);**
- **Public Right of Way Advisory Group (PROWAG);**
- **American with Disability Accessible Design Requirements;**
- **NCDOT Policy on Street and Driveway Access To North Carolina Highways Manual;**
- **The City of Raleigh Complete Streets Policy (Adopted June 2, 2015);**
- **Advancing Green Infrastructure and Low Impact Development in Raleigh (CR-11791).**

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CHAPTER 1. STREET TYPES

Article 1.1 Process of Street Design

Section 1.1.1 Intent

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.

Article 1.2. Street Element Overview

Section 1.2.1. 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 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.

Section 1.2.2. 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.

Section 1.2.3. Roadway Classification Design Vehicle Type

The **Design Vehicle Table (Table 1)** lays out the vehicle types have been used in the engineering specifications for each street type. Every street type shall appropriately accommodate emergency vehicles and Solid Waste Pickup 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) |

Article 1.3. Street Types

Section 1.3.1 Street Types Overview

These street typologies are set forth in the Unified Development Ordinance, Article 8.4. This Manual provides schematic and required dimensions for the typologies with additional and more detailed engineering and technical specification. Cross-sections of each can be found in the City of Raleigh Standard Details.

A. Sensitive Area Streets

1. Sensitive Area Parkway
2. Sensitive Area Avenue
3. Sensitive Area Residential Street

B. Local Streets

1. Neighborhood Yield
2. Neighborhood Local
3. Neighborhood Street
4. Multifamily Street

C. Mixed Use Streets

1. Avenue 2-Lane, Undivided or Divided
2. Avenue 3-Lane, Parallel Parking
3. Main Street, Parallel or Angular Parking

B. Major Streets

1. Avenue 4-Lane, Parallel Parking
2. Avenue 4-Lane and 6-Lane, Divided
3. Multi Way Boulevard, Parallel Parking or Angular Parking

C. Industrial and Service Streets

1. Industrial Street
2. Alley, Residential
3. Alley, Mixed Use

D. Accessways

1. Primary Internal Access Drive
2. Pedestrian Passage

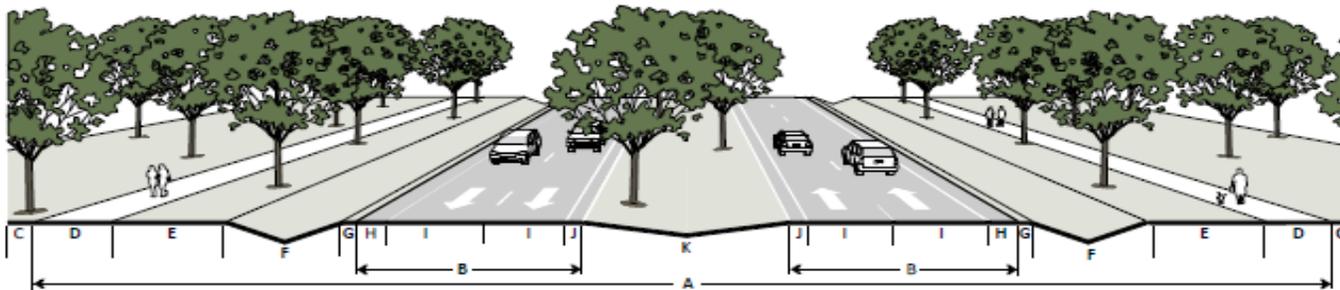
Section 1.3.2. Sensitive Area Streets

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 Parkway**s are semi-limited access corridors and 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.

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.

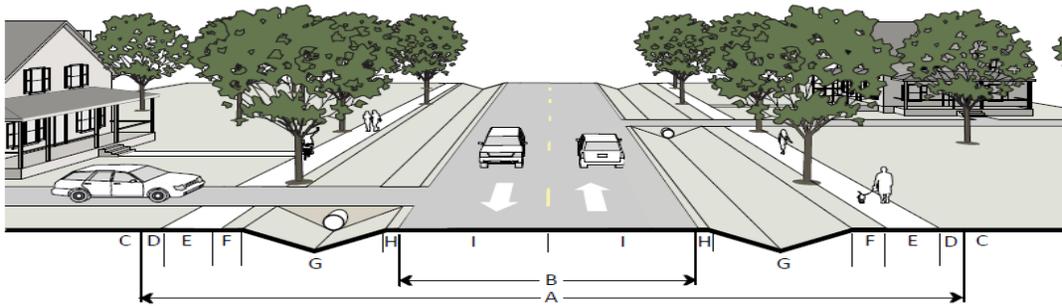


| Width | |
|-------------------------------|------------------|
| A Right-of-way width | 154' |
| B Pavement width | 32' |
| Streetscape | |
| C Maintenance strip | 2' |
| D Multi-use trail (min) | 10' |
| E Planting area (min) | 6' |
| F Drainage (min) | 10' |
| Travelway | |
| G Grassed shoulder | 2' |
| H Paved shoulder/bicycle lane | 4' |
| 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. average |

| Engineering Specifications | |
|---------------------------------|---|
| Standard Construction Detail | T-10.07 Sensitive Area Avenue |
| Design Speed (mph) | 50 mph |
| Design Vehicle | WB-62 |
| Signalized Intersection Density | As warranted |
| Driveway Spacing | 1/4 mile, minimum |
| 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 | As needed |

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.

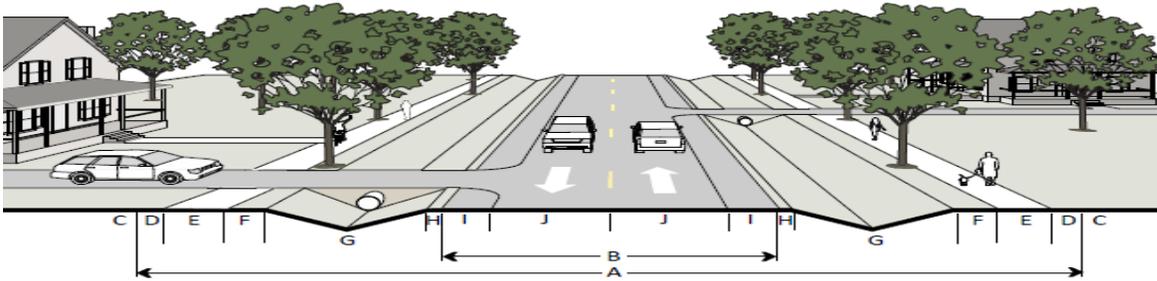


| Width | |
|-------------------------------|------------------|
| A Right-of-way width | 80' |
| B Pavement width | 30' |
| Streetscape | |
| C Utility placement, easement | 5' |
| D Maintenance strip (min) | 2' |
| E Sidewalk (min) | 5' |
| F Planting area (min) | 6' |
| G Drainage (min) | 10' |
| 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. average |

| Engineering Specifications | |
|---------------------------------|---|
| Standard Construction Detail | T-10.08 Sensitive Area Avenue |
| Design Speed (mph) | 50 mph |
| Design Vehicle | WB-62 |
| Signalized Intersection Density | As warranted |
| Driveway Spacing | 1/4 mile, minimum |
| 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 | As needed |

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 | 80' |
| B Pavement width | 30' |
| 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' |
| J Travel lane | 11' |
| General | |
| Walkway type | Sidewalk |
| Planting type | Tree lawn |
| Tree spacing | 50' o.c. average |

| Engineering Specifications | |
|---------------------------------|---|
| Standard Construction Detail | T-10.09 Sensitive Area Residential Street |
| 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 1.3.3. Local Streets

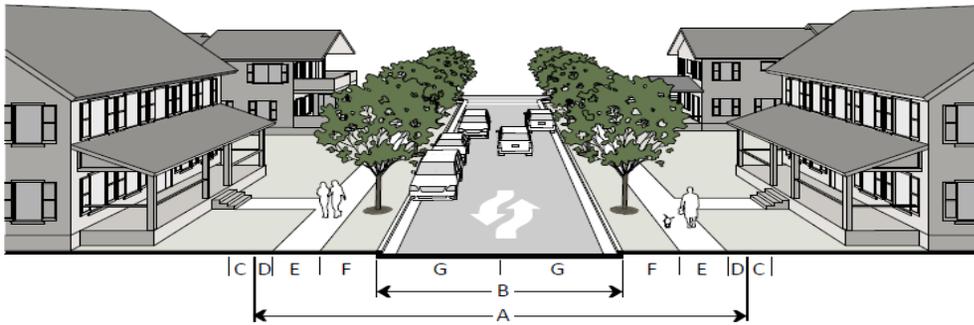
Local Streets provide access to individual lots, accommodate pedestrians and serve as low speed bicycle and vehicle routes. Local streets should be relatively short in total distance and used less frequently compared to other street typologies. **Table 2 – Unit Specifications for Local Street Types** 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 (150 units or less) |

A. Neighborhood Yield Street

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.

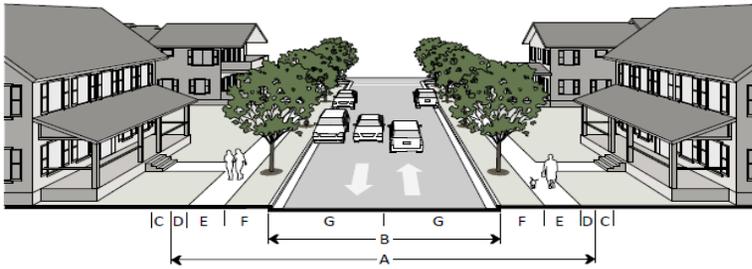


| Width | |
|--------------------------------|------------------|
| A Right-of-way width | 55' |
| B Back-of-curb to back-of-curb | 27' |
| Streetscape | |
| C Utility placement, easement | 5' |
| D Maintenance strip (min) | 2' |
| E Sidewalk (min) | 6' |
| F Planting area (min) | 6' |
| Travelway |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

| Engineering Specifications | |
|-------------------------------------|---|
| Standard Construction Detail | T-10.10 Neighborhood Yield |
| 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 |

B. Neighborhood Local Street

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.

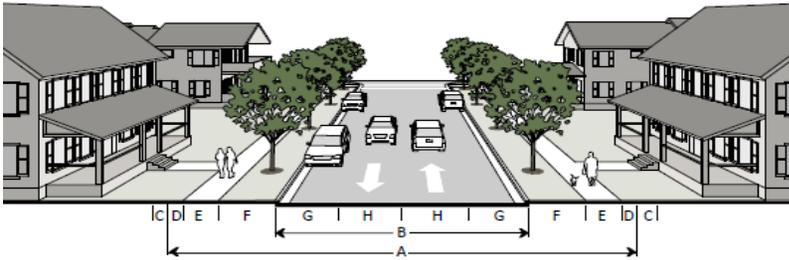


| Width | |
|--------------------------------|------------------|
| A Right-of-way width | 59' |
| B Back-of-curb to back-of-curb | 31' |
| Streetscape | |
| C Utility placement, easement | 5' |
| D Maintenance strip (min) | 2' |
| E Sidewalk (min) | 6' |
| F Planting area (min) | 6' |
| Travelway |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

| Engineering Specifications | |
|---------------------------------|---|
| Standard Construction Detail | T-10.11 Neighborhood Local |
| 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 |

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.

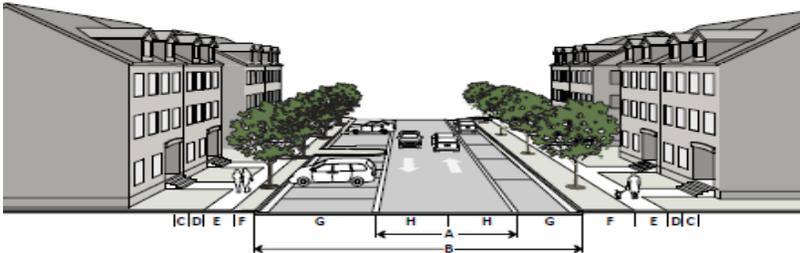


| Width | |
|--------------------------------|------------------|
| A Right-of-way width | 64' |
| B Back-of-curb to back-of-curb | 36' |
| Streetscape | |
| C Utility placement, easement | 5' |
| D Maintenance strip (min) | 2' |
| E Sidewalk (min) | 6' |
| F Planting area (min) | 6' |
| Travelway |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

| Engineering Specifications | |
|---------------------------------|---|
| Standard Construction Detail | T-10.12 Neighborhood Street |
| 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 |

D. Multifamily Street

Multi-Family Local Streets are intended to provide direct lot access and a relatively high level of on-street parking capacity (minimum of 75% along the frontage of this street type) 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. Multi-family streets cannot be used to meet the block perimeter. The street type is limited to 150 units and must tie into the appropriate street section per **Table 2 – Unit Specifications for Local Street Types**. 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. average |
| Parking type | Parallel, head-in, 60 degree angular |

| Engineering Specifications | |
|---------------------------------|---|
| Standard Construction Detail | T-10.13 Multifamily Street |
| 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 1.3.4. Mixed-Use Streets

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

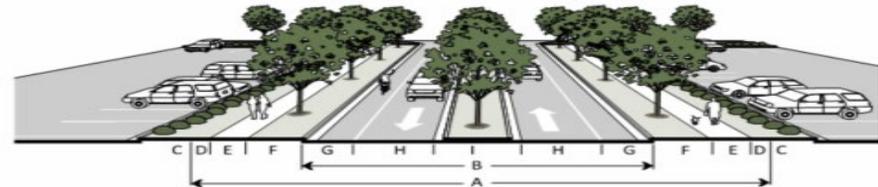
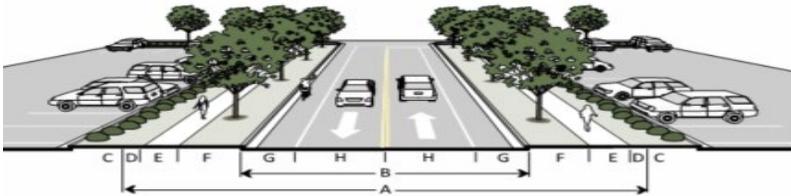
- A. **Avenue 2-Lane, Undivided or Divided**
- B. **Avenue 3-Lane, Parallel Parking**
- C. **Main Street, Parallel or Angular Parking**

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.

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. **The center turn lane right of way width should be used for existing streets. The median right of way width should be used when new streets are constructed, or medians are present along the existing facilities.** 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.

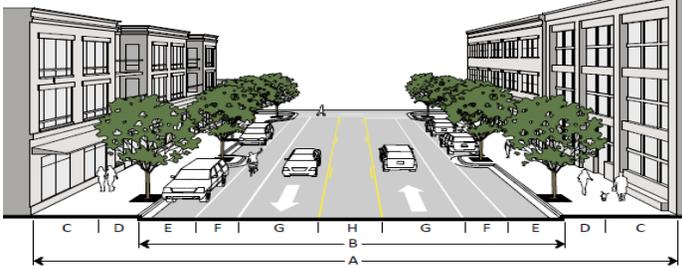


| Width | Undivided | Divided |
|--------------------------------|------------------|------------------|
| A Right-of-way width | 64' | -- |
| With center turn lane | -- | 76' |
| With median | -- | 80' |
| B Back-of-curb to back-of-curb | 36' | -- |
| With center turn lane | -- | 48' |
| With median | -- | 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. average | 40' o.c. average |

| Engineering Specifications | |
|---------------------------------|---|
| Standard Construction Detail | T-10.14 Avenue 2-Lane Undivided |
| Standard Construction Detail | T-10.14 Avenue 2-Lane Divided |
| 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, Shelters |

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. average |
| Parking type | Parallel |

| Engineering Specifications | |
|---------------------------------|---|
| Standard Construction Detail | T-10.16 Avenue 3-Lane, Parallel Parking |
| 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, Shelters |

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.



| Width | Parallel Parking | Angular Parking |
|--------------------------------|------------------|------------------|
| 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/ lawn | Tree grate/ lawn |
| Tree spacing | 40' o.c. average | 40' o.c. average |
| Parking type | Parallel | 60°angle |

| Engineering Specifications | |
|---------------------------------|---|
| Standard Construction Detail | T-10.17 Main Street, Parallel or Angular Parking |
| 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, Shelters |

Section 1.3.5. 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**

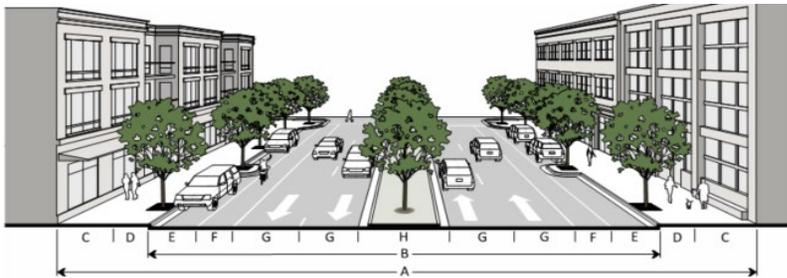
Four- and Six-Lane Avenues have a similar purpose to two- and three-lane Avenues but apply to thoroughfare and arterial streets that require four or more lanes to accommodate traffic demand. Avenues with four or more lanes always feature medians. Signalized intersections are spaced further apart on major 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.

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.

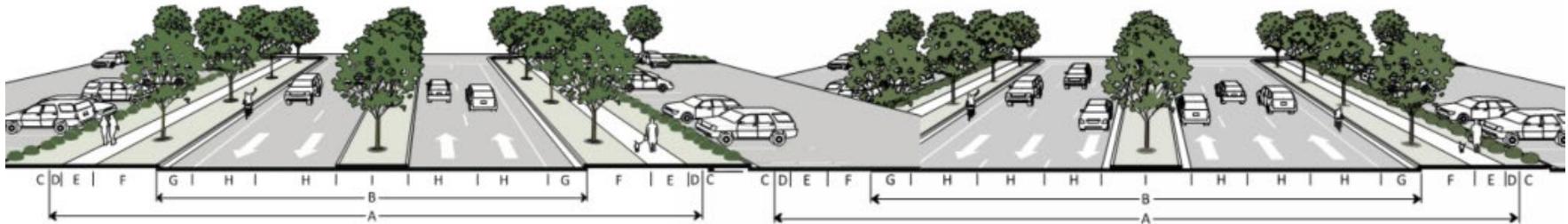


| Width | |
|--------------------------------|------------------|
| A Right-of-way width | 122' |
| B Back-of-curb to back-of-curb | 90' |
| Streetscape | |
| C Sidewalk (min) | 10' |
| D Planting area (min) | 6' |
| Travelway | |
| E Parallel parking lane | 8.5' |
| F Bike lane | 6' |
| G Travel lane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

| Engineering Specifications | |
|---------------------------------|---|
| Standard Construction Detail | T-10.18 Avenue 4-Lane, Parallel Parking |
| 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 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, Shelters |

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.

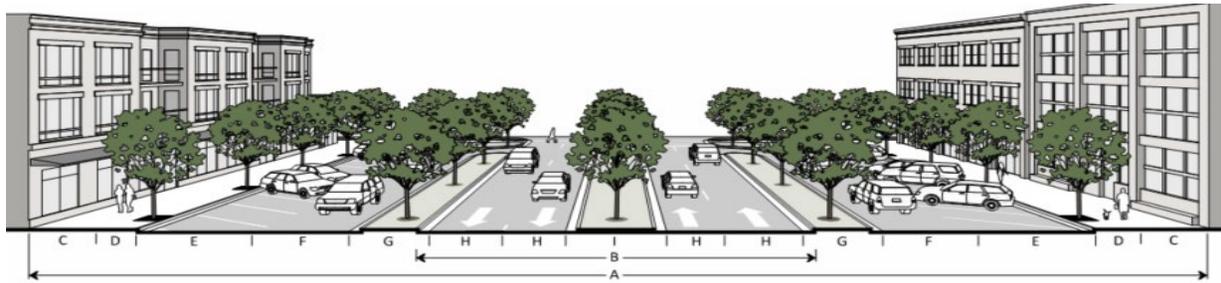


| Width | 4-Lane | 6-Lane |
|--------------------------------|------------------|------------------|
| A Right-of-way width | 104' | 126' |
| B Back-of-curb to back-of-curb | 76' | 98' |
| Streetscape | | |
| C Utility placement, easement | 5' | 5' |
| D Maintenance strip (min) | 2' | 2' |
| E Sidewalk (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 lawn | Tree lawn |
| Tree spacing | 40' o.c. average | 40' o.c. average |

| Engineering Specifications | |
|-------------------------------------|---|
| Standard Construction Detail | T-10.19 Avenue 4-Lane and 6-Lane, Divided |
| 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 |

C. Multi Way Boulevard, Parallel Parking 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.



| Width | Parallel Parking | Angular Parking |
|--------------------------------|-------------------------|--------------------------|
| 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 lawn | Tree lawn |
| Tree spacing | 40' o.c. average | 40' o.c. average |
| Parking type | Parallel in access lane | 60° angle in access lane |

| Engineering Specifications | |
|---------------------------------|---|
| Standard Construction Detail | T-10.20 Multiway Boulevard, Par. or Ang. Parking |
| Design Speed (mph) | 40 mph in general lanes |
| Design Vehicle | WB-40 (Travel Lane), SU-30 (Access Lane) |
| 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 1.3.6. Industrial (Commercial) and Service Streets

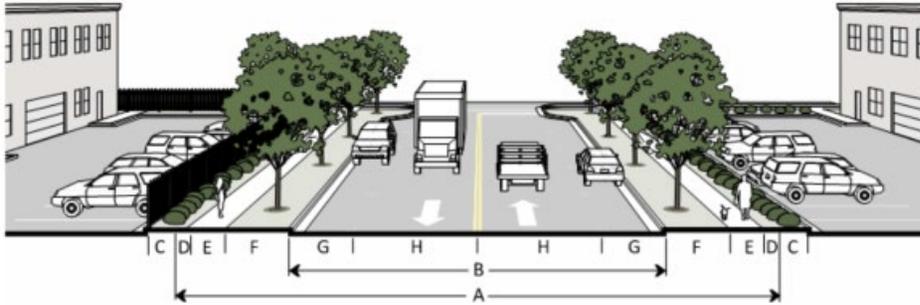
Streets within industrial and service areas typically carry lower traffic volumes but accommodate a higher proportion of truck traffic. Pedestrian facilities do not need to be as generous as in mixed-use areas, and separate bicycle facilities are not provided for. This street section represents the minimum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

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

A. Industrial (Commercial) Street

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

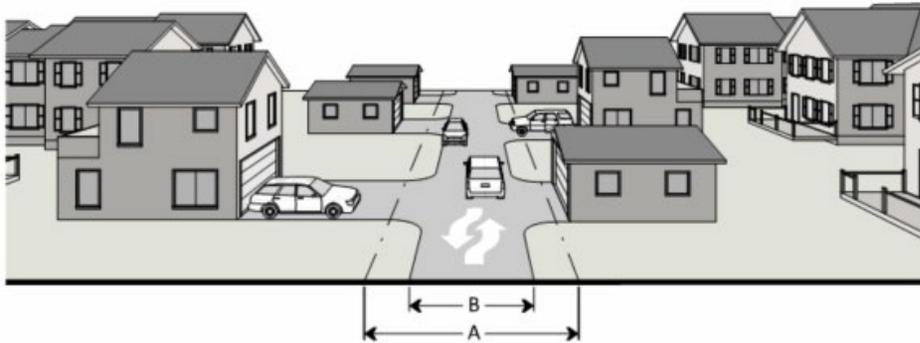


| Width | |
|--------------------------------|------------------|
| A Right-of-way width | 69' |
| B Back-of-curb to back-of-curb | 41' |
| Streetscape | |
| C Utility placement, easement | 5' |
| D Maintenance strip (min) | 2' |
| E Sidewalk (min) | 6' |
| F Planting area (min) | 6' |
| Travelway |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

| Engineering Specifications | |
|---------------------------------|---|
| Standard Construction Detail | T-10.21 Industrial Street |
| 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 | Benches, Shelters |

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.

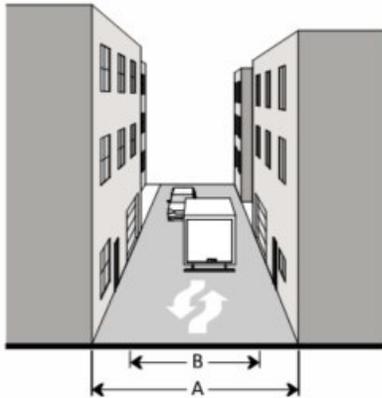


| Width | |
|-----------------------------------|-------------|
| A Easement width | 20' |
| Travelway | |
| B Travel lane | 16' minimum |
| B Travel lane, fire service route | 20' |

| Engineering Specifications | |
|------------------------------|----------------------------|
| Standard Construction Detail | T-10.22 Alley, Residential |

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 |

| Engineering Specifications | |
|------------------------------|--------------------------|
| Standard Construction Detail | T-10.22 Alley, Mixed Use |

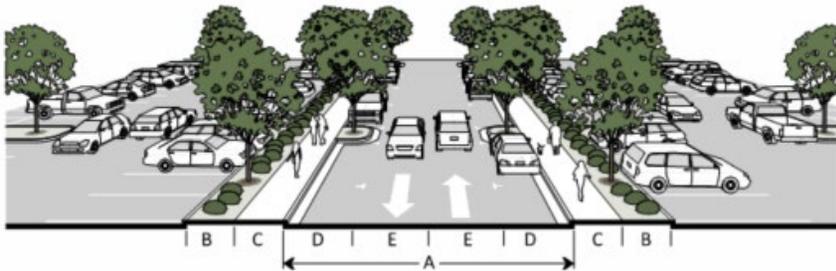
Section 1.3.7. Accessways

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**

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.

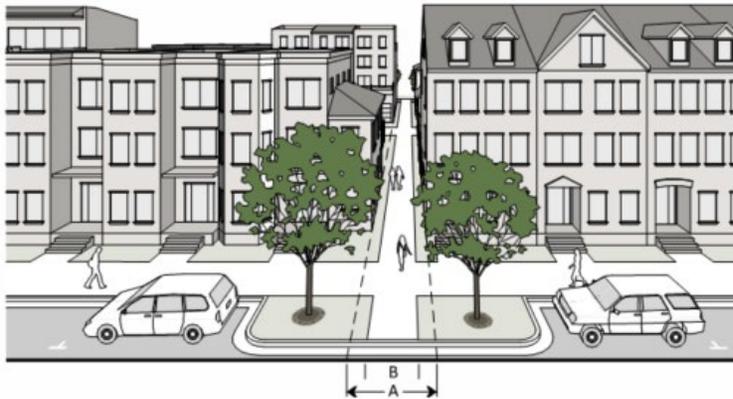


| Width | |
|--------------------------------|----------|
| A Back-of-curb to back-of-curb | 36' |
| Streetscape | |
| B Planting strip (min) | 5' |
| C Sidewalk (min) | 6' |
| Travelway | |
| D Parallel parking lane | 13.5' |
| E Travel lane | 10' |
| General | |
| Walkway type | Sidewalk |
| Parking type | Parallel |

| Engineering Specifications | |
|---------------------------------|---|
| Standard Construction Detail | T-10.23 Primary Internal Access Drive |
| 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 | Benches, Shelters |

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 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 | 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 | Benches, Shelters |

Section 1.3.7. Existing Streets

Article 8.5 of the UDO describes the guidelines for the construction of street improvements and streetscapes for existing streets throughout the City. It outlines the necessity and standards as they relate to:

- A. Intent;
- B. Applicability;
- C. Letter of Acceptance requirements;
- D. Tree Planting;
- E. Fee-in-lieu;
- F. Adopted Streetscape Plans;
- G. Administrative Design Adjustment Findings.

CHAPTER 2. PROCESS

Article 2.1. Intent

The Engineering program of the Development Services Department reviews all plans that are submitted to the City of Raleigh through the various review and permitting processes to ensure that proposed development and construction activities within the public rights-of-way, easements and construction sites in Raleigh's jurisdiction comply with all applicable codes and standards. Permits and approvals are required for plans by the City of Raleigh and North Carolina Department of Transportation (NCDOT hereby). Applications and checklists, along with information about the individual review and permitting processes can be found on the *Guide to Raleigh's Development Process Article*.

Article 2.2. Permit and Approval Requirements

- A. A Right-of-way permit is required for any type of construction that impacts the public right-of-way in Raleigh's City Limits and Extraterritorial Jurisdiction (ETJ hereby). This includes, but is not limited to:
 - a. Excavation;
 - b. Boring Operations;
 - c. Digging and Trenching;
 - d. Placing pipes, wires, or poles;
 - e. Grading;
 - f. Paving;
 - g. Repairs to existing infrastructure
- B. Right-of-way permits are required for any work on or under NCDOT maintained roads and sidewalks in Raleigh's ETJ.
- C. An Encroachment into City of Raleigh maintained public right-of-way requires an approval by City Council or Administrative approval. A contract must be executed between the City and the Applicant. Right-of-way permits can be issued after the execution of the contract when required.
- D. A Right-of-way Occupancy permit is required for any work or operation that impacts the public right-of-way.

Article 2.3. Right-of-way Permits

Section 2.3.1. Purpose

Section 2.3.2. Right-of-way Permits issued

LIST ENERGOV PERMITS

Driveway permits

Right-of-way work

Infrastructure Permits

Water/reuse

Sewer

Streets

Streetscape

Storm drainage

Section 2.3.3. Approval Process

Article 2.4. Encroachments

Section 2.4.1. Purpose

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. **This includes, but is not limited to landscaping, structures, irrigation lines, and other permanent items.** 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.

Section 2.4.2. Encroachment Approvals

- A. 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.
- B. Minor Encroachments are temporary items for private use in the public right-of-way. Examples include outdoor dining tables, awnings and street vending carts. **The Standards for Private use of Public Spaces ([PUPS](#)) is a guide for procedures and standards for approval.** Requests for minor encroachments are reviewed and approved by City staff.

LIST ALL PROCESSES

Section 2.4.3. Approval Process

Article 2.5. Right-of-way Occupancy Permits

Section 2.5.1. Purpose

Section 2.5.2. Occupancy Permits issued

A. Full Street Closures for construction operations

1. A full street closure is designed to eliminate the exposure of motorists to work zones, while providing a safe working environment for workers by temporarily closing a street for construction or maintenance. During a full street closure, traffic is detoured, allowing workers full access to roadway facilities and ensuring that motorists and City services are rerouted properly to their destinations around the work area.

B. Lane Obstructions

1. A lane obstruction involves the occupation of a lane or lanes during a project but not closing the street off completely.
2. This can be in the form of a flagging operation, or other traffic shifts to allow continuous vehicular movement.
3. This does include shoulder work, as equipment may need to be moved on and off the road.

C. Sidewalk Obstructions and Pedestrian Detours

Section 2.5.3. Approval Process

Article 2.6. Contractor Requirements for working in the right-of-way

Section 2.6.1. Purpose

Section 2.6.2. Requirements

Section 2.6.3. Registering as a Contractor in the City of Raleigh

Article 2.7. North Carolina Department of Transportation (NCDOT) Coordination

Section 2.7.1. Purpose

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.

Section 2.7.2. Permitting and Approval Requirements on NCDOT maintained Roads

- A. 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.
- B. 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.
- C. 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.
- D. The NCDOT's Street and Driveway Access Permit Application requires a Local Governmental Authority's approval prior to submission to NCDOT. **A plan must be in review with the City and access locations must be agreed to by applicant and the City. All improvements and driveway locations must meet City of Raleigh Standards or Specifications prior to submittal of the NCDOT Driveway permit application to the City for signatures.**
- E. **The City must have an approved NCDOT Driveway access permit or encroachment prior to Site Permitting Review or Building Permit approval, whichever occurs first. The City will withhold final construction and/or building permit approval until all executed NCDOT permits are approved and incorporated into the Infrastructure Plans or Final Site Plans.**
- 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 all issued 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 2.8. United States Postal Service (USPS) Coordination

Section 2.8.1. Purpose

The former process that allowed residential developers to choose between curbside and cluster box delivery, for new construction, is no longer in place. In April 2012, the Postal Service changed this process and USPS now determines the type of delivery that is most efficient and appropriate for the area to be served.

Section 2.8.2. Standards

- A. During the development stage of a new subdivision, it is the responsibility of the customer (developers and builders) to provide the necessary mail receptacle equipment.
- B. The City of Raleigh does not allow encroachments in the public right-of-way for the mail receptacles.
- C. The developer or builder may place the mail receptacle in an easement on private property or set aside a lot that residents of the subdivision can utilize by vehicle or foot and pick up mail.
- D. The *Modes of Delivery and Installation Standards* provide information for developers to ensure that the project will receive mail service.
- E. information on installation requirements can be provided by the Growth Development Coordinator for the US Postal Service. For contact information please visit the "*USPS Delivery Requirements*" page on the City of Raleigh Website.
- F. The City of Raleigh requires that all cluster box units meet ADA Accessibility requirements.

CHAPTER 3. ADMINISTRATIVE REQUIREMENTS

Article 3.1. 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 **and this Street Design Manual**. 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

The information **for the applicability of design adjustment requests and the findings** can be found in Section 10.2.18 of the Unified Development Ordinance

A. Applicability

1. The Development Services Director has the authority to approve a request for a design adjustment set forth in this UDO.
2. All design Adjustments shall be reviewed in accordance with the provisions of this section and the applicable design adjustment findings.

B. Application Requirements

1. An application for a design adjustment shall be submitted in accordance with Sec. 10.2.1.B.
2. 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.
3. An application for a design adjustment must be signed and notarized by the property owner in order to initiate a request for an adjustment.
4. 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.

C. Development Services Director Action

1. In reviewing the design adjustment, the Development Services Director or designee 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.
2. The Development Services 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.
3. 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 Development Services Director.
4. 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 Development Services Director prior to their decision.
5. Within 30 days from the date the application was decided, an appeal of the Development Services Director's action may be made to the Board of Adjustment in accordance with Section 10.2.11.

Article 3.2. Fees-in-Lieu for Infrastructure and Streetscape

Section 3.2.1. Purpose

- A. Where the Development Services 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.
- B. 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 **required**.
- C. **When a Fee-in-lieu has been paid previously, the Developer will be responsible for the difference between the new infrastructure requirements and the previous infrastructure requirements.**

Section 3.2.2. Exemptions to Fee-in-lieu **and/or** 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, **and fees for additional pavement and streetscape improvements** 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 Development Services Director determines that construction of frontage improvements would be more appropriate.
- I. Article 5.3 Surety **No Street Tree fee-in-lieu will be required for street trees around the bulb of a cul-de-sac. The Street trees end where sidewalk ends per detail T-10.06.**

Article 3.3. Surety

Section 3.3.1. Surety requirements

Sureties are required for all public improvements. This information can be found in Section 8.1.3 of the UDO.

A. Construction Surety

1. 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.

2. The surety shall be 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.
3. 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.
4. 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.
5. 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.
6. Where the Development Services 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.
7. The landscaping improvements shall be installed within 12 months of issuance of the conditional letter of acceptance.

B. Acceptance

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

C. Warranty

1. 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.
2. 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.
3. The warranty shall list the City as a beneficiary.
4. 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 3.4. Reimbursements

Section 3.4.1. Reimbursement Procedure

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 \(List requirements\)](#). This information can be found in Section 8.6.3 of the UDO.

A. Improvements Eligible for Reimbursement

1. 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.
2. 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
3. improvements that are over and above improvements needed for the development to comply with any ordinance or regulation. The following
4. 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.
5. 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.
6. Reimbursements are subject to availability of funds and eligibility for reimbursement through the City's facility fee program.

B. Method and Conditions of Reimbursement

1. 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.
2. 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.

3. 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.
4. The dedicators shall waive their statutory right to withdraw dedications prior to receiving any payment.
5. Reimbursements shall be paid at the rate in effect when dedication occurs or construction costs are incurred.
6. 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.

C. Expiration of Reimbursement

1. Any request for reimbursement for street, greenway, utility, or stormwater infrastructure installation must be submitted to the City within 2 years of completion and final acceptance by the City or State, whichever is applicable.

Section 3.4.2. Complete Street Exceptions

The City of Raleigh will give due consideration to Complete Streets principles on all street projects, including those involving new construction, upgrades, reconstruction, resurfacing, rehabilitation, or roadway retrofit. Adequate provisions to reasonably, safely, and conveniently cross all transportation facility shall be provided, without exception. In the case of an exception where accommodations for all users are not reasonable or feasible for the corridor, alternate transportation facilities should be provided in a parallel corridor as close as reasonably possible.

A. Applicability

1. Exceptions are applicable for projects involving only ordinary or emergency maintenance activities designed to keep assets in serviceable condition such as mowing, cleaning, sweeping, spot repair, concrete joint repair, or pothole filling, or when interim measures are implemented on temporary detour or haul routes
2. Exceptions are applicable for projects involving a facility on which bicyclists and/or pedestrians are prohibited by law, such as interstate freeways or pedestrian malls.
3. Exceptions are applicable for projects where the cost of establishing a bikeway, walkway, transit, or other enhancement as part of a project is determined to be excessive or disproportionate to the cost of the project, defined as the greater of \$25,000 or 25% of the project's transportation-related costs.

B. Application Requirements

1. In the case of an exception where accommodations for all users are not reasonable or feasible for the corridor, alternate transportation facilities should be provided in a parallel corridor as close as reasonably possible.

D. Council Action

1. Any determination that a project will not meet Complete Streets principles, whether based on the above exceptions or not, will be reviewed and confirmed by the City Council.

CHAPTER 4. INFRASTRUCTURE REQUIREMENTS

Article 4.1. 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.
- D. Plot plans may not be subject to infrastructure improvements but will be reviewed and can be subject to safety improvements.

Section 4.1.1. 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 4.1.2. Minimum Paving Construction

- A. The developer shall be responsible for the cost and installation of the applicable width and pavement design requirements.
- B. Frontage improvements shall be installed for roadways in accordance with adopted City or State standards and specifications.
- C. The developer shall make off site street improvements constructed to minimum street pavement standards in accordance with this section.

- D. 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.
- E. 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.
- F. 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.
- G. 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 Fees-in-lieu for Infrastructure and Streetscape (Article 3.2. of the RSDM).
- H. An exemption from paving construction requirements shall not relieve the developer of a payment in-lieu of construction unless otherwise specified.
- I. An asphalt overlay may be required for the frontage along developments when there are multiple cuts, and/or the road has been damaged by construction traffic.

Section 4.1.3. Minimum Stormwater Infrastructure Requirements

- A. Minimum requirements for stormwater infrastructure shall be in accordance with 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.
- C. 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 5. RIGHT-OF-WAY CONVEYANCE AND EASEMENTS

Article 5.1. Right-of-Way Dedication

- A. 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.
- B. 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.
- C. Extra right-of-way dedication can be required for additional pavement to accommodate turning movements.

Table X 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 | 76 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 |

Section 5.1.1. Reservation for Public Land

- A. 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.
- B. 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.
- C. 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.
- D. Further extensions may be permitted upon mutual agreement between the land owner and the City Council, each of which shall not exceed 2 years.

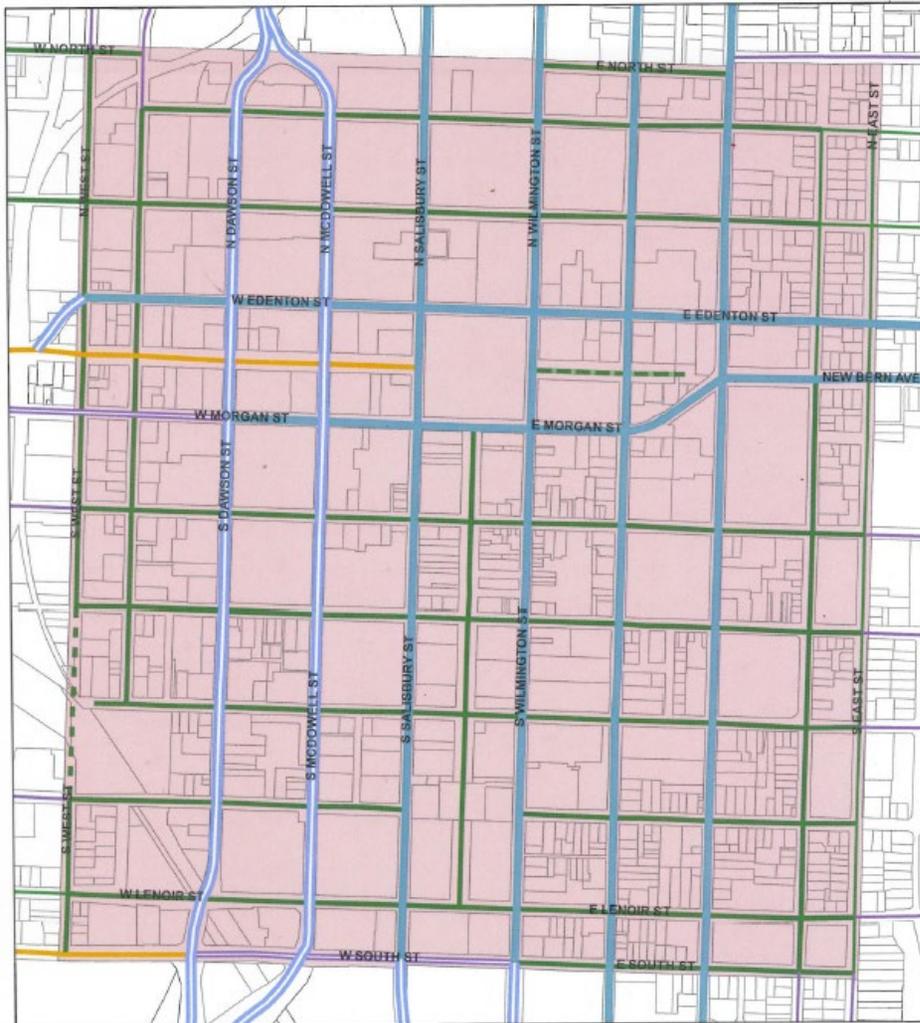
Section 5.1.2. Adjustments to Required Right-of-Way Widths

- A. The Development Services 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.
- B. A Design Adjustment shall be required for any exemption.

Section 5.1.3. Christmas Plan Boundary

Raleigh's geographic limits were originally established by the William Christmas Plan of 1792. North, East, South, and West streets defined the extent of the walkable city at that time. The Christmas Plan provided a simple urban design hierarchy containing a dominant street grid with 66-foot wide rights-of-way, four strong axial 99-foot wide streets emanating from the State Capitol, four public parklike squares, and a central six-acre square designed to serve as the Capitol grounds. Among the axial boulevards, Fayetteville Street, extending southward from the Capitol, was intended to be the high street of the City. Fayetteville Street is still home to Raleigh's most significant urban design features, the terminated vistas that spotlight the Capitol and the Performing Arts Center. The area regarded as downtown Raleigh today currently spans approximately 754 acres, or 1.18 square miles.

- A. The area within the "Christmas Plan" which is bounded by North, East, South and West Streets may be exempt from right-of-way dedications.
- B. Streets within this boundary may still be subject to any improvements required in Chapter 4 of this Manual.
- C. Any property whose direct frontage is on North, East, South and West Street is eligible for the adjustment.
- D. For a corner lot that has frontage on North, East, South and West Streets, and frontage on a right-of-way, not in the Christmas Plan, the frontage not within the Christmas plan boundary is not eligible for the adjustment.



Christmas Boundary

- Legend**
- Neighborhood Street
 - Main Street, Parallel Parking
 - - - Main Street, Parallel Parking Proposed
 - - - Main Street, Angle Parking
 - Avenue 6-Lane, Divided
 - Avenue 4-Lane, Parallel Parking
 - Avenue 3-Lane, Parallel Parking
 - Avenue 2-Lane, Undivided
 - Avenue 2-Lane, Divided
 - Christmas Boundary



Article 5.2. Slope Easements

A slope easement of twenty (20) feet in width shall be required adjoining each side of a street right-of-way when additional future improvements may be required.

Section 5.2.1. Slope Easement Standards

- A. The City may reduce or increase the slope easement width due to topography.
- B. The slope easement shall be located behind the new proposed right-of-way dedication.
- C. Tree Conservation Areas cannot be located within a slope easement per Section 9.1.4 C of the UDO.
- D. A slope easement must be dedicated when a stub street is extended to an adjoin parcel to connect in the future per Section 8.3.4 C.

Article 5.3. Additional Easements

Section 5.3.1. Additional Easement requirements

A. Public Access Easement

- 1. Grants an easement for public use, to allow the public an access over the property owned by a private entity.

B. A Right of Access

- 2. Grants access rights to the adjacent properties for the purpose of allowing their residence or business to be maintained and to government agencies for the purpose of installing, removing and reading water meters, maintaining and replacing water and sewer facilities, fire lanes and acting for other purposes consistent with public safety and welfare, including law enforcement, fire protection, animal control, emergency services, solid waste collection and the delivery of mail.

C. Sidewalk Easement

- 3. Allows the City of Raleigh to access and maintain the sidewalk beyond the right of way when the footprint of the sidewalk exceeds the existing right of way.

CHAPTER 6. BLOCKS AND ACCESS REQUIREMENTS

Article 6.1. Purpose

- 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.
- E. The majority of block and access information can be found in Article 8.3 of the UDO. For NCDOT maintained Roads, the Policy on Street and Driveway Access to NC Roads must also be considered and the more stringent policy applies.

Article 6.2. 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.
- B. Except as otherwise stated in this UDO, all lots must front on a street that has a pavement width of at least 20 feet.

Section 6.2.1. Block Perimeter

- A. **Block Standards**
 - 1. 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.
 - 2. Table XX – 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 XX – 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 |

B. Block Perimeter and Dead-End Street Measurement

1. 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.
2. 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.
3. 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.
4. 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.
5. 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.

6. The Development Services 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.
7. 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 ½ of the maximum block perimeter.
8. Methods of measuring the block perimeter and Dead-End Street length can be found in Article 8.3 of the UDO.

Article 6.3. Residential Access System

Section 6.3.1. Local Street Access Standards

The Local Street access system consists of roadways that are relatively short in length and primarily serve residential uses. The main function is to provide direct driveway access to abutting land and connect to the higher classified streets. Residential access to and from streets shall be constructed in accordance with City Standards.

- A. Neighborhood Yield and neighborhood Local streets are used primarily to serve residential developments
- B. Neighborhood Streets can be used where residential uses may be compatible with non-residential uses in a mixed-use context.
- C. Multi-family streets cannot be used to meet the block perimeter.
- D. The Multi-family street type is limited to 150 units and must tie into the appropriate street section per Table XX - Unit Specifications for Local Street Types.

Table XX – Unit Specification 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) |

Section 6.3.2. Local Street Dwelling Unit Standards

The determination of thresholds or the number of dwelling units a Local access system will serve shall use the following criteria and shall be constructed accordance with City Standards.

- A. Dwelling units with direct driveway access to the street shall be counted as being served by the street.
- B. Dwelling units without direct driveway access to the street but that reasonably use the street as primary access points to the main transportation network (mixed use and major streets) shall be counted as being served by the street.
- C. Any multi-unit development (townhomes and apartments) that gain access to the street shall count each dwelling unit to determine the amount.
- D. Multi-unit living developments require one access point from a public street (not counting multi-family street type) for every 150 dwelling units.
- E. Table XX – Access Point Requirements Per Unit Count shall be used to determine the amount of access points.

Table XX – Access Point Requirements Per Unit Count

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

Article 6.4. Subdivision Access

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

Section 6.4.1. 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 the UDO.
- 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.
- G. Any right-of-way and slope easements needed to build the connection shall be dedicated.
- H. Where a stub street is provided, a barricade using a design approved by the Development Services 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.
- I. The Development Services Director may eliminate the requirement for a stub street in accordance with the standards outlined in the UDO.

Article 6.5. Site Access

Section 6.5.1. Access Requirements

A. General Access Requirements

1. 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.
2. All on-site parking areas must have vehicular access from a street, an alley, a drive aisle, or a cross-access easement.
3. 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 Development Services Director. An improved alley may be used as maneuvering space for access to on-site parking areas.
4. 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.
5. 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 Development Services 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

Other uses not containing a principal building on the premise (with the exception of a parking facility)

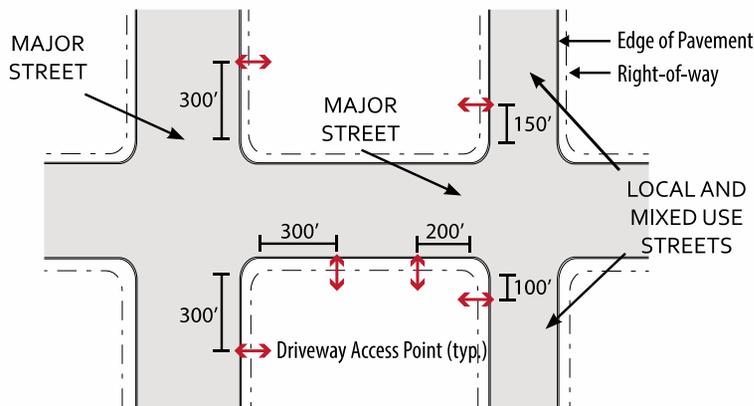
Section 6.5.2. General Driveway Access Requirements

- 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 x – Driveway Dimensions**
- E. The Development Services 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 x – 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 6.5.3. Residential Driveways

- 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 6.5.4. 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 Development Services 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 6.5.5. Cross-Access

- A. All lots abutting a street other than a local street shall comply with the following standards:**
 - 1. Internal vehicular circulation areas shall be designed and installed to allow for cross-access between abutting lots;
 - 2. 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.
 - 3. When cross-access is waived by the Development Services 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.
 - 4. 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:**
 - 1. 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.
 - 2. 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.

3. The beneficiaries granted access rights include the lot owners, their successors, heirs and assigns, tenants and subtenants, lenders, employees, customers and guests.
4. 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.
5. 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.
6. 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.
7. A notice provision explaining how and where to send written notice.
8. A provision prohibiting the erection of fences walls and other obstructions that prevent the use of vehicular and pedestrian access ways.
9. 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.
10. 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.
11. The cross-access agreement shall be signed by all of owners of the granting property.
12. All lenders and their trustees with interests in the granting property shall subordinate their security interest to the cross-access agreement.

CHAPTER 7. PARKING AREAS

Article 7.1. Intent

This chapter addresses the parking space design and layout for on street spaces and parking spaces on a site. Article 7.1. of the UDO provides guidance about parking as it relates to the following:

- a) Required Parking;
- b) Specialized Vehicle Parking Requirements;
- c) Vehicle Parking Reductions;
- d) Additional Vehicle Provisions;
- e) Vehicle Parking Location and Layout;
- f) Vehicle Parking Lot Landscaping;
- g) Bicycle Parking Facilities;
- h) Vehicle Loading Areas.

Section 7.1.1. 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. On-site surface and structured parking must be located behind the parking setback line. This does not apply to on-street parking or the upper stories of a parking deck.
- D. Required parking spaces shall be arranged and sized in accordance with **Figure xx – On-Site Parking Layout** and **Table xx – Standard Parking Space Dimensions**.
- E. Compact spaces shall comply with **Figure xx – On-Site Parking Layout** and **Table xx – Compact Parking Space Dimensions**.
- F. Stall depths and module widths shall be measured to the back of curb or to the edge of pavement if curbing is not used.
- G. 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.
- H. Parking lots should also be signed and maintained with appropriate traffic control devices, **signage**, and pavement markings to regulate the safe movement of vehicles and pedestrians within the parking area.
- I. 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.
- J. **Required parking and drive aisles must be constructed of permanent non-erodible surface treatments as follows:**

- a) permeable or semi-permeable monolithic or paver material; [(e.g., permeable concrete, permeable asphalt, or concrete turfblock)
- b) Masonry or concrete pavers (e.g., permeable interlocking concrete pavers (PICP)) or
- c) Poured concrete or asphalt

Figure xx – On-Site Parking Layout

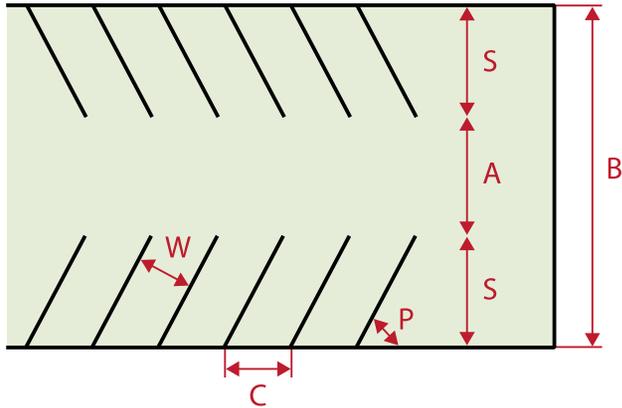


Table xx – Standard Parking Space Dimensions

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 xx – Compact Parking Space Dimensions

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 | 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 |

Section 7.1.2. On-Site Parking Layout Modifications

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.

Section 7.1.3. Structured Parking

- A. Up to 30% of the total spaces within a structured parking facility may be compact spaces.
- B. No more than 2 compact spaces may abut each other.
- C. Compact spaces must be clearly marked for compact car use only.
- D. Compact spaces must comply with all other parking layout standards.

Section 7.1.4. Queuing Areas

- A. Adequate space must be made available on-site for the stacking, storage and queuing of vehicles.
- B. A queuing space is defined as a 10-foot-wide by 25-foot-long rectangle.
- C. Vehicles using drive-thru facilities may not encroach on or interfere with the public use of streets and sidewalks by vehicles or pedestrians.
- D. A restaurant with drive-thru facilities must provide at least 8 queuing spaces for vehicles from the order board when 1 drive-thru lane exists and 6 spaces at each when more than 1 lane exists.
- E. A bank with drive-thru facilities must provide at least 3 queuing spaces per drive-thru lane.
- F. For service stations where the pump islands are parallel to the pavement edge, a minimum setback of 25 feet between the pump islands and public right-of-way must be provided.
- G. For service stations where pump islands are not parallel to the pavement edge, a minimum vehicle storage of 50 feet in length between the pump islands and the public right-of-way must be provided.

Section 7.1.5. Solid Waste and Emergency Vehicle Requirements for Parking Areas

- A. The Solid Waste Collection Design Manual dictates the requirements for regulations and standards for adequate and coordinated land development, collection, storage, and disposal plans with necessary facilities, devices, pre and post collection practices to allow for the most efficient, effective, and sustainable provision of materials management services throughout the City.
- B. The Fire Code dictates the requirements for curbing and efficient movements of Emergency vehicles throughout a parking area.

Section 7.1.6. Parking Space Design and Layout in the Public Right-of-Way (On-street Parking)

- A. On-street parking shall consist of parallel, angular (60 degree) or perpendicular spaces only in accordance with **Table xx – On-street Parking Space Standards**.
- B. On-street parking cannot be utilized to meet on-site parking requirements for any development.

Table xx – On-street Parking Space Standards

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) |
|------------------|------------------|-----------------|-----------------|
| 90 | 8.5 | 18.0 | 8.5 |
| 60 | 9.8 | 19.8 | 8.5 |
| 0 | 22.0 (20.0 min.) | 8.0 | 8.0 |

CHAPTER 8. STREETSCAPE DESIGN AND OPERATION

Article 8.1. Purpose

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 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 8.2. Streetscape Types

Section 8.2.1. General Streetscape Standards

- A. The required streetscape type is determined by the zoning district or by the designated frontage.
- B. Where there is a conflict between a designated frontage and the zoning district, the designated frontage standard applies.
- C. If more than one streetscape can be used, the Planning and Development Officer shall make the final determination.
- D. 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.
- E. A variation to the Streetscape may require a Design Adjustment by the Development Services Director.
- F. 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.
- G. Design specifications for streetscape improvements can be found in this Street Design Manual, the City Tree Manual, and the City Stormwater Design Manual.
- H. 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 8.2.2. 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 Development Services Director may adjust the streetscape standards to the minimum extend necessary to accommodate the existing area between the face of the building and back of curb.

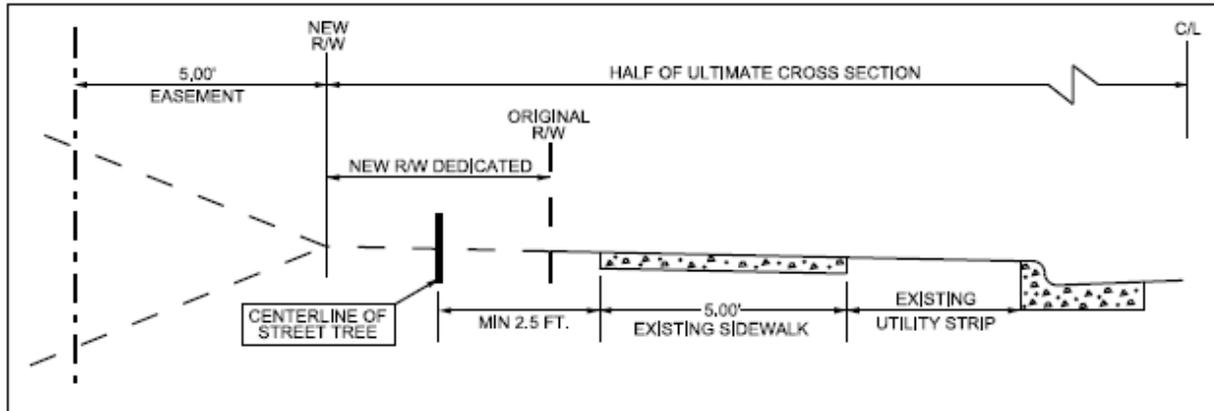
Section 8.2.3. Administrative Adjustments for Alternative Streetscapes on Existing Roadways

This section is intended to provide supplemental design criteria for applying the Unified Development Ordinance (UDO) streetscape along existing public streets and accommodating existing conditions. Per Section 8.5.1 G of the UDO, the Development Services Director has the ability to approve a design adjustment on an existing street. Recognizing the most common existing conditions along public streets within the City of Raleigh, this is intended to provide a standard approach to allowing specific alternatives that meet the detailed conditions and provisions, shown hereafter. *Section 8.5.2 of the UDO* provides the information and diagrams for the streetscape types. The purpose of this is to address the challenges associated with the streetscapes for “Commercial”, “Residential” and “Sidewalk and Tree Lawn”.

- A. The reviewer must still document the use of an “Approved Alternative Streetscape” when applying development required infrastructure improvements to an existing street.
- B. A formal application to and reviewed by the Development Services Director is not necessary, if all the specified conditions of the utilized alternate are met. This section shall be used at the discretion of Public Works staff only, shall only be applicable along existing streets.
- C. The alternatives will be pertinent only for placement of new street trees within public Right of Way.

- D. Requests to use existing street trees on private property to satisfy the infrastructure responsibility along the development's frontage would require an exclusive *Design Adjustment*, independent of this section.

Approved Alternate Streetscape A



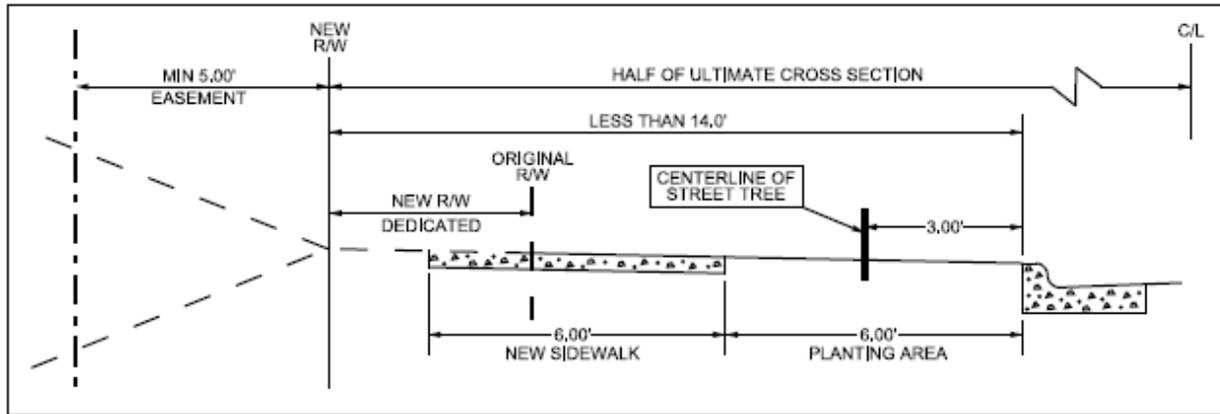
Required Existing Conditions:

- There shall be an existing 5-foot concrete sidewalk with a utility strip at the back of the curb**
- With new right-of-way dedication, sufficient width is available for street tree placement at least 2.5 feet (3 feet is preferred) from the back of the existing sidewalk**
- The trees will be within the public right-of-way on City maintained streets.**

Additional Requirements:

- A fee-in-lieu for the remaining 1-foot concrete sidewalk along the entire property frontage shall be paid to the City.**

Approved Alternate Streetscape B



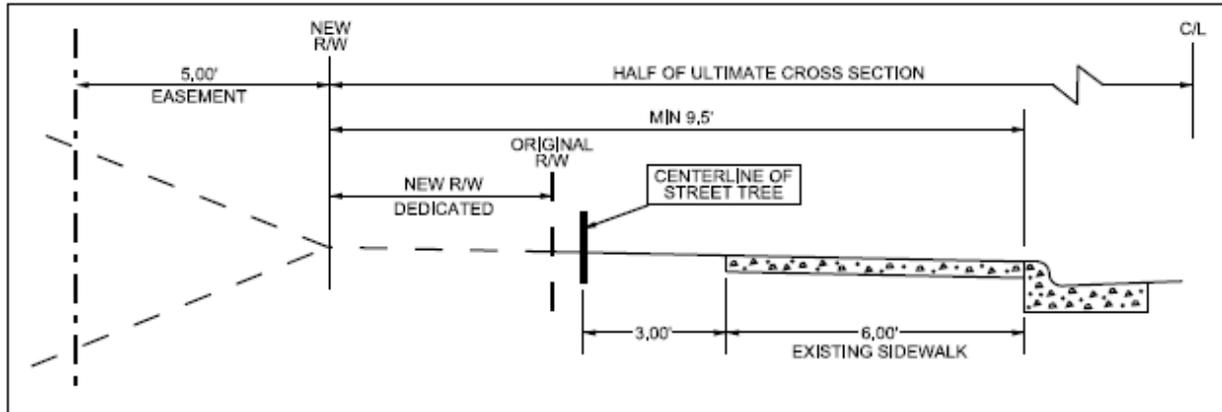
Required Existing Conditions:

- a) **Even with new right-of-way dedication, a 14-foot streetscape section cannot be accommodated.**
- b) **The sidewalk does not exist or will not be retained with development.**

Additional Requirements:

- a) **Based on existing right-of-way width and new required dedication, a portion of sidewalk may fall outside the right-of-way. A public sidewalk easement will be required.**

Approved Alternate Streetscape C



Required Existing Conditions:

- a) **Existing 6-foot sidewalk along the back of curb.**
- b) **With new right-of-way dedication, sufficient width is available for street tree placement at least 3 feet from the back of the existing sidewalk and still be within public right-of-way.**

Additional Requirements:

- a) **None.**

Article 8.3. Streetscape Elements

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

Section 8.3.1. 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.
- C. Utility Poles are required to be installed behind the sidewalk in the utility placement easement or maintenance strip.

Section 8.3.2. Maintenance Strip

- A. The 2' maintenance strip behind the sidewalk is intended for Fire Hydrant and as an additional area if maintenance on the sidewalk must be performed.

- B. Standard Detail T-10.29 provides an overview of the cross section of a street and the various utility locations in the Maintenance Strip and Utility Placement Easement

Section 8.3.3. 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 xx – 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.
- D. Sidewalks shall provide general pedestrian access within the development served and shall connect with all public sidewalks, public streets, and greenway access points.
- E. Each block, or each building in the case of multi-unit living, shall be served by a connection to the pedestrian access system.
- F. 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.
- G. The minimum sidewalk dimension is a clear width requirement which cannot contain obstacles and shall allow for the minimum ADA required width.
- H. 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.
- I. 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.

Table xx – 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 8.3.4. Tree Planting in the Right-of-Way

A. Tree Planting

1. All required street trees shall be installed in the planting area per City of Raleigh Standards and the City Tree Manual.
2. Unless otherwise noted below, all trees planted in accordance with Article 8.2 of the UDO must be shade trees.
3. 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.
4. 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.
5. **Street Trees in City of Raleigh maintained right-of-way shall be installed in the following order when feasible:**
 - a. **Street trees shall be placed between the sidewalk and back of curb;**
 - b. **Street trees shall be placed between the sidewalk and property line, in the maintenance strip;**
 - c. **If the above order cannot be accomplished, a Fee-in-lieu will be required.**

B. Planting for Development Abutting NCDOT Streets

1. 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.
2. Unless otherwise noted below, all trees planted in accordance with this Article must be shade trees.
3. 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.
4. 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.
5. 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.
6. **When Urban Trees are installed with root expansion paths, it must be ensured that the minimum density requirements under the sidewalk sections are met**
7. **In a downtown setting (buildings up to the right-of-way line), the utilities, shall be located in line with the planting strip.**
8. A fee-in-lieu can be required when it is determined that **street trees are** not to be installed.

9. No Street Tree installation will be required for street trees around the bulb of a cul-de-sac. The Street trees end where sidewalk ends per detail T-10.06.
10. 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.
11. Street Trees in NCDOT maintained right-of-way shall be installed in the following order with allowance of NCDOT:
 - a. Street trees shall be placed between the sidewalk and back of curb;
 - b. Street trees shall be placed between the sidewalk and property line, in the maintenance strip;
 - c. In a C2 yard provided on private property (Fee-in-lieu will still be required);
12. If the Planning Reviewer or Appearance Commissions deems a C2 yard infeasible, a Fee-in-lieu will be required;
13. SHOD Yards, Tree Conservation Areas, and a PK frontage can take the Place of a C2 Yard.

Section 8.3.5. 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) Bus Shelters;
- d) Pedestrian Lighting;
- e) Planters and/or Flower boxes;
- f) Trash Receptacles;
- g) Stormwater flow-through planters;
- h) Rain barrels.

Section 8.3.6. Drainage and Green Stormwater Infrastructure

- A. 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.
- B. 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.
- C. 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.
- D. On wider street cross-sections, drainage may occur in medians and/or behind the curb.
- E. GSI practices are allowed in the streetscape in accordance with the City's standard details.
- F. Installation of GSI practices must not negatively impact existing street drainage patterns.
- G. Curb extension/bump-out and median design must maintain drainage of stormwater and not cause ponding within travel or pedestrian areas.

Section 8.3.7. 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.
- B. For roads that are City maintained the requirements are dictated by the Guide for Street Lighting and Developers Requirements.
- C. For roads that fall on the State Highway System, lighting standards must adhere to NCDOT's standards.

- D. 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.
- E. 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).
- F. 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.
- G. 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.
- H. 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.
- I. 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 xx – 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 8.3.8. 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. Refer to Standard Detail B.20.03 in the City of Raleigh Standard Details.

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.).

B. Standard 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. Refer to *Standard Detail B.20.03* in the *City of Raleigh Standard Details*.

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.

Section 8.3.9. Transit Amenities and Elements

Bus Stop elements and amenities are placed within the Streetscape area of the public right-of-way or can be placed on private property on an easement.

CHAPTER 9. ROADWAY, INTERSECTION, AND TURN LANE DESIGN

Article 9.1. 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 the latest Manual on Uniform Traffic Control standards and specifications.
- E. Consideration of GSI practices is encouraged in roadway improvement projects.

Section 9.1.1. 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 xx – Horizontal and Vertical Alignment Design Criteria** rates.
- B. Minimum runoff lengths and methods of distribution should be in accordance with American Association of State Highway and Transportation Officials (AASHTO) standards and specifications.
- C. The minimum tangent length of an approaching intersection should be 50 feet for local access system streets.
- D. 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 9.1.2.

- A. Wherever practical, streets should follow the existing contours of a site to avoid excessive grading and removal of existing vegetation.
- B. Street grades shall not be less than 0.75%. Standards for vertical street design are listed in **Table xx – Horizontal and Vertical Alignment Design Criteria**.
- C. 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.
- D. 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 xx – 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 per % of Crest |
|--|--------------------|-------------------------------|--|--|------------------------|--------------------------------------|------------------------|
| | | | | | | | Crest |
| Sensitive Area Streets | | | | | | | |
| 1. Sensitive Area Parkway | 50 | 930 | 0.04 | 400 | 7 | 150 | 84 |
| 2. Sensitive Area Avenue | 40 | 535 | 0.04 | 250 | 8 | 125 | 44 |
| 3. Sensitive Area Residential Street Collector | 35 | 375 | 0.04 | 200 | 9 | 100 | 29 |
| 4. Sensitive Area Residential Street Local | 25 | 150 | NA | 0 | 12 | 50 | 12 |
| Local Street | | | | | | | |
| 1. Neighborhood Yield | 25 | 150 | NA | 0 | 12 | 50 | 12 |
| 2. Neighborhood Local | 25 | 150 | NA | 0 | 12 | 50 | 12 |
| 3. Neighborhood Street (Collector) | 35 | 375 | 0.04 | 200 | 9 | 100 | 30 |
| 4. Multifamily Street | 35 | 375 | 0.04 | 200 | 9 | 100 | 30 |
| Mixed Use Streets | | | | | | | |
| 1. Avenue 2-Lane Undivided | 30 | 250 | 0.04 | 150 | 9 | 100 | 19 |
| 2. Avenue 2-Lane Divided | 35 | 375 | 0.04 | 200 | 8 | 100 | 30 |
| 3. Avenue 3-Lane Parallel Parking | 40 | 535 | 0.04 | 250 | 8 | 125 | 44 |
| 4. Main Street Parallel Parking | 30 | 250 | 0.04 | 150 | 9 | 100 | 19 |
| 5. Main Street Angular Parking | 30 | 250 | 0.04 | 150 | 9 | 100 | 19 |
| Major Streets | | | | | | | |
| 1. Avenue 4-Lane, Parallel Parking | 40 | 535 | 0.04 | 250 | 8 | 125 | 44 |
| 2. Avenue 4-Lane, Divided | 40 | 535 | 0.04 | 250 | 8 | 125 | 44 |
| 3. Avenue 6-Lane Divided | 50 | 930 | 0.04 | 400 | 7 | 150 | 84 |
| 4. Multi-Way Boulevard, Parallel Parking | 40 | 535 | 0.04 | 250 | 8 | 125 | 44 |
| 5. Multi-Way Boulevard, Angular Parking | 40 | 535 | 0.04 | 250 | 8 | 125 | 44 |
| Industrial and Service Streets | | | | | | | |
| 1. Industrial Street | 35 | 375 | 0.04 | 200 | 9 | 100 | 29 |
| 2. Alley, Residential | 20 | 75 | NA | 0 | 12 | 50 | 12 |
| 3. Alley, Mixed Use | 20 | 75 | NA | 0 | 12 | 50 | 12 |
| Accessways | | | | | | | |
| 1. Primary Internal Access Drive | 25 | 150 | NA | 0 | 12 | 50 | 12 |

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 9.1.3. Cul-de-sac Design

- A. Minimum dimensions for circular cul-de-sac streets are shown in the City of Raleigh Standard Details.
- B. Alternative turnaround designs on residential streets serving six dwelling units or less may be considered for alternate designs.

- C. Alternative designs must readily accommodate emergency vehicles and Solid Waste Trucks.
- D. 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.
- E. 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.
- F. Streets that do not require fire turn-around may utilize 75' diameter cul-de-sac measured back-of-curb to back-of-curb.
- G. For different turn around designs other than a cul-de-sac, see alternate Fire Apparatus Access Roads in the 2015 International Fire Code.
- H. See **Table xx – Block Perimeter and Dead-end Streets** for dead-end street length.

Section 9.1.4. Intersection Design

- A. Streets should intersect at or as near 90 degrees as possible, but no less than 75 degrees.
- B. Intersections with more than four legs should be avoided whenever possible.
- C. **Table xx – Optimal Street Spacing Requirements** describes optimal street spacing specifications.
- D. 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 xx – 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 9.1.4. Traffic Control Devices

- A. All traffic control devices should be designed in accordance with the latest Manual on Uniform Traffic Control standards and specifications.
- B. 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.

- C. 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.
- D. Signal control may only be provided at intersections where vehicle or pedestrian volumes meet the thresholds set forth for new signals in the MUTCD.
- E. A roundabout may be constructed at any intersection location where it may be desired to enhance intersection capacity, reduce vehicle speeds along a corridor, or enhance intersection aesthetics.
- F. Roundabouts shall be designed in accordance with the criteria set forth in Roundabouts, An Informational Guide, Second Edition.
- G. 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 9.1.5. Roadway Transitions

- A. 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.
- B. 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.
- C. 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

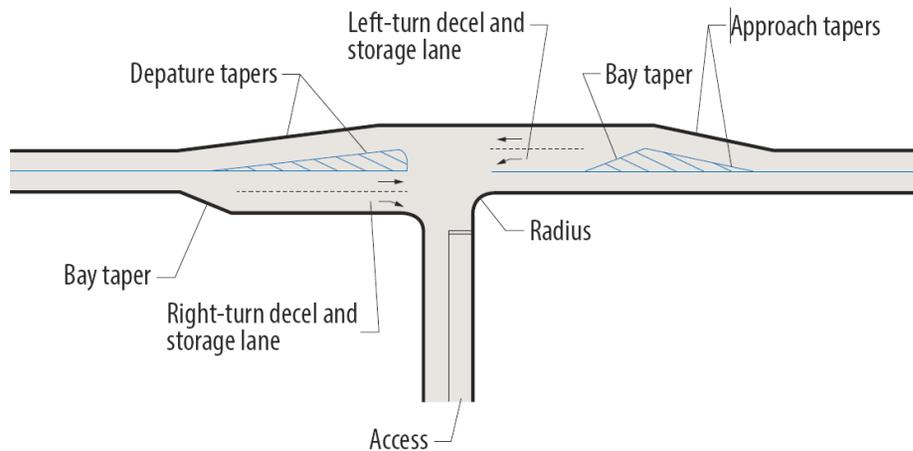
W = width of pavement offset (feet)

S = roadway design speed (mph)

Article 9.2. Turn Lanes

- A. 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.
- B. 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.
- C. Design elements, which make up a turning lane, are shown in the **Figure xx - Turn Lane Design Elements**.
- D. Turn lanes should be 12 feet in width; however, the lane width may be reduced to be compatible with the adjacent roadway lane width.
- E. In no event shall the turn lane width be less than ten feet.

Figure xx – Turn Lane Design Elements



Section 9.2.1. Turn Lane Warrants

Additional pavement surfaces to accommodate movements shall be required and constructed at intersections to the standards specified in **Table xx** – **Left Turn Lane Warrants for Two-Lane Roads** and **Figure xx – Right Turn/Deceleration Warrants** under the following conditions:

A. 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.

B. Right Turn Lane – Signalized Intersections

- a) 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.
- b) When calculating the adjacent through lane volume, it should be assumed that all through lanes have equal volumes.

C. Left Turn Lane – Unsignalized Intersections

- a) 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.
- b) 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.

D. Right Turn/Deceleration Lane – Unsignalized Intersection

- a) 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.

E. Additional Turn Lanes

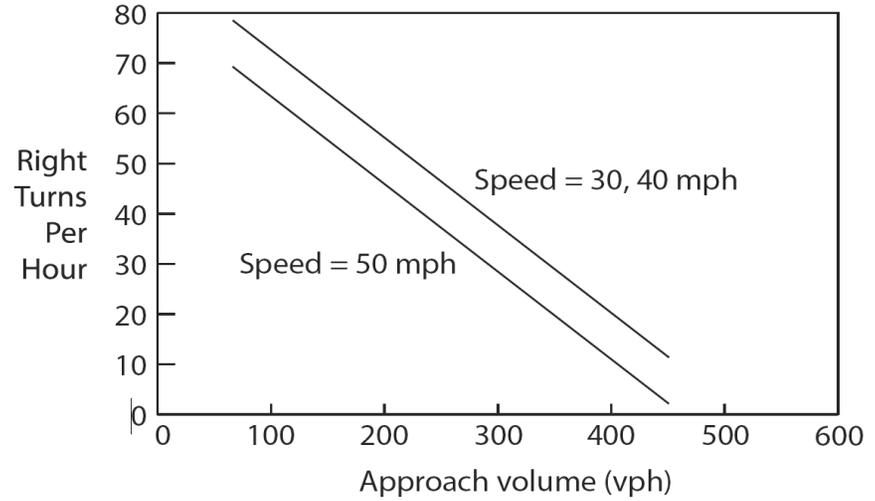
- a) The City may require additional turning lanes and tapers or other improvements when it believes that the absence of such improvement will create an unsafe condition or would reduce the operating capacity of the intersection below level of service “D” (LOS-D), as defined in the latest Highway Capacity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

Table xx – 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 xx – Right Turn/Deceleration Warrants



Section 9.2.2. Total Turn Lane Length

- A. A separate turning-lane consists of a taper plus a full width turn lane.
- B. 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.
- C. 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 9.2.3. Turn Lane Storage

A. Signalized Intersection

- 1. 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.
- 2. 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

- a) 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

1. 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.
2. Storage requirements should be based on an assumed minimum cycle length of 90 seconds.

C. Right Turn/Deceleration Length

1. The lengths required to come to a stop from either the design speed or an average running speed of a roadway, are indicated in **Table xx – Right Turn/Deceleration Lengths**
2. The lengths assume the roadway is on a two percent or less vertical grade.
3. The desirable deceleration lengths should be used on new roadways and the minimum may be used along existing roadways.
4. Longer deceleration lengths may be required on downgrades greater than two percent.

Table xx – Right Turn/Deceleration Lengths

| 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 9.2.4. 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 \leq 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 9.3. On-Road Bicycle Facilities

- A. Bicycle Lanes are along portions of the roadway that has been designated by pavement markings for the preferential and exclusive use of bicyclists.
- B. Bicycle Lanes are always located on both sides of the roadway and carry bicyclists in the same direction as motor vehicle traffic.
- C. Standard Details B-10.01 through B-10.04 outline the Bike Lane and Shared Lane (Sharrow) design.

A. Bike Lane Design Standards

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

B. Shared Lane (Sharrow) Markings

1. Sharrows should be placed after every decision point or at intervals of 250-feet
2. When parking is prohibited, and travel lane width is greater than or equal to 13 feet, place Sharrow 48 inches from face of curb.
3. When parking is prohibited, and travel lane width is less than 13 feet, place Sharrow in center of travel lane.
4. When parking is present and travel lane width is greater than or equal to 15-feet, place Sharrow 13 feet from face of curb.
5. When parking is present and travel lane width is less than 15 feet, place Sharrow in center of travel lane.

Article 9.4. Drainage, Curb and Gutter Design

- A. 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.
- B. 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.
- C. 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.

- D. Alternative curb systems include flat curb, standard curb with openings, and other curb systems approved by the Engineering Services Director or a designee.
- E. See Detail T-10.26.1 for standard curb and gutter installation. See Detail T-10-26.2 for alternative curb installation.

Section 9.4.1. Curb and Gutter Installation Requirements

- A. Standard curb and gutter can be used on all streets.
- B. Granite curb shall be required when it previously existed, or a streetscape plan recommends the use.
- C. 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.
- D. 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.

Section 9.4.2. Curb and Gutter Exemptions

- 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. (NOTE: Curb and gutter shall be installed at all intersections around the radii.)
- 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.
- D. 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.

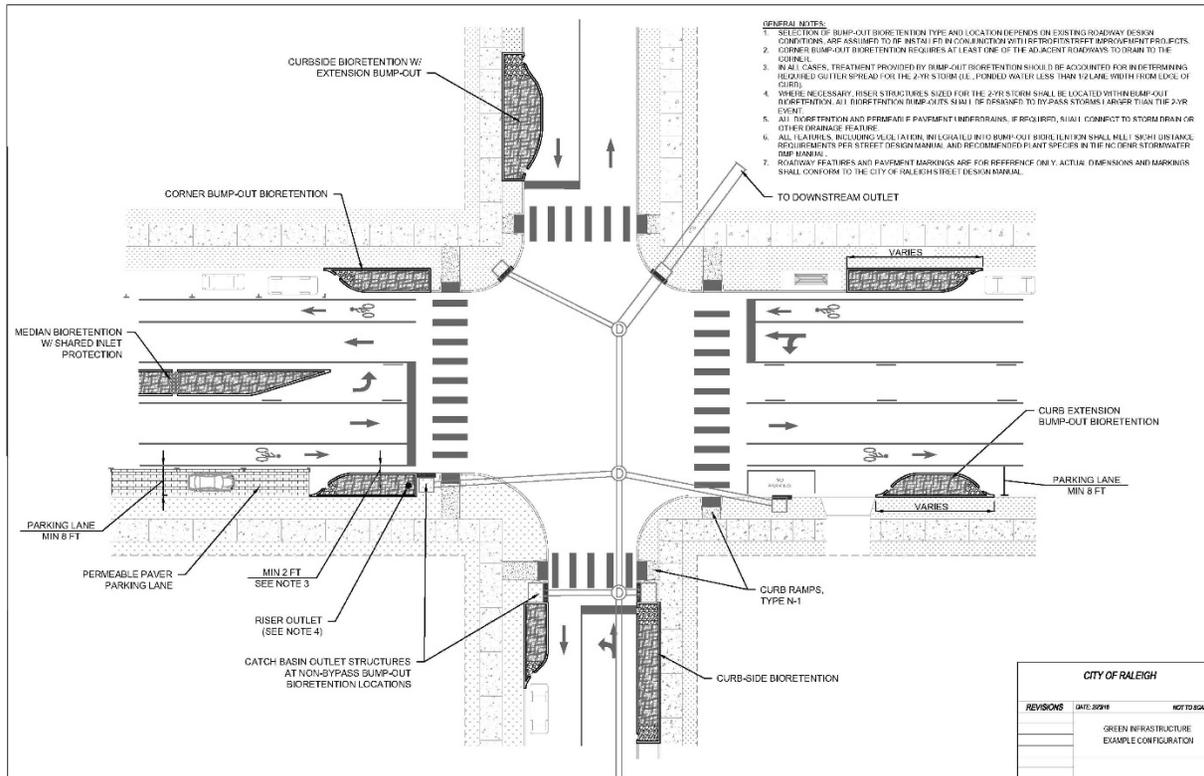
Section 9.4.3. Curb Return Radii

- A. Public street Intersections shall provide appropriate curb radii using **Table xx – 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.
- C. 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.
- D. 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.
- E. 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.
- F. Every intersection shall appropriately accommodate Emergency Vehicles.

Section 9.4.4. Drainage and Green Stormwater Infrastructure

- A. The use of GSI practices for managing stormwater within the right-of-way is encouraged.
- B. GSI practices typically are installed behind the curb either outside of the Travelway or in a median or curb bump-out.
- C. **Figure xx – Green Stormwater Infrastructure Elements near a Street Intersection** 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 xx – Green Stormwater Infrastructure Elements near a Street Intersection



Article 9.5. Sight Distance

- 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.
- 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.
- Adequate sight distance should be provided at all driveway access points and shall be in accordance with the standards provided in this Manual.
- 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.

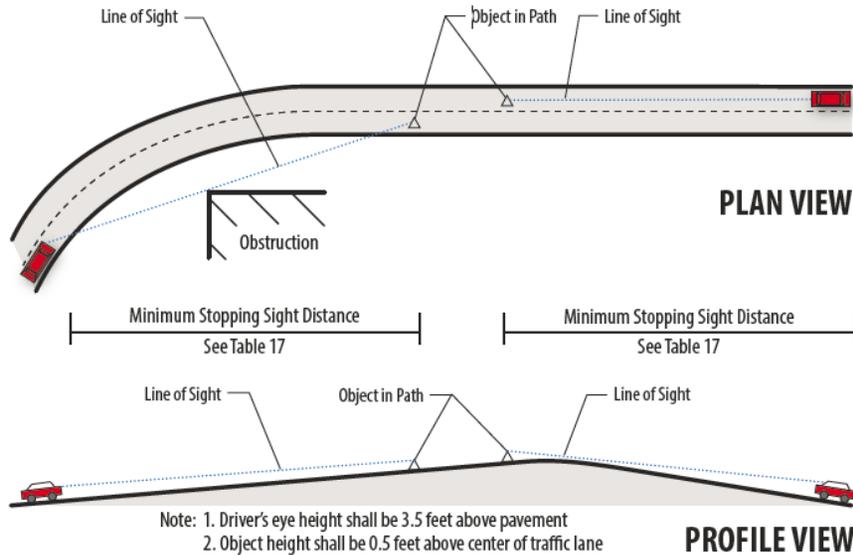
Section 9.5.1. Stopping Sight Distance

- A. When sight obstructions (such as walls, cut slopes, buildings and other hazards) are located 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.
- B. **Table xx – Stopping Sight Distance** provides the minimum stopping sight distance for the percentage of street grades.
- C. **Figure xx – Sight Distance Measurement** shows the measurement technique.

Table xx – Stopping Sight Distance

| Speed limit (mph) | Minimum stopping sight distance (in feet), Street grade in percent | | | | | | |
|-------------------|--|-----|-----|------|------------|-----|-----|
| | 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 xx – Sight Distance Measurement



Section 9.5.2. 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.
- B. Stopping sight distance on all approaches is needed as a minimum. Obstruction-free sight triangles shall be provided in both the horizontal and vertical planes, as related to assumed driver's eye height and position.
- C. At any intersection of two roadways **or a driveway**, 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 approach's edge of pavement or entrance to the road and 15 feet from the edge of pavement of the major **approach or driveway**, with a point that is distance (L) along the major **approach's** edge of pavement.
- D. **Figure xx – Sight Distance Graphic** depicts the method of measuring the sight distance at any intersection or driveway.
- E. **Table xx – Intersection Stopping Sight Distance** summarizes the required sight distance (L) along the road for a stopped vehicle to cross the street.
- F. 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.

Figure xx – Sight Distance Graphic

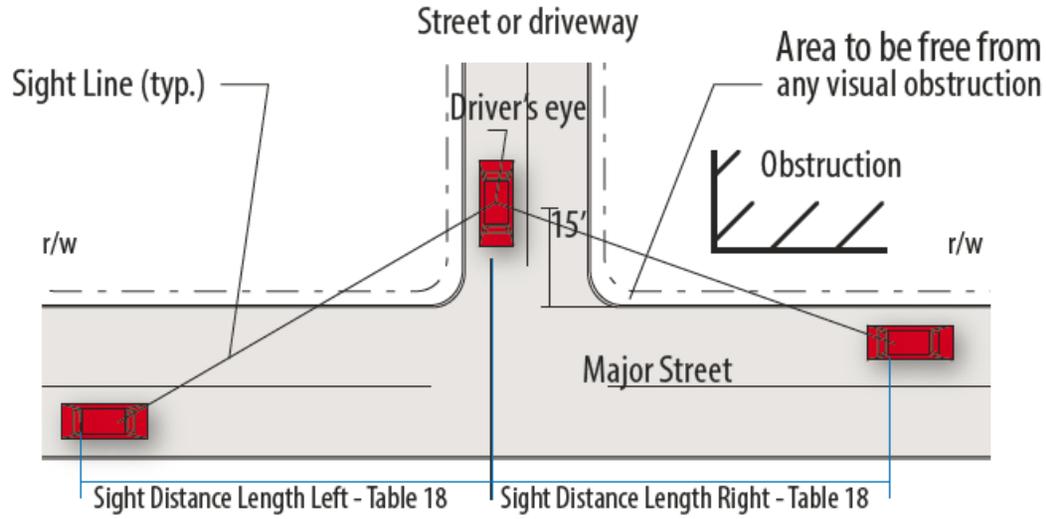


Table xx – Intersection Stopping Sight Distance

| 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.

CHAPTER 10. CONSTRUCTION STANDARDS

Driveway, Sidewalks, Storm Drain and Streets

Sec. 10-7001: Sidewalk and Driveway Construction Specifications

All sidewalks and driveways constructed in the *City* shall be construction under the specifications as set out in this section.

a) Driveway width, location and type

Driveway design type, width, location, number permitted, alignment, and associated sight distances for driveways *shall* comply with the **Street, Sidewalk and Driveway Access Handbook**, on file in the City Clerk's office.

b) Materials

1) Concrete

Concrete used in this construction *shall* conform to the requirements of section 207, "Portland Cement Concrete," of the latest edition of the "N.C. State Highway and Public Works Commission Standard Specifications for Roads and Structures" for class B concrete.

2) Joint Filler

The joint filler *shall* be of a nonextruding joint material conforming to the ASTM specifications for preformed expansion joint fillers for concrete (nonextruding and resilient types), designation D-544.

3) Curing Compound

Curing compound *shall* meet the requirements of section 406 of the "N.C. State Highways and Public Works Commission Standard Specifications," as amended.

c) Construction Methods

1) Subgrade Preparation

The subgrade for sidewalks and driveway *shall* be shaped to the proper cross-section and thoroughly compacting by rolling or tamping before placing any concrete. Tree roots shall be removed to a depth of one foot below subgrade for the full width of the walk. All soft and spongy material *shall* be removed and replaced with suitable materials which *shall* be compacted in layers not exceeding six (6) inches in thickness.

2) **Dimensions**

The minimum thickness of a sidewalk *shall* be four (4) inches except where it is crossed by a driveway; then it *shall* be a minimum of six (6) inches. The minimum thickness for driveway turnouts *shall* be six (6) inches.

A 4" capped conduit pipe shall be placed at all driveway crossings.



The minimum width of a sidewalk *shall be six (6) feet* except in the *following* cases, when approved by the Chief Engineer of the City or his authorized agent:

- a. Where an existing sidewalk is to be repaired and is not less than four (4) feet in width.
- b. Where the right-of-way of a street is such that the distance from the back of curb to the right-of-way line is less than eight and one half (1/2) feet.
- c. Where allowed specifically by the *Council* in cases of extreme hardship or excessive *property* damage.

3) **Alignment and grades**

Sidewalk shall be constructed in conformity with the *street* lines and grades established by the engineering department. Sidewalk *shall* have a uniform slope toward the curb of one-fourth inch per foot. The elevation of the front edge of the sidewalk shall be established by projecting the slope upward from the top of the curb of one-half inch per foot to the front edge of the sidewalk.

Sidewalks *shall* be horizontally located as follows:

- When the distance from the back of curb to the right-of-way line is twelve and one-half feet or less, the horizontal position of the back edge of the sidewalk *shall* be two (2) foot from the right-of-way line
- When the distance from the back of curb to the right-of-way line is greater than twelve and one-half feet, the horizontal position of the back edge of the sidewalk *shall* be four (4) foot from the right-of-way line

Where the ground elevation of a point located on a proposed driveway and thirty (30) feet horizontally from the right-of-way does not lie between slope limits twenty (20) percent projecting up and down the back edge of the sidewalk as established by the *preceding* standards, the following variances from the standards shall be permitted at the option of the permitted: the sidewalk section of the driveway *shall* be constructed on the slope established by projecting a line away from the edge of the sidewalk between the slope limits of one inch per foot upward and one-half inch per foot downward.

4) **Forms**

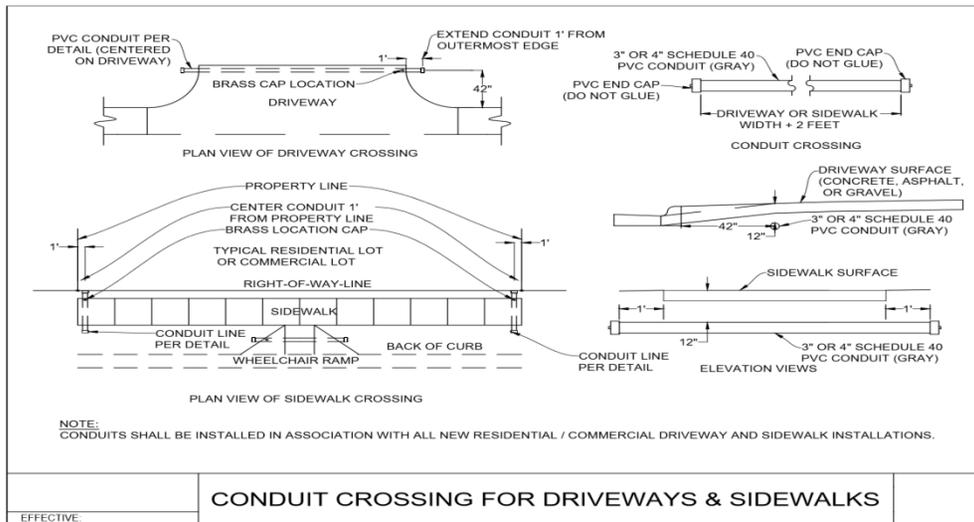
Forms used in constructing sidewalk *shall* be of wood or metal, of the full depth of the concrete. If of wood, they *shall* be of two-inch surfaced plank. All wood forms *shall* be thoroughly wetted and metals forms oiled before placing concrete. Forms shall be thoroughly cleaned before reuse.

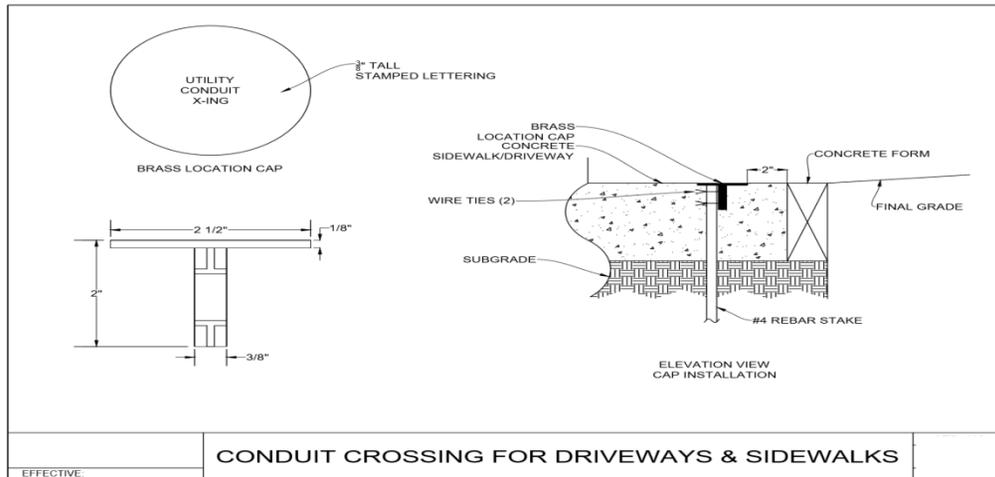
5)  **Utility Conduits**

Buried conduits for low voltage utility installations shall be installed in accordance with the Standard Detail. All residential and commercial driveways shall have at minimum one 3inch diameter Schedule 40 PVC conduit installed across the entire width of the driveway, extending 1 foot beyond the edges of the driveway. Conduits shall be sealed at each end with an unglued PVC cap.

For all lots that require sidewalk along the road frontage, conduits shall be installed below the sidewalk in accordance with the Standard Detail. All sidewalks, along a lot frontage, shall have at minimum 2 individual 3-inch diameter Schedule 40 PVC conduits installed across the entire width of the sidewalk, extending 1 foot beyond the edges of the sidewalk. Sidewalk conduits shall be installed on both sides of the lot and at a location of approximately 1 foot inside of the lot's property line. Conduits shall be sealed at each end with an unglued PVC cap.

All conduits shall be marked with a 2-inch brass cap, cast into the concrete curb and/or the sidewalk to indicate the location of the buried conduit. Brass caps shall be stamped with the words "Utility Conduit Crossing" in 3/8-inch tall lettering. All caps shall be held true to final elevation, within the forms, prior to and during placement of concrete, by the use of a 12-inch long rebar stake. One cap shall be installed at each individual utility conduit installation.





6) **Placing Concrete**

No concrete *shall* be placed until the forms and subgrade have been approved by the Chief Engineer of the *City* or his duly authorized agent. The concrete *shall* be placed thereon in one course to the required depth. The concrete *shall* be thoroughly spaded and rammed and struck off with a template to the required grade and cross-section. Successive batches of concrete *shall* be deposited in a continuous operation until individual sections are completed.

7) **Joints**

Contraction joints shall provide uniformly to separate Contraction joints *shall be* provided uniformly to separate the slabs and *shall* be cut to a depth equal to at least one-third the slab thickness.

A one-half-inch expansion joint filled with joint filler *shall* be placed between all sidewalks and **adjoining backs of curbs and** between the intersection of two (2) sidewalks and between all side- walks and **driveways. Sidewalks constructed adjacent to buildings** shall be separated from the building with a similar joint. The maximum distance between transverse joints *shall* be fifty (50) feet.

8) **Finishing**

After the freshly poured concrete has been brought to the established grade, it shall be floated with a wooden float to produce a surface free from irregularities. The final surface *shall* be obtained by troweling with a steel trowel or hand float and brushing lightly with a light weight brush in a transverse direction so as to produce a uniform gritty surface of the proper texture. All edges and joints *shall* be rounded to one-fourth of an inch

9) **Cold weather pouring**

Concreting operations shall not be undertaken or continued when the surrounding air temperature is below forty (40) degrees Fahrenheit, or the local weather reports indicate the possibility of temperatures of thirty-two (32) degrees Fahrenheit or lower within the ensuing twenty-four (24) hours unless provisions are made to insulate or heat the concrete in a manner satisfactory to the engineer. In any event, the contractor shall plan and prosecute his work in a manner which will assure satisfactory results. Any concrete damaged by freezing *shall* be removed and replaced by the contractor at his own expense.

10) **Curing and protection**

As soon as the concrete has hardened sufficiently to prevent damage, liquid membrane forming curing compound shall be used. When used, it shall be applied at a rate of one gallon per one hundred fifty (150) square feet of area immediately after the concrete has been finished and the surface water sheen has disappeared. Sufficient barricades, signs and warning devices shall be provided by the contractor to protect the finished concrete

11) **Removal of forms and backfilling**

After the concrete has set sufficiently, the form shall be removed and the spaces on both sides shall be backfilled with suitable earth, uniformly spread and compacted. The areas between the curb and sidewalk and immediately back of the sidewalk shall be left in a smooth, neat and workmanlike condition. If additional material is needed to smooth these areas to insure proper drainage, it shall be hauled in by the contractor at his expense.

12) **Removal of defective work**

The Chief Engineer of the City or his duly authorized agent *shall have the authority to and shall* require the removal of any sidewalk or driveway or portion thereof laid under these specifications which does not conform to the requirements as set forth herein. Upon notification in *writing* by the Chief Engineer of the City the contractor shall take immediate action to correct the faulty work at his own expense.

13) **Brick Sidewalks**

(1) **Installation and maintenance.**

Installation and maintenance of brick sidewalks shall be permitted only;

- a. Where an existing sidewalk is brick and is being replaced or repaired; or
- b. In an area designated as an overlay historic district; or
- c. Adjacent to an historic property, - or
- d. Where proposed for an entire block and all property owners agree to brick installation;
- e. Where a streetscape plan has been approved by City *Council* specifying brick sidewalk. In such areas brick sidewalk may be installed on a lot by lot basis.

14) **Construction Methods for Brick Sidewalks**

Subgrade preparation

- 1- The subgrade for sidewalks and driveways *shall* be shaped to the proper cross-section and thoroughly compacted by rolling or tamping. Tree *roots shall be* removed to a depth of one foot below subgrade for the full *width or* the walk. All soft and spongy material *shall be* removed and replaced with suitable material which *shall be* compacted in layers not exceeding six (6) inches in thickness.
- 2- (2) A five-inch thick base of stone screenings or sand well compacted and properly graded to provide drainage according to the standard sidewalk slope shall be installed. Where the sidewalk is crossed by a driveway, the base shall be increased to six (6) inches.
- 3- Except when repairing a nonconforming brick sidewalk, a five-foot-wide sidewalk of paving brick (conforming to ASTM C902) shall be laid to grade with a smooth uniform surface with a slope of one-fourth inch per foot toward the street
- 4- The voids between the bricks *shall be* filled with a mixture of sand and cement broomed into the voids. The sand—cement ratio *shall be* one-third (1/3) cement and two-thirds (2/3) sand well mixed before brooming into the voids. After the voids are well filled, the brick surface *shall be* cleaned of all excess sand and cement.

Where the ground elevation of a point located on a proposed driveway and thirty (30) feet horizontally from the right-of-way line does not lie between slope limits of twenty (20) per cent projecting up and down from the back edge of the sidewalk as established by the preceding standards, the following variances from the standards shall be permitted at the option of the permittee:

The sidewalk section of the driveway shall be constructed on the slope established by projecting a line away from the front edge of the sidewalk between the slope limits of one inch per foot upward and one-half inch per foot downward.

Removal of Defective work

The Chief Engineer of the City or his duly authorized agent *shall have the authority to and shall* require the removal of any sidewalk or driveway or portion thereof laid under these specifications which does not conform to the requirements as set forth herein.

Upon notification in *writing* by the by the Chief Engineer of the City the contractor shall take immediate action to correct the faulty work at his own expense

15) Driveways in Conservation Management Districts and protective yards

To preserve the screening function of Conservation Management Districts, Resource Management Districts and protective yards, as set forth in the UDO, driveways located in Conservation Management Districts, or in tree protection areas of other Resource Management Districts, or in protective yards *shall be* located and constructed to minimize disruption of the Conservation Management District, tree protection areas, and/or the protective yard and *shall* only be allowed if the driveway is the shortest distance through such areas.

16) Driveway Operation

- (1) Where ingress or egress to a driveway has been restricted, the property owner shall erect and maintain barriers and signs implementing such restrictions, and the failure of such owner to enforce such restrictions on users of said driveways is a violation of this Code. It shall be unlawful for any person to operate a motor vehicle in a restricted driveway except in conformity with the restriction.
- (2) The area which the driveway serves shall not be expanded to include other properties without the issuance of a new driveway permit by the City

17) Specifications

- (1) All work done in the construction of driveways shall conform to the standard specifications for concrete sidewalk and driveways as established by the Chief Engineer.
- (2) The sidewalk shall be constructed separately from the driveway which crosses it. All longitudinal and transverse joints of the sidewalk shall be complete joints through the full depth of the slab and not false joints or markings.
- (3) No driveway apron shall extend out into the street farther than the face of the curb and under no circumstances shall such driveway apron extend into the gutter area
- (4) Every person who intends or plans to use or is not using any portion of the sidewalk as a private driveway shall, if the Chief Engineer of the City certifies that the sidewalk area is inadequate for vehicular traffic, reconstruct such sidewalk in such a manner that the sidewalks capable of carrying vehicular traffic without creating pedestrian hazards and in accordance with the specifications hereinbefore referred to.
- (5) Curbs or equivalent *shall* be constructed between the sidewalk area and parking areas at all places except the **driveway width**. There *shall* be a distance of at least three (3) feet from this curb to the outside edge of the sidewalk

18) Appeal

The decisions of the Chief Engineer of the City made under the provisions of this section may be appealed by the applicant in writing to be City Manager

19) Hardship Appeal to Council

Where applicant can show practical difficulties or undue hardship in the way of carrying out the strict letter of this section, he may appeal to the Council and the Council may authorize a variation from the provisions of this section. Such appeal to the Council shall be filed with the City Clerk in writing and accompanied with three (3) sets of plans showing the desired locations and dimensions of requested driveways

d) Sidewalk and Driveway Permit

- (a) No sidewalk or driveway shall be constructed until a permit has been issued by the Development Services, the fees prescribed paid, the provisions of §7-2001 complied with, and the permit has been posted in a conspicuous place at the site of the authorized work.
- (b) No driveway or a preliminary site plan or master plan approved by the City Council shall be relocated into any Conservation Management District, transition yard, tree protective areas of street yards in Resource Management Districts, City easement, natural area, or other buffer area shown on the preliminary site plan, mixed use development, or master plan development without the approval of the Council. No additional driveway can be added to a preliminary site plan or master plan without the approval of the City Council. No driveway on a preliminary site plan or master plan approved by the City Council, or on a site for which preliminary site plan by City Council is required, shall otherwise be substantially relocated, widened or altered without the approval of the City Council.
- (c) No permit shall be issued to any person, firm or corporation who has failed after notice to remedy defective work or to otherwise comply with provisions for which a permit is required by this chapter or by this Code. No permit shall be issued for the construction of a sidewalk for only a part of a block.
- (d) No person shall pave, construct, widen or reconstruct a sidewalk or driveway across any public sidewalk, walkway or parkway, or into any street or alley, or cut any curb for the construction of a driveway without first having obtained a permit therefor as required herein. Fees for permits shall be according to the following schedule and shall be paid to the Development Services Department of Inspections at the time of issuance of permit:-
- Sidewalk fee:
 - Driveway fee
 - Re-inspection fee
 - Extra Inspection Fee
 - Obstruction Fee

The permit holder shall pay the actual cost of any compaction test or material test required by the Central Engineering Department.

(e) Application for such permit shall be made to the Department of Inspections and shall state, among other things, the location, grade and dimensions of the proposed sidewalk or driveway and the purpose for which it is desired. If the proposed driveway or sidewalk complies with provisions of this Code, the Department of Inspections shall issue a permit therefor. Two (2) sets of plans showing all pertinent information shall accompany the application for all commercial or filling station driveways. Plans for residential driveways shall be furnished when requested by the traffic engineer. The applicant shall comply with §7-2001, and all other ordinances and regulations of the City.

1) Existing Driveway

(1) Existing driveways shall not be relocated, altered or reconstructed without a permit approving the relocation, alteration or reconstruction, and such driveways shall be subject to the limitations as set forth in this section.

(2) When, in the opinion of the City Manager or his agent, an existing driveway has been abandoned or is no longer needed to serve abutting property or the closing of one or more multiple driveways on the lot achieves greater safety or conformance with the standards Streets, Sidewalk, and Drive- way Access Handbook or when the City Council determines that a driveway should be closed in whole or in part, it shall be the duty of the abutting property owner to restore the curbs and sidewalks to the standard described in this chapter. The procedure described in §7-2002 shall be followed to require the restoration.

e) Street Construction

- (a) No public *streets* or private *streets* required by Part 10, chapter 3, constructed by a developer, shall be approved by the City unless the requirements of Part 10, chapter 3, article B are met.

(b) Grading and improving.

Within right-of-way.

All *streets* shall have the full width of the *right-of-way* cleared and graded within fifty (50) feet of any *street* intersection. Additional *street* grading and clearing shall be as follows:

- a. The full *right-of-way* width of all major, minor, and sensitive area thoroughfares,
- b. The full *right-of-way* width of commercial streets where sidewalks are provided on each side pursuant to §10-3046(a)(3) and three and one-half (3 1/2) feet back of curb or the back of the swale where no sidewalk is provided on that side
- c. The full right-of-way width on one (1) side of the *street* and a minimum of three and one-half () feet back of the curb or the back of the swale on the other side for all other *streets*.

(2) Minimizing grading.

Unless required by any standard of this Code, *streets* are to follow the existing contours of the site to reduce grading, especially in Reservoir Watershed Protection Area Overlay and Conservation Management Districts, transitional yards as set forth in Part 10, chapter 2, and for *streets* crossing watercourses and wetlands.

3) Street Fill

Suitable fill material for all *streets* requiring fill, including any *street* crossing a watercourse, *shall* be placed in six-inch layers and compacted to a minimum density equal to at least ninety-five (95) percent of that obtained by compacting a sample of the material in accordance with ASSHTO-T99 (standard proctor) or latest revisions

Street Patch

a) Purpose

The purpose of this section is to protect and improve City of Raleigh streets by providing clear, consistent pavement repair standards for street cuts. This document specifies the size, shape, quality and general materials required to repair street cuts. It is not intended as a complete guide to pavement structures or materials standards. Adoption of these standards will increase the initial repair costs for the City and private utilities and contractors. However, these standards are necessary to preserve the original investment of the streets within the City, should save funds for the City in the long term and minimize the costs for the private sector by avoiding the costs to fix poor repairs.

b) Applicability

These standards apply to anyone cutting and excavating City of Raleigh streets, regardless of the reason for the cut and excavation. The standards apply to private and public utilities and contractors as well as the City of Raleigh. These standards are not intended to supersede more substantial repair or resurfacing requirements on projects where specified repairs are shown on approved construction drawings or otherwise directed by RDOT, Engineering/ Infrastructure Inspections or City Planning.

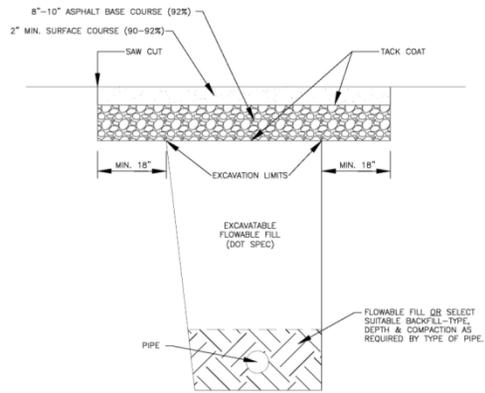
c) General Requirements

Street cuts cause damage that reduces the level of service of the street on which they are made. To minimize this damage, and in some cases actually improve the street conditions where cuts are made, the City is adopting the backfill, patch and surface repair standards as described in the following sections. In general, the repair standard will be what is termed a "T-patch", which includes flowable fill and a minimum bench (or key) of 18 inches beyond the edges of the excavation. This 18-inch bench will define the width of the required surface repair (if applicable) measured parallel to the travel direction of the street. The length of the surface repair (if applicable) measured perpendicular to the street will be at a minimum the full width of a travel lane (from curb or edge of pavement to the crown or edge of travel lane). If the edge of the excavation crosses or is less than 2 feet from the crown or edge of travel lane, the surface repair must extend to the full width of the street or edge of the next travel lane. The cost of all repairs shall be borne by party cutting the streets.

Resurfacing requirements could possibly be reduced or increased, at City Engineering's discretion, in situations where extenuating circumstances exist such as pending resurfacing or road widening projects, safety and traffic flow issues, speed humps, adjacent pavement features or the condition of adjacent pavement.

-Insert illustrations from Durham Street Cut Repair Standards

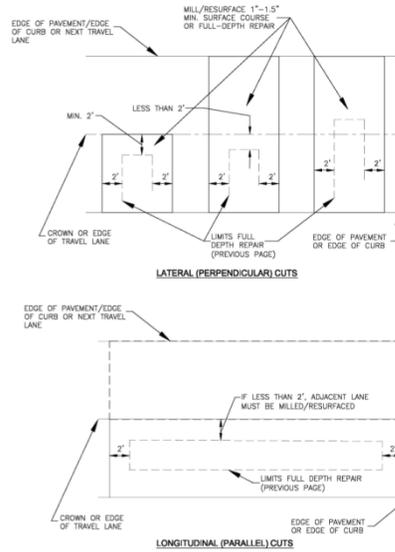
Street Cut Repair Detail Cross Section (All Repairs)



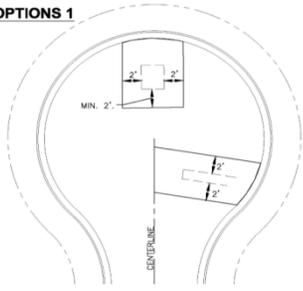
GENERAL NOTES:

1. SAW CUT EDGES MUST BE STRAIGHT AND CLEAN.
2. PATCHES MUST BE REGULAR, SQUARE OR RECTANGULAR WITH 4 STRAIGHT SIDES.
3. FINISH SURFACE COURSE MUST BE FLUSH WITH THE EDGE OF EXISTING PAVEMENT, VERTICALLY AND HORIZONTALLY, WITH NO SPILLOVER OF ASPHALT OR TACK COAT.
4. CARE MUST BE TAKEN NOT TO DAMAGE INTEGRITY OR APPEARANCE OF SURROUNDING PAVEMENT. IF DAMAGED, THE ENTIRE SURFACE PATCH MUST BE EXPANDED TO COVER DAMAGES.
5. ALL STREET STRIPING IMPACTED BY THE REPAIRS MUST BE REPLACED TO CITY OF DURHAM AND/OR NCDOT STANDARDS.
6. PROPER TRAFFIC CONTROL AND PLATING OF THE ROAD DURING CURE TIME FOR FLOWABLE FILL MUST BE CONDUCTED APPROPRIATELY AND TO CITY, STATE AND FEDERAL STANDARDS.
7. THE MAXIMUM TIME TO COMPLETE THE FULL REPAIR SHALL NOT EXCEED 10 WORKING DAYS.
8. FOR SMALLER REPAIRS, SURFACE ASPHALT MAY BE SUBSTITUTED FOR BASE COURSE, BUT MUST BE COMPACTION IN 2"-2.5" LIFTS.

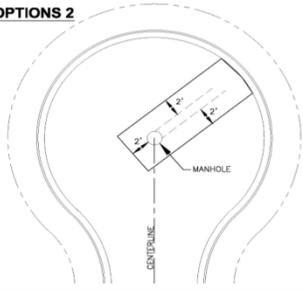
Surface Repair Plan Views (PCI ≥ 50)



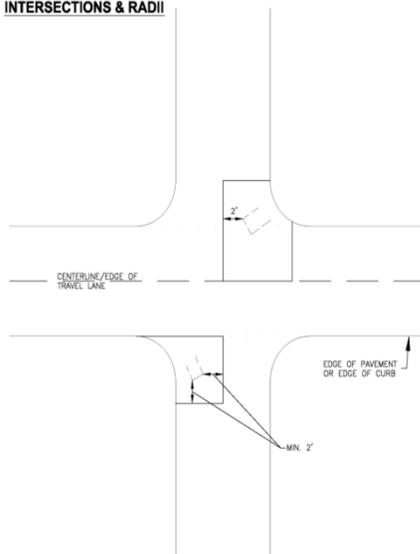
CUL-DE-SAC OPTIONS 1



CUL-DE-SAC OPTIONS 2

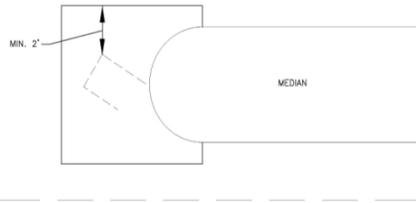


INTERSECTIONS & RADII

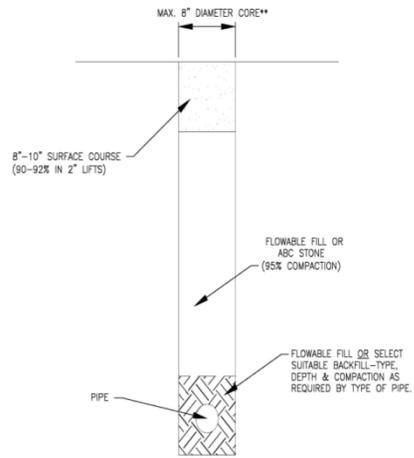
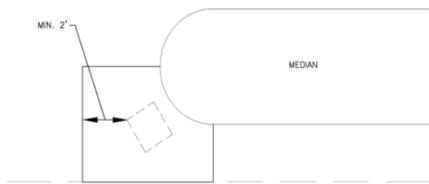


UTILITY SPOT CORES (LOCATES)

MEDIAN 1



MEDIAN 2



** LARGER CORES MAY REQUIRE MORE STRINGENT REPAIRS SUCH AS CORE REPLACEMENT WITH EPOXY BONDING GROUT AND SEALANT.

Examples

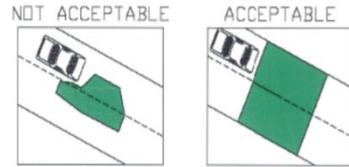
(adopted from Nashville, TN)

Utility Cut Repair Details

Some examples of repair methods that are not acceptable and the corresponding acceptable method are provided in the following examples. These examples must also meet the requirements given in Figures 2009.

Example 1

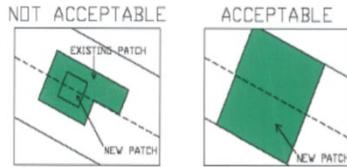
Existing pavements should be removed to clean, straight lines parallel and perpendicular to the flow of traffic. Do not construct patches with angled sides and irregular shapes. All repairs should be full lane width.



Example 1: Do not construct patches with angled sides and irregular shapes.

Example 2

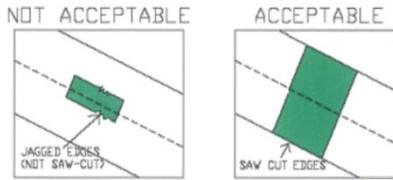
Avoid patches within existing patches. If this cannot be avoided, make the boundaries of the patches coincide. All repairs should be full lane width.



Example 2: Avoid patches within existing patches.

Example 3

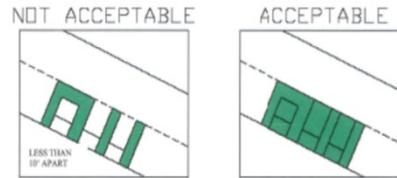
Asphalt and concrete pavements should be removed by saw cutting or grinding. Avoid breaking away the edges of the existing pavement or damaging the remaining pavement with heavy construction equipment.



All edges shall be saw cut.

Example 4

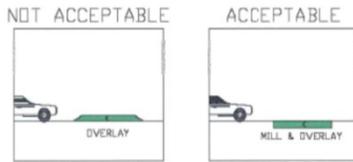
In the case of a series of patches or patches for service lines off a main trench, repair the pavement over the patches by grinding and overlay when the spacing between the patches is less than 10 feet.



The patched area must include any existing patches within 10 feet.

Example 5

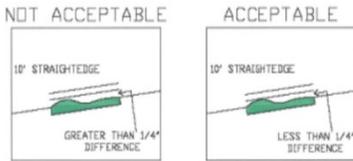
Completed street repairs should have rideability at least as good as, if not better than, the pavement prior to the repairs. A driver may be able to see a street repair, but in the case of a quality repair, should not be able to "feel" it in normal driving. A patch should provide a smooth ride with smooth transitions on and off the repair and all joints should be located outside the wheel path. Overlays should be placed by first removing the existing pavement to the desired depth by grinding or milling, and then placing the pavement flush with the adjacent surfaces. Overlays with feathered edges are not acceptable.



Patches may not decrease rideability.

Example 6

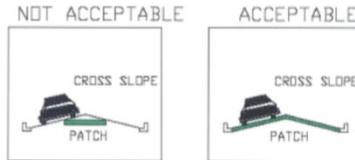
Surface tolerances for street repairs should meet the standard for new construction. That is, the finished surface of the street repair should be tested with a ten (10) foot straightedge parallel to the centerline or perpendicular across joints. Variations measured from the testing face of the straightedge to the surface of the street repair should not exceed one-quarter (1/4) inch.



Surface tolerances for street repairs should meet the standard for new construction.

Example 9

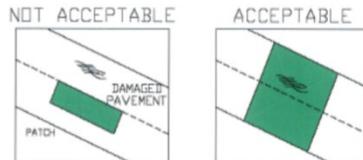
Patches should have a smooth longitudinal grade consistent with the existing roadway. Patches should also have a cross slope or cross section consistent with the design of the existing roadway.



Patch slope and grade must match existing pavement.

Example 10

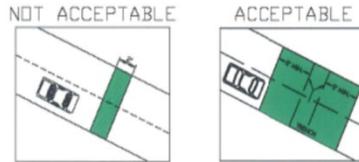
When the proposed excavation falls within ten feet of a section of pavement damaged during the utility repair, the failed area shall be removed to sound pavement and patched. Scarring, gouging, or other damaged pavement adjacent to a patch shall be removed and the pavement repaired to the satisfaction of Public Works Engineering.



Damaged pavement within 10 feet of a patch must also be patched.

Example 7

Transverse patches on arterial and collector streets shall be overlaid across the entire street width for a distance of two (2) feet minimum on all sides of the trench using a T-Patch.



Trenches must be patched using a T-Patch.

Example 8

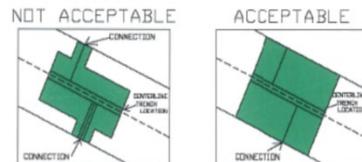
Do not allow the edges of patches to fall in existing wheel paths. The edges of patches parallel to the direction of traffic shall be limited to the boundaries of lanes or to the centerline of travel lanes.



Do not allow the edges of patches to fall in wheel paths.

Example 11

For patches in asphalt, a tack coat shall be applied to all edges of the existing asphalt before placing the new pavement. After placing the new asphalt, all seams (joints) between the new and existing pavements shall be sealed with an asphalt tack coat or rubberized crack seal material. Avoid frequent changes in width of patches. For future maintenance, this simplifies removal of adjacent pavement failures.



NOTE - TRENCH AND CONNECTOR LOCATIONS ARE CONCEPTUAL ONLY. SEE DETAILLED CROSSSECTION AND PROFILE SHEETS FOR CONSTRUCTION PROCEDURES AND WIDTHS.

Patches must avoid frequent width changes.

Information transferred from other municipalities -----Stormwater

A. Stormwater Drainage

Storm drainage facilities shall be designed to dispose of stormwater generated upon or passing through the project location. The determination of the quantities of water which must be accommodated will be based upon peak flows from storms having the following return periods:

| <i>Drainage Structure</i> | <i>Storm Event - Return Frequency</i> |
|------------------------------|---------------------------------------|
| Curb Inlet, Roadside Ditches | 2-year storm |
| Storm Sewer Collector | 10-year storm |
| Cross Street Storm Drainage | 25-year storm |
| Greenways | 25-year storm |
| Structures in Floodplain | 100-year storm* |

Drainage structures in the floodplain should pass 100-year storm without over-topping the roadway -- or in the alternative, the structures may be designed to pass only the 25year event, in which case, the downstream roadway embankment shall be fully protected from the residual flow which may overtop the roadway during a 100-year event.

Prediction of the peak flow rates shall be calculated using the procedure in the USDA Soil Conservation Service Method, the Rational Method, or other acceptable calculation procedures as determined by the City of Raleigh . The size of stormwater conduits shall be determined by utilizing the standard energy equation for inlet control or outlet control and headwater nomographs as published by various federal agencies – US FHWA - H.E.C. #5, Soil Conservation Service, etc. The minimum pipe size to be used shall be 15-inch diameter.

Discharge from the stormwater drainage systems shall not be of such a velocity as to cause damage after leaving the pipe. Maximum allowable outlet velocity will be 2.5 feet per second Exiting velocities shall be in conformance with the sedimentation and erosion guidelines and outlet protection used whenever the velocity exceeds the allowable limit. Pipe outlets, flared end sections and head walls shall be provided, with rip-rap aprons designed to reduce velocity and dissipate energy so that downstream damage from erosion does not occur. Calculations shall be submitted with plan review to the City of Raleigh Stormwater Department .

B. Location

Structures or Manholes shall be installed at each deflection of line or grade. Acute angle junctions (angles less than 90 degrees) between pipe runs should be avoided. No inaccessible junction boxes shall be permitted. The maximum distance between access openings shall not exceed 400 feet for pipes 30 inches and smaller. For pipes 36 inches and larger, the maximum distance between access openings may be increased to 500 feet.

Stormwater shall not generally be allowed to flow across the roadway. Any deviation shall require pre-approval by the City of Raleigh Stormwater Department. Catch basins shall be provided to intercept the flow prior to the radius of an intersection, or the design of the roadway shall indicate a continuous grade around the radius to allow the flow to continue down the intersecting street. Inlet spacing shall be sufficient to limit spread to no more than half of a through lane during a 4-inch per hour rain storm. No catch basin shall be installed in the radius of a curve.

Stormwater that is piped or is conveyed as open channel flow and originates within or passes through the public street rights-of-way shall be conveyed through a contiguous public drainage easement. The public drainage easement must extend from the public street rights-of-way through points downstream, to the point of open discharge.

Private storm drainage systems will be permitted, provided that: (1) such systems collect and discharge impounded stormwater wholly within the same lot; or (2) such systems collect water from one single lot and discharge into the public storm drainage system; or (3) such systems are properly engineered and approved on the signed set of construction drawings. Private storm drainage systems that connect to the public storm drainage system shall have the connecting leg of such a system, which crosses into the public street rights-of-way or easement, constructed in accordance with City specifications, including but not limited to: the necessary easements, piping, inlets and junction boxes. Connection of plastic pipe to City infrastructure is prohibited. Piped private storm drainage systems may not cross property lines, convey stormwater from one lot to another unless criterion #3 is met, or point discharge adjacent to curb. Where permitted by topography and site conditions, storm drainage systems that serve a single nonresidential lot (i.e., parking lots, private streets, vehicular use areas), shall be privately maintained.

C. Easements

All storm sewers shall be installed in dedicated street rights-of-way or easements. Minimum width of permanent storm drainage easements for public storm drain pipe shall be 20 feet. Where storm drain pipes are installed at a depth in excess of 10 feet or for pipes greater than or equal to 36-inch diameter, the easement widths shall be increased in accordance with the following table:

| <i>Pipe Diameter (in)</i> | <i>Pipe Depth (D, ft)</i> | <i>Easement Width (ft)</i> |
|---------------------------|---------------------------|---|
| 36 -- 48 | $10 < D \leq 15$ | 30 |
| 54 -- 72 | $15 < D \leq 20$ | 40 |
| > 72 | > 20 | To be determined by the City of Raleigh |

No structures or equipment such as buildings, fences, playsets, pools, HVAC units, etc. shall be placed within any public easement. The City of Raleigh is not liable for any damage to personal property located on public easements that may occur resulting from enactment of official duties.

Where multiple pipes are installed, the edges of the easement shall be a minimum of 10 feet from the centerline of the outside pipe with 3 feet clearance between the exterior of the parallel storm sewer pipes. Pipes shall not outfall in the front yard of a lot, but should extend to the rear third of the lot or property line in residential subdivisions.

D. Maintenance of Municipal Separate Storm Sewer System

The City shall maintain all piping and structures within City of Raleigh identified easements. The easements must be labeled as the following: "City of Raleigh Storm Sewer Easement" or "City of Raleigh Public Drainage Easement". Easements labeled as "Drainage Easement" or "Private" shall be maintained by the responsible party or property owner where such system is located.

When an approved Private Drainage System is designed and installed onto private property and connects to the Public COR street rights-of-way, a COR approved stormwater structure will be required and placed no further than 10 feet from the recorded or proposed street rights-of-way. A City approved easement will be placed around the stormwater structure that meets the current City specifications. The City of Raleigh shall stop all maintenance activities at this point. A private easement boundary shall be shown beyond this point and recorded to describe and allow ownership inspection and maintenance activities. The City shall not be responsible for any infrastructure, grassed swales, or other stormwater conveyances located within private easements.

Structure Design

All structures (manholes, curb inlets, catch basins, junction boxes, etc.) shall be constructed of concrete brick masonry units, cast-in-place reinforced concrete, or precast concrete. Structures shall be repaired and re-built with solid concrete brick and mortar. Materials such as broken concrete pipe, clay brick, and rock are prohibited. Structure walls shall be repaired to original manufacturer conditions. Waffle boxes are permitted. All pre-cast boxes shall be solid boxes.

Curb inlets in streets with curb and gutter shall be topped with City of Raleigh Open Throat Standard or NCDOT type standard frame, grate, and hood.

A. Concrete Brick Masonry Units

Concrete brick masonry units shall be solid units meeting the requirements of ASTM C55, Grade S-II. Clay brick shall not be permitted for any drainage structure.

B. Precast Concrete Manholes

Pre-cast concrete manholes shall meet the requirements of ASTM C478. Manholes shall have joints sealed with a pre-formed rope-type gasket per ASTM C990. Manhole base diameters shall conform to the following for the various storm sewer pipe sizes:

| <i>Pipe Diameter (in)</i> | <i>Manhole Base Diameter (ft)</i> |
|---------------------------|-----------------------------------|
| 15 - 36 | 5 |
| 42 - 48 | 6 |
| 54 | 8 |

For pipes greater than 54 inches, manhole base sections shall be sized as required and shall be approved by the ENGINEER. All precast manholes installed on thoroughfare routes shall be approved and stamped by the NCDOT Materials and Tests Unit at the manufacturer's facility prior to delivery.

Transition reducing slabs may be used to enable the use of 4-foot diameter eccentric cones at the top. All pre-cast manholes for storm sewers in traffic areas shall be of the eccentric type for ease of access. Manholes in non-traffic areas shall be flat-top type.

.....C. Mortar

Mortar shall be proportioned as shown below for either Mix No. 1 or Mix No. 2. All proportions are by volume. Water shall be added only in the amount required to make a workable mixture. MIX NO. 1

| | |
|-----------|---|
| MIX NO. 1 | 1 part Portland Cement 1/4 part Hydrated Lime 3 3/4 parts Mortar Sand (maximum) |
| MIX NO. 2 | 1 part Portland Cement 1 part Masonry Cement 6 parts Mortar Sand (maximum) |

Portland cement shall be ASTM C-150, Type 1. Hydrated lime shall conform to ASTM C207, Type S. Masonry cement shall meet the requirements of ASTM C91. Mortar sand shall be standard size 4S, per requirements of the NCDOT.

.....D. Castings

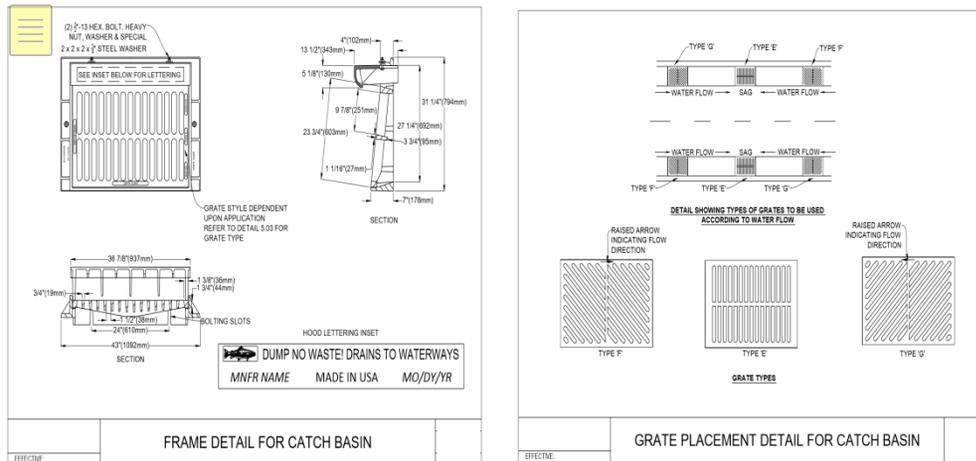
1) General – All castings shall meet the requirements of ASTM A48, Grade 35B iron and shall be manufactured in the USA. Country of origin shall be embossed on each casting.

At a minimum, manufacturers shall submit the following to substantiate to the ENGINEER that castings meet the minimum criteria:

a. Bar tensile test reports from an independent testing laboratory. The results must confirm that the material meets ASTM A48 Class 35B. b. Casting proof load test report on the subject casting. Proof load tests shall be conducted in accordance with AASHTO M306, Section 7.0. During proof load testing, castings shall maintain a 40,000 lb proof load for one minute without experiencing any cracking or detrimental deflection. c. A written statement of certification by a qualified licensed engineer, employed by the producing foundry, that castings meet these specifications.

2) Curb Inlet - Grates, frames, and hoods shall be in accordance with City of Raleigh Standard SW 10.06.1, NCDOT Standard 840.02 and 840.03. Curb inlet hoods shall be embossed with “**Dump No Waste! Drains to Waterways**”.

3) Grates & Frames - Cast iron grates and frames for yard inlets shall be of the size indicated on the approved plans. Grates and frames shall be in compliance with City of Raleigh and NCDOT Standards.



.....**4) Manhole Rings & Cover** - Cast iron manhole rings and covers shall be in compliance with the Standard Detail with the words “**STORM SEWER**” cast on the cover. Covers shall have two 1-inch holes. Manhole castings shall be machined to provide a continuous bearing around the full periphery of the frame.

F. Portland Cement Concrete

Portland cement concrete used for storm drainage structures, end walls, etc. shall have a minimum compressive strength of 3,000 psi at 28 days. Primary structures, such as box culverts, may require concrete having a compressive strength greater than 3,000 psi, and may require the submission of mix designs and testing of the concrete by an independent laboratory. These special requirements may be imposed by the City of Raleigh for all such structures where deemed necessary.

G. Reinforcing Steel

Reinforcing steel shall be new billet steel conforming to ASTM A615 for grade 60. Reinforcing steel shall be deformed per current ASTM standards.

H. Connections

All storm drain connections shall be made with non-shrink grout.

I. Pipe Material

All storm sewer pipes to be installed in projects within the jurisdictional limits of the City shall conform to the specifications presented herein. In special cases where material other than those listed below is requested, the applicant's plan submittal must contain a formal request to use other material and complete background data to justify its use.

1) Depth of Cover

Cover heights shall be as follows:

- Reinforced Concrete Pipe (RCP)
- Corrugated Polypropylene Pipe (CPP)
- Corrugated Aluminized Steel Pipe - Type 2 (CSP)
- Corrugated Aluminum Pipe (CAP)



| RCP | | |
|-------|----------|----------|
| CLASS | MIN (ft) | MAX (ft) |
| III | 2 | 20 |
| IV | 1 | 30 |

| Pipe Diameter (in) | CPP | | CSP | | CAP | |
|--------------------|----------|----------|----------|----------|----------|----------|
| | MIN (in) | MAX (ft) | MIN (in) | MAX (ft) | MIN (in) | MAX (ft) |
| 15 | 12 | 28 | 12 | 158 | 12 | 98 |
| 18 | 12 | 28 | 12 | 131 | 12 | 81 |
| 21 | | | 12 | 113 | 12 | 69 |
| 24 | 12 | 26 | 12 | 98 | 12 | 60 |
| 30 | 12 | 26 | 12 | 79 | 12 | 57 |
| 36 | 12 | 20 | 12 | 65 | 12 | 47 |
| 42 | 12 | 20 | 12 | 55 | 12 | 40 |
| 48 | 12 | 20 | 12 | 48 | 12 | 35 |
| 54 | | | 12 | 56 | 15 | 31 |
| 60 | 24 | 20 | 12 | 50 | 15 | 28 |

.....2). Reinforced Concrete Pipe (RCP)

RCP shall be as per ASTM C76 (or the latest revision), Class III or Class IV with a minimum 15-inch diameter. All joints shall include gaskets conforming to ASTM C 1628. All RCP installed on thoroughfare routes shall be approved and stamped by the NCDOT Materials and Tests Unit at the manufacturer's facility prior to delivery.

Any of the following criteria will be grounds for rejection of RCP material:

- 1) Any fracture or crack that visibly passes through the wall of pipe;
- 2) Any fracture or crack that is 0.01 inch wide or greater at the surface and 12 inches or longer regardless of position in the wall of the pipe;
- 3) Offsets in form seam that would prevent adequate concrete cover over reinforcing steel;
- 4) Delamination in the body of the pipe when viewed from the ends;
- 5) Evidence of inadequate concrete cover for reinforcing steel;
- 6) Any severe surface condition that affects the majority of the pipe section surface and could reduce the durability and service life of the pipe;
- 7) Damaged or cracked ends where such damage would prevent making a satisfactory joint.

.....3) Corrugated Polypropylene Pipe (CPP)

The pipe and fittings shall be an annular corrugated wall and a smooth interior wall (double-wall) or pipe and fittings with an annular corrugated wall and a smooth interior and exterior wall (triple-wall), conforming to the requirements of ASTM F2764 and AASHTO Specifications M330 (latest edition) for Corrugated Polypropylene Pipe.

Bell and spigot joints are required on all pipes. Bells shall cover at least two full corrugations on each section of pipe. The spigot shall be double-gasketed. The bell and spigot joint shall have "O"-ring rubber gaskets meeting ASTM F477 with the gaskets factory installed and placed on the spigot end of the pipe. Pipe joints shall meet all requirements of AASHTO M330. Transitions from CPP to RCP shall be made with the appropriate adapter. Refer to Section 505 A.

.....4) **Corrugated Aluminized Steel Pipe - Type 2** (CSP)

Aluminized Steel Type 2 pipe shall be 14 gauge minimum for 15-inch and 18-inch diameters, 12 gauge for all other sizes. Coils shall conform to the applicable requirements of ASTM A929. CSP shall be manufactured in accordance with the applicable requirements of ASTM A760. All fabrication of the product shall occur within the United States. Coupling bands shall be made of the same base metal and coatings as the CSP to a minimum of 18 gauge.

.....5) **Corrugated Aluminum Pipe (CAP)**

Aluminum pipe shall be 14 gauge minimum. Coils shall conform to the applicable requirements of ASTM B744. CAP shall be manufactured in accordance with the applicable requirements of ASTM B745. All fabrication of the product shall occur within the United States. Coupling bands shall be made of the same base metal and coatings as the CAP to a minimum of 18 gauge.

.....6) **High Density Polyethylene (HDPE)**

Create Spec.

.....7) **High P Polyethylene (HPP)**

Create Spec.

J. Miscellaneous Materials

.....1). **Rip Rap**

Riprap shall be large aggregate of the size and class shown on the approved drawings. Stormwater calculations shall be submitted with the construction plan review application.

Inlets and Outlets

.....1) Headwalls, Endwalls, and Flared End Sections

Headwalls, endwalls, and flared end sections shall be constructed of structural cast-in-place concrete, pre-cast concrete in accordance with NCDOT specifications, or Engineer Designed Keystone /Block and shall be installed at all discharge points and inlets where there is not a structure. Details and design of headwalls, endwalls, and flared end sections shall be in accordance with NCDOT requirements. Details shall be shown on all plan submissions. The City of Raleigh maintains the right to reject and proposed material and dictate the material used for any given Headwall or Endwall.

Flared end sections shall be installed on single pipe culverts up to and including 36 inches in diameter, and on multiple pipe culverts less than 30 inches in diameter. Flared end sections shall also be installed at the outlet point of all storm drainage systems. Dissimilar pipe couplers shall be used to connect CPP, CSP, or CAP pipe to end sections.

Headwall and endwall shall be installed on single pipe culverts greater than 36 inches in diameter, and on multiple pipe culverts greater than and including 30 inches in diameter.

.....2). Dissipaters and Scour Protection

Energy dissipaters shall be installed at all discharge points and shall be properly sized to ensure that stormwater is released at a non-erosive velocity.

Scour protection shall be provided for all drainage ways where, in the opinion of the COR ENGINEER, erosive velocities or other factors require the use of protective measures. All protective measures shall be shown on all plan submissions.

Additional information on the impact of stormwater discharge onto adjacent properties may be required by the COR ENGINEER.

Stormwater Control Measures (SCMs) within the Primary and Secondary Watershed Protection Overlay Districts

Stormwater Control Measures (SCMs) shall be designed and constructed per the guidelines and minimum design criteria presented in the State of North Carolina Department of Environmental Quality (NCDEQ) Stormwater Design Manual, latest revisions. These structures shall be designed to meet all stormwater requirements presented in Section 6.1 of the TOWN Unified Development Ordinance (UDO).

In addition to the guidelines and minimum design criteria presented in the NCDEQ Stormwater Design Manual, the following specifications shall be used for all SCMs:

- 1) The invert elevation for the inlet to the SCM shall be set no lower than the normal/permanent pool elevation controlled by the water quality orifice(s).

- 2) The outlet device shall be constructed of either precast Reinforced Concrete Pipe or CMP material. No masonry structures will be approved.
- 3) All water quality drawdown devices that penetrate the dam embankment shall be constructed of ductile iron pipe.
- 4) All vegetated side slopes and tops of dams shall be sodded with non-clumping turf grass.
- 5) All SCM side slopes stabilized with vegetated cover shall be no steeper than 3:1 (horizontal to vertical).

Prior to issuance of a certificate of occupancy (with respect to a site plan), or commencement of a use for any development upon which an SCM is required, the applicant shall certify that the completed project is in accordance with the approved stormwater management plans and designs, and shall submit actual "as-built" plans and corresponding as-built supplements for all SCMs.

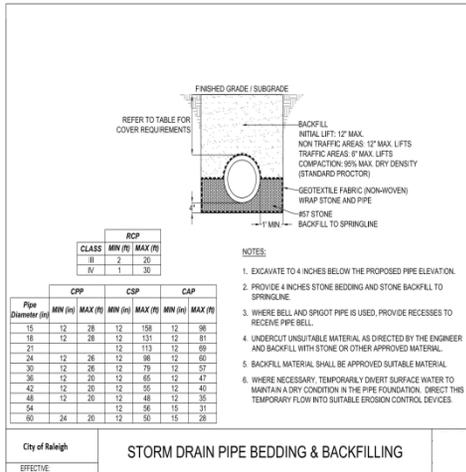
The "as-built" plans shall show the final design specifications for all SCMs and practices and the field location, size, elevations, and planted vegetation of all measures, controls, and devices, as installed. The designer of the SCMs shall certify, under seal, that the asbuilt SCMs, controls, and devices are in compliance with the approved plans and designs as required by the City of Raleigh Stormwater Design Manual.

A final inspection and approval by the City of Raleigh Stormwater & Utility Engineering Manager or his/her designee must occur before the release of any performance and/or maintenance securities.

Construction Methods

A) Trenching & Bedding for Storm Sewers

The trench shall be constructed per the Standard Detail. Where the foundation is found to be of poor supporting value, the pipe foundation shall be conditioned by undercutting the unacceptable material to the required depth as directed by the INSPECTOR, and backfilling with stone or other approved material. Where necessary, surface water shall be temporarily diverted in order to maintain the pipe foundation in a dry condition. The flow of water from such temporary diversions shall be directed into suitable erosion control devices.



B) Pipe Laying

Concrete pipe culverts shall be laid carefully with bells or grooves upgrade and ends fully and closely jointed.

C) Backfilling

The trench shall be backfilled per the Standard Detail. The backfill materials shall be moistened when necessary in the opinion of the INSPECTOR to obtain maximum compaction. Water setting or puddling shall not be permitted.

All trash, forms, debris, etc., shall be cleared from the backfill material before backfilling. Backfilling around structures shall be done symmetrically and thoroughly compacted in 6inch layers with mechanical tampers to the specified 95% density (Standard Proctor)

D). Masonry Structures

Excavations shall be made to the required depth, and the foundation, on which the brick masonry is to be laid, shall be approved by the City. The brick shall be laid so that they will be thoroughly bonded into the mortar by means of the "shove-joint" method. Buttered or plastered joints will not be permitted. The headers and stretchers shall be so arranged as to thoroughly bond the mass. Brickwork shall be of alternate headers and stretchers with consecutive courses breaking joint. All mortar joints shall be at least 3/8 inches in thickness. The joints shall be completely filled with mortar. No spalls or bats shall be used except for shaping around irregular openings or when unavoidable to finish out a course. All details of construction shall be in accordance with approved practice and to the satisfaction of the INSPECTOR.

Steps as shown on the plans shall be placed in all catch basins and inlets when they are greater than five feet in depth. The steps shall be set in the masonry as the work is built up, thoroughly bonded, and accurately spaced and aligned.

1) Inverts in the structures shall be shaped to form a smooth and regular surface free from sharp or jagged edges. They shall be sloped adequately to prevent sedimentation. The castings shall be set in full mortar beds. All castings when set shall conform to the finish grade shown on the drawings. Any castings not conforming shall be adjusted to the correct grade.

Two (2) 2-inch diameter weep holes shall be installed above the upstream pipe invert in all storm drain structures. Protect weep holes with screen wire or fabric outside the structure to prevent clogging.

2) Concrete Construction

The forming, placing, finishing, and curing of Portland cement concrete shall be performed in strict accordance with all applicable requirements as contained in the Standard Specifications for Road & Structures latest edition, as published by the NCDOT and pertinent ACI (American Concrete Institute) codes and guidelines.

E. Installation of Precast Concrete Structures

Pre-cast concrete manholes, junction boxes, etc. shall be installed level and upon a firm, dry foundation, approved by the INSPECTOR. Structures shall be backfilled with suitable materials, symmetrically placed and thoroughly compacted so as to prevent displacement. Castings shall be set in full mortar beds to the required finished grade. Refer to the Standard Detail.

Two (2) 2-inch diameter weep holes shall be installed above the upstream pipe invert in all storm drain structures. Protect weep holes with screen wire or fabric outside the structure to prevent clogging.

Inspection CCTV

PIPE VIDEO STANDARDS: Installation of pipes/culverts consisting of the following approved materials (concrete, high density polyethylene – HDPE, and corrugated aluminum or aluminized) used for the purpose of conveying stormwater runoff in and out of public rights-of-way, that are eligible for maintenance by the City, is subject to the following:

a). All storm drainage system installation requires a Closed Circuit Television (CCTV) video as part of the inspection process after installation and prior to the approval process. Pipe larger than 48 inches may require manual entry and inspection (confined space regulations may be applicable).

No acceptance of a street(s) or associated map phase(s) will be considered by the City until a CCTV video of the associated storm drainage system is approved. CCTV video inspection may be performed by the City or provided via Third Party to the City of Raleigh for approval. The City will monitor, evaluate, and review videos and reports submitted by the owner or certified consultants as a quality assurance/quality control (QA/QC) practice. Any discrepancies between the report and the City review may constitute non-acceptance of the approval. All CCTV video will be performed by a current National Association of Sewer Service Companies-Pipeline assessment and Certification Program (NASSCO-PACP) certified contractor and in compliance with NASSCO-PACP standards. All videos, reports, and repair methods will meet the most recent published version of City Standards. The City expects storm drainage systems to be clean, have good alignment, tight joints, no broken or cracked pipes, and built per the approved plans prior to submittal of CCTV video documentation. Any systems that do not meet the above may be rejected at the discretion of the City of Raleigh Inspector, Engineer or Agent.

b. The storm drainage system owner (developer, builder, property owner, etc.) will provide at their cost the following prior to final inspection and City acceptance:

1). Plat, map or drawing identifying each pipe segment being presented for acceptance with all inlet nodes labeled and corresponding to the accompanying video such that it is clear as to the pipe/culvert being accepted. For example, start of video is at inlet CB1 to JB2 as shown on accompany drawing. (video map segments should match the approved drawings.)

2) The INSPECTOR shall arrange a camera inspection of all storm drainage lines with the City of Raleigh Street Maintenance Division or a CCTV video performed by a NASSCO-PACP certified Third-Party contractor for each pipe/culvert segment being considered for acceptance.

.....**3)** A digital copy of the report for each pipe/culvert segment that certifies the condition of pipe as installed is in compliance with the most recent version of NASSCO-PACP methodology and standards. All defects are to be coded and reported per NASSCO-PACP certification guidelines to the City for review, after all repairs have been made. Any repair or treatment to defects (prior to submittal of video or as observed by the City agency) will be corrected in compliance with Industry Standard approved methods. Example: by following the American Concrete Pipe Association acceptable methods and applicable material treatments associated with concrete pipe deficiency (broken concrete pipe will be repaired structurally by an approved method.)

.....**4)** Deficiencies found/observed by City staff may require an additional CCTV video to document they have been corrected appropriately and repair or treatment followed Industry Standard approved methods. Deficiencies must exceed the ACPA standards for acceptable pipe variations.

.....**5)** The name of the contractor who installed the drainage system, and their contact information.

When inspection indicates possible excessive deflection in CPP, CSP, HDPE, HPP or CAP, the contractor shall complete a deflection test by mandrel using a rigid device approved by the INSPECTOR. The mandrel size shall be clearly labeled and shall be sized so as to provide a diameter of at least 95% of the inside pipe diameter. If deflection exceeds 5%, the pipe shall be evaluated to determine what corrective measures are required.

CHAPTER 11. RIGHT-OF-WAY PROVISIONS

Article 11.1. Purpose

This Chapter outlines the responsibilities of anyone that has acquired permits for any activity that impacts the public right-of-way. All projects within the City's right-of-way shall be adequately reviewed for coordination, and ensure the health, safety, and welfare of citizens.

- A. No person shall make any excavation or opening or dig any ditch, trench, tunnel or hole in, along, across or under any street, sidewalk or other public place for the purpose of laying or placing therein any pipe, wires, pole or for any other purposes.
- B. No person shall grade, construct, pave or otherwise improve or repair or undertake the grading, construction, paving, improvement or repair of any street or sidewalk or other public place, including the construction, extension, paving or repair of any driveway which extends over or within the boundaries of any street, sidewalk or street right-of-way.
- C. No person shall engage in any work or activity which shall in any way obstruct or tend to obstruct any street, sidewalk or other public place except those operating according to a valid permit issued pursuant to this Code.
- D. No person shall engage in the erection, construction, repair, demolition, renovation, maintenance or any other work or activity in or upon, over, under or adjacent to or within five (5) feet horizontally of any street, sidewalk or other public property within the City outside of any permanent building.
- E. Permits shall be issued for any of the activities described above, to ensure proper compliance with all Local, State and Federal requirements. Any applicant shall provide a certificate of liability insurance and performance bond to the City of Raleigh.

Article 11.2. Standard Provisions

Section 11.2.1. Pre-Construction Requirements

A. Pre-construction Meeting

1. A pre-construction meeting may be required prior to performing any work. The permittee, utility owner, contractor(s), stakeholders, and any party involved in the project shall be in attendance.
2. At this time or upon request, permittee and/or owner shall present necessary construction plans and schedule; including staging, lane/street obstructions, project duration, work hours, paving restoration, construction inspection, public notification, etc.
3. A pre-construction meeting is required for any downtown area or high-volume road.
4. All pre-construction meetings are to be coordinated with the inspections coordinator.

5. The Contractor shall take a sufficient number of preconstruction photos and videos. All damaged items along property frontages (asphalt, curb, and sidewalk) shall be replaced, and in acceptable condition prior to closeout of all applicable right-of-way permits.

B. Public Notification Requirements

1. The permittee shall inform all residents, businesses, and emergency services with a notification letter at least 2 (Two) weeks prior to the commencement of construction within the area of the proposed project.
2. Information within the letter shall include, but not limited to, the anticipated timeframe of the construction, any proposed traffic disruptions, the responsible party's contact information, and the subcontractor's contact information.
3. Additional means of communication may include door hangers, neighborhood meetings, and face to face discussions, etc.

C. Traffic Control

1. All traffic control signage and practices shall adhere to the Manual on Uniform Traffic Control Devices (MUTCD), and the latest edition of the NCDOT, "Standard Specification for Roadway Structures" NCDOT, "Roadway Standard Drawing Manual" and the NCDOT supplement to the MUTCD.

D. Traffic Signals and Intersection Operations during Construction

1. Prior to construction or work around traffic signals a preconstruction walk through shall be coordinated with the Department of Transportation with City of Raleigh Signals, so that locates are completed, and the contractor will be made aware of the signal utilities underground.
2. Any construction operation where a contractor wishes to use law enforcement must initiate and coordinate with the appropriate agency. The City of Raleigh must be informed of such operation prior.

E. Tree disturbing activity in the right of way

1. The contractor shall coordinate with Urban Forestry when trees in the public right-of-way are impacted, removed, or disturbed during any activity. The Urban Forestry Manual is the guidance document for any rules, regulations, and process.

F. Public Utilities Critical Infrastructure Notification

1. The Public Utilities Handbook for the City of Raleigh is the official guidance document for any rules, regulations, and process regarding Critical Infrastructure Notification Rules.

G. Illicit Discharge

1. An illicit discharge is an unlawful act of disposing, dumping, spilling, emitting, or other discharge of any substance other than storm water into the storm water drainage system. The storm water drainage system includes streets, ditches, catch basins, yard inlets, lakes, and streams. The Stormwater Quality Improvement Program has information regarding the rules, regulations, and processes related to illicit discharge.

Section 11.2.2. Lane Obstructions

A. Definition of a Lane Obstruction

A lane obstruction involves the occupation of a lane or lanes during projects but not closing the lane or lanes off completely. This can be in the form of a flagging operation, lane merges, or other traffic shifts to allow traffic to still flow and not close the street. This does include shoulder work in which equipment may need to move and operate.

1. Any work in which obstructs traffic on a street or in a lane must comply with the Americans with Disabilities Act, Manual on Uniform Traffic Control Devices, and Public Right of Way Accessibility Guidelines.
2. An Right of Way permit is required for all activity that is performed in the Right of Way.
3. If work is being performed 5' from back of curb no lane closure is required. Signage in compliance with the Manual on Uniform Traffic Control of work ahead is required to notify traffic and pedestrian is required.
4. A minimum access of 20' is required at all times for traffic. This does not include the curb and gutter areas.
5. If any operator/contractor parks in a residential area forcing the homeowner/resident to park on the other side of the road, narrowing to 20' or less, the operator/contractor is liable to ensure a lane closure permit is obtained. All lane closures must abide by Local, State, and Federal Laws.
6. Sight visibility must be maintained at all intersections and in the work zone.

B. Lane Closure Times for roads with a marked centerline

1. No lane closures are permitted between 6:00 a.m. to 9:00 a.m. and 4:00 p.m. to 6:00 p.m.
 - a. Further restrictions may apply due to traffic conditions.
 - b. Further restrictions apply in a School Zone.
2. Night work regulations are as follows:
 - a. No lane closures are permitted prior to 7:00 p.m. and must allow traffic to resume at 6:00 a.m.
 - b. The City of Raleigh Noise Ordinance applies during any night work.

C. Lane Closure times for unmarked roads

1. Standard hours for lane closures are 7:00 a.m. to 7:00 p.m.

- a. Further restrictions may apply due to traffic conditions.
 - b. Further restrictions apply in a School Zone.
2. Night work regulations are as follows:
 - a. No lane closures are permitted prior to 7:00 p.m. and must allow traffic to resume at 6:00 a.m.
 - b. The City of Raleigh Noise Ordinance applies during any night work.

Section 11.2.3. Sidewalk Obstructions and/or Detours

A. Sidewalk Obstructions

A sidewalk can be obstructed temporarily for the contractor to perform work. The contractor should strive to keep the sidewalk accessible.

Any obstruction in the sidewalk must be approved prior to the setup of the work area.

1. Sidewalks can be obstructed temporarily for a contractor to perform work with a permit.
2. Any obstruction in the sidewalk shall be approved prior to the setup of the work area.
3. Any time a sidewalk is obstructed and impedes pedestrians, a safe alternative route shall be provided.
4. If overhead work is to be performed a lane closure and sidewalk closure permit is required.
5. All public sidewalks must be accessible to all pedestrians, and those who are visually impaired and/or people with mobility concerns.
6. Existing and alternative pedestrian routes during construction shall be required to be compliant with the Public Rights of Way Accessibility Guidelines (PROWAG), the ADA Standards for Accessible Design and the Manual on Uniform Traffic Control Devices (MUTCD).
7. No vehicles are permitted to park or stop on sidewalks.
8. The driver of a motorized vehicle shall not drive on any sidewalk except at a permanent or temporary driveway.
9. Scaffolding or overhead protection requires a Building and Electrical permit along with a Right-of-way permit.
10. Sight visibility must be maintained at all intersections and in the work zone.

Section 11.2.4. Full Street Closures

A. Full Street Closures

A full street closure is designed to eliminate the exposure of motorists to work zones, while providing a safe working environment for workers by temporarily closing a street for construction or maintenance. During a full street closure, traffic is detoured, allowing workers full access to roadway facilities and ensuring that motorists and City services are rerouted properly to their destinations around the work area.

Section 11.2.5. Holiday Schedule and Special Event Work

1. No work is permitted during the City of Raleigh Holiday Schedule. If the Holiday encompasses a weekend, no work is permitted during that weekend.
2. No street, lane, or sidewalk occupancy is allowed in the vicinity of any scheduled event. This includes detour routes for the event. It is the contractor's responsibility to verify events in the vicinity.
3. Any dumpster, equipment, vehicles or stored materials must be moved out of any parking area during any event.

Section 11.2.6. Emergency Work

An emergency is the results from or is caused by any unanticipated event or happening which endangers the health or safety of persons. Emergency situations continue for the reasonable length of time necessary for the person, persons, firm or corporation working to remove the obstruction to comply with the requirements of this article in a manner consistent with providing protection for the health, safety, and property of persons using or desiring to use the obstructed street.

Article 11.2. Construction Provisions

Section 11.2.1. Requirements during construction or occupancy of the right-of-way

1. The permittee shall have a superintendent available on a 24-hour basis, who is authorized to carry out orders from the City's representative, while work is in progress. The permittee shall provide the name of the superintendent prior to the start of work.
2. Any field conflict must first be addressed with an Inspector by the Field Supervisor. If no resolution is reached, the Inspector shall contact the Project Coordinator in Inspections, who shall confer with all appropriate parties to reach a solution.

3. The City reserves the right to require the presence of a police officer for the following but not limited to: construction activity, construction operations within the public right of way, for security and safety purposes, vehicular traffic control, pedestrian traffic control, noise control, dust control, and vibration control. The permittee shall be required to comply with the City of Raleigh Police Department.
4. Any trash or debris tracked onto a public road shall be removed and swept immediately.
5. Portable toilets, trash receptacles, construction materials and debris, pre-made building packages, gravel, sod, dirt, mulch, etc., SHALL NOT be placed or stockpiled on or within the public right-of-way including sidewalks or pedestrian path.
6. Concrete wash-out areas shall not be located within the public right-of-way and shall not drain into the Public Street and/or storm drainage system.
7. Contractors are NOT allowed to operate any City of Raleigh water valves.
8. Contractors shall contact City of Raleigh Public Utilities to have existing valves on or near waterlines serving the proposed project located, and checked for accessibility and operation, no less than 48 hours prior to construction (see contacts list).
9. No drain pipes shall be installed within the curb or outlet onto sidewalks within the public right-of-way unless permitted.
10. All construction traffic shall adhere to the City of Raleigh Truck Route Ordinance. Any questions regarding this ordinance shall be forwarded to Raleigh's Department of Transportation.
11. Contractors shall provide traffic and/or pedestrian access during construction, where applicable. Loading and unloading areas shall be properly identified, and not obstruct traffic and/or pedestrians. This shall be in accordance with the MUTCD and ADA Standards.
12. All areas shall be defined by a machined saw cut. Sidewalk sections shall be removed to the nearest joint. If any area of curb and gutter removed is less than five (5) feet from the nearest construction joint, the curb and gutter shall be removed to the joint. – see if this is in Eric's write up, if already there, no need for it to be here.
13. If any curb, gutter, or sidewalk is disturbed or damaged in the area which would normally encompass a sidewalk access ramp, a sidewalk access ramp shall be installed according to the slopes and dimensions of the latest ADA standards.
14. All street and sidewalk construction shall be continuously maintained in a safe manner in accordance with ADA and MUTCD standards. Permit holders shall utilize flashing barricades and sidewalk closed signs where applicable.
15. The use of steel plates is greatly discouraged. However, if no other option exists, their use shall be approved by the City of Raleigh's Engineering Inspections Group.
16. Steel shall meet the requirements set forth in the "Standard Specifications for Highway Bridges" by AASHTO. In general, the minimum requirements for a 24-inch cut, is to utilize a 5-foot wide by 8-foot long by 1-Inch thick steel plate. The plates shall be secured from lateral movement while in use by the installation of asphalt material.
17. All disturbed driveways shall be replaced with full panels. Replacement of driveways shall be in accordance with current standards, and not create safety issues with adjacent sidewalks. Typical driveways shall have an expansion joint at the curb tie-ins, and the end of the apron.
18. All Construction Vehicles or Construction Equipment SHALL clearly display the parking permit and have the Company Logo and Name on the Vehicle. Private vehicles are not permitted.

19. Any dumpster, equipment, vehicles or stored materials must be moved out of any parking area during any event.
20. No equipment, vehicle, dumpster, or storage of materials is permitted in a “No Parking” area.
21. A “Commercial Loading Zone” only allows for one-hour parking (no dumpster or equipment placement).
22. No parking or obstructions allowed in Bike Lanes unless in a permitted area.
23. A port-a-john is not allowed to be in any portion of the city’s right of way.
24. Any Dumpster or Portable Storage Device is required to have a permit to be placed in the right of way.
25. Vaults cannot be placed in handicapped ramps unless prior approval is issued.
26. Any deviation from any of these requirements shall result in immediate stoppage of activities until all policies, procedures, and standards are met.
27. All work shall be completed with minimum delay.

Article 11.3. Post Construction

All completed work will require an Inspection. Please contact XX

Section 11.3.1. Post Construction Repairs and Restoration

A. Concrete and Asphalt Repairs

1. All areas shall be repaired and restored to or exceed City standards.
2. Repair and restoration requirements are the responsibility of the permit holder.
3. Permanent patches shall be made within 72 hours of the initial cut.
4. Temporary cold patch shall be used in asphalt until the permanent patch is made, and crush and run shall be used within concrete until the permanent patch is made.
5. Repairs and restoration will be inspected by an inspector, and the inspector will determine if the restorations are made to standards.

B. Grass, Lawn, and Plant Restoration

1. All grass and lawn restoration shall be made within ten (10) calendar days from the initial date of the ground disturbance.
2. Clean top soil, seed, and straw shall be utilized when restoring any beauty strip or lawn area in which was impacted during construction.
3. Any damages to grass, plants, flowers, or bushes shall be replaced with the same type of grass, plant, flower, and/or bush.
4. Grass and lawn restoration will include shoulders, ditches, and ditch slopes.
5. All grass and lawn restorations will be determined as satisfactory by an inspector.
6. Any tree damage(s) shall be reported to the Urban Forester to coordinate remediation and/or replacement at no expense to the City.

C. City Assets and Survey Monuments

1. Any damaged City assets shall be reported and repaired immediately by an approved contractor.
2. Right of Way monuments disturbed during construction shall be referenced by a Registered Land Surveyor and reset after construction.

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.

Development Services Director - The Department Head of the City of Raleigh Development Services 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