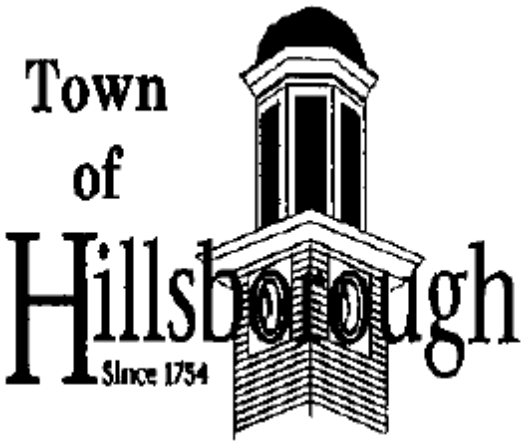
Town of Hillsborough

Street Design Standards



Prepared by Triangle J Council of Governments

July 2014 Draft

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Section 1 – Introduction & Background

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1.1 INTRODUCTION

This document has been developed to provide basic standards for the design of new streets within the Town of Hillsborough and the Town's planning jurisdiction, as well as for improvements to existing streets. Sections 1.2 and 1.3 provide information and links to a number of relevant policies, standards, and requirements that have been previously developed by the Town of Hillsborough (1.2) and North Carolina Department of Transportation (1.3). This Street Design Standards document is not intended to replace these existing policies, but rather to supplement them. Section 1.4 provides information and links to a variety of adopted transportation plans that impact the street system in the Town of Hillsborough—these plans contain important information about proposed improvements.

In Section 2.1, a roadway classification system is defined that categorizes all streets in the Town into one of six categories. Standard cross-sections are provided for each category, including several categories with multiple optional cross-sections. Section 2.2 provides more detailed information on a number of individual design elements of the transportation system, such as roadway lanes, sidewalks, lighting, and landscaping. Section 3.1 provides information on the process for approving street designs as well as other procedural concerns.

In any cases of conflict between this document and the Unified Development Ordinance of the Town of Hillsborough, the Unified Development Ordinance shall have precedence.

The standards defined in this document are drawn from a number of sources, but are most prominently based on the NCDOT Complete Streets Planning and Design Guidelines. The document was prepared by the Triangle J Council of Governments under contract to the Town of Hillsborough. The document was adopted by the Hillsborough Board of Commissioners on _____, 2014.

1.2 RELATED TOWN OF HILLSBOROUGH POLICIES

The Town of Hillsborough has several existing policies related to the design and construction of streets that are found within other ordinances and documents. These policies are important to consider in relation to the information contained within this document. Links are provided to each of these resources.

It is important to note that the information in this Roadway Design Standards document is intended to supplement the information found in these other policies and resources, not to replace them. Please refer to each of these documents as needed.

Town of Hillsborough Ordinances, Part II, Chapter 7 – Streets and Sidewalks

Chapter 7 of the Town Ordinances contains a number of policies related to the design and construction of streets and sidewalks, including policies on the following issues (among others):

- Obstruction of street and sidewalk traffic
- Trimming of trees, shrubs, grass, and weeds that encroach upon streets and sidewalks
- Drainage impacts on sidewalks

- Maintenance of sidewalks
- Driveway permits
- Excavation permits
- Damage to streets, sidewalks, signs, bridges, culverts, ditches, and drains
- Assignment of street numbers
- Planting, removal, and maintenance of street trees

In addition, Appendix A of this document provides detailed information on the Town's **Street Construction Standard Specifications**. These specifications cover topics such as:

- Erosion and sedimentation control requirements
- Maintenance of flow of traffic/traffic control plan
- Traffic control and warning devices
- Construction inspection requirements
- Removal of excess materials, earth, and debris
- Guarantee/certification of materials, equipment, and workmanship
- Grading requirements
- Drainage and curb/gutter requirements
- Bridge and culvert requirements
- Base and pavement requirements
- Signage requirements
- Pavement marking requirements
- Materials and testing requirements

This document can be found online at http://www.ci.hillsborough.nc.us/content/town-code.

Town of Hillsborough Engineering Department Checklist for Approval and Acceptance of Utilities Projects

This document provides a checklist of items that must be completed before the Town will accept the dedication of a utility system or street to the Town by a developer/contractor. The document outlines 31 activities that must occur before, during, and after construction, as well as at the end of the warranty period, and on multiple-phase projects. The most recent version of the checklist can be found at http://www.ci.hillsborough.nc.us/content/engineeringutilities.

Town of Hillsborough Unified Development Ordinance

The Unified Development Ordinance contains numerous policies related to the development of the street system. The following sections are of particular relevance:

- Section 6.5 discusses buffer requirements between streets and developed areas/buildings
- Section 6.9 discusses requirements for the connection of driveways with streets
- Section 6.10 discusses landscaping requirements in parking lots
- Section 6.11 discusses lighting requirements within developments

- Section 6.12 discusses open space requirements, including walking trails
- Section 6.13 discusses parking, loading, and circulation requirements within a development site
- Section 6.15 discusses recreation, including hiking/biking trails
- Section 6.16 discusses screening requirements for certain non-residential land uses
- **Section 6.17 discusses requirements for sidewalks and walkways**
- Section 6.18 discusses requirements for signage that can be seen from vehicular rights-of-way
- Section 6.20 discusses stormwater management requirements
- **Section 6.21 discusses requirements for streets**
- Section 6.22 discusses tree protection requirements

The Unified Development Ordinance can be found online at http://www.ci.hillsborough.nc.us/content/unified-development-ordinance-documents.

Town of Hillsborough Traffic Calming Policy

The Town has established this policy to govern the use of traffic calming measures that are intended to reduce speeding, excessive traffic volumes, improve dangerous intersections, or address other public safety concerns. The policy establishes a number of criteria for evaluating potential traffic calming projects. The Town requires the use of a petition process in order to show neighborhood support for the proposed traffic calming, with a number of requirements. The Town Board of Commissioners makes a final determination based on the information identified in the policy. Funding for improvements is decided on a case-by-case basis. The traffic calming policy identifies a wide variety of potential traffic calming treatments.

The policy can be found in **Appendix A** at the end of this document.

1.3 RELATED NCDOT POLICIES

The following policies are used by the North Carolina Department of Transportation to regulate the design and construction of roads that are on the state road system, or are intended to be dedicated to the state in the future. Several Town of Hillsborough policies also reference these state policies. These and other NCDOT policies can be found online at https://connect.ncdot.gov/projects/Roadway/Pages/Guidelines--Standards.aspx.

NCDOT Roadway Design Manual

The Roadway Design Manual provides standards and guidelines for roadway design on state-owned roads. The standards are based on factors such as design speed, functional classification, traffic volumes, and terrain classifications, and the manual provides additional guidance regarding cost reduction measures, selection of an appropriate cross-section, appropriate slopes and drainage, lane width, shoulder design, clear zones and other similar features/issues. The manual is updated frequently, and information on updates can be found at the website listed above. This manual incorporates standards from the AASHTO *Green Book* of 2011. All state roadway projects must conform with this manual, or seek a design exception.

NCDOT Policies & Procedures for Accommodating Utilities on Highway Rights-of-Way

This document contains the policies for working with utilities in state highway rights-of-way, including sections on encroachment agreements, utilities in freeway rights-of-way, pipelines, overhead power and communication lines, underground electric power and communication lines, plowed-in cable, lighting, utilities located on or near highway structures, and utility agreements. The document contains a section specifically dealing with residential subdivision streets (beginning on Page 81).

NCDOT Bridge Policy

The bridge policy establishes the controlling design elements of new and reconstructed bridges on the state-owned highway system. The primary factors governing the design of the bridge are functional classification, traffic volume, design speed, safety/crash history, and bicycle/pedestrian elements. Box culverts are not considered part of this policy.

NCDOT Guidelines for Agreement Process and Reimbursement to NCDOT by Municipality/Developer

This document provides guidance on the process for incorporating changes into current NCDOT construction projects in order to accommodate proposed development. Any additional cost that results is borne by the developer.

NCDOT Guidelines for Planting Within Highway Right-of-Way

This document provides information about the process and design requirements for planting trees and shrubs within the state highway right-of-way. It outlines the process for obtaining a permit for this activity, including maintenance responsibilities. It also provides sample cross-sections showing proper placement of trees and shrubs, and provides an extensive list of recommended plant types.

NCDOT Manual for Construction Layout

This manual provides instructions for contract surveyors regarding the proper construction layout and staking procedures.

NCDOT Municipal/Developer Submittals Guidelines for Plan Reviews and Encroachments

This document provides information to municipalities and developers on the requirements for obtaining an Encroachment Permit from NCDOT. Generally speaking, an encroachment permit is required any time that construction, installation, activity, or operation will take place within NCDOT's right-of-way. The document includes a form to be completed when requesting an encroachment permit, as well as a detailed list of the information that will potentially be required for submittal as part of the plan review process.

NCDOT Policy on Street and Driveway Access to North Carolina Highways

This policy provides detailed information on the requirements for connecting driveways and streets with the state highway system. It outlines the procedure and requirements for requesting a street/driveway

access permit, the required coordination with other agencies, the conditions and limitations that apply to these permits, requirements for site plans and studies (including traffic impact studies, traffic signal studies, and drainage studies), the permit appeals process, and the detailed design criteria for streets and driveways that access the state highway system. The District Engineer of NCDOT is responsible for the review of applications and approval or denial of permits. The District Engineer for the Hillsborough area is based in Graham.

NCDOT Traditional Neighborhood Development Street Design Guidelines

Traditional Neighborhood Development (TND) is a type of development that features a denser, more-interconnected street network, a higher-than-typical density of development, and a mixture of land uses. These types of developments generally have lower transportation impacts than typical developments due to the greater potential for bicycling and walking to capture mode share and the greater potential for internal trips within the development reducing the overall volume of traffic entering and leaving the site. NCDOT has developed this document with criteria for streets within these TND projects, which supersede the design criteria in other documents where applicable. In general the TND street design guidelines allow for narrower streets with smaller turning radii.

NCDOT Best Management Practices for Construction and Maintenance Actitivities

This document provides information on best management practices for controlling erosion and sedimentation from transportation projects, in order to maintain/improve water quality.

NCDOT Complete Streets Planning and Design Guidelines

NCDOT adopted a "complete streets" policy in 2009 and developed this document in 2012 to provide guidance for implementation of the policy. The document provides an overview of the complete streets concept and the need for this type of approach, and discusses how complete streets fit into the existing transportation planning, programming, and project development process. The document defines nine "area types" and eleven "street types" for the purpose of classifying roadways. For each street type, the document provides a sample plan view and cross-section of the street, as well as dimensional guidelines. Dimensions are defined for a number of "zones" within the cross-section, such as the "sidewalk/multi-use path zone" and the "motor vehicle zone." Following the chapter on street types, additional chapters discuss intersection treatments (including plan drawings and information on standard intersections, roundabouts, interchanges, mid-block crossings, greenway crossings, and rail crossings), transit, and bicycle/pedestrian facilities on structures. The document can be found online at http://www.completestreetsnc.org/wp-content/themes/CompleteStreets_Custom/pdfs/NCDOT-Complete-Streets-Planning-Design-Guidelines.pdf.

NCDOT Standard Specifications and Provisions

All of NCDOT's standard specifications and provisions can be found online at https://connect.ncdot.gov/resources/Specifications/Pages/Specifications-and-Special-Provisions.aspx.

NCDOT Roadway Standard Drawings

All of NCDOT's standard drawings for roadway design can be found online at https://connect.ncdot.gov/resources/Specifications/Pages/2012-Roadway-Drawings.aspx.

1.4 RELATED TRANSPORTATION PLANS

The Town of Hillsborough has a number of existing plans that relate to the transportation system. This is a summary of these plans; for more information please refer to the plan documents, many of which can be found at http://www.ci.hillsborough.nc.us/content/planning. **Please note:** several of these plan documents are old and may no longer reflect the plans or policies of the town – all plans are presented here for informational purposes only and those that are most at risk of containing outdated information are marked with a ‡ symbol. Please consult with town staff regarding the currency of planning documents before using them for decision-making purposes.

Durham-Chapel Hill-Carrboro Metropolitan Planning Organization (DCHC MPO) Metropolitan Transportation Plan

The Metropolitan Transportation Plan (MTP) is a long-range regional transportation plan that identifies major transportation projects that are planned for construction within the next 20 to 30 years. A project must be identified in the MTP in order to receive funding in the Transportation Improvement Program (see below). The DCHC MPO, of which the Town of Hillsborough is a member, is responsible for developing and approving this plan, which must be updated every four years. The most recent MTP at the time of this document's writing was adopted in 2013. In addition to identifying projects for which available funding is anticipated within the next 20-30 years, the MTP also identifies other projects that are needed, but for which funding has not been identified – these are sometimes referred to as CTP projects (for "Comprehensive Transportation Plan"). In addition to highway projects, the MTP also includes a listing of planned bicycle and pedestrian projects. More information on the MTP can be found at www.dchcmpo.org.

DCHC MPO Transportation Improvement Program & North Carolina Statewide Transportation Improvement Program

The Transportation Improvement Program (TIP) is the document that determines which transportation projects will receive federal and state funding for construction. Because Hillsborough is within the DCHC MPO, its projects must be listed in both the DCHC MPO TIP and the North Carolina Statewide TIP, which must be in agreement with each other. The TIP is usually updated every two years. The most recent TIP at the time of this document's writing was adopted in 2011. Projects selected for funding in the TIP must be drawn from the list of projects included in the MTP (discussed above). The most up-to-date version of the Statewide Transportation Improvement Program (STIP) can be found at https://connect.ncdot.gov/projects/planning/Pages/.

DCHC MPO Collector Street Plan

The DCHC MPO is in the process of developing a Collector Street Plan, which is intended to serve as a plan for the development of roads that may be too minor to appear on the Metropolitan Transportation Plan, which focuses on major facilities. A draft collector street map for Hillsborough was developed in 2012, and can be found at http://www.dchcmpo.org/dmdocuments/CSPHillsboroughMPOonlyAug20DraftRevised.pdf. Typically, roads proposed on a collector street plan include those that might be constructed by developers as properties become developed.

Town of Hillsborough Community Connectivity Plan

In 2009, the Town of Hillsborough adopted this plan that addresses the needs of non-motorized modes of transportation within the Town. An update to this plan was developed in 2013. Following an extensive analysis of existing safety data, destinations, existing bicycle and pedestrian facilities, barriers to connectivity, existing plans, pedestrian and bicycle amenities, and public input, the plan was developed to provide design policies, recommended facilities, and a program for implementation. Among the recommendations are maps showing high-priority and low-priority locations for sidewalk improvements, recommended curb cuts, recommended striped bicycle lane locations, and a recommended marked bicycle route through the Town. The 2009 and 2013 plans can be found at http://www.ci.hillsborough.nc.us/content/plans-and-studies.

Town of Hillsborough Churton Street Corridor Strategic Plan ‡

In 2006, the Town adopted a plan for the Churton Street corridor between the I-40 interchange and the NC 86-57 split. This road functions as the "Main Street" of the Town of Hillsborough, and therefore has some characteristics that are unique to it among roadways within the Town. The plan identified several key issues to be addressed, including: walkability and pedestrian safety, buried utilities, traffic flow and congestion, sign clutter, building design and signage guidelines, landscaping, redevelopment, and transportation links. The transportation element of the plan includes a number of recommendations:

- Use a boulevard design with a planted median where possible, north and south of downtown
- Minimize curb cuts, traffic signals, and left turns
- Use modern roundabouts at key intersections
- Construct secondary access roads to remove local shopping traffic from Churton Street
- Develop connected rear parking lots
- Use striped bicycle lanes where feasible
- Construct continuous sidewalks along corridor
- Construct intersection and mid-block crosswalks with contrasting pavers
- Improve landscaping at street edges
- Replace overhead utility lines with underground utilities and decorative light poles
- Encourage planned transit station and park-and-ride lot at realigned intersection of US 70 Business and Orange Grove Road

Specifically, the plan calls for a four-lane divided cross-section with a planted median on Churton Street between I-40 and I-85; and for a two-lane divided cross-section with a planted median on Churton Street between I-85 and the railroad crossing, and between Corbin Street and NC 57. The plan calls for the construction of roundabouts at five key intersections along Churton Street. It also includes many drawings showing proposed cross-sections, before and after illustrations, and detailed plan drawings showing median, intersection, roundabout, sidewalk, landscaping, crosswalk, and trail locations. In addition to these transportation recommendations, the plan also includes recommendations related to future development patterns, districts, gateways, landscaping and parks, wayfinding signage, commercial signage, and NCDOT guide signage.

A copy of the plan can be found at http://www.ci.hillsborough.nc.us/content/churton-street-strategic-plan.

Town of Hillsborough US 70/Cornelius Street Corridor Strategic Plan ‡

In 2007, the Town adopted a plan for the US 70/Cornelius Street corridor, between Churton Street and Lakeshore Drive/Holiday Park Road. This plan examines issues including land use, transportation, crime, code enforcement, and site planning/design. The plan anticipates a need to widen US 70 through this area in the future based on growing traffic volumes, and identifies a preferred cross-section for the widened facility as a four-lane divided roadway, including a multi-use sidepath on each side of the road. The plan also recommends the connection of several side streets that are currently unconnected to each other, and the closure of some intersections with minor side streets. The plan also includes recommendations related to future development within the corridor. This plan may be found at http://www.ci.hillsborough.nc.us/content/us-70cornelius-street-corridor.

Town of Hillsborough Downtown Access Study ‡

The Downtown Access Study was developed in 2012, in response to a decision to remove the planned Elizabeth Brady Road Extension from the region's Metropolitan Transportation Plan. The study examined the section of Churton Street between US 70 Bypass and US 70 Business and developed specific recommendations to improve congestion and traffic flow, improve the pedestrian environment, allow for loading zones in the downtown area, and generally improve the safety of the area and enhance the experience of traveling through and around Downtown Hillsborough. Some key recommendations included lane striping changes, intersection improvements, on-street and off-street parking changes, construction of sidewalks and crosswalks, and designation of an alternate bike route. The plan can be found at http://www.ci.hillsborough.nc.us/content/downtown-access-improvements-project.

Town of Hillsborough Downtown Parking Study ‡

In 2010, the Town conducted a study on parking in the downtown historic area, including an examination of on-street parking. This resulted in recommendations about parking time limits, the marking of "No Parking" zones and striping of on-street parking spaces, changes in signage, and removal of some parallel parking spaces on Margaret Lane to allow construction of a sidewalk. There were

several specific recommendations with an impact on the transportation system. The plan can be found at http://www.ci.hillsborough.nc.us/content/plans-and-studies.

Town of Hillsborough Downtown Appearance Improvements Plan ‡

This plan was developed in 1998, and recommended several streetscape items to improve the overall appearance of the downtown area, including street trees, planters, litter receptacles, and lighting. This was followed up by a "Streetscape Feasibility Report" in 2001, which developed more detailed recommendations. Both documents can be found at http://www.ci.hillsborough.nc.us/content/plans-and-studies.

Town of Hillsborough Wayfinding Signage Plan ‡

This plan was developed in 2009, and recommends a coordinated and consistent system of signs to guide travelers to various points of interest in the town. The plan includes design and location details for a wide variety of signs, including highway directional signs, town limit signs, "Welcome to Hillsborough" signs, trailblazing signs, proximity signs, destination signs, historic district identification signs, parking directional and identification signs, route markers, and pedestrian kiosks. Maps showing the locations of proposed signs are also available. The plan can be found online at http://www.ci.hillsborough.nc.us/content/wayfinding-signage-plan.

2.1 ROADWAY CLASSIFICATIONS

For the purpose of defining design standards for different types of roadways within the Town of Hillsborough, this document breaks roads into six basic categories, three of which are further divided into options with and without closed drainage. Each of these categories is discussed below, followed by more detailed information on the applicable standards and cross-section and plan-view illustrations.

Category	Closed Drainage (C&G)	Open Drainage (Swale)
Residential Local	✓	✓
Residential Collector	✓	✓
Commercial/Industrial Local	✓	
Commercial/Industrial Collector	✓	
Two-lane Arterial	✓	✓
Multi-lane Boulevard	✓	

Residential Local

This street type includes the majority of streets within the Town, which are low-volume, low-speed streets in primarily residential areas. These streets should be designed to encourage low speeds and a safe environment for automobiles, bicycles, parked vehicles, and the occasional truck to share the available pavement. In general, these streets should usually be designed with curbs and gutters, but in some cases topographic, hydrologic, or policy considerations may make the design option with drainage swales more appropriate. If on-street parking is anticipated then the curb and gutter design is more appropriate to use. Local streets typically carry less than 800 vehicles per day.

Residential Collector

Collectors are moderate-speed, moderate-volume roadways that "collect" traffic from local streets and connect with the larger roadway network of the community. In residential areas, collector streets often provide access to individual homes in addition to their role in the connectivity of the street network. It is appropriate to provide markings on the roadway to separate the spaces designated for automobiles and trucks, bicycles, and parked vehicles on a collector street. The default cross-section assumes the use of curbs and gutters and provides on-street parking on one side of the street[1]. An alternate design with open drainage swales is also available, although it does not allow for on-street parking. Collector streets typically carry more than 800 vehicles per day.

[1] In cases where it can be reasonably shown that on-street parking is unnecessary, the on-street parking lane width may be omitted.

Commercial/Industrial Local

Local streets in commercial or industrial areas are similar to their residential counterparts, although they are wider to allow for easier navigation by trucks. These streets generally have low speeds and low traffic volumes, and are able to accommodate automobiles, trucks, bicycles, and parked vehicles within a shared space. There are generally center line and stop bar markings on the roadway. The standard design for these streets includes curbs and gutters. Local streets typically carry less than 800 vehicles per day.

Commercial/Industrial Collector

Like their residential counterparts, collector streets in commercial and industrial areas are designed to carry moderate levels of traffic at moderate speeds and to connect local streets to the larger roadway network. The lane widths on residential and commercial/industrial collector streets are the same, but in commercial/industrial areas the design allows for on-street parking on both sides of the road. Alternatively, the design also allows for the presence of a dedicated left-turn lane or two-way left-turn lane in lieu of on-street parking. The decision for which of these two design options is most appropriate within a given site should be based on the characteristics of the site and whether it would be more appropriate to provide on-street parking or to provide a dedicated left-turn lane[2]. All streets in this category are assumed to use curbs and gutters for drainage. Collector streets typically carry more than 800 vehicles per day.

Two-lane Arterial

An arterial is a higher-volume, higher-speed roadway that serves a primary purpose as a long-distance through-route connecting different communities. These are typically state primary highways or major secondary highways, and are typically located in more suburban and rural areas (major roads through downtown areas, such as Churton Street, typically function more similarly to collector streets). Two-lane arterials can be designed either with curbs and gutters (more appropriate in developed areas) or with open drainage swales (more appropriate in undeveloped areas). These roads can also be designed with a left-turn lane when needed, which is appropriate in areas with a high number of driveways or a high volume of left-turning traffic. Arterial streets carry more than 1200 vehicles per day, often significantly more.

It is important to note that the difference between a collector and an arterial is primarily based on the function of the roadway, not on the volume alone—collectors are designed to connect local neighborhoods to the larger roadway system and also serve as local access routes, whereas arterials are designed to carry higher volumes of traffic at higher speeds with fewer interruptions of traffic flow.

[2] In cases where it can be reasonably shown that both on-street parking and left-turn lanes are unnecessary along a street (or a portion of a street), these may be omitted and the overall roadway width narrowed accordingly.

Multi-lane Boulevard

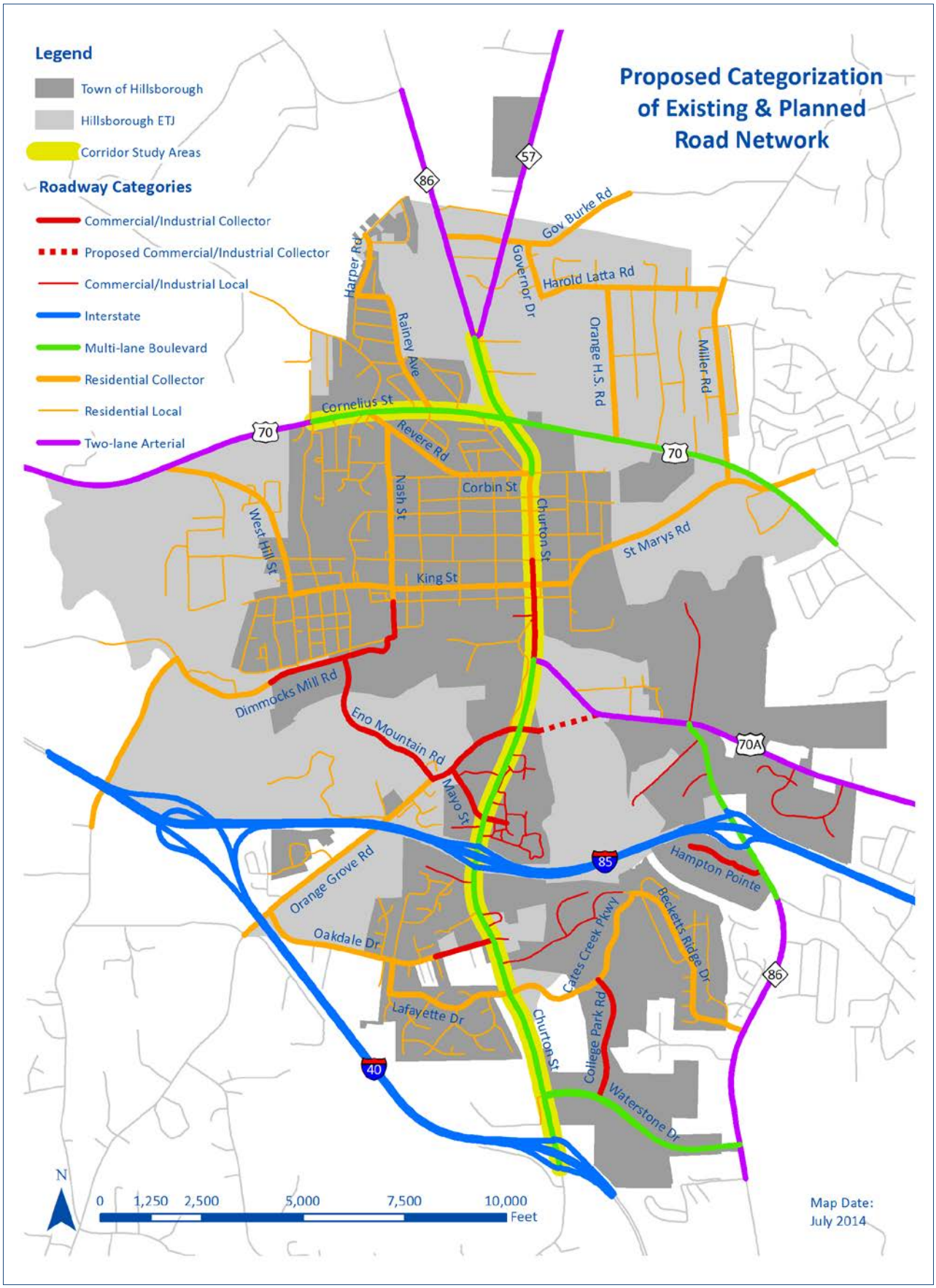
In general, any road with four or more lanes should be designed as a divided "boulevard" with a grass and/or landscaped median. This type of design has multiple benefits over an undivided or "5-lane" design, including improved safety, traffic flow, and aesthetics. These roads should be designed with curbs and gutters, and should have separate lanes for motor vehicles and bicycles. On-street parking is generally not recommended on this type of roadway, due to the higher volumes of traffic.

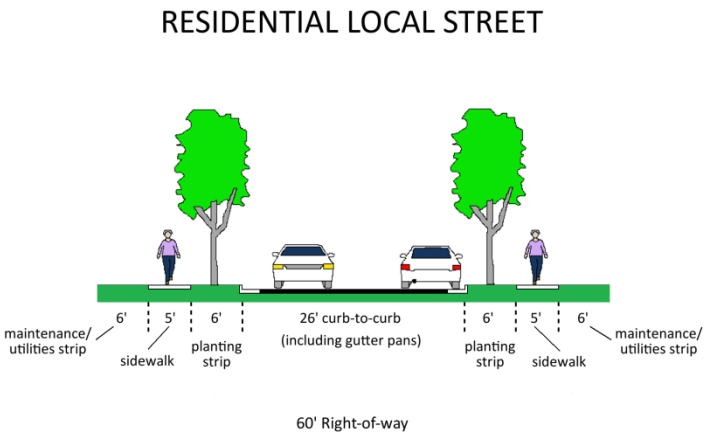
A multi-lane boulevard may be used on either a collector street or an arterial street, with similar design features; however, in general the median width and planting strip width for a collector-type boulevard should be on the shorter end of the provided range and the median width and planting strip width for an arterial-type boulevard should be on the longer end of the provided range, due to the higher volumes and speeds on an arterial roadway versus a collector roadway. An example of a collector-type boulevard is Waterstone Drive. An example of an arterial-type boulevard is the proposed future widening of South Churton Street.

Map of Existing Roadway Classifications

On the next page you will find a map showing recommended classifications for all streets currently within the Town of Hillsborough and its Extra-territorial Planning Jurisdiction. This map is intended to provide guidance regarding improvements that may be undertaken along existing streets in connection with development activity—for more information on retrofitting existing streets, see Section 2.2. Please note that it is not the intention of the Town of Hillsborough to bring all existing streets up to the standards outlined in this document. Please note that the map incorporates planned roadway improvements from the DCHC MPO Metropolitan Transportation Plan and the Churton Street and Cornelius Street corridor plans.

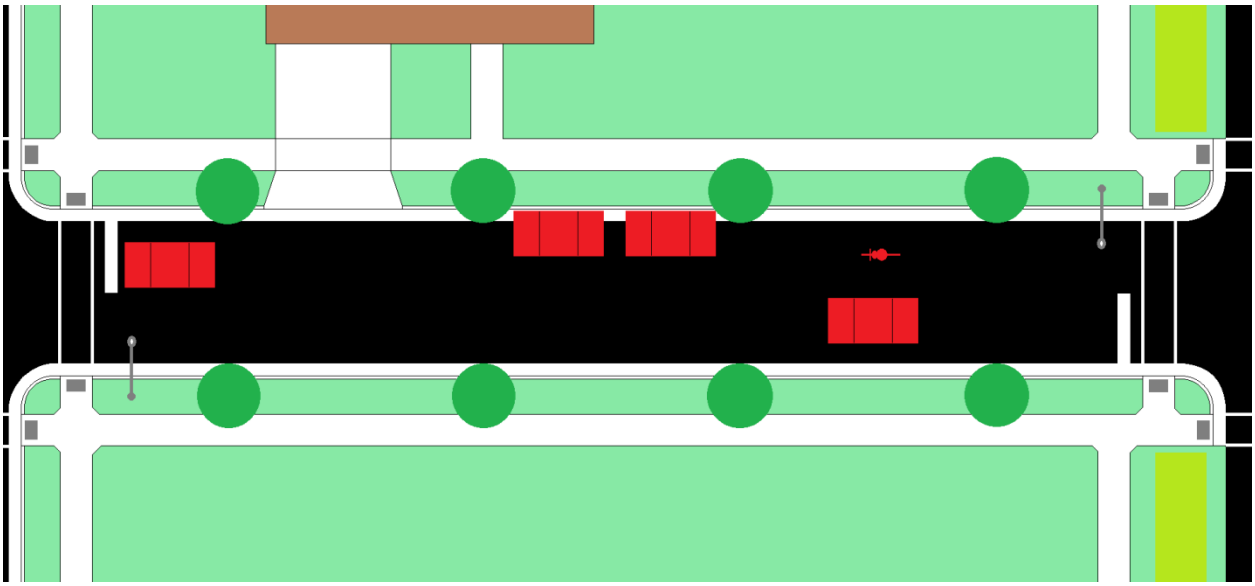
On the pages that follow the map you will find diagrams showing the proposed cross-section and plan view for each of the nine roadway classifications, as well as a summary of the design elements for each. These drawings are meant to be illustrative of the "typical" design for streets, and are not engineering drawings. In some situations, particularly retrofits of existing streets, there may be variations from these typical sections. There is additional information available regarding each of the design elements in Section 2.2.


Legend
Town of Hillsborough
Hillsborough ETJ
Corridor Study Areas
Roadway Categories
Commercial/Industrial Collector
Proposed Commercial/Industrial Collector
Commercial/Industrial Local
Interstate
Multi-lane Boulevard
Residential Collector
Residential Local
Two-lane Arterial
Proposed Categorization of Existing & Planned Road Network
57
86
Gov Burke Rd
Governor Dr
Harold Latta Rd
Harper Rd
Rainey Ave
Orange H.S. Rd
Miller Rd
Cornelius St
70
Revere Rd
Corbin St
Nash St
West Hill St
Churton St
St Marys Rd
King St
Dimmocks Mill Rd
Eno Mountain Rd
Mayo St
70A
85
Hampton Pointe
Orange Grove Rd
Oakdale Dr
Cates Creek Pkwy
Beckett's Ridge Dr
College Park Rd
Lafayette Dr
40
Waterstone Dr
N
0 1,250 2,500 5,000 7,500 10,000
Feet
Map Date:
July 2014



Residential Local Streets

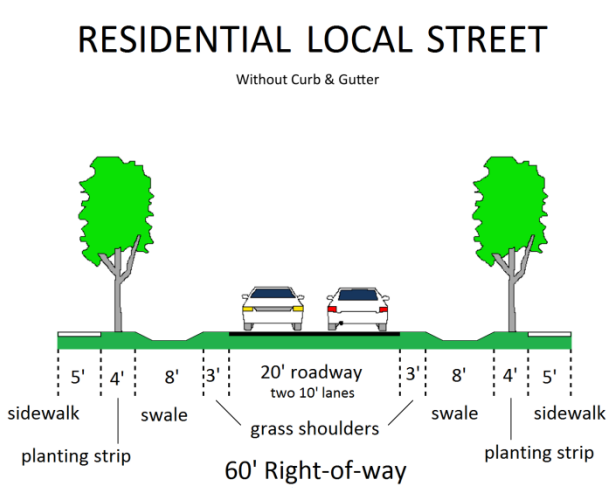
are the primary type of street found within residential neighborhoods. These are low-volume, low-speed streets, where it is appropriate for bicycles, automobiles, and parked vehicles to share space within the roadway. By default, most new residential local streets should be designed with curb and gutter, although there may be exceptions – a separate design is provided for streets without curb and gutter.



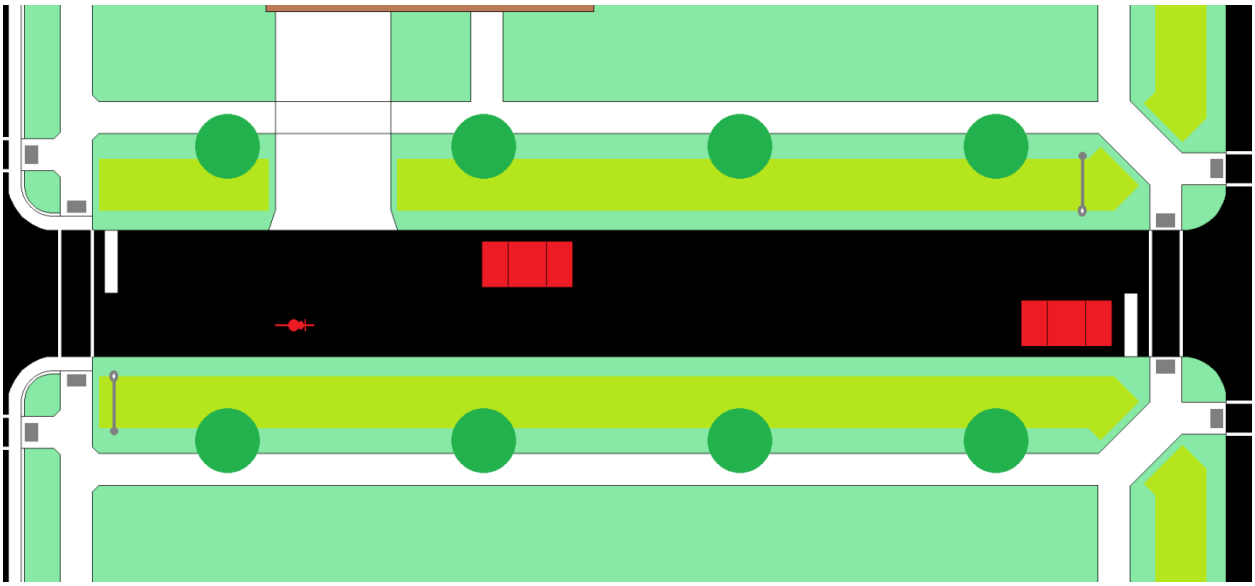
Summary of Design Elements

Right-of-way width	60 feet
Roadway width (face of curb to face of curb)	26 feet
Planting strip width	6 feet on each side of street
Sidewalk width	5 feet on each side of street
Maintenance/utilities strip width	6 feet on each side of street
Curb radius at intersections	5 feet recommended, 10 feet maximum
Street trees (within planting strip)	every 40 feet
Street lighting (within planting strip)	at intersections, and at least every 175 feet
Speed limit	20-25 miles per hour
Lane striping	none
Crosswalk striping	standard
On-street parking	allowed

Please see next page for information on Residential Local Streets without curb and gutter treatments.

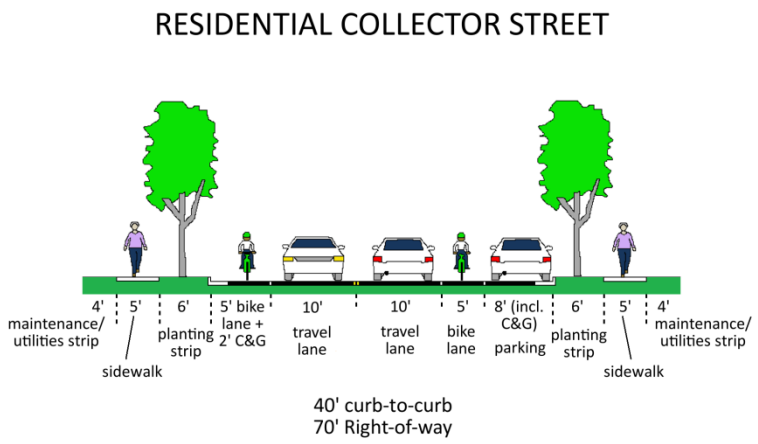


Residential Local Street (option without curb & gutter) *– this street type is appropriate in locations with low traffic volumes and speeds, very low usage of on-street parking, and geographic conditions that make open drainage preferable. This design should only be used sparingly in new developments. The design is not able to accommodate on-street parking. Sidewalks are located on the rear side of drainage swales.*



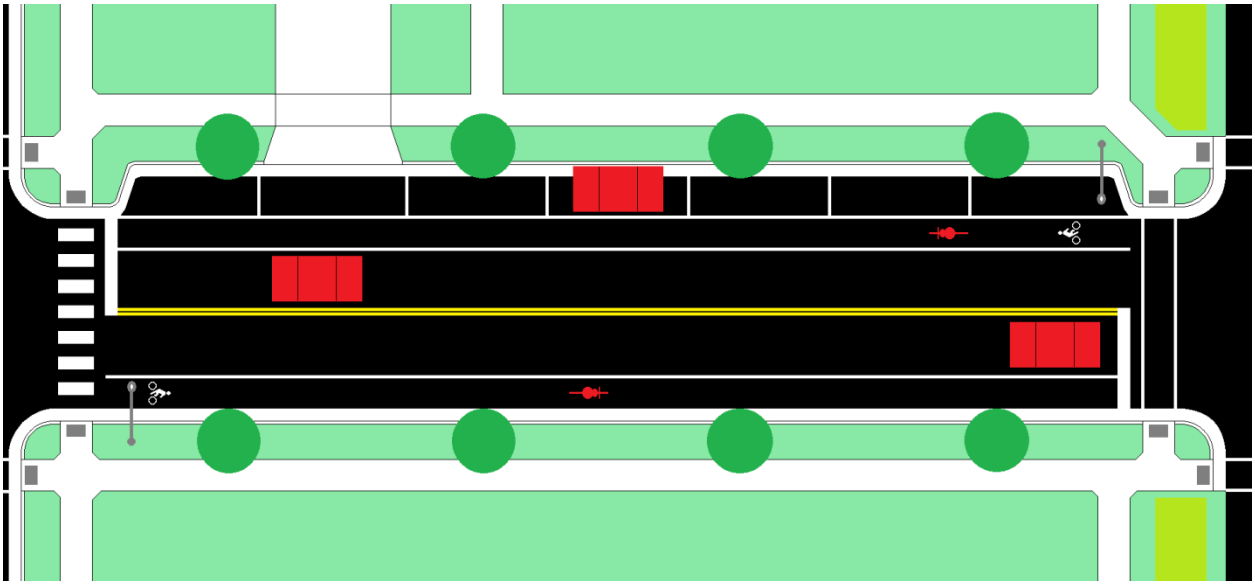
Summary of Design Elements

Right-of-way width	60 feet
Roadway width (to edge of pavement)	20 feet
Grass shoulder width	3 feet
Drainage swale width	8 feet on average (may vary)
Planting strip width	4 feet, located behind drainage swale
Sidewalk width	5 feet, located behind drainage swale
Curb radius at intersections	5 feet recommended, 10 feet maximum
Street trees (within planting strip)	every 40 feet
Street lighting (within planting strip)	at intersections, and at least every 175 feet
Speed limit	20-25 miles per hour
Lane striping	none
Crosswalk striping	standard
On-street parking	not recommended



Residential Collector Streets

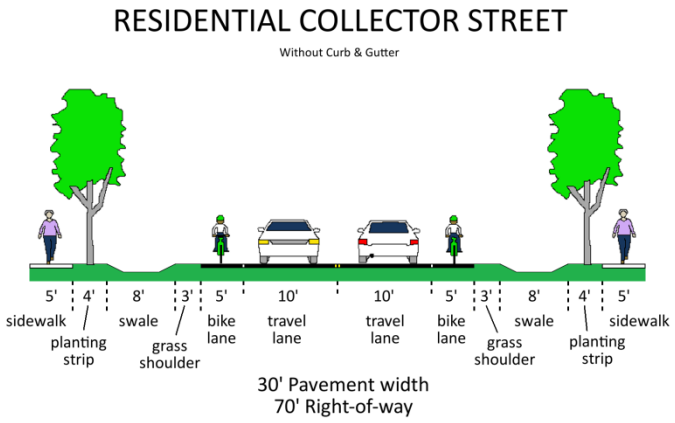
are the streets that "collect" traffic from local streets and connect to the larger transportation network. These are medium-speed, medium-volume streets, and as such include separated lanes for motor vehicle traffic, bicycle traffic (optional as appropriate), and parked vehicles. By default, most new residential collector streets should be built with curb and gutter, although there may be exceptions – a separate design is provided for streets without curb and gutter.



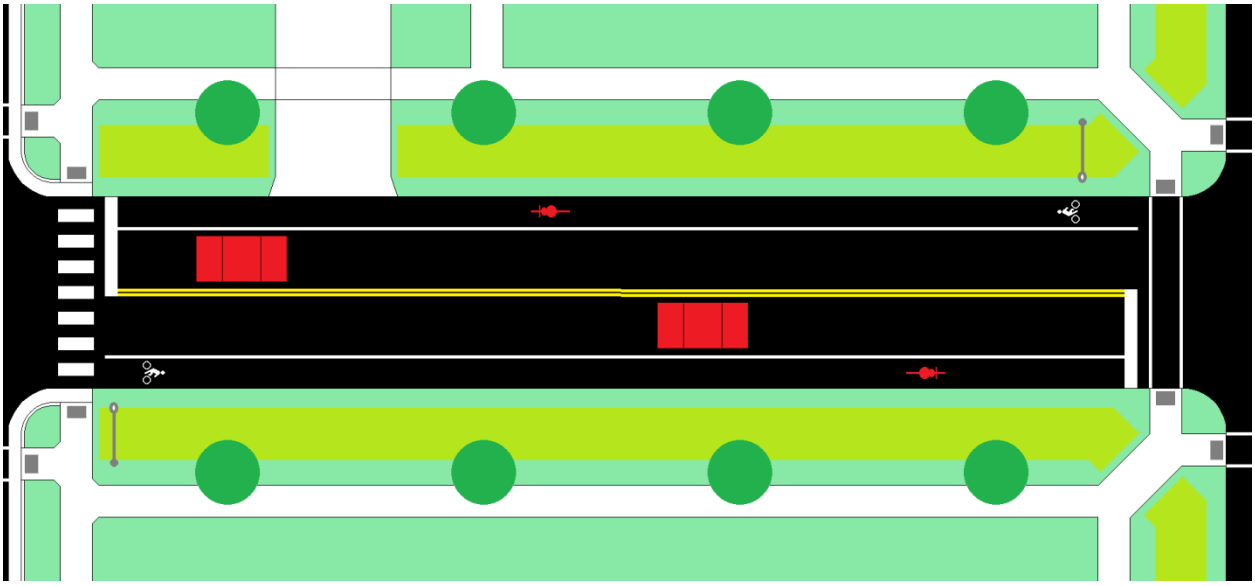
Summary of Design Elements

Right-of-way width	70 feet
Roadway width (face of curb to face of curb)	40 feet (34 feet at crosswalk bulbouts)
Planting strip width	6 feet on each side of street
Sidewalk width	5 feet on each side of street
Curb radius at intersections	5 feet recommended, 10 feet maximum
Street trees (within planting strip)	every 40 feet
Street lighting (within planting strip)	at intersections, and at least every 175 feet
Speed limit	25-35 miles per hour
Lane striping	travel lanes, bicycle lanes (opt.), parking lane
Crosswalk striping	standard (minor crossings) or high-visibility (major crossings or poor-visibility crossings)
On-street parking	allowed on one side only (marked)

Please see next page for information on Residential Collector Streets without curb & gutter treatments.

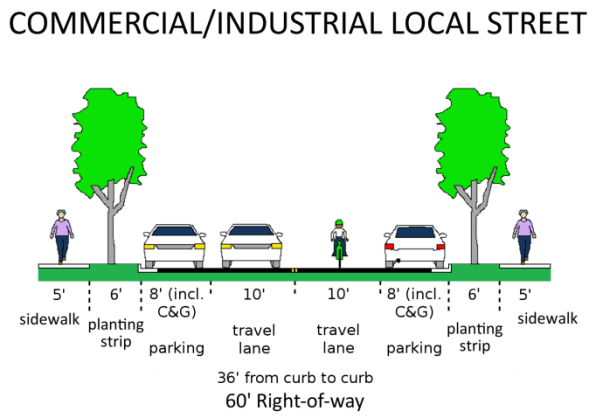


Residential Collector Street (option without curb & gutter) *– this street type is appropriate in locations where a residential collector street is desired but geographic conditions make open drainage preferable. This design should only be used sparingly in new developments. The design is not able to accommodate on-street parking and should not be used in areas where on-street parking is desirable. Sidewalks are located on the rear side of drainage swales.*

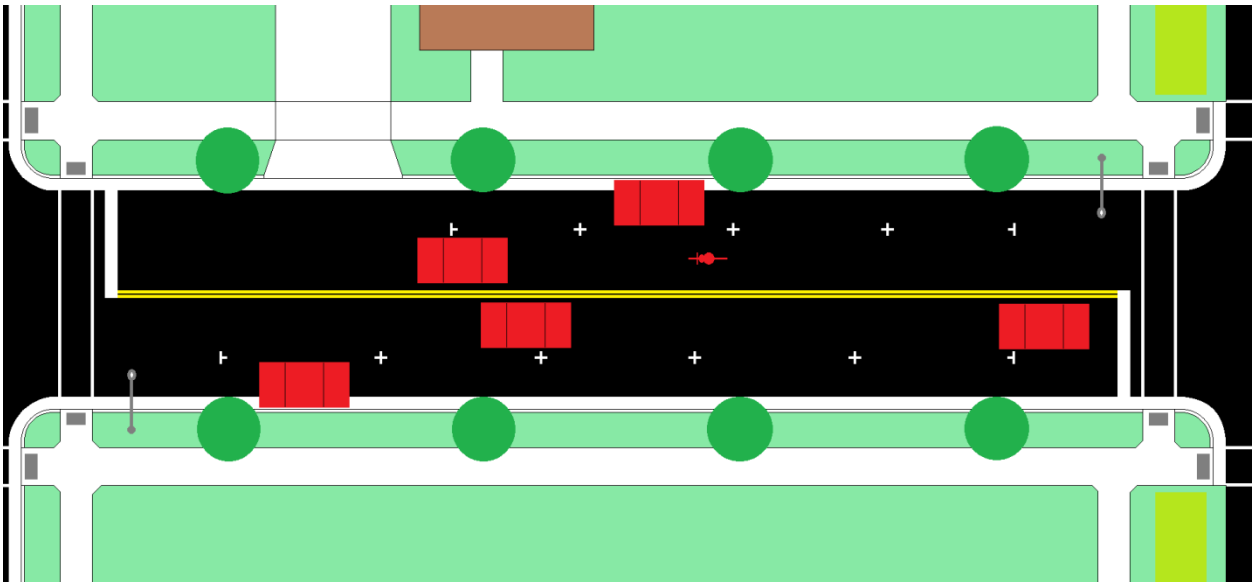


Summary of Design Elements

Right-of-way width	70 feet
Roadway width (to edge of pavement)	30 feet
Grass shoulder width	3 feet
Drainage swale width	8 feet on average (may vary)
Planting strip width	4 feet, located behind drainage swale
Sidewalk width	5 feet, located behind drainage swale
Curb radius at intersections	5 feet recommended, 10 feet maximum
Street trees (within planting strip)	every 40 feet
Street lighting (within planting strip)	at intersections, and at least every 175 feet
Speed limit	25-35 miles per hour
Lane striping	travel lanes, bicycle lanes (or paved shoulders)
Crosswalk striping	standard (minor crossings) or high-visibility (major crossings or poor-visibility crossings)
On-street parking	not allowed



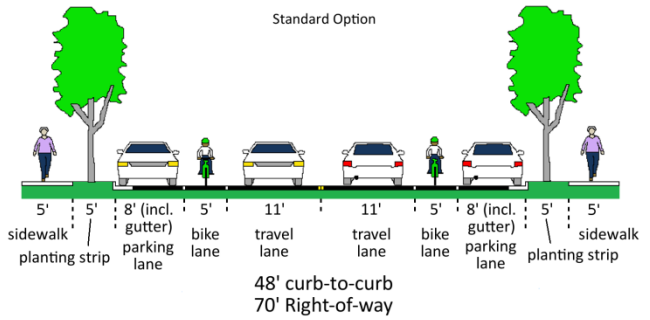
Commercial/Industrial Local Streets *are the standard type of streets found within business and industrial districts. These are low-speed streets intended to provide access to businesses, and are appropriate for mixed traffic. All commercial/industrial streets should be designed with curb and gutter as the standard design. These streets are intended to allow on-street parking and provide room for truck movements.*



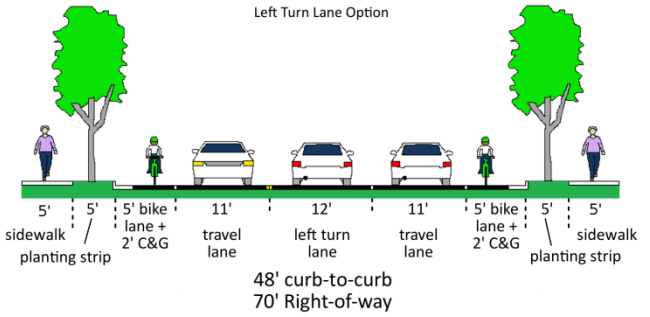
Summary of Design Elements

Right-of-way width	60 feet
Roadway width (face of curb to face of curb)	36 feet
Planting strip width	6 feet on each side of street
Sidewalk width	5 feet on each side of street
Curb radius at intersections	10 feet
Street trees (within planting strip)	every 40 feet
Street lighting (within planting strip)	at intersections, and at least every 175 feet
Speed limit	20-25 miles per hour
Lane striping	marked center line, parking stalls
Crosswalk striping	standard
On-street parking	allowed

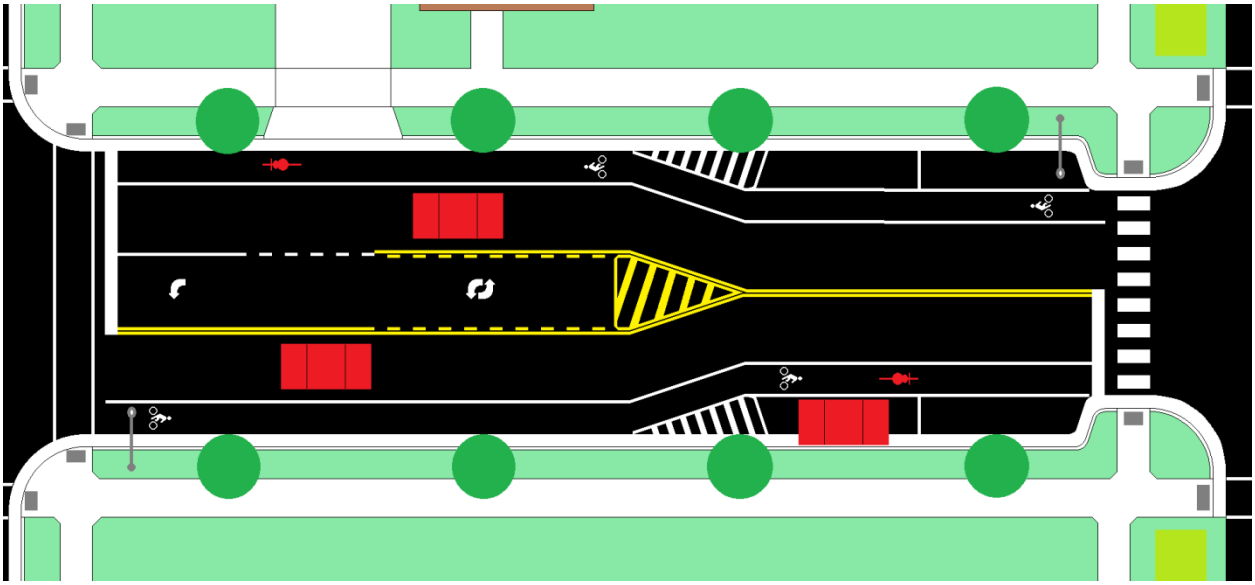
COMMERCIAL/INDUSTRIAL COLLECTOR STREET



COMMERCIAL/INDUSTRIAL COLLECTOR STREET

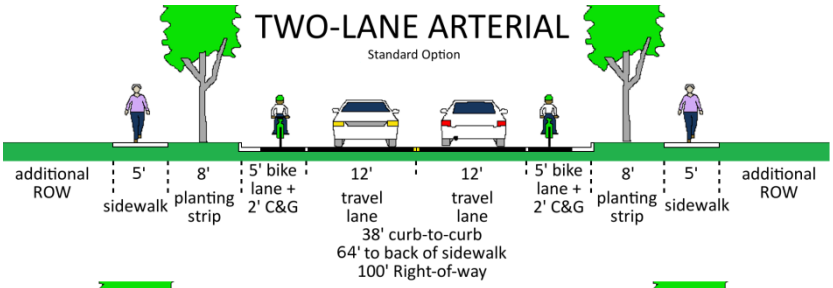


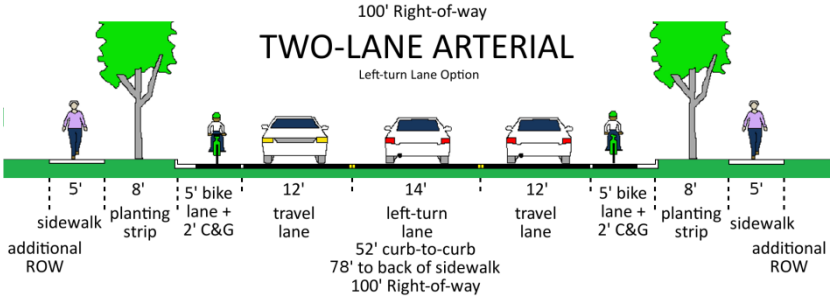
Commercial/Industrial Collector Streets *are the network of streets within business/industrial areas that connect local streets with the larger highway network. These are generally medium-speed, medium-volume streets, and as such should have separate marked lanes for motor vehicle traffic, bicycle traffic, and parked vehicles. All commercial/industrial streets should be designed with curb and gutter as the standard design. The standard cross-section should be used in areas with little turning traffic or where on-street parking is desirable. The left-turn lane cross-section should be used in areas with heavy left-turn volumes, and can be either a standard turn lane or a two-way left turn lane.*



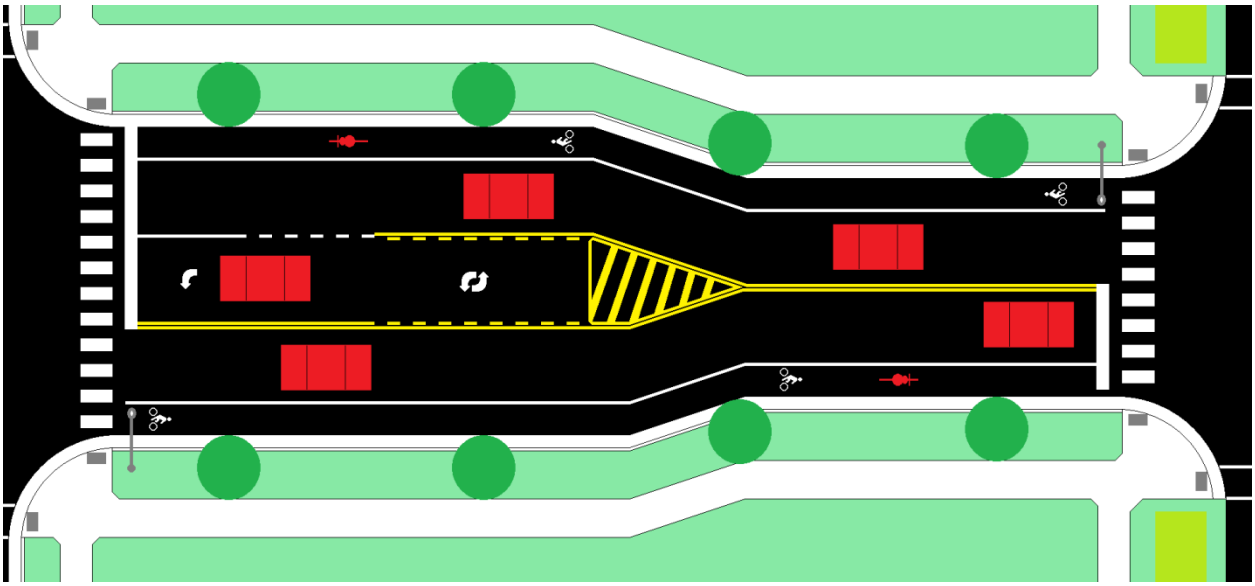
Summary of Design Elements

Right-of-way width	70 feet	Roadway width (FOC to FOC)	48 feet (36’ at bulbouts)
Planting strip width	5 feet (each side)	Sidewalk width	5 feet (each side)
Curb radius at intersections	10 feet	Street trees (in planting strip)	every 40 feet
Street lighting (in planting strip)	at intersections, and at least every 175 feet	On-street parking	allowed in marked areas
Speed limit	25-35 miles per hour	Crosswalk striping	standard (high visibility at major/poor-visibility crossings)
Lane striping	travel lanes (11’), turn lanes (12’), bike lanes (opt., 5’), parking lanes (8’)		





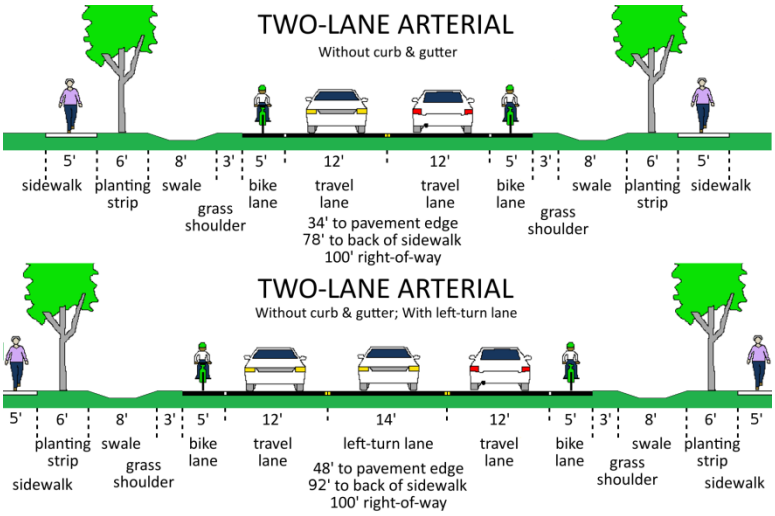
Two-lane Arterial *– this category includes major streets whose primary function is to move higher volumes of traffic over longer distances. Many of these streets are maintained by the NCDOT. These cross-sections are intended to complement the NCDOT Complete Streets Planning and Design Guidelines. Two options are provided, with and without a left-turn lane. Curb and gutter drainage treatments are assumed by default.*



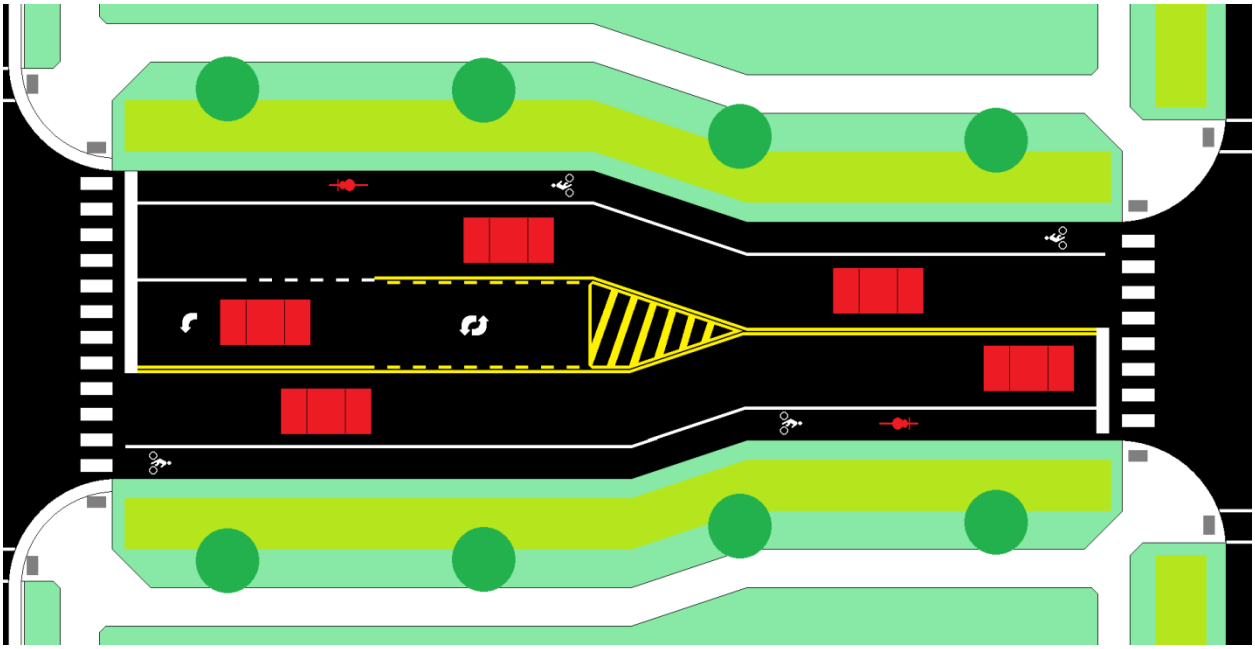
Summary of Design Elements

Right-of-way width	100 feet
Roadway width (face of curb to face of curb)	38 feet (52 feet with left turn lane)
Planting strip width	8 feet on each side of street
Sidewalk width	5 feet on each side of street
Curb radius at intersections	15 feet
Street trees (within planting strip)	every 40 feet
Street lighting (within planting strip)	at intersections, and at least every 175 feet
Speed limit	35-55 miles per hour
Lane striping	travel lanes (12’), left turn lane (14’), bike lane (opt., 5’, not including gutter)
Crosswalk striping	high-visibility
On-street parking	not recommended

See next page for an example without curb & gutter treatments.

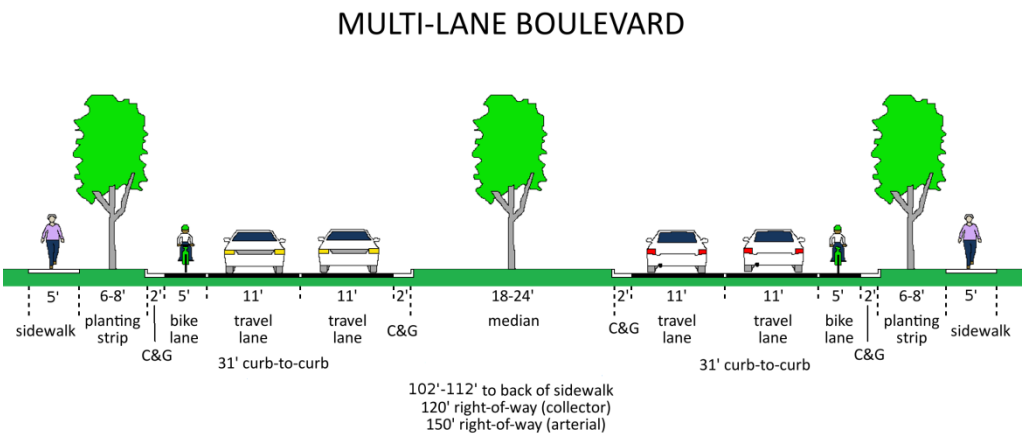


Two-lane Arterial (option without curb & gutter) *– in some cases, it may be necessary to design arterial streets with open drainage due to site-specific reasons. This optional cross-section has been developed for those cases, and has similar characteristics to the standard arterial cross-section. Two options are provided, with and without a turn lane (which may be a directional turn lane or a two-way left turn lane).*



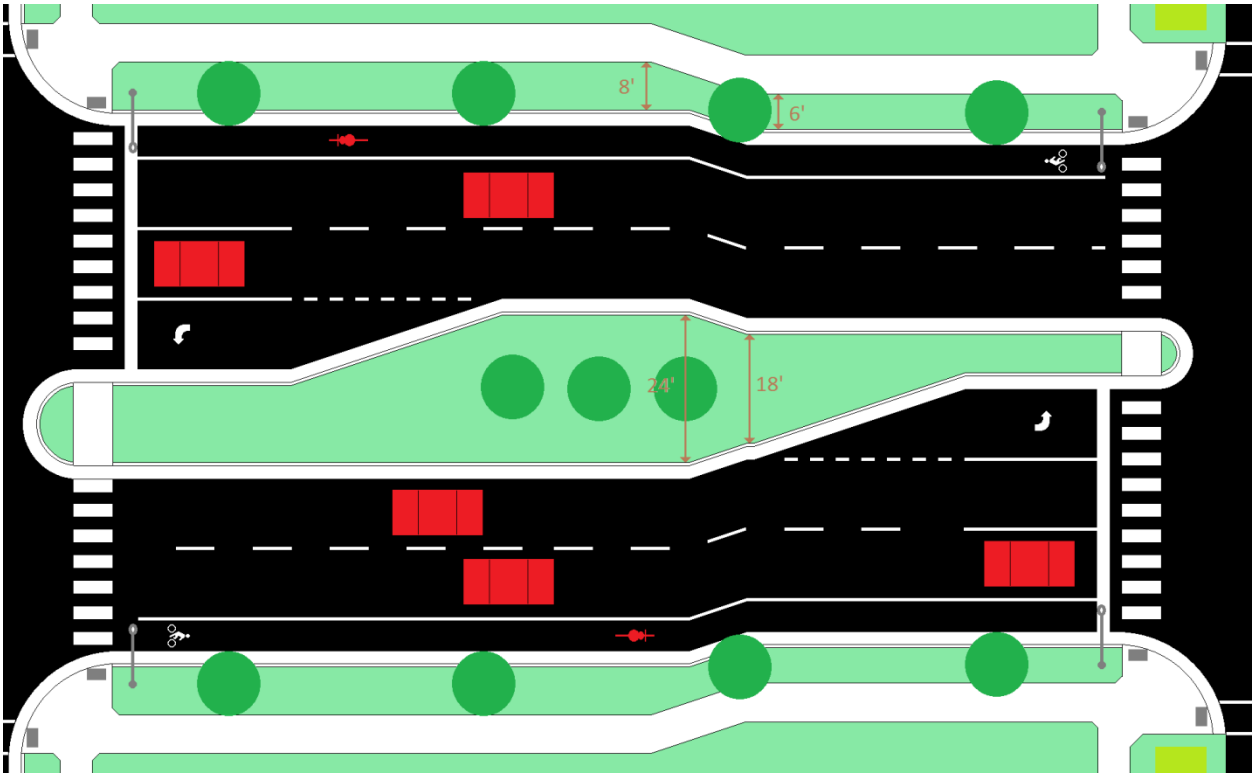
Summary of Design Elements

Right-of-way width	100 feet
Roadway width	34 feet (48 feet with left turn lane)
Grass shoulder width	3 feet on each side of street
Drainage swale width	8 feet on average (may vary)
Planting strip width	6 feet on each side of street
Sidewalk width	5 feet on each side of street
Curb radius at intersections	15 feet
Street trees (within planting strip)	every 40 feet
Street lighting (within planting strip)	at intersections, and at least every 175 feet
Speed limit	35-55 miles per hour
Lane striping	travel lanes (12’), left turn lane (14’), bike lane or paved shoulder (5’)
Crosswalk striping	high-visibility
On-street parking	not recommended



Multi-lane Boulevard

All multilane roadways should be designed as boulevards, with grassy and/or landscaped medians. This type of design may be appropriate on collector or arterial streets.



Summary of Design Elements

Right-of-way width	120 feet (collector) 150 feet (arterial)	Roadway width (FOC to FOC)	31 feet (one side) (42’ at LT lanes)
Planting strip width	6-8 feet (each side)	Sidewalk width	5 feet (each side)
Curb radius at intersections	15 feet	Street trees (in planting strip)	every 40 feet
Street lighting (in planting strip, both sides)	at intersections, and at least every 175 feet	Street trees (in median)	when median is wider than 15’
On-street parking	not recommended	Median width	18-24 feet
Speed limit	25-55 miles per hour	Crosswalk striping	high-visibility
Lane striping	travel lanes (11’), turn lanes (11’), bike lanes (opt., 5’)		

2.2 ROADWAY DESIGN ELEMENTS

There are a number of elements that must be considered in the design and construction of streets. This section provides more detailed information about these design elements, including potential variations and notes of caution.

Note: All measurements involving curbs are taken from the face of the curb, not the back!

Motor Vehicle Travel Lanes

The main travel lanes of a street are generally designed to be between 10 feet and 12 feet wide, with narrower lanes on minor, low-speed streets and wider lanes on major, high-speed streets. This document calls for the following lane widths within each roadway classification:

Residential Local streets – no striped lanes; roadways are generally wide enough to accommodate 9-10 feet of space for each of two cars to pass each other when cars are parked on one side of street and 12 feet of space for a single car to pass between cars parked on both sides of street

Commercial/Industrial Local streets – no striped lanes; roadways are generally wide enough to accommodate 11 feet of space for each of two cars to pass each other when cars are parked on both sides of street

Residential Collector streets – 10 feet

Commercial/Industrial Collector streets – 11 feet

Two-lane Arterial streets – 12 feet

Multi-lane Boulevards – 11 feet

It is important to note that when travel lanes are adjacent to the curb, the width of the gutter pan *does not* count as part of the travel lane, so the effective width of the lane (including the gutter pan) would be two feet wider.

Bicycle Lanes

Bicycle lanes are required on streets that are designated for bicycle lanes in the Town's Community Connectivity Plan, and are recommended but optional on all other collectors, arterials, and boulevards. These lanes should be 5 feet wide, not including the width of any adjacent gutter pan (the effective width when including the gutter pan is 7 feet). In general, bicycle lanes should always be placed to the right of the main travel lanes and to the left of any on-street parking lane. On streets with curbs and gutters, the bicycle lane should contain pavement markings and/or signage to indicate that it is a bicycle lane, so it is not confused with an on-street parking lane. On streets without curbs and gutters, the bicycle lane can be marked as such *or* it can simply be left unmarked as a paved shoulder. For information on bicycle lane signage and pavement markings, please refer to the Manual on Uniform Traffic Control Devices (MUTCD).

The Community Connectivity Plan calls for bicycle lanes on US 70/Cornelius Street; Churton Street between US 70 and Corbin Street; Churton Street south of US 70A near the Eno River; US 70A east of Churton Street; and NC 86 south of US 70A.

See the sections below on Right-turn Lanes and Roundabouts for additional information on accommodating bicycle lanes at intersections.

Parking Lanes

Parking lanes may be provided on residential and commercial/industrial collector streets. On-street parking is also permitted on local streets, although a specific parking lane is not striped on residential local streets. Spaces are marked on commercial/industrial local streets, but are not striped as a "lane." Parking lanes are 8 feet wide, which *does include* the width of the gutter pan (unlike the other categories of lanes)—this means that the edge of the parking lane should be striped 6 feet from the edge of the gutter pan. In most areas, individual parking stalls should be marked within these parking lanes; however, in some lower-use areas it may be possible to stripe the parking lane without marking individual stalls to allow more flexible use of the space. Spaces should be between 22 and 26 feet in length, depending on the space available; spaces that are at the beginning or end of a line and which have room to maneuver straight in and out without encroaching on other parking spaces may be a minimum of 20 feet in length.

When approaching an intersection or mid-block crosswalk on a collector street, the parking lane should end before reaching the crosswalk, allowing for a pedestrian "bulb-out" at the location of the pedestrian crossing. This improves safety by shortening the distance that pedestrians must cross in the street and improving visibility between pedestrians and motorists. On local streets, where bulb-outs are not required, parking spaces should not be marked within 20 feet of a crosswalk.

In some areas, there may not be a need to provide on-street parking on a collector street (for example, if the street is passing through a protected open space where there are no nearby buildings, or if the neighboring land uses all have adequate off-street parking lots).

Left-turn Lanes

Left-turn lanes are permissible on Commercial/Industrial Collector streets, Two-lane Arterial streets, and Multi-lane Boulevards. On boulevards, left-turn lanes should be provided at all median breaks where left turns and/or U-turns are permitted. On commercial/industrial collector and arterial streets, left-turn lanes should be provided at locations where (1) there are many intersections or driveways in close proximity or (2) there is an intersection or driveway with a heavy left-turn volume. Left-turn lanes can serve vehicles in a single direction (typically at an intersection or major driveway) or with a two-way left-turn lane (TWLTL). The need for left-turn lanes will typically be determined through a Traffic Impact Analysis.

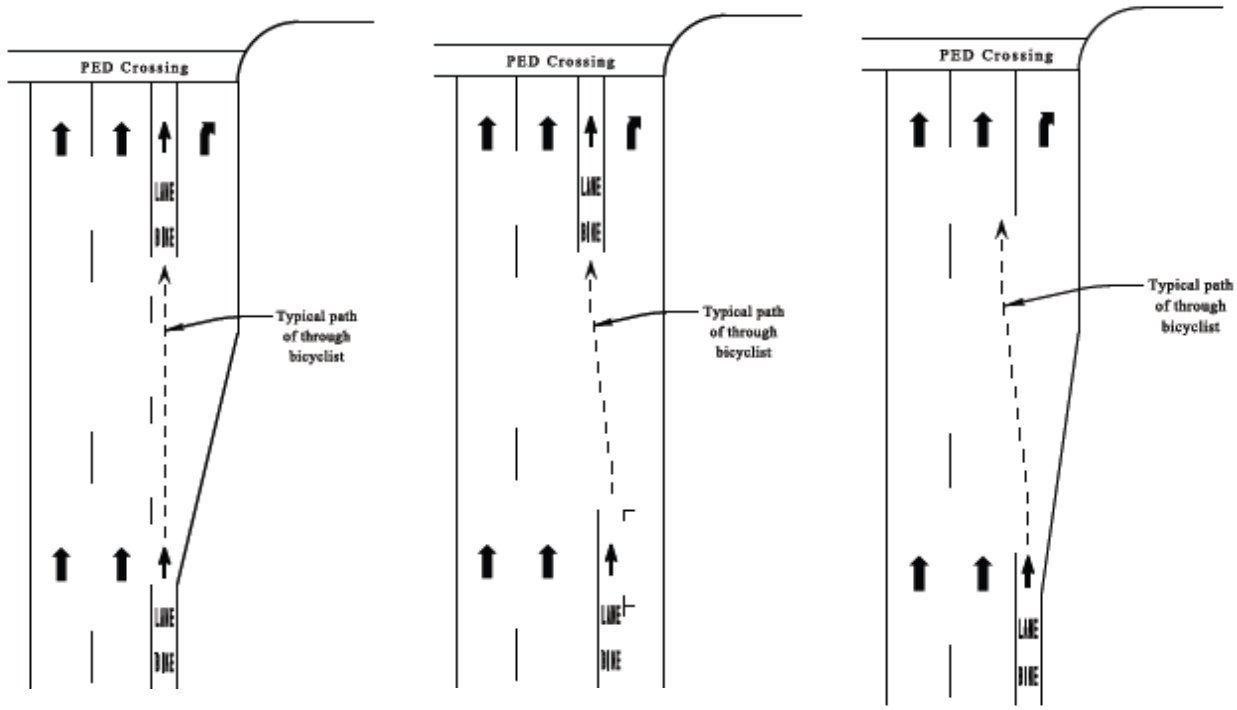
Left-turn lanes should have the following widths within each roadway classification:

Commercial/Industrial Collector streets – 12 feet
Two-lane Arterial streets – 14 feet
Multi-lane Boulevards – 11 feet (13 feet effective width when including gutter pan)

Right-turn Lanes

The provision of dedicated right-turn lanes is generally discouraged, unless a completed Traffic Impact Analysis indicates a demonstrated need for one. Otherwise, right-turn traffic should use the right-most motor vehicle travel lane. When right-turn lanes are provided, they should have the same dimensions as the nearest motor vehicle travel lane (not including the width of the gutter pan as part of the lane). The right-turn lane should be adjacent to the curb or edge of pavement, to the right of the bicycle lane.

The diagram below provides an illustration of the location and marking of bicycle lanes in relation to right-turn lanes. **When the bicycle lane continues straight through the intersection:** At the beginning of the right-turn lane, the bicycle lane marking should transition to a dashed line indicating the space where bicycle traffic will cross over the path of the right-turning motor vehicle traffic. At the intersection, the bicycle lane should be located between the main travel lane(s) and the right-turn lane. A sign at the beginning of the right-turn lane should indicate that turning vehicles must yield to bicycles in the bicycle lane. **When the bicycle lane ends at the intersection:** The bicycle lane should end shortly before the beginning of the right-turn lane and there should be a sign indicating that bicycles must merge into the travel lane.



Images taken from North Carolina Complete Streets Planning & Design Guidelines

Intersection Curb Radius and Approach Angle

The curb radius (or edge-of-pavement radius for a street without curbs) at an intersection has an impact on the ease of making turns in large vehicles and the ease of crossing the intersection for pedestrians and bicycles. Larger curb radii make it easier for vehicles to turn, but smaller curb radii make it easier and safer for pedestrians to cross the street. In general, streets that are more likely to have truck traffic or have higher speeds will need larger curb radii. The following curb radii are recommended for each roadway category:

Residential Local – 5 feet recommended, but up to 10 feet allowed
Residential Collector – 5 feet recommended, but up to 10 feet allowed
Commercial/Industrial Local – 10 feet
Commercial/Industrial Collector – 10 feet
Two-lane Arterial – 15 feet
Multi-lane Boulevard – 15 feet

When a dedicated right-turn lane is provided, a larger curb radius may be necessary for truck movements, since the lane is located directly adjacent to the curb.

In addition to curb radius, another major consideration at intersections is the approach angle of intersecting streets. Streets should intersect at as close to a 90-degree angle as possible. Approach angles less than 60 degrees are not permitted.

Roundabouts

Roundabouts are growing in popularity as an alternative way to design intersections. There are several special considerations that must be addressed when designing roundabouts. The following information is taken from the North Carolina Complete Streets Planning and Design Guidelines:

Roundabouts are a type of yield-controlled intersection characterized by a generally circular shape and design features that create a low-speed environment. A roundabout requires entering traffic to yield the right of way to traffic already in the roundabout. This yield control keeps traffic flowing and can prevent traffic backups as well as delays for motorists, bicyclists, and pedestrians. When operating within their capacity, roundabout intersections typically operate with shorter vehicle delays than other intersections, especially during non-peak traffic times. For this reason, roundabouts support motor vehicle capacity objectives and, when properly designed, also support bicycle and pedestrian travel.

The size, geometry, and applicability of a roundabout is determined by many variables, including street and area type, available space, layout of the existing intersection, intended objectives, traffic volume, the sizes of the vehicles using the roundabout, and the need to design appropriately for speeds that provide safe accommodation for all users.

Roundabouts can help address safety and congestion concerns at intersections. They are designed to enhance traffic efficiency, safety, and aesthetics, and minimize delay for all users including motorists, bicyclists, and pedestrians. The benefits to bicyclists and pedestrians are easiest to obtain with single-

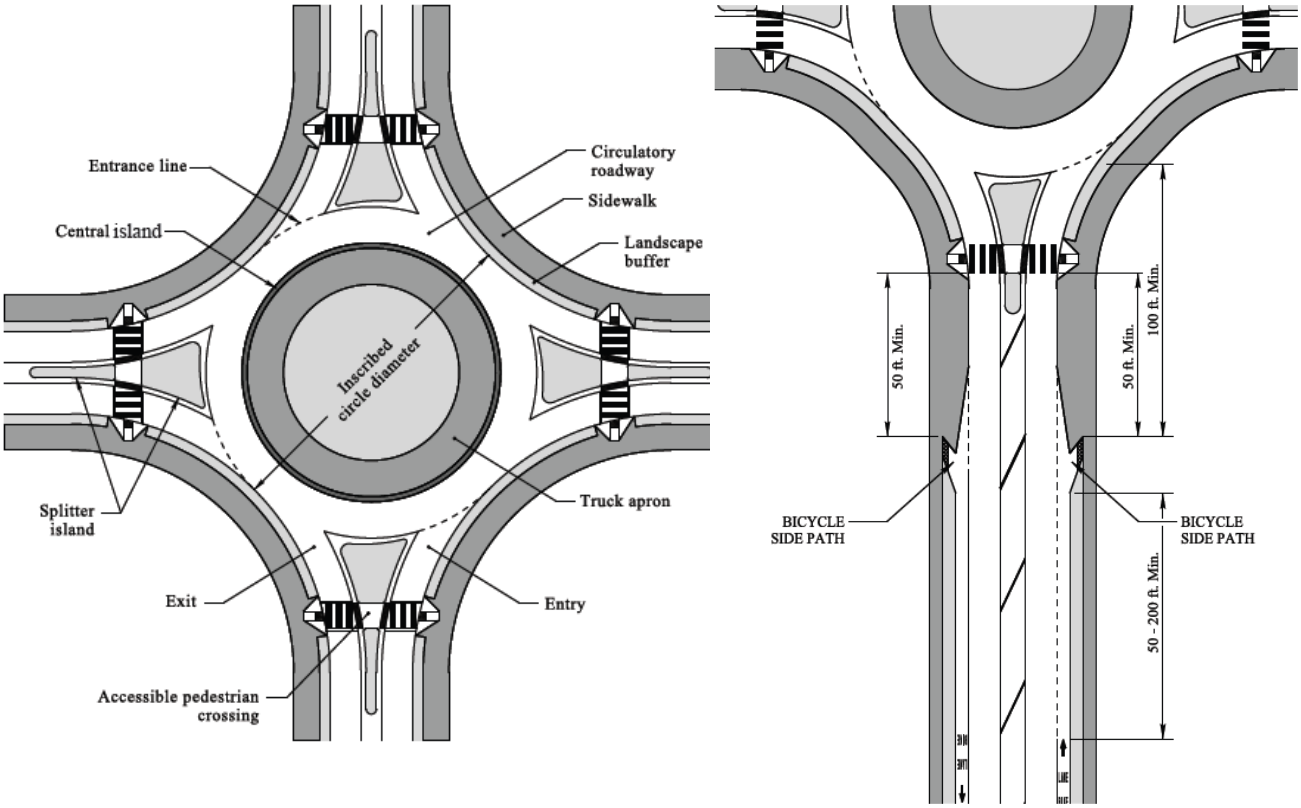
lane roundabouts. Multiple-lane roundabouts can provide difficulties for pedestrians and bicyclists and are not recommended in most situations. When designing a roundabout, the design team should consider the following:

- Apply roundabouts where the context and design objectives allow, but avoid their use for capacity improvements where there are very unequal traffic volumes between the intersecting streets (particularly where one has a very high volume)
- Construct crosswalks (and pedestrian refuges) at least one car length from the roundabout entrance
- Construct the smallest diameter roundabout necessary, with the minimum number of lanes to meet the capacity needs, with single-lane roundabouts preferred
- Construct roundabouts to keep the internal circulation speed low enough to minimize the speed differential between motor vehicles and bicycles
- Construct splitter islands at all entrances, and design them to slow vehicle speeds through deflection, guide motorists and cyclists properly into the roundabout, and to be wide enough to serve as pedestrian refuge islands at crosswalks
- On high-volume roundabouts, provide a separate bike path to allow bicyclists to leave the street prior to the roundabout and re-enter after the roundabout – design carefully to avoid bicycle and pedestrian conflicts at these points; and note that in all roundabouts bicyclists may "take the lane" and travel through the roundabout as a vehicle
- For most roundabouts, the bicyclist should generally "take the lane", so provide for a transition out of the bike lane prior to entering the roundabout
- Consider reducing entrance speeds by providing speed tables at crosswalks (see Traffic Calming discussion below)
- Provide for large vehicle movements by constructing a mountable apron for the roadway center – ensure that the apron is not comfortably mounted by passenger cars

The illustrations on the next page show the general features of a roundabout and the treatment of bicycle lanes as they approach roundabouts. Additional information about roundabout design can be found at http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_672.pdf.

The Federal Highway Administration makes the following recommendations regarding the sizing of roundabouts (inscribed circle diameter), based on the area type and design vehicle:

- Mini-roundabouts (design vehicle is Single Unit Truck) – 45-80 feet
- Urban compact (design vehicle is Single Unit Truck/Bus) – 80-100 feet
- Urban single lane (design vehicle is WB-50 truck) – 100-130 feet
- Rural single lane (design vehicle is WB-67 truck) – 115-130 feet



Images taken from North Carolina Complete Streets Planning & Design Guidelines

Bridges & Culverts

Bridges and culverts should be designed in accordance with applicable NCDOT standards, and should be designed to accommodate bicycle lanes and sidewalks as indicated in the appropriate cross-section for the category of roadway involved. Bridge railings should be designed at an appropriate pedestrian scale when located adjacent to a sidewalk.

Driveways & Access Management

The Unified Development Ordinance for the Town of Hillsborough and the NCDOT Policy on Street and Driveway Access to North Carolina Highways provide rules regarding the design and location of driveways. In general, on Commercial/Industrial Collectors, Two-lane Arterials, and Multi-lane Boulevards it is recommended to limit the number of direct driveway access points and encourage access management concepts such as shared driveways and improved internal circulation within and between development sites.

Curbs & Gutters

It is expected that most new or improved streets within the Town of Hillsborough will be designed with curbs and gutters for stormwater drainage. These should be designed in accordance with the standards of the Town of Hillsborough and the NCDOT. The standard design will include a gutter pan that is 2 feet wide and a curb that is 6 inches wide (for a total width of 2.5 feet).

All measurements that are provided in the cross-sections within this document measure from the face of the curb. This means that the effective width of any features located behind the curb will actually be 6 inches shorter when measured from the back of the curb. For example, the Residential Local street cross-section includes a 6-foot planting strip adjacent to the curb—the effective width of this planting strip, after accounting for the width of the curb, will only be 5.5 feet.

Gutter pans are generally not included in the calculation of the width of an adjacent lane, with the exception of parking lanes. This is because motorists and bicyclists do not generally treat the gutter as part of the travel lane.

Drainage Swales

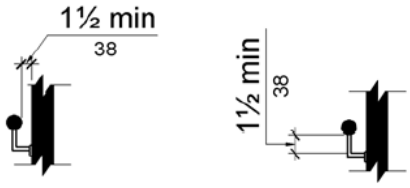
It is anticipated that most new or improved streets in the Town of Hillsborough will be designed with curbs and gutters, but in some cases there may be topographic, hydrologic, or policy reasons for designing streets with open drainage for stormwater. This is permissible on Residential Local, Residential Collector, and Two-lane Arterial streets. The cross-sections provided in this document assume an average width of 8 feet for drainage swales, but in reality the necessary width of these swales would be determined by site conditions and topography. Changes in the right-of-way width may be necessary to accommodate swales greater than 8 feet wide. The width of the grass shoulder, planting strip, and sidewalk on these streets should not be modified.

Sidewalks, Crosswalks, and Handrails

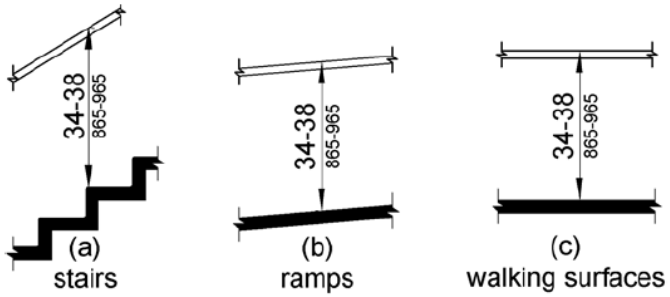
Generally, sidewalks are required on both sides of all new or improved streets. Sidewalks should be a minimum of 5 feet wide. All sidewalks should be constructed to a depth of 5 inches and should be designed with a 1% cross-slope for drainage. The cross-slope of a sidewalk may not exceed 2%. The running grade of a sidewalk may not exceed 5% or the running grade of the adjacent roadway, whichever is greater—in areas where a steeper grade is necessary, the sidewalk should be designed as a ramp, which may not have a slope greater than 1:12. All sidewalks must meet the requirements of the Americans with Disabilities Act (ADA), including the provision of curb ramps and detectable domes at intersections. In the downtown historic district, the detectable domes should be black and set in concrete, with paver or stamped paver walkways; outside downtown, the detectable domes should be yellow. For more information on potential curb ramp designs, refer to Appendix D of the North Carolina Complete Streets Planning and Design Guidelines at http://www.completestreetsnc.org. Sidewalks on new streets should be located behind a planting strip containing street trees.

Handrails are necessary on sidewalks that are adjacent to a slope or retaining wall, as well as on ramps (other than standard curb ramps) and stairs. Handrails must be placed between 34 and 38 inches above the sidewalk and the handrail posts should be located no more than 8 feet apart. There must be at least 1.5 inches clearance between the handrail and an adjacent wall or obstacle. Handrails must have a continuous gripping surface that is not obstructed along the top or sides of the rail—no more than 20% of the bottom of the rail may be obstructed. Circular handrails are preferred and must be between 1.25 and 2 inches in diameter. At each end of a ramp or sidewalk section with a handrail and at the top of a flight of stairs, the rail must extend for an additional 12 inches beyond the required distance and then

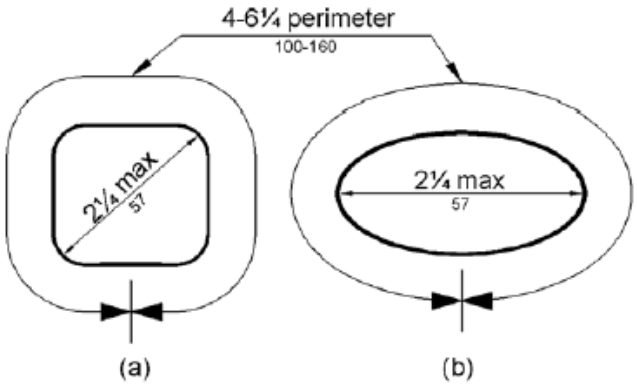
return to a wall, guard, or landing surface. At the bottom of a flight of stairs the rail must extend at the same slope as the stairs for a distance of at least one tread depth and then return to a wall, guard or landing surface. For more information, see http://www.ada.gov/regs2010/2010ADAStandards/2010ADAstandards.htm#pgfId-1006316. The following drawings are taken from the ADA standards and provided for reference.



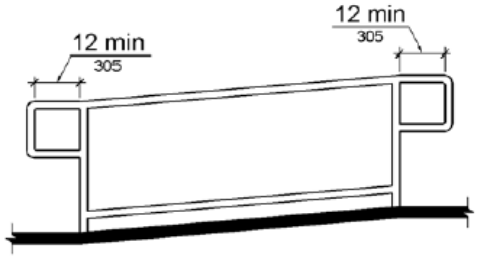
Clearance requirements around handrails



Handrail height requirements



Handrail shape/diameter requirements



Handrail extension requirements at top/bottom of ramp

While this document does not prescribe a specific brand or product design for handrails, it is recommended that any handrails constructed under these guidelines be black or brown metal.

Additionally, within the Historic District, handrails should be designed to be consistent with the wrought-iron style handrails used elsewhere within the district. An example from downtown Hillsborough is shown on the next page. This style of handrail (or comparable) is *recommended* for use throughout the community, but is *required* in the historic district. Available brands in this type of style include Specrail Bridgeport with ADA handrail and Alumi-guard Handrails, but other similar-looking styles or custom designs are also acceptable.

These pictures from the stairway between E Margaret Lane and the Orange County Sheriff's Office show a railing that combines vertical elements similar to a wrought-iron fence with an ADA-compliant handrail attached.

Crosswalks are required at all intersections where there are sidewalks on both sides to connect with (for example, if a new road with a sidewalk ends at an intersection with an existing road without sidewalks, then it is not necessary to stripe a crosswalk across the existing road since there is not a sidewalk to connect to on the far side of the road). There are three types of crosswalks: standard, high-visibility, and stamped concrete. A standard crosswalk is simply marked with a white line running along each edge of the crosswalk. Standard crosswalks are appropriate for crossings of local streets and lower-volume collector streets. High-visibility crosswalks are marked with a "zebra" pattern of alternating 2-foot-wide white stripes perpendicular to the crosswalk, and are appropriate on higher-volume collector streets, arterial streets, and multi-lane boulevards, as well as any location with poor visibility or where a crosswalk might be unexpected (such as mid-block crossings). Stamped concrete crosswalks use colored and textured concrete (typically designed to resemble a brick pattern) to demarcate the crosswalk location, and are typically located in historic districts or other areas with special streetscape designs. All crosswalks should have a minimum width of 6 feet, with wider crosswalks appropriate in areas of high pedestrian activity.

Multi-use Paths

Multi-use paths are an integral part of the Town's transportation and recreation systems. These paths are typically asphalt-paved and 8 feet wide. When a multi-use path runs parallel to a roadway (as a "sidepath") it should be located in the area where the sidewalk would normally be located, with any

additional width located on the side farther from the street. Care should be taken to ensure visibility of multi-use paths when they cross streets and driveways. High-visibility crosswalks are appropriate for locations where multi-use paths cross public streets at a mid-block location and should have the same width as the multi-use path. Independent rights-of-way are generally preferred for multi-use paths. For safety reasons, sidepaths are generally not recommended along streets that have a high density of driveways or intersections, as motorists entering the street from these driveways often look left toward oncoming traffic and do not notice bicycles that are approaching on the sidepath from the right at relatively high speeds.

Street Trees

Street trees should generally be planted within the planting strip that is located between the street and the sidewalk, and should be spaced approximately every 40 feet. Street trees should not be placed within 20 feet of an intersection, in order to ensure visibility for motor vehicles. The trees should generally be placed at the center of the planting strip, or at minimum 2.5 feet from the edge of the sidewalk (center of tree)—on some cross-sections with narrow (4 foot) planting strips next to drainage swales this means that the trees should be placed closer to the swale rather than at the center of the planting strip.

When retro-fitting existing streets, it may not be possible to place the street trees in a planting strip between the sidewalk and the road. In this case, the street trees may be placed behind the sidewalk, and a narrower planting strip (minimum 3 feet) may be used between the street and sidewalk. It may also be impermissible to place trees in the planting strip between a street and sidewalk on certain NCDOT-maintained streets based on NCDOT regulations, in which case the street trees should be placed behind the sidewalk and a narrower planting strip (minimum 3 feet) may be used between the street and sidewalk.

On divided boulevards, street trees *may* also be provided in the median in any location where the median width exceeds 15 feet (face of curb to face of curb). These trees should be located at the center of the median and should be spaced approximately every 40 feet. Street trees should not be placed within 20 feet of an intersection, and by default should not be placed in areas with left-turn lane pockets (since the median width in these areas will be less than 15 feet).

The types of trees permitted are governed by the Town of Hillsborough, as well as the NCDOT (on state-owned roadways). A list of recommended and prohibited trees may be found in the Hillsborough Unified Development Ordinance Administrative Manual at http://www.ci.hillsborough.nc.us/content/administrative-manual-udo.

Street Lighting

Street lighting must be provided along all new or improved streets. Lights should be provided at all intersections, and at least every 175 feet along a street. On multi-lane boulevards, lights should be provided along both sides of the street. Developers will be responsible for the cost of the first three years of operating this lighting—the Town will take over the operating costs for lighting after the three

year period ends. The Town will only take on operating costs of lights that use standard cobra flat lens design provided by the electric utility; operating costs of any other style of street lighting (including the Traditional or Sanibel designs shown below) will be the ongoing responsibility of the developer, property owner, or homeowners' association (as applicable). The following three designs are recommended for use as street lights in the Town.

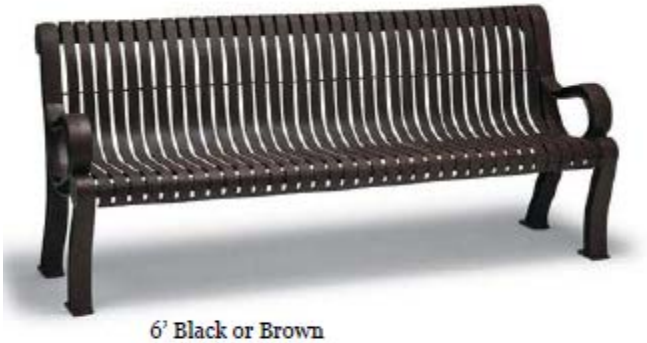
Cobra Flat Lens

Traditional

Sanibel LED

Street Amenities

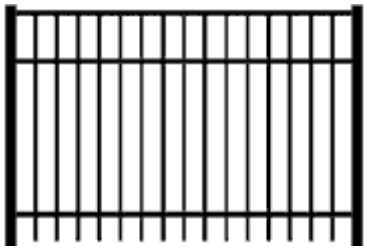
The Town of Hillsborough Community Connectivity Plan includes recommendations on the style of street furniture and amenities to be used within the Town. Among these, the Connectivity Plan sets the Butler bench and trash can by Urbanscape in either brown or black as the standard design to be used along streets and greenways, and in parks in the Town (see picture below). The Connectivity Plan also recommends use of U-shaped bicycle racks (see example at right) and the dark green Aluminum Complete Dog Waste Station (numerous suppliers). Additionally, the plan discusses the possibility of incorporating public art into the design of these amenities, particularly benches and bicycle racks, and provides examples.



6' Black or Brown
Metal Bench
153 lbs.

Matching Metal
Trashcan
111 lbs.

In cases where fencing is necessary along a street frontage, a style similar to that used for handrails is recommended (see page 31), but without the need to attach a handrail. One such style is the Specrail Saybrook (see picture below). Fencing along a street frontage should be black or brown metal and should be similar to this style. When the fencing will also serve as a handrail for a sidewalk, refer to Page 29 on handrail requirements.



Saybrook fencing by Specrail

Signage & Street Naming

All signs placed along streets must conform to the requirements of the Manual on Uniform Traffic Control Devices (MUTCD), which can be found at http://mutcd.fhwa.dot.gov/. Customized signs that differ from the standard street signs used within the Town of Hillsborough are permitted, but must conform to MUTCD requirements, which can also be found in Appendix B. The developer, property owner, or homeowners' association (as applicable) will be responsible for maintenance of any non-standard or customized signage. The Town will assume maintenance responsibility for standard signs.

Street names must not duplicate or be similar to the names of streets elsewhere within Orange County. For example, Hampton and Hampden or Frazier and Fraser are too similar to each other. Evergreen Court and Evergreen Drive are also too similar, as are Howard Road and Howard School Road, and would not be allowed. All street naming must be done in coordination with Orange County Emergency Services.

Utilities

All utilities must be placed underground in new developments and along new streets. On streets with curb and gutter, the utilities (with the exception of water and sewer lines) should generally be located behind the sidewalk. On streets with drainage swales, the utilities should be located either in the grassy shoulder or behind the sidewalk as space allows. Water and sewer lines are typically located under the street.

Signals

All traffic signals should be designed according to the design criteria of the NCDOT. Currently all signals within the Town are maintained by NCDOT as they are all located on state roads, but any future signals that may be located exclusively on town-maintained roads would be maintained by the Town.

Street Spacing and Layout

Section 6.21 of the Town's Unified Development Ordinance provides detailed requirements on the minimum spacing between intersections, maximum block length, provision of stub-outs, and connection of streets between parcels. These requirements can be found at http://www.ci.hillsborough.nc.us/content/unified-development-ordinance-documents.

Traffic Calming

Traffic calming treatments may be appropriate on some new streets, particularly on residential collector streets where there is a desire to strike a balance between the needs of residents on a street and the traffic passing through the neighborhood. The Town has a Traffic Calming Policy (included in Appendix A) that includes a discussion of a number of potential traffic calming treatments that could be appropriate to apply to a new street. Any proposed traffic calming treatments should take care to ensure pedestrians and bicyclists are not impeded by the proposed treatment. While a petition is not necessary when proposing traffic calming treatments on a new street, the proposed treatments must still be reviewed and approved by the Town. Traffic calming measures may only be used on streets classified as Residential Local or Residential Collector and only on town-maintained streets (not on NCDOT-maintained streets), in accordance with Town policy.

Right-of-Way

Minimum rights-of-way are defined in this document for each category of roadway. In some areas, topographic conditions may require that additional right-of-way be provided, particularly if large amounts of earthwork will be required. The minimum rights-of-way are:

Residential Local – 60 feet[3]
Residential Collector – 70 feet
Commercial/Industrial Local – 60 feet
Commercial/Industrial Collector – 70 feet
Two-lane Arterial – 100 feet
Multi-lane Boulevard (collector-type) – 120 feet
Multi-lane Boulevard (arterial-type) – 150 feet

Special Considerations when Retrofitting Existing Streets

The standards in this document are intended primarily for use in designing new streets, but they can also be useful in designing improvements to existing streets. For example, these standards can be used to design off-site street improvements that are necessitated by new developments. When applied to existing streets that are being retro-fitted, these standards should be viewed as guidelines rather than requirements—it is understood that it may not be possible or desirable bring all existing roads up to

[3] The Unified Development Ordinance allows a 50-foot minimum right-of-way on cul-de-sac streets. The Residential Local cross-section can be accommodated on a 50-foot right-of-way by placing the utility strip outside the public right-of-way. However, a 60-foot right-of-way is still recommended on these streets.

these design standards, but they do establish a baseline level of expectation regarding necessary improvements. In retrofit situations, the developer and town will need to negotiate regarding the appropriate design of improvements.

Example:

A developer is proposing a 200-unit apartment complex along an existing commercial collector street. The complex will also have a rear access point along an existing narrow residential local street. A Traffic Impact Analysis is completed and suggests the need for a left-turn lane on the collector street. Due to right-of-way constraints on the existing collector street, the lanes on the street are narrowed to 10 feet instead of 11 or 12 feet, in order to accommodate the turn-lane with minimal impacts to neighboring properties. Town staff also requests improvements to a 300-foot section of the residential local street between the apartment complex entrance and a nearby collector street. The local street currently has open drainage, no sidewalks, and a 40-foot right-of-way. In order to remain within the existing right-of-way, the developer proposes to modify the standard cross-section by installing curb and gutter and not constructing a planting strip or street trees between the street and the sidewalk.

Private Streets

The Town of Hillsborough Unified Development Ordinance (UDO) includes regulations regarding the design, location, and permissible application of private streets—refer to Section 6.21.4 for more information. In general, private streets located in attached-dwelling or multi-family developments must conform to the same design standards as public streets. Private streets are also permitted in minor subdivisions in single-family residential areas when four or fewer homes will have access/frontage on the street, and the design of these streets is governed by the UDO.

3.1 APPROVAL PROCESS

The process for approving street designs is interwoven with the overall process for approving new developments within the Town of Hillsborough. However, there are a few procedural matters that are specific to street design, and these are highlighted below.

Traffic Impact Analysis (TIA)

A Traffic Impact Analysis (TIA) is a document that analyzes the impacts that a proposed development will have on the nearby transportation network, primarily due to increased traffic generated by the development. The TIA will identify necessary improvements to the transportation network in order to ensure that the new development does not adversely impact traffic flow and congestion. The TIA is generally performed by an engineer hired by the Town and paid by the developer, and is reviewed by the Town for approval.

The threshold for developments requiring the completion of a Traffic Impact Analysis is whether the development will generate 800 or more vehicle trips on an average weekday. The following table provides guidelines for the types of developments that will generally rise above this threshold and require completion of a TIA. However, this is only provided for guidance and any final determination should be based on the anticipated number of trips to be generated by the development (per the Institute of Transportation Engineers' *Trip Generation* manual), not by this table.

Estimated TIA Requirement Thresholds[4]

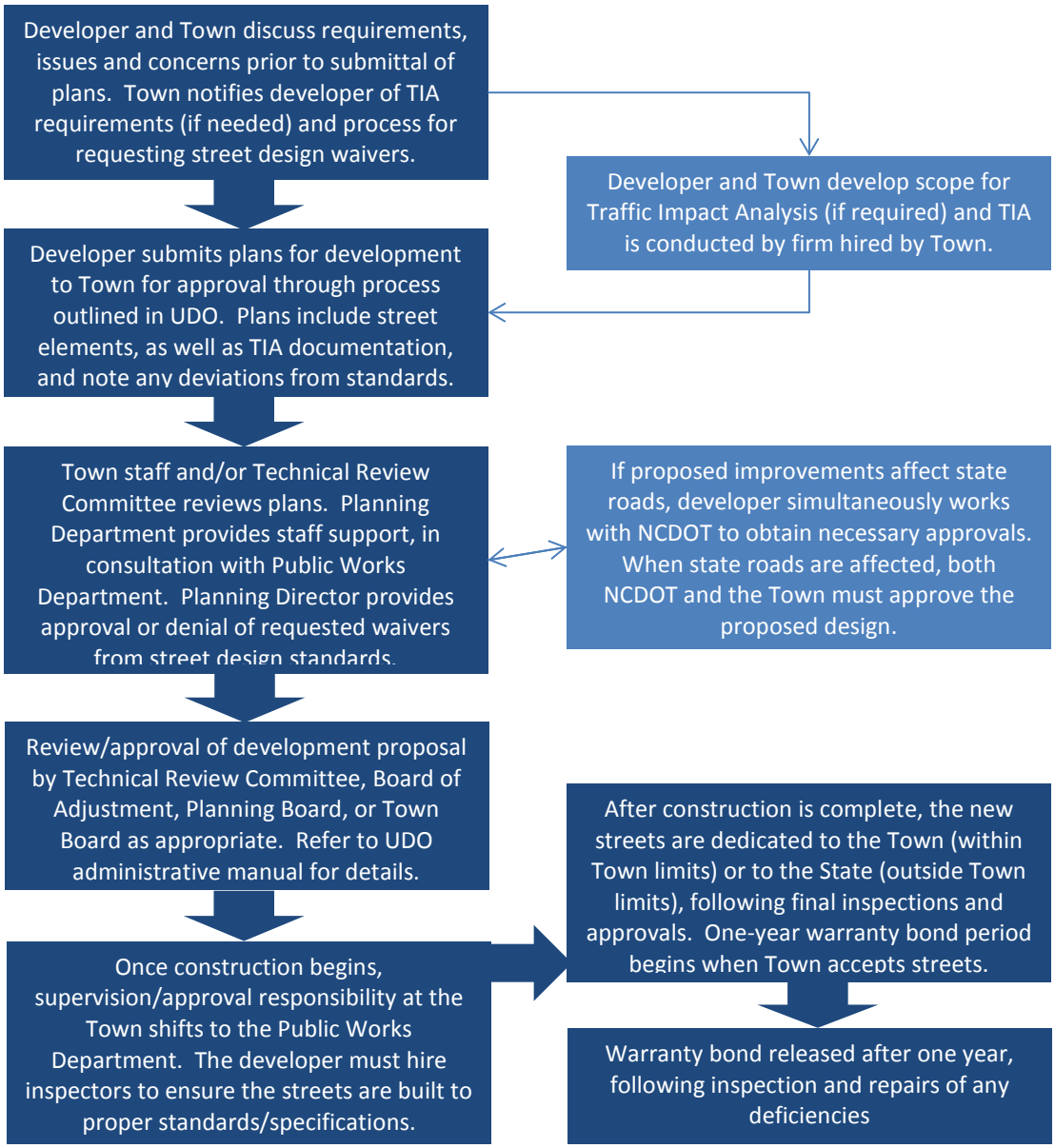
Land Use	Size of Development
Single-family Residential	75 units
Apartments	110 units
Condominiums/Townhouses	130 units
Mobile Home Parks	150 units
General Retail	4,000 square feet
Fast Food Restaurant	2,000 square feet
Gas Station/Convenience Store	5 fuel pumps
Bank	3,000 square feet
Hotel/Motel	130 rooms
General Office	50,000 square feet
Medical/Dental Office	25,000 square feet

[4] Estimated using *ITE Trip Generation, 7th Edition*. Fitted curve equations were used where available (all except fast food restaurant, day care center, and school, which use average rates). General retail is based on the Shopping Center category since a general retail category is not available in the manual.

Research & Development	75,000 square feet
Light Industrial	120,000 square feet
Manufacturing	210,000 square feet
Day Care Center	10,000 square feet
School	60,000 square feet

Process Flowchart

The following flowchart shows the typical process for approval of street design.



For information on the general approval process for a development, refer to the Unified Development Ordinance Administrative Manual, found at http://www.ci.hillsborough.nc.us/content/administrative-manual-udo.

Design Standard Waivers

Exceptions to the design standards discussed in this document may be necessary for a variety of reasons. To request a waiver from the design standards, contact the Town of Hillsborough Planning Department. Approval or denial of the waiver is at the discretion of the Planning Director, subject to appeal to the Board of Adjustment.

Construction Inspection

During street construction, the developer (or developer's contactor) is responsible for hiring a firm to provide inspection services. The firm should be selected from the list of pre-approved firms that is maintained by the Town of Hillsborough Public Works Department, and must be a different firm than the one used by the developer for design and engineering work in the development.

Responsibility for Maintenance

The developer is responsible for maintenance of all streets and street-related infrastructure until such time as the street is accepted for dedication by the Town or the NCDOT. See below for additional requirements related to warranty bonds.

Dedication of Streets to Town

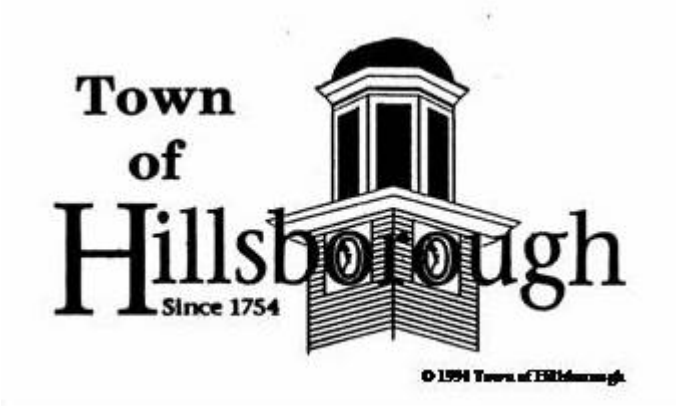
Before the Town will accept any street for dedication, the developer must complete the Town of Hillsborough Engineering Department Checklist for Approval and Acceptance of Utilities Projects, which can be found online at www.ci.hillsborough.nc.us/content/engineeringutilities. The checklist includes a requirement for a one-year warranty bond on the improvements that begins at the time the Town accepts the roadway dedication. At the end of the one-year period, an additional inspection must be completed and any punchlist items must be repaired at the developer's expense before the Town will release the bond and assume full maintenance responsibilities.

Coordination with NCDOT

Improvements that will impact state-owned roadways, or new streets that will be dedicated to the state (generally outside the Town limits) must be approved by both the Town and the NCDOT. While efforts have been made to ensure that the requirements contained in this document are compatible with NCDOT requirements, there may be cases when the requirements differ. When there are conflicts, the state's requirements have precedence, but the Town's requirements should still be followed to the extent possible.

Appendix A – Traffic Calming Policy

This appendix includes the full text of the Town of Hillsborough Traffic Calming Policy, which was previously adopted as a standalone document.



Traffic Calming Policy

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TOWN OF HILLSBOROUGH
RESIDENTIALTRAFFIC CALMING POLICY

Policy Statement

The Town of Hillsborough wishes to have a procedure whereby its' residents can petition the Town to incorporate traffic calming devices and systems in order to alleviate speeding, excessive traffic volume, dangerous intersections or other conditions that are of a public safety nature.

The purpose of this document is to present ways in which residents can find solutions to residential traffic problems as approved by the Hillsborough Town Board. Consideration is given to a variety of residential traffic concerns and to the characteristics of these concerns on a case-by-case basis. Each situation is reviewed with respect to the available traffic control measures that have been, or could be, found effective in alleviating the neighborhood traffic concern.

The following outlines these guidelines and procedures which can be used to develop the optimum solution or solutions to each particular situation. There are many factors taken into consideration when reviewing residential traffic concerns to determine the most feasible traffic control measure. These factors include the surrounding roadway network, resident access, speeds and/or volume of traffic, accident history, neighborhood response and budget considerations.

Note: Public health and safety concerns are always the overriding consideration when installing or removing traffic control devices.

Evaluation Criteria for Streets

1. The street must be classified as a two-lane residential street.
2. The street must be a municipality maintained roadway that receives Powell Bill funding. State roadways are excluded under this policy.
3. The posted speed limit on the affected length of the street must be 25 miles per hour which is the standard speed limit for residential streets.
4. Vehicle speeds (for at least 85% of the vehicles, established by radar or equivalent method) must exceed 35 MPH (+ 10 MPH over posted speed limit).
5. Actual traffic volume will be based on traffic counts conducted by the Town of Hillsborough Public Works staff or its designee. Guidelines reviewed by staff as received from the Institute of Transportation Engineers (ITE) that is appropriate for town streets.
6. A positive recommendation for installation must be received from Police, Fire, and EMS.

Petition Requirements

1. Those parties requesting the installation of a Traffic Calming Device must demonstrate sufficient support for the installation of the device in the affected area; support shall be shown by signatures obtained on the standard Petition for Traffic Control Devices provided by the Town.

2. Only one signature per household can be obtained.
3. Signatures must be of the current residents within the defined study area.
4. Residents must provide their address in the space allotted.
5. Signatures will be checked by Town Hall staff using property tax records.
6. Signatures that do not adhere to these requirements will be considered invalid.
7. The number of valid signatures either for or against installation must meet or exceed 65% of the total number of residents of the impacted area.

Procedure for Obtaining Approval

1. The process is initiated when the Public Works Director receives a request for installation of a traffic control device. A preliminary investigation into the first five qualifying criteria will be completed. If these criteria are met, the Public Works Director or his designee will conduct a field investigation of the impacted area. A petition package containing the Town of Hillsborough Traffic Calming Policy and a Petition Form will be mailed to the requesting party.
2. The requesting party is responsible for obtaining signatures on the petition form and returning it to Town Hall. If the number of valid signatures equals or exceeds 65% of the total number of residents of the impacted area; Police, Fire, and EMS will be contacted for recommendations.
3. Traffic monitoring devices will be used to determine average daily traffic, vehicle speeds, and vehicle types.
4. When all qualifying criteria are met, a report will be prepared for the Board of Commissioners outlining all relevant information and any extenuating circumstances concerning the characteristics of a requested street.
5. The Board of Commissioners will approve or disapprove installations for the requested street based on the "finding of fact" report provided by the Public Works Director.

Funding

The Town of Hillsborough has not identified any special funding source for traffic calming projects. Nor has the Town set-aside any existing funds to be used exclusively on traffic calming projects. Funding options available are special assessments, operating funds, and private funding. The Town of Hillsborough Board of Commissioners will determine the appropriate funding mechanism for the installation of traffic calming devices on a case by case basis.

Special Assessments:

Installation of traffic calming devices is considered a street improvement and are eligible for special assessments in accordance with North Carolina General Statute § 160A-216 (1).

Powell Bill (Operating Budget):

The Town of Hillsborough will cover the cost of activities associated with the development, construction, and installation of traffic calming devices dependent upon the availability of funding.

Private Funding:

Residents of an existing neighborhood wishing to accelerate the process may choose to fund all or part of the development, construction, and installation of their requested traffic calming device.

Powell Bill (Operating Budget)/Private Funding:

The Town of Hillsborough and residents of an existing neighborhood will share the cost of activities associated with the development, construction, and installation of traffic calming devices. The Town's participation in any cost sharing venture is dependent on the availability of funding.

Traffic Calming Measures

Generally, traffic calming measure fall into 4 types: non-physical, vertical, horizontal, and diversion. Non-physical options generally don't directly impact the street design, but can influence driver behavior. Vertical measures change the vertical smoothness of the driving surface to impact driver behavior. Horizontal measures impact the straightness of the driving path to impact driver behavior. Diversion measures change the available road network to re-route drivers.

Non-Physical Traffic Calming Measures

1. **Speed Enforcement**- Temporary targeted speed limit enforcement in areas where residents are concerned.
2. **Radar Trailers** - A radar trailer can be placed adjacent to a roadway to measure and display a passing vehicles speed. Providing the posted speed limit on the device reminds drivers to slow down if they are traveling too fast.
3. **Lane Striping** - Lane striping can be used to visually narrow travel lanes in a given area. By using highly visible stripes, vehicles are encouraged to slow down.
4. **Signage**- Placing appropriate warning and information signs and additional regulatory signs reminds motorists of the various roadway conditions and hazards of the area.
5. **Pavement Marking Legends**- The speed limit or other driver information can be painted onto the street to remind drivers of the speed limit or other area conditions that warrant special attention.
6. **High Visibility Crosswalk**- High intensity paint or plastic can be used in a dense pattern to clearly delineate a cross walk. Crosswalk should be accompanied by appropriate signage.
7. **On-Street Parking**- Designates area along a street to store vehicles. On-street parking may be used along one or both sides of the street. May also be a revenue generator through permit, meter, or other methods.
8. **Raised Pavement Markers**- Raised pavement markers are plastic reflectors installed in the pavement that, when installed in series, alert the driver when they are deviating from the travel lane. They can be installed on the centerline and edge line of a roadway or across a roadway to function as a rumble strip. They are often used on curves.
9. **Streetscaping** - Streetscaping can incorporate many different ideas and approaches. Typically, Streetscaping includes planting street trees and other landscaping along the roadway. Streetscaping also usually involves establishing a planting area between the street and the sidewalk.
10. **Multi-Way Stops**- Multi-way stops involve placing stop signs on all approaches to an intersection. Considerations for Multi-way stops should follow guidelines as described in the Manual on Uniform Traffic Control Devices (MUTCD).

11. **Turn Prohibitions and Other Restrictions** - Turn prohibition signs are posted to restrict movement through a given area and to limit travel in certain directions. Other restrictions, such as "No Trucks", can also help reduce cut-through traffic. Speed limit reductions can be used in areas where existing speed limits are higher than desired; however, speed limit changes alone are generally not effective in significantly reducing travel speeds on local residential streets.
12. **Gateways/Entryways** - Gateways include decorative signing and/or landscaping to visually identify the entrance to a neighborhood or commercial district. This measure helps to make the area appear as a destination rather than a connection to another area. Gateways are often incorporated into a median island.
13. **Colored Pavements**- Pavement can be installed with many colors and patterns. These unique properties can slow drivers by forcing them to process different patterns as they approach an area. Colored pavement can also help delineate the separation between a travel lane and lanes that accommodate other modes of transportation.

Vertical Traffic Calming Measures

1. **Textured Pavement**- Textured pavements can alert motorists to special conditions through sound and/or vibration. Rumble strips are typical example of how textured pavement can produce a sound to warn a driver approaching a hazardous condition. Textured pavements combined with colored pavements can delineate a special area, such as a historic district. Brick pavers are a form of textured pavement.
2. **Speed Humps** - Raised hump (pavement undulation) in the roadway with a parabolic top which exceeds across the road at right angles to the direction of traffic flow. Most effective if used in a series; spaced 300'-500' apart
3. **Speed Lumps**- Speed lumps are a variation of speed humps that add two cut-outs for tires of larger vehicles. The cut-outs are designed so that wider vehicles, such as emergency vehicles, can fit through with little slowing but a standard vehicle must pass at least one side of its wheels over the hump.
4. **Speed Tables** - Speed tables are elongated speed humps with flat tops that usually allow for the entire wheel base of a standard vehicle to be on the top flat part Usually, a textured pavement or alternative design is used to distinguish the speed table from the rest of the roadway.
5. **Raised Crosswalks** - Raised crosswalks are equivalent to speed tables with crosswalk markings. Should be accompanied by appropriate signage.
6. **Raised Intersections** - Raised intersections are equivalent to speed tables, only they are applied over the entire intersection with ramps on all sides. They are normally at or near the same elevation as the sidewalk. Often include textured and/or colored pavements.

Horizontal Traffic Calming Measures

1. **Traffic Circles**- Provides circular, counter clockwise operations at intersections by placing a raised island in the middle of the intersection. Vehicles on the 'thru' street must change

their travel path to maneuver around the circle. Entry into the intersection is often controlled by Yield signs on all approaches.

2. **Roundabouts -** Similar to traffic circles but larger and with "splitter" islands on each approach that flare entry into the circle.
3. They are more typically used as a substitute for a traffic signal. Traffic on the approaches must yield to vehicles within the circle.
4. **Curb Extensions -** Used to make pedestrian crossing movements shorter and easier. Used to narrow the roadway cross- section at particular points (intersection, mid-block, etc.) but still maintains separate lanes for opposing traffic flows. Often used in combination with a raised crosswalk.
5. **Chicanes-** Physical constriction built at the curbside of the roadway to create bends in a formerly straight road. Vehicles are forced to negotiate the narrowed street in a serpentine fashion. Retrofitting an existing street typically allows one lane through the chicane so that opposing traffic must alternate passage through the constraints.
6. **Lateral Shifts** - A lateral shift is a curb extension which shifts the roadway horizontally. A second shift downstream may move the roadway back to the original alignment. These are also frequently called two-lane chicanes.
7. **Neckdowns -** Neckdowns are used to make streets more pedestrian-friendly by shortening the crossing distance and reduce speed by narrowing the travel lanes.
8. **Realigned Intersections –** Realigned intersections are changes in alignment that cover T- intersections with straight approaches into curving streets that meet at right angles. A former "straight-through movement along the top of the T becomes a turning movement. This is one of the few traffic calming measures available for T-intersections.
9. **Bulb outs –** Similar to curb extensions at intersections. Used to narrow the street width to help facilitate pedestrian movements and reduce speeds on one or more approaches.
10. **Two-Lane Chokers**- Two-lane chokers are used at mid-block points to reduce the overall cross section of the street providing a natural slow down point.
11. **One-Lane Chokers** - Curb extensions toward the center of the roadway that reduce the street from two lanes to one lane. This requires vehicles to come to a stop and yield to oncoming traffic.
12. **Center Island Narrowing**- Narrowing of the roadway with a raised center island, typically planted, between the travel lanes. They also provide a pedestrian refuge thereby allowing pedestrians to cross one travel lane at a time.
13. **Medians**- Used to separate lane movements and provide a visual cue along the roadway. Medians can be especially effective along curves. Medians can also be used as a diversion device by restricting access at intersections and to adjacent properties.

Diversion Traffic Calming Measures

1. **Street Closures-** Barrier or pavement removal intended to block all vehicle access on a street. Pedestrian and bicycle access is typically maintained. Often designed to allow emergency vehicles to 'break-through' the closure. Cul-de-sacs are a common form of this measure.
2. **Diagonal Diverters** - Diagonal diverters bisect an intersection diagonally, disconnecting the legs of the intersection and creating two separate roadways. This can be accomplished with a simple barrier such as guardrail or through pavement removal and landscaping.

Pedestrian and bicycle access is typically maintained. Can be designed to allow emergency vehicles to 'break-through' the barrier.

3. **Semi-diverters**- A semi-diverter is a barrier, usually a landscaped island, on one side of a street at an intersection that permits traffic on the opposite direction to pass through; thereby creating a one-way street at the intersection but maintaining two-way traffic for the rest of the block.

Comparison of Speed Control Devices			
DEVICES	ADVANTAGES	DISADVANTAGES	COSTS
Speed Enforcement	- May be implemented immediately with little planning - No impact to emergency response times - Secondary benefits include reduced crime and higher sense of security	- Expensive to maintain for an extended period of time - May only be effective for a short time - May only be effective for short distances	Varies
Radar Trailers	- In the long-term, less expensive than police enforcement - May be implemented immediately with little planning - No impact on emergency response times - Effective for reducing speeds in a short span	- Only effective for one direction of travel at a time - May only be effective for a short time - May only be effective for short distances	Varies
Lane Stripping	- Inexpensive - May be implemented quickly with little planning - No impact to emergency response times	- Increases maintenance costs	$0.15-$1.00 per lineal foot (paint) $1.00-$5.00 per lineal foot (plastic)
Signage	- Inexpensive - No impact to emergency response times	- Increases maintenance costs - Signs typically considered unsightly – most people do not want them in their yard	$50-$100 per sign
Pavement Marking Legends	- Inexpensive - May be implemented immediately with little planning - No impact to emergency vehicle response times	- Increased maintenance costs - Has not been proven to reduce speed	$25-$50 per letter or number $100-$200 per symbol
High Visibility Crosswalk	- Inexpensive - No impact to emergency vehicle response time - Helps collect and distribute pedestrians along the street - Increases visibility of pedestrians	- Requires more maintenance than normal crosswalk - May provide pedestrians with false sense of security, especially when used at mid-block location or uncontrolled approaches to an intersection	$200 per crosswalk lane

On-Street Parking	- Provides more vehicle storage - Narrows street width to encourage slower vehicular travel - Shortens pedestrian crossing distance - Encourages pedestrian activity in an area	- May be ineffective if parking is not adequately utilized - May reduce sigh distance for both drivers and pedestrians - May increase certain types of vehicular crashes - May restrict bicycle movements - Traffic volumes may increase especially in areas of high demand an low availability of off-street parking - May impede emergency response vehicles and solid waste collection	Dependent on frequency of spaces, enforcement costs, etc.
Raised Pavement Markers	- Inexpensive - May be implemented immediately with little planning - No impact to emergency vehicle response times - Secondary benefits include increased delineation and roadway safety	- Noise - May be unintentionally removed during snow removal - Increased maintenance costs	$2-$7 per marker
Streetscaping	- May reduce speed and volumes - Positive aesthetic effects - Good functionality - Increases pedestrian safety - Improves quality of life for neighborhood - No impact to emergency response times	- Can create vehicular hazards - Can create poor visibility conditions if installed too dense - Possibly increased maintenance costs	Varies depending upon materials, length, and width of application area, and availability of right-of-way
Multi-Way Stops	- If traffic signals are warranted, can be used as temporary measure - Can reduce intersection collisions - Little impact to emergency response times - May be implemented quickly with little planning - May provide a safer crossing for pedestrians	- Speeds between intersections often decrease - Increases noise and air pollution - Can cause read-end accidents - Requires enforcement - If stop signs are warranted, disregard for measure can create dangerous situations	$300-$600 per intersection

Turn Prohibitions and Other Restrictions	- Inexpensive to install - No impact to emergency response time - May increase pedestrian traffic - Transit and school buses can be exempted - Restrictions can be "part-time"	- Deliberate violation could create a hazard - May divert problem onto another street - Requires enforcement - Requires approval of an enabling ordinance - Not effective for reducing speeds	$100-$200 enforcement costs
Gateways/Entryways	- May reduce volumes - Positive aesthetic effects - Good functionality - Improves quality of life for neighborhood - No impact to emergency response times	- Can increase vehicular hazards - Can create poor visibility conditions - Can be expensive	Varies depending on materials, length, and width of application area
Colored Pavements	- May reduce speeds and volumes - Positive aesthetic effect - Good functionality - Increases pedestrian safety - Improves quality of life for neighborhood - No impact to emergency response times	- Can create vehicular hazards - Can make roadway features difficult to see if installed too densely - Increased maintenance - Surface can be slick – hazardous to pedestrians and cyclists	Varies depending on materials, length, and width of application area
Textured Pavement	- May reduce vehicle speeds - May add aesthetic value - If used at an intersection can calm two streets at once - Little or no impact to emergency response times	- Textured materials are expensive - Increased noise - Difficult for physically challenged individuals to maneuver - Increased maintenance costs	Varies with material and area of installation
Speed Humps	- Effective in reducing speed - Compatible with pedestrians and bicycle movement - May also decrease cut-through traffic by increasing travel time - Inexpensive	- Increased noise when vehicles travel over them - Increased maintenance costs - Slows emergency vehicles and buses - Aesthetics - Can be very uncomfortable to vehicle occupants with certain disabilities	$1,500-$2,000
Speed Lumps	- Effective in reducing speeds - Maintains rapid response time - Inexpensive - Relatively easy for bicyclists to cross if installed correctly	- Aesthetics - Private vehicles with large wheel bases can avoid the humps - Increased noise - Increased maintenance costs	$1,800-$2,000

		- Can be very uncomfortable to vehicle occupants with certain disabilities	
Speed Tables	- Smoother than humps for larger vehicles - Effective in reducing speeds - Compatible with pedestrian and bicycle movements - May also decrease cut-through traffic by increasing travel time	- Aesthetics, if decorative surface material is not used - Decorative materials are expensive - Increased noise - Increased maintenance costs - Slows emergency vehicles and buses - Can be very uncomfortable to vehicle occupants with certain disabilities	$1,500-$4,000 (depending on materials
Raised Crosswalks	- Smoother than humps for larger vehicles - Effective in reducing speeds - Increases visibility for pedestrians - Slows vehicular traffic at conflict point with pedestrians - Better than simple crosswalk for visually impaired pedestrians - May also decrease cut-through traffic by increasing travel time	- Aesthetic, if decorative surface material is not used - Decorative materials are expensive - Increased noise - Increased maintenance costs - Slows emergency vehicles and buses - Can be very uncomfortable to vehicle occupants with certain disabilities	$1,800-$4,000 (depending on materials
Raised Intersections	- Smoother than humps for larger vehicles - Effective in reducing speeds - Increases visibility for pedestrians - Slows vehicular traffic at conflict point with pedestrians - May also decrease cut-through traffic by increasing travel time	- Aesthetics, if decorative surface material is not used - Decorative materials are expensive - Increased noise - Increased maintenance costs - Slows emergency vehicles and buses - Can be very uncomfortable to vehicle occupants with certain disabilities	Varies by materials used and intersection size
Traffic Circles	- May significantly reduce speeds on “thru” streets - Reduces intersection collisions - Provides additional street	- May require removal of parking near intersection - May cause sight distance problems for vehicles - Depending on size and	$5,000-$10,000

	aesthetics - May be used as a volume control device without limiting access	location, may have high installation costs - May impact emergency response times - May impede large vehicles	
Roundabouts	- Reduces vehicles speeds - Eliminates typical left-turn conflicts - In the long run, more economical to maintain than traffic signal - Adds to street aesthetics - Reduces crash severity at intersections	- Often requires a large amount of right of way - May require additional lighting to lessen driver confusion at night - Not a typical traffic calming measure for local streets (used for collections and minor thoroughfares) - Initial costs are high	Single lane roundabout $20,000-$120,000 (depending on Right-of-Way requirements)
Curb Extensions	- Narrows street width to encourage slower vehicle traffic at specific points - Shortens pedestrian crossing distance and makes pedestrians more visible - May facilitate more on-street parking spaces - Intended to reduce vehicle speeds	- Conflicts with flow of bicycle lanes - Requires removal of some on-street parking	$7,000-$10,000
Chicanes	- Typically results in lower speeds - One lane chicanes can significantly reduce cut-through traffic - Can be aesthetically pleasing	- May lead to an increase in head-on collisions - Higher maintenance costs - Can severely impact emergency response vehicles - Should not always be used in areas with frequent driveways - Loss of on street parking	$4,000-$8,000 (depends on length of road affected)
Lateral Shifts	- Is an effective tool for slowing traffic on high volume streets - Easy functionality for large vehicles	- Les effective for reducing speeds than a one lane chicane - Proper design is crucial to avoid lane changing by vehicles - Loss of on street parking - May require additional right-of-way	Varies by length, width, and shift distance
Neckdowns	- Increased pedestrian safety and range - Reduces speeds	- May require bicyclists to merge with traffic - May slow emergency vehicles	$4,000-$5,000

		- Loss of on-street parking	
Realigned Intersections	- Reduces speeds at T-intersections - Can reduce cut-through traffic by reassigning right of way at intersection	- Typically requires additional right of way on one corner - Construction can be costly - May have minor impacts on emergency response times	Varies with magnitude of the project
Bulb outs	- Reduces vehicle speeds near intersection - Makes pedestrian crossing safer and easier - Improve sight line between vehicles and pedestrians - May accommodate pedestrians with disabilities - May facilitate more on-street parking	- Does not accommodate bicycle paths - May affect turning movements (especially for large trucks)	$4,000-$5,000 per corner
Tow-Lane Chokers	- May reduce speeds - May reduce volumes - Positive aesthetic effect - Good functionality - Provides safer pedestrian crossings - May encourage more use of on-street parking - No impact on emergency response times	- No vertical and little or no horizontal deflection - Loss of on-street parking - Bicyclists may have to merge with traffic	$7,000-$10,000
One-Lane Chokers	- Reduces speed and volumes - Positive aesthetic effect - Good functionality - Safer pedestrian crossings	- Loss of on-street parking - Bicyclists may have to merge with traffic - Opposing vehicles trying to use same space - Can significantly delay emergency vehicles	$7,000-$10,000
Center Island Narrowing	- May reduce speeds and volumes - Positive aesthetic effect - Good functionality - Increases pedestrian safety	- Loss of on-street parking - Can impact emergency response vehicles if lanes are made too narrow - Should not be used in areas with frequent driveways	Varies depending on size and material
Medians	- Prevents passing maneuvers along roadway - Provide area for street landscaping - Reduces vehicle speeds along	- May require parking removal - May be costly - May limit access depending on length of	Varies depending on size and material

	a curve - Provides pedestrians refuge area and aids crossing maneuvers - Can be used to restrict movements at intersections	median section - May reduce sight distance depending on roadway alignment, size of median - May impact emergency response times	
Street Closures	- Eliminates through traffic - Reduces speeds - Improves safety for all modes of transportation	- Limits access - Creates problems for emergency vehicles - Often need to construct turn-arounds or cul-de-sacs near the closure point	$20,000 (dependent on size)
Diagonal Diverters	- Reduces speeds and volumes - Can be aesthetic enhancement - Good functionality - Increases pedestrian safety - Improves quality of life for neighborhood	- Can create vehicular hazards - Can create poor visibility conditions - Can be expensive - Potentially severe impacts on emergency response times	Varies depending on size and materials
Semi-Diverters	- Reduces volumes - Positive aesthetic effect - Increases pedestrian safety - Improves quality of life for neighborhood - Limits cut-through traffic	- Can create vehicular hazards - Restricts access at all times – not just during peak periods - Can create poor visibility conditions - Can be expensive - Does not control speed - May impact emergency vehicle response times	Varies with application size

PETITION FOR TRAFFIC CONTROL DEVICES

We, the undersigned residents, hereby petition the Board of Commissioners to approve the traffic control devices described below upon indicated street or part thereof.

THE STREET OR PART THEREOF DESIRED TO BE AMENDED IS:

THAT PART OF _____STREET

FROM _____STREET TO _____STREET.

WITH RESPECT TO THE TRAFFIC CONTROL DEVICE PETITIONED FOR, WE REQUEST:

1) _____

2) _____

3) _____

[Please note: a maximum of three (3) traffic calming devices may be requested]

Resident's signatures	Street address (mailing if different)

*The addresses of properties that will be directly affected by the proposed change have been determined by the Hillsborough Planning Department. By policy, the Board of Commissioners has stated that it would prefer to entertain request for changes in street regulations proposed by citizens only where 75% of the occupants of the properties directly affected by the proposed change have signed a petition requesting the changes.

CERTIFICATE AS TO
SUFFICIENCY OF PETITION
FOR TRAFFIC CONTROL DEVICE

TO THE MAYOR AND BOARD OF COMMISSIONERS OF THE TOWN OF HILLSBOROUGH:

I,_____, Town Clerk of the Town of Hillsborough, North Carolina do hereby certify that the attached "Petition for Traffic Control Devices" was presented to me on the _____day of _____, 20___; that I have investigated the sufficiency of the petition; and that the results of my investigation is as follows:

The total number of properties directly affected by the requested change is_____. With respect to the signatures on the attached petition, _____ signatures are those of residents of the affected area which is _____%of the residents on the project street.

This the_____ day of_____, 20

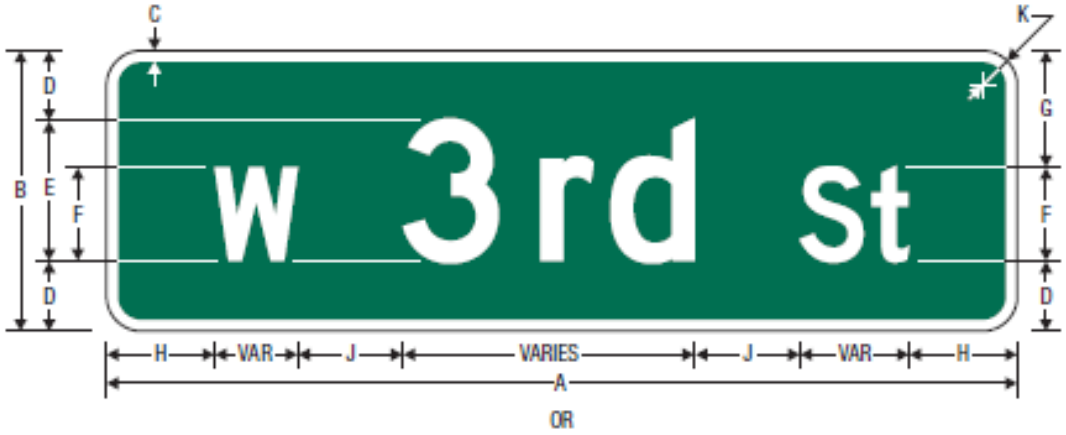
SEAL

_____
Town Clerk

THIS FORM MUST BE ATTACHED TO THE
"PETITION FOR TRAFFIC CONTROL DEVICES" AFTER ALL
PETITIONERS' SIGNATURES HAVE BEEN OBTAINED.

Appendix B – MUTCD Street Sign Requirements

This appendix includes the section of the 2012 Supplement to the Standard Highway Signs element of the Manual on Uniform Traffic Control Devices that discusses the requirements for street name signs. This is provided for informational purposes. Refer to the FHWA Manual on Uniform Traffic Control devices website at http://mutcd.fhwa.dot.gov/ for future updates to this information.



OR

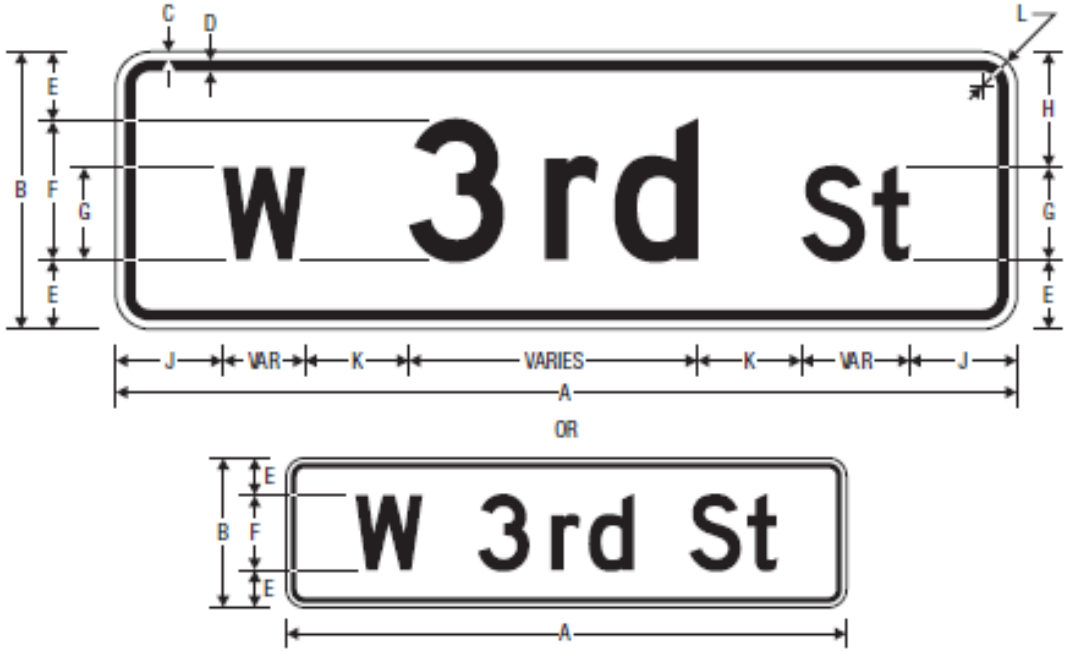
D3-1
STREET NAME SIGN

D3-1 – PRINCIPAL LEGEND WITH DESCENDING STROKES

D3-1 – WITHOUT BORDER, PRINCIPAL LEGEND WITH OR WITHOUT DESCENDING STROKES

A	B	C	D	E	F	G	H	J	K	L	M	N
VAR	8	0.375	2	4 D	3 D	3	3 (MIN)	3	1	1.75	2.25	2.75
VAR	12	0.5	3	6 D	4 D	5	4.5 (MIN)	4.5	1.5	2.75	3.25	4.75
VAR	18	0.75	5	8 D	5.33 D	7.67	5.33 (MIN)	6	1.875	5	5	7.67
VAR	24	1	6	12 D	8 D	10	9 (MIN)	9	2.25	5.5	6.5	9.5

COLORS: LEGEND, BORDER – WHITE (RETROREFLECTIVE)
BACKGROUND – GREEN (RETROREFLECTIVE)
BACKGROUND (ALTERNATE) – BLUE OR BROWN (RETROREFLECTIVE)

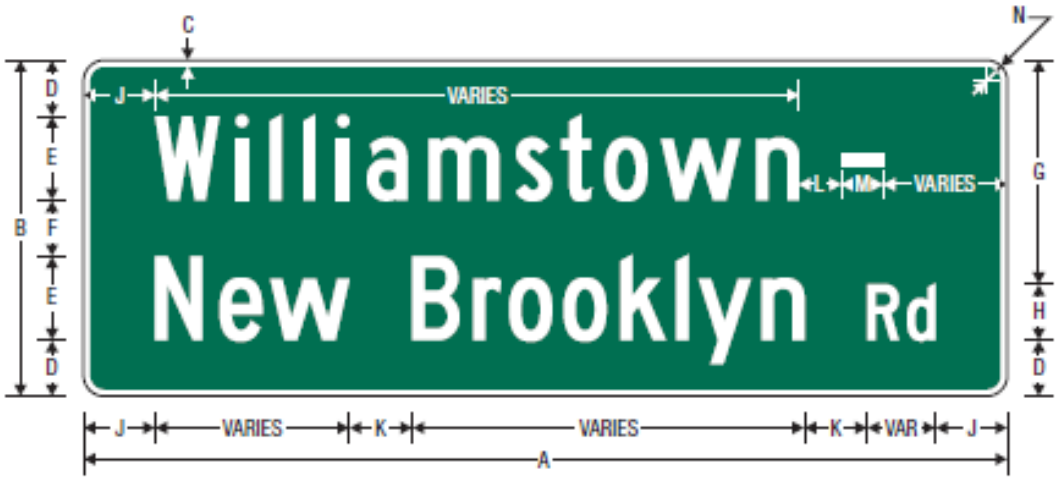


D3-1
STREET NAME (1 LINE, ALTERNATE COLOR ARRANGEMENT)

D3-1 – PRINCIPAL LEGEND WITH DESCENDING STROKES
(ALTERNATE COLOR ARRANGEMENT)

A	B	C	D	E	F	G	H	J	K	L	M	N	P
VAR	8	0.25	0.375	2	4 D	3 D	3	3 (MIN)	3	1	1.5	2.5	2.5
VAR	12	0.375	0.5	3	6 D	4 D	5	4.5 (MIN)	4.5	1.5	2.5	3.5	4.5
VAR	18	0.5	0.75	5	8 D	6 D	7	5.33 (MIN)	6	1.875	4.5	5.5	6.5
VAR	24	0.625	0.875	6	12 D	8 D	10	9 (MIN)	9	2.25	5	7	9

COLORS: LEGEND, BORDER – BLACK (NON-RETROREFLECTIVE)
BACKGROUND – WHITE (RETROREFLECTIVE)



D3-1

STREET NAME (1 LINE)

A	B	C	D	E	F	G	H	J	K	L	M	N
VAR	15	0.375	2.25	4 C	2.5	9.75	3 C	3 (MIN)	3	2	2	1
VAR	24	0.5	4	6 C	4	16	4 C	4.5 (MIN)	4.5	3	3	1.5
VAR	33	0.75	5.5	8 C	6	22.17	5.33 C	5.33 (MIN)	6	4	4	1.875
VAR	48	1	8	12 C	8	32	8 C	9 (MIN)	9	6	6	2.25

COLORS: LEGEND, BORDER — WHITE (RETROREFLECTIVE)
BACKGROUND — GREEN (RETROREFLECTIVE)
BACKGROUND (ALTERNATE) — BLUE OR BROWN (RETROREFLECTIVE)

D3-1a

STREET NAME WITH ROUTE SIGN

* See M1-1 through M1-6 sign details. Scale dimensions proportionally.

A	B	C	D	E	F	G	H	J	K	L	M
VAR	8	0.375	0.75	6.5"	2	4 D	3 D	2	3 (MIN)	3	1
VAR	12	0.5	1	10"	3	6 D	4 D	3	4.5 (MIN)	4.5	1.5
VAR	18	0.75	1.5	15"	5	8 D	5.33 D	4	5.33 (MIN)	6	1.875
VAR	24	1	2	20"	6	12 D	8 D	6	9 (MIN)	9	2.25

COLORS: LEGEND, BORDER – WHITE (RETROREFLECTIVE)
BACKGROUND – GREEN (RETROREFLECTIVE)
BACKGROUND (ALTERNATE) – BLUE OR BROWN (RETROREFLECTIVE)
ROUTE SIGN – SEE M1-1 THROUGH M1-6 SIGN DETAILS