A vigorous five-mile walk will do more good for an unhappy but otherwise healthy adult than all the medicine and psychology in the world.

~Paul Dudley White

Walking: the most ancient exercise and still the best modern exercise. ~Carrie Latet

The true charm of pedestrianism does not lie in the walking, or in the scenery, but in the talking. The walking is good to time the movement of the tongue by, and to keep the blood and the brain stirred up and active; the scenery and the woodsy smells are good to bear in upon a man an unconscious and unobtrusive charm and solace to eye and soul and sense; but the supreme pleasure comes from the talk. ~Mark Twain

I only went out for a walk and finally concluded to stay out till sundown, for going out, I found, was really going in.

~John Muir, 1913

The civilized man has built a coach, but has lost the use of his feet.

~Ralph Waldo Emerson, "Self-Reliance," 1841

Now shall I walk
or shall I ride?
"Ride," Pleasure said:
"Walk," Joy replied.
~W.H. Davies

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## Acknowledgements

The Cornelius Comprehensive Pedestrian Plan was made possible through the joint efforts of Town staff, the Pedestrian Advisory Committee, North Carolina Department of Transportation (NCDOT), and citizens of Cornelius. It was funded through the bicycle and pedestrian planning grant initiative of the NCDOT. The plan highlights Cornelius' commitment to improving walkability and mobility throughout Town.

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## Introduction

The Town of Cornelius received a grant from NCDOT to develop a comprehensive pedestrian plan. The timing of the project coincided with the development of the Town's first comprehensive plan entitled, *Navigate Cornelius*. The sequencing of the two plans allowed for an overlap of participation, shared planning resources, and enhanced integration between the two initiatives.

Participants in the process included local planners, committee members from *Navigate Cornelius*, the general public and members of the parks and recreation commission.

Through a series of activities a vision statement for the plan emerged:

*"Our Vision is a community where walking is a reasonable choice for short trips; a place where our citizens encounter a safe and inviting pedestrian network that connects to places of interest; a place where walking contributes to a healthy lifestyle; and a place where families can thrive and visitors can enjoy all that Cornelius has to offer."*

### *Benefits of Walking*

Participants discussed the many benefits of walking and how it can contribute to the community. A brief summary of these benefits include:

- **Health benefits** – Walking is a form of physical activity that can be accomplished by most citizens. Regular physical activity helps prevent or reduce the risk of heart disease, obesity, high blood pressure, type 2 diabetes, osteoporosis, and mental health problems such as depression.

- **Transportation benefits** – Walking can help to reduce roadway congestion. Many streets and highways carry more traffic than they were designed to handle, resulting in gridlock, wasted time and energy, pollution, and driver frustration. Many of the trips that Americans make every day are short enough to be accomplished on foot or via wheelchair. The 1995 National Personal Transportation Survey (NPTS) found that approximately 40 percent of all trips are less than two miles in length—which represents a 30-minute walk.

- **Environmental/Energy benefits** - Motor vehicles create a substantial amount of air pollution. In fact, according to the EPA, transportation is responsible for nearly 80 percent of carbon monoxide and 55 percent of nitrogen oxide emissions in the U.S.

- **Economic benefits** – Walking is an affordable form of transportation. Car ownership is expensive, and consumes a major portion of many family incomes. When safe facilities are provided for pedestrians, people can walk more and spend less on transportation, meaning they have more money to save or spend on other things. Walking is free!

- **Quality of life benefits** – The walkability of a community is an indicator of its livabililty. This factor has a profound impact on attracting businesses and workers as well as tourism. In cities and towns where people can regularly be seen out walking, there is a sense that these are safe and friendly places to live and visit. By providing appropriate pedestrian facilities and amenities, communities enable the interaction between neighbors and other citizens that can strengthen relationships and contribute to a healthy sense of identity and sense of place.

- **Social justice** - Perhaps the most important factor in walking and social justice is choice. When providing pedestrian facilities such as sidewalks and crosswalks, communities allow people to choose how they want to travel. For those who do not have the option to drive, such as adolescents, elderly, those unable to afford a car, and people with certain disabilities, this lack of choice in transportation creates an inconvenient and socially unjust barrier to mobility.

## *Project Purpose*

One community aspiration identified during *Navigate Cornelius* was to "Improve overall access and mobility throughout the study area, including improvements for bicyclists, pedestrians, and transit users." Although Cornelius has made great strides in improving its pedestrian network through the recent addition of new sidewalks on West Catawba Avenue and completion of the Town's first greenway, bicycle and pedestrian facilities are limited. The Town faces both natural and physical barriers to connectivity. I-77 bisects the town into east and west and Lake Norman and a rail line limit growth along its western and eastern edges, respectively. Furthermore, the pace of development has resulted in suburban decentralized growth pattern that includes numerous cul-de-sacs, limited connectivity, and curvilinear street patterns.

The purpose of the Comprehensive Pedestrian Plan is to identify and develop safe amenities that encourage a walkable and pedestrian friendly community. This includes a comprehensive assessment of existing facilities, policies, and procedures that relate to "walkability," a review of planned facilities, identification of pedestrian needs and deficiencies, a review of transportation priorities, safety considerations, barriers to walkability, and special population needs, and development of short and long term project recommendations, associated cost estimates, and viable funding sources.

## *Study Area*

The study area for the Comprehensive Pedestrian Plan includes all land within the corporate limits and the Town's designated sphere of influence. The sphere of influence is a mutually agreed upon boundary established with Mecklenburg County within which the Town may annex in the future.

A map of the study area is shown on page 1-4.

## *Public Involvement*

**Pedestrian Advisory Committee**: The Consultant Team worked with Town staff and NCDOT to establish a Pedestrian Advisory Committee (PAC). The PAC met regularly to provide direct oversight and counsel to the planning process. The PAC met regularly throughout the planning process and the committee was augmented to include input from the parks and recreation commission given the desire to enhance connectivity and accessibility to community reaction areas.

**Public Questionnaire:** An informal questionnaire was created and filled out by all members of the PAC to obtain feedback on specific issues related to walkability. The questionnaire was also made available to the general public on the Town's website and during public workshops. In addition, the questionnaire was distributed in the local schools to students, faculty, and parents. A total of 216 completed questionnaires were collected. The responses were incorporated into the recommendations detailed later in the plan.

**Public Workshops:** Two public workshops were held during the course of the planning process. The first public workshop was held May 3rd, 2011 at Town Hall. The purpose of this workshop was to increase awareness of the planning process, help with the identification of barriers, identify, safety concerns, pedestrian attractions, and gaps in the existing network.

A second public workshop was held June 7th, 2011 at Town Hall. Participants were offered an opportunity to review and comment on draft recommendations.

*iscussed*
*neeting.*

Study Area

Cornelius - North Carolina

## Existing Conditions

Early in the process an effort was made to observe, identify, and inventory existing conditions. The project team focused on information relevant to walkability with an emphasis on demographics, physical features, pedestrian attractions, and barriers. Existing conditions are summarized on the following pages.

*Pedestrian Beacon on Washam Potts Road*

*40 percent of all trips are less than two miles in length which represents a 30-minute walk...*

## *Demographics ay a Glance*

**Population:** The certified population estimate for Cornelius in 2009 is 24,847 according to the North Carolina Office of Budget and Management (OSBM).

The 2010 median age for residents of the Town of Cornelius is 40, and the average age of Town residents is 38.

The median age for the community is significantly higher than that of the County, the MSA, and North Carolina as a whole.

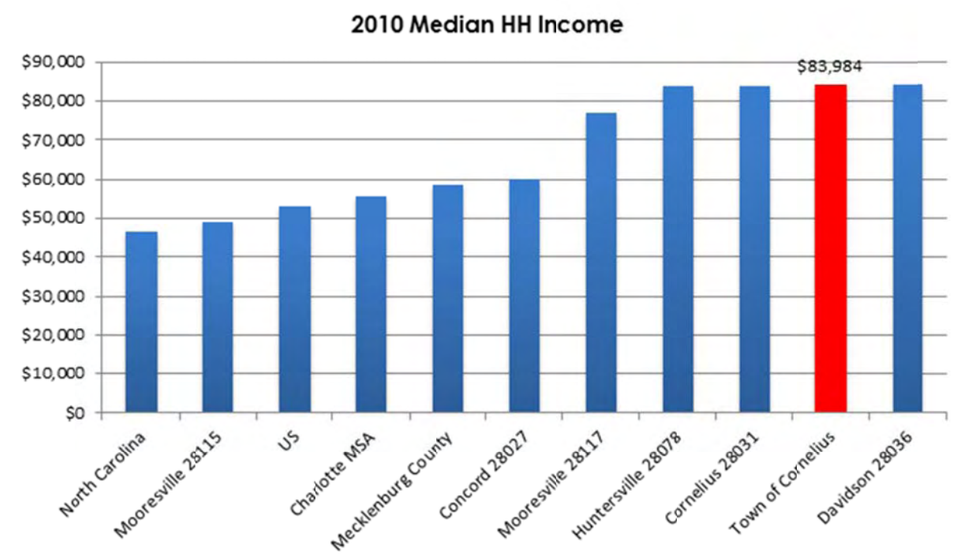
**Income:** The median household income in the Town of Cornelius is nearly $84,000, which dwarfs the state median of $46,494, the MSA median of $55,666, and the Mecklenburg County median of $58,431. In fact, the income figures for the Town of Cornelius (both median household and per capita) place the community at the high end of the regional income distribution.

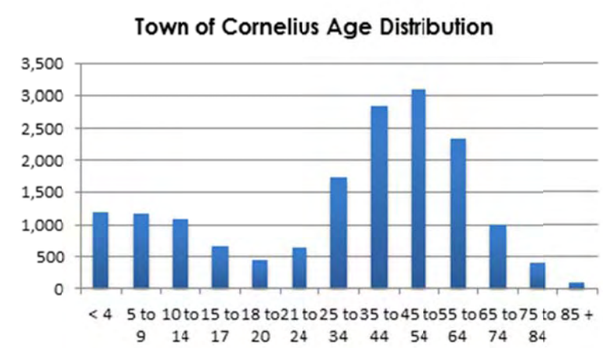
The same is true for per capita income figures. In fact, Cornelius has the highest per capita income figures of the northern Mecklenburg County communities. The per capita income of the Town of Cornelius is over double that of the State of North Carolina and nearly two-thirds higher than that of Mecklenburg County.

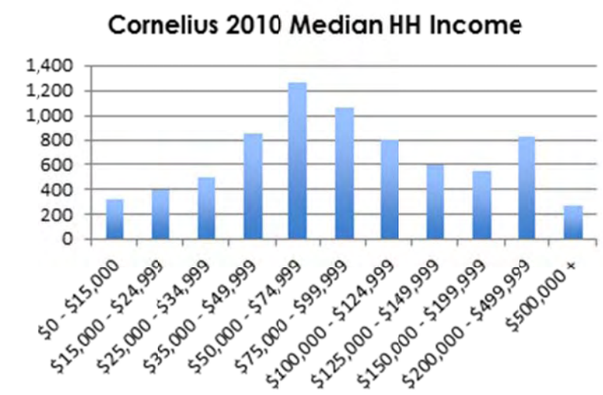
A closer look at the median household income distribution for the Town of Cornelius reveals that more households have income levels between $50,000 and $74,999 than any other tier. However, there is a significant "spike" at the $200K to $499K level for households.

**Education:** Income levels are often a bellwether statistic related to educational attainment. Over half of the population of Cornelius has a college degree while less than ten percent have not graduated from High School. By contrast, about one third of North Carolina residents possess a degree from an institution of higher learning while 18% have received no high school diploma.

**Commuter:** Many residents of Cornelius are commuters who travel into Charlotte, with 71.2% staying inside Mecklenburg County. However, the Census Bureau indicates that one-quarter of the residents of Cornelius travel to other counties for employment. According to Claritas, the average commute time for a resident of Cornelius is 31 minutes and only 22% of residents have less than a 15-minute commute to work.



### *Physical Features*

Effectively planning for Cornelius' future pedestrian network requires a thorough understanding of current conditions.

**Sidewalk Network:** There are approximately 120 miles of sidewalk currently constructed in Cornelius. These sidewalks are predominately found in the traditional center of Town and within residential subdivisions. On those streets with sidewalks, there is roughly an even distribution between streets with sidewalks on one side of the street versus those with sidewalk on both sides of the street. The typical sidewalk is five feet wide and constructed of concrete; however, sidewalks on East Catawba Avenue are comprised of brick. The sidewalk network along many of the Town's major streets including West Catawba Avenue, Torrence Chapel Road, and Westmoreland Road are fragmented. Most of the sidewalks are in fairly good repair with the exception of the oldest facilities located in early neighborhoods. Some cracking and lifting has resulted from large specimen trees located adjacent to the sidewalk. The map on page 2.9 shows the network of existing sidewalks in Town.

**Greenways Network:** Cornelius has one greenway in Town, the McDowell Creek Greenway, which was completed in October 2009. The greenway is 1.5 miles in length and connects several neighborhoods in Cornelius and Huntersville to Birkdale Village. The greenway will eventually connect to Robbins Park and Westmoreland Athletic Complex, both of which are currently under construction.

### *Destinations*

One of the primary goals of the pedestrian plan is to connect people with significant places of activity. The Destinations Map on page 2.10 shows important community locations. Generally these destinations fall into the following categories:

**Schools:** There are currently four schools in the study area: Cornelius Elementary School, JV Washam Elementary, Bailey Middle, and Hough High.

**Parks:** The Town of Cornelius has over 550 acres of parkland in 9 parks. Parks include Bailey Road Park, Glen Oak Green Park (within the Oakhurst subdivision), Jetton Park, Legion Park, Smithville Park, Yacht Club Park Playground (in The Peninsula), Walter Henderson Park, Torrence Chapel Road Park, and Blythe Landing. Robbins Park is currently under construction.

**Library:** Charlotte Mecklenburg Libraries has a branch location on East Catawba Avenue.

**Neighborhoods:** 158 neighborhoods in Cornelius, 100 of which are single family. Other neighborhood types include multifamily, mixed housing type, and mixed use.

**Activity Centers:** Activity centers can be locations where a mix of activities occur and are often destination shopping centers where commercial and service related activities occur. They also can be places where community gatherings occur and local government service occur. The best example is the Town Center located at the intersection of Old Statesville Road and East Catawba Avenue.

*Recently improved West Catawba Avenue streetscape*

*Redline trail through Bailey Road Park*

*Westmoreland Road in front of J.V. Washam Elementary School*

### *Barriers and Field Inventory*

**Barriers:** Several man-made barriers impact walkability in Cornelius, the most significant of which is I-77. Not only is the road a formidable physical barrier, but the highway is also a psychological barrier that can deter citizens from walking altogether. There are few, if any, pedestrian-friendly roadway crossings of I-77, and the shoulders are extremely hazardous to pedestrians.

Development patterns in Cornelius also create a barrier to safe, effective pedestrian connections. As with most suburban communities many developments are largely designed with a priority for automobile access. Large parking lots, setbacks, and limited connectivity severely reduce the opportunities for walking to and from these destinations. However, Cornelius has several good examples of how to integrate a suburban form with design characteristics that contribute to walkability. The live-work units along East Catawba Ave are a good example of in-fill development that intentionally mixes uses with a building form that orients towards the street. West Catawba Avenue is a large street with higher traffic volumes and multiple travel lanes. Despite these roadway characteristics many of the new commercial buildings were encouraged to be constructed with reduced front setbacks, parking behind the buildings and dual sided entrances that allow customers to enter from both the street frontage and the rear parking areas.

Many of Cornelius's neighborhoods have limited connectivity reflective of the subdivision designs of most post war neighborhoods. Still others are limited by geographic features. The numerous peninsulas along the shoreline offer few opportunities for neighborhood interconnectivity. Located primarily on the west side of town these lake front neighborhoods offer low connectivity resulting from their cul-de-sac designs.

The railroad tracks in Cornelius create another type of barrier. The tracks themselves can be an obstacle for disabled or elderly citizens. They also restrict future off-road pedestrian connections (greenways and shared-use paths) because of the expense, liability, and other limitations associated with crossing the tracks.

A review of existing and historic average daily traffic volumes reveals changing traffic volumes along streets within Town. Average daily traffic volumes represent the total number of vehicles traveling along a roadway segment on an average day. *Table 2.1* provides a breakdown of the tabulated traffic volumes on roadways within Town.

Table 2.1: 2010 Average Annual Daily Traffic Volumes

| Location | 2010 AADT Counts |
|---|---|
| I-77 from Exit 28 to Exit 30 | 88,000 |
| I-77 from Exit 25 to Exit 28 | 83,000 |
| Catawba Avenue between NC 115 and I-77 | 17,000 |
| West Catawba Avenue between Jetton Road and I-77 | 22,000 |
| West Catawba Avenue between Jetton Road and Nantz Road | 21,000 |
| West Catawba Avenue between Nantz Road and NC 73 | 18,000 |
| Torrence Chapel Road | 6,800 |
| Bethal Church Road | 5,600 |
| Jetton Road | 12,000 |
| Nantz Road | 1,500 |
| Washam Potts Road | 7,900 |
| US 21 | 19,000 |
| NC 115 south of Catawba Avenue | 12,000 |
| NC 115 north of Catawba Avenue | 13,000 |
| Westmorelnd Road | 9,800 |

The highest traffic volumes were recorded along major roadways including I-77, US 21 and West Catawba Avenue. I-77 from Exit 28 to Exit 30 carried 88,000 vehicles in 2010. Areas around the I-77 interchange with Catawba Avenue had the next greatest volumes in 2010.

*Peak hour congestion along I-77 approaching Cornelius*

### *Safety*

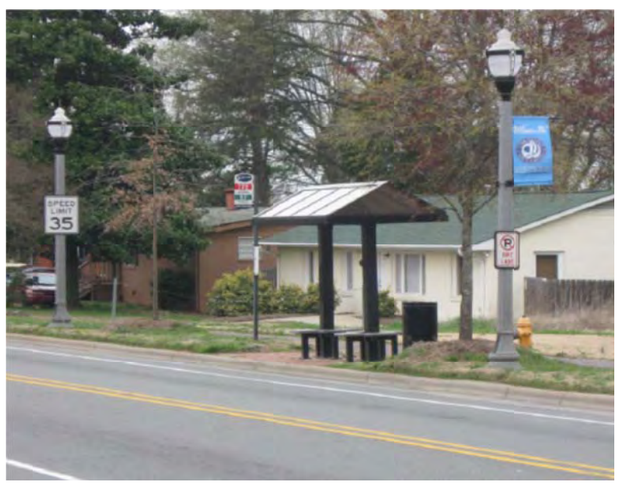
The NCDOT Bicycle and Pedestrain Division collects amny statistics on bicycle and pedestrain crashes including crash numbers, severity, casue, time of day and other vital pieces of information. According to this data Mecklenburg County ranks #1 in the state for pedestrain crashes with cars with 1,940 occuring between 2004 and 2008. This accounts for 12.4% of the stateside crashes.

In looking at the recorded crashes for the Town of Cornelius, as provided by NCDOT, there were seven pedestrain related crahses between 1990 and 2012. The highest frequency of these crashes were located along Catawba Avenue between Ferry Street and Hill Street. It is improtant to note that these crashes occurred prior to the streetscape improvemetns along this section of Catawba Avenue.

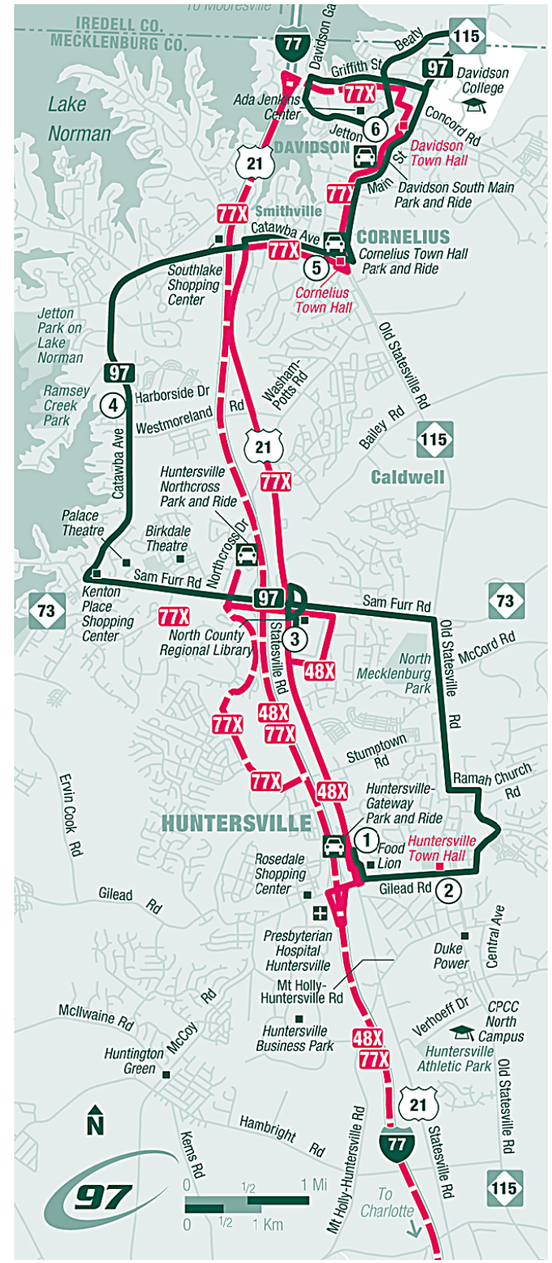
### *Transit*

Charlotte Area transit (CATS) provides local and express bus, neighborhood shuttle, can pools and car pools, as well as specialized transportation services for the greater Charlotte region. The town of Cornelius is services by CATS with the express route service from Cornelius to Uptown Charlotte via the North Mecklenburg Express (77X) and the Cornelius Village Rider (97) routes.

The Cornelius Village Rider circulates amongst the North Mecklenburg communities of Davidson, Cornelius, and Huntersville. The route includes several bus stops in Cornelius with service generally between 6:30 am to 6:30 pm and service at regular 1 hour intervals. In addition, CATS offers express bus service (route 77x) with connections for commuter to the City of Charlotte. Park and ride facilities located behind Town Hall and Huntersville Northcross offer Cornelius commuters an alternative commute to the City of Charlotte. Future commuter rail service is still being planned and includes two stops along Old Statesville Road: one near Caldwell Station and a second near the Town Center.



*Exiting CATS bus shelter along Catawba Avenue*




*Cornelius Village Rider*
*Towns*

CATS also provides park-and-ride lots through the region. A number of park-and-ride lots are located in northern Mecklenburg County, including one in Cornelius near Town Hall. Riders are allowed to park for free and catch either the 97x route to the Charlotte Transportation Center in downtown Charlotte or the Village Rider.

*Park-and-ride lot in downtown Cornelius*

The map on page 2.10 shows the transit stops existing and proposed within the study area.

Currently, commuter rail service does not extend north into Cornelius; however CATS has proposed a North Corridor Commuter Rail Project which would offer commuter rail service between downtown Charlotte and the Mount Mourne Area of Iredell County. Known as the Red Line, the rail line would run through downtown Cornelius creating another travel option for residents commuting to Charlotte.

## *Past and On Going Efforts*

The Town of Cornelius has taken and continues to take proactive steps towards planning for future development and growth. *Table 2.2* to the right highlights those efforts by The Town of Cornelius as well as other regional planning agencies.

For additional information please see Appendix D or the Comprehensive Master Plan.

Table 2.2 Current Planning Efforts in Cornelius

| Agency | Plans/Policies/ Ordinances | Date Completed | Plan Purpose | Recommendations |
|---|---|---|---|---|
| MUMPO | 2035 LRTP | 2010 | The LRTP details the transportation improvements and policies to be implemented in the MPO's planning area through 2035. | The LRTP contains recommendations for streets and roads, transit routes, guideways, and greenways and bicycle, and pedestrian facilities in the planning area. These recommendations are illustrated in figures in Ch 11 of the Plan. Recommendations are incorporated into the Planned System Map and the Bike/Greenways/Transit Map. |
| | Thoroughfare Plan | 2004 | The thoroughfare plan designates the role of each major route within the local and regional transportation network. | The plan shows the existing interchanges (at I-77 and Catawba Ave and I-77 and Sam Furr Rd) and a proposed interchange at I-77 and Westmoreland Rd. It also recommends two additional major thoroughfare east-west connections and one minor thoroughfare north-south connector. |
| CDOT | NC 73 Transportation and Land Use Corridor Plan | 2004 | The impetus of the plan was the recognition that increased development pressures along the corridor, and the resulting vehicular activity, have overwhelmed the roadway's capacity to serve as a reliable facility for its many users. The plan considers needed physical improvements and evaluates current and foreseeable land uses along the corridor. | The plan recommends that each participating jurisdiction adopt a Memorandum of Understanding (MOU) and a Council of Planning (NC 73 Council of Planning). It recommends getting all of NC 73 added to the TIP List. Jurisdiction responsibilities set forth in the plan include maintain land use plans that are consistent with corridor recommendations, undertake area plans at locations identified in the segment plans, require developments to follow corridor access guidelines, maintain or adopt development policies that will maintain ROW necessary for appropriate road typology, require as part of the land use and zoning approval process that some road be funded and built as part of the developments, and take responsibility for implementing some aspects of recommended roadway projects. |
| CATS | 2030 Transit Corridor System Plan | 2006 | The plan details needed service and facility improvements throughout the Charlotte region through 2030. | The plan recommends 25 miles of commuter rail, 21 miles of light rail, 16 miles of streetcar, 14 miles of bus rapid transit and an expanded network of buses and other transit services. Of particular importance to Cornelius is the planned commuter rail service and rail stop in Cornelius and the construction of HOV lanes along I-77. |
| Town of Cornelius (PARC Department, Planning Department) | Greenway/Bikeway Master Plan | 2004 | The purpose of this plan is to guide the planning and implementation of an interconnecting system of greenways and bikeways in Town. | The plan identifies 18 potential greenway/bikeway corridors in Town. These recommendations are shown in the Bike/Greenways/Transit Map. |
| | Centennial Transportation Plan | 2006 | The Centennial Transportation Plan is a multimodal plan for the town's future transportation system that seeks to address public safety and mobility while simultaneously supporting economic development and quality of life initiatives. | The plan includes recommendations to improve street connectivity, accommodate pedestrians and cyclists, to facilitate intergovernmental coordination, and to pursue alternative funding sources, along with an action plan to improve streets. Project corridor sheets are included for 6 major corridors in town that include information on recommended projects, project costs, responsible party, and timeframe for completion. |
| | Cornelius East Village Plan | 2003 | The plan develops a vision for the east side of Cornelius and for the area west of Davidson-Concord Road in Davidson and serves as a guide for development in the area. | The plan calls for the development of office/institutional uses to occur north of Bailey Road, residential development on the Coulter Farm property, and an employment village between the Coulter Farm and Mayes Road. The plan also calls for improved street connectivity and the development of interconnecting greenways, multi-use paths, and open spaces throughout the study area. |
| | Land Development Code | adopted 1996, amended through 2009 | The Land Development Code (LDC) establishes regulations to the development and use of all land and structures within the study area. | The LDC requires the placement of bicycle lanes when new development occurs as well as requiring their placement on certain connecting thoroughfares. It also provides for bicycle support facilities in new development, requires a curb cut design that is both bicycle friendly and which reduces bicycle/vehicle conflict, encourages a bicycle network, and requires five-foot bicycle lanes on certain designated streets. The LDC also typically requires 5 foot sidewalks to be built on both sides of the street. |
| | Parks and Recreation Comprehensive Master Plan 2005/2015 | 2005 | The Parks and Recreation Comprehensive Master Plan defines a vision for parks and recreation in town through 2015. | The plan recommends improvements to the park system and greenway network. Additionally, a community needs assessment was conducted as a part of the plan based on 2005 LOS standards for biking (1 mile/1,000 residents) . It concluded that the Town needed 30 additional miles of urban bikeway paths by 2015. Bike lane extensions were recommended along Catawba Ave, Old Statesville Road, NC 73, Torrence Chapel Road, Bethel Church Road, Jetton Road, Nantz Road, and Westmoreland Road. |
| Lake Norman Rural Planning Organization | Lake Norman Regional Bicycle Plan | 2009 | The plan, when completed, provides a means for bicyclists to travel around Lake Norman through Mecklenburg, Iredell, Catawba, and Lincoln counties. | The plan breaks the route into Initial and Ultimate Routes. Initial routes are those segments already appropriate for bicyclists or segments that only need limited improvements. Ultimate routes include planned future routes. The plan prioritized projects and includes a high priority list of 9 projects currently estimated to be approximately $15 million. It also includes a range of funding strategies.Some of Mecklenburg's high priority projects are located within the Town of Cornelius including construction/improvements along the McDowell Creek Greenway and Washam Street, Church Street, and Catawba Avenue. |
| Catawba Lands Conservancy | Carolina Thread Trail | 2009 | The Carolina Thread Trail (CTT) is a regional network of greenways and trails, that when completed, will link people, places, cities, towns, and attractions in 15 counties and preserve significant natural areas in the region. | The Mecklenburg County Steering Committee and Technical Advisory Team adopted an official Carolina Thread Trail Map for Mecklenburg County. The map identifies proposed CTT connections, priority destinations, and planned greenways and overland connectors. These recommendations are shown in the Bike/Greenways/Transit Map. |
| Mecklenburg County Parks and Recreation Department | Mecklenburg County Parks and Recreation Greenway Plan Update | 2008 | The plan serves as the official greenway plan for Mecklenburg County. | The plan identifies primary greenway corridors and overland trail corridors in the county and creates an action plan that includes 5 and 10 year strategies for expanding the trail system. The strategies were ranked and prioritized. High priority projects in Cornelius include the South Prong Rocky River Greenway and the McDowell Creek Greenway. Recommendations from this plan are shown in the BIke/Greenways/Transit Map. |

### *Panned Roadway Projects*

Table 2.3 depicts the regionally significant roadway project that will be constructed by 2035 in the vicinity of Cornelius.

For additional information please see Appendix D or the Comprehensive Master Plan.

Table 2.3 MUMPO 2035 LRTP Funded Projects in Cornelius

| NCDOT STIP # | Project Name | Project Description/ Limits | Timeframe | Existing Facilities | Length (miles) |
|---|---|---|---|---|---|
| U-5130 | Jim Cooke Road | New road (2-3 lanes), Northcross Dr. Ext. to Bailey Rd | 2010-2015 | n/a | 0.20 |
| U-5131 | Northcross Drive Extension | New road (3 lanes) from end of Northcross Dr to Westmoreland Rd | 2010-2015 | n/a | 1.35 |
| I-5127 | I-77/Westmoreland Rd | New Interchange, SPUI | 2010-2015 | n/a | n/a |
| I-5126 | I-77 Widening (North) | Adding Managed lanes (1/each way) (6 lanes) from Hambright Rd to Catawba Ave | 2010-2015 | 4-lane road, median divided | 5.72 |
| U-5128 | Statesville Road (US 21) | Widening (4 lanes) from Northcross Center Ct to Boat House Ct. | 2010-2015 | 2-lane road | 1.83 |
| U-5129 | Westmoreland Road* | Widening (4 lanes) from W. Catawba Ave to US 21 | 2010-2015 | n/a | 1.03 |
| | Westmoreland Road* | Widening (4 lanes), US 21 to Washam-Potts Rd | 2010-2015 | 3-lane road | 0.24 |
| I-4733 | I-77/ Catawba Avenue* | Convert interchange from simple diamond to urban diamond | 2016-2025 | simple diamond interchange | n/a |
| | Old Statesville Rd (NC 115)* | Widening (4 lanes) from Bailey Rd to Potts St | 2016-2025 | 2-lane road | 1.65 |
| | Old Statesville Rd (NC 115)* | Widening (2 lanes) from Potts St to County line | 2016-2025 | 2-lane road | 3.69 |
| R-2555B | W. Catawba Avenue* | Widening (4 lanes) from Jetton Rd to NC 73 | 2016-2025 | 2-lane road | 2.37 |

**=Project is both locally and regionally significant*

### *Required Work on the Ground*

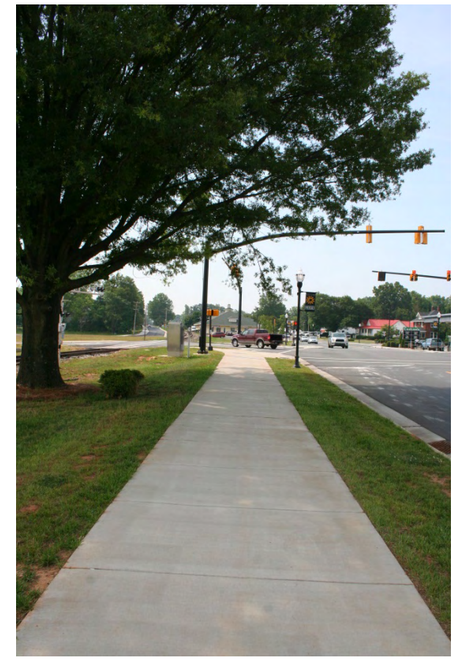
New sidewalks are typically built when new development projectsa are approved. The Land Development Code typically requires 5 foot sidewalks to be built on both sides of the street, except in the industrial campus land use which requires a sidewalk on one side of the street. In locations where the sidewalk is directly abutting curbs without a planting strip, parallel parking, or when adjacent to walls or other built elements that reduce useable width then the sidwalk with will be 6 feet. Sidewalks serving non-residnetial uses within the Town Center or Village Center zonign districts shall be a minimum of 8 feet in width, with 10-12 feet preferrable in front of shops.

All sidwalks are to be constructed of brick pavers, concrete or similar material. Concrete sidewalks are to be a minimum of 4 inches in depth.

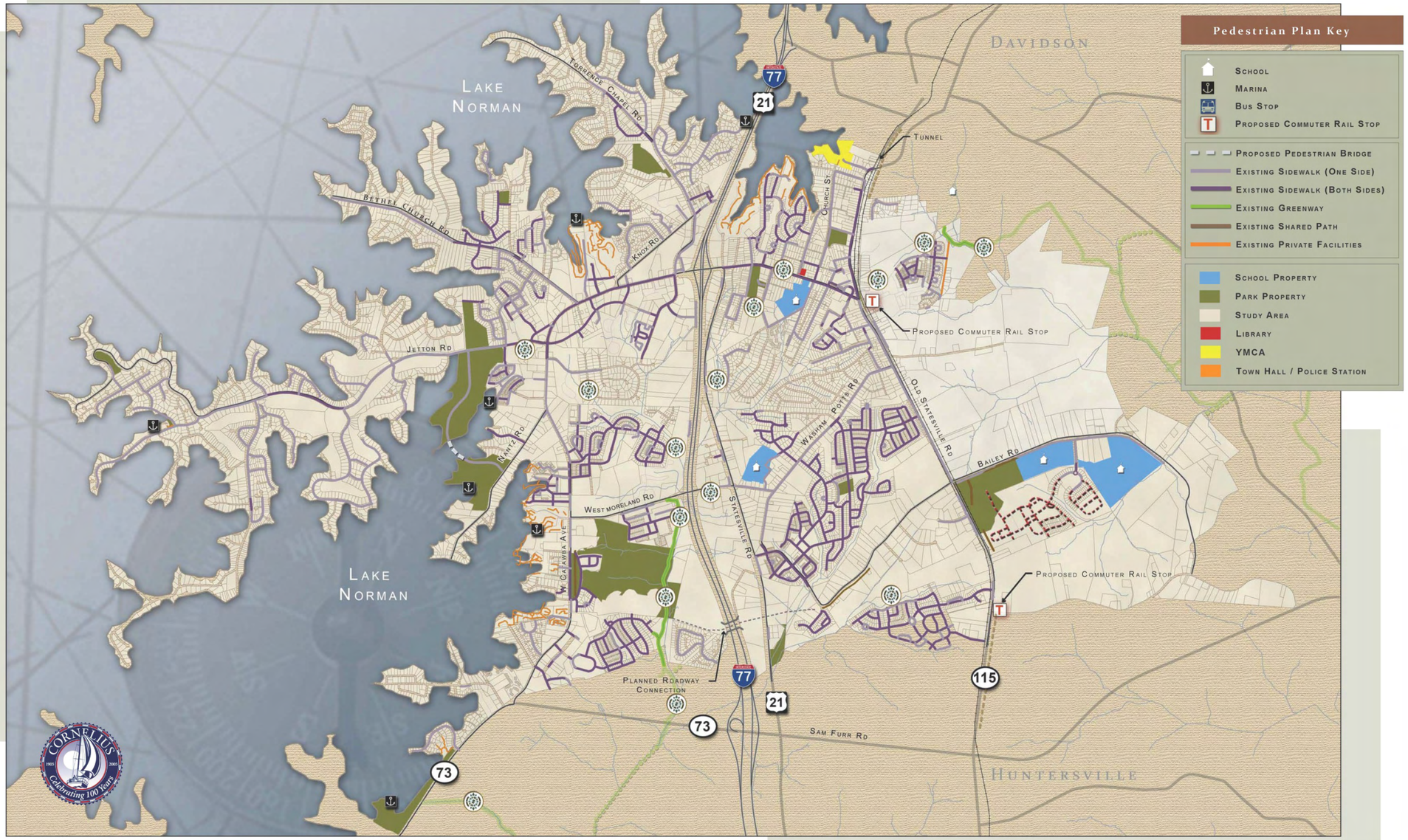
Planting strips are typically located between the curb and sidewalk and parallel to the street. Within the commercial areas on town and other location with high pedestrain volumes, grated tree wells may be used on lieu of planting strips. The minimum width of all planting stripsis 6 feet.

The Town is currently using Powell Bill funds as well as money from the Town's general fund (as funds are available) to fill in gaps in the existing sidewalk network. These funds are also used in the repair of existing facilities, which limits the funding available for new sidwalk consturction.

Projects are currently being prioritized based on need, cost, and avaialblity of funds.

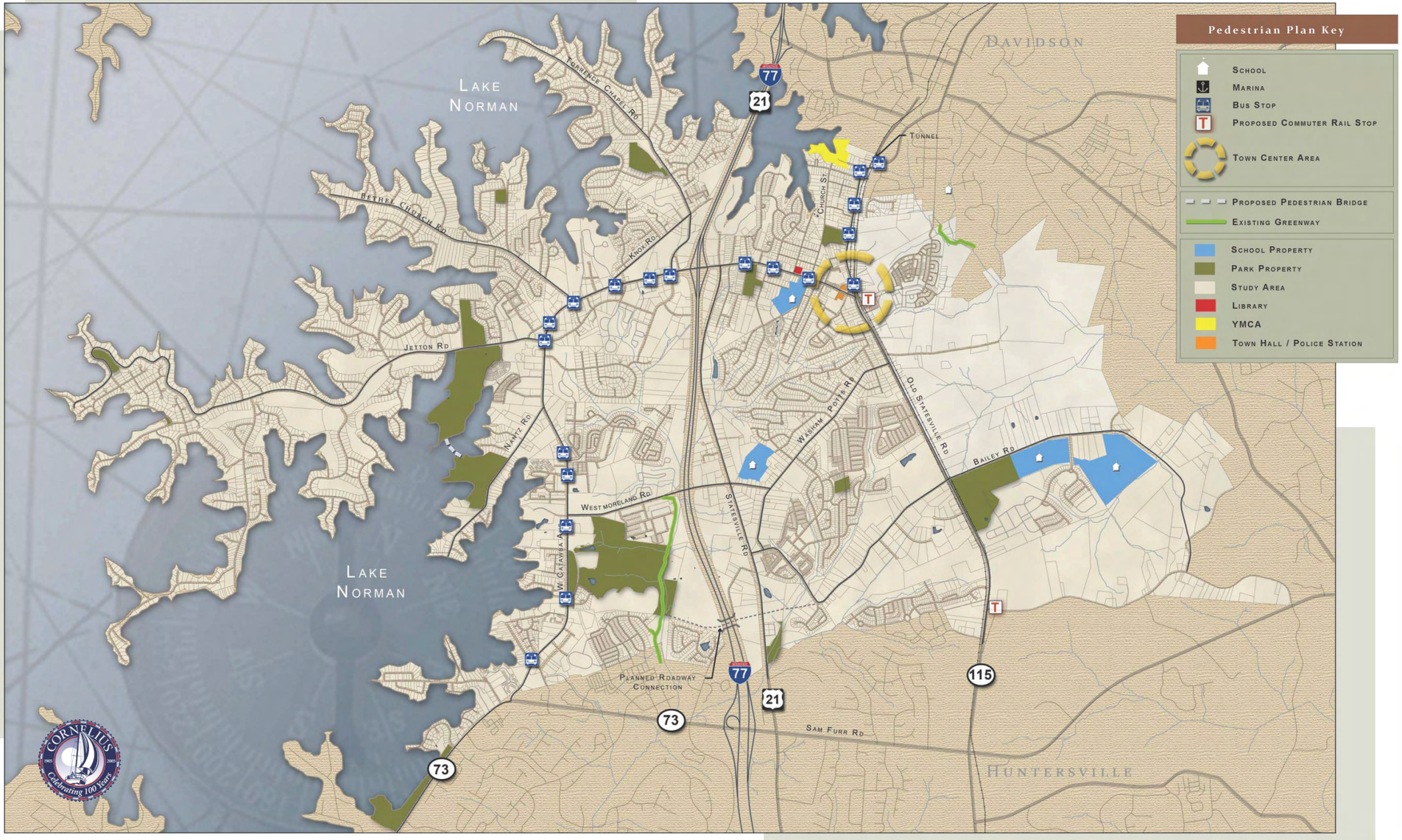


*The collage of images to the right depict a varying array of sidewalk typical sections throughout the Town.*




# Existing Pedestrian Facilities

Cornelius - North Carolina




# Pedestrian Attractors

Cornelius - North Carolina

## Developing a Vision

The impetus for the plan came from initiatives that began during the development of the Town's comprehensive plan. Maintaining consistency between the two plans was intentional, so that the pedestrian plan would integrate with overarching Town strategies. While the pedestrian plan has its genesis in the comprehensive plan, a series of specific planning activities were conducted in order to bring the plan's vision in to focus. The following contributed to the development of a vision for the pedestrian plan:

- Navigate Cornelius
- Pedestrian Plan Questionnaire
- Public Workshops
- Pedestrian Advisory Committee

### *Navigate Cornleius*

The Town began the development of a comprehensive plan in March 2010. Entitled "Navigate Cornelius", the plan includes theme committees intended to address the following topics:

- Economic Development
- Place Making and Town Services
- Mobility
- Community Service
- Leisure and Commerce

The Mobility Theme Committee addressed a comprehensive approach to transportation and established a set of Goals and Desired Outcomes for a series of initiatives including:

- Enhance-Maintain a Better Quality of Life
- Safe-Efficient Ways to Get Around on Bicycles
- Safe-Efficient Ways to Get Around on Foot
- Showcase Cornelius
- Better Traffic Flow
- Better and Specific Guidelines for Residential and Commercial Development
- Public Utilization of Lake Norman-Lake Cornelius
- Maintain-Improve Traffic Safety

The desired outcomes for walking and bicycling are summarized below:

**Safe-Efficient Ways to Get Around on Bicycles:**

- Bikes for commuting, local errands
- Integrate existing infrastructure
- Develop/maintain infrastructure for multi-modal transit
- Improve chances for cyclists to get away from using their car
- Identify target area for cycling improvements
- Examine impact of drive-through businesses
- Safe & consistent speed limits
- Safe routes for cycling to school
- Education/promotion for non-car transit

**Safe-Efficient Ways to Get Around on Foot:**

- Identify target areas for pedestrian improvements
- Install pedestrian crossings, especially on artery roads
- Connect current sidewalks/install new
- Develop/maintain infrastructure for multi-modal transit
- Give the pedestrians the choice to not use their car
- Examine the impact of drive-through businesses
- Safe & consistent speed limits
- Safe routes to schools
- Education/promotion for non-car transit

More information regarding Navigate Cornelius can be found at the following: http://www.navigatecornelius.org/

### *Pedestrian Plan Questionnaire*

An informal questionnaire was developed specifically for the comprehensive pedestrian plan. It was offered to all plan participants during regular meetings as well as public outreach activities. In addition, the questionnaire was made available online and the Town sent copies to parents of students that attend local schools. There were a total of 216 completed questionnaires resulting in a representative cross-section of the community. The questionnaire allowed the Town to better understand attitudes regarding existing walkability, why and where people choose to walk, what deters people from walking, community priorities, and the relative importance of improving community walkability.

A review of the results suggests the following:

- A majority of respondents have lived in Cornelius between 5 and 10 years
- Majority of respondents were between 35-44 years of age (those with families), the second and third largest cohort groups included the 25-34 and 45-54 age groups (these three groups combined to represent 87.5% of the 216 respondents
- Top two reasons for walking (1) Fitness/recreation (2) Walking with children or family pets
- Biggest factor discouraging walking – lack of sidewalks/trails
- Top destination for walking was trails and greenways with parks being a close second
- West Catawba Avenue is the highest priority for improvements

### *Public Workshops*

Two public workshops were conducted during the pedestrian plan development. They were conducted on May 3rd and June 7th, 2011. These workshops were used to communicate the plan objectives, gather input on critical locations, and collected feedback on plan recommendations.

### *Pedestrian Advisory Committee (PAC)*

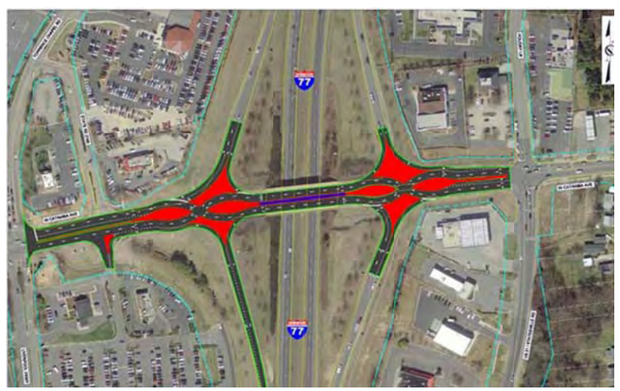
The PAC met regularly throughout the development of the plan and was responsible for establishing and refining the plan's visions. They considered the objectives outlined in Navigate Cornelius, results of the questionnaire, and input received during the two public workshops. The result was the following vision statement:

*"The Town seeks to develop a community where residents and visitors can safely walk to community features with an emphasis on providing families safe and convenient facilities that connect to the Town's recreation, education and community facilities."*

## Bridging the Gap

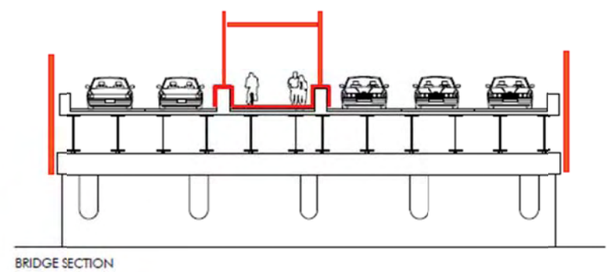
For years, I-77 has been viewed as a barrier to east-west mobility within the Town of Cornelius. Plagued by congestions and a challenging pedestrian realm, the interchange at Catawba Avenue has been a point of concern.

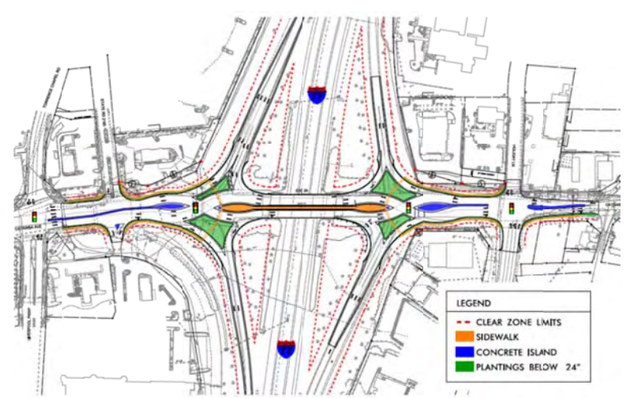
The NC Department of Transportation has plans to modify the existing interchange (Exit 28) into a Diverging Diamond Interchange (DDI). The purpose of the Diverging Diamond Interchange is to improve mobility and minimize congestion. The design accomplishes this by transforming movements that are traditionally left-turns (at a diamond interchanges) into through movements.



Capitalizing on this opportunity, the Town is partnering with NCDOT on the development of a design that will seek to enhance the aesthetics of the improved interchange solidifying its place as a recognizable gateway to the community. The goal of the project is to add visual and economic value to the interchange by reflecting on the characteristics of the Town of Cornelius. It will also ensure that safe and comfortable accommodations for walkers and cyclists are included.

Likewise, the design concepts seek to improve the operations and safety of the adjacent "bookend" intersection at Old Statesville Road-Hwy 21 (east side) and the Liverpool Pkwy-Torrence Chapel Road intersection (west side).




Early concepts are already underway with final recommendations expected by May 2012. Given the future completion date of this project the Comprehensive Pedestrian Plan defers recommendations at this location in support of the ongoing NCDOT-Town of Cornelius combined efforts.

For additional information regarding this effort please visit the following:

http://www.communitycollaborate.com/projects/diverging-diamond-interchange-(ddi)-enhancements

*Left: One of many unique design characteristics of a diverging diamond interchange is the inclusion of bicycle and pedestrian facilities within the center island*

The NC 73 Transportation/land Use Corridor Plan suggests that the one possible solution to alleviating congestion along NC 73 is to provide another interchange on I-77 between Exit 25 and Exit 28. Specifically, the study recommends Westmoreland Road.

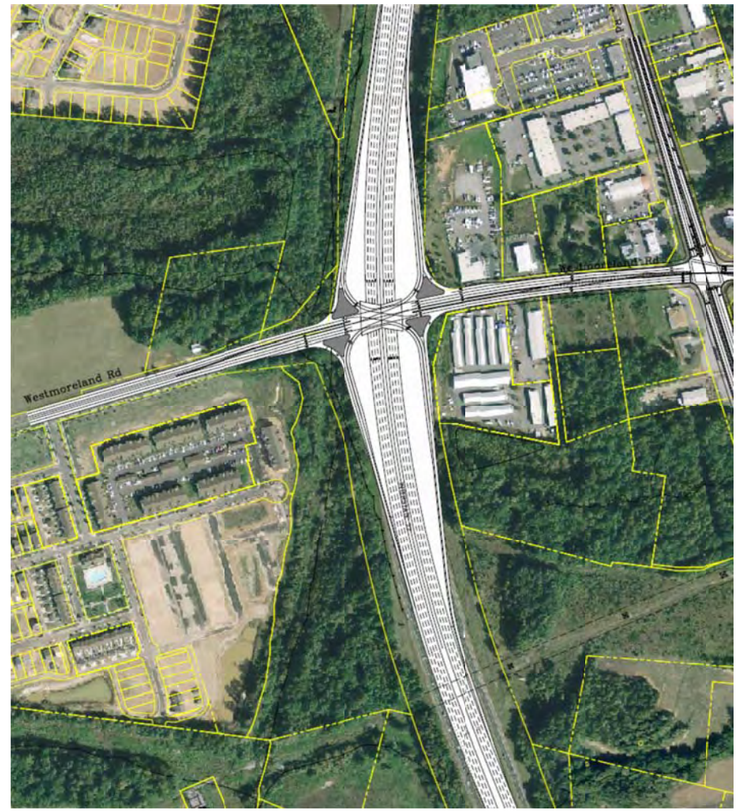
In addition, the plan recommends a grade separation crossing of I-77 south of Westmoreland Road, connecting Bailey Road to the east and Northcross Drive extension to the west.

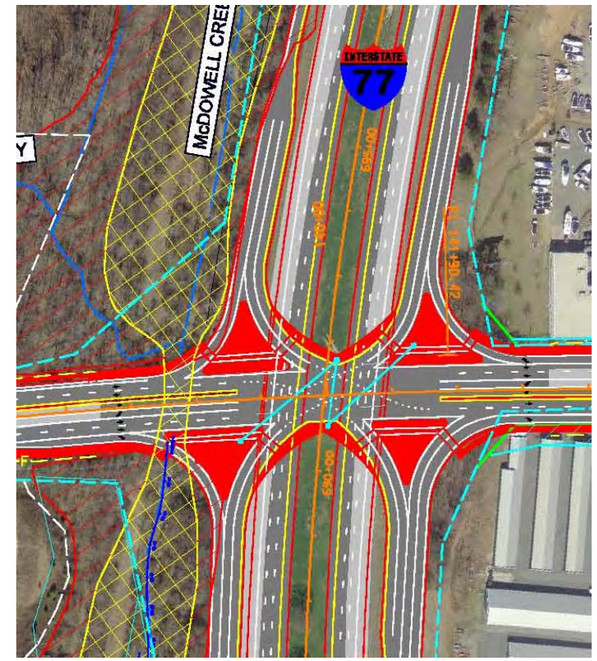
As discussed earlier, the MUMPO Long Range Transportation Plan currently recommends an interchange between Westmoreland Road and I-77. The interchange is currently planned to be constructed by 2015. Based on current economic conditions and the cost of this improvement the horizon year for construction has been extended to 2025.

As the only un-restricted crossing of I-77, Westmoreland Road plays a vital role in the connectivity of the pedestrian network on the east and west sides of I-77. As the Town of Cornelius is currently doing with Catawba Avenue, partnering with NCDOT on the design of the proposed interchange at Westmoreland Road is critical to ensure pedestrian elements are accommodated.

As with Westmoreland Road, the proposed grade separation south of Westmoreland Road is also a critical piece to the future pedestrian infrastructure for the Town of Cornelius. Ensure that the grade separation is designed to accommodate all modes of transportation is critical.

With any interstate project, federal, state and local approvals are needed. It is recommended that the Town of Cronelius work with NCDOT, FHWA, and MUMPO on the implementation of any improvements to Westmoreland Road or the planned grade separation to protect and enhance the pedestrian connectivity these elements provide.




*Potential interchange configuration at Westmoreland Road and I-77*

In order to achieve a well-rounded pedestrian system, it is important to evaluate the performance of infrastructure, guidance, and supporting facilities and programs. The needs of pedestrians are best served when all of these elements complement each other. The recommendations for the Town of Cornelius Pedestrian Plan seek to achieve this balance.

This chapter includes a discussion of physical improvement projects, including on and off-road facilities as well as intersection-level improvements. Policies and guidelines currently in place have been reevaluated in an effort to strengthen demand. Education, encouragement, and enforcement measures are also discussed.

The Town of Cornelius Comprehensive Pedestrian Plan was developed based on feedback from the Pedestrian Advisory Committee, Town staff, NCDOT, and the public. Draft recommendations were formed and presented at a public workshop on June 7th, 2011 where participants were asked for their feedback and comments related to the draft project recommendations, guidelines, and policy measures. The recommendations discussed in this chapter represent the culmination of these outreach efforts.

## Pedestrian Facility Recommendations

Pedestrian facility recommendations were developed based on field review, collaboration with existing planning efforts and ongoing multimodal improvements, public input, and validation by town staff and NCDOT. The vision for the plan was referenced throughout this process, serving as a backbone for establishing these recommendations.

Facility recommendations have been developed for the following areas: sidewalks, shared use paths, greenways, and intersection improvements (more information on these facility types can be found in Chapter 2). Areas warranting further study were also identified. It is important for these recommendations to function as a cohesive system. The map on the next page documents all of the pedestrian facility recommendations. This map clearly indicates how the different recommendation types will interface with each other. Conceptual cross-section treatments with sidewalks, shared use path, and greenway facilities are also included on this map to provide a reference for future treatments. This map also includes an inventory of the major attractors and destination points within the Town, including the Carolina Thread Trail, in an effort to demonstrate how recommended pedestrian facilities would serve these locations.

The following sections consider the four major recommendation types independently. This process allows for clear communication of priorities within each project type, important for when funding opportunities are identified for a certain improvement type. Each improvement type discussion includes a map noting the proposed project locations, as well as a table providing more details on the recommendations and the priority projects.

### *Priority Projects*

Identifying facility needs and improvement types is only one part of the recommendations development process. Given the existing and anticipated funding sources available for pedestrian projects in the region, there is a possibility that all of the projects recommended here may not be built within the next 30 years.

In order to produce a set of projects that best reflect the potential for funding within the life of this plan, a subset of the highest-priority projects has been identified for each facility type. Priority recommendations for each facility type are listed separately, in an effort to produce a range of projects that could make the best use of a range of funding sources and maximize our effectiveness in allocating limited resources.

A range of criteria were considered to identify the priority projects. Members of the Town's technical staff were consulted in the development of this methodology for determining high priority locations. These criteria included:

- **Making connections to recreational facilities and other pedestrian generators.** The Town of Cornelius is primarily a bedroom community. With this in mind, emphasis was placed on connecting households to their desired activity nodes.
- **Represent community equity.** In order to ensure the biggest needs in different sections of town were addressed, priority projects were identified in the four quadrants of the town.
- **Emphasize east-west connections.** Since I-77 serves as a barrier to pedestrian travel between the eastern and western portions of town, a priority was placed on projects that could span this barrier.

The priority projects are highlighted in the tables that follow later in the chapter.

*West Catawba Avenue Streetscape near Cornelius Elementary School*

Example Cross-Section with Sidewalk
Example Cross-Section with Shared Path
Example Cross-Section with Greenway
Lake Norman
Davidson
Hunter
Pedestrian Plan Key
School
Marina
Town Center Area
Carolina Thread Trail
Proposed Commuter Rail Stop
Proposed Greenway
Proposed Shared Path
Proposed Pedestrian Bridge
Proposed Sidewalk
Committed Sidewalk
Existing Sidewalk (One Side)
Existing Sidewalk (Both Sides)
Existing Greenway
Existing Shared Path
Existing Private Facilities
1 Conduct feasibility study to evaluate potential crossing of greenway tunnel of I-77
2 Perform a pedestrian safety analysis to determine enhanced intersection design
3 Perform feasibility study to evaluate potential pedestrian bridge connecting both peninsulas
4 Perform a mid-block crossing study in the vicinity of Robbins Park
School Property
Park Property
Study Area
Library
YMCA
Town Hall / Police Station
A Walter Henderson Park
B Torrence Chapel Park
C Legion Park
D Smithville Park
E Jetton Park
F Ramsey Creek Park
G Glen Oak Green Park
H Bailey Road Park
I Robbins Park
J Eco Park
K Blythe Landing
L Jetton Rd Park
M Yacht Club Park
N Westmoreland Athletic Complex
Pedestrian Master Plan
Cornelius - North Carolina
Kimley-Horn and Associates, Inc.

### *Sidewalks*

The sidewalk inventory performed for this study is detailed in Chapter 2. This inventory provided a clear picture of the existing facilities, as well as whether facilities are available on both sides of the roadway. Based on this assessment, a list of infill recommendations was prepared. All of the sidewalk facilities recommended are less than a mile in length, with some segments as small as 250 feet. The purpose of these sidewalk recommendations is to create a more cohesive network through infill. Generally, it is recommended to construct sidewalks on both sides of the street if possible. However, infill projects should be constructed to maintain consistency with the existing facilities they connect.

Construction costs of sidewalks are estimated at $25/LF. With a 5' sidewalk width and sidewalks on both sides of the road, this equates to $250,000 per mile. Additional right-of-way, utilities, and environmental mitigation costs yield an overall estimated cost of $33/LF, or $350,000 per mile.

### *Shared Use Paths*

Shared use paths provide a wide, inviting facility that can be used by both pedestrians and cyclists. They easily facilitate connections to desired activity nodes by using existing roadway corridors. While the current network of shared used paths is limited in the Town of Cornelius, this facility type is highly desired. Recommended shared use paths are slightly longer, varying between fractions of a mile to a couple miles each in length. Shared use paths are only recommended along one side of a roadway, but can be complemented with a sidewalk on the opposing side of the road if desired.

Construction costs of shared use paths are estimated at$350,000 per mile. With consideration for right-of-way, utilities, and environmental mitigation, total costs are estimated at $500,000 per mile.

### *Greenways*

While exhibiting many of the same design characteristics of shared use paths, greenways are more often located along natural features, utilities, or their own unique path. Southern Cornelius already benefits from the presence of an existing greenway. The recommended greenways build off of existing easements, serve existing neighborhoods, or forge their own paths. With this flexibility comes the opportunity to efficiently link recreational facilities together. The proposed projects also cover a geographically diverse area of the Town, and provide opportunities for greenway connections to neighboring communities.

Construction costs of greenways are estimated at $350,000 per mile. With consideration for easements, and environmental mitigation, total costs are estimated at $500,000 per mile.

*McDowell Creek Greenway entrance off Westmoreland Road*

### *Intersection Improvements*

The Town of Cornelius has historically done a good job of providing intersection crossing amenities for pedestrians. Crosswalks currently exist at almost every major intersection in town. However, many of these facilities were put in place at a time when design standards were not as rigorous as they are now. Many of the markings have worn over time and are need of replacement. Consideration for replacement of the worn crosswalks with high visibility markings is recommended.

Potential pedestrian facility upgrades at these intersections may include improvements such as high-visibility crosswalks, pedestrian-level lighting, push button pedestrian signal heads, ADA curb ramps with textured pavement. Thermoplastic high-visibility crosswalks are the preferred treatment, similar to those recently put in place at the intersection of Bailey Road and Old Statesville Road. More information regarding recommended design details can be found in Appendix B of this report.

*Estimated construction costs of intersection improvement projects vary by improvement type and location*

### *Special Studies*

During the outreach process for this plan, three areas were identified for special study. Due to the complex nature of these issues, additional time is needed to evaluate appropriate treatments at these locations. A brief description of each issue is included here.

- Conduct a feasibility study to evaluate potential pedestrian crossing of I-77. Since I-77 effectively splits the Town of Cornelius in half, a linkage across this facility could help improve crosstown pedestrian connectivity.
- Perform a pedestrian safety analysis to determine enhanced intersection design options at the intersection of Bailey Road and Old Statesville Road. Two schools and a regional park are located near this intersection. High automobile traffic volumes, combined with proximity to a rail line and heavy bus turning movements, create a crossing atmosphere that is daunting to potential pedestrians. Additional study at this location could be used to assess safety issues and recommend potential design solutions.
- Perform feasibility study to evaulate a potential pedestrian bridge connecting both peninsulas. This connection could potentially link pedestrian generators such as Jetton Park and Ramsey Creek Park, and would also provide quick access between two different marinas.

Proposed Infill Sidewalks

Cornelius - North Carolina

| Proposed Infill Sidewalks | | | | | | |
|---|---|---|---|---|---|---|
| Project ID | Project Location | From | To | Length (mi.) | Improvements Needed | Estimated Cost |
| 1 | Holiday Lane | Catawba Avenue | Sterling Bay Lane | 0.19 | New sidewalk | $70,224 |
| 2 | Burton Lane/ S. Hill Street | Burton Lane dead end | Vivian Lane | 0.34 | New sidewalk | $125,664 |
| 3 | Potts Street | N. Main Street | Town Limits | 0.19 | Extend existing sidewalk to make a continuous connection | $70,224 |
| 4 | N. Main Street | Pecan Street | Davidson Street | 0.12 | Extend existing sidewalk to make a continuous connection | $44,352 |
| 5 | Church Street | Cornelius Street | Dead end | 0.04 | Extend existing sidewalk to make a continuous connection | $14,784 |
| 6 | Pecan Street | Church Street | N. Main Street | 0.18 | New sidewalk | $66,528 |
| 7 | McCall Street | Church Street | N. Main Street | 0.18 | New sidewalk | $66,528 |
| 8 | Spring Street | Church Street | N. Main Street | 0.17 | New sidewalk | $62,832 |
| 9 | Brinkley Street | Beard Street | Church Street | 0.23 | Extend existing sidewalk to make a continuous connection | $85,008 |
| 10 | Pine Street | Beard Street | Washam Street | 0.12 | Extend existing sidewalk to make a continuous connection | $44,352 |
| 11 | Pine Street | Church Street | Mulberry Street | 0.11 | Extend existing sidewalk to make a continuous connection | $40,656 |
| 12 | S. Hill Street | Weathers Street | Dead end | 0.08 | Extend existing sidewalk to make a continuous connection | $29,568 |
| 13 | Floral Lane | Smith Circle | End of Road | 0.5 | Extend existing sidewalk to make a continuous connection | $184,800 |
| 14 | Center Street | Dead End | Carter Circle | 0.3 | New sidewalk | $110,880 |
| 15 | Meridian Street | Willard Street | Carter Circle | 0.19 | Extend existing sidewalk to make a continuous connection | $70,224 |
| 16 | Ferba Place | Kimbrough Lane | Altonshire Drive | 0.15 | Continue sidewalk to intersection with Altonshire Drive | $55,440 |
| 17 | Danesway Lane | Bon Meade Lane | Tryon Street | 0.63 | New sidewalk | $232,848 |
| 18 | Bon Meade Lane-Footsman Place | Danesway lane | Coachmans Trace | 0.14 | New sidewalk | $51,744 |
| 19 | Heartland Street | Danesway Lane | Washam Potts Road | 0.29 | New sidewalk | $107,184 |
| 20 | Coachmans Trace | Squires Way | Washam Potts Road | 0.49 | New sidewalk | $181,104 |
| 21 | John Hawks Road | Treetop Lane | Coachmans Trace | 0.23 | Extend existing sidewalk to make a continuous connection | $85,008 |
| 22 | Bailey Road | Bailey Road | William A. Hough High Scho | 2.5 | New sidewalk | $924,000 |
| 23 | Old Statesville Road | Treynorth Drive | Caldwell Depot Road | 0.58 | Extend existing sidewalk to make a continuous connection | $214,368 |
| 24 | Norman Island Drive | End of Road | 100 Norman Place | 0.43 | Extend existing sidewalk to make a continuous connection | $158,928 |
| 25 | Norman Island Drive | Fidler Lane | NC 73 | 0.29 | Extend existing sidewalk to make a continuous connection | $107,184 |
| 26 | West Catawba Avenue | Robbins Crescent Drive | Sam Furr Road | 0.75 | New sidewalk | $277,200 |
| 27 | Dunmore Drive | Kenton Drive | Kenton Drive | 0.02 | Connect Sidewalk along Dunmore Drive | $7,392 |
| 28 | Vineyard Point Lane | Monbrison Circle | Tuscany Lane | 0.24 | New sidewalk | $88,704 |
| 29 | Westmoreland Road | West Catawba Avenue | Statesville Road | 1.00 | New sidewalk | $369,600 |
| 30 | Nantz Road | End of Road | West Catawba Avenue | 1.10 | New sidewalk | $406,560 |
| 31 | HM Junker Drive | Harbor View Drive | West Catawba Avenue | 0.19 | Extend existing sidewalk to make a continuous connection | $70,224 |
| 32 | Harbor View Drive | Amy Lee Drive | West Catawba Avenue | 0.06 | Extend existing sidewalk to make a continuous connection | $22,176 |
| 33 | Magnolia Estates Drive-Dutch Iris Lane | Brookgreen Garden Place | Liverpool Parkway | 0.29 | New sidewalk that ties into existing sidewalks on Liverpool Parkway | $107,184 |
| 34 | Malta Road | Bustle Road | Scotsdale Lane | 0.05 | New sidewalk that ties into existing sidewalks on Liverpool Parkway | $18,480 |
| 35 | Deep Cove Court-Walter Henderson Road | End Of Road | Bethel Church Road | 0.65 | New sidewalk | $240,240 |
| 36 | Norman Colony Road | McKenzie Place Drive | Bethel Church Road | 0.16 | Extend existing sidewalk to make a continuous connection | $59,136 |
| 37 | Trinfella Lane | Baltic Drive | Harken Drive | 0.62 | Extend existing sidewalk to make a continuous connection | $229,152 |
| 38 | Knox Road | Burlington Way | End of Road | 0.09 | New sidewalk | $33,264 |

Denotes a high priority project

Proposed Shared Use Paths

Cornelius - North Carolina

| Proposed Shared Use Paths | | | | | | |
|---|---|---|---|---|---|---|
| Project ID | Project Location | From | To | Length (mi.) | Improvements Needed | Estimated Cost |
| 1 | Don Avenue | Summerbrook Drive | Town Limits at Mayes Road | 2.41 | Connect Cornelius along Old Statesville Road from the northern edge to Bailey Middle School | $1,566,500 |
| 2 | Statesville Road | Catawba Avenue | Westmoreland Road | 1.5 | Proposed shared use path from I-77 to Westmoreland Road along Statesville Road | $975,000 |
| 3 | Washam Potts Road | Westmoreland Road | Old Statesville Road | 1.31 | Connect Statesville Road to Proposed Greenway at Old Statesville Road | $851,500 |
| 4 | Statesville Road | Westmoreland Road | Northcross Center Court | 1.21 | Connect Westmoreland Road to southern edge of Cornelius along Statesville Road | $786,500 |
| 5 | Bailey Road | Northline Drive | Old Statesville Road | 0.7 | Connect existing shared path along Bailey Road to Old Statesville Road | $455,000 |
| 6 | Future Extension | Forest Shadow Circle | Bailey Road | 1.15 | Connect existing Carolina Thread Trail to existing shared path at Bailey Road | $747,500 |
| 7 | West Catawba Avenue | Robbins Crescent Drive | Blythe Landing Park | 0.22 | Connect existing shared path to Blythe Landing Park along West Catawba Avenue | $143,000 |
| 8 | West Catawba Avenue | Vineyard Point Lane | Invermere Avenue | 1.8 | Connect proposed shared path along West Catawba Avenue to Invermere Avenue | $1,170,000 |
| 9 | Northcross Drive extension | Northcross Drive | Westmoreland Road | 1.1 | Connect Northcross Drive to greenway and Westmoreland Athletic Complex | $715,000 |
| 10 | Westmoreland Road | West Catawba Avenue | Statesville Road | 1 | Connect West Catawba Avenue along Westmoreland Road to proposed shared path | $650,000 |
| 11 | Nantz Road | Arbor Place | West Catawba Avenue | 0.7 | Connect Jetton Park to West Catawba Avenue | $455,000 |
| 12 | West Catawba Avenue | Jetton Park Road | Robbins Crescent Drive | 1.3 | Connect proposed shared path along West Catawba Avenue to existing shared path | $845,000 |
| 13 | Magnolia Estates Drive | West Catawba Avenue | Proposed greenway | 0.2 | Connect proposed shared path along Magnolia Estates Drive to proposed Carolina Thread Trail | $130,000 |
| 14 | Jetton Road | Jetton Park Road | West Catawba Avenue | 0.4 | Proposed shared use path from I-77 to Jetton Road | $260,000 |
| 15 | West Catawba Avenue | I-77 | Jetton Road | 1.09 | Proposed shared use path from I-77 to Jetton Road | $708,500 |
| 16 | Charlotown Drive | West Catawba Avenue | Proposed McDowell Creek Greenway | 1.12 | Proposed shared use path from I-77 to southern edge of Cornelius along Charlotown Road | $728,000 |
| 17 | Knox Road | West Catawba Avenue | Torrence Chapel Road | 0.61 | Proposed shared use path connecting Catawba Avenue to Torrence Chapel Road | $396,500 |
| 18 | Torrence Chapel Road | West Catawba Avenue | Schooner Drive | 0.8 | Proposed shared use path connecting Torrence Chapel Park to West Catawba Avenue | $520,000 |
| 19 | Bailey Road | Bailey Springs Drive | Mayes Road | 0.75 | Proposed shared use path connecting William Amos Hough High School to Mayes Road | $487,500 |
| | | | | 19.37 | | $12,590,500 |

Denotes a high priority project

Proposed Greenways

Cornelius - North Carolina

| Proposed Greenways | | | | | | |
|---|---|---|---|---|---|---|
| Project ID | Project Location | From | To | Length (mi.) | Improvements Needed | Estimated Cost |
| 1 | Dirt Road | North Main Street | South Street | 0.6 | New greenway to connect Cornelius to existing gateway | $390,000 |
| 2 | No existing path | Catawba Avenue | Willow Pond Road | 0.63 | Connect Smithville Park and Catawba Avenue to proposed greenway #3 | $409,500 |
| 3 | Parallel Statesville Road | South Hill Street | Washam Potts Road | 1.1 | Connect proposed greenway #2 to JV Washam Elementary | $715,000 |
| 4 | No existing path | Floral Lane | Meridian Street & Oak Street | 1.28 | Connect proposed greenway #3 to Town Hall area | $832,000 |
| 5 | No existing path | Zion Avenue | Existing Multi-Use path | 1.55 | Connect Old Statesville Road to existing greenway | $1,007,500 |
| 6 | Easement | Bailey Road | Proposed Greenway (#5) | 0.54 | Connect Bailey Road to proposed greenway #5 | $351,000 |
| 7 | Easement | Coachmans Trace | Old Statesville Road | 0.55 | Connect neighborhood park to Old Statesville Road | $357,500 |
| 8 | No existing path | Old Statesville Road | Proposed Greenway (#7) | 1.57 | Connect proposed shared path along Statesville Road to proposed greenway #7 | $1,020,500 |
| 9 | No existing path | Statesville Road | Old Statesville Road | 1.75 | Connect proposed shared path along Statesville Road to Old Statesville Road | $1,137,500 |
| 10 | No existing path | Old Statesville Road | Davidson Greenway | 1.91 | Connect Statesville Road to Davidson - Concord Road | $1,241,500 |
| 11 | Easement | Forest Shadow Circle | Existing Multi-Use Path | 0.26 | Connect proposed shared path to Carolina Thread Trail | $169,000 |
| 12 | McDowell Creek Court | McDowell Creek Court | Existing Multi-Use Path | 0.03 | Connect McDowell Creek Court to existing Carolina Thread Trail | $19,500 |
| 13 | No existing path | Westmoreland Road | Lake Path Drive | 0.67 | Connect Westmoreland Road to proposed Carolina Thread Trail | $435,500 |
| 14 | No existing path | West Catawba Avenue | Magnolia Estates Drive | 0.23 | Connect Nantz Road and proposed shared path to proposed Carolina Thread Trail | $149,500 |
| 15 | No existing path | Magnolia Estates Drive | Charlotown Drive | 1.18 | Connect proposed shared path along Magnolia Estates Drive to Charlotown Drive | $767,000 |
| 16 | No existing path | Jetton Road | Endless Oaks Court | 0.3 | Connect north Jetton Park to Jetton Road and proposed shared use path | $195,000 |
| | | | | 14.15 | | $9,195,000 |

Denotes a high priority project

Proposed Intersection Improvements

Cornelius - North Carolina

| Proposed Intersection Improvement Locations | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Project ID | Intersection | Traffic Control | Ped Signal | Crosswalks | Transit Stop | Curb Radii | Curb Ramps | Median |
| 1 | Catawba Avenue at Main Street | Signal | Yes | Yes - Paint | Yes | Large | Yes (4/4) | No |
| 2 | S. Main Street at Washam Potts Road | Signal | Yes | Yes - Paint | No | Medium | Yes (2/4) | No |
| 3 | S. Main Street at Bailey Road | Signal | Yes | Yes - Paint | No | Medium | Yes (2/2) | No |
| 4 | Bailey Road at Statesville Road | Signal | Yes | Yes - Paint | No | Medium | Yes (2/4) | No |
| 5 | Westmoreland Road at Statesville Road | Signal | No | No | No | Large | Yes (2/4) | No |
| 6 | Westmoreland Road at Washam Potts Road | Stop Controlled | - | Yes - Paint | No | Large | Yes (2/4) | No |
| 7 | Catawba Avenue at School Street/Church Street | Signal | Yes | Yes-Brick | No | Tight | Yes (4/4) | No |
| 8 | Catawba Avenue at Smith Circle | Signal | Yes | Yes - Brick | Yes | Tight | Yes (4/4) | No |
| 9 | Catawba Avenue at Statesville Road | Signal | No | No | No | Large | No | No |
| 10 | Catawba Avenue at I-77 Ramps | Signal(s) | No | No | No | Large | Yes (1/4) | No |
| 11 | West Catawba Avenue at Torrence Chapel Road | Signal | Yes | Yes - Paint | No | Medium | Yes (4/4) | Yes |
| 12 | West Catawba Avenue at 1 Norman Boulevard | Signal | Yes | Yes - Paint | Yes | Medium | Yes (4/4) | Yes |
| 13 | West Catawba Avenue at Bethel Church Road | Signal | Yes | Yes - Paint | No | Medium | Yes (4/4) | Yes |
| 14 | West Catawba Avenue at Jetton Road | Signal | Yes | Yes - Paint | No | Medium | Yes (4/4) | Yes |
| 15 | Jetton Road at Jetton Park Road | Stop Controlled | - | Yes - Paint | No | Medium | Yes (2/4) | Yes |
| 16 | West Catawba Road at Nantz Road | Stop Controlled | - | No | No | Large | No | No |
| 17 | West Catawba Road at Westmoreland Road | Signal | No | No | Yes | Medium | No | No |
| 18 | West Catawba Road at Dunmore Drive | Stop Controlled | - | No | No | Medium | Yes (2/4) | No |
| 19 | N. Main Street at Davidson Street | Stop Controlled | - | No | Yes | Tight | No | No |
| 20 | Harbor Light Boulevard at Flying Jib Road | Stop Controlled | - | No | No | Medium | Yes (2/3) | No |
| 21 | Washam Potts Road at Ruffner Drive/Oakbranch Lane | Stop Controlled | - | Yes - Paint | No | Tight | Yes (2/4) | No |
| 22 | Bethel Church Road at Queensdale Drive | Stop Controlled | - | No | No | Medium | Yes (4/4) | No |
| 23 | North Main Street at Legion Street | Stop Controlled | - | Yes - Paint | Yes | Tight | No | No |
| 24 | Torrence Chapel Road at Knox Road | Stop Controlled | - | No | No | Large | Yes (2/4) | No |

Denotes a high priority project

## Policies and Guidelines

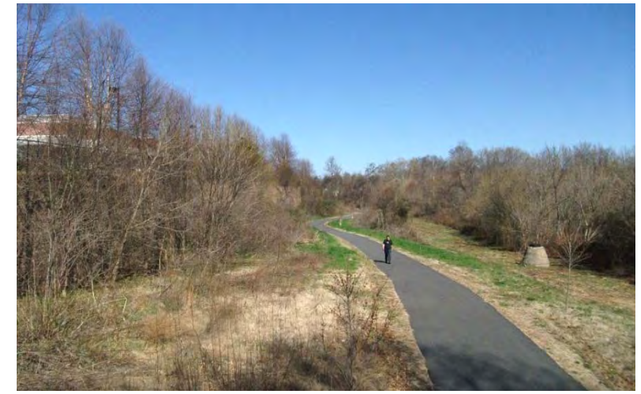
The Town of Cornelius has done a good job moving pedestrian projects forward through establishing smart policies and providing good guidance. The Town currently requires sidewalks be constructed as new development projects are completed in the area. However, there are some other policy and guidance initiatives that could be put in place to further improve the pedestrian environment.

- Revisit design guidelines periodically to ensure consistency with best practices. Appendix B of this report provides a summary of design guideline best practices.
- Develop a capital improvements program for the Town of Cornelius. This program should include a dedicated funding source for pedestrian facilities.
- Take a more active role in promoting enhanced funding opportunities through grant applications and other initiatives. More information on existing and potential funding sources can be found in Appendix A.
- Adhere to the agreed-upon set of priorities to ensure funds are directed towards priority projects. Funding opportunities are limited, so conforming to the vetted methodology is a good way to allocate money where it is most needed.
- Partner with the Charlotte Area Transit System on regional transit initiatives. Placing emphasis on quality bus stop locations and amenities (benches, covered areas, route information, etc.) and supporting those bus stops with pedestrian facility improvements leads to a more integrated the multimodal network.
- Consider making the PAC a permanent oversight committee for pedestrian related decisions-making promoting consistency with the adopted pedestrian plan.

## Education, Enforcement, Encouragement

Improvements to pedestrian infrastructure and enhanced local policies will result in a better walking environment. However, the positive impacts of these improvements can be further expanded by complementing them with a set of encouragement, enforcement, and education programs.

- The four schools within the Town of Cornelius should continue to participate in the National Walk to School Day each year. This program offers encouragement to children, parents, faculty, and staff to walk to school and provides an opportunity to educate students about safe practices and the benefits of walking.
- Work with the Chamber of Commerce and local businesses to expand the concept of the walk to school day by also including walk/bike to work days.
- In order to improve pedestrian crossing safety, local enforcement agencies should monitor driving speeds on local roads and actively ticket speeders when problems are identified.
- Work with local schools to take part in the Safe Routes to School program to encourage and provide a safe environment for children and educators to walk or bike to school. More information on this program can be found at www.safety.fhwa.dot.gov/saferoutes.
- Participate in the North Carolina School Crossing Guard Training Program to properly train law enforcement officers who are responsible for training crossing guards.
- Coordinate with Charlotte Area Transit System to encourage locals to use transit in combination with walking to reach their desired destination.



*Jogger using the McDowell Creek Greenway*

*Meandering sidewalk along US 21 to avoid the built environment*

*Existing sidepath along West Catawba Avenue*

# Appendix

Appendix A Funding Strategies
Appendix B Design Resources
Appendix C Questionnaire/Results
Appendix D Community Inventory and Assessment Report

Items in the technical appendix represent components that have been developed outside the process of creating the Comprehensive Pedestrian Plan. The placement of *Funding Strategies* (Appendix A) and *Design Resources* Appendix B) in this section was done to keep the narrative of the summary workbook specific to the Town of Cornelius allowing for ease of use by the typical reader. The appendix therefore serves as a technical resource for practitioners and staff.

The construction of a comprehensive connected pedestrian network and ancillary facilities can occur through incremental adoption of local policies and programs and State programs, as well as through the receipt of private contributions. With this in mind, it will be important for the Town of Cornelius to identify funding sources to implement the recommendations of this plan. While some projects and programs will be funded by the Town, alternatives are available to provide financial support for improving the local pedestrian network.

## Local and Regional Programs

Local funds should be used for projects not on major state routes. Usually these are most successful when a state-funded incidental project — such as a road widening — has already been programmed. Local funding sources tend to be flexible, and include general revenue expenditures as well as proceeds from bond programs. An exception to this policy may include high priority connections along roads unlikely to be developed.

### *Capital Improvement Program*

As mentioned in Chapter 4, the Town of Cornelius does not currently have an established capital improvement program. Formally developing this program would provide the Town with a formalized way to allocate their resources and stick to their vetted prioritization methodology.

### *Powell Bill*

Powell Bill funds are collected by the state in the form of a gasoline tax. The amount of these funds distributed to a municipality is based on the number of street miles to be maintained and the town's population. These funds are most often used for maintenance of existing or construction of new sidewalks.

### *Transportation Bonds*

Transportation bonds have been instrumental in the strategic implementation of local roadways, transit, and non-motorized travel throughout North Carolina. Voters in communities both large and small regularly approve the use of bonds in order to improve their transportation system. Improvements to the pedestrian system in Cornelius would be a type of project that could be funded using a transportation bond program.

### *Mecklenburg-Union Metropolitan Planning Organization (MUMPO)*

Cornelius is a member of the Mecklenburg-Union MPO, one of 17 MPOs designated by NCDOT. MUMPO aids in local planning efforts and provides services and guidance in coordinating with NCDOT. MUMPO is responsible for developing the Unified Planning Work Program (UPWP) which allocates funds for planning and administration to its members. In some cases, MUMPO oversees the disbursement of federal or state monies to the Town.

## State and Federal Programs

In comparison with local funds, state and federal funds are not as flexible in terms of their use. Usually these projects focus on the needs of vehicles, either in terms of capacity or safety — for example, widening projects. It can be difficult, however, to secure sidewalk and pedestrian crossing facilities in state construction projects.

On August 10, 2005, the President signed into law the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEALU). With guaranteed funding for highways, highway safety, and public transportation totaling $244.1 billion, SAFETEA-LU represents the largest surface transportation investment in our Nation's history. Provisions address specific safety issues, including pedestrian and bicycle safety. New federal transportation legislation is currently under consideration by Congress.

Funds for pedestrian and bicycle projects come from several different sources that are described in this section; however, allocation of those funds depends on the type of project or program and other criteria. The information provided in this section is intended to present a basic overview of the process.

### *Transportation Improvement Program (TIP)*

As a part of the state's Transportation Improvement Program (TIP), pedestrian TIP projects can receive allocations through an array of funding resources including Federal Aid Construction Funds and State Construction Funds. As a part of the application process, strict criteria must be met before project selection. These criteria include providing right-of-way information, meeting a set of design standards, showing a need for a project, local support of the project, and the inclusion of the project in a pedestrian planning process. Pedestrian projects may appear in the TIP as standalone projects or as incidental projects through another roadway project.

### *Safe Routes to School*

Safe Routes to School receives funding through the federal SAFETEA-LU legislation and provides funding for individual schools to create route plans or develop facilities that create a safer walking and biking environment for their students. North Carolina has a yearly application program for which any school, school district, municipality or other governmental body, or non-profit association may apply. The Town of Cornelius is encouraged to partner with local schools in pursuing funding from this source. For more information, visit http://www.saferoutesinfo.org/.

### *Enhancement Grants*

The Enhancement Grant program promotes the implementation of projects not typically associated with the road-building mindset. While the construction of roads is not the intent of the grant, the construction of bicycle and pedestrian facilities is one of many enhancements that the grant targets. Enhancement funding is administered through the TIP. For more information, visit http://www.ncdot.org/programs/enhancement/.

### *Congestion Mitigation and Air Quality (CMAQ)*

Mecklenburg County is currently designated as a non-attainment area for the 8-hour ozone standard and as a maintenance area for the 8-hour carbon monoxide

standard. SAFETEA-LU devoted approximately $8.6 billion in an effort to promote the implementation of projects that would reduce congestion and air quality emissions. Pedestrian and bicycle projects historically receive about 5% of this funding. The Town of Cornelius should work with MUMPO to identify and promote priority projects that could be funded using this mechanism. For more information, visit http://www.fhwa.dot.gov/environment/air_quality/cmaq/.

### *Recreational Trails Program*

The Recreational Trails Program is a federal initiative assisting with the development of non-motorized and motorized trails. Grant recipients must demonstrate conformity with North Carolina's Statewide Comprehensive Outdoor Recreation Plan (SCORP). This program is administered for North Carolina through the NC Division of Parks and Recreation. For more information, visit http://www.ncparks.gov/About/trails_RTP.php.

### *Land and Water Conservation Fund (LWCF)*

The Land and Water Conservation Fund was developed in 1965 with the objective of encouraging the creation of local parks and recreation facilities. This fund is now the primary source of federal money for land acquisition for open space, parks, and natural areas. Grants from the LWCF can be used for a range of recreational facilities, including trails and greenways. For more information, visit http://www.ncparks.gov/About/grants/lwcf_main.php.

### *Community Development Block Grant*

Federal funding for pedestrian projects can come from sources outside the transportation and environmental realms. The Community Development Block Grant program is administered by the U.S. Department of Housing and Urban Development (HUD). The intent of this grant is to serve the needs of moderate or low-income areas through activities such as neighborhood revitalization, economic development, and facilities improvements. These grants have been successfully been used for the development of pedestrian facilities in the state of North Carolina. For more information, visit http://portal.hud.gov/hudportal/HUD?src=/program_offices/comm_planning/communitydevelopment/programs.

### *Hazard Elimination and Railway-Highway Crossing Programs*

These funds are an additional subset of the State Transportation Improvement Program (STIP) funding, constituting 10% of a state's funds. This program is intended to inventory and correct the safety concerns of all travel modes. These funds can be used to construct corridor or intersection-level improvements that focus on safety enhancements.

### *NCDOT Division Funds*

NCDOT separates the state into 14 divisions. Mecklenburg County is in Division 10. Division funds are another resource that provides allocations or discretionary funding for special projects within each division.

### *North Carolina's Clean Water Management Trust Fund (CWMTF)*

At the end of each fiscal year, 6.5 percent (or a minimum of $30 million) of the unreserved credit balance in North Carolina's General Fund is placed in the CWMTF. The revenue of this fund is allocated as grants to local governments, state agencies, and conservation nonprofits to help finance projects that specifically address water pollution problems. CWMTF funds may be used to establish a network of riparian buffers and greenways for environmental, educational, and recreational benefits. For more information, visit http://www.cwmtf.net/.

### *North Carolina Parks and Recreation Trust Fund (PARTF)*

The NC Parks and Recreation Trust Fund provides funding to acquire park lands and to build and maintain park facilities. This program, managed by the North Carolina Division of Parks and Recreation, offers grants to local communities that can be used for programs such as trail construction or maintenance. For more information, visit http://www.ncparks.gov/About/grants/partf_main.php.

### *North Carolina Conservation Tax Credit*

The North Carolina Conservation Tax Credit was developed with the intent of preserving natural or rural areas by incentivizing conservation. Through this program, open spaces or natural areas can be set aside for future use as greenways or trail facilities. For more information, visit http://www.onencnaturally.org/pages/conservationtaxcredit.html.

### *Governor's Highway Safety Program (GHSP)*

The Governor's Highway Safety Program is committed to enhancing the safety of the roadways in North Carolina. To achieve this, GHSP funding is provided through an annual program, upon approval of specific project requests, to undertake a variety of pedestrian and bicycle safety initiatives. Communities may apply for a GHSP grant to be used as seed money to start a program to enhance highway safety. Once a grant is awarded, funding is provided on a reimbursement basis and evidence of reductions in crashes, injuries, and fatalities is required. For more information, visit www.ncdot.org/secretary/GHSP.

### *North Carolina Adopt-A-Trail Grant Program*

The North Carolina Division of Parks and Recreation oversees this grant program with the intent of funding trail construction and maintenance projects. Grant amounts typically do not exceed $5,000. For more information, visit http://www.ncparks.gov/About/trails_AAT.php.

## Public/Private Initiatives

### *Active Living by Design (ALbD)*

Active Living by Design is a program sponsored by the Robert Wood Johnson Foundation. ALbD seeks to bring together the health care and transportation communities to create an environment that encourages residents to pursue active forms of transportation such as walking and bicycling. Grants are awarded each year to a selected number of communities that are then required to produce a local match. These grants can be used to create plans, change land use policies, institute education policies, and

develop pilot projects. For more information, visit www.activelivingbydesign.org.

### Fit Together

Fit Together is a partnership of the NC Health and Wellness Trust Fund and Blue Cross and Blue Shield of NC. The grant initiative "recognizes and rewards North Carolina communities' efforts to support physical activity and healthy eating initiatives in the community, schools, and workplaces, as well as tobacco-free school environments." This program awards up to nine partnerships with up to $30,000 annually for a two year period. For more information on the Fit Together grant initiative, visit www.healthwellNC.com.

### The Trust for Public Land

Founded in 1972, the Trust for Public Land (TPL) is the only national nonprofit working exclusively to protect land to enhance the health and quality of life in American communities. TPL works with landowners, government agencies, and community groups to create urban parks and greenways as well as to conserve land for watershed protection. For more information on the Trust for Public Land, visit www.tpl.org.

### National Trails Fund

The National Trails Fund was established by the American Hiking Society in 1998. This privately-funded grant program awards money for the construction and maintenance of hiking trails. Awards range between $500 and $5,000, and are targeted for non-profit organizations. For more information, visit http://www.americanhiking.org/.

### Developer Contributions

Through diligent planning and early project identification, regulations, policies, and procedures can be developed to protect future pedestrian corridors and require contributions from developers when the property is subdivided. The Town of Cornelius does a good job with its coordination with developers on the construction of pedestrian facilities. This collaboration has allowed the Town to benefit from new pedestrian facilities, which are also viewed as an asset to the new development to prospective residents and businesses

### Impact Fees

Developer impact fees and system development charges are another funding option for communities looking for ways to pay for transportation infrastructure. They are most commonly used for water and wastewater system connections or police and fire protection services, but they have recently been used to fund school systems and pay for the impacts of increased traffic on existing roads. Impact fees place the costs of new development directly on developers and indirectly on those who buy property in the new developments. Impact fees free other taxpayers from the obligation to fund costly new public services that do not directly benefit them. Although other states in the country use impact fees, they have been controversial in North Carolina and only a handful of communities have approved the use of impact fees. The use of impact fees requires special authorization by the North Carolina General Assembly.

### Corporate Partnerships

Involvement between public and private entities does not have to be strictly financial in nature. By providing area businesses with information on the benefits of walking and bicycling, along with material on the infrastructure available in the community, employees may be encouraged to pursue alternate forms of transportation. These collaborative relationships can also be used when building support for new infrastructure projects.

### Volunteer Participation

When considering the development of off-road trail systems, volunteer participation is a definitive way to express community buy-in and build a case for financial support. Much of the clearing and natural-surface trail building work can be completed through volunteer efforts. The Town should collaborate with local interest groups and organizations such as the Chamber of Commerce to gather volunteers. Volunteer input is also a great way to emphasize the desire for priority projects to potential funding agencies.

Founded in 1972, the Trust for Public Land (TPL) is the only national nonprofit working exclusively to protect land to enhance the health and quality of life in American communities. TPL works with landowners, government agencies, and community groups to create urban parks and greenways as well as to conserve land for watershed protection. For more information on the Trust for Public Land, visit www.tpl.org.

## Design Resources – Best Practices

The Comprehensive Pedestrian Plan isn't intended to be a substitute for feasibility analysis or engineering design. However, the provision of best practices regarding design and placement is intended to aid planners and decision makers as incremental implementation occurs. The information contained within this appendix represents an assemblage of information collected by the project team and NCDOT. Overtime these standards may as new techniques evolve. Therefore, it's important to reference new reference material when published by industry leaders including, Federal Highway Administration (FHWA), American Association of State Highway and Transportation Officials (AASHTO), Institute of Traffic Engineers (ITE), American

### *Sidewalks*

Sidewalks are extremely important public right of-way components often times adjacent to, but separate from automobile traffic. In many ways, they act as the seam between private residences, stores, businesses, and the street. Sidewalks are spaces where children play, neighbors meet and talk, shoppers meander casually, parents push strollers, and commuters walk to transit stops or directly to work. Because of the social importance of these spaces, great attention should be paid to retrofit and renovate areas with disconnected, dangerous, or otherwise malfunctioning sidewalks.

The Federal Highway Administration (FHWA) defines sidewalks as "walkways that are parallel to a street or highway" and walkways as generally being "pedestrian paths, including plazas and courtyards."

### *Sidewalk Widths*

BPTD recommends a minimum travel path width of 5 ft. for a sidewalk or walkway, in accordance with the American Association of State and Highway Transportation Officials (AASHTO), the Federal Highway Administration (FHWA), and the Institute of Transportation Engineers (ITE). A sidewalk width of 5 feet is considered ample room for two people to walk abreast or for two pedestrians to pass each other.

Often downtown areas, near schools, transit stops, or other areas of high pedestrian activity call for much wider sidewalks. Sidewalks are typically built with curb and gutter sections. The division recommends that areas with significant pedestrian traffic should feature eight- to ten-feet wide sidewalk. Where sidewalks align with the edge of an angled or 90-degree parking lot, a minimum of 30 inches of parked car overhang obstructing the sidewalk shall be taken into account in order to maintain the minimum travel path width.

AASHTO recommends the construction of sidewalks on all city or town streets, including those in rural areas. The Institute of Transportation Engineers (ITE) recommends sidewalk installation on both sides of the street whenever possible for new urban and suburban streets, especially in commercial areas, residential areas with 4 or more units per acre, or residential areas on major arterials and collectors. If sidewalks on both sides of the road are not possible, lower density rural residential or suburban areas might adequately serve its pedestrians with a sidewalk on only one side. Under certain low-traffic, low-density situations, a wide paved shoulder can serve as an adequate pedestrian path.

It is important to note the potential for conflict between pedestrians and bicyclists on paved shoulder. Both bicyclists and pedestrians must exercise caution in order to avoid potential crashes on paved shoulders.

### *Construction Materials and Methods*

Improvements for new, retrofitted, and repair to sidewalks throughout the municipality should be constructed using the following methods and materials:

**Materials** — Sidewalks should be constructed of Portland Cement Concrete (PCC) with a 14-day flexural strength that is not less than 3,000 pounds per square inch (psi).

**Subgrade Preparation** — Subgrade should be thoroughly compacted and finished to a smooth, firm surface, and should be moist at the time the concrete is placed.

**Subgrade Compaction** — Except in areas where it is impractical to use standard type rollers, compaction should be by means of vibratory hand compactors.

**Final Finish** — Surface finish for sidewalks should be completed by brushing (with brooms) or by another approved method to provide a uniform non-skid surface.

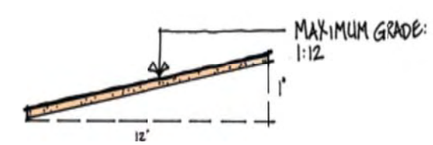
**Inspections and Performance** — Sidewalk forms should be inspected by municipal staff prior to the placement of concrete. Concrete that does not meet minimum mixture and strength standards or settles after placement should be removed and replaced by the installer.

**Alternative Materials Usage** — Use of materials for sidewalks other than concrete and the construction methods used therewith must be approved by the city or town engineer or designated representative on a case by case basis. There are some successful examples where other materials such as asphalt, crushed stone, granite fines, or other slip resistant material have been used. Concrete is preferred surface, providing the longest service life and requiring the least maintenance.

### *Grade*

AASHTO recommends the following grades for sidewalks: Continuous sidewalk grades should not exceed 5% (1:20). However, in areas where the existing topography or the adjacent street cause grades of more than 5%, sidewalk grades of up to 8.33% (1:12) may be used for a rise of no more than 2.5 feet, provided that level landings (grades less than 0.5%) are provided at the end of such grades and are at least 5 feet long.

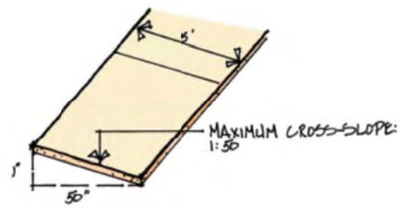
In cases where grades greater than 8.33% (1:12) must be negotiated, switchbacks or other approved ramping techniques must be provided and will conform to ADA requirements. Additional right-of-way and/or easements necessary to accommodate these features will be obtained by the applicant and legally dedicated to the city or town.




### *Cross-Slope*

Sidewalks and walkways should be designed such that grades and cross slopes are minimized to allow those with mobility impairments to negotiate with greater ease. The maximum allowable cross-slope for sidewalks is 2% (1:50). At driveways, curb cuts, and both marked and unmarked crosswalks, the maximum allowable cross-slope must be maintained for a minimum width of 3 feet. Cross-slope

should be oriented toward the adjacent roadway and sufficient to provide storm water runoff without creating standing water on the walkway.




## *Sidewalk Thickness*

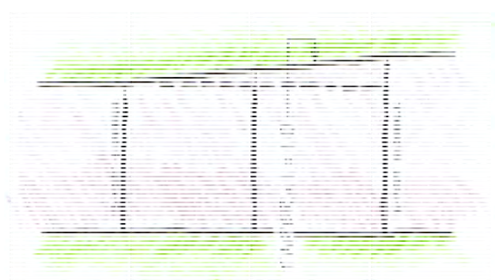
A minimum thickness (or depth) of 4 inches of concrete is required for all new sidewalks except as noted. To accommodate the additional loading caused by pedestrian density or by vehicles crossing a sidewalk, a thickness of 6 inches is required where sidewalks intersect at wheelchair/crosswalk ramps, and at driveways that use a ramp or apron-type access to cross the sidewalk from the adjacent public street.

## *Transitions*

Wheelchair ramp and driveway transitions to or crossing sidewalks must conform to current ADA requirements.

## *Tapers*

Transitional tapers to and from sidewalks of different widths are to be at a maximum rate of 1-foot of width per 10 feet of length (1:10) except as approved by the city or town.

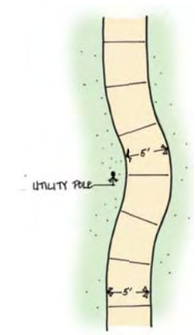


## *Sidewalk Alignment*

Sidewalks should parallel the roadway. Typical exceptions include:

**Horizontal Curve Sections on Roadways** — In situations where a roadway curves at an angle greater than 60 degrees (and where right-of-way permits), the designer is permitted to adjust the curve of the sidewalk to more easily accommodate pedestrians.

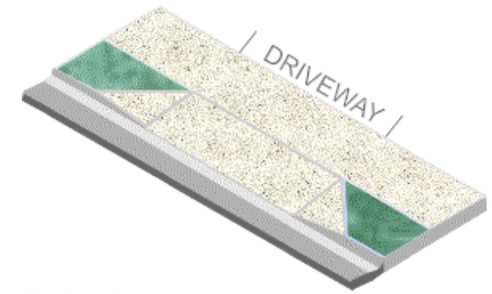
**Presence of Natural and Manmade Features** — The 5-foot minimum width of the travel path must be free of obstructions. The designer is permitted to alter the sidewalk path to avoid significant obstructions including but not limited to: transformers, utilities and utility poles, fire hydrants, and traffic signal hardware. Sidewalk path exceptions should be evaluated and approved on a case-by-case basis by the city or town. Care should also be used to ensure that the travel path does not interfere with the integrity of trees or of historic features.



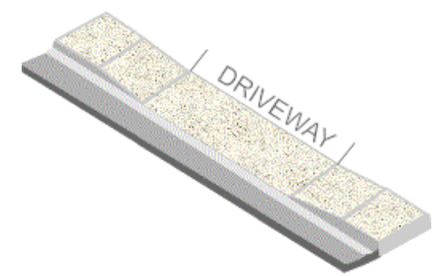

**Meanders** — Sidewalk meandering is strongly discouraged. People generally prefer to walk in a straight line, particularly when walking for utilitarian purposes. Meanders must meet minimum ADA requirements unless otherwise approved by the municipality.

**ADA:** *Dealing with Cross-Slope from Driveways*

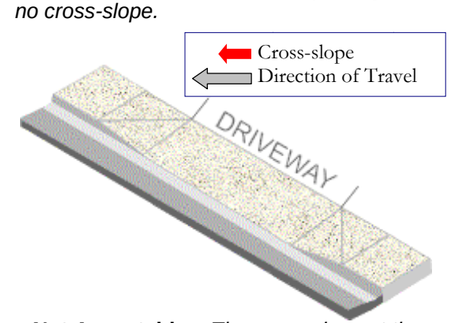
The figures at right indicate the preferred (top), conditionally acceptable (middle), and unacceptable (bottom) design solutions for new driveways as they interface with sidewalks. The intent is to make wheelchair travel safe along the sidewalk without directing the user into traffic through angled (cross) slope designs. Cross-slope on sidewalks should not exceed 2%, preferably not 1.5% where possible.




**Preferred** – *The sidewalk is set behind the driveway apron and planting strip.*




**Conditionally Acceptable** – *The "dip" at the driveway apron allows for safer passage with no cross-slope.*




**Not Acceptable** – *The cross-slope at the driveway apron provides a difficult challenge for a person using a wheelchair or cane.*

### Sidewalk Buffers

Buffer zones between pedestrian paths and vehicular traffic provide a sense of security to those on foot or in wheelchairs and give the path a comfortable scale and clear definition. Buffers can also provide other benefits to pedestrians depending on the type used. Buffer zones may either be paved, providing space between the pedestrian and traffic, or they may involve a planting strip with trees and shrubs, but is not recommended for high-traffic pedestrian areas. Much like the sidewalk itself, the form and topography of a buffer may vary greatly. AASHTO recommends a buffer width of two to four feet for local or collector streets, and a buffer width of five to six feet for arterial or major streets, whether for a paved buffer zone or a planting strip.

### Planting Strips

Continuous zones of landscape, located between the sidewalk and the street curb or the edge of road pavement, perform a multitude of essential tasks. Planting strips contribute to the walkability of a street by providing shade. In addition to providing shade, street trees - along with turf and other plantings - help reduce urban temperatures, improve water quality, lower stormwater management costs, and add beauty to the street for the pedestrian, the driver, and the adjacent land use.

The recommended planting width to permit healthy tree growth is 4 to 10 feet measured from the back of curb. Planting strips, or tree lawns, are the preferred means of providing a buffer, but are not feasible or appropriate in all pedestrian situations.

The width of the planting strip shall increase with a greater plant density and potential as the intensity of development increases. This separation from motorized traffic decreases road noise while increasing a pedestrian's sense of security and comfort. Added benefits of this separation include space for signage, utilities (fire hydrants), and vegetation.

### Paved Buffer Zones

In some situations, continuous planting strips are not feasible, particularly where there is a high degree of foot traffic between the sidewalk and the street. As such, these planting strips are typically used in downtown or commercial areas. In these cases, a paved buffer zone should be provided between the travel path of the sidewalk and the curb. Though a constant width is preferred for this buffer zone, the width may vary as long as the buffer does not interrupt the pedestrian travel path. Items located in the buffer zone can include street furniture, planters, trees planted with tree grates, streetlights, street signs, fire hydrants, etc. Such items are placed in the buffer zones so as not to restrict pedestrian flow in the travel path.

Street tree plantings in tree pits (with grates and guards, have historically proven to work successfully within these buffer zones. They regulate micro-climate, create a desirable sense of enclosure, promote a local ecological identity and connection to place, and can act as a pleasant integration of nature into an urban environment. For healthy trees, attention should be given to amending the soil and providing drainage within the tree pits. In the event that a paved or vegetative buffer zone is not possible, a row of parked cars or a bike lane can be used to create this buffer.

| Type | Sidewalk Width | Planting Strips/ Buffer | |
|---|---|---|---|
| | | With Street Tree | No Street Tree |
| Local residential | 5 ft. | 4 - 6 ft. | 3 - 5 ft. |
| Thoroughfares/ Collectors | 6 - 8 ft. | 6 – 10 ft. | 5 - 6 ft. |
| Downtown or business districts | *10 - 15 ft. | n/a | n/a |

** Planting strip or tree pit would be located within sidewalk width Buffer Paving Options*

A different type of paving from the sidewalk paving could be considered for the buffer zone for various reasons.

Textured pavements, pavers or pervious pavement can be used to add significant aesthetic value and help define a unique place. Using pervious materials for parking, sidewalk furniture areas, and for frontage zones could reduce environmental concerns. A change in paving type can help distinguish the pedestrian buffer zone from the pedestrian travel path. Sand-set pavers are recommended in the buffer zone for ease of utility maintenance. In designing sidewalk buffers, it is important to provide adequate clearance from potential obstructions.

### Additional Considerations

Though the buffers described above each provide some sort of physical barrier from moving vehicular traffic, it is vital for pedestrians on the sidewalk to have a clear view of drivers and vice-versa. This is a particularly important consideration in designing and maintaining planting strips. It is important to eliminate both high and low contact points with tree branches, mast-arm signs, overhanging edges of amenities or furniture. In addition, it is necessary to provide two feet of clear space from store fronts to accommodate shy distance from walls and the opening and closing of doors.

## Paths/Greenways

### Shared-Use Paths

Shared-use paths are paved road-like facilities designed to be used by pedestrians and bicyclists as well as others, including those on roller blade, skateboards and other alternative modes of transportation. Paths can be paved or unpaved, can be along creeks or streams, and can be designed to accommodate a variety of path users.

The alignment of these corridors should avoid road right-of-way whenever possible to minimize intersection and driveway crossings. Because these paths typically do not cross roads at signalized intersections, they should include pedestrian crosswalks, underpasses, culverts, or overpasses at each road crossing for safety.

## *Design Criteria*

Shared-use paths shall be designed with clearance requirements, minimum radii, stopping sight distance requirements, and other criteria — similar to the criteria for roadway design. High standards should be observed when designing these paths.

Shared-use paths shall be a minimum of 10 feet wide; with minimum 2 foot wide graded shoulders on each side (AASHTO recommends 5 foot shoulders) to protect users from grade differences. These shoulders can be grass, sand, finely crushed rock or gravel, natural groundcover, or other material. Sections of the path where shoulders cannot be provided because of stream crossings or other elevated grade issues should have protection such as rails, fences, or hedges.

Paths of 12'-14' in width are preferred for areas where high volumes of users are expected. If it is not possible to increase the width, including a divider line down the center for bi-directional traffic can be helpful as a means of increasing safety for path users. Width of a path may be reduced to 8 feet, depending upon physical, environmental or right-of-way constraints and topography.

These paths should keep the contour of the land for aesthetic and environmental reasons, but for practicality reasons should not be unnecessarily curved. The minimum radii or curvature recommended by AASHTO is 30-50 feet, and the cross slope should typically be less than 2%. The grade should not be more than 5%, but could reach 11% for short distances according to ADA and AASHTO guidelines. Right angles should be avoided for safety reasons, especially when considering bridge and road crossings.

Vegetation clearing guidelines for path

## *Vertical and Horizontal Clearance*

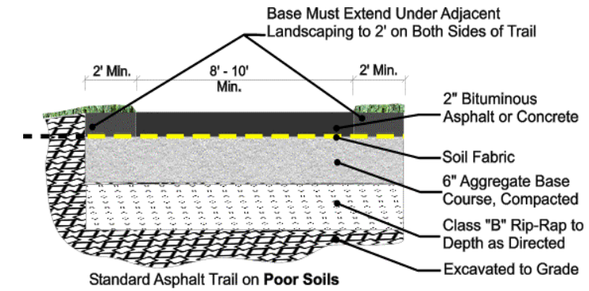
Selective thinning of vegetation along a path increases sight lines and distances and enhances the safety of the path user. This practice includes removal of underbrush and limbs to create open pockets within a forest canopy, but does not include the removal of the forest canopy itself. A total of 8 to 10 feet of vertical clearance should be provided.

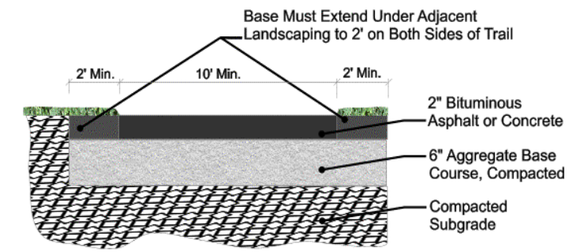
## *Pavement Types*

Each path is unique in terms of its location, design, environment, and intended use. For each segment of the path, care should be given to selecting the most appropriate pavement type, considering cost-effectiveness, environmental benefit, and aesthetics.

Typical pavement design for a paved, off-road, shared-use paths and greenway paths should be based upon the specific loading and soil conditions for each project. These paths should be designed to withstand the loading requirements of occasional maintenance and emergency vehicles. Pavement types may vary between conventional or pervious concrete, asphalt, crusher fines, dirt or boardwalk.

**Conventional Concrete** – In areas prone to frequent flooding, it is recommended that concrete be used because of its excellent durability. Concrete surfaces are capable of holding up well against the erosive action of water, root intrusion and subgrade deficiencies such as soft soils. Of all surface types, it is the strongest and has the lowest maintenance requirement, if it is properly installed. Installation of concrete is the most costly of all surface types, but, when properly installed, requires less periodic maintenance than asphalt or crusher fines. It is recommended to install 4-inch thickness on compacted 4-inch aggregate base course.




**Pervious Concrete** – This concrete is a recent invention which allows storm water to percolate, reducing pollutants included in the stormwater runoff, when used over permeable soils, superior traction, unfavorable to rollerblading and skateboarding, higher installation cost.

**Asphalt** – Asphalt is a flexible pavement and can be installed on virtually any slope. Asphalt is smooth, joint free and softer than concrete, preferred by runners, rollerbladers, cyclists, handicap users, and parents pushing baby buggies. In most cases, construction costs significantly less. Standard installation calls for a minimum of 2-inch I-2 asphalt thickness with 4-inch aggregate base course. Installation of a geotextile fabric beneath a layer of aggregate base course (ABC) can help to maintain the edge of a path. Asphalt pavement is also helpful in supporting a path in poor soils. Asphalt pavement can last up to 20 years with periodic maintenance. One important concern for asphalt paths is the deterioration of path edges. It is important to provide a 2' wide graded shoulder to prevent path edges from crumbling.

**Crusher fines** – Excellent for running paths, as well as walking, mountain bike and equestrian use. Can be constructed to meet ADA requirements. Paths must be smoothed out and graded several times per year.

Constructed of small, irregular and angular particles of rock, crushed into an interlocking tight matrix. It does require additional maintenance.

**Dirt** – Recommended for hiking trails, mountain bike tracks, and equestrian uses. It is important to grade swells on steep slopes to avoid erosion.

**Boardwalk** – A structure made of wooden planks constructed for pedestrians or cyclists along beaches or through wetlands, coastal dunes and other sensitive environments.

### Environmental Issues

Environmental protection should be a priority with the planning and construction of a path. Path design, construction type, and construction schedule should all reflect environmental considerations. For example, a path offers some leniency with its alignment compared to a sidewalk, offering opportunities for selective clearing of vegetation. Also, asphalt may not be considered a good surface material in wet areas because of its petroleum base and its tendency to float when flooded.

Greenway paths improve water quality by establishing buffers along creeks and streams. These buffers provide habitat for a diversity of plant and animal species. They serve as natural filters, trapping pollutants from urban runoff, eroding areas and agricultural lands. Stream buffers also reduce the severity of flooding by releasing storm water more gradually, giving the water time to evaporate, or percolate into the ground and recharge aquifers, or be absorbed and transpired by plants. In addition, paths provide more transportation choices for people who wish to walk or bicycle. By doing so, they help to decrease dependence upon automobiles and thus contribute to improved air quality. All proposed paths and other improvements should be designed, constructed and maintained with their ecological value in mind. Any disturbance of natural features should be kept to a minimum and conform to all jurisdictional environmental policy and ordinances.

The protection of streams by easement and the creation of paths along this greenway easement can help to ensure that no dumping occurs in the waterway, as users of this facility would report dumping to authorities. There is a need to help preserve these resources by ensuring that there is sufficient space between the greenway path and the waterway, by avoiding building adjacent to trees, and by avoiding constructing on rock features, such as escarpments.

### Path Amenities and Accessibility

Though paths should be thought of as roadways for geometric and operational design purposes, they require much more consideration for amenities than do roadways. Shade and rest areas with benches and water sources should be designed along shared-use paths. Where possible, vistas should be preserved. Way finding signs (e.g., how far to the library or the next rest area, or directions to restrooms) are important for non-motorized users.

Path amenities should be just as accessible as the paths themselves. Periodic rest areas off to the side of accessible paths are important features as well, and should be level and placed after a long ascent.

## Sidepath/Wide Sidewalk

A sidepath is essentially a shared-use path that is oriented alongside a road. The AASHTO *Bike Guide* and *North Carolina Design Guidelines* strongly caution those contemplating a sidepath (or wide sidewalk) facility to investigate various elements of the roadway corridor environment and right-of-way before making a decision. AASHTO provides nine cautions/criteria for designing sidepaths.[1]

In addition to the AASHTO cautions, research from the US and abroad confirm that bicycle/ motor vehicle crash rates are higher for bicyclists riding on a sidepath than on a roadway.[2,3,4,5,6]

Consequently, designers are advised to be very careful when choosing to design sidepaths.There are some high-volume, high-speed roadways where sidepaths are the only bicycle facility that can be provided without very costly changes to the roadway corridor. In these cases, a sidepath may be the preferred alternative. This decision must consider the magnitude of intersecting driveway and roadway conflicts. If possible, sidepaths should be provided on both sides of the roadway to encourage bicyclists to ride in the same direction as adjacent traffic. Finally, the long-term strategy on these roadways should be to widen the road or narrow the lanes to provide additional space for bicyclists in on-road bike lanes or shoulders.

One recently completed research study suggests that there may be ways to mitigate some of the safety risks associated with sidepaths.[7] This research effort found that crashes occur less often when the speed of the trail user is reduced. This means some sort of "traffic calming" treatment for the trail may be appropriate at intersections. At signalized intersections, it is best to treat the path

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[1] AASHTO, pp. 34-35.

[2] Kaplan, J. "Characteristics of the Regular Adult Bicycle User." FHWA, U.S. Department of Transportation, 1975.

[3] Moritz, W. "Adult Bicyclists in the United States - Characteristics and Riding Experience in 1996." Transportation *Research Record 1636*, TRB, Washington, DC, 1998

[4] Wachtel, A. and D. Lewiston. "Risk Factors for Bicycle-Motor Vehicle Collisions at Intersections." *ITE Journal*, September, 1994.

[5] Räsänen, M. "How to decrease the number of bicycle accidents? A research based on accidents studied by road accident investigation teams and planning guides of four cities." Finnish Motor Insurer's Centre, Traffic Safety Committee of Insurance Companies. VALT. Finland, 1995.

[6] Summala, H., E. Pasanen, M. Räsänen, and J. Sievänen, J. "Bicycle Accidents and Drivers' Visual Search at Left and Right Turns." *Accident Analysis and Prevention*. Elsevier Science Ltd., 1996/03, 28(2), pp.147-53, 1996.

[7] Petritsch, Landis, Huang, Challa. "Sidepath Safety Model - Bicycle Sidepath Design Factors Affecting Crash Rates," submitted to TRB for publication, July 2005.

roadway crossings as crosswalks, bringing the pathway close to the adjacent roadway so its signals can be incorporated into the overall signalization plan. Additional treatments to the typical pedestrian heads may be desirable at these intersections. At unsignalized intersections it is best to move the sidepath out of the area of the side street intersection with the adjacent roadway. This allows motorists to deal with one intersection at a time. Additionally, bicyclists are only required to scan in two directions.

## Roadway Features

### Raised or Lowered Medians

Medians are barriers in the center portion of a street or roadway. Medians allow for less interaction between cars and bicycle and pedestrians, and make more opportunities for bicycle lanes. A center turn lane can be converted into a raised or lowered median thus increasing motorist safety. Travel lanes may be narrowed to accommodate the placement of a median. Raised or lowered medians should provide ample cues for people with visual impairments to identify the boundary between the crossing island and the roadway. According to AASHTO guidelines, the length of a median should be a least 20 feet.

A continuous median can present several problems when used inappropriately. If all left-turn opportunities are removed, there runs a possibility for increased traffic speeds and unsafe U-turns at intersections. Additionally, the space occupied may be taking up room that could be used for bike lanes or other treatments. An alternative to the continuous median is to create a segmented median with left turn opportunities.

Sensitivity to large vehicles (buses, trucks and fire equipment) dictates some elements of the median design, curb style, and placement. Median-controlled roadways reduce the number of turning conflicts and are generally preferred for both pedestrians and cyclists over a two-way, left-turn lane (TWLTL) roadway.

### Landscaping

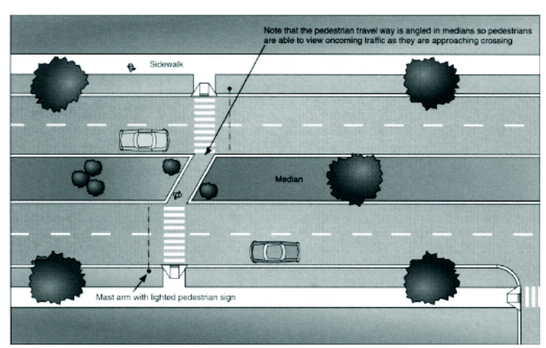
Medians provide opportunities for landscaping that in turn can change the character of the street and help to slow traffic. Landscaping should not obstruct the visibility between motorists and pedestrians.

### Median Pedestrian Refuge Islands

When used in conjunction with mid-block or intersection crossings, medians can be used as a crossing island to provide a place of refuge for pedestrians. Pedestrian refuge islands should be designed along roadways with fewer lanes and pedestrian signals that will allow the pedestrian enough time to cross the street.

Median pedestrian refuge islands should be provided as a place of refuge for pedestrians crossing busy or wide roadways at either mid-block locations or intersections. Median crossings should be at least 6 feet wide in order to accommodate more than one pedestrian, while a width of 8 feet (where feasible) should be provided for bicycles, wheelchairs, and groups of pedestrians.

The graphic below indicates the design and markings associated with refuge islands. Note that pavement markings delineate the approach to the islands and that the islands are “split” to allow for a level platform for wheelchair use. Median crossings should possess a minimum of a 4 foot square level landing to provide a rest point for wheelchair users. In cases where there are wide roads and high traffic volumes, a push-button pedestrian signal may be mounted in the refuge area to allow pedestrians to split their trip into two halves as they cross the street. Note that the crosswalk on the right side of the diagram is configured at a skewed angle as it crosses the median. This allows pedestrians to have a better angle of sight as they approach and cross each side of the street. In all cases, a minimum 10-foot travel lane is maintained for pedestrians.




Median Pedestrian Refuge Island

### Marked Crosswalks

A marked crosswalk designates a pedestrian right-of-way across a street. It is often installed at controlled intersections or at key locations along the street (a.k.a. mid-block crossings). A study should be completed prior to placing crosswalks to determine the need and the best type and location of that crosswalk.

North Carolina state law permits crossing at all intersections whether the intersection is marked with a crosswalk or not. Every attempt should be made to install crossings in places where pedestrians are most likely to cross. A well-designed traffic calming location is not effective if pedestrians are using other unmodified and potentially dangerous locations to cross the street.

Marked pedestrian crosswalks may be used under the following conditions: 1) At locations with stop signs or traffic signals, 2) At non-signalized street crossing locations in designated school zones, and 3) At non-signalized locations where engineering judgment dictates that the use of specifically designated crosswalks are desirable.

There is a variety of form, pattern, and materials to choose from when creating a marked crosswalk. It is important however to provide crosswalks that are not slippery, are free of tripping hazards, or are otherwise not difficult to maneuver by any person including those with physical mobility or vision impairments.

Although marked crosswalks provide strong visual clues to motorists that pedestrians are present, it is important to consider the use of these elements in conjunction with other traffic calming devices to fully recognize low traffic speeds and enhance pedestrian safety.

**Width** - Marked crosswalks should not be less than six feet in width. In downtown areas or other locations of high pedestrian traffic, a width of ten feet or greater should be considered.

An engineering study may need to be performed to determine the appropriate width of a crosswalk at a given location.

**Paint** - Reflective paint is inexpensive but is considered more slippery than other devices such as inlay tape or thermoplastic. A variety of patterns may be employed as detailed in the figure above. Crosswalk markings should be white, per MUTCD. Crosswalk markings should extend the full length of the crossings. Crosswalk lines of 10-12 inches of width are the recommended minimum. Curb

ramps and other sloped areas should be fully contained within the markings.

*Pavement Treatment*

A variety of colors or textures may be used to designate crossings. These materials should be smooth, skid-resistant, and visible. Although attractive materials such as inlaid stone or certain types of brick may provide character and aesthetic value, the crosswalk can become slippery. Also, as it degrades from use or if it is improperly installed, it may become a hazard for the mobility or vision impaired.

### Raised Crosswalk

In areas with a high volume of pedestrian traffic, particularly at mid-block crossings, a crosswalk can be raised to create both a physical impediment for automobiles and a reinforced visual clue to the motorist. Raised crosswalks are typical on two-lane streets with a speed limit of less than 35 mph. In conjunction with raised crosswalks, it is necessary to use detectable truncated dome warnings at the curb lines. Visible pavement markings are necessary for the roadway approach slopes.

### Mid-Block Crossings

Midblock crossings can help pedestrian access by supplementing crossing options. Midblock crossings may be used in areas where there are substantial pedestrian generators or where intersections along a roadway are spaced far apart. Mid-block crossings pose special problems for many state and local departments of transportation, since pedestrians will often choose to cross at the location that is the most convenient for them to do so, not necessarily where it is the safest. As a result, engineers and planners have developed guidelines for mid-block crossings.

Below are some general guidelines on mid-block crossings:

- Provide only on roads with a speed limit of less than 45 MPH.
- Do not install within 300 feet from another signalized crossing point.
- Base installation of a mid-block crossing on an engineering study or pedestrian route placement.
- These crossings are recommended near schools, pedestrian routes, retail areas, recreation, and residential areas.
- Require advance auto-warning signs and good visibility for both the driver and the pedestrian.
- Providing a safe crossing point is necessary since pedestrians tend not to walk far for a signalized intersection.
- Provide an audible tone.
- Include a pedestrian refuge island on wide streets that:
    a) Have fast vehicle speeds, or with large vehicle or pedestrian traffic volumes.
    b) Where children, people with disabilities, or elderly people would cross.
    c) Have complex vehicle movements.

### Advance Stop Bars

Vehicle and pedestrian visibility is increased by placing a vehicle advance stop bar 4 to 10 feet back from the pedestrian crosswalk at signalized crossings and mid-block crossings. In certain situations, a larger setback of the advance stop bar may be required. Advance stop bars are 1–2 feet wide and they extend across all approach lanes at intersections. The time and distance created allows a buffer in which the pedestrian and motorist can interpret each other's intentions. Studies have shown that this distance translates directly into increased safety for both motorist and pedestrian. One study in particular claims that by simply adding a "Stop Here for Pedestrians" sign reduced pedestrian motorist conflict by 67%. When this was used in conjunction with advance stop lines, it increased to 90%.

### Pedestrian Signals

Traffic signals assign the right of way to motorists and pedestrians and produce openings in traffic flow, allowing pedestrians time to cross the street.

When used in conjunction with pedestrian friendly design, proper signalization should allow for an adequate amount of time for an individual to cross the street. The suggested amount of pedestrian travel speed recommended in the Manual on Uniform Traffic Control Devices (MUTCD) is 4ft/sec. However, a longer crossing time may be necessary to accommodate the walking speed of the elderly or children. Therefore it is suggested that a lower speed of 3.5ft/sec be used whenever there are adequate numbers of elderly and children using an area.

Engineering, as well as urban design judgment, must be used when determining the location of traffic signals and the accompanying timing intervals. Although warrants for pedestrian signal timing have been produced by the MUTCD, each site must be analyzed for factors including new facility and amenity construction (i.e. a popular new park or museum) to allow for potential future pedestrian traffic volume. In addition, creating better access to existing places may in fact generate a higher pedestrian volume.

### Pedestrian Signals & Intersections

International Pedestrian Symbols - According to the MUTCD, international pedestrian signal indication should be used at traffic signals whenever warranted. As opposed to early signalization that featured "WALK" and

Advance stop bar

Source: Pedestrian and Bicycle Information Center Image Library

"DON'T WALK", international pedestrian signal symbols should be used on all new traffic signal installations. Existing "WALK" and "DON'T WALK" signals should be replaced with international symbols when they reach the end of their useful life. Symbols should be of adequate size, and clearly visible to make crossing safe for all pedestrians.

**Countdown Signals** - Countdown signals are pedestrian signals that show how many seconds the pedestrian has remaining to cross the street. The countdown can begin at the beginning of the WALK phase, perhaps flashing white

or yellow, or at the beginning of the clearance, or DON'T WALK phase, flashing yellow as it counts down.

**Audible Signals** - Audible cues can be used to pulse along with a countdown signal. The signals are used for visually and audibly impaired individuals. Consideration should be paid to the noise impact on the surrounding neighborhoods when deciding to use audible signals.

**Pedestrian Signal Timings** - The timing of these or other pedestrian signals needs to be adapted to a given situation. There are three types of signal timing generally used: concurrent, exclusive, and leading pedestrian interval (LPI). The strengths and weaknesses of each will be discussed with an emphasis on when they are best employed.

Concurrent signal timing refers to a situation where motorists running parallel to the crosswalk are allowed to turn into and through the crosswalk, left or right, after yielding to pedestrians. This condition is not considered as safe as some of the latter options, however this type of signal crossing generally allows for more pedestrian crossing opportunities and less wait time. In addition, traffic is allowed to flow a bit more freely. Concurrent signal timing is best used where lower volume turning movements exist.

Where there are high-volume turning situations that conflict with pedestrian movements, the exclusive pedestrian interval is the preferred solution. The exclusive pedestrian interval stops traffic in all directions. In order to keep traffic flowing regularly, there is often a greater pedestrian wait time associated with this system.

A proven enhancement that prevents many of the conflicts addressed under either of the former methods is Leading Pedestrian Signal (LPI). An LPI works in conjunction with a concurrent signal timing system and simply gives the pedestrian a few seconds head start on the parallel traffic. An advance walk signal is received prior to a green light for motorists. This creates a situation where the pedestrian can better see traffic, and more importantly, the motorists can see and properly yield to pedestrians. As with the exclusive pedestrian interval, an audible cue will need to accompany the WALK signal for the visually impaired.

The use of infrared or microwave pedestrian detectors has increased in many cities worldwide. These devices replace the traditional push-button system. Although still experimental, they appear to be improving pedestrian signal compliance as well as reducing the number of pedestrian and vehicle conflicts. Perhaps the best use of these devices is when they are employed to extend crossing time for slower moving pedestrians. Whether these devices are used or the traditional push-button system is employed, it is best to provide instant feedback to pedestrians regarding the length of their wait. This is thought to increase and improve pedestrian signal compliance.

A low cost sign that restricts right-hand turns at a red light.

Source: Pedestrian and Bicycle Information Center

Passive pedestrian detection equipment is becoming more common, and can be recommended in high-volume locations where many pedestrians are crossing a five-lane (or greater) street cross-section.

## *Right Turn on Red Restrictions*

Introduced in the 1970's as a fuel saving technique, the Right Turn on Red (RTOR) law is thought to have had a detrimental effect on pedestrians. The issue is not the law itself but rather the relaxed enforcement of certain caveats within the law such as coming to a complete stop and yielding to pedestrians. Often motorists will either nudge into a crosswalk to check for oncoming traffic without looking for pedestrians or slow, but not stop, for the red-light while making the turn. There is legitimate concern that eliminating an RTOR will only increase the number of right-turn-on-green conflicts where all of the drivers who would normally have turned on red, now are anxious to turn on green.

R10-11

R1-5

Consider elimination on case by case basis and only where there are usually high pedestrian volumes.

## *Curb Ramps*

Curb ramps are critical features that provide access between the sidewalk and roadway for wheelchair users, people using walkers, crutches, or handcarts, people pushing bicycles or strollers, and pedestrians with mobility or other physical impairments. In accordance with the 1973 Federal Rehabilitation Act and to comply with the 1990 Federal ADA requirements, curb ramps must be installed at all intersections and mid-block locations where pedestrian crossings exist. In addition, these federal regulations require that all new constructed or altered roadways include curb ramps. Although the federally prescribed maximum slope for a curb ramp is 1:12 or 8.33% and the side flares (or "sidewings" as listed in the graphic) of the curb ramp must not exceed a maximum slope of 1:10 or 10.0%, it is recommended that much less steep slopes be used whenever possible. It is also recommended that two separate curb ramps be provided at each intersection. The minimum width for the curb ramp is four feet. With only one large curb ramp serving the entire corner, there is not safe connectivity for the pedestrian. Dangerous conditions exist when the single, large curb ramp inadvertently directs a pedestrian into the center of the intersection, or in front of an unsuspecting, turning vehicle. To provide a tactile warning to the visually impaired, raised truncated domes with a color contrast to the background material (typically concrete) should be used.i Two separate curb ramps, one for each crosswalk, should be provided at each corner of an intersection.

For additional information on curb ramps see the Federal Highway Administration and Designing Sidewalks and Trails for Access, Parts I and II, by the Federal Highway Administration.

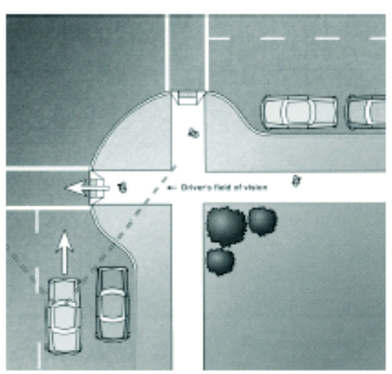
## *Curb Extensions ("Bulb Outs," "Chokers," "Neckdowns") and Curb Radii*

A curb extension, or bulb out, is an extension of the sidewalk into the parking lane of a street. Because these curb extensions physically narrow the roadway, a pedestrian's crossing distance and consequently the time spent in the street is reduced. In addition, curb extensions may encourage motorists to drive slower by narrowing the travel lane and reducing vehicular speeds during turning movements at intersections. Curb extensions can be

placed either at mid-block crossings or at intersections. Curb extensions at midblock locations are known as "chokers." Curb extensions at intersections can also be referred to as "neckdowns."

Sightlines and pedestrian visibility are reduced when motor vehicle parking encroaches too close to corners creating a dangerous situation for pedestrians. When placed at an intersection, curb extensions preclude vehicle parking too close to a crosswalk. Also, curb extensions at intersections can greatly reduce turning speed, especially if curb radii are set as tight as possible. Finally, curb extensions also reduce travel speeds when used in mid-block crossings because of the reduced street width. Curb extensions should only be used where there is an existing on-street parking lane and should never encroach into travel lanes, bike lanes, or shoulders.

By reducing a pedestrian's crossing with a bulb out, less time is spent in the roadway, and pedestrian vehicle conflicts are reduced.




| Posted Speed Limit (mph) | Minimum Curb Radius (Feet) |
|---|---|
| Residential Street, 15-25 mph | 5 |
| Residential Street, 25-35 mph | 10 |
| Collector Street, 30-45 mph | 20 |

**Maximum Desired Speed and Curb Radii**

The following table illustrates the relationship between posted speeds and the curb (often called "corner") radiusii.Motorists will travel more slowly around corners with smaller curb radii even without the use of curb extensions.

## *Lighting*

Proper lighting in terms of quality, placement, and sufficiency can greatly enhance a nighttime urban experience as well as create a safe environment for motorists and pedestrians. Two-thirds of all pedestrian fatalities occur during low-light conditions. Attention should be paid to lighting walkways and crossings, so that there is sufficient ambience for motorists to see pedestrians. Pedestrian lighting should be considered for areas of higher pedestrian volume, including downtown and key intersections. Lighting in commercial areas should be provided on both sides of the street.

In most cases, roadway street lighting can be designed to illuminate the sidewalk area as well. The visibility needs of both pedestrian and motorist should be considered. In commercial or downtown areas and other areas of high pedestrian volumes, the addition of lower level, pedestrian-scale lighting to streetlights with emphasis on crossings and intersections may be employed to generate a desired ambiance. Lighting for sidewalks and off-street paths should be provided where considerable pedestrian traffic is expected at night, where there is insufficient available light from the surrounding area, and at all designated road crossings.

Each lighting situation is unique and must be considered on a case-by-case basis. Average maintained horizontal illumination levels of 5 lux (0.5 foot candles) to 22 lux (2 foot candles) should be considered. Sometimes, higher levels are advisable in special areas where security problems might exist. Light poles should generally be 12 to 15 ft. high for lighting pedestrian areas. Luminaries and poles should be at a scale appropriate for pedestrian use.

Light fixtures, as well as other on-street facilities, like street furniture, can add a great deal in terms of street aesthetics and reinforce community identity. It is recommended that the community adopt a particular style of street lighting fixture appropriate for the municipality's identity and coordinate this choice with stylistic choices in other street facilities.

Sophisticated lighting needs to be directional and focused upon the street. A flat lens light is the best choice in lighting the street. Fixtures that produce glare should be avoided, as they produce diffused light, and sometimes make visibility difficult. The pedestrian-level lighting that is preferred includes mercury vapor, metal halide, or incandescent. Although low-pressure sodium lights may be energy-efficient, they are less desirable due to the color distortion they create. High-pressure sodium lights are preferable, as they create less color distortion.

Lighting should be sufficient so that pedestrians can see cars, and cars can see pedestrians. However, overlighting of an area can produce an environment that is unattractive to pedestrians, and the resulting glare becomes an environmental issue.

Source: Pedestrian and Bicycle Information Center

It is important to note that every effort should be made to address and prevent light pollution. Also known as photo pollution, light pollution is "excess or obtrusive light created by humans." Whenever urban improvements are made where lighting is addressed, a qualified lighting expert should be consulted early in the process. This individual should not only create a safe and attractive ambiance,

but will do so with the minimum of fixtures, an awareness of the importance of minimizing photo pollution,

and with a focus on minimizing future energy use. A thoughtful plan of how and where to light will reap benefits not only in potential reduced infrastructure cost, but future energy costs as well.

## *Signage*

Signage can be an effective tool to alert drivers to reduce speeds and allow pedestrians to exercise extra caution. It is important not to cause "clutter" when using a variety of signage. This can cause complacency and noncompliance with signs in general. Signs, and the sign text, should be large enough to be seen from a distance. It is imperative that all signs be properly located so as not to obstruct the pedestrian and visibility triangles of motorists.

Signage is governed by the MUTCD, which provides specifications on the design and placement of signage on the right-of-way. There are three types of signage: 1) *Wayfinding* signage 2) *Regulatory* and 3) *Warning signs*. Maintenance of signage is as important as walkway maintenance. Clean, graffiti free, and relevant signage enhances guidance, recognition, and safety for pedestrians.

### *Wayfinding*

Wayfinding or guide signs give notice of traffic laws or regulations that pedestrians, cyclists, and motorists are required by law to follow. Wayfinding signage should orient and communicate in a clear, concise and functional manner. It should enhance pedestrian circulation and direct visitors and residents to important destinations. In doing so, the goal is to increase the comfort of visitors and residents while helping to convey a local identity. Regulations should also address the orientation, height, size, and sometimes even style of signage to comply with a desired local aesthetic.

It is recommended that municipalities adopt consistent and descriptive graphics to identify pedestrian routes. This signage system would assure pedestrians that they are safe and will not encounter gaps in facilities along these routes. A map should be incorporated into each route illustrating the entire pedestrian system and their location. Bus stops, destinations, and mileage should also be identified on the signs.

### *Regulatory Signs and Warning Signs*

Regulatory signs give notice of traffic laws or regulations that pedestrians, cyclists and motorists are required by law to follow. Warning signs call attention to unexpected conditions on, or adjacent to, a roadway, bike or pedestrian facility that can be potentially hazardous to users.

Pedestrian-related signage serves primarily to notify motorists and others of the presence of pedestrians. The intended effect is to cause motorists drive more cautiously and reduce their speeds, thereby improving the safety for pedestrians in the given area. Signs can be used in a variety of places, including at crosswalks, at intersections, in-street, and near schools. National standards for sign placement and use can be found in the Manual for Uniform Traffic Control Devices (MUTCD). The MUTCD provides guidance for warning signs which can be used at both crosswalks, or along the roadway:

The following are some recommended signs which municipalities should consider installing. For more signs and more detailed guidelines for sign installation and use, the municipality should consult the MUTCD. The S4-3/R1-6 as well as the W11-2 signs are regulatory, while the sign furthest to the right is a wayfinding signs. The remaining signs directly below are warning signs.

The first sign is usually installed within the street to warn motorists to yield to pedestrians in a crosswalk. The "school" sign (MUTCD S4-3) is added to the in-street sign for placement near a school. The second and third signs are commonly used pedestrian warning signs, while the fourth and fifth signs notify motorists of specific instances to watch for pedestrians. The fourth sign, "Turning Traffic", is usually placed at intersections to warn motorists that are turning right or left to yield to pedestrians in crosswalks. The sign at the far right is an examples of typical wayfinding signage to help direct cyclists at major decision points along a route. For the fifth sign, the top sign can either be combined with the smaller "ahead" sign or the arrow symbol to indicate the presence of a crosswalk to motorists in a school zone.

### *School Zone Treatments / School Routes*

Section 7 of the MUTCD is entirely devoted to "Traffic Controls for School Areas" and is the dominant guidance available to municipalities for installing signs and markings in school zones. The section provides valuable additional guidance for school crossing treatments that can be utilized for the planning and design of schools that should be considered when making safety improvements.

| Sign | MUTCD Code | MUTCD Section | Conventional Road | |
|---|---|---|---|---|
| Yield here to Peds | R1-5 | 2B.11 | 450x450 (18x18) | Regulatory |
| Yield here to Peds | R1-5a | 2B.11 | 450x600 (18x24) | |
| In-Street Ped Crossing | R1-6, R1-6a | 2B.12 | 300x900 (12x36) | |
| Peds and Bikes Prohibited | R5-10b | 2B.36 | 750x450 (30x18) | |
| Peds Prohibited | R5-10c | 2B.36 | 600x300 (24x12) | |
| Walk on Left Facing Traffic | R9-1 | 2B.43 | 450x600 (18x24) | |
| Cross only at Crosswalks | R9-2 | 2B.44 | 300x450 (12x18) | |
| No Ped Crossing | R9-3a | 2B.44 | 450x450 (18x18) | |
| No Hitch Hiking | R9-4 | 2B.43 | 450x600 (18x24) | |
| No Hitch Hiking (symbol) | R9-4a | 2B.43 | 450x450 (18x18) | |
| Bikes Yield to Peds | R9-6 | 9B.10 | 300x450 (12x18) | |
| Ped Traffic Symbol | R10-4b | 2B.45 | 225x300 (9x12) | |
| | | | | |
| School Advance Warning | S1-1 | 7B.08 | 900x900 (36x36) | School Warning Signs |
| School Bus Stop Ahead | S3-1 | 7B.10 | 750x750 (30x30) | |
| Pedestrian Traffic | W11-2 | 2C.41 | 750x750 (30x30) | |
| Playground | W15-1 | 2C.42 | 750x750 (30x30) | |
| Hiking Trail | I-4 | – | 600x600 (24x24) | |

1. Larger signs may be used when appropriate.
2. Dimensions are shown in millimeters followed by inches in parentheses and are shown as width x height.
3. First dimension in millimeters; dimensions in parentheses are in inches.
4. All information in table taken directly from MUTCD.

### *Street Trees*

Street trees enhance the landscape for pedestrians, creating an attractive and comfortable environment for walking. Street trees also act as a traffic calming device, encouraging drivers to drive more slowly. In addition, a large line of leafy street trees can absorb engine noise, providing enough of a buffer to block street traffic noise from reaching private yards and homes. Trees also improve air quality by consuming carbon dioxide and emitting oxygen. Street trees may also increase real estate values by increasing curb appeals of homes. This Plan strongly recommends that municipalities adopt a tree ordinance to give direction for tree installation and maintenance.

Planting requirements - All street trees should be selected according to the standards described in the American Standard for Nursery Stock of the American Nursery and Landscape Association. Install and maintain trees according to the International Society of Arboriculture (ISA) guidelines. A landscape architect should be consulted to select the proper tree and planting technique.

**Visibility** - Street trees should never be allowed to obscure the line of sight between pedestrians and drivers. A clear view should be maintained between 30" and 72" above street. This area must be free of limbs and foliage for safe cross visibility. Other plantings should also follow this rule within 50 ft. proximity of street corners and other designated crossing points. In order to maintain visibility, provide shade, and a comfortable pedestrian corridor, street trees should primarily be vase shaped, columnar, or oval in form (habit) with large spreading crowns.

**Roots** - Avoid trees with aggressively invasive roots adjacent to pavement or buildings.

**Size** - Large trees (growing over 35 ft. in height at maturity) are preferred as street trees except near overhead utility lines. Small trees (growing less than 35 feet in height at maturity) should be used in areas directly adjacent to or under utility lines.

**Spacing** – typically, large trees should be spaced approximately 40 – 50 feet on center when planted in a line, and small trees spaced at approximately 30 ft. The spacing of street trees in a planting strip will depend upon the size of the tree and upon the demand for sidewalk furniture and parking.

**Tree Pits and Tree Grates** - Street trees should generally be located in open planting strips. However, tree pits with tree grates may be a practical, although expensive, alternative in very high pedestrian traffic areas. Tree grates should generally not encroach upon the travel path. For optimal pedestrian safety and comfort, all tree grates used should meet the ADA standards for "accessible pathway".

**Maintenance** - Trees and landscaping require ongoing maintenance. Local municipalities typically take responsibility for maintenance of these amenities, although there are instances where local community groups have provided funding and volunteers for maintenance. In order to reduce the amount of maintenance necessary, it is helpful to use native plant material that is already adapted to the local soil and climate. Growth pattern and space for maturation, particularly with larger tree plantings, are important to avoid cracking sidewalks and causing a pedestrian obstruction.

### *Pedestrian Overpass/Underpass*

Pedestrian overpasses and underpasses efficiently allow for pedestrian movement across busy thoroughfares. These types of facilities typically feature very high construction costs.

*Attempting to separate pedestrians from the street is often problematic. As shown here, given the opportunity, many choose to cross at street level.*

These facilities are problematic in many regards and should only be considered when no other solution is expected to be effective. Research shows that pedestrians will avoid using such a facility if they perceive the ability to cross at grade as taking about the same amount of time. ADA requirements for stairs, ramps, and elevators often require the construction of an enormous structure that is visually disruptive.

Overpasses and underpasses should only be considered with rail lines, high volume traffic areas such as freeways, and other high volume arteries.

In addition, they should be considered only for crossing arterials with greater than 20,000 vehicle trips per day and speeds 35 - 40 mph and over. Minimum widths for these structures should follow the guidelines for sidewalk width. Underpasses should have a daytime illuminance minimum of 10 fc achievable through artificial and/or natural light provided through an open gap to sky between the two sets of highway lanes, and a night time level of 4 foot-candle. In underpasses, where vertical clearance allows, the pedestrian walkway should be separated from the roadway by more than a standard curb height. Consider

acoustics measures within underpasses to reduce noise impacts to pedestrians and bicyclists.

### Transit Stop Treatments

To accommodate as many users as possible, a transit system must include well-planned routes and safe, accessible stops. Bus stops should be designed to accommodate the appropriate number of users and should be highly visible to pedestrians and motorists.

Bus or other transit stops should be located in places that are most suitable for passengers. For example, stops should be provided near higher density residential areas, commercial or business areas, and schools, and connected to these areas by sidewalk.

As with any human scale design element discussed, safety is an important factor to consider when locating bus stops. In the case of a bus stop, special attention should be paid to the number of lanes and direction of traffic when deciding to locate a stop on the near or far side of an intersection. Also special consideration must be paid to the wheelchair lifts in terms of how and where the mobility impaired will exit and enter the bus. It is good practice to construct a transit stop just beyond an intersection, which encourages riders to cross the intersection behind the bus and in full view of approaching motorists. The location also should be set back enough from the roadway to buffer users from traffic without impeding pedestrian activity.

Safety and comfort at a bus stop is determined by the amenities offered to users. Bus stop signage including route information, shelter with seating, trash cans, and bicycle parking encourage transit use. Pedestrian-level lighting improves the visibility of pedestrians to motorists and increases the level of safety for users. At a minimum, marked crosswalks (especially at mid-block stops), curb ramps, and proper sidewalk widths should be considered.

### Bridges

Provisions should be made to include a walking facility as a part of vehicular bridges, if there is an indication that pedestrians would use the facility. It is important to consider the needs of pedestrians when planning for a bridge replacement or the construction of a new bridge. Sidewalks on bridges should be a minimum of 5 feet wide, with a minimum handrail height of 42."

*Images Right: standard DOT bridge with sidewalk and railing*

*Bottom High quality bust station amenities*

### *Traffic Calming Techniques*

Traffic Calming Devices (TCDs) are physical measures in street design that cue drivers to slow down. The effectiveness of TCDs does not depend upon a driver's compliance with traffic signs and signals, or police enforcement, though they may be used effectively in conjunction with them. In coordinated combinations, TCDs reduce speeds, alert drivers to pedestrians, and reduce the severity of collisions. TCDs listed below are generally recommended for consideration on a project-by-project basis. These include traffic circles, roundabouts, speed humps, speed tables, textured pavements and curb extensions (bulbouts). Curb extensions are discussed in detail earlier in this section.

**Neighborhood Traffic Circles** - a small, raised circular island positioned in the center of an intersection, designed to slow traffic by requiring traffic to maneuver around the island.

**Roundabout** –circular intersection with raised circular islands in the center, with "yield on entry" and deflecting islands on all approaches designed to slow traffic. Traffic proceeds in a counterclockwise direction. Roudabouts are highly engineered to accommodate specific traffic types, volumes and speeds.

**Speed Humps** - raised sections of a roadway. They are similar to a speed bump in their application, but a speed hump is wider and has a sloping side taper so they are easy to navigate at slower speeds. They are placed across residential streets to control chronic speeding problems where other methods of slowing traffic have not been effective. They are designed to calm traffic in residential areas, particularly near parks and schools. The physical impact on passing vehicles is less severe at slower speeds than at higher speeds. Studies indicate that speed humps reduce speeds by approximately six miles per hour. A standard speed hump has a length of approximately 22 feet and a height of 3 and 5/8 inches at its center.

**Speed Tables** – flat-topped speed humps typically long enough for the entire wheelbase of a passenger car to rest on the flat section. They often constructed with brick or other textured materials on the flat section.

**Textured Pavements** - stamped pavement or alternate paving materials to create an uneven surface for vehicles and pedestrians to traverse. Textured street pavement provides a visual and tactile cue for both drivers that they are driving in an area of high pedestrian usage. Similarly, they cue pedestrians that they are entering a vehicular zone, and are a particularly effective treatment to warn visually impaired pedestrians. Textured street pavements should be used in areas of substantial pedestrian activity and where noise is not a major concern.

**Curb Extensions** –rounded extensions of the curb which slow vehicles by alerting drivers to potential pedestrians, visually tightening the vehicular path, and physically reduces turning radii, thereby encouraging a decrease in vehicle speeds. Curb extensions also increase safety for pedestrians by shortening the road crossing distance. Curb extensions are covered in more detail earlier in this section.

*Top left: neighborhood traffic circle* *Top right: modern roundabout*
*Bottom left: raised crosswalk* *Bottom right: Speedbump*

### *Temporary Work*

Temporary work should be accessible. Where construction blocks a public sidewalk for more than a short time, an alternate accessible route should be provided that is cane-detectable. Sidewalk barriers should be continuous and cane-detectable as well. Temporary events and facilities should also meet accessibility criteria.

[i] Vanguard Company, accessed November, 2005 (http://www.vanguardonline.com/downloads.asp)

[ii] City of Durham Public Works "Reference Guide for Development," Table of Minimum Design Requirements for Public and Private Residential Streets. Rev. October, 2003. Page 154. (http://www.ci.durham.nc.us/departments/works/handbook/reference_guide.pdf)

## Cornelius Comprehensive Pedestrian Plan

### 1. INTRODUCTION

The Town of Cornelius needs your input concerning pedestrian access and mobility in Town. Your responses to this questionnaire will be combined with other materials collected during the study to help shape recommendations of the Comprehensive Pedestrian Plan.

**1. How long have you lived in Cornelius?**

- ◯ Less than one year
- ◯ 1-5 years
- ◯ 5-10 years
- ◯ More than 10 years
- ◯ Do not reside in Cornelius

**2. How old are you?**

- ◯ Under 18
- ◯ 18-24
- ◯ 25-34
- ◯ 35-44
- ◯ 45-54
- ◯ 55-64
- ◯ 65 or older

**3. How important to you is the goal of creating a walkable community?**

- ◯ Very important
- ◯ Somewhat important
- ◯ Not important
- ◯ Don't know

**4. How pedestrian friendly is Cornelius today?**

- ◯ Very pedestrian friendly
- ◯ Somewhat pedestrian friendly
- ◯ Somewhat unfriendly to pedestrians
- ◯ Very unfriendly to pedestrians

## Cornelius Comprehensive Pedestrian Plan

**5. How often do you make walking trips now?**

- ◯ 5+ times per week
- ◯ 3-4 times a week
- ◯ At least once a week
- ◯ A few times a month
- ◯ Never

**6. For what purpose do you walk now or would you want to walk in the future? (check all that apply)**

- ☐ Fitness or recreation
- ☐ Primary transportation
- ☐ Social visits
- ☐ Shopping
- ☐ Walking the baby or dog
- ☐ Other (please specify) _____

**7. What are the biggest factors that discourage walking in Town? (check all that apply)**

- ☐ Lack of sidewalks or trails
- ☐ Poorly maintained sidewalks
- ☐ Traffic
- ☐ Unsafe road crossings
- ☐ Lack of nearby destinations
- ☐ Aggressive motorists behavior
- ☐ Physical barriers
- ☐ Lack of time
- ☐ Lack of interest
- ☐ Other (please specify) _____

## Cornelius Comprehensive Pedestrian Plan

**8. What destinations would you most like to get to in Town? (select your top THREE destinations)**

- ☐ Trails and greenways
- ☐ Parks
- ☐ Shopping
- ☐ Restaurants
- ☐ Civic buildings (library, town hall)
- ☐ Work
- ☐ Entertainment
- ☐ Public Transportation
- ☐ School
- ☐ Other (please specify)

**9. The Town has limited funding to address all of the pedestrian needs in Town. To help prioritize, which types of improvements are most important to you (select your top THREE)**

- ☐ Replace/repair existing sidewalks
- ☐ Fill in the gaps in the existing sidewalk network
- ☐ Add new sidewalks
- ☐ Add crosswalks and other improvements at key crossings
- ☐ Construct a greenway trail/multi-use path system
- ☐ Plant street trees
- ☐ Create more pedestrian friendly destinations
- ☐ Improve public transportation
- ☐ Other (please specify)

## Cornelius Comprehensive Pedestrian Plan

**10. Rate the importance of adding crosswalk and sidewalk improvements to the following locations.**

| | Very important | Important | Somewhat important | Not important |
|---|---|---|---|---|
| Transit stops | ○ | ○ | ○ | ○ |
| Schools | ○ | ○ | ○ | ○ |
| Retail developments | ○ | ○ | ○ | ○ |
| Grocery stores | ○ | ○ | ○ | ○ |
| Pharmacies | ○ | ○ | ○ | ○ |
| Parks | ○ | ○ | ○ | ○ |
| Neighborhoods | ○ | ○ | ○ | ○ |

Other (please specify)

**11. What do you think are the top THREE roadway corridors most needing pedestrian facilities or pedestrian facility improvements?**

1.
2.
3.

**12. What do you think are the top THREE intersections most needing pedestrian facilities or pedestrian facility improvements?**

1.
2.
3.

**13. What strategies would you be supportive of the Town using to develop/improve pedestrian facilities in Town? (check all that apply)**

- ☐ Provisions in the Land Development Code (LDC)
- ☐ Dedicated funding sources in Town budget
- ☐ Bonds
- ☐ Grants
- ☐ Private financing

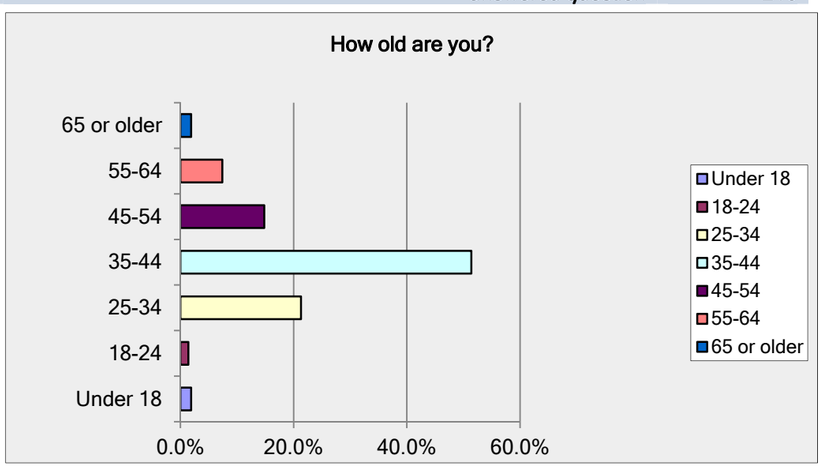
Other (please specify)

### Question 1: How long have you lived in Cornelius?

| How long have you lived in Cornelius? | | |
|---|---|---|
| Answer Options | Response Percent | Response Count |
| Less than one year | 6.0% | 13 |
| 1-5 years | 23.1% | 50 |
| 5-10 years | 38.4% | 83 |
| More than 10 years | 28.2% | 61 |
| Do not reside in Cornelius | 4.2% | 9 |
| *answered question* | | 216 |

### Question 2: How old are you?

| How old are you? | | |
|---|---|---|
| Answer Options | Response Percent | Response Count |
| Under 18 | 1.9% | 4 |
| 18-24 | 1.4% | 3 |
| 25-34 | 21.3% | 46 |
| 35-44 | 51.4% | 111 |
| 45-54 | 14.8% | 32 |
| 55-64 | 7.4% | 16 |
| 65 or older | 1.9% | 4 |
| *answered question* | | 216 |




### Question 3: How important to you is the goal of creating a walkable community?

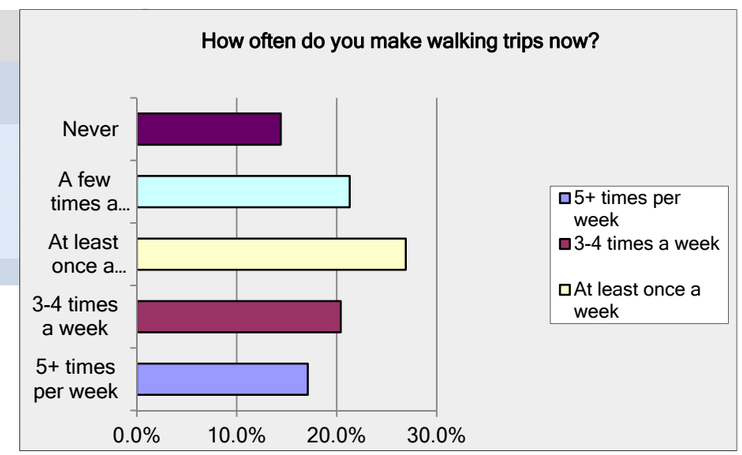
| How important to you is the goal of creating a walkable community? | | |
|---|---|---|
| Answer Options | Response Percent | Response Count |
| Very important | 74.1% | 160 |
| Somewhat important | 20.4% | 44 |
| Not important | 4.2% | 9 |
| Don't know | 1.4% | 3 |
| *answered question* | | 216 |

### Question 4: How pedestrian friendly is Cornelius today?

| How pedestrian friendly is Cornelius today? | | |
|---|---|---|
| Answer Options | Response Percent | Response Count |
| Very pedestrian friendly | 13.9% | 30 |
| Somewhat pedestrian friendly | 55.6% | 120 |
| Somewhat unfriendly to pedestrians | 24.5% | 53 |
| Very unfriendly to pedestrians | 6.0% | 13 |
| *answered question* | | 216 |

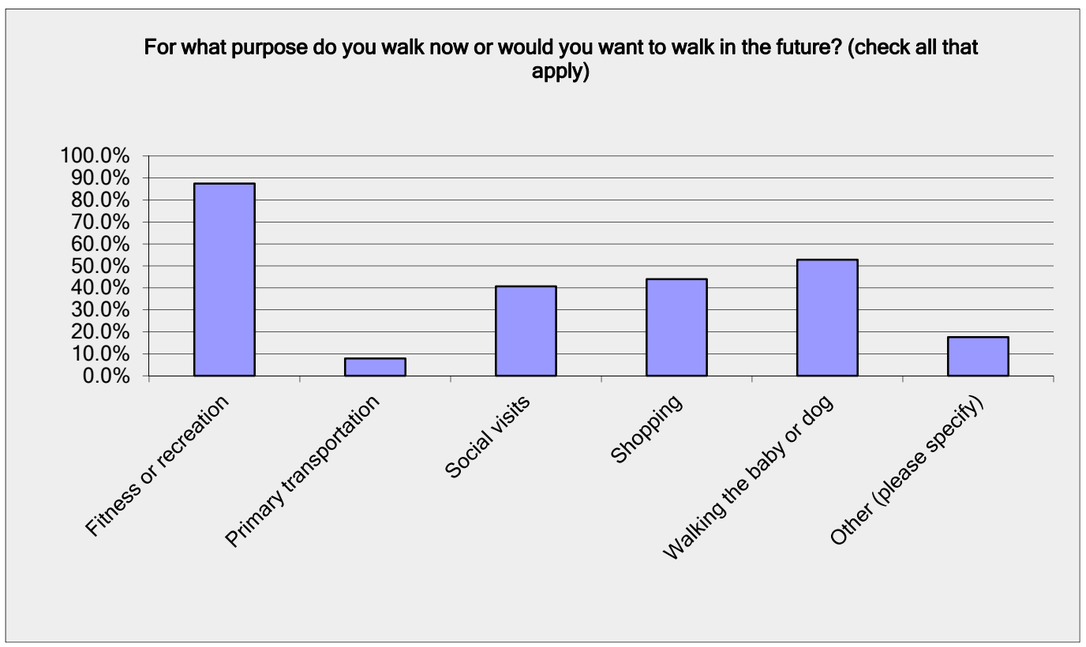
### Question 5: How often do you make walking trips now?

| How often do you make walking trips now? | |
|---|---|
| Answer Options | Response Percent |
| 5+ times per week | 17.1% |
| 3-4 times a week | 20.4% |
| At least once a week | 26.9% |
| A few times a month | 21.3% |
| Never | 14.4% |
| *answered question* | |



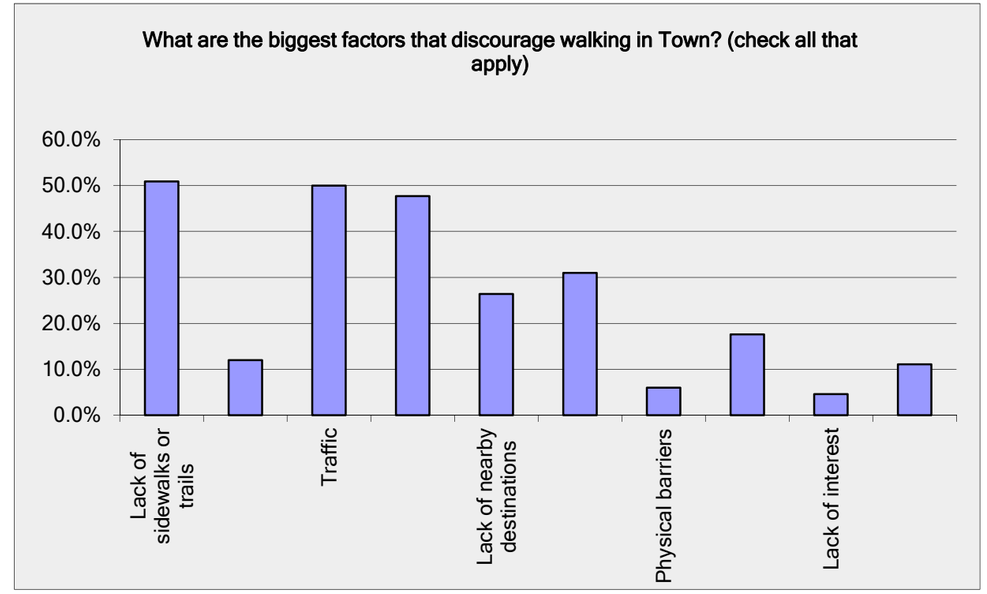
**Question 6: For what purpose do you walk now or would you want to walk in the future?**

| For what purpose do you walk now or would you want to walk in the future? (check all that apply) | | |
|---|---|---|
| Answer Options | Response Percent | Response Count |
| Fitness or recreation | 87.5% | 189 |
| Primary transportation | 7.9% | 17 |
| Social visits | 40.7% | 88 |
| Shopping | 44.0% | 95 |
| Walking the baby or dog | 52.8% | 114 |
| Other (please specify) | 17.6% | 38 |
| *answered question* | | 216 |



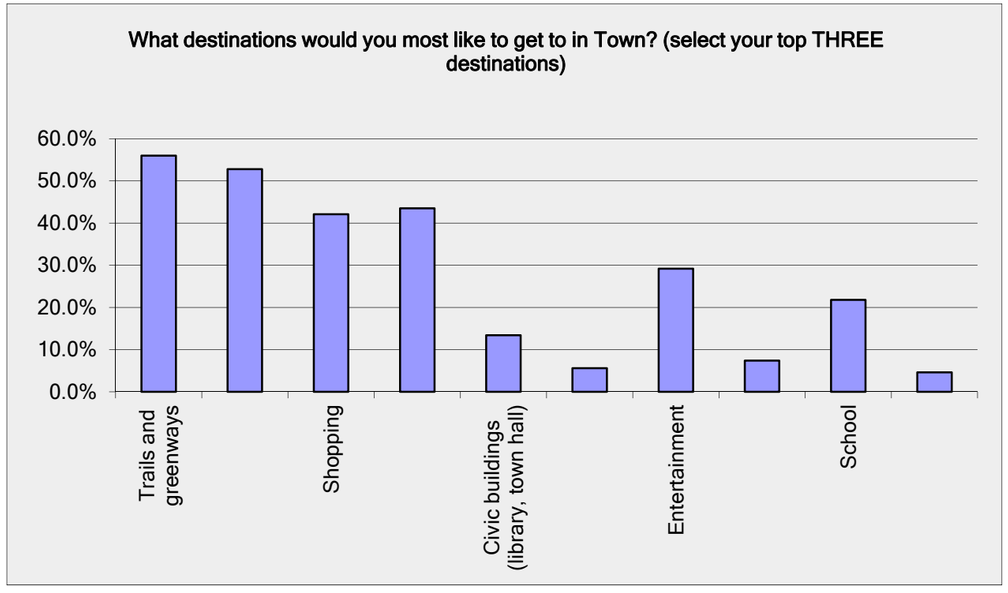

**Question 7: What are the biggest factors that discourage walking in Town?**

| What are the biggest factors that discourage walking in Town? (check all that apply) | | |
|---|---|---|
| Answer Options | Response Percent | Response Count |
| Lack of sidewalks or trails | 50.9% | 110 |
| Poorly maintained sidewalks | 12.0% | 26 |
| Traffic | 50.0% | 108 |
| Unsafe road crossings | 47.7% | 103 |
| Lack of nearby destinations | 26.4% | 57 |
| Aggressive motorists behavior | 31.0% | 67 |
| Physical barriers | 6.0% | 13 |
| Lack of time | 17.6% | 38 |
| Lack of interest | 4.6% | 10 |
| Other (please specify) | 11.1% | 24 |
| *answered question* | | 216 |



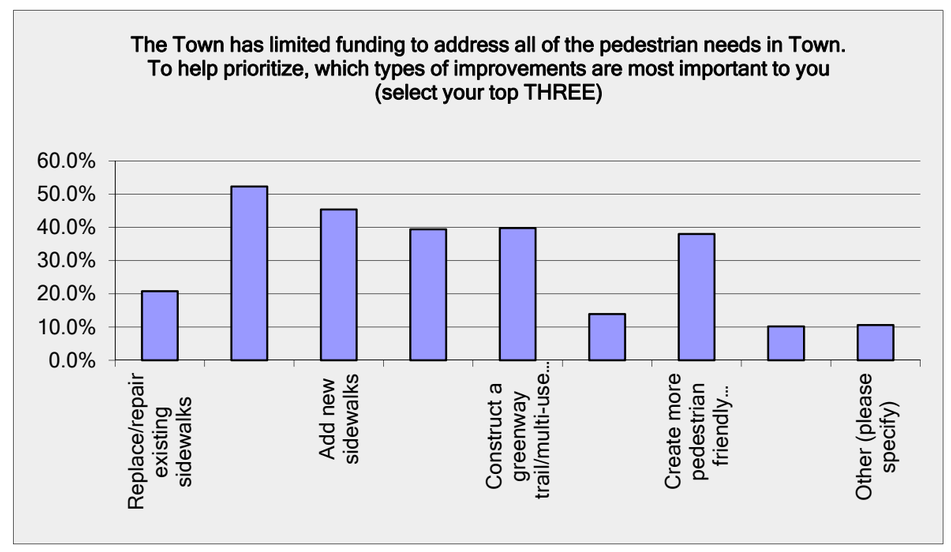
**Question 8: What destinations would you most like to get to in Town?**

| What destinations would you most like to get to in Town? (select your top THREE destinations) | | |
|---|---|---|
| Answer Options | Response Percent | Response Count |
| Trails and greenways | 56.0% | 121 |
| Parks | 52.8% | 114 |
| Shopping | 42.1% | 91 |
| Restaurants | 43.5% | 94 |
| Civic buildings (library, town hall) | 13.4% | 29 |
| Work | 5.6% | 12 |
| Entertainment | 29.2% | 63 |
| Public Transportation | 7.4% | 16 |
| School | 21.8% | 47 |
| Other (please specify) | 4.6% | 10 |
| *answered question* | | 216 |



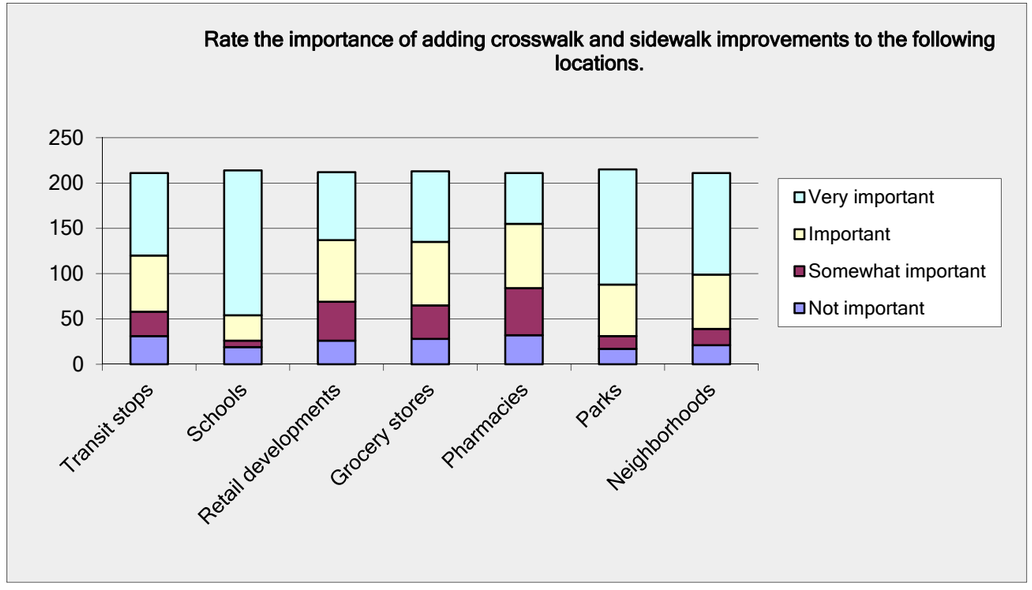

**Question 9: The Town has limited funding to address all of the pedestrian needs in Town. To help prioritize, which types of improvements are most important to you?**

| The Town has limited funding to address all of the pedestrian needs in Town. To help prioritize, which types of improvements are most important to you (select your top THREE) | | |
|---|---|---|
| Answer Options | Response Percent | Response Count |
| Replace/repair existing sidewalks | 20.8% | 45 |
| Fill in the gaps in the existing sidewalk network | 52.3% | 113 |
| Add new sidewalks | 45.4% | 98 |
| Add crosswalks and other improvements at key crossings | 39.4% | 85 |
| Construct a greenway trail/multi-use path system | 39.8% | 86 |
| Plant street trees | 13.9% | 30 |
| Create more pedestrian friendly destinations | 38.0% | 82 |
| Improve public transportation | 10.2% | 22 |
| Other (please specify) | 10.6% | 23 |
| *answered question* | | 216 |



**Question 10: Rate the importance of adding crosswalk and sidewalk improvements to the following locations.**

| Rate the importance of adding crosswalk and sidewalk improvements to the following locations. | | | | | |
|---|---|---|---|---|---|
| Answer Options | Very important | Important | Somewhat important | Not important | Response Count |
| Transit stops | 91 | 62 | 27 | 31 | 211 |
| Schools | 160 | 28 | 7 | 19 | 214 |
| Retail developments | 75 | 68 | 43 | 26 | 212 |
| Grocery stores | 78 | 70 | 37 | 28 | 213 |
| Pharmacies | 56 | 71 | 52 | 32 | 211 |
| Parks | 127 | 57 | 14 | 17 | 215 |
| Neighborhoods | 112 | 60 | 18 | 21 | 211 |
| Other (please specify) | | | | | 22 |
| | | | | *answered question* | 216 |




**Question 11: What do you think the top three Roadway corridors most needing pedestrian facilities or pedestrian facility improvements?**

1. **West Catawba Avenue**
2. **US 21**
3. **NC 115**

**Question 12: What do you think are the Top THREE intersections most needing pedestrian facilities or pedestrian facility improvements?**

1. **West Catawba Avenue at Bailey Road**
2. **US 21 at Catawba Avenue**
3. **West Catawba Avenue at NC 73**

**Question 13:** What strategies would you be supportive of the Town using to develop/improve pedestrian facilities in Town?

| What strategies would you be supportive of the Town using to develop/improve pedestrian facilities in Town? (check all that apply) | | |
|---|---|---|
| Answer Options | Response Percent | Response Count |
| Provisions in the Land Development Code (LDC) | 37.5% | 81 |
| Dedicated funding sources in Town budget | 68.5% | 148 |
| Bonds | 39.8% | 86 |
| Grants | 46.3% | 100 |
| Private financing | 27.8% | 60 |
| Other (please specify) | | 41 |
| | *answered question* | 216 |

Appendix D contains a complete copy of the Community Inventory and Assessment Report developed as a part of the Town of Cornelius Comprehensive Master Plan