

Walk Wilmington: A COMPREHENSIVE PEDESTRIAN PLAN

Adopted by Wilmington City Council on August 4, 2009



prepared by:

TooleDesignGroup

Appendices

Appendix

PLANNING CONTEXT

Wilmington's commitment to pedestrian planning is demonstrated in the city's comprehensive plan, *Choices: The City of Wilmington Future Land Use Plan 2004-2025*. Many of the priorities identified in the *Choices* plan are formalized in the adoption of the *Wilmington Urban Area Metropolitan Planning Organization 2005-2030 Long-Range Transportation Plan*. The decision to draft this pedestrian plan is a direct result of the goals and priorities originally identified by the community when the future land use plan was developed. This section highlights key pedestrian related components of the following plans:

- *Choices: The City of Wilmington Future Land Use Plan Cape Fear Historic Byway*
- *WMPO 2005-2030 Long Range Transportation Plan*
- *Wilmington Vision 2020: A Downtown Waterfront Plan*
- *Cape Fear Historic Byway Corridor Management Plan*
- *Dawson and Wooster Corridor Plan*
- *US 17 Business (Market Street) Corridor Study 2007*
- *Joint Safe Routes to School Workshop*
- *Market Street Corridor Study 2009*

Choices: The City of Wilmington Future Land Use Plan 2004-2025

There are several specific strategies identified in the city's comprehensive plan that relate to improving the pedestrian environment. These are identified below:

Infill

Strategy 1.2.3

Encourage mixed used development as an alternate to the typical development pattern in the city characterized by unconnected, uncoordinated, commercial development along thoroughfares and isolated limited access residential developments. In addition to a mixture of compatible uses, this type of development should provide amenities and walkways to increase pedestrian activity, decrease a reliance on individual vehicles, and foster transit usage. All structures should be fully integrated into the mixed use development through common themes (including, but not limited to lighting, benches, landscaping, and other decorative features but not necessarily building design), integration with a variety of uses, non-linear arrangement, common spaces, pedestrian walkways, vehicular access connections and other features.

Environmental Resources

Strategy 1.2.1

Promote compact development and infill that minimizes vehicle trips and vehicle miles traveled with a mix of integrated community uses (e.g., housing, shops, workplaces, schools, parks, and civic facilities) within walking or bicycling distance.

Strategy 1.2.2

Encourage development patterns and neighborhood street designs that are conducive to pedestrian and bicycle use (e.g., narrower streets with bike paths).

Neighborhoods

Strategy 1.2.1

Implement Neighborhood Traffic Studies throughout the city to identify each neighborhood's specific traffic, parking, and pedestrian problems. The study may be a part of the residential area planning process.

Public Spaces

Strategy 1.2.5

Evaluate options for creating a pedestrian mall integrated with the Riverwalk and associated public space along a section of North Water Street.

Transportation

Strategy 1.2.1

Improve safety by limiting the number of conflict points along all major roadways. Non-traversable medians, driveway restrictions, internal development cross-access, and other techniques that minimize the number of potential collision points on higher-volume public roadways increases safety and reduces vehicle delay. Limiting the number and type of conflict points between vehicles, and between vehicles and pedestrians, or bicyclists also creates a less complex driving environment and reduces the occurrence of driver error.

Strategy 1.3.2

Include pedestrian and bicycle accommodations as an integral element of all transportation-related capital projects and programs when feasible. It should be noted that not all streets should have sidewalks, multi-use paths, or bicycle lanes. Given limited funding, factors such as connectivity, safety, environmental issues, and cost will be a consideration in evaluating the feasibility of constructing a pedestrian or bicycle facility.

Level of Service

Strategy 1.1.2

Acceptable Level of Service for sidewalks shall be defined as sidewalks located within a one-quarter mile walking distance from all elementary and middle schools and from all major medical facilities.

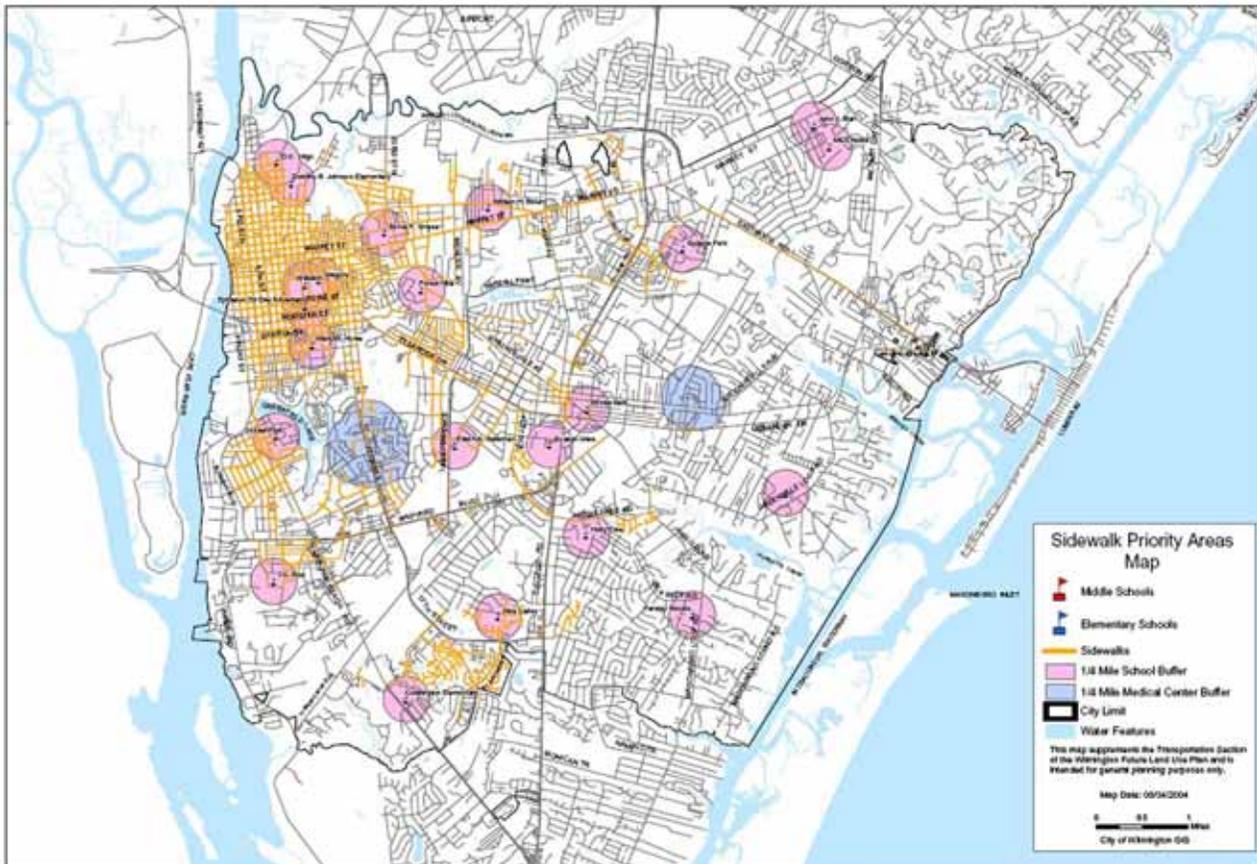


Figure 1: Sidewalk Priority Areas Map from *Choices: The City of Wilmington Future Land Use Plan*

The City of Wilmington Future Land Use Plan 2005 Progress Report relates a relevant finding drawn from public outreach conducted as part of the report development- “Although the City has developed to support cars as a main mode of transportation, **there is a poor network of sidewalks for pedestrians**, particularly in the recently annexed areas.”

WMPO 2005-2030 Long Range Transportation Plan (LRTP)

The LRTP provides a foundation for all future transportation planning efforts, including pedestrian and bicycle facilities. This pedestrian plan aims to further develop and implement the pedestrian-oriented vision and goals established by the pedestrian element of the LRTP.

*Wilmington Urban Area Metropolitan Planning Organization
2005-2030 Long-Range Transportation Plan*

The emphasis on pedestrian accommodation is clear from the vision statement of the *Wilmington Urban Area Metropolitan Planning Organization: 2005-2030 Long-Range Transportation Plan (LRTP)*:

*“To develop and maintain a safe place to live, work, raise a family and retire. The region will be known for its historic character and culture, a vibrant metropolitan urban area that promotes its water fronts, protects its environmental assets, recognizes the importance of its many neighborhoods, provides convenient travel choices for access to amenities throughout the Wilmington Metropolitan Area including well-integrated, connected public transportation, **pedestrian**, and **bicycle** networks and freight movement.”*

Chapter 5: *The Regional Pedestrian System* element of the LRTP is dedicated to pedestrian transportation facilities. The chapter clearly explains the benefits of walking, and why future policies and plans should prioritize improvements to the pedestrian environment. Among the benefits, the chapter lists improvements in public transit, alleviation of traffic congestion, public cost saving, improvement in air quality, improvement in public health and energy efficiency.

The LRTP also identifies corridors and mixed-use transit oriented centers that should be retrofitted to better accommodate pedestrians. They include:

- Independence Boulevard
- Oleander Drive
- North and South Kerr Avenue

Wilmington Vision 2020: A Downtown Waterfront Plan

Vision 2020 seeks to strengthen and enhance the connections between downtown Wilmington and its historic waterfront. Currently, surface parking lots, a parking garage, a large hotel and other uses separate the restaurants, stores and clubs along Front Street from the Cape Fear River waterfront. Although there is the Riverwalk along the water, it is not as heavily used as it could be if the pathways to the waterfront were improved. *Vision 2020* contains a number of specific strategies and actions for improving these connections.

Strategy 1.1.1: Provide an interconnected street and circulation system to support a mix of alternative modes of transportation and provide alternative routes for bicyclists, pedestrians, and drivers. Since well-planned communities provide a supporting network of local and collector streets to accommodate development, as well as unified property access, and circulation systems, all new development and redevelopment approvals should support this strategy.

Strategy 1.1.5: Support and help implement policies of the Wilmington Urban Area Transportation Plan

Strategy 1.3.1: Protect pedestrian safety and provide mobility, particularly in high-pedestrian use areas such as schools, residential neighborhoods, parks, medical centers, and other activity centers by constructing sidewalks or multi-use paths. Sidewalk priority investment areas should focus on locations identified in the Sidewalk Priority Areas Map that follows this section. Those areas within a ¼ mile of schools and medical centers that show sidewalk deficiencies should be prioritized through an internal assessment and then included in the CIP.

Strategy 1.3.7: Consider establishing a transit overlay zone in the vicinity of the new transfer facility allowing higher-density and reduced parking in exchange for a higher level of pedestrian and transit infrastructure and amenities. The transit overlay zone should be considered in conjunction with priority redevelopment strategies outlined in this Plan.

Strategy 2: Connect People to the River by increasing *physical* and visual access to the water.

Action 1. Improve access to the Riverwalk along key pedestrian routes. There are 15 east-west streets that should be improved with shade trees, streetscape furnishings, and sensitively designed signage directing visitors to the waterfront. Crosswalks on east-west streets should be paved with special materials to reinforce pedestrian direction to the waterfront and create an organized hierarchy in the street pattern.

Strategy 5: Invest Public Resources to improve public amenities, attract private investment, and increase overall community value.

Action 1. Return Front Street to a two-way traffic pattern with new streetscape treatment.

Streetscape improvements should focus on the sidewalk and include tree species, prototypes for tree grates, lighting standards, underground utilities, and special paving materials to identify crosswalks and emphasize the significance of the street. In addition, historic medallions could be placed in the sidewalk at each corner of an intersection to mark the historic district.



Figure 2 Proposed Front Street Section from Vision 2020 Downtown Waterfront Plan

Cape Fear Historic Byway Corridor Management Plan

The Cape Fear Byway extends along the Cape Fear River from Wilmington's historic downtown along a series of city streets to Greenfield Lake Park. The *Historic Byway Corridor Management Plan* seeks to preserve and promote the historic character and natural beauty of North Carolina's first urban scenic byway.



Figure 3 Official Route of the Cape Fear Historic Byway

Source: *Cape Fear Historic Byway Management Plan*

The plan identifies a number of goals that directly or indirectly relate to *Walk Wilmington: Comprehensive Pedestrian Plan*.

- **Goal #1:** Encourage visitors to get out of their cars and safely explore the corridor by alternative means of transportation such as on foot, bike, trolley, horse carriage and even boat.
- **Goal #11:** Increase pedestrian and biking safety along the byway corridor, particularly on 3rd Street.
- **Goal #12:** Preserve the existing brick streets and make recommendations for additional streets to be covered in brick.

The corridor management plan contains several recommendations for improving the streetscape and visitor experience along the corridor, including installing street trees and plantings, street furniture, and landscaped medians. In this vein of enhancing the overall aesthetics of the corridor, the plan recommends installing brick (not stamped colored pavement) sidewalks and road crossings in several locations. While this does contain a certain visual appeal, consideration should be given to the accessibility of this surface treatment. Over time, bricks may shift and become dislodged, creating an uneven surface for pedestrians. This may result in a tripping hazard and it may become difficult for people in wheelchairs or using other assistive devices to navigate. People using white tipped canes may also have difficulty navigating the uneven surface. There are several cities around the country, such as Alexandria, Virginia, that

are considering either removing brick sidewalks in certain areas rather than contend with the annual cost and inconvenience of maintaining their brick sidewalks.

The historic byway plan contains a number of specific recommendations intended to improve pedestrian convenience, safety and comfort along the corridor. These include sidewalk repair, wayfinding signage, several midblock crossings, curb extensions and pedestrian refuges, crosswalk marking enhancements, and pedestrian scale lighting. The plan also recommends a new pedestrian bridge across a portion of Greenfield Lake. In addition to pedestrian-oriented recommendations, there are several topics related to improvements for bicyclists. .



Figure 4 Photo Simulation of Greenfield Park Entrance
Source: Cape Fear Historic Byway Corridor Management Plan

Dawson and Wooster Corridor Plan

Dawson Street and Wooster Street are a parallel pair of one-way streets south of the city’s central business district. Together, these streets are a heavily traveled segment of US 76 connecting Wilmington and points to the east with the bridge to Brunswick County and beaches to the west. According to the corridor plan, NCDOT ranked the intersections of Wooster/8th Streets and Wooster/6th Streets amongst “the most ‘potentially hazardous intersection locations’ in the state.” The plan presents a number of recommendations for improving the safety and comfort of pedestrians, bicyclists and motorists along the corridor.



Figure 5 Improvements along the Dawson Street and Wooster Street Corridor
Source: Dawson and Wooster Corridor Plan

Included are a number of specific recommendations for decorative stamped asphalt crosswalks, pedestrian signal heads and landscaping at the intersections with South 5th Avenue, South 8th Street, South 10th Street, South 13th Street, South 16th Street and South 17th Street.

US 17 (Market Street) Business Corridor Study (2007)

The 2007 Market Street study focuses on the corridor between 3rd Street and Covil Avenue. According to the study, the corridor presents a relatively uncomfortable environment for pedestrians.¹ The study is a refinement of a 2004 project that looked at the entire length of Market Street from the waterfront to the eastern edge of the city. The general purpose of the project was to evaluate this section of Market Street for opportunities to improve the streetscape, control heavy vehicle traffic, and improve corridor operation and safety for both motorists and pedestrians. A number of different alternatives were considered, including reducing Market Street from a four lane roadway (two lanes in each direction) to a two lane roadway with a landscaped median, bike lanes, and on-street parking. The preferred alternative includes the lane reduction down to two lanes, median improvements and intersection improvements. The recommended roadway should also include pullout areas for bus stops and curb extensions to further control traffic and reduce pedestrian crossing distances.

Market Street Corridor Study (2009)

The WMPO is currently developing a corridor plan for Market Street from Colonial Drive to the Pender County line. The project is focused on improving safety and mobility along the corridor for motorists, pedestrians, and other users. Recommendations will address access management,



Figure 6 Market Street Corridor Study Bicycle and Pedestrian Connectivity Map

Source: Map developed by Kimley-Horn and Associates for WMPO

¹ The US 17 Business Corridor Study states that the level of service for pedestrians ranges from “C” to “F.”

design standards, and conceptual designs.

According to a survey conducted for the plan, sidewalks, bike accommodations and intersection improvements were amongst the most frequently identified improvements needed, well ahead of road widening.² Currently, the preferred design continues the landscaped median identified through the US 17 (Market Street) Corridor Study for much of the length of the corridor. The plan is anticipated to be completed in February, 2009.

Joint Safe Routes to School Workshop for Bradley Creek, Holly Tree and Parsley Elementary Schools

In September, 2007, the city hosted a Safe Routes to Schools workshop for three elementary schools. This meeting marked the beginning of the Safe Routes to Schools program in Wilmington. Through the workshop, a number of goals were established:

- Increase the number of parents who feel that their children are safe when walking and bicycling
- Increase the number sidewalks and bicycle paths
- Educate parents about walking school buses
- Improve the health of children
- Make existing sidewalks and bicycle paths safer
- Increase the number of bicycle racks
- Decrease the number of parents driving their children to school
- Create model educational program
- Enforce speed limits
- Increase adult supervision where children walk or bicycle
- Educate children on proper walking and bicycling techniques in order to instill confidence
- Better connect communities and schools
- Create safer walking routes to school bus stops
- Develop walking and bicycling habits early in life



Figure 7 Holly Tree Safe Routes to School Recommendations

The report identifies a series of specific recommendations for improving pedestrian and bicyclist comfort and safety along routes leading to each of the schools. Suggested

² Source: Market Street Corridor Study Public Workshop presentation, October 2008. Accessed on WMPO website at: <http://www.wmpo.org/market.html>.

improvements include new sidewalks, crosswalks, traffic signals, and other accommodations. The report also recommends the implementation of recommendations from several neighborhood traffic studies that should help control vehicle speeds in the adjoining neighborhoods. In addition to funding, implementation of workshop recommendations will also require coordination with NCDOT, private property owners, local school officials and homeowner associations.

INTERAGENCY COORDINATION

At the state and regional level there are a number of agencies and plans that address transportation improvements which have a direct impact on pedestrian facilities in the city of Wilmington. Streets are either owned by the North Carolina Department of Transportation (NCDOT) or by the City of Wilmington, but all sidewalks in the public right-of-way are owned and maintained by the City of Wilmington.

Transportation Policy Boards and Departments

Wilmington Metropolitan Planning Organization (WMPO)

Under federal law, any urbanized area (as defined by the Census Bureau) exceeding a population of 50,000 people shall establish a Metropolitan Planning Organization (MPO) whose purpose is to coordinate transportation planning and programming among the member governments. The WMPO planning area includes New Hanover County, the southeastern portion of Pender County and the northeastern portion of Brunswick County.

The WMPO is charged with adopting the federally-mandated Long-Range Transportation Plan and the state-mandated Comprehensive Transportation Plan; the Metropolitan Transportation Improvement Program (MTIP) for road, transit, bicycle, and pedestrian investments; and the Unified Planning Work Program. After appropriate planning, engineering, and public input, the WMPO adopts specific alignments for proposed thoroughfares and transit corridors.

North Carolina Board of Transportation

The governor of the State of North Carolina appoints the members of the North Carolina Board of Transportation. The board adopts the State Transportation Improvement Program (STIP), the seven-year investment program determining how state and federal transportation funds will be spent statewide. The board then awards contracts for construction based on the STIP. The Board is charged with setting policies for state-maintained and -operated transportation systems regardless of mode. The board has 19 members, plus the non-voting Secretary of Transportation.

The NCDOT Board of Transportation Strategic Plan

This is a Board of Transportation policy document which guides the functions to be carried out by the North Carolina Department of Transportation.

The plan's system vision states that:

“The transportation system in North Carolina will provide safe, affordable choices for the movement of all people and products. The system will support and sustain economic

opportunities throughout the state. It will be a well-maintained, reliable, multi-modal and connected system that is considerate of local land-use plans, natural resources and the environment. This system will be planned and operated in partnership with communities, local, regional, state and federal agencies, and private entities.”

The plan identifies balance, choices, partnership, open communication and safety as guiding principles that relate to pedestrian mobility. The plan includes the following goal and objectives:

Goal:

Provide a safe and well-maintained interconnected transportation system that offers modal choices for the movement of all people and goods.

Objectives:

Strive to meet transportation system needs for services, construction and maintenance

- Develop partnerships with other transportation providers
- Support the development of multi-modal transportation systems
- Ensure transportation safety through the enforcement of applicable state and federal laws
- Continuously monitor and update the department’s long-range transportation plan

NCDOT Board of Transportation Resolution: *Bicycling and Walking in North Carolina, a Critical Part of the Transportation System*

In 2000, the NCDOT Board adopted a resolution stating that:

“Bicycling and walking shall be a routine part of the NCDOT’s planning, design, construction, and operations activities and supports the Department’s study and consideration methods of improving the inclusion of these modes into the everyday operations of North Carolina’s transportation system.” It also resolves that “North Carolina cities and towns are encouraged to make bicycling and pedestrian improvements an integral part of their transportation planning and programming.”

North Carolina Department of Transportation (NCDOT)

Almost 20% of the roadways in Wilmington are owned and maintained by NCDOT. Local NCDOT maintenance and operations are performed at the division level, and Wilmington is in Division 3. The Division of Bicycle and Pedestrian Transportation is headquartered in Raleigh, and it has is a central resource for bicycle and pedestrian planning in North Carolina.

“NCDOT recognizes the importance of bicycling and walking and seeks to provide a supportive environment, both physically and institutionally, for these non-motorized modes of transportation. Although historically a municipal rather than state responsibility, in 1992 the DOT began to join with localities in making improvements to the pedestrian environment, thus setting in motion the expansion of opportunities for the walking public.

NCDOT Division of Bicycle and Pedestrian Transportation policy (2007)

A number of key milestones in the 1990s advanced pedestrian transportation in North Carolina and acknowledged the need to provide for the oldest mode of transportation used by humans:

- 1992: NCDOT expanded their bicycle program to include pedestrian transportation. The Office of Bicycle and Pedestrian Transportation was born and was later elevated to division status within the department.
- 1993: North Carolina Board of Transportation set aside \$500,000 for pedestrian projects.
- 1994: NCDOT implemented a policy for providing incidental pedestrian facilities in highway improvement projects.
- 1995: the Board of Transportation allocated \$1.4 million annually for pedestrian facility construction.

Most construction of pedestrian facilities occurs at the local or highway division level. The current statewide allocation for small scale pedestrian improvements stands at \$1.4 million, divided equally among the state's 14 highway divisions. In addition to state funding, the 2005 Safe, Accountable, Flexible, Efficient, Transportation, and Equity Act: A Legacy for Users (SAFETEA-LU) requires NCDOT to set aside federal funds from eligible categories for the construction of pedestrian transportation facilities.

NCDOT Comprehensive Transportation Plans

The Transportation Planning Branch (TPB) of NCDOT provides technical assistance to metropolitan planning organizations (MPOs), small urban areas and counties across North Carolina in the development of Comprehensive Transportation Plans (CTPs).

CTPs are 20-25 year plans for improvements to the transportation system, based on future land use, employment and population changes in an area.

A CTP is mutually adopted by the MPO or local governments (if not in an MPO) and the North Carolina Department of Transportation and becomes the blueprint for which transportation infrastructure improvements are made in an area.

The transportation needs identified through the development of the CTP are prioritized by either the MPOs or the rural planning organizations (RPOs) and presented to the Board of Transportation for programming during the biennial update of the STIP.

All designated metropolitan planning organizations are required every three years to update and maintain a transportation plan with a 20-year planning horizon.

NCDOT State Transportation Improvement Program

This program of capital projects describes the region's and the state's anticipated investments in transportation over a 7-year period. The STIP is updated every two years by the North Carolina Board of Transportation and include projects from the MTIPs that are endorsed by local MPOs.

Improvements for bicycling and walking may be included in the STIP as part of the construction of a highway project or, where no highway project is programmed, as an independent bicycle or pedestrian project. Bicycle and pedestrian projects follow essentially the same STIP process as do highway projects. One distinction, however, is that bicycle and pedestrian improvements may not be part of a long-range transportation plan. Integrating these two modes into local transportation plans in the future will strengthen both the incidental and independent project selection process.

NCDOT: Bicycling and Walking: A Long Range Transportation Plan

This plan was adopted in 1996 by the Board of Transportation. The plan established the following vision.

“All citizens of North Carolina and visitors to the state will be able to walk and bicycle safely and conveniently to their desired destinations, with reasonable access to all roadways.”

To meet the plan's vision, a series of goals are stated as follows:

Goal 1

Provide the bicycle and pedestrian facilities necessary to support the mobility needs and economic vitality of communities throughout North Carolina.

Focus Areas:

- Provide for quality independent projects and schedule more local bicycle and pedestrian transportation improvements in the State Transportation Improvement Program
- Provide for more incidental bicycle and pedestrian improvements by ensuring that the various units within the NCDOT consider bicyclists and pedestrians
- Develop and fund projects that improve transit access for bicyclists and pedestrians
- Identify, preserve, and develop abandoned rail corridors for bicycle and pedestrian transportation

Goal 2

Provide a comprehensive program of education and enforcement strategies that will improve the safety of all bicyclists and pedestrians.

Focus Areas:

- Develop and implement school-based pedestrian safety curricula and programs
- Develop, publish, and maintain a clearinghouse of bicycle, pedestrian, and motorist safety materials targeting at-risk ages and groups
- Encourage law enforcement agencies to enforce laws impacting bicycle and pedestrian safety

Goal 3

Institutionalize bicycle and walking considerations to enhance current transportation practices at the state, regional, county, and local level.

Focus Areas:

- Provide ongoing training and information exchange for state and local staff and officials
- Assess and incorporate federal, state, and local legislation, regulations, ordinances, and policies concerning bicyclists and pedestrians
- Advocate the establishment of bicycle and pedestrian citizen committees to promote the development of local plans and programs

Goal 4

Identify and promote new and innovative ways to advance bicycle and pedestrian safety and enjoyment through research and needs assessment.

Focus Areas:

- Conduct research to identify pedestrian and bicyclist safety needs to guide countermeasure and program development
- Periodically evaluate the effectiveness of bicycle and pedestrian facility and safety education programming
- Implement and evaluate innovative programming procedures, training

Goal 5

Encourage bicycling and walking as viable transportation options.

Focus Areas:

- Sponsor statewide promotions and events, and encourage local activities aimed at increasing awareness of bicycling and walking opportunities
- Improve tourism opportunities for non-motorized travel throughout North Carolina
- Develop, implement and promote bicycle/pedestrian commuter incentive programs at the state, regional, county, and local level

NCDOT Pedestrian Policy

A sidewalk policy was developed in 1993 whereby the NCDOT will participate with localities in the construction of sidewalks as “incidental features” of highway improvement projects. Prior to this policy, the NCDOT participation in sidewalk construction was limited to replacing sidewalks which were disturbed during roadway construction. At the request of a locality, state funds for a

sidewalk are made available if matched by the requesting locality, using a sliding scale based on population. The NCDOT participation generally may not exceed two percent of the highway project construction cost. NCDOT will only cover the cost for installing a 5-foot wide concrete sidewalk within NCDOT right-of-way. Additional costs for right-of-way acquisition, wider sidewalks or different paving materials are borne by the municipality.

NCDOT Greenway Policy

In 1994 the NCDOT adopted an administrative policy to consider greenways and greenway crossings in the highway planning process. This policy was incorporated so that critical corridors which have been adopted by localities for future greenways will not be severed by highway construction.

STAKEHOLDER INTERVIEWS

City of Wilmington

Traffic Engineering Division

Don Bennett	Signals & management	910-341-4696
Richie Brown	Signs, pavement markings	
& TRC review	910-341-4699	

Engineering Division

Brett Russell	Construction management	910-341-5890
Dave Cowell	Capital projects	910-341-5879

Planning Division

Christine Hughes	Long range planning	910-341-5885
Anthony Prinz	Transportation (TRC Review)	910-341-5891
Joshuah Mello	Transportation (Long Range)	910-341-3234
Bill McDow	Neighborhood traffic	910-341-7819
Jamison Fair (starts in May)	Current planning	910-341-5807

Police

David Conklin	Deputy chief	910-343-3610
---------------	--------------	--------------

Parks, Recreation & Downtown Services

Andrea Talley	Recreation supervisor	910-341-0836
---------------	-----------------------	--------------

Streets

Jay Carter	Street & sidewalk maintenance	910-341-7899
------------	-------------------------------	--------------

Cape Fear Public Transportation Authority (WAVE Transit)

Albert Eby	Director	910-202-2035
Matthew Kunic	Planner	910-202-2057

New Hanover County Public Schools

Bill Hance	Planning, technology & operations	910-763-5431
Carmen Gintoli	Facilities planning	910-254-4325
Ken Nance	Transportation	910-254-4285
Kiersten Wildeboer	Health & drivers' ed	910-254-4173

Planning Division

April 9, 2008

Christine Hughes	Long range planning	910-341-5885
Anthony Prinz	Transportation (TRC Review)	910-341-5891
Bill McDow	Neighborhood traffic	910-341-7819

Ron Saderfield

1. Briefly describe what your role in helping to create a more walkable city.
2. How does the City address internal circulation on private development and the connection of these developments to surrounding areas? Example: Military Cutoff Road.

We encourage as many connections as possible, especially to the sidepath, through the Technical Review Committee (TRC) process. Developers consider these connections as amenities that make their development attractive; thus, they don't resist them. Surrounding neighborhoods sometime resist, however. Example: Windemere and Mayfair. Neighborhoods also resist connections through their neighborhoods to schools. Vehicle connections between neighborhoods are one issue that people more easily agreed to.

Pedestrian connections can be considered as adding to the overall project costs, especially for developers. And, once the connection is made, it must match existing elevations and amenities.

3. What does the City's SRTS program look like?

The MPO is certified to receive funds and administer grants. We now have a pilot program grant for Bradley Creek ES, with the major element being sidewalks between a trailer park and the school

Joshua Mello is the City's SRTS coordinator and the money flows through the MPO. It's easier for the City's Public Works department to install sidewalks to schools using City money. Grant funding is more complicated and takes longer. It's easy to justify the expense.

There are no specific design standards for sidewalks to schools.

4. Do you address internal pedestrian circulation for parking lot layouts?

There is the code, and there's what happens in real life. We just amended the code for parking lot landscaping, because we want a people-friendly design. However, the code doesn't specify pedestrian circulation; we rely on the TRC reviewer to pay attention to this.

5. Do the current codes/ordinances/standards support pedestrian-oriented design/development? What are the loopholes? What are the shortcomings?

The existing built environment does not support pedestrian travel. We require, but then waive connections in new and re-development. And, some requirements are contradictory, such as buffers around commercial development which limit pedestrian access and don't add to a pedestrian-friendly environment.

We are currently working through a series of code amendments. Changes to the multi-family development regulation will make access easier overall, however, pedestrians are not addressed specifically. In contrast, pedestrian needs are specifically addressed in the urban mixed use district, which aims to make these developments more self-sufficient, (i.e., people don't need to travel outside the district for shopping, schools, works, etc.).

6. What types of pedestrian-friendly design elements or requirements do developers most often resist? What strategies have you used to encourage more pedestrian-friendly development/design?

It is a mixed bag and depends on the developer. City policies are not clear on where pedestrian facilities should be and what the standards for them are. While the policy says pedestrian facilities are required, there is not much undeveloped land – the City is 90% built out -- to apply them to. Redevelopment and small developments are it and developers push back on the requirement to include pedestrian facilities in their project when the surrounding areas have none.

Driveway permits are approved by the City's traffic engineer.

7. What role does the City have on issues of safety, ADA accessibility and transit stops/accessibility?

Safety and ADA compliance is also inconsistent, with ramps missing or in the wrong place.

Pedestrian access to WAVE Transit

- The City recently built sidewalks, ramps and installed striping for the temporary central station created coincident with the March 31 route restructuring.
- There are growing pains associated with WAVE transitioning from a City department to a regional transit agency.
- The City does not create bus stops. It is up to WAVE Transit to do this.
- The sidewalk prioritization plan does not reflect bus routes because they change.
- Properly done, excess parking needs can be resolved through better public transit, if the funding is there. The perception is that only a certain class of people ride the bus, i.e., those who are transit dependent.

8. What strategies (either processes or aspects of the Zoning Ordinance, Sidewalk Ordinance or other ordinances) have worked well in getting new development to adequately address pedestrian needs?

There is an effort through the TRC process to have all development plans comply with existing transportation plans, such as collector street plans, especially with respect to pedestrians and bicycles. See: Monkey Junction Collector Street Plan.

New Hanover County and the Wilmington Metropolitan Planning Organization are currently working on a collector street plan for the Monkey Junction area. With your help, we hope to develop a guide and design standards for collector streets and also produce a map of future connections (automobile, bicycle and pedestrian) between area neighborhoods, shopping centers, schools and workplaces. The goals of these activities are to improve interconnectivity and relieve pressure on S.College Road (NC 132), Carolina Beach Road (US 421) and Myrtle Grove Road. A public workshop was held on February 28, 2008.

The goal is to find funding for retrofits, especially for County land annexed to the City. The collector street plan includes 50 spots to retrofit.

The issues differ, depending upon where you are in the City:

1. Downtown the issue is how to cross arterials
2. In the suburbs, sidewalks are what's needed.

9. Should improvements to existing sidewalks be required during redevelopment if the sidewalk does not meet the City's standards?

The County did not require sidewalks, so portions of the County annexed to the City do not have sidewalks. This has created issues for the City.

The City's sidewalk program places higher priority for sidewalks in high pedestrian areas, such as schools, hospitals and downtown.

The Neighborhood Traffic Program started with only 1 traffic-calming installation – a round about when the program was revised, each neighborhood wanted sidewalks.

Sidewalks are managed by the traffic engineer.

10. When you look at where Wilmington is today and the vision for walkability in the future, what are the biggest barriers to getting there?

Walkability is an issue when developing neighborhood plans. Speeding and internal circulation are factors affecting walkability.

The City-wide master plan is more concerned with vehicular traffic. Sidewalks are used for internal neighborhood circulation; major intersections are not always addressed. They are wide and have higher speeds. Even when pedestrian facilities are installed at major intersection, pedestrians and motorists get mixed signals. And some intersections on roads under NCDOT control don't have pedestrian facilities, creating a "missing link." The conflict extends to aesthetics, as NCDOT wants arterials and intersections to be easily maintainable, i.e., no pedestrian facilities, no landscaping, few signs, etc.

We need to have a longer vision in mind when deciding whether or not to include pedestrian facilities on a road or at an intersection. Even when crash data and other information make the case for installing facilities, doing so is complex and costly. Drainage, signal timing, signage, striping, landscaping, etc., all need to be redesigned and recalibrated.

11. With regards to the City's relationship with NC-DOT, what are the top 3 things you wish they would do, at the project level, to ensure walkability.

NCDOT has the final say on TRC reviews of roads they maintain. Their policy does not allow much flexibility; they adhere fairly strictly to the AASHTO. It is only when we have hard

evidence of a different outcome, such as crash data, or a project is related to SRTS, that they are more flexible.

Examples of successes in working with NCDOT are:

- Wooster & Wrightsville Avenue
- A mid-block crossing near the Dawson Street & Oleander Drive intersection

12. What would you like to get out of the Pedestrian Master Plan?

1. Something to educate the development community and elected officials as leverage to propose/agree to/approve more pedestrian-friendly facilities. 6 of the 7-member Council are connected to the development community, and 6 of the 7-member Planning Commission, which is appointed by the Council, are, too. We can use
 - case studies/best practices from other communities
 - information on how a good pedestrian network will reduce congestion and crashes
2. Site-specific recommendations. We can identify about 20 locations with pedestrian connection issues. THEN, need to negotiate with NCDOT to allow changes. (NCDOT is paying for this study, so they should be willing to implement its recommendations.)
3. Change NCDOT's policy and practices for pedestrian facilities. Their re-organization may solve part of this. The plan should identify what the problems are, suggest ways to improve our relationship with them, and end up with their willingness to make trade-offs between pedestrian and vehicular facilities.
4. A ranking system for new sidewalk installation (talk with Richard Kind) that includes all criteria. For example, transit access is missing.

- Understanding that anything built ends up in his maintenance schedule. The new pavements management system does not currently include sidewalks and shared use paths; they will need to be included in the future as more are built – i.e., the complaint-based maintenance system will no longer be the best way to maintain them.

Traffic Engineering Division

Friday, April 4, 2008

Don Bennett	Signals & management	910-341-4696
Richie Brown	Signs, pavement markings	
& TRC review	910-341-4699	

1. Briefly describe what your role in helping to create a more walkable city.
 - a. Richie Brown
 - Completes plans reviews for sidewalk improvements. He also sometimes reviews internal circulation for proposed developments.
 - He oversees the crew that installs and maintains signal and pavements markings.
 - Sometimes provide crosswalk information to Engineering for larger projects.
 - Works with Streets Division of Public Services when they install new sidewalks.
 - b. Don Bennett
 - Evaluates signals for re-timing
 - Counts pedestrians (through observation)
 - Recommends pedestrian facilities needed on NCDOT roads
 - Works with other City departments, eg, works with Andrea Talley on the cross city trail to identify the best intersections for the trails to cross roads – to avoid conflicts between motorized and non-motorized.
 - Does some work on capital projects
 - Has not received requests for pedestrian facilities to improve access to bus stops.

2. What are the responsibilities of the Street Maintenance Division in regards to maintenance of pedestrian facilities? Who handles enforcement?
 - a. Work with others to develop mid-block crossings with pedestrian refuge
 - Install between complex intersections
 - May include HAWK or beacon
 - Create in locations where motorists expect to see pedestrians, e.g., at major pedestrian generators/attractors.
3. What internal divisions and/or agencies do you collaborate with most when it comes to pedestrian facility maintenance issues?
 - a. They both work with NC DOT, Wilmington Parks & Recreation (especially on the Cross City Trail) Development Review (with the objective of having sidewalks on all existing streets and at intersections).
 - With respect to development review – they review the internal circulation and sometimes the inter-connectedness between the private property owner and surrounding areas/destinations.
 - They will propose paths between developments that are not in the public ROW. For example, the multi-use path on Eastwood Road. This is a City project with some private development money.
 - b. They do some review of proposals for improved walking and biking to schools. The SRTS position was filled less than a year ago, so the program is just beginning.
 - Their review is limited to technical comments.
 - Schools built when the land was in the County (but now in the City) have fewer sidewalks than City schools
 - c. They do some transportation planning work with the MPO
4. What do you want from the plan?
 - a. System for non-motorized travel that allows people to walk short distances, e.g, to the mall, school.

- IMPORTANT to facilitate these movements without compromising the vehicular traffic system. Wilmington has no by-passes or over passes. There are no good alternative routes for vehicles to travel than on the existing roads. North-South roads have especially high volumes that cannot be interrupted.
- b. Recognition that pedestrian paths are not corridors of crime. This is a stigma that needs to change.
- c. Funding to resolve pedestrian access problems inherited when neighborhoods were annexed from the County – especially schools, e.g., Forest Hills.
 - Sidewalks are added to some schools when they are renovated.
 - Example of school that desperately needs sidewalks: Bradley Creek – is a trailer park next to it with no sidewalks, so the kids take the bus to school.
- d. A change in policy from the State. Currently, the City needs NCDOT approval to put pedestrian facilities on state-maintained roads. Most state roads are rural with low volumes and NCDOT state policies are geared towards these, not roads in a city such as Wilmington.

Practice: Because Wilmington does not use LPI, Don Bennett tries to install more pedestrian facilities at intersections where there is less pedestrian-vehicle conflict, even if it means pedestrians do not have a direct path.

Engineering Division

April 9, 2008

Brett Russell

Construction management

910-341-5890

1. Briefly describe what your role in helping to create a more walkable city.
2. Do inspections take place of all new pedestrian facilities? What is most often out of compliance? How could the process (application, review) or laws/codes be adjusted to ensure greater compliance?
3. Some communities require SF infill development (single lot) to build sidewalk on streets with no sidewalk or sidewalk with missing gaps. Does Wilmington? If not, should it?

4. Should improvements to existing sidewalks be required during redevelopment if the sidewalk does not meet the City's standards? *Examples: No sidewalks, Sidewalks at back of curb or 4' wide sidewalks.*

Brett is a construction manager for capital projects who makes sure things are built correctly. He is not part of the TRC process.

If a sidewalk does not exist, a property owner is required to put in a sidewalk when making an improvement to their property, especially if the improvement affects the public ROW – e.g., a driveway apron.

In terms of maintenance standards, the City requires those that disrupt the sidewalk to replace an entire panel, not just restore with a patch. This is a good policy.

We have a lot of sidewalks to nowhere and lack a management plan to tie things together. There is no sidewalk in-fill budget; no pot of money to fund in-fill sidewalks.

Payment-in-lieu program payments are absorbed into the general fund.

For new development the City code requires a 4' to 6' wide planting strip (called a plaza in Wilmington) between the sidewalk and the street. To get this, the City requires a pedestrian access easement on the far side of the ROW. The easement is limited by building set back requirements.

Sidewalks are an underused City asset, including 10' multi-use paths.

Parks, Recreation & Downtown Services

Friday, April 4, 2008

Andrea Talley Recreation supervisor 910-341-0836

1. Briefly describe what your role in helping to create a more walkable city.
 - Project manager for 10-mile Cross City Trail, which is an off-road, multi-use trail. It will eventually get to Wrightsville Beach.
 - Heads “Wilmington Walks”, a healthy community/fitness organization that measures walking courses for neighborhoods. The program provides Education and Encouragement materials for neighborhoods.
 - Works with Joshua Mello in Planning

- Meets with staff in Public Services department to identify easy places for sidewalks.
 - Participates in MPOs ped/bike advisory committee, which makes recommendations on ped/bike projects. Because each jurisdiction funds its own projects, the recommendations are “advisory” and not used to spend regional funds. Priority projects are listed at the local level.
2. What are the things you see as most useful for walkability?
- The signage plan that is in-process. The plan will include way-finding and destinations signs, street signs.
3. What are the things that have a negative impact on walkability?
- Need Ped heads at crosswalks.
 - The City is bisected by major roads that are barriers, e.g., Carolina Beach Road between Shipyard and 3rd Street – 45 mph with some sidewalks, but mostly dirt paths.
 - Need to complete missing sidewalks.
 - Need mid-block crossing @ neighborhood streets where the cross city trail is.
 - Need sidewalks from places people walk to from their neighborhoods, e.g., Wrightsville Avenue (County Club neighborhood) is not walkable because there are no sidewalks. Lots of older people live there. There is some internal circulation, but no connection to the nearby park.
 - No historic preservation staff to oversee the downtown district.³
4. How walkable are most City parks?
- OK. Access will improve with build-out of Cross-City Trail, as it will connect 6 parks and 5 schools, UNCW and 3 neighborhood shopping centers.
5. What would you like to get from the Pedestrian Master Plan?
- Changes to policies that inhibit walkability, such as

³ No public spaces manager, such as exists in Washington, D.C.

- i. The loophole that waives sidewalks from a new development if a storm water retention pond is built.
 - ii. Developments on corners are only required to build on 1 street, not all streets
 - iii. No pedestrian circulation plan for developments – only a sidewalk along the street and in front of retail stores.
- A policy that any new development built across the cross city trail must build the trail
- A greenways map that includes
 - i. Portion of the East Coast Greenway and the connections to it from Wilmington
 - ii. the River to Sea trail
 - iii. Cross City Trail
- Sidewalks on Wrightsville Avenue between downtown and College Road
 - i. Students cannot walk to businesses along Wrightsville Avenue because there are very, very few sidewalks.
- More connections from neighborhoods to the Cross City Trail. Traffic Engineering can help make this happen. The public will want the connections.

Cape Fear Public Transportation Authority (WAVE Transit)

April 7, 2008

Albert Eby	Director	910-202-2035
Matthew Kunic	Planner	910-202-2057

1. Briefly describe what your role in helping to create a more walkable city.
 - City and County bus systems combined in 2004, based upon a 5-year plan resulting from the merger. Now, operates as a separate transit authority serving both. Result is a more efficient service, with fewer stops – better spaced. Short term plan is at: http://wmpo.org/PDF/2004_WAVETransit_Short_Range_Plan.pdf

- Restructured bus routes took effect on March 31, 2008. Service was expanded in the County and the north end of the City to new apartment and condo complexes.
- Local newspaper articles on the changes are at:
<http://www.starnewsonline.com/article/20080407/NEWS/804070348/-1/xml>
http://wwaytv3.com/wave_transit_kicks_off_new_routes_schedules_with_free_fare_day/03/2008
- Temporary center transfer location includes is on-street with shelters, passenger waiting area.
- Same amount of service – just redistributed.
- Some bus stops were eliminated. Stops with highest use and customer comment were kept. Stops that were too close together were consolidated. Standard of ¼ mile maximum distance between stops. Stops at generators such as the hospital were maintained.
- New administrative center/Central Station to be constructed a couple blocks away will have a covered bus passenger area, restrooms, real-time bus arrival information⁴, etc.
- All signs were replaced with new WAVE Transit signs. Bus schedule information is not posted at stops.
- Service included in 5-year plan for which funds were not available include:
 - Airport Shuttle
 - Southern Beaches
 - _____Neck
- Contract service to UNC Wilmington
 - Provides transportation for students living within 1 mile of campus
 - No parking zone within 1 mile radius around UNCW; no cars on campus between 7:00 am and 4:00 pm (need to confirm this).

⁴ Currently, real-time bus arrival information is available for 3 bus routes. Customers can check on-line (via a desktop computer or a PDA). Dispatchers use the system to manage bus service.

- More information on UNCW bus service is at:
http://www.uncw.edu/ba/parking_trans/parkandride.htm
2. In general, how accessible are WAVE stops? How accessible are they for your customers with disabilities?
 - Over 50% of the stops do not have sidewalks. Sidewalks are harder to get in the County, as the development standards do not require developers to install stops.
 - Customers with disabilities who cannot access their bus stop are offered paratransit service.
 - WAVE does work pro-actively with the City to install sidewalks, but WAVE has no authority or funding to install better access to bus stops.
 - WAVE maintains bus stops with amenities such as shelters and trash cans. The City does the same for a few stops, but most bus stop maintenance is the responsibility of the property owner of the property on which the stop is located.
 3. How do you manage bus stops? Do you have a bus stop inventory program? So you have standards for location and amenities?
 - WAVE has 300 bus stops. Transit systems has an inventory (note: inventory never received)
 4. What is your relationship with the City of Wilmington to improve access to bus stops?
 - Community telephone survey in 2007 –
 - Designed to learn what transportation improvements people want and if they are willing to pay additional taxes to get it. Public transportation included, e.g., “What would make you more inclined to ride the bus?”
 - 1154 responses
 - Hope to get federal or state funding to add sidewalks, e.g., New Freedom grant program.
 5. How would you describe the general approach/attitude of the development community in Wilmington towards creating a more walkable City? Do developers automatically include adequate pedestrian facilities? Are they amenable to design changes to accommodate pedestrians?

- Not involved with route/stop planning with new developments.
- Learn of project after approval/build-out.

6. What would you like to get from the Pedestrian Master Plan?

- Funds to install more sidewalks
- More user-friendly service
- Implement more of the service identified in the short range plan.
- Increase the percentage of choice riders. Currently only at 10 to 15%.
- More information is included in their annual report at:

http://www.wavetransit.com/07_Annual_Report.pdf

Wave Transit Community Attitude Survey

A communitywide public attitude survey administered by the UNCW Department of Public and International affairs has given the Authority a great barometer of the how Southeastern North Carolina residents feel about public transportation. In early 2008, the Authority plans to present the findings and analysis of the survey to local elected officials. The survey sought public attitudes on items ranging from public perception, to use of the system, to funding transit initiatives in the area.

New Hanover County Public Schools

Bill Hance	Planning, technology & operations	910-763-5431
Carmen Gintoli	Facilities planning	910-254-4325
Ken Nance	Transportation	910-254-4285
Kiersten Wildeboer	Health & drivers' ed	910-254-4173

Ken Nance

4-9-08

1. Briefly describe what your role in helping to create a more walkable city.

City's Sidewalk Committee just formed and Ken is a citizen appointee to the committee. The committee is determining priorities for new sidewalk installation. The City has an interest in

providing sidewalk access to schools. However, he understands that sidewalks are expensive to build.

Ken is the assistant director of transportation for the NHCPS's transportation office, he supports this, as it will eventually reduce operating costs for busing kids to school. He represents the schools on the Cape Fear Breeze employer group.

<http://www.capefearbreeze.com/Default.htm>

2. In general, how accessible are New Hanover County Public Schools for kids walking or biking to school?

Sidewalk access to schools is limited. Most kids take the bus to school or are driven to school. Very few walk or bike to school. Riding the bus is preferable to being driven.

3. Do you have a SRTS program? If so, what impact has it made?

Ken is not involved with SRTS efforts. The NHCPS does not have a SRTS person.

4. What is your relationship with the City of Wilmington to improve access to schools?

Through his participation with Cape Fear Breeze – involved with non-motorized transportation indirectly.

Even if developers install sidewalks, someone needs to maintain them. This is the issue.

5. How would you describe the general approach/attitude of the development community in Wilmington towards creating a more walkable City? Do developers automatically include adequate pedestrian facilities? Are they amenable to design changes to accommodate pedestrians?

Does not know.

6. What would you like to get from the Pedestrian Master Plan?

More sidewalks so kids can walk to school safely and reduce dependence on being bused.

Carmen Gintoli

April 11, 2008

1. What is your relationship with the City of Wilmington to improve access to schools?

Work with the City in 2 ways:

- a. City requires the school system to upgrade/restore sidewalks around the perimeter of a school when renovating it. Last new school built in the City was in 1997. No more room; an elementary school requires 17 acres; middle and high schools require more.
 - b. Attend TRC meetings when a development is proposed that impacts schools. Schools request to mitigate impact. The City decides what developer does or does not provide.
2. How would you describe the general approach/attitude of the development community in Wilmington towards creating a more walkable City? Do developers automatically include adequate pedestrian facilities? Are they amenable to design changes to accommodate pedestrians?

See answer in 1b above.

Also – not a guarantee that school system’s requests will be given. Developers only talk with the school system in the TRC process. It is through the TRC process that the school system learns of the developer’s plans.

In some cases, the County requires developers to provide set aside for land to build a new school or expand an existing school. The County also has a mechanism for developers making a cash contribution for improvements to schools needed to accommodate projected enrollment from the development. For example, one developer provided \$2M over a 10 year period for a 2000 household development. This is a relatively new requirement. Chris O’Keeffe from the County Planning Office can provide more information. Not aware that the City does the same.

3. Do you have a SRTS program? If so, what impact has it made?

Not aware of a safe routes to schools program.

For new or renovated schools, on-site circulation is reviewed by NCDOT.

The school systems policy/practices for internal circulation are:

- Non-motorized is separated from motorized.
- ESs and MSs have 2 parking lots – 1 for visitors and 1 for faculty and staff
- An ADA accessible pathway is striped in each parking lot, but no other sidewalks or pedestrian facilities are provided.

- Each school has a bus drop off facility
 - Sidewalks are in a greenbelt and students only cross the front driveway to get into the school. A speed hump is used to calm traffic. It is level with the sidewalk at the highest point, 8' to 10' wide and painted.
4. What would you like to get out of the Pedestrian Master Plan?

Wants to support pedestrian access, but needs City assistance in doing so.

SUPPLEMENTAL POLICY INFORMATION

Crosswalk Marking Research and Crosswalk Marking Policy Implications

Introduction

Planning for Pedestrians

Walking is the most basic form of travel. The pedestrian is also the most challenging transportation user to successfully design for. Most able bodied pedestrians can travel anywhere (e.g. crossing mid-block, through vegetated areas, or diagonally across an intersection). The lack of pedestrian facilities (sidewalks, shoulders, signals, etc) is an inconvenience often overcome by necessity. The pedestrian's mobility allows them to take the most direct route to save time and energy. Pedestrians are also reluctant to take out of the way routes as they are the slowest mode of travel. Unlike



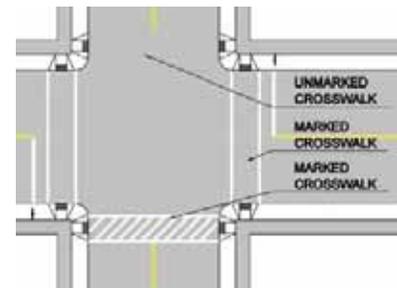
Winter Park Elementary School generates regular pedestrian traffic at this marked crosswalk location where the sidewalk network is incomplete on S. McMillan

motorists, who are restricted to roadways, it should be assumed that pedestrians will walk almost anywhere whether or not dedicated pedestrian infrastructure is present.

This paper examines the issues related to pedestrian crosswalks and provides recommendations for the city to improve accommodations for residents and visitors. Research indicates that a lack of pedestrian facilities makes walking less attractive and decreases pedestrian safety. The recommendations overview below is followed by a discussion of research on crosswalk marking, an overview of current NCDOT and city crosswalk marking policy, and finally detailed recommendations for improving crosswalk related policy in Wilmington. The research should be viewed as complimentary as each successive research project built upon the previous research. The earliest research controlled for few variables limiting its applicability, while recent research assessed multiple variables allowing the development of detailed crosswalk marking recommendations that are being applied at a national level.

Pedestrian Rights While Crossing the Street

Pedestrian travel requires crossing roadways. Due to the pedestrian’s slower speed, inherent vulnerability and conflicts with motor vehicles, the majority of pedestrian injuries and fatalities occur while crossing the road. North Carolina law⁵ recognizes this problem by providing the pedestrian the right to claim the right-of-way at all intersections unless they are controlled by traffic signals or specifically prohibited with signs.



Example of legal marked and unmarked pedestrian crossings

Pedestrian crossings at intersections without painted lines or other markings are known as unmarked crosswalks. Similar to marked crosswalks, drivers are required by law to yield to pedestrians within unmarked crosswalks. Marking crosswalks alerts motorists to locations where they should expect pedestrians and shows pedestrians a preferred crossing location.

Recommendations Overview

The list below highlights recommendations for improving crosswalks within the city. For a more detailed discussion, please see the section Crosswalk Recommendations at the end of this paper.

- Develop and adopt crosswalk marking guidelines
- Modify standard design details to show pedestrian accommodations
- Modify current high-visibility marking design to reduce maintenance

Background

Safety and Effectiveness of Marking Crosswalks

Over the last 35 years, a number of research studies have looked at the safety implications of marking crosswalks at controlled crossings (stop sign or signal) versus uncontrolled crossings. Some studies have also attempted to identify how other variables such as vehicle volume, speed, crossing distance, motorists behavior, and pedestrian behavior should influence the decision to mark crosswalks.

⁵North Carolina Law 20-155. Right-of-way. (c) The driver of any vehicle upon a highway within a business or residence district shall yield the right-of-way to a pedestrian crossing such highway within any clearly marked crosswalk, or any regular pedestrian crossing included in the prolongation of the lateral boundary lines of the adjacent sidewalk at the end of a block, except at intersections where the movement of traffic is being regulated by traffic officers or traffic direction devices.

Research to date indicates marking crosswalks has the following results:

Marking crosswalks at controlled crossings

- Increases motorist awareness of pedestrians.
- Does not significantly increase or decrease pedestrian crash rates.
- Encourages pedestrian use and enables engineers to channelize pedestrians to locations where they are most visible to approaching motorists (i.e. in front of stopped vehicles at intersections instead of between).

Marking crosswalks at uncontrolled crossings

- Increases motorist awareness of pedestrians.
- Neither increases nor decreases pedestrian crash rates for two-lane crossings.
- Potentially increases pedestrian crash rates for crossing more than 2 travel lanes if other devices are not implemented in conjunction with the marked crossing depending upon vehicle volumes and speeds.

Analysis of Significant Crosswalk Research

To assess existing City of Wilmington and NCDOT crosswalk marking policies, the major crosswalk studies completed since 1972 were reviewed to determine the limits of the research and to synthesize their findings as they relate to developing policies for marking crosswalks.

Pedestrian Crosswalk Study: Accidents in Painted and Unpainted Crosswalks, City of San Diego Study 1972

This study was the first major study of pedestrian safety at uncontrolled crossings. For the first phase of the study, the author analyzed crosswalk crash data covering a five-year period at 400 intersections. Only four-leg perpendicular intersections with two-way main road traffic were analyzed. A second phase of the study involved the collection of 24-hour pedestrian counts and vehicular counts at 40 of the 400 intersections to enable calculation of exposure risk while analyzing 5-years of crash data for each intersection.

Study Limitations:

- Results applicable only to uncontrolled intersections as signal and stop intersections were not studied.

- Pedestrian behavior was not recorded. Conclusions regarding pedestrian behavior were hypothesized based upon crash statistics and pedestrian counts.
- Motorist behavior was not recorded. Author did not attempt to hypothesize motorists behavior (i.e. failure to yield, speeding, passing stopped vehicles, etc.)
- No control for the following critical variables:
 - number and width of travel lanes (and corresponding pedestrian crossing exposure)
 - vehicle volumes
 - vehicle speeds
 - crosswalk design (i.e. ladder style or parallel lines)

Study findings supported by study data:

- Highest percentages of accidents involved persons under age 14 (32%) and persons over age 70 (21%).
- Highest percentage of accidents was between 5 and 7 p.m. (24%).
- Pedestrians were twice as likely to be struck in a marked crosswalk versus an unmarked crosswalk:
- Pedestrian crashes in marked crosswalks were higher than in unmarked crosswalks by a 6 to 1 ratio
- Pedestrians utilized the marked crosswalk by a ratio of almost 3 to 1 over unmarked crosswalks.
- Highest percentage of pedestrian crashes occurred while pedestrian was finishing crossing (36%).
- Lowest percentage of pedestrian crashes occurred while pedestrian was beginning crossing (9%).
- Only three percent of crashes involved a turning vehicle.

Study findings not supported by study data:

- Pedestrians have a “false sense of security” at marked crosswalks.

- Pedestrians engage in risky behavior at marked crosswalks indicated by far side crashes.

Discussion of study limitations and findings:

The study author's conclusion that marked crosswalks "may cause pedestrians to have a false sense of security and to place themselves in a hazardous position with respect to vehicular traffic" is not supported by the collected data.

As the author did not collect data on pedestrian behavior, the author apparently came to this conclusion based upon the fact that pedestrians were almost three times likely to be struck in a marked crossing. Since the analysis did not divide the different accident rates with vehicular volume, speed, and travel lanes crossed, this generalized statement may not be true for all uncontrolled crossings. The author did not assess motorist behaviors such as passing a stopped vehicle, failing to yield, speeding, etc. The author's conclusions place an extraordinary burden on the pedestrian that is not supported by law.

The locations pedestrians were struck does not prove they suffered from "a false sense of security". Only six percent of the pedestrians were struck as they began crossing the roadway. This small percentage of crashes may have been caused by pedestrians who were not paying attention or may have had a false sense of security. Given that this is a small percent, it is not appropriate to apply this finding to all pedestrians.

The majority of the pedestrians (94%) were struck within the crosswalk, with 36% struck while finishing their crossing. This data does not support the hypothesis the pedestrians had a false sense of security. This data more likely indicates the pedestrians had trouble judging gaps, were impatient waiting for gaps (i.e. ran across road), were in multiple threat situations where a vehicle hit them by passing another stopped vehicle, or motorists failed to yield the right-of-way as required. The author failed to consider the motorists role in these crashes as it could be easily surmised the motorists failed to understand their duties to give the right-of-way to the pedestrian once they were within the crosswalk. The lack of data indicating the number of travel lanes crossed is a critical factor that was overlooked in this study.



Pedestrians crossing Castle Street at 6th Street in middle of intersection looking at oncoming traffic

Pedestrian Crosswalk Case Studies, FHWA Study 2001

This study analyzed the effect of crosswalk markings on driver and pedestrian behavior at uncontrolled intersections. The study utilized a before/after methodology at eleven intersections in four cities to determine:

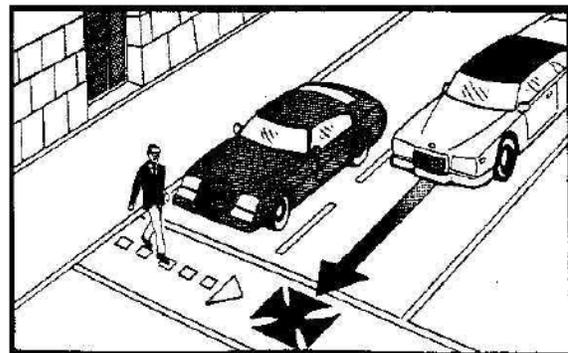
- Whether pedestrians were more likely to cross a street within a marked crosswalk
- Whether drivers operate slower and/or yielded more often to pedestrians crossing at a marked location
- Whether pedestrians use more, less, or the same amount of caution when crossing at a marked pedestrian crosswalk compared with an unmarked location

Study findings supported by data:

1. Pedestrian scanning for traffic increased 3-10% after installation of marked crosswalks.
2. Motorist awareness of pedestrians increased after installation of marked crosswalks, as indicated by the reduction in speed of vehicles approaching a pedestrian in a crosswalk.
3. Marking crosswalks neither improved nor degraded motorists yielding behavior.
4. Marked crosswalks attracted pedestrians walking alone (increase from 7-17%) to cross within them.
5. Marked crosswalks do not have a significant impact attracting groups of pedestrians to cross within them.

Discussion of study limits and findings:

This study only focused on lower volume (approximately 10,000 ADT or less) roadways with no more than 2 travel lanes. The study results should not be applied to multiple threat conditions found on roadways with four or more lanes of traffic. The study also did not assess roadways with posted vehicle speeds over 30 MPH. The study supports marking crosswalks on lower speed, two lane roadways at uncontrolled crossings.



Multiple-threat graphic detailing how pedestrians are struck on multi lane roads by car passing stopped vehicle from FHWA 2005 Study.

Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations, FHWA Study 2005

This study analyzed five years of pedestrian crash data at 1,000 marked and 1,000 unmarked crosswalk locations at comparable uncontrolled locations (i.e. traffic volume, pedestrian exposure, number of lanes, median type, speed limit). The study did not analyze pedestrian or motorists behavior but did describe causes of crashes based upon the crash reports. Sample pedestrian and vehicle counts were developed for each location to calculate relative exposure.

Study findings which are supported by data:

1. On two-lane roads, marked crosswalks alone were no safer than unmarked crosswalks.
2. On multi-lane roads, without raised medians, and under 12,000 vehicles per day, marked and unmarked crosswalks provided the same amount of protection.
3. On multi-lane roads, with raised medians, and under 15,000 vehicles per day, marked and unmarked crosswalks provided the same amount of protection.
4. On multi-lane roads, with or without raised medians, and over 15,000 vehicles per day, a marked crosswalk by itself, without other safety enhancements, was associated with greater pedestrian danger.
5. The presence of a raised median provided significantly greater protection on multi-lane roads compared to no median.
6. No correlation between crosswalk condition and pedestrian crashes.
7. Pedestrian counts showed that 66.1% of pedestrians crossed at marked crosswalks compared to 33.9% at unmarked crosswalks.
8. On multi-lane roads, 81.3% of older adults and 76% of young children crossed in marked crosswalks.

Discussion of study limits and findings:

The author was careful to conclude that “When considering marked crosswalks at uncontrolled locations, the question should not simply be: ‘should I provide a marked crosswalk or not?’ Instead, the question should be: ‘Is this an appropriate tool for getting pedestrians across the street?’ Regardless of whether marked crosswalks are used, there remains the fundamental obligation to get pedestrians safely across the street.”

The findings in this report provide further context to the findings of the 1972 crosswalk study - uncontrolled crossing with marked crosswalks alone on higher volume, multi-lane arterials place increase the likelihood pedestrians will be injured. The author was clear in recommending additional engineering treatments (signal, medians, active warning signs, etc) on multi-lane

roadways over 12,000 ADT are necessary for pedestrians to safely cross the roadway – not just recommending the elimination of the crosswalk.

The study did not encompass a wide range of pedestrian crossing treatments for multi-lane roadways so it was not possible to develop warrant criteria for specific treatments (i.e. raised crossings, flashing signs, etc.). The study was also limited by the fact that 93% of the crossings analyzed were on roadways with speed limits between 25 to 35 MPH which limits the studies applicability to developing recommendations based upon a roadways speed limit. The results of this study have led to the development of specific guidance language for marking uncontrolled marked crosswalks proposed for the next edition of the MUTCD.

Crosswalk Markings and the Risk of Pedestrian-Motor Vehicle Collisions in Older Pedestrians, Journal of American Medical Association Report, Nov. 2002

This observational study assessed urban marked and unmarked crosswalks at approximately 800 controlled (stop or signal) and uncontrolled locations. The control broke down as follows:

Control Type	Number	Percent
Signal	406	51%
Stop	134	17%
Uncontrolled	254	32%
Other	5	<1%

The study adjusted for traffic volume, speed, travel lanes, crosswalk type (parallel line, high visibility) and crosswalk condition, presence of pedestrian refuge islands, pedestrian age, and pedestrian volume.

Study findings which are supported by data:

1. 300% increase in risk for pedestrians at locations where crosswalks were faded or worn.
 - Indicates need to maintain crosswalk markings.
 - Indicates crosswalk markings have an awareness effect.
2. Minimal difference in pedestrian risk found for marked or unmarked crosswalks located at signal or stop control locations.

3. Approximately four times increased pedestrian risk at locations where crosswalks were marked at uncontrolled locations when not adjusted for crossing distance, vehicle flow, and pedestrian age.
4. Approximately two times increased risk at locations where crosswalks were marked at uncontrolled locations when adjusted for crossing distance, vehicle flow, and pedestrian age.
5. Of the 406 traffic signalized intersections, 95% of the traffic signals had pedestrian signal heads installed.

Discussion of study limits and findings:

These results, show a 3.6 times greater risk of crash for pedestrians crossing at uncontrolled crossings adding, support for the findings of the 1972 study showing a six-times greater risk of crashes. This is the most comprehensive study found to date that included controlled intersections (signal and stop) as part of the analysis. The analysis of the pedestrian/vehicle crashes was limited to pedestrians over 65 years old; therefore there may be limits to the applicability of these findings to other age groups. It is important to note however, that older pedestrians are a known high-risk group for crashes and injuries.

Implications of Research on Commonly Held Crosswalk Safety Theories

Theory #1: Marked crosswalks create a “false sense of security”

Throughout the country, many agencies and engineers are reluctant to install marked crosswalks at controlled (stop, yield, or signal) and uncontrolled locations. This is primarily due to a misinterpretation of a groundbreaking 1972 study⁶ of uncontrolled crossing locations in San Diego, California. This study only analyzed uncontrolled crosswalks and did not take into account variations in traffic conditions and roadway geometry. *Therefore this study and its conclusions do not apply to controlled marked crosswalk locations.*

Unfortunately, due to failures to understand the context and limits of the 1972 crosswalk study, this study has been cited to prove the perception that marked crosswalks increase pedestrian risk taking and create a false sense of security.

⁶ Herms, Bruce. 1972. Pedestrian Crosswalk Study: Accidents in Painted and Unpainted Crosswalks, Transportation Research Record No. 406, Transportation Research Board, Washington, DC.

The FHWA 2001 study found that pedestrians scanned more for oncoming traffic in marked crosswalk versus unmarked crosswalks. This is indicative of more cautious rather than less cautious behavior. These studies show that it is not appropriate to classify all pedestrians as having a “false sense of security” while in a crosswalk.

Theory #2: Crosswalks should only be installed where “warranted” based on pedestrian volume to maintain motorist awareness

There is no legal difference between marked crosswalks and unmarked crosswalks at intersections. The majority of traffic engineering is arranged around the concept of meeting warrants to justify need. Unfortunately, developing warrants to prove pedestrian need for facilities is not a simple task. Therefore most agencies are moving towards land use policies for pedestrian accommodation restricting the use of warrant for pedestrian crossing signals. The pedestrian-only traffic signal (a signal to stop traffic - not a pedestrian signal head) is the only existing warrant within the MUTCD specific to pedestrians.

NCDOT has developed a midblock-uncontrolled crossing warrant to justify marking crosswalks. This warrant is based upon the 2005 FHWA uncontrolled crossing study with the exception of the pedestrian volume. The 2005 FHWA study did not recommend any pedestrian volume warrants.

There is no evidence from research that marking crosswalks reduces their effectiveness for promoting motorists to yield for pedestrians or that marked crosswalks lose credibility to motorists if pedestrians are not routinely present. The 2001 FHWA study of behavior showed that motorist behavior neither improved nor degraded when crosswalks were marked.

Theory #3: Crosswalks should be installed at all legal crossing locations as they encourage pedestrians to use them and they protect the pedestrian

The 1972 study, 2001 study, and 2005 study showed that marked crosswalks were effective at attracting pedestrians to utilize them. These studies show that where it is important to channelize pedestrians for their safety, a marked crosswalk is a useful tool for the engineer.

The marking of the crosswalk alone at uncontrolled crossings should be done carefully in accordance with the findings of the 2005 study when applied to uncontrolled crossings of multilane roadways with speeds over 40 mph. These roadways will require additional engineering treatments to supplement the marked crosswalk.

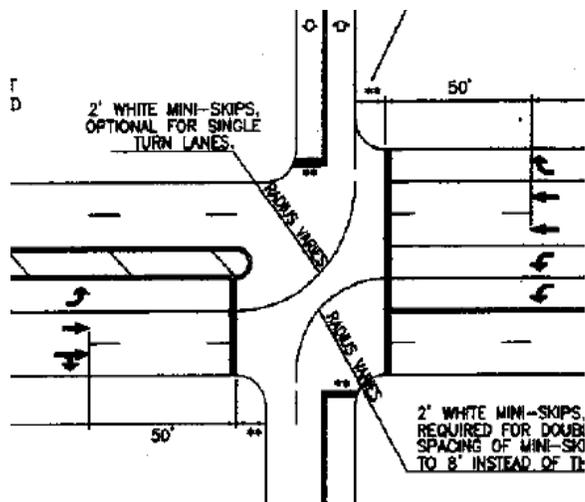
The research does provide evidence marking crosswalks at controlled (stop or signal) intersections degrades pedestrian safety or motorist respect for pedestrians regardless of volume (vehicle or pedestrian), width, or speed of the roadway.

Current Policy and Practice

Existing City of Wilmington Policies

Existing policies are informal and not in writing. The informal policy generally follows the following practices:

- Crosswalks are marked at controlled locations only when there is a demonstrated pedestrian demand of one pedestrian present per signal cycle.
- Marked crosswalks are only installed in combination with pedestrian signals and pushbuttons.
- The marked crosswalks are generally placed where the crossing conflicts least with turning traffic.
- Marking crosswalks across all legs of an intersection is rare except in the downtown area.
- Stop bar placement varies:
 - Stop bars are typically set back on local streets beyond the sidewalk or pedestrian crossing area
 - At some locations the bar is placed within the pedestrian crossing area (College Road, Eastwood Road, Wrightsville Avenue)
- Standard details for intersection design do not show crosswalks or sidewalks to provide guidance on stop bar or signal detection placement.



City of Wilmington controlled intersection detail does not provide crosswalk marking guidance and is identical to NCDOT standard details for signalized intersections

Existing NC DOT Policies

Pedestrian Policy Guidelines:

- Requires Wilmington to ask for pedestrian facilities on NCDOT roadways.
- No written guidelines for marking crosswalks at signalized or stop control intersections.

- Requires Wilmington to match 40% - 50% of project cost [verify] for new projects.
- Stop bar placement varies but typically set back on 10-15 feet from intersection.

NCDOT STANDARD PRACTICE C-36 For Crosswalks – Mid-Block (Unsignalized) Signing

- Requires engineering study.
- Should not be installed on roadways with a speed limit greater than 35 MPH.
- Should not be located within 300 feet of a non-signalized intersection and 400 feet of a signalized intersection.
- On street parking spaces should be eliminated no less than 50 feet on each curbside approach lane to the mid-block crosswalk and no less than 25 feet on each curbside exiting lane
- Installations of refuge or safety islands should be installed for mid-block crosswalks on multi-lane roadways if sufficient roadway width is available
- Mid-block crosswalks should not be installed on streets with an ADT volume exceeding 12,000 vehicles per day. If a raised pedestrian refuge median is provided the ADT should not exceed 15,000 vehicles per day.
- A minimum pedestrian crossing volume of 25 pedestrians per hour for at least four hours of a typical day should be met in order to warrant a Mid-Block Crosswalk.
- Provide raised median pedestrian refuge at mid-block crosswalks where the total crossing width is greater than 60 feet
- Use high-visibility (ladder-style) crosswalk markings to increase visibility longitudinally.
- Provide advance stop or yield lines to reduce multiple threat collisions.
- Provide advanced crosswalk warning signs for vehicle traffic.
- Use curb extensions to increase the visibility of the driver and the pedestrian.
- Utilize Z crossing configuration to require pedestrian to face oncoming traffic.

State of the Practice

The Manual on Uniform Traffic Control Devices (MUTCD) – Section 3B.17

The *MUTCD* states “Crosswalk markings provide guidance for pedestrians who are crossing roadways by defining and delineating paths on approaches to and within signalized intersections, and on approaches to other intersections where traffic stops.”

It further states that “crosswalks should be marked at all intersections where there is substantial conflict between vehicular and pedestrian movements.” It also states “crosswalk markings should not be used indiscriminately. An engineering study should be performed before they are installed at locations away from highway traffic signals or STOP signs.”

This has been misconstrued by some to mean that they should only be marked if there is a significant pedestrian demand. In actuality, this statement is in the *MUTCD* to advise an engineering study before marking a crosswalk at an uncontrolled location. There are no restrictions or guidelines for installing crosswalks at signalized intersections.

Pedestrian Facilities Users Guide, FHWA

The *Pedestrian Facilities Users Guide*, published by the Federal Highway Administration (FHWA) in 2002 recommends utilizing marked crosswalks to improve predictability and visibility by encouraging pedestrians to cross at locations visible to conflicting traffic. Additionally crosswalks should be located to limit exposure by routing pedestrians in as direct a manner as possible, taking advantage of crossing islands where available.

Designing Sidewalks and Trails for Access, Part II of II

The flared portion of the curb ramp does not necessarily need to be contained within the crosswalk. The majority of the examples of “Good Curb Ramp Design” included in this manual show the flared portion of the curb ramp extending beyond the marked crosswalk. The guide also recommends the provisions of crosswalk markings with edge lines to guide vision impaired pedestrians across the roadway.

Crosswalk Recommendations

Develop and Adopt Crosswalk Marking Guidelines

The City of Wilmington should adopt clear crosswalk marking guidelines for use by staff and consultants. An adopted policy will be a helpful tool for negotiations to provide pedestrian accommodations across NCDOT controlled roadways. An adopted policy will also provide a framework to assess crosswalk marking requests. It is also recommended that the City of Wilmington:

- Develop a marked crosswalk policy for stop controlled and signalized intersections that supports marking of crosswalks to channelize pedestrians.
- Adopt the NCDOT pedestrian midblock, uncontrolled crosswalk marking policy.
- Develop an uncontrolled pedestrian crosswalk marking policy that follows the guidelines outlined in the 2005 FHWA crosswalk study.
- Provide high visibility markings at all uncontrolled crosswalks and all crosswalks (including signalized or stop-controlled crosswalks) leading to a block with a school, within a designated school zone area, along a designated school walking route, on blocks adjacent to a major WAVE Transit facility, or at locations with high pedestrian activity.

Modify Standard Design Details to Show Pedestrian Accommodations

City of Wilmington standard design details should be modified to show pedestrian accommodations. The current details largely mirror NCDOT roadway designs which are not appropriate for urbanized areas. Adoption of new standard details showing pedestrian facilities will be a helpful tool for negotiations with developers and NCDOT as new roadway projects are constructed or existing roadways are reconstructed. Details showing pedestrian facilities will give more appropriate guidance to the placement of stop lines, signal detection equipment, signal control boxes, and other utilities within the pedestrian realm. Having identical details to NCDOT implies full support for the application of NCDOT roadway design standards (rural and suburban character) within the City of Wilmington (urban character).

Modify Existing Decorative Crosswalk Marking Design to Improve Visibility

High-visibility crosswalk markings are strongly preferred over decorative markings because they are easier for motorists to see. Wilmington’s policy should be modified to require crosswalks constructed of decorative materials to include 12 inch wide reflective white lines along the boundary of the crosswalk to maximize visibility. It is recommended the policy also require that the decorative surface be firm, stable and slip resistant and vertical displacement not exceed 1/4 inch, and horizontal gaps not exceed 1/2 inch per ADA requirements.



Decorative crosswalks require the solid white markings to conform to the MUTCD and to be visible to motorists

Modify Current High-Visibility Marking Design to Reduce Maintenance

The current Wilmington and NCDOT high-visibility marking

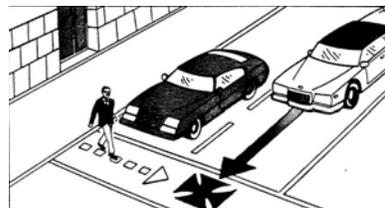
style consists of white longitudinal stripes 24 inches wide and spaced 24 inches apart bounded by 6 inch parallel white lines. This style is generally fairly visible to motorists but subject to wear by motor vehicles.

It is recommended that Wilmington utilize the flexibility provided by the MUTCD to develop a high-visibility crosswalk marking that will reduce wear of the pavement marking by motor vehicles. An example is the City of Seattle's high-visibility marking style (piano) which consists of two white longitudinal stripes eight inches wide separated by and 8 inch space. Each set of lines is separated by a space of 60 inches.

Advance Yield Lines at Uncontrolled Marked Crosswalks

Introduction

Multiple threat crashes are common on multi-lane roads when a driver in one lane yields to a pedestrian, and a driver in the adjacent lane fails to yield or stop – striking the pedestrian. These types of crashes are often fatal for the pedestrian due to the higher speed nature of the crash. Numerous studies have shown that the use of advance yield lines at uncontrolled marked crosswalks in conjunction with “Yield Here for Pedestrians” signs can reduce the incidence of multiple threat crashes.



Current Policy or Practice

City of Wilmington

The city has adopted the MUTCD which defines the placement of advance yield lines. Advance yield lines do not appear to be in use in Wilmington.

NCDOT

NCDOT has adopted the MUTCD which controls the placement of advance yield lines. Advance yield lines do not appear to be in use in Wilmington. The NCDOT Midblock Pedestrian crossing warrant specifies the use of an advanced yield line for multi-lane crossings.

The Manual on Uniform Traffic Control Devices

Section 3b.16 defines yield lines in the MUTCD. The current wording of the MUTCD implies advanced yield lines are to only be utilized for uncontrolled, midblock crossings.

Recommendations Overview

Adopt the proposed 2009 MUTCD language for placement of Advanced Yield Lines

Discussion of Existing Policies

State of the Practice

The MUTCD allows for the use of advance yield lines at unsignalized midblock crosswalks. This is in accordance with the North Carolina law requiring motorists to yield to pedestrians within marked crosswalks at uncontrolled crossings. Proposed changes to the 2009 edition of the MUTCD include improvements to the text to allow the placement of advanced yield line at uncontrolled crosswalks located midblock and at intersections.

Excerpts of proposed 2009 MUTCD language:

Section 3B.16 Stop and Yield Lines

Guidance:

Yield lines may be used to indicate the point behind which vehicles are required to yield in compliance with a YIELD (R1-2) sign or a Yield Here To Pedestrians (R1-5 or R1-5a) sign.

Yield lines (see Figure 3B-15) shall consist of a row of solid white isosceles triangles pointing toward approaching vehicles extending across approach lanes to indicate the point at which the yield is intended or required to be made.

If yield or stop lines are used at a crosswalk that crosses an uncontrolled multi-lane approach, the yield lines should be placed 6.1 to 15 m (20 to 50 ft) in advance of the nearest crosswalk line, and parking should be prohibited in the area between the yield or stop line and the crosswalk (see Figure 3B-16).

Standard:

If yield lines are used at a crosswalk that crosses an uncontrolled multi-lane approach, Yield Here To Pedestrians (R1-5 series) signs (see Section 2B.11) shall be used.

Recommendation

Develop guidelines and design details for use of advanced yield lines at uncontrolled pedestrian crossings

It is recommended that City of Wilmington develop guidelines and standard details for utilizing advanced yield lines at all multi-lane uncontrolled crossings. Advance stop bars should be allowed mid-block and at uncontrolled intersections on multi-lane roads. The adopted standard should follow the proposed language provided in the 2009 MUTCD.

The following additional criteria should be considered in the City of Wilmington to complement the proposed MUTCD language:

- The application of this treatment should only be used where a crosswalk meets the warrants of the City of Wilmington's crosswalk marking policy.
- On streets with on-street parking, it is recommended that parking be restricted near the crosswalk, and curb extensions be provided to improve sight distances between motorists and pedestrians.
- Solid lane line striping should be provided on the upstream side of the stop bar for a distance equivalent to the required stopping sight distance (i.e. 155 feet at 25 mph, 200 feet at 30 mph, 2004 AASHTO Exhibit 3-1 on level ground).
- Consideration should be given to providing an overhead pedestrian crosswalk sign on multi-lane roadways with uncontrolled crosswalks.

Leading Pedestrian Interval

Introduction

Pedestrian signals are intended to control the flow of pedestrian traffic across a roadway. They are most frequently at intersections, but they are installed at non-intersection locations as well. The most common type of pedestrian signal timing provides pedestrians with a WALK signal at the same time adjacent street vehicular traffic has a green light (concurrent phasing). At locations where there are large movements of turning vehicles, it can be difficult for pedestrians to begin crossing the roadway at the start of the walk signal as the turning vehicles are often reluctant to yield to the pedestrians. A Leading Pedestrian Interval (LPI) signal provides a two- to four-second WALK signal in advance of the green light.

Background

Since most signals are timed to provide the minimum time required for a pedestrian crossing, a delay in beginning the crossing movement may leave pedestrians trapped in the roadway or at the curb as the WALK signal changes to DON'T WALK. This places them in potential conflict with cross street traffic as it receives a green light. This may be particularly problematic if the crossing distance is long or does not provide a median refuge where pedestrians can wait for the next WALK signal. Frustrated pedestrians who are not able to cross the roadway may be more likely to take risks (crossing away from the signal or crossing on a DON'T WALK signal). In addition to the potential for a pedestrian crash, a pedestrian crossing away from the signal or on a DON'T WALK signal may increase vehicular delay.

LPI is a signal phasing strategy to improve pedestrian visibility to motorists in locations with heavy volumes of turning traffic and frequent pedestrian

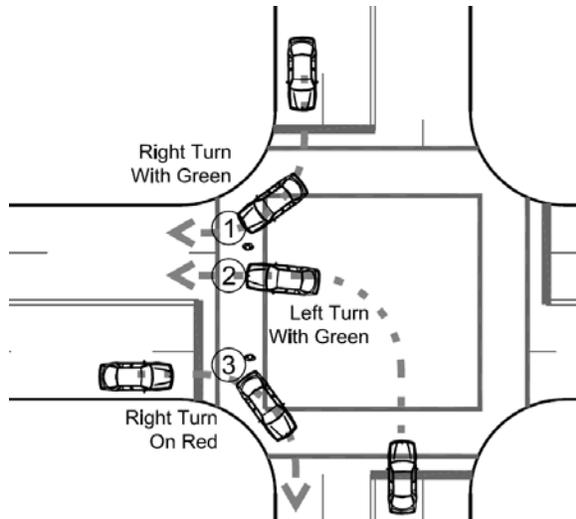


Figure 9 – There are three potential conflict points between pedestrians and motorists at a typical intersection



Figure 8 - Leading pedestrian interval provides person a head start – walk signal is given while motorists have red light

crossings. During the LPI, all motor vehicle flows are stopped for two to four seconds while pedestrians are given the WALK signal. This is designed to allow pedestrians to begin crossing in advance of vehicular turning movements which makes them more visible to motorists. The reduction in pedestrians entering the crosswalk after the signal changes may improve intersection efficiency as well as pedestrian safety. In many cases, an LPI is a simple, inexpensive treatment because the signal controller can be retimed relatively easily or programmed to operate only during peak pedestrian demand times. LPIs can be complemented by geometric design changes that shorten crossing distances which contributes to reductions in the required signal cycle duration.

Recommendations Overview

The list below highlights recommendations for implementing LPIs in the city. For a more detailed discussion, please see the section Recommendations at the end of this paper.

- Develop policy for the use of LPI at signalized intersections
- Pilot LPI in high pedestrian demand areas (such as N. 3rd St. at Chestnut St. and Princess St., and Market St. at Front St.)

Current Policy or Practice

City of Wilmington

The city currently does not have a policy on the use of Leading Pedestrian Intervals (LPI) nor is it in use anywhere in Wilmington. According to city staff, the current instrumentation is not readily capable of reprogramming with LPI due to technology limitations. However, the city will soon be upgrading signal timing equipment which will allow increased control over discrete elements of the signal operation.

NCDOT

The NCDOT currently does not have a policy on the use of Leading Pedestrian Intervals (LPI).

State of the Practice

LPIs have been used successfully for decades in the United States. They are in use in:

- Ashville, Raleigh, Charlotte, Chapel Hill, Cary
- St. Petersburg, FL
- Washington, DC

Jacksonville, NC is considering several locations around the city to pilot LPI signals. Numerous studies have confirmed that LPIs reduced right-of-way violations by turning motorists with pedestrians. LPIs are an effective treatment as they are typically low in cost yet offer much of the benefit of dedicated pedestrian signal phasing/pedestrian scramble patterns while minimizing delay to pedestrians and motorists.

The Manual on Uniform Traffic Control Devices

There is no specific language on this signal timing strategy in the MUTCD. The timing is accomplished by extending the time of the all red clearance interval while simultaneously providing the desired WALK signal. Changing this interval is allowed in the MUTCD.

Recommendation

Develop Policy for the use of LPI at Signalized Intersections

The City of Wilmington should develop a guiding policy for the use of Leading Pedestrian Intervals at signalized intersections. The city is well positioned to utilize this technique as all existing pedestrian crossings utilize the pedestrian push button to generate the walk signal. The use of this technique will:

- Improve pedestrian safety by allowing them to exert their right to cross the roadway in a safe manner
- Improve pedestrian safety by encouraging them to cross where they are most visible to cross traffic
- minimize delay to motorists as the extra time will not be called unless a pedestrian is present
- encourage use of the pedestrian push buttons as the pedestrian will be rewarded with LPI

LPIs are recommended in locations where there are frequent conflicts between pedestrians and turning vehicles at signalized intersections. In particular, LPIs should be utilized at intersections where multiple left turn lanes are provided and pedestrian phase must be concurrent with the turning vehicle phase. Where an LPI is in use, Accessible Pedestrian Signals (APS) should be provided to alert pedestrians with vision impairments that the pedestrian crossing phase has begun. Restrictions of motorists turning right-on red are also advisable to maintain the integrity of the LPI timing scheme.

Pilot LPI in High Pedestrian Demand Areas

As soon as the technology is available, Wilmington should pilot LPI signals in several high pedestrian demand areas around the city. Suggested locations should have relatively high pedestrian volumes such as areas in the historic downtown or near the University of North Carolina at Wilmington Campus.

Island Channelization and Median Pedestrian Refuges at Intersections

Introduction

Many arterial roadways have multiple lanes of traffic which require pedestrians to make long crossings. In Wilmington, it is not unusual to find arterials with eight or nine travel lanes with intersection crossing distances of 100 feet or more. Island channelization and median pedestrian refuges are two approaches that can effectively reduce the time the pedestrian is in a travel lane by dividing the crossing into shorter ‘segments.’ Instead of facing an uninterrupted stretch of asphalt from one curb to another, the islands and refuges insert places in the crossing where a pedestrian is allowed to stand outside of the vehicle travel way. These improvement approaches can make these long crossings feel more comfortable to users.

A number of research studies have shown that pedestrians receive a safety benefit from raised medians. For example, in *Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations: Executive Summary and Recommended Guidelines*, the presence of a raised median was found to improve the safety of crosswalks. This study found that there was no safety benefit from medians that were not raised. This is particularly important on roadways with more than one travel lane in each direction.

Refuge islands are also beneficial for pedestrians as they can potentially reduce exposure to motor vehicles. When utilized at signalized intersections, refuge islands separating right turn lanes from through lanes can shorten cycle lengths by reducing the pedestrian crossing time. This can be particularly helpful on roadways such as College Road where the time required to cross pedestrians exceeds the time required for motorists to clear the side roads. An example retrofit at Randall Parkway and College Road



Figure 10 – Example retrofit opportunity at College Road and Randall Parkway to shorten pedestrian crossing.

shows how a pedestrian crossing island at the right turn can reduce the required crossing time (at 3.5 ft/sec) by 13 seconds by reducing the pedestrian crossing from 145 feet to 100 feet.

At complex or irregularly shaped intersections, median refuges can provide pedestrians with a place to stop and assess the traffic pattern through the intersection.

Recommendations Overview

The list below highlights recommendations for improving push buttons within the City. For a more detailed discussion, please see the section Recommendations at the end of this paper.

- Provide Median Refuge Islands on all Roadways with 4 or More Travel Lanes
- Provide Island Channelization between Through and Turning Traffic

Current Policy or Practice

Existing City of Wilmington Policies

- Vertical curbing is required to protect median function and landscaping. Many of the existing medians in Wilmington extend this vertical curbing into the crosswalk area (marked or unmarked).
- For local streets: minimum median width - 10' face-to-face.
- For collector streets: minimum median width - 13' face-to-face, to provide for possible left turns, access cuts, etc.
- Medians are reserved for landscaping only; no decorative structures, non-traffic signs, etc. are permitted.
- Sight distance triangle standards apply based on a case-by-case review using AASHTO stopping distance information for the rated speed of the street.
- Minimum length of medians shall be 100 feet.

NCDOT

- Generally provide medians along roadways – vary from flush to raised
- Prefer flush pavement with markings to raised islands where speeds exceed 45 mph
- Section 6.5 (Crossing Distances) of NCDOT's *Guidelines for the Investigation and Remediation of Potentially Hazardous Bicycle and Pedestrian Locations* (September, 2003) states that "...it is not recommended that non-motorists be forced to cross more than three lanes at a time, including turn lanes..."

The Manual on Uniform Traffic Control Devices (MUTCD)

Adequate roadway capacity should be provided at a signalized location. Before an intersection is widened, the additional green time pedestrians need to cross the widened roadways should be considered to determine if it will exceed the green time saved through improved vehicular flow. (Section 4B.05 Adequate Roadway Capacity).

Discussion of Existing Policies

The guidelines and policies established by NCDOT, Wilmington, and AASHTO allow for the use of medians. The NCDOT guidelines establish medians of sufficient width to provide pedestrian refuge (i.e. minimum 6 feet at the crossing).

Channelizing islands and medians can also be used in conjunction with other measures to reduce vehicle turning speed. Slower turning vehicles provide more time for pedestrians to cross and are easier for pedestrians to anticipate. Additionally, slower turning vehicles allow drivers increased reaction time and are easier to stop or slow down when necessary. All of these factors have the potential to benefit pedestrians through safer and more comfortable crossings and increase driver rates of yielding to pedestrians in the crossing.

State of the Practice

ITE's Context Sensitive Solutions in Designing Major Urban Thoroughfares for Walkable Communities provides some guidance on the use of medians for pedestrian refuge (2006):

- On multi-lane thoroughfares, medians are important to aid pedestrians in their crossings. Even a narrow median of 6 to 8 ft. can be more desirable to a crossing pedestrian than the same width added to another element of the thoroughfare.
- At intersection crossings, extend the median nose beyond the crosswalk to provide an enclosed pedestrian refuge.
- Avoid providing overly wide medians at the expense of unreasonably narrowing the roadside. In urban contexts, roadsides of appropriate widths should take higher priority than wide medians. However, the design needs to balance the safety, operational, and pedestrian needs of the street.
- In contrast to medians in rural areas, in urban areas the width of medians at intersections should only be as wide as necessary to provide the desired function (such as pedestrian refuge), otherwise the intersection loses operation efficiency and vehicles crossing the median may use the width inappropriately (side-by-side queuing, angled stopping, etc.).

- If the median will not be landscaped, consider using pavers, colored stamped concrete, stone, or other contrasting material to create visual interest and an aesthetic appearance.
- The guidelines further recommend 6 feet as the minimum width for a median that serves as a pedestrian refuge, with a recommended width of 8 feet.

Multiple Median Islands

Figure 2 at right depicts the use of multiple medians in Washington, DC. At this busy intersection, medians have been installed on both sides of traffic turning left from New York Avenue (east-west) onto Bladensburg Road (north-south). For pedestrians, this provides two locations to stand outside of the vehicle travelway while crossing New York Avenue. This allows pedestrians to make this crossing more comfortably, especially if they are forced to interrupt their crossing due to insufficient time.



Figure 2 – Dual median islands on New York Avenue at

Note also the use of colored surface treatments on the islands to make them more noticeable to both drivers and pedestrians. This is also designed to improve the overall aesthetic of the streetscape in this vicinity.

Recommendation

Provide Median Refuge Islands on all Roadways with 4 or More Travel Lanes

It is recommended that Wilmington require pedestrian refuge islands to limit crossings to no more than three travel lanes.

At intersections, medians provide effective refuge for pedestrians when the median nose extends beyond the crosswalk. An accessible route through the median is required for pedestrians, either through the use of curb ramps, or a cut-through. Wilmington should work with NCDOT to retrofit multilane arterial intersections with channelizing traffic islands to separate right turning lanes from through lanes to shorten crossing distances. This would also allow for reduced traffic signal cycle lengths as the pedestrian crossing time may be shortened. Wilmington should develop standard detail drawings that show an urbanized, preferred design which provides the following:

- Provision of raised medians on all roadways with four or more through travel lanes. Minimum width should be six feet to accommodate pedestrians and eight feet to accommodate bicyclists.
- Pavement level cut-throughs or ADA compliant curb ramps should be installed leading to all crosswalks to ensure accessibility.
- An approach that is offset from the edge of the traffic lane and appropriately treated with signage, markings or other treatments to provide motorists with sufficient warning of the island's presence.

Provide Island Channelization between Through and Turning Traffic

- An option for shortening pedestrian crossings is to separate left turn and through lanes to allow trapped pedestrians a place to wait and to limit last second lane changes by motorists

Wilmington should develop policies and design guidance for reducing turning vehicle speed while enhancing pedestrian visibility to motorists. Wilmington should work with NCDOT ensure various speed reducing features when median islands (“porkchops”) are installed on multilane arterials. Wilmington should develop standard detail drawings that show an urbanized, preferred design which provides the following:

- Turning radii and 55-60 degree approach angle that will require slower vehicle turning speeds.
- Implementation of raised crosswalks across the slip ramp approach to require slower speeds and to promote yielding to pedestrians.

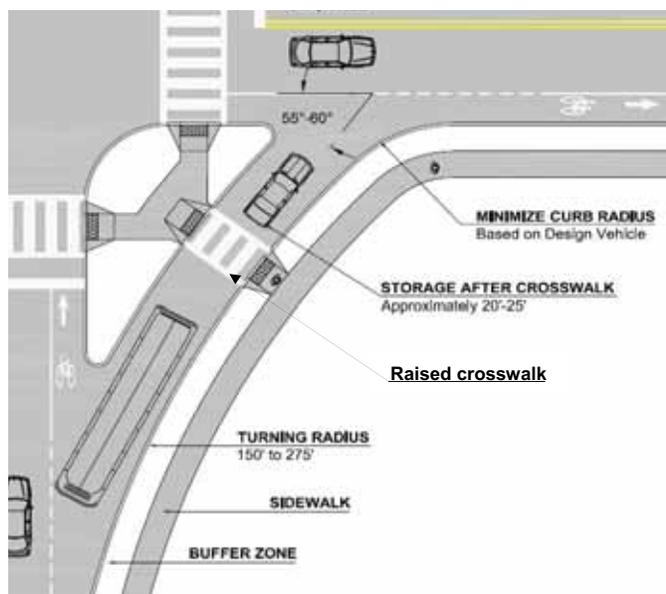


Figure 3 – Example of a slip design that can shorten pedestrian crossings of wide roadways and minimize high speed right turns and promote motorist yielding for pedestrians. Source: Maryland SHA

- Consider allowing yield control right turns for motorists to improve intersection capacity and reduce need for long right turn lanes (utilize only if raised crosswalk is implemented).

Turning Radius and Intersection Size

Background

The intersection of two roadways requires construction of curves (designated by a curb radius) to allow vehicles to maneuver while turning without driving over the curb line or entering into opposing travel lanes. Large curves are utilized to allow larger vehicles (such as trucks) to turn within the roadway and/or to allow smaller vehicles to turn at higher speeds. Larger curves require more land and lengthen pedestrian crossing distances. The required curb radius for a vehicle to make the turn is known as the effective curb radius. Oftentimes, this differs from the actual constructed curb radius. When roadways are constructed without consideration of the actual required turning radius of the vehicles utilizing them, the curb radius may be constructed to be larger than necessary which lengthens pedestrian crossing distances and increases vehicle turning speeds.

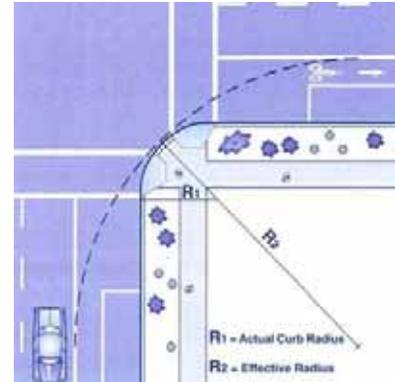


Figure 11 – Illustration of actual curb radius vs. effective curb radius from Oregon Pedestrian and Bicycle Design Guide.

Recommendations Summary

- Allow Flexibility in Choosing Appropriate Curb Radii
- Specify Minimum Curb Radii based upon the Required Effective Curb Radius
- Develop Criteria for Use of Curb Extensions

Current Policy

Existing City of Wilmington Policies

Current policy requires a minimum radius of 35 feet for all intersections with no reference to design vehicle or the context of the roadway.



Figure 12 – The darkened pavement shows the typical vehicle tracking requirements at Kerr Avenue/Fountain Drive intersection. Utilizing larger curb radius results in intersections that are larger in size than necessary.

Existing NC DOT Policies

Existing NC DOT policies reference the AASHTO design guideline to determine curb radius.

State of the Practice

The American Association of State Highway and Transportation Officials, Policy on the Geometric Design of Highways and Streets (AASHTO Green Book, 2004) provides the basis for roadway geometric design throughout the country. The Green Book states that “Where it is appropriate to provide for turning vehicles within minimum space, as at unchannelized intersections, the corner radii should be based on the minimum turning path of the selected

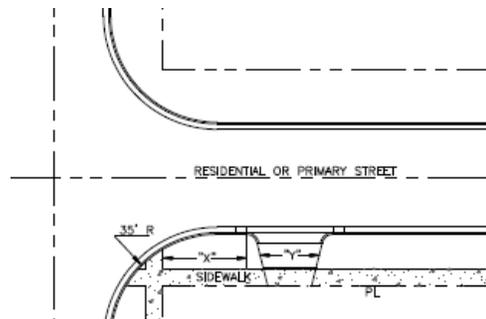


Figure 13 – Design detail from Wilmington design guideline specifying 35’ minimum radius.

design vehicles.” The Green Book also states that “the appropriate design may depend on other factors such as the type, character and location of the intersecting roads, the vehicular and pedestrian traffic volumes, the number and frequency of the larger vehicles involved in turning movements, and the effect of these larger vehicles on other traffic. For example, if turning traffic is nearly all passenger vehicles, it may not be cost-effective or pedestrian friendly to design for large trucks. However, the design should allow for the occasional large truck to turn by swinging wide and encroaching on other traffic lanes without disrupting traffic significantly.”

The following general principles and recommended practices for intersection size and turning radius design are provided in *the ITE Context Sensitive Solutions in Designing Major Urban Thoroughfares for Walkable Communities*:

- Intersections should be designed as compact as practical in urban contexts. Intersections should minimize crossing distance, crossing time, exposure to traffic, encourage pedestrian travel and increase safety.
- Use a design speed appropriate for the context. Motorists traveling at slower speeds have more time to perceive and react to conflicts at intersections.
- Curb return radii should be designed to accommodate the largest vehicle type that will frequently turn the corner (sometimes referred to as the control vehicle). This principle assumes that the occasional large vehicle can encroach into the opposing travel lane. If encroachment is not acceptable, then a larger design vehicle should be used.
- Curb return radii should be designed to reflect the “effective” turning radius of the corner. The effective turning radius takes into account the wheel tracking of the design vehicle utilizing the width of parking and bicycle lanes. Use of the effective turning radii allows a smaller curb return radius while retaining the ability to accommodate larger design vehicles.

- In urban centers and urban cores where pedestrian activity is intensive, curb return radii should be as small as possible.
- On multi-lane thoroughfares, large vehicles may encroach entirely into the adjacent travel lanes (in the same direction of travel).
- To help select a design vehicle, identify bus routes to determine whether buses are required to turn at the intersection. Also check transit service plans for anticipated future transit routes. Map existing and potential future land uses along both streets to evaluate potential truck trips turning at the intersection.
- Apply curb return radii that are compatible with the design vehicle. Occasional turns by vehicles that are larger than the design vehicle could be accomplished by turning more slowly and possibly encroaching into oncoming travel lanes to complete the turn.
- Curb return radii of different lengths can be used on different corners of the same intersection to match the design vehicle turning at that corner. Compound, spiral, or asymmetrical curb returns can be used to better match the wheel tracking of the design vehicle (see AASHTO's Green Book for the design of spiral and compound curves).
- If large vehicles need to encroach into an opposing travel lane, consider placing the stop line for opposing traffic further from the intersection.

- In urban centers and urban cores at intersections with no vehicle turns, the minimum curb return radii should be 5 ft.
- A typical minimum curb return radius of 10 to 15 ft. should be used where:
 - High pedestrian volumes are present or reasonably anticipated;
 - Volumes of turning vehicles are low;
 - The width of the receiving intersection approach can accommodate a turning passenger vehicle without encroachment into the opposing lane;
 - Passenger vehicles constitute the majority of turning vehicles;
 - Bicycle and parking lanes create additional space to accommodate the “effective” turning radius of vehicles;
 - Low turning speeds are required or desired; and
 - Occasional encroachment of turning school bus, moving van, fire truck, or oversized delivery truck into an opposing lane is acceptable.

- Curb radii will need to be larger where:
 - Occasional encroachment of a turning bus, school bus, moving van, fire truck, or oversized delivery truck into the opposing lane is not acceptable;
 - Curb extensions are proposed or might be added in the future; and
 - Receiving thoroughfare does not have parking or bicycle lanes and the receiving lane is less than 12 ft. in width.

Recommendation

Allow Flexibility in Choosing Appropriate Curb Radii

It is recommended that Wilmington update its turning radii policy to match the flexibility provided within the AASHTO guide. Wilmington's current minimum radius policy (Chapter 7, table 2) requires a 35 ft radius for all streets regardless of need.

The curb radius design policy should be expanded to allow more flexibility in intersection design based on site conditions and traffic characteristics. The designer should be permitted to select the smallest curb radius that serves the required design vehicles, considering the available effective curb radius, the presence of turning bus traffic, vehicular volumes, the percentage of heavy vehicles (i.e. potential design vehicle), pedestrian safety, land use, and convenience (relative to the heavy vehicle driver). The *ITE Context Sensitive Solutions in Designing Major Urban Thoroughfares for Walkable Communities* detailed previously should be used as a guide in expanding the policy.

Specify Minimum Curb Radii based upon the Required Effective Curb Radius

The discussion of minimum curb radius should be reorganized around the minimum effective curb radius.

Develop Criteria for Use of Curb Extensions

It is also recommended that Wilmington develop a policy describing when curb extensions should be installed as part of retrofit projects, rehabilitation projects, resurfacing projects, and new construction. It is generally recommended that curb extensions be utilized to shorten crossing distances and to enhance the public space or to provide space for a bus shelter wherever possible on arterial roadways and at multi-legged intersections.

Driveway Design

Introduction

Driveways are low volume intersections. They require curb cuts which intrude across the pedestrian walking area. Pedestrians have the legal right-of-way while walking across all driveways unless they are controlled by a traffic signal. The design of the driveway influences driver behavior and pedestrian comfort. Motorists are unlikely to yield to pedestrians crossing wide driveways that allow vehicles to turn into them at speeds over 10-15 mph placing them at risk of being struck by a vehicle.

Roadways with frequent driveways can contribute to a poor pedestrian environment as the pedestrian must constantly be assessing traffic for potentially turning traffic across their path. These types of roadways are typically congested and often have higher vehicle crash rates because of the frequent and possibly unexpected entry and exit of vehicles into the roadway. These factors further contribute to an uncomfortable pedestrian environment. Access management is a technique where agencies limit driveways by encouraging shared driveways or otherwise limiting access points to specified locations along a roadway.



Figure 14 – Example left turn conflict where pedestrian may not be seen by turning motorist along Market Street.

Multi-lane roadways without medians present particular challenges to both pedestrians and motorists as motorists turning left into a driveway are focused on finding gaps in oncoming traffic. While focusing on gaps in traffic, the motorist’s sight lines of potentially conflicting pedestrians are blocked by the approaching vehicles. Motorists often accelerate rapidly to clear a gap on multi-lane roadways which puts the pedestrian at risk when walking along the roadway.

Recommendations Summary

- Identify Opportunities to Improve Existing Driveways
- Develop More Flexible Driveway Design Standards
- Require all New Driveways to Conform to Wilmington Standards for Vertical Alignment and Construction Materials

Current Policy or Practice

Existing City of Wilmington Policies and Standards

Wilmington policies provide a range of options for driveway design. The driveway widths at the property

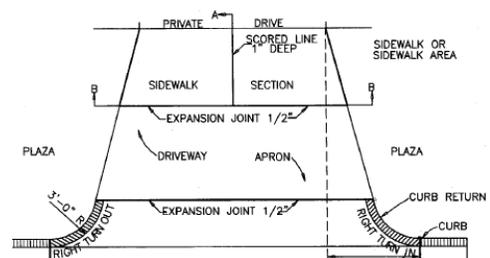


Figure 15 – Wilmington standard driveway detail (SD 8-02)

line provide a range of widths from 13 feet to 36 feet depending upon the use with an option for widths up to 50 feet with approval by the engineer.⁷ Wilmington requires minimum driveway tapers of 13 feet for access, and 3 feet for exit (Standard Details- Table 4, pg 7-10). Detail SD 8-02 is the preferred design to be used in all circumstances unless otherwise approved by the engineer. The details require the transition to occur at the apron if a plaza is present maintaining a level sidewalk. The minimum driveway radius is 3 feet for both entrance and exit.

Wilmington’s current driveway design requires the driveway apron to rise from street level to the sidewalk level so that a pedestrian crossing a driveway will not experience a change in grade.

Thoroughfare standards dictate the maximum number of driveways per property frontage, minimum separation between driveways on a single property, and minimum separation from intersecting roadways and property lines.⁸ Shared driveways serving adjoining properties are allowed with approval by the City Engineer, and interconnectivity between adjoining parking lots is strongly encouraged.

For all other locations, driveways may not exceed fifty percent of the property line.

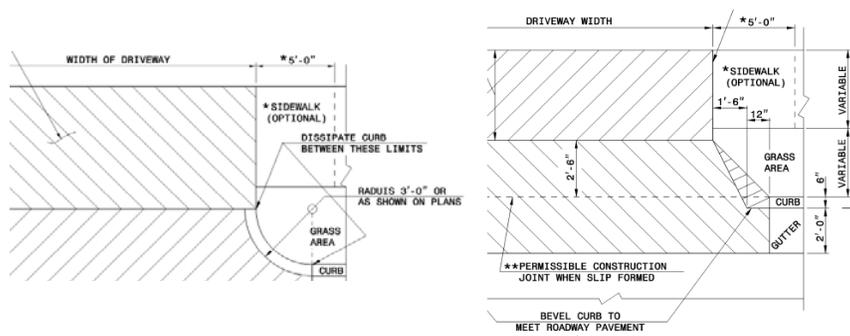


Figure 16 – NCDOT Std. 848.02 and 848.03

Existing NC DOT Policies

A paved driveway turnout (Std. No. 848.04) shall be used for commercial type entrances that generate 500 ADT or more. A 25 foot minimum curb radii is recommended with a 20 foot minimum driveway width. Uses that generate less than 500 ADT may use NCDOT Std. No. 848.02 or Std. No. 848.03 utilizing the 3 foot minimum curb radii.

Discussion of Existing Policies

Current city driveway design standards are similar to NCDOT standards; however there are opportunities for improvement. The minimum driveway taper requirement requires pedestrians



Figure 17 -Driveway built to SD 8-02 standards on Fountain Drive

⁷ For the purposes of this paper, the focus will be on non 1 or 2 Family Residential Standards which allow driveways as narrow as 9 feet.

⁸ For a list of all Thoroughfare Segments, see page 7-12 of the Technical Standards and Specification Manual.

to make longer crossings than if no taper is required. Furthermore, the minimum driveway taper required for SD 8-02 results in an effective curb radius of 20 feet which can allow motorists to turn at speeds of 10-20 mph across the sidewalk reducing the likelihood they will yield to pedestrians crossing on the sidewalk within the driveway.

Some recent commercial development projects on NCDOT maintained arterials have driveways that continue at street grade through the sidewalk crossing. This effect is a driveway which looks and feels like a narrow road intersection. Pedestrians walking along the sidewalk step down into the driveway apron. The driveway aprons have asphalt surfaces which further contributes to the sense of crossing a road intersection as opposed to crossing a driveway.

The NCDOT recommendation for a minimum curb return radius of 25 feet on many commercial driveways exposes a pedestrian to turning vehicles for longer periods of time than a smaller requirement would due to the resulting crossing distance.

The access management standards do have the potential to reduce the number of driveways pedestrians in Wilmington will be required to cross.

Recommendations

Look for Opportunities to Improve Existing Driveways

Wilmington should expand its driveway policy to address access management and limit conflict points when properties are redeveloped, sold, or change use. Additionally, when roadways are being constructed, reconstructed or resurfaced, existing driveways should be reviewed for opportunities to consolidate or reduce their width to conform to the access management policy.

Revise Standards to Reduce Driveway Crossing Distance

Wilmington should consider develop driveway design standards appropriate to the ADT of the site (similar to NCDOT's policy). New design standards should require the minimum necessary driveway width, curb radii, and tapers to facilitate access for larger vehicle access (if necessary) and to accommodate the anticipated vehicle volume. The curb radii selected should be based upon the effective turning radius necessary to make the turn without off tracking onto the curb. Locations which allow parking may be constructed with curb radii as small as 3 feet.

Require all New Driveways to Conform to Wilmington Standards for Vertical Alignment and Construction Materials

Wilmington should require all new driveway aprons to be constructed of concrete or other contrasting surfacing. Additionally, all driveways within the city should be constructed so that the driveway apron is at sidewalk level where the sidewalk crosses the driveway.

Turning Traffic “Yield to Pedestrians” Sign (at Signalized Intersections)

Introduction

When crossing a street with a WALK signal at a signalized intersection, pedestrians may be deterred from entering the crosswalk by vehicles turning across their path from intersecting roadways. Many communities are installing “Yield to Pedestrians” signs to alert drivers of the presence of pedestrians and the applicable laws.

Background

The most common type of pedestrian signal timing provides pedestrians with a WALK signal at the same time as parallel vehicular traffic has a green light (concurrent phasing). At locations where there are large movements of turning vehicles, it can be difficult for pedestrians to begin crossing the roadway at the start of the walk signal as turning motorists are often reluctant to yield to the pedestrians. At long crossings where pedestrians are provided the minimum crossing time, this can leave them in the roadway when the signal changes.

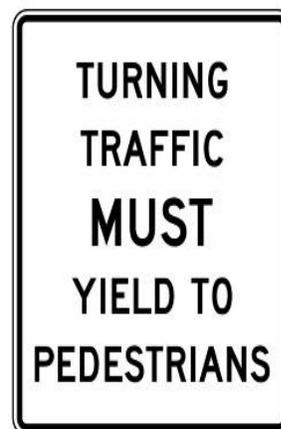


Figure 18 – At locations where motorists regularly fail to give the right of way to the pedestrian while turning, a TURNING TRAFFIC YIELD TO PEDESTRIANS sign can be a useful educational tool to reduce conflicts.

Drivers are unaware of their responsibility to yield to pedestrians in crossing in the legal marked or unmarked crosswalk when they turn onto the receiving roadway.

At locations with higher volumes of turning traffic, pedestrians may be stuck at the curb for multiple signal cycles before they get a gap. In severe cases, pedestrians may be left with three choices:

- jaywalking at any perceived acceptable gap in traffic which may leave them in the roadway and may impede traffic
- moving down or upstream from the signal for a midblock crossing



Current MUTCD R10-15



Proposed MUTCD R10-15

- waiting for motorists on subsequent signal changes to allow them to begin to cross

Pedestrians have the same intolerance to delay as motorists so they often resort to jaywalking or midblock crossings if they must wait longer than 30-60 seconds for a crossing opportunity⁹. On multi-lane roadways this may place them at risk of being struck as they are frequently difficult to see for drivers in adjacent travel lanes. Crossing outside of the intersection also conflicts with driver expectance to look for pedestrians at intersections in front of stopped vehicles. For reasons of pedestrian and driver safety, as well as North Carolina Law providing pedestrians legal right of way at all crosswalks (marked or unmarked), it is important to educate and remind drivers of their responsibility to yield.

Current Policies or Practice

When a pedestrian is provided with a WALK signal or a green light (if pedestrian signals are not provided), North Carolina law requires vehicular traffic to yield to pedestrians in crosswalks at signalized intersections while turning, unless separate phases are provided for the turning vehicle and crossing pedestrian.

City of Wilmington

The city has adopted the MUTCD which controls use of this sign. However, this sign does not appear to be in use in Wilmington.

NCDOT

NCDOT has adopted the MUTCD which controls use of this sign.

The Manual on Uniform Traffic Control Devices

The MUTCD allows use of the TURNING TRAFFIC MUST YIELD TO PEDESTRIANS sign (R10-15) as an additional reminder to drivers to yield to pedestrians while turning.

State of the Practice

Proposed changes to the 2009 edition of the MUTCD include an update of the text only sign design to improve readability by adding figures in place of the text legend. Variations of this sign are in widespread use throughout the United States. Testing of this sign found that it was effective in reducing left-turn conflicts between motorists and pedestrians 20-65% and right-turn conflicts 15-30%¹⁰.

⁹ The Highway Capacity Manual indicates pedestrians engage in risk taking crossing behavior as their wait times exceed 30 seconds. At 60 seconds of waiting they are very likely to not comply with traffic control devices if an opportunistic gap appears in traffic.

¹⁰ Effect on Vehicle-Pedestrian Conflicts of "Turning Traffic Must Yield to Pedestrians" Sign. *TRANSPORTATION RESEARCH RECORD 1553*

Recommendation

It is recommended that the City of Wilmington adopt the YIELD TO PEDESTRIANS WHILE IN CROSSWALK sign proposed for 2009 MUTCD and install these signs at signalized locations where there is regular conflict between turning motorists and pedestrians. This sign may be used at signalized intersections with and without marked crosswalks provided pedestrians are not lawfully restricted from the roadway.

Pedestrian Actuated Signals and Push Button Locations

Introduction

Pedestrian signals are used to inform pedestrians when it is their turn to cross a street. There are two general approaches to controlling pedestrian signals: pedestrian actuated signals are designed so that a button must be depressed to call the WALK signal; concurrent signals are designed so that the WALK signal is displayed every cycle and no button is required.

The actuation device (generally a button) should be placed in a location where it is easily accessible by all users, including those with disabilities. Furthermore, the controls should clearly instruct users on proper signal operation.

Generally, pedestrian actuated signals are used in cases where pedestrians are not routinely provided sufficient time to completely cross a roadway before the signal changes and there is not sufficient pedestrian demand to warrant a WALK signal every cycle. In these cases, if the push button is not actuated by a crossing pedestrian, the pedestrian may become trapped within the roadway while the cross traffic is given a green light, potentially placing the pedestrian at risk of being struck by a moving vehicle.



Figure 1 – Pedestrians jaywalk during midweek evening with low traffic volume on 3rd Street at Chestnut

Pedestrians are less likely to utilize push buttons or are likely to jaywalk in areas with low or intermittent vehicular volume and/or long wait times. Pedestrians are also likely to jaywalk (even if the button is pushed) if there is a delay of more than 30 seconds and gaps in traffic are available.

It is challenging for cities that attract

large volumes of visitors to educate them to utilize pedestrian push buttons to generate a walk signal. This is particularly true if the visitor is used to being provided sufficient time to cross the roadway as a routine accommodation at signalized intersections.

Recommendations Overview

The list below highlights recommendations for improving push buttons within the City. For a more detailed discussion, please see the section Recommendations at the end of this paper.

- Adopt 2009 MUTCD Guidance for Signal Siting and Design
- Reposition and Upgrade Older Non-Compliant Push Buttons
- Use Concurrent Signal Operation in Peak Demand Areas without Pushbuttons

Current Policy and Practice

City of Wilmington

The city has adopted the MUTCD which controls placement of push buttons and pedestrian signals. The City of Wilmington currently utilizes push buttons and pedestrian signals at almost all signalized intersections where pedestrian signals and crosswalks are provided.

In many places, the signal design is the flashing hand and countdown timer combination. However, there are locations where there are no countdown timers in use. According to discussions with Wilmington staff, the city plans to upgrade all pedestrian signals with a countdown timer.

Throughout Wilmington, push buttons are installed in a variety of locations. In many locations, buttons are positioned in a manner that makes them easily accessible to all pedestrians. However there are several situations where the pedestrian signal push buttons are not located in accordance with best practices or MUTCD guidance.

Examples include locations where the push button is located too high for a wheelchair user and locations where the push button is located away from the sidewalk or is blocked by utilities (such as a signal control box). The example in the photo below shows a push button at the intersection of South College Street and Randall Road where the push button is attached to a phone pole which is away from the paved area of the sidewalk. This push button may be difficult to reach for a user in a wheelchair or other assistive device who cannot easily move on unpaved areas. Generally, these examples of incorrectly positioned buttons appear to be older installations.



Figure 2 - College and Randall - not accessible



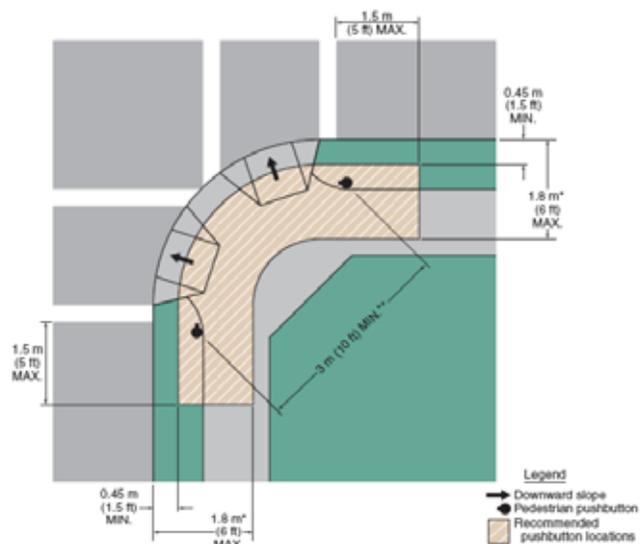
Figure 3 - Castle and South – Good Retrofit

NCDOT

NCDOT recommends the installation of countdown pedestrian signal heads at all locations with pedestrian signals on NCDOT maintained roads.

The Manual on Uniform Traffic Control Devices

The MUTCD provides guidance on the location of push buttons and pedestrian signals. There are no warrants for installing a pedestrian signal head or push buttons. The manual states “where pedestrian movements regularly occur, pedestrians should be provided with sufficient time to cross the roadway by adjusting the traffic control signal operation and timing to provide sufficient crossing time every cycle or by providing pedestrian detectors.”



* Where there are constraints that make it impractical to place the pedestrian pushbutton between 0.45 m (1.5 ft) and 1.8 m (6 ft) from the edge of the curb, shoulder, or pavement, it should not be further than 3 m (10 ft) from the edge of curb, shoulder, or pavement.
 ** Where there are constraints on a particular corner that make it impractical to provide the 3 m (10 ft) separation between the two pedestrian pushbuttons, the pushbuttons may be placed closer together or on the same pole.

Figure 5 - Proposed graphic for the 2009 MUTCD: Recommended Pushbutton Locations

The timing is accomplished by extending the time of the all red clearance interval while simultaneously providing the desired WALK signal. Changing this interval is allowed in the MUTCD.

Discussion of Current Policy and Practice

The city has a mixture of both old and new technology in its current inventory of pedestrian push button mechanisms. In many locations, actuators are positioned in such a way that they may be difficult to use for some users. More recent push button installations appear to be using

current technology and installation practices which should make them more accessible to all users.

The existing timing of signals within Wilmington provides inconsistent messaging to pedestrians. At some signalized locations they are provided with crosswalks, pedestrian signals, and push buttons. The timing allows most pedestrians sufficient time to cross the roadway. At other signalized locations there is no pedestrian infrastructure provided but there is sufficient time for the pedestrian to cross while other signalized intersections do not provide time for pedestrians to cross the roadway.

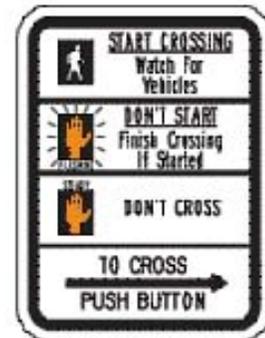


Figure 4- Pedestrian Push Button Instructions

State of the Practice

It is a common misconception that pedestrian push buttons are required for a signal to be accessible to the disabled. Push buttons are not required at locations where the walk signal is provided with each signal cycle.

Research on push buttons has also found that the location and design of the push button is critical to ensure usage. A push button that is located close to the crossing and shows an indication that it has been activated is more likely to be used by waiting pedestrians. Additionally, instructions should be provided to inform pedestrians on proper crossing behavior, including which button to push to cross in the desired direction.

One example of current technology is the audible pedestrian system which is designed to aid pedestrians with vision impairments. This approach provides noises, such as chirping, clicks, and other tones that are strategically located to guide sight-impaired pedestrians at street crossings (also in use in other locations where additional information is important). These audible techniques should be complemented by Braille writing on instruction signs that are reachable and located for that purpose.

Pedestrian and Bicycle Information Center (PBIC)

For optimal pedestrian service, fixed-time signal operation usually works best. Pedestrian pushbuttons may be installed at locations where pedestrians are expected intermittently. Quick response to the pushbutton or feedback to the pedestrian (e.g.- indicator light comes on) should be programmed into the system. When used, pushbuttons should be well-signed and within reach and operable from a flat surface for pedestrians in wheelchairs and with visual disabilities. They should be conveniently placed in the area where pedestrians wait to cross. Section 4E.09

within the MUTCD provides detailed guidance for the placement of pushbuttons to ensure accessibility (www.walkinginfo.org).

2009 MUTCD

Proposed language for the 2009 MUTCD provides enhanced guidance on the placement of push buttons (see figure 6 which has been developed for addition to the 2009 MUTCD).

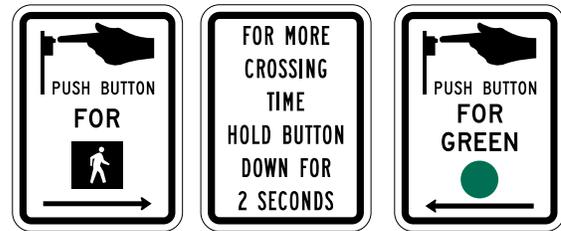


Figure 6 - Proposed pushbutton signs for the 2009 MUTCD

The new MUTCD edition also contains a provision to provide additional crossing time for pedestrians who hold the button for 2 seconds or more, and has added a number of additional pedestrian pushbutton signs (right) based on signs successfully used in Canada.

Recommendation

Adopt 2009 MUTCD Guidance for Siting and Design

It is recommended that City of Wilmington adopt the proposed 2009 MUTCD language to provide more guidance on locating push buttons in typical and constrained situations.

Push buttons should be designed according to the standards and guidelines in Sections 4E.08 and 4E.09 of the Manual of Uniform Traffic Control Devices (MUTCD). They shall be a minimum of 2” across in at least one direction. The force required to activate the buttons should not be greater than 5 pounds. It is desirable for pushbuttons to offer confirmation that the button has been pressed. In locations where new pedestrian signals are being installed, Accessible Pedestrian Signals should be provided.

Reposition and Upgrade Older Non-Compliant Push Buttons

In order to improve the utility of pedestrian infrastructure for all users, the City of Wilmington should develop an inventory and replacement plan for noncompliant pedestrian push buttons. These should be assessed for both push button design as well as location. These older push button mechanisms should be upgraded to newer technology that is easier to operate and incorporates instructions for users.

Use Concurrent Signal Operation in Peak Demand Areas without Pushbuttons

In general, if pedestrians are present during a majority of the signal phases during the peak hour for a particular leg of an intersection, the pedestrian signal phase should be automatic and pedestrian push buttons should not be used. In particular, the City of Wilmington should consider eliminating pedestrian push buttons in the downtown core as this is an area that

attracts a lot of tourists and it is an area where pedestrians are present at the majority of the signal cycles.

However, in areas with intermittent pedestrians, push buttons may be used to reduce delays to vehicular traffic. It is recommended that the City of Wilmington evaluate push button installations throughout the city for compliance with ADA and to determine actual need for push button. Where a signal requires pedestrian actuation, it is recommended that it be installed to meet the accessibility guidelines.

Signs for Uncontrolled Crossings

Introduction

Many street crossings a pedestrian must make during a trip occur at locations where there are no traffic signals, stop signs, or other traffic controls. These are classified as “uncontrolled crossings.” These locations include intersections where only one leg of travel is required to stop (e.g. a local street intersecting an arterial).



Figure 19 – W11-2

Background

Research of pedestrian safety at uncontrolled crossings has shown that some motorists are not in complete understanding of yield to pedestrian laws nor do they understand what the standard MUTCD (W11-2) sign is attempting to convey (the MUTCD W11-2). To help motorists understand the law, an in-street bollard (the MUTCD R1-6) was developed which graphically tells the motorists what to do. As of 2003 it has been adopted for use at a national level for uncontrolled pedestrian crossings.

Recommendations Overview

The list below highlights recommendations for improving motorist compliance with the yield to pedestrian in crosswalk law at uncontrolled crosswalks:

- Adopt a Side-of-Street Uncontrolled Crosswalk Sign
- Develop an Uncontrolled Crosswalk Signing Policy
- Evaluate Uncontrolled Crosswalk Signing Policy and Effectiveness
- Upgrade Uncontrolled Crossing Locations Across the City to Comply with New Policy

Current Policy or Practice

City of Wilmington Policies



The City of Wilmington does not appear to have a policy for signing uncontrolled pedestrian crossings. However, there are many places around the city where Pedestrian Warning Signs are used.

NCDOT Policies

NCDOT has adopted the MUTCD which provides for the use of the R1-6 or W11-2

Manual on Uniform Traffic Control Devices - Pedestrian Warning Signs

Figure 20 - R1-6

Section 2C.01 of the 2003 MUTCD states “warning signs call attention to unexpected conditions on or adjacent to a highway or street and to situations that might not be readily apparent to road users.” ITE’s Traffic Control Devices Handbook (TCDH) further explains that it is not possible to identify every potential hazard a driver may encounter, and thus the decision to provide a warning should be based on the definition of the function of a warning sign (2001). The TCDH points out “warning signs are particularly useful to unfamiliar drivers. The role of warning signs is especially important in view of the fact that the driver may not be able to get information from other sources.” While drivers should possess a basic knowledge of the types of potential hazards that may be encountered, the driver is not expected to anticipate extraordinary dangers, impediments, or obstructions. This is particularly true for drivers who are unfamiliar with a given road. However, signs should be installed judiciously, as overuse may cause noncompliance and create visual clutter, reducing the readability of each sign.

Warning signs associated with pedestrian, bicyclist, and school zone conditions may utilize a fluorescent yellow-green background to increase visibility. Warning signs that identify locations of unexpected entries into the roadway in advance (through the use of supplemental plaques with the legend AHEAD, XX FEET, or NEXT XX MILES) should be accompanied by a similar warning at the point of entry, supplemented with a diagonal downward pointing arrow plaque identifying the location of the crossing. The 2003 MUTCD recommends fluorescent-yellow green warning signs not be mixed with yellow signs within the same area.

Proposed language for the 2009 MUTCD recommends that all pedestrian, bicyclist, and school zone related signing use the fluorescent-green color instead of yellow. It will require that all school zone related signs be fluorescent-green in color.

Manual on Uniform Traffic Control Devices - In-Street Pedestrian Crossing Signs

The R1-6a in-street pedestrian sign is in the MUTCD (see right) and is in widespread use across the country and in the City of Wilmington to remind motorists of their responsibilities at

crosswalks. The 2003 MUTCD does not provide guidance for when to use the sign except to restrict its use at signalized intersections.

Proposed revisions for the 2009 MUTCD clarify conditions under which it is appropriate to provide the sign. The following criteria are proposed additions:

- Prohibition of post mounting this sign on the left or right side of the roadway
- The sign shall be mounted on the center line, lane line, or median island

State of the Practice

In-Street Pedestrian Signs

The City of Wilmington currently uses these signs on certain collector and neighborhood streets.

Side-of-Street Pedestrian Uncontrolled Crosswalk Signs

To compensate for the poor legibility of the in-street crossing sign (R1-6a), some agencies have developed a side-of-street sign. This is not found in the MUTCD, but is a modified version of the R1-6a for use on the side of the road.

Maryland State Highway

MD SHA utilizes a Side-of-Street Pedestrian Crossing sign (see right)

which may be used at uncontrolled crosswalk locations that do not meet the specifications MD SHA prescribed for the use of the in-street pedestrian crossing sign (where the roadway’s clear width is less than 24 feet, where the speed limit is over 35 mph, or where there are 4 or more lanes of vehicular traffic).

Boulder, Colorado

Boulder uses a similar sign (see right) which was tested as a replacement for the warning sign assembly (W11-2). The City of Boulder found that motorists’ yielding rates increased following installation of this sign, compared to locations with the W11-2 only. A summary of their yielding rates is shown in the table on the following page. Boulder also developed warrant criteria for this sign which requires a minimum of 20 pedestrians crossing per hour and a minimum vehicular volume of 1,500 per day.



Figure 21 - Maryland SHA MD-MUTCD Side-of-Street Pedestrian Crossing Sign R1-6a (1)



Figure 22 – Boulder, CO side of street uncontrolled pedestrian crossing sign

Compliance Results for Boulder, CO “State Law – Yield to Pedestrians” Sign

Location	Vehicle Volume (daily) *	Pedestrian Volume (3 peak hours)	Yield Compliance (Before)	Yield Compliance (After)	Percent Increase
9 th Street & Walnut	10,000	190	54%	93%	+72%
9 th Street & Hawthorne	-----	-----	-----	-----	-----
19 th Street & Sumac	3,000	50	96%	**	n/a
University & 15 th Street	10,000	180	47%	69%	+47%
University & 17 th Street	10,000	170	68%	89%	+31%
Iris & 15 th Street	20,000	10	5%	50%	+900%
Arapahoe & 13 th Street	14,000	140	34%	65%	+91%
Arapahoe & 11 th Street	12,000	130	38%	70%	+84%
Alpine west of Broadway	5,000	550	91%	90%	0%
Mapleton & 8 th Street	-----	70	82%	87%	+6%
19 th Street & Norwood	3,000	40	24%	33%	+38%
Greenbriar & Chambers	-----	-----	-----	-----	-----
Walnut & 16 th Street	3,000	140	25%	**	n/a
19 th Street & Upland	-----	-----	-----	-----	-----
Pearl & 19 th Street	12,000	80	21%	66%	+214%
Linden & 4 th Street	3,000	100	45%	81%	+80%
Folsom south of Arapahoe	14,000	50	28%	**	n/a

Table 1 – Boulder, Colorado motorist yielding behavior results of evaluation of side street crossing sign

Recommendations

Adopt a Side-of-Street Uncontrolled Crosswalk Sign

The City of Wilmington should develop a Side-of-Street Uncontrolled Crosswalk Sign similar to that used in Boulder and MD SHA in lieu of the current practice of providing a W11-2 supplemented with the R1-6a.

Develop an Uncontrolled Crosswalk Signing Policy

The City of Wilmington should update its uncontrolled crosswalk signing policy and sign standards to better align with current research and best practices. The City of Wilmington should adopt the proposed language for the 2009 MUTCD describing the use of the R1-6a sign.

The City of Wilmington should develop warrant criteria (similar to the City of Boulder) to determine when to provide pedestrian signs. Criteria may also include vehicle volume, roadway cross section, motorist operating speed, and sight distance.

Evaluate Uncontrolled Crosswalk Signing Policy and Effectiveness

The City of Wilmington should develop draft criteria and study the effectiveness of the sign in increasing motorist compliance. Results of an evaluation of the sign should be used to further refine the warrant criteria for installation. Once criteria are developed for uncontrolled crossing

signs, it is recommended that the City of Wilmington develop a plan to upgrade signs at all uncontrolled crossings to bring them into compliance.

It is recommended that the City of Wilmington develop guidelines restricting the use of the W11-2 pedestrian warning sign at uncontrolled crosswalks and develop guidance for utilizing the W11-2 to provide advanced warning of unexpected pedestrian crossings.

Upgrade Uncontrolled Crossing Locations Across the City to Comply with New Policy

It is recommended that the City of Wilmington develop a plan for upgrading all uncontrolled crossings to comply with policies developed for marking and signing uncontrolled crossings.

Signalized Intersection Crosswalk Markings and Pedestrian Signals

Introduction

It can be assumed that people will walk almost anywhere regardless of whether specific pedestrian infrastructure is present or not. Furthermore, pedestrians generally have an expectation that a signalized intersection will allow them to safely cross the roadway. It is therefore important that signalized intersections accommodate the pedestrian crossing.



Figure 23 – Crosswalks encourage pedestrians to cross where they can be seen by turning traffic. This person is crossing between vehicles which makes difficult to see to turning vehicles. This potentially places him at risk of being struck. Stop lines placed close to the adjacent roadway encourage pedestrians

Traffic signals are designed to stop traffic and allow cross street traffic (including pedestrians) to cross the intersecting roadway. In North Carolina, as in most states, the pedestrian has the legal right-of-way when the traffic signal displays green (for motorists) and/or when the pedestrian signal displays a “walk” symbol for the desired direction of travel. Restricting pedestrians from the right-of-way is accomplished by posting a “NO PEDESTRIANS” sign or by displaying a DO NOT WALK symbol where signals are installed.

Transportation engineering is built on the principals of uniformity and predictability. It is reasonable that pedestrians should have the expectation that if traffic is stopped by a signal, they should have an opportunity to cross the entire street unless they are given information stating otherwise. Since most signals are timed to provide the minimum time required for a pedestrian

crossing, any delay by the pedestrian in beginning to cross may leave them in the roadway or at the curb as the WALK signal changes to DONT WALK. This places them in potential conflict with cross street traffic. This is particularly problematic if the crossing distance is long or does not provide a refuge (protected area on the median) for pedestrians. Pedestrians who are not able to cross the roadway relatively easily are more likely to take risks (crossing away from the signal or crossing on a DONT WALK signal) which can increase vehicular delay or result in a crash.

Pedestrians are typically reluctant to travel out of their way so it is incumbent upon designers to make safer crossings such as signalized intersections more convenient or to make the convenient crossing safer. If designated crossings are located far apart, pedestrians may choose their own time and location for crossing the roadway, which may not be the optimal time or location, potentially placing them at risk.

Recommendations Summary:

The list below highlights recommendations for signalizing crosswalks within the City. For a more detailed discussion, please see the section Recommendations at the end of this paper.

- Modify standard design details to show pedestrian crosswalks
- Install pedestrian signals on signalized crossings greater than two lanes
- Mark crosswalks at signalized intersections across all crossings

Current Policy or Practice

Current City of Wilmington Policies

Existing policies are informal and not in writing. The informal policy generally includes the following practices:

- Crosswalks are marked at controlled locations only when there is a demonstrated pedestrian demand of one pedestrian present per cycle (on average)
- Marked crosswalks are only installed in combination with pedestrian signals and pushbuttons

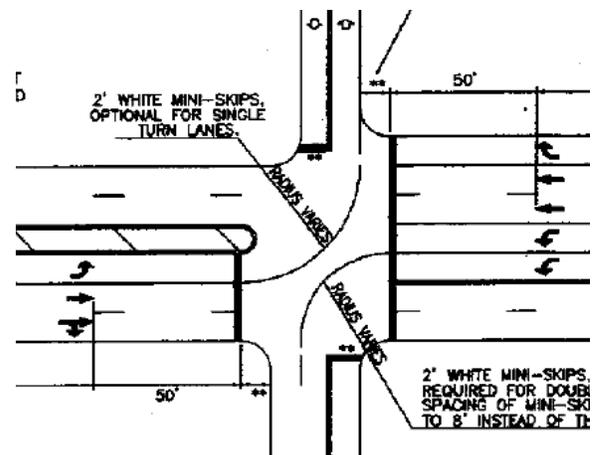


Figure 24 - City of Wilmington controlled intersection detail does not provide crosswalk marking guidance and is identical to NCDOT standard details for signalized intersections.

- The marked crosswalks are generally placed where the crossing conflicts least with turning traffic
- Marking crosswalks across all legs of an intersection is rare except in the downtown area
- Stop line placement varies, but on local streets is typically set back beyond the sidewalk or pedestrian crossing area
- Standard details for intersection design do not show crosswalks or sidewalks to provide guidance on stop bar or signal detection placement.

Crosswalks are not included on standard intersection marking details. Therefore, magnetic vehicle detection loops are generally installed immediately behind the vehicle stop line. This has an unintended and potentially costly consequence that increases the difficulty for retrofitting because crosswalk installation generally results in moving the stop bar back from the intersection, which then requires moving the detection loop back accordingly. Moving the loop requires revisions to the signal plan and timing.

Current NCDOT Policies

Pedestrian Policy Guidelines

- Requires Wilmington to ask for pedestrian facilities on NCDOT roadways and TIP projects
- Requires Wilmington to match 40% - 50% of project cost (verify) for new projects
- At some locations, stop line is placed within the pedestrian crossing area (College Road, Eastwood Road, Wrightsville Avenue)
- NCDOT standard practice C-36 details signalization and crosswalk marking procedures for uncontrolled midblock crossings



Figure 25 – Stop lines placed within the pedestrian area in conjunction with no pedestrian signals sends a message the pedestrian is not welcome – regardless of the fact that the pedestrian is legally entitled to cross at this location. This layout would be a likely contributing factor in a pedestrian crash at this location.

Manual on Uniform Traffic Control Devices (MUTCD)

The MUTCD does not provide specific guidance on marking crosswalks or pedestrian signalization at signalized intersections. The MUTCD provides guidance on the dimensions and

design of painted crosswalks. The MUTCD section 3B.17 states “crosswalks should be marked at all intersections where there is substantial conflict between vehicular and pedestrian movements.”

The MUTCD also states, “The design and operation of traffic control signals shall take into consideration the needs of pedestrian as well as vehicular traffic.” If at signalized intersections there is a need for “provisions for a given pedestrian movement, signal faces conveniently visible to pedestrians shall be provided by pedestrian signal heads or a signal face for an adjacent vehicular movement.” There are currently many instances in the study area where signals are not visible at pedestrian crossing locations.

Discussion of Existing Policies

The existing timing of signals within Wilmington provides inconsistent messages to pedestrians. At some signalized locations they are provided with crosswalks, pedestrian signals, and push buttons with crossing time provided for them to cross roadway. At other signalized locations there is no pedestrian infrastructure provided but there is sufficient time for the pedestrian to cross, yet other signalized intersections do not provide time for pedestrians to cross the roadway. This inconsistent application of pedestrian signals and timing is likely to be a contributing factor in pedestrian crashes. This inconsistency may also contribute to the pedestrians’ lack of confidence in provided pedestrian amenities which may contribute to poor compliance and use of existing facilities.

Some pedestrian crossings are compromised by the placement of motor vehicle stop lines near the curb line of the adjacent roadway while others are set to protect the pedestrian crossing area. When marked crosswalks are provided at intersections, it varies from marking all legs to only marking one leg. This has resulted in a system that is inconsistent and unpredictable for the pedestrian, and which may lead to poor stop back compliance at marked crossings.

This typically results in the installation of crosswalks only a portion of the legal crossings across the major roadway. The minor roadway typically will not have marked crossings. However, recent intersection improvement projects may have expanded upon the pedestrian accommodations by providing additional marked crosswalks, set back stop lines, sidewalks, curb ramps, and signals varying from two legs to four legs of a typical junction of two roadways.

The current NCDOT standards for installing crosswalks are more applicable to rural areas of the



Figure 26 – Examples of the variations in stop line placement and crosswalk placement.

state, where there is lower crossing activity than is found in most parts of Wilmington. Many other North Carolina cities (such as Raleigh and Charlotte) have developed and adopted their own crosswalk marking standards that are used during discussions with NCDOT when installing or improving state-owned and operated roadways.

Recommendations

Modify Standard Design Details to Show Pedestrian Accommodations

City of Wilmington standard design details should be modified to show pedestrian accommodations. The present details largely mirror NCDOT roadway designs which are not appropriate for urbanized areas. Adoption of new standard details showing pedestrian facilities will be a helpful tool for negotiations with developers and NCDOT as new roadway projects are constructed or existing roadways are reconstructed. Standard details should also show advance stop bars.

Details showing pedestrian facilities will minimize placement of stop lines, signal detection equipment, signal control boxes, and other utilities within the pedestrian realm. Having identical details to NCDOT implies full support for the application of NCDOT roadway design standards (rural in character) within the City of Wilmington, which is not always appropriate given the city's urban (or urbanizing) character.

Install Pedestrian Signals on Signalized Crossings greater than Two Lanes

The City should install pedestrian signals on roadways over two travel lanes in width. At crossings wider than two lanes, pedestrians may have difficulty making it all the way across the roadway if they do not start crossing at the beginning of the crossing cycle (typically crossing is

on the green light at intersections without pedestrian signals) or if they move more slowly than the ‘design pedestrian.’

There are currently pedestrian signals at most signalized intersections in the downtown and immediate surrounding areas. The City should expand on this commitment to multi-modal travel by installing pedestrian signals at major intersections in other areas. Understanding that it is impractical to install signal heads immediately, priority should be given to locations that are of significant value to pedestrians, such as:

- Intersections near educational and institutional facilities such as schools, universities and libraries;
- Intersections near retail and employment centers;
- Intersections serving the Cross-City Trail, River-to-Sea Bikeway, Greenfield Park and other major recreational or pedestrian facilities;
- Intersections near transit stops; and
- Areas with slower moving pedestrians, such as senior communities, hospitals and tourist areas.

Many of these locations will require collaboration with NCDOT and/or a detailed study to determine the ultimate location and configuration of the crosswalks.

Mark Crosswalks at Signalized Intersections Across All Crossings

The City of Wilmington should begin a program to mark crosswalks at all signalized intersections. It is recommended that the standard be to mark all legs of the intersection. Variations from this standard should occur only in rare circumstances where engineering judgment determines a safety problem will be created by marking a crosswalk, or where pedestrian facilities do not exist. The pedestrian should be accommodated at all legal crossing locations. (i.e. a 4 leg intersection should have a minimum of 3 crosswalks).

High visibility (ladder) markings should be the standard marking at all crosswalks leading to a block with a school, within a designated school zone area, along a designated school walking route, or at locations with high pedestrian activity.

It is recommended that Wilmington work with NCDOT to provide marked crosswalks at all NCDOT controlled intersections with traffic signals. Pedestrian traffic signals should be provided at legal crossings and signal timing should be evaluated to determine if adequate time to cross based on the surrounding context is provided.

Flashing Warning Beacons

Introduction

A flashing beacon is a traffic control signal that operates in a flashing mode (flash rate is defined as one flash per second). It is typically a single light, but can be installed in other combinations. A common application is to add a flashing amber signal to the top of a standard pedestrian sign to provide warning of a pedestrian crossing. The flashing signal has also been used on overhead signs at crosswalks. School zones are sometimes identified with flashing beacons that operate during specific periods of the day. Studies have found inconsistent rates of motorist compliance with laws to stop or yield for pedestrians at uncontrolled crosswalks when only flashing beacons were provided.



Rapid Flashing Beacon

A modified version of the flashing beacon – a rapid flashing beacon (LED lights with flash rates of 60 flashes per second) has undergone evaluation in Florida, Washington, DC, and Colorado. This sign has shown to result in high rates of motorist compliance with laws to stop or yield for pedestrians at uncontrolled crosswalks when only rapid flashing beacons were provided.

Current Policy or Practice

City of Wilmington

The city has adopted the MUTCD which defines the use of flashing beacons. The City of Wilmington does not have a current policy for rapid flashing beacons.

NCDOT

NCDOT has adopted the MUTCD which defines the use of flashing beacons. The NCDOT does not have a current policy for rapid flashing beacons.

The Manual on Uniform Traffic Control Devices

Section 4k defines flashing beacons in the MUTCD. FHWA issued an interim approval for this device on July 16, 2008.



Flashing Beacon

Recommendations Overview

- Develop a policy based upon the FHWA interim approval recommendation for use of the rapid flash beacon with the exception of the sign design.
- Develop a standard detail for the design of the sign
- Develop a policy for restricting the use of the standard flashing beacon at uncontrolled pedestrian crossings

State of the Practice

Flashing Beacons

A flashing beacon is a traffic control signal that operates in a flashing mode (flash rate is typically one flash per second). It is typically a single light, but can be installed in other combinations. A common application is to add a flashing amber signal to the top of a standard pedestrian sign to provide warning of a pedestrian crossing. The flashing signal has also been used on overhead signs at crosswalks. School zones are sometimes identified with flashing beacons that operate during specific periods of the day.

In some cases, pedestrian detection is used to activate the beacons. Detection can be either passive or active. For flashing beacons with active detection a pedestrian must press a pushbutton. For flashing beacons with passive detection, there are a number of options including bollards with motion sensors. The MUTCD provides guidance for the use of flashing beacons in Chapter 4K.

Studies have found inconsistent rates of motorist compliance with laws to stop or yield for pedestrians at uncontrolled crosswalks when only flashing beacons were provided. This is in large part due to variations in roadway conditions at each of the study sites.

Rapid Flash Beacon, RFB

The Rapid Flash Beacon is a device using LED technology (instead of the traditional incandescent bulbs) in combination with crosswalk warning signs. The RFB design differs from the flashing beacon by utilizing:

- A rapid flashing frequency (60 times per second vs. 1 per second)
- Brighter light intensity
- Ability to aim the LED lighting



Rapid Flashing Beacon, Washington DC

Additionally, pauses can be incorporated at chosen intervals to create patterns and increase motorist recognition of accompanying information.

The RFB can be constructed using solar power to simplify installation. They are currently not included in the MUTCD but are similar in concept to in-roadway lighting, which is permitted in the MUTCD. RFBs have been used on crosswalk signs in a number of locations around the US including:

- Boulder, Colorado
- St. Petersburg, Florida
- Washington, DC

These jurisdictions have tested the effectiveness of the device and the results indicate that this device increases motorist compliance to a much higher percentage than the standard flashing beacon.

Boulder uses a pedestrian activated RFB, with the Side-of-Street Uncontrolled Crosswalk sign with imbedded LED lights. In St. Petersburg, the RFB is also pedestrian activated but is used with a standard W11-2 sign with a separate LED device. In St Petersburg, the RFB includes an audible message to give the pedestrian crossing safety information, and a light directed on the pedestrian to improve visibility for approaching motorists. Both cities have evaluated motorists yielding rates at locations with the RFB. Results are summarized in the following tables.

St. Petersburg, Florida Motorist Compliance Rates

Lanes	24 Hour Volume	Posted Speed	Media n	Baseline Yield Rate	7 Day Yield Rate	90 Day Yield Rate	180 Day Yield Rate	Location
3	12,245	35	No	n/a	75%	82%	n/a	1 st N/61 st St
4	18,367	35	Yes	n/a	96%	92%	91%	22 nd Ave N/7 th St
4	17,657	35	Yes	n/a	60%	62%	68% ¹¹	4 th St/18 th Ave S
5	19,192	35	Yes	0.26%	84%	82%	n/a	58 th /3 rd Ave N
5	16,352	40	No ¹²	n/a	93%	71%	n/a	Central Ave/61 st St
4	19,422	35	Yes	0.49%	84%	82%	n/a	MLK St/15 th Ave. S
4	12,723	35	No ¹³	n/a	78%	93%	76%	9 th Ave N/26 th St

¹¹ This is actually a 270 day count, there was no data for 180 days at this location

¹² Parking is restricted on this roadway so sight distance to the crosswalk and the sign is ideal because the roadway is flat and straight. There are opposing left turn pockets (the 5th lane) at this location.

¹³ Parking is restricted on this roadway so sight distance to the crosswalk and the sign is ideal because the roadway is flat and straight

City of Boulder Compliance Results – Pedestrian actuated flashing signs

Location	Year Installed	Vehicle Volume (daily) *	Pedestrian Volume (3 peak hours)	Yield Compliance (Before)	Yield Compliance (After)	Percent Increase
Pearl (2900 Block)	10/00	24,000	70	26%	54%	+110%
Canyon & 11 th Street	01/01	19,000	460	38%	80%	+110%
Broadway & Pleasant	07/01 removed 10/04	39,000	530	16%	71%	+340%
Broadway & 18 th Street	07/01	43,000	440	23%	78%	+240%
Pearl west of 48 th Street	01/02 removed 07/03	18,000	10	0%	9%	Infinite
Folsom & Walnut	06/02	23,000	100	11%	54%	+390%
Broadway & Norwood	09/02	17,000	20	6%	60%	+900%
Valmont & Center Green	07/03	24,000	10	6%	83%	+1280%
Canyon & 19 th Street	02/04	24,000	80	10%	55%	+450%
Broadway & 17 th Street	10/04	43,000	180	42%	67%	+60%
Canyon & 10 th Street **	02/05	19,000	No Data	No Data	No Data	n/a

* - Many of the daily traffic volumes have been estimated from peak-hour turning movement counts and should be considered approximations.

** - Data collection has not yet occurred.

Recommendation

Develop a rapid flashing beacon policy based upon FHWA’s interim approval notice

It is recommended that the City of Wilmington develop a rapid flashing beacon policy and sign standard for use at uncontrolled crossings to better align with current research and best practices. City of Wilmington should develop warrant criteria (similar to the City of Boulder) to determine when to use the RFB. Factors to consider may include vehicle volume, roadway cross-section, motorist operating speed, and sight distance. The warrant criteria should be adjusted based on the RFB’s effectiveness in increasing motorist compliance to stop for pedestrians under various conditions.

The proposed Side-of-Street Uncontrolled Crosswalk Sign should be utilized as the sign base for the RFB standard in place of the W11-2 as shown in the example photo. Boulder has adopted the side-of-street sign as the base sign for the RFB. This will be consistent with the sign proposed for uncontrolled crossings in the City of Wilmington.

Develop a policy restricting the use of the standard flashing beacon at uncontrolled pedestrian crossings

It is recommended that the City of Wilmington develop a policy restricting the use of the standard flashing beacon (1 flash per second) at uncontrolled pedestrian crossings. To ensure uniformity of application, the rapid flash beacon should be the only device utilized for uncontrolled pedestrian crossings where an enhanced warning device is warranted.

Pedestrian Hybrid Signals (HAWK) and Pedestrian Volume Signal Warrant

Introduction

Engineers base their decision to install a traffic signals on 8 criteria (warrants) defined in the MUTCD. One of the criteria is based on pedestrian volumes (Warrant 4). Roadways which are difficult to cross due to high traffic volumes and/or high operating speeds will reduce pedestrian demand by discouraging pedestrians from attempting to cross. This makes the pedestrian warrant difficult to achieve in practice.



It can also be undesirable to install a signal on a high volume roadway if pedestrian use is infrequent or occurs at specific, but limited periods of time.

To provide a balance between pedestrian crossing needs and vehicular movement, some jurisdictions around the country have adopted the Pedestrian Hybrid Signal, otherwise known as the HAWK (**H**igh-intensity **A**ctivated **C**ross**W**alk) signal. The signal stops traffic when pedestrian activated, and is appropriate in locations where a full signal may cause unnecessary traffic delay by stopping traffic for the entire pedestrian phase.

This pedestrian activated signal is a combination of a flashing beacon and a traffic signal with pedestrian pushbuttons and pedestrian signal heads. It controls traffic on the main road using a combination of red and yellow signal lenses, while the minor approach is controlled by pedestrian signals and a stop sign for vehicles. This signal has been approved for inclusion into the MUTCD by the National Committee and is included in the proposed language for the 2009 MUTCD. This signal may also be used at mid-block locations. The National Committee has also approved a reduction in the pedestrian volume warrant.

Recommendations Overview

Adopt the proposed language for the 2009 MUTCD for both the pedestrian volume signal warrant and the Pedestrian Hybrid Signal.

Current Policy or Practice

City of Wilmington

The city has adopted the MUTCD which defines the pedestrian warrant for traffic control devices. The City of Wilmington does not have a current policy for Pedestrian Hybrid Signals

NCDOT

NCDOT has adopted the MUTCD which defines the pedestrian warrant for traffic control devices. NCDOT does not have a current policy for Pedestrian Hybrid Signals.

The Manual on Uniform Traffic Control Devices

Section 4C.05 defines the existing MUTCD pedestrian volume signal warrant (No. 4) shown below.

Standard: The need for a traffic control signal at an intersection or midblock crossing shall be considered if an engineering study finds that both of the following criteria are met:

- A. The pedestrian volume crossing the major street at an intersection or midblock location during an average day is 100 or more for each of any 4 hours or 190 or more during any 1 hour; and*
- B. There are fewer than 60 gaps per hour in the traffic stream of adequate length to allow pedestrians to cross during the same period when the pedestrian volume criterion is satisfied. Where there is a divided street having a median of sufficient width for pedestrians to wait, the requirement applies separately to each direction of vehicular traffic.*

The Pedestrian Volume signal warrant shall not be applied at locations where the distance to the nearest traffic control signal along the major street is less than 90 m (300 ft), unless the proposed traffic control signal will not restrict the progressive movement of traffic.

The MUTCD does not have a current policy for Pedestrian Hybrid Signals.

State of the Practice

Pedestrian Hybrid Signal (Hawk)

In the City of Tucson, Arizona, the HAWK signal, combined with a media campaign, has generated a high motorist yield rate, increasing compliance from 30 percent under normal conditions to 93 percent over an eight-month study period. This treatment is profiled in ITE's *Traffic Control Devices Handbook*. The signal has proven to be a successful tool to assist pedestrian crossings of multi-lane arterials with high vehicular volumes while minimizing vehicular delay to the arterial and discouraging minor roadway cut-through traffic.

Placement

The HAWK signal is best suited for uncontrolled crossings of multi-lane, higher speed or volume roadways where there is a need to provide occasional pedestrian crossings without inordinate delay to motor vehicles (i.e. school crossings, low volume neighborhood street crossings of high volume, multi-lane arterials). See proposed MUTCD warrant graphic included below.

Design of Vehicular Signal

Traffic signal head with the following 3-lens configuration:

Red – Red
Yellow

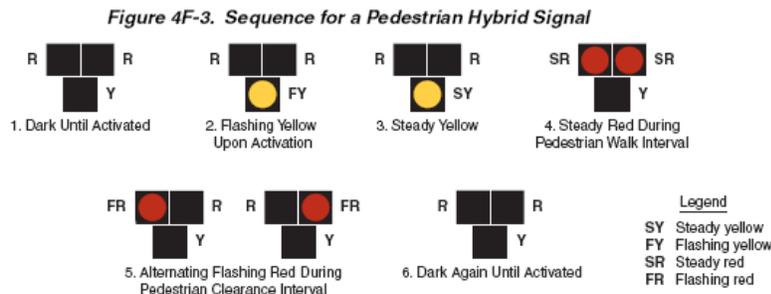
Design of Pedestrian Signal

Standard pedestrian countdown signal head

Operation

The HAWK signal remains dark for vehicles and a DON'T WALK signal is shown for pedestrians until it's activated. The signal proceeds in the following manner upon activation by a pedestrian:

- A flashing yellow light alerts the driver that conditions are changing and to use caution. (Pedestrians see a steady "DON'T WALK" signal)
- A steady yellow light alerts drivers that they should prepare to stop.
- A steady red light gives the clear signal to motorists to stop for pedestrians (pedestrians receive the "WALK" signal)
- After a set interval, a wigwag flashing red signal (i.e. top and bottom alternating red flash) is used to indicate to drivers to stop and only proceed after pedestrians have cleared the crosswalk (pedestrians receive the flashing "DON'T WALK" signal).



Graphical depiction of operating sequence – graphic proposed for 2009 MUTCD

Proposed language for the 2009 MUTCD defines the HAWK signal operation, provides warrants for its use, and provides installation guidance. The following pages contain the proposed language.

CHAPTER 4F. PEDESTRIAN HYBRID SIGNALS

Section 4F.01 Application of Pedestrian Hybrid Signals

Support: A pedestrian hybrid signal is a special type of hybrid signal used to warn and control traffic at an unsignalized location to assist pedestrians in crossing a street or highway at a marked crosswalk.

Option: A pedestrian hybrid signal may be considered for installation at a location that does not meet other traffic signal warrants to facilitate pedestrian crossings.

Standard: If used, pedestrian hybrid signals shall be used in conjunction with signs and pavement markings to warn and control traffic at locations where pedestrians enter or cross a street or highway. A pedestrian hybrid signal shall only be installed at a marked crosswalk.

Guidance: If a location meets the traffic control signal warrants under Sections 4C.05 and/or 4C.06 and a decision is made not to install a traffic control signal, a pedestrian hybrid signal should be considered. If one of the signal warrants of Chapter 4C is met and a traffic control signal is justified by an engineering study, and if a decision is made to install a traffic control signal, it should be installed based upon the provisions of Chapters 4D and 4E.

If a traffic control signal is not justified under the signal warrants of Chapter 4C and if gaps in traffic are not adequate to permit pedestrians to cross, or if the speed for vehicles approaching on the major street is too high to permit pedestrians to cross, or if pedestrian delay is excessive, the need for a pedestrian hybrid signal should be considered on the basis of an engineering study that considers major-street volumes, speeds, widths, and gaps in conjunction with pedestrian volumes, walking speeds, and delay.

For a major street where the posted or statutory speed limit or the 85th-percentile speed is 60 km/h or less or is 35 mph or less, the need for a pedestrian hybrid signal should be considered if the engineering study finds that the plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding total of all pedestrians crossing the major street for 1 hour (any four consecutive 15-minute periods) of an average day falls above the applicable curve in Figure 4F-1 for the length of the crosswalk.

For a major street where the posted or statutory speed limit or the 85th-percentile speed exceeds 60 km/h or exceeds 35 mph, the need for a pedestrian hybrid signal should be considered if the engineering study finds that the plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding total of all pedestrians crossing the major street for 1 hour (any four consecutive 15-minute periods) of an average day falls above the applicable curve in Figure 4F-2 for the length of the crosswalk.

For crosswalks that have lengths other than the four that are specifically shown in Figures 4F-1 and 4F-2, the values should be interpolated between the curves.

Section 4F.02 Design of Pedestrian Hybrid Signals

Standard: Except as otherwise specified in this Section, a pedestrian hybrid signal shall meet the provisions of Chapters 4D and 4E.

A pedestrian hybrid signal face shall consist of three signal sections, with a CIRCULAR YELLOW signal indication centered below two horizontally aligned CIRCULAR RED signal indications (see Figure 4F-3).

When an engineering study finds that installation of a pedestrian hybrid signal is justified, then:

- A. At least two pedestrian hybrid signal faces shall be installed for each approach of the major street,
- B. A stop line shall be installed for each approach of the major street,
- C. A pedestrian signal head conforming to the provisions set forth in Chapter 4E shall be installed at each end of the marked crosswalk, and
- D. The pedestrian hybrid signal shall be pedestrian actuated.

Guidance: When an engineering study finds that installation of a pedestrian hybrid signal is justified, then:

- A. Parking and other sight obstructions should be prohibited for at least 30 m (100 ft) in advance of and at least 6.1 m (20 ft) beyond the marked crosswalk,
- B. The installation should include suitable standard signs and pavement markings, and
- C. If installed within a signal system, the pedestrian hybrid signal should be coordinated.

On approaches having posted speed limits or 85th-percentile speeds in excess of 60 km/h (35 mph) and on approaches having traffic or operating conditions that would tend to obscure visibility of roadside hybrid signal face locations, both of the minimum of two pedestrian hybrid signal faces should be installed over the roadway.

On multi-lane approaches having posted speed limits or 85th-percentile speeds of 60 km/h (35 mph) or less, either a pedestrian hybrid signal face should be installed on each side of the

approach (if a median of sufficient width exists) or at least one of the pedestrian hybrid signal faces should be installed over the roadway.

Support: Section 4D.11 contains additional provisions regarding lateral and longitudinal positioning of signal faces for approaches having a posted or 85th-percentile speed exceeding 60 km/h or exceeding 40 mph.

Standard: A CROSSWALK STOP ON RED (symbolic circular red) (R10-23) sign (see Section 2B.59) shall be mounted adjacent to a pedestrian hybrid signal face on each major street approach. If an overhead pedestrian hybrid signal face is provided, the sign shall be mounted adjacent to the overhead signal face.

Option:

A Pedestrian (W11-2) sign (see Section 2C.52) with an AHEAD (W16-9P) supplemental plaque may be placed in advance of a pedestrian hybrid signal. A warning beacon may be installed to supplement the W11-2 sign.

Guidance: If a warning beacon supplements a W11-2 sign in advance of a pedestrian hybrid signal, it should be programmed to flash only during the yellow and red signal indications of the pedestrian hybrid signal.

Standard: If a warning beacon is installed to supplement the W11-2 sign, the design and location of the beacon shall comply with the provisions of Sections 4L.01 and 4L.03.

If a pedestrian hybrid signal is installed at or immediately adjacent to an intersection with a side road or driveway, vehicular traffic on the side road or driveway shall be controlled by STOP signs.

Section 4F.03 Operation of Pedestrian Hybrid Signals

Standard: Pedestrian hybrid signal indications shall be dark (not illuminated) during periods between actuations.

Upon actuation by a pedestrian, a pedestrian hybrid signal face shall display a flashing CIRCULAR YELLOW signal indication, followed by a steady CIRCULAR YELLOW signal indication, followed by both steady CIRCULAR RED signal indications during the pedestrian walk interval, followed by alternating flashing CIRCULAR RED signal indications during the pedestrian clearance interval (see Figure 4F-3). Upon termination of the pedestrian clearance interval, the pedestrian hybrid signal faces shall revert to a dark (not illuminated) condition.

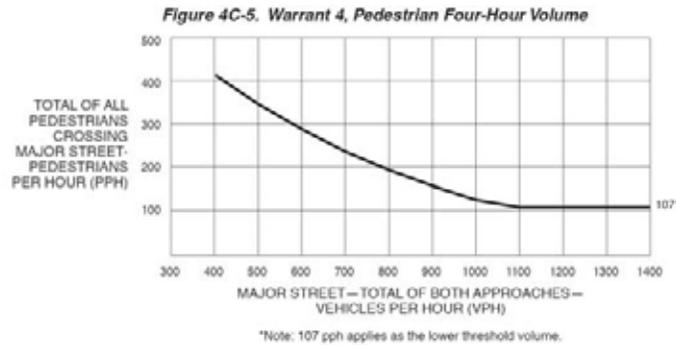
Except as noted in the Option below, the pedestrian signal heads shall continue to display a steady UPRAISED HAND (symbolizing DONT WALK) signal indication when the pedestrian hybrid signal faces are either dark or displaying flashing or steady CIRCULAR YELLOW signal indications. The pedestrian signal heads shall display a WALKING PERSON (symbolizing WALK) signal indication when the pedestrian hybrid signal faces are displaying steady CIRCULAR RED signal indications. The pedestrian signal heads shall display a flashing UPRAISED HAND (symbolizing DONT WALK) signal indication when the pedestrian hybrid signal faces are displaying alternating flashing CIRCULAR RED signal indications. Upon termination of the pedestrian clearance interval, the pedestrian signal heads shall revert to a steady UPRAISED HAND (symbolizing DONT WALK) signal indication.

Option: Where the pedestrian hybrid signal is installed adjacent to a roundabout to facilitate crossings by pedestrians with visual disabilities and an engineering study determines that pedestrians without visual disabilities can be allowed to cross the roadway without actuating the pedestrian hybrid signal, the pedestrian signal heads may be dark (not illuminated) when the pedestrian hybrid signal faces are dark.

Guidance: The duration of the flashing yellow interval should be determined by engineering judgment. The steady yellow interval should not have a duration of less than 3 seconds or more than 6 seconds (see Section 4D.26). The longer intervals should be reserved for use on approaches with higher speeds.

Pedestrian Volume Signal Warrant (No. 4)

Proposed language and figures have been developed for the next edition of the MUTCD to simplify the pedestrian volume signal warrant (warrant 4). The proposed warrant eliminates the gap analysis required by the existing warrant, and is based on a combination of pedestrian volume and vehicle volume (a surrogate for gaps). The proposed graphic depicting the pedestrian signal warrant is shown below. If a crossing meets this warrant, the designer has the option to choose either a full signal or the hybrid pedestrian signal.



Revised warrant criteria for Warrant 4 – graphic proposed for 2009 MUTCD

Recommendation

Adopt the proposed language for the 2009 MUTCD for both the pedestrian volume signal warrant and the Pedestrian Hybrid Signal.

It is recommended that City of Wilmington adopt the proposed language for the 2009 MUTCD for both the pedestrian volume signal warrant and the Pedestrian Hybrid Signal.

This signal will be a useful tool for roadways with an uncontrolled crossing where a marked crosswalk alone is not recommended and where the installation of a full signal will cause excessive vehicular delay or induce traffic to shift to lower volume neighborhood streets. This signal will also be an important option for improving the safety of crosswalks on the cities multi-lane arterials that do not have median islands. Although this device was not in widespread use at the time of the FHWA crosswalk study, it may be an appropriate treatment for uncontrolled crossings that require a signal as per the study.

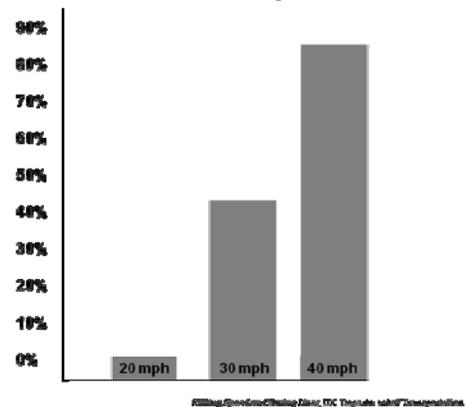
Posted Speed Limits

Introduction

The establishment of speed limits requires balancing the relative importance of safety, convenience, engineering, and enforcement. The public will disregard speed limits if they are perceived to be unreasonable by their standards. If large percentages of motorists ignore the speed limits, it then becomes difficult to enforce the speed limit.

Fatalities based on speed of vehicle

A pedestrian's chance of death if hit by a motor vehicle



The most effective way to manage speed on roadways is to engineer the roadway to the desired operating speed within the context of the surrounding land use. The roadway should be a balanced designed developed in a context sensitive manner¹⁴ that balances efficiency, safety, aesthetics, and multi-modal mobility.

The existing practice of primarily relying on the 85th percentile speed of motorists and functional classification of the roadway fails to account for potential changes to the roadway environment. Relying primarily on existing speeds also limits the ability to change critical engineering values such as lane width, horizontal deflection, deceleration lane lengths, and corner curb radii which can be utilized to manage operating speeds on a roadway.

Speed is also a major factor in the severity of crashes. Higher speed crashes between vehicles result in increases in injuries, fatalities, and property damage. Pedestrians hit by vehicles at speeds in excess of 30 mph have a 45-50% chance of death.

Recommendations Overview

Wilmington should develop an arterial context sensitive speed limit policy based upon surrounding land use, roadway purpose, and multi-modal balance goals.

Current Policies or Practice

City of Wilmington

The City of Wilmington does not appear to have a speed limit policy.

NCDOT

NCDOT follows the Guidelines for the Establishment of Restrictive Speed Limits policy developed in 1995. This policy states:

“35 mph or lower speed limits should be considered when the overall amount of roadside development is or exceeds 75% for a given roadway length of 0.25 mile. This development may be residential and/or commercial.”

AASHTO Green Book

From page 71:

Urban arterial streets should be designed and control devices regulated, where practical, to permit running speeds of 20 to 45 mph. Speeds in the lower portion of this range are applicable to local and collector streets through residential areas and to arterial streets through more crowded business areas, while the speeds in the higher

¹⁴ See handbook – “When Main Street is a State Highway” developed by the Maryland State Highway Association <http://www.marylandroads.com/businesswithSHA/projects/ohd/mainstreet/mainstreet.asp>

portion of the range apply to hightype arterials in outlying suburban areas. For arterial streets through crowded business areas, coordinated signal control through successive intersections is generally needed to permit attainment of even the lower speeds. Many cities have substantial lengths of signal-controlled streets that operate at speeds of 15 to 25 mph.

Under less crowded conditions in suburban areas, it is common on preferred streets to adopt some form of speed zoning or control to limit high operating speeds. In such areas, pedestrians along the arterial or vehicles on cross streets, although relatively infrequent, may be exposed to potential collisions with through drivers. Such through drivers may gradually gain speed as urban restrictions are left behind or may retain their open-road speeds as they enter the city. Thus, although through traffic should be expedited to the extent practical, it may be equally important to limit speeds to reduce the risk of crashes and to serve local traffic.

Discussion of Existing Policies

The application of speed limits on NCDOT owned roadways within Wilmington strongly favors the through movement of motorists. It appears that there is a need to reevaluate speed limits along NCDOT roadways within the context of the extent of development alongside the roadway. The evaluation should consider the number of access points, pedestrian and bicyclist access along and across the roadway and the accident rate of the roadway.

The posted 45 mph speed limits the engineering flexibility which will be required to improve pedestrian crossing accommodations across NCDOT roadways by making it difficult to narrow travel lanes. Travel lanes of 11 feet will create additional space on many roadways to create or improve pedestrian refuge islands enabling the signalization and installation of crosswalks at many locations.

The higher posted speed limit along these arterial roadways also limits the ability to reduce speeds to a more appropriate 25 mph in school zones to reduce the likelihood of a child fatality in the event of a collision.

It appears that the City of Wilmington the authority to establish speed limits within the City Limits, including NCDOT owned roadways.

State of the Practice

Expert System for Recommending Speed Limits in Speed Zones, NCHRP Report 0367, November 2006

This report recommended setting speed limits differently in urban areas:

In urban areas with high pedestrian and bicycle activity, many experts recommend selecting the 5 mph multiple closest to the 50th percentile speed (the 50th percentile speed is the speed at or below which 50 percent of motorists drive on a given road) as the speed limit.

An analysis of 52 studies between 1966 and 1995 found “a reduction in speed limit was associated with a reduction in fatal and injury crashes”

- a 6 mph reduction in the speed limit was associated with approximately a 10% reduction in injury crashes and a 20% reduction in fatal crashes
- a 12 mph reduction in the speed limit was associated with approximately a 20% reduction in injury crashes, and a 40% reduction in fatal crashes.

Recommendation

Develop an arterial context sensitive speed limit policy based upon surrounding land use, roadway purpose, and multi-modal balance goals.

It is recommended that speed limits be restricted to the following:

- 25 mph in school zones
- 35 mph on arterials with development in accordance with NCDOT policy
- 25 mph on residential streets

COST ESTIMATES

Estimated Unit Construction Costs for Various Elements

Unit costs are based on 2008 dollars and were assigned based on historical cost data from state departments of transportation and other sources. The costs are intended to be general and used for planning purposes. Construction costs will vary based on the ultimate project scope (i.e. potential combination of projects, or use of City of Wilmington or NCDOT forces) and economic conditions at the time of construction.

Item	Unit	Unit Cost
Thermoplastic Pavement Marking 4"	LF	0.50
Thermoplastic Pavement Marking 6"	LF	1.00
Thermoplastic Pavement Marking 8"	LF	2.00
Thermoplastic Pavement Marking 12"	LF	3.00
Thermoplastic Pavement Marking Symbol	EA	250.00
Thermoplastic Pavement Marking Parking "T"	EA	2.50
Thermoplastic Pave. Marking High Visibility Crosswalk (15 FT x 40 FT)	EA	250.00
Eradicate Pavement Marking	LF	2.00
Sign Panel	SF	15.00
Sign Post	LF	10.00
Sign (Average 6 SF Panel, 11 LF Post)	EA	200.00
Sign Post Removal	EA	45.00
Remove and Reset Sign Panel and Post	EA	500.00
Remove and Reset Sign Panel	EA	250.00
Oversized Sign and Support (Double Post)	EA	1000.00
Cantilever Sign and Support	EA	27000.00
Asphalt Concrete Surface	TON	65.00
Asphalt Concrete Base	TON	60.00
Aggregate	CY	50.00
Concrete Pavement	SY	40.00
Trail Pavement (4 IN Surface, 6 IN Base, 6 IN Aggregate)	SF	2.50
Trail Pavement (6 FT Wide, 4 IN Surface, 6 IN Base, 6 IN Aggregate)	LF	15.00
Trail Pavement (8 FT Wide, 4 IN Surface, 6 IN Base, 6 IN Aggregate)	LF	20.00
Trail Pavement (10 FT Wide, 4 IN Surface, 6 IN Base, 6 IN Aggregate)	LF	25.00
Trail Pavement (12 FT Wide, 4 IN Surface, 6 IN Base, 6 IN Aggregate)	LF	30.00
Pavement Milling (1.5 in)	SY	5.25
Asphalt Entrance (30 FT Wide, 20 FT Long)	EA	1900.00
Demolition of Pavement/Excavation	CY	15.00
Obscuring	SY	200.00
Raised Crossing Pavement (3 IN high, 15 FT Wide, 40 FT Long)	EA	715.00
Raised Crossing Pavement (6 IN high, 15 FT Wide, 40 FT Long)	EA	1430.00
Textured Concrete	SF	8.00
Colored Concrete		
Stamped/Colored Asphalt	SF	5.00

Item	Unit	Unit Cost
Signal Loop Detector	EA	1210.00
Signal Head	EA	5000.00
Pedestrian Signal Head	EA	5000.00
Pedestrian/Bike Signal (Best Guess for 4 leg Intersection)	EA	40,000.00
Fully Signalized 4 Leg Intersection	EA	121000.00
Remove Roadway Lighting Structure	EA	500.00
Sidewalk (4 IN PCC)	SF	5.00
Curb Ramp	EA	400.00
Curb and Gutter	LF	45.00
Concrete Median	SY	300.00
Bollard	EA	260.00
	SY	126.00
Unit Pavers	SF	15.00
Remove Drainage Inlet	EA	500.00
Drainage Inlet/Catch Basin	EA	3000.00
Project Drainage (Per SF of New Pavement)	SF	2.13
Engineering Costs	Percent	15%
Contingency	Percent	25%

Long Term Sidewalk Improvements Recommendations

Construction cost estimates were developed for the recommendations based on an estimated cost of \$5 per square foot for 4” thick, 5’ wide poured in place concrete sidewalk. Because this is a city-wide plan and not a detailed project site design study, the costs are intended to be general and used for planning purposes only and do not include right-of-way acquisitions, curb ramp installation, new driveway aprons, grading, drainage improvements or retaining walls, and other elements. Construction costs will vary based on the ultimate project scope (i.e. potential combination of projects, or use of Wilmington or NC DOT labor) and economic conditions at the time of construction. Actual construction costs should be determined at the time of the project and should include estimates based on: sidewalk thickness and width, number of curb ramps required, driveway aprons, surface (if surface other than concrete is desired), drainage improvements, curb and gutter or grassed swale, signage, right of way acquisition, demolition, engineering, utility relocation, mobilization, temporary access, bus stop improvements, street furniture and other project costs.

Street	Length (FT)	Length (MI)	Approx. Cost.
10TH ST	1,864	0.35	\$46,604
11TH ST	333	0.06	\$8,331
12TH ST	2,959	0.56	\$73,976
14TH ST	1,665	0.31	\$41,626
15TH ST	4,556	0.86	\$113,894
18TH ST	834	0.16	\$20,856
19TH ST	3,830	0.72	\$95,762
20TH ST	1,474	0.28	\$36,849
21 ST ST	805	0.15	\$20,126
22 ND ST	982	0.19	\$24,549
23 RD ST	1,467	0.28	\$36,679
26 TH ST	725	0.14	\$18,113
27 TH ST	1,433	0.27	\$35,816
29 TH ST	3,869	0.73	\$96,734
2ND ST	2,002	0.36	\$47,594
30 TH ST	2,795	0.53	\$69,867
31ST ST	2,689	0.51	\$67,222
39 TH ST	2,620	0.50	\$65,492
3RD ST	116	0.02	\$2,908
41 ST ST	5,499	1.04	\$137,481
43 RD ST	1,700	0.32	\$42,488
47 TH ST	1,185	0.22	\$29,637

Street	Length (FT)	Length (MI)	Approx. Cost.
48 TH ST	609	0.12	\$15,231
48TH ST	611	0.12	\$15,268
4TH ST	5,994	1.14	\$149,838
51st ST	773	0.15	\$19,337
52 ND ST	2,668	0.51	\$66,698
54TH ST	2,117	0.40	\$52,929
58TH ST	4,019	0.76	\$100,477
5TH AV	704	0.13	\$17,592
5TH ST	1,277	0.24	\$31,916
6TH ST	3,232	0.61	\$80,804
7TH ST	785	0.15	\$19,622
8TH ST	1,214	0.23	\$30,354
ADAMS ST	1,446	0.27	\$36,155
ADELAIDE DR	2,962	0.56	\$74,053
AIRLIE FOREST CT	1,971	0.37	\$49,269
ALABAMA AV	1,278	0.24	\$31,954
ALBERT	3,006	0.57	\$75,159
ALLENS LN	743	0.14	\$18,582
ALLEY	55	0.01	\$1,374
ALOHA LN	399	0.08	\$9,985
ALPINE DR	1,910	0.36	\$47,757
AMHEARST CT	938	0.18	\$23,461
AMPHITHEATRE DR	869	0.16	\$21,715
AMY DR	2,359	0.45	\$58,982
ANDERSON ST	375	0.07	\$9,376
ANDOVER	465	0.09	\$11,634
ANDOVER RD	5,108	0.97	\$127,707
ANDREWS REACH LP	3,637	0.69	\$90,921
ANTELOPE TRAIL	738	0.14	\$18,453
APOLLO DR	2,872	0.55	\$71,805
APPLETON	3,830	0.73	\$95,749
ARCHER DR	1,587	0.30	\$39,668
ARDLEY CT	458	0.09	\$11,444
ARIZONA AV	462	0.09	\$11,544
ASHLEY	5,375	1.02	\$134,378
ASTER CT	9,251	1.75	\$231,267
ATHENS LN	1,324	0.25	\$33,090
ATLANTIS CT	2,102	0.40	\$52,541
AUTUMN HALL DR	2,753	0.52	\$68,834
AVENTURAS DR	2,251	0.43	\$56,279

Street	Length (FT)	Length (MI)	Approx. Cost.
AVINE CT	313	0.06	\$7,836
AZALEA DR	1,104	0.21	\$27,612
BAGLEY	879	0.17	\$21,969
BARCLAY HILLS DR	2,494	0.47	\$62,338
BAREFOOT DR	1,684	0.32	\$42,103
BARKLEY AV	710	0.14	\$17,758
BARKSDALE RD	1,282	0.24	\$32,061
BARLOW CT	138	0.03	\$3,439
BARNETT AV	768	0.15	\$19,205
BATTERY PL	1,439	0.27	\$35,979
BEAR CT	313	0.06	\$7,829
BEASLEY ST	323	0.06	\$8,085
BEAUREGARD DR	3,683	0.70	\$92,065
BEAVER CREEK CT	998	0.19	\$24,962
BEDFORD FOREST DR	1,911	0.36	\$47,767
BEECHCLIFF DR	774	0.15	\$19,353
BELGRAVE	508	0.10	\$12,692
BELL ST	1,484	0.28	\$37,112
BELVEDERE DR	717	0.14	\$17,934
BENJAMIN AV	1,906	0.36	\$47,649
BENTLEY DR	205	0.04	\$5,114
BETHAL RD	4,525	0.86	\$113,121
BIRCH CREEK DR	3,989	0.76	\$99,722
BIRDIE LN	1,900	0.36	\$47,509
BLACK ST	434	0.08	\$10,856
BLAIR SCHOOL RD	4,162	0.79	\$104,044
BLAND ST	527	0.10	\$13,164
BLENHEIM PL	571	0.11	\$14,285
BLUEBIRD LN	852	0.16	\$21,311
BOATHOUSE RD	1,279	0.24	\$31,975
BOGEY DR	1,962	0.37	\$49,053
BONHAM AV	6,458	1.22	\$161,448
BORDEAUX AV	938	0.18	\$23,454
BOUGAINVILLEA	3,067	0.58	\$76,672
BRADFORD RD	2,863	0.54	\$71,566
BRAEMAR LN	1,808	0.34	\$45,193
BRAGG DR	5,333	1.01	\$133,337
BRICKLE AV	723	0.14	\$18,087
BRISTOL RD	1,711	0.32	\$42,774
BRITTAIN DR	29	0.01	\$723
BROAD ST	1,132	0.21	\$28,294

Street	Length (FT)	Length (MI)	Approx. Cost.
BROOKSHIRE LN	6,427	1.22	\$160,678
BRUNSWICK ST	517	0.10	\$12,933
BRYAN AV	1,888	0.36	\$47,210
BUCKINGHAM AV	1,433	0.27	\$35,825
BUNTING DR	448	0.08	\$11,195
BURKE AV	525	0.10	\$13,123
BURNEY ST	2,156	0.41	\$53,906
BUTTER CLAM CT	208	0.04	\$5,206
CABLE CAR LN	3,143	0.60	\$78,571
CADDY	1,521	0.29	\$38,028
CAIN CT	396	0.08	\$9,905
CALHOUN DR	2,590	0.49	\$64,755
CALVERT PL	356	0.07	\$8,908
CAMDEN	5,024	0.95	\$125,594
CAMELIA DR	2,803	0.53	\$70,077
CAMELLIA LN	2,264	0.43	\$56,607
CAMERON CT	4,277	0.81	\$106,918
CAMPBELL ST	898	0.17	\$22,456
CAMPUS VIEW	225	0.04	\$5,631
CAMWAY DR	3,998	0.76	\$99,955
CANTERBURY RD	58	0.01	\$1,451
CAPE FEAR	1,521	0.29	\$38,021
CAPE HARBOR DR	28	0.01	\$701
CAPRI DR	1,739	0.33	\$43,480
CARL ST	2,712	0.51	\$67,800
CARLTON AV	1,940	0.37	\$48,502
CARNATION CT	1,055	0.20	\$26,376
CARRIAGE WY	342	0.07	\$8,542
CARTER AV	2,146	0.41	\$53,661
CASCADE RD	3,946	0.75	\$98,649
CASTLE HAYNE RD	4,091	0.77	\$102,287
CASTLE ST	406	0.08	\$10,147
CASTLEWOOD DR	289	0.05	\$7,216
CASWELL ST	1,399	0.27	\$34,979
CEDAR AV	5,141	0.97	\$128,515
CEDAR RIDGE DR	2,455	0.47	\$61,366
CELLINE CT	376	0.07	\$9,389
CENTER ST	1,159	0.22	\$28,965
CHALMERS DR	5,763	1.09	\$144,085
CHANCERY PL	32	0.01	\$798
CHAPPEL AV	909	0.17	\$22,732

Street	Length (FT)	Length (MI)	Approx. Cost.
CHARLES PAINE DR	1,048	0.20	\$26,211
CHARTER DR	3,030	0.57	\$75,757
CHELON	4,623	0.88	\$115,580
CHELSEA LN	2,207	0.42	\$55,178
CHENEY PL	236	0.05	\$5,900
CHERRY AV	4,397	0.83	\$109,930
CHESTER ST	3,289	0.62	\$82,213
CHESTNUT ST	303	0.06	\$7,566
CHURCH ST	619	0.12	\$15,486
CIRCLE ST	392	0.07	\$9,803
CLAIRIDGE RD	1,543	0.29	\$38,571
CLAY ST	4,925	0.93	\$123,129
CLEMSON DR	1,567	0.30	\$39,177
CLUBHOUSE DR	2,177	0.41	\$54,437
COBBLESTONE DR	2,790	0.53	\$69,749
COLLEGE ACRES DR	2,569	0.49	\$64,220
COLLEGE RD	4,232	0.80	\$105,788
COLLETON CT	597	0.11	\$14,934
COLLINWOOD CT	943	0.18	\$23,585
COLONY	1,762	0.33	\$44,053
COLUMBUS	1,686	0.32	\$42,159
COLWELL AV	1,809	0.34	\$45,217
COMPTON ST	2,646	0.50	\$66,156
CONFEDERATE DR	4,697	0.89	\$117,426
CONSTITUTION	1,282	0.24	\$32,062
COOPER CT	253	0.05	\$6,332
COPLEY RD	423	0.08	\$10,564
CORBETT ST	1,542	0.29	\$38,541
COSTMARY LN	948	0.18	\$23,708
COULTER PL	795	0.15	\$19,868
COUNTRY CLUB RD	27	0.01	\$668
COVINGTON RD	1,480	0.28	\$37,010
COWAN ST	1,546	0.29	\$38,648
CRAWLDAD CT	1,413	0.27	\$35,329
CRETE DR	1,176	0.22	\$29,388
CREWS DR	1,296	0.25	\$32,400
CROCUS CT	689	0.13	\$17,220
CROMWELL	873	0.17	\$21,836
CROQUET DR	1,018	0.19	\$25,457
CROSS CREEK RD	1,134	0.22	\$28,362
CROSSOVER ST	703	0.13	\$17,576

Street	Length (FT)	Length (MI)	Approx. Cost.
CROWLEY	313	0.06	\$7,836
CURLEW DR	582	0.11	\$14,551
CYPRESS DR	1,736	0.33	\$43,394
CYPRESS GROVE DR	4,436	0.84	\$110,908
DANBURY ST	214	0.04	\$5,345
DAPHINE	869	0.17	\$21,725
DAPHINE CT	122	0.02	\$3,061
DAPHINE DR	430	0.08	\$10,748
DAPPLE CT	998	0.19	\$24,949
DARBY ST	2,184	0.41	\$54,600
DARE ST	977	0.19	\$24,432
DARTMOUTH ST	1,204	0.23	\$30,105
DAVIE DR	2,134	0.40	\$53,356
DAVIS LN	116	0.02	\$2,906
DAWSON ST	488	0.09	\$12,211
DECATUR DR	2,556	0.48	\$63,904
DELAWARE AV	1,251	0.24	\$31,270
DELGATO AV	384	0.07	\$9,602
DEPARTURE CT	502	0.10	\$12,556
DERBY DOWN	1,398	0.27	\$34,959
DEVON CT	647	0.12	\$16,169
DEVONSHIRE LN	3,583	0.68	\$89,580
DEWITT RD	1,116	0.21	\$27,903
DEXTER ST	2,015	0.38	\$50,384
DISNEY DR	3,035	0.58	\$75,874
DIXIE AV	3,231	0.61	\$80,780
DOBBS ST	1,477	0.28	\$36,934
DOCTORS	1,007	0.19	\$25,173
DOE CLEARING CT	471	0.09	\$11,784
DOGWOOD LN	281	0.05	\$7,020
DOLPHIN CT	446	0.08	\$11,155
DONNA AV	966	0.18	\$24,151
DORSETT PL	1,702	0.32	\$42,554
DOUGHTON DR	1,077	0.20	\$26,936
DOVE CT	907	0.17	\$22,674
DOVER RD	2,690	0.51	\$67,245
DUCK HAWK CT	264	0.05	\$6,607
DUDLEY DR	198	0.04	\$4,945
DUNMORE RD	4,051	0.77	\$101,287
DURBIN CT	1,659	0.31	\$41,467

Street	Length (FT)	Length (MI)	Approx. Cost.
EARLY DR	2,474	0.47	\$61,858
EASTWIND RD	6,693	1.27	\$167,323
EBB TIDE LN	760	0.14	\$19,007
ECHO FARMS	2,892	0.55	\$72,307
EDGEWOOD RD	2,939	0.56	\$73,463
EDINBORO LN	1,040	0.20	\$25,993
EDWARDS ST	2,127	0.40	\$53,185
ELISHA DR	5,112	0.97	\$127,809
ELM ST	2,087	0.40	\$52,187
ELMORE ST	654	0.12	\$16,352
EMERALD COVE CT	831	0.16	\$20,773
EMERSON ST	1,266	0.24	\$31,657
EMORY ST	377	0.07	\$9,414
EMPIE PARK	459	0.09	\$11,470
ESTATE DR	2,311	0.44	\$57,777
ESTATE RD	753	0.14	\$18,826
ESTELLE LEE DR	837	0.16	\$20,915
EVANS ST	5,169	0.98	\$129,228
EVERGREEN DR	1,005	0.19	\$25,133
EWELL DR	1,439	0.27	\$35,976
EXETER PL	87	0.02	\$2,168
FAIRLAWN DR	2,355	0.45	\$58,884
FAIRVIEW DR	3,628	0.69	\$90,689
FALL DR	2,263	0.43	\$56,587
FANNING ST	509	0.10	\$12,724
FAWN CREEK DR	807	0.15	\$20,184
FEDERAL EXPRESS RD	454	0.09	\$11,358
FEDERAL PARK DR	1,422	0.27	\$35,551
FENWICK PL	1,548	0.29	\$38,706
FILLMORE DR	3,040	0.58	\$76,005
FINIAN DR	1,451	0.28	\$36,286
FLINT DR	475	0.09	\$11,873
FLORIDA	551	0.10	\$13,773
FOREST AV	2,021	0.38	\$50,522
FOREST CREEK	1,261	0.24	\$31,523
FOREST PARK RD	1,560	0.30	\$38,988
FOREST RD	3,792	0.72	\$94,802
FOWLER ST	2,013	0.38	\$50,325
FOXGLOVE CT	308	0.06	\$7,688
FOXHALL CT	1,448	0.28	\$36,210
FRANCIS MARION	5,845	1.11	\$146,115

Street	Length (FT)	Length (MI)	Approx. Cost.
DR			
FRANKLIN AV	2,554	0.48	\$63,847
FRATERNITY CT	247	0.05	\$6,175
FRENCH RD	2,422	0.46	\$60,548
GADDY DR	377	0.07	\$9,413
GADWALL CT	635	0.12	\$15,866
GARDEN AV	1,225	0.23	\$30,633
GARDEN TERRACE DR	181	0.03	\$4,518
GARDENIA CT	197	0.04	\$4,930
GARDENIA LN	2,296	0.43	\$57,406
GASTON ST	858	0.16	\$21,455
GATEWAY DR	1,371	0.26	\$34,286
GEORGE ANDERSON DR	2,233	0.42	\$55,823
GEORGETOWN RD	71	0.01	\$1,779
GIBSON AV	1,768	0.34	\$44,205
GILES	1,609	0.30	\$40,222
GILLETTE DR	6,029	1.14	\$150,732
GILLMOSS LN	194	0.04	\$4,862
GLASGOW DR	495	0.09	\$12,367
GLEASON RD	1,690	0.32	\$42,245
GLEN MEADE RD	1,692	0.32	\$42,304
GLENN ST	685	0.13	\$17,115
GOLDEN EAGLE CT	699	0.13	\$17,479
GORDON RD	653	0.06	\$8,361
GORES	644	0.12	\$16,092
GORHAM	1,859	0.35	\$46,479
GRADY AV	1,690	0.32	\$42,244
GRAHAM ST	956	0.18	\$23,909
GRANDE MANOR CT	550	0.10	\$13,762
GREENDALE DR	2,303	0.44	\$57,574
GREENLEAF DR	1,529	0.29	\$38,236
GREENWELL CT	944	0.18	\$23,609
GREENWOOD AV	2,938	0.56	\$73,456
GREY LEAF DR	2,623	0.50	\$65,571
GROUSE CT	1,756	0.33	\$43,912
GUFFORD DR	1,492	0.28	\$37,291
HALIFAX RD	2,751	0.52	\$68,785
HAMILTON DR	794	0.15	\$19,845
HAMPSHIRE DR	2,266	0.43	\$56,651

Street	Length (FT)	Length (MI)	Approx. Cost.
HAMPTON RD	831	0.16	\$20,775
HANOVER ST	720	0.14	\$17,990
HARDSCRABBLE CT	1,755	0.33	\$43,874
HARNETT ST	671	0.13	\$16,778
HARRISON ST	542	0.10	\$13,538
HART ST	1,479	0.28	\$36,963
HARVEST GROVE LN	609	0.12	\$15,227
HAVELOCK LN	486	0.09	\$12,153
HAWTHORNE PL	883	0.17	\$22,066
HAYMARKET LN	4,994	0.95	\$124,852
HEAD RD	1,947	0.37	\$48,686
HEIDE DR	2,891	0.55	\$72,284
HENRY H WATTERS DR	1,523	0.29	\$38,079
HENRY ST	4,132	0.78	\$103,305
HILL ST	1,363	0.26	\$34,080
HILLANDALE DR	767	0.15	\$19,187
HILLSDALE DR	3,594	0.68	\$89,853
HILTON ST	2,487	0.47	\$62,187
HOGGARD DR	3,564	0.68	\$89,098
HOLLINS RD	3,158	0.60	\$78,943
HOLLY DR	1,498	0.28	\$37,454
HOLMLOCK	796	0.15	\$19,889
HONEYSUCKLE ST	1,291	0.24	\$32,277
HOOD DR	2,576	0.49	\$64,407
HORSHAM CT	305	0.06	\$7,632
HOSPITAL PLAZA DR	1,773	0.34	\$44,316
HOWARD ST	1,607	0.30	\$40,167
HUDSON DR	1,971	0.37	\$49,276
HUGH MACRE PARK	919	0.17	\$22,978
HUGH MCRAE PARK	1,396	0.26	\$34,895
HUGH MCRAE PARK RD	7,142	1.35	\$178,538
HUNT CLIFF CT	305	0.06	\$7,632
HUNT CLUB RD	3,819	0.72	\$95,479
HUNTER DR	1,075	0.20	\$26,887
HUNTING RIDGE RD	5,358	1.02	\$133,951
HUNTINGTON RD	4,672	0.89	\$116,800
HURST ST	1,172	0.22	\$29,292
IBIS CT	623	0.12	\$15,568
IKE DR	403	0.08	\$10,080

Street	Length (FT)	Length (MI)	Approx. Cost.
IKNER LN	969	0.18	\$24,236
INLAND GREENS	735	0.14	\$18,372
INLAND GREENS DR	7,045	1.34	\$176,127
IRIS ST	3,281	0.62	\$82,037
ISLAND COVE	1,458	0.28	\$36,460
IVOCET DR	1,939	0.37	\$48,475
J R KENNEDY DR	2,073	0.39	\$51,822
JACKSON DR	1,636	0.31	\$40,890
JACKSON ST	1,561	0.30	\$39,035
JACKSONVILLE AV	2,066	0.39	\$51,652
JARED CT	1,203	0.23	\$30,068
JASPER PL	1,530	0.29	\$38,241
JEB STUART DR	1,779	0.34	\$44,467
JEFFERSON ST	1,074	0.20	\$26,849
JENNINGS DR	3,834	0.73	\$95,853
JOHN D BARRY DR	366	0.07	\$9,141
JOHN S MOSBY DR	1,508	0.29	\$37,706
JOHNSON ST	498	0.09	\$12,461
JONES RD	829	0.16	\$20,725
JUMPIN RUN DR	3,953	0.75	\$98,824
KAY ST	780	0.15	\$19,504
KELLUM CT	448	0.08	\$11,193
KELLY RD	1,212	0.23	\$30,300
KENAN CT	315	0.06	\$7,875
KENT ST	1,731	0.33	\$43,278
KENTUCKY AV	640	0.12	\$16,009
KESTRAL DR	164	0.03	\$4,107
KESWICK CT	844	0.16	\$21,109
KETTERING PL	568	0.11	\$14,194
KIDDER ST	3,800	0.72	\$95,004
KILDARE RD	132	0.03	\$3,292
KIMBERLY	763	0.14	\$19,077
KING ST	715	0.14	\$17,866
KINGSLEY RD	912	0.17	\$22,788
KINGSTON RD	5,647	1.07	\$141,164
KINSTON AV	1,307	0.25	\$32,680
KIRBY SMITH DR	2,109	0.40	\$52,733
KIRKLEY CT	328	0.06	\$8,193
KORNEGAY AV	785	0.15	\$19,615
KUBECK CT	1,294	0.25	\$32,350

Street	Length (FT)	Length (MI)	Approx. Cost.
KYLE CT	503	0.10	\$12,578
LAKE DR	1,551	0.29	\$38,780
LAKE FOREST	8,303	1.57	\$207,582
LAKE SHORE DR	609	0.12	\$15,227
LAKEWOOD PL	488	0.09	\$12,191
LAME ST	124	0.02	\$3,095
LAMPPOST	1,598	0.30	\$39,941
LANCASTER RD	4,869	0.92	\$121,713
LANCOME CT	535	0.10	\$13,382
LANDS END CT	581	0.11	\$14,537
LANTERN	1,705	0.32	\$42,619
LARCHMONT DR	3,078	0.58	\$76,950
LARK CT	268	0.05	\$6,704
LATIMER DR	945	0.18	\$23,634
LAUREL LN	683	0.13	\$17,067
LEATHERWOOD DR	856	0.16	\$21,389
LEE DR	4,245	0.80	\$106,134
LEEWARD LN	53	0.01	\$1,337
LEGARE CT	478	0.09	\$11,956
LEXINGTON DR	2,191	0.41	\$54,770
LIBERTY CT	454	0.09	\$11,358
LILAC CT	397	0.08	\$9,932
LILLINGTON DR	42	0.01	\$1,051
LINCOLN CT	1,297	0.25	\$32,420
LINGO AV	1,045	0.20	\$26,135
LIONS	626	0.12	\$15,651
LIONS DEN DR	405	0.08	\$10,129
LIONS GATE DR	1,554	0.29	\$38,845
LISMORE	264	0.05	\$6,593
LITTLE JOHN	933	0.18	\$23,323
LIVERPOOL ST	1,140	0.22	\$28,502
LONG LEAF ACRES DR	3,236	0.61	\$80,895
LONG LEAF HILLS DR	11	0.00	\$275
LORING	701	0.13	\$17,520
LOU BELLE ST	2,079	0.40	\$51,973
LOUISA LN	1,181	0.22	\$29,533
LOUISIANA AV	2,619	0.50	\$65,464
LOVINGSTON LN	1,556	0.30	\$38,900
LYNCHFIELD CT	408	0.08	\$10,205
LYNDON AV	1,990	0.38	\$49,749

Street	Length (FT)	Length (MI)	Approx. Cost.
MACCUMBER LN	1,258	0.24	\$31,449
MACRAE AV	89	0.02	\$2,231
MADELINE DR	2,320	0.44	\$58,009
MADISON ST	366	0.07	\$9,152
MAIDES AV	3,154	0.60	\$78,857
MALLARD ST	1,140	0.22	\$28,510
MALPASS AV	1,144	0.22	\$28,595
MALVERN RD	919	0.17	\$22,987
MAMIE CT	220	0.04	\$5,489
MANHATTAN DR	431	0.08	\$10,764
MANLY AV	1,833	0.35	\$45,820
MAPLE AV	6,324	1.20	\$158,089
MARBLEHEAD CT	442	0.08	\$11,060
MARGUERITE DR	596	0.11	\$14,889
MARIGOLD CT	1,237	0.23	\$30,915
MARION DR	408	0.08	\$10,193
MARKET ST	2,857	0.51	\$68,006
MARLBORO ST	463	0.09	\$11,578
MARLIN CT	1,507	0.29	\$37,686
MARSTELLAR ST	4,012	0.76	\$100,303
MARTIN ST	4,963	0.94	\$124,078
MARYLAND AV	576	0.11	\$14,395
MAULTSBY DR	21	0.00	\$536
MAYFIELD	955	0.18	\$23,867
MAYFLOWER DR	433	0.08	\$10,820
MCCARLEY	543	0.10	\$13,566
MCCLAMMY ST	1,037	0.20	\$25,936
MCCLELLAND DR	1,436	0.27	\$35,893
MCCOMBERS LN	806	0.15	\$20,144
MCDONALD DR	1,720	0.33	\$43,010
MCEACHERN CT	1,984	0.38	\$49,605
MCKINNON DR	266	0.05	\$6,662
MCRAE ST	3,926	0.75	\$98,160
MEARES ST	439	0.08	\$10,987
MEETING CT	417	0.08	\$10,420
MEGANS PLACE DR	1,142	0.22	\$28,539
MELINDA DR	1,054	0.20	\$26,361
MELISSA CT	1,019	0.19	\$25,466
MERCER AV	9,843	1.87	\$246,066
MERRIMAC DR	1,482	0.28	\$37,041
METTING RD	2,187	0.41	\$54,674

Street	Length (FT)	Length (MI)	Approx. Cost.
MICHIGAN AV	575	0.11	\$14,377
MILDRED AV	567	0.11	\$14,167
MILITARY CUTOFF RD	1,644	0.22	\$28,412
MIMOSA PL	443	0.08	\$11,080
MOCKINGBIRD LN	5,973	1.13	\$149,320
MONITOR DR	2,085	0.40	\$52,120
MONROE ST	4,181	0.79	\$104,527
MONTCLAIR DR	2,953	0.56	\$73,835
MONTFORD DR	1,880	0.36	\$47,001
MONTGOMERY AV	2,624	0.50	\$65,605
MOONLIGHT LN	398	0.08	\$9,949
MORGAN ST	692	0.13	\$17,308
MORTON CT	324	0.06	\$8,109
MOSLEY ST	3,403	0.65	\$85,085
MOSS ST	992	0.19	\$24,792
MULBERRY AV	734	0.14	\$18,346
MYERS ST	686	0.13	\$17,153
MYNA	669	0.13	\$16,733
NASH DR	1,532	0.29	\$38,307
NAUTILUS DR	454	0.09	\$11,359
NEW BERN AV	2,608	0.49	\$65,199
NEWKIRK AV	302	0.06	\$7,558
NEWTON ST	436	0.08	\$10,902
NINA PL	305	0.06	\$7,630
NOBEL SCHOOL RD	279	0.05	\$6,987
NORTH CAROLINA AV	933	0.18	\$23,335
NORTHWOOD DR	5,047	0.96	\$126,181
NORWOOD AV	788	0.15	\$19,695
NOTTINGHAM LN	2,025	0.38	\$50,615
NUN ST	363	0.07	\$9,074
NUTT ST	1,191	0.23	\$29,764
OAK BLUFF LN	3,376	0.64	\$84,393
OAK ST	644	0.12	\$16,102
OAKCLIFF DR	1,377	0.26	\$34,436
OAKCREST DR	3,323	0.63	\$83,073
OAKLAND DR	792	0.15	\$19,794
OAKLEAF DR	3,647	0.69	\$91,182
OFF FLORAL & 39	723	0.14	\$18,078
OLD DAIRY RD	884	0.17	\$22,094
OLD EASTWOOD RD	2,451	0.47	\$61,268

Street	Length (FT)	Length (MI)	Approx. Cost.
OLD FOARDS LN	575	0.11	\$14,365
OLD MEARS RD	1,560	0.30	\$38,992
OLD MILITARY RD	2,320	0.44	\$57,994
ORCHARD AV	674	0.13	\$16,845
ORCHARD TRACE	1,329	0.25	\$33,236
ORIOLE DR	395	0.08	\$9,868
OSPREY LN	661	0.13	\$16,527
OVERBROOK RD	3,111	0.59	\$77,767
OWENCROFT CT	974	0.18	\$24,362
OXMORE PL	492	0.09	\$12,295
PARK	2,586	0.49	\$64,648
PARK AV	10,137	1.92	\$253,417
PARKWAY	3,077	0.58	\$76,934
PARKWAY DR	2,604	0.49	\$65,102
PARMELE DR	2,651	0.50	\$66,277
PARTRIDGE RD	5,440	1.03	\$135,999
PATRICK AV	2,630	0.50	\$65,743
PATRIOT	753	0.14	\$18,819
PAVILION PL	411	0.08	\$10,267
PEACHTREE AV	9,892	1.87	\$247,299
PEIFFER	2,483	0.47	\$62,063
PENN ST	753	0.14	\$18,827
PEPYS LN	2,213	0.42	\$55,317
PERSHING CT	788	0.15	\$19,688
PETREL CT	699	0.13	\$17,476
PICKARD RD	1,470	0.21	\$28,135
PICKETT DR	2,153	0.41	\$53,833
PINE CLAY RD	2,031	0.39	\$50,787
PINE CLIFF DR	5,203	0.98	\$130,080
PINE GROVE DR	1,003	0.19	\$25,085
PINE HILLS DR	4,098	0.78	\$102,443
PINE NEEDLE DR	1,707	0.32	\$42,674
PINE ST	9,202	1.74	\$230,062
PINECREST	10,379	1.97	\$259,486
PINEWOOD	536	0.10	\$13,395
PINTAIL CT	745	0.14	\$18,623
PLAZA DR	702	0.13	\$17,555
PLUM NEARLY LN	802	0.15	\$20,058
POLK ST	1,091	0.21	\$27,286
POMPANO CT	488	0.09	\$12,206
PONDEROSA LN	2,146	0.41	\$53,639

Street	Length (FT)	Length (MI)	Approx. Cost.
POPLAR ST	1,432	0.27	\$35,809
POWELL	254	0.05	\$6,341
PRICES LA	998	0.19	\$24,947
PURDUE DR	1,115	0.21	\$27,873
QUEEN ST	1,480	0.28	\$37,008
RABBIT RUN RD	1,814	0.34	\$45,350
RACINE DR	475	0.09	\$11,863
RAINBOW DR	1,787	0.34	\$44,672
RAMP	287	0.05	\$7,179
RANDALL	1,400	0.19	\$24,542
RAYNOR CT	491	0.09	\$12,277
RED BERRY DR	4,469	0.85	\$111,725
RED BIRD RD	1,695	0.32	\$42,371
RED BUD	688	0.13	\$17,189
RED WING LN	874	0.17	\$21,861
REGENCY DR	1,034	0.20	\$25,843
REILLY DR	2,079	0.39	\$51,963
RENOVAH	5,612	1.06	\$140,310
RESTON CT	2,351	0.45	\$58,774
RIEGEL DR	618	0.12	\$15,454
RIEGEL RD	1,423	0.27	\$35,587
RILL RD	1,712	0.32	\$42,804
ROBERT HOKE RD	1,466	0.28	\$36,646
ROLLING HILLS CV	1,750	0.33	\$43,741
ROSELAND DR	901	0.17	\$22,530
ROYAL BONNET DR	1,915	0.36	\$47,884
RUTLEDGE DR	1,133	0.22	\$28,331
RUXTON	2,883	0.55	\$72,083
SABRA DR	525	0.10	\$13,120
SAINT JOHNS CT	2,392	0.45	\$59,795
SAMUEL COOPER DR	943	0.18	\$23,564
SAND HILLS DR	1,939	0.37	\$48,476
SCHRIBERS LN	712	0.13	\$17,791
SEA EAGLE CT	816	0.15	\$20,390
SEABROOK CT	1,080	0.20	\$26,993
SEABURY CT	286	0.05	\$7,138
SEAHAWK CT	761	0.15	\$19,031
SEBRELL	904	0.17	\$22,588
SEMMES DR	6,904	1.31	\$172,611
SENTINEL LN	7	0.00	\$185
SEQUOIA CT	632	0.12	\$15,796

Street	Length (FT)	Length (MI)	Approx. Cost.
SHADOW CT	1,306	0.25	\$32,648
SHADY GROVE DR	446	0.08	\$11,142
SHAMROCK DR	3,337	0.63	\$83,423
SHELLEY DR	708	0.13	\$17,696
SHERWOOD DR	1,277	0.24	\$31,925
SHINNWOOD RD	537	0.10	\$13,418
SHIPYARD	37	0.01	\$916
SMITH CREEK	662	0.13	\$16,547
SOLID HOLLOW LN	208	0.04	\$5,192
SORORITY CT	323	0.06	\$8,081
SOUTH CAROLINA AV	3,520	0.67	\$88,009
SOUTHGATE RD	3,960	0.75	\$98,991
SOUTHALL DR	842	0.16	\$21,049
SOUTHWOOD RD	2,148	0.41	\$53,712
SOVEREIGN PL	1,565	0.30	\$39,117
SPARROW HAWK CT	1,709	0.32	\$42,725
SPAULDING DR	1,735	0.33	\$43,379
SPOFFORD	1,559	0.30	\$38,975
SPOTSWOOD CT	506	0.10	\$12,656
SPRING AV	700	0.13	\$17,491
SPRUCE	710	0.13	\$17,738
SPRUCE DR	4,262	0.81	\$106,560
STADIUM DR	2,962	0.56	\$74,062
STAFFORDSHIRE DR	398	0.08	\$9,958
STERLING PL	1,586	0.30	\$39,649
STEWART	2,199	0.42	\$54,969
STOCKBRIDGE PL	573	0.11	\$14,322
STONEBRIDGE RD	1,611	0.31	\$40,266
STRADLEIGH RD	2,831	0.54	\$70,787
STRATFORD	2,514	0.48	\$62,851
SUFFOLK LN	986	0.19	\$24,662
SUMMIT	1,347	0.26	\$33,670
SUMTER DR	1,112	0.21	\$27,807
SUNCOURT VILLA DR	808	0.15	\$20,209
SURREY DOWNS CT	463	0.09	\$11,582
SURRY ST	750	0.14	\$18,751
SWEETBRIAR RD	2,777	0.53	\$69,420
SWEETGUM	1,982	0.38	\$49,553

Street	Length (FT)	Length (MI)	Approx. Cost.
HOLLOW RD			
SYCAMORE ST	1,663	0.32	\$41,583
SYLVAN DR	1,792	0.34	\$44,791
TALON CT	131	0.03	\$3,280
TANBRIDGE RD	796	0.15	\$19,912
TANSEY CLOSE DR	1,220	0.23	\$30,492
TARA DR	1,107	0.21	\$27,680
TEAL ST	4,057	0.77	\$101,423
TENNESSEE AV	396	0.08	\$9,898
TERRACE	1,641	0.31	\$41,020
THAXTON CT	138	0.03	\$3,455
THRUSH DR	1,595	0.30	\$39,883
TIDEWATER LN	1,067	0.20	\$26,685
TIPTON CT	2,021	0.38	\$50,537
TOTTENHAM CT	977	0.19	\$24,424
TOULON DR	3,203	0.61	\$80,071
TRADD CT	923	0.18	\$23,077
TREADWELL ST	786	0.15	\$19,650
TREYBROOKE DR	4,352	0.82	\$108,809
TROLLY LN	790	0.15	\$19,738
TROWBRIDGE ST	2,464	0.47	\$61,593
TUDOR CT	463	0.09	\$11,579
TULANE DR	2,277	0.43	\$56,937
TULIP DR	295	0.06	\$7,366
TULLAMORE RD	73	0.01	\$1,816
TWIN MAGNOLIAS LN	886	0.17	\$22,150
TWO CHOPT RD	3,142	0.60	\$78,560
UNIVERSITY DR	1,307	0.25	\$32,681
Unknown	3,104	0.59	\$77,589
UNNAMED	1,035	0.20	\$25,871
UPPER REACH DR	1,719	0.33	\$42,968
UPTON CT	808	0.15	\$20,199
VARSAITY DR	3,707	0.70	\$92,677
VENUS CT	374	0.07	\$9,344
VERBINIA DR	1,847	0.35	\$46,176
VERDURA DR	602	0.11	\$15,060
VICTORY GARDENS DR	1,749	0.33	\$43,731
VILLA PL	891	0.17	\$22,269
VILLAGE DR	1,594	0.30	\$39,850
VILLAGE PARK DR	1,472	0.28	\$36,793

Street	Length (FT)	Length (MI)	Approx. Cost.
VINEYARD LN	925	0.18	\$23,122
VIOLET CT	1,741	0.33	\$43,521
VIRGINIA AV	271	0.05	\$6,767
WADDELL ST	604	0.11	\$15,088
WAGON CT	659	0.13	\$16,479
WAKEFIELD RD	737	0.14	\$18,430
WALDEN DR	1,515	0.29	\$37,875
WALLACE	556	0.11	\$13,897
WALLACE AV	5,925	1.12	\$148,131
WALLINGTON RD	5,856	1.07	\$141,645
WALNUT ST	708	0.13	\$17,692
WARD ST	829	0.16	\$20,715
WARLICK DR	1,130	0.18	\$24,010
WASHINGTON ST	960	0.18	\$24,008
WATER ST	2,312	0.44	\$57,793
WAYNE DR	3,347	0.63	\$83,665
WEB TRACE	390	0.07	\$9,755
WEeping WILLOW RD	3,615	0.69	\$90,384
WELLESEY PL	964	0.18	\$24,092
WELLSPRING	722	0.14	\$18,055
WESLEY AV	2,171	0.41	\$54,274
WEST CASCADE RD	2,630	0.50	\$65,744
WEST DR	1,782	0.34	\$44,541
WESTCHESTER RD	4,317	0.82	\$107,918
WESTON CT	377	0.07	\$9,416
WESTOVER RD	1,102	0.21	\$27,538
WESTPRONG	890	0.17	\$22,258
WESTWOOD DR	2,444	0.46	\$61,098
WETSIG RD	2,649	0.50	\$66,222
WHINBRELL CT	275	0.05	\$6,866
WHISPER CREEK LN	5,116	0.97	\$127,899
WHISTLER AV	609	0.12	\$15,227
WHITING CV	663	0.13	\$16,580
WHITNER DR	4,083	0.77	\$102,079
WICKFORD RD	3,884	0.74	\$97,104
WICKSLOW DR	1,083	0.21	\$27,074
WIDGEON DR	2,104	0.40	\$52,605
WILLANDA DR	2,148	0.41	\$53,712
WILLARD ST	1,092	0.21	\$27,312
WILLIAMSON DR	1,935	0.37	\$48,369

Street	Length (FT)	Length (MI)	Approx. Cost.
WILLOW ST	2,631	0.50	\$65,776
WILMINGTON AV	1,379	0.26	\$34,485
WILSHIRE	1,182	0.22	\$29,538
WILTON CT	968	0.18	\$24,203
WIMBLEDON CT	776	0.15	\$19,401
WINDEMERE RD	3,906	0.74	\$97,642
WINDTREE RD	1,634	0.31	\$40,858
WINSLOW AV	197	0.04	\$4,931
WINSTON	2,317	0.44	\$57,931
WINTERGREEN RD	1,464	0.28	\$36,610
WISTERIA DR	2,504	0.47	\$62,591
WISTERIA LN	1,311	0.25	\$32,783
WOOD DALE DR	144	0.03	\$3,591
WOODBINE ST	1,048	0.20	\$26,201
WOODFIELD CT	332	0.06	\$8,311
WOODLAND DR	2,150	0.41	\$53,747
WOODS	719	0.14	\$17,978
WOOSTER ST	708	0.13	\$17,697
WORTH DR	4,698	0.83	\$109,925
WRENWOOD	417	0.08	\$10,418
WRIGHT ST	982	0.16	\$21,641
WRIGHTSVILLE AV	511	0.10	\$12,779
WYNNWOOD ST	715	0.14	\$17,865
YAUPON DR	2,143	0.41	\$53,571
YESTER OAKS DR	364	0.07	\$9,097
YORKSHIRE LN	5,519	1.05	\$137,976
YUCCA DR	1,000	0.19	\$24,993
ZINNIA CT	696	0.13	\$17,388
Grand Total	1,259,943	238.13	\$31,433,549

Recommended Signal Improvements

The following table details the signal recommendations identified on the facility recommendations maps in the master plan report document. Costs are approximate and are for planning purposes only. They are based on the unit cost of installing additional pedestrian signal heads and related signal appurtenances and do not include other potential project costs such as timing reprogramming, striping (variable due to pavement width), moving existing stop bars, right of way acquisition, and other potential project requirements. The field “CITYID” relates to the traffic signal dataset obtained from the City of Wilmington.

Intersection	CITYID	Approximate Cost
Short Term		\$4,088,000
10TH ST & DAWSON ST	0026	\$40,000
10TH ST & WOOSTER ST	0088	\$40,000
13TH ST & DAWSON ST	0027	\$40,000
13TH ST & WOOSTER ST	0078	\$40,000
16TH ST & DAWSON ST	0028	\$40,000
16TH ST & GREENFIELD ST	0246	\$30,000
16TH ST & ROBIN HOOD RD	0491	\$40,000
17TH ST & CASTLE ST	0030	\$40,000
17TH ST & DAWSON ST	0029	\$40,000
17TH ST & GEORGE ANDERSON DR	C037	\$40,000
17TH ST & GLEN MEADE RD	0204	\$40,000
17TH ST & INDEPENDENCE BLVD	C031	\$40,000
17TH ST & J D BARRY DR/ST ANDREWS DR	C033	\$40,000
17TH ST & SAVANNAH CT/HOSPITAL PLAZA DR	0616	\$40,000
17TH ST & SHIPYARD BLVD	0070	\$40,000
17TH ST & WELLINGTON AVE	0432	\$40,000
23RD ST & CHESTNUT ST	0378	\$40,000
23RD ST & MARKET ST	0040	\$30,000
23RD ST & PRINCESS PLACE DR	0038	\$40,000
3RD ST & BRUNSWICK ST	(blank)	\$121,000
3RD ST & RED CROSS ST	0003	\$40,000
5TH AVE & CASTLE ST	C009	\$40,000
5TH AVE & DAWSON ST	0025	\$40,000
5TH AVE & WOOSTER ST	0079	\$40,000
8TH ST & DAWSON ST	0089	\$40,000
ANN ST & 3RD ST	(blank)	\$15,000
CAROLINA BCH RD & FRONT ST/BURNETT BLV	0019	\$40,000
CAROLINA BCH RD & RALEIGH ST/PARKWAY BLV	0313	\$40,000
CAROLINA BEACH RD & BELL ST	(blank)	\$40,000
CAROLINA BEACH RD & GEORGE ANDERSON DR	(blank)	\$40,000
CAROLINA BEACH RD & INDEPENDENCE BLVD	0601	\$40,000
CAROLINA BEACH RD & SHIPYARD BLVD	0024	\$40,000
COLLEGE RD & HOGGARD DR/HURST DR	0531	\$30,000
COLLEGE RD & HOLLY TREE RD	0362	\$40,000
COLLEGE RD & NEW CENTRE DR	0240	\$40,000
COLLEGE RD & PEACHTREE AVE	0435	\$40,000

Intersection	CITYID	Approximate Cost
COLLEGE RD & RANDALL PKWY	0128	\$30,000
COLLEGE RD & WILSHIRE BLVD	0237	\$40,000
COLONIAL DR & WAYNE DR	(blank)	\$15,000
EASTWOOD RD & AUTUMN HALL DR	(blank)	\$121,000
EASTWOOD RD & CARDINAL DR	0339	\$20,000
EASTWOOD RD & LONGLEAF ACRES DR	(blank)	\$121,000
EASTWOOD RD & PLAZA EAST/HAMPTON INN	0644	\$40,000
EASTWOOD RD & ROGERSVILLE RD	0778	\$40,000
EASTWOOD RD & WRIGHTSVILLE AVE	0213	\$40,000
EASTWOOD RD near TOWN CENTER DR	(blank)	\$55,000
GREENFIELD ST & 5TH AVE	C012	\$40,000
GREENVILLE LOOP RD & STONEBRIDGE RD	(blank)	\$15,000
INDEPENDENCE/COVIL & RANDALL/MERCER	0900	\$40,000
KERR AV & MCCLELLAND DR	(blank)	\$121,000
KERR AV & PRIVATE (south of FRANKLIN AV)	(blank)	\$121,000
KERR AVE & CINEMA DR	(blank)	\$121,000
KERR AVE & WILSHIRE BLVD	0332	\$40,000
MARKET & GREEN MEADOWS	(blank)	\$121,000
MARKET ST & 10TH ST	0037	\$40,000
MARKET ST & 29TH ST	(blank)	\$55,000
MARKET ST & BARCLAY HILLS DR	0440	\$40,000
MARKET ST & COVIL AVE	0357	\$40,000
MARKET ST & FOREST HILLS DR	0041	\$30,000
MARKET ST & KERR AVE	0049	\$40,000
MARKET ST & NEW CENTRE DR	0346	\$40,000
MARKET ST & NORTH 17 SHOPPING CENTER	0224	\$40,000
MASONBORO LP & DUNMORE RD	(blank)	\$15,000
MILITARY CUTOFF RD & CAYMAN CT	(blank)	\$30,000
MILITARY CUTOFF RD & DESTINY WAY	0952	\$30,000
MILITARY CUTOFF RD & EASTWOOD RD	0202	\$40,000
MILITARY CUTOFF RD & GORDON RD	0884	\$40,000
MILITARY CUTOFF RD & MONUMENT DR	(blank)	\$55,000
MILITARY CUTOFF RD & STANTON RD	(blank)	\$30,000
MILITARY CUTOFF RD & THE FORUM	0895	\$30,000
OLEANDER DR & 41ST ST	0227	\$40,000
OLEANDER DR & 42ND ST	0231	\$40,000
OLEANDER DR & AUDUBON BLVD/LINCOLN RD	0233	\$40,000
OLEANDER DR & DAWSON ST	0420	\$40,000
OLEANDER DR & DOGWOOD LN	(blank)	\$55,000
OLEANDER DR & FLORAL PKWY/FORDHAM RD	0046	\$40,000

Intersection	CITYID	Approximate Cost
OLEANDER DR & PINE GROVE DR	0050	\$40,000
OLEANDER DR & WALLACE AVE	C027	\$55,000
PRINCESS PLACE DR & 26TH ST	(blank)	\$15,000
PRINCESS PLACE DR & 30TH ST	0379	\$40,000
PRINCESS PLACE DR & FIRE STATION	C029	\$40,000
RACINE DR & NEW CENTRE DR	C032	\$40,000
RACINE DR & ORIOLE DR	C036	\$40,000
TABOR LN & KERR AV	(blank)	\$121,000
WOOSTER ST & 8TH ST	(blank)	\$40,000
WRIGHTSVILLE AV & PAGE AV	(blank)	\$40,000
WRIGHTSVILLE AVE & FLORAL AVE	0318	\$40,000
WRIGHTSVILLE AVE & HAWTHORNE DR	0607	\$40,000
WRIGHTSVILLE AVE & MACMILLAN AVD	0483	\$40,000
WRIGHTSVILLE AVE & WILSHIRE BLVD	0223	\$40,000
Mid Term		\$1,790,000
10TH ST & CASTLE ST	C018	\$40,000
13TH ST & CASTLE ST	C020	\$40,000
16TH ST & CHESTNUT ST	0198	\$40,000
16TH ST & DOCK ST	0203	\$40,000
16TH ST & GRACE ST	0035	\$40,000
16TH ST & WOOSTER ST	0080	\$40,000
17ST ST & DOCK ST	0193	\$40,000
17TH AND GRACE ST/PRINCESS PL DR	0034	\$40,000
17TH ST & MEDICAL CENTER DR	0206	\$30,000
17TH ST & WOOSTER ST	0081	\$40,000
2ND ST & GRACE ST	C002	\$40,000
3RD ST & GRACE ST	0005	\$40,000
3RD ST & GREENFIELD ST	(blank)	\$20,000
3RD ST & WALNUT ST	0004	\$40,000
4TH ST & CHESTNUT ST	C005	\$40,000
5TH AVE & CHESTNUT ST	C010	\$40,000
5TH AVE & GRACE ST	C011	\$40,000
5TH AVE & PRINCESS ST	C013	\$40,000
5TH AVE & RED CROSS ST	C014	\$40,000
6TH ST BRIDGE	C015	\$40,000
8TH ST & CASTLE ST	C016	\$40,000
8TH ST/MCRAE ST & RED CROSS ST/RANKIN ST	C017	\$40,000
CAROLINA BCH RD & NORTHERN BLVD	0021	\$30,000
CAROLINA BEACH RD & CENTRAL BLVD	0022	\$20,000

Intersection	CITYID	Approximate Cost
CAROLINA BEACH RD & SOUTHERN BLVD	0023	\$20,000
COLLEGE RD & KMART SHOPPING CENTER	0212	\$30,000
COLLEGE RD & OLEANDER DR	0047	\$40,000
COLLEGE RD & PINE VALLEY RD	0365	\$40,000
COLLEGE RD & SHIPYARD BLVD/LONG LEAF HILLS	0067	\$40,000
COLLEGE RD & UNIVERSITY SHOP CENTERS	0561	\$40,000
COLLEGE RD & WRIGHTSVILLE AVE	0048	\$40,000
EASTWOOD RD & RACINE DR	0624	\$40,000
MARKET ST & COLLEGE RD EAST RAMP	0242	\$40,000
MARKET ST & COLLEGE RD WEST RAMP	0243	\$40,000
MARKET ST & LULLWATER DR	0409	\$40,000
MARKET ST east of DARLINGTON AV	(blank)	\$40,000
NEW CENTRE DR & BOB KING DR	0914	\$40,000
NEW CENTRE DR & SHOPPING CENTER	0784	\$40,000
OLEANDER DR & GREENVILLE LP RD/GREENVILLE AVE	0052	\$40,000
OLEANDER DR & HAWTHORNE DR	0291	\$40,000
PINE GROVE DR & LONG LEAF HILLS DR	0199	\$40,000
PINE GROVE RD & GREENVILLE LP RD	0220	\$40,000
PINE GROVE RD & HOLLY TREE RD	0604	\$40,000
RACINE DR & CARL ST	C038	\$40,000
RANKIN ST & 10TH ST	C019	\$40,000
WRIGHTSVILLE AVE & DAWSON ST	0421	\$40,000
WRIGHTSVILLE AVE & MILITARY CUTOFF RD	0782	\$40,000
Long Term		\$1,010,000
16TH ST & CASTLE ST	0031	\$40,000
3RD ST & DAWSON ST	0335	\$40,000
3RD ST & WOOSTER ST	0334	\$40,000
41ST ST & LAKE AVE	C022	\$40,000
4TH ST & GRACE ST	C006	\$40,000
4TH ST & PRINCESS ST	C007	\$40,000
4TH ST & RED CROSS ST	C008	\$40,000
COLLEGE RD & BRAGG DR	0924	\$40,000
COLLEGE RD & CASCADE RD/SHOPPING CENTER	0361	\$40,000
COLLEGE RD & HUNTERS TRL	0338	\$40,000
COLLEGE RD & LAKE AVE	0441	\$30,000
COLLEGE RD & ORIOLE DR	0239	\$40,000
COLLEGE RD & RIEGEL DR	0234	\$40,000
DAVIS ST & N 4TH ST	0919	\$40,000
MARKET ST & BLAIR SCHOOL RD	0482	\$40,000
MARKET ST & CARDINAL DR	0888	\$40,000

Intersection	CITYID	Approximate Cost
MARKET ST & MLK JR PKWY/EASTWOOD RD	0721	\$40,000
MLK PKW/3RD ST & FRONT ST/DAVIS ST	0082	\$10,000
NEW CENTER DR @ COLLEGE ACRES APTS	(blank)	\$40,000
OLEANDER DR & 39TH ST	0232	\$40,000
OLEANDER DR & COLUMBUS DR/	0214	\$20,000
OLEANDER DR & COUNTRY CLUB RD	0043	\$20,000
OLEANDER DR & MALL ENTRANCE	0228	\$40,000
RANDALL DR & RACINE DR	UNCW	\$40,000
RANDALL PKWY & SHOPPING CENTER	C035	\$40,000
SHIPYARD BLVD & HOGGARD H S/SHOPPING CENTER	0209	\$30,000
WRIGHTSVILLE AVE & COLONIAL DR/COUNTRY CLUB DR	0042	\$20,000
WRIGHTSVILLE AVE & INDEPENDENCE BLVD	0899	\$40,000
With Trail Construction		\$620,000
16TH ST & ANN ST	(blank)	\$15,000
17TH ST & ANN ST	(blank)	\$15,000
COLLEGE RD & 17TH ST/WALTMOOR RD	0395	\$40,000
EASTWOOD RD & PEMBROKE JONE DR/LIONS GATE	0751	\$40,000
HAMILTON DR & HURST DR	UNCW	\$40,000
INDEPENDENCE BLVD & PARK AVE	0898	\$40,000
INDEPENDENCE BLVD & CANTERBURY RD	0205	\$40,000
INDEPENDENCE BLVD & MALL ENTRANCE	0947	\$40,000
KERR AVE & RANDALL PKWY	0605	\$40,000
MARKET ST & GORDON RD	0390	\$40,000
MARKET ST near 21ST ST	(blank)	\$55,000
MLK PKW & ISABEL HOLMES BRIDGE	0918	\$40,000
OLEANDER DR & INDEPENDENCE BLVD	0045	\$40,000
PINE GROVE DR @ Municipal Golf Course	(blank)	\$15,000
SHIPYARD BLVD & INDEPENDENCE BLVD	0603	\$40,000
SHIPYARD BLVD & LONGSTREET DR/CONVERSE RD	0068	\$40,000
WRIGHTSVILLE AVE & AIRLIE RD/OLEANDER DR	0189	\$40,000
Grand Total		\$7,508,000

NORTH CAROLINA LAWS AND REGULATIONS RELATING TO BICYCLING AND WALKING

North Carolina General Statutes, Chapter 20: Motor Vehicles

Part 11. Pedestrians' Rights and Duties.

§ 20-172. Pedestrians subject to traffic control signals.

(a) The Board of Transportation, with reference to State highways, and local authorities, with reference to highways under their jurisdiction, are hereby authorized to erect or install, at intersections or other appropriate places, special pedestrian control signals exhibiting the words or symbols "WALK" or "DON'T WALK" as a part of a system of traffic control signals or devices.

(b) Whenever special pedestrian control signals are in place, such signals shall indicate as follows:

(1) WALK. – Pedestrians facing such signal may proceed across the highway in the direction of the signal and shall be given the right-of-way by the drivers of all vehicles.

(2) DON'T WALK. – No pedestrian shall start to cross the highway in the direction of such signal, but any pedestrian who has partially completed his crossing on the "WALK" signal shall proceed to a sidewalk or safety island while the "DON'T WALK" signal is showing.

(c) Where a system of traffic control signals or devices does not include special pedestrian control signals, pedestrians shall be subject to the vehicular traffic control signals or devices as they apply to pedestrian traffic.

(d) At places without traffic control signals or devices, pedestrians shall be accorded the privileges and shall be subject to the restrictions stated in Part 11 of this Article. (1937, c. 407, s. 133; 1973, c. 507, s. 5; c. 1330, s. 31; 1987, c. 125.)

§ 20-173. Pedestrians' right-of-way at crosswalks.

(a) Where traffic control signals are not in place or in operation the driver of a vehicle shall yield the right-of-way, slowing down or stopping if need be to so yield, to a pedestrian crossing the roadway within any marked crosswalk or within any unmarked crosswalk at or near an intersection, except as otherwise provided in Part 11 of this Article.

(b) Whenever any vehicle is stopped at a marked crosswalk or at any unmarked crosswalk at an intersection to permit a pedestrian to cross the roadway, the driver of any other vehicle approaching from the rear shall not overtake and pass such stopped vehicle.

(c) The driver of a vehicle emerging from or entering an alley, building entrance, private road, or driveway shall yield the right-of-way to any pedestrian, or person riding a bicycle, approaching on any sidewalk or walkway extending across such alley, building entrance, road, or driveway. (1937, c. 407, s. 134; 1973, c. 1330, s. 32.)

§ 20-174. Crossing at other than crosswalks; walking along highway.

(a) Every pedestrian crossing a roadway at any point other than within a marked crosswalk or within an unmarked crosswalk at an intersection shall yield the right-of-way to all vehicles upon the roadway.

(b) Any pedestrian crossing a roadway at a point where a pedestrian tunnel or overhead pedestrian crossing has been provided shall yield the right-of-way to all vehicles upon the roadway.

(c) Between adjacent intersections at which traffic control signals are in operation pedestrians shall not cross at any place except in a marked crosswalk.

(d) Where sidewalks are provided, it shall be unlawful for any pedestrian to walk along and upon an adjacent roadway. Where sidewalks are not provided, any pedestrian walking along and upon a highway shall, when practicable, walk only on the extreme left of the roadway or its shoulder facing traffic which may approach from the opposite direction. Such pedestrian shall yield the right-of-way to approaching traffic.

(e) Notwithstanding the provisions of this section, every driver of a vehicle shall exercise due care to avoid colliding with any pedestrian upon any roadway, and shall give warning by sounding the horn when necessary, and shall exercise proper precaution upon observing any child or any confused or incapacitated person upon a roadway. (1937, c. 407, s. 135; 1973, c. 1330, s. 33.)

Part 11A. Blind Pedestrians – White Canes or Guide Dogs.

§ 20-175.1. Public use of white canes by other than blind persons prohibited.

It shall be unlawful for any person, except one who is wholly or partially blind, to carry or use on any street or highway, or in any other public place, a cane or walking stick which is white in color or white tipped with red. (1949, c. 324, s. 1.)

§ 20-175.2. Right-of-way at crossings, intersections and traffic control signal points; white cane or guide dog to serve as signal for the blind.

At any street, road or highway crossing or intersection, where the movement of traffic is not regulated by a traffic officer or by traffic control signals, any blind or partially blind pedestrian shall be entitled to the right-of-way at such crossing or intersection, if such blind or partially blind pedestrian shall extend before him at arm's length a cane white in color or white tipped with red, or if such person is accompanied by a guide dog. Upon receiving such a signal, all vehicles at or approaching such intersection or crossing shall come to a full stop, leaving a clear lane through which such pedestrian may pass, and such vehicle shall remain stationary until such blind or partially blind pedestrian has completed the passage of such crossing or intersection. At any street, road or highway crossing or intersection, where the movement of traffic is regulated by traffic control signals, blind or partially blind pedestrians shall be entitled to the right-of-way if such person having such cane or accompanied by a guide dog shall be partly across such crossing or intersection at the time the traffic control signals change, and all vehicles shall stop and remain stationary until such pedestrian has completed passage across the intersection or crossing. (1949, c. 324, s. 2.)

§ 20-175.3. Rights and privileges of blind persons without white cane or guide dog.

Nothing contained in this Part shall be construed to deprive any blind or partially blind person not carrying a cane white in color or white tipped with red, or being accompanied by a guide dog, of any of the rights and privileges conferred by law upon pedestrians crossing streets and highways, nor shall the failure of such blind or partially blind person to carry a cane white in color or white tipped with red, or to be accompanied by a guide dog, upon the streets, roads, highways or sidewalks of this State, be held to constitute or be evidence of contributory negligence by virtue of this Part. (1949, c. 324, s. 3.)

Part 11B. Pedestrian Rights and Duties of Persons with a Mobility Impairment.

§ 20-175.5. Use of motorized wheelchairs or similar vehicles not exceeding 1000 pounds gross weight.

While a person with a mobility impairment as defined in G.S. 20-37.5 operates a motorized wheelchair or similar vehicle not exceeding 1000 pounds gross weight in order to provide that person with the mobility of a pedestrian, that person is subject to all the laws, ordinances, regulations, rights and responsibilities which would otherwise apply to a pedestrian, but is not subject to Part 10 of this Article or any other law, ordinance or regulation otherwise applicable to motor vehicles. (1991, c. 206, s. 1.)

North Carolina General Statutes, Chapter 136: Roads and Highways

§ 136-44.14. Curb ramps or curb cuts for handicapped persons.

(a) Curbs constructed on each side of any street or road, where curbs and sidewalks are provided and at other major points of pedestrian flow, shall meet the following minimum requirements:

(1) No less than two curb ramps or curb cuts shall be provided per lineal block, located at intersections.

(2) In no case, shall the width of a curb ramp or curb cut be less than 40 inches.

(3) The maximum gradient of such curb ramps or curb cuts shall be eight and thirty-three one hundredths percent (8.33%) (12 inches slope for every one inch rise) in relationship to the grade of the street or road.

(4) One curb ramp or curb cut may be provided under special conditions between each radius point of a street turnout of an intersection, if adequate provisions are made to prevent vehicular traffic from encroaching on the ramp.

(b) Minimum requirements for curb ramps or curb cuts under subsection (a) shall be met (i) in the initial construction of such curbs, and (ii) whenever such curbs are reconstructed, including, but not limited to, reconstruction for maintenance procedures and traffic operations, repair, or correction of utilities.

(c) The Department of Transportation, Division of Highways, Highway Design Section, is authorized and directed to develop guidelines to implement this Article in consultation with the Governor's Study Committee on Architectural Barriers (or the Committee on Barrier Free Design of the Governor's Committee on Employment of the Handicapped if the Governor's Study Committee on Architectural Barriers ceases to exist). All curb ramps or curb cuts constructed or reconstructed in North Carolina shall conform to the guidelines of the Highway Design Section.

(d) The Department of Transportation, Division of Highways, Highway Design Section, is authorized and directed to provide free copies of this Article together with implementer guidelines and standards, to municipal and county governments and public utilities operating within the State. (1973, c. 718, ss. 1-4.)

ONLINE SURVEY RESULTS

Memorandum

Subject: Online Questionnaire Results
Project: Wilmington Pedestrian Master Plan (TDG No. 5177)
Location: Wilmington, NC
Date: April 23, 2008

The purpose of this memorandum is to summarize the results of an online survey that was available for the citizens of Wilmington, North Carolina that asked for their opinions and perceptions of the pedestrian amenities throughout the City. The survey was administered electronically and was publicized in local publications such as The Wilmington Star and on the Metro Planning Organization's website. The questionnaire was made available from February through March of 2008. 135 responses were received. Respondents represented a fairly balanced mix of ages and genders.

Included in this memo are key highlights of the survey as well as graphic representations of the data. This is followed by a list of typed-in responses to multiple choice questions when "other" was selected. Attached to the memo are the original questions with summaries of the responses.

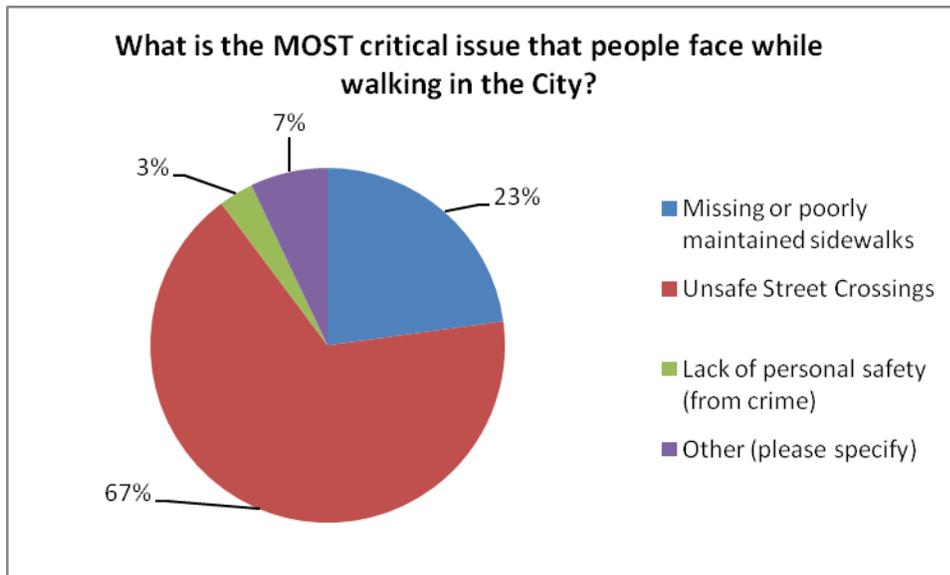
Key Highlights of the Survey:

- Many respondents cited missing or incomplete sidewalks as one of the most critical challenges to walking in Wilmington. This was followed closely by a concern over lack of crosswalks taking people where they want to walk.
- There were many requests and recommendations for improvements to specific neighborhoods, intersections, or sidewalks.
- Respondents tend to drive to their locations. 80% said that their most frequent walking trips were to their cars. Most respondents rarely walk (less than 1-2 times per month) to destinations such as work, school or to a bus stop.
- Other common reasons for walking in Wilmington were for leisure and fitness.
- 14% walk to work frequently (3 or more days per week).
- In response to a question about factors that make it more difficult or unpleasant to walk in Wilmington, the most frequently cited factors were
 - No sidewalks or gaps in sidewalks
 - Heavy Traffic
 - Drivers not stopping for pedestrians
 - Fast vehicle speeds
- The need to improve pedestrian conditions was also emphasized 67% of respondents cited unsafe crossings and intersections as the most critical issues that pedestrians face in the City. Many of the written-in responses also suggested that more crosswalks be added to make for a more comfortable pedestrian experience.
- In response to questions about locations that need improvements to better accommodate pedestrians, the most popular areas were on major corridors such as Market Street and near

highway interchanges such as Market Street at College Road or Martin Luther King, Jr. Parkway at North 23rd Street.

- Neighborhood streets were also cited an area in need of some improvements as well.
- Although 98% of the respondents answered that they do not have mobility limitations, a common request in the comments was to improve accessibility for people of all mobile abilities. Respondents are aware that the multi-modal paths and crossings may not be fully serving people with various ability limitations.
- Along with requests for improvements in crossings and buffers (tree lawns, parked cars and other objects that separate motorized transit from pedestrians and bikers), respondents requested improvements in bicycling access as well. Future improvements in bicycling amenities such as improved paving and crossings would improve the pedestrian experience as well.

The online questionnaire was used to broaden the reach of public input; however it is important to note that this questionnaire is self-selected and the results should not be considered statistically significant. Summary tables and charts illustrating the results of the questionnaire are included in the following pages. A complete table of responses is included as an addendum to this memo.



If you walk in the City of Wilmington, please tell us why and how often.

	Frequently (3 or more days per week)	Occasionally (several times per month)	Rarely or never (less than 1-2 times per month)
I walk or exercise for personal fitness	69.9% (86)	26.0% (32)	4.1% (5)
I walk the dog	55.8% (58)	10.6% (11)	33.7% (35)
I walk for leisure	61.7% (71)	33.0% (38)	5.2% (6)
I walk to the bus stop	11.5% (10)	6.9% (6)	81.6% (71)
I walk all the way to work	14.4% (13)	3.3 (3)	82.% (74)
I walk all the way to school	9.5% (8)	6.0% (5)	84.5% (71)
I walk to reach destinations for running errands, shopping or entertainment	37.3% (38)	34.3% (35)	28.4% (29)
I walk to my car	80.6% (79)	7.1% (7)	12.2% (12)

Written-In Responses

Written-in responses to multiple choice questions when “Other” was selected. Responses have been organized by question, and then thematically by the general topic of the response. Where one response covers multiple topics, it has been

Question No. 4. What is the MOST critical issue that people face while walking in the City of Wilmington? (“Other” selected)

Physical Improvements (7 responses)

Sidewalks, Crosswalks, and Intersections (5 of 7)

- Lack of sidewalks and crosswalks
- There are very few places that one does not require a car to get to; these needs to be addressed. For example, if I wanted to walk from my Pine Valley home to Hoggard High School or Hugh MacRae Park, it is nearly impossible because of lack of sidewalks, dangerous crossings, and heavy traffic. An elevated crosswalk would help get from one side to another.
- No sidewalks
- Not enough safe sidewalks to travel through the city.
- Many intersections have no "walk" signal

Other (2 of 7)

- Beautification efforts
- Lack of pleasant downtown venues and shops, aside from Riverwalk and central Front Street

Question No. 5. Which of the following factors make it more difficult or unpleasant for you to walk in Wilmington? (“Other” selected)

Physical Improvements (20 of 21)

Sidewalks, Crosswalks, and Intersections (20 of 20)

- Not enough sidewalks and lack of pedestrian crossings e.g. Eastwood Rd and Military Cutoff Intersection
- lack of sidewalks, lack of crosswalks, lack of crosswalk technology
- Sidewalks never constructed in areas annexed by the City. Example- College Acres.
- No designated cross walks at Mercer or Covil and Market. No cross walks on Market from Forest Hills to Kerr Ave.
- Though I am not disabled, I do think the lack of curb ramps on sidewalks in Wilmington is a big issue
- No side walks in my neighborhood or work area.
- bushes and trees obstructing sidewalk

- Two of the most dangerous ped intersections are New Center & Market and Kerr & Market. We need a walk light at both as there are many people who try to walk at these 2 and occasionally a ped is killed j-walking down the block. I drive this street twice a day every day and see tourists trying to get over to Target all the time looking frustrated and scared, for good reason. At Kerr & Market the neighborhood people walk all the time and endanger themselves and their children because there's not enough time to cross and there's always a turn arrow for cars even when the light is red for straight.
- no opportunity to cross Military Cutoff safely
- Lack of crosswalks near bus stops and at handicapped ramps
- lack of crosswalks/pedestrian signals at intersections
- Lack of adequate cross walks
- Lack of crosswalks
- too long distances between controlled intersections
- Large intersections with no island in center for pedestrians
- No crosswalks at many busy intersections
- no crosswalk nor pedestrian cycle in traffic lights
- lack of crosswalks on busy thoroughfares
- not enough crosswalks towards the Wrightsville beach area

Driver Behavior (1 of 21)

- Drivers seem to be unaware of pedestrian "right of way", especially where schools and youth are concerned.

Other (1 of 20)

- no trees for shade

Question no. 7. Which areas of Wilmington need the most improvements (such as new sidewalks or safer crossings) to improve your walking experience? Please rate each area according to need. ("Other" selected)

Physical Improvements (13 of 17)

Sidewalks, Crosswalks, and Intersections (8 of 14)

- A sidewalk leading to Halyburton on 17th extension would be great!!!
- All areas need sidewalks to promote people using them. Many neighborhoods have no sidewalks at all, and this should be seriously considered as a "step" in the right direction toward a more walker-friendly city.
- Many neighborhoods have no sidewalks at all, and this should be seriously considered as a "step" in the right direction toward a more walker-friendly city.

- Cross walks on Oleander
- At major intersections, especially near UNCW and Hospital
- many more crosswalks
- Crosswalks at Market & Porters Neck Rd
- At most major intersections, there are no pedestrian cross-walks or "Walk" lights - cars rule

Other (6 of 14)

- Bike access
- Need PRIMARY corridors linking downtown to UNCW, Wrightsville Beach, etc. with wide (10') separate surfaces; with arterial corridors linking schools, parks, neighborhoods, etc., using a minimum of 6' wide separate paved surfaces. These paved "walkways" should serve as multi-use facilities for walking, jogging, biking, roller blading, etc. Other cities throughout the country provide this service.
- Pedestrian over passes needed on College near UNCW, Market between Forest Hill and Kerr, and Oleander between the Mall and Shopping Center.
- bus stops
- Bradley creek bridge - lots of pedestrians in danger
- Need shelters and benches at bus stops

Miscellaneous (3 of 17)

- Independence Avenue and Park Avenue
- substantial improvements needed on N. 2nd St near bus depot
- To and from downtown from Greenfield Lake

Other comments (not related to a specific question)

Physical Improvements (65 of 85)

Sidewalks/Trails (41 of 65)

- All major intersections should have a crosswalk signal with a pedestrian button to push when you want to cross the street!! Sidewalks are also a must.
- As Wilmington grows and the availability of retail around many of the neighborhoods grows, particularly in the neighborhoods away from downtown Wilmington, there is no reason more people could walk. I would love to be able to walk to the park near my house, or walk to the grocery store or local restaurants, however, I can't because there are no crosswalks or sidewalks along the busiest of roads, Market St. It is taking my own life in my hands. Maybe if people could walk around more, we actually would be a "Fit Community" like our sign says and there would be less of a need for cars on the road.

- Everything I need is within walking distance, but I drive because the traffic is too dangerous! No sidewalks, no bike lanes and overdevelopment is insane. There are no cross walks on any of the corridors I use.
- Generally there seems to be more interest in moving traffic than pedestrian safety. There are long sections of Market St with no where to cross safely. Right turn on red is a problem where Mercer and Covil meet Market. And sections of sidewalk are missing in that area
- If Wilmington were more pedestrian friendly, our tourist industry would improve, and it would take some of the traffic off the streets as well. It's really a quality of life issue. It's ridiculous that I live within 1 mile of two shopping centers, a mall, and schools, and grocery stores, and within two miles of downtown, and I have to drive to those places because I'm afraid of crossing streets, etc, with my child. I could walk to almost everything I need to get to, if there were adequate walks. My out of town visitors think it's ridiculous that they have to drive downtown and find parking when they could easily walk there (if there were walks) as well.
- Living in the winter park area one sees the patch work of sidewalks that do not intersect with other sidewalks. The massive volume of traffic makes it difficult for mothers with strollers, bicycle and foot traffic to walk the edge of the road. On floral pwky old people are walking in knee high grass to get to Hanover shopping center? From my house to Hugh McRae Park or to Empie Park there are no safe crosswalks or acceptable sidewalks. I would like to see the trolley easement combined into the project and branches reaching out from some main point or pathway.
- Love to walk and ride bicycles. Sidewalks and bikeways are not connected simply end. Pedestrian crossing signals outside of downtown are non-existent. On wide streets e.g. Military Cutoff, there is no safety island.
- Pedestrians are treated like 3rd class citizens in this town. Everything about the way the system works (from the short light changes, to the lack of sidewalks, to the lack of cuts to make wheeling a stroller or a wheelchair down from the sidewalk) seems to say "we don't want you to walk here. Walking downtown is marginally better than walking further away from the downtown, but all the sidewalks in this city need work, and its a crime that developments are allowed to build without sidewalks. Every morning, I cross Market at Lullwater to catch the bus to work, and I am afraid I'm going to be hit by a car. A non-able bodied person would not be able to cross the street before the light changes.
- the city needs to become pedestrian friendly - sidewalks everywhere, crosswalks, pedestrian crossing lights - keep us fit, save gas, make the town even more enjoyable.
- We need more sidewalks in Wilmington, not just downtown. There should be a sidewalk along Greenville Loop Road so people can walk to the bus stop on Oleander. The new sidewalks and bike paths along Eastwood Rd and Military Cutoff have no pedestrian crossings at the intersection of those streets. There should be a pedestrian crossing across from St. Mark Catholic School. There should be a pedestrian crossing on Military Cutoff to get from the sidewalk to Mayfair Towne Center. As gas prices rise, it is increasingly important that people be able to walk to a bus stop or to shopping centers. Children should be able to walk to school e.g. Bradley Creek School, but they can't without the sidewalks in place along Greenville Loop Road.

- Wilmington is a lovely city and I would like to walk (and bike) more, but do not because of lack of sidewalks and traffic safety issues.
- Would like to see more sidewalks or walking paths put in place where feasible
- A good example for sidewalks would be all around the neighborhoods near UNCW. For example, the grass along Racine drive has a trail worn it not as there are now sidewalks. Pine Valley and Eagles Nest HAD a plan for sidewalks a couple of years ago but was taken away.
- Downtown neighborhoods generally have sidewalks and we use them often. Other neighborhoods have few sidewalks - and people must walk in the streets. Above certain approved density. Developers should be made to design with sidewalks.
- I don't know who to complain to about messy sidewalks, and cars parked blocking the sidewalk
- I feel like there should be more connection throughout the city by means of walking/biking. Chattanooga is a great example of how they connecting their city via old vehicle bridges, etc.
- I often walk with a stroller downtown, and some sidewalks have poor handicap access. Most downtown are very dirty, especially outside of bars. The stench in the mornings is embarrassing to the city!
- I love walking around Wilmington and it's one of the major reasons I moved into the downtown. I find it very difficult and extremely unsafe to cross Third Street, especially with dogs. I can't even imagine doing it with children! The cars go way too fast and there's no safe place to wait. Many other streets in downtown are pleasant to walk on. However, it's impossible to walk or bike around the rest of Wilmington like down 16th. I biked it one day and felt I had taken my life in my hands. To be a great city we need to have pedestrian and bike areas where people can feel safe. This will make our city more welcoming, pleasant and green. Thanks!
- I would like to walk more, but the lack of sidewalks on through streets keeps me in my car.
- I would LOVE sidewalk in my neighborhood. Lots of people walk, walk their dogs, stroll their children and we have to jockey for right of way in the MIDDLEBORO SUBDIVISION.
- If there were sidewalks and bikepaths and safer intersections I would use them!
- Need to have additional crosswalk signals and striping along 3rd street downtown, particularly near CFCC. Should have a law that requires cars to yield to pedestrians within crosswalks and fine vehicles if they don't stop. Need to have bus that goes from downtown, to college, to the beach. Need to have bus shelters at key bus stop locations, or at least benches so people are not "loitering". Would like more greenways, or off road biking facilities for families and young kids that allow you to get from place to place, not just at parks.
- Really looking forward to the trail system that will link many of the areas parks/amenities. I am involved with the NC Geocachers Organization, and we would be happy to help with this effort in any way that we can! Michelle Frazier
- Rule of thumb - every major street should also have a pedestrian option!

- There are many places with sidewalks that simply end for no reason or end in a steep curb, making it ridiculous for physically impaired people to use the sidewalks. Also, a neighborhood such as Forest Hills is in great proximity to New Hanover Center & Independence Mall but walking there is almost out of the question due to lack of crosswalks, ending sidewalks. Also it could be beautified along Oleander in those locations to make people feel like it is a pleasant walk to go to the shopping centers, instead of across some asphalt wasteland -- so much parking that is never used -- certainly some space could be carved out for trees to lure in the pedestrians.
- We need more trails to connect all parks and downtown. A trail to the beach would be nice as well.
- 3rd St. S at Ann St. needs crosswalk and improvement. There should be a stop sign there to calm excessive speeding on 3rd St.
- Crossing 3rd Street is a real challenge.
- Crossing Independence Blvd from Park Avenue or Oleander Drive is a nightmare. Missing or obscured sidewalks on north side of Oleander Drive near Independence Blvd. Missing sidewalks on north side of Park Ave.
- Crossing lights were installed all along Military Cutoff even across side streets which see relatively little traffic but there was no provision made for crossing Military Cutoff for those living on the north side to get to the stores or Mayfaire. It would be wise to reinstall some of those crossing lights from the small side streets to the major thoroughfare.
- Crossing major north south streets in downtown (3rd and Orange for example) is horrible due to fast traffic, no crosswalk, and limited visibility. Crossing any major road in the Wrightsville Beach/Mayfaire area can be impossible and even more so during "the season". Such a shame to have the potential for not using a car but have concerns for safe crossings.
- Crossing South Third Street is a nightmare.
- I live downtown on 3rd street. Crossing 3rd street is nearly impossible due to the traffic (mostly speed). The only intersections on the South side to cross are Market and Castle. That is at least 6 blocks from one another. The lights on Market and Castle have long waits and the buttons to press when you want to cross do not always work. I am very concerned about the safety, particularly with children walking to St. Mary's. Aside from that, the medians are way too narrow. People who try to cross and get stuck in a median are in real danger.
- I live in the Forest Hills neighborhood with my wife and two children. We walk or run everyday in and around Forest Hills but would really like to have safe routes available across Independence to Hanover Center and Empie Park. There are many people in our neighborhood who would walk or ride bikes to nearby shopping if we had available pedestrian crosswalks. This would help the relieve traffic congestion, ease stress to the environment and contribute to more healthy lifestyle for all. Thank you.
- I would like to see if the city of Wilmington and the town of Wrightsville beach can place a cross walk at the intersection of eastwood rd and Wrightsville ave. along this major road, there

is no convenient crosswalk from the north side of the road to the south side where lumina station one and two are. Thank you for your time and consideration. Wendell Seebachan

- I would like to walk to shops in my neighborhood, or bike to school, but I will not cross college or market without an improvement in pedestrian safety.
- I'm sorry I haven't written before about the pedestrian problems of crossing Market St but I've observed the problems of people on foot, of all ages, for at least 10 yrs (since traffic picked up). Another location that could use a walk light is College Rd to allow foot traffic close to New Center and the shopping centers on both sides of College. It would help the college students as well.
- It makes no sense that sidewalks w/ handicapped ramps end at intersection where there are NO crosswalks. Many examples all over city, such as at all Dawson & Wooster intersections, 3rd & cross streets, traffic signaled intersections. There are far too many locations to cite all here.
- My children attend Holly Tree Elementary and ride their bicycles to school on Kirby Smith. The intersection between Kirby Smith and Greenhowe currently has stop signs on Greenhowe only. THIS IS NOT SAFE FOR THE MANY CHILDREN THAT WALK OR BIKE TO AND FROM TO SCHOOL USING KIRBY SMITH. YOU MUST, AGAIN, MUST INSTALL 4-WAY STOP SIGNS AT THIS PARTICULAR INTERSECTION. Many students on bicycles go left onto Greenhowe from Kirby Smith and are frequently in danger of being hit by cars driving straight on Kirby Smith. PLEASE CONSIDER PUTTING IN 4-WAY STOP SIGNS AS SOON AS POSSIBLE. Also, we see a lot of children going to Roland-Grise and Hoggard from Masonboro area, trying to cross College on Holly Tree. We have witnessed many, again, many accidents here, once involving a high school student on a bicycle who was, needless to say, badly injured. As of now, I see a student on a bicycle every morning at about 8:20 traveling north on College and then crossing Holly Tree to go to Hoggard. So many students from Masonboro area attend Hoggard and I see many of them trying to cross. Please make this crossing safer for students also by installing pedestrian lights with push-buttons.
- Need to have additional crosswalk signals and striping along 3rd street downtown, particularly near CFCC. Should have a law that requires cars to yield to pedestrians within crosswalks and fine vehicles if they don't stop. Need to have bus that goes from downtown, to college, to the beach. Need to have bus shelters at key bus stop locations, or at least benches so people are not "loitering". Would like more greenways, or off road biking facilities for families and young kids that allow you to get from place to place, not just at parks.
- One of the joys of living in the historic district is walking in the downtown. Tourists as well as residents should feel that crossing streets is safe and orderly. Third street north of Market has opportunities for crossing, but south of Market where tourists like to "visit" neighborhoods crossing is difficult and often dangerous.
- Please add blinking lights to pedestrian cross walks, especially at the intersection of 23rd & Chestnut, near the Annie Snipes School. Thank you
- The city is essentially divided into pockets by major traffic arteries. Without adequate, protected crosswalks, pedestrian traffic is extremely limited. i.e., you can't cross Market, Carolina Beach Rd. or S. College Rd. on foot without risking your life.

- We need a 3rd street crosswalk at Ann.

Pedestrian Facilities in General/Overpasses (8 of 65)

- Being downtown requires walking. Unfortunately, I am unable to take my family downtown because much of the area is still not very handicap accessible.
- There need to be pedestrian bridges or overpasses over S.College and Market so that areas are connected for pedestrians. E.g., from Hugh McCrae Park over to the senior center would be an ideal place, and there's already a height-limiting sign over that road anyway.
- Being downtown requires walking. Unfortunately, I am unable to take my family downtown because much of the area is still not very handicap accessible.
- Fix the bridges and put in pedestrian or vehicle overpasses wherever possible. Make dead end neighborhood streets interconnect. Put overhead streetlights everywhere possible. Make shoulders wider. Signage needs to be improved, you have to be in the intersections to read the names of intersecting streets. Street names change at intersections, confusing at best, for travelers. The sign in the intersection will only list the name of one the connector streets. Road surfaces are poor. Lines painted on the surface are faded. Signal lights are hanging from wooden poles hung by electric cables. Fix them in place on metal poles, hurricanes come through here.
- Wilmington is a college town, and it is really quite a shame how few options pedestrian, and or bike riders have for maneuvering their way around this town, especially college students.
- As it develops, I hope the north end of downtown can become a pedestrian friendly zone, with easy and attractive access to the Almont properties, convention center and Hilton Park.
- I walk 4 times a week for health benefits. If the conditions were more accommodating for pedestrians and cyclist I would also walk to my local grocery store in New Hanover center, to Independence Mall and the parks and other services within walking and cycling distance.
- I strongly endorse more & better walking / running/ green space in this community. Quality of life has yielded to rapid development. Everybody loses!

Bicycle Facilities (11 of 65)

- We walk and ride bikes as a family often. The more biking and pedestrian friendly our town in the higher our standard of living in this town.
- Bike paths go hand-in-hand with this problem, and since the area is so flat, more people would take advantage of biking given the right opportunities. Too many kids get driven to school because of inadequate bike and walking paths. Also, please consider a car-free zone downtown, where people can park outside the CBD and walk to the center.
- I'd like to add that biking in Wilmington is dangerous, too. I'd love to bike and walk more often. Please listen to the citizens, consider the future of all of our children, and add sidewalks and bike lanes for our health!
- Don't forget bicycles. Wilmington seems very unsafe and not friendly to bicycles and pedestrians.

- Because of poor road design, both walking and bike riding are very dangerous! Narrow bridges and busy major highways separate the city into zones that are impossible to cross.
- All developers should be required to consider pedestrians and bicyclers when getting approval for development. If we are going to be less car/gas dependent, we need to create communities where getting around without cars is possible.
- Addressing walking facilities is certainly needed, but in my opinion creating a safe space and barrier between vehicles and all alternative transportation methods, such as BIKING, are essential for better mobility in this City.
- Thank you so much for taking action on this issue. The deaths and injuries caused by cars in this city are entirely unacceptable. I support every effort the city may take in making streets safer for walkers and bikers of all ages.
- More bike paths
- We live in a tourist, nature and family-oriented area and the city is woefully lacking in walkways and bike paths for locals and visitors alike. I would ride my bike far more if it were safe to do so and a lot of people like me could save on gas and the city could save on road wear and experience fewer accidents.
- Getting to Greenfield Lake from downtown area (17th Street to River/North side across Castle, Dawson and Wooster via walking or cycling is dangerous and tedious.

Other (2 of 65)

- Streetscape improvements such as more trees and better lighting would increase pedestrians on the sidewalk outside of the commercial historic district and could lead to less criminal activity.
- When I do walk for exercise, it is not always convenient for me to carry water. Maybe water fountain or drink machine in some areas. Mainly water fountains because I don't like to carry cash, and change will slow me down.

Plan/Policy Improvements (3 of 85)

- The proposed Pedestrian Master Plan should be expanded in scope to include not only walking but jogging, bicycle use, roller blade use, and skate board use. Surfacing should be sufficiently wide to accommodate all of these uses. A 10' wide paved surface is sufficient. Political, social, and economic issues associated with providing just pedestrian facilities are too significant to limit the scope to a single activity. A "Master Plan" is more comprehensive than planning for a single function. It reviews and analyzes all allied uses of the limited resources of funds, land availability, enforcement, maintenance, etc. In theory or reality, one would not plan individually for each of the above listed multiple uses of a trail or "sidewalk". Suggest wrapping them all into a multiple use pedestrian, walking, hiking, bicycle, jogging master plan that provides catch up for the old downtown and early subdivisions, the recently annexed areas of the City, proposed County areas to be annexed, and the remainder of this small county so that this public need can be planned and executed as new annexation and new construction is approved, and not after the fact. As you are aware, walking for pleasure has been the number one recreational activity in America for the last 15 years. Let's assure that Wilmington and

New Hanover County do their part in providing a Master Plan and facilities for the number one recreational activity sought by its residents and those looking for retirement amenities.

- It will be best to encourage walking where the community and business owners can benefit: retail/shopping areas. There will more support if citizens benefit from pedestrian traffic instead of feeling burdened for the cost of it.
- Pedestrians and transit riders are viewed as second-class citizens in Wilmington. We need to focus more resources on pedestrian and transit facilities so that they become more appealing forms of transportation. All people are pedestrians before they are drivers, we need to remember that!

Transit Improvements (4 of 85)

- Need to have additional crosswalk signals and striping along 3rd street downtown, particularly near CFCC. Should have a law that requires cars to yield to pedestrians within crosswalks and fine vehicles if they don't stop. Need to have bus that goes from downtown, to college, to the beach. Need to have bus shelters at key bus stop locations, or at least benches so people are not "loitering". Would like more greenways, or off road biking facilities for families and young kids that allow you to get from place to place, not just at parks.
- Walking improvements need to be coordinated with improvements to WAVE.
- Market Street between 16th and Colonial is a residential area, not a high-speed highway corridor. The city needs to enforce speed limits every day, including the WAVE buses. To pretend that this stretch of road is safe for four lanes of traffic is a dereliction of duty on the part of public officials. It is a death trap.

Driver Behavior (11 of 85)

- Need to have additional crosswalk signals and striping along 3rd street downtown, particularly near CFCC. Should have a law that requires cars to yield to pedestrians within crosswalks and fine vehicles if they don't stop. Need to have bus that goes from downtown, to college, to the beach. Need to have bus shelters at key bus stop locations, or at least benches so people are not "loitering". Would like more greenways, or off road biking facilities for families and young kids that allow you to get from place to place, not just at parks.
- drivers need to be educated/reprimanded about sharing the roads with pedestrians
- Market Street between 16th and Colonial is a residential area, not a high-speed highway corridor. The city needs to enforce speed limits every day, including the WAVE buses. To pretend that this stretch of road is safe for four lanes of traffic is a dereliction of duty on the part of public officials. It is a death trap.
- In the county, speed of the cars is out of control and unsafe for and pedestrian (i.e. walkers, joggers, and bikers...)
- Everything I need is within walking distance, but I drive because the traffic is too dangerous! No sidewalks, no bike lanes and overdevelopment is insane. There are no cross walks on any of the corridors I use.
- Drivers turning when light walk is on. Drivers are looking at traffic not pedestrian.

- I live downtown and specifically moved here so I could walk to all our wonderful restaurants, art galleries, coffee shops, theatres, shops, the river, etc. I walk my dogs daily from one end of Front Street to the other and back. I also jog several times a week in the downtown area. Unfortunately, so many drivers don't pay any attention to pedestrians. I've almost been run over countless times by drivers who don't come to a full stop at stop signs and red lights, who don't look both ways before turning, who stop on top of crosswalks, etc. There are also too many skateboarders and bicyclists on the sidewalks. It's dangerous for everyone when someone tries to ride their bike or board down a crowded sidewalk. This seems to happen more often near Cape Fear Community College. I think Segways can be dangerous on crowded sidewalks as well. Anything that can be done to make downtown safer for pedestrians would be wonderful.
- We have lived in Wilmington for the past 7 years. Having moved our family from a state that is pedestrian friendly throughout, this was the first issue we noticed. The unsafe speed limit around the schools and neighborhoods, the lack of stop signs where common sense dictates necessity, the attitude of drivers towards pedestrians, all of which encourages driving as the only means of transportation.
- I'm very pleased that Wilmington is interested in improving our pedestrian facilities. Next we'll have to crack down on the crazy drivers.
- I don't know who to complain to about messy sidewalks, and cars parked blocking the sidewalk
- Creating a safe walking/biking pathway from downtown Wilmington/Front Street to the intersection of Carolina Beach Road/Third Street/Greenfield Lake would be a welcome change in Wilmington's pedestrian landscape. Many times, for festivals and other activities, my family has wanted to walk or ride our bikes downtown, but the hazardous conditions and traffic on Front Street and Third Street are daunting enough to keep us at home us put us in the car.

Funding (1 of 85)

- Any pedestrian improvements made should not be funded by monies intended for roads (i.e. gas tax, etc.). Separate funding should be made available by other means. (Tennis shoe tax, sales tax, jaywalking fines, etc. Education is extremely important. No one uses existing crosswalks so why build more?

Miscellaneous (4 of 85)

- I like the neighborhood walks. I.e. Forest Hills walkway.
- Stop talking about it - act!
- Have already sent comments via e mail
- Walking around Wilmington makes you feel like you're in a reverse fishbowl with all the people in there metal coffins staring out at you like there's something wrong with you - why are you walking? Are you poor? Lost your license? For cycling things are even worse.

FUNDING

Funding Sources

Local, state, federal, and private funding is available to support the planning, construction, right of way acquisition and maintenance of bicycle and pedestrian facilities. Available funding sources are related to a variety of purposes including transportation, water quality, hazard mitigation, recreation, air quality, wildlife protection, community health, and economic development. This appendix identifies a list of some of the bicycle and pedestrian facility funding opportunities available through federal, state, nonprofit and corporate sources. An important key to obtaining funding is for local governments to have adopted plans for greenway, bicycle, pedestrian or trail systems in place prior to making an application for funding.

Funding Allocated by State Agencies

Funding Opportunities Through NCDOT:

Bicycle and Pedestrian Independent Projects Funded Through the Transportation Improvement Program (TIP)

In North Carolina, the Department of Transportation, Division of Bicycle and Pedestrian Transportation (DBPT) manages the Transportation Improvement Program (TIP) selection process for bicycle and pedestrian projects. Projects programmed into the TIP are independent projects – those which are not related to a scheduled highway project. Incidental projects – those related to a scheduled highway project – are handled through other funding sources described in this section. The division has an annual budget of \$6 million. Eighty percent of these funds are from STP-Enhancement funds¹⁵, while the State Highway Trust provides the remaining 20 percent of the funding. Each year, the DBPT regularly sets aside a total of \$200,000 of TIP funding for the department to fund projects such as training workshops, pedestrian safety and research projects, and other pedestrian needs statewide. Those interested in learning about training workshops, research and other opportunities should contact the DBPT for information.

A total of \$5.3 million dollars of TIP funding is available for funding various bicycle and pedestrian independent projects, including the construction of multi-use trails, the striping of

¹⁵ After various administrative adjustments for programs within the Surface Transportation Program, or "STP", there is a 10% set-aside for Transportation Enhancements. The 10% set-aside is allocated within NCDOT to internal programs such as the Bicycle/Pedestrian Division, the Rail Division, the Roadside Environmental Unit, and others. The Enhancement Unit administers a portion of the set-aside through the Call for Projects process.

bicycle lanes, and the construction of paved shoulders, among other facilities. Prospective applicants are encouraged to contact the DBPT regarding funding assistance for bicycle and pedestrian projects. For a detailed description of the TIP project selection process, visit: http://www.ncdot.org/transit/bicycle/funding/funding_TIP.html. Another \$500,000 of the division's funding is available for miscellaneous projects.

Incidental Projects – Bicycle and pedestrian accommodations such as bike lanes, widened paved shoulders, sidewalks and bicycle-safe bridge design are frequently included as incidental features of highway projects. In addition, bicycle-safe drainage grates are a standard feature of all highway construction. Most bicycle and pedestrian safety accommodations built by NCDOT are included as part of scheduled highway improvement projects funded with a combination of National Highway System funds and State Highway Trust Funds.

Sidewalk Program – Each year, a total of \$1.4 million in STP-Enhancement funding is set aside for sidewalk construction, maintenance and repair. Each of the 14 highway divisions across the state allocates \$100,000 annually from each division's budget for this purpose. Funding decisions are made by the district engineer. Prospective applicants are encouraged to contact their district engineer for information on how to apply for funding.

Governor's Highway Safety Program (GHSP) – The mission of the GHSP is to promote highway safety awareness and reduce the number of traffic crashes in the state of North Carolina through the planning and execution of safety programs. GHSP funding is provided through an annual program, upon approval of specific project requests. Amounts of GHSP funds vary from year to year, according to the specific amounts requested. 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. Evidence of reductions in crashes, injuries, and fatalities is required. For information on applying for GHSP funding, visit: www.ncdot.org/programs/ghsp/.

Funding Available Through North Carolina Metropolitan Planning Organizations (MPOs)

MPOs in North Carolina which are located in air quality nonattainment or maintenance areas have the authority to program Congestion Mitigation Air Quality (CMAQ) funds. CMAQ funding is intended for projects that reduce transportation related emissions. Some NC MPOs have chosen to use the CMAQ funding for bicycle and pedestrian projects. Local governments in air quality nonattainment or maintenance area should contact their MPO for information on CMAQ funding opportunities for bicycle and pedestrian facilities.

Transportation Enhancement Call for Projects, EU, NCDOT

The Enhancement Unit administers a portion of the enhancement funding set-aside through the Call for Projects process. In North Carolina the Enhancement Program is a federally funded cost reimbursement program with a focus upon improving the transportation experience in and through local North Carolina communities either culturally, aesthetically, or environmentally. The program seeks to encourage diverse modes of travel, increase benefits to communities and to encourage citizen involvement. This is accomplished through the following twelve qualifying activities:

1. Bicycle and Pedestrian Facilities
2. Bicycle and Pedestrian Safety
3. Acquisition of Scenic Easements, Scenic or Historic Sites
4. Scenic or Historic Highway Programs (including tourist or welcome centers)
5. Landscaping and other Scenic Beautification
6. Historic Preservation
7. Rehabilitation of Historic Transportation Facilities
8. Preservation of Abandoned Rail Corridors
9. Control of Outdoor Advertising
10. Archaeological Planning and Research
11. Environmental Mitigation
12. Transportation Museums

Funds are allocated based on an equity formula approved by the Board of Transportation. The formula is applied at the county level and aggregated to the regional level. Available fund amount varies. In previous Calls, the funds available ranged from \$10 million to \$22 million.

The Call process takes place on even numbered years or as specified by the Secretary of Transportation. The Next Call is anticipated to take place in 2009. For more information, visit: www.ncdot.org/financial/fiscal/Enhancement/

Bicycle and Pedestrian Planning Grant Initiative, managed by NCDOT, DBPT

To encourage the development of comprehensive local bicycle plans and pedestrian plans, the NCDOT Division of Bicycle and Pedestrian Transportation (DBPT) and the Transportation

Planning Branch (TPB) have created a matching grant program to fund plan development. This program was initiated through a special allocation of funding approved by the North Carolina General Assembly in 2003 along with federal funds earmarked specifically for bicycle and pedestrian planning by the TPB. The planning grant program was launched in January 2004, and it is currently administered through NCDOT-DBPT and the Institute for Transportation Research and Education (ITRE) at NC State University. Over the past three grant cycles, 48 municipal plans have been selected and funded from 123 applicants. A total of \$ 1,175,718 has been allocated. Funding is secured for 2007 at \$400,000. Additional annual allocations will be sought for subsequent years. For more information, visit www.itre.ncsu.edu/ptg/bikeped/ncdot/index.html

Safe Routes to School Program, managed by NCDOT, DBPT

The NCDOT Safe Routes to School Program is a federally funded program that was initiated by the passing of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) in 2005, which establishes a national SRTS program to distribute funding and institutional support to implement SRTS programs in states and communities across the country. SRTS programs facilitate the planning, development, and implementation of projects and activities that will improve safety and reduce traffic, fuel consumption, and air pollution in the vicinity of schools. The Division of Bicycle and Pedestrian Transportation at NCDOT is charged with disseminating SRTS funding.

The state of North Carolina has been allocated \$15 million in Safe Routes to School funding for fiscal years 2005 through 2009 for infrastructure or non-infrastructure projects. All proposed projects must relate to increasing walking or biking to and from an elementary or middle school. An example of a non-infrastructure project is an education or encouragement program to improve rates of walking and biking to school. An example of an infrastructure project is construction of sidewalks around a school. Infrastructure improvements under this program must be made within 2 miles of an elementary or middle school. The state requires the completion of a competitive application to apply for funding. For more information, visit www.ncdot.org/programs/safeRoutes/ or contact Leza Mundt at DBPT/NCDOT, (919) 807-0774.

The North Carolina Conservation Tax Credit (managed by NCDENR)

This program, managed by the North Carolina Department of Environment and Natural Resources, provides an incentive (in the form of an income tax credit) for landowners that

donate interests in real property for conservation purposes. Property donations can be fee simple or in the form of conservation easements or bargain sale. The goal of this program is to manage stormwater, protect water supply watersheds, retain working farms and forests, and set-aside greenways for ecological communities, public trails, and wildlife corridors. For more information, visit: www.enr.state.nc.us/conservationtaxcredit/.

Land and Water Conservation Fund (LWCF)

The Land and Water Conservation Fund (LWCF) program is a reimbursable, 50/50 matching grants program to states for conservation and recreation purposes, and through the states to local governments to address "close to home" outdoor recreation needs. LWCF grants can be used by communities to build a trail within one park site, if the local government has fee-simple title to the park site. Grants for a maximum of \$250,000 in LWCF assistance are awarded yearly to county governments, incorporated municipalities, public authorities and federally recognized Indian tribes. The local match may be provided with in-kind services or cash. The program's funding comes primarily from offshore oil and gas drilling receipts, with an authorized expenditure of \$900 million each year. However, Congress generally appropriates only a small fraction of this amount. The allotted money for the year 2007 is \$632,846.

The Land and Water Conservation Fund (LWCF) has historically been a primary funding source of the US Department of the Interior for outdoor recreation development and land acquisition by local governments and state agencies. In North Carolina, the program is administered by the Department of Environment and Natural Resources. Since 1965, the LWCF program has built a permanent park legacy for present and future generations. In North Carolina alone, the LWCF program has provided more than \$63 million in matching grants to protect land and support more than 800 state and local park projects. More than 37,000 acres have been acquired with LWCF assistance to establish a park legacy in our state. For more information, visit: <http://ils.unc.edu/parkproject/lwcf/home1.html>

NC Adopt-A-Trail Grant Program

This program, operated by the Trails Section of the NC Division of State Parks, offers annual grants to local governments to build, renovate, maintain, sign and map and create brochures for pedestrian trails. Grants are generally capped at about \$5,000 per project and do not require a match. A total of \$108,000 in Adopt-A-Trail money is awarded annually to government agencies. Applications are due during the month of February. For more information, visit : <http://ils.unc.edu/parkproject/trails/grant.html>.

Recreational Trails Program

The Recreational Trails Program (RTP) is a grant program funded by Congress with money from the federal gas taxes paid on fuel used by off-highway vehicles. This program's intent is to meet the trail and trail-related recreational needs identified by the Statewide Comprehensive Outdoor Recreation Plan. Grant applicants must be able contribute 20% of the project cost with cash or in-kind contributions. The program is managed by the State Trails Program, which is a section of the N.C. Division of Parks and Recreation.

The grant application is available and instruction handbook is available through the State Trails Program website at <http://www.fhwa.dot.gov/environment/rectrails/>. Applications are due during the month of February. For more information, call (919) 715-8699.

North Carolina Parks and Recreation Trust Fund (PARTF)

The fund was established in 1994 by the North Carolina General Assembly and is administered by the Parks and Recreation Authority. Through this program, several million dollars each year are available to local governments to fund the acquisition, development and renovation of recreational areas. Applicable projects require a 50/50 match from the local government. Grants for a maximum of \$500,000 are awarded yearly to county governments or incorporated municipalities. The fund is fueled by money from the state's portion of the real estate deed transfer tax for property sold in North Carolina.

The trust fund is allocated three ways:

For information on how to apply, visit: www.partf.net/learn.html

Powell Bill Program

Annually, State street-aid (Powell Bill) allocations are made to incorporated municipalities which establish their eligibility and qualify as provided by statute. This program is a state grant to municipalities for the purposes of maintaining, repairing, constructing, reconstructing or widening of local streets that are the responsibility of the municipalities or for planning, construction, and maintenance of bikeways or sidewalks along public streets and highways. Funding for this program is collected from fuel taxes. Amount of funds are based on population and mileage of town-maintained streets. For more information, visit http://www.ncdot.org/programs/Powell_Bill/.

Urban and Community Forestry Assistance Program

This program offers small grants that can be used to plant urban trees, establish a community arboretum, or other programs that promote tree canopy in urban areas. The program operates as a cooperative partnership between the NC Division of Forest Resources and the USDA Forest Service, Southern Region. To qualify for this program, a community must pledge to develop a street-tree inventory, a municipal tree ordinance, a tree commission, and an urban forestry-management plan. All of these can be funded through the program. For more information, contact the NC Division of Forest Resources. For more information and a grant application, contact the NC Division of Forest Resources and/or visit http://www.dfr.state.nc.us/urban/urban_grantprogram.htm.

North Carolina Health and Wellness Trust Fund

The NC Health and Wellness Trust Fund was created by the General Assembly as one of 3 entities to invest North Carolina's portion of the Tobacco Master Settlement Agreement. HWTF receives one-fourth of the state's tobacco settlement funds, which are paid in annual installments over a 25-year period.

Fit Together, a partnership of the NC Health and Wellness Trust Fund (HWTF) and Blue Cross and Blue Shield of North Carolina (BCBSNC) announces the establishment of Fit Community, a designation and grant program that recognizes and rewards North Carolina communities' efforts to support physical

activity and healthy eating initiatives, as well as tobacco-free school environments. Fit Community is one component of the jointly sponsored Fit Together initiative, a statewide prevention campaign designed to raise awareness about obesity and to equip individuals, families and communities with the tools they need to address this important issue.

All North Carolina municipalities and counties are eligible to apply for a Fit Community designation, which will be awarded to those that have excelled in supporting the following:

- physical activity in the community, schools, and workplaces
- healthy eating in the community, schools, and workplaces
- tobacco use prevention efforts in schools
- Designations will be valid for two years, and designated communities may have the opportunity to reapply for subsequent two-year extensions. The benefits of being a Fit Community include:

- heightened statewide attention that can help bolster local community development and/or economic investment initiatives (highway signage and a plaque for the Mayor's or County Commission Chair's office will be provided)
- reinvigoration of a community's sense of civic pride (each Fit Community will serve as a model for other communities that are trying to achieve similar goals)
- use of the Fit Community designation logo for promotional and communication purposes. The application for Fit Community designation is available on the

Fit Together Web site: www.FitTogetherNC.org/FitCommunity.aspx.

Fit Community grants are designed to support innovative strategies that help a community meet its goal to becoming a Fit Community. Eight to nine, two-year grants of up to \$30,000 annually will be awarded to applicants that have a demonstrated need, proven capacity, and opportunity for positive change in

addressing physical activity and/or healthy eating. For more information, visit: www.healthwellnc.com/

Federal Agency Funding Sources

Wetlands Reserve Program

This federal funding source is a voluntary program offering technical and financial assistance to landowners who want to restore and protect wetland areas for water quality and wildlife habitat. The US Department of Agriculture's Natural Resource Conservation Service (USDA-NRCS) administers the program and provides direct payments to private landowners who agree to place sensitive wetlands under permanent easements. This program can be used to fund the protection of open space and greenways within riparian corridors. For more information, visit <http://www.nrcs.usda.gov/PROGRAMS/wrp/>.

The Community Development Block Grant (HUD-CDBG)

The U.S. Department of Housing and Urban Development (HUD) offers financial grants to communities for neighborhood revitalization, economic development, and improvements to community facilities and services, especially in low and moderate income areas. Several communities have used HUD funds to develop greenways, including the Boulding Branch Greenway in High Point, North Carolina. Grants from this program range from \$50,000 to \$200,000 and are either made to municipalities or non-profits. There is no formal application

process. For more information, visit:
www.hud.gov/offices/cpd/communitydevelopment/programs/.

USDA Rural Business Enterprise Grants

Public and private nonprofit groups in communities with populations under 50,000 are eligible to apply for grant assistance to help their local small business environment. \$1 million is available for North Carolina on an annual basis and may be used for sidewalk and other community facilities. For more information from the local USDA Service Center, visit:
<http://www.rurdev.usda.gov/rbs/busp/rbeg.htm>

Rivers Trails and Conservation Assistance Program (RTCA)

The Rivers, Trails, and Conservation Assistance Program, also known as the Rivers & Trails Program or RTCA, is the community assistance arm of the National Park Service. RTCA staff provide technical assistance to community groups and local, State, and federal government agencies so they can conserve rivers, preserve open space, and develop trails and greenways. The RTCA program implements the natural resource conservation and outdoor recreation mission of the National Park Service in communities across America

Although the program does not provide funding for projects, it does provide valuable on-the-ground technical assistance, from strategic consultation and partnership development to serving as liaison with other government agencies. Communities must apply for assistance. For more information, visit: www.nps.gov/ncrc/programs/rtca/ or call Chris Abbett, Program Leader, at 404-562-3175 ext. 522.

Public Lands Highways Discretionary Fund

The Federal Highway Administration administers discretionary funding for projects that will reduce congestion and improve air quality. The FHWA issues a call for projects to disseminate this funding. The FHWA estimates that the PLHD funding for the 2007 call will be \$85 million. In the past, Congress has earmarked a portion of the total available funding for projects. For information on how to apply, visit: <http://www.fhwa.dot.gov/discretionary/>

Local Funding Sources

Municipalities often plan for the funding of pedestrian facilities or improvements through development of Capital Improvement Programs (CIP). In Raleigh, for example, the greenways system has been developed over many years through a dedicated source of annual funding that has ranged from \$100,000 to \$500,000, administered through the Recreation and Parks Department. CIPs should include all types of capital improvements (water, sewer, buildings,

streets, etc.) versus programs for single purposes. This allows municipal decision-makers to balance all capital needs. Typical capital funding mechanisms include the following: capital reserve fund, capital protection ordinances, municipal service district, tax increment financing, taxes, fees, and bonds. Each of these categories are described below.

Capital Reserve Fund

Municipalities have statutory authority to create capital reserve funds for any capital purpose, including pedestrian facilities. The reserve fund must be created through ordinance or resolution that states the purpose of the fund, the duration of the fund, the approximate amount of the fund, and the source of revenue for the fund. Sources of revenue can include general fund allocations, fund balance allocations, grants and donations for the specified use.

Capital Project Ordinances

Municipalities can pass Capital Project Ordinances that are project specific. The ordinance identifies and makes appropriations for the project.

Municipal Service District

Municipalities have statutory authority to establish municipal service districts, to levy a property tax in the district additional to the citywide property tax, and to use the proceeds to provide services in the district. Downtown revitalization projects are one of the eligible uses of service districts.

Tax Increment Financing

Tax increment financing is a tool to use future gains in taxes to finance the current improvements that will create those gains. When a public project, such as the construction of a greenway, is carried out, there is an increase in the value of surrounding real estate. Oftentimes, new investment in the area follows such a project. This increase in value and investment creates more taxable property, which increases tax revenues. These increased revenues can be referred to as the “tax increment.” Tax Increment Financing dedicates that increased revenue to finance debt issued to pay for the project. TIF is designed to channel funding toward improvements in distressed or underdeveloped areas where development would not otherwise occur. TIF creates funding for public projects that may otherwise be unaffordable to localities. The large majority of states have enabling legislation for tax increment financing.

Installment Purchase Financing

As an alternative to debt financing of capital improvements, communities can execute installment/ lease purchase contracts for improvements. This type of financing is typically used for relatively small projects that the seller or a financial institution is willing to finance or when up-front funds are unavailable. In a lease purchase contract the community leases the property or improvement from the seller or financial institution. The lease is paid in installments that include principal, interest, and associated costs. Upon completion of the lease period, the community owns the property or improvement. While lease purchase contracts are similar to a bond, this arrangement allows the community to acquire the property or improvement without issuing debt. These instruments, however, are more costly than issuing debt.

Taxes

Many communities have raised money through self-imposed increases in taxes and bonds. For example, Pinellas County residents in Florida voted to adopt a one-cent sales tax increase, which provided an additional \$5 million for the development of the overwhelmingly popular Pinellas Trail. Sales taxes have also been used in Allegheny County, Pennsylvania, and in Boulder, Colorado to fund open space projects. A gas tax is another method used by some municipalities to fund public improvements. A number of taxes provide direct or indirect funding for the operations of local governments. Some of them are:

Sales Tax

In North Carolina, the state has authorized a sales tax at the state and county levels. Local governments that choose to exercise the local option sales tax (all counties currently do), use the tax revenues to provide funding for a wide variety of projects and activities. Any increase in the sales tax, even if applying to a single county, must gain approval of the state legislature. In 1998, Mecklenburg County was granted authority to institute a one-half cent sales tax increase for mass transit.

Property Tax

Property taxes generally support a significant portion of a municipality's activities. However, the revenues from property taxes can also be used to pay debt service on general obligation bonds issued to finance greenway system acquisitions. Because of limits imposed on tax rates, use of property taxes to fund greenways could limit the municipality's ability to raise funds for other activities. Property taxes can provide a steady stream of financing while broadly distributing the tax burden. In other parts of the country, this mechanism has been popular

with voters as long as the increase is restricted to parks and open space. Note, other public agencies compete vigorously for these funds, and taxpayers are generally concerned about high property tax rates.

Excise Taxes

Excise taxes are taxes on specific goods and services. These taxes require special legislation and the use of the funds generated through the tax are limited to specific uses. Examples include lodging, food, and beverage taxes that generate funds for promotion of tourism, and the gas tax that generates revenues for transportation related activities.

Occupancy Tax

The NC General Assembly may grant towns the authority to levy occupancy tax on hotel and motel rooms. The act granting the taxing authority limits the use of the proceeds, usually for tourism-promotion purposes.

Fees

Three fee options that have been used by local governments to assist in funding pedestrian and bicycle facilities are listed here:

Stormwater Utility Fees

Greenway sections may be purchased with stormwater fees, if the property in question is used to mitigate floodwater or filter pollutants.

Stormwater charges are typically based on an estimate of the amount of impervious surface on a user's property. Impervious surfaces (such as rooftops and paved areas) increase both the amount and rate of stormwater runoff compared to natural conditions. Such surfaces cause runoff that directly or indirectly discharge into public storm drainage facilities and creates a need for stormwater management services. Thus, users with more impervious surface are charged more for stormwater service than users with less impervious surface. The rates, fees, and charges collected for stormwater management services may not exceed the costs incurred to provide these services. The costs that may be recovered through the stormwater rates, fees, and charges includes any costs necessary to assure that all aspects of stormwater quality and quantity are managed in accordance with federal and state laws, regulations, and rules.

Streetscape Utility Fees

Streetscape Utility Fees could help support streetscape maintenance of the area between the curb and the property line through a flat monthly fee per residential dwelling unit. Discounts would be available for senior and disabled citizens. Non-residential customers would be charged a per foot fee based on the length of frontage on streetscape improvements. This amount could be capped for non-residential customers with extremely large amounts of street frontage. The revenues raised from Streetscape Utility fees would be limited by ordinance to maintenance (or construction and maintenance) activities in support of the streetscape.

Impact Fees

Developers can be required to provide greenway impact fees through local enabling legislation. Impact fees, which are also known as capital contributions, facilities fees, or system development charges, are typically collected from developers or property owners at the time of building permit issuance to pay for capital improvements that provide capacity to serve new growth. The intent of these fees is to avoid burdening existing customers with the costs of providing capacity to serve new growth (“growth pays its own way”). Greenway impact fees are designed to reflect the costs incurred to provide sufficient capacity in the system to meet the additional needs of a growing community. These charges are set in a fee schedule applied uniformly to all new development. Communities that institute impact fees must develop a sound financial model that enables policy makers to justify fee levels for different user groups, and to ensure that revenues generated meet (but do not exceed) the needs of development. Factors used to determine an appropriate impact fee amount can include: lot size, number of occupants, and types of subdivision improvements. If Wilmington is interested in pursuing open space impact fees, it will require enabling legislation to authorize the collection of the fees.

Exactions

Exactions are similar to impact fees in that they both provide facilities to growing communities. The difference is that through exactions it can be established that it is the responsibility of the developer to build the greenway or pedestrian facility that crosses through the property, or adjacent to the property being developed.

Bonds and Loans

Bonds have been a very popular way for communities across the country to finance their pedestrian and greenway projects. A number of bond options are listed below. Contracting with a private consultant to assist with this program may be advisable. Since bonds rely on the support of the voting population, an education and awareness program should be implemented

prior to any vote. Billings, Montana used the issuance of a bond in the amount of \$599,000 to provide the matching funds for several of their TEA-21 enhancement dollars.

Revenue Bonds

Revenue bonds are bonds that are secured by a pledge of the revenues from a certain local government activity. The entity issuing bonds, pledges to generate sufficient revenue annually to cover the program's operating costs, plus meet the annual debt service requirements (principal and interest payment). Revenue bonds are not constrained by the debt ceilings of general obligation bonds, but they are generally more expensive than general obligation bonds.

General Obligation Bonds

Cities, counties, and service districts generally are able to issue general obligation (G.O.) bonds that are secured by the full faith and credit of the entity. In this case, the local government issuing the bonds pledges to raise its property taxes, or use any other sources of revenue, to generate sufficient revenues to make the debt service payments on the bonds. A general obligation pledge is stronger than a revenue pledge, and thus may carry a lower interest rate than a revenue bond. Frequently, when local governments issue G.O. bonds for public enterprise improvements, the public enterprise will make the debt service payments on the G.O. bonds with revenues generated through the public entity's rates and charges. However, if those rate revenues are insufficient to make the debt payment, the local government is obligated to raise taxes or use other sources of revenue to make the payments. G.O. bonds distribute the costs of land acquisition and greenway development and make funds available for immediate purchases and projects. Voter approval is required.

Special Assessment Bonds

Special assessment bonds are secured by a lien on the property that benefits by the improvements funded with the special assessment bond proceeds. Debt service payments on these bonds are funded through annual assessments to the property owners in the assessment area.

State Revolving Fund (SRF) Loans

Initially funded with federal and state money, and continued by funds generated by repayment of earlier loans, State Revolving Funds (SRFs) provide low interest loans for local governments to fund water pollution control and water supply related projects including many watershed

management activities. These loans typically require a revenue pledge, like a revenue bond, but carry a below market interest rate and limited term for debt repayment (20 years).

Partnerships

Another method of funding pedestrian systems and greenways is to partner with public agencies and private companies and organizations. Partnerships engender a spirit of cooperation, civic pride and community participation. The key to the involvement of private partners is to make a compelling argument for their participation. Major employers and developers should be identified and provided with a “Benefits of Walking”-type handout for themselves and their employees. Very specific routes that make critical connections to place of business would be targeted for private partners’ monetary support following a successful master planning effort. Potential partners include major employers which are located along or accessible to pedestrian facilities such as multi-use paths or greenways. Name recognition for corporate partnerships would be accomplished through signage trail heads or interpretive signage along greenway systems. Utilities often make good partners and many trails now share corridors with them. Money raised from providing an easement to utilities can help defray the costs of maintenance. It is important to have a lawyer review the legal agreement and verify ownership of the subsurface, surface or air rights in order to enter into an agreement.

Local Trail Sponsors

A sponsorship program for trail amenities allows smaller donations to be received from both individuals and businesses. Cash donations could be placed into a trust fund to be accessed for certain construction or acquisition projects associated with the greenways and open space system. Some recognition of the donors is appropriate and can be accomplished through the placement of a plaque, the naming of a trail segment, and/or special recognition at an opening ceremony. Types of gifts other than cash could include donations of services, equipment, labor, or reduced costs for supplies.

Volunteer Work

It is expected that many citizens will be excited about the development of a greenway corridor. Individual volunteers from the community can be brought together with groups of volunteers from church groups, civic groups, scout troops and environmental groups to work on greenway development on special community work days. Volunteers can also be used for fund-raising, maintenance, and programming needs.