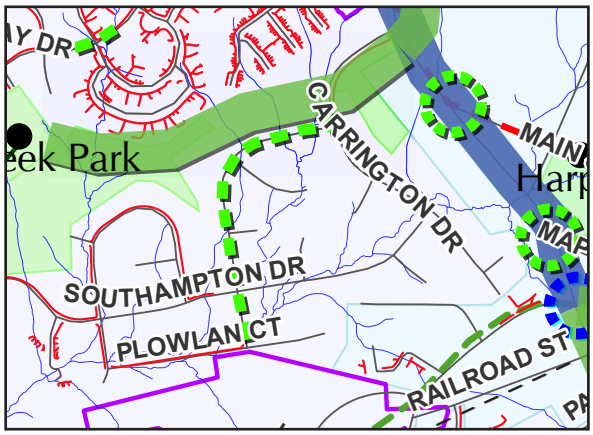
- **Sidewalk Construction on Brookfield Drive**

Construct a 5′ minimum concrete sidewalk along at least one side of Brookfield Drive from Carrington Drive to the Town Limits. This road connects a residential area with sidewalks to the eventual sidewalk system along Smithfield Road. This connection will enable residents to access commercial areas of Town and community amenities, such as the proposed greenway and Harper Park. In addition, development is expected to occur south of Brookfield Drive, resulting in additional vehicular traffic as this road becomes a more important connector. This will provide additional need for a sidewalk along Brookfield to ensure pedestrians are safe when walking this connection.

Sidewalk Construction on Brookfield Drive

	High	Medium	Low
Usage		X	
Connections	X		
Safety Issue		X	
Functional Issue	X		

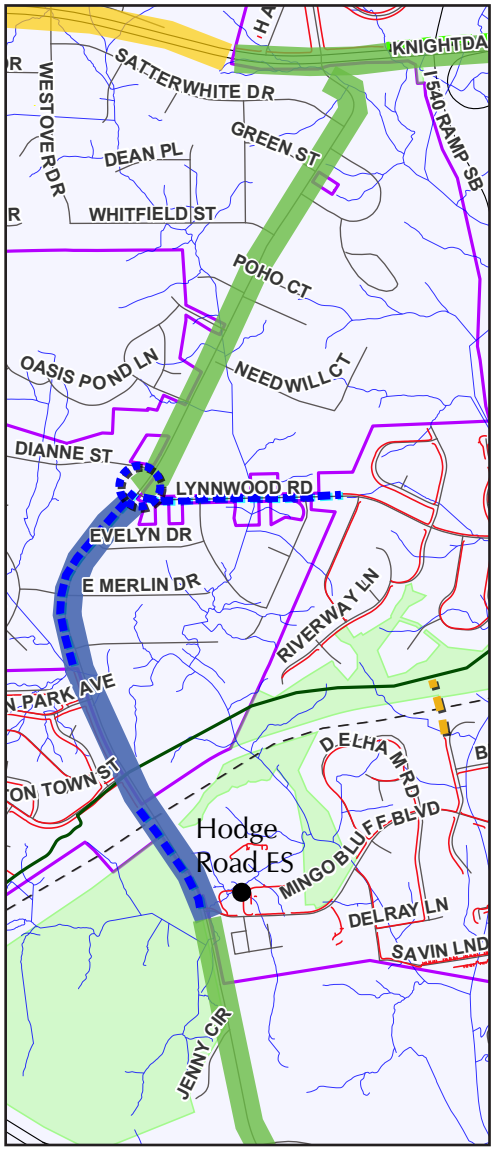


- **Hodge Road**

As mentioned earlier, Hodge Road is an important north/south connector in Town. Hodge Road connects residential neighborhoods to Knightdale Boulevard and US 264. The central portion of the corridor was identified earlier as a Tier One project because of its importance as a connector between the elementary school, residential neighborhood and Lynwood Road. Lynwood Road provides access to Knightdale Boulevard and shopping centers. The northern and southern sections of this corridor are ranked as Tier Two projects because of their overall prominence in creating safe connectivity within the Town but their reduced usage.

Hodge Road Corridor (north and south)

	High	Medium	Low
Usage			X
Connections		X	
Safety Issue		X	
Functional Issue		X	

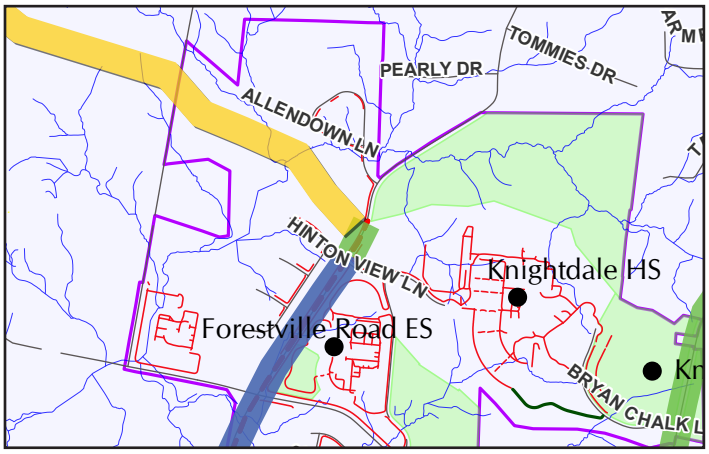


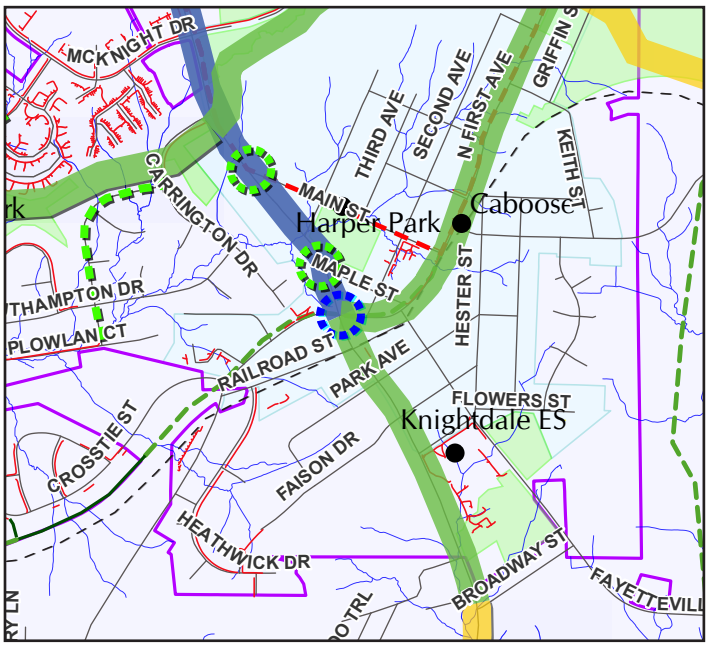
- **Smithfield Road**

As discussed earlier, Smithfield Road is in need of critical improvments along the entire corridor to improve pedestrian safety and connectivity. The section to the very north makes a connection to a proposed Tier 3 greenway that extends westward and the section toward the south/central improves the corridor in front of the elementary school. These two sections are not as well-travelled as the central primary section of Smithfield Road discussed as a Tier One corridor project.

Smithfield Road Corridor (far north and central)

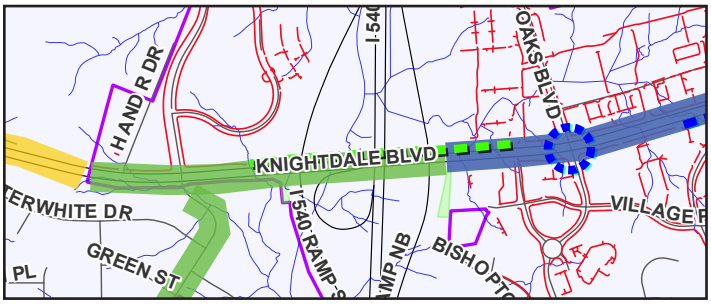
	High	Medium	Low
Usage			X
Connections			X
Safety Issue		X	
Functional Issue		X	





Knightdale Boulevard Corridor from I-540 west to Town Limits

	High	Medium	Low
Usage			X
Connections			X
Safety Issue		X	
Functional Issue		X	



- **Knightdale Boulevard (Business 64)**

The Knightdale Boulevard corridor through Knightdale was identified in every public discussion and through site analysis as a critical component to improving pedestrian connectivity in Knightdale. Knightdale Boulevard is a highly trafficked, highly visible corridor through Town. This corridor bisects the Town, attracts visitors and residents to the commercial businesses lining the road, and acts as a major obstacle to pedestrian connectivity. Improving the corridor through landscape treatments to soften walking along the busy highway, connecting commercial strips with sidewalks, and adding signalized crosswalks and other pedestrian safety treatments for crossing the highway is critical to creating a more walkable Town.

The corridor should include certain traffic calming methods such as “bulb outs” or curb extensions in an effort to reduce high vehicular speeds by

- **Sidewalk construction on Knightdale Boulevard from Old Knight Road to Schneider Electric.**

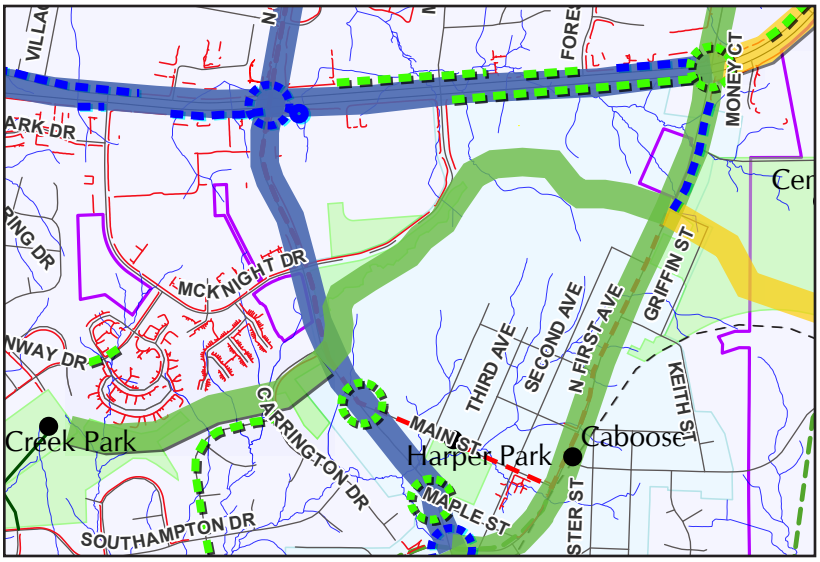
This sidewalk extension east of Knightdale on Knightdale Boulevard will connect the eastern side of Town, including the Town Hall, new Town Community Park and commercial areas with a large employer - Schneider Electric and residential neighborhoods. Construct a minimum 5′ wide concrete sidewalk along the northern side of Knightdale Boulevard to the Schneider Electric entrance sidewalk.

Sidewalk construction on Knightdale Boulevard Old Knight Road east

	High	Medium
Usage		
Connections		
Safety Issue	X	
Functional Issue		X

Greenway Trail extension of Mingo Creek Greenway to 1st Avenue

	High	Medium	Low
Usage		X	
Connections	X		
Safety Issue			X
Functional Issue		X	



4.4-LONG-TERM PROJECTS

The Pedestrian System Plan also includes corridors in need of future improvement herein noted as Long Term Improvements. Following the Short Term Spot and Corridor Improvement projects, roadway corridors on the Long Term improvements list should be improved and enhanced as recommended when funding becomes available. These future corridors offer roadways with a finer degree of interconnectivity and pedestrian linkages throughout Knightdale and are not in as immediate need of improvement as the short-term projects listed previously.

Long-term projects have been identified as projects that would benefit the community, but are not considered a top priority for safety or connectivity. However, these projects would be valuable amenities to the Town and should be included in future requests for grant money or state funding.

- **Corridor Improvements along east Knightdale Boulevard**

Some residents expressed a desire to connect Knightdale to points east on Knightdale Boulevard, such as Schneider Electric and Wendell farther east. People who live in Wendell and work in Knightdale, or vice versa, have expressed a desire to have a clearly defined bicycle lane on Business 64 to increase connectivity. As funding becomes available, improve the corridor by including pedestrian level lighting, bicycle lanes, sidewalks, and landscape enhancements. This corridor will also act as a gateway into Town from points east and should be enhanced with Welcome Signage and landscaping.

- **Corridor Improvements along west Knightdale Boulevard**

Residents have also expressed a desire to have a safer, more connected way to move between Raleigh and Knightdale on Knightdale Boulevard. Citizens pointed out that pedestrians have been seen walking along Knightdale Boulevard west of 540 on the shoulder of the road. This is clearly an unsafe condition on a busy that could benefit from sidewalks, pedestrian level lighting, bicycle lanes, and landscape enhancements. This corridor will also act as a gateway into Town from points west and should be enhanced with Welcome Signage and landscaping. The City of Raleigh should be engaged in any corridor improvements in order to coordinate design and funding efforts.

- **Multi-jurisdictional Greenway Trail Construction to Wendell**

Construct a minimum 10' wide asphalt trail. Knightdale has discussed with the Town of Wendell the benefit of a greenway trail between the two Towns. This multi-jurisdictional greenway trail would extend the Mingo Creek Greenway from North 1st Avenue (Central Community Park) to Wendell.

- **Greenway trail connections to residential neighborhoods.**

As funding is available, add greenway trail connections over the railroad to the Mingo Creek Greenway from residential neighborhoods. Residents already make this connection unsafely across the railroad tracks and would benefit from a safe crossing via bridge or with a "Z" type crossing with signage as mentioned earlier at Hodge Road. These connectors should extend from the Mingo Creek neighborhood and the Churchill neighborhood.

- **Future Greenway trail from Smithfield Road west**

As funding is available, the next greenway trail to be constructed should be in the northern section of Knightdale extending west from Smithfield Road. This greenway trail will provide recreational opportunities for neighborhoods north of Town and begin to "close the loop" for greenway trails in Town.

- **Corridor Improvements along Smithfield Road**

Improve the corridor by including pedestrian level lighting, bicycle lanes, sidewalks, and landscape enhancements. This corridor will also act as a gateway into Town from US 264 south and should be enhanced with Welcome Signage and landscaping.

- **Corridor Improvements on Knightdale Boulevard west of I-540**

Providing a safe, attractive connection between City of Raleigh and Knightdale would benefit residents, commuters, and cyclists on this busy stretch of road. Add sidewalks, bicycle lanes, cohesive landscaping and signage.

- **Sidewalk Construction in outlying residential neighborhoods**

Many residents stated that although walking on the streets in their neighborhoods generally felt safe, sidewalks would be preferred to increase safety and promote walking. As funding becomes available, construct a minimum 5' wide concrete sidewalk in residential neighborhoods south of US 264 with no existing sidewalk system.

SECTION 5 - FACILITY STANDARDS & GUIDELINES

5.1-STANDARDS OVERVIEW

The Division of Bicycle and Pedestrian Transportation (DBPT) of the North Carolina Department of Transportation (NCDOT) created pedestrian guidelines to assist municipalities in planning and engineering a safe and comfortable walking environment for pedestrians. The guidelines presented are in accordance with standards set by the American Association of State Highway Transportation Officials (AASHTO), the Manual for Uniform Traffic Control Devices (MUTCD) and the Americans with Disabilities Act (ADA).

5.2-SIDEWALKS

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

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

Sidewalk Widths

BPTD recommends a minimum travel path width of 5 feet for a sidewalk or

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

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

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

It is important to note the potential for conflict between pedestrians and bicyclists on a paved shoulder. Both

bicyclists and pedestrians must exercise caution in order to avoid potential crashes on paved shoulders.

Construction Materials and Methods

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

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

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

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

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

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

♦ Alternative Materials Usage — Use of materials for sidewalks other than concrete and the construction methods used therewith must be approved by the city or town engineer or designated

Examples of urban sidewalks

representative on a case by case basis. There are some successful examples where other materials such as asphalt, crushed stone, granite fines, or other slip resistant material have been used. Concrete is a preferred surface, providing the longest service life and requiring the least maintenance.

Grade

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

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

Cross-Slope

Sidewalks and walkways should be designed such that grades and cross slopes are minimized to allow those with mobility impairments to negotiate with greater ease. The maximum allowable cross-slope for sidewalks is 2% (1:50). At driveways, curb cuts, and both marked and unmarked crosswalks, the maximum allowable cross-slope must be maintained for a minimum width of 3 feet. Cross-slope should be oriented toward the adjacent roadway and sufficient to provide storm water runoff without creating standing

water on the walkway.

Sidewalk Thickness

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

Transitions

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

Tapers

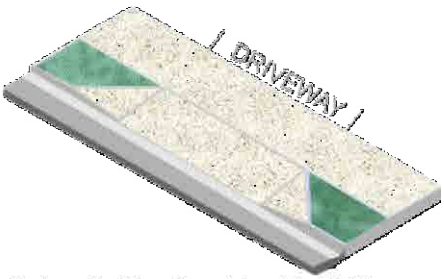
Transitional tapers to and from sidewalks of different widths are to be at a maximum rate of 1-foot of width per 10 feet of length (1:10) except as approved by the city or town.

Sidewalk Alignment

Sidewalks should parallel the roadway. Typical exceptions include:

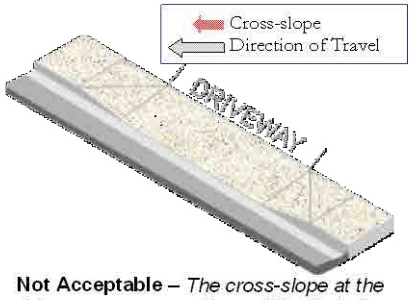
Horizontal Curve Sections on Roadways — In situations where a roadway curves at an angle greater than 60 degrees (and where right-of-way permits); the designer is permitted to adjust the curve of the sidewalk to more easily accommodate pedestrians.

Presence of Natural and Man made Features — The 5-foot minimum width of the travel path must be free of obstructions. The designer is permitted to alter the sidewalk path to avoid significant obstructions including but not limited to: transformers, utilities and utility poles, fire hydrants, and traffic signal hardware. Sidewalk path exceptions should be evaluated and approved on a



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

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



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

case-by-case basis by the city or town. Care should also be used to ensure that the travel path does not interfere with the integrity of trees or of historic features.

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

ADA: Dealing with Cross-Slope from Driveways

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

Sidewalk Buffers

Buffer zones between pedestrian paths and vehicular traffic provide a sense of security to those on foot or in wheelchairs and give the path a comfortable scale and clear definition. Buffers can also provide other benefits to pedestrians depending on the type used. Buffer zones may either be paved, providing space between the pedestrian and traffic, or they may involve a planting strip with trees and shrubs. Much like the sidewalk itself, the form and topography of a buffer may vary greatly. AASHTO recommends a buffer width of two to four feet for local or collector streets, and a buffer width of five to six feet for arterial or major streets, whether for a paved buffer zone or a planting strip.

5.3-PLANTING STRIPS

Continuous zones of landscape, located between the sidewalk and the street curb or the edge of road pavement, perform a multitude of essential tasks. Planting strips contribute to the walkability of a street by providing shade. In addition to providing shade, street trees, along with turf and other plantings, help reduce urban temperatures, improve water quality, lower stormwater management costs, and add beauty to the street for the pedestrian, the driver, and the adjacent land use. The recommended planting width to permit healthy tree growth is 4 to 10 feet measured from the back of curb. Planting strips, or tree lawns, are the preferred means of providing a buffer, but are not feasible or appropriate in all pedestrian situations. The width of the planting strip shall increase with a greater plant density and potential as the intensity of development increases. This separation from motorized traffic may decrease road noise while increasing a pedestrian's sense of security and comfort. Added benefits of this separation include space for signage, utilities (fire hydrants), and vegetation.

Planting strips provide a buffer between the road and the sidewalk.

Paved buffer zones

In some situations, continuous planting strips are not feasible, particularly where there is a high degree of foot traffic between the sidewalk and the street. As such, these planting strips are typically used in downtown or commercial areas. In these cases, a paved buffer zone should be provided between the travel path of the sidewalk and the curb. Though a constant width is preferred for this buffer zone, the width may vary as long as the buffer does not interrupt the pedestrian travel path. Items located in the buffer zone

can include street furniture, planters, trees planted with tree grates, streetlights, street signs, fire hydrants, etc. Such items are placed in the buffer zones so as not to restrict pedestrian flow in the travel path.

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

Buffer Paving Options

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

Additional Considerations

Though the buffers described above each provide some sort of physical barrier from

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

5.4-PATHS/GREENWAYS

Multi-Use Paths

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

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

Design Criteria

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

Multiple-use paths shall be a minimum of 10 feet wide;

Multi-use paths are wide, paved sidewalks for pedestrians and bicyclists.

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

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

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

Vertical and Horizontal Clearance

Selective thinning of vegetation along a path increases sight lines and distances and enhances the safety of the path user. This practice includes removal of underbrush and limbs to create open pockets within a forest canopy, but does not

include the removal of the forest canopy itself. A total of 8 to 10 feet of vertical clearance should be provided.

Pavement Types

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

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

Conventional Concrete

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

Pervious Concrete

This concrete is a newer invention which allows storm water to percolate, reducing pollutants in stormwater runoff when used over permeable soils. Although pervious concrete provides superior traction, it is unfavorable to in-line skates and skateboarding and has a higher installation cost.

Asphalt

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

Crusher fines

Crusher fines are constructed of small, irregular and angular particles of rock, crushed into an interlocking tight matrix. The aggregate is excellent for running paths, as well as walking, mountain bike riding and equestrian use and can be constructed to meet ADA requirements. Paths must be smoothed out and graded several times per year.

Dirt

Dirt paths can be utilized well for hiking trails, mountain

bike tracks, and equestrian uses. It is particularly important in steep terrain to include swales and other measures to direct water off the paths in an effort to avoid erosion in a rain event.

Boardwalk

Boardwalks are structures made of wooden planks constructed for pedestrians or cyclists along beaches or through wetlands, coastal dunes and other sensitive environments. They are typically constructed on piers and are elevated, providing rare interaction with an ecologically unique area.

Environmental Issues

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

Greenway paths improve water quality by establishing buffers along creeks and streams. These buffers provide habitat for a diversity of plant and animal species. They serve as natural filters, trapping pollutants from urban runoff, eroding areas and agricultural lands. Stream buffers also reduce the severity of flooding by releasing storm water more gradually, giving the water time to evaporate, or percolate into the ground and recharge aquifers, or be absorbed and transpired by plants.

In addition, paths provide transportation choices for

people who wish to walk or bicycle. By doing so, they help to decrease dependence upon automobiles and thus contribute to improved air quality. All proposed paths and other improvements should be designed, constructed and maintained with their ecological value in mind. Any disturbance of natural features should be minimized as reasonably as possible and conform to all jurisdictional environmental policy and ordinances.

The protection of streams by easement and the creation of paths along a greenway easement can help to protect sensitive environments. Greenway trail users will see any littering or dumping that occurs and can report such events quickly.

However, greenway trails should be constructed in such a manner as to not disrupt the existing ecosystem and provide adequate space between any waterways and the trail to filter pollutants and mitigate ill effects from flooding. Wake County requires a 50-foot buffer on either side of a creek for greenway facility development, as measured from the top of streambank.

Path Amenities and Accessibility

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

Path amenities, such as trash containers and benches, should be accessible to all users and located based

upon expected usage and maintenance budgets. At a minimum, benches and trash cans should be located at entrances to the trail and after a long ascent.

5.5-SIDEPATHS/FOOTPATHS

Sidepaths/Wide Sidewalks

A sidepath is essentially a multi-use path that is oriented alongside a road. The AASHTO bike guide and North Carolina Design Guidelines strongly caution those communities contemplating the construction of a sidepath (or wide sidewalk) facility to investigate various elements of the roadway corridor environment and right-of-way before committing to its construction. If a road needs to be widened in the future, there will be costs associated with relocating the sidepath alongside the road.

However, sidepaths can also be important connectors within a larger greenway system. These roadside walkways can often provide a valuable link through a congested area to connect to the greenway or as a part of the greenway system.

Foot Path

In environmentally sensitive areas, such as stream banks and lowlands, a four-foot wide soft surface should be used (crusher fines recommended), with two-foot wide shoulders. A minimum vertical clearance of eight-feet should be maintained and paths should have a five-foot cleared area from the edge of the path on each side. The paths should be sloped to drain with a 2% minimum grade.

5.6-MEDIANS

Medians are barriers in the center portion of a street or roadway. Medians allow for less interaction between cars and bicycle and pedestrians, and make more opportunities for

bicycle lanes. A center turn lane can be converted into a raised or lowered median thus increasing motorist safety. Travel lanes may be narrowed to accommodate the placement of a median. Raised or lowered medians should provide ample cues for people with visual impairments to identify the boundary between the crossing island and the roadway. According to AASHTO guidelines, the length of a median should be a least 20 feet.

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

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

Landscaping

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

Median Pedestrian Refuge Islands

When used in conjunction with mid-block or intersection crossings, medians can be used as a crossing island to provide a place of refuge for pedestrians. Pedestrian

refuge islands should be designed along roadways with fewer lanes and pedestrian signals that will allow the pedestrian enough time to cross the street.

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

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

Top: Striped crosswalk; Source: PBIC Bottom: Raised and stamped crosswalk; Source: caactive-communities.org

5.7-MARKED CROSSWALKS

A marked crosswalk designates a pedestrian right-of-way across a street. It is often installed at controlled intersections or at key locations along the street (a.k.a. mid-block crossings). A study should be completed

prior to placing crosswalks to determine the need and the best type and location of that crosswalk.

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

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

There is a variety of form, pattern, and materials to choose from when creating a marked crosswalk. It is important however to provide crosswalks that are not slippery, are free of tripping hazards, or are otherwise not difficult to maneuver by any person including those with physical mobility or vision impairments. Although marked crosswalks provide strong visual clues to motorists that pedestrians are present, it is important to consider the use of these elements in conjunction with other traffic calming devices to fully recognize low traffic speeds and enhance pedestrian safety.

Width

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

width of ten feet or greater should be considered. An engineering study may need to be performed to determine the appropriate width of a crosswalk at a given location.

Paint

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

Pavement Treatment

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

Raised Crosswalk

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

Mid-block crossing with pedestrian refuge island and signage; Source: fhwa.dot.gov

Mid-Block Crossings

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

Below are some general guidelines on mid-block crossings:

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

disabilities, or elderly people would cross.
-Have complex vehicle movements.

Advance Stop Bars

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

Pedestrian Signals

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

Advance stop bar at a crosswalk; Source:caactivecommunities.org

International symbol for a pedestrian crossing, along with a countdown signal; Source: ITE Pedestrian Bike Council

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

5.8-TYPES OF PEDESTRIAN SYMBOLS

International Pedestrian Symbols

According to the MUTCD, international pedestrian signal indication should be used at traffic signals whenever warranted. As opposed to early signalization that featured "WALK" and "DON'T WALK", international pedestrian signal symbols should be used on all new traffic signal installations. Existing "WALK" and "DON'T WALK" signals should be replaced with international symbols when they reach the end of their useful life. Symbols should be of adequate size, and clearly visible to make crossing safe for all pedestrians.

Countdown signals

Countdown signals are pedestrian signals that show how many seconds the pedestrian has remaining to cross the street. The countdown can begin at the beginning of the WALK phase, perhaps flashing white or yellow, or at the beginning of the clearance, or DON'T WALK phase, flashing yellow as it counts down.

Audible signals

Audible cues can be used to pulse along with a countdown signal. The signals are used for visually and

audibly impaired individuals. Consideration should be paid to the noise impact on the surrounding neighborhoods when deciding to use audible signals.

Pedestrian signal timings

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

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

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

A proven enhancement that prevents many of the conflicts addressed under either of the former methods is Leading Pedestrian Signal (LPI). An LPI works in conjunction with a concurrent signal timing system and simply gives the pedestrian a

Push Button Crossing;
Source: ITE Pedestrian Bike Council

few seconds head start on the parallel traffic. An advance walk signal is received prior to a green light for motorists. This creates a situation where the pedestrian can better see traffic, and more importantly, the motorists can see and properly yield to pedestrians. As with the exclusive pedestrian interval, an audible cue will need to accompany the WALK signal for the visually impaired.

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

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

Right Turn on Red Restrictions

Introduced in the 1970's as a fuel saving technique, the Right Turn on Red (RTOR) law is thought to have had a detrimental effect on pedestrians. The issue is not the law itself but rather the relaxed enforcement of certain caveats within the law such as coming to a complete stop and yielding

to pedestrians. Often motorists will either nudge into a crosswalk to check for oncoming traffic without looking for pedestrians or slow, but not stop, for the red-light while making the turn. There is legitimate concern that eliminating an RTOR will only increase the number of right-turn-on-green conflicts where all of the drivers who would normally have turned on red, now are anxious to turn on green. Consider elimination on case by case basis and only where there are usually high pedestrian volumes.

5.9-CURB RAMPS/CURB EXTENSIONS

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

conditions exist when the single, large curb ramp inadvertently directs a pedestrian into the center of the intersection, or in front of an unsuspecting, turning vehicle. To provide a tactile warning to the visually impaired, raised truncated domes with a color contrast to the background material (typically concrete) should be used. Two separate curb ramps, one for each crosswalk, should be provided at each corner of an intersection.

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

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

A curb extension, or bulb out, is an extension of the sidewalk into the parking lane of a street. Because these curb extensions physically narrow the roadway, a pedestrian's crossing distance and consequently the time spent in the street is reduced. In addition, curb extensions may encourage motorists to drive slower by narrowing the travel lane and reducing vehicular speeds during turning movements at intersections. Curb extensions can be placed either at mid-block crossings or at intersections. Curb extensions at mid-block locations are known as "chokers." Curb extensions at intersections can also be referred to as "neckdowns."

Sight lines and pedestrian visibility are reduced when motor vehicle parking encroaches too close to corners creating a dangerous situation for pedestrians. When placed at an intersection, curb extensions preclude vehicle parking too close to a crosswalk.

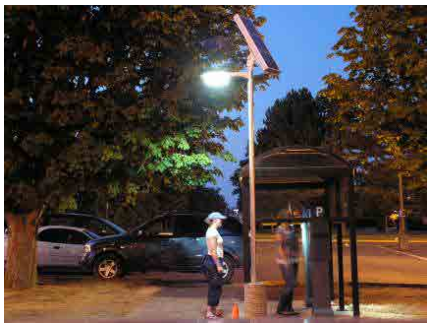
Also, curb extensions at intersections can greatly reduce turning speed, especially if curb radii are set as tight as possible. Finally, curb extensions also reduce travel speeds when used in mid-block crossings because of the reduced street width. Curb extensions should only be used where there is an existing on-street parking lane and should never encroach into travel lanes, bike lanes, or shoulders. The below table illustrates the relationship between posted speeds and the curb (often called "corner") radius. Motorists will travel more slowly around corners with smaller curb radii even without the use of curb extensions.

5.10-LIGHTING

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

In most cases, roadway street lighting can be designed to illuminate the sidewalk area as well. The visibility needs of both pedestrian and motorist should be considered. In commercial or downtown areas and other areas of high pedestrian volumes, the addition of lower level, pedestrian-scale lighting to streetlights with emphasis on crossings and intersections may be employed to generate a desired ambiance. Lighting for sidewalks and

Curb extensions shorten the distance pedestrians must walk across a street; Source: coast-santabarbara.org



Pedestrian level lighting enhances the walking environment
Top: LED lighting;
Source: carmanah.com;
Bottom: Decorative lightiing is incorporated with a banner;
Source: phillydweller.com

off-street paths should be provided where considerable pedestrian traffic is expected at night, where there is insufficient available light from the surrounding area, and at all designated road crossings.

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

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

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

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

It is important to note that every effort should be made to address and prevent light pollution. Also known as photo pollution, light pollution is "excess or obtrusive light created by humans." Whenever urban improvements are made where lighting is addressed, a qualified lighting expert should be consulted early in the process. This individual should not only create a safe and attractive ambiance, but will do so with the minimum of fixtures, an awareness of the importance of minimizing photo pollution, and with a focus on minimizing future energy use. A thoughtful plan of how and where to light will reap benefits not only in potential reduced infrastructure cost, but future energy costs as well.

5.11-SIGNAGE

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

Signage is governed by the MUTCD, which provides specifications on the design and placement of signage on the right-of-way. There are three types of signage:

Examples of regulatory and instructional signage;

1) Wayfinding signage 2) Regulatory and 3) Warning signs. Maintenance of signage is as important as walkway maintenance. Clean, graffiti free, and relevant signage enhances guidance, recognition, and safety for pedestrians.

Wayfinding Signs

Wayfinding or guide signs provide directional cues to attractions, points of interest or main districts of a town. Wayfinding signage should orient and communicate in a clear, concise and functional manner. It should enhance pedestrian circulation and direct visitors and residents to important destinations. In doing so, the goal is to increase the comfort of visitors and residents while helping to convey a local identity. Regulations should also address the orientation, height, size, and sometimes even style of signage to comply with a desired local aesthetic. It is recommended that municipalities adopt consistent and descriptive graphics to identify pedestrian routes. This signage system would assure pedestrians that they are safe and will not encounter gaps in facilities along these routes. A map should be incorporated into each route illustrating the entire pedestrian system and their location. Bus stops, destinations, and mileage should also be identified on the signs.

Regulatory and Warning Signs

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

Pedestrian-related signage

This type of signage serves primarily to notify motorists and others of the presence of pedestrians. The intended effect is for motorists to drive more cautiously and reduce their speeds, thereby improving the safety for pedestrians in the given area. Signs can be used in a variety of places, including at crosswalks, at intersections, in streets, and near schools. National standards for sign placement and use can be found in the Manual for Uniform Traffic Control Devices (MUTCD). The MUTCD provides guidance for warning signs which can be used at both crosswalks, or along the roadway. The following are some recommended signs which municipalities should consider installing. For more signs and more detailed guidelines for sign installation and use, the municipality should consult the MUTCD.

The S4-3/R1-6 crosswalk warning sign as well as the W11-2 signs are regulatory. The remaining signs directly below are warning signs. The first sign (R1-6) is usually installed within the street to warn motorists to yield to pedestrians in a crosswalk. The small "school" sign installed directly above (S4-3) is added to the in-street sign for placement near a school. The fourth sign, "Turning Traffic", is usually placed at intersections to warn motorists that are turning right or left to yield to pedestrians in crosswalks. For the fifth sign, the top sign can either be combined with the smaller "ahead" sign or the arrow symbol to indicate the presence of a crosswalk to motorists in a school zone.

The following signs are additional MUTCD signs related to pedestrians.

School Zone Treatments

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

5.12-STREET TREES

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

Planting requirements

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

Visibility

Street trees should never be allowed to obscure the line of sight between pedestrians and drivers. A clear view should

be maintained between 30″ and 72″ above the street. This area must be free of limbs and foliage for safe cross visibility. Other plantings should also follow this rule within 50 ft. proximity of street corners and other designated crossing points. In order to maintain visibility, provide shade, and a comfortable pedestrian corridor, street trees should primarily be vase shaped, columnar, or oval in form (habit) with large spreading crowns.

Roots

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

Size

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

Spacing

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

Tree Pits and Tree Grates

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

Street trees enhance the pedestrian environment and cool the heat island effect;

radial spokes from the grate as the tree matures and the trunk grows in diameter.

Maintenance

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

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

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

5.13-OVER/UNDER PASSES /TRANSIT STOP TREATMENTS/BRIDGES

Underpasses/Overpasses

Pedestrian overpasses and underpasses efficiently allow for pedestrian movement across busy thoroughfares. These types of facilities typically feature very high construction costs. These facilities are problematic in many regards and should only be considered when no other solution is expected to be effective. Research shows that pedestrians will avoid using such a facility if they perceive

the ability to cross at grade as taking about the same amount of time. ADA requirements for stairs, ramps, and elevators often require the construction of an enormous structure that is visually disruptive.

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

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

Transit Stop Treatments

To accommodate as many users as possible, a transit system must include well-planned routes and safe, accessible stops. Bus stops should be designed to accommodate the appropriate number of users and should be highly visible to pedestrians and motorists. Bus or other transit stops should be located in places that are most suitable for passengers. For example, stops should be provided near higher density residential areas, commercial areas and schools, and be connected to these areas by sidewalks.

As with any human scale design element discussed,

Pedestrian bridges, such as this one in Cary, NC, can provide connectivity and opportunities for art

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

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

Bridges

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

5.14-TRAFFIC CALMING TECHNIQUES

Traffic Calming Devices (TCDs) are physical measures

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

Neighborhood Traffic Circles

These are small, raised circular islands positioned in the center of an intersection, designed to slow traffic by requiring traffic to maneuver around the island.

Roundabout

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

Neighborhood Traffic circle in Durham, NC; Source:photobucket.com

Speed Humps

Raised sections of a roadway. They are similar to a speed bump in their application, but a speed hump is wider and has a sloping side taper so they are easy to navigate at slower speeds. They are placed across residential streets to control chronic speeding problems where other methods of slowing traffic have not been effective. They are designed to calm traffic in residential areas, particularly near parks and schools. The

One-lane chicane slows down traffic; Source:Richard Drdul

physical impact on passing vehicles is less severe at slower speeds than at higher speeds. Studies indicate that speed humps reduce speeds by approximately six miles per hour. A standard speed hump has a length of approximately 22 feet and a height of 3 and 5/8 inches at its center.

Speed Tables

Flat-topped speed humps typically long enough for the entire wheelbase of a passenger car to rest on the flat section. They are often constructed with brick or other textured materials on the flat section. These are usually designated as crosswalks.

Textured pavements

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

Curb Extensions

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

Chicanes

Chicanes are used to slow traffic down, usually on smaller, more residential streets.

Drivers are forced to slow down in order to navigate the bump outs, which can be either paved or landscaped.

During construction, pedestrians should be re-routed on an accessible path; Source:SoundTransit

5.15-TEMPORARY WORK

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

Signage in Raleigh, NC, helps direct pedestrians and vehicles; Source:City of Raleigh

6.1-ADDITIONAL SIGNAGE AND MAPPING

As mentioned earlier, wayfinding systems are a means for a municipality to increase directional clarity, visibility, and mobility within their jurisdiction, helping corporate and private individuals as well as visitors maneuver about their municipality with ease and certainty. Continuity of color, shape, size, and text aid in providing clarity within the town. The Town of Knightdale should engage a design professional for their assistance in developing these standards. There are many publications to research this topic prior to engaging any outside professional. The following types of signs are part of a town's wayfinding system.

Directional Signage OR Pedestrian Related Signage

Directional signage, referred to as **Pedestrian Related Signage** in the previous section, is effective in alerting motorists to reduced speeds and encourage pedestrians to exercise caution in certain conflict areas. It is important to not cause "visual clutter" when using a variety of signage. Signs and their text should be large enough to be seen from a viewing distance of around 50'. It is imperative that all signs are properly located so they do not obstruct pedestrians and visibility triangles of motorists. All signage for motorists and pedestrians must meet Department of Transportation and MUTCD signage standards.

Interpretative Signage

Interpretative signage is an effective means of displaying information other than traffic rules and regulations. Visually consistent signage within Knightdale can help guide visitors to important sites, destinations, or to share interesting information. These signs may be effective in encouraging people to experience a particular place or engage in an activity such as visiting a park, greenway, historic caboose, library, or retail corridor. This concept could be expanded to develop a self-guided walking tour of historic Old Town.

Sign Placement

Locate signs in prominent locations so they can be easily viewed. It is important to ensure they do not interfere with pedestrian and vehicular movement. For example, signs should not be placed within a sidewalk or reduce the clearance of a sidewalk to less than five feet.

Pedestrian Corridor Mapping

It is recommended that the Town of Knightdale adopt consistent illustrative graphics to identify pedestrian routes in Knightdale. Destinations such as schools, greenways, and the commercial development on Market Street should be identified so pedestrians are aware of distances and locations of these areas.

6.2-SCHOOL AREAS

Safe interconnectivity to schools from surrounding neighborhoods is a high priority and concern for everyone in any community. Safety programs should be developed and implemented at all schools within Knightdale's planning jurisdiction. It is recommended that the Town of Knightdale adopt a "Safe Routes to School" program to promote and support students walking and bicycling to school. This is a

Children walking to school; Source: Indystar

federal program to encourage and enable children to walk and bike to school safely and hopefully increase an opportunity to incorporate exercise into the children's daily schedule. These routes are usually patrolled by bicycle police officers. The National Center for Safe Routes to School is available to assist communities in developing and implementing programs and strategies to create successful results.

Safe Routes to School Programs help to reduce traffic congestion and traffic speeds around schools which allow children to experience a greater sense of independence and personal responsibility, as well as encourage them to learn important traffic safety skills. Schools should work with their communities to develop routes for children to take to and from school. These routes should include those with adult crossing guards, stop signs, traffic signals, and traffic calming measures. Involvement with the local police force is highly encouraged.

In addition to the **School Zone Treatments** outlined in the previous section, the following safety standards should be implemented at all school locations:

- Install sidewalks within a half mile radius of all schools.
- Incorporate traffic calming measures such as decorative pavement and those discussed in Section 5 within a half mile radius of all schools.
- Incorporate signage to alert motorists that they are in a school zone. Signs placed in the median or the middle of the street are effective.

- Adopt a Safe Routes to School Program in all elementary and middle schools.
- Provide educational programs on pedestrian and bicycle safety at all schools.

6.3-SAFETY EDUCATION PROGRAMS

Pedestrian safety and health programs can help target problem areas and educate the residents of Knightdale about safety and accessibility issues. Below is a description of safety and health programs which should be implemented in the Town of Knightdale planning jurisdiction.

School Zone Safety Program

Creating a School Zone Safety Program provides information to students, parents, and community members of the safe routes to school and safe pedestrian behavior. It will also help identify areas in need of additional attention such as problem areas or locations in need of traffic calming devices. The School Zone Safety Program can be done in conjunction with a Safe Routes to School Program. The local school, school district, and safety committee can develop a safety plan which consists of the following:

- Develop a school route plan
- Evaluate and configure the school site
- Consider other safety elements
- Distribute and maintain the plan

Safe Routes to School Program

Safe Routes to School (SRTS) is a program focused on encouraging and enabling children to walk and bike to school safely. The program assists in the facilitation of planning, developing and

Safe Routes to School is a program designed to encourage students to walk or ride a bike to school instead of being driven by car. Source: la-bike.org

An advertisement by the "Parnters for Active Living" to help promote pedestrian safety. Source: active-living.org

implementing projects that improve safety for pedestrians and bicyclists and helps make these an appealing mode of transportation for children and adults alike. SRTS encourages infrastructure improvements, education programs, and funding to provide safe and comfortable pedestrian environments and instill active lifestyles at an early age. For more information please visit:

www.ncdot.org/transit/bicycle/safety/programs_initiatives/Safe_Routes.html

Pedestrian Safety Campaign

The Pedestrian Safety Campaign is available to municipalities and communities within North Carolina. States and communities are eligible to receive a free Pedestrian Safety Campaign Planner from the Federal Highway Administration which is a tool kit for municipalities to customize and apply within their communities. The materials provided in the Campaign Planner are available in multiple Medias: television, radio, cinema, and print advertising. A Step by Step Guide is also available to assist in implementing the campaign at the local level.

The purposes of the campaign are as follows:

- Educate motorists that pedestrians and bicyclists are legitimate road users and they should expect them on or near roadways.
- Educate pedestrians on how to minimize risks to their safety
- Develop program materials which explain pedestrian facilities such as sidewalks, crosswalks, pedestrian refuge islands, etc., and their purpose and function

For more information please visit:

http://safety.fhwa.dot.gov/local_rural/pedcampaign/

Share the Road Initiative

The North Carolina Department of Transportation (NCDOT) Division of Bicycle and Pedestrian Transportation is dedicated to educating the general public of pedestrian and bicycle rights and responsibilities. The Share the Road Initiative is an example of NCDOT's efforts to educate motorists of the presence of pedestrians and bicyclists in traffic areas. Additionally, the Division of Bicycle and Pedestrian Transportation assisted in the development of the North Carolina Driver's Handbook which includes sections devoted to pedestrian and bicycle rights and responsibilities.

For more information please refer to:

http://www.ncdot.gov/bikeped/safetyeducation/

North Carolina School Crossing Guard Training Program and Manual

In 1998 NCDOT Division of Bicycle and Pedestrian Transportation developed a program to train law enforcement officers who in turn trained school crossing guards. The purpose of the course is to standardize procedures and instruction of school crossing guards, as well as educate children on how to cross streets safely. In 1999 the program was updated and is currently training law enforcement officers in 42 jurisdictions. The Town of Knightdale is not included on this list and the law enforcement department should contact the Division of Bicycle and Pedestrian Transportation to participate in the program.

For the NC School Crossing Guard Training Manual and more information please visit:

http://www.ncdot.gov/bikeped/about/training/

The Share the Road Initiative's goal is "to educate cyclists and motorists, to encourage safe roadway behavior, and promote safe travel spaces for all road users."

Source: bikesiliconvalley.org

A Parent leads a group of children to school creating a "Walking School Bus" where children along the way join the bus.

Source: kingston-ny.gov

school_crossing_guard/ or 919-707-2600

National Walk a Child to School Program

Together the Partnership for a Walkable America, the US Department of Transportation, and the Pedestrian & Bicycle Information Center sponsor the National Walk a Child to School Program. The purpose of the program is to increase the number of children who walk to school. The NCDOT Division of Bicycle and Pedestrian Transportation supports this program. Typically the program is held in October with the following objectives:

Encourage adults including teachers, parents, staff, and community members to teach children safe pedestrian behavior

Encourage adults to help children identify and use safe routes to school

Remind everyone in the community of the health benefits of walking on a daily basis

For more information please visit: www.ncdot.org/transit/bicycle/safety/programs_initiatives/walk2school_national.html

Walk a Child to School in North Carolina

To encourage North Carolina residents to walk to school, the State of North Carolina has its own initiative. Support from the NC Governor's Highway Safety Program has helped make this a growing and successful program. To view a list of schools participating visit: www.ncdot.org/transit/bicycle/safety.programs_initiatives/walk2school_NC2001.html

Walking School Bus

A walking school bus is a group of children walking to school with one or more adults. It can be as simple as two families taking turns walking their children to school to as structured as a

route with meeting points, a timetable and a regularly rotated schedule of trained volunteers.

For more information, visit:
http://www.walkingschoolbus.org/

6.4-ENCOURAGEMENT AND PROMOTION

The Town of Knightdale is committed to improving the pedestrian environment and overall walkability of the Town. This section deals with how the Town and its residents can encourage and promote walking to improve residents' health, foster a dynamic community, and create better connectivity around Town.

Education about pedestrian facilities and routes is an important component in the development of Knightdale's Pedestrian Master Plan. Following the design and implementation process, it is imperative that pedestrian and bicyclist facility education continues to be addressed. This may be accommodated through advocacy groups, pedestrian citizen committees, schools and the media. This will ensure that safety is emphasized, new challenges are addressed and that opportunities are identified and realized.

Maintenance Policies and Enforcement

Maintaining an accessible, functional, and clean pedestrian environment is essential to a walkable community. Regular upkeep and maintenance that ensures sidewalks, greenways and other pathways are clear of debris and other obstructions demonstrates a municipal commitment to a walkable environment. In order to meet the needs of maintenance and enforcement, the Town of Knightdale should evaluate current maintenance policies to determine if they

are adequate to include implementation of the recommendations outlined in this Pedestrian Master Plan.

Identify Funding Sources

Identifying sources of funding that support pedestrian facilities and their construction helps ease the burden of expensive pedestrian facility projects. There are a variety of funding programs and sources from the Federal, State, and local level. For a complete list of funding sources please see Section 7.3.

Education Programs and Events

Pedestrian and bicycle education programs aimed at all residents of Knightdale, regardless of age or ability, encourage people to walk and bike safely. These types of programs can easily be organized through the Parks and Recreation Department and public school systems. For example, the Safe Routes to School Program is an excellent example of how a school program can educate children about safe pedestrian behaviors and pedestrian routes. The Town has the opportunity to team with schools, senior centers, and other groups to educate all residents about safe pedestrian behavior and routes.

Tourism and Local Events

Events such as "Walk-to-School" days and "Walk-for-Health" days can help spark interest, attract visitors, and bring the community together.

SECTION 7 - PROJECT DEVELOPMENT

7.1-COSTS

The Pedestrian Master Plan provides numerous recommendations for the integration and locations for pedestrian facilities.

A list of sample costs for recommended pedestrian facilities and greenway trails is shown to the right. Specific site factors and cost fluctuations can increase actual costs; these estimates are intended to serve only as a rough guide.

The following list provides suggestions to reduce the total costs of pedestrian facilities:

- Include pedestrian facilities such as sidewalks in all road construction projects (water/sewer lines, underground utility projects, roadway widening, etc.).
- Combine pedestrian facility projects. Rather than constructing

Greenway Costs

Item	Approximate Cost
Multi-Purpose Path (10' wide asphalt)	$100-130/LF
Gravel Screenings Path (10' wide)	$15-22/LF (higher maintenance costs)
Information Sign	$250-$800 each (varies, depending on materials and size)
Benches	$600-$1,000 each
Trash Receptacles	$200-$800 each
Restrooms	$40,000 - $100,000 each
Boardwalk	$160 per linear foot

General Pedestrian Upgrade Costs

Item	Approximate Cost
Sidewalks (5' wide concrete)	$25 per linear foot
Concrete Curb and Gutter	$15-$20 per linear foot
Standard Handicap Ramp	$500-$800 per corner
Simple Crosswalk (Signs and Pavement markings)	$500-$1,500 each
Decorative Crosswalk (stamped or colored)	$5,000-$15,000 each
Pedestrian Refuge Island (Signage and Markings)	$7,500-$40,000 each
Pedestrian Signal	$40,000-$75,000 each
Pedestrian Sign	$250 each
Speed Hump (Signage and Markings)	$2,500-$5,000 each
Bicycle Lane	$25,000-75,000/mile
Curb Extensions (creating larger pedestrian areas)	$10,000-$25,000 per corner
Chokers (narrowing street to slow traffic)	$10,000-$30,000
Chicane (shifting the travel lane to slow traffic)	$20,000-$40,000
Roundabouts (generally, larger than traffic circles)	$50,000-$550,000
Traffic Circle	$20,000-$40,000
Raised Intersections	$15,000-$20,000

sidewalks along one side of a street, combine it with several other smaller sidewalk projects to help reduce costs. However, be sure to provide connectivity between segments of sidewalk, avoiding sidewalks that end abruptly.

- Combine pedestrian facility projects with other compatible uses, such as School Bonds.
- Advanced land and right of way acquisition can help disperse the total costs of pedestrian facility projects. Growth and development trends indicate where future pedestrian facilities may be necessary.
- Utilize funding sources such as Tax Incremental Financing Bonds to offset costs through incremental payment.

The following list provides suggestions to reduce the total construction costs for greenways and off-road trails:

- Collect *Impact Fees* from developers to help pay for improvements and necessary facilities to serve new growth. These fees are charged to all new development and alleviate the burden on existing residents to pay for new growth. These fees can be used for greenways and obtaining the land necessary to serve a growing community.
- *In-Lieu-Of Fees* allow a developer to pay up front the cost of greenways rather than construct the section within their development. This allows a municipality to use the funds for the appropriation of optimum land for conservation and greenway as well as park development rather than accepting less than optimum parcels that meet the minimum standards for greenways.

- *Volunteers* have the potential to significantly contribute to the maintenance and development of greenways. The Parks and Recreation Department can organize a volunteer work day for participants, as well as encourage other groups such as scouts, churches, and schools to contribute to fund-raising and maintenance. This not only alleviates the burden of maintenance and fund-raising, it can also increase the awareness of the greenway system and bring the community together.

7.2-FUNDING SOURCES

Pedestrian projects like the Knightdale Pedestrian Master Plan are eligible for funding from many of the major Federal-aid highway, transit, safety, State, and private programs. This section will focus on potential funding sources for the implementation of the Knightdale Pedestrian Master Plan.

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 list identifies 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 prior to making an application for funding.

The following descriptions of funding resources were taken directly from each

fund's marketing materials. Additional information can be gained from the contact or web site listed.

Federal and State Funding

Federal transportation dollars are a significant source of funding for greenway, bicycle and pedestrian projects. The federal government provides money to the states and the states manage the money. Local MPO's establish project priorities through a process resulting in a Long Range Transportation Plan. As the local MPO, federal transportation funding for local projects will be allocated through CAMPO.

For more information, visit: http://www.campo-nc.us

Some of the current applicable federal programs are listed here.

STP-DA

Surface Transportation Program/Direct Attributable funds may be used for bicycle/pedestrian projects, transit projects, or road projects. STP-DA funds are administered through the MPO. Local governments should work with the MPO to pursue funding.

CMAQ

Congestion Mitigation and Air Quality funds may be used for projects that improve transportation systems managements and operations that mitigate congestion and improve air quality. CMAQ funds are administered through the MPO. Local governments should work with the MPO to pursue funding.

Transportation Enhancement Program

The Federal Transportation Enhancement funding is administered by the NCDOT Enhancement Unit. Transportation enhancement activities are awarded through

the NC Call for Projects process and must benefit the travelling public and help communities increase transportation choices and access, enhance the built or natural environment and create a sense of place. Projects must have a relationship to surface transportation and fit into one of 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. The available fund amount varies. In previous Calls, the funds available ranged from $10 million to $22 million. The Call process usually takes place on even numbered years or as specified by the Secretary of Transportation.

NCDOT has not had a Call in years and does not intend on having any in the near future. This is a potential future funding source. Local governments should work through the MPO to try to secure funds when they become available.

For more information, visit: www.ncdot.org/financial/fiscal/Enhancement/

Safe Routes to School Program

The NCDOT Safe Routes to School Program (SFTS) 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 amount of money available for funding this program is unclear at this time.

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 http://www.ncdot.org/doh/preconstruct/traffic/congestion/cm/msta/docs/

SRTS.pdf

Or contact Ed Johnson, Safe Routes to School Coordinator for the NCDOT Division of Transportation Mobility and Safety Program (919)-662-4344.

State Trails Program (NC Division of Parks and Recreation)

The NC Division of Parks and Recreation and its State Trails Program offers two grant programs:

Adopt-A-Trail (state money)

Recreational Trails Program (federal money)

Governmental agencies and non-profits are encouraged to apply for grants for trail construction and maintenance projects and for land acquisition projects.

The grant application and instruction handbook are available through the State Trails Program website at http://www.ncparks.gov/About/trails_grants.php

NCDOT Division Small Projects

Division 7 typically has funding for small projects that could potentially pay for portions of a greenway. These projects could include sidewalk, intersection improvements or other items approved by the Division.

For more information, visit: http://www.ncdot.gov

North Carolina Parks and Recreation Trust Fund (Parks and Recreation Authority)

The North Carolina Parks and Recreation Trust Fund (PARTF) 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 typically 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 usually awarded annually to county governments or incorporated municipalities. Funding available through PARTF varies from year to year, based upon decisions in the state budget.

The trust fund is allocated three ways:

- 65 percent to the state parks through the N.C. Division of Parks and Recreation.
- 30 percent as dollar-for dollar matching grants to local governments for park and recreation purposes.
- 5 percent for the Coastal and Estuarine Water Access Program.

For information on how to apply, visit: http://www.ncparks.gov/About/grants/partf_main.php

The North Carolina Conservation Tax Credit (NCDENR)

This program, managed by the North Carolina Department of Environment and Natural Resources (NCDENR), 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/ and www.onencnaturally.org/pages/conservationtaxcredit.htm

Powell Bill Program (NCDOT)

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. Amount of funds are based on population and mileage of town-maintained streets.

For more information, visit http://www.ncdot.gov/programs/Powell_Bill/

Governor's Highway Safety Program (NCDOT)

The mission of the Governor's Highway Safety Program (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. The GHSP launched a new web-based grant system on April 1, 2011.

For information on applying for GHSP funding, visit: www.ncdot.org/programs/ghsp/default/html

Clean Water Management Trust Fund

The Clean Water Management Trust Fund (CWMTF) was established in 1996 and has become one of the largest sources of money in North Carolina for land and water protection. The CWMTF receives a direct appropriation from the NC General Assembly in order to issue grants to local governments, state agencies and conservation non-profits to help finance projects that specifically address water pollution problems.

CWMTF funds may be used to establish a network

of riparian buffers and greenways for environmental, educational, and recreational benefits. The fund has provided funding for land acquisition of numerous greenway projects featuring trails, both paved and unpaved.

For a history of awarded grants in North Carolina and more information about this fund and applications, visit www.cwmtf.net/

Natural Heritage Trust Fund

The Natural Heritage Trust Fund (NHTF), managed by the NC Natural Heritage Program, has contributed more than $328 million through 518 grants to support the conservation of North Carolina's most significant natural areas and cultural heritage sites. The NHTF is used to acquire and protect land that has significant habitat value. Some large wetland areas may also qualify, depending on their biological integrity and characteristics. Only certain state agencies are eligible to apply for this fund, including the Department of Environment and Natural Resources, the Wildlife Resources Commission, the Department of Cultural Resources and the Department of Agriculture and Consumer Services. As such, municipalities must work with State level partners to access this fund. Additional information is available from the NC Natural Heritage Program.

For more information and grant application information, visit www.ncnhtf.org/

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) announced 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.

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.

Fit Community grants are designed to support innovative strategies that help a community meet its goal to becoming a Fit Community. Eight, two-year grants of up to $60,000 annually are usually awarded to applicants that have a demonstrated need, proven capacity, and opportunity for policy and environmental change in addressing physical activity and/or healthy eating behaviors (e.g. designate and promote safe walking routes). The grant component of Fit Community is on hold at this time

For more information and an application, visit: http://www.fitcommunitync.com/

Land and Water Conservation Fund (NCDENR)

The Land and Water Conservation Fund (LWCF) program is a reimbursable, 50/50 matching grant program to states for conservation and recreation purposes, and through the states to local governments to address "close to home" outdoor recreation needs. This is a federal program managed by the state. 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 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 NCDENR. 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 $75 million in matching grants to protect land and support more than 875 state and local park projects. More than 38,500 acres have been acquired with LWCF assistance to establish a park legacy in our state. At this time, the level of funding available for the federal LWCF has not been determined.

For more information, visit: http://www.ncparks.gov/About/grants/lwcf_main.php

Ecosystem Enhancement Program (NCDENR)

Developed in 2003 as a new mechanism to facilitate improved mitigation projects for NC highways, the Ecosystem Enhancement Program (EEP) offers funding for restoration projects and for protection projects that serve to enhance water quality and wildlife habitat in NC. The EEP helps to preserve open space and sensitive wetlands and water bodies.

For more information, visit www.nceep.net

Water Resources Development Grant Program

The NC Division of Water Resources offers cost-sharing grants to local governments on projects related to water resources. Of the seven project application categories available, the category which relates to the establishment of greenways is "Land Acquisition and Facility Development for Water-Based Recreation Projects." Applicants may apply for funding for a greenway as long as the greenway is in close proximity to a water body.

For more information, visit: www.ncwater.org/Financial_Assistance.

State Administered

Community Development Block Grants

State-level Community Development Block Grants (CDBG) are allocated through the NC Department of Commerce, Division of Community Assistance, to be used to promote economic development and to serve low-income and moderate-income neighborhoods. Greenways and sidewalks that are part of a community's economic development plans may qualify for assistance under this program. Recreational areas that serve to improve the quality of life in lower income areas may also qualify. Planning activities, demolition, street construction and property acquisition are also qualifying activities.

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

US Department of Agriculture's Natural Resource Conservation Service (USDA-NRCS)

NRCS offers various easement programs to landowners who want to maintain or enhance their land in a way beneficial to agriculture and/or the environment. All NRCS easement programs are voluntary. They provide technical help and financial assistance, but local landowners and organizations are needed to make NRCS easement programs successful.

The easement programs include the following:

1. The Farm and Ranch Land Protection Program (FRPP) helps purchase development rights to keep productive farm and ranchland in agricultural uses.

2. The Grasslands Reserve Program (GRP) protects, restores, and enhances

grassland, including rangeland, pastureland, shrubland, and certain other lands.

3. The Healthy Forests Reserve Program (HFRP) assists landowners in restoring, enhancing and protecting forestland resources on private lands

4. The Wetlands Reserve Program (WRP) protects, restores, and enhances wetlands. Achieving the greatest wetland functions and optimum wildlife habitat on every acre enrolled in WRP is the goal.

These programs can help to preserve prime land for greenway easements and protect natural corridors and farmland from development.

For more information, visit http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/easements.

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. Grants may be used for a number of projects, including acquisition of land, easements and constructions projects (such as sidewalks and other community facilities) that benefit small and emerging private businesses in rural areas. Small projects are given priority and grants usually range from $10,000-$500,000.

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 (NPS)

The Rivers, Trails, and

Conservation Assistance Program (RTCA), is the community assistance arm of the National Park Service. RTCA supports community-led natural resource conservation and outdoor recreation projects. On average, RTCA helps project partners protect more than 700 miles of rivers, create over 1,400 miles of trails, and conserve more than 63,700 acres of open space annually.

The RTCA program does not provide funding for projects. The RTCA program provides technical assistance to its project partners by: building partner relationships; helping partners define goals through consensus; developing conceptual, strategic, and workable project plans; helping the public participate in defining community goals; identifying potential sources of funding for project implementation; and teaching "hands-on" conservation and other technical skills necessary to successfully realize conservation and outdoor recreation projects. Assistance is provided for one year and may be renewed for a second year, if warranted. Communities must apply for assistance.

For more information, visit: www.nps.gov/ncrc/programs/rtca/.

LOCAL FUNDING SOURCES

Capital Improvement Programs

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

NRCS grants can help preserve open space and farmland; Source: nrcs_usda.gov

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.

Exactions

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

In-Lieu-Of Fees

As an alternative to requiring developers to dedicate on-site greenway sections that would serve their development, some communities provide a choice of paying a front-end charge for off-site protection of pieces of the larger system. Payment is generally a condition of development approval and recovers the cost of the off-site land acquisition or the development's proportionate share of the cost of a regional facility serving a larger area. Some communities prefer in-lieu-of fees. This alternative allows community staff to purchase land worthy of

protection rather than accept marginal land that meets the quantitative requirements of a developer dedication but falls a bit short of qualitative interests. Staff can also ensure the acquired land fits into the overall greenway system - providing better connectivity within the community.

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. Austin, Texas has also used bond issues to fund a portion of their bicycle and trail system. Raleigh, NC, passed an $88 million bond issue for parks and greenway projects in 2007. Wake County, NC, passed a $50 million bond for open space in 2007 in an effort to preserve land along stream corridors to protect drinking water supplies.

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 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).

Facility Maintenance Districts

Facility Maintenance Districts (FMDs) can be created to pay for the costs of on-going maintenance of public facilities and landscaping within the areas of the Town where improvements have been concentrated and where their benefits most directly benefit business and institutional property owners. An FMD is needed in order to assure a sustainable maintenance program. Fees may be based upon the length of lot frontage along streets where improvements have been installed, or upon other factors such as the size of the parcel. The program supported by the FMD should include regular maintenance of streetscape or off road trail improvements.

The municipality can initiate public outreach efforts to merchants, the Chamber of Commerce, and property owners. In these meetings, Town staff will discuss the proposed apportionment and allocation methodology and will explore implementation strategies. The municipality can manage maintenance responsibilities either through its own staff or through private contractors.

ADDITIONAL FUNDING SOURCES

Endowments

Creating a third-party organization that raises donations for sidewalks and greenway trails can be a successful and instrumental funding source.

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/Sidewalk 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 or sidewalk enhancement. Particularly for a greenway, individual volunteers from the community can be brought together with groups of volunteers form church groups, civic groups, scout troops and environmental groups to work on greenway development on special community work days. Volunteers can also work on fund-raising, maintenance, and programming needs.

PRIVATE FOUNDATIONS AND ORGANIZATIONS

Many communities have solicited sidewalk and greenway funding assistance from private foundations and other conservation-minded or health-minded benefactors. Below are a few examples of private funding opportunities available in North Carolina.

Land for Tomorrow Campaign

Land for Tomorrow is a diverse partnership of businesses, citizens, interest groups and local governments committed to securing support from the NC General Assembly for the state's conservation trust funds. Land for Tomorrow will enable North Carolina to

reach a goal of ensuring that working farms and forests, sanctuaries for wildlife, land bordering streams, parks and greenways, land that helps strengthen communities and promotes job growth, and historic downtowns and neighborhoods will exist to enhance the quality of life for generations to come.

For more information, visit http://www.landfortomorrow.org/

The Trust for Public Land

Land conservation is central to the mission of the Trust for Public Land (TPL). Founded in 1972, the Trust for Public Land is the only national nonprofit working exclusively to protect land for human enjoyment and well being. TPL helps conserve land for recreation and spiritual nourishment and to improve the health and quality of life of American communities. TPL's legal and real estate specialists work with landowners, government agencies, and community groups to:

- Create urban parks, gardens, greenways, and riverways.
- Build livable communities by setting aside open space in the path of growth.
- Conserve land for watershed protection, scenic beauty, and close-to- home recreation, and to safeguard the character of communities by preserving historic landmarks and landscapes.

The following are TPL's Conservation Services:

- Conservation Vision: TPL helps agencies and communities define conservation priorities, identify lands to be protected, and plan networks of conserved land that meet public need.
- Conservation Finance: TPL helps agencies and communities identify and raise funds for conservation

from federal, state, local, and philanthropic sources.

• Conservation Transactions: TPL helps structure, negotiate, and complete land transactions that create parks, playgrounds, and protected natural areas.

• Research & Education: TPL acquires and shares knowledge of conservation issues and techniques to improve the practice of conservation and promote its public benefits.

Since 1972, TPL has worked with willing landowners, community groups, and national, state, and local agencies to complete more than 4,250 land conservation projects nationwide, protecting more than 3 million acres. Since 1994, TPL has helped states and communities craft and pass over 380 ballot measures, generating almost $34 billion in new conservation-related funding.

For more information, visit http://www.tpl.org/

Z. Smith Reynolds Foundation

This Winston-Salem based Foundation has been assisting with environmental projects of local governments and non-profits in North Carolina for many years. The foundation has two grant cycles per year and looks for innovative community-based projects within its prescribed focus areas reaching low-resource and/or rural regions in the state. The foundation has a focus area dealing with environmental issues that may relate to greenway, open space and pedestrian projects.

For more information, visit http://www.zsr.org

North Carolina Community Foundation

The North Carolina Community Foundation,

The American Hiking Society funds trail improvements, sponsors National Trail Day and promotes volunteerism and advocacy; Source: americanhiking.org

established in 1988, is a statewide foundation seeking gifts from individuals, corporations, and other foundations to build endowments and ensure financial security for nonprofit organizations and institutions throughout the state. Based in Raleigh, North Carolina, the foundation also manages a number of community affiliates throughout North Carolina that make grants in the areas of human services, education, health, arts, religion, civic affairs, and the conservation and preservation of historical, cultural, and environmental resources. In addition, the foundation manages various scholarship programs statewide.

For more information, visit: http://www.nccommunityfoundation.org/

National Trails Fund

In 1998, the American Hiking Society created the National Trails Fund, the only privately supported national grants program providing funding to grassroots organizations working toward establishing, protecting and maintaining foot trails in America. National Trails Fund grants give local organizations the resources they need to secure access, volunteers, tools and materials to protect America's cherished public trails. Awards typically range from $500 - $5,000 per project.

For more information, visit: http://www.americanhiking.org/our-work/national-trails-fund/

SECTION 8 - PROJECT RECOMMENDATIONS

8.1-SPECIFIC PROJECT RECOMMENDATIONS

Section 4 listed each project recommendation in both the Short-Term and Long-Term categories, along with a detailed description of the project. Short-Term projects were identified as either a Tier One or Tier Two project, based upon a Matrix of criteria.

All recommended pedestrian projects are also listed in the Project Priority charts shown in the Appendix. All long-term projects fall into Tier 3. The chart for Tier One also identifies possible funding sources for each project, based upon the previously described list of funding sources shown in Section 7.2.

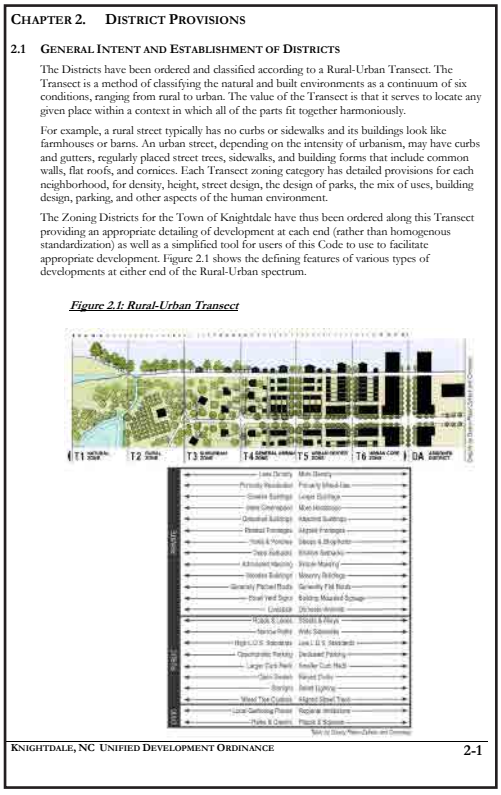
8.2-RECOMMENDATIONS FOR POLICIES, GUIDELINES, PROCEDURES

The Knightdale UDO was reviewed carefully to determine how to introduce additional language related to pedestrian connectivity. The Town's efforts at including Form-Based Code language within the Comprehensive Plan (Comp Plan) and the Unified Development Ordinance (UDO) were given particular attention to ensure the pedestrian language was consistent with Town objectives.

In reviewing the UDO and Comp Plan, several general recommendations developed for both, along with many recommendations for specific language within the UDO. A discussion of all recommendations follows.

Reconcile UDO and Comp Plan

Overall, the UDO and Comp Plan should relate to and reference one another more. The Comp Plan is a strong document with explanations of Form-Based



CHAPTER 2. DISTRICT PROVISIONS

2.1 GENERAL INTENT AND ESTABLISHMENT OF DISTRICTS

The Districts have been ordered and classified according to a Rural-Urban Transect. The Transect is a method of classifying the natural and built environments as a continuum of six conditions, ranging from rural to urban. The value of the Transect is that it serves to locate any given place within a context in which all of the parts fit together harmoniously.

For example, a rural street typically has no curbs or sidewalks and its buildings look like farmhouses or barns. An urban street, depending on the intensity of urbanism, may have curbs and gutters, regularly placed street trees, sidewalks, and building forms that include common walls, flat roofs, and cornices. Each Transect zoning category has detailed provisions for each neighborhood, for density, height, street design, the design of parks, the mix of uses, building design, parking, and other aspects of the human environment.

The Zoning Districts for the Town of Knightdale have thus been ordered along this Transect providing an appropriate detailing of development at each end (rather than homogenous standardization) as well as a simplified tool for users of this Code to use to facilitate appropriate development. Figure 2.1 shows the defining features of various types of developments at either end of the Rural-Urban spectrum.

Figure 2.1: Rural-Urban Transect

KNIGHTDALE, NC UNIFIED DEVELOPMENT ORDINANCE 2-1

Chapter 2 of the Knightdale UDO describes zoning districts and transects zones.

Code and detailed guidelines. However, the Comp Plan is not a regulatory document, rather it is an advisory document with recommended guidelines. The UDO does not contain as many details on designing pedestrian and bicycle amenities, but the language in the UDO is regulatory. In order for the Comp Plan to serve as a useful advisory document, it should be referred to with more frequency within the UDO. In particular, when reading the UDO, reference to the Design Districts listed in the Comp Plan are not clear when reviewing the Transect Districts and the Base Districts.

1. UDO Chapter 2 Recommendations

A logical order should be prescribed for following the rules in the UDO and guidelines in the Comp Plan. This will give developers and planners the tools to understand how to use the Comp Plan in conjunction with the UDO.

Recommendation 1:

Within Chapter 2.1 in the UDO, provide clear language on how to reference the Comp Plan:

1. First determine what Design District your project lies in (see Comp Plan, Chapter 5).

2. Determine where the project falls in the Transect Zones.

3. Determine which Zoning District applies to the project.

4. Cross-reference the Zoning District with the Transect Zone, as shown in the chart in Chapter 2.2.

5. The Comp Plan Design Districts will provide additional insight into the vision the Town has for your project area.

Recommendation 2:

In Chapter 2.2, add information regarding the stream-lined process available to developers by using Form-Based Code. Language should state that part of

the benefit of Form-Based Code is that if the developer follows the requirements, the approval process can be solely Administrative (through staff), which is faster and less expensive.

Recommendation 3:

The chart in Chapter 2.2 of the UDO states that Street Trees are Not Required in districts within the Natural and Rural Transect Zones. This language conflicts with information provided in the street diagrams within Chapter 17 and with the Countryside Street Design in the Comp Plan. It is recommended that this requirement be strengthened to read as follows:

"Recommended: 40' average spacing"

Recommendation 4:

The setbacks listed for each of the Zoning Districts within Chapter 2 should be altered to meet the recommendations for Form-Based Code. Instead of ***minimum*** setbacks ***from*** the property line as is typically described in a Conventional Zoning Code, the requirements should read as "Zero Front Lot Lines" or "Build-to-Lines". These prescribe a ***maximum*** distance the building can be from the front property line in an effort to create a more street-focused character.

2. UDO Chapter 9 Recommendations

Chapter 9 deals with circulation around Knightdale. Section 9.5 cross-references Chapters 10 and 17 for design standards as they apply to pedestrian circulation.

Recommendation:

It is recommended that Section 9.5 specifically call out an additional requirement for developers to install sidewalks along the right-of-way to provide regional connectivity to the greater pedestrian network.

3. UDO Chapter 10 Recommendations

Chapter 10 deals mostly with vehicular requirements

in parking lots, but has some mention of pedestrian walkways.

Recommendation 1:

Mention is made to potential conflict points between vehicles and pedestrians. This problem should be specifically addressed more within this Chapter, perhaps with a specific Chapter section, similar to Section 10.7 that discusses Bicycle Parking Design Standards. The specific pedestrian walkway section should reference design standards in Chapter 17, but also make specific mention of the need for safe pedestrian connectivity within parking lots and drives. Attention should be given to the safety of pedestrians as they walk from their vehicles to their destinations, in the form of designated crosswalks, pedestrian signage, bulb-outs to slow down traffic, pavement markings to warn of pedestrian crossings, safe walkways.

Recommendation 2:

Section 10.2 discusses possible parking exemptions or payments in lieu of parking. A sentence should clarify that sidewalk and bicycle requirements are not exempt.

Recommendation 3:

Section 10.3 discusses requirements for Park & Ride locations. Language should be added that states a sidewalk shall be installed from Park & Ride spaces to bus shelters or transit easements.

Recommendation 4:

Section 10.3 discusses reductions in parking that may be made. The UDO should give parking reductions if additional pedestrian or bicyclist accommodations are made. For example, parking requirements could be reduced by 5% if additional pedestrian amenities are included, such as benches, wider sidewalks or plazas, trees along sidewalks, or recreational trails. Parking

could also be reduced by providing carpool parking spaces, motorcycle parking, pervious paving or other innovative measures.

Recommendation 5:

Section 10.4 E. discusses pedestrian walkways within parking lots. For clarification on the safest designs for pedestrians, the section should state that a sidewalk shall be provided for every bay of parking. This will ensure that pedestrians are provided access to a protected walkway no matter where they park within the lot.

4. UDO Chapter 16 Recommendations

Chapter 16 discusses plan submittal requirements.

Recommendation 1:

Section 10.6 N. discusses Easements required on plans. The width of Public Access Easements for sidewalks, greenways, trails, etc. should be defined in this section.

It is recommended that sidewalk/greenway easements be a minimum of 30 feet wide to allow for future development of these pedestrian walkways.

5. UDO Chapter 17 Recommendations

Chapter 17 gives detail on design standards for streets and sidewalks. This chapter should contain more specific language of minimum design standards for pedestrian walkways.

Recommendation 1:

Section 17.3 discusses the importance of streets as the most important public space in Town. This should be clarified to state that the ***streetscape*** (the street and the area adjacent to the street) is the most important public space. This streetscape is created by the relationship of the buildings to the sidewalk and street, and the relationship and character of sidewalks and other amenities along the street corridor.

Recommendation 2:

The street classifications shown in this chapter

should reference and relate to the street sections in the Comprehensive Plan. Currently, the Comp Plan and the UDO show different standards for sidewalk widths and planting strip widths.

Recommendation 3:

Adjust the street classification details shown in this chapter to reflect current *Best Practices* for street design. See additional information in this document - Section 5.2 - Sidewalks: Buffers and Section 5.3 - Planting Strips for on the importance of a buffer between the curb and the sidewalk. Creating a safer and more appealing streetscape is an important aspect of street design. The UDO should recommend a wider planting strip along the back of curb in order to allow for street trees where possible and utilities in this location. In particular, streets that are not within NCDOT's jurisdiction should include street trees between the sidewalk and curb for greater pedestrian security and enjoyment.

NDCOT guidelines do not typically allow for any obstruction with in the "Clear Recovery Zone". However, precedents exist for street trees in cases where there is on-street parking and with speed limits under 35 miles per hour. The Town is encouraged to take other specific scenarios to the NCDOT Division representative for clarification.

Recommendation 4:

Add a section specifically for Sidewalks and Bicycle Lanes, reflecting the design standards shown in the Comp Plan. Specifically, the following should be included:

Sidewalks and Bicycle Lanes:

All street types, other than alleys and freeways require sidewalks. Increase safety and desirability of pedestrian and bicycle travel along Town roadways by:

1. Providing sidewalks and

bicycle lanes (where possible) along all roadways.

2. Installing streets trees and planting strips (where possible) to buffer the pedestrian from the street.

3. Install lighting to increase safety.

4. Complete any gaps in the sidewalk system, creating a complete network.

Specifically:

1. The developer shall improve infrastructure both internal to their site and along the right-of-way to ensure that sidewalks connect all areas of Town and are in good condition.

2. The developer shall provide safe crossings at intersections through the use of pedestrian signals, signage, and/or crosswalks.

3. The developer shall work with the Town to make sidewalks more enjoyable to walk on by providing shade trees and landscape strips (where possible) between the road and the sidewalk, decorative pavers in high traffic areas, site amenities, pedestrian lighting, and pedestrian crossing signals.

4. In Transect Zones T-4, T-5, and T-6 the developer shall include elements that encourage pedestrian activity, such as canopies or arcades along buildings, decorative planters, articulated facades, site amenities, and street trees.

5. Bicycle racks shall be provided outside of all new commercial and residential developments in Town.

6. Developers shall provide a shared bicycle lane indicated with appropriate lane markings (Sharrow) or separate bicycle lanes on all roads other than Alleys and Freeways. See Chapter 7 in the Comprehensive Plan for additional pedestrian and bicycle travel guidelines.

Recommendation 5:

Section 17.3 references "Other Design Criteria" . Traffic Calming Devices are mentioned but it is unclear in what instances they should be

used. The UDO should state that traffic calming devices, such as bulb-outs and traffic circles, should be used on Avenues and Boulevards with higher vehicles or pedestrian traffic volumes.

6. UDO Chapter 19 Recommendations

Chapter 19 provides definitions for terms within the UDO.

Recommendation:

It is recommended that definitions be added for "Canopy" tree and "Understory" tree.

SECTION 9-PLAN IMPLEMENTATION

9.1-ADOPTING THE PLAN

After approval from Town staff, the Knightdale Town Council should adopt the Comprehensive Pedestrian Plan. This step will be required when the Town seeks funding in the future.

Following adoption of the plan, the Town and CAMPO can utilize this master plan as a guide and tool for future sidewalk connections and installations and for access to funding. The following action plan denotes specific steps that will best position the Town to implement the plan in its entirety.

9.2-ACTION STEPS

1. Create a Sidewalk Master Plan development committee, similar to the Steering Committee comprised of representatives from Town staff, CAMPO, the Land Use Review Board, and Town Council. This committee will spearhead efforts to advance the sidewalk network in Town.
2. Review plans and timelines for future NCDOT highway projects impacting the sidewalk system to align planning efforts and funding. Cost savings can be realized by the joint development of road and sidewalk projects. Missed opportunities could significantly delay or even make certain sidewalk segments prohibitively costly to implement.
3. Evaluate existing Land Development Ordinances and make modifications as appropriate to protect sidewalk corridors prior to residential and commercial development and to guide the aesthetics of sidewalk installation.

4. Develop plans and coordinate efforts for the design and construction of sidewalk segments with existing funding committed by the Town of Knightdale and NCDOT.
5. Using the list of funding sources in Chapter 7, create a strategy and timeline for seeking financial assistance from various agencies and private foundations.
6. Increase public awareness and actively develop a volunteer citizen base to support greenway trail development, host trail-related events, conduct fundraising activities, and aid in the management and operation of the trail.

SECTION 10 - CONCLUSION

By adopting a comprehensive pedestrian master plan, the Town of Knightdale is showing its commitment to encourage increased pedestrian connectivity for residents, safer access businesses for visitors, and greater clarity in how to reach destinations.

The proposed Pedestrian System Plan promotes increased connectivity in Knightdale by:

- Installing additional sidewalks on both sides of the street where possible.
- Including sidewalks to outlying residential neighborhoods.
- Connecting sidewalks to proposed greenway trails for a different user experience and added recreational opportunities for tourists and residents.
- Providing highly visible crosswalks and traffic-calming measures at high-volume intersections, particularly intersections along Knightdale Boulevard and along Smithfield Road.

This Comprehensive Pedestrian Master Plan also recommends the following:

- The Town of Knightdale should expand their wayfinding signage system to create a unified aesthetic around the Town and make attractions and destinations easily identifiable.
- The Town of Knightdale should use the list of possible funding sources in the master plan document to identify ways to implement the Pedestrian System Plan.
- The Town of Knightdale should make short-term improvements as identified in the report, as soon as funding is available to increase safety and connectivity immediately.