This section provides a set of standards for the design of pedestrian facilities recommended as part of the City's Comprehensive Pedestrian Plan.

Section 4. Design Guidelines

4.1 Introduction

This section provides guidance for the City of Dunn as they, private developers, and the State Department of Transportation (NCDOT) construct new pedestrian facilities and reconstruct existing pedestrian facilities to meet better standards. This section is divided into the following topics:

- legal rights of pedestrians
- pedestrian facilities and their design
  - sidewalks
  - crossings: signalized or unsignalized
  - greenways
- ADA requirements
- downtown area standards
- school standards
- sidewalk construction policy and maintenance
- parking lots
- railroad crossings

Currently, the City has few standards for pedestrian facilities – sidewalks, crosswalks, and other pedestrian-related amenities are constructed on an ad-hoc, as-needed basis. This section of the Plan is important because it provides a consistent set of guidelines within the City to help create a uniform appearance to Dunn's sidewalks and a more connected system.

4.2 Legal Rights of Pedestrians

It is important to understand the legal rights of pedestrians because these guide and define how pedestrian facilities are constructed and provided. Some of the legal rights of pedestrians are defined in Sections 20-172 through 20-175.2 of the North Carolina General Statutes.

More information can also be found in the NC Bike/Pedestrian Laws Guidebook, available at the NCDOT's Division of Bicycle and Pedestrian Transportation webpage:

http://www.ncdot.org/transit/bicycle/laws/resources/BikePedLawsGuidebook-Part-1.pdf.

Specific items which should be considered are the following:

- Drivers must yield to pedestrians (or cyclists) crossing a driveway, alley exit, or parking garage exit on a sidewalk. (§20-173)
- Vehicles should yield right-of-way to pedestrians at all marked and unmarked crosswalks, unless at a traffic signal the car is given exclusive right-of-way. (§20-173)
- If sidewalks are available, pedestrians are not to walk in the roadway. Where sidewalks are not provided, any pedestrian walking along the roadway should walk to the extreme left, facing in the direction of approaching traffic. (§20-174d)
- Every driver must consider pedestrians at all times, especially exercising care in the presence of children or incapacitated persons on the roadway. (§20-174)
- Special emphasis on leaving adequate crossing room at intersections is noted for visually handicapped persons. (§20-175.2)

In addition, pedestrian access is also governed by the requirements of the American Disabilities Act of 1990, a civil rights law which prohibits discrimination against people with disabilities in all aspects of life. As done throughout the US, the City of Dunn must provide transportation facilities, including sidewalks and other pedestrian facilities, which comply with the guidelines set forth in the ADA Accessibility Guidelines (ADAAG) in order to meet the standards of the American Disabilities Act. Some of the major items related to pedestrian facilities that are addressed by ADAAG include curb ramps and cross-slopes. The following bullets describe ADAAG-compliant design for these items:

- **Curb ramps: design and placement.**

DESIGN: Curb ramps are a significant and required feature of accessible pedestrian transportation systems, and must be designed carefully to fulfill their function and the requirements of the Americans with Disabilities Act. Curb ramps should not have a slope greater than 1:12, meaning that for every foot of travel, the slope should not rise more than one inch. 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, with measurements shown in Figure 4-1.i The *ADA Accessibility Guidelines for Buildings and Facilities* (http://www.access-board.gov/adaag/html/adaag.htm#A4.29.2) has an easy-

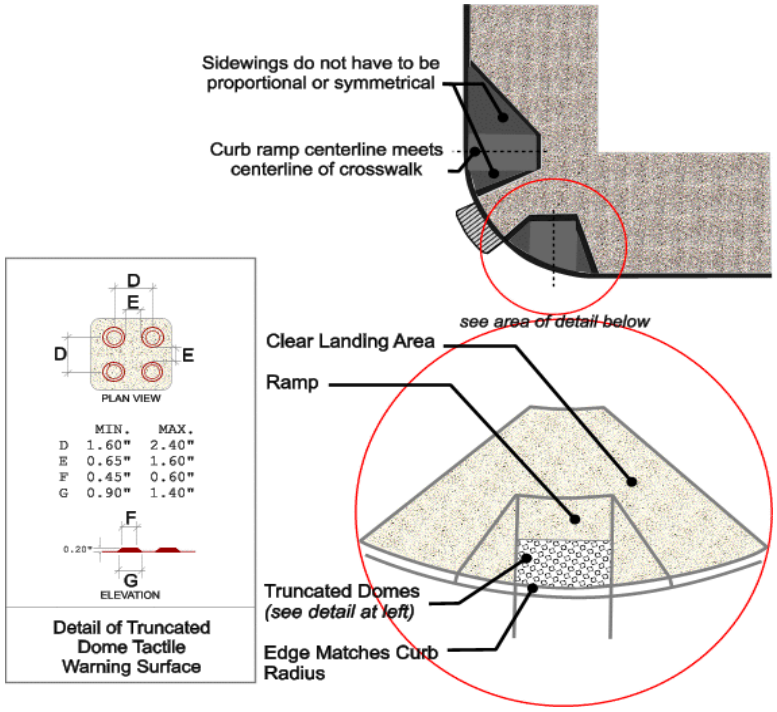


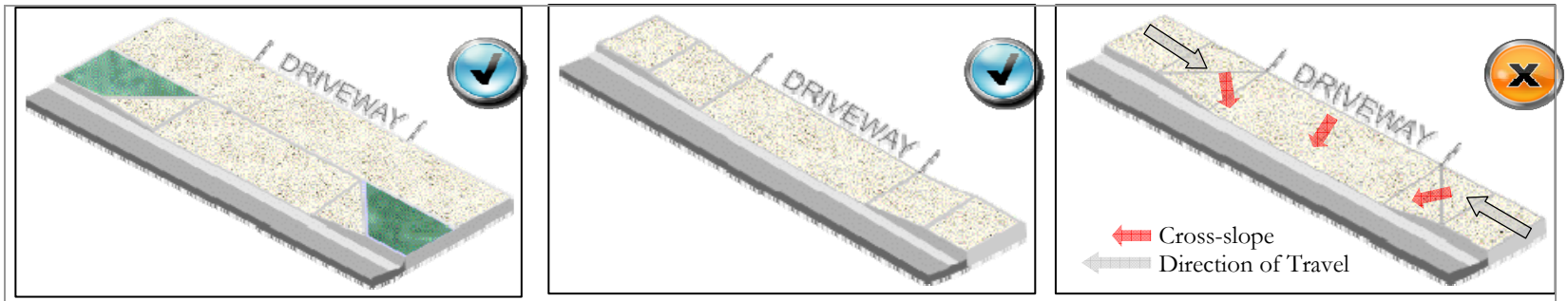
Figure 4-1 . Detail of an ADA-complaint curb ramp design with truncated dome measurements.

Figure 4-2. Appropriate curb ramp placement *(above) directs pedestrians into the crosswalks. Detectable warning strips (left) should be used in all curb ramps for compliance with ADA standards for the visually-impaired.*

to-use format for locating specific design criteria related to curb ramps, rise/run restrictions on ramps, and figures illustrating basic concepts.[ii]

PLACEMENT: Curb ramps should be placed entirely within the area of a marked crosswalk, so that a pedestrian can enter the ramp space at an angle perpendicular to the direction of travel. Generally, the standard is to have separate curb ramps on each corner; if a shared (sometimes called corner or diagonal) curb ramp is constructed, then the width and radius should accommodate the user so that entry onto the ramp is parallel to the direction of travel. Figure 4-2 provides examples of well-constructed curb ramps and placement of detectable warning strips.

- **Cross-Slopes.** Cross-slopes, or a slope along the travelway surface which is perpendicular to the direction of travel, can often make it very difficult for wheelchair travel. In addition, it can also make for treacherous walking conditions for individuals with problems with their balance and coordination. Cross-sloping most frequently occurs in conditions in which a driveway meets a sidewalk, but can also occur in other situations. In order to minimize the risk of a dangerous and difficult travel condition for some, cross-slope is regulated by ADAAG such that cross-slopes should not exceed two percent, and preferably not exceed 1.5 percent where possible. Figure 4-3 indicates the preferred (left), conditionally acceptable (middle), and unacceptable (right) design solutions for new driveways as they interface with sidewalks.



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*

Figure 4-3. *Examples of acceptable and unacceptable design solutions for minimizing cross-sloping at a driveway-sidewalk interface.*

For a complete guide to ADA requirements please see the National Access Board's website: www.access-board.gov.

4.3 Pedestrian Facilities and their Design

There are a variety of sources for design guidance for pedestrian facilities, including the following:

- NCDOT Highway Design Manual (2002)
- NCDOT Traditional Neighborhood Street Design Guidelines (2002)
- The American Association of State Highway and Transportation Officials' *Guide for the Planning, Design, and Operation of Pedestrian Facilities* (AASHTO, 2004)
- Manual on Uniform Traffic Control Devices (MUTCD), frequently updated
- Federal Highway Administration (FHWA)

The North Carolina Department of Transportation adheres to the design guidelines provided in the AASHTO and MUTCD guidebooks. In general, pedestrian facilities can be described in the following categories:

- sidewalks
- crossings
- greenways

The City currently does not have its own standards for pedestrian facilities. The following paragraphs provide national standards and best practices for pedestrian facilities by category.

4.3.1 Sidewalks

A standard sidewalk is usually five feet minimum in width, concrete, and is often placed along roadways with curb and gutter. In general, the width of sidewalks should accommodate two persons walking past one another, which is generally perceived to be five feet at minimum. Other circumstances that may require additional sidewalk width are: (1) to accommodate the overhang of parked vehicles from off-street or angled on-street parking areas; (2) to accommodate a larger number of pedestrians in high-use zones such as central business districts; and (3) to create an additional buffer from traffic when a planting strip cannot be installed.

Additional design considerations for on-street sidewalk facilities include the following:

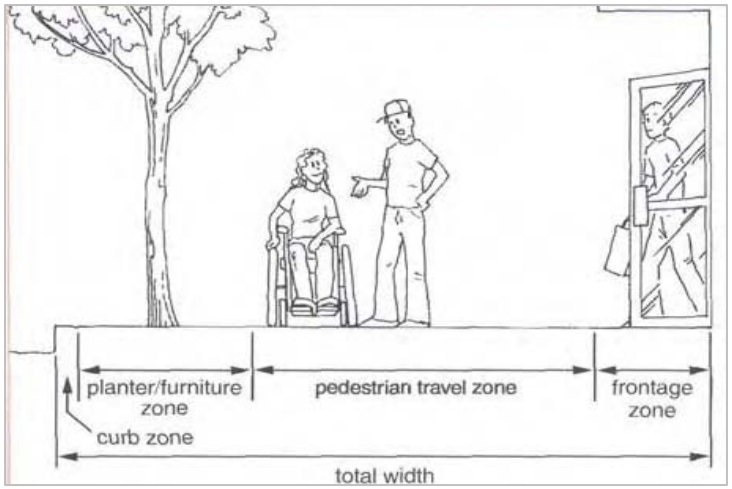


Figure 4-4. Horizontal clearance "zones" for a sidewalk, most typically found in a central business district.
Source: FHWA/USDOT "Accessible Sidewalks and Street Crossings" Informational Guide.

Figure 4-5. Examples of pedestrian- activated, signalized, mid-block crossings.

Top: An example of a pedestrian-activated signalized mid-block crossing.

Bottom-right: Guide for pedestrians to assist them in understanding the meaning of the push-button signals.

- Sidewalk should be clear of vertical and horizontal obstructions at both high and low contact points; tree branches, mast-arm signs, and/or overhanging signs should offer a 7ft minimum overhead clearance. Street furniture and other amenities should be installed outside of the 5ft pedestrian travel zone or "clear zone" (see Figure 4-4).
- Sidewalk should have a running grade of 5% or less.
- All street furniture and other stationary objects should consider "detectability" for visually-impaired white cane users, and amenities such as water fountains, bus stops or benches should provide wheelchair accessibility for physically-disabled pedestrians.
- A planting strip or "buffer" space of at least 5ft is preferrable for sidewalks adjacent to busy streets with curb-and-gutter cross-sections. In downtown areas, a 2-3ft buffer may be most feasible. This space can be used for street trees or other landscaping and improves aesthetics as well as the comfort level of pedestrians using the sidewalk. On roadways with ditch or shoulder cross-sections, the swale separation from roadway provides an adequate buffer. A wider sidewalk can be used as a replacement for a planted buffer, such as in the case of a central business district. A planting strip of 4-10ft is typically necessary to permit healthy tree growth.

Table 4-1. Typical minimum sidewalk and buffer widths.

Land Use – Street Type	Minimum	Planting Strip
Central Business District or Pedestrian Activity Center	8ft	variable
Commercial/Industrial	5ft	2ft
Arterial or Major Streets*	5-6ft	3ft
Local or Collector Streets (Residential)*	5ft	2ft

** Source: AASHTO Guide of the Planning, Design, and Operation of Pedestrian Facilities*

In general, standard sidewalks should be concrete, which is more durable than asphalt. A more flexible material, such as rubberized paving, can be considered in situations in which there is the potential for tree roots to crack and lift the concrete. Using these types of materials can reduce the risk of a tripping hazard, and also lower maintenance costs. More permeable materials, such as porous concrete or pavers, can also be considered for walkways, and are often used for greenways near streams, in order to reduce run-off from storm events.

4.3.2 Crossings

Pedestrian-friendly crossings are a critical feature in a well-connected pedestrian system because they provide the linkages between one segment of sidewalk to another as a pedestrian may cross a street, connect to another existing piece of sidewalk, or pass to a new development. A well-placed crossing can dramatically reduce pedestrian travel time and improve pedestrian safety – greatly increasing the convenience of walking as a mode of travel. Pedestrian crossings can be signalized or unsignalized, and located at intersections or at mid-block locations. The City of Dunn has several signalized and unsignalized crossings at various intersections throughout the City.

The most basic crossing is an unsignalized intersection with standard, continental or zebra crosswalk markings. Other potential treatments for unsignalized crossings include raised crosswalks and/or signage. In-street or overhead "yield to pedestrian" signs are an effective treatment for unsignalized intersections, encouraging motorists to stop for pedestrians as they cross the street. These signs offer a visual cue and instill some friction in the roadway, as they are typically placed in the middle of a bi-directional, two-lane road. Additional treatments can be added for crosswalk visibility at unsignalized and signalized locations, including decorative brick, textured crosswalks or experimental paint colors.

All signalized intersections should be outfitted with countdown pedestrian signals and crosswalks, per NCDOT and MUTCD standards. MUTCD recommends that signals are operated on a 4ft/second pedestrian travel speed. In some cases, the built environment or user context may require audible pedestrian signals or special treatments like a High Intensity Activated Crosswalk (HAWK) Signal. Marked crosswalks (at signalized and unsignalized locations) should not be less than 6 ft in width, with 10 ft or greater for downtown areas and locations of high pedestrian traffic. Advance stop bars should be placed 4 - 10 ft from the pedestrian crosswalk (with 6 - 15 ft recommended in uncontrolled locations or multilane roads). Pedestrian push buttons should accompany pedestrian signals that are not phased into the regular traffic signal cycle; push buttons should be placed in a convenient and wheelchair accessible location. Pedestrian-activated signals should be used for roadways with long traffic signal cycles where pedestrians are to be given preference when present, and/or for signals where the pedestrian cue is not phased into the traffic cycle unless a button is activated. Pedestrian-activated signalization can also be used to provide lead

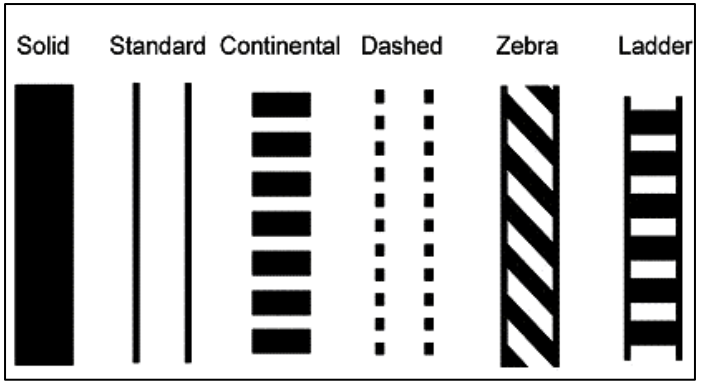


Figure 4-6. Typical styles for marked crosswalks.
Source: Federal Highway Administration.

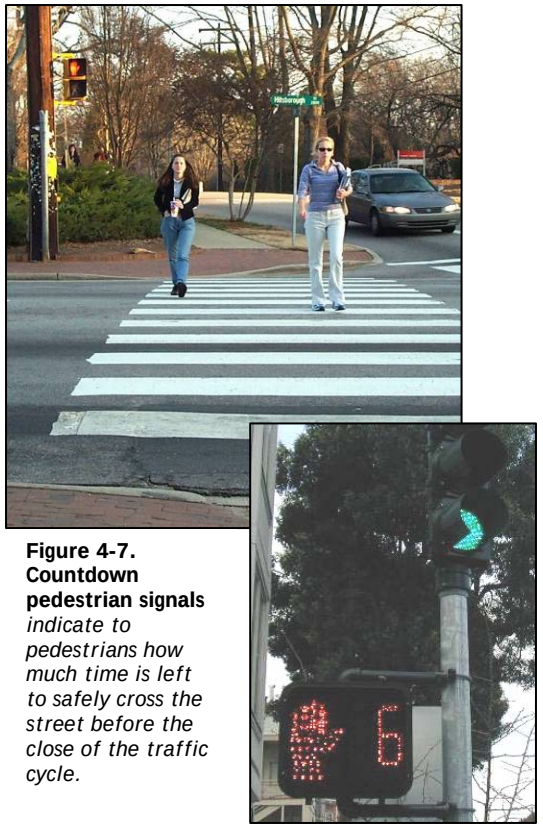
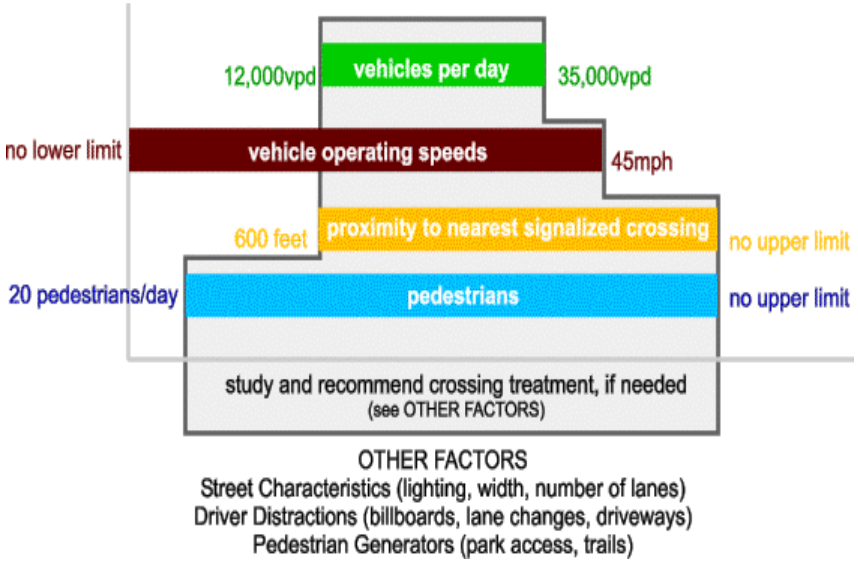


Figure 4-7. Countdown pedestrian signals *indicate to pedestrians how much time is left to safely cross the street before the close of the traffic cycle.*

Figure 4-8. *Textured crosswalk gives sensory and visual cues to motorists in a pedestrian zone.*

pedestrian intervals in high-conflict areas, in order to give pedestrians a few seconds of full use of the intersection or crosswalk prior to allowing right or left turning movements for motorists. These options reinforce pedestrian safety at high-conflict intersection locations with significant crash history.

Mid-block crossings are typically unsignalized crossings, but can also utilize pedestrian-activated signalization. There is still no national consensus for when a crossing should be created mid-block, and when the mid-block crossing should be signalized. The City of Charlotte Department of Transportation has created a set of guidelines for assessing mid-block crossings, based in part on the work of FHWA and Charles Zegeer of the Pedestrian and Bicycle Information Center. In addition to numbers of pedestrians, vehicle speed, and vehicle volume on the roadway, there are a variety of other considerations which must be accounted for when determining whether to construct a mid-block crossing. These considerations include: lighting conditions, sight distance, numbers of lanes, and roadway width. Figure 4-9 shows the "solution space" identified by the City of Charlotte for considering a mid-block crossing. Table 4-2 shows the decision matrix created by the City of Charlotte for determining when to construct a mid-block crossing and identifying appropriate treatments.



Given the sensitive nature of mid-block crossings, every new mid-block crossing treatment will require a specific investigation by the City and NCDOT (on State-maintained streets) prior to initiating design and construction. Nevertheless, mid-block treatments can be useful in improving safety in areas with fairly high pedestrian crossings and low numbers of vehicles and vehicle speeds, if located and designed properly. All mid-block crossings will require advance warning signage and good visibility for both pedestrians and vehicles. On State-maintained roadways, mid-block crossings are not permitted within 300 ft of another signalized crossing point. Though NCDOT does not have established guidelines for the placement of pedestrian signals, they generally use MUTCD and AASHTO warrants for the installation of traffic signals.

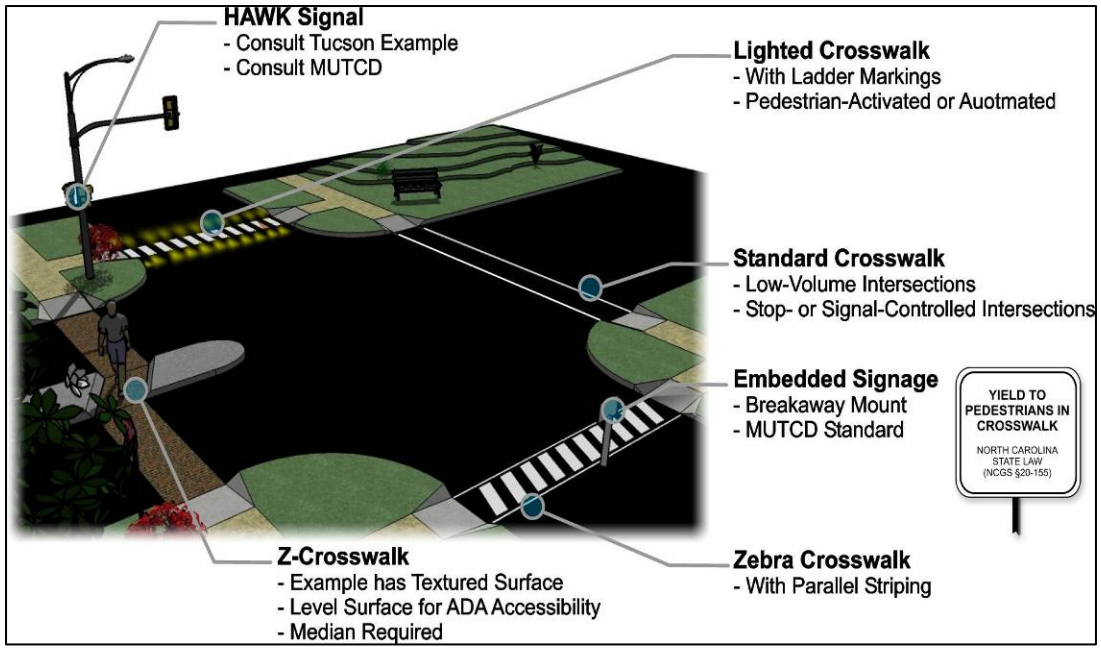
Figure 4-9. *The City of Charlotte's solution space for considering when to apply signalized mid-block pedestrian crossings.*

Table 4-2. Mid-Block Crossing Treatment Design Criteria (Charlotte DOT, 2005).

Pedestrian Mid-block Crossing Treatment	AADT	Operating Speed	Approx. Cost
Signs (including in-street Yield Sign)	5,000 – 35,000	Less than 45 mph	$250 - 350
High-Visibility Markings	5,000 – 12,000	Less than 35 mph	$500 – 1,500
Colored and Textured Markings	5,000 – 12,000	Less than 35 mph	$5,000+
Curb Extensions	5,000 – 12,000	Less than 35 mph	$5,000 – 25,000
Raised Crosswalks* **	5,000 – 15,000	Less than 30 mph	$2,000 – 15,000
Refuge Island	12,000 – 30,000	Less than 40 mph	$10,000 – 40,000
Median	15,000 – 35,000	35 - 45 mph	Varies greatly
In-Pavement Illumination	5,000 – 15,000	Less than 35 mph	$40,000
Pedestrian-Only Signal*	15,000 – 35,000	35 – 45 mph	$40,000 – 75,000
HAWK Signal**	15,000 – 35,000	35 – 45 mph	$35,000 – 60,000

**Note: MUTCD recommends pedestrian volumes of at least 400 for a four-hour period. **A HAWK (High-Intensity Activated Crosswalk) signal is a pedestrian-activated system used for high-volume crossings found to be useful in increasing the rate of driver responses to pedestrian crossings, especially in Tucson, AZ where they have been utilized extensively.[1] ***Raised crosswalks are most applicable on two-lane streets with a speed limit of 35 mph or less.*

Figure 4-10. *A diagram of various crossing treatments Dunn might consider improving pedestrian accessibility and safety crossing the street.*



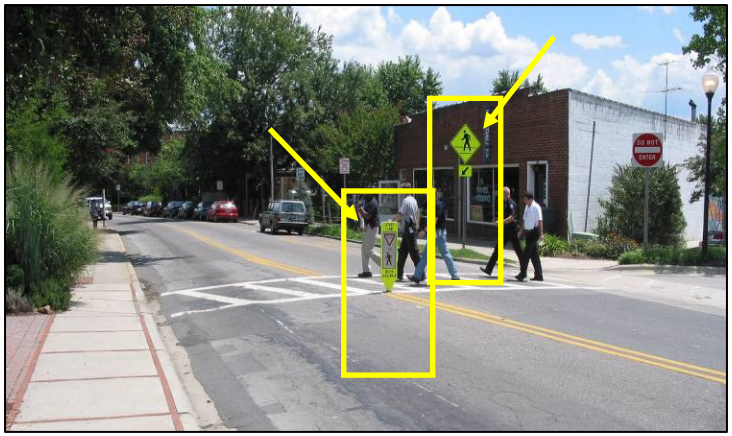


Figure 4-11. *An example of two types of signs used to notify motorists of a pedestrian crossing.*

4.3.3 Signage

In addition to sidewalks and crossings, pedestrian facilities also include signage along major pedestrian routes. Regulatory and warning signs serve primarily to reinforce traffic laws and rules of the road, and notify motorists and others of the presence of pedestrians. Often, the intended effect is to instruct motorists to drive more cautiously and reduce their speeds, thereby improving the safety for pedestrians in the given area.

Regulatory and warning signs can be used in a variety of places, including at crosswalks, at intersections, in-street, and near schools. National standards for sign placement and use can be found in the Manual for Uniform Traffic Control Devices (MUTCD). The MUTCD provides guidance for warning signs which can be used at both crosswalks, or along the roadway:

> "Non-vehicular signs may be used to alert road users in advance of locations where unexpected entries into the roadway or shared use of the roadway by ***pedestrians*****,** animals, and other crossing activities might occur." (Page 2C – 21, 2003 Edition)

The following are some recommended regulatory and warning signs which Dunn should consider installing. For more signs and more detailed guidelines for sign installation and use, Dunn should consult the MUTCD.

Figure 4-12. Example standard pedestrian warning signs. *The first sign (far left) is usually installed within the street to warn motorists to yield to pedestrians in a crosswalk - it does not have to be near a school. The second and third signs are common general pedestrian warning signs, while the fourth and fifth signs notify motorists of specific instances to watch for pedestrians. The fourth sign, "Turning Traffic", is usually placed at intersections to warn motorists that are turning right or left to yield to pedestrians in crosswalks. 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.*

In addition to regulatory and warning signs, many communities are adding non-traditional wayfinding signage to their public streets as an added amenity to pedestrians, cyclists and motorists. Pedestrian wayfinding signs typically give directional cues to pedestrians navigating a dense central business district or downtown area by foot. These signs include general directional information to major cultural, civic, institutional or historic landmarks, and sometimes include distances to those destinations (by mile or by block). Wayfinding signs can also indicate local "districts" or neighborhoods via specialized color-schemes or other symbolic gateway décor. Pedestrian wayfinding signs can be in the form of gateway banners, kiosks or maps, placed in the "furniture zone" of the walkway, out of the way of pedestrian traffic and at a height of 7ft or more for appropriate clearance but within legible distance of the reader. Associate hardcopy maps are often used to complement these signs. Figure 4-13 is an example of pedestrian wayfinding signage in Charlotte, NC's central business district.

4.3.4 Greenway Trails

Greenway trails, sometimes called multi-use trails or simply "greenways," are one of the most popular pedestrian facilities, especially for recreation. Greenway trails can be paved or unpaved paths, often unassociated with a roadway. They can be used by pedestrians, cyclists, and other non-motorized users. Greenways are typically no less than 10 feet wide with minimum 2 feet wide graded shoulders on each side of the trail. Surface options include paving with standard or permeable asphalt or concrete, or using pea gravel or granite screenings (like the Dunn-Erwin trail). Trail design and maintenance should provide for an 8 ft minimum vertical clearance from obstructions, including tree canopy. Proper pedestrian-scale lighting is essential if the trail will be open to commuters or recreational users in the early morning or late evenings. Bushes, trees and undergrowth should be well-maintained to ensure user safety. Often, additional amenities are added to greenways for user convenience, such as benches, water fountains, interpretative trail signs, map kiosks with distance and landmark information, and even emergency telephones if crime is considered a problem. Additional guidance on greenway design and standards can be found at: www.ncdot.org/transit/bicycle/projects/project_types/Multi_Use_Pathways2.pdf.

An example greenway cross-section is provided in Figures 4-14 and 4-15.

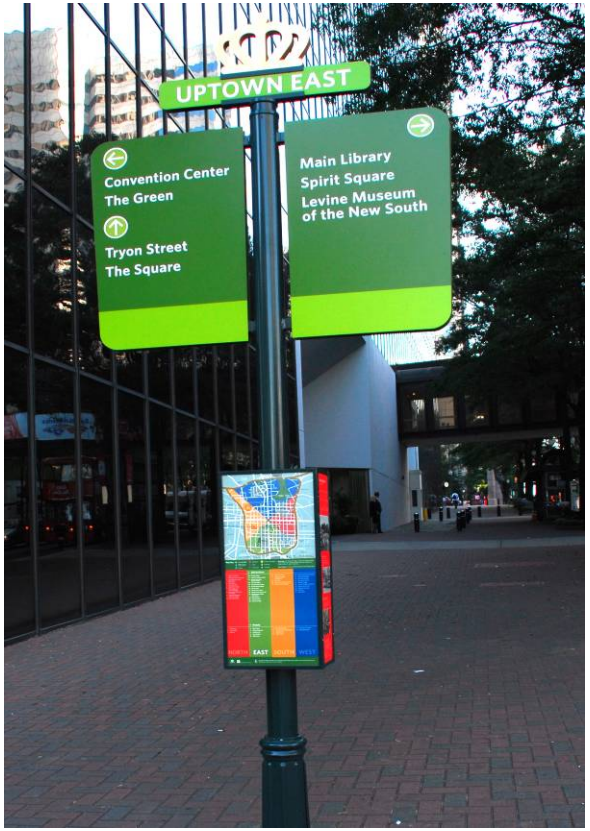


Figure 4-13. *Example of a wayfinding sign in Charlotte, North Carolina's central business district. This sign provides directional information to local landmarks, a transit map and gateway logo to indicate to the reader which district he/she is travelling in.*

Figure 4-14. *Example cross-section for a typical greenway.*

Figure 4-15. Typical greenway cross-section with bollard treatments at roadway crossing.
Source: www.pedbikeimages.com

Trail crossings should be carefully designed for pedestrian, bicycle and motorist safety. All trail crossings of roadways should be highlighted with a marked crosswalk and advanced warning signs for motorists, stop or yield signs for trail users, and overhead flashing beacons to alert motorists of the trail crossing where poor site distance warrants added safety measures. At signalized crossings, trail users should be provided with a pedestrian-activated signal so that the green light or "walk" signal is given to the trail only when in use. Other important considerations for placement and design of trail crossings include the following:

- Crossings should be a safe distance from neighboring intersections so to not interfere with or be negatively impacted by traffic flow.
- Roadway crossing placement should consider topography and roadway alignment for optimal motorist visibility of the path crossing.
- Motorists and trail users should be warned, such as with signage (including trail stop signs), changes in pavement texture, flashing beacons, raised crossings, striping and other treatments.
- A refuge is needed where crossing distance is excessive and in conditions exhibiting high volumes/speeds or where the primary user group crossing the roadway requires additional time, such as school children and the elderly.
- The crossing should occur as close to perpendicular (90 degrees) to the roadway as possible.
- If possible, it may be desirable to bring the path crossing up to a nearby signalized crossing in situations with high speeds/ADT and design and/or physical constraints.
- Signalized crossings may be necessary on trails with significant usage when intersecting with high-traffic roadways; MUTCD warrants must be met for the installation of a signalized crossing.

4.3.5 Pedestrian Underpasses

It is often desirable to provide a grade-separated crossing of a major street or freeway (such as I-95) with an existing or planned greenway or other walkway. In many cases, such pedestrian access can be provided in conjunction with a stream crossing at the same location. Pedestrians are sensitive to uninviting interiors of such crossings, and will not use them if they perceive them to be threatening due to especially long traverses in poorly lit conditions. If the roadway is not elevated, then the openings of the underpass should be flared out to provide clear lines of sight. Minimum widths are 10'-14' for traverses less than 60' in length. Wider widths are suggested for urban areas or longer traverses. Vertical clearances should be a minimum of 8', but 10' is more desirable, particularly if the trail permits equestrian use.

AASHTO provides guidance for lighting in underpasses in their *Roadway Lighting Design Guide*[iii]. Providing below-grade crossings must also be dependent on the proximity to floodways: pedestrians should not be put into a situation where they are at risk from rapidly rising flood waters.

4.4 Downtown Area Standards

Many municipalities consider the Downtown their starting point and standard for creating a pedestrian-friendly City. Downtowns were typically constructed, as is the case with Dunn, in a time period where walking was a much more functional mode of transportation, not an amenity or form of optional exercise. In order to maintain its pedestrian-oriented nature, and also to enhance the area's attractiveness and visual appeal, the Downtown area should have certain standards which may or may not be required beyond the downtown area. Some of these recommendations are as follows:

- **Build on the Downtown.** Already, the Downtown Area has good height-to-width (of street) ratios, architectural detailing, and wide sidewalks that are the foundation of a good walking environment. Figure 4-17 illustrates these features and describes how both expensive and more costly treatments could improve the streetscape.
- **Provide wide sidewalk.** Currently, the sidewalk in the Downtown area is approximately 8 to 10 feet wide. New or reconstructed sidewalk should be kept at a minimum of 10 feet, if not wider, in the Downtown. Pedestrians need space to window shop, stroll, walk side-by-side with their families,

Figure 4-16. *Pedestrian tunnels can be used to provide pedestrian connections under major roadways, active rail beds or other barriers. Effective lighting and visibility are essential to comfortable use by pedestrians and cyclists.*

Photos courtesy of Steven Neuschafer, City of Dunn.

Figure 4-17. *Wide sidewalk in downtown Dunn. More street-level windows, burying overhead utilities, and adding textured pavements could add aesthetic value for pedestrians in the CBD. Lower cost treatments like street planters, repainting/restriping markings, and street furniture could act as initial supplements to the larger cost streetscaping items. Many of the latter items could be sponsored in part by downtown merchants.*

and even stop for a rest in the sidewalk space. The City should also consider accommodating restaurants or cafes interested in creating outdoor, on-street seating, which is often a major booster to making a street look more popular and pedestrian-friendly. It also attracts even more visitors and potential shoppers and diners.

- **Provide many pedestrian amenities.** In addition to sidewalk width, the City should also provide pedestrian amenities such as benches, trash cans, and water fountains to make walking in downtown more comfortable for the visitors that come to the Downtown. The City should consider adding street trees and allowing a few street vendors (through a permitting process) to add life to the street. The more pedestrian amenities available in a particular area, the more inviting the area for pedestrians and visitors.
- **Provide frequent pedestrian crossings.** The Downtown area also already has many crosswalks and pedestrian crossings. In order to maintain the accessibility of the downtown area, crosswalks should be required at various intervals along major streets that are uninterrupted by intersections.
- **Require countdown pedestrian signals with audible cues at all intersections.** Countdown pedestrian signals should be required at all intersections in the Downtown area, and automatically cycle through the signal phases without pedestrian activation. In order to automatic visual cues, the City may wish to consider use of audible pedestrian cues as needed for visually-impaired residents.

4.5 Schools

In addition to Downtown, another area in Dunn that merits special treatment is the area around schools. Schools require special treatment because of the presence of both children and very high levels of traffic during drop-off and pick-up. Especially during drop-off and pick-up, traffic near schools can be incredible varied - consisting of small and large personal vehicles, school and other activity buses, pedestrians, and cyclists. Specific design features should be required around schools to improve safety within a ½-mile radius of the school, emphasizing higher-density residential areas first. Some of these design features include:

- Providing “school zone” pavement markings and reduced speed limit signs to delineate this zone;
- Requiring sidewalks on both sides of the street;

- Placing crosswalks and pedestrian signals at all intersections near the school;
- Installing school crossing signs at intersections to warn drivers of the school's presence and the potential for children in the street; and
- Reducing speed limits along adjacent streets.

4.6 Construction Zones

It is important that during construction of any kind, convenient and safe pedestrian access to destinations remain open and accessible. During the construction or expansion of private development, roadways or utilities, the entity responsible for the construction is also responsible for providing adequate pedestrian access through or around the site as well as signage that provides advance warning to pedestrians and motorists of the closure. Both the MUTCD (Manual on Uniform Traffic Control Devices)[iv], NCDOT's Planning and Designing Local Pedestrian Facilities[v], and the ADA (Americans with Disabilities Act)[vi] stipulate that safe passage should be maintained throughout a temporary closure unless it occurs during an extreme situation such as a natural or man-made emergency. During private construction within City limits, it is the responsibility of the City of Dunn to ensure compliance with these rules by regular monitoring.

The following should be considered whenever a sidewalk or trail will be closed temporarily:

- *Accessibility for Mobility Impaired Citizens.* At least one accessible route should be provided to transportation or transit facilities; accessible parking areas/spaces; public streets/sidewalks; and public parking areas to an accessible entrance of the building. This route(s) will comply with all other accessibility provisions contained in the ADA regardless of whether they are temporary or permanent. A barrier shall be placed across the full width of the sidewalk or trail to be detectable by a visually impaired person using a cane. An audible information device may be needed in cases where there are especially high traffic volumes challenging a visually impaired person making a street crossing.
- *Temporary Obstructions.* Parked construction equipment, erosion control fencing, storage of materials/construction debris, and other potential

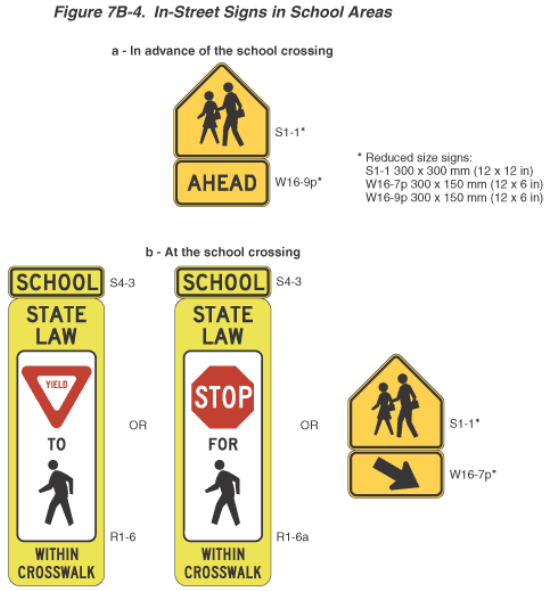


Figure 4-18. Sample School Area Signage.

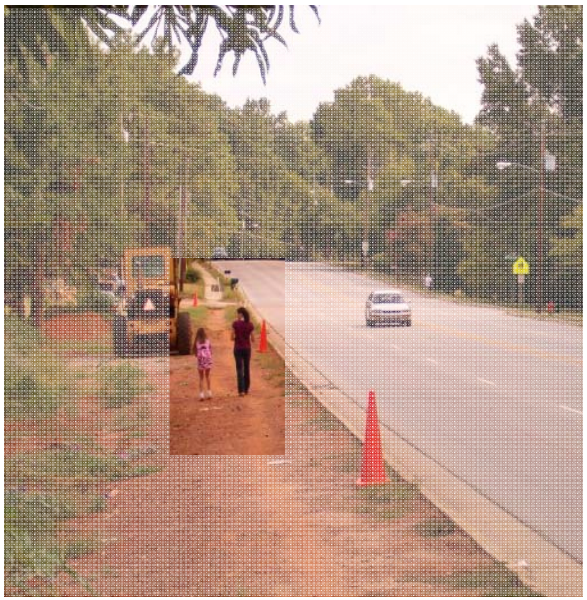
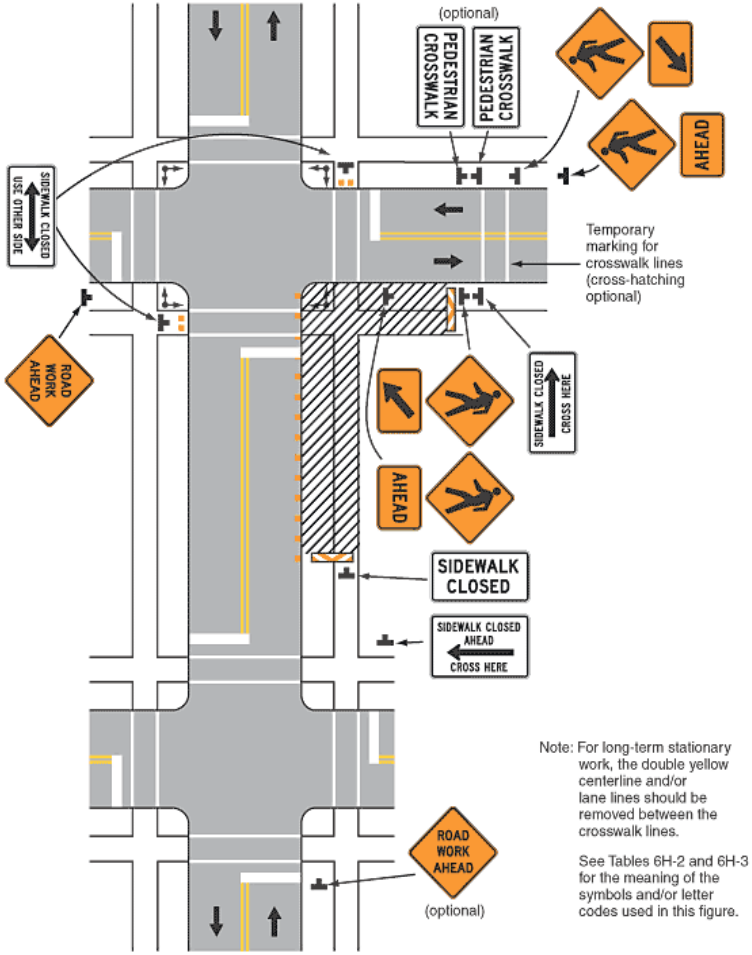


Figure 4-19. *Poor pedestrian access at a construction site in Cary, NC.*

Figure 4-20. Sample Signage Plan for Temporary Sidewalk Closure and Re-routed Pedestrian Crossing.
Source: MUTCD, Figure 6H-29.



obstructions should be kept away from roadside pedestrian access and pedestrian or multi-use trails so as to keep a permanent passageway open for pedestrians crossing the site. Signs and other devices should not protrude more than 4" into the pedestrian passageway and 7' or less above a sidewalk (8' min. preferred).

- *Advance Warning and Signage.* Advance warning may consist of a single sign to a flashing strobe, depending on the nature of the construction or context (such as vehicular volumes) of the work area. Advance signage should be placed so that pedestrians have an opportunity to read the sign and make a safe crossing at a street intersection to the opposite side of the roadway. Smaller, mid-block closures will require fewer treatments, but will still retain the "Sidewalk Closed Ahead Cross Street" advance warning at an appropriate and safe crossing point in advance of the closure, at a minimum.
- *Route Design.* Temporary traffic barriers like jersey barriers (although not intermittent short sections of jersey barriers) and breakaway bollards should be considered as tools to help delineate a buffer from moving vehicles in areas with high pedestrian traffic volumes and/or to help ensure worker safety.

4.7 Parking Lot Design

Everyone becomes a pedestrian once they park their car, but there are many examples of poor parking lot design. Poor parking lot design at the least will deter customers that may be walking or riding transit to a store, and at the most can create a dangerous safety hazard by increasing pedestrian-vehicle interaction. The most common design issue is that the primary carriageway for vehicles in the parking lot happens to coincide with where the greatest number of pedestrians cross: directly in front of the main entrance. Other issues include poor sight lines to spot pedestrians; bad transition areas from the public domain (e.g., streets) to the private parking area; and inconvenient pedestrian access between parking areas, shops, and adjacent communities. Figure 4-21 indicates a preferred set of suggestions to overcome these common problems. The larger the parking lot, the more vehicles and pedestrians, therefore the more important it is to carefully design treatments to minimize vehicle-pedestrian interaction. Some suggested treatments:

1. **Parking in the rear and sides.** One way to attract pedestrians to a store and to reduce pedestrian-vehicle interaction is to minimize the amount of parking lot that a pedestrian must walk through to get to the store entrance. This can be done by placing parking in the rear or sideyards of a building, which will reduce travel time for pedestrians approaching the store from the street-front and sidewalk. It will also minimize pedestrian-vehicle interaction by keeping pedestrian customers separate from vehicles by allowing the pedestrian customers to access the store directly from the sidewalk rather than through a parking lot. Parking lots in the rear also create a more attractive streetscape – something that encourages pedestrian use.
2. **Create safe "landing areas".** Provide continuous transitions from the street into a safe "landing" area in the parking lot; don't just "dump" pedestrians into the throat of a driveway.
3. **Maintain good sight lines** at major turning points inside the parking area.
4. **Provide well-marked pedestrian access perpendicular to store fronts.** Whenever possible, provide perpendicular pedestrian access into the front of a high volume land use such as major retail uses. The final crossing to the store entrance(s) should be well-marked, preferably with a raised crosswalk and/or colored demarcations to provide good visual cues to the driver. Moving the main parking aisle away from the principal entrance is another option.
5. **Supply adequate, pedestrian-scale lighting.** Adequate lighting is often perceived as a personal security issue in many large parking areas, and should be provided while avoiding disabling glare (looking into a direct light source and being partially blinded) or causing light pollution to adjoining properties. In order to make customers and pedestrians feel more comfortable, lighting should also be provided at a pedestrian scale. This means lowering the height of some light poles and providing lighting at key locations, such as the entrances and exits to stores, and not just in the parking lots.
6. **Provide awnings.** Especially for some "big box" stores, it is important that the transition for customers from inside the store to the outside be gradual and protected as much as possible from conflicts with vehicles. By providing awnings, a store protects its customers from the rain while allowing for a more comfortable pedestrian environment for customers to window shop and wait for rides or a bus to arrive. This can make a store seem much more comfortable while encouraging customers to remain within the protected awning area and out of conflict with vehicles in the travelway.

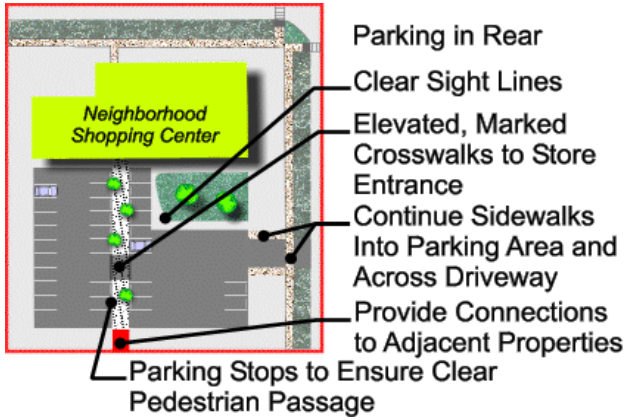


Figure 4-21. *An example of pedestrian-friendly parking lot design*

Figure 4-22. *Pedestrian access was successfully incorporated into the parking lot design of this downtown lot in New Bern, NC.*

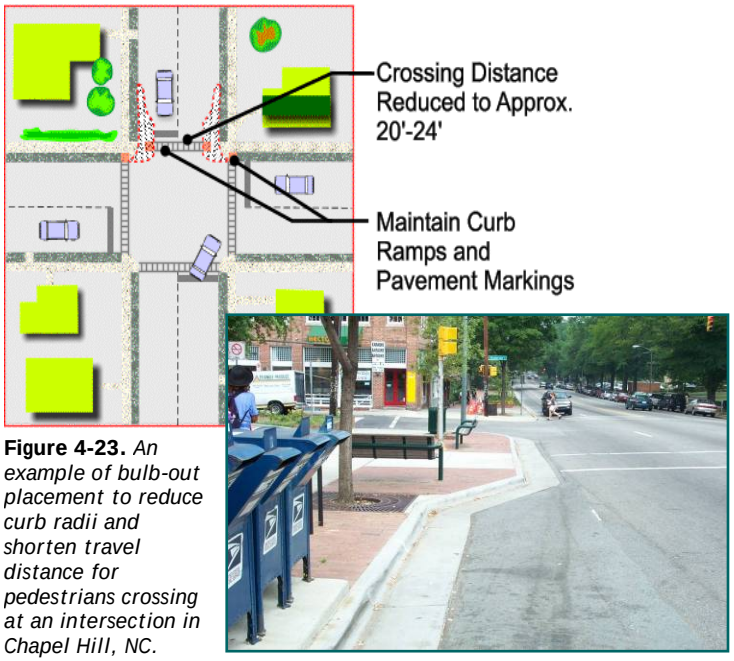


Figure 4-23. *An example of bulb-out placement to reduce curb radii and shorten travel distance for pedestrians crossing at an intersection in Chapel Hill, NC.*

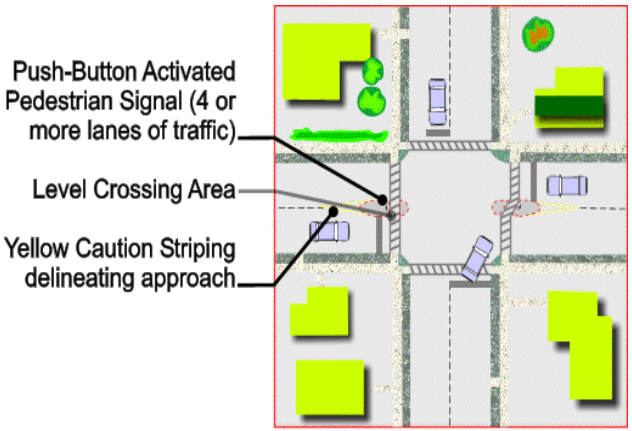


Figure 4-24. *An example of well-designed median and refuge islands*

Dunn has several shopping centers and areas with large parking lots, and others may be on the way. It is important that the City keep the pedestrian's access and safety in mind when reviewing development proposals. Through better design and better design review, the City will be able to create parking lots that are both convenient for a car and comfortable for a pedestrian.

4.8 Traffic Calming Considerations

Traffic calming is the term used to describe a toolbox of improvements that can be used to "calm," or slow, traffic along a street, usually in a neighborhood or similar area with low signed traffic speeds and relatively lower traffic volumes. Although not directly pedestrian-related, traffic calming efforts can help to create a safer, more comfortable pedestrian environment by reducing vehicle speeding. Traffic calming comes in a variety of forms. Some of the most common techniques are described in the paragraphs below.

4.8.1 Curb Extensions (Bulb-Outs) and Curb Radii

The primary purpose of bulb-outs is to shorten the distance that pedestrians must travel to cross a street at an intersection or mid-block crossing. In addition, they may encourage motorists to drive slower by narrowing the travel lane and reducing vehicular speeds during turning movements at intersections. Motorists will travel more slowly around corners with smaller curb radii even without the use of curb extensions. Landscaping and other aesthetic treatments such as special paving textures should be carefully designed to avoid hazards to drivers and visually-impaired citizens while minimizing maintenance costs. Figure 4-23 shows an example of a bulb-out placement to reduce curb radii and make an intersection more pedestrian-friendly.

Table 4-3. Maximum Desired Speed and Curb Radii.

Desired Max. Speed (mph)	Maximum Curve Radius*
15	43
20	88
25	167
30	273

** Maximum Curve Radius refers to the angle of each corner at an intersection.*

4.8.2 Medians and Refuge Islands

Figure 4-24 and 4-25 illustrate the design and markings associated with median refuge islands. Note that pavement markings delineate the approach to the islands; that the islands are "split" to allow for a level platform for wheelchair use; and that 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 a pedestrian to split their trip into two halves as they cross the street. Note that the crosswalk on the right side of the diagram is configured at a skewed angle as it crosses the median. This allows pedestrians to have a better angle of sight as they approach and cross each side of the street. In all cases, a minimum 10-foot travel lane is maintained. Sensitivity to large vehicles (buses, trucks and fire equipment) dictates some elements of the median design, curb style, and placement. Median crossings should be at least 6 ft wide with 8 ft recommended in locations of high usage by pedestrians and bicyclists. 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.

Figure 4-25. Example of a median refuge island in use.
Source: www.pedbikeimages.com

4.8.3 Roundabouts

Traffic circles and roundabouts are also an increasingly popular traffic calming technique, used instead of a stop control or traffic signal installation at an intersection. No roundabout is expressly recommended in the Pedestrian Plan, but may be considered for future intersection designs in Dunn. Federal design guidance for roundabouts is available at http://www.tfhrc.gov/safety/00068.htm and should be consulted when necessary to ensure compliance with the Americans with Disabilities Act (ADA).

4.9 Road Diets

Many roadways across the United States have been built over the years with future [car] traffic capacity in mind to the detriment of other roadway users. This has led to a number of unnecessarily wide roadways that encourage speeding and create unsafe circumstances for pedestrians. As more and more people are turning to bicycles, transit and walking for increasing cost-effective and healthy travel modes, many cities are re-thinking the old paradigm and looking for new opportunities to add bicycle lanes, sidewalks, traffic calming treatments and transit access. A growing trend nationwide is to shrink travel lane or effective street widths through "road diets." Road diets trim down unnecessary width of existing roadways to create safer, more multi-modal access along those streets.

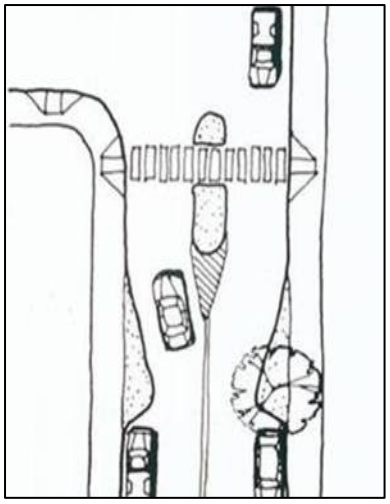


Figure 4-26. Example of a travel lane diet for the retrofit installation of a pedestrian refuge island and neckdowns.
Source: www.pedbikeimages.com

Figure 4-27. Existing Railroad Crossing Example in downtown Dunn. *Poor pavement condition (top) and poor design complicate crossings here. Design issues include placing the gate in front of (instead of behind) the sidewalk, constructing the ADA ramp, and extending the concrete pads across the sidewalk path would have been low-cost and a better long-term maintenance solution.*

Often, road diets are used on four and five-lane roads with a traffic capacity that could be served more safely and effectively with fewer lanes. By taking a four-lane roadway to a three-lane facility, there is an "extra" 10-12 feet of space in which to fit sidewalks, bike lanes or other multi-modal accommodations. Similarly, a four-lane roadway with 12ft travel lanes may be dieted and remain a four-lane roadway but with 10ft travel lanes; the additional 4ft in each direction could then be used for bicycle or pedestrian facilities. Finally, some road diets are more appropriately termed travel "lane diets" because they essentially shrink wide travel lanes in order to install traffic calming and other pedestrian facilities.

In Dunn, there are a number of arterial and non-arterial roadways that are particularly wide and may be eligible for road diets to help reduce speeding and intersection conflicts, as well as provide sidewalks. Many of these streets have curb and gutter that was installed without sidewalks and without leaving sufficient space for future sidewalks. Such roadways include Cumberland Avenue, Friendly Road, Erwin Road and Granville Street. In the case of these and other streets in Dunn, right-of-way constraints make sidewalk retrofits quite expensive. However, if road diets are possible, existing road right-of-way could be converted to sidewalk facilities and/or other pedestrian-friendly features, such as planting strips or stormwater treatment swales. In the case of Granville Street, for instance, it may be possible to shrink existing travel lanes to 10 or 11 feet and utilize the extra width to add sidewalks, which are built as extensions of the current curb line onto the existing asphalt travel lane. This would eliminate the need to acquire expensive right-of-way, while still providing a much-needed pedestrian facility. In this and all cases, further study will be required on a case-by-case basis to evaluate a range of complex issues including cost, pedestrian facility type, right-of-way, stormwater management, etc.

4.10 Railroad Crossing Treatments

The City of Dunn has a special interest ensuring that pedestrian crossings of railroads is handled safely, since the CSX railroad bisects the City and separates potential origins and destinations. Perception of the barrier effect is even stronger on the part of long-time residents, furthering the need to provide connectivity to both sides of the tracks. Working with railroad companies, which typically have ownership of their rights-of-way in fee simple arrangements and closely guard the frequency and width of crossings of any sort ("encroachments"), has proved to be time consuming in many cases. However, ideas that improve safety, stem from

published FRA (Federal Railroad Administration) sources, and can reduce liability are more likely to receive a favorable reception from the railroad. Treatments can be thought of in three broad categories:

- Crossings adjacent to an existing or planned roadway;
- Crossings independent of an existing or planned roadway (e.g., greenways); and
- Education and Enforcement techniques (discussed in Section 6).

Additionally, railroad crossing safety devices can be thought of as either active and change their appearance and/or position in the event of an oncoming train (e.g. gates and flashing signals), or passive, such as the familiar "crossbuck" sign.

It is interesting to note that the Federal Railroad Administration, a normally conservative agency, in recent guidance has stated that "a guiding principle in the design and development of pedestrian crossing facilities should be to cause as little deviation as is practical from a direct pathway."[vii] It is also important to note that several of these devices or treatments are not in widespread use at this time, and are not incorporated into the Manual on Uniform Traffic Control Devices (MUTCD) at this point in time. Hence, the application of any such device cannot be required, and would need to be coordinated with appropriate state and federal transportation agencies.

Innovation is warranted in preventing train-pedestrian collisions, however, since the potential for serious injuries in any collision with a moving train is very high. The amount of dynamic energy that even a slow-moving train possesses is enormous, with the result that collisions are frequently fatal. Additionally, the CSX Railroad line in Dunn is quite active, seeing around 40 trains per day, which includes several Amtrak passenger trains. It is worth noting that suicides are often the cause behind many fatalities involving trains, and that these attempts are obviously impervious to warning devices.

The standard crossbuck warning sign (passive) is illustrated in Figure 4-28). The "Look" sign can be used below the crossbuck sign to reinforce this message to the eye-height of most pedestrians. The Number of Tracks signage (MUTCD R15-2) supplements the crossbuck when there is more than one set of tracks to cross.

There has also been a recommendation by FHWA to allow the standard crossbuck sign to be supplemented with a Yield or Stop sign for motorists

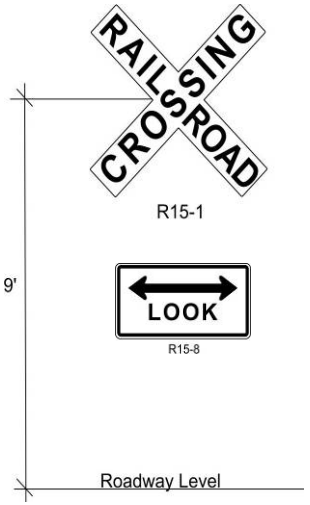


Figure 4-28.Crossbuck and "Look" Signs
Source: MUTCD

Figure 4-29. "Low-Rise" Pedestrian signal in use in Portland, Oregon.
Source: FRA Compilation of Pedestrian Safety Devices in Use at Grade Crossings.

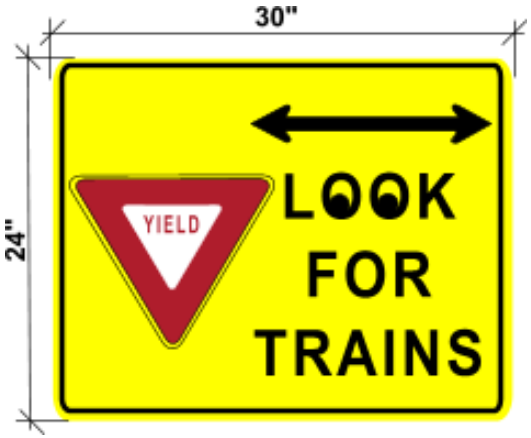


Figure 4-30. "Look for Trains" Warning Sign
Source: FRA Compilation of Pedestrian Safety Devices in Use at Grade Crossings.

Figure 4-31. Pavement Marking and Counterweight-Mounted Warning Sign
Source: FRA Compilation of Pedestrian Safety Devices in Use at Grade Crossings.

immediately below the crossbuck on the same post[viii]. However, this has not yet been adopted in the MUTCD. Further, the Yield option may send an inaccurate message to the driver, who is used to different operating characteristics associated with cars at a Yield control on cross-streets, and is therefore not recommended here.[ix]

An active, low-rise pedestrian signal design has been put into place in Portland, Oregon (Figure 4-29). The flashing signal is accompanied by a warning sign cautioning pedestrians to look in both directions. Again, this device is not mentioned in the MUTCD, and would need special attention in terms of its design, placement, and allowance at any location.

A second active signalization type (not shown) for combination roadway – pedestrian crossings is when the crossing gate arm is mounted behind the sidewalk, so that when horizontal the arm crosses both the sidewalk (and, potentially, the bike lane, if present) and the roadway. A more eye-catching – although non-regulatory – sign is shown in Figure 4-30.

A combination of passive (pavement markings) and active (sign mounted to counterweight of crossing arm) is shown in Figure 4-31. This installation is near the light rail line in Salt Lake City, Utah.

It is worthwhile to note here that the American Railroad Engineering and Maintenance-of-Way Association (AREMA) is considering crossing treatments for pedestrian and cycling paths (e.g., greenways) that are not adjacent to a roadway. At the time of this writing, new standards or design recommendations have not been promulgated. Another useful reference is (www.fhwa.dot.gov/environment/sidewalk2), especially Chapter 8.11 on railroad-pedestrian crossings. Figure 4-32 illustrates an important safety consideration for both cyclists and wheelchair or cane users: the flangeway filler to close the gaps that often exist in older crossings between the rail and adjacent asphalt or concrete surfaces.[x] Such a filler, sometimes using wood in older rail corridors which deteriorates fairly quickly (see photograph at right), helps to create a smoother ride for wheelchair users particularly, although there are similar benefits for road bikes (skinny tires) as well.

Figure 4-33 shows an amalgam of typical railroad crossing treatments. Minimum standards, such as the 18' minimum distance between railroad centerline and gate crossing or the 38' maximum gate length, will also influence the placement of warning devices. Note how landscaping allows for current and future sight distances to the warning devices; the fencing style ensures adequate sight through it; and painted stop bars and advance warning signals in addition to stop controls (not shown) reinforce safe stopping distances. The standard crossbuck sign/flasher/audible warning (with or without gate) may also be supplemented with a YIELD or STOP control; however, NCDOT is reviewing the appropriate design situations where these controls may be used, based in part on a 2006 Federal Highway Administration (FHWA) memorandum describing their usage.[xi]

The audible signal on these devices ties to the signalization of the train, and is typically a minimum of 85 decibels. Continuous bell warnings are warranted in select cases, but the level of noise intrusion, especially in sensitive areas such as churches, cemeteries, schools, health facilities, and residential areas often produce conflicts with audible warning devices.

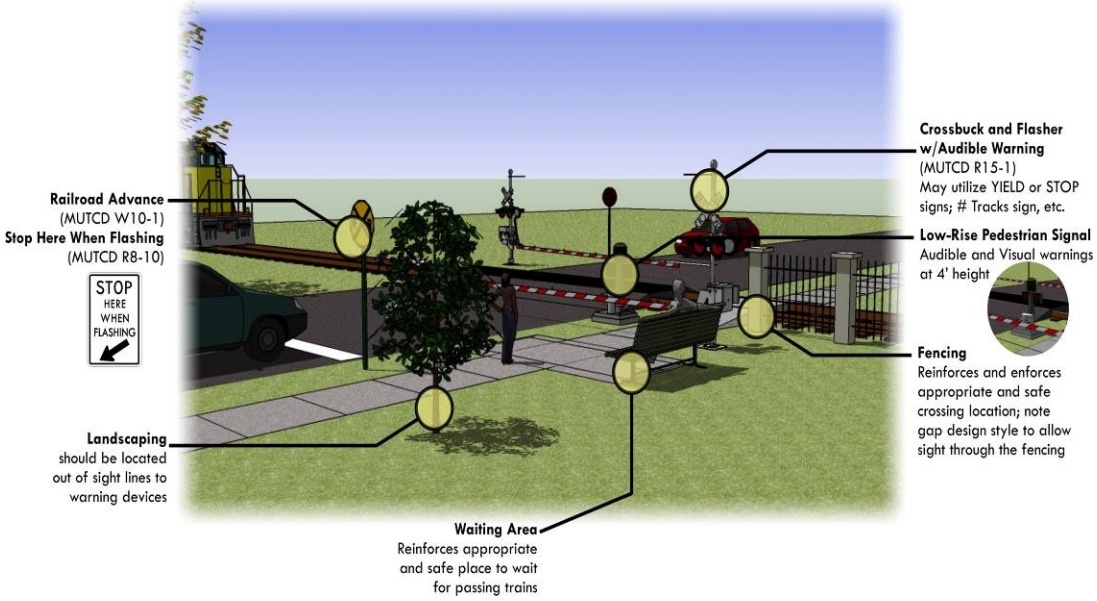


Figure 4-33. Typical Railroad Crossing Treatments
Source: FRA Compilation of Pedestrian Safety Devices in Use at Grade Crossings; Manual on Uniform Traffic Control Devices; The Louis Berger Group, Inc.

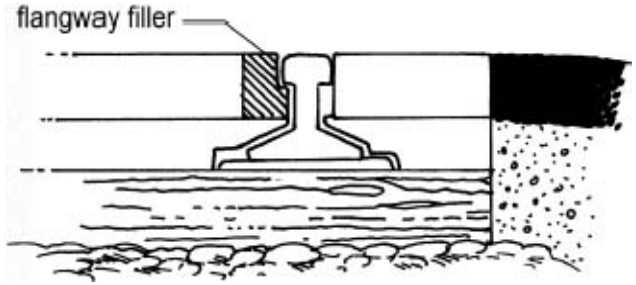


Figure 4-32. Diagram of Flangeway Filler
Source: Designing Sidewalks and Trails for Access Part II of II: Best Practices Design Guide, Chapter 8.11.

I.I. = [(PF)*(ADT)*(TV)*(TSF)*(TF)]/160 + (70*A/Y)² + SDF

Where: **PF** = **P**rotection **F**actor

No Warning Devices =1.0
Crossbuck Signs = 1.0
Traffic Signal Preemption Only = 0.5
Flashing Light Signals = 0.2
Flashing Light Signals with Gates = 0.1

ADT = **A**verage **D**aily **T**raffic

When school buses use crossing:
Add (No. of School Bus Passengers/1.2) to ADT
*When passenger trains use crossing: Multiply ADT*1.2*

TV = **T**rain **V**olume

TSF = **T**rain **S**peed **F**actor (Max. Allowable Train Speed, MPH)/50+0.8)

TF = **T**rack **F**actor

No. of Tracks	• No. of Through Tracks				
	0	1	2	3	4
1	1.00	1.00	--	--	--
2	1.50	1.75	2.00	--	--
3	1.60	1.85	2.25	2.50	--
4	1.75	2.00	2.50	2.75	3.00

A/Y = Train-Vehicle **A**ccidents per **Y**ear

Note: Model uses a 10-year history of crashes; therefore, input is normally in tenths. This input can calculate a value for any given number of crashes within a given period of time in years.

SDF = **S**ight **D**istance **F**actor

*SDF = [sum(SDF_n)/4]*16*
Where SDF_n = Sight Distance Factor for Quadrant n
SDF = 0 when Sight Distance is Open/Clear

Figure 4-34. NCDOT Investigative Index (I.I.) Formula
The NCDOT I.I. uses train frequencies and speeds, as well as sight distance, existing crossing treatments and accident histories, to determine an objective measure of the hazard potential for every rail – roadway crossing in North Carolina.

More expensive devices, such as fencing, waiting areas, and low-rise pedestrian signals, would be used only in situations where there is a high exposure of trains and pedestrians (for example, at rail stations, event areas, and so forth). The choice of each device is dependent on the number of pedestrians, speed/frequency of trains, sight distances, and so forth. Generally, the following questions should be considered when considering the type, design, and placement of devices.

- What is the accident history involving pedestrians?
- What is the sight distance and crossing distance for pedestrians? Are the pedestrians crossing at a "skewed" angle?
- How many pedestrians are crossing the tracks?
- What are the numbers of trains and speeds at a crossing?

The last two bullets (number of pedestrians and number of trains crossing in a day), when combined, can produce an exposure index that indicates a relative prioritization method for pedestrian crossings. Even when exact pedestrian counts are not available, a Likert-scale rating system can be employed to produce priority locations for improvements. The second bullet impacts the design and treatment placing characteristics. Putting these factors together results in a typical priority index that is easily represented by the formula:

Px = Tx * Px
Where:
Px = Priority of Crossing X
Tx = Number of Trains / Day at Crossing X
Px = Number of Pedestrians / Day at Crossing X

NCDOT uses a similar index, the Investigative Index (I.I.), to prioritize every rail crossing in the State. As funds have become available, safety improvements are installed. Figure 4-34 indicates how this index is calculated.[xii] Even if a particular crossing ranks highly on the index, availability of funds and the costs associated with modifying the safety treatments at a particular location will influence how quickly these improvements can be implemented. The use of this index is primarily oriented towards vehicular crossing traffic.

In terms of policy, the Nevada DOT has adopted the following policies for pedestrian crossings at railroad tracks, which is worthy of reprinting here nearly verbatim.[xiii]

- Grade crossing design features follow all national standards including the FHWA *Designing Sidewalks and Trails for Access Part II*.
- All signals are to be set behind the sidewalk, to provide the same level of warning for pedestrians as motor vehicles. If this cannot be done, add pedestrian gates. With signals set in back of the sidewalks, Nevada has found that they do not run into conflicts with the ADA prohibition of protrusions over the walkway.
- Crossing surface panels must be at least one foot wider than the sidewalk or edge or roadway, if there is no sidewalk.
- There must be a level turn-around area (for wheelchair users) next to the rail that is five feet by five feet wide, on both sides of the track. The sidewalk slope can not increase more than 1 in 12 after that.
- The walkways can be no less than 36" wide but Nevada encourages the use of walkways that are six feet wide.
- "RxR" pavement markings are applied in bicycle lanes and W10-1 Advance Warning signs are placed next to the pavement markings. This is in addition to the W10-1 signs placed further back for motorists.

The diagnostic tool that Nevada DOT uses is also useful for considering alternative treatments for cyclists, pedestrians, and persons falling under the Americans with Disabilities Act (ADA). The full spreadsheet used by NVDOT is included as Appendix E of the Plan. A portion of the diagnostic in Figure 4-35 deals with pedestrian/cyclist and mobility impaired crossing considerations. In contrast to the NCDOT Investigative Index, the Nevada diagnostic relates to pedestrians, cyclists, and ADA public segments more directly.

4.10 Pedestrian-Friendly Street Design

In addition to all the treatments noted above, it is often important to consider pedestrians as part of the built environment from roadway design to architectural standards. Including pedestrian-friendly elements throughout a roadway or development project - from the creation of conceptual alternatives to construction and maintenance phases – can greatly impact the long-term walkability of an area. In recognition of this fact, NCDOT has developed a set of Traditional Neighborhood Development Street Design Guidelines (http://www.ncdot.org/doh/preconstruct/altern/value/manuals/tnd.pdf). These guidelines are available for proposed TND developments and permit localities and developers to design certain roadways according to TND guidelines rather

ADA

Are there curb cuts at nearby intersections and a clear path present to curb cuts at nearby intersections?	☐ Yes	☐ No
Are detectable warnings advised?	☐ Yes	☐ No
Is the path width adequate (36" is minimum)?	☐ Yes	☐ No
Are there vertical obstructions (standard: none between 27" to 80" above ground or within path)?	☐ Yes	☐ No
Slope of path transition (standard is 12:1 or less).	☐ Yes	☐ No
Landing platform (standard is level and 5' x 5' or more).	☐ Yes	☐ No
Is surface smooth (standard: passable by a wheelchair, no broken or buckled asphalt, edges < ¼")?	☐ Yes	☐ No
Panel length (crossing surface panel needs to extend 1' behind back of path to be standard).	☐ Yes	☐ No
Are there flange gaps 2½", or less, or flange fillers?	☐ Yes	☐ No
Can full flange fillers be used in low speed applications?	☐ Yes	☐ No
Is grade 5% or less? If grade is over 5%, how long is grade? '	☐ Yes	☐ No
If grade is 8% and 200', 10% and 30' or 12.5% and 10', are there rest areas?	☐ Yes	☐ No
Are there 43" handrails for grades over 5%?	☐ Yes	☐ No
Is widening proposed? How wide? '. When? Consider in project?	☐ Yes	☐ No
Mitigation:		

AWARENESS OF XING

Overall awareness of railroad crossing, including visibility and effectiveness of possible signs, signals and markings.	☐ Acceptable	
Horizontal and vertical alignment considerations.	☐ Acceptable	
Pedestrian Sight Distance: Clearing sight distance of _____ ' from 17' from rail needed. North/East Side of Xing _____ ' South/West Side of Xing _____ '	☐ Acceptable	
Bicycle Sight Distance 1: *Distance where crossing can be identified.* North/East Side of Xing _____ feet South/West Side of Xing _____ feet	☐ Acceptable	
Bicycle Sight Distance 2: *Need _____ ' down tracks from _____ ' down path.* North/East Side Looking East/North _____ ' West/South _____ ' South/West Side Looking East/North _____ ' West/South _____ '	☐ Acceptable ☐ Recommend Improvement	
Bicycle Sight Distance 3: *Distance down path to see _____ ' down tracks if #2 not acceptable.* North/East Side Looking East/North _____ ' West/South _____ ' South/West Side Looking East/North _____ ' West/South _____ '	☐ Acceptable ☐ Recommend Improvement	
Bicycle Sight Distance 4: Stopped 17' *from rail, need _____ ' down tracks.* North/East Side Looking East/North _____ ' West/South _____ ' South/West Side Looking East/North _____ ' West/South _____ '	☐ Acceptable ☐ Recommend Improvement	
Nighttime visibility, including ambient lighting.	☐ Acceptable	
Skew of Xing: ____ ° Does skew limit perception?	☐ Yes	☐ No
Are there simultaneous train movements on multiple tracks? Can standing boxcars block the view?	☐ Yes	☐ No ☐
Do Pedestrians and bicycles violate warning devices?	☐ Yes	☐ No
Mitigation of inadequate perception: ☐ Additional Signage ☐ Luminaires & Where ☐ Multiple Track Removal		

Figure 4-35. ADA Evaluation (bottom) and Pedestrian/Cyclist Evaluation (top)
Source: Nevada DOT Railroad Safety Diagnostic Review Form

than the conventional subdivision street standards. The guidelines recognize that in TND developments, mixed uses are encouraged and pedestrians and bicyclists are accommodated on multi-mode/shared streets.

4.11 Summary

Pedestrian facility use is a function of a variety of factors, including the connectivity of the facilities, their safety, their convenience, and their comfort. For this reason, pedestrian facility design should be thoughtful and sensitive to the needs of its users. By following the guidelines provided in this section for sidewalk, crossing, and trail design, as well as other items associated with pedestrian facilities, Dunn should be able to create a built environment that will promote walking and increase the number of pedestrians in the City.

Resources and Citations

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

[ii] United States Access Board, ADA Accessibility Guidelines Homepage, accessed November, 2005. (http://www.access-board.gov/adaag/html/adaag.htm#A4.29.2)

[iii] AASHTO, "Roadway Lighting Design Guide." American Association of State Highway Officials, 2005.

[iv] *Manual on Uniform Traffic Control Devices for Streets and Highways*, 2003 Edition. Federal Highway Administration, 2003. Especially Sections 6B-1, 6D, 7, and Figures 6H-28, 6H-29, 7A-1, and 7B-4.

[v] *Planning and Designing Local Pedestrian Facilities*, North Carolina Department of Transportation Office of Bicycle and Pedestrian Transportation. February, 1997, Chapter 10.

[vi] Americans with Disabilities Act, US Code 28 CFR Part 36: ADA Standards for Accessible Design. Page 496 (www.usdoj.gov/crt/ada/adastd94.pdf).

[vii] Office of Safety, Federal Railroad Administration, "A Compilation of Pedestrian Safety Devices in Use at Grade Crossings." January, 2008.

[viii] Jeffrey Pamatti, "MUTCD - Guidance for Use of YIELD or STOP Signs with the Crossbuck Sign at Passive Highway-Rail Grade Crossings." Federal Highway Administration Memorandum dated March 17, 2006.

[ix] Saylor, Scott M., President, North Carolina Railroad Company, discussion on rail crossing treatments, April 25, 2008.

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[xi] Thomas, Drew, PE. NCDOT Rail Division Engineering and Safety Branch, Crossing Safety Engineering Manager, discussion on rail crossing treatments, April 1, 2008.

[xii] Thomas, Drew, PE. NCDOT Rail Division Engineering and Safety Branch, Crossing Safety Engineering Manager. "Draft Railroad Crossing Guidance." E-mail to Scott Lane. April 8, 2008.

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Section 5. Project Recommendations

This section provides a set of project recommendations to improve pedestrian conditions in Dunn, as well as suggestions for phased implementation of the Plan.

5.1 Introduction

This section identifies potential future projects that will improve pedestrian conditions in Dunn, and outlines a prioritization methodology for these projects. The projects in this section were developed based upon input from City staff, the Steering Committee, and public input through surveys, a project hotline and the April 29, 2008 Open House.

5.2 Project Recommendations

Pedestrian facilities can include sidewalks, greenways, and intersection improvements, as well as streetscaping projects and traffic calming efforts. Such facilities can be built "incidentally" as part of a roadway construction project, or independently. The Dunn Comprehensive Pedestrian Plan identifies a number of proposed pedestrian facilities that can help make Dunn a more walkable community. Project recommendations for the Pedestrian Plan are broken out into three distinct categories: Sidewalks, Greenway Connections and Crossing Improvements. These projects were identified through the public involvement process, survey results, discussions with staff and Steering Committee members, as well as field and data reviews by the consultants.

Recommended locations and treatments for each project type are summarized, respectively, in Sections 5.2.1 (sidewalks), 5.2.2 (greenways) and 5.2.3 (crossing improvements). Tables in each section show the project and proposed action. The sidewalk projects recommended in Table 5-1 include a number of short segments that will only need "spot improvements" to create continuous sidewalk connections to nearby pedestrian destinations. These projects should be considered "short-term" recommendations and constructed as opportunities arise and/or through new construction programs like the sidewalk petition process or payment in-lieu funding recommended in Section 6. Table 5-2 includes more significant "corridor" projects that may be longer, more costly and/or more difficult to construct. Projects in Table 5-2 were prioritized based on criteria set by the Steering Committee at their March 27, 2008 meeting, which included proximity to local schools, parks, shopping venues and the Dunn-Erwin trail, as well as factors such as average daily traffic (ADT) on adjacent streets and the presence of existence sidewalk connections. Sidewalk project prioritization and

phasing recommendations are discussed in Section 5.3 and summarized in Tables 5-5 and 5-6.

In addition to sidewalk recommendations, the proposed greenway trails in Table 5-3 are intended to offer safe, scenic connections between key pedestrian destinations, such as schools and parks, as well as create tourism and economic development opportunities for Dunn. Finally, the crossing improvements recommended in Table 5-3 recognize the need for important safety improvements at key intersections and crossings, including the installation of crosswalks, signage, and/or pedestrian signals.

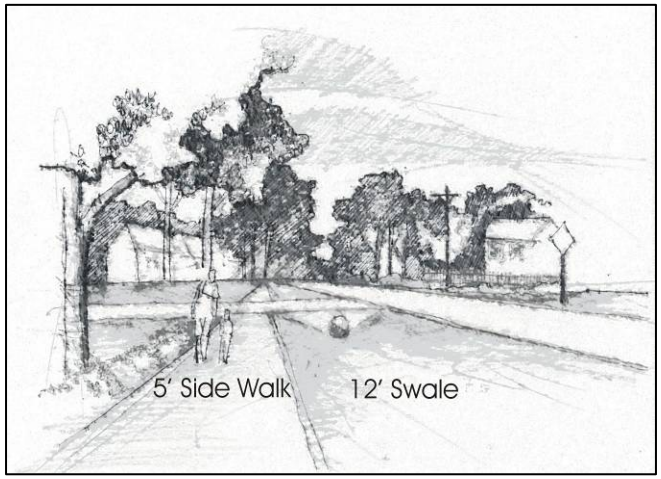


Figure 5-1. *Hand-drawn sketch of proposed future sidewalk facility for Meadowlark Road or other roadways with similar cross-section. This type of sidewalk installation fills the pedestrian needs of the area, while respecting the rural character of the roadway and preserving the existing drainage infrastructure. Though right-of-way costs may be high, depending on the location, this design would eliminate the need to install expensive curb and gutter treatments and related drainage systems.*

5.2.1 Sidewalk Recommendations

At the time of the Pedestrian Plan effort, there are approximately 14 miles of sidewalk in Dunn. The bulk of these existing sidewalks lie along the older downtown streets, while newer developments in the outskirts of the urban core have been constructed in the post 1950's era when automobiles became the primary mode of transportation for most people and the pedestrian was forgotten. Now that environmental, economic and health concerns have highlighted the many benefits of walking for transportation and recreation, many cities and towns across the state are looking at sidewalk retrofits to help complete the gaps in their existing sidewalk network.

Many of the proposed sidewalks for Dunn follow fairly major thoroughfares and help connect existing sidewalks, in addition to providing links between significant pedestrian destinations such as schools, shopping centers, parks and the downtown area. Many of the routes currently see a high rate of pedestrian use, but do not provide a safe pedestrian environment due to the lack of sidewalks, heavy traffic and/or high travel speeds, such as along Cumberland Street. These roads were chosen because of these factors, and because they ultimately will serve the most number of Dunn residents by connecting residential areas with major pedestrian generators.

Tables 5-1 and 5-2 below highlight sidewalk projects identified through field analysis and public feedback throughout the planning process. The "spot improvement" projects listed in Table 5-1 are short sidewalk segments that will fill gaps in the existing sidewalk network and create continuous pedestrian facilities to nearby destinations. These projects should all be considered short-term priorities and constructed as opportunity presents, such as during roadway

projects, new development or with new sidewalk program funds that become available. It should be noted that the cost estimates are for sidewalk installation on one side of the road only. Cost assumptions for these calculations are explained in Section 5.3.1.

Proposed Spot Improvement	From	To	Proposed Action	Length (Feet)	Estimated Cost
Carr	Clinton	Washington	2-block sidewalk gap project	789	$ 59,211
Cumberland	Washington	Wilmington	1-block sidewalk gap project	450	$ 22,500
General Lee	Pearsall	Broad	3-block sidewalk gap project	1118	$ 55,900
Guy*	Granville	Friendly	3-block sidewalk gap project	1160	$ 87,000
Johnson	Burke	Granville	1-block sidewalk gap project	305	$ 22,872
Orange	Surles	Barrington	2.5-block sidewalk gap project	1064	$ 53,183
Pope	Fayetteville	Clinton	3-block sidewalk gap project	1175	$ 58,727
Powell*	Ashe	Friendly	2-block sidewalk gap project	1607	$ 120,525
Vance	Washington	Codrington Park	2-block sidewalk gap project	1337	$100,240
TOTAL				**9005**	**$580,158**

Table 5-1. Proposed Spot Improvements in Alphabetical Order

** Indicates added cost for curb & gutter ($25/LF for C&G plus $50/LF for sidewalk)*

The more significant sidewalk projects identified through the public process are listed in Table 5-2 (below) and are further ranked into project "priorities" and a phased implementation schedule in Section 5.3. These projects represent longer sidewalk projects or "corridor" projects that create access to major local destinations. Prior to implementation, some of these sidewalks may require further study to address right-of-way constraints, drainage and grating issues, or other engineering concerns. Constructability will be impacted greatly by such constraints, so all innovative options should be considered including road diets instead of right-of-way purchase or the use of vegetated swales instead of curb-and-gutter.

Priority Rating	Proposed Sidewalk Location	From	To	Proposed Action
4	**Broad**	General Lee	Cumberland	Spot improvements and new sidewalk, near downtown.
5	**Clinton (US301)**	Cleveland	Granville	Sidewalk connection from downtown to major shopping.
2	**Cumberland 1 (US421)**	General Lee	Broad	New sidewalk, connecting downtown to Cumberland Square
16	**Cumberland 2 (US421)**	Broad	Powell	New sidewalk, connecting major shopping areas along US421.
28	**Cumberland 3 (US421)**	Powell	ETJ (Black River)	New sidewalk, connecting major shopping areas along US42.
24	**Cumberland 4 (US421)**	Sampson	Winterlochen	New sidewalk connecting over I-95 to new SE developments.
13	**Divine**	Canterbury	General Lee	Sidewalk connection in residential area near primary schools.
27	**Duke**	McKay	Hodges	New sidewalk, connects residents with Tart Park and Cemetery.
10	**Edgerton 1**	Fayetteville	Wilmington	Sidewalk connection from downtown/residential to shopping.
22	**Edgerton 2**	Wilmington	Holland	New sidewalk, near Codrington Park, shopping.
26	**Elm**	Duke	Jackson	New sidewalk, connect residential area with Tart Park.
15	**Erwin**	Tilghman	Cumberland	New sidewalk, connects Hospital area with commercial and residential.
25	**Fairground**	US301	Beale	New sidewalk, near Dunn Middle School.
17	**Friendly**	Powell	Fairground	New sidewalk, connects residential with Meadowlark and future trail.
21	**Granville 1 (US301)**	King	Johnson	New sidewalk connecting downtown/residential with park.
9	**Granville 2 (US301)**	Morris	King	New sidewalk connecting to downtown and shopping on US301.
30	**Jackson**	Hodges	Spring Branch	New sidewalk connecting to Tart Park.
6	**Johnson**	Railroad	Magnolia	Short 3-block sidewalk to connect downtown/residential area with park.
3	**Magnolia**	Edgerton	Johnson	New sidewalk; possible alternative for downtown trail.
7	**McKay 1**	Broad	Granville	New sidewalk connecting downtown/residential with Hospital area.
20	**McKay 2**	Susan Tart	Broad	New sidewalk in downtown/residential area.
*1**	**Meadowlark**	Fairground	Chelsea	New sidewalk connecting residential area with Dunn Middle School.
14	**Pearsall 1**	Watauga	Railroad	New sidewalk, near shopping area on US421.
18	**Pearsall 2**	Elm	Sampson	Spot improvement; creates continuous access in downtown residential
19	**Sampson**	Pearsall	Codrington Park	New sidewalk; future connection b/w residential area and Codrington
12	**Spring Branch**	Pope	Jackson	New sidewalk; connects near downtown residential to Tart Park.
23	**Susan Tart**	Tilghman	McKay	New sidewalk; connects to Hospital area.
29	**Tilghman**	Susan Tart	Erwin	New sidewalk; connects to Hospital area.
11	**Washington**	Hodges	Cleveland	New sidewalk; critical N-S link between residential and
8	**Wilson**	Edgerton	Granville	New sidewalk along 5 blocks to connect Granville area with downtown.

Table 5-2. Proposed sidewalk corridor projects in alphabetical order.

** NOTE: Meadowlark Road was moved up in priority by the Steering Committee to address student access to Dunn Middle School.*

Figure 5-2. Map of Existing Sidewalks and Final Sidewalk Recommendations

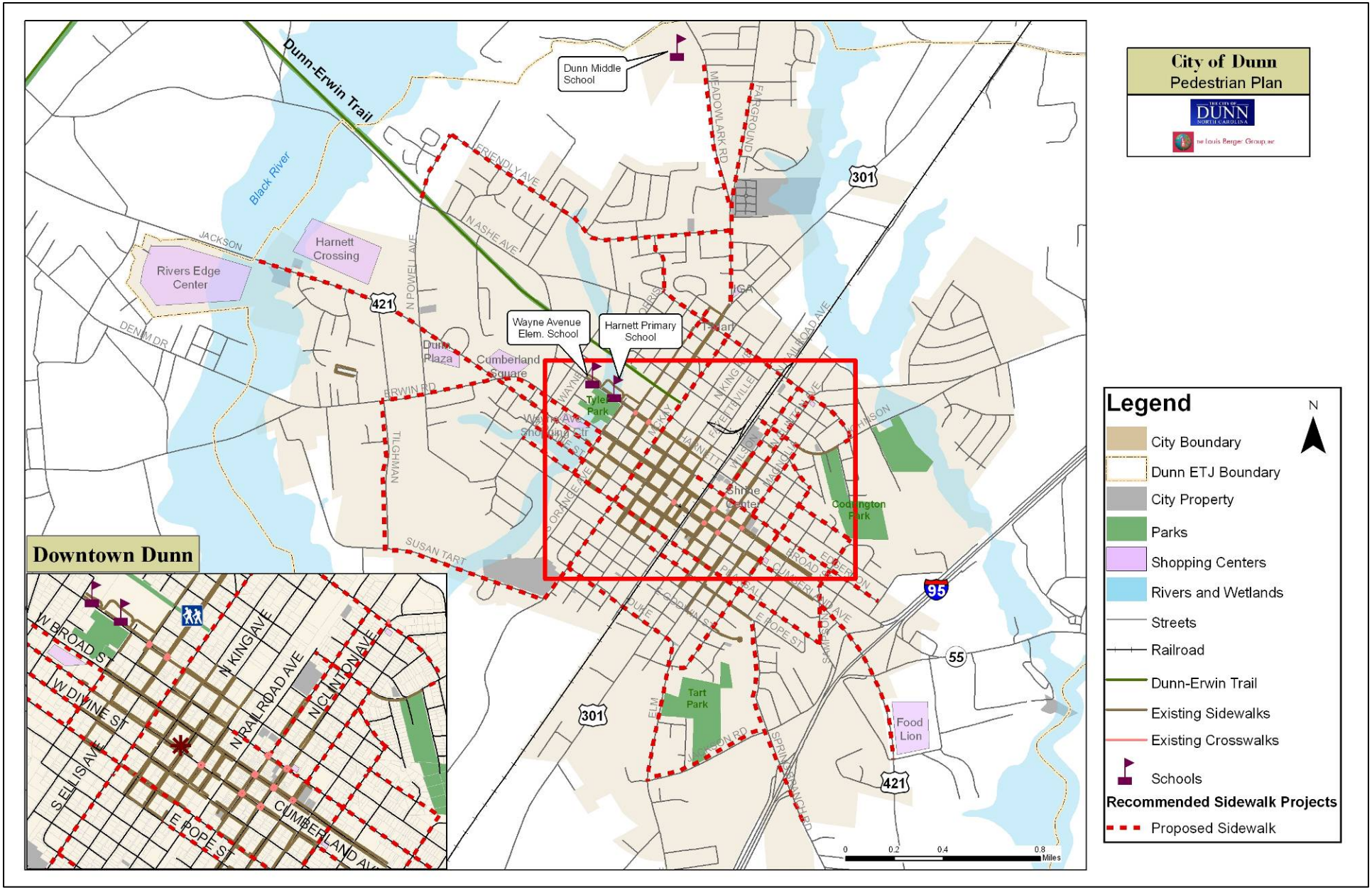


Figure 5-3. Greenway trail.
Source: www.pedbikeimages.org

The greenway cross-section provides two-way bicycle and pedestrian traffic. Bollards and markings (below) help ensure that only pedestrians and cyclists use the trail; the bollards can be of the lock-down variety to help emergency vehicles to gain access to the trail.

5.2.2 Greenway Recommendations

Shared-use paths, greenways and trails are among the terms used to describe off-road facilities for pedestrians, bicyclists, skaters and other non-motorized users. Such facilities are often along linear parks, stream buffers or green space corridors, and are favored by recreational and beginner cyclists for their scenic qualities. Dunn's seven mile rail-trail, the Dunn-Erwin trail, is widely favored and used by residents and visitors alike. The trail provides a popular connector between downtown Dunn and the neighboring town of Erwin, but also offers residents a transportation route to/from local neighborhoods and major local destinations such as Tyler Park, Harnett Primary School and Wayne Avenue Elementary School. The City has a wonderful opportunity to create additional greenways throughout the community to connect to the existing Dunn-Erwin trail, highlight local natural resources such as the Black River, and provide a convenient and accessible alternative for child and senior pedestrians.

Several trails are recommended in the Dunn Pedestrian Plan, including a "downtown trail" extension of the Dunn-Erwin rail-trail into historic downtown Dunn. Following existing sidewalks in the Central Business District, the downtown trail can be easily accomplished through the installation of signage and creation of a trail map. For other proposed trails, it may take years for the City to acquire contiguous easements through future development and right-of-way purchase for trail construction, but with the proper ordinances and policies in place, the City of Dunn is in a unique position to achieve a beautiful trail network through future development. These facilities can be a worthwhile investment and valuable asset for any community; in addition to providing transportation and recreational options for residents, greenway trails can be an economic development tool to attract tourists and newcomers, and have also been known to raise property values for adjacent landowners. The City of Dunn should consider policy changes and new ordinance language that requires dedication of trail easements for future construction and/or construction of connector trails to proposed and existing greenways during all new development.

Minimum easements for a greenway trail include width for a 10-14 foot trail surface, in addition to a minimum 4 foot buffer (2 foot on each side) with a recommended 10-20 foot buffer, depending on the nature of the corridor. Typically, a wider buffer provides a more scenic greenway. The City should consider inclusion of the recommended greenway trails into any future Open Space and Trails or Parks and Recreation Plans, and may also consider educating

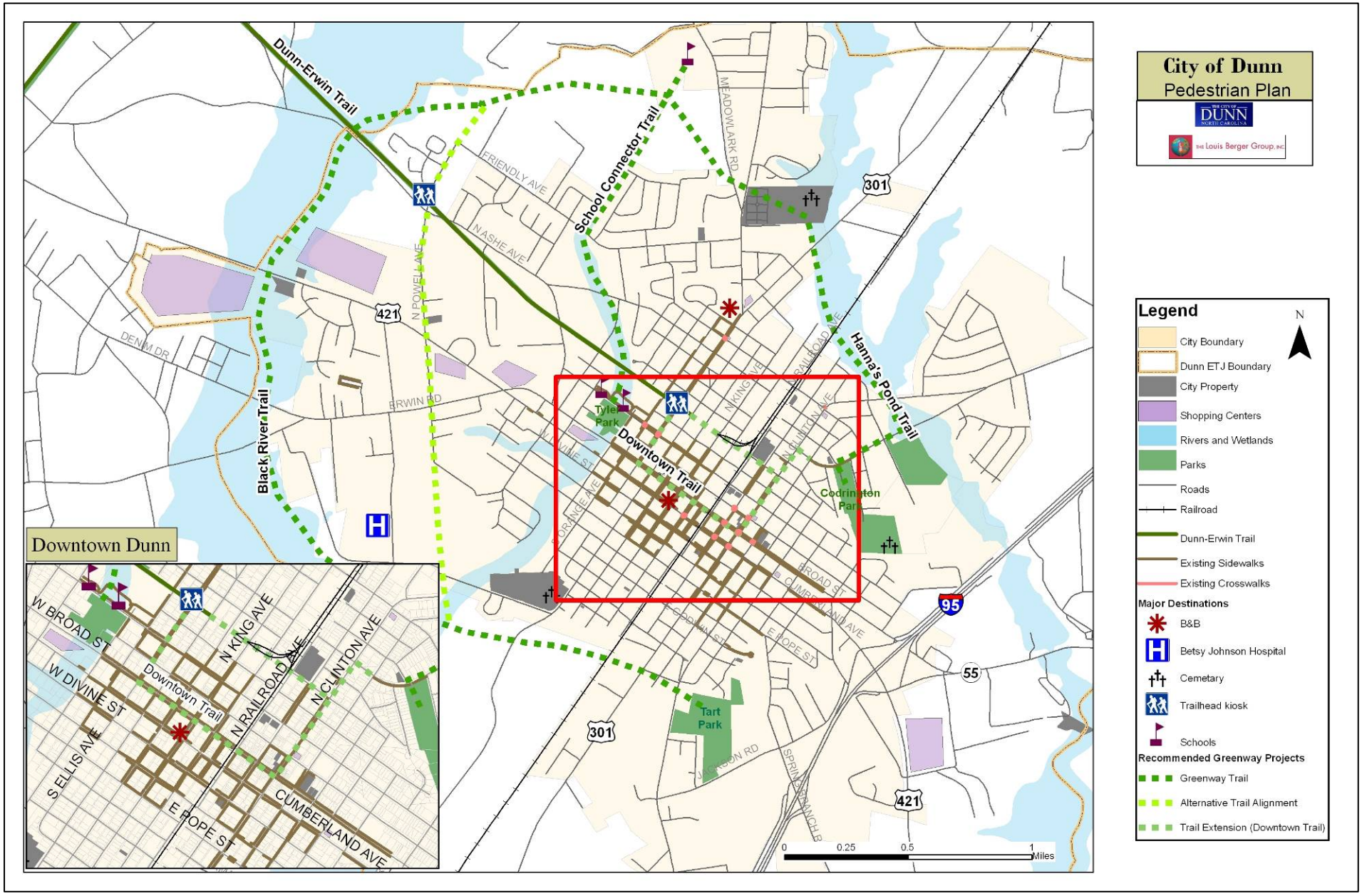
development review staff and developers on any new requirements for trail easements to ensure appropriate right-of-way dedication. Additionally, the City might work with the proposed Bicycle and Pedestrian Advisory Committee on concept development for the proposed greenway trails and related amenities.

Table 5-3 and Figure 5-4 describe proposed greenway locations.

Proposed Greenway Trail	From	To	Details	Alignment Details
Downtown Trail	Ellis Ave (Dunn-Erwin Trail)	Johnson Rd (Codrington Park)	The Downtown Trail will create an attractive walking route from the Dunn-Erwin trail through downtown Dunn, highlighting history, local shops and restaurants, as well as City landmarks. Total length = 9191ft (2,591ft new; 6,600ft existing sidewalk).	Suggested alignment is along sidewalk connections from Dunn-Erwin trailhead on Ellis Ave, along Broad St, up Clinton Ave, then over on Johnson Rd to Codrington Park.
School Connector Trail	Tyler Park	Dunn Middle School	The School Connector Trail provides safe off-road access between Dunn's two primary schools and the Middle School, as well as a recreational walking route from the northern part of the City to downtown and Tyler Park. Total length = 8,010 ft.	The suggested alignment is along a creek/wetland; alternative alignment part of the way is to construct a shared-use trail along Watauga Ave (between creek and roadway) from the school property, then connect to creek alignment up to Middle School.
Hanna's Pond Trail	Codrington Park	Dunn Middle School	Hanna's Pond Trail provides a scenic multi-use path along a wooded wetland area and provides an off-road walking route from Codrington Park to the middle school. Total length = 11,150 ft.	This trail creates an eastern portion of a loop trail for Dunn; this segment would connect to the "Black River Trail" below, creating a complete loop.
Black River Trail	Dunn Middle School	Tart Park	The Black River Trail offers a scenic recreational route for joggers, walkers and bicyclists to enjoy Dunn's riverfront, and also provides access to/from various destinations such as the middle school, Dunn-Erwin trail, Cumberland Avenue shopping centers, the Hospital and Tart Park. Total length = 26,000 ft.	This trail creates the western portion of a loop trail for Dunn and would connect to the "Swamp Trail" above. The proposed alignment is along the river's edge; an alternative is to use a multi-use trail connection along Powell St to create the north-south connection, bringing the loop closer to town but away from river.

Table 5-3. Proposed Multi-use Greenway Trails

Figure 5-4. Map of final greenway project recommendations



5.2.3 Recommended Crossing Improvements

Throughout the planning process, many of Dunn's intersections have been continuously highlighted by stakeholders as major barriers to pedestrian travel. Dunn has two United States highways that bisect the town (US 301 and US 421), each creating wide crossing distances for pedestrians attempting to access adjacent land uses, especially commercial centers that include grocery stores, convenient stores, pharmacies and restaurants. Additionally, the downtown area is bisected by active Norfolk-Southern railroad tracks and receives as many as 40 trains per day. This creates a major barrier for Dunn's walkable downtown, especially for physically-disabled pedestrians who will have difficulties crossing the tracks due to poor pavement condition, unsmooth surfaces and other unsafe conditions such as a lack of detectable warning strips (for the blind). Finally, the presence of I-95 in the eastern section of the City creates a barrier by preventing east-west pedestrian movement throughout the corridor, as well as by increasing traffic flow and speeds near the four interstate exits in the City.

Many intersections in Dunn can be greatly improved by adding crosswalks and, in the case of signalized intersections, countdown pedestrian signals (or "walk signals"). Other intersections may require crosswalks and pedestrian signals, as well as additional safety features such as pedestrian refuge islands or curb extensions. These additional treatments are often referred to as "traffic calming tools," and can be more expensive than paint of signals, but will greatly improve a wide intersection that creates an unsafe crossing situation for pedestrians. Pedestrian refuge islands are essentially medians wide enough to accommodate pedestrians who need a half-way point when crossing an intersection; medians allow a refuge where pedestrians can wait for traffic to slow or stop before attempting to cross. Curb extensions are used to tighten curb radii at intersections and make the intersection approaches closer to 90 degrees, so as to prevent fast-moving cars from treating wide turn angles as "slip lanes," which can be dangerous for pedestrians. Still other intersections may call for features such as special signage or innovative rail crossing treatments. These and other proposed treatment types are described in *Section 4: Design Guidelines* of the Plan.

Table 5-4 and Figure 5-7 describe proposed crossing treatments for Dunn. These crossing treatments were ranked based on input of the Steering Committee and stakeholders through various public meetings and involvement efforts, such as the pedestrian survey. Prioritization of crossings also took into account pedestrian

Figure 5-5 (above) Intersection of Commerce Drive and Cumberland Street. *The use of common intersection treatments such as crosswalks and pedestrian signals at signalized intersections, could greatly improve pedestrian safety at major intersections in Dunn.*

Figure 5-6 (below) Intersection of Erwin Road and Tilghman Road. *Wide corners or "curb radii" at intersections can encourage high-speed right-turning movements and create wider crossing distances for pedestrians at intersections. Intersection treatments called "curb extensions" can help create a safer environment for pedestrians in these instances.*

crash rates and severity, empirical safety concerns noted during various field visits by the consultant, and proximity of the crossing to schools, parks, shopping centers and other major attractors. The intersections of Cumberland Avenue with Wilmington Street and Washington Road, for instance, ranked as priorities number one and two, respectively. Pedestrians at these intersections were observed darting between traffic to cross the 5-lane section of Cumberland between a lower-income residential area and major commercial shopping district. These intersections should be evaluated for traffic light warrants (at one of the two cross streets) and/or pedestrian-activated countdown signals for safe pedestrian crossings. Other key intersections requiring safety improvements include busy railroad crossings, especially in the Central Business District. Intersections providing key connections to local schools are also ranked high, such as that of Ellis Avenue and Broad Street, which provides access between a sizeable neighborhood and Dunn's two elementary schools, or Meadowlark Road and Chelsea Street in front on Dunn Middle School.

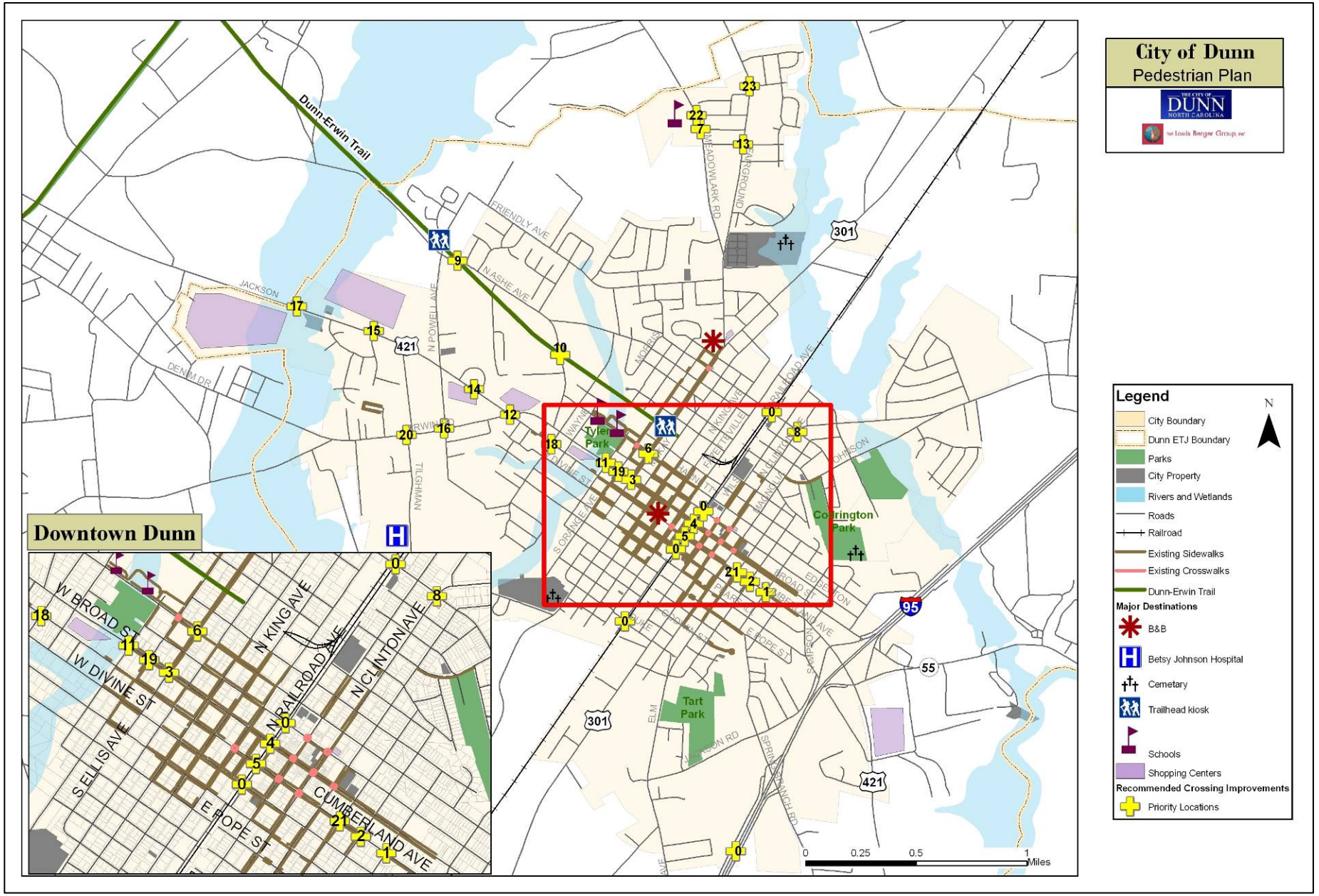
Note that all map ID numbers in Figure 5-7 that read "0" reflect the non-rated (NR) projects in Table 5-4. These projects were not rated due to the lack of existing sidewalk approaches to the intersection or railroad crossing, making them less of a priority than those that are crossed by sidewalk facilities. In the future, as new sidewalk or greenway is installed, these locations should be improved to provide safe and comfortable pedestrian crossings. The crossing of I-95 (southwest of Spring Branch Road) should be noted as a below-grade [tunneled] crossing opportunity. As noted in Section 3, all at-grade interstate crossings should be improved with future construction projects along I-95. Similarly, intersection projects along local streets can often be made in coordination (or incidental to) sidewalk projects, so all intersection improvements should be considered as sidewalks are installed during implementation of the Pedestrian Plan.

As indicated in Table 5-4, further study is needed on several projects prior to final implementation. For instance, in the case of the Meadowlark Road and Beasley Street intersection and the Fairground Road and Sycamore Street intersection, current pedestrian traffic may not warrant immediate improvements, but should be monitored after the installation of treatments at the Meadowlark Road and Chelsea Street intersection. If pedestrian traffic increases, future treatments should be installed to accommodate that future demand. The same is true for the Cumberland Street intersections at Elm Street and Canterbury Street.

Priority	Crossing Location	Description	Recommended Treatments
10	Ashe St & Dunn-Erwin Trail (north)	trail crossing near Martin St intersection	Install flashers, crosswalks & advanced pavement marking
9	Ashe St & Dunn-Erwin Trail (south)	trail crossing between Cole & Harnett	Install flashers, crosswalks & advanced pavement marking
3	Broad St & Ellis St	proposed downtown trail connection	Install crosswalks and pedestrian signals
11	Broad St & General Lee St	near Tyler Park & elementary schools	Install crosswalks, in-street "Yield to Peds" sign
19	Broad St & Orange St	near Tyler Park & elementary schools	Install crosswalks
4	Broad St & RR	Downtown CBD	Create sidewalk connections; add transition over tracks
17	Cumberland St & Black River Bridge	access to Rivers Edge Center	Add sidewalks & pedestrian railing to existing bridge
15	Cumberland St & Briarcliff Rd	Harnett Crossing entrance	Install xwalks & ped signals; expand median refuge; tighten radii
12	Cumberland St & Broad St	Cumberland Square shopping center	Close right "slip lanes" and tighten curb radii; install median refuge islands, crosswalks, ped signals
18	Cumberland St & Canterbury St	access to Tyler Park & schools	Further study needed
14	Cumberland St & Commerce Dr	Dunn Plaza entrance	Extend median refuge; install crosswalks and add pedestrian signals at existing traffic light
21	Cumberland St & Elm St	IGA crossing	Further study needed
5	Cumberland St & RR	Downtown CBD	Create sidewalk connections; add transition over tracks
2	Cumberland St & Washington St	IGA crossing	Install traffic signal at Wilmington St with ped signals
1	Cumberland St & Wilmington St	IGA crossing	May warrant traffic signal with ped signals and crosswalks
NR	Divine St & RR	downtown	Transition over tracks when/if sidewalk installed
NR	Duke St & RR	south-central downtown	Transition over tracks when/if sidewalk installed
NR	Edgerton & RR	downtown	Transition over tracks when/if sidewalk installed
16	Erwin Rd & Powell Rd	near Hospital	Install crosswalks & ped signals at existing traffic signal
20	Erwin Rd & Tilghman Rd	near Hospital	Install new signal with crosswalk & ped signals; tighten curb radii. A photo rendering of potential treatments for this location is included on page 73.
13	Fairground Rd & Beale St	access to Dunn Middle	Install traffic signal with ped signals
23	Fairground Rd & Sycamore St	access to Dunn Middle	Further study needed
8	Granville St & Clinton Ave	near IGA & Codrington Park	Install crosswalks and ped signals at existing traffic light
NR	Granville St & RR	north-central downtown	Transition over tracks when/if sidewalk installed
6	Harnett St & Ellis St	downtown, near Tyler Park & schools	Install crosswalks and ped signals; consider "No Right on Red"
22	Meadowlark Rd & Beasley St	access to Dunn Middle	Further study needed
7	Meadowlark Rd & Chelsea St	access to Dunn Middle	Consider in-street “Yield to Peds” sign during school hours
NR	I-95 Underpass	access to Food Lion shopping center	Consider underpass during future I-95 construction

Table 5-4. Proposed Intersection Improvements

Figure 5-7. Map of final crossing improvement recommendations by priority



5.3 Project Prioritization

Following project development, projects were then prioritized to help create a phased implementation plan for the City.

5.3.1 Sidewalk Prioritization and Phasing Schedule

As can be seen in Table 5-6, the proposed sidewalk projects are extensive – they cover approximately 17 miles of roadway in Dunn along thirty segments of twenty-three named roads. Even if Dunn plans to expand its budget for pedestrian facilities, it will still take a long time for all of these projects to be constructed. To help the City determine which projects to construct first, an analysis was performed to prioritize projects and create a recommended phasing schedule of short-term, mid-term, and long-term projects for construction.

Factors

Prioritization and scheduling were based on the following factors:

Public input: Comments from the Steering Committee and participants in the Open Houses, survey, and other public forums

Project characteristics: In the second Steering Committee meeting, committee members were asked to identify their priority projects regardless of cost. Members then discussed the key factors that contributed to projects receiving top priority. From this discussion, the following items were identified as important project characteristics to making a project a priority:

- Accessibility: Proximity to schools, parks, commercial areas and the Dunn-Erwin trail
- Safety: Measured by the average daily traffic (ADT) on the roadway where the sidewalk is proposed
- Connectivity: Project's potential to complete a critical connection from one location to another, measured by the project's connection to existing sidewalks

Constructability and Cost: Ease of constructing the project, including preliminary design analysis and engineering preparation, right-of-way purchase as well as actual construction.

Process

Project prioritization and scheduling was a layered process which incorporated all of the above factors in the following steps:

1. **Rate projects on key characteristics.** Projects were rated on accessibility, safety and connectivity. A project received points for any of the following characteristics:
   - **Accessibility**: *Schools*. Is a school located within the project limits?
     Yes, between .125 - .25 miles = 3 points
     Yes, between .25 - .5 miles = 2 points
     Yes, between .5 – 1 mile = 1 point
     No = 0 points
   - **Accessibility**: *Parks*. Is a park located within the project limits?
     Yes, between .125 - .25 miles = 3 points
     Yes, between .25 - .5 miles = 2 points
     Yes, between .5 – 1 mile = 1 point
     No = 0 points
   - **Accessibility**: *Commercial Areas.*. Is a major shopping venue located within the project limits?
     Yes, between .125 - .25 miles = 3 points
     Yes, between .25 - .5 miles = 2 points
     Yes, between .5 – 1 mile = 1 point
     No = 0 points
   - **Accessibility**: *Dunn-Erwin Trail*. Does the sidewalk project provide connections with the local trail system, i.e. is the Dunn-Erwin trail within the project limits?
     The sidewalk is proposed as a downtown trail connector = 4 points
     Yes, between .125 - .25 miles = 3 points
     Yes, between .25 - .5 miles = 2 points
     Yes, between .5 – 1 mile = 1 point
     No = 0 points
   - **Safety**. What is the average daily traffic (ADT) count of the roadway?
     Residential Street or Cul-de-Sac = 1
     Collector Street = 2
     Marginal Access Street = 3
   - **Connectivity**. Does the project link one destination to another by way of existing sidewalk?
     (Yes = 1 point, No = 0 points)

- **Constructability**. Will the project be difficult and/or expensive to construct, based on right-of-way constraints, existence or lack of curb and gutter, etc?
  (Very Difficult = 1, Least Difficult = 5)

Table 5-4 lists projects in order of priority ranking based on the above formula.

2. **Assess cost estimates and constructability.** Next, projects were assessed a cost estimate based on proposed treatments and existing conditions. Cost estimates for treatments were as follows:

   - *High Cost: > $200,000*
     - Generally, high cost projects entail construction of significant sections of sidewalk or installation of sidewalk on roadways without existing shoulder width to accommodate sidewalks as is. The latter would prove costly due to the need to pipe existing drainage ditches and install curb and gutter on roadways with shoulder sections.
   - *Moderate Cost: $100,000 - $200,000*
     - Projects in this range generally have some curb and gutter and are less lengthy sidewalk installations on roadways that may have some existing sidewalk in place.
   - *Low Cost: < $100,000*
     - Projects in this category are generally short sidewalk segments ("spot improvements") on roadways with adequate width to install new sidewalks without significant roadway engineering.

3. **Place projects into schedule.** The project cost analysis was then compared to the list of projects organized by rating to determine the appropriate phased implementation schedule. Projects which were estimated to be low cost and also received high ratings were placed in the short-term project category, whereas projects with high cost and low ratings were placed in the long-term project category. Mid-term projects included those projects with low costs and low ratings, and those with high cost but high ratings. By organizing projects in a short-term, mid-term,

and long-term fashion, the City has a list of projects that it can implement quickly in order to take immediate steps towards making Dunn more pedestrian-friendly in the interim before more intensive, long-term projects are undertaken. Table 5-5 and Figure 5-7 show projects organized into short-, mid-, and long-term phasing schedules.

5.3.2 Cost Assumptions

In order to complete the sidewalk phasing schedule outlined above, each proposed sidewalk project was assigned a generic cost estimate. Each cost estimate was calculated based on the length (in linear feet) of that segment and the presence or lack of curb and gutter. All cost estimates are for one-side only, though the ideal condition would be to have sidewalks on both sides of the street. The basic cost assumptions for the calculations in Table 5-6 are:

- Sidewalk (one-side): $50 per linear foot
- Curb and Gutter (one-side): $25 per linear foot

Source: NCDOT Division of Pedestrian and Bicycle Transportation

For each sidewalk project, the following cost factors may increase the per foot cost of constructing sidewalk by the amount shown inside the parentheses. These cost factors were not included in the generic estimates of Table 5-6 due to lack of data, but should be considered prior to implementation by a qualified engineer or engineering professional. All cost figures can be found in Appendix F.

1. Right-of-Way Constraints (cost varies). In some cases, there may not be sufficient right-of-way for sidewalk construction. Property negotiations and land acquisition would need to occur, significantly increasing the cost of the project.
2. Trees and Landscaping ($40). Sometimes, significant trees or landscaping are present in the right-of-way and will need to be removed for sidewalk construction.
3. Structure ($50). The presence of a bridge overpass/wing wall, building, or other structure potentially in the path of the proposed facility.
4. Ditching ($25). Some roadways have drainage ditches near the edge of pavement of the roadway, which would either force piping the ditch or moving the sidewalk further from the roadway and encroaching more on private right-of-way. Either way, project costs would increase as a result.
5. Utility ($15). The presence of utility poles in the path of a proposed sidewalk. As with trees, the sidewalk can be installed "behind" the utility poles, but again would increase the potential for right-of-way conflicts.

Priority Rating (by Rank)	Proposed Sidewalk Location	From	To	Weighted Rank
*1**	Meadowlark	Fairground	Chelsea	31
2	Cumberland 1 (US421)	General Lee	Broad	69
3	Magnolia	Edgerton	Johnson	68
4	Broad	General Lee	Cumberland	68
5	Clinton (US301)	Cleveland	Granville	59
6	Johnson	Railroad	Magnolia	57
7	McKay 1	Broad	Granville	56
8	Wilson	Edgerton	Granville	55
9	Granville 2 (US301)	Morris	King	54
10	Edgerton 1	Fayetteville	Wilmington	53
11	Washington	Hodges	Cleveland	51
12	Spring Branch	Pope	Jackson	51
13	Divine	Canterbury	General Lee	48
14	Pearsall 1	Watauga	Railroad	48
15	Erwin	Tilghman	Cumberland	48
16	Cumberland 2 (US421)	Broad	Powell	46
17	Friendly	Powell	Fairground	44
18	Pearsall 2	Elm	Sampson	44
19	Sampson	Pearsall	Codrington Park	44
20	McKay 2	Susan Tart	Broad	40
21	Granville 1 (US301)	King	Johnson	39
22	Edgerton 2	Wilmington	Holland	38
23	Susan Tart	Tilghman	McKay	33
24	Cumberland 4 (US421)	Sampson	Winterlochen	30
25	Fairground	US301	Beale	28
26	Elm	Duke	Jackson	27
27	Duke	McKay	Hodges	26
28	Cumberland 3 (US421)	Powell	ETJ (Black River)	25
29	Tilghman	Susan Tart	Erwin	23
30	Jackson	Hodges	Spring Branch	22

Table 5-5. Proposed sidewalk project locations by priority rank.

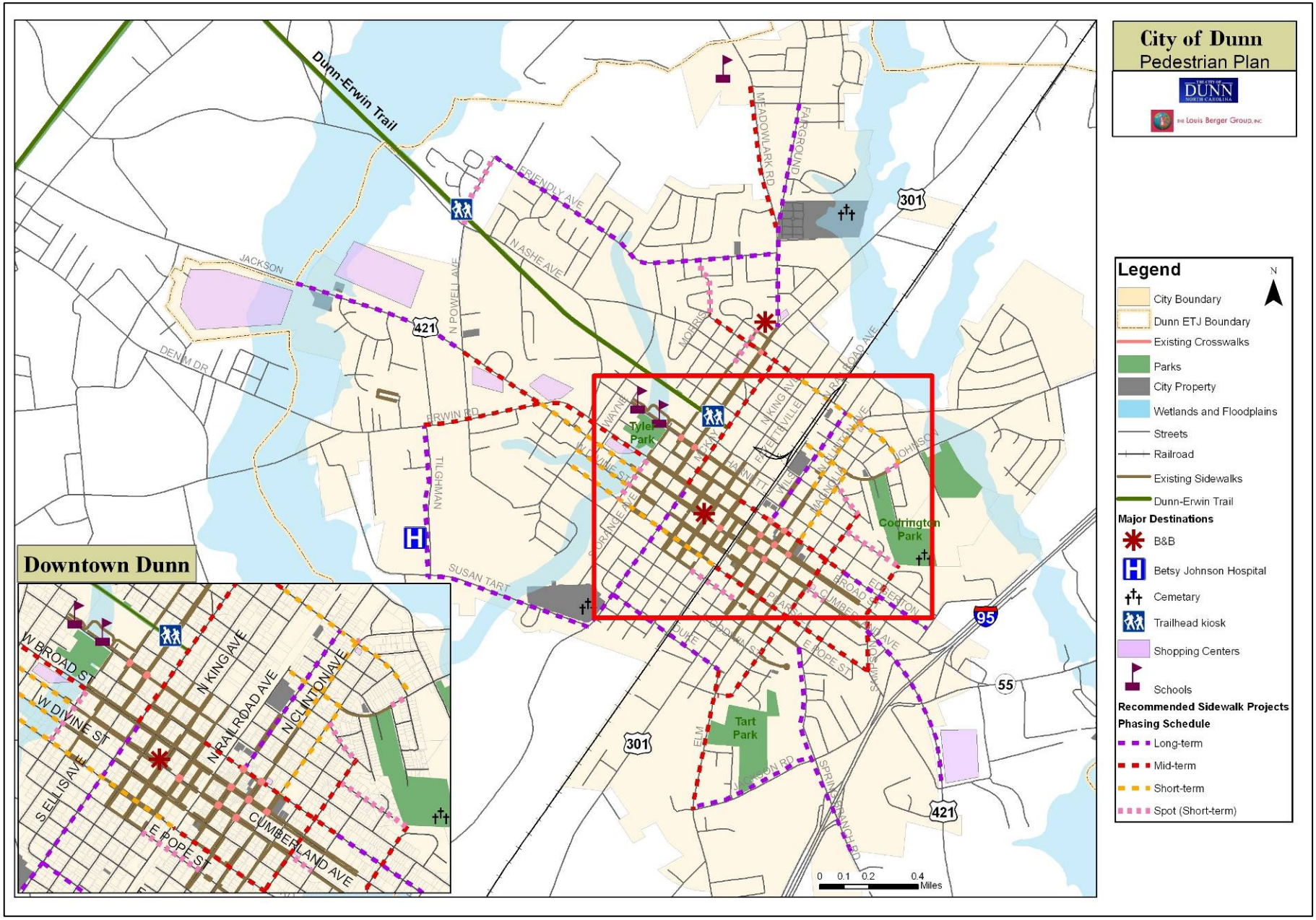
** NOTE: Meadowlark Road was moved up in priority by the Steering Committee to address access to Dunn Middle School.*

Phase	Proposed Sidewalk Corridor Project	From	To	Length (Feet)	Est. Project Cost
Short	**Cumberland 1 (US421)**	General Lee	Broad	2527	$126,329
Short	**Clinton (US301)**	Cleveland	Granville	1721	$86,071
Short	**Johnson**	Railroad	Magnolia	1077	$80,757
Short	**Divine**	Canterbury	General Lee	1354	$67,709
Short	**Pearsall 1**	Watauga	Railroad	4031	$130,550*
Short	**Granville 1 (US301)**	King	Johnson	2787	$139,348
Short	**Magnolia**	Edgerton	Johnson	1774	$133,067
Mid	**Broad**	General Lee	Cumberland	2525	$126,250
Mid	**McKay 1**	Broad	Granville	3217	$241,304
Mid	**Granville 2 (US301)**	Morris	King	2045	$122,657
Mid	**Edgerton 1**	Fayetteville	Wilmington	2714	$135,718
Mid	**Washington**	Hodges	Cleveland	5074	$380,521
Mid	**Erwin**	Tilghman	Cumberland	2534	$126,705
Mid	**Cumberland 2 (US421)**	Broad	Powell	2008	$150,608
Mid	**Pearsall 2**	Elm	Sampson	2475	$185,649
Mid	**Sampson**	Pearsall	Codrington Park	2464	$184,766
Mid	**Meadowlark**	Fairground	Chelsea	3086	$231,473
Mid	**Elm**	Duke	Jackson	3042	$228,181
Long	**Wilson**	Edgerton	Granville	2839	$212,908
Long	**Spring Branch**	Pope	Jackson	4600	$229,991
Long	**Friendly**	Powell	Fairground	6812	$510,878
Long	**McKay 2**	Susan Tart	Broad	3678	$275,854
Long	**Edgerton 2**	Wilmington	Holland	2148	$161,119
Long	**Susan Tart**	Tilghman	McKay	3613	$271,005
Long	**Cumberland 4 (US421)**	Sampson	Winterlochen	3860	$289,491
Long	**Fairground**	US301	Beale	4834	$362,579
Long	**Duke**	McKay	Hodges	2777	$208,268
Long	**Cumberland 3 (US421)**	Powell	ETJ (Black River)	3861	$289,563
Long	**Tilghman**	Susan Tart	Erwin	3275	$245,603
Long	**Jackson**	Hodges	Spring Branch	2709	$203,188
TOTAL				**91,461**	**$6,209,118**

Table 5-6. Proposed sidewalk project phasing

** 3-blocks (1,420 ft) of existing sidewalk deducted from total estimated cost for Pearsall 1 corridor project*

Figure 5-8. Map of recommended sidewalk project phasing.



5.3.3 Greenway Prioritization and Phasing

In order to implement the greenway trail recommendations of the Dunn Pedestrian Plan, the City will need to focus on policy actions that require greenway easements to be dedicated during future development and redevelopment projects. As of November 2008, the City's Code of Ordinances does not require dedication of right-of-way by a developer although a small incentive reducing the amount open space required by half is allowed (Sec. 22-59.8). It is recommended that the City amend this ordinance to require greenway easements and/or construction of trail segments along proposed trail corridors during all future development projects. Once a significant number of easements or trail segments are collected in a given corridor, the City should focus on completion of that greenway trail in full or as a significant trail corridor as part of the City's Capital Improvement Program.

In order to further plan for future implementation, the greenway trail projects have been prioritized into a suggested phasing schedule below. The suggested phasing schedule is a guide for implementation based on ease of construction, cost, available funding mechanisms and current conditions. It is recommended that the City conduct a Trails and Open Space planning effort to create a more detailed analysis of preferred trail alignments, design standards and implementation options. Costs below are based on a per mile figure for construction of 10ft paved greenway trail ($700,000 per mile) or 10ft crushed stone greenway trail ($100,000 per mile) and do not include land acquisition.

Phase	Proposed Greenway Trail	Total Trail Length	Estimated Cost (Paved Trail)	Estimated Cost (Unpaved Trail)
Short-term	**Downtown Trail**	9,191ft* (1.74 miles) *6,600ft existing sidewalk on Ellis, Broad and Clinton Streets plus 2,591ft new trail along the railroad easement from Ellis to Clinton Streets for a downtown "loop"	$ 343,000 (new trail) + signage	$ 49,000 (new trail) + signage
Mid-term	**School Connector Trail**	8,010 ft (1.52 miles)	$ 1,164,000	$ 152,000
Long-term	**Hanna's Pond Trail**	11,150 ft (2.11 miles)	$ 1,477,000	$ 211,000
Long-term	**Black River Trail**	26,000 ft (4.92 miles)	$ 3,444,000	$ 492,000

Table 5-7. Proposed Greenway Trail Phasing Schedule

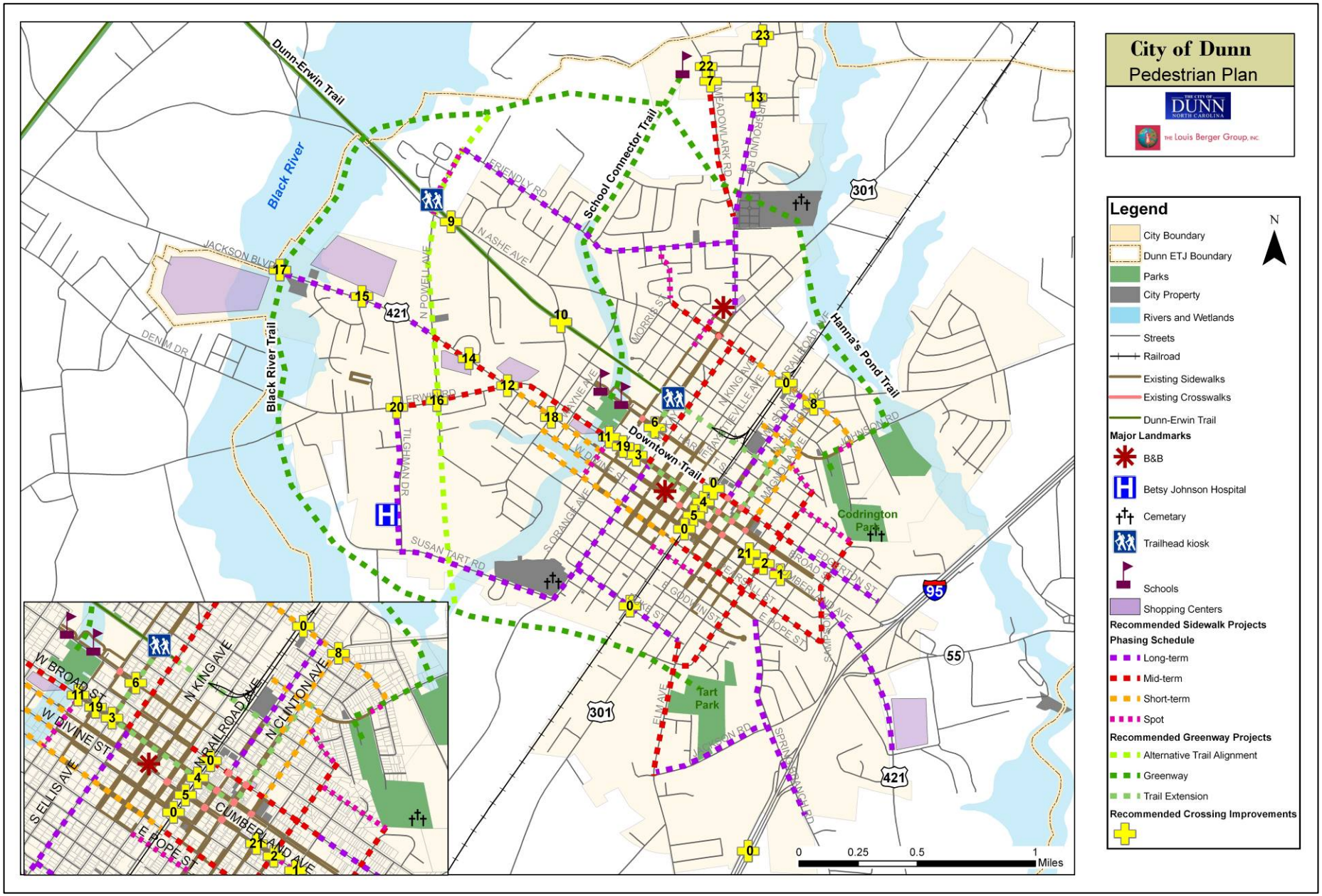
5.3.4 Intersection Prioritization and Phasing

Proposed crossing improvements are primarily located at existing intersections and have been placed into a phasing schedule based on their priority ranking. This phasing schedule should be used as a guide for implementation, but intersection improvements should be constructed as opportunities arise through future intersection or roadway construction projects. Further study by a professional engineer may be necessary prior to installation.

Phase	Priority	Crossing Location	Recommended Treatments	Estimated Cost
Short	*1*	**Cumberland St & Wilmington St**	New traffic signal with pedestrian signals and high-visibility crosswalks	$101,200
Short	*2*	**Cumberland St & Washington St**	Standard crosswalks for north-south crossings (Washington St legs)	$200
Short	*3*	**Broad St & Ellis St**	Add crosswalks and pedestrian signals to existing signalized intersection	$5,000
Short	*4*	**Broad St & RR**	Create sidewalk connections; add transition over tracks	$3,200
Short	*5*	**Cumberland St & RR**	Create sidewalk connections; add transition over tracks.	$3,200
Short	*6*	**Harnett St & Ellis St**	Crosswalks and pedestrian signals; "No Right on Red" signage (4 legs)	$5,360
Short	*7*	**Meadowlark Rd & Chelsea St**	Add mobile in-street "Yield to Peds" sign during school hours	$250
Short	*8*	**Granville St & Clinton Ave**	Add crosswalks and pedestrian signals to existing signalized intersection	$5,000
Mid	*9*	**Ashe St & Dunn-Erwin Trail (south)**	Install flashers, crosswalks & advanced "Ped Xing" pavement marking	$5,700
Mid	*10*	**Ashe St & Dunn-Erwin Trail (north)**	Install flashers, crosswalks & advanced "Ped Xing" pavement marking	$5,700
Mid	*11*	**Broad St & General Lee St**	Install high-visibility crosswalks and in-street "Yield to Peds" sign	$2,200
Mid	*12*	**Cumberland St & Broad St**	Tighten curb radii; install median refuge islands, crosswalks, ped signals	$35,000
Mid	*13*	**Fairground Rd & Beale St**	New traffic signal with pedestrian signals and high-visibility crosswalks	$101,200
Mid	*14*	**Cumberland St & Commerce Dr**	Extend median refuge; install crosswalks and pedestrian signals	$9,000
Mid	*15*	**Cumberland St & Briarcliff Rd**	Crosswalks & pedestrian signals; extend median refuge; tighten radii	$35,000
Mid	*16*	**Erwin Rd & Powell Rd**	Add crosswalks and pedestrian signals to existing signalized intersection	$5,000
Mid	*17*	**Cumberland St & Black River Bridge**	Add sidewalks & pedestrian railing to existing bridge	N/A
Mid	*18*	**Cumberland St & Canterbury St**	Further study needed	N/A
Mid	*19*	**Broad St & Orange St**	Install high-visibility crosswalks	$ 1,200
Long	*20*	**Erwin Rd & Tilghman Rd**	New traffic signal with crosswalk & pedestrian signals; tighten curb radii	$121,200
Long	*21*	**Cumberland St & Elm St**	Further study needed	N/A
Long	*22*	**Meadowlark Rd & Beasley St**	Further study needed	N/A
Long	*23*	**Fairground Rd & Sycamore St**	Further study needed	N/A
Long	*NR*	**Granville St & RR**	Transition over tracks when/if sidewalk installed	$3,200
Long	*NR*	**Divine St & RR**	Transition over tracks when/if sidewalk installed	$3,200
Long	*NR*	**Duke St & RR**	Transition over tracks when/if sidewalk installed	$3,200
Long	*NR*	**Edgerton & RR**	Transition over tracks when/if sidewalk installed	$3,200
Long	*NR*	**I-95 Underpass**	Construct pedestrian underpass during future I-95 construction	$4 million

Table 5-8. Suggested phasing schedule for proposed crossing improvements

Figure 5-9. System map of all recommended sidewalks, greenways and crossing improvements



5.4 Other Physical Improvements

Beyond the construction of new sidewalks and greenways, there are a number of actions and improvements to the physical environment that can greatly improve pedestrian conditions at a fairly low cost. Sidewalk maintenance, for instance, can increase accessibility along existing walkways, especially for wheelchair users, as well as decrease liability for the City. In Dunn, many sidewalks in the older downtown neighborhoods have been overgrown by grass from adjacent lawns and could be "unearthed" and cleared to provide pedestrian access at a fraction of the cost of new sidewalk construction. Also, the development of parks and open space areas can complement other pedestrian amenities and provide "rest stops" for walkers and runners. Finally, the improvement of local intersections with crosswalk and pedestrian signal installations can drastically help improve safety on many walking routes, and crosswalks can be maintained annually to correct fading. Below are some additional ideas for "non-construction" projects:

- Create a regular maintenance schedule for existing sidewalks and crosswalks.
- Work with the NCDOT Rail Division and CSX to improve the conditions of pedestrian crossings of the railroad, especially those identified in this Plan, making smoother transitions over the railroad tracks and providing aesthetic enhancements.
- Create pocket parks that provide refuge along a system of walking trails; an example of one such location would be the abandoned rail car location. Connecting these park areas with signature landscaping and gateway treatments would help to improve and coordinate the aesthetics of the City.
- Consider developing a pedestrian focus area at East Denim Drive/Erwin Road and Powell Avenue to accommodate the new residential development taking place at this location, and that could be connected to nearby shopping opportunities.
- Provide pedestrian-scale lighting, street trees and landscaping, alleyway improvements and other enhancements to the downtown walking environment during upcoming streetscaping project in Downtown Dunn.
- Improve local alleyways to make them more user-friendly for pedestrians through better lighting and landscaping. One recommended improvement would be to enhance the attractiveness of the alley connecting planned Parking Lot #2 to Broad Street, potentially converting it to a pedestrian-only access at some future time. Other immediate options would be to install lighting and use landscaping planters to create a nice pedestrian walkway.

- Formalize a citywide 35mph speed limit (unless otherwise signed) and post related warning signs at the gateway entrances into the City, such as off of I-95.
- Create a system of pedestrian wayfinding signs and complementary route maps for the downtown walking trail - the "DuWalk" trail - proposed in Section 6.
- Consider the use of in-street "Yield to Pedestrians" signage at problem intersections.
- Install street lighting as necessary along dark corridors for pedestrian safety.

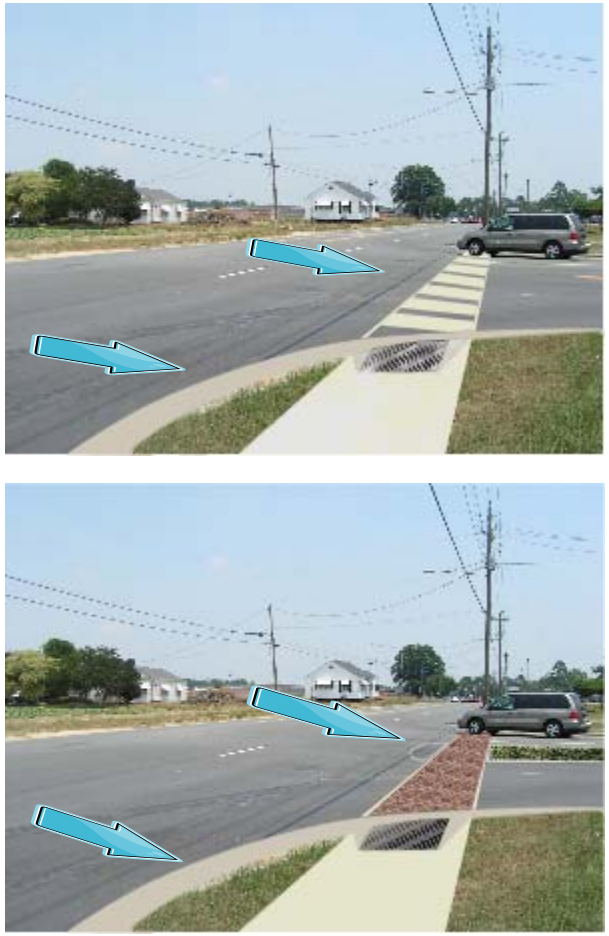


Figure 5-10. *This photograph illustrates the wide curb radius at the Erwin Rd and Tilghman Rd intersection. The images to the right illustrate possible treatments including a curb extension and high-visibility crosswalk (top), or a combination of the curb extension treatment with a textured asphalt crosswalk and median refuge island for added pedestrian safety and comfort (bottom).*