DESIGN GUIDELINES 6

CHAPTER OUTLINE:

6.0 OVERVIEW

These recommended guidelines originate from and adhere to national design standards as defined by the American Association of State Highway Transportation Officials (AASHTO), the Americans with Disabilities Act (ADA), the Federal Highway Administration (FHWA) Pedestrian Facilities Users Guide, the Manual on Uniform Traffic Control Devices (MUTCD), and the NCDOT. Another major source of information in this chapter is the Pedestrian and Bicycle Information Center, found online at http://www.walkinginfo.org. Should the national standards be revised in the future and result in discrepancies with this chapter, the national standards should prevail for all design decisions. A qualified engineer or landscape architect should be consulted for the most up to date and accurate cost estimates.

The sections below serve as an inventory of pedestrian design elements/treatments and provide guidelines for their development. These treatments and design guidelines are important because they represent minimum standards for creating a pedestrian-friendly, safe, accessible community. The guidelines are not, however, a substitute for a more thorough evaluation by a landscape architect or engineer upon implementation of facility improvements. Some improvements may also require cooperation with the NCDOT for specific design solutions.

6.1 PEDESTRIAN WALKWAYS

SIDEWALKS AND WALKWAYS

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

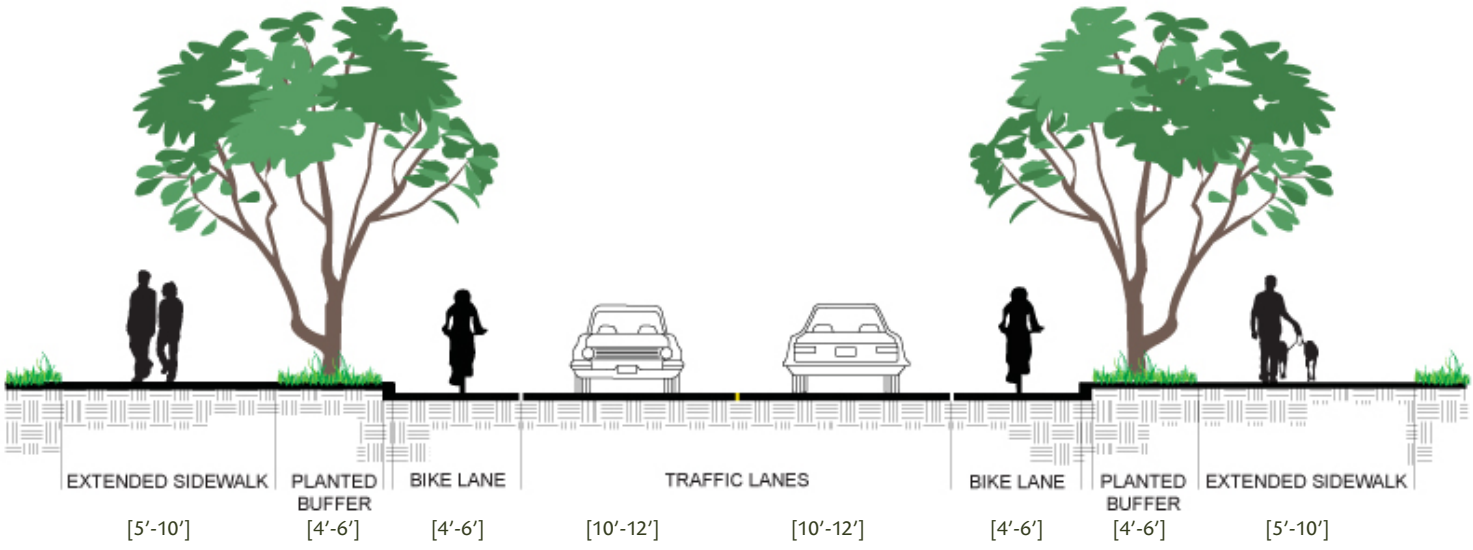
There are a number of options for different settings, for both downtown Pittsboro and more rural and/or suburban areas. From a wide promenade to, in the case of a more rural environment, a simple asphalt or crushed stone path next to a secondary road, walkway form and topography can vary greatly. In general, sidewalks are constructed of concrete although there are some successful examples where other materials such as asphalt, crushed stone, or other slip resistant material have been used. The width of the walkways should correspond to the conditions present in any given location (i.e. level of pedestrian traffic, building setbacks, or other important natural or cultural features). FHWA (Federal Highway Administration) and the Institute of Transportation Engineers both suggest five feet as the minimum width for a sidewalk. This is considered ample room for two people to walk abreast or for two pedestrians to pass each other. Often downtown areas, near schools, transit stops, or other areas of high pedestrian activity call for much wider sidewalks.

A well designed residential sidewalk will have a width of at least five feet. (Image from http://www.walkinginfo.org)

Sidewalk with a vegetated buffer zone. Notice the sense of enclosure created by the large canopy street trees. (Image from http://www.walkinginfo.org)

Sidewalks are typically built in curb and gutter sections but can also be planned in coordination with ditches or planted swales. They need to be kept completely free of obstructions such as utility poles, trash cans, overgrown bushes, etc. A four to eight foot buffer zone parallel to the sidewalk or walkway is recommended to separate pedestrian traffic from automobile traffic and to keep the sidewalk free of light pole obstructions. Much like the sidewalk and walkway itself, the form and topography of this buffer will vary greatly. Native street tree plantings have historically proven to work successfully within these buffer zones. They regulate micro-climate, create a desirable sense of enclosure, promote a local ecological identity and connection to place, and can act as a pleasant integration of nature into an urban environment. In the event that vegetation is not possible, a row of parked cars, bike lane, or street furniture can be used to create this buffer.

Below: Typical street with bike lanes and adjacent sidewalk.



SIDEWALKS AND WALKWAY GUIDELINES:

- Concrete is preferred surface, providing the longest service life and requiring the least maintenance. Permeable pavement such as porous concrete may be considered to improve water quality.

- Sidewalks should be built as flat as possible to accommodate all pedestrians; they should have a running grade of five percent or less; with a two percent maximum cross-slope.

- Concrete sidewalks should be built to minimum depth of four inches; six inches at driveways.

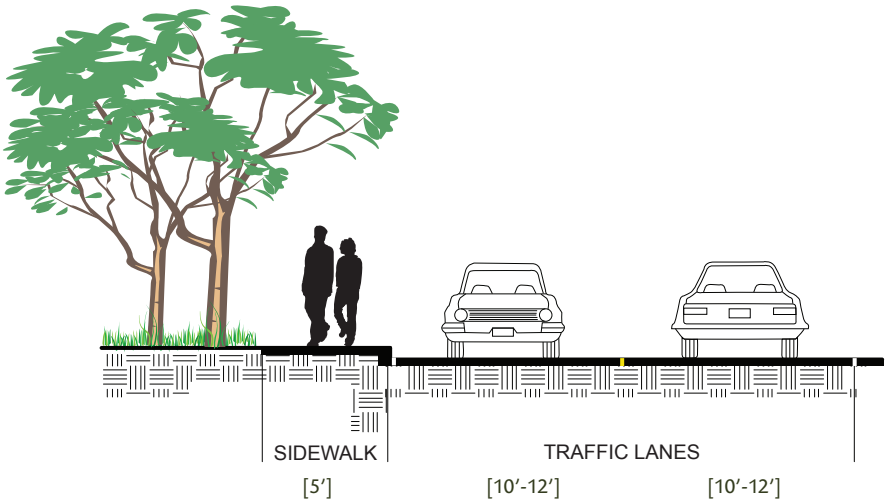
- Sidewalks should be a minimum of five feet wide; sidewalks serving mixed use and commercial areas shall be a minimum of 8 ft in width (12–15 feet is required in front of retail storefronts).

- Buffer zone of two to four feet in local or collector streets; five to six feet in arterial or major streets and up to eight feet in busy streets and downtown to provide space for light poles and other street furniture. See the Vegetation section later in this chapter for shade and buffer opportunities of trees and shrubs.

- Motor vehicle access points should be kept to minimum.

- In Pittsboro, if a sidewalk with buffer on both sides is not feasible due to topography and right-of-way constraints, then a sidewalk on one side is better than no facility. Each site should be examined in detail to determine placement options.

Right: Where space and topography are limiting, this cross section may be applied.

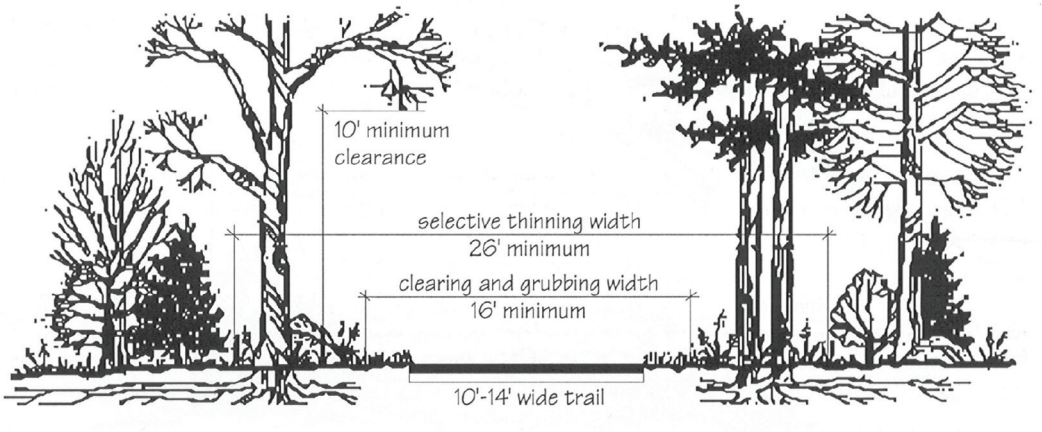


GREENWAY TRAIL

A greenway is defined as a linear corridor of land that can be either natural, such as rivers and streams, or manmade, such as abandoned railroad beds and utility corridors. Most greenways contain trails. Greenway trails can be paved or unpaved, and can be designed to accommodate a variety of trail users, including bicyclists, walkers, hikers, joggers, skaters, horseback riders, and those confined to wheelchairs.

Single-tread, multi-use trails are the most common trail type in the nation. These trails vary in width and can accommodate a wide variety of users. The minimum width for two-directional trails is 10', however 12'-14' widths are preferred where heavy traffic is expected. Centerline stripes should be considered for paths that generate substantial amounts of pedestrian traffic, or along curved portions of the trail, where sight-lines are limited. Possible conflicts between user groups must be considered during the design phase, as cyclists often travel at a faster speed than other users. Radii minimums should also be considered depending on the different user groups.

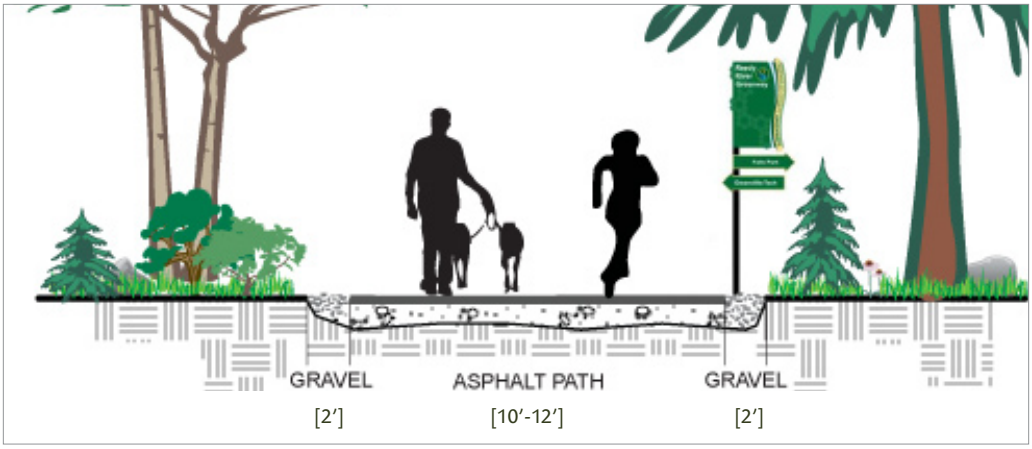
While the vegetative clearing needed for these trails varies with the width of the trail. The minimum width for clearing and grubbing a 14' wide trail is 16'. Selective thinning increases sight lines and distances and enhances the safety of the trail user. This practice includes removal of underbrush and limbs to create open pockets within a forest canopy, but does not include the removal of the forest canopy itself.



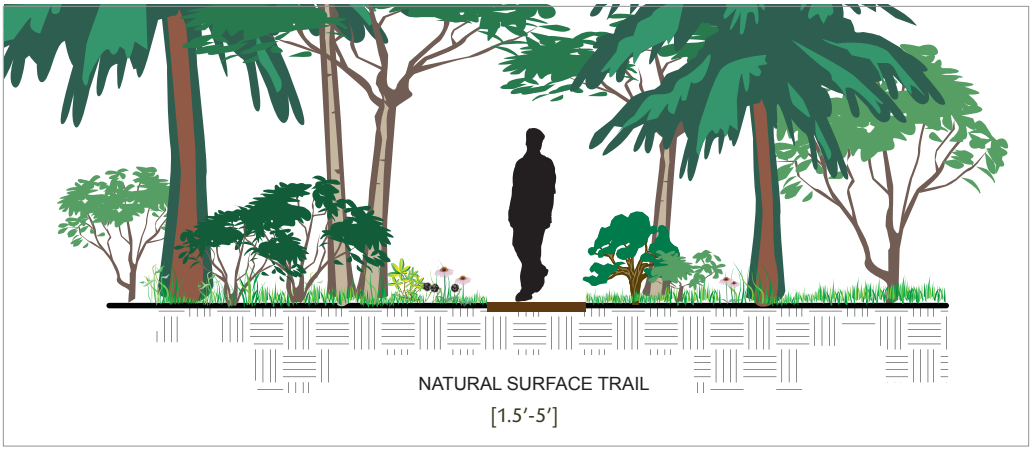
Left: Vegetation clearing guidelines

Typical pavement design for a paved, off-road, multi-use trail should be based upon the specific loading and soil conditions for each project. Asphalt or concrete trails should be designed to withstand the loading requirements of occasional maintenance and emergency vehicles.

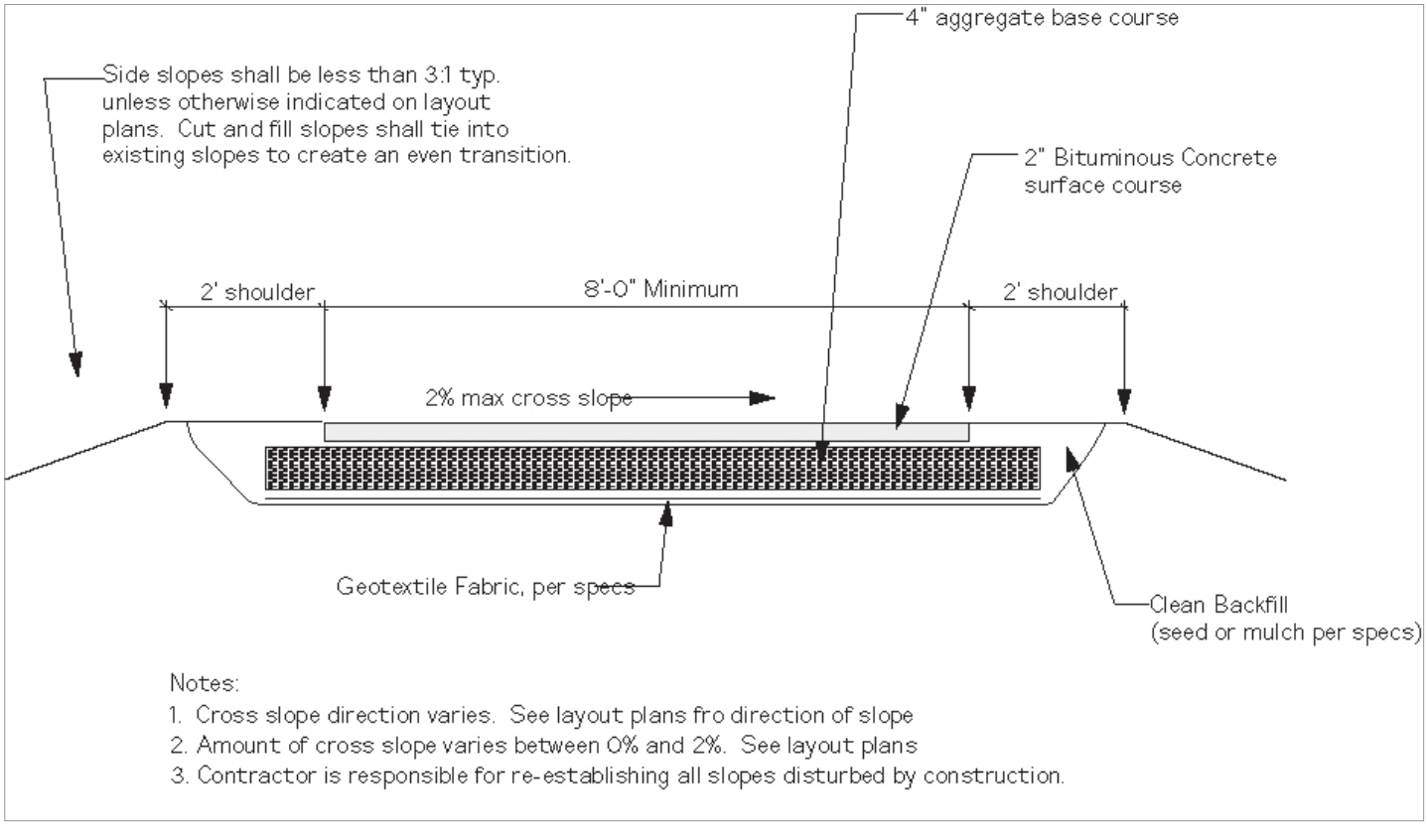
Right: Typical asphalt path section



Right: Typical natural surface trail section



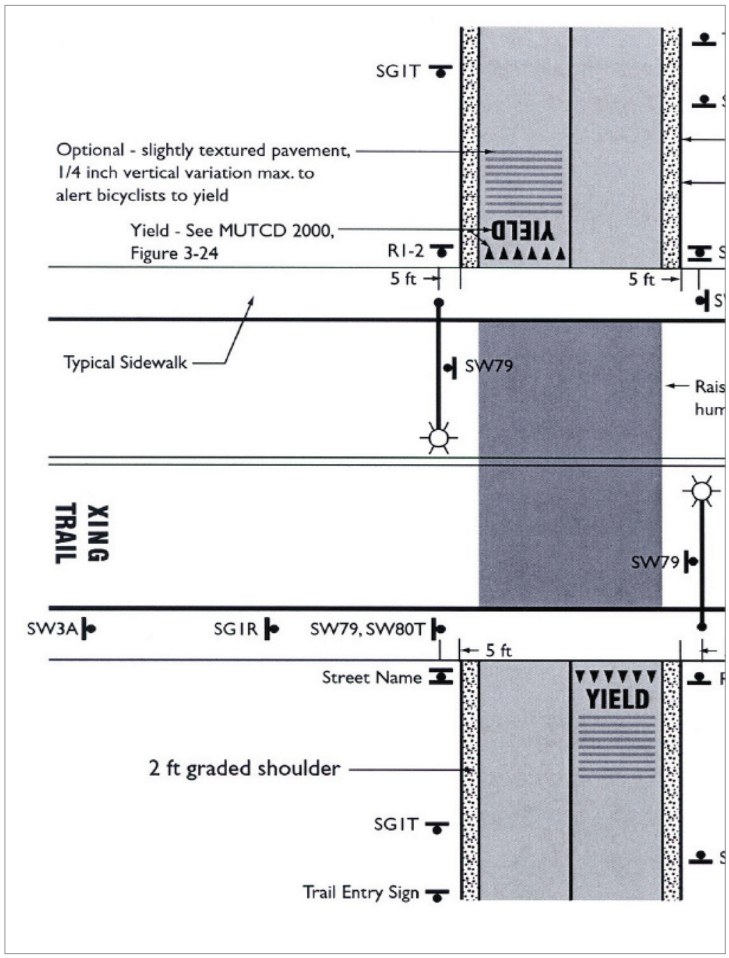
Below: Asphalt pavement construction detail



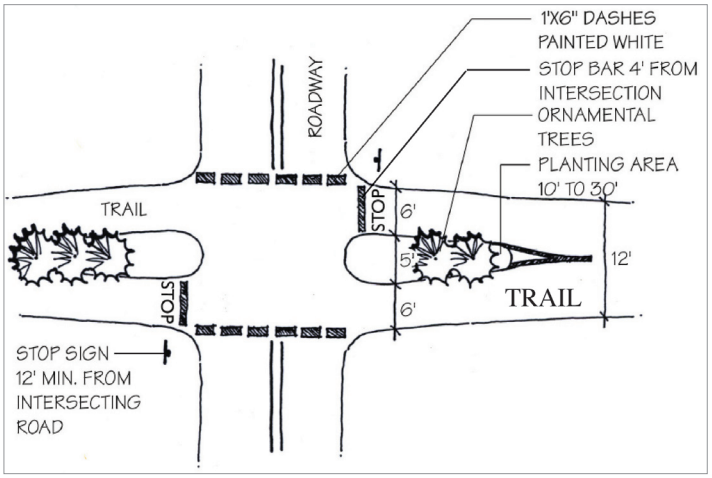
Concrete: In areas prone to frequent flooding, it is recommended that concrete be used because of its excellent durability. Concrete surfaces are capable of withstanding the most powerful environmental forces. They hold up well against the erosive action of water, root intrusion and subgrade deficiencies such as soft soils. Most often, concrete is used for intensive urban applications. Of all surface types, it is the strongest and has the lowest maintenance requirement, if it is properly installed.

Asphalt: Asphalt is a flexible pavement and can be installed on virtually any slope. One important concern for asphalt trails is the deterioration of trail edges. Installation of a geotextile fabric beneath a layer of aggregate base course (ABC) can help to maintain the edge of a trail. It is important to provide a 2' wide graded shoulder to prevent trail edges from crumbling.

Trail and Roadway Intersections: The images below present detailed specifications for the layout of intersections between trail corridors and roadways. Signage rules for such intersections are available in the Manual for Urban Traffic Control Devices (MUTCD).



Typical greenway trail crossing a roadway



Typical greenway trail approach to a roadway

6.2 PEDESTRIAN FACILITY ELEMENTS

MARKED CROSSWALKS

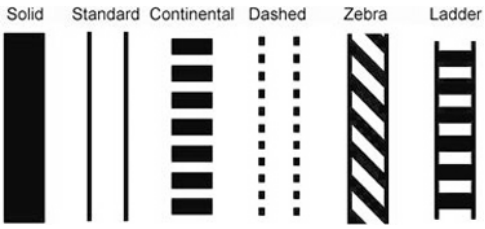
Notice the wide, well marked crosswalk with a crossing island in the middle. The crosswalk size and street furniture decoration make this a safe and visible pedestrian crossing (Image from http://www.walkinginfo.org).

A marked crosswalk designates a pedestrian right-of-way across a street. It is often installed at controlled intersections or at key locations along the street (a.k.a. mid-block crossings) and in this Plan are prescribed for the downtown area, school areas, along East Street and West Street (US 64) and key residential and commercial areas where pedestrian activity is greatest. Although marked crosswalks provide strong visual clues to motorists that pedestrians are present, it is important to consider the use of these elements in conjunction with other traffic calming devices to fully recognize low traffic speeds and enhance pedestrian safety. In general, "marked crosswalks should not be installed in an uncontrolled environment [at intersections without traffic signals] where speeds exceed 40 mph" (AASHTO, 2004). Every attempt should be made to install crossings at the specific point at which pedestrians are most likely to cross: a well-designed traffic calming location is not effective if pedestrians are instead using more seemingly convenient and potentially dangerous location to cross the street.

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

A variety of patterns are possible in designating a crosswalk; an example of a 'continental' design is shown above.

There is a variety of form, pattern, and materials to choose from when creating a marked crosswalk. It is important however to provide crosswalks that are not slippery, are free of tripping hazards, or are otherwise difficult to maneuver by any person including those with physical mobility or vision impairments. Although attractive materials such as inlaid stone or certain types of brick may provide character and aesthetic value, the crosswalk can become slippery. Potential materials can be vetted by requesting case studies from suppliers regarding where the materials have been successfully applied. Also, as some materials degrade from use or if they are improperly installed, they may become a hazard for the mobility or vision impaired.



A variety of color or texture may be used to designate crossings. These materials should be smooth, skid-resistant, and visible. Reflective paint is inexpensive but is considered more slippery than other devices such as inlay tape or thermoplastic. A variety of patterns may be employed as detailed at left. In areas with a high volume of pedestrian traffic, particularly at mid-block crossings, a crosswalk can be raised to create both a physical impediment for automobiles and a reinforced visual clue to the motorist. These can be provided on top of a speed table.

An engineering study may need to be performed to determine the appropriate width of a crosswalk at a given location, however marked crosswalks should not be less than six feet in width. In downtown areas or other locations of high pedestrian traffic, a width of ten feet or greater should be considered.

CROSSWALK GUIDELINES:

- Should not be installed in an uncontrolled environment where speeds exceed 40 mph.

- Crosswalks alone may not be enough and should be used in conjunction with other measures to improve pedestrian crossing safety, particularly on roads with average daily traffic (ADT) above 10,000 (East Street and 15-501).

- Width of marked crosswalk should be at least six feet; ideally ten feet or wider in downtown areas.

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

- Crosswalk markings should extend the full length of the crossings.

- Crosswalk markings should be white per MUTCD.

- Either the 'continental' or 'ladder' patterns are recommended for intersection improvements in Pittsboro for aesthetic and visibility purposes. Lines should be one to two feet wide and spaced one to five feet apart.

ADVANCE STOP BARS

Moving the vehicle stop bar 15–30 feet back from the pedestrian crosswalk at signalized crossings and mid-block crossings increases vehicle and pedestrian visibility. Advance stop bars are 1–2 feet wide and they extend across all approach lanes at intersections. The time and distance created allows a buffer in which the pedestrian and motorist can interpret each other's intentions. Studies have shown that this distance translates directly into increased safety for both motorist and pedestrian. One study in particular claims that by simply adding a "Stop Here for Pedestrians" sign reduced pedestrian motorist conflict by 67%. When this was used in conjunction with advance stop lines, it increased to 90% (Pedestrian and Bicycle Information Center: http://www.walkinginfo.org/engineering/crossings-enhancements.cfm).

CURB RAMPS

Curb ramps are critical features that provide access between the sidewalk and roadway for wheelchair users, people using walkers, crutches, or handcarts, people pushing bicycles or strollers, and pedestrians with mobility or other physical impairments. In accordance with the 1973 Federal Rehabilitation Act and to comply with the 1990 Federal ADA requirements, curb ramps must be installed at all intersections and mid-block locations where pedestrian crossings exist (Pedestrian and Bicycle Information Center: http://www.walkinginfo.org/engineering/roadway-ramps.cfm). In addition, these federal regulations require that all new constructed or altered roadways include curb ramps. Although the federally prescribed maximum slope for a curb ramp is 1:12 or 8.33% and the side flares of the curb ramp must not exceed a maximum slope of 1:10 or 10.0%, it is recommended that much less steep slopes be used whenever possible.

It is also recommended that two separate curb ramps be provided at each intersection (see image below). With only one large curb ramp serving the entire corner, there is not safe connectivity for the pedestrian. Dangerous conditions exist when the single, large curb ramp inadvertently directs a pedestrian into the center of the intersection, or in front of an unsuspecting, turning vehicle.

For additional information on curb ramps see Accessible Rights-of-Way: A Design Guide, by the U.S. Access Board and the Federal Highway Administration, and Designing Sidewalks and Trails for Access, Parts I and II, by the Federal Highway Administration. Visit: www.access-board.gov for the Access board's right-of-way report.

CURB RAMP GUIDELINES:

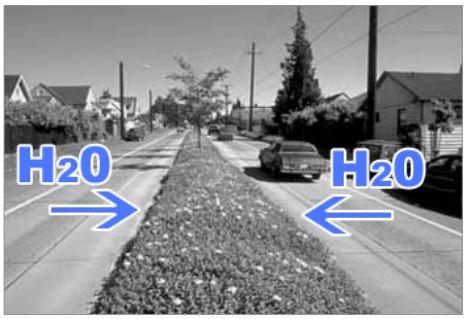
- Two separate curb ramps, one for each crosswalk, should be provided at corner of an intersection.

- Curb ramp should have a slope no greater than 1:12 (8.33%). Side flares should not exceed 1:10 (10%).

Curb ramps shown have two separate ramps at the intersection (visable across the street) (Image from http://www.walkinginfo.org).

RAISED OR LOWERED MEDIANS

Medians are barriers in the center portion of a street or roadway. When used in conjunction with mid-block or intersection crossings, they can be used as a crossing island to provide a place of refuge for pedestrians. They also provide opportunities for landscaping that in turn can help to slow traffic. A center turn lane can be converted into a raised or lowered median thus increasing motorist safety.



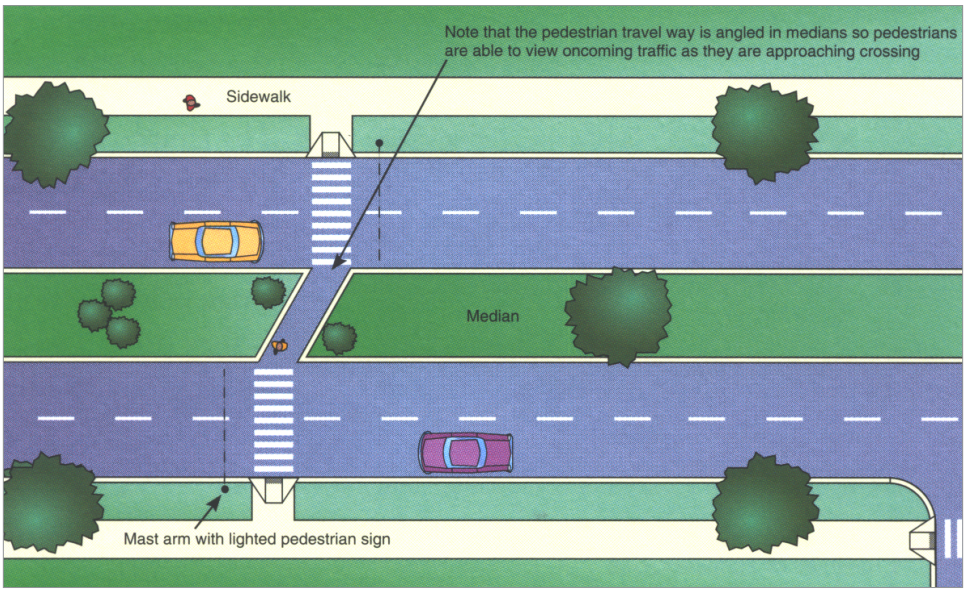
Above: an attractive lowered and landscaped median that collects stormwater, yet appears to be raised. (Image from AASHTO)

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

Raised or lowered medians are best suited for high-volume, high-speed roads, and they should provide ample cues for people with visual impairments to identify the boundary between the crossing island and the roadway.

MEDIAN GUIDELINES:

- Median pedestrian refuge islands should be provided as a place of refuge for pedestrians crossing busy or wide roadways at either mid-block locations or intersections. They should be utilized on high speed and high volume roadways.
- Medians should incorporate trees and plantings to change the character of the street and reduce motor vehicle speed.
- Landscaping should not obstruct the visibility between motorists and pedestrians.
- Median crossings should provide ramps or cut-throughs for ease of accessibility for all pedestrians.

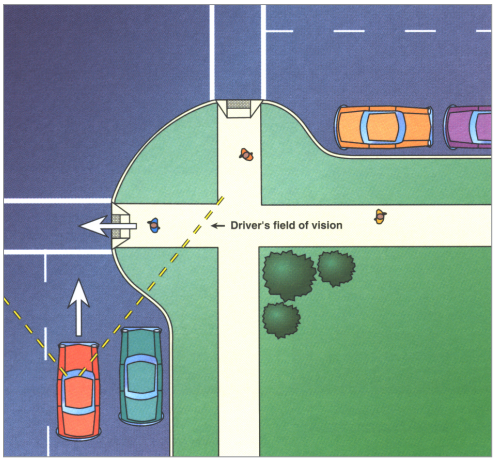


A lowered median can be used to filter storm water and provide refuge for pedestrians crossing a roadway (Image from AASHTO).

• Median crossings should be at least 6 feet wide in order to accommodate more than one pedestrian, while a width of 8 feet (where feasible) should be provided for bicycles, wheelchairs, and groups of pedestrians.

• Median crossings should possess a minimum of a 4 foot square level landing to provide a rest point for wheelchair users.

• Pedestrian push-buttons should be located in the median of all signalized mid-block crossings, where the roadway width is in excess of 60 feet.



By reducing a pedestrian's crossing distance, less time is spent in the roadway, and pedestrian vehicle conflicts are reduced (Image from AASHTO).

BULB-OUTS

A bulb-out, or curb extension, is a place where the sidewalk extends into the parking lane of a street. Because these curb extensions physically narrow the roadway, a pedestrian's crossing distance—and consequently the time spent in the street—is reduced. They can be placed either at mid-block crossings or at intersections.

Sightlines and pedestrian visibility are reduced when motor vehicle parking encroaches too close to corners creating a dangerous situation for pedestrians. When placed at an intersection, bulb-outs preclude vehicle parking too close to a crosswalk. Also, bulb-outs at intersections can greatly reduce turning speed, especially if curb radii are set as tight as possible (Pedestrian and Bicycle Information Center: http://www.walkinginfo.org/engineering/crossings-curb.cfm). Finally, bulb-outs also reduce travel speeds when used in mid-block crossings because of the reduced street width.

Bulb-outs should only be used where there is an existing on-street parking lane and should never encroach into travel lanes, bike lanes, or shoulders (Pedestrian and Bicycle Information Center.

BULB-OUT GUIDELINES:

• Bulb-outs should be used on crosswalks in heavy pedestrian areas where parking may limit the driver's view of the pedestrian.

• Where used, sidewalk bulb-outs should extend into the street for the width of a parking lane (a minimum five feet) in order to provide for a shorter crossing width, increased pedestrian visibility, more space for pedestrian queuing, and a place for sidewalk amenities and planting.

• Curb extensions should be used on mid-block crossing where feasible.

• Curb extensions may be inappropriate for use on corners where frequent right turns are made by trucks or buses.

PEDESTRIAN OVERPASS/UNDERPASS

Pedestrian overpasses and underpasses efficiently allow for pedestrian movement across busy thoroughfares. These types of facilities are problematic in many regards and should only be considered under suitable circumstances or where no other solution is possible. Perhaps the best argument for using them sparingly is that research proves pedestrians will avoid using such a facility if they perceive the ability to cross at grade as taking about the same amount of time (Pedestrian and Bicycle Information Center:http://www.walkinginfo.org/engineering/crossings-overpasses.cfm).

Example trail overpass (above) and underpass (below).

The other areas of contention arise with the high cost of construction. There are also ADA requirements for stairs, ramps, and elevators that in many cases once complied with result in an enormous structure that is visually disruptive and difficult to access.

Overpasses work best when existing topography allows for smooth transitions. Underpasses as well work best with favorable topography when they are open and accessible, and exhibit a sense of safety. Each should only be considered with rail lines, high volume traffic areas such as freeways, and other high volume arteries.

OVERPASS/UNDERPASS GUIDELINES:

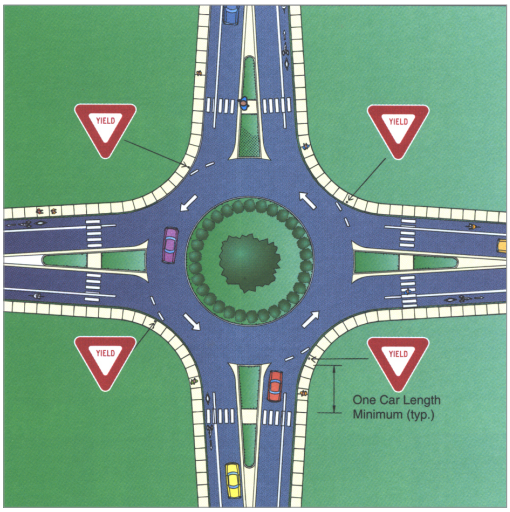
- Over and underpasses should be considered only for crossing arterials with greater than 20,000 vehicle trips per day and speeds 35 - 40 mph and over.

- Minimum widths for over and underpasses should follow the guidelines for sidewalk width.

- Underpasses should have a daytime illuminance minimum of 10 fc achievable through artificial and/or natural light provided through an open gap to sky between the two sets of highway lanes, and a night time level of 4 foot-candle.

- In underpasses, where vertical clearance allows, the pedestrian walkway should be separated from the roadway by more than a standard curb height.

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



Typical roundabout (Image from AASHTO)

Above: A pedestrian crosses part of Downtown Pittsboro's roundabout at the Chatham County Courthouse.

ROUNDABOUTS

Pittsboro is home to one of the region's most identifiable roundabouts, at the Chatham County Courthouse.

A roundabout is a circular intersection that maneuvers traffic around in a counterclockwise direction so that cars make a right-hand turn onto a desired street. Vehicles from approaching streets are generally not required to stop although approaching vehicles are required to yield to motorists in the roundabout. It is believed that this system eliminates certain types of crashes at traditional intersections.

Every effort must be made to prompt motorists to yield to pedestrians crossing the roundabout. A low design speed is required to improve pedestrian safety. Splitter islands and single lane approaches both lend to pedestrian safety as well as other urban design elements discussed in this chapter.

Problems also arise with the vision-impaired because there are not proper audible cues associated with when to cross. Studies are underway to develop and test solutions. Auditory accessible pedestrian signals placed on sidewalks and splitter islands are one solution, but again there is no research to prove their efficacy.

In areas where traffic is low, a roundabout presents little in the way of a barrier for bicyclists. However, in multi-lane roundabouts where speeds are higher, and the traffic is heavy, bicyclists are at a distinct and dangerous disadvantage. Adding a bike lane within such a roundabout has not proven to be effective. A possible solution involves creating a bike lane that completely skirts the roundabout allowing the cyclist to use or share the pedestrian route.

ROUNDABOUT GUIDELINES:

- The recommended *maximum* entry design speed for roundabouts ranges from 15 mph for 'mini-roundabouts' in neighborhood settings, to 20 mph for single-lane roundabouts in urban settings, to 25 mph for single-lane roundabouts in rural settings.

- Refer to roundabout diagram for typical crosswalk placement.

- Please refer to FHWA's report, Roundabouts, an Information Guide, available online through: www.fhrc.gov. The report provides information on general design principles, geometric elements, and provides detailed specifications for the various types of roundabouts.

TRAFFIC SIGNALS

Traffic signals assign the right of way to motorists and pedestrians and produce openings in traffic flow, allowing pedestrians time to cross the street. When used in conjunction with pedestrian friendly design, proper signalization should allow for an adequate amount of time for an individual to cross the street. The suggested amount of pedestrian travel speed recommended in the Manual on Uniform Traffic Control Devices (MUTCD) is 4ft/sec however this does not address the walking speed of the elderly or children. Therefore it is suggested that a lower speed of 3.5ft/sec be used whenever there are adequate numbers of elderly and children using an area.

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

Fixed timed sequencing is often used in high traffic volume commercial or downtown areas to allow for a greater efficiency of traffic flow. In such instances, the pedestrian speed must be carefully checked to ensure safety.

PEDESTRIAN SIGNALS

There are a host of possible traffic signal enhancement opportunities that can greatly improve the safety and flow of pedestrian traffic. Some include: international symbols for WALK and DON'T WALK, providing large traffic signals, the positioning of traffic signals so that those waiting at a red-light cannot see the opposing traffic signal and anticipate their own green-light, installing countdown signals to provide pedestrians information on how long they have remaining in the crossing interval, automatic pedestrian sensors, and selecting the proper signal timing intervals (Pedestrian and Bicycle Information Center: http://www.walkinginfo.org/engineering/crossings-signals.cfm).

International symbols used in a crosswalk to designate WALK and DON'T WALK (Image from http://www.walkinginfo.org).

According to the MUTCD, international pedestrian signal indication should be used at traffic signals whenever warranted. As opposed to early signalization that featured "WALK" and "DON'T WALK", international pedestrian symbols should be used on all new traffic signal installations as illustrated at right. Existing "WALK" and "DON'T WALK" signals should be replaced with international symbols when they reach the end of their useful life.

Symbols should be of adequate size, clearly visible, and, in some circumstances, accompanied by an audible pulse or other messages to make crossing safe for all pedestrians. Consideration should be paid to the noise impact on the surrounding neighborhoods when deciding to use audible signals.

Audible cues can be used along with a countdown signal for pedestrians.

Audible cues can also be used to pulse along with a countdown signal. Countdown signals are pedestrian signals that show how many seconds the pedestrian has remaining to cross the street. The countdown can begin at the beginning of the WALK phase, perhaps flashing white or yellow, or at the beginning of the clearance, or DON'T WALK phase, flashing yellow as it counts down.

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

Concurrent signal timing refers to a situation where motorists running parallel to the crosswalk are allowed to turn into and through the crosswalk, left or right, after yielding to pedestrians. This condition is not considered as safe as some of the latter options, however this type of signal crossings generally allows for more pedestrian crossing opportunities and less wait time. In addition, traffic is allowed to flow a bit more freely. Concurrent signal timing is best used where lower volume turning movements exist (Pedestrian and Bicycle Information Center: http://www.walkinginfo.org/engineering/crossings-signals.cfm).

Where there are high-volume turning situations that conflict with pedestrian movements, the exclusive pedestrian interval is the preferred solution. The exclusive pedestrian intervals stop traffic in all directions. In order to keep traffic flowing regularly, there is often a greater pedestrian wait time associated with this system. Although it has been shown that pedestrian crashes have been reduced by 50% in some commercial or downtown areas by using these intervals, the long wait times can encourage some to attempt a cross when there is a perceived lull in traffic (Pedestrian and Bicycle Information Center: http://www.walkinginfo.org/engineering/crossings-signals.cfm). These types of crossings are dangerous and may negate the use of the system. A problem is also created for those with visual impairments when the audible cues of the passing parallel traffic is eliminated. Often an audible signal will have to accompany a WALK signal.

A proven enhancement that prevents many of the conflicts addressed under either of the former methods is LPI. An LPI works in conjunction with a concurrent signal timing system and simply gives the pedestrian a few seconds head start on the parallel traffic. An advance walk signal is received prior to a green light for motorists. This creates a situation where the pedestrian can better see traffic, and more importantly, the motorists can see and properly yield to pedestrians. Long-term research has shown that this system has worked well, even in high volume places like New York City (where it has been used for 20 years), at reducing motorist and pedestrian conflictPedestrian and Bicycle Information Center: http://www.

walkinginfo.org/engineering/crossings-signals.cfm). As with the exclusive pedestrian interval, an audible cue will need to accompany the WALK signal for the visually impaired.

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

PEDESTRIAN SIGNAL GUIDELINES:

- Pedestrian signals should be placed in locations that are clearly visible to all pedestrians.

- Larger pedestrian signals should be utilized on wider roadways, to ensure readability.

- Pedestrian signal pushbuttons should be well-signed and visible.

- Pedestrian signal pushbuttons should clearly indicate which crossing direction they control.

- Pedestrian signal pushbuttons should be reachable from a flat surface, at a maximum height of 3.5 feet and be located on a level landing to ensure ease of operation by pedestrians in wheelchairs.

- Walk intervals should be provided during every cycle, especially in high pedestrian traffic areas.

RIGHT TURN ON RED RESTRICTIONS

Introduced in the 1970's as a fuel saving technique, the Right Turn on Red (RTOR) law is thought to have had a detrimental effect on pedestrians. The issue is not the law itself but rather the relaxed enforcement of certain caveats within the law such as coming to a complete stop and yielding to pedestrians. Often motorists will either nudge into a crosswalk to check for oncoming traffic without looking for pedestrians or slow, but not stop, for the red-light while making the turn.

A low cost sign that restricts right-hand turns at a red light (Image from http://www.walkinginfo.org).

There is legitimate concern that eliminating an RTOR will only increase the number of right-turn-on-green conflicts where all of the drivers who would normally have turned on red, now are anxious to turn on green. As discussed in the prior section, LPI or exclusive pedestrian intervals my help

Landscaping used on the Sea Street in Seattle, Washington shows how stormwater treatment can be tied to aesthetically pleasing plantings. (Image from Seattle, WA, Public Utilities: Seattle.gov)

Street trees buffer and soften often urban environments in a number of psychological, physical, and ecological ways; their shade is particularly helpful to pedestrians in North Carolina during summer months (West 64 in Pittsboro shown above).

to alleviate this problem. Eliminating RTOR should be considered on a case-by-case basis and only where there are high pedestrian volumes. This can be done by simple sign postings as illustrated at right.

LANDSCAPING

The introduction of vegetation in an urban environment can provide a welcomed intervention of nature into a place that is otherwise hardened from buildings, concrete, and asphalt. It can be used to provide a separation buffer between pedestrians and motorists, reduce the width of a roadway, calm traffic by creating a visual narrowing of the roadway, enhance the street environment, and help to generate a desired aesthetic.

Street trees and other plantings provide comfort, a sense of place, and a more natural and inviting setting for pedestrians. Landscaping and the aforementioned street furniture make people feel welcome

There are also some instances where islands of vegetation are created to collect and filter stormwater from nearby streets and buildings. These islands are referred to as constructed wetlands, rain gardens, and/or bioswales. When these devices are employed, the benefits listed above are coupled with economic and ecologic benefits of treating stormwater at its source. There are many examples of this in Oregon and Washington, particularly Seattle's Green Streets Program. Using thoughtful design to treat stormwater as an amenity rather than waste to be disposed of in an environmentally harmful manner is gaining popularity nationwide.

An issue with this or any landscaping treatment is that of ongoing maintenance. The responsibility often falls on local municipalities although there are instances where local community groups have provided funding and volunteers for maintenance. The best way to address the maintenance issue is to design using native plant material that is already adapted to the local soil and climate. Growth pattern and space for maturation, particularly with larger tree plantings, are important to avoid cracking sidewalks and other pedestrian obstructions.

LANDSCAPING GUIDELINES:

- Buffer zone plantings should be maintained at no higher than three feet to allow sight distance for motorists and pedestrians.

- Trees with large canopies planted between the sidewalk and street should generally be trimmed to keep branches at least seven feet above the sidewalk.

- Plantings should be chosen from those recommended by the Parks and Recreation Advisory Board whenever possible (see following pages)

PLANTINGS PREFERRED BY THE PITTSBORO PARKS AND RECREATION ADVISORY BOARD

The following plantings should be used to landscape sidewalks and greenway trails in Pittsboro. These are primarily native plants that are not normally used in landscaping but have color, uniqueness, and wildlife interest. Most of them occur in the Piedmont but are overlooked or crowded out by the ubiquitous crepe myrtle and invasives. Some can use help locally, and all will be great tools for educating the general public on the great variety of plantings available. *Astricks indicates higher preference by the Pittsboro Parks and Recreation Advisory Board.

****Ostrya virginiana, Hophornbeam/ironwood (http://plants.usda.gov/java/profile?symbol=OSVI)
Quercus pagoda Raf., cherrybark oak (http://plants.usda.gov/java/profile?symbol=QUPA5)
Carya spp., Hickory (ANY)
Tilia americana, Basswood/Linden (http://plants.usda.gov/java/profile?symbol=TIAMC)
****Celtis occidentalis, Hackberry
***Corylus americana, American hazelnut
Amelanchier arborea, Serviceberry
Amelanchier canadensis, Canadian Serviceberry
***Physocarpus opulifolius, Ninebark
***Viburnum prunifolium, Blackhaw (http://plants.usda.gov/java/profile?symbol=VIPR)
Viburnum nudum, Possumhaw (http://plants.usda.gov/java/profile?symbol=VINU)
Crataegus spp., Hawthorn, especially
    Crataegus marshallii, Parsley hawthorn (http://plants.usda.gov/java/profile?symbol=CRMA5)
    Crataegus flabellata (Bosc ex Spach) K. Koch, Fanleaf hawthorn
    Crataegus flava, Yellowleaf hawthorn
Asimina triloba, Paw Paw
***Cephalanthus occidentalis, Buttonbush (http://plants.usda.gov/java/profile?symbol=CEOC2)
***Prunus serotina, Wild black cherry
Prunus americana, American Plum
Magnolia virginiana, Sweetbay Magnolia (http://plants.usda.gov/java/profile?symbol=MAVI2)
Magnolia acuminata, Cucumber Tree (http://plants.usda.gov/java/profile?symbol=MAAC)
Lindera benzoin, Spicebush
***Sambucus canadensis, Elderberry
Rhus copallinum, Winged sumac
Rhus glabra, Smooth sumac
Rhus typhina, Staghorn sumac
Illicium floridanum, Purple Anise
Calycanthus floridus, Sweet shrub
***Sassafras albidium, Sassafras
Ceanothus americanus, New Jersey tea
ANY PYRACANTHA SPP. (lots of disease-resistant varieties available now)

COMMON PLANTINGS USED BY NCDOT

The following list are plantings approved for use in NCDOT-related projects (Source: http://www.ncdot.org/doh/Operations/dp_chief_eng/roadside/design/graphics/PlantingGuidelines.pdf). *Astricks indicates higher preference by the Pittsboro Parks and Recreation Advisory Board..

TREES
Acer rubrum, Red Maple- D, LT, XFC
Acer saccharum, Sugar Maple- D, LT, XFC
***Amelanchier arborea, Downy Serviceberry, D, ST, FL, FR, BK, XFC
***Betula nigra, River Birch- D, LT, BK
Cercis canadensis, Eastern Red Bud- D, ST, FL
***Chionanthus virginicus, White Fringetree- D, ST, FL, FR
****Cladrastis lutea (kentukea)- American Yellowwood- LT, FL, XFC
Cornus florida, Flowering Dogwood- D, ST, FL, FR, XFC
***Fagus grandiflora, American Beech- D, LT, FR, BK, XFC
Fraxinus pennsylvanica, Green Ash- D, LT
Juniperus virginiana- Eastern Red Cedar- E, LT, H/S
Liriodendron tulipifera, Tulip Poplar- D, LT, FL, XFC
Magnolia grandiflora, Southern Magnolia- E, LT, FL, FR, H/S
Magnolia- a large selection of deciduous native and cultivated magnolia species are worthy of use- LT to ST, FL, FR, BK

***Malus, Flowering Crabapple- variety of sizes fit well into the landscape (research selection for disease and insect resistance) - D, ST, FL, FR
Nyssa sylvatica, Black Gum- D, LT, FR, BK, XFC
****Oxydendrum arboreum, Sourwood- D, ST, FL, FR, BK, XFC
Pinus strobus, White Pine- E, LT, H/S
Pinus virginiana, Virginia Pine- E, LT, H/S
***Platanus occidentalis, American Plane Tree (or Sycamore)- D, LT, FR, BK
Prunus cerasifera, Flowering Plum- D, ST, FL
Prunus subhirtella, Higan Cherry- D, ST, FL, FR, BK
Quercus alba, White Oak, D, LT,
Quercus acutissima, Sawtooth Oak- D, LT, FR
Quercus coccinea, Scarlet Oak- D, LT, FR, XFC
Quercus falcata, Southern Red Oak- D, LT, FR
Quercus virginiana, Live Oak- E, LT, FR
Taxodium distichum, Bald Cypress- E, LT, BK, XFC
Tsuga canadensis, Canadian (Eastern) Hemlock- E, LT, FR, H/S
***Tsuga caroliniana, Carolina Hemlock- E, LT, FR, H/S
***Vitex agnus-castus, Chastetree (or Vitex)- D, ST, FL

SHRUBS, ETC.
***Abelia x grandiflora- Glossy Abelia (many wonderful cultivars)- E, MS, FL, H/S
***Aesculus parviflora, Bottlebrush Buckeye- D, LS, FL, FR
***Aronia arbutifolia, Red Chokeberry- D, LS, FR, XFC
Buddleia davidii, Butterfly-bush- D, MS, FL
Callicarpa americana, American Beautyberry- D, MS, FL, FR
Callicarpa dichotoma, Purple Beautyberry- D, SS, FL, FR
Caryopteris x clandonensis, Bluebeard (or Blue-spirea)- D, SS, FL
***Chaenomeles speciosa, Common Flowering Quince- D, LS, FL, FR
Clethra alnifolia, Summersweet- D, MS, FL, FR, XFC
Cornus sericea, Redosier Dogwood ñ D, LS, BK, XFC
Cotinus coggygria, Smokebush (or Smoke Tree)- D, LS (ST), FL, XFC
Forsythia x intermedia, Border Forsythia- D, LS, FL
***Fothergilla gardenii, Dwarf Fothergilla- D, SS, FL, XFC
***Hamemelis virginiana, Witchhazel- D, LS (ST), FL, XFC
***Hamemelis x intermedia- group of hybrid Witchhazels- D, LS (ST), FL, XFC
Hemerocallis- Daylily (thousands of varieties available)- D to E, G, FL
Hydrangea quercifolia, Oakleaf Hydrangea- D, MS, FL, XFC
Hypericum frondosom, Golden St. Johnswort- D, SS, FL
Ilex x attenuata- group of hybrid hollies (Foster)- E, LS (ST), FR, H/S
Ilex glabra, Inkberry- E, LS, FR, H/S
Ilex opaca, American Holly (good selection of upright hollies)- E, LS (ST), FR, H/S
Ilex verticillata, Winterberry- D, LS, FR
Ilex vomitoria, Yaupon Holly- E, LS (ST),, FR, H/S
Itea virginica, Virginia Sweetspire- D, MS, FL, XFC
Juniperus- multitude of junipers ideal for various landscape uses- E, LS to G
Myrica cerifera, Southern Wax Myrtle- E, LS, FR, H/S
Pyracantha coccinea, Scarlet Firethorn- E, LS, FL, FR, H/S
Taxus x media, Spreading Yew- E, height varies, FR, H/S
Viburnum- multiple species and cultivars worthy of use- E to D, LS to MS, FL, H/S
Weigela florida, Weigela (various sizes, colors, etc.)- D, LS, FL

KEY:
E-evergreen
D-deciduous
LT- large tree
ST- small tree
LS- large shrub
MS- medium shrub
SS- small shrub

G-groundcover
FL- conspicuous flower
FR- conspicuous fruit
BK- attractive bark or stem color
H/S-good hedge/screen
XFC- exceptional fall color

SIZE CATEGORIES (based on average size at maturity):
LT (Large Tree): 30í- taller
ST (Small Tree): 15í- 30í
LS (Large Shrub): 8í-taller
MS (Medium Shrub): 4í- 8í
SS (Small Shrub): less than 4í

ROADWAY LIGHTING IMPROVEMENTS

Proper lighting in terms of quality, placement, and sufficiency can greatly enhance a nighttime urban experience as well as create a safe environment for motorists and pedestrians. Two-thirds of all pedestrian fatalities occur during low-light conditions (AASHTO, 2004: Guide for the Planning, Design, and Operation of Pedestrian Facilities). Attention should be paid to crossings so that there is sufficient ambience for motorists to see pedestrians. To be most effective, lighting should be consistent, adequately spaced, and distinguished, providing adequate light.

In most cases, roadway street lighting can be designed to illuminate the sidewalk area as well. The visibility needs of both pedestrian and motorist should be considered. In commercial or downtown areas and other areas of high pedestrian volumes, the addition of lower level, pedestrian-scale lighting to streetlights with emphasis on crossings and intersections may be employed to generate a desired ambiance. A variety of lighting choices include mercury vapor, incandescent, or less expensive high-pressure sodium lighting for pedestrian level lighting. Roadway streetlights can range from 20-40 feet in height while pedestrian-scale lighting is typically 10-15 feet.

It is important to note that every effort should be made to address and prevent light pollution. Also known as photo pollution, light pollution is 'excess or obtrusive light created by humans'. The Pittsboro Lighting Ordinance addresses these and should be referenced as the primary guide to lighting.

GUIDELINES:

- Ensure pedestrian walkways and crossways are sufficiently lit.
- Consider adding pedestrian-level lighting in areas of higher pedestrian volumes, downtown, and at key intersections.
- Install lighting on both sides of streets in commercial districts.
- Use uniform lighting levels
- Use full cut-off light fixtures to avoid excess light pollution

The street furniture shown here is placed in such a manner so as to create a safe, pleasurable, and accessible walking environment (West 64 in front of Pittsboro's General Store Cafe shown above).

STREET FURNITURE AND WALKING ENVIRONMENT

As part of a comprehensive sidewalk and walkway design, all street furniture should be placed in a manner that allows for a safe, pleasurable, and accessible walking environment. Good-quality street furniture will show that the community values its public spaces and is more cost-effective in the long run. Street furniture includes benches, trash bins, signposts, newspaper racks, water fountains, bike racks, restaurant seating, light posts, and other ornaments that are found within an urban street environment. Street furniture should mostly be considered in the downtown area and other important pedestrian-active areas such as US 64.

In addition to keeping areas free of obstruction from furniture, a walking environment should be clean and well maintained. Attention should be given to removing debris, trimming vegetation, allowing for proper stormwater drainage, providing proper lighting and sight angles, and repairing or replacing broken or damaged paving material can make an enormous difference in pedestrian perception of safety and aesthetics. Special attention should be paid to the needs of the visually impaired so that tripping hazards and low hanging obstructions are removed.

GUIDELINES:

- Ensure proper placement of furniture; do not block pedestrian walkway or curb ramps or create sightline problems.

- Wall mounted Objects = not to protrude more than 4" from a wall between 27" and 7' from the ground

- Single post mounted Objects = not to protrude more than 4" from each side of the post between 27" and 7' from the ground

- Multiple Post Mounted Objects = lowest edge should be no higher than 27" and no lower than 7'

- Place street furniture at the end of on-street parking spaces rather than in middle to avoid vehicle-exiting conflict.

This typical transit stop has all of the key features of shelter, ample seating, bicycle parking, landscaping, and trash bins (Image from http://www.walkinginfo.org).

TRANSIT STOP TREATMENTS

Currently Pittsboro is not served by public transportation, but the Town will soon partner with Chapel Hill Transit to provide a commuter bus with multiple stops along US 15-501 North, linking the two Towns. When such opportunities are made available, it is appropriate to consider some of the basic elements of a well designed, accessible, and functional transit stop.

Bus or other transit stops should be located in places that are most suitable for the passengers. For example, stops should be provided near higher density residential areas, commercial or business areas, and schools, and connected to these areas by sidewalk. Some of the most important elements to consider are the most basic: sidewalk connectivity to the stops, proper

lighting, legible and adequate transit stop signage, shelter, seating, trash bins, bicycle and even car parking. Transit stops create an area of activity and may generate additional business and pedestrian traffic. Therefore an opportunity is created to provide adequate sidewalks and other pedestrian oriented design elements. At a minimum, marked crosswalks (especially at mid-block stops), curb ramps, and proper sidewalk widths should be considered.

As with any human scale design element discussed, safety is an important factor to consider when locating bus stops. In the case of a bus stop, special attention should be paid to the number of lanes and direction of traffic when deciding to locate a stop on the near or far side of an intersection. Also special consideration must be paid to the wheelchair lifts in terms of how and where the mobility impaired will exit and enter the bus.

PEDESTRIAN SIGNS AND WAYFINDING

Signage provides important safety and wayfinding information to motorist and pedestrian residents and tourists. From a safety standpoint, motorists should be given advance warning of upcoming pedestrian crossings or of traffic calming areas. Signage of any type should be used and regulated judiciously. An inordinate amount of signs creates visual clutter. Under such a condition, important safety or wayfinding information may be ignored resulting in confusion and possible pedestrian vehicle conflict. Regulations should also address the orientation, height, size, and sometimes even style of signage to comply with a desired local aesthetic.

For a step-by-step guide to help non-professionals participate in the process of developing and designing a signage system, as well as information on the range of signage types, visit the Project for Public Places website: http://www.pps.org/info/amenities_bb/signage_guide

Regulatory signage is used to inform motorists or pedestrians of a legal requirement and should only be used when a legal requirement is not otherwise apparent (AASHTO, 2004: Guide for the Planning, Design, and Operation of Pedestrian Facilities).

Regulatory Signs

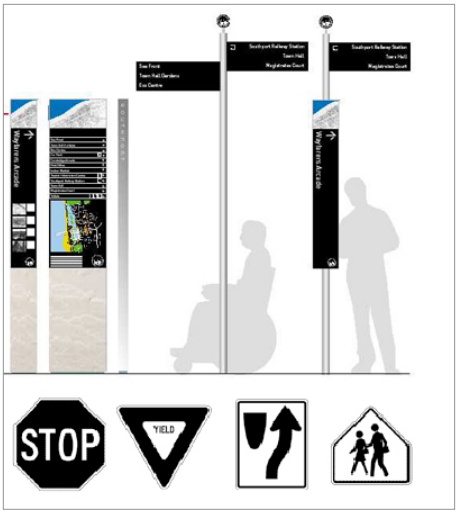
School, Warning, and Informational Signs

S1-1 S3-1 W11-2 W15-1 I-4

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

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

Above: Typical traffic signs found around pedestrian friendly places. Below: Wayfinding signs promote aesthetics as well as provide important information (image from Stefton, UK: http://www.sefton.gov.uk



Warning signage is used to inform motorists and pedestrians of unexpected or unusual conditions. When used, they should be placed to provide adequate response times. These include school warning signs and pedestrian crossing signs3.

Informational and wayfinding signage can provide information providing guidance to a location along a trail or other pedestrian facility. Wayfinding signage should orient and communicate in a clear, concise and functional manner. It should enhance pedestrian circulation and direct visitors and residents to important destinations. In doing so, the goal is to increase the comfort of visitors and residents while helping to convey a local identity.

Maintenance of signage is as important as walkway maintenance. Clean, graffiti free, and relevant signage enhances guidance, recognition, and safety for pedestrians.

BRIDGES

Provisions should always be made to include a walking facility as a part of vehicular bridges, underpasses, or tunnels, especially if the facility is part of the Pedestrian Network. All new or replacement bridges, other than those for controlled access roadways, should accommodate pedestrians with wide sidewalks on both sides of the bridge. Even though bridge replacements do not occur regularly, it is important to consider these in longer-term pedestrian planning.

It is NCDOT bridge policy that within Urban Area boundaries (which are ambiguously defined as the "outer limits of potential urban growth"), sidewalks shall be included on new bridges with curb and gutter approach roadways with no controlled access. Sidewalks should not be included on controlled access facilities. A determination on whether to provide sidewalks on one or both sides of new bridges will be made during the planning process according to the NCDOT Pedestrian Policy Guidelines. When a sidewalk is justified, it should be a minimum of five to six feet wide with a minimum handrail height of 42".

It is also NCDOT bridge policy that bridges within the Federal-aid urban boundaries with rural-type roadway sections (shoulder approaches) may warrant special consideration. To allow for future placement of ADA acceptable sidewalks, sufficient bridge deck width should be considered on new bridges in order to accommodate the placement of sidewalks. The full Bridge Policy for NCDOT can be download as a Microsoft Word document at this address:

www.ncdot.org/doh/preconstruct/altern/value/manuals/bpe2000.doc

BRIDGE GUIDELINES:

- Sidewalks should be included on roadway bridges with no controlled access with curb and gutter approach in Urban Areas.

- Sufficient bridge deck width should be considered on new bridges with rural-type shoulder approaches for future placement of sidewalks.

- Sidewalk should be 5' to 6' wide.

- Minimum handrail height should be 42''