CHAPTER 6 – BICYCLE AND PEDESTRIAN FACILITY DESIGN GUIDELINES

Bicycle and pedestrian facility design is constantly evolving. Past guidance provided by organizations such as the American Association of State Highway and Transportation Officials (AASHTO) and the National Association of City Transportation Officials (NACTO) focused on providing on-street bicycle facilities for experienced and confident riders rather than off-street SUPs that less-accomplished cyclists preferred. This guidance has resulted in bicycle lanes being included in the design and construction of roadways for more than two decades. In the last 10 years, however, an increasing number of people have begun riding, and research indicates that most people need more than the standard 4-ft bike lane to feel comfortable riding.

Level of Comfort and Facility Type – Designing for All Ages & Abilities

Due to the strong correlation between comfort and facility type, communities around the US are developing bicycle networks that also support more casual cyclists who may be interested in riding but are intimidated by sharing the road with vehicles. Building facilities that are more protected will expand the number and types of users to include those who are less expert and feel less safe riding in or adjacent to vehicular travel lanes.

The NACTO publication titled *Designing for All Ages & Abilities-Contextual Guidance for High-Comfort Bicycle Facilities* (December 2017) (Figure 23) builds on NACTO's *Urban Bikeway Design Guide* and establishes All Ages & Abilities criteria for selecting and implementing bike facilities. According to NACTO, "Building bicycle infrastructure that meets these criteria is an essential strategy for cities seeking to improve traffic safety, reduce congestion, improve air quality and public health, provide better and more equitable access to jobs and opportunities, and bolster local economies."

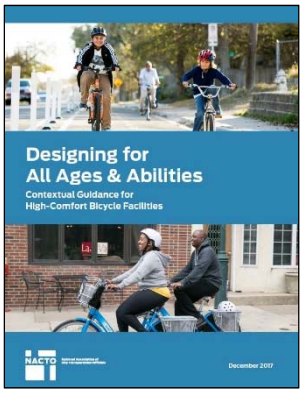


Figure 23. Designing for All Ages and Abilities

The All Ages & Abilities facility selection guidance is focused on urban street types and considers factors such as vehicular speeds and volumes, operational uses, and what NACTO terms "bicycling stress"—the level of comfort or discomfort cyclists of all ages and abilities feel riding alongside vehicular traffic. The guidance indicates when traffic calming tools, such as speed reduction and volume management, may be needed in addition to roadway design changes, such as full lane separation, to reduce traffic fatalities and increase cycling rates and rider comfort.

The box on the next page defines the terms used by NACTO to describe how bicycle facilities meet the needs of riders of all ages and abilities, increase cycling rates and rider comfort.

NACTO has also developed contextual guidance for selecting the most appropriate type of bicycle facility to meet the needs of riders of all ages and abilities (Figure 24).

88% of survey respondents said there are places they want to ride in Collier County but do not because they feel unsafe.

In keeping with the general trends reported around the country, the online survey developed to capture input for this Plan found that although many people ride and walk, feeling unsafe is the primary reason reported by those who do not ride often. In total, 88% of survey respondents said there are

places they want to ride in Collier County but do not because they feel unsafe. Comfort and safety are the primary motivators for people who ride by choice. The analysis of safety crash data (Chapter 2) shows that areas of high use for walking and cycling coincide with a high number of vehicular crashes. Residents who rely on these modes to meet daily transportation needs are particularly at risk.

All Ages & Abilities Bike Facilities are ...

Safe	Comfortable	Equitable
More people will bicycle when they have safe places to ride, and more riders mean safer streets. Among seven NACTO cities that grew the lane mileage of their bikeway networks 50% between 2007–2014, ridership more than doubled while risk of death and serious injury to people biking was halved.[6] Better bicycle facilities are directly correlated with increased safety for people walking and driving as well. Data from New York City showed that adding protected bike lanes to streets reduced injury crashes for all road users by 40% over four years.[7]	Bikeways that provide comfortable, low-stress bicycling conditions can achieve widespread growth in mode share. Among adults in the US, only 6–10% of people generally feel comfortable riding in mixed traffic or painted bike lanes.[8] However, nearly two-thirds of the adult population may be interested in riding more often, given better places to ride, and as many as 81% of those would ride in protected bike lanes.[9] Bikeways that eliminate stress will attract traditionally under-represented bicyclists, including women, children, and seniors.	High-quality bikeways expand opportunities to ride and encourage safe riding. Poor or inadequate infrastructure—which has disproportionately impacted low-income communities and communities of color—forces people bicycling to choose between feeling safe and following the rules of the road, and induces wrong-way and sidewalk riding. Where street design provides safe places to ride and manages motor vehicle driver behavior, unsafe bicycling decisions disappear,[11] making ordinary riding safe and legal and reaching more riders.

Figure 24. NACTO Guidance for Selecting Appropriate Bicycle Facilities

Contextual Guidance for Selecting All Ages & Abilities Bikeways

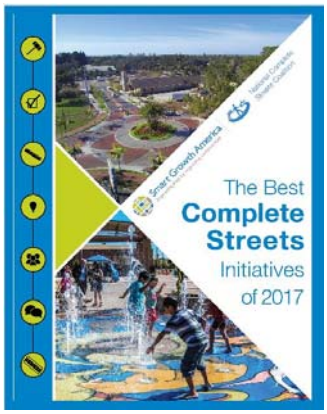
Roadway Context				All Ages & Abilities Bicycle Facility
Target Motor Vehicle Speed*	Target Max. Motor Vehicle Volume (ADT)	Motor Vehicle Lanes	Key Operational Considerations	
Any		*Any*	*Any of the following:* high curbside activity, frequent buses, motor vehicle congestion, or turning conflicts‡	**Protected Bicycle Lane**
< 10 mph	Less relevant	No centerline, or single lane one-way	Pedestrians share the roadway	**Shared Street**
≤ 20 mph	≤ 1,000 – 2,000		< 50 motor vehicles per hour in the peak direction at peak hour	**Bicycle Boulevard**
≤ 25 mph	≤ 500 – 1,500			
	≤ 1,500 – 3,000	Single lane each direction, or single lane one-way	Low curbside activity, or low congestion pressure	**Conventional or Buffered Bicycle Lane, or Protected Bicycle Lane**
	≤ 3,000 – 6,000			**Buffered or Protected Bicycle Lane**
	Greater than 6,000			**Protected Bicycle Lane**
	Any	Multiple lanes per direction		
Greater than 26 mph†	≤ 6,000	Single lane each direction	Low curbside activity, or low congestion pressure	**Protected Bicycle Lane, or Reduce Speed**
		Multiple lanes per direction		**Protected Bicycle Lane, or Reduce to Single Lane & Reduce Speed**
	Greater than 6,000	*Any*	*Any*	**Protected Bicycle Lane, or Bicycle Path**
High-speed limited access roadways, natural corridors, or geographic edge conditions with limited conflicts		*Any*	High pedestrian volume	**Bike Path with Separate Walkway or Protected Bicycle Lane**
			Low pedestrian volume	**Shared-Use Path or Protected Bicycle Lane**

* While posted or 85th percentile motor vehicle speed are commonly used design speed targets, 95th percentile speed captures high-end speeding, which causes greater stress to bicyclists and more frequent passing events. Setting target speed based on this threshold results in a higher level of bicycling comfort for the full range of riders.

† Setting 25 mph as a motor vehicle speed threshold for providing protected bikeways is consistent with many cities' traffic safety and Vision Zero policies. However, some cities use a 30 mph posted speed as a threshold for protected bikeways, consistent with providing Level of Traffic Stress level 2 (LTS 2) that can effectively reduce stress and accommodate more types of riders.[18]

‡ Operational factors that lead to bikeway conflicts are reasons to provide protected bike lanes regardless of motor vehicle speed and volume.

FDOT Guidance



Two FDOT publications, the *Florida Greenbook* and the *Florida Design Manual,* provide essential design guidelines to follow when seeking State and federal transportation funding for local projects. The MPO values FDOT's design guidance for reasons that go beyond funding considerations—FDOT has nationally-recognized expertise in integrating the concept of Complete Streets into FDOT practices. Smart Growth America identified the *Florida Design Manual* as one of the 12 best Complete Streets Initiatives of 2017. FDOT design guidance takes into consideration the 2010 ADA Standards for Accessible Design and the US Department of Transportation 2006 ADA Standards for Transportation Facilities.

The *Manual of Uniform Minimum Standards for Design, Construction and Maintenance (Florida Greenbook*) provides criteria for public streets, roads, highways, bridges, sidewalks, curbs and curb ramps, crosswalks, bicycle facilities, underpasses and overpasses used by the public for vehicular and pedestrian travel. The current (2016) *Florida Greenbook* became effective on June 19, 2017. The current version of the *Florida Design Manual* (January 2018) includes design criteria for pedestrian and bicycle facilities that are linked to the Context Classification System developed by FDOT.

Florida Design Manual, Context Classification and Complete Streets[17]

FDOT adopted a Complete Streets Policy in 2014 that accommodates all users along the State roadway system. In August 2017, FDOT published guidance on Context Classification, which states,

> FDOT will routinely plan, design, construct, reconstruct and operate a context-sensitive system of Complete Streets. To this end, a context classification system comprising eight context classifications has been adopted. The context classification of a roadway, together with its transportation characteristics, will provide information about who the users are along the roadway, the regional and local travel demand of the roadway, and the challenges and opportunities of each roadway user. The context classification and transportation characteristics of a roadway will determine key design criteria for all non-limited-access State roadways.

Although counties typically follow the *Florida Green Book*, it has not yet been updated to match the *Florida Design Manual*, which sets the design criteria for State roads. The two resources, while separate, are coordinated in their approach to developing a transportation system that serves all users. To better serve the different users of the system, FDOT developed a Context Classification methodology that, according to infrastructure and land use, assigns a context that reflects where the roadway is in the land development continuum, as shown in Figure 25. This continuum ranges from undeveloped conservation land to the most urban downtowns. By analyzing land use, FDOT determined the facilities that are most appropriate for where they are located. It is FDOT policy that roadways in all counties be classified before or when work is anticipated to assist in the determination of what facilities to include.

[17] Additional information can be found at http://flcompletestreets.com or at http://fdot.gov/roadway/fdm/.

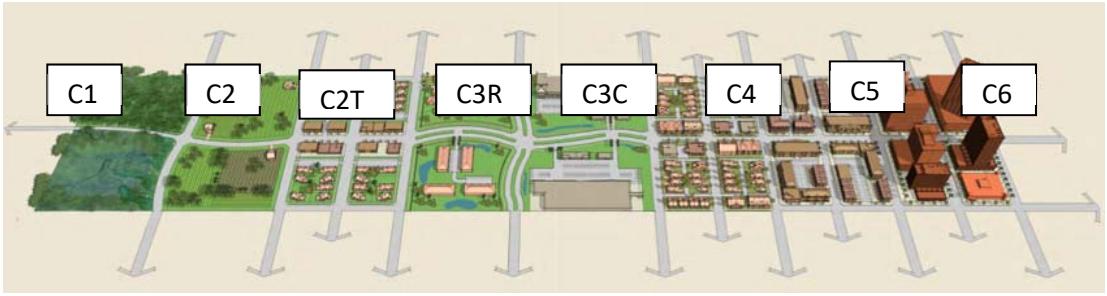


Figure 25. Illustration of FDOT Context Classification System

FDOT Guidance on Pedestrian Facilities

Table 15 identifies sidewalk facilities by FDOT Context Classification.

Table 15. FDOT Context Classification Guidance for Sidewalks

Context	Allowable Range (mph)	SIS Minimum (mph)	Sidewalk
C1 Natural	55-70	65	5' sidewalk if demand warrants
C2 Rural	55-70	65	5' sidewalk if demand warrants
C2T Rural Town	25-45	40 (35 with design elements)	6' sidewalk
C3R Suburban Residential	35-55	50 (45 with curb)	6' sidewalk
C3C Suburban Commercial			6' sidewalk if demand warrants
C4 Urban General	30-45	45	6' sidewalk
C5 Urban Center	25-35	35	10' sidewalk
C6 Urban Core	25-30	30	12' sidewalk

Notes: 1) C2T, C3, C4 sidewalk may be increased to 8' with demand; 2) C5 and C6 should be maximum width possible, not less than 6'; 3) For RRR projects, 4' sidewalk may be retained.

Crosswalks

According to the *Florida Design Manual* (FDM), Special Emphasis Crosswalk markings should be used at signalized intersections, roundabouts, and midblock crosswalks. Midblock crosswalks should be illuminated, marked, and signed in accordance with the *Manual of Uniform Traffic Control Devices* (MUTCD), *Traffic Engineering Manual* (TEM), and FDM. An engineering study supporting the need for the installation is required before a midblock crosswalk can be placed on a State roadway.

Standard crosswalk markings should be used for stop or yield-controlled intersections. When separated right-turn lanes are used, crosswalks should be placed so that an approaching motorist has a clear view of the pedestrian, and the crossing distance is minimized. School Zone crosswalks have additional criteria for signing and pavement markings (see *Manual on Speed Zoning for Highways, Roads, and Streets in Florida*, Chapter 15). The FDM advises that, as roadway volumes, speeds, and number of travel lanes increase, marked crosswalks are best used in conjunction with other treatments, e.g., signals, signs, beacons, curb extensions, raised medians, refuge islands, and enhanced overhead lighting.

Bicycle Facilities

Table 16 identifies bicycle facilities by FDOT Context Classification. It is important to note that the vision or community intent for a corridor is a factor that FDOT considers when it designs a facility, and coordination between agencies is critical to the final result. Bicycle lanes are a portion of a roadway designated for the preferential or exclusive use of bicyclists. Bike lanes are designated by a bicycle symbol pavement marking and signage in accordance with *Standard Plans* and MUTCD.

According to the FDM, bicycle lanes are the preferred bicycle facility type on curbed roadways with a design speed of ≤ 45 mph. For new construction projects, a 7' buffered bicycle lane is the standard. A buffered bicycle lane has a separated, double 6" white edge line separating the bike lane and the adjacent travel lane. For projects where a bike lane is needed, but it is not practical to move the existing curb, the width of the bicycle lane depends on the width of available roadway pavement. The options in the order of priority are:

- 7-ft buffered bicycle lane
- 6-ft buffered bicycle lane
- 5-ft bicycle lane
- 4-ft bicycle lane
- Do not provide a bike lane when available roadway pavement is less than 4 ft

Table 16. FDOT Context Classification Guidance for Bicycle Facilities

Context	Allowable Range (mph)	SIS Minimum (mph)	Bicycle Facility
C1 Natural	55-70	65	Unmarked paved shoulder or Shared Use Path
C2 Rural	55-70	65	Unmarked paved shoulder or Shared Use Path
C2T Rural Town	25-45	40 (35 with design elements)	Marked bicycle lane
C3R Suburban Residential	35-55	50 (45 with curb)	Marked bicycle lane when speed is ≤ 45pmh and Shared Use Path not present or Shared Use Path
C3C Suburban Commercial	35-55	50 (45 with curb)	Marked bicycle lane when speed is ≤ 45pmh and Shared Use Path is not present or Shared Use Path
C4 Urban General	30-45	45	Buffered bike lanes when posted speed is ≤ 45pmh. Facility options, in decreasing order of priority are 7'-buffered bike lane, 6'-buffered bike lane, 5' bicycle lane, 4' bicycle lane
C5 Urban Center	25-35	35	Buffered bike lanes when posted speed is ≤ 45pmh. Facility options, in decreasing order of priority are, 7'-buffered bike lane, 6'-buffered bike lane, 5' bicycle lane, 4' bicycle lane
C6 Urban Core	25-30	30	Buffered bike lanes when posted speed is ≤ 45pmh. Facility options, in decreasing order of priority are, 7'-buffered bike lane, 6'-buffered bike lane, 5' bicycle lane, 4' bicycle lane

Illustrated Guide to Bicycle and Pedestrian Facilities

On-Road Bicycle Facilities

Several different types of on-road bicycle facilities make use of the current roadway network by working between existing curbs; they can enhance the off-road network by connecting parks and trails and creating transportation opportunities and accommodating different categories of users. They also tend to be less expensive to build and may be able to be implemented with a resurfacing project. Increasingly, as noted, research is showing that the more protection bicyclists have from vehicles, the more comfortable they feel, and the more people ride. Following are facility types, from least to most protected or comfortable, and a discussion of where they should be considered for construction.

Paved Shoulders

Paved shoulders (Figure 26) are commonly used on rural roads that provide a separated space for bicyclists but are not marked as a bicycle facility. The minimum shoulder width is 4', but on high-speed roadways or roadways with many bicycle users, wider shoulders are recommended.

Figure 26. Paved Shoulder

Audible Pavement Markings

This is an enhanced paved shoulder, primarily used along rural roads. Many cyclists report feeling unsafe on a standard paved shoulder, especially when adjacent to high-speed traffic or high volumes of trucks. FDOT has developed audible pavement markings to buffer bike lanes on high-speed rural roads. The audible pavement markings act like a rumble strip, providing additional separation between vehicles, and require only a modest increase in shoulder width (Figure 27).

Figure 27. Audible Pavement Marking

Bike Lanes

Bike lanes (Figure 28) are spaces dedicated to bicycle travel on roadways. They are a minimum of 4-ft-wide if no curb and gutter, and 5-ft wide if included. Typical users are those who are comfortable riding with traffic and who represent a small segment of the bicycle-riding community. This facility type should be the minimum considered during roadway resurfacing projects and can be used to make connections between s. Bike lanes are not considered a preferred facility type for developing a community-friendly Shared Use Path system.

Figure 28. Marked Bicycle Lane

Buffered Bike Lanes

Buffered bike lanes (Figure 29) are spaces dedicated to bicycle travel on roadways and are 6- to 7-ft wide with a painted buffer to provide extra space between bicyclists and adjacent vehicles. These facilities provide an additional degree of comfort to bicyclists and should be considered for all new roads being constructed in Collier County, particularly where higher volumes of bicycle traffic are anticipated.

Figure 29. Buffered Bicycle Lane

Separated Bicycle Lanes and Cycle Tracks

Separated bicycle lanes/cycle tracks are on-road facilities that include a traffic separator and dedicated space for bicyclists. They can be one- or two-way depending on the need or the roadway condition. Figure 30 depicts a two-way cycle track. Separated bicycle lanes can often be constructed between existing curbs if the roadway has excess capacity. In urban areas, this type of facility can provide a high level of comfort for bicyclists (similar to a Shared Use Path) and decrease the number of bicycle crashes. Design care must be taken at intersections and driveways. Adding this type of facility has also been shown to increase ridership.[18]

Figure 30. Cycle Track

[18] "Lessons from the Green Lanes: Evaluating Protected Bike Lanes in the US," Transportation Research Board, RIP #32182, June 30, 2014.

Green Bike Lanes

Green paint can be applied to bike lanes in areas of potential conflict where motorists must cross the bike lane to turn or to exit a parking area. Green paint is considered a traffic control device and, after receiving approval (Interim Approval 14) is subject to guidance in the Manual on Uniform Traffic Control Devices (MUTCD). See Figure 31.

Figure 31. Green Bicycle Lane Central Avenue, Naples

Advisory Bike Lane

An advisory bike lane is used on low-speed roadways where there is not enough room for both bike lanes and travel lanes. These markings communicate to both bicyclists and motorists where to ride while also communicating to motorists that they can pass when there is room (Figure 32).

Figure 32. Advisory Bike Lane

Advisory Shoulder

Advisory shoulders (Figure 33) may be used on roads where it is not possible to construct a traditional shoulder. Using paint, space is designated for pedestrians within the travel lane; a dashed line is used to delineate the space may be crossed by motorists if the way is clear. Considered an innovative facility type by FHWA, an approved Request to Experiment is required to implement this facility on federally-funded projects. Additional information can be found in FHWA's *Small Town and Rural Multimodal Networks.*

Figure 33. Advisory Shoulder

Two-Stage Queue Box

A two-stage queue box (Figure 34) allows bicyclists to more easily make a left turn. Rather than having to move into a turn lane to make a left turn, the turn box allows bicyclists to proceed across the intersection and position themselves to cross the intersection with the signal. It received FHWA Interim Approval IA-20 in 2017.

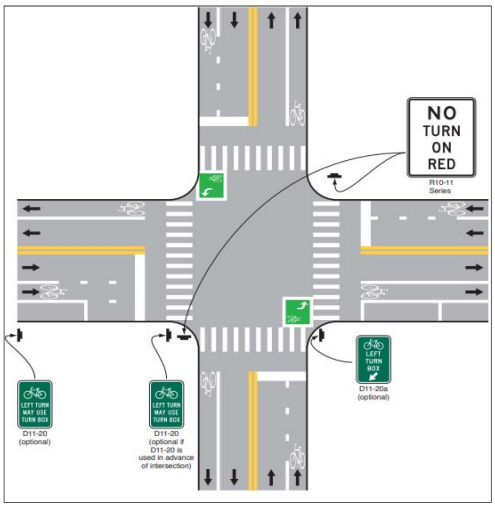


Figure 34. Two-Stage Queue Box

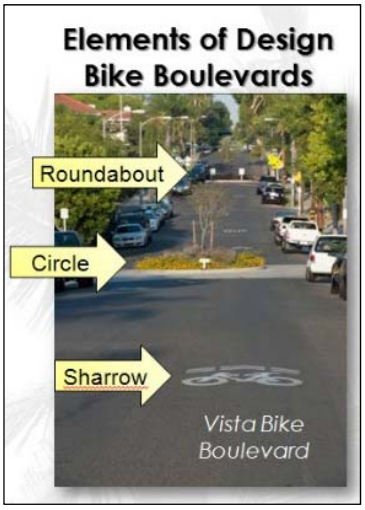


Figure 35. Bicycle Boulevard

Bicycle Boulevard

A bicycle boulevard (Figure 35) is a low-volume, low-speed street designed to give bicycles priority, typically achieved by a combination of signage and infrastructure. Also called neighborhood greenways, bicycle boulevards generally provide convenient access to local destinations and often connect or go through neighborhoods.

Off-Road Bicycle & Shared-Use Facilities on Independent Rights-of-Way

Shared Use Paths on Independent Rights-of-Way

AASHTO defines a Shared Use Path on an independent right-of-way as a facility that provides a separated path for nonmotorized users to supplement the on-road network. It may be used for recreation or transportation purposes and falls under the accessibility requirements of the ADA (Figure 36).

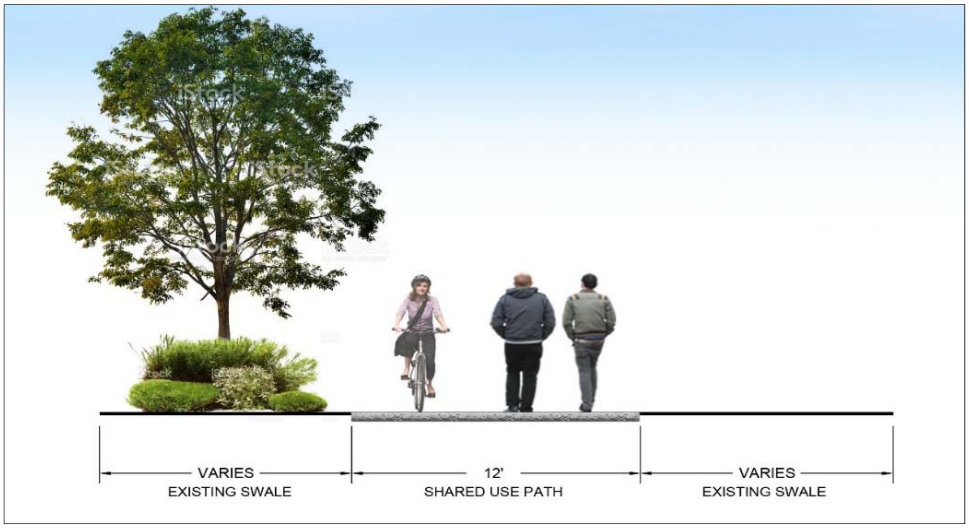


Figure 36. Cross-Section

Sidepaths

AASHTO defines a sidepath (Figure 37) as a Shared Use Path immediately adjacent or parallel to a roadway and lists 10 reasons why using a sidewalk as a Shared Use Path or providing a sidepath is undesirable:

Figure 37. US-41

Sidewalks on US-41 between the 5th Avenue and 9th Street intersection and Airport Road are heavily used by cyclists, often riding against traffic. They are a good example of a situation to be strenuously avoided in new and retrofit designs.

- Conflicts at intersections and driveways; motorists often do not notice bicyclists approaching from the right because they do not expect wheeled traffic from this direction.
- Bicyclists are apt to cross intersections and driveways at unexpected speeds that are significantly faster than pedestrian speeds.
- Drivers often pull forward to get an unobstructed view of traffic, in doing so they block the sidepath crossing.
- Attempts to require bicyclists to yield or stop at each cross-street or driveway are inappropriate and ineffective
- When a sidepath is provided on just one side of the road, it tends to produce wrong-way travel by bicyclists when a sidepath. Wrong-way travel may also result when a sidepath abruptly ends. Wrong-way travel by cyclists is a common factor in bicycle-automobile crashes; a two-way sidepath on one side of the road may need additional road crossings to provide safe access.
- Signs and traffic signals posted for roadway users are backwards for contra-flow riders.
- Because of proximity of roadway traffic, barriers or railings are sometimes needed.
- Sidepath width may be constrained by fixed objects such as utility poles, mailboxes, etc. Eight feet is the minimum width for a sidewalk intended to accommodate bicyclists and pedestrians.
- Due to operational issues, some bicyclists will use the roadway instead of the sidepath; when this occurs, drivers may harass the cyclists, even though Florida does not have a law requiring cyclists to use a path if one is provided.
- When using a sidepath, bicyclists must yield to traffic twice instead of once when making a pedestrian style left turn thereby introducing unnecessary delay.

The sidepath on Airport Road adjacent to Naples Municipal Airport is a good example of a sidepath application that works due to the edge condition – the absence of multiple driveways and curb cuts.

Sidepaths (Figure 38) may be considered where one or more of the following conditions exist:

- If bicyclists cannot be accommodated on nearby parallel streets and a sidepath is the only practical alternative.

- The sidepath is used for a short distance to provide continuity between sections of path in independent rights-of-way, or to connect to local streets.
- The sidepath can be built with few roadway and driveway crossings.
- The sidepath can be terminated at each end onto streets that accommodate cyclists, onto another path, or in a location that is bicycle compatible.

Figure 38. Sidepath on Airport Road

Bicycle and Pedestrian Counters

Understanding bicycle and pedestrian usage is critical to properly plan and design bicycle and pedestrian facilities. Information on usage can help make the case to expand the system or improve facilities. The Collier MPO recently submitted a proposal, which was accepted, to be a participant in FDOT's Statewide Non-motorized Traffic Monitoring Program. FDOT has looked at two candidate sites for installing permanent bicycle and pedestrian counters, and it is possible that both sites will be approved:

- County-owned and maintained bicycle/pedestrian bridge over the Gordon River on the Gordon River Greenway
- City of Naples-owned and maintained bicycle/pedestrian bridge connecting Baker Park to the west side of the Gordon River/Naples Bay

FDOT will share the count data gathered at these sites with participating agencies and use the data to calibrate bicycle and pedestrian trip data assumptions statewide.

Cycling Facility Crossings on Major Roadways

Walkers and bicycle riders are especially vulnerable as they cross a roadway, whether at an intersection or at a Shared Use Path or a sidewalk that is functioning as a sidepath and road crossing. Several engineering design techniques are available to help minimize the risks. Crossing features for both pedestrian and bicycle infrastructure are discussed below.

Two primary challenges for bicyclists are the speed differential between vehicles and bicyclists and sight distance, which is related to speed. Designing intersections that give bicyclists and vehicle operators enough time to react to each other is crucial to minimizing the opportunities for crashes. Several design tools are available to help all users navigate intersections, as described below.

Because each crossing is unique, the specific geometry and location will factor into the design of each intersection. It is important to note that circumstances of use may change over time; this should trigger a review and modification as needed at certain intersections. If, for example, a bicycle lane, Shared Use Path, or sidewalk has a higher volume of users than might have been anticipated, it is recommended that the road crossings be reviewed. It is also important to consider changes to surrounding land use. A crash trend or

higher-than-projected volumes for either vehicles or bicyclists may require the need to redesign the crossing to address the challenges.

Pedestrian Safety Countermeasures

FHWA is promoting a number of pedestrian safety countermeasures through its Every Day Counts (EDC-4) program:[19]

- Road diets can reduce vehicle speeds and the number of lanes pedestrians cross and can create space to add new pedestrian facilities.
- Pedestrian hybrid beacons (PHBs) are a beneficial intermediate option between Rectangular Rapid Flashing Beacons (RRFBs) and a full pedestrian signal. They provide positive stop control in areas without the high pedestrian traffic volumes that typically warrant signal installation.
- Pedestrian refuge islands allow pedestrians a safe place to stop at the midpoint of the roadway midpoint before crossing the remaining distance. This is particularly helpful for older pedestrians or others with limited mobility.
- Raised crosswalks can reduce vehicle speeds.
- Crosswalk visibility enhancements, such as crosswalk lighting and enhanced signing and marking, help drivers detect pedestrians—particularly at night.

Enhanced At-Grade Crossing or Signalized Crossing

Pedestrian Hybrid Beacon

A Pedestrian Hybrid Beacon (Figure 39) is a pedestrian-activated traffic control device that is dark to motorists until activated by a pedestrian, at which time a flashing yellow light followed by a solid red light is provided to motorists to direct them to stop. The solid red advances to a flashing red that allows motorists to proceed with caution once the pedestrian has cleared the crossing).

Figure 39. Pedestrian Hybrid Beacon

[19] https://www.fhwa.dot.gov/innovation/everydaycounts/edc_4/step.cfm.

Rectangular Rapid Flashing Beacon (RRFB)

A RRFB (Figure 40) is a traffic control device consisting of two rapidly and alternately flashing rectangular yellow indications with an LED array that functions as a warning beacon. This device has Interim Approval through FHWA for use at unmarked crosswalks.

Figure 40. Rectangular Rapid Flashing Beacon (RRFB)

Mid-Block Crosswalks

Crosswalks provide critical clarification at intersections. In mid-block locations, the design of the crosswalk is particularly critical to identify a safe space for bicyclists and pedestrians to cross and heighten the visibility of users of the crossing. The design of a crosswalk should depend on the facility type, location, adjacent street function, surrounding land use, and level of potential conflict.

The Small Town and Rural Design Guide has identified several factors that can be included to make a crossing safer, including median islands, raised crossings, and crosswalk markings (Figure 41). NACTO's *Bikeway Design Guide* has also identified a number of crosswalk designs that can be implemented depending on context. Features highlighted in the guide include green paint in the intersection and "elephant tracks" or wider white striping along the outside of the intersection. It is recommended that each intersection or crossing be designed for the context, including the features that would provide the most clarity for all users of the crossing.

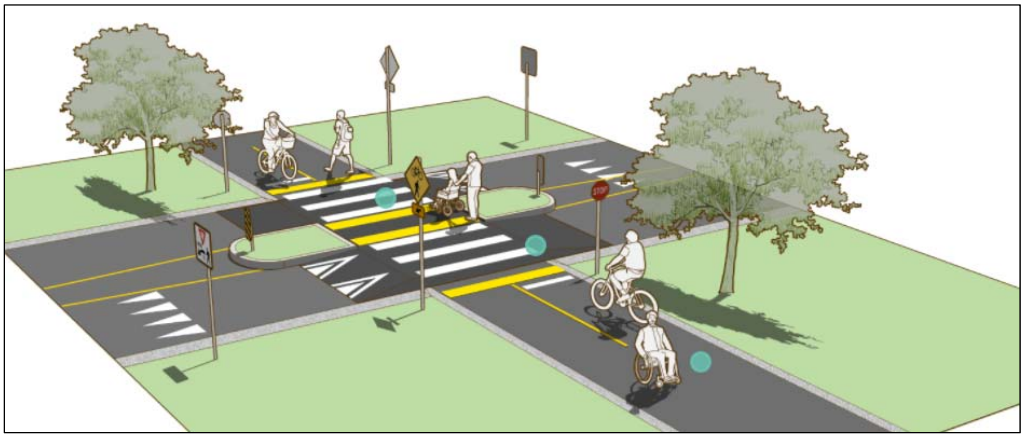


Figure 41. Shared Use Path Crossing

Source: FHWA Small Town and Rural Design Guide

Overpasses and Underpasses

Overpasses and underpasses could be considered in locations where traffic volumes and speeds are too high to manage with an at-grade crossing, such as multi-lane highway crossings. In some instances, based on usage volume, it may be appropriate to consider the construction of an overpass as part of a long-term plan for the bicycle and pedestrian network. Overpasses and underpasses present their own design challenges, however, and require a great deal of study prior to making the determination that they are the preferred roadway crossing solution.

Wayfinding

Wayfinding is an important component of a bicycle network and can be defined as:

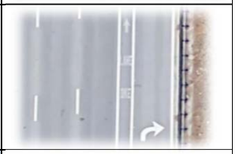
> … a system [that consists] of comprehensive signing and/or pavement markings to guide bicyclists to their destinations along preferred bicycle routes. Signs are typically placed at decision points along bicycle routes – typically at the intersection of two or more bikeways and at other key locations leading to and along bicycle routes. (*NACTO Urban Bikeway Design Guide*)

The Collier MPO has areas that would benefit from signage that informs bicycle riders in the same way roadway signage informs motorists. Although cell phones have put maps and information at rider fingertips, signage creates confidence in the route being traveled and can quickly and conveniently convey directions and distance. Established local signage plans are helpful when riding in defined areas. Signage can also be used to help 'bridge the gap' between Shared Use Paths and on-street facilities, telling users how to get to a Shared Use Path or a destination.

Summary Chart and Illustrative Cross Sections

The design guide lines summarized in Table 17 are customized to fit the characteristics of the Collier MPO's road network and consider established land uses, development patterns, and form-giving environmental conditions such as canals, drainageways, and protected conservation lands. The MPO Design Guidelines account for the fact that major arterials located in high growth areas in Collier County exhibit current Average Daily Traffic (ADT) that far exceeds the levels envisioned in the source manuals referenced at the beginning of this chapter. Figures 42–46 show illustrative cross-sections based on roadway characteristics with an emphasis on bicycle and pedestrian facilities. The following chapter on Policy and Implementation provides additional guidance.

for All Ages & Abilities

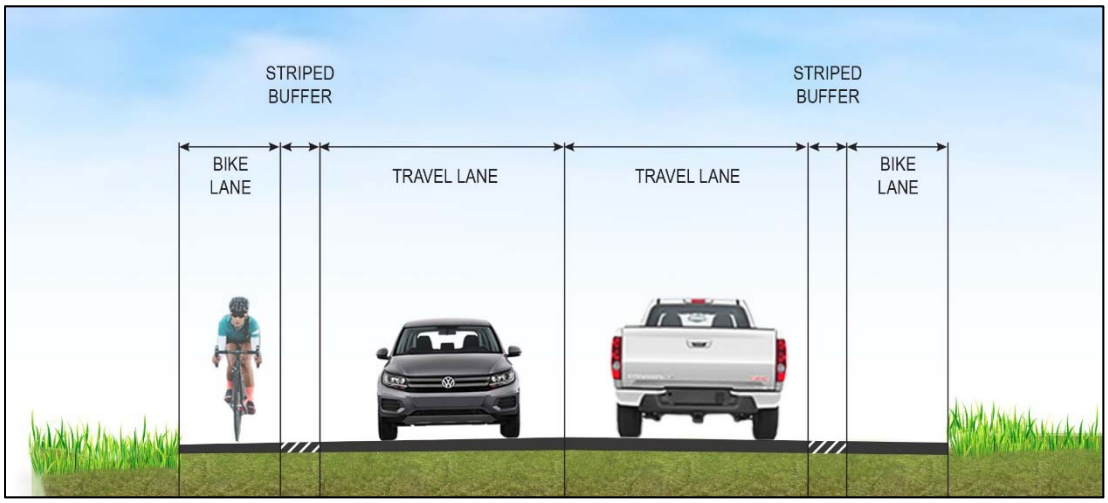
Federal/FDOT Roadway Functional Classification	Roadway Description	Motor Vehicle Posted Speed	Target Maximum Motor Vehicle Volume in (ADT)	Number of Vehicular Lanes	Type of Bikeway	Minimum Bikeway Width	Minimum Sidewalk Width	Photos
unclassified (i.e. residential or "local" roads) - urban and rural settings	Minor, low volume roads	up to 25 mph	up to 1,000	2-lanes (1 in each direction)	Shared lanes, marked (sharrows) or unmarked	N/A	5' in residential areas	
unclassified (i.e. residential or "local" roads) - urban and rural settings	Local, low volume, low speed roads	up to 25 mph	over 1,000 up to 3,000	2-lanes (1 in each direction)	Bicycle Boulevards	N/A	5' in residential areas	
Collectors and Arterials with Severely Constrained ROW	Lower volume, moderate speed, major roads with space constraints	26 to 35 mph	over 3,000 up to 6,000	2-4 lanes (1-2 in each direction)	on roads serving residential land uses, reducing road pavement width may be a traffic calming measure: 10' lanes with 2' shoulder fits context; in mixed-use or commercial areas, a wide, shared-use outside lane marked with "sharrows" fits context	10' lane + 2' shoulder; or 14' outside lane	6'	
Collectors and Arterials with Moderately Constrained ROW	Moderate volume and speed, major roads with space constraints	26 to 35 mph	over 3,000 up to 6,000	2-4 lanes (1-2 in each direction)	Conventional, Marked Bike Lanes in urban setting; Paved Shoulders in rural settings	minimum 4' bike lane width; 5' adjacent to curbs, walls, guardrails, other fixed verticle objects)	6'	
Rural Highways (State Roads - US41 & SR29 are prime examples)	Low to Moderate volume, high speed and high commercial or RV traffic	45 to 60 mph	under 6,000	2-lanes (1 in each direction)	Wide, paved shoulders, Buffered bike lanes or Shared Use Paths; 8'-wide sidewalks may be substituted for Shared Use Paths on State roads; and on locally-owned roads on a case-by-case basis	min. 5'-wide paved shoulders, preferred 7' with 2' buffer or 11' SUP on one side; 7' shoulder width required if marked as a bike lane (FDM)	pedestrians use shoulders or SUP; if marked bike lanes, include signage - cyclists yield to peds	
Collectors and Arterials with higher speeds, higher volumes	Higher volume, higher speed, limited access, urban and rural highways	36 to 45 mph	over 6,000	2-4 lanes (1-2 in each direction)	Buffered Bike Lanes or Shared Use Paths (AASHTO & FDOT Greenbook); 8'-wide sidewalks may be substituted for Shared Use Paths on State roads; and on locally-owned roads on a case-by-case basis.	5' bike lane and 2' painted buffer (may include a rumble strip)	6' with minimum 5' wide planting strip; if adjacent to protected bike lane, can eliminate planting strip	
High volume, High speed Arterials with greater than 20% Commercial or Recreational Vehicular Traffic (only truck count data (not RV) available; RV use based on observation, not %)	High volume, high speed urban and rural highways	45 mph and greater	over 6,000	4-6 lanes (2-3 in each direction)	Protected Bike Lanes or Shared Use Paths (NACTO- All Ages & Abilities 26 mph and greater) - ***in places with low curbside activity;*** 8'-wide sidewalks may be substituted for Shared Use Paths on State roads; and on locally-owned roads on a case-by-case basis.	5' bike lane and sufficient width to provide curbed or other verticle separation	6' with minimum 5' wide planting strip; if adjacent to protected bike sidewalks on flush shoulder roadways should not be constructed directly adjacent to the roadway or shoulder pavement.	
Collectors and Arterials with limited access and sufficient ROW	Adjacent to roadways with no or very few intersections or driveways	45 mph and greater	over 6,000	4-6 lanes (2-3 in each direction)	Sidepath defined by AASHTO as a two-way Shared Use Path adjacent to roadways - ***in places with low curbside activity per NACTO;*** 8'-wide sidewalks may be substituted for Shared Use Paths on State roads; and on locally-owned roads on a case-by-case basis.	11' -AASHTO 12' - FDOT	N/A	
OFF ROAD FACILITIES	**Location**							
N/A - Facilities constructed outside of road ROW	Linear greenways typically within or adjacent to drainage and utility ROW	N/A	N/A	N/A	a two-way Shared Use Path in independent ROW	12'	N/A	

Illustrative Roadway Cross-Sections

The following illustrations of roadway cross-sections show MPO-recommended bicycle and pedestrian facilities on roadways having posted or target speeds of 40 mph and higher.

Figure 42. Two-Lane Rural Roadway

Buffered bike lanes on both sides of road; option to add audible pavement markings and green surface



*Note Applicable to Figures 43– 46: An 8' sidewalk meets minimum standards and may be substituted for on State roads, and on locally-owned roads where ROW is limited.

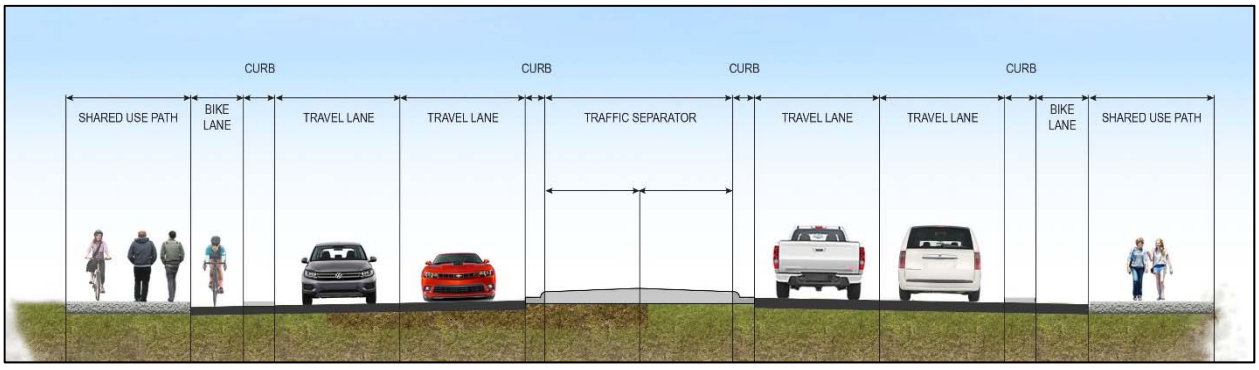


Figure 43. Multi-Lane Urban Roadway

Shared Use Path* and Protected Bike Lane on Both Sides

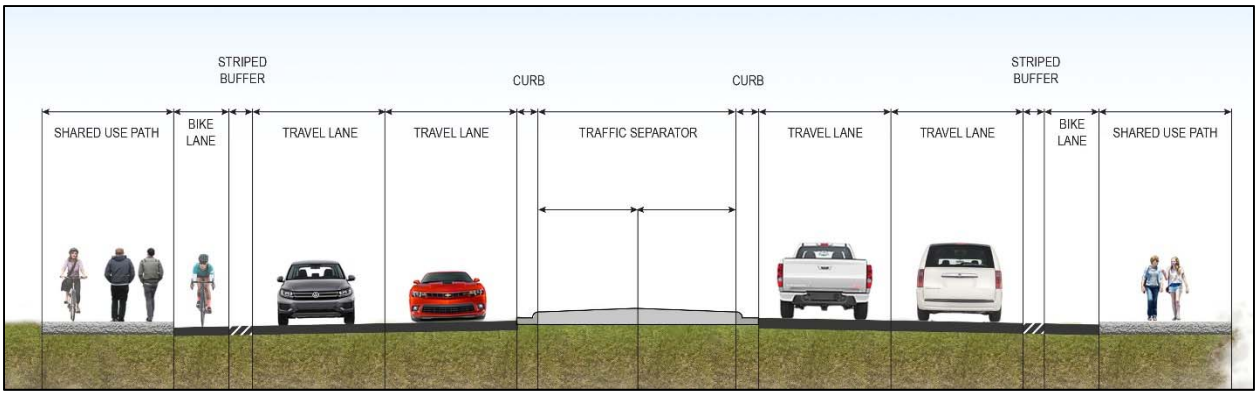


Figure 44. Multi-Lane Urban Roadway
Shared Use Path* and buffered bike lane on both sides

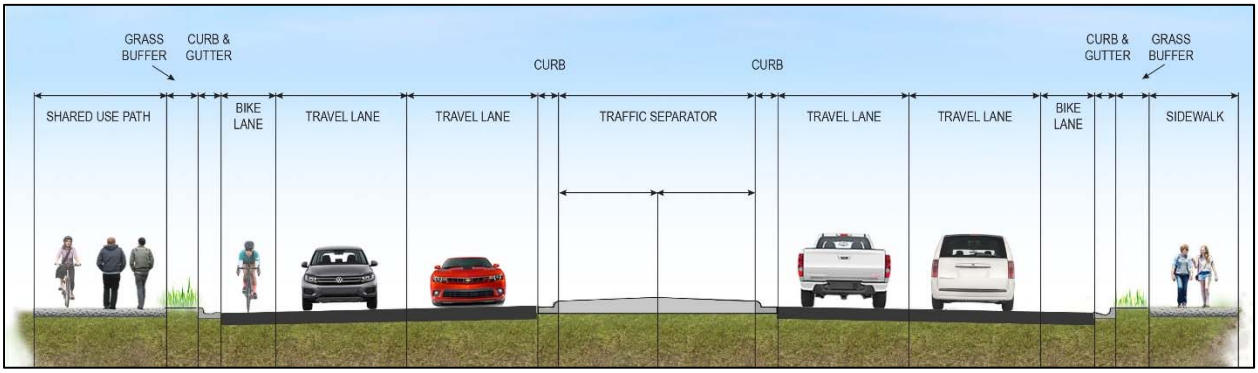


Figure 45. Multi-Lane Urban Roadway
Shared Use Path on one side, 8' sidewalk on other side, standard bike lanes both sides*

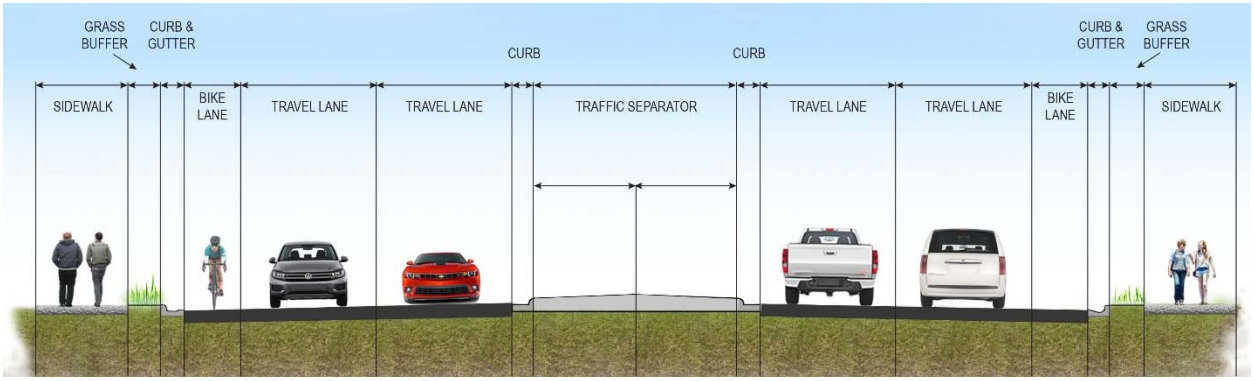


Figure 46. Multi-Lane Urban Roadway – Retrofit
8'-wide sidewalks and standard bike lanes on both sides*