PEDESTRIAN WAYS

Getting Started

This section presents best practices for creating pedestrian ways. These tools are tested, widely supported, and currently used across the country. Facility descriptions and resources are included.

3a

SIDEWALK ZONE SYSTEM 3.1

The Sidewalk Zone System is widely used to create clear walking areas. Each zone is a distinct sidewalk area; the four zones are:

CURB ZONE Curbed area between the sidewalk and the vehicle ways; usually includes drain inlets.

FURNITURE ZONE Area of the sidewalk where refuse receptacles, benches, utilities and other objects are best placed.

PEDESTRIAN ZONE Area of the sidewalk that should be clear for walking.

FRONTAGE ZONE Area of the sidewalk that transitions to adjacent land uses; commonly used for quasi-public activities, such as outdoor cafes and sidewalk sales.

Each zone has a specific, important function; omitting any zone compromises the quality of the walking experience.

Using the Sidewalk Zone System makes it easier to meet basic ADA requirements for a continuous, smooth and level sidewalk, free of obstructions. Under the system, it easier to place ramps correctly and keep the sidewalk level across driveways. Following the system also keeps all potential obstructions, such as utility poles, signs, trees, drinking fountains and benches, in the furniture or frontage zones. The system also places pedestrians further from traffic, increasing comfort and security. The Pedestrian Right-of Way Accessibility Guidelines (PROWAG) offer guidance on selecting the practices for accessibility.

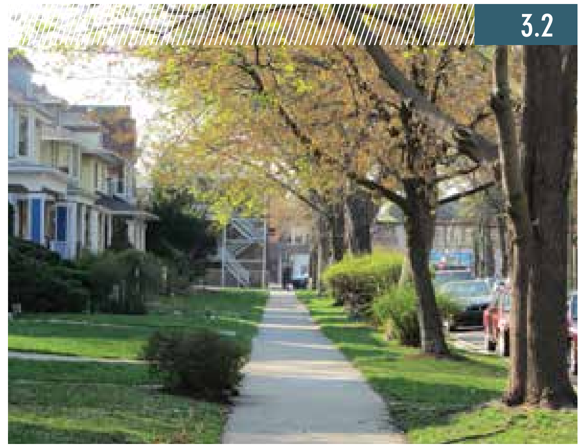

FIGURE 3.2
RESIDENTIAL SIDEWALKS
Chicago, IL

RESIDENTIAL SIDEWALK CONTEXT 3.2

Sidewalks should be standard practice in residential neighborhoods. A well-designed residential sidewalk has a minimum 5-foot unobstructed width, allowing two people to walk comfortably side-by-side. A residential sidewalk should also provide separation from the street. If possible, a width of 6 to 8 feet is preferable.

CURB ZONE

The curb zone in residential areas can vary between 1 to 2 feet. Residential areas with open drainage do not have curb zones. Where there is urban drainage, the shoulder is often considered part of the curb zone.

FURNITURE ZONE

The furniture zone is the area between the sidewalk and the curb or vehicle way. It provides separation from traffic and improves the pedestrian experience. In residential areas, this zone is often a planting strip for trees or grass. Most trees require at least 6 feet of open space around the trunk to reach maturity and maintain health. Utilities and other structures can be located in the furniture zone.

PEDESTRIAN ZONE

The pedestrian zone is the unobstructed area for walking, usually 5 to 6 feet wide in residential areas.

COMMERCIAL SIDEWALK CONTEXT 3.3

Commercial sidewalks typically are used by many more people than residential sidewalks, so the widest possible walkway should be provided to create areas of social exchange and interaction.

CURB ZONE

The curb zone in commercial areas can vary from 1 to 2 feet.

FURNITURE ZONE

In commercial areas, the furniture zone is typically part of the paved walkway. Any potential obstacles, such as benches, transit shelters, trash cans, utilities, parking meters, and vending machines, should be placed in the furniture zone. This zone should be at least 2 feet wide, to provide separation between pedestrians and vehicle traffic; widths of at least 5 to 6 feet are preferable to allow for tree placement and other uses. Tree growth requires a minimum of 36 square feet.

PEDESTRIAN ZONE

In commercial areas, the pedestrian zone should be a continuous, unobstructed area for walking, at least 8 to 10 feet wide.

FRONTAGE ZONE

The minimum frontage zone in commercial areas is 1 to 2 feet. However, a 5- to 10-foot frontage zone provides improved access to buildings and allows space for sidewalk sales, café seating and other uses.

COMMERCIAL TREE GRATE PLACEMENT

Tree grates should be placed immediately adjacent to the curb; spacing will depend on the mature size of the selected tree species. Tree grates should be at least 5 feet wide; 6-foot widths are preferable for most trees. In extremely limited spaces where tree grates extend into the pedestrian zone, they can be designed to prevent tripping hazards.

FIGURE 3.3A
COMMERCIAL SIDEWALKS
Chicago, IL

FIGURE 3.3B
COMMERCIAL FURNITURE ZONE
Oak Park, IL

FIGURE 3.3C
COMMERCIAL FRONTAGE ZONE
Chicago, IL

FIGURE 3.3D
COMMERCIAL TREE GRATE PLACEMENT
Chicago, IL

Going the Distance

These practices build on the tools detailed above, offering tested strategies to create more attractive, sustainable, user-friendly pedestrian ways that promote walking and social interaction. Facility descriptions and resources are provided.

FIGURE 3.4A
HOME ZONES
Chicago, IL

FIGURE 3.4B
SOCIAL STREETS
New York, NY

FIGURE 3.6
PAVEMENT-TOPARKS
Open Streets Event,
Chicago, IL

3.4A

3.4B

3.6

SOCIAL STREETS/ HOME ZONES 3.4

Social streets and home zones are shared-use streets that encourage pedestrian use of the entire travel way. Social streets in commercial areas are not "pedestrian malls" because vehicular traffic is allowed; significant traffic calming interventions and very low speed limits are used to allow safe shared use by pedestrians and motorists. In many residential areas, the natural street character lends itself to creation of a home zone. In these areas, sidewalks are not needed because the roadway accommodates all modes of traffic. In both social streets and home zones, speeds limits are so low that walkers and cyclists can rely on eye contact to communicate with drivers.

GREEN STREETS 3.5

Green streets incorporate environmentally friendly infrastructure, such as stormwater processing methods, rain gardens and drainage swales. More information on Green Infrastructure design is included in Chapter 4.

PARKLETS/PAVEMENT-TO-PARKS 3.6

There are a number of low-cost ways to improve pedestrian environments and create pedestrian park spaces without major infrastructure investment in curb replacement and drainage systems. Paved areas of the street can be set off by bollards or planters and painted to mark pedestrian park areas. "Parklets" also can be created by removing vehicle lanes, repurposing parking spaces and tightening intersections.

TABLE 3A
PEDESTRIAN WAYS

			Dimensions				Urban Contexts			Suburban Contexts				Rural Contexts		Places: Overlays for Planned Contexts						
			MIN	Target	MAX	Notes	Commercial/ Mixed Use	Residential	Single Use	Commercial	Residential	Village Mixed-Use	Single Use	Residential/ Agricultural	Village Mixed-Use	Pedestrian Priority Areas	TOD	Entertainment and Cultural Districts	Green Streets	Schools Zones and Campuses	Park Zones	Home Zones/ Social Zones
Getting Started	3.2 Residential Sidewalks	Curb Zone	1	1.5	2	Clear zone for utility and furnishings, not applicable if there is no curb.	—	Required	Permitted	—	Permitted	—	Permitted	Discouraged	—	Required	Required	—	Required	Required	Required	Encouraged
		Furniture Zone	2	6	10	A tree lawn separation area is desired.	—	Required	Permitted	—	Permitted	—	Permitted	Permitted	—	Required	Required	—	Required	Required	Required	Encouraged
		Pedestrian Zone	4	5	8	Unobstructed walking area required.	—	Required	Permitted	—	Permitted	—	Permitted	Permitted	—	Required	Required	—	Required	Required	Required	Encouraged
	3.3 Commercial Sidewalks	Curb Zone	1	1.5	2	Clear zone for utility and furnishings.	Required	—	Permitted	Permitted	—	Required	Permitted	—	Permitted	Required	Required	Required	Required	Required	Required	Encouraged
		Furniture Zone	4	5	6	Furnishing zone for benches and transit shelters etc. Ideally 6 ft. allow for 6 ft. x 6 ft. tree grates.	Required	—	Permitted	Required	—	Required	Permitted	—	Required	Required	Required	Required	Required	Required	Required	Encouraged
		Pedestrian Zone	5	5	10	Consider tree grate surfaces in pedestrian zone.	Required	—	Permitted	Required	—	Required	Permitted	—	Required	Required	Required	Required	Required	Required	Required	Encouraged
		Frontage Zone	1	5	10	Larger frontage zone allows for café seating.	Required	—	Permitted	Permitted	—	Required	Discouraged	—	Permitted	Required	Required	Required	Required	Required	Required	Encouraged
Going the Distance	3.4a Home Zones	Furniture Zone	0	6	10	Same as residential sidewalk. Except in rural and some suburban contexts. Additionally replaces vehicle travel way.	—	Encouraged	Discouraged	—	Encouraged	—	Discouraged	Discouraged	—	Encouraged	Permitted	—	Encouraged	Encouraged	Permitted	—
		Pedestrian Zone	0	5	8	Same as residential sidewalk. Except in rural and some suburban contexts. Additionally replaces vehicle travel way.	—	Encouraged	Discouraged	—	Encouraged	—	Discouraged	Discouraged	—	Encouraged	Permitted	—	Encouraged	Encouraged	Permitted	—
	3.4b Social Streets	Furniture Zone	2	6	10	Same as residential sidewalk. Additionally replaces vehicle travel way.	Permitted	—	Discouraged	Discouraged	—	Permitted	Discouraged	—	Permitted	Encouraged	Permitted	—	Encouraged	Encouraged	Permitted	—
		Pedestrian Zone	5	5	10	Same as commercial sidewalk. Additionally replaces vehicle travel way.	Permitted	—	Discouraged	Discouraged	—	Permitted	Discouraged	—	Permitted	Encouraged	Permitted	Permitted	Encouraged	Encouraged	Permitted	—
		Frontage Zone	1	5	10	Same as commercial sidewalk. Additionally replaces vehicle travel way.	Permitted	—	Discouraged	Discouraged	—	Permitted	Discouraged	—	Permitted	Encouraged	Permitted	Permitted	Encouraged	Encouraged	Permitted	—
	3.5 Green Streets	Furniture Zone	6	8	10	Includes space for rain gardens and drainage swales. Lighting should be LED.	Permitted	Encouraged	Permitted	Permitted	Encouraged	Encouraged	Encouraged	Permitted	Encouraged	Encouraged	Permitted	Permitted	—	Encouraged	Encouraged	Encouraged
		Pedestrian Zone	4	5	8	Clear walking area should be made of pervious materials.	Permitted	Encouraged	Permitted	Permitted	Encouraged	Encouraged	Encouraged	Permitted	Encouraged	Encouraged	Permitted	Permitted	—	Encouraged	Encouraged	Encouraged
		Frontage Zone	1	2	10	Could include space for community gardens.	Permitted	Encouraged	Permitted	Permitted	Encouraged	Encouraged	Encouraged	Permitted	Encouraged	Encouraged	Permitted	Permitted	—	Encouraged	Encouraged	Encouraged
		Median	6	8	12	Includes space for rain gardens and drainage swales. Lighting should be LED.	Permitted	Encouraged	Permitted	Permitted	Encouraged	Encouraged	Encouraged	Permitted	Encouraged	Encouraged	Permitted	Permitted	—	Encouraged	Encouraged	Encouraged
	3.6a Parklets	In Roadway	7	8	8	Replaces parking space. A one space parklet is between 18 and 20 ft.	Encouraged	Encouraged	Discouraged	Discouraged	Discouraged	Permitted	Discouraged	Discouraged	Permitted	Encouraged	Permitted	Encouraged	Encouraged	Encouraged	Encouraged	Encouraged
	3.6b Pavement-to-Parks	In Roadway	Varies	Varies	Varies	Created where there is excess roadway room to repurpose in the pedestrian realm.	Encouraged	Encouraged	Discouraged	Discouraged	Discouraged	Permitted	Discouraged	Discouraged	Permitted	Encouraged	Permitted	Encouraged	Encouraged	Encouraged	Encouraged	Encouraged

KEY				
KEY	Encouraged	Permitted	Discouraged	Required


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BICYCLE WAYS

3b

Getting Started

This section presents best practices for creating bicycle ways. These tools are tested, widely supported, and currently used across the country. Facility descriptions and resources are included.

Bicycle Facility Selection 3.7

This manual recommends that land use context be considered first when selecting bicycle accommodations. (See Table 2.2.) Vehicle speed and volumes also should be considered. As a general rule, separation between vehicles and bicycles should increase as vehicle speed and vehicle volume increase. The graph in Figure 3.7 presents guidelines for selecting the most appropriate bicycle facility with respect to vehicle speed and vehicle volume; however, these guidelines must be weighed against design objectives, system plans, and resident expectations.

Right-of-way constraints also may limit bicycle facility selection, especially in retrofit projects, and may require a facility to change in type in more constricted areas. (A common example is a bicycle lane that becomes a marked shared lane for a segment of a corridor.) Additional considerations for bicycle facility selection include modal conflicts at intersections, pedestrian crossings, driveways, curb inlets, vehicle parking bays, and transit stops.

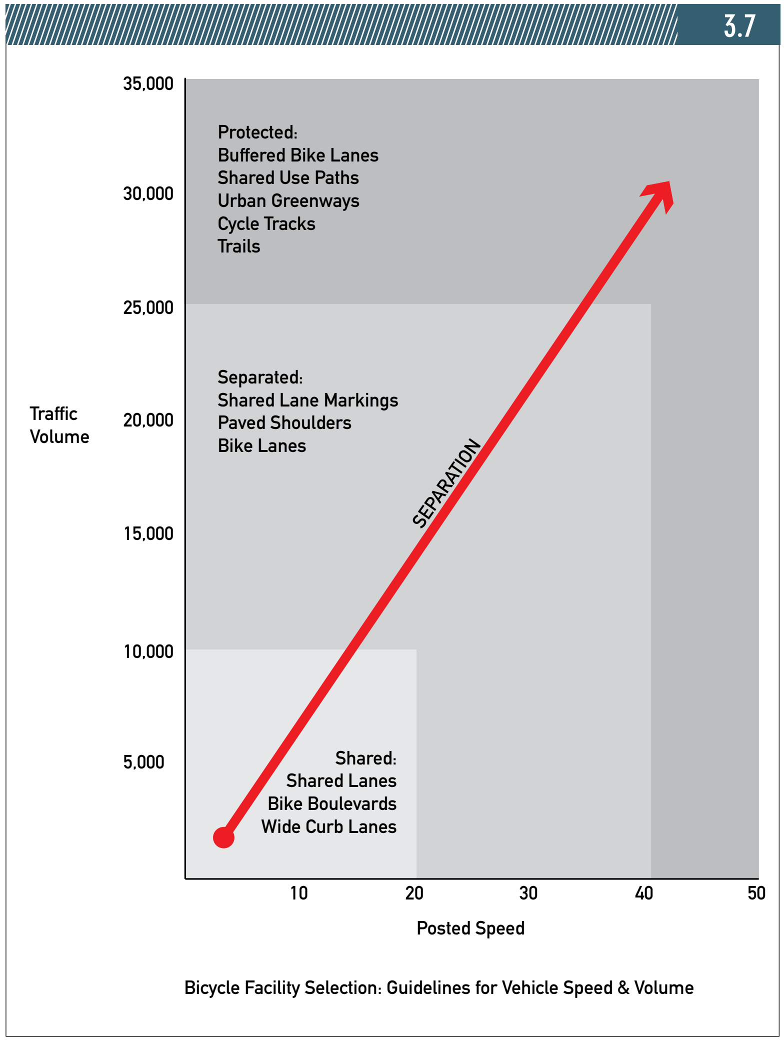

FIGURE 3.7
BICYCLE FACILITY SELECTION
Guidelines for Vehicle Speed and Volume.

SIGNED ROUTES 3.8

Adding signage to the network provides immediate value and encouragement to cyclists, raises all users' awareness and acceptance of cycling, and makes all residents aware of the most bike-friendly routes in their communities. Bike route signs are appropriate for any roadway that provides an essential link in a bicycle system, and can offer important, affordable motorist education and traffic calming. However, signage is no substitute for installation of an appropriate infrastructure to support safe cycling. Instead of posting simple "Bike Route" signs, the best solution is to implement a system of wayfinding signs that provide directions to specific destinations. Routes can be named after streets or destinations, or can be numbered in conjunction with a bike map that shows where different numbered routes lead. These types of bikeway signs provide useful information and directions for cyclists, drivers and pedestrians alike.

SHARED LANES 3.9

Shared lanes are streets that can be used comfortably by cyclists with moderate tolerance for traffic. These are typically streets with low traffic volumes and speeds, such as most residential streets. These lanes do not require on-street bicycle markings or signs.

FIGURE 3.8A
BIKE ROUTES
Chicago, IL

FIGURE 3.8B
BIKE ROUTES
Oak Park, IL

FIGURE 3.9
SHARED LANES
Palos Heights IL

FIGURE 3.10
WIDE CURB LANES
Chicago, IL

FIGURE 3.11
PAVED SHOULDERS
Palos Heights, IL

WIDE CURB LANES 3.10

Wide curb lanes are 13- to 15-foot-wide vehicle lanes on the outside (curbside) lane of a roadway. Wide curb lanes provide space for a vehicle to pass a bike within the lane. However, wide lanes encourage high speeds, especially over long distances, and 10- to 12-foot lanes are wide enough to allow most vehicles to pass cyclists with minimal encroachment into the adjacent lane. For these reasons, wide curb lanes should be discouraged or used only in combination with shared lane markings, traffic calming, and bicycle wayfinding signs. Where possible, wide curb lanes should be replaced by bike lanes, marked shared lanes, or paved shoulders.

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PAVED SHOULDERS 3.11

Paved shoulders are the paved areas adjacent to motor vehicle travel lanes. They can be considered for corridors that cannot accommodate 5-foot bike lanes, or as an interim step for corridors where funding has not yet been secured to add bike lane markings and signs. Paved shoulders also can be considered on roads where demand for bike lanes is limited, or on rural roads where shoulders are shared with pedestrians.

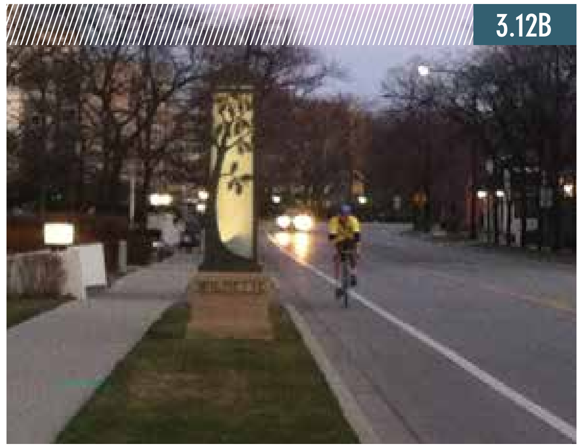


FIGURE 3.12A
BIKE LANES
Oak Park, IL

FIGURE 3.12B
BIKE LANES
Kenilworth, IL

FIGURE 3.12C
BIKE LANES
Chicago, IL

BIKE LANES 3.12

Bike lanes are appropriate on streets with heavy traffic. Bike lanes are indicated by on-street markings, which can be supplemented with signage. At minimum, bike lanes should be 5 feet wide; where possible, 6-foot-wide lanes are preferred, as they allow cyclists to ride further away from parked cars. Bike lanes reinforce proper roadway etiquette, raise the visibility of bicyclists, and help both bicyclists and drivers behave predictably when sharing road space. They also reduce motor vehicle speeds, lowering the risk of severe crashes. Bicycle lanes require regular sweeping to remain acceptably free of road debris.

BIKE LANES PROVIDE A NUMBER OF BENEFITS TO THE ARTERIAL NETWORK:

TRAFFIC CALMING Reducing lane width to 10 feet to provide bike lanes encourages motorists to drive at the speed limit.

SIDEWALK BUFFER In the absence of on-street parking, a bike lane provides separation between the vehicle travel ways and abutting sidewalks.

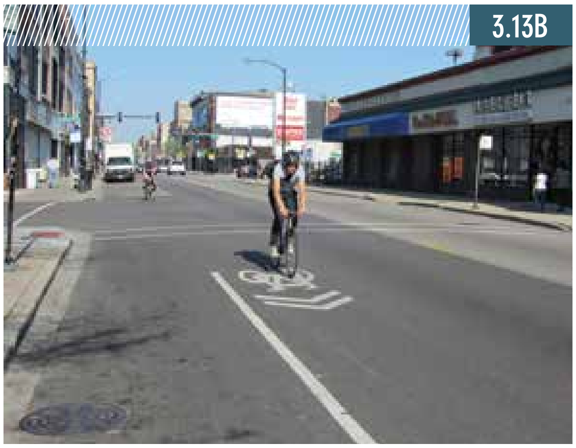
LARGER EFFECTIVE TURNING RADII Bike lanes create larger effective turning radii, allowing construction of smaller actual corner radii and potentially making it possible to shorten pedestrian crossing distances.

PLACEMAKING & EDUCATION A bike lane creates awareness of active transportation by alerting drivers to the presence of other modes of transportation.

FIGURE 3.13A
MARKED SHARED LANES
Chicago, IL

FIGURE 3.13B
MARKED SHARED LANES
Chicago, IL

FIGURE 3.13C
MARKED SHARED LANES
Oak Park, IL



MARKED SHARED LANES 3.13

Marked shared lane use a double chevron and bicycle marking, or "sharrow," in the general-use lane to alert drivers to the presence of bicyclists and to encourage safe bicycle use. Chevron symbols direct bicyclists to ride in the safest location within the lane, outside of the door zone of parked cars and areas where debris is likely to collect. Generally, marked shared lanes are a low-cost treatment suitable for lightly travelled collectors and arterials when speeds are lower than 35 mph. They are also appropriate for high-volume and low speed corridors with on-street parking, like central business districts where cross streets and traffic signals are closely spaced and speeds seldom exceed 20 mph. Marked shared lanes are often combined with additional traffic calming techniques, such as curb extensions, chicanes, medians, and vertical visual cues, such as trees. Marked shared lanes also can be useful on corridors that include a separated bike facility, such as a cycle track or a side path, to provide additional options for cyclists who prefer riding on the roadway. In some priority corridors that include bike lanes, a marked shared lane can bridge short sections where constraints make it impossible to accommodate the bike lane. Marked shared lanes increase cyclists' comfort levels and encourage predictable, cautious behavior for both motorists and cyclists.

FIGURE 3.14A
BIKE-BUS LANE
Chicago, IL

FIGURE 3.14B
BIKE-BUS LANE
Chicago, IL

FIGURE 3.15A
SHARED-USE PATHS
Chicago, IL

FIGURE 3.15B
SHARED-USE PATHS
Chicago, IL

BIKE-BUS LANES 3.14

Bike-bus lanes are shared lanes limited to bus and bicycle traffic. The low traffic volume in these lanes makes them safer for bicycles, while the dedicated lane reduces congestion delays for buses, benefiting transit users. The recommended width of 16 feet for a shared bike-bus lane provides room for passing, but these lanes can be as narrow as 14 feet in areas with lower speeds.

SHARED-USE PATHS 3.15

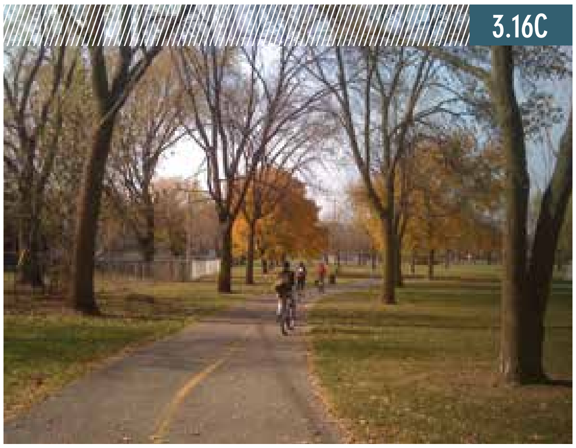
Shared-use paths are off-street facilities shared with pedestrians and recreational users. These paths are a good option for high-speed, high-volume corridors with wider block spacing, providing access for users who are not comfortable riding bicycles in heavy traffic. These paths also can link regional trail networks. Shared-use paths should be at least 8 feet wide; widths of 12 to 14 feet are preferred. Paths can be provided on both sides of a street; if a shared-use path is on one side only, adequate crossing accommodations must be provided to access land uses on the other side of the roadway. Special care should be taken to design driveway and intersection crossings to reduce potential conflicts. Adequate separation from the curb face can be created by a tree row, shoulder, or parking lane.

FIGURE 3.16A
TRAILS
Chicago, IL

FIGURE 3.16B
TRAILS
Schaumburg, IL

FIGURE 3.16C
TRAILS
Palos Heights, IL

FIGURE 3.16D
TRAILS
Des Plaines, IL



TRAILS 3.16

Trails are off-street facilities that can enhance network connectivity, filling in gaps where the street network is not complete or cannot accommodate bike facilities. Trails should meet the same design criteria as shared-use paths. They function best on exclusive rights-of-way, such as along waterways, utility corridors, or railroad corridors. Although trails are more expensive to build than on-street bike facilities and generally offer only limited access points, they provide important connections to regional trail systems and great opportunities for recreational cycling.

Going the Distance

These practices build on the tools detailed above, offering enhanced strategies to create more attractive, sustainable, user-friendly bicycle ways. These tools are currently in use in communities across the country, although local testing may be needed. Facility descriptions and resources are provided.

FLOATING BIKE LANES 3.17

Floating bike lanes can be used on roadways with high-volume traffic during peak hours and where on-street parking is allowed only during certain periods of the day. These lanes are generally adjacent to the curb. During peak traffic hours, on-street parking is not allowed; the lanes are used only by bicyclists. At off-peak hours, the lanes are used for parking and bicyclists move to the traffic lane or to another bicycle facility on the roadway.

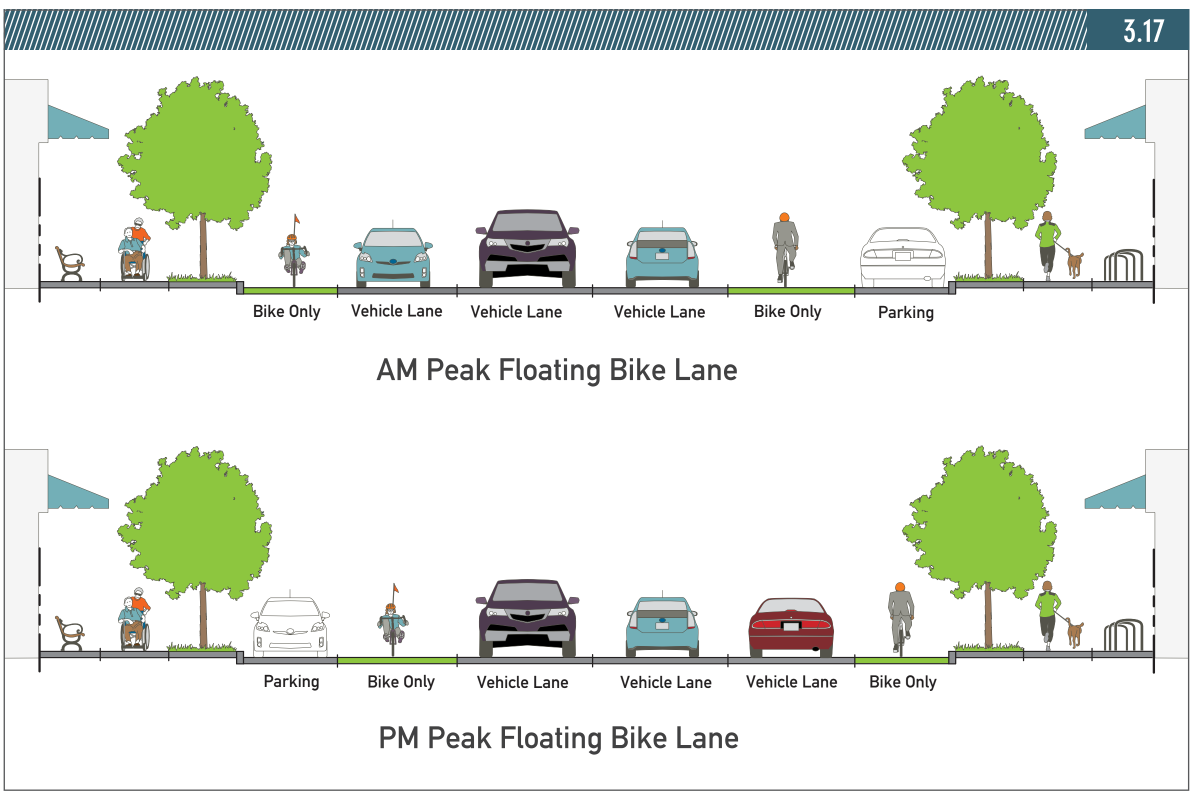


FIGURE 3.17
FLOATING BIKE LANES

FIGURE 3.18
ADVISORY BIKE LANES
Minneapolis, MN
Image Credit:
Steve Clark

FIGURE 3.19A
BIKE BOULEVARD
Berkeley, CA

FIGURE 3.19B
BIKE BOULEVARD
TRAFFIC DIVERTER
Portland, OR
Image Credit:
City of Portland
Image Courtesy
of NACTO

ADVISORY BIKE LANES 3.18

Advisory bike lanes are typically installed on narrow roadways with two-way vehicle traffic, low volume and very low speeds. The lanes are marked by dashed white lines on both sides of the roadway, creating a single center lane for motor vehicles. When oncoming cars approach, the motorists move carefully into the bike lanes to pass each other. Advisory bike lanes are common in Northern Europe and require a shared-use environment where motorists and bicyclists yield to each other to allow for passing movements and two-way traffic flow.

BIKE BOULEVARDS 3.19 & NEIGHBORHOOD GREENWAYS 3.20

Bike boulevards, also called neighborhood greenways, are a refinement of the shared roadway concept. They are created by modifying a local street to give priority to bicyclists while maintaining local access for automobiles. Traffic-calming measures reduce motor vehicle speeds and through trips; traffic controls limit conflicts between motorists and bicyclists, giving priority to bicyclists' through-movement. Some bike boulevards replace stop signs with mini-circles and mini-roundabouts to reduce stopping for cyclists. Bike boulevards and neighborhood greenways also include provisions for crossing intersecting arterial corridors. They are good options for low-volume, low-speed corridors. They also can play a prominent role in a bicycle network by serving as viable alternatives to major arterials, linking important community places, and connecting multiple intersecting bike routes. Additionally, these treatments can serve as places that highlight urban design and neighborhood identity.

FIGURE 3.21
CONTRAFLOW BIKE LANES
Washington, DC
Image Credit:
Dylan Passmore

CONTRAFLOW BIKE LANES 3.21

Contraflow bike lanes can help to increase network connectivity in areas with many one-way streets, by allowing bike traffic against the flow of vehicular traffic on one-way streets. A double yellow line provides separation and indicates that bicyclists will be moving against traffic. These facilities can make short but necessary connections between important bike corridors.

FIGURE 3.22
LEFT SIDE BIKE LANES
Chicago, IL

LEFT-SIDE BIKE LANES 3.22

Left-side bike lanes can be used on one-way streets that have many conflicts on the right side, such as frequent stopping or parking, or on boulevards where a median separates the lane from oncoming traffic. Under these circumstances, a left-side bike lane allows for fewer disruptions in the flow of bicycle traffic. On highly travelled corridors and commuter routes, left-side bike lanes reduce conflicts where bicyclists make left turns; right turns can be made in a box-turn style, by stopping and rotating the bicycle into the desired travel lane.

FIGURE 3.23
COLORED PAVEMENT
BIKE LANES
Chicago, IL

FIGURE 3.24
DOUBLE BIKE LANES
Portland, OR
Image Credit:
Jason McHuff

COLORED PAVEMENT BIKE LANES 3.23

Colored pavement bike lanes improve visibility and identity, and help reduce the perceived width of the vehicular travel way. Paint can be used to mark the lanes if the roadway surface is pretreated to avoid slipperiness; colored asphalt or a thermoplastic coating provide a higher level of traction. These lanes are often used to bridge short areas where there is higher potential for vehicular conflicts; cost permitting, however, they are a viable option on an entire corridor. Green has become the standard choice for colored pavement bike lanes in the United States.

DOUBLE BIKE LANES 3.24

Double bike lanes provide two separate lanes in the same direction for bicycle travel. Like a buffered lane, a double bike lane provides separation from vehicle and parking lanes; it also allows faster cyclists to pass slower ones. Double bike lanes can be considered on corridors with high-volume bicycle use and also can be installed over short segments along commuter routes.

FIGURE 3.25A
BUFFERED BIKE LANES
Chicago, IL

FIGURE 3.25B
BUFFERED BIKE LANES
Minneapolis, MN

FIGURE 3.26A
CYCLE TRACKS
Washington, DC

FIGURE 3.26B
CYCLE TRACKS
Chicago, IL

BUFFERED BIKE LANES 3.25

Buffered bike lanes use a painted buffer area to separate the vehicle travel lane from the bike lane. This buffer, usually 2 to 3 feet wide, can provide sufficient separation to improve cyclists' comfort and safety on heavily traveled arterial corridors. Where there is sufficient space within the curb-to-curb area, buffered bike lanes provide a more affordable solution than a shared-use path. Buffers also can be used between the bike lane and on-street parking, to separate the lane from the door zone.

CYCLE TRACKS 3.26

Cycle tracks are bike lanes separated from vehicle traffic by a curb, rail, or bollards, providing dedicated space for bicyclists who are not comfortable riding on busy streets. Cycle tracks typically are wider than bike lanes, allowing cyclists to ride side-by-side or to pass each other. On corridors with on-street parking, cycle tracks usually are placed between the parking lane and the sidewalk; two-way cycle tracks also can be placed along the center of a roadway. Cycle tracks must be wide enough to allow street sweepers to pass. Cycle tracks require careful implementation at intersecting streets and driveways, where motorists may not see bicyclists entering the roadway from behind parked cars. Colored pavement, mixing zones or exclusive bike signal phasing can be used to increase safety at intersection points. Cycle tracks are most appropriate on high-speed, high-volume roadways in urban and mixed-use settings, where bicycles are a prioritized mode and a regular feature of the transportation environment. Cycle tracks may be less appropriate in suburban settings, where additional separation is easier to achieve via a shared-use path.

FIGURE 3.27A
URBAN GREENWAY
Cambridge, MA
Image Credit: City of Cambridge
Image Courtesy of NACTO

FIGURE 3.27B
LAKEFRONT TRAIL
Chicago, IL

URBAN GREENWAYS 3.27

An urban greenway is a linear park that extends a regional shared-use path or trail into urban/suburban bicycle networks and core districts. They are a form of raised cycle tracks. Urban greenways have unique names and identity features, such as the Indianapolis Cultural Trail and the Minneapolis Midtown Greenway. An urban greenway can serve as a transportation link and also can be a destination for recreational bicycling, shopping, entertainment, and tourism.

FIGURE 3.27C
LAKEFRONT TRAIL
Chicago, IL

KEY	Encouraged	Permitted	Discouraged	Required

TABLE 3B
BICYCLE WAYS

		Dimensions				Urban Contexts			Suburban Contexts				Rural Contexts		Places: Overlays for Planned Contexts						
		MIN	Target	MAX	Notes	Commercial/ Mixed Use	Residential	Single Use	Commercial	Residential	Village Mixed-Use	Single Use	Residential/ Agricultural	Village Mixed-Use	Pedestrian Priority Areas	TOD	Entertainment & Cultural Districts	Green Streets	Schools Zones and Campuses	Park Zones	Home Zones/ Social Zones
Getting Started	3.8 Signed Routes	9	10	14	Can be used on shared lanes or in combination with bicycle facilities.	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
	3.9 Shared Lanes	9	10	14	Replaces vehicle lane. Paved shoulder, marked shared lane, or bike lane is preferred.	Yellow	Green	Yellow	Yellow	Green	Yellow	Yellow	Yellow	Green	Green	Green	Yellow	Green	Yellow	Yellow	Green
	3.10 Wide Curb Lane	12	13	14	Less desirable than other types of accommodations; should be replaced by bike lanes, marked shared lanes or paved shoulders.	Red	Red	Yellow	Yellow	Yellow	Red	Yellow	Yellow	Red	Red	Red	Red	Red	Red	Yellow	Red
	3.11 Paved Shoulder	3	4	5	New AASHTO allows paved shoulders of a minimum 3 ft. with closed drainage in retrofit projects.	Red	Red	Yellow	Yellow	Yellow	Yellow	Yellow	Green	Yellow	Yellow	Red	Red	Yellow	Yellow	Yellow	Red
	3.12 Bike Lanes	4	5	6	Include bike lane marking.	Green	Yellow	Green	Yellow	Yellow	Yellow	Green	Yellow	Red	Yellow	Green	Yellow	Yellow	Yellow	Green	Red
	3.13 Marked Shared Lanes	10	13	14	Marking centered 11 ft. off curb with parking 4 ft. w/o. Place every 50 to 100 ft. preferred; maximum of every 250 ft. on low volume roadways. Place in center of lane if travel lane is 12 ft. or less.	Green	Yellow	Yellow	Yellow	Yellow	Green	Green	Yellow	Yellow	Yellow	Yellow	Green	Yellow	Yellow	Green	Yellow
	3.14 Bike-Bus Lanes	14	15	16	Combine with transitional painting and pavement markings. Allow room for bike and bus to pass frequently.	Yellow	Yellow	Yellow	Red	Red	Red	Red	Red	Red	Yellow	Yellow	Yellow	Red	Yellow	Yellow	Red
	3.15 Shared Use Paths	8	10	12	Replaces the pedestrian zone. Can be 6 ft. with engineering judgement. Also side path.	Red	Red	Yellow	Green	Yellow	Red	Green	Green	Red	Yellow	Red	Red	Yellow	Green	Green	Red
	3.16 Trails	8	10	12	Can be 6 ft. with engineering judgement. Can be gravel or limestone.	Red	Green	Yellow	Yellow	Green	Yellow	Green	Green	Yellow	Green	Green	Red	Green	Green	Green	Red
Going the Distance	3.17 Floating Bike Lanes	7	7	8	Replaces a parking lane.	Yellow	Red	Yellow	Yellow	Red	Red	Yellow	Red	Red	Red	Yellow	Red	Yellow	Yellow	Yellow	Red
	3.18 Advisory Bike Lanes	4	5	6	Dashed line space shared with part of a vehicle lane.	Yellow	Green	Yellow	Red	Green	Red	Yellow	Red	Red	Yellow	Green	Yellow	Green	Yellow	Green	Yellow
	3.19 Bike Boulevards and 3.20 Neighborhood Greenways	9	10	13	Replaces vehicle lane. Include bike boulevard marking.	Red	Green	Yellow	Red	Green	Yellow	Yellow	Yellow	Yellow	Yellow	Green	Red	Green	Green	Green	Red
	3.21 Contraflow Bike Lanes	4	5	6	Include bike lane marking and signs.	Yellow	Green	Yellow	Red	Yellow	Yellow	Yellow	Red	Yellow	Yellow	Green	Yellow	Yellow	Yellow	Yellow	Red
	3.22 Left Side Bike Lanes	4	5	6	Include bike lane marking and signs.	Green	Yellow	Yellow	Red	Red	Yellow	Yellow	Red	Yellow	Yellow	Green	Yellow	Yellow	Yellow	Yellow	Red
	3.23 Colored Pavement Bike Lanes	4	5	6	Pavement color should be green. Include bike lane marking and signs.	Green	Yellow	Yellow	Yellow	Red	Yellow	Yellow	Red	Yellow	Yellow	Green	Yellow	Green	Green	Green	Red
	3.24 Buffered Bike Lanes	6	7	9	Buffer of 2-3 ft. Maximum may be higher if larger buffer is required due to right-of-way dimensions.	Yellow	Yellow	Green	Green	Yellow	Red	Green	Yellow	Red	Yellow	Green	Red	Red	Yellow	Green	Red
	3.25 Double Bike Lanes	8	9	10	Facilitates passing movements where bicycle volumes are high; also provides buffer.	Green	Yellow	Green	Yellow	Red	Red	Green	Yellow	Red	Yellow	Yellow	Red	Red	Yellow	Green	Red
	3.26 Cycle Track – Inside Parking	7	8	9	Parking zone is the separation. Includes 1 to 3 ft. buffer to passenger side door zone. 14 ft. minimum with parking.	Green	Yellow	Yellow	Red	Red	Yellow	Yellow	Red	Yellow	Yellow	Green	Yellow	Yellow	Yellow	Yellow	Red
	3.26 Cycle Track – One direction	6	8	10	Buffer of 2-3 ft. Maximum may be higher if larger buffer is required due to right-of-way dimensions.	Green	Yellow	Yellow	Red	Red	Yellow	Yellow	Red	Yellow	Yellow	Green	Yellow	Yellow	Yellow	Yellow	Red
	3.26 Cycle Track – Two direction	8	10	15	Buffer of 2-3 ft. Maximum may be higher if larger buffer is required due to right-of-way dimensions.	Yellow	Yellow	Green	Red	Red	Yellow	Yellow	Red	Yellow	Red	Green	Yellow	Yellow	Yellow	Green	Red
	3.26 Cycle Track – Center	10	14	16	Buffer of 2-3 ft. on each side. Maximum may be higher if larger buffer is required due to right-of-way dimensions.	Yellow	Red	Yellow	Red	Red	Red	Yellow	Red	Red	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Red
	3.27 Urban Greenways	8	10	14	Created in pedestrian realm, can be shared with pedestrian zone or adjacent to pedestrian zone.	Green	Yellow	Yellow	Yellow	Red	Green	Yellow	Red	Yellow	Yellow	Green	Green	Green	Yellow	Green	Yellow

TRANSIT WAYS

Getting Started

This section presents best practices for creating transit ways. These tools are tested, widely supported, and currently used across the country. Facility descriptions and resources are included.

3C

Bus Stop Design Considerations 3.28

Bus stops should be designed to facilitate comfortable, easy passenger access. Bus stop areas should be clear from obstructions, allowing adequate room for waiting passengers who may be carrying parcels or baggage, or who may be traveling with bicycles. The following principles are fundamental to passenger-friendly bus stop design:

Space directly adjacent to bus loading areas should be free of all street-level obstacles. Apart from stop signs, all street furnishings (such as benches, light posts, shelters, kiosks and garbage receptacles) should be set back a minimum of 8 feet from the curb. If adequate space is not available, these items can be placed outside the bus loading area in the furniture zone, between the curb and sidewalk.

A clearance zone extending at least 4 feet from the curb is required so that opening bus doors are not blocked by street furnishings, signposts, landscaping, or other obstructions.

Provide 8 feet of clearance from the curb for wheelchair lift operation; 4 feet for the lift to extend and 4 feet for the wheelchair to maneuver beyond the lift. The ADA requires a minimum width of 3 feet for accessible paths of travel. Design bus stops to accommodate wheelchair lifts.

Ensure that overhanging tree branches are far enough from the ground to avoid signing obstruction or interference with mirrors on the buses.

When there is a planting strip directly adjacent to the curb, provide a sidewalk slab that extends from the existing sidewalk to the curb so that passengers do not have to cross wet grass or mud during inclement weather.

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FIGURE 3.30A
NEAR SIDE STOPS
Chicago, IL

FIGURE 3.30B
FAR SIDE STOPS
Chicago, IL

SHARED LANES 3.29

Bus transit typically shares the road with other vehicular traffic and does not require special design consideration; in most cases, buses are considered large vehicles (see section 1.4), with similar requirements for turning radii. Buses can use an adjacent lane to facilitate turning movements and also can benefit from the extended effective turning radii created by bike lanes. As semi-frequent users of the corridor, buses are not the typically selected as a design vehicle, unless designing for a priority transit routes.

NEAR SIDE/FAR SIDE STOPS 3.30

The first priority in selecting bus stop location is user convenience: they should be placed as close as possible to where passengers will be coming from or going to, very close to a safe and convenient street crossing. In urban settings it is usually best to place bus stops on the far side of the intersection. Exceptions can be made where the passenger generator is on the near side of an intersection, or where the street crossing on the near side is more convenient.

BUS PULL-OFFS 3.31

Bus pull-offs allow vehicles to pass stopped buses quickly and safely, and are most appropriate on corridors with higher speeds and lower volumes. Pull-offs are typically 40 feet long at intersections and 80 feet long at mid-block points. Pull-offs fit easily into streets with on-street parking but may require road widening on streets without parking areas. Transit providers often resist pull-offs because they fear delays caused by re-entering traffic. However, far-side intersection pull-offs are unlikely to cause delays, as buses can reenter traffic at the end of the signal phase if necessary. If reentering traffic is a concern, mid-block pull-offs can be limited.

MID-BLOCK CURB EXTENSIONS 3.32

Curb extensions are useful for mid-block stops where a pull-off could potentially cause delay for transit users. Extending the curb into the parking or travel lane to create bus stop space provides benefits for motorists and transit users alike:

Unlike longer mid-block pull-offs, curb extensions typically are 40 feet or less in length, so they have less impact on the on-street parking supply.

Curb extensions create additional sidewalk areas for siting bus shelters and reduce the crossing distance at stop locations.

On roadways with on-street parking, curb extensions reaching into the parking lane allow passengers to board or dismount the bus directly without stepping onto the street.

Curb extensions make it easier for passengers with disabilities to board the bus.

By speeding bus passengers' boarding and dismount, curb extensions reduce dwell time and resulting traffic congestion behind stopped buses.

Curb extensions allow buses to resume traveling immediately instead of waiting to merge back into traffic.

Curb extensions also can be useful for bus stops at intersections, where they provide additional benefits by improving visibility for turning motorists and shortening crossing distances for pedestrians and bicyclists.

FIGURE 3.33
BUS PADS
Chicago, IL

BUS PADS 3.33

Bus pads are concrete pads designed to support the standing weight of buses at bus stops. Bus pads should be considered on high-volume bus corridors where there is existing or developing degradation of asphalt surfaces, as evidenced by potholes or sinking areas near bus stops.

PEDESTRIAN ACCOMMODATIONS 3.34

Sidewalks should be provided wherever transit service exists or is planned for the future. Sidewalks that access transit should be a minimum of 6 feet in width, enabling two adults to walk comfortably side-by-side. In urban areas, where street furnishings, parking meters, signposts and other elements may clutter the sidewalk, the desirable minimum width is 10 feet.

BIKE-BUS LANES 3.35

Bike-bus lanes are effective for prioritization of transit routes, particularly in high ridership areas where frequent stops are required, because the lanes are wide enough to allow bicyclists and buses to pass without encroachment on neighboring vehicle lanes. (See description provided in section 2.1.)

Going the Distance

These practices build on the widely accepted tools detailed above, offering tested strategies to create more attractive, sustainable, user-friendly transit ways. These tools may have significant cost and planning implications. Facility descriptions and resources are provided.

FIGURE 3.36A
DEDICATED BUS LANES
Chicago, IL

FIGURE 3.36B
DEDICATED BUS LANES
London, UK

FIGURE 3.37A
PROTECTED BUS LANES
Minneapolis, MN

FIGURE 3.37B
PROTECTED BUS LANES
Paris, France


3.36A


3.37A

3.36B

3.37B

DEDICATED BUS LANES 3.36

Dedicated bus lanes are travel ways reserved for bus transit; no other vehicles may use the lanes, but they remain part of the roadway network. Signal prioritization can be created.

PROTECTED BUS LANES 3.37

Protected bus lanes use curbed buffers or bollards to separate the bus network from the roadway. These lanes are often placed in the center of the street. Separated lanes encourage prioritization of transit at signals and can be shared with bicyclists.

BUS RAPID TRANSIT (BRT) 3.38

BRT systems typically combine separated lane configurations with signal prioritization and improved vehicles and stations. BRT vehicles have increased capacity and modernized seating configurations, and allow street-level access to the bus. BRT stations resemble rail-transit stations, with improved waiting areas, bike parking, and covered/temperature-controlled shelters. Spacing of BRT stops (½ mile to 1 mile) reduces headway and system delay. Prepaid fares reduce dwell times. BRT also can use express routes to facilitate peak-hour travel and meet commute-related system demand.

STREETCARS 3.39

Streetcars allow for shared use of the travel way with other vehicles and offer some advantages over buses. Streetcars typically feature improved station amenities and vehicle design, like BRT, along with the flexibility to stop more frequently and integrate with the vehicle network, like traditional bus transit. As a fixed-route service, streetcars also have a more profound impact on community land use.

FIGURE 3.38A
BUS RAPID TRANSIT
Mexico City, Mexico

FIGURE 3.38B
BUS RAPID TRANSIT
Mexico City, Mexico

FIGURE 3.39
STREETCARS
San Francisco, CA

FIGURE 3.40A
CTA PUBLIC TRANSIT
Chicago, IL

FIGURE 3.40B
LIGHT RAIL TRANSIT
Minneapolis, MN

FIGURE 3.40C
METRA COMMUTER
RAIL TRANSIT
Elgin, IL

FIGURE 3.41
HIGH OCCUPANCY
VEHICLE LANES
Toronto, Canada
Image Credit:
Jess Fizscy


3.40A


3.40B


3.40C

RAIL TRANSIT 3.40

Light rail, heavy rail, and other forms of rail transit typically run outside of the roadway network and are for the most part beyond the scope of this manual. However, coordinating bicycle network access and pedestrian facilities with rail transit stations is a priority for Complete Streets networks.


3.41

HOV LANES 3.41

High-occupancy vehicle (HOV) lanes are limited to use by multi-passenger vehicles, including public buses and carpools. In some cases, these lanes also allow motorcycle use.

GREEN LANES 3.42

A variation on the HOV lane, a green lane allows use by any energy-efficient vehicle, including flex-fuel, hybrid, and electric cars and other non-petroleum powered vehicles. These lanes can be shared with motorcycles and bicycles.

TABLE 3C
TRANSIT WAYS

Section	Facility	Element	MIN	Target	MAX	Length Range	Notes	Urban Contexts: Commercial/ Mixed Use	Urban Contexts: Residential	Urban Contexts: Single Use	Suburban Contexts: Commercial	Suburban Contexts: Residential	Suburban Contexts: Village Mixed-Use	Suburban Contexts: Single Use	Rural Contexts: Residential/ Agricultural	Rural Contexts: Village Mixed-Use	Places: Overlays for Planned Contexts: Pedestrian Priority Areas	Places: TOD	Places: Entertainment and Cultural Districts	Places: Green Streets	Places: Schools Zones and Campuses	Places: Park Zones	Places: Home Zones/ Social Zones
Getting Started	3.28 Bus Stop Design	Furnishing Clearance	4	8	8	Varies	Where space is available, otherwise remove furnishings from stop.	Required	Encouraged	Required	Required	Encouraged	Encouraged	Encouraged	Encouraged	Encouraged	Encouraged	Required	Encouraged	Encouraged	Required	Required	Encouraged
		Door Clearance	4	4	8	Varies	At bus doors	Required	Encouraged	Required	Required	Encouraged	Encouraged	Encouraged	Encouraged	Encouraged	Encouraged	Required	Encouraged	Encouraged	Required	Required	Encouraged
		Wheel Chair Lift Clearance	4	9	9	Varies	At wheel chair lift location, ADA requires 3 ft. of width for wheelchair operation.	Required	Encouraged	Required	Required	Encouraged	Encouraged	Encouraged	Encouraged	Encouraged	Encouraged	Required	Encouraged	Encouraged	Required	Required	Encouraged
	3.29 Shared lanes		9	10	12	NA	Same as vehicle lane	Encouraged	Permitted	Permitted	Permitted	Permitted	Encouraged	Permitted	Permitted	Permitted	Encouraged	Encouraged	Encouraged	Permitted	Encouraged	Encouraged	Encouraged
	3.30 Near/Far Side Stops		7	8	12	80	Can use a pull-off or a vehicle lane.	Encouraged	Permitted	Encouraged	Encouraged	Permitted	Encouraged	Encouraged	Permitted	Permitted	Permitted	Encouraged	Permitted	Permitted	Permitted	Permitted	Encouraged
	3.31 Bus Pull Offs		7	8	10	120	7 ft. pull-offs may require buses to take a small portion of an adjacent lane.	Discouraged	Discouraged	Permitted	Encouraged	Encouraged	Permitted	Encouraged	Encouraged	Permitted	Permitted	Permitted	Permitted	Permitted	Permitted	Permitted	Discouraged
	3.32 Mid-Block Stops and Curb Extensions		9	10	12	40	Uses a vehicle lane. A curb extension is with on-street parking.	Encouraged	Permitted	Permitted	Permitted	Permitted	Encouraged	Permitted	Discouraged	Encouraged	Encouraged	Encouraged	Encouraged	Permitted	Permitted	Permitted	Encouraged
	3.35 Bike-Bus Lanes		14	15	16	—	Combine with transitional painting and pavement markings. Allow room for bike and bus to pass frequently.	Permitted	Permitted	Permitted	Discouraged	Discouraged	Discouraged	Discouraged	Discouraged	Discouraged	Permitted	Encouraged	Permitted	Permitted	Permitted	Permitted	Discouraged
Going the Distance	3.36 Dedicated Lanes		10	11	12	—	Bus only lanes	Encouraged	Permitted	Encouraged	Permitted	Discouraged	Discouraged	Permitted	Discouraged	Discouraged	Encouraged	Encouraged	Permitted	Permitted	Permitted	Permitted	Discouraged
	3.37 Separated Lanes		12	14	18	—	Requires a minimum of a 2-4 ft. bollard/wall separation. Separate signal or grade separation.	Encouraged	Permitted	Encouraged	Permitted	Discouraged	Discouraged	Permitted	Discouraged	Discouraged	Encouraged	Encouraged	Permitted	Permitted	Permitted	Permitted	Discouraged
	3.38 Bus Rapid Transit (BRT)		12	14	18	—	Requires a minimum of a 2-4 ft. bollard/wall separation. Separate signal or grade separation and prepaid fares. Includes special vehicles, system identification/branding, and station considerations.	Encouraged	Permitted	Encouraged	Permitted	Discouraged	Permitted	Permitted	Discouraged	Discouraged	Encouraged	Required	Permitted	Permitted	Permitted	Permitted	Discouraged
	3.39 Modern Streetcars		10	12	14	—	Requires special considerations for station/stop access.	Encouraged	Permitted	Encouraged	Discouraged	Discouraged	Discouraged	Discouraged	Discouraged	Discouraged	Permitted	Encouraged	Permitted	Permitted	Permitted	Permitted	Discouraged
	3.40 Rail Transit		20	30	66	—	Typical applications are raised above the roadway, tunneled or parallel. Retrofits typically use existing rail corridors. Light rail can be retrofitted into the roadway network.	Encouraged	Permitted	Encouraged	Permitted	Permitted	Permitted	Permitted	Discouraged	Discouraged	Encouraged	Required	Permitted	Permitted	Permitted	Permitted	Discouraged
	3.41 HOV Lanes		9	10	12	—	Same as vehicle lanes. All vehicles with more than one passenger.	Permitted	Discouraged	Encouraged	Permitted	Discouraged	Discouraged	Encouraged	Permitted	Discouraged	Discouraged	Encouraged	Discouraged	Permitted	Permitted	Permitted	Discouraged
	3.42 Green Lanes		9	10	12	—	Same as vehicle lanes. All vehicles with more than one passenger, plus bicycles, motorcycles, and green vehicles.	Permitted	Discouraged	Encouraged	Permitted	Discouraged	Discouraged	Encouraged	Permitted	Discouraged	Permitted	Encouraged	Discouraged	Encouraged	Permitted	Permitted	Discouraged

KEY				
KEY	Encouraged	Permitted	Discouraged	Required


LOYA
74 FULLERTON

VEHICLE WAYS

Getting Started

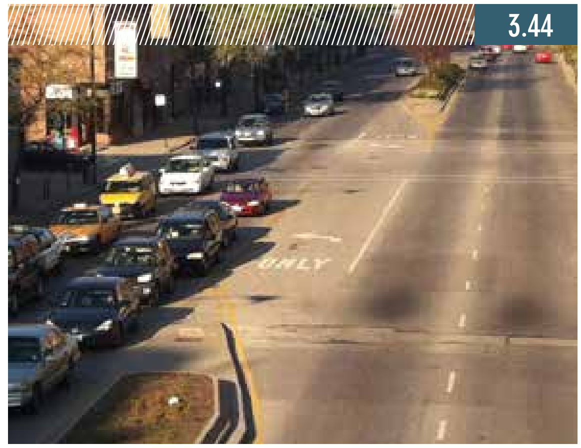
This section presents best practices for creating vehicle ways and utilizing design approaches that optimize roadways for Complete Streets. Guidance is provided for redefining traditional considerations like design vehicle, design speed, and turning radius.

3d

FIGURE 3.43
VEHICLE LANES
Chicago, IL

FIGURE 3.44
TURNING LANES
Chicago, IL

FIGURE 3.45
PARKING LANES
Chicago, IL



VEHICLE LANES 3.43

Vehicle lanes are suitable for all vehicles that use the roadway system. Too often, however, roadways are designed to prioritize trucks and other larger vehicles, even though the majority of users are in smaller vehicles. As a result, space within the right-of-way is allocated to create wider vehicle lanes instead of improving pedestrian and bicycle accommodations. This manual recommends a target vehicle lane width of 10 feet to maximize multimodal comfort. The outside lanes on transit ways and truck routes can be expanded to a width of 11 feet to accommodate larger vehicles, with a maximum design width of 12 feet for a standard vehicle lane. On local/low-volume two-way roadways, minimum lane widths of 8 to 9 feet are acceptable.

TURNING LANES 3.44

Turning lanes can be placed in medians or parking lanes. Two-way left-turn lanes are acceptable but not desirable; medians with structured turning movements are preferred. Design should support turning speeds under 15 mph. Two-way left-turn lanes are appropriate if used to reduce vehicle lanes, via a road diet.

PARKING LANES 3.45

On-street parking slows traffic and facilitates access to adjacent land uses. Parallel parking is most common, but angled parking is an option where parking demand is high. Back-in angled parking is the preferred choice, because car doors open to direct exiting passengers toward the sidewalk, motorists can access car trunks from the curb, and drivers have a better view of bicycle and vehicle traffic when re-entering the travel way. The creation of transit ways, on-street bike facilities, and sidewalk expansion sometimes can be accommodated by creative redesign of on-street parking. In a constrained right-of-way, it may be necessary to consider removing parking lanes to prioritize other modal accommodations.

DESIGN SPEED 3.46

This manual recommends a new approach to application of design speed for Complete Streets. A common practice is to select a design speed 5 or 10 mph above the expected travel speed; this approach is based on the "85th percentile" (85% of the vehicles are travelling at a speed lower than the 85th percentile). As a result, many roadways are overbuilt; this practice also leads to faster and faster traffic movement, because motorists tend to drive faster on roadways designed to support higher speeds. Roadway designs that encourage high-speed traffic have multiple negative effects – increasing the risk of serious crashes, reducing land access, making adjacent properties less accessible to cyclists and pedestrians, and degrading the social and retail life of a street.

Design speed neither determines nor predicts motorists' actual speed on a given roadway segment; rather, design speed determines which design features are allowable and/or mandated. High-speed designs are associated with large curb radii, straight and wide travel lanes, clear zones without on-street parking or street trees, guardrails, and other features that degrade the walking experience and make it difficult to design living streets. Conversely, many of the features that create livable streets, such as narrower lanes, tighter curb radii, street furniture, on-street parking and street trees, are allowable only at lower design speeds. Selecting a lower design speed will create a virtuous cycle, naturally encouraging slower traffic that will then make the street even safer and more attractive for pedestrians and bicyclists.

TARGET SPEED 3.47

To create livable streets, this manual recommends establishing a target speed based on roadway context, street typologies and desired outcomes, with a goal of creating a safer, more comfortable environment for motorists, pedestrians, and bicyclists. For many streets in urbanized areas, target speeds of 15 to 30 mph are desirable. These target speeds correlate to a higher pedestrian crash survival rate. Alleys and narrow roadways intended to function as shared spaces for motorists, cyclists and pedestrians may have design speeds as low as 10 mph.

SPEED CONTROL MECHANISMS

Speed control mechanisms influence motorists to drive at speeds that are safe within the roadway context. Simply posting a lower speed limit usually is not effective; instead, many design practices can be used to slow traffic if the 85th percentile speed is significantly higher than the target speed:

Signals should be timed to facilitate traffic at the target speed.

Narrow lanes encourage driving at appropriate speeds. As noted above, 10-foot lane widths are appropriate on all roadways with a target speed of 45 mph or less. (Bus routes and roadways in industrial areas with significant truck volumes may require 11-foot-wide right-hand lanes.)

Bike lanes and on-street parking add detail to the visual plane and encourage drivers to travel more slowly, to allow safe reaction to bicyclists and drivers entering the travel way.

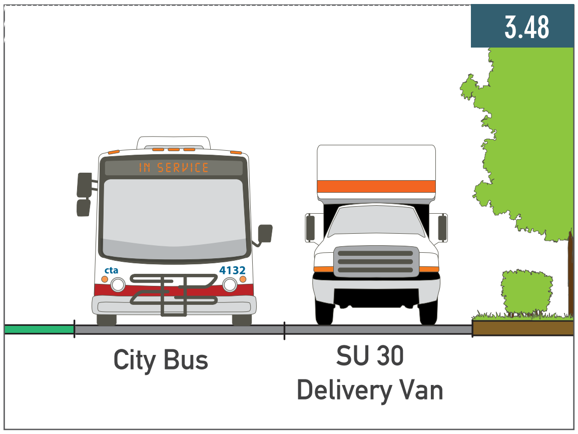
Medians and curb bulbouts add to the visual plane and encourage drivers to adjust to target speeds.

Street trees and other landscaping encourage drivers to notice their surroundings, engage with the environment, and drive at appropriate speeds.

Additional infrastructure features that can be used as speed control mechanisms are in section 3.4.

FIGURE 3.46
MEDIANS AND LANDSCAPING
Chicago, IL

FIGURE 3.48
DESIGN VEHICLES



DESIGN VEHICLE 3.48

The design vehicle influences several geometric design features, including lane width, corner radii, median nose design, and other intersection design details. Designing for a larger vehicle than necessary is undesirable, as larger dimensions lengthen pedestrian crossing distances and increase the speed of turning passenger vehicles. On the other hand, designing for a smaller vehicle can result in operational problems if larger vehicles frequently use the facility.

For design purposes, the target vehicle should be SU-30 or a delivery van. On some roadways, a smaller passenger car (P) can be used as the design vehicle for certain segments. On bus routes, CITY-BUS (or similar) may be a desirable design vehicle. When selecting a design vehicle, transit agencies can be consulted to assess future plans for accommodating transit service. On truck routes, where trucks constitute more than 2% of the daily traffic, designing for large trucks (either the WB-50 or WB-62FL design vehicle) may be appropriate. Vehicles larger than the default SU-30 should be considered mainly at the corners of intersections where these vehicles make turns. For corner radii, different design vehicles can be used for each corner, rather than a "one-size-fits-all" approach that results in larger radii than needed at most corners. The design vehicle should be accommodated with minimal encroachment into opposing traffic lanes; encroachment onto multiple same-direction traffic lanes on the receiving roadway is generally acceptable.

It is not appropriate to design a facility to accommodate a larger "control vehicle" that uses the street infrequently or makes infrequent turns at specific locations. Depending on the frequency of use, such "control vehicles" may be permitted to encroach on opposing traffic lanes or make multiple-point turns.

EFFECTIVE TURNING RADIUS

When designing intersections, the effective turning radius, rather than the corner radius, should be used wherever possible. On corridors that are prioritized for multimodal facilities, tighter turning radii are preferred because they result in shorter crossing distances and slower vehicle turning speeds.

Two design decision approaches can create a larger effective turning radius while maintaining small corner radii:

Bike lanes and parking lanes dramatically increase the effective turning radius, at a ratio of 3.4 feet added for every foot of lane at right-angle intersections.

Because vehicle codes require motorists to turn into the first or nearest available lane, designers of multiple-lane roadways can interpret the "nearest available" lane to be the second vehicle lane. On roadways with single lanes, this could be interpreted to allow large vehicles to encroach into oncoming traffic lanes.

TABLE 3D VEHICLE LANES

		Dimensions				Urban Contexts			Suburban Contexts				Rural Contexts		Places: Overlays for Planned Contexts						
		MIN	Target	MAX	Notes	Commercial/ Mixed Use	Residential	Single Use	Commercial	Residential	Village Mixed-Use	Single Use	Residential/ Agricultural	Village Mixed-Use	Pedestrian Priority Areas	TOD	Entertainment and Cultural Districts	Green Streets	Schools Zones and Campuses	Park Zones	Home Zones/ Social Zones
Getting Started	3.43a Low-volume	8	9	10	Under 1000 ADT. Includes service lanes on boulevards.	—	Encouraged	Permitted	Discouraged	Encouraged	Permitted	Permitted	Permitted	Permitted	Permitted	Permitted	Permitted	Permitted	Permitted	Permitted	Permitted
	3.43b Standard	10	10	12	Includes most streets and avenues.	Permitted	Permitted	Permitted	Permitted	Permitted	Permitted	Permitted	Permitted	Permitted	Permitted	Permitted	Permitted	Permitted	Permitted	Permitted	Permitted
	3.43c High volume	10	10	12	Over 20,000 ADT	Permitted	Discouraged	Encouraged	Encouraged	Discouraged	Permitted	Encouraged	Discouraged	Discouraged	Discouraged	Permitted	Permitted	Discouraged	Discouraged	Discouraged	Discouraged
	3.43d Truck/Emergency Route	11	11	12	For roadways with more than 2 lanes in one direction, one lane may be standard. Over 2% truck traffic or include in an emergency action plan.	Permitted	Discouraged	Encouraged	Encouraged	Discouraged	Discouraged	Encouraged	Permitted	Discouraged	Discouraged	Permitted	Discouraged	Discouraged	Discouraged	Discouraged	Discouraged
	3.44a Turning Lane	8	9	10	Turning speed under 15 mph. 8 ft. turning lane is easily modified to become a transit pull-off or parking lane.	Permitted	Discouraged	Permitted	Encouraged	Permitted	Permitted	Encouraged	Permitted	Permitted	Discouraged	Permitted	Permitted	Permitted	Discouraged	Discouraged	Discouraged
	3.44b Median/Center Turn Lane	10	10	14	Turning speed under 15 mph. Larger or multiple medians may be used on boulevards. Left turn turning lanes should be a minimum of 9 ft.	Encouraged	Permitted	Permitted	Encouraged	Permitted	Permitted	Permitted	Discouraged	Permitted	Encouraged	Encouraged	Encouraged	Encouraged	Encouraged	Encouraged	Permitted
	3.45a Parking Lane	7	8	9	8 ft. parking lane is interchangable with transit pull-offs.	Encouraged	Encouraged	Permitted	Permitted	Encouraged	Encouraged	Permitted	Discouraged	Encouraged	Encouraged	Encouraged	Encouraged	Permitted	Permitted	Permitted	Encouraged
	3.45b Angled Parking Lane	16	18	20	Back in parking is preferred for multimodal priority corridors. 16 ft. at 30 degrees, 18 ft. at 45 degrees, 20 ft. at 90 degrees. ADT < 4000. Speed ≤ 30 mph.	Encouraged	Discouraged	Discouraged	Discouraged	Discouraged	Encouraged	Discouraged	Discouraged	Encouraged	Encouraged	Encouraged	Encouraged	Permitted	Permitted	Permitted	Permitted
	3.47 Target Speed	10-15	20-30	35-40	Target speed can vary depending on context. If lower than posted speed, target speed becomes a control speed.	Required	Required	Encouraged	Encouraged	Required	Required	Encouraged	Permitted	Required	Required	Required	Required	Required	Required	Required	Required
	3.48 Target Design Vehicle	Pass-enger	SU-30	City bus	Target design vehicle can vary within a roadway for each turning movement.	Required	Required	Encouraged	Encouraged	Required	Required	Encouraged	Permitted	Required	Required	Required	Required	Required	Required	Required	Required

KEY	Encouraged	Permitted	Discouraged	Required

INTERSECTIONS & TRANSITIONS

Getting Started

This section includes best practices for textures and markings, focusing on options for material selection beyond the typical use of concrete and asphalt.

3e

Active Intersection Treatments

Design characteristics at intersections with corridors where bicycles and pedestrians are prioritized should focus on the needs of walkers and bicyclists. This section focuses on specific improvements for bicycles and pedestrians. (See section 1.4 for basic coordination measures that improve intersection function, such as tightening turning radii standards and reducing lane widths.)

FIGURE 349A LONGITUDINAL STYLE CROSSWALKS
Chicago, IL

FIGURE 3.49B LADDER STYLE CROSSWALKS
Chicago, IL

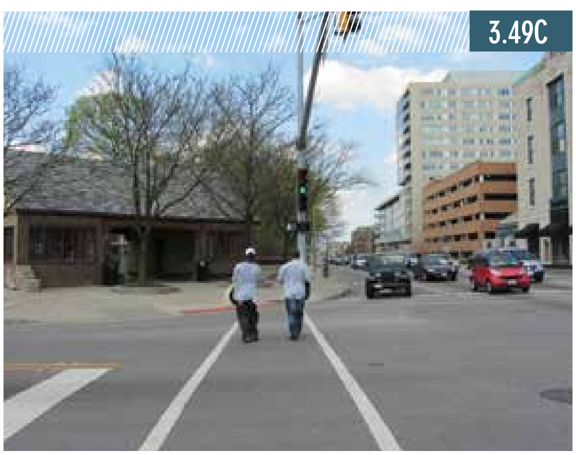


FIGURE 3.49C TRANSVERSE LINE STYLE CROSSWALKS
Oak Park, IL

FIGURE 3.49D PAVER STYLE CROSSWALKS
Forest Park, IL


3.49E

FIGURE 3.49E
UNSIGNALIZED CROSSING
Chicago, IL


3.49F

FIGURE 3.49F
MIDBLOCK CROSSING
Oak Park, IL


3.49G

FIGURE 3.49G
CROSSING ISLAND
Chicago, IL

PEDESTRIAN TREATMENTS 3.49

Many intersections lack basic accommodations for pedestrian crossings. The following treatments can be implemented on corridors where pedestrians may be present:

CROSSWALK VARIATIONS

All crosswalks not controlled by signals or stop signs should have longitudinal markings, per the 2009 Manual of Uniform Traffic Control Devices (MUTCD). These markings are significantly more visible to drivers than transverse crosswalks. Crosswalks in special districts may have custom designs, but these must comply with ADA standards for smoothness and visibility. When signalized intersections include an exclusive pedestrian phase, diagonal crossing can be permitted; this is sometimes called a pedestrian scramble.

UNSIGNALIZED MIDBLOCK CROSSINGS

Most pedestrians will cross the street where it is most convenient. Formalized midblock crossings can decrease random crossing movements. Along corridors where cross-street spacing would require impractical out-of-direction travel to reach signalized intersections, it is appropriate to provided formalized crossings at midblock transit stops, commercial destinations, unsignalized intersections and other pedestrian origin and destination points.

CROSSING ISLANDS

Crossing islands reduce crossing distance and allow pedestrians to cross only one direction of traffic at a time. Crossing islands are most beneficial at unsignalized pedestrian crossings, but they also can be useful to shorten crossing distances at signalized intersections.

TABLE 3E PEDESTRIAN TREATMENTS

		Dimensions	Design Considerations	Guideline	Notes
Crosswalk Variations	Transverse Lines	Lines 6 to 24 in. wide. Spacing 6 ft. wide minimum. Should be as wide as approaching sidewalk.	Lines should extend across entire roadway and can connect to lines of intersecting roadways crosswalk.	Should be used at signalized and controlled intersections to indicate proper crossing location. Can be used at uncontrolled and midblock crossings as determined by study. Markings should be located so as to center curb ramps within the crosswalk.	Edgelines are the minimal crosswalk treatment.
	Longitudinal or Diagonal Lines	Lines 12 to 24 in. wide with 12 to 60 in. gaps. Spacing 6 ft. wide minimum. Should be as wide as approaching sidewalk.	Gap between lines should not exceed 2.5 times the width of the line. Gaps should be placed to align with wheel base of vehicles.	Should be used at signalized and controlled intersections to indicate proper crossing location. Can be used at uncontrolled and midblock crossings as determined by study. Markings should be located so as to center curb ramps within the crosswalk.	Longitudinal markings are the preferred crosswalk treatment. 24 in. wide markings do not need a supplemental edge line.
	Custom	Spacing 6 ft. wide minimum. Should be as wide as approaching sidewalk.	Crosswalks can be created with bricks, pavers, or thermoplastic.	Should be used at signalized and controlled intersections to indicate proper crossing location. Can be used at uncontrolled and midblock crossings as determined by study. Markings should be located so as to center curb ramps within the crosswalk.	Custom designs should be supplemented with a 24 in. wide edge line to improve visibility. Line can be implied through color variations by using complementary materials.
	Pedestrian Scramble and Diagonal Crossings	Same as for transverse lines. Custom designs can be created to inscribe the entire intersection.	Interior transverse lines should not connect, but be angled at curb ramps to support the diagonal crossing movement. Inside markings and custom designs are permitted.	Signal must include an exclusive pedestrian phase timed for the longest crossing distance at 3.5 ft. per second. 3 ft. per second may be used in highly prioritized pedestrian areas.	—
Unsignalized	Stop Signs	Standard R1-1 stop sign as defined by MUTCD.	Use at unsignalized intersections within signalized areas.	Use at unsignalized intersections within signalized areas, intersections of minor roads with major roads or designated highways. Also consider on minor roads where multimodal volumes exceed 2000 units per day, sight is limited or obstructed, and crashes are caused by failure to yield (3 within 5 yrs. or 2 within 3 yrs.).	—
	Signed	Preferred signs included R1-5b, R1-6a, and W11-15 with W16-7p and W16-9p as defined by MUTCD.	Pedestrian crossing warning signs and must stop for pedestrian signs are considered a controlled crossing. R1-5b should be placed where vehicles are expected to stop. W11-15/W16-7p should be placed where pedestrians (and bicyclists) are expected to cross. W11-15/W16-9p should be placed within 300 ft. of the crossing.	Use where transit routes or pedestrian destinations support crossings, or where residents have requested crossing improvements but signal or stop sign warrants/guidance has not been met.	Crosswalks are encouraged at signed crossings but not required.
	Mid-Block	Same as crosswalks and/or signed crossings.	Mid-block crossings should include crosswalks and median crossing islands on 4-lane roads. Mid-block crossings can be signed or even signalized if warrants are met.	Midblock crossings should be used in combination with transitional infrastructure features to heighten driver awareness. They should not be used alone on 4 lane roadways where vehicle speeds exceed 40 mph and ADT exceeds 12,000 or 15,000 with a raised median/crossing island.	Engineering study should be conducted when installing. Consider number of lanes, pedestrian volumes, roadway speed, potential to accommodate crossings, medians, geometry and lighting.
Crossing Islands	Traditional	Varies; minimum 5 to 6 ft. in width to allow for a wheel chair to sit in the island.	Can be used on bus routes. Requires clear bicycle accommodations on bike routes.	ADT $< 20{,}000$ Speed limit of ≤ 30 mph	Can be designed with offset entrances to encourage drivers and pedestrians to face each other.

BICYCLE TREATMENTS 3.50

Bicycles are a part of the vehicular travel system. For the most part, bicyclists and motorists should obey the same rules of the road. However, some areas pose potentially higher risks of conflict between cyclists and motorists. Crash data can help to identify problem intersections, but three years of data are required to pinpoint problem areas, given the relatively low rate of car-bike crashes. The following treatments can be implemented on corridors prioritized for bicycle travel:

3.50A

FIGURE 3.50A
BIKE BOXES
Chicago, IL

3.50B

FIGURE 3.50B
BIKE BOXES
Chicago, IL

BIKE BOXES

Bike boxes are wide marked areas on the roadway pavement at intersections. Motorists must stop behind the edge of the bike box. Bike boxes give bicyclists priority in leaving the intersection and reduce conflicts caused by the slower pedal-power startup of bicycles. Bike boxes are usually green, to improve visibility, and usually require No Turn on Red (NTOR) restrictions. There are three kinds of bike boxes:

LEFT-TURN ACCESS These extend all the way across the through-travel lanes, giving bicyclists priority in making left turns.

RIGHT LANE PRIORITY These allow bicyclists to proceed to an advance queue area at the front of the intersection, reducing the risk of crashes between cyclists in bike lanes and motorists making right turns.

BOX-TURN ACCESS Also called two-stage turn-queue boxes, these are usually used with cycle tracks or shared-use paths, which do not allow cyclists to merge into traffic lanes to make traditional left turns. These boxes create a queue area on the far side of the intersection and allow bicyclists to turn left in two stages: first crossing the street, then repositioning into the right lane or bike path of the intersecting street.

FIGURE 3.50D
THRU BIKE LANES AND COLORED PAVEMENT
Chicago, IL

FIGURE 3.50E
PED-BIKE CROSSINGS
Chicago, IL

FIGURE 3.50F
SHARED LANE MARKINGS (INTERSECTIONS)
New York, NY

FIGURE 3.50G
SHARED LANE MARKINGS WITH DASHING
Chicago, IL

BICYCLE TREATMENTS, CONTINUED 3.50

THRU BIKE LANES, TRANSITIONAL DASHING, COLORED PAVEMENT, AND MARKINGS

At intersections where there are conflicting travel movements, dashing can indicate hazards or guide bicyclists to the proper path. For instance, a dashed line can indicate where a right-turn-only lane requires motor vehicles to cross a bike lane. In areas where there are many conflicts, high crash rates, and/or high vehicle/bike usage, dashed lines can be supplemented with colored pavement or shared lane marking to improve visibility.

SHARED LANE MARKINGS

Although space is at a premium at many intersections, this should not limit the inclusion of bicycle ways. In these situations, shared lane markings can guide bicycle movements.

FIGURE 3.50H
MIXING ZONES
New York, NY
Image Credit: City of New York DOT
Image Courtesy of NACTO

FIGURE 3.50I
MIXING ZONES
New York, NY
Image Credit: City of New York DOT
Image Courtesy of NACTO

FIGURE 3.50J
COMBINED BIKE LANE TURN LANE
Eugene, OR
Image Credit: City of Eugene
Image Courtesy of NACTO

FIGURE 3.50K
THRU BIKE LANE TURN LANE
Chicago, IL

MIXING ZONES

Mixing zones are an option where separated bike facilities, such as cycle tracks or buffered bike lanes, are desired to be maintained through the intersection but right turn lanes are needed to facilitate vehicle turning movements. A mixing zone integrates the vehicle traffic into the cycle track area in a shared space advance of the intersection. Best practices for signs and markings in a shared traffic environment should be employed through the intersection. The separated bikeway can resume on the far side of the crossing.

COMBINED BIKE LANE TURN LANES

A combined bike lane-turn lane is another option for intersections with limited space. This treatment uses a dashed separation line to mark a bike lane on the appropriate side of the turn lane, showing bicyclists and motorists where to position themselves to share the lane safely.

FIGURE 3.50L
REFUGE ISLANDS
Chicago, IL

FIGURE 3.50M
REFUGE ISLANDS
Vancouver, BC
Image Credit Carl Sundstrom
Image Courtesy of NACTO

FIGURE 3.50N
REFUGE ISLANDS
Portland, OR
Image Credit: City of Portland
Image Courtesy of NACTO

BICYCLE TREATMENTS, CONTINUED 3.50

REFUGE ISLANDS

Refuge islands provide protection at busy crossings and work well for separated bike facilities and bike boulevard crossings. The queue area should be sized appropriately to accommodate bicyclists and pedestrians.

TABLE 3F BICYCLE TREATMENTS		Dimensions	Design Considerations	Guideline
Bike Boxes	Left turn access	10 to 16 ft. deep, to allow for two rows of bicyclists in the queue area. Extends to the farthest left lane.	Use on high volume bicycle ways where conflicts exist between vehicular and bicycle turning movements. Particularly where high instances of left turning bicyclists or right turning vehicles.	Bicycle symbol pavement markings should be centered within the box and the pavement should be colored green. Transverse lines form the outer edge of the box and a stop bar should be placed to indicate the appropriate stopping locations to vehicles. Intersections with bike boxes must be designated as No Turn on Red (NTOR).
	Right lane priority	10 to 16 ft. deep, to allow for two rows of bicyclists in the queue area. Extends over only the right lane.	Use on high volume bicycle ways where conflicts exist between vehicular and bicycle turning movements. Particularly where high instances of right turning vehicles.	Bicycle symbol pavement markings should be centered within the box and the pavement should be colored green. Transverse lines form the outer edge of the box and a stop bar should be placed to indicate the appropriate stopping locations to vehicles. Intersections with bike boxes must be designated as No Turn on Red (NTOR).
	Box-turn Access or Two-stage Turn Queue Boxes	Minimum of 3 ft. wide by 10 ft. deep.	Typically used on high volume/high speed roadways where additional separation between vehicles and bicycles is desirable. Should be used in combination with cycle tracks and shared use paths to facilitate left turns, but can be used with any bicycle accommodations. Should be used in combination with intersection markings.	Queue area should be placed within a buffered area of the roadway. Can be placed to the left of a bicycle through travel way when a separation buffer exists; otherwise can be placed to the right of the bicycle through travel way extending to the crosswalk. Bicycle symbol and turning arrow should be placed in box to indicate the direction of travel. Green colored paving should be placed within the box. Intersections with two-stage queue boxes should be designated as No Turn on Red (NTOR).
Markings	Dashings	Minimum of 6 in. Dashed lines should be at least the same width as the line they are extending. Crossing lane width should be the same as the lane they are extending. Bicycle lane marking, or shared lane marking may be used, per MUTCD.	Can be used at intersections with complicated turning movements to direct bicyclists to facility on other side. Should be considered on roadways with cycle tracks or bike lanes.	Dashed lines should be 2 ft. long with a 2 to 6 ft. spacing. Alternatively, 14 to 20 in. squares can be spaced evenly to improve visibility.
	Colored Pavement	Same as area being designated.	Can be used in bike lanes and cycle tracks to increase visibility. Should be used in turning conflict areas or through intersections to improve visibility and demarcate unclear bicycle travel paths.	The color green shall be used to indicate bicycle facilities. Edges will be marked with solid bike lane lines or dashed lines. Coloring can be dashed in conjunction with dashed lines to minimize material use. Yield to bike signs can be used in conjunction with colored paving. Should use skid resistant and retro-reflective materials.
	Thru Bike Lanes	Lane should be 6 ft. wide, with a 4 ft. minimum. The line should be at least the same width as the line they are extending. Width of lane should be equal to lane that is being extended. Bicycle lane marking can be used, per MUTCD. The adjacent turn lane should be a minimum of 9 ft.	Through bike lanes should be used where right turn lanes conflict with through bicycle movements (or left turn lanes on one-way streets with left-side bike lanes).	Dashed lines should be 2 ft. long with a 2 to 6 ft. spacing. Dashings signifying merge area should begin 50 to 100 ft. in advance of the intersection; 100 ft. should be used for high volume and high speed corridors. Should be placed to the left of a right turn lane (or right of a left turn lane on one-way streets with a one side bike lane). Should not be used on streets with double right turn lanes.
Shared Lane Markings	Thru and directional	Same as shared lane marking per MUTCD.	Can be used at intersections with complicated turning movements to direct bicyclists to facility on other side. Should be considered on roadways with cycle tracks or bike lanes.	Can be placed in the center of a shared vehicle lane or within the center of a dashed through bicycle lane. If used to indicate two-way flow in intersection crossings of two-way cycle paths or shared use paths markings facing opposite directions, should be placed next to each other with a dashed center line separating the traffic flow.
		Same as shared lane Marking per MUTCD.	Chevrons may be oriented in the direction of travel to improve wayfinding; this practice can delineate turns in established bicycle routes and improve visibility at conflict points when cyclists are moving across vehicle travel lanes.	Place shared lane marking in the appropriate location within the vehicle lane. Rotate the chevrons to indicate the direction of travel.
Mixing Zone		13 ft. shared travel area with a 1 to 3 ft. buffer maintained.	Should be considered on all corridors with cycle tracks or buffered bike lanes. Mixing zones are better for bicycle priority roadways than abandoning the separated facilities for dedicated or shared travel ways.	Sharks teeth yield pavement markings should be used where vehicles enter the mixing zone. Shared lane markings can be used in the mixing zone.
Combined Bike Lane/ Turn Lanes		A 4 in. dashed line placed a minimum of 4 ft. from the outer edge of the turning lane.	Consider use when there is not enough room for a thru bike lane.	Bicycle lane marking should be placed within the bicycle travel area. Right turn only sign with "except bikes" placard can be placed in conjunction with the lane. A shared lane marking may be used within the turn lane instead of a dashed line and bicycle lane marking.
Refuge Islands		6 to 10 ft. wide islands with 6 ft. of raised island on each side of refuge area. Raised area should be curb height, 6 in. Refuge area should be wide enough to accommodate two bicycles.	Consider using on roadways with high vehicle volumes and high speeds; particularly where there are infrequent traffic gaps, at midblock crossings, or at shared use path crossings and cycle track crossings.	Toward the oncoming vehicle traffic, a 45 degree angled cut through can be used to improve bicycle and driver visibility. Raised refuge areas are permitted, but it is preferred to keep the refuge area at street level. If used in conjunction with a landscaped median, visibility must be maintained.

Modern Roundabouts

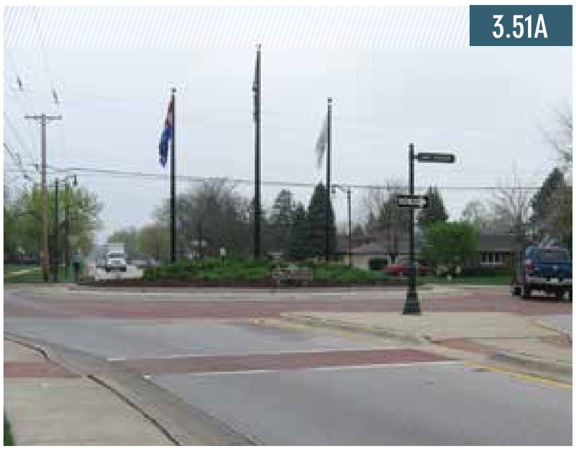
Roundabouts direct users through intersections in a predictable manner at slow speeds. Roundabouts provide simple pedestrian crossings, set a tone of cautious driving, and reduce all crashes by 50% or more compared to traffic signals.

FIGURE 3.51A
SINGLE LANE
ROUNDABOUTS
South Holland, IL

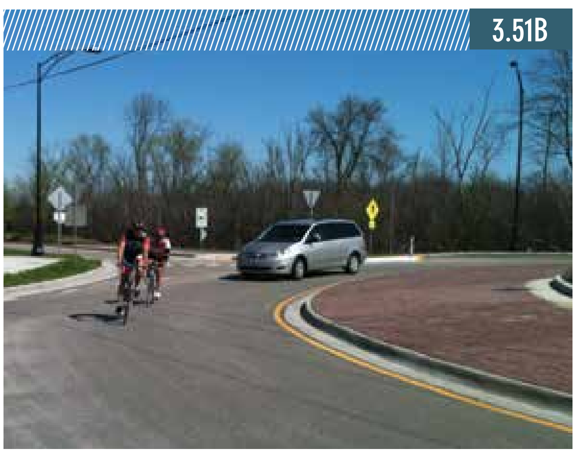
FIGURE 3.51B
SINGLE LANE
ROUNDABOUTS
Lincolnshire, IL

FIGURE 3.51C
SINGLE LANE
ROUNDABOUTS
Lincolnshire, IL

FIGURE 3.52
MULTILANE
ROUNDABOUTS
Valparaiso, IN.


3.51A


3.51C


3.51B


3.52

SINGLE-LANE 3.51

Single-lane roundabouts can process up to 25,000 vehicles per day. Single-lane roundabouts can vary in inscribed circle diameter from 80 to 180 feet.

MULTILANE 3.52

Multilane roundabouts can process up to 45,000 vehicles per day. Multiple lane roundabouts can vary in diameter from 130 to 300 feet.

3.53A

3.54

FIGURE 3.53A
MINI-ROUNDABOUT
Chicago, IL

FIGURE 3.53B
MINI-ROUNDABOUT
Seattle, WA

FIGURE 3.54
CIRCULAR
INTERSECTIONS
Normal, IL
Image Credit: Scott Shigley; Courtesy of Farr Associates

3.53B

CIRCULAR INTERSECTIONS 3.54

Circular intersections are a variation on single-lane urban roundabouts and are suited commercial/mixed use contexts, with traffic volumes of below 5,000 to 10,000 ADT. Circular intersections allow/encourage pedestrians and bicyclists to use the center of the circle.

MINI-ROUNDABOUTS & MINI-TRAFFIC CIRCLES 3.53

A mini-roundabout is a smaller version of the traditional modern roundabout, with a fully mountable center island that can be driven over by emergency vehicles and occasional buses or large trucks, when necessary. Mini-traffic circles are similar, small circular islands placed in the center of intersections to calm traffic.

FIGURE 3.55A
PEDESTRIAN CROSSINGS
Valparaiso, IN

FIGURE 3.55B
SHARED USE PATH CROSSINGS
Lincolnshire, IL

FIGURE 3.56
BIKE RAMPS
South Holland, IL

PEDESTRIAN ACCOMMODATIONS 3.55

Single-lane roundabouts can be quite pedestrian-friendly, because they break the street crossing into two short single-lane crossings. Crosswalks should be clearly marked and the design should incorporate splitter islands, which act as pedestrian refuges. Because multi-lane roundabouts have multi-lane entries, they are more problematic for pedestrians, especially those who have visual impairments.

BICYCLIST ACCOMMODATIONS 3.56

Generally, properly sized roundabouts work well for bicyclists because traffic in the circle moves at speeds compatible with bicycling, allowing shared use with motor vehicles. A few bicycle-friendly techniques can improve safety for bicyclists in modern roundabouts:

SIGNS Placing appropriate MUTCD signs at approaches to roundabouts can alert motorists to the presence of bicyclists. Bike signs should be used only at roundabouts where there are documented safety concerns, such as high crash rates.

BIKE RAMPS At roundabouts with multiple lanes or high traffic volumes and speeds, it is common practice to place bike ramps on the roundabout approach to allow novice bicyclists access to the sidewalk. In this case, the bicyclist can use pedestrian accommodations to cross the intersection.

TABLE 3G MODERN ROUNDABOUTS

		Dimensions	Design Considerations	Guideline	Notes
Single Lane		Diameter ranges between 80 and 180 ft.	Minimum design radius of 50 ft. for bus routes. Not used on neighborhood streets.	ADT ≤ 25,000. Entering speed ≤ 45 mph.	—
Multi-Lane		Diameter ranges between 130 and 300 ft.	Can be used for higher speed and higher volume roadways. Can be used on bus routes.	ADT ≤ 45,000. Entering speed ≤ 45 mph.	—
Mini-roundabouts & Mini-traffic Circles		Varies, should fit easily within a typical 4-way of two 2-lane roadway intersection.	Used on neighborhood streets. Not used on bus routes.	ADT < 7500. Entering speed ≤ 25 mph.	—
Circular Intersections		Can be small or large in diameter; similar to single or multilane roundabout.	People are encouraged to occupy the center of the intersection. Tools should be used to maximize public use of the shared space.	ADT ≤ 10,000. Entering speed ≤ 25 mph.	—
Pedestrian Accommodations		Same designs as crosswalks	Multi-lane roundabouts should be discouraged in areas with high pedestrian counts.	Included at all roundabouts with sidewalk approaches.	Consider if will be a future need for sidewalks if designing a roundabout for an area without existing sidewalks.
Bicycle Accommodations	Signage	MUTCD Bike signs are appropriate.	Avoid over signing roundabouts. When signing, place bike route signs on the approach to the roundabout.	Consider at roundabouts with documented bicycle crashes.	—
	Bike Ramps	Minimum of 6 ft. width for ramp.	Roundabouts with bike ramps require crossing designs that meet specs for shared use paths. Bicyclists who are comfortable can ride with traffic through the roundabout.	Bike ramps should be provided for roundabouts on roadways with current or planned bicycle accommodations.	Grade ≤ 6% for bike routes.

Contextual Transitions

Transitions occur in places in the network where there is a functional change in the corridor or street typology, or a change in the adjacent land use or context zone. Identifying transition points is a useful tool for planning and design purposes. Transitions provide opportunities to create gateways, start or end traffic calming, begin or end on-street bikeways, change the posted speed or modify lane configuration. Transitions also help determine the logical extents of redevelopment projects or corridor studies.

EXAMPLES OF TRANSITION POINTS BASED ON LAND-USE CHANGES WHERE TREATMENTS ARE USEFUL:

DOWNTOWNS AND SPECIAL DISTRICTS Transition treatments at entrances to special districts bring attention to changes in travel patterns and behaviors.

CITY/NEIGHBORHOOD BORDERS OR NATURAL BOUNDARIES Transition treatments at the edges of adjacent areas provide definition and a sense of local identity.

HIGH-VOLUME PEDESTRIAN ACTIVITY AREAS Transition treatments in places where many pedestrians are present help to slow traffic speeds, improve walkability, and raise motorist awareness of active transportation,

TRANSIT USE AREAS AND TRANSIT HUBS Transition treatments in areas of high transit use can improve modal coordination.

RURAL/SUBURBAN CONTEXT ZONES Transition treatments in places where a roadway transitions from an open rural context to a more suburban or small-town context can help to slow traffic and alert drivers to increased pedestrian and bicycle activity.

EXAMPLES OF TRANSITIONS BASED ON CHANGES IN CORRIDOR FUNCTIONS WHERE TREATMENTS ARE USEFUL:

LANE WIDTH CHANGES Transition treatments can alert drivers to changes in vehicle lane width.

ROAD DIETS Transition treatments can improve coordination where lanes are being eliminated to facilitate the inclusion of bicycle or pedestrian ways.

TURNING LANES Transition treatments can alert all users to potential conflicts between turning vehicles and bicyclists and/or pedestrians.

BICYCLE AND PEDESTRIAN WAY CHANGES Transition treatments alert users in places where bicycle or pedestrian ways change from one type of facility to another, such as a bicycle lane-sidewalk pairing that transitions to a shared-use path.

Transition Treatments

Additional treatments that can be used at transition points to improve visibility, create safety, and instill identity include:

3.57A

3.58

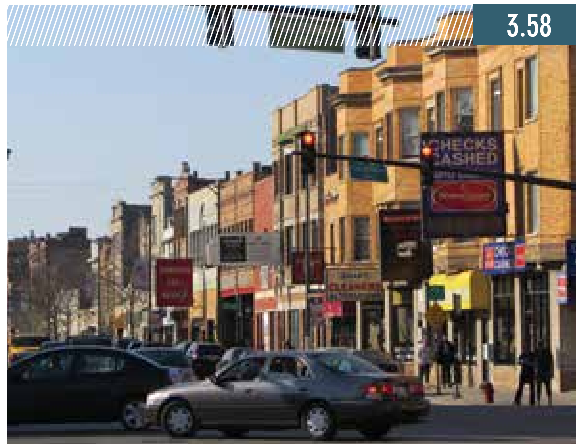
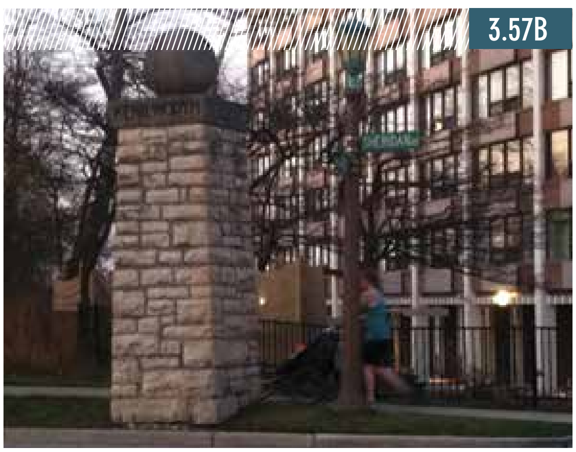


FIGURE 3.57A
GATEWAYS
Chicago, IL

FIGURE 3.57B
GATEWAYS
Kenilworth, IL

FIGURE 3.58
STREET WALLS
Chicago, IL

3.57B



GATEWAYS 3.57

Gateways identify entrances to communities and districts. Gateways can be bold statements, such as arched entryways, or can be more simply marked by signs and landscaping. Gateway areas are good places to site wayfinding signs and other identity features, such as banners and public art installations.

STREET WALLS 3.58

Natural street walls can be created by surrounding land uses, buildings and topography. In traditional commercial areas, zero-setback buildings with storefront doors and windows create a street wall that produces a human-scaled walking environment. In residential areas, where houses are set back from the street, tree rows and hedgerows can have the same effect. Many places offer unpleasant walking environments because they lack visual unity, human scale, and comfort created by a street wall; in these places, features such as lampposts, trees, and banners can be used to define the edges of the space. Modification of zoning regulations also can encourage pedestrian-friendly building placement.

SIGNS 3.59

Signs are an effective way to welcome, alert, inform and direct users, especially at transition points. The MUTCD contains guidelines for signage use in the transportation network, including pedestrian and bicycle signs. Some special districts use distinctive wayfinding signs, interpretive placemaking signs and banners to provide necessary user information and convey a sense of local identity.

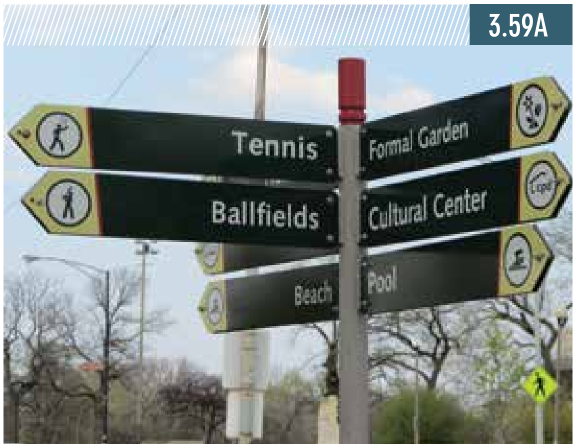


FIGURE 3.59A
WAYFINDING SIGNS
Chicago, IL

FIGURE 3.59B
IDENTITY SIGNS
Chicago, IL

FIGURE 3.59C
MODE TRANSITION SIGNS
St. Louis, MO

INFRASTRUCTURE FEATURES 3.60

FIGURE 3.60A
CURB BULBOUT
Chicago, IL

FIGURE 3.60B
CURB EXTENSION
Oak Park, IL

Infrastructure modifications can facilitate transitions in the transportation network. Many techniques described here are considered best practices for traffic calming to create a pedestrian-friendly environment. These techniques also have a broader positive impact on all users, improving the relationships between pedestrians, bicyclists, transit users and motorists and addressing their overlapping needs.

NARROWING LANES

Narrowing lanes from high-speed 12-foot-wide lanes to 10-foot-wide lanes encourages motorists to slow down and underscores a transition to a calmer context. The MUTCD includes a warning sign that can be paired with narrowing lanes.

CURBING

Curbing can be a very effective tool in marking transitions. Seeing the change from roadside shoulders with open drainage to curbs with closed drainage alerts drivers to a more urban context and reminds them to slow down.

CURB BULBOUTS

A curb bulbout is an extension of the sidewalk into the parking lane, reducing roadway width and creating a shorter crossing distance for pedestrians. These can also be called neckdowns. Curb extensions can be used to slow vehicular traffic and increase awareness of pedestrians. All curb bulbouts on bus routes and at bus stops should be at least 40 feet long, to accommodate passenger access at both bus entrances. Bulbouts should not extend into bicycle lanes.

INFRASTRUCTURE FEATURES (CONTINUED) 3.60

FIGURE 3.60D
CHICANES
Chicago, IL

CHICANES

Chicanes are planted areas, curb extensions and/or medians that create horizontal deflection on roadways, requiring users to slow down to negotiate the bends in the lane. Chicanes should not be used on streets with bus transit service

FIGURE 3.60E
SPEED HUMPS
Chicago, IL

SPEED HUMPS AND SPEED LUMPS

Speed humps and speed lumps are raised pavement areas in the travel way that require drivers to slow down. Speed humps and speed lumps are most often used in pedestrian priority areas. Speed humps should be clearly marked and should be avoided in bicycle priority areas and on streets with bus transit service. Speed Lumps are speed humps with gaps to accommodate the wheel base of emergency service vehicles or buses. Speed lumps can also have gaps to accommodate bicyclists.

FIGURE 3.60F
RAISED CROSSWALK
Oak Park, IL

RAISED CROSSWALKS AND INTERSECTIONS

Similar to a speed hump, a raised crosswalk or intersection brings the roadway pavement to sidewalk level at pedestrian crossings to facilitate walking and reduce vehicle speeds. This technique works best in pedestrian priority areas and should be combined with complementary pedestrian infrastructure. Raised crosswalks should not be used on streets with transit service.

FIGURE 3.60G
RAISED MEDIANS
Chicago, IL

FIGURE 3.60H
RAISED MEDIANS
Elgin, IL

FIGURE 3.60I
BOLLARDS
Chicago, IL

FIGURE 3.60J
BOLLARDS
Chicago, IL

MEDIANS

Medians can be placed at intersections and midblock locations to provide traffic calming and placemaking benefits. Medians offer pedestrians and bicyclists refuge at busy crossings, allowing them to consider only one direction of traffic at a time. Medians can be used to filter rainwater or add landscaping to roadways and also provide locations to pile plowed snow.

RIGHT-TURN CORNER ISLANDS

A right-turn corner island, or “pork-chop” island, creates a refuge between a right-turn lane and the through lanes, splitting up the crossing movement. Right-turn corner islands can be used to retrofit existing intersections with large turning radii that promote higher vehicle speeds.

BOLLARDS AND RAILINGS

Bollards and railings provide separation between traffic flows in constricted roadway areas. Bollards and railings can be used at intersections to prevent turning vehicles from encroaching onto sidewalks or bike lanes and to provide visual cues alerting motorists to potential conflicts with other users. Bollards and railings also can be used at roundabouts to mark entrances and direct visually impaired pedestrians to marked crosswalks.

FIGURE 3.60K
POSTS
Elgin, IL

FIGURE 3.60L
PUBLIC ART
St. Louis, MS

FIGURE 3.60M
PUBLIC ART
Chicago, IL

FIGURE 3.60N
PUBLIC ART
Chicago, IL


3.60K


3.60L

INFRASTRUCTURE FEATURES (CONTINUED) 3.60

UTILITY, LIGHTING, AND POSTS

Although utility poles, lampposts, and signposts are often eyesores, they can be attractively designed and used to create a street wall. These features belong in the furniture zone and should be relocated if they are in the pedestrian zone.

PUBLIC ART

Public art installations along the public right-of-way, such as sculptures and murals, can greatly accentuate the transportation network and improve the value of a place. These features should be carefully placed so that they improve the walkability and bikeability of the roadway without creating hazardous obstacles or distracting drivers.


3.60M


3.60N

TABLE 3H INFRASTRUCTURE FEATURES

TABLE 3H INFRASTRUCTURE FEATURES	Dimensions	Design Considerations	Guideline
Narrowing Lanes	Vehicle lanes can be reduced to 8, 9, or 10 ft., depending on width of entering lanes. (See Table 3D.)	Can be accomplished with edgeline striping, centerline striping, medians, or curb extensions. Can be used on bus routes and emergency routes.	ADT of ≤ 10,000 Speed limit of ≤ 35mph
Curbing	Typically 6 inches high with a 1 to 2 ft. drainage pan.	Curbing is usually installed with enclosed drainage systems and is an effective transitional tool from rural to suburban to urban contexts. Can be installed with new sidewalks.	Appropriate for any roadway that closed drainage or new sidewalk installations.
Curb Bulbouts	Varies, often 7 to 8 ft., when used with parallel parking, only where curb parking exists.	Can be used on bus routes and emergency routes. Requires clear bicycle accommodations on bike routes. Also called neckdowns/chokers.	ADT < 20,000 Speed limit of ≤ 30 mph
Chicanes	20 ft. minimum length; width can be maximized based on available space. Requires an edgeline with an 8:1 taper length per MUTCD.	Best on neighborhood streets. Can be used on bus routes and emergency routes. Grade ≤ 10%.	ADT of < 5000 Speed limit < 35 mph
Speed Humps/Lumps	Typically 12 ft. across with a parabolic or sinusoidal surface reaching 3.5 to 4 in. in height. Speed lumps have 2 ft. gaps to allow for emergency vehicle wheel base.	Best on neighborhood streets. Speed lumps work on bus routes, emergency routes, and are better for bicyclists. Sinusoidal surfaces are also better for bicyclists, but harder to construct. Grade ≤ 8%.	ADT of < 4000 Speed limit < 30 mph
Raised Crosswalks & Intersections: Crosswalks	Typical 34 ft. w/10 ft. table and 12 ft. approaches. Typical 6 inch curb height.	Can be used on all streets. Can be designed for emergency routes. Grade ≤ 8%.	ADT of < 7500 Speed limit < 35 mph
Raised Crosswalks & Intersections: Intersections	Varies based on intersection height	Can be used on all streets. Can be designed for emergency routes. Grade ≤ 8%.	ADT of < 7500 Speed limit < 35 mph
Medians	Varies; depends on roadway constraints, minimum 4 ft. wide	Can be used on bus routes and emergency routes. Requires clear bicycle accommodations on bike routes.	ADT < 20,000 Speed limit of ≤ 30 mph
Right-turn Corner Islands	Varies; depends on under utilized space between right turn lane and thru lanes. Includes a pedestrian refuge area.	Includes pedestrian refuge areas; crossings should be placed so as to shorten the crossing distance and maximize vehicle visibility. Crossings should include a stop bar placed 4 ft. from the cross walk. Can be used on bus routes and emergency routes.	Appropriate tool to retrofit any roadway that has been designed with wide turning radii and excessive pedestrian crossing distances.
Bollards and Railings	4 in. to 24 in. diameter and 3 to 4 ft. H	Adding a bollard row or railing forms a protective barrier between modes and encourages motorists to drive slower, taking note of the barrier. These can also be used to signify transitions between contexts or modal transitions.	Appropriate for any roadway. Should be considered when adequate separation between pedestrians and vehicles cannot be provided.
Utility and Lighting Posts	Varies	Changes to utility pole or lighting patterns can be used to signify transitions between contexts and elicit changes in motorist behavior	Appropriate for any roadway
Public Art	Varies	Public art can be installed to enhance gateways and district transitions.	Appropriate for any roadway

Multimodal Signals

Signals can improve pedestrian and bicycle flow and safety. The following signal device improvements can be used on corridors prioritized for pedestrian and bicycle travel.

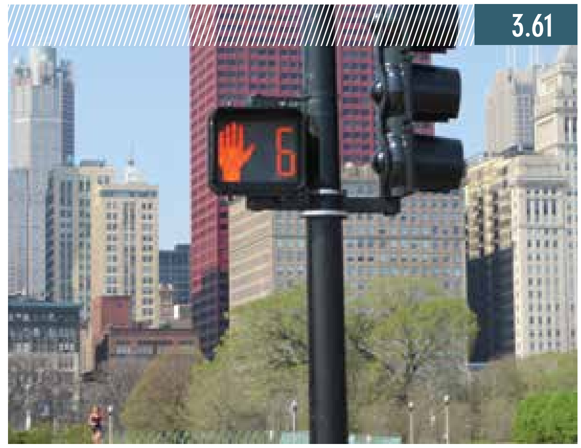


FIGURE 3.61
COUNTDOWN PEDESTRIAN SIGNAL
Chicago, IL

PEDESTRIAN INDICATORS 3.61

Typically, pedestrian indicators provide limited signals – a white-lit pedestrian figure ("Walk") and an orange-lit flashing or steady hand ("Don't Walk"). Many pedestrians do not understand the difference between the flashing "Don't Walk" signal, which warns against starting to cross the street, and the steady signal, which forbids all crossing. These signals also do not indicate how much time is left before the traffic signal changes. Pedestrians often must reference the vehicle signal for additional information; this can be particularly problematic on one-way streets where no signal is immediately visible to people walking against the flow of traffic.

COUNTDOWN PEDESTRIAN SIGNALS

Countdown pedestrian signals show how much time remains before the traffic signal changes and are designed to reduce the number of pedestrians who start crossing when there is not enough time to complete their crossing safely. Countdown pedestrian signals are now required by the MUTCD for all new and rehabbed pedestrian signal installations.

TIMING

Signal timings at crossings should be set at 3.5 feet per second to allow adequate time for pedestrians to cross; timings of 3 feet per second may be needed to allow safe crossings for older people and those with disabilities.

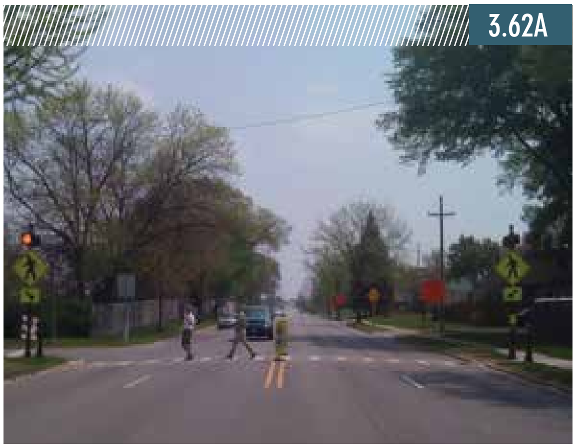


FIGURE 3.62A & 3.62B
PEDESTRIAN HYBRID BEACON
La Grange, IL

FIGURE 3.63A & 3.63B
RECTANGULAR RAPID FLASHING BEACONS
Crystal Lake, IL

PEDESTRIAN HYBRID BEACONS (HAWK SIGNAL) 3.62

A pedestrian hybrid beacon is used to control traffic at unsignalized crossings with lower pedestrian volumes. The beacon remains dark until activated by a pedestrian. When in use, the beacon first displays a flashing yellow light to oncoming vehicular traffic, followed by a steady yellow light. During the WALK interval, the beacon displays a steady red light. Then the red light starts flashing, allowing vehicles to proceed after the pedestrian has cleared their lanes. Because these beacons are used only when pedestrians are crossing, they create fewer vehicle delays than traditional red-yellow-green signals; vehicle delays can be reduced further by installing pedestrian refuges at these crossings. Studies have found motorist compliance rates for pedestrian hybrid beacons are similar to compliance with other types of pedestrian signals.

RECTANGULAR RAPID FLASH BEACONS (RRFB) 3.63

Rectangular rapid flash beacons are extremely visible, using flashing yellow LED lights to supplement standard pedestrian crossing warning signs at mid-block and other unsignalized crossing locations. These user-activated beacons are FHWA-approved and promote increased yield rates and improved pedestrian safety.

FIGURE 3.64
ACCESSIBLE PEDESTRIAN SIGNAL
Chicago, IL

FIGURE 3.65A
BIKE TRAFFIC SIGNALS
New York, NY

FIGURE 3.65B
BIKE TRAFFIC SIGNALS
Amsterdam, Netherlands

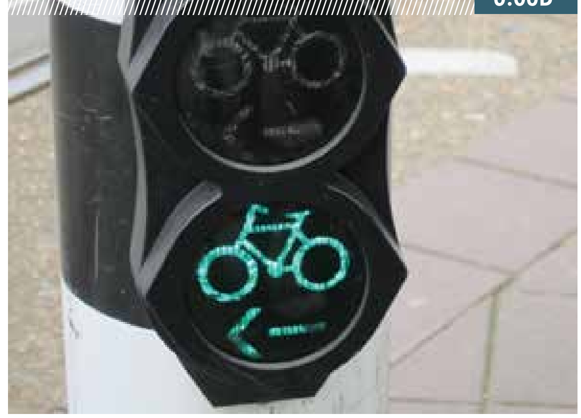
3.64

3.65A

ACCESSIBLE PEDESTRIAN SIGNALS (APS) 3.64

An accessible pedestrian signal (APS) provides audio and vibro-tactile cues to identify the pushbutton location and indicate the WALK interval for pedestrians with visual disabilities. To ensure ease of use, these devices must be installed in accessible locations, immediately adjacent to the sidewalk at the crosswalk area.

3.65B



BIKE-ONLY SIGNALS 3.65

Bike-only signals can be used in areas with high volumes of bike traffic or on special bike facilities, such as cycle tracks or urban greenways. These signals display the traditional green-yellow-red colors of vehicular signals, with bicycle symbols on the signal faces.

BIKE-ACTUATED SIGNALS 3.66

Traditional in-pavement detector loops for demand-actuated traffic signals do not detect most bicycles. All demand-actuated signals should be designed to detect a normal bike with metal rims, through loop detectors or alternative detection methods, such as video or microwave detectors. Additionally, pavement markings should show bicyclists where to position themselves to actuate in-pavement detectors. Bicycle-actuated signals are equally effective and beneficial for motorcyclists.

FIGURE 3.66A
BIKE-ACTUATED SIGNALS
Image Credit: Richard Drudl

FIGURE 3.66B
BIKE-ACTUATED SIGNALS
Image Courtesy of NACTO

TABLE 3I
MULTIMODAL SIGNALS

		Design Considerations	Guidance	Notes
Pedestrian Indicators	Pedestrian Signal Heads	Should be used to assist pedestrians in determining when to safely begin crossing.	Shall be used in conjunction with vehicle signals where the MUTCD pedestrian volume warrant (Section 4C.05) or the School Crossing Warrant is met (Section 4C06).	—
	Countdown Pedestrian Signals	Should be considered for all crossings with pedestrian signal heads.	Must be included on all pedestrian signal heads where the pedestrian change interval is more than 7 seconds.	—
	Timing	Signal timing is typically designed based on an average walking speed. Assuming a lower walking speed will accommodate more users.	Signal must be timed for the crossing distance at 3.5 ft. per second. 3 ft. per second should be used in high volume pedestrian areas.	—
HAWK Pedestrian Beacons		Should be used in conjunction with crossing signs and must include crosswalk marking. Typically used at mid-block crossings of high-volume roadways. Can be used for bicycle crossings as well.	When traffic control signals are not justified but traffic gaps do not permit safe pedestrian crossings and pedestrian volumes guidelines are met per MUTCD section 4F.02. Roadways with lower speeds (35 mph or less) must have more pedestrians per hour for consideration. The lower threshold for consideration is 20 pedestrians per hour. If being used at a pedestrian and bicycle crossing, bicycle volumes can be added to pedestrian volumes.	Engineering study should be conducted. Consider traffic volumes, speeds, crossing distances, crossing gaps, pedestrian volumes, walking speed, and pedestrian delay. Education can be conducted in conjunction with installation to improve signal compliance.
Rectangular Rapid Flash Beacons		Can be used to emphasize midblock crossings or signed crossings. Can be used when driver compliance to stop for pedestrians (or bicyclists) at crossing location is low.	Beacons actuated by pedestrians or bicyclists are appropriate for any unsignalized crossing to provide additional warning to vehicles approaching the designated crossing. Beacons should remain dark until activated.	—
Accessible Pedestrian Signals		APS should have audible and vibrotactile indications. Push buttons should be placed in the direction of the crossing next to the curb ramps	The accessible walk indication should last for the first 7 seconds of the walk interval but be triggered at any point when there is enough time left during the signal phase to cross safely.	Should be designed to meet the standards outlined in the MUTCD.
Bike Only Signals		Should be considered for shared use path and cycle-track crossings, especially when bicycle signal clearance times differ from ped and vehicle phases. Can be used to provide a lead bicycle interval and to signal contra-flow bike movements.	Signal must be placed to maximize visibility by bicyclists. Bicycle signals can be actuated depending on volumes. Bicycle signals are preferred over directing bicyclists to use pedestrian signals.	When a vehicle yellow signal phase is 3 seconds or less a bicycle signal can be used to provide bicyclists with a better indication of clearance times.
Bike Actuated Signals		Should be considered on bike routes where vehicle signals are actuated to assure that bicyclists can trigger the signal change. Must be combined with pavement markings and instruction signs to indicate the place in the queue area where the signal will be triggered.	Devices should be regularly tested and adjusted to assure that bicyclists are detected as intended. If a bicycle facility is provided, detection must be located within the designated facility. If a push button is provided, instruction signs should be placed in a location visible to bicyclists.	Can be used in combination with bike boxes and bicycle signals.