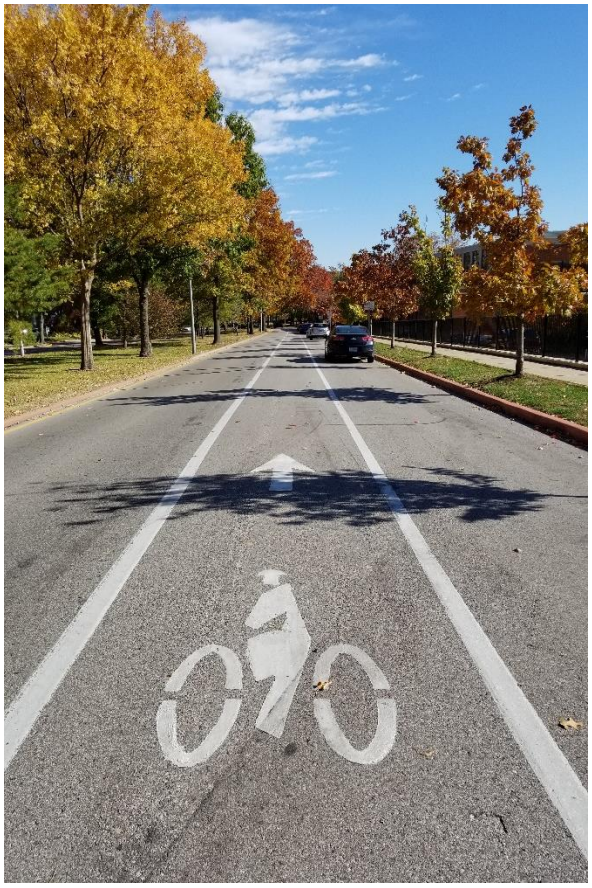
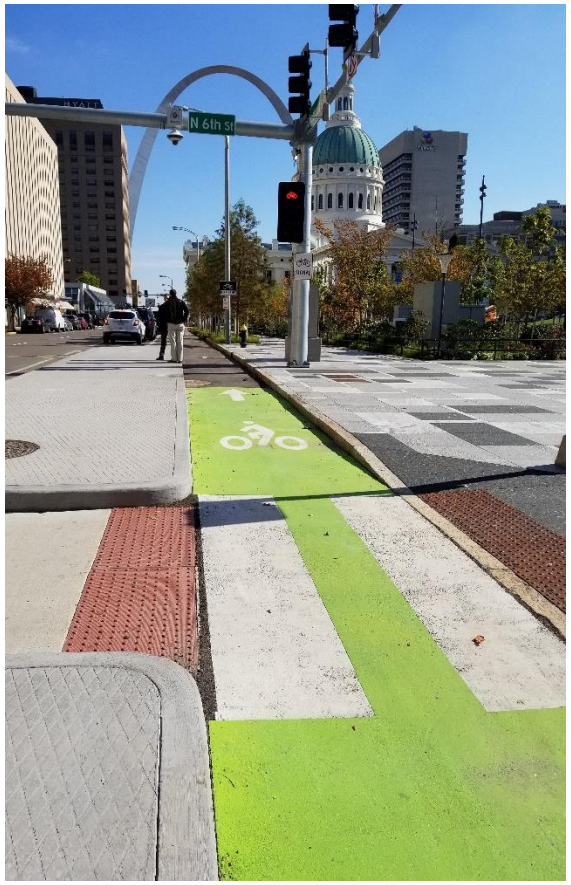
Bicycle Planning Guide





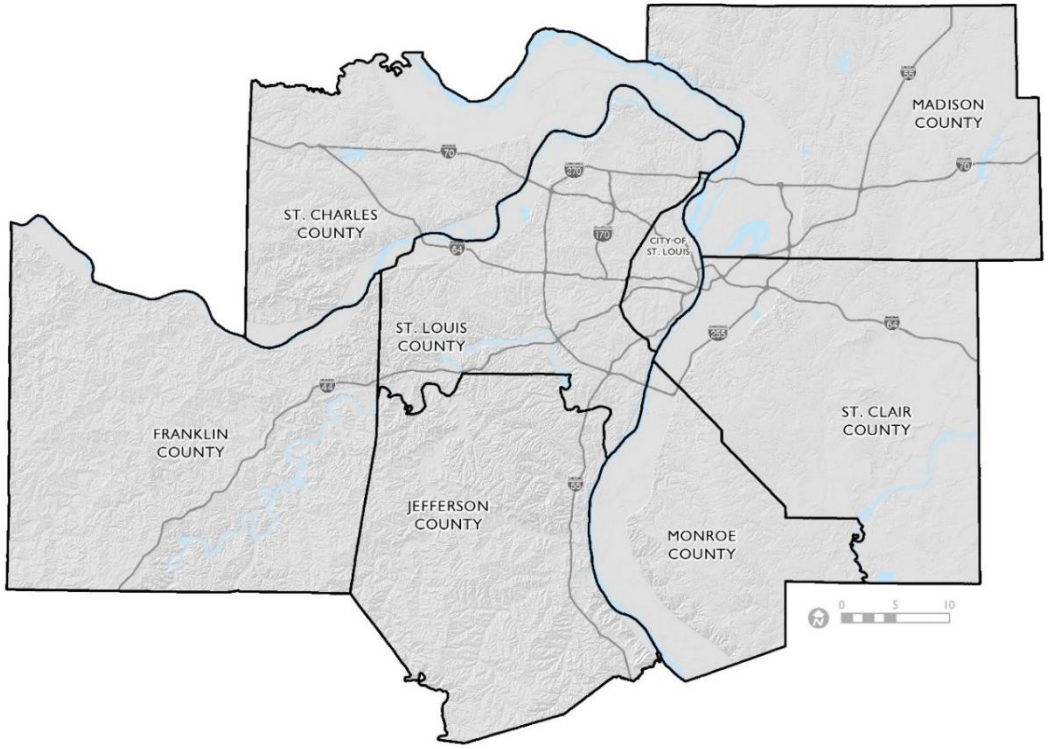
EAST-WEST GATEWAY
Council of Governments

Creating Solutions Across Jurisdictional Boundaries

Table of Contents

East-West Gateway Region

Metropolitan Planning Area Boundary



Introduction

Bicycling is an inexpensive, quick, and eco-friendly form of travel. Well-designed bicycle facilities can increase use, provide safer access, help grow vibrant communities, improve health and fitness, and contribute to a more balanced transportation system for our region.

This guide was developed by East-West Gateway Council of Governments (EWG) with the purpose of assisting Local Public Agencies as they develop projects for Transportation Improvement Program (TIP) funding consideration. Research on bicyclists' attitudes, and how different types of bicycle facilities can influence perceived levels of comfort and safety, particularly when traffic speeds and volumes are high, has been included to illustrate how these elements relate, and should factor into local planning efforts.

This guide will enable Local Public Agencies to:

- Understand how various user groups respond to different types of bicycle facilities
- Determine the recommended type of bicycle facility to be developed based on the vehicular speed and average annual traffic volume
- Be strategic about the placement of bicycle facilities to take advantage of existing low-stress connections

In addition, guidance issued by the Federal Highway Administration (FHWA) has outlined several key points that Local Public Agencies need to take into consideration when planning any transportation project:

- Treat walking and bicycling as equals with other transportation modes.
- Ensure convenient access for people of all ages and abilities, especially children.
- Go beyond minimum design standards.
- Integrate bicycle and pedestrian accommodation on new, rehabilitated, and limited-access bridges.
- Collect data on walking and bicycling trips.
- Set a mode-share target for walking and bicycling.
- Maintain sidewalks and shared-use paths the same way roadways are maintained.
- Improve non-motorized facilities during maintenance projects.

This guide is intended to function as an overview of planning for bicycle facilities and a compilation of current best practices. It is not meant to be a replacement for existing federal guidance or to provide specific solutions. Flexibility and context-sensitivity are essential for successful local projects and this guide should serve as a starting point that can provide direction and resources for planning, design, and implementation.

Types of Bicyclists

Many factors influence bicycle travel, including the type of bicyclist and the type of bicycle facility. In 2005, the City of Portland[1] identified four general groups of attitudes toward bicycling:

Strong and Fearless – Very confident bicyclists who are comfortable operating in the roadway as a vehicle.

Enthused and Confident – Bicyclists who are comfortable riding on some roadways, but prefer bicycle facilities separate from vehicle traffic (bike lanes or shared use path).

Interested, but Concerned – Bicyclists who would like to ride more, but have safety concerns that are discouraging them.

No Way, No How – Those with no interest in riding a bike for transportation.

The "strong and fearless," making up less than 1% of the City of Portland's population, will ride regardless of the roadway condition and are comfortable operating in the roadway as a vehicle. The "enthused but confident," consisting of 7% of the population, are comfortable riding on some roadways, but prefer bicycle facilities separate from vehicular traffic. The "interested, but concerned" make up most of the population at 60%. This group includes people who are curious about bicycling and would like to ride more, but are afraid to do so and will not ride on high volume, high speed roads. The remaining 33% of the population are classified as the "no way, no how" group and are not going to ride a bicycle because of topography, inability, or lack of interest.

In 2013, research conducted at Portland State University[2] examined the validity of the City of Portland's typology. The research, which included a random phone survey of 908 adults in the Portland region, found that nearly all of the sampled population fit into one of the four categories and the distribution was similar to the City of Portland's findings. In 2015, Dill and McNeil surveyed 3,000 residents of the 50 largest U.S. metros[3], St. Louis included. The results align with Geller's 2005 estimates as well as Dill and McNeil's 2013 findings.

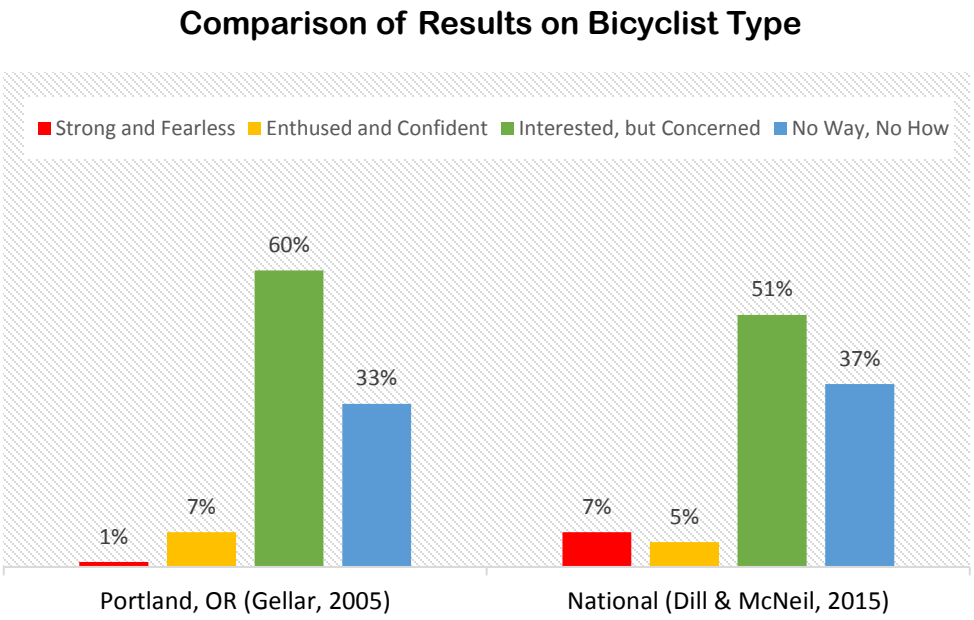


Figure 1: Types of Bicyclists

[1] Geller, Roger. "Four Types of Cyclists." Portland Office of Transportation (updated 2009): https://www.portlandoregon.gov/transportation/article/264746.
[2] Dill, Jennifer and Nathan McNeil. "Four Types of Cyclists? Examination of Typology for Better Understanding of Bicycling Behavior and Potential." Transportation Research Board: Journal of the Transportation Research Board 2387.1 (2013): 129-138.
[3] Dill, Jennifer. "Four Types of Cyclists: A National Look" Presentation. August 11, 2015.

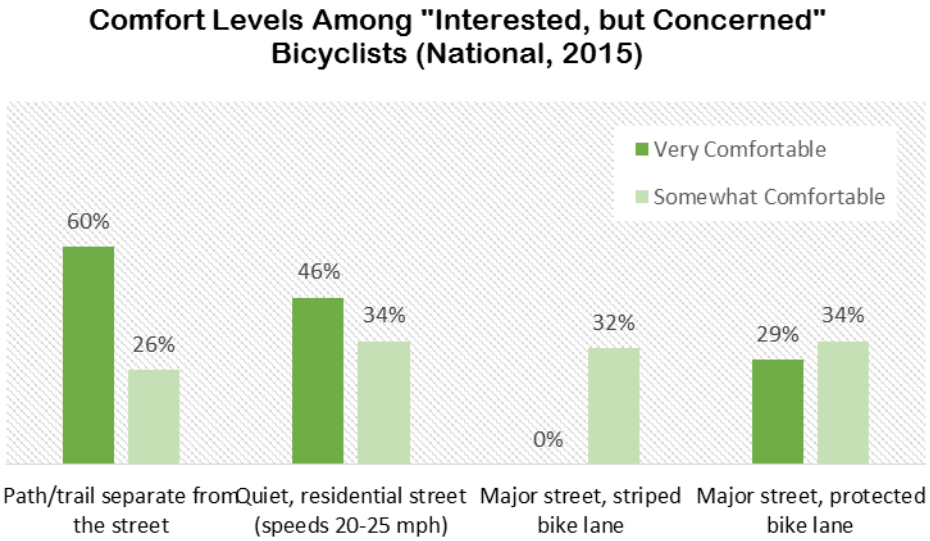
The figures below highlight the comfort levels of bicyclists riding on various types of bicycle facilities. On the left, responses collected from Dill's 2015 national survey show a large gap in the types of facilities where those identified as "Interested, but Concerned" bicyclists feel safe riding. Most feel very or somewhat comfortable riding in a path or trail separated from the street, and on low-speed, quiet residential streets. It is important to note that no respondents feel very comfortable riding on major streets, in a striped, unprotected bike lane.

On the right, responses collected from the EWG 2017 Bicycling Survey show similar results. Most bicyclists feel extremely comfortable on off-street paths and quiet, residential streets. Although more EWG survey respondents felt at least somewhat comfortable on a major street with only a striped bike lane, there was a clear preference for separated bike lanes on major streets with higher speeds and traffic volumes.

These findings highlight the importance of developing networks of low-stress facilities, such as physically separated bicycle facilities and calm streets, to attract the largest subset of riders, those that are "interested, but concerned."

According to the East-West Gateway 2017 Bicycling Survey results, the top three places rated "extremely comfortable" to ride were:

1) A path or trail separate from the street (81%)
2) A quiet residential street with traffic speeds of 20-25 mph (56%)
3) A *separated bike lane* on a major street with two lanes in each direction, a center divider, on-street parking, and traffic speeds of 35-40 mph (37%)



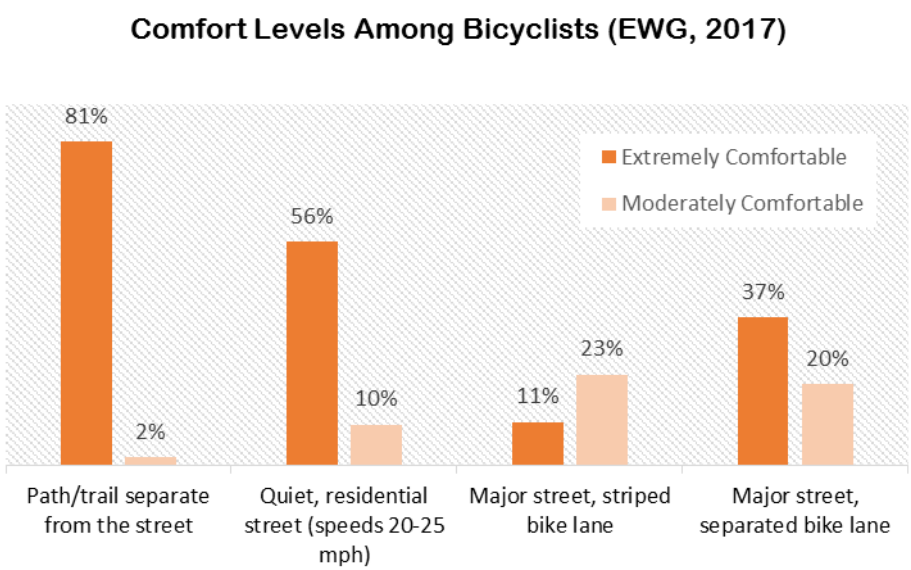


Figure 2: Comfort Levels on Bicycle Facilities

Levels of Traffic Stress

Low-stress bicycle and pedestrian facilities attract bicyclists because they are safe, comfortable, and convenient routes. Examples of low-stress facilities include shared-use paths, buffered and separated bike lanes, and calm streets. The functional class of the roadway impacts the bicycle level of stress. For instance, shared-lane markings can be low-stress or high-stress depending on the speed and traffic volume of the roadway.

In 2012, a report published by the Mineta Transportation Institute[4] proposed a scheme for classifying roads for bicyclists by one of four levels of traffic stress (LTS) identified below. The LTS methodology is based on comfort level that bicyclists experience on a given facility and under certain traffic conditions, how much attention it demands of the individual bicyclist, and the category of cyclist.

LTS 4 – High-Stress – Uncomfortable for most bicyclists. Tolerated by those characterized as "strong and fearless," and only suitable for experienced bicyclists. Demands close attention by bicyclists.

LTS 3 – Medium-Stress – Comfortable for some bicyclists. Acceptable to bicyclists who are "enthused and confident" but may still prefer having their own dedicated space for riding.

LTS 2 – Low-Stress – Comfortable for most adult bicyclists. Adequate for the mainstream adult population and the "interested, but concerned" group of bicyclists.

LTS 1 – Lowest-Stress – Comfortable for all ages and abilities. Demands less attention from bicyclists and is suitable for children.

Figure 3: Levels of Traffic Stress
Source: Alta Planning + Design https://blog.altaplanning.com

[4] Mekuria, Maaza C., Peter G. Furth, and Hilary Nixon. "Low-Stress Bicycling and Network Connectivity." Mineta Transportation Institute. Report 11-19 (2012).

Connectivity

A collection of connected bikeways create a network. Developing a network that is low-stress and accessible to novice bicyclists (the "interested, but concerned" bicyclists) allows people of all ages and abilities to safely and conveniently access destinations throughout a community.

Barriers and breaks in the network reduce connectivity and can increase levels of stress. Examples of barriers include railroads, highways, natural barriers like creeks and rivers, and high-stress corridors without adequate bicycle facilities that leave a gap in the network. Different types of bicycle facilities will impact connectivity in different ways. Context and design flexibility should influence the type of bicycle facility selected, intersection treatments, and other design elements to promote safety. A well-developed bicycle network will utilize a variety of context-sensitive facility types to meet local needs, improve connections, and expand the reach of the network.

The two maps below illustrate network connectivity, and how the level of stress associated with various bicycle facilities impacts the overall network. The first map shows downtown San Jose, California, with bicycle facilities color-coded to reflect their level of stress. The second map shows a closer look at the downtown street grid, but only includes bicycle facilities with lower levels of stress (LTS 1 or 2). Barriers and breaks in the network quickly become apparent when level of stress is factored into the analysis. The result has been referred to as "connectivity clusters" – small, local networks, often lacking essential low-stress connections between each other.

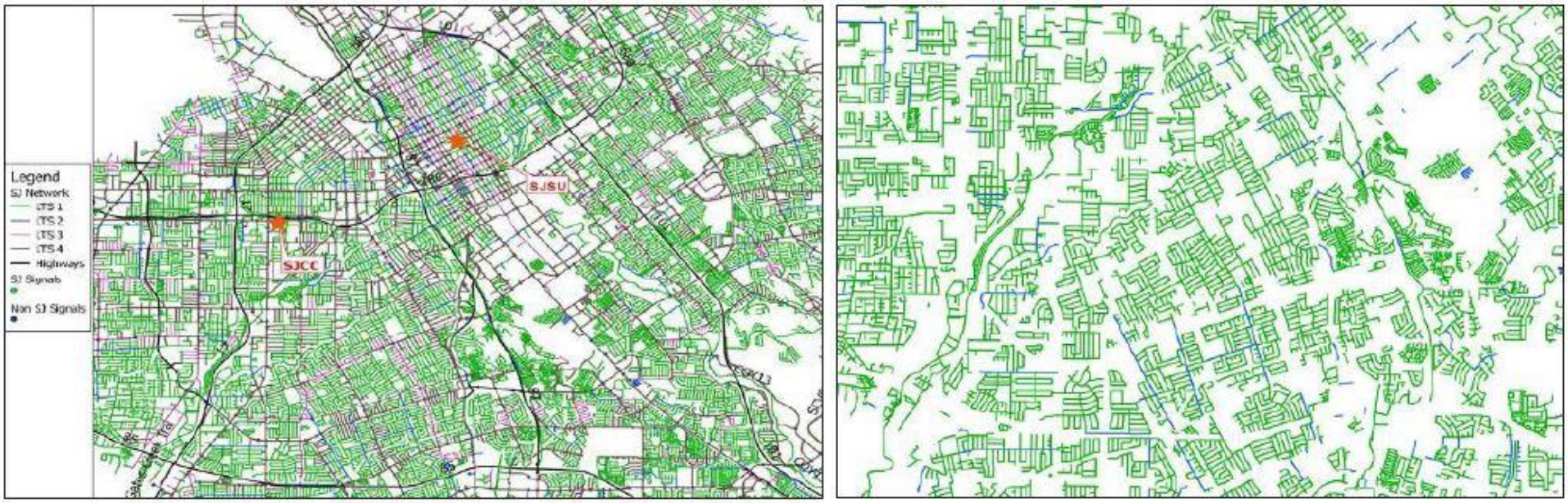


Figure 4: Bicycle Network Connectivity
Source: Mekuria, Maaza C., Peter G. Furth, and Hilary Nixon. "Low-Stress Bicycling and Network Connectivity." Mineta Transportation Institute. Report 11-19 (2012).

Bicycle Facility Selection

Bicycle facilities fall into one of two umbrella categories: shared bikeways and separated bikeways. **Shared bikeways** are on-street facilities that share road space with motor vehicles, such as shared lanes and bicycle boulevards. **Separated bikeways** are facilities that are separate from motor vehicle traffic, whether on- or off-street. Separated bikeways can be further categorized as visually or physically separated facilities. **Visually separated** facilities, such as bike lanes and buffered bike lanes, are designated by striped lanes or pavement markings that provide a visual indicator of the space designated for people bicycling. **Physically separated** facilities, such as shared-use paths or separated bike lanes, provide an additional physical or vertical buffer between bicycle and motor vehicle traffic.

When determining the appropriate bicycle facility type for a project, the level of separation is closely related to level of stress. **Speed** and **volume** are fundamental and interrelated factors influencing bicycle level of stress and should be analyzed together. The higher the vehicle speed or traffic volume, the greater the level of separation needed between bicycle and motor vehicle traffic to create a safer, low-stress bicycle facility.

The **number of lanes** should also be considered since level of stress increases on multi-lane roadways. Increased separation is recommended on roads with more than one lane of travel in each direction, and as such, shared bikeways are not typically an acceptable low-stress facility on these types of roads. The chart below illustrates level of stress for shared bikeways, based on speed limit and number of lanes.

	Street Width		
Speed Limit	2-3 lanes	4-5 lanes	6+ lanes
Up to 25 mph	LTS 1[a] or 2[a]	LTS 3	LTS 4
30 mph	LTS 2[a] or 3[a]	LTS 4	LTS 4
35+ mph	LTS 4	LTS 4	LTS 4

Figure 5: Considering street width on shared bikeways
Note: [a] Use lower value for streets without marked centerlines or classified as residential and with fewer than 3 lanes; use higher value otherwise
Source: Mineta Transportation Institute

The Bicycle Facility Contextual Guidance chart was modified from the original NACTO version, for use in determining appropriate bicycle facilities. It offers guidance on what types of treatments are recommended depending on roadway speed and volume, with the stipulation that these are not the only factors to be considered. Regardless of where bikeway treatments are applied, special attention needs to be paid to intersections, driveways, on-street parking, sight distance, and any other relevant roadway characteristics.

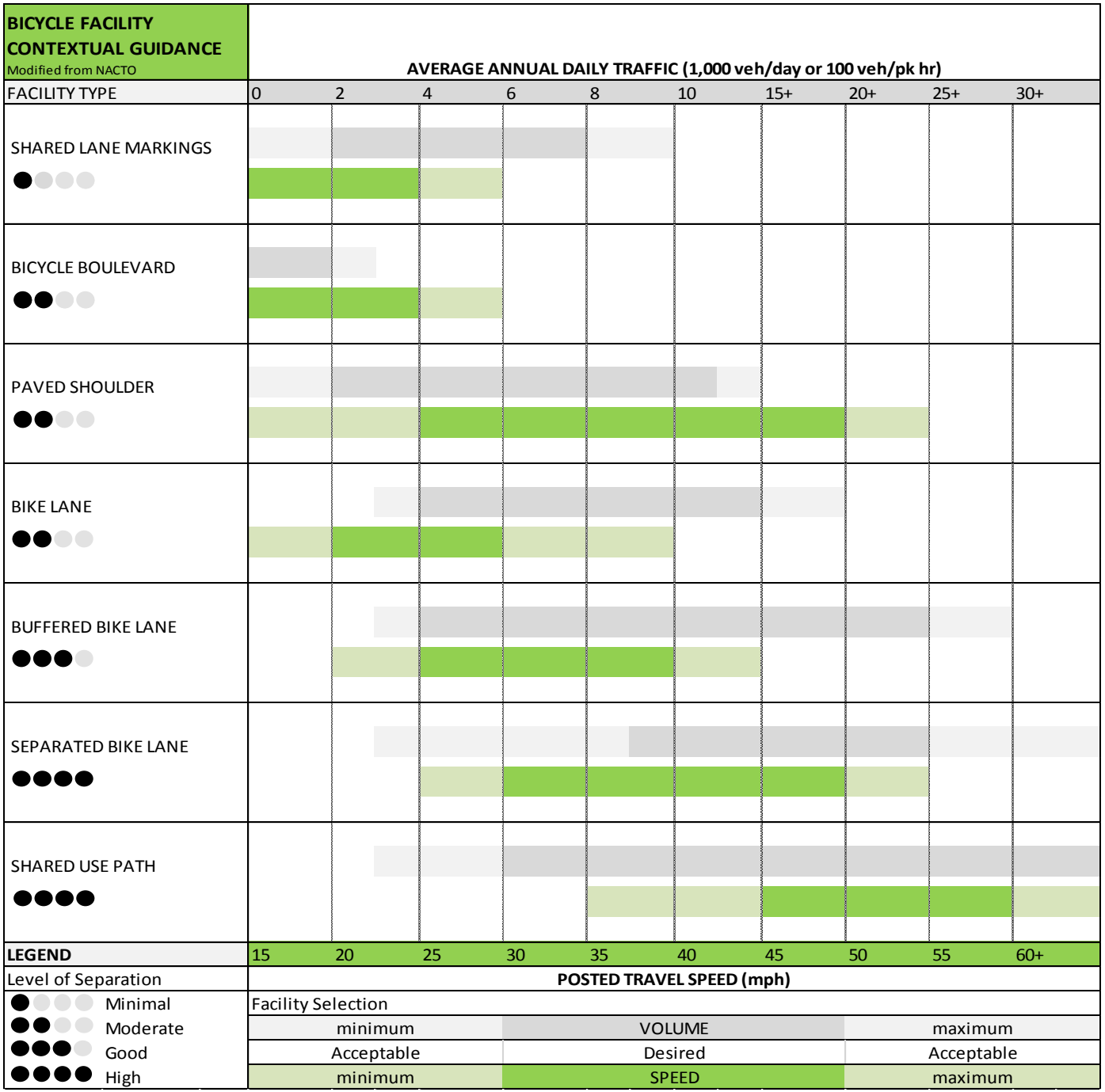


Figure 6: Bicycle Facility Contextual Guidance
Source: Modified from NACTO

Shared Lane Markings

Shared lanes employ pavement markings (also known as “sharrows”) paired with signage to create a bicycle route that is shared with motor vehicle traffic. Shared lanes are appropriate for low-speed, low-volume streets, often in neighborhoods or residential areas. Shared lane pavement markings should be positioned in the lane of travel so that they align with a practical path for bicycle travel, alerting users to the presence of bicyclists and allowing adequate space between parked cars or the curb.

Benefits

- Useful in creating a network of low-stress streets for bicyclists to navigate.
- Signage can be used for wayfinding and identifying bike routes.

Limitations

- Shared lane pavement markings and signage alone are not typically considered a bicycle “facility” and are not sufficient to create a low-stress bicycle facility on higher speed or higher volume roads.
- Shared lanes are appropriate for streets with 2-3 lanes of traffic, but are not sufficient on roads with 4+ lanes of traffic.

Other Considerations

- Placement should be carefully considered to avoid the door zone – the area where parked car doors open into the street.
- Shared lane markings should be used exclusively in shared traffic lanes and should not be used in bike lanes or on shoulders.
- “*Bikes May Use Full Lane”* or “*Change Lanes To Pass”* signs provide more specific instruction to people driving and bicycling than *“Share The Road”* signs.

Connectivity

- Serves local, residential roadways and smaller, neighborhood bike networks.

Level of Separation: Minimal

Figure 7: Shared Lane Markings

Bicycle Boulevards

Bicycle Boulevards (also known as calm streets or neighborhood greenways) are shared bikeways that utilize traffic calming techniques rather than physical separation, to create a low-stress bicycling environment. They are typically implemented on low-speed, low-volume streets and may employ multiple techniques to prioritize bicycling, including chicanes, speed humps, bulb-outs, pinch points, high-visibility crosswalks, etc.

Benefits

- Slower motor vehicle traffic and increased driver awareness help to create a streetscape that is conducive to both bicycling and walking.
- Can allow for a continuous on-street bicycle route, or connect an entire neighborhood.

Limitations

- Adequate traffic calming strategies must be in place to ensure the slower speeds and calmer motor vehicle traffic that make this facility type truly low-stress.

Other Considerations

- Directional markings and wayfinding signage can help bicyclists navigate planned corridors and neighborhoods.
- Centerlines are often unnecessary on bicycle boulevards, and removal can help to encourage passing of bicycles at a safe distance.

Connectivity

- Serves local, residential roadways and smaller, neighborhood bike networks.

Level of Separation: Moderate

Figure 8: Bicycle Boulevards

Paved Shoulders

Where there are no other bicycle facilities, paved shoulders can serve as a bicycle facility on rural roads with lower volumes of bicyclists, and moderate to high motor vehicle volumes and speeds. Paved shoulders do not typically include pavement markings, and are not restricted to bicycle use only. Signage is not required, but may be used to identify a bicycle route or alert users to the presence of bicyclists.

Benefits

- Provides a degree of visual separation from motor vehicle traffic.
- Encourages bicycling in the same direction as traffic when paved shoulders are present on both sides of the road.

Limitations

- Potential conflicts with motor vehicles or pedestrians using the shoulder.
- Debris from the roadway may collect on the shoulder, posing hazards to bicyclists.

Other Considerations

- If rumble strips are present, a bicycle gap pattern may be used to allow access into and out of the shoulder area by bicyclists.
- Signage should be spaced so that it does not "clutter" the roadway or disrupt the rural character of the roadway.
- Width is an important factor to consider for this facility type, and it is recommended that shoulder width increases as traffic volumes and speed increase.

Connectivity

- Provides connections between rural links in the regional or local biking network.

Level of Separation: Moderate

Figure 9: Paved Shoulders

Bike Lanes

Bike lanes (also known as standard or conventional bike lanes) are on-street facilities that use pavement markings to designate a lane of travel for bicyclist-only use. Signage may also be used to indicate the presence of a bike lane, its beginning, or end. Bike lanes are located directly adjacent to the motor vehicle lane, in the same direction as the flow of traffic, on the right side of the street.

Benefits

- Promotes safe bicycling by reducing wrong-way travel and bicycling on sidewalks.
- Allows bicyclists to travel at a comfortable speed, without the need for cars to pass.

Limitations

- Most appropriate on streets with low to moderate traffic volumes and speeds.

Other Considerations

- Design variations exist to accommodate bike lanes on the left side of the street if appropriate, or on one-way streets, such as contra-flow bike lanes.
- Width and placement of bike lanes should provide enough space for bicyclists to avoid the door zone – the area where parked car doors open into the street.
- Enough space should be provided in the bike lane for bicyclists to avoid drainage grates or other roadway fixtures, or the fixtures should be designed to reduce potential hazards to people bicycling.

Connectivity

- Serves moderate distance trips connecting local bikeway routes to regional corridors.

Level of Separation: Moderate

Figure 10: Bike Lanes

Buffered Bike Lanes

Buffered bike lanes have the same characteristics of a standard bike lane, but with a wider pavement marking between bicycle and motor vehicle traffic. The painted buffer can be marked on one or both sides of the bike lane, depending on factors such as right-of-way constraints or the availability of on-street parking.

Benefits

- The additional space between lanes can reduce the level of stress on bicyclists and allow room for passing or maneuvering.
- A marked buffer between the bike lane and parking lane can also be used to protect bicyclists from the door zone – the area where parked car doors open into the street.

Limitations

- Buffered bike lanes are recommended over standard bike lanes if there are higher traffic *volumes*, although they may not provide enough separation or protection on roadways with higher traffic *speeds*.

Other Considerations

- Cross hatching or chevron markings within the buffer increase visibility.
- Flexible delineators can be used within the buffers on the left side of the bike lane, if there is no parking present.

Connectivity

- Serves essential, primary connections on major roads through and across communities.

Level of Separation: Good

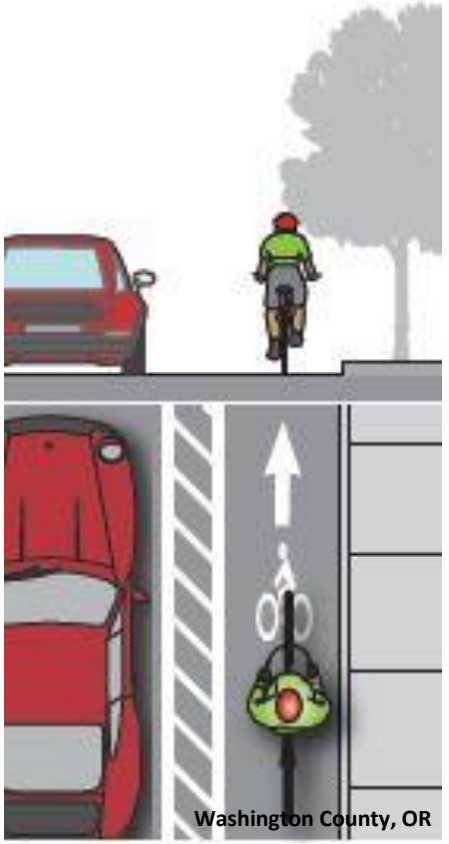


Figure 11: Buffered Bike Lanes

Separated Bike Lanes

Separated bike lanes (also known as protected bike lanes or cycle tracks) are bike lanes that have a physical and/or vertical buffer between the bicycle lane and motor vehicle lane, in addition to pavement markings. Bollards, raised medians, curbs, and even on-street parking can be used as a buffer to further separate lanes of travel. This type of bicycle facility can be used on any road where space allows, but is strongly recommended for use on higher-speed, higher-volume roads, or roads with multiple lanes of travel.

Benefits

- Appeals to a wide variety of bicyclist skill levels due to the high level of separation, which reduces level of stress.
- Typically also separated from pedestrian traffic, minimizing congestion in pedestrian-heavy locations.

Limitations

- Physical separation or protection often ends at intersections, which may require additional treatments to ensure safe, comfortable crossings and turning movements for people bicycling.

Other Considerations

- If available, on-street parking can be considered as a physical buffer.
- Separated bike lanes can be one-way or two-way. For two-way cycle tracks, consider surrounding land use and connecting facilities to determine which side of the street is most appropriate for placement, and use pavement markings to indicate the direction of travel on both sides of the cycle track.

Connectivity

- Serves essential, primary connections on major roads through and across communities.

Level of Separation: High

Figure 12: Separated Bike Lanes

Shared-Use Paths

Shared-use paths (also known as multi-use paths) are off-street facilities, physically separated from traffic, often by a tree lawn or other type of vegetation. These paths are shared by a variety of users, including both bicyclists and pedestrians. This facility type is often based on opportunity and connectivity rather than the context of the roadway (such as volume and speed) and can establish routes completely separate from the street network. Shared-use paths that run parallel or directly adjacent to the roadway are sometimes referred to as sidepaths.

Benefits

- Separation from the roadway appeals to more vulnerable bicyclists, such as families with children.
- Creates a very low stress environment for bicyclists of all skill levels.
- Viable option if road space for bike lanes is limited.

Limitations

- As an off-street facility, shared-use paths can limit connectivity to the on-street network.
- May require additional right-of-way to construct.

Other Considerations

- Bicycle paths should be separated from pedestrian walkways where a significant volume of either exists.
- Frequent driveways and crossings, obtrusive bollards, and sharp geometry can disrupt the comfort and convenience of shared-use paths.

Connectivity

- Serves connections independently of the street network, but works best when tied into the on-street bicycle network.

Level of separation: High

Figure 13: Shared-Use Paths

Other Considerations

Traffic volumes and vehicle speeds are critical factors in determining the most appropriate bicycle facility, but there are a variety of other factors that should be considered as well, depending on the specifics of the roadway and the nature of the project area. Several additional considerations are listed here, although this is not an exhaustive list. Flexibility and context-sensitivity are key to building a successful bicycle facility and network.

Social Equity

Historically, communities of color and low-income communities have struggled with disinvestment in transportation infrastructure, which is reflected in issues of access and safety. When planning a bicycle facility, consider the needs of these communities, as well as other vulnerable and often underrepresented groups, such as zero-vehicle households, children, women, seniors, persons with disabilities, and those with limited English proficiency (LEP). Taking a closer look at socio-economic factors is helpful in examining issues of equity in the region, and in building facilities that are both context- and culturally-sensitive. Improving bicycle infrastructure will only go so far in building a better bicycle network if improvements are not equitably distributed.

Bike Parking

For bicycling to be utilized as a mode of transportation, availability of bike parking is essential. Bike parking should be included anywhere there is motor vehicle parking – schools, parks, business and shopping districts – and especially at destinations along major bicycle routes. The type of bike parking should also be considered. Standard U-racks are often the easiest to use and the most cost-effective. Covered or secure bike parking should be considered in areas with significant volumes of bicyclists or demand for long-term bicycle parking. In areas with dockless bike share programs, designated parking zones (without racks) can be utilized to keep bicycles orderly and out of the through-zone, while preserving rack space for those who need to lock up their bikes

Figure 14: Bike Parking

On-street Parking

If on-street parking is available, the type and location of parking should factor into the design of the bicycle facility. When determining the location and width of a bike lane or pavement markings, be aware of the door zone, where people exiting their vehicles may conflict with bicyclists. Floating parking can be used as an effective barrier in separated bike lanes, and implementation can be as simple as shifting the parking lane away from the curb when re-striping to add a bike lane.

Figure 15: On-street parking establishes a physical barrier between the bike lane and motor vehicle lanes

Figure 16: Protected intersection utilizing colored pavement and curb bump-outs to increase visibility and reduce crossing distance for people walking and bicycling

Intersections

Intersections are a critical point in the bicycle network. A low-stress facility can quickly become stressful when it ends abruptly or in a confusing manner at an intersection. Signage and pavement markings can alert both bicyclists and motorists to the proper wait area or route through an intersection, and can go a long way in helping bicyclists navigate a tricky intersection. Other innovative treatments include protected intersections (shown at left) or bike boxes, which are typically placed ahead of waiting motor vehicle traffic, and provide a dedicated, highly visible space for people on bikes to wait and get a head start.

Emergency Vehicles

Access for emergency vehicles should be considered when planning a bicycle facility or route, and coordination with emergency response teams may be recommended. Particularly on smaller, local roads or if traffic calming strategies are being implemented, it is important to ensure that vehicles such as ambulances and fire trucks will have access in case of emergency.

Figure 17: Emergency vehicle straddles speed cushion

Figure 18: Public transit is separated from bicycle traffic with a raised bus stop, allowing bicyclists to continue through the bike lane without interruption as buses stop for passengers

Public Transit

Bicycling and public transit often nicely complement each other, and combining the two modes can greatly extend the reach of bicycle travel and bridge the gap of the "first/last mile" for transit users. However, there are also a number of potential conflict points between bicyclists and transit vehicles, given that they both typically operate on the right side of the road and travel at lower speeds than other vehicles. A variety of innovative treatments are available based on the type of transit serving the area, transit frequency, and volume. Shared Bus-Bike Lanes are one example, and can be considered on roadways with appropriate bus speeds and space constraints.

Railways

Planning for bicycle facilities that are near or intersect railways often requires coordination with the railroad company or transit agency. Facilities running parallel to railways should use appropriate setbacks from the rails, and fencing if necessary to provide adequate separation. Bike facilities intersecting railways should implement cautionary design elements, such as detectable warning pavers, high visibility signage, and/or dedicated swing arms to ensure bicyclist awareness. For streetcar or light rail lines operating within the roadway, similar cautionary design elements can be used to ensure safe crossings. These facilities should also provide sufficient space for people to ride outside of the track zone. Signage can be used to direct bicyclists where to safely cross tracks, and to instruct them to cross at as close to a 90-degree angle as possible, to prevent tires from getting caught in the flangeway.

Figure 19: Fencing is used to separate the railroad from the bicycle facility

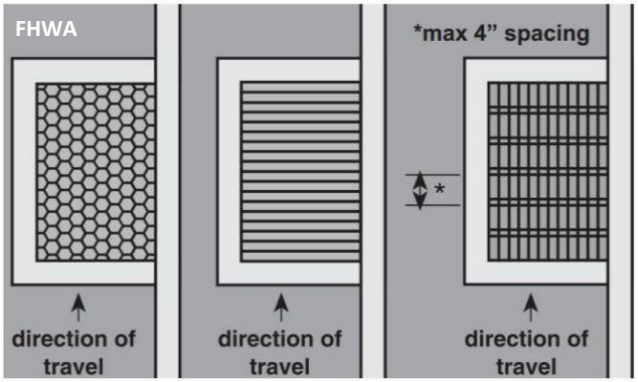


Figure 20: Drainage Grates

Drainage Grates

Poorly designed or placed drainage grates can pose serious safety hazards to bicyclists. A bike lane abutting the curb may need to accommodate drainage grates, as well as stormwater runoff and roadway debris, in addition to bicyclists. Drainage grates located within a bicycle facility or route should always be placed with openings properly sized, and positioned perpendicular to the flow of traffic to prevent bicycle wheels from becoming stuck and causing a crash. Non-slip coatings and finishes for metal grates are can also help to prevent tires from slipping in wet conditions. Curb inlet drainage systems can avoid many of these hazards altogether, when feasible.

Signage

Signage is an essential element of any bicycle facility as it can provide key information to people driving and bicycling. According to MUTCD, there are three types of signage for bicycle facilities – regulatory, warning, and guide – each serving a distinct purpose and function. The three types of signs are defined below, with examples. Signage alone is not considered a bicycle facility, and is not sufficient to reduce the level of traffic stress for bicyclists.

Regulatory – Instructs users on regulations and rules of the road and/or path.

Warning – Alerts users to potential hazards, upcoming or unexpected curves and stops, and changes in the roadway.

Guide – Directs users along bicycle routes and can provide wayfinding information, such as distance to popular destinations.

Figure 21: Left to right: standard bike route (guide), Bike St. Louis route (guide), no motor vehicles allowed on the path (regulatory), drivers turning right must yield to bicyclists (regulatory), bicyclists should avoid trolley tracks in the roadway (warning), and path users must yield to vehicles at the upcoming crossing (regulatory + warning)

Resources

Federal Agency Policy Statements, Memorandums, and Initiatives

Policy Statement on Bicycle and Pedestrian Accommodation Regulations and Recommendations
U.S. Department of Transportation (USDOT) – March 2010

This policy statement stresses that every transportation agency has the obligation to improve conditions and opportunities for walking and bicycling and to integrate walking and bicycling into their transportation systems, by following these recommended actions:

- Treat walking and bicycling as equals with other transportation modes.
- Ensure convenient access for people of all ages and abilities, especially children.
- Go beyond minimum design standards.
- Integrate bicycle and pedestrian accommodation on new, rehabilitated, and limited-access bridges.
- Collect data on walking and bicycling trips.
- Set a mode-share target for walking and bicycling.
- Maintain sidewalks and shared-use paths the same way roadways are maintained.
- Improve non-motorized facilities during maintenance projects.

Memorandum on Bicycle and Pedestrian Facility Design Flexibility
Federal Highway Administration (FHWA) – August 2013

This memorandum expresses FHWA's support for taking a flexible approach to bicycle and pedestrian facility design and encourages appropriate use of the following resources:

- AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities, 2004
- AASHTO Guide for the Development of Bicycle Facilities, 2012
- NACTO Urban Bikeway Design Guide, 2010
- ITE Designing Walkable Urban Thoroughfares: A Context Sensitive Approach, 2010

Safer People, Safer Streets:
Pedestrian and Bicycle Safety Initiative
USDOT – 2015

This initiative was launched in an effort to address non-motorized safety issues and help communities create safer, better connected bicycling and walking networks by providing a variety of resources, research, and tools for transportation professionals.

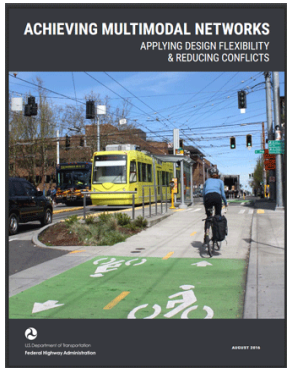
Policy Statement on Funding Eligibility for Bicycle and Pedestrian Improvements
Federal Transit Administration (FTA) – August 2011

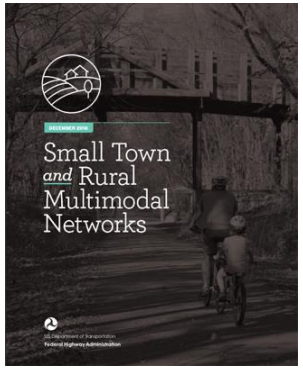
This policy statement emphasizes the importance of quality bicycle and pedestrian infrastructure in extending the reach of both transit and non-motorized transportation modes, and defines the catchment area for these improvements as well:

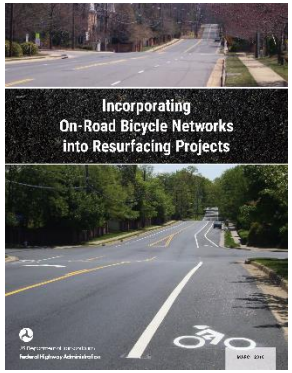
> "All pedestrian improvements located within *one-half mile* and all bicycle improvements located within *three miles* of a public transportation stop or station shall have a de facto physical and functional relationship to public transportation"

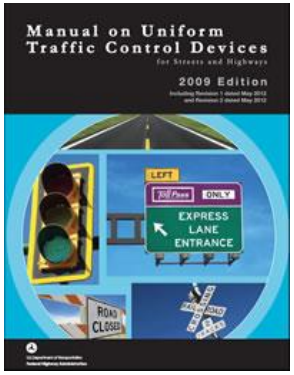
Bicycle Facility Design Guides & Resources

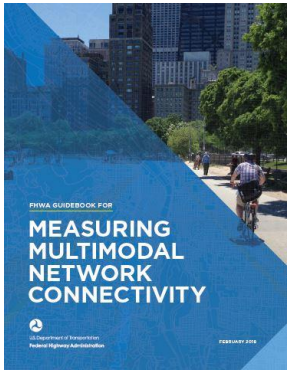
Federal Highway Administration (FHWA)

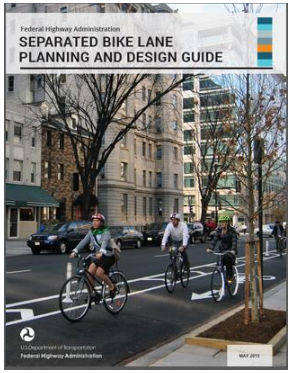












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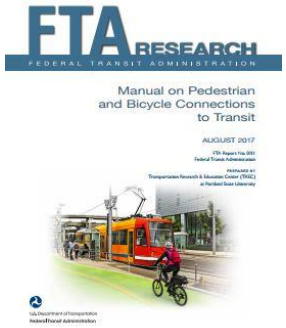
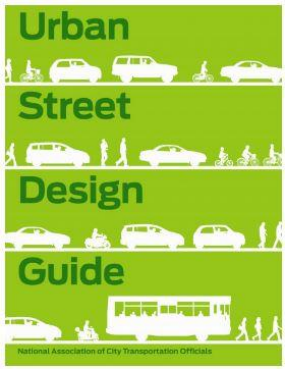
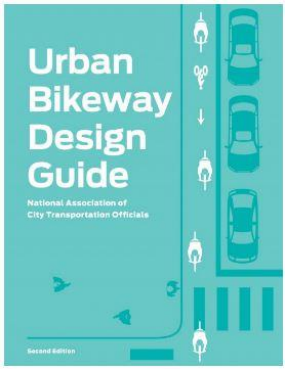
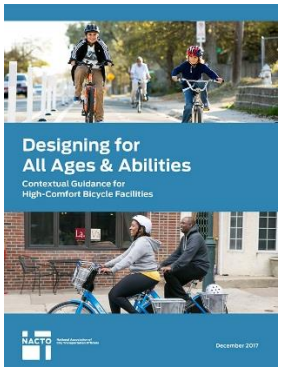


National Association of City Transportation Officials (NACTO)







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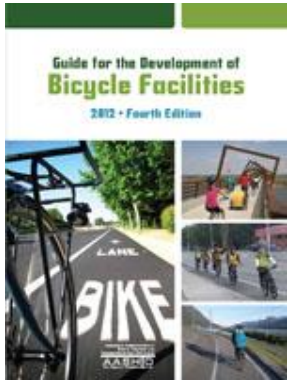
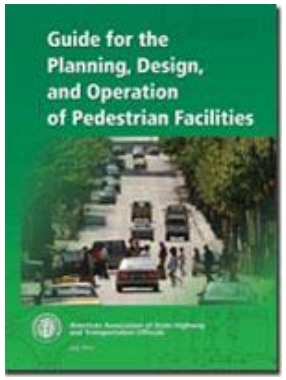
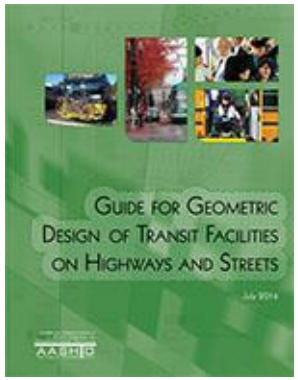
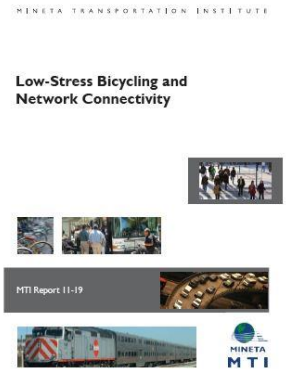


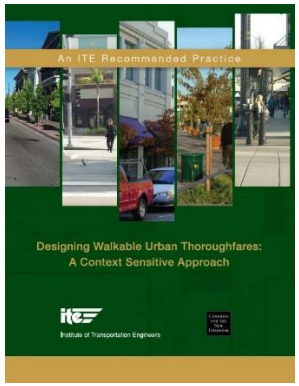




Mineta Institute of Transportation



Institute of Transportation Engineers (ITE)



Local Bicycle Planning and Design Guides

Bicycle Facility Design Guidance Modified from PBIC	Manual on Uniform Traffic Control Devices *2012* FHWA	Small Towns and Rural Multimodal Networks *2014* FHWA	Separated Bike Lane Planning & Design Guide *2015* FHWA	Achieving Multimodal Networks *2016* FHWA	Incorporating On-Road Bicycle Networks Into Resurfacing Projects *2016* FHWA	Designing Walkable Urban Thoroughfares *2010* ITE	Traffic Control Devices Handbook *2013* ITE
Shared Bikeways + General Design							
Guidance on bicycle facility selection		Throughout Document	Throughout Document	Throughout Document		Section 1	Page 571-572
Paved shoulders		Pages 3-3 to 3-10		Pages 41-44	Pages 30-31		Pages 598-600
Bicycle route signs	Sections 9B.20, 9B.21						Pages 578
Shared lane markings	Section 9C.07	Page 2-12					Pages 588-596
Shared lane signage	Sections 9B.06, 9B.19, 9B.20	Page 2-6					Pages 597-598
Shared Streets		Pages 2-3 to 2-8 (Yield Roadway)		Pages 107-110			
Bicycle boulevards/neighborhood greenways		Pages 2-9 to 2-16		Pages 57-60 (Slow Streets)			Pages 586-587
Bicycle accommodations related to traffic calming		Pages 5-3 to 5-6					
Bicycle accommodations on bridges/tunnels	Section 9B.19	Pages 5-19 to 5-26		Pages 53-56			
Bicycle treatments at rail tracks/crossings	Section 9B.19			Pages 79-82 (transit tracks)			Pages 595-596, 613
Bicycle-safe drainage grate design							Page 597
Rumble strips (bicycle guidance)		Page 3-6		Page 43	Pages 34-35		Pages 600-601
Colored bicycle facilities	Interim Approval (April 2011)						Pages 583-584, 616
Bicycle Parking				Pages 72, 76			
Bicycle Lanes							
Bicycle lane signs and pavement markings	Sections 9B.04, 9C.04	Pages 3-13, 3-14					Pages 603-604
Bicycle lane design	Section 9C.04	Pages 3-11 to 3-16			Pages 22-25	Pages 143-145	Pages 601-606
Bicycle lanes on one-way streets (left or right side)							Page 602
Retrofitting bicycle facilities							
Buffered bicycle lanes	Section 3D.02				Page 26		Pages 605-606
Contra-flow bicycle lanes							Pages 612-613
Bicycle lanes adjacent to on-street parking	Section 9C.04						Pages 604-605

Bicycle Facility Design Guidance Modified from PBIC	Manual on Uniform Traffic Control Devices *2012* FHWA	Small Towns and Rural Multimodal Networks *2014* FHWA	Separated Bike Lane Planning & Design Guide *2015* FHWA	Achieving Multimodal Networks *2016* FHWA	Incorporating On-Road Bicycle Networks Into Resurfacing Projects *2016* FHWA	Designing Walkable Urban Thoroughfares *2010* ITE	Traffic Control Devices Handbook *2013* ITE
Advisory bicycle lanes	Experimental Status (2014)	Pages 2-17 to 2-24					
Bicycle lanes adjacent to peak-hour parking							
Bicycle lanes adjacent to transit stops	Figure 9C-6			Pages 76, 79-82			
Shared Bus-Bike Lane							
Separated Bicycle Lanes							
Sidepath/shared-use path		Pages 4-3 to 4-18		Pages 99-102			Pages 613-623
One-way separated bicycle lanes	Section 9C.04	Pages 4-25 to 4-32	Pages 77-79	Pages 45-48	Page 27		Pages 605-606
Two-way separated bicycle lanes	Section 9C.04		Pages 80-82, 138-143				Pages 605-606
Separated bicycle lane design at transit stops			Pages 92-96	Pages 76, 79-82			
Intersection + Interchange Design							
Bicycle detection	Sections 9B.13, 9C.05		Page 116				Pages 624-625
Signal timing for bicycle clearances	Section 9D.02		Pages 115, 119-121				Pages 625-628
Bicycle signalheads	Interim approval (Dec 2013)		Page 118	Page 39			Pages 628-629
Bicycle push buttons	Section 9B.11						Page 624
Bicycle lane intersection approaches	Figures 9C-1, 9C-4, 9C-5, 9C-6					Pages 197-198	Pages 606-610
Combined bicycle lane/ turn lane	Section 9C.07						
Bicycle boxes	Interim approval (2016)		Pages 122-123				
Bicycle crossing markings	Section 3B.08		Pages 113-114				
Two-stage bicycle turn boxes	Interim approval (2017)		Pages 124-125				
Separated bicycle lane intersection approaches		Pages 4-29, 4-30	Pages 102-114	Pages 95-98			
Bicycle design treatments at roundabouts	Section 9C.04						Pages 611-612
Bicycle lanes through on- and off-ramps							Pages 610-611

Bicycle Facility Design Guidance Modified from PBIC	Roadside Design Guide *2011* **AASHTO**	A Policy on Geometric Design of Highways and Streets *2011* **AASHTO**	Guide for the Development of Bicycle Facilities *2012* **AASHTO**	Urban Street Design Guide *2013* **NACTO**	Urban Bikeway Design Guide *2014* **NACTO**	Transit Street Design Guide *2016* **NACTO**	Designing for All Ages & Abilities *2017* **NACTO**	Manual on Bicycle and Pedestrian Connections to Transit *2017* **FTA**
Shared Bikeways + General Design								
Guidance on bicycle facility selection			Section 2.5.2		Throughout document	Page 186-187	Throughout document	
Paved shoulders		Sections 2.7, 4.4	Section 4.5					
Bicycle route signs			Section 2.5.3		Page 139			
Shared lane markings			Section 4.4		Page 133		Page 10	
Shared lane signage			Section 4.3					
Shared Streets				Pages 26-29				
Bicycle boulevards/neighborhood greenways			Section 4.10	Page 99	Pages 149-214		Page 10	
Bicycle accommodations related to traffic calming			Sections 4.12.6, 4.12.7	Page 48	Pages 167-214			
Bicycle accommodations on bridges/tunnels		Sections 4.10.3, 4.16.4	Section 4.12.3					
Bicycle treatments at rail tracks/crossings			Section 4.12.1			Pages 46, 116, 166-167		Pages 38-39 (streetcar tracks)
Bicycle-safe drainage grate design		Section 2.7, 4.7.2	Section 4.12.8					
Rumble strips (bicycle guidance)		Section 4.5	Section 4.5.2					
Colored bicycle facilities			Section 4.7.2		Page 119			
Bicycle Parking				Pages 48, 75		Page 105		Pages 55-72
Bicycle Lanes								
Bicycle lane signs and pavement markings			Section 4.7		Page 3			
Bicycle lane design	Section 10.2.1.7	Section, 2.7, 4.3	Section 4.6	Page 16	Page 3		Page 11	
Bicycle lanes on one-way streets (left or right side)			Section 4.6.3	Page 9	Page 21			
Retrofitting bicycle facilities			Section 4.9	Pages 104-105				
Buffered bicycle lanes			Section 4.7		Page 9		Page 11	
Contra-flow bicycle lanes			Section 4.6.3	Page 9	Page 15			
Bicycle lanes adjacent to on-street parking			Section 4.6.5	Pages 9, 12	Page 3		Page 11	

Bicycle Facility Design Guidance Modified from PBIC	Roadside Design Guide *2011* **AASHTO**	A Policy on Geometric Design of Highways and Streets *2011* **AASHTO**	Guide for the Development of Bicycle Facilities *2012* **AASHTO**	Urban Street Design Guide *2013* **NACTO**	Urban Bikeway Design Guide *2014* **NACTO**	Transit Street Design Guide *2016* **NACTO**	Designing for All Ages & Abilities *2017* **NACTO**	Manual on Bicycle and Pedestrian Connections to Transit *2017* **FTA**
Advisory bicycle lanes								
Bicycle lanes adjacent to peak-hour parking							Page 11	
Bicycle lanes adjacent to transit stops				Pages 12, 50		Pages 26, 27, 32, 36, 73-79, 88, 130, 143	Page 11	Pages 20, 36
Shared Bus-Bike Lane						Page 122-123		
Separated Bicycle Lanes								
Sidepath/shared-use path	Section 5.2.3	Section 7.3.9	Section 5.2.2	Page 19				
One-way separated bicycle lanes	Sections 5.2.3, 10.2.1.7			Pages 9, 12, 22	Pages 29, 35		Page 12	
Two-way separated bicycle lanes	Sections 5.2.3., 10.2.1.7			Pages 9, 21, 22	Page 41		Page 12	
Separated bicycle lane design at transit stops				Pages 9, 50	Page 32	Pages 26, 27, 32, 36, 73-79, 88, 130, 143	Page 12	
Intersection + Interchange Design								
Bicycle detection			Section 4.12.5		Page 99			
Signal timing for bicycle clearances		Section 7.3.9		Pages 95, 127, 134	Page 97		Page 14	
Bicycle signalheads	Section 4.6			Pages 9, 11, 95	Page 93			
Bicycle push buttons					Page 96			
Bicycle lane intersection approaches		Section 9.11.3	Section 4.8	Page 11	Page 73			
Combined bicycle lane/ turn lane				Page 95	Page 79			
Bicycle boxes				Page 15	Page 49		Page 14	
Bicycle crossing markings				Page 11	Page 55			
Two-stage bicycle turn boxes				Pages 15, 95	Page 61		Page 14	
Separated bicycle lane intersection approaches				Page 11	Page 85		Page 13	
Bicycle design treatments at roundabouts		Section 9.3.4	Section 4.12.11					
Bicycle lanes through on- and off-ramps			Section 4.12.10					

Table of Figures

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EAST-WEST GATEWAY
Council of Governments

Creating Solutions Across Jurisdictional Boundaries

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