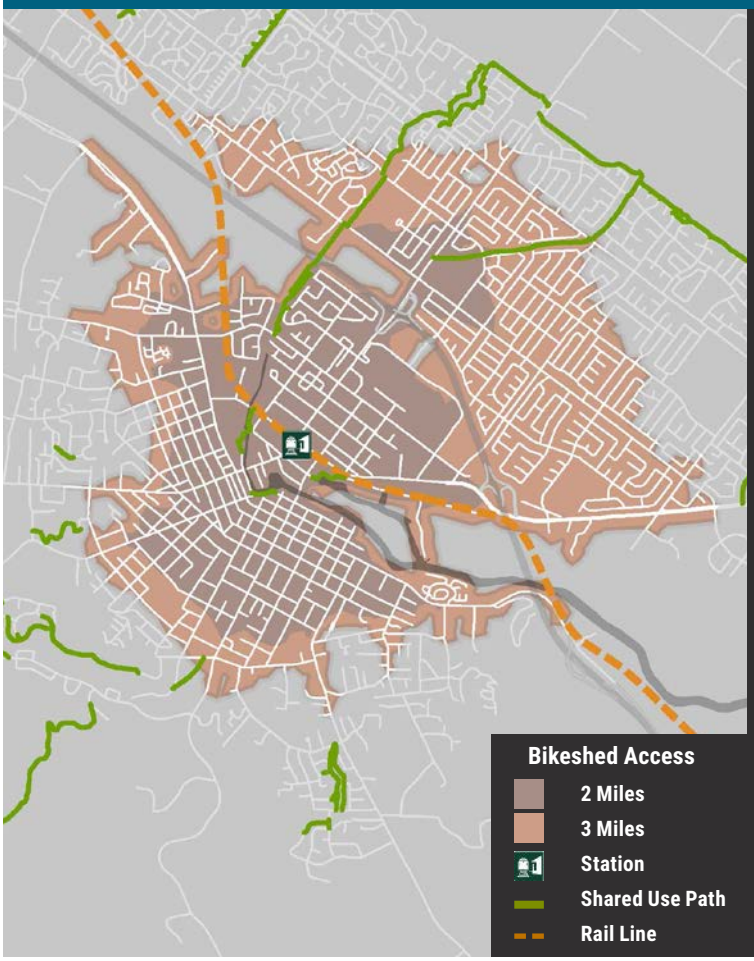
NETWORK CONNECTIVITY

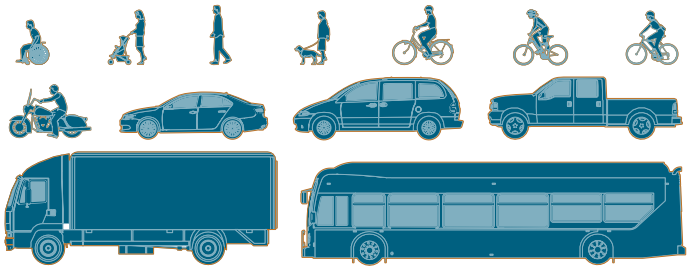


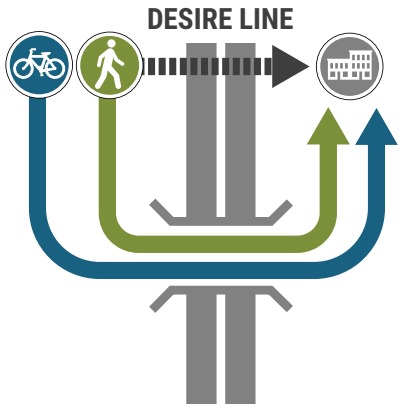
The provision of connected and consistent facilities for pedestrians and bicyclists can reduce conflicts among modes and encourage higher levels of walking and bicycling. Walking and biking routes should form a comfortable network for all ages and abilities.

The network must enable a comfortable trip from beginning to end to maximize use. To accomplish this, disconnected street networks, highway or railroad barriers, high-crash or uncomfortable intersections, and difficult midblock crossings must be addressed. Appropriate treatments along roadways vary widely based on context.

The pedestrian network is a connected transportation system made up of components such as sidewalks, street crossings, shared streets, shared use paths, and in some cases paved shoulders. The bicycle network is a connected system made up of facilities such as separated bike lanes, bike lanes, bicycle boulevards, low-volume streets, shared use paths, and paved shoulders. Pedestrian and bicycle networks should allow people to access any destination including mixed-use developments, transit stations and stops, commercial districts, residential areas, and employment centers. Pedestrian and bicycle facilities are particularly important where destinations are located in close proximity and short trips are likely.

COMMON USERS IN CONFLICT





A well-connected network of pedestrian and bicycle facilities reduces conflicts by providing access where desired.

GUIDING PRINCIPLES TO REDUCE CONFLICTS

SAFETY
The design of pedestrian and bicycle network facilities should decrease the likelihood and severity of all crashes.

ACCOMMODATION AND COMFORT
Pedestrian and bicycle facilities should create a comfortable walking and biking environment for all ages and abilities.

COHERENCE
Pedestrian and bicycle network facilities should be delineated and continuous throughout the user's trip.

PREDICTABILITY
Pedestrians and bicyclists should travel on predictable, defined facilities.

CONTEXT SENSITIVITY
Pedestrian and bicycle facilities should be appropriate to the surrounding environment.

EXPERIMENTATION
Designers should consider innovative solutions to create connected networks, particularly at crossing locations where conflicts are more likely and on higher-speed streets.

DESIGN STRATEGIES

Pedestrian and bicycle networks are planned at many scales from region-wide route systems to small-area plans. The following strategies address the challenges and potential solutions to improve nonmotorized access to a major destination in a suburban region. These network challenges are common in many communities that were constructed with minimal consideration for walking or bicycling needs. For additional destination considerations, refer to the design topics on **School Access**, **Multimodal Access to Existing Transit Stations**, and **Multimodal Access to New Transit Stations**.

DISCONNECTED STREET NETWORKS

Typical suburban street networks are a combination of major arterials and cul-de-sac developments that create challenges for bicyclist and pedestrian circulation. Cul-de-sac street networks force people to use the higher-volume, higher-speed arterials rather than the low-volume, local streets. These street networks lengthen trip routes to the point that people are less willing to bike or walk.

CONSIDERATIONS

- Keep block sizes small to reduce pedestrians walking through parking lots or other undeveloped areas. 1
- Connect cul-de-sac street networks through a system of shared use paths providing key links. 2

BARRIERS

Limited-access highways and railroad tracks can create major barriers for people on foot and bike. Infrequent barrier crossings create excessive distances for pedestrians and bicyclists. Adding barrier crossings such as bridges and tunnels will improve network connectivity, provide safer and more comfortable crossings, and reconnect bisected communities. 3 For more information, refer to the design topic on **Bridge Design**.

PEDESTRIAN CONNECTIONS

A well-developed pedestrian network promotes walking trips by providing facilities that are connected, comfortable, and appropriate for their street type.

A lack of appropriate pedestrian facilities can result in people walking in the street, running across the street, or walking on private property. Higher-volume multilane roadways require pedestrians to cross four or more travel lanes at intersections. Long crossing distances expose pedestrians to potential conflicts and create a psychological barrier to walking.

CONSIDERATIONS

- Provide sidewalks on both sides of the street, especially higher-volume, higher-speed roadways. 4 For more information, refer to the design topic on **Accessibility**.
- Narrow travel lanes and construct curb extensions and/or pedestrian crossing islands to reduce crossing distances. 5 For more information, refer to the design topics on **Design Criteria and Lane Width**, **Enhanced Crossing Treatments**, and **Intersection Geometry**.
- Consider enhanced treatments, such as pedestrian hybrid beacons or Rectangular Rapid Flash Beacons, at uncontrolled crossings. For more information, refer to the design topic on **Enhanced Crossing Treatments**.
- Provide pedestrian countdown signals and accessible pedestrian signals at signalized crossings. For more information, refer to the design topic on **Signalized Intersections**.

BICYCLE CONNECTIONS

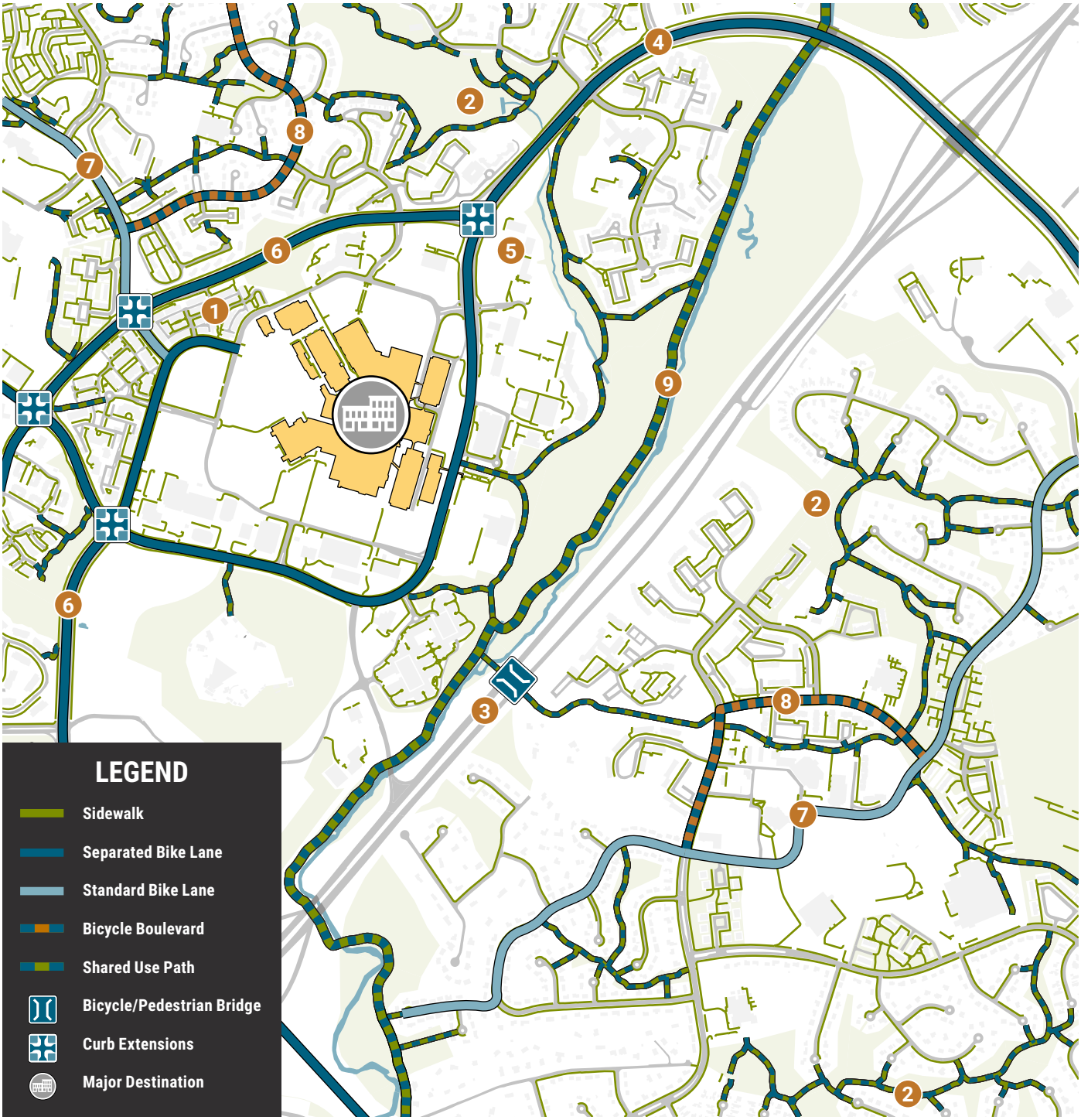
A well-connected bicycle network can encourage people to bike to key area destinations. In addition to appropriate facilities along segments, high-quality networks include safe and comfortable intersection crossings and connections between facilities.

CONSIDERATIONS

- Provide separated bike lanes on higher-volume, higher-speed roadways. 6 For more information, refer to the design topics on **Separated Bike Lanes** and **Separated Bike Lanes at Intersections**, as well as the **FHWA Separated Bike Lane Guide 2015**.
- Provide standard bike lanes to define space for bicyclists. 7 For more information, refer to the **AASHTO Bike Guide 2012**.
- Provide bicycle boulevards on low-volume, low-speed roadways. 8 For more information, refer to the design topic on **Slow Streets**.
- Provide paved shoulders on rural roadways. For more information, refer to the design topic on **Paved Shoulders**.
- Consider enhanced treatments, such as bicycle signals or Rectangular Rapid Flash Beacons, at uncontrolled crossings of higher-volume, higher-speed roadways. For more information, refer to the design topic on **Enhanced Crossing Treatments**.

SHARED USE PATH CONNECTIONS

Regional paths can serve as major components of the transportation network. Paths connecting to important destinations can increase the number of people walking or biking there. Providing a shared use path connection 9 with wayfinding can connect the path users to the destination comfortably. For more information, refer to the design topics on **Shared Use Paths** and **Midblock Path Intersections**.



WAYFINDING AND SIGNS

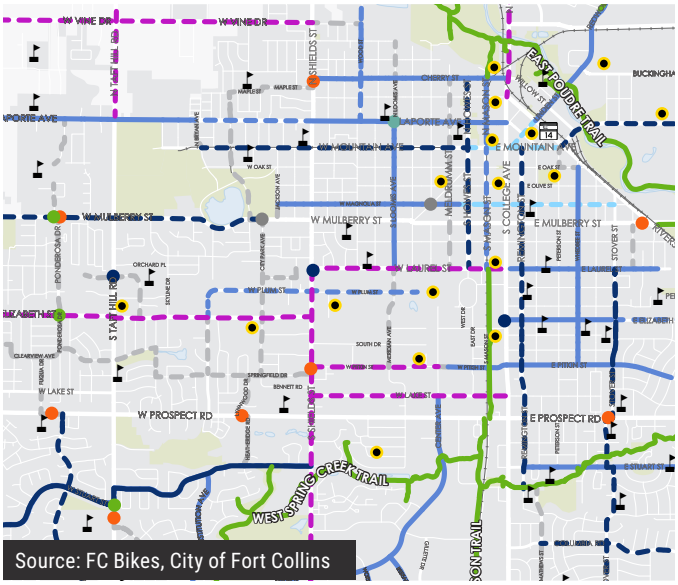
Wayfinding signs can be used to direct pedestrians and bicyclists to key destinations via low-stress routes. Curvilinear street networks, such as those shown above, can be disorienting to pedestrians and bicyclists. Wayfinding signs can help overcome this challenge. Off-street paths are sometimes difficult to locate, so adding signs can be especially helpful to provide connectivity within and between neighborhoods. Signs should comply with the **MUTCD**.

ROUTE-SELECTION APPLICATIONS

Route-selection applications, which allow users to identify routes by entering their origin and destination, are now available on most mobile devices. Developers are currently building options within applications that allow users to optimize their bicycle route for different characteristics. For example, some riders may feel comfortable sharing a higher-volume roadway with automobiles. Other riders may want to avoid those streets and optimize their route accordingly. Applications developed by public agencies must meet accessibility requirements.

BICYCLE MASTER PLAN
FORT COLLINS, CO

Creating connections between existing comfortable streets and trails guided the development of the Fort Collins bicycle network. These "low-stress" facilities consist of low-volume and low-speed local streets, local streets with bike lanes, and wide, paved shared use paths. Planning focused on locations where these streets cross major arterials without signalization or where streets are offset across an arterial. Design recommendations for these locations vary but emphasize creating shorter crossing distances and making drivers aware of bicyclists' presence. Where existing low-stress segments were not present, more robust treatments such as separated bike lanes were recommended on higher-speed arterials.



Source: FC Bikes, City of Fort Collins

STREET CONNECTIVITY POLICY
CHARLOTTE, NC

The City of Charlotte undertook a connectivity planning effort starting in 2006 to overcome the mobility and access challenges created by its disconnected street network. An initial project identified 20 high-priority areas within the city where barriers precluded convenient pedestrian and bicyclist access. In 2007, the City launched a capital program with the purpose of connecting local streets.

The City's connectivity efforts are supported by Charlotte's subdivision ordinance. These regulations prohibit the use of cul-de-sacs in street network design except where geographic or topographic barriers necessitate their use. In such cases, a pedestrian and bicycle connection may still be required where the street network is fragmented. Cul-de-sacs are also prohibited in transit station areas where pedestrian connections are prioritized.

Source: Charlotte Department of Transportation

FOR MORE INFORMATION

American Association of State Highway and Transportation Officials. *Guide for the Development of Bicycle Facilities*. 2012.

American Association of State Highway and Transportation Officials. *Guide for the Planning, Design, and Operation of Pedestrian Facilities*. 2004.

Federal Highway Administration. *Manual on Uniform Traffic Control Devices*. 2009.

Federal Highway Administration. *Guidebook for Pedestrian and Bicycle Performance Measurement*. 2016.

Federal Highway Administration. *Separated Bike Lane Planning and Design Guide*. 2015.

Institute of Transportation Engineers. *Recommended Design Guidelines to Accommodate Pedestrians and Bicycles at Interchanges*. 2014.

National Association of City Transportation Officials. *Urban Bikeway Design Guide*. 2014.

National Association of City Transportation Officials. *Urban Street Design Guide*. 2013.