Since the original Intermodal Surface Transportation Efficiency Act of 1991, progressive communities across the United States have embraced the directive to include, to a greater extent, pedestrian and bicycle mobility in the planning process. As a result, there have been significant efforts toward re-looking at pedestrian and bicycle standards and guidelines.

This document represents a compilation of the standards and guidelines of the member jurisdictions and best practices from jurisdictions across the country. It includes a review of Complete Street requirements as required by FHWA, best practices in pedestrian and bicycle facilities planning, and a discussion on travel demand management.

The Pedestrian and Bicycle Guidelines are intended as recommendations for member jurisdictions to improve bicycle and pedestrian mobility. Member jurisdictions are not required to adopt these guidelines; but rather, to use them as a planning tool in developing pedestrian and bicycle plans for their local communities. The guidelines are intended to be flexible to allow for implementation, as appropriate.

Complete Streets

In 2000, the Federal Highway Administration (FHWA) provided the following guidance: “Bicycling and walking facilities will be incorporated into all new transportation projects unless exceptional circumstances exist.” Since then, cities and counties throughout the country have started working toward providing “complete streets” in their communities. A complete street is one that works for all travel modes, including motorists, transit, bicyclists, pedestrians, and wheelchairs. A complete street policy ensures that the entire right-of-way is routinely designed and operated to enable safe access for all users. In keeping with the “complete streets” philosophy, the following outlines some general guidelines or “best practices” for creating “complete streets” and accommodating bicyclists and pedestrians within roadway corridors.

Complete Street Guidelines

Federal Guidance

In 2003, FHWA published Design Guidance Accommodating Bicycle and Pedestrian Travel: A Recommended Approach (Guidance), a policy statement to guide jurisdiction in integrating bicycling and walking into their transportation systems. The Guidance establishes the following four policies:

1. Bicycle and pedestrian ways shall be established in new construction and reconstruction projects in all urbanized areas unless one or more conditions are met:
   - Bicyclists and pedestrians are prohibited by law from using the roadway;
   - The cost of establishing bikeways or walkways would be excessively disproportionate to the need or probable use (i.e., >20%); and
   - Where a sparse population or other factors indicate that there is no need.

2. In rural areas, paved shoulders should be included in all new construction and reconstruction projects on roadways used by more than 1,000 vehicles per day.

3. Sidewalks, shared use paths, street crossing, pedestrian signals, signs, street furniture, transit stops and facilities, and all connecting pathways shall be designed, constructed, operated, and maintained so that all pedestrians, including people with disabilities, can travel safely and independently.

4. The design and development of the transportation infrastructure shall improve conditions for bicycling and walking through the following additional steps:
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- Planning projects for the long-term;
- Addressing the need for bicyclists and pedestrians to cross corridors as well as travel along them;
- Getting exceptions approved at a senior level; and
- Designing facilities to the best currently available standards and guidelines.

It should be noted that exemptions to the complete streets requirement require exceptional reasons and facilities with federal funding require FHWA approval of the exemption. A state or local agency could be put on probation for receiving additional federal funds, if the FHWA finds inappropriate use of exemptions to exclude accommodation of all modes.

Local Implementation

Many jurisdictions are amending their street standards to include a recommendation promoting “complete streets.” A suggested description is as follows:

“Construct complete streets designed to accommodate all users. In all new roadway projects or major reconstruction projects, accommodate travel by pedestrian, bicyclists, and transit users, except where pedestrians and bicyclists are prohibited by law from using a given facility or where construction of bikeways or walkways would be unsafe or impractical. Such facilities for pedestrian and bicycle use shall be designed to the best currently available standards and guidelines.”

Complete Street Design

While the definition of a complete street is universally applicable, the design of complete streets is variable. Each street has unique characteristics that make it distinctive from another. Therefore, a complete street in a rural area will look quite different from a complete street in a highly urban area. However, both streets are designed to balance safety and convenience for everyone using the road.

Elements that may be found on a complete street includes: sidewalks, bike lanes, crosswalks, wide shoulder, medians, bus pullouts, special bus lanes, raised crosswalks, audible pedestrian signals, sidewalk bulb-outs, and more. The following outlines the characteristics of “typical” complete streets in an urban and rural setting.

- Rural. Rural roadways provide unique design challenges to develop complete streets. Rural streets typically have low traffic volume and the traffic lanes serve as multi-modal pathways often accommodating pedestrians, bicyclists, and motorists. These types of streets typically lack sidewalks and few pedestrians use these routes. Streets may be striped in order to provide the best use of the right-of-way and not limit mobility. Rural complete streets provide adequate shoulders (at least 5 feet) for use by bicyclists. Ideally, the shoulder should be 8 feet wide to allow a vehicle to pull off the roadway in an emergency.
**Urban.** Urban streets are utilized to access mixed use and commercial areas. These streets typically carry a higher volume of traffic and have more pedestrians and bicyclists present. Transit is an active component of these areas and intermodal connections are prioritized.

There are many different types of streets found in urban settings. Recommended standards for different types of urban streets are outlined below. These standards include provisions for narrow street widths where low speeds are appropriate, detached sidewalks, bicycle facilities, and shorter block lengths.

### Local Streets
- The maximum width of local residential streets is 30-32 feet (two 7-foot parking lanes and two 8-9 foot travel lanes) depending on the expected travel volume.
- Landscape strips, separating curb from the sidewalk, are required on local residential streets.
- Maximum block length is 600 feet for low-volume residential streets and 800 feet for medium-volume residential streets.
- 6-inch vertical curbs are required.

### Collector Streets
- Landscape strips, separating curb from the sidewalk, would be required on most new streets.
- Maximum block length is 1,000 feet for collector streets.
- Streets with on-street parking bulbouts are encouraged at intersections to reduce the crossing distance for pedestrians and discourage speeding through intersections.
- Roundabouts should be considered where residential streets intersect and ultimate combined volume will exceed 1,000 vehicles daily or where the unimpeded distance on any of the approaches not subject to stop control exceeds 600 feet.
- Bicycle lanes should be provided on all collector streets.

### Arterial Streets
- Bulbouts would be encouraged at some intersections to reduce the crossing distance for pedestrians and discourage speeding through intersections.
- Maximum block length is 1,320 feet (four intersections per mile). This could be lengthened if bike/ped paths were provided that shortens the effective block length for non-auto users.
- Raised medians with turn pockets should be provided.
- Bicycle lanes should be provided on all arterial streets.
Pedestrian Facilities

Walking is the fundamental mode of human mobility. Everyone is a pedestrian at some point in every journey that they take, including walking to a bus or walking to a parking lot. It includes people of all ages, from children to older adults, as well as pedestrians with visual and mobility impairments. Unfortunately, many of our streets and highways were primarily built to facilitate the smooth flow of motor vehicles. People should be able to walk safely, whether for fun and recreation, errands, getting to work or schools, shopping or other reasons. The following provides recommended standards and guidelines for facilitating pedestrian access and increasing pedestrian safety on local roadways.

Sidewalks and Walkways

Sidewalks are integral to the transportation system. Safe, convenient, accessible pedestrian sidewalks and access should be provided on all new streets within an urban/suburban setting. At a minimum, sidewalks should be provided along all streets used for pedestrian access to schools, parks, shopping areas, and transit stops.

To the extent feasible, pedestrian traffic and those using wheelchairs should be separated from vehicle traffic. Where complete separation of pedestrians from vehicles and bicycles is not possible, potential hazards should be minimized by using techniques such as special paving, pavement marking, signs, striping, bollards, median refuge areas, traffic calming features, landscaping, lighting, or other means to clearly delineate pedestrian areas day and night.

Some effective pedestrian safety measures may increase motor vehicle travel time and have a slight negative impact on motor vehicle level of service (LOS). A rebalancing of the transportation system where pedestrian LOS and safety are included may sometimes mean a change in expectation about the priority that motor vehicle LOS is given in design and decision-making. If serious safety measures are to be achieved, the particular LOS may be lower for motor vehicles than if those measures were not taken.

Development plans should include site amenities that enhance safety and convenience, and promote walking or bicycling as alternative means of transportation. Site amenities may include bike racks, drinking fountains, canopies, and benches.
Techniques for Accommodating Pedestrians

The parking and circulation system within each development should accommodate the movement of vehicles, bicycles, and pedestrians throughout the proposed development and to/from surrounding areas, safely and conveniently. The system should provide adequate directness, continuity, and street crossing. Walls, fences, and barricades should not restrict access to adjacent uses, particularly for public uses such as schools, parks, and recreational areas.

To the maximum extent feasible, the following guidelines should be incorporated into the design of all new developments to ensure safe and convenient pedestrian access into and within the site, with minimum potential for conflict with motor vehicles. These design elements complement the five measures of pedestrian level of service: Directness, Continuity, Street Crossings, Visual Interest and Amenity, and Security.

DIRECTNESS

Sidewalks within the site should be located and aligned to directly and continuously connect areas or points of pedestrian origin and destination, and should not be located and aligned solely based on the outline of a parking lot configuration that does not provide such direct pedestrian access. To the maximum extent feasible, walkways and bicycle connections should provide the most direct access route between intended points of travel.

- **Visible Connections.** Provide visible connections to key pedestrian destinations. Align and locate buildings, roadways, and open space so that pedestrians can see their destinations before arriving there. Minimize and remove physical obstructions/barriers that impede direct pedestrian access.

- **Building Entries.** Provide clearly marked building entries that can be viewed from the street. Entries from parking lots should be subordinate to those related to the street. Buildings should be sited in ways to make their entries or intended uses clear to pedestrians. Provide clear and direct pedestrian entries from the street, not just from parking areas.

- **Development Patterns.** The location and pattern of streets, buildings, and open space must facilitate direct pedestrian access. Locate buildings near street corners to improve access to bus stops and provide pedestrian connections to neighboring activities. Establish appropriate lot patterns that provide direct and visible connections of sidewalks between blocks and between cul-de-sacs. Offer more route choices along quiet local streets. The following exhibits provide examples of typical developments as compared to developments with pedestrian compatible improvements. These examples illustrate the same development yield for the site, illustrating that good pedestrian connections and development opportunities are compatible and efficient.

- **Lighting.** Use light fixtures to provide direct indication for pedestrian traffic.

- **Accessory Uses.** Ensure that sidewalk uses such as outdoor cafes, in high-use retail pedestrian settings, are compatible with direct pedestrian access to buildings and other destinations.
Appendix B | Pedestrian and Bicycle Best Practices

City of Loveland Bicycle and Pedestrian Plan

Residential

Typical

Pedestrian Compatible

Residential Apartment

Typical

Pedestrian Compatible
Appendix B | Pedestrian and Bicycle Best Practices

Commercial Retail Shopping Center

Office Development

Typical

Pedestrian Compatible

Typical

Pedestrian Compatible
### Continuity

Sidewalks should provide a continuous and understandable pedestrian network that links schools, neighborhoods, parks, activity centers, and other destinations. In order to provide a continuous pedestrian network to destinations, the local jurisdiction may require additional sidewalks, walkways, or bike paths not associated with a street, or the extension of a sidewalk from the end of a cul-de-sac to another street or walkway and connections between developments. When necessary to assure the public’s safety in using on-site or connecting pedestrian sidewalks, the jurisdiction may require a developer to provide on-site or off-site pedestrian overpasses, underpasses, or traffic signalization.

- **Design Elements.** Consistent design can help to create a uniform, readily identifiable pedestrian network. Incorporating the following facilities, measures, and elements can provide a uniform, continuous pedestrian network:
  - Continuous sidewalks on both sides of the street;
  - A continuous alignment of building facades near the sidewalk;
  - A consistent park strip between the curb and the sidewalk; and
  - Consistent street trees.

- **Pedestrian-Scale.** Use pedestrian-scaled furnishings, signs, landscaping, and facilities that appears as unified and themed entities in pedestrian networks, areas, and corridors.

- **Accessory Uses.** Ensures that sidewalk cafes and other uses/features of the sidewalk area support rather than obstruct a continuous pedestrian network.

- **Bridges and Overcrossings.** Provide bridges and crossings over railroads, rivers, drainages, and other features that are major barriers to a continuous pedestrian network. Design these crossings to minimize out of direction travel.

### Street Crossings

Jurisdictions should develop safe, comfortable, and attractive street crossings. Intersections crossing multiple lanes require pedestrian enhancements. If it is determined that the traffic demand warrants additional through or turn lanes, then pedestrian mobility should be evaluated to determine whether or not additional pedestrian enhancements should be required to offset the traffic impacts on the pedestrian.
Appendix B | Pedestrian and Bicycle Best Practices

- **Roadway Design.**
  Design roadways to improve the safety and comfort of arterial street crossings. The greater the number of lanes that a pedestrian must cross, the greater is the pedestrian’s exposure to vehicles. In addition, wider streets tend to carry higher volumes of traffic and higher speeds. Consider the following roadway design elements:
  
  - **Number of Lanes.** The number of travel lanes to cross is a significant safety factor for a pedestrian crossing the street. When the number of travel lanes increase, it is generally in response to higher traffic volumes. In addition, the pedestrian is exposed for a longer period of time in crossing those additional lanes.
  
  - **Lane Widths.** Typically, a travel lane is 12 feet wide. If the lane width is reduced, the time it takes a pedestrian to cross is also reduced. In addition, the narrower travel lane tends to calm or slow traffic, which is a benefit to the pedestrian.
  
  - **Parking Lanes.** When parking lanes exist along the street, the pedestrian walk times to cross the street increase as the pedestrian must first cross the parking lane before beginning to cross the traffic lanes. At intersections, vehicles that make wider, higher speed turns often use these parking lanes.
  
  - **Travel Speed.** Speed is a significant safety factor for pedestrians trying to cross a street. Factors that might affect speed include minimum cross street traffic, low number of access points, and geometric design. As mentioned previously, lane widths also contribute to travel speeds.

- **Crosswalks.** Design crosswalks to create safe crossings for pedestrians. The location and frequency of crosswalks along primary arterials, secondary arterials, and collector streets need to be balanced between need, traffic flow, and cost. Whereas an optimum pedestrian environment would have crosswalks at all major activity areas and spaced at 400-foot increments, too great a frequency of crosswalks can create a situation where the typical driver becomes immune to the crosswalk, which might create a safety hazard. The following should be taken into account when considering locations for crosswalks:
  
  - All signalized intersections with ADA-accessible pedestrian activated push buttons;
  
  - Locations that will attract high volumes of pedestrian traffic;
  
  - Locations for safety, such as crosswalks to school sites, transit stops or activity areas; and
  
  - Mid-block crossings at a minimum of 350 feet from adjacent intersection crosswalks.

In areas that have high volumes of pedestrians crossing a street, pedestrian crosswalks should be installed. The need for these crosswalks is a function of roadway type and pedestrian volumes. Roadway types from collector to primary arterial result in more travel lanes to cross in which the pedestrian is exposed, higher traffic volumes, and often increased traffic speeds. The chart and table below is a guideline as to where unprotected intersection and mid-block crosswalks should be considered based on street width/type and pedestrian volumes.
### Guidelines for Installing Marked Crosswalks

<table>
<thead>
<tr>
<th>Roadway Type (Number of Travel Lanes and Median Type)</th>
<th>Vehicle ADT ≤ 9,000</th>
<th>Vehicle ADT &gt; 9,000 to 12,000</th>
<th>Vehicle ADT &gt; 12,000 to 15,000</th>
<th>Vehicle ADT &gt; 15,000</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Speed Limit</td>
<td>≤ 30 mph</td>
<td>35 mph</td>
<td>40 mph</td>
</tr>
<tr>
<td>2 Lanes</td>
<td>C</td>
<td>C</td>
<td>P</td>
<td>C</td>
</tr>
<tr>
<td>3 Lanes</td>
<td>C</td>
<td>C</td>
<td>P</td>
<td>C</td>
</tr>
<tr>
<td>Multi-Lane (4 or more lanes) with raised median</td>
<td>C</td>
<td>C</td>
<td>P</td>
<td>C</td>
</tr>
<tr>
<td>Multi-Lane (4 or more lanes) without raised median</td>
<td>C</td>
<td>P</td>
<td>N</td>
<td>P</td>
</tr>
</tbody>
</table>

C = Candidate for marked crosswalks.
P = Possible increase in pedestrian crash risk may occur if crosswalk markings are added without other pedestrian facility enhancements.
N = Marked crosswalks alone are insufficient and pedestrian crash risk may increase when providing marked crosswalks alone. Consider using other treatments, such as traffic signals with pedestrian signals where warranted or other substantial crossing improvements to increase crossing safety.

Source: FHWA 2006
Appendix B | Pedestrian and Bicycle Best Practices

- **Mid-Block Crossings.** Mid-block crossings should be provided where there is an existing or potential pedestrian demand to cross at higher volume roadways or streets where crossings are greater than 800 feet. Ideally, these crossings should be accommodated with a refuge island. Where mid-block crosswalks are installed at uncontrolled locations (i.e., where no traffic signals or stop signs exist), crossing islands should be considered as a supplement to the crosswalk in order that the pedestrian will only cross one lane at a time. Providing an angled pedestrian travel way across the median allows oncoming traffic to be better viewed before crossing, further improving safety.

- **Median Refuge Areas.** Painted medians offer little refuge other than getting the pedestrian out of a lane of traffic. Substantive raised medians of significant width with a cut through provide some increase in security for the crossing pedestrian. For arterials with four or greater lanes, a raised median refuge island should be designed for all intersections and mid-block crossings. Center crossing islands allows the pedestrian to deal with only one direction of traffic at a time, and they enable them to stop partway across the street and wait for an adequate gap in traffic before crossing the second half of the street.

- **Signs and Signals.** Pedestrian signal heads should be included for all signalized intersections with crosswalks and the heads should be easily visible to the pedestrian. It would be desirable for all activity areas to have designated pedestrian walk phases. Pedestrian push buttons should be required for all other intersections. The location of the push button should be easily accessible and not require pedestrians to divert from their travel route. Signals without dedicated walk phases or push buttons are not acceptable since the only way a pedestrian may ever get a green light is when an automobile on the side street activates the cycle.

  At signal locations that experience a high number of pedestrians, such as at transit stops or universities, have experienced a large number of pedestrian accidents, or any other area where pedestrians often cross during the “Do Not Walk” phase, countdown signal heads should be considered to provide additional information about how much time is remaining for being able to cross the street.

- **Lighting Levels.** The intersection should be well lit so that the pedestrian is visible at night. Ensure that street crossings are lit to reflect the patterns of use.

- **Amenities.** In pedestrian districts, amenities should include such elements as signage and design features that strongly suggest the presence of a pedestrian crossing. Enhancements to crosswalks including color, stenciling, and pavement treatments should be considered for all major intersection entryways to mixed-use centers. Develop civic improvements including pedestrian scale elements, landscaping, and sidewalk.
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Widenings which improve the visibility and suggestion of pedestrians at street crossings.

- **Line-of-Sight Distance.** Sight distance measures the unobstructed view between the motorist and the pedestrian. This can be a problem, particularly when a motorist intends to make a left-turn under the permissive left-turn phase, and it is difficult to see pedestrians around the opposing left-turn vehicle. Sight distance should be analyzed as a part of all intersection designs.

- **Right-Turn on Red (Left-Turn on Red on One-Way Streets).** One of the greatest increases in pedestrian accidents has been associated with right-turns on red lights. Research has determined that an extremely high number of drivers do not stop at the crosswalk before making their turn and instead, continue on while looking to the left for approaching conflicting vehicles, not pedestrians in the crosswalk. Some jurisdictions have installed signs that do not permit right-turns on red in specific places and circumstances in order to improve safety for crossing pedestrians.

- **Bulbouts/Curb Extensions.** In special applications, the City or developer may consider bulbouts to reduce traffic speed and to improve pedestrian safety. Bulbouts are simply intersection curb extensions, which extend past the parking lanes, but not into the bicycle or through lanes. The advantages of bulbouts are as follows:
  - Bulbouts provide an entry or gateway statement into activity areas or where high volumes of pedestrians are present. Entering an area where a bulbout is present provides a clear difference between the arterial function and a local pedestrian activity area.
  - Bulbouts enhance the visibility of the pedestrian because they physically permit the pedestrian to be located closer to the travel lanes, especially where parking is permitted, and allow the pedestrian to be seen more easily by the driver.
  - Bulbouts constrict traffic flow through reduced lateral clearance. This reduction effects a reduction in travel speed along the corridors and improves safety for both pedestrians and vehicles.
  - The bulbout changes the turning radius at the intersection, which reduces turning speed and vehicle and pedestrian conflicts.
  - The extension of the bulbout reduces the time it takes pedestrians to cross from curb to curb. This reduction in pedestrian crossing time consequently reduces the time the pedestrian is exposed to moving vehicles.
  - Bulbouts change the character of the intersection from automobile-dominant to pedestrian-friendly and multimodal-shared.
  - Bulbouts can be an extremely positive visual and aesthetic enhancement. Features such as pedestrian lighting, planters, and benches create a focal point for pedestrian activity and change the character of the intersection from automobile to pedestrian. It should be noted that care must be taken when aesthetically enhancing bulbouts as such enhancements can block sight distances and create accident problems.

- **Modern Roundabouts.** The use of modern roundabouts as an alternative to conventional stop and signal control intersections is becoming increasingly popular in the United States. Studies conducted by the insurance industry have determined that these types of intersections result not only in a significant decrease in automobile traffic at an intersection, but also a reduction in pedestrian accidents as well.
At a conventional intersection, the pedestrian faces four (4) potential vehicle conflicts:

1. Crossing movements on red (typically high-speed, illegal);
2. Right-turns on green (legal);
3. Left-turns on green (legal for protected-permitted or permitted left-turn phasing); and
4. Right-turns on red (typically legal).

Pedestrians at roundabouts, on the other hand, face two (2) conflicting movements on each approach:

1. Conflict with entering vehicle; and
2. Conflict with exiting vehicle.

The crossing of the roundabout is relatively simple. The pedestrian waits for a gap in traffic and crosses from the curb to the splitter island that provides protection, and then crosses from the splitter island to the far curb when a gap in traffic occurs. Crossing in two steps reduces the vehicle exposure in half for each segment. In addition, safety is improved because the vehicles are forced to go slower through the roundabout than at a conventional intersection. The modern roundabout pedestrian crosswalk treatment consists of:

- ADA Compliant Ramps;
- Conventional Crosswalk Striping;
- Raised Splitter Island Pedestrian Pass Through and Refuge;
- Pedestrian Crossing Sign;
- Yield Street Markings; and
- Yield Signs.

Typically, the crosswalk is placed approximately one car length from the yield bar to permit the pedestrian to safety walk behind a vehicle that is awaiting a merge into the roundabout when traffic permits.

- **Zig-Zag Pavement Markings.** A technique to increase driver awareness as they approach a pedestrian or bicycle crossing is the use of Zig-Zag pavement markings in advance of pedestrian or trails crossing. They have been found to:
  - Heightened the awareness of approaching motorists,
  - Reduced mean vehicle speeds within the marking zones,
  - Changed driving behavior, and
  - Increased the tendency to yield.
The uniqueness of the Zig-Zag pavement markings is likely why they are effective. Therefore the use of these markings should be used sparingly at strategic locations.

**Visual Interest and Amenity**

Development plans should include site amenities that enhance safety and convenience and promote walking or bicycling as an alternative means of transportation. Well-designed walking environments are enhanced by urban design elements, street furniture, and landscaping.

- **Pedestrian Facilities and Elements.**
  Pedestrian scale improvements should fit the urban context of the area. The color, materials, and form of pedestrian facilities and features should be appropriate to the area where it is located, as well as to the functional unity of the pedestrian network. Develop attractive improvements including landscaping, vertical treatments, sidewalk widenings, and furnishing which improve the character and pedestrian scale of the urban environment. Special design features, public art and site details enhance the pedestrian scale of streets and become an urban amenity.

- **Lighting.** Standardized lighting improvements can enhance the character of the pedestrian environment. Consider the following criteria:
  - Varied light spacing and heights to be compatible with site specific issues;
  - Poles to incorporate pedestrian scale features such as banners, potted plants, etc.; and
  - Attractive luminaries to provide an organized and unified appearance throughout the pedestrian network.

- **Landscaping.** The careful use of landscaping along a street can provide separation between motorists and pedestrians, reduce the visual width of the roadway (which can help to reduce vehicle speeds), and provide a more pleasant street environment for pedestrians and bicyclists. Consider the following criteria in order to provide attractive landscaping:
  - Develop a continuous edge of deciduous canopy street trees on both sides of the street. Select species that provide shade, shelter, and scale for the sidewalk/pedestrian environment, and continuity for the pedestrian/ sidewalk environment.
  - Develop attractive landscaping by considering the following criteria:
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- **Buildings.** Outdoor cafes and activity areas that provide pedestrian character and human scale to the sidewalk environment should be encouraged. Windows and other openings should relieve blank walls, adding visual interest, improving pedestrians’ sense of security, and introducing a human scale to building frontages. Appropriate building design and details should be used to provide human scale character to the street. Incorporate building entry details like porches and recesses, occupied spaces like bay windows and balconies.

**Urban Open Spaces.** Attractive urban open spaces with a distinctive and definite shape, enclosed by buildings on 2-3 sides so it feels like an “outdoor room,” are favored by pedestrians. To be useful, these urban open spaces should be located at intersections of two or more pedestrian routes.

**Retaining/Building Walls.** Retaining walls should be of materials, which reduce their apparent scale, like brick or stone, or treated architecturally to create an appropriate scale and rhythm. Hanging or climbing vegetation can soften the appearance of retaining walls. High retaining walls should be terraced down and include landscaped setbacks. Blank building walls and retaining walls should be screened with landscaping, architectural features, or art to enrich the pedestrian environment.

**Security**

Development plans should include site amenities that enhance safety and convenience and promote walking or bicycling as alternative means of transportation. Secure pedestrian settings should be provided by developing a well-lit, inhabited pedestrian network and by mitigating the impacts of vehicles.

- **Human Activity.** Streets should appear inhabited to the greatest extent possible. New development should accommodate human activity by providing balconies, terraces, and yards for residents’ use and interaction. In mixed-use buildings, retail elements like large windows, canopies, and integrated signage add activity by enhancing the shopping experience. Entrances, porches, balconies, decks, and seating should be located to promote pedestrian use of the street edge by providing weather protection, security, and safety.

- **Sight Lines.** Clear and direct lines of sight in pedestrian settings should be provided to increase feelings of security. Minimize the use of shrubs, walls, berms, and other vertical features, which screen lines of sight to pedestrian facilities to achieve clear and direct lines of sight.
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- **Lighting.** General illumination should be provided for security and visual safety of pedestrian areas and corridors. Use lighting fixtures to identify and highlight key pedestrian facilities and elements such as pedestrian intersections, paths, sidewalks, and entrances, while enhancing safety, and security. Provide a desirable and safe pedestrian environment by decreasing glare associated with tall, high intensity street fixtures. Provide indirect light to the sidewalk by lighting elements in the street environment such as trees, walkways, canopies, and entryways. Avoid over-illumination of pedestrian areas, since these create, by contrast, shadowy areas nearby which may be threatening to pedestrians.

- **Buffers.** Develop physical buffers/edges between sidewalks and streets/parking lots.

### Bicycle Facilities

Bicycles are a viable and popular form of transportation. Some bike routes have been signed and shared use paths are established in some parks, in an extensive greenway system, and in some private developments. The safety of bicycle travel is enhanced by the proper design and location of bicycle facilities. Well-developed shared use facilities are an increasingly important part of the transportation and recreation system.


### Bikeways

Developers are encouraged to include bikeways in developments. Bikeways should be indicated on site plans and preliminary plats. Existing and future bike lanes and paths within proximity of the development should be identified, along with a description of how the resident or business would safely access these facilities. It is the responsibility of the developer to conform to the standards in this chapter and the requirements for traffic control devices in the Manual for Uniform Traffic Control Devices.

While bicyclists can ride on any City street, a system of designated bicycle paths, routes, and lanes exists to identify those roads that are best suited for bicycles. The American Association of State Highway Officials (AASHTO) guidelines for bikeway design delineate three different types of bikeway facilities.

- **Bicycle Paths** include separated pathways along major arterials and portions of the multi-use trail system. While these facilities provide the safety of a separated facility, intersections with roadways and the multiple crossing of driveways and entrances provides the potential for conflict with motor vehicles, and increases the likelihood of accidents. Also, the presence of pedestrians and equestrians on trails increases the likelihood of conflicts with bicyclists. Bicycle paths require a minimum 10-foot width with two feet clear on either side of the trail.

- **Bicycle Lanes** are portions of streets that are dedicated to the exclusive use of bicycles and are usually marked with white lanes on the pavement. Bicycle lanes are located on streets that have sufficient width and high bicycle traffic. The dedicated lane decreases the chance of one mode being slowed by the other and provides a clear lane for the bicyclist. Bike lanes do, however, restrict the cyclist to a relatively narrow section of the roadway and channels them to the far right of through traffic, posing a potential hazard for turning movements of both bicyclists and motor vehicles. Standard bicycle lane widths should be six feet;
five feet is the minimum width adjacent to curbs and four feet is the minimum width when no curb exists.

- **On-Street Bicycle Routes/Wide Shoulders** are streets or segments of streets that bicyclists share with motor vehicles. In general, designated routes have lower traffic volumes and are sufficiently wide for drivers and bicyclists to share. Most routes are located on secondary or minor streets that parallel busier, major routes. Many of the routes are marked with special signs. Numerous commuting bicyclists prefer on-street, non-striped routes where room is provided on the outside travel lane for both cyclist and motor vehicles, but the cyclist is not restricted to one part of the roadway or another. Bicycle routes require a 14-foot outside travel lane, wide shoulder, or the ability to share the lane (local residential streets).

**Shared Lane Use Designation “Sharrow”**

Sharrows are becoming a popular form of striping bike routes on lower volume roadways that are to be shared by automobile and bicyclist and are proposed on bike routes in Champaign. Benefits of Sharrows include:

- Encouraged motorists to be more aware of bicycles.
- Increased the distance between bicyclists and parked cars.
- Increased the distance between bicyclists and passing vehicles.
- Reduced the number of sidewalk riders.
- Significantly reduced the number of wrong-way riders.
Off-Street Bikeways

Off-street bikeways consist mostly of multi-use trails that are shared with pedestrians, horses, in-line skaters, and others. Urban trails are used primarily for recreation, but also provide an off-street transportation system for non-motorized uses. An urban trail corridor can vary from 25 to 50 feet in width. However, where feasible, a 50-foot wide corridor is found to provide adequate buffer room from other uses and a safer and more pleasant trail experience. A variety of trail designations are used throughout the area. For the purposes of the Non-Motorized Transportation System Plan, two types have been designated based on the trail tread: paved trails and unpaved trails.

- **Paved Trails** often accommodate a variety of users, depending on trail width and intensity of use, as shown in the two examples below. Paved trails in high use areas accommodate a variety of trail users, including walkers, joggers, recreational bikers, commute bikers, roller bladders, and horseback riders within the same corridor. A soft shoulder on each side of the trail can be provided to separate the “wheels” from the “heels” to reduce user conflicts. The main trail tread is a single, paved trail (approximately 12'-wide). The soft shoulder consists of crushed gravel and provides a four-foot surface adjacent to or separated from the main trail head.

- **Unpaved Trails** are also multi-purpose but do not accommodate the variety of users that paved trails can accommodate. Unpaved trails are often located in the mountains or foothills and are less improved than paved trails. Unpaved trails can vary in width from four to eight feet and are constructed with a soft surface tread (i.e., native soil, crushed limestone or crushed gravel). Most users are hikers, mountain bikers, and equestrians.

Where insufficient right-of-way is available to accommodate such a trail or where the intensity of use is not as high, a paved trail may consist of a single, 12-foot trail paved with concrete or asphalt. A four-foot soft shoulder on either side of the trail consists of crushed gravel or mowed grass.
INNOVATIVE BICYCLE LANE AND PATH TREATMENTS

Evidence is increasing that bicyclist safety improves as more bicyclists are part of the traffic stream. Some innovative techniques for accommodating bicyclists on area roadways are described below.

- **Wide Curb Lane/Wide Outside Lanes.** A wide curb lane is the lane nearest the curb that is wider than a standard lane and provides extra space so that the lane may be shared by motor vehicles and bicyclists. A desirable width is 14 feet, not including the gutter pan area. Wide curb lanes are sometimes designed when right-of-way constraints preclude the installation of “full width” bike lanes.

- **Contra Flow Bike Lanes.** Bicyclists are expected to follow established rules-of-the-road like riding in the same direction as motor vehicle traffic. However, in certain situations placement of a bicycle lane counter to the normal flow of traffic may increase safety or improve access for bicyclists. For example, a contra flow bike lane designated on some one-way streets may enhance connectivity and eliminate out-of-the-way detours and wrong-way riding.

- **Combination Lanes.** A combination lane usually refers to a lane nearest the curb, which serves various modes of traffic or movements. Combination lanes are generally designated for the exclusive use of buses, bicycles, and right-turning vehicles. Because bicycles generally travel at slower speeds and buses make frequent stops, these lanes can often function without impeding traffic flow. Generally, multiple uses are operationally acceptable unless there is considerable bus and bike traffic. These combination lanes are not without problems. If there is a shortage of bus and bike traffic, the lane can become another peak hour traffic lane.

  If bus and bike traffic need to be separated, the bus lane is usually nearest the curb, which reduces conflicts between buses accessing stops and bicycles traveling through, and between bus passengers and bicyclists. Separated lanes should reduce conflicts associated with buses moving into and out of a single bus and bike lane.

- **Raised Bike Lane.** Raised bike lanes have a slightly raised edge to prevent motorists from driving in the lane, protecting bicyclists from fast-moving traffic.

- **Median Bike Paths.** Median bike paths are separated bikeways constructed within the medians of major arterial roads.

- **Bicycle Boulevard.** Bicycle boulevards are generally a single street or series of local streets that are connected to form a thoroughway for bicycling and walking. These boulevards often include tree canopies, occasional diverters to keep motorists from using them for direct travel, and some connectors, bridges, and other methods to provide trip continuity.
Bicycle Networks

Establishing a vision of how bicycling fits into the overall transportation system of a community or region is important in developing a safe and enjoyable bicycle network. Identifying appropriate bicycle routes requires recognition of various user needs and abilities, and analysis of traffic operations and design factors of individual roadways.

Average bicyclists prefer to ride on neighborhood streets or designated bicycle facilities. Experienced bicyclists should be anticipated on roadways where bicycles are not excluded by statute or regulation, regardless of functional classification. Safe accommodation of all bicyclists is best accomplished by creating a comprehensive and continuous bicycle and pedestrian network in built-up areas in order to enhance the safety and travel comfort of users. General guidelines for determining the type of bikeway facility best suited to various roadway types are provided in the tables below.

A study conducted by the Federal Highway Administration (FHWA Bicycle Compatibility Index) identified several other factors that should be considered when evaluating the capability of urban and suburban roadways to accommodate both motorists and bicyclists. These factors included:

- Presence and density of on-street parking;
- Type of development or land use adjacent to the roadway;
- Large truck volume in the curb lane;
- Right-turn volumes; and
- Parking time limits.

Techniques for Facilitating Bicycle Use

Bicycles are vehicles and need to be safely accommodated on our streets and roadways. Over half of all bicycle-motor vehicle crashes occur at or near intersections or other jurisdictions. Improvements at these locations have the potential to significantly increase safety. Specialized intersection markings that may help bicyclists and motorists safely navigate through intersections and use of innovative techniques are gaining more prominence in some communities.

ROADWAY NARROWING

"Road diet" is a term used to describe the process of reducing the number of travel lanes on a given roadway. Road diets are often conversions of four-lane undivided roads into three lanes (two through lanes and a center turn lane). The fourth lane may be converted to bicycle lanes, sidewalks, and/or on-street parking. Road diets have been shown to improve mobility and access for all travel modes, enhance safety by reducing vehicle speeds, and to promote economic vitality for the community. A variety of reconfigurations are possible for lane number reductions depending on the current configuration, user needs, and potential operational and safety outcomes.
### Roadway Design Options for Urban Roadways

<table>
<thead>
<tr>
<th>Motor Vehicle AADT/Lane</th>
<th>&lt; 250 cars</th>
<th>250-500 cars</th>
<th>500-1,000 cars</th>
<th>1,000-2,500 cars</th>
<th>2,500-5,000 cars</th>
<th>&gt; 5,000 cars</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak Hour Volume/Lane</td>
<td>&lt; 22 cars</td>
<td>22-44 cars</td>
<td>44-88 cars</td>
<td>88-220 cars</td>
<td>220-440 cars</td>
<td>&gt; 440 cars</td>
</tr>
<tr>
<td>Avg. Peak Hour Headway/Lane</td>
<td>&gt; 164 sec</td>
<td>164-182 sec</td>
<td>82-44 sec</td>
<td>44-16 sec</td>
<td>16-8 sec</td>
<td>&lt; 8 sec</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Average Motor Vehicle Operating Speed</th>
<th>0-19 mph</th>
<th>20-31 mph</th>
<th>32-43 mph</th>
<th>&gt; 43 mph</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shared Lane</td>
<td>Shared Lane</td>
<td>Wide Curb Lane</td>
<td>Bike Lane</td>
<td>Bike Lane</td>
</tr>
<tr>
<td>Shared Lane</td>
<td>Wide Curb Lane</td>
<td>Wide Curb Lane</td>
<td>Bike Lane</td>
<td>Bike Lane</td>
</tr>
<tr>
<td>Shared Lane</td>
<td>Wide Curb Lane</td>
<td>Bike Lane</td>
<td>Bike Lane</td>
<td>Bike Lane</td>
</tr>
<tr>
<td>N/A</td>
<td>Bike Lane</td>
<td>Bike Lane</td>
<td>Bike Lane</td>
<td>Bike Lane</td>
</tr>
</tbody>
</table>

### Shoulder Widths for Rural Roadways

<table>
<thead>
<tr>
<th>Motor Vehicle AADT/Lane</th>
<th>&lt; 1,000 cars</th>
<th>1,000-2,500 cars</th>
<th>2,500-5,000 cars</th>
<th>&gt; 5,000 cars</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Motor Vehicle Operating Speed</td>
<td>0-30 mph</td>
<td>30-36 mph</td>
<td>36-43 mph</td>
<td>&gt; 43 mph</td>
</tr>
<tr>
<td>4 ft.</td>
<td>4 ft.</td>
<td>6 ft.</td>
<td>6 ft.</td>
<td>8 ft.</td>
</tr>
<tr>
<td>4 ft.</td>
<td>6 ft.</td>
<td>6 ft.</td>
<td>6 ft.</td>
<td>8 ft.</td>
</tr>
<tr>
<td>4 ft.</td>
<td>6 ft.</td>
<td>6 ft.</td>
<td>8 ft.</td>
<td>8 ft.</td>
</tr>
</tbody>
</table>
Along with lane elimination, roadway lane narrowing may also help to reduce vehicle speeds and enhance movement and safety for pedestrians and bicyclists. Lane narrowing is best used where motor vehicle speeds are low. Lane width reduction can be achieved in several different ways:

- Lane widths can be reduced to 10 or 10.5 feet and excess pavement striped with a bicycle lane or shoulder.
- Excess land width can be reallocated to parking.
- The street and lanes can be physically narrowed by extending the curb for wider sidewalks and landscaped buffers or by adding a raised median.

**Median Crossing Islands/Mid-Block Crossings**

Median crossing islands help manage traffic, particularly left-turn movements, and reduce the number of potential conflict areas between bicyclists and motorists. Restricted access to side streets may also help to reduce cut-through traffic and calm local streets. Median crossing islands provide a refuge for bicyclists crossing a busy street at unsignalized locations where gaps in traffic are rare. The medians must be at least six feet wide to provide sufficient waiting space for bicyclists.

The objective of a mid-block crossing is to make an off-street bike path crossing safer and more visible. Various traffic calming devices exist, such as refuge islands and speed tables, which may be appropriately used at mid-block bicycle crossings. This application is appropriate at the mid-block intersection of an off-street bikeway and a street, and is suitable for streets with faster moving traffic. A bicycle logo and “XING” pavement legend are installed prior to the crossing, at a distance dependent on the roadway design speed.

**Pedestrian Actuated Rectangular Rapid Flashing Beacon (RRFB)**

One alternative to a traffic signal is the Pedestrian Actuated Rectangular Rapid Flashing Beacon (RRFB). The RRFB is a special LED flashing device installed below a crosswalk sign and placed at marked, unsignalized crosswalk locations. The RRFB increases pedestrian visibility by attracting driver attention.
with the flashing beacons and making them aware of the pedestrian’s presence.

**Pedestrian Hybrid Beacon - High Intensity Activated Crosswalk (HAWK)**

A pedestrian hybrid beacon (commonly referred to as a HAWK) uses a Yellow-Red lens configuration (two red lenses on top and yellow lens on bottom) to provide a signalized, mid-block pedestrian crossing. The pedestrian hybrid beacon is used to warn and control traffic to assist pedestrians in crossing a street at a marked crosswalk. The pedestrian hybrid beacon is designed to require traffic to stop for the pedestrian walk interval (steady red) and to allow traffic movement during the flashing ‘don’t walk’ stage of the pedestrian crossing (flashing red). The pedestrian hybrid beacon also provides flashing yellow and solid yellow warning indication to traffic that indicates the upcoming ‘walk’ stage/steady red.

**Access Management/Driveway Improvements**

Managing the number, spacing, access, directional flow, and other aspects of driveway and side street connections protects those traveling along the roadway from conflicts with those entering/leaving the roadway.

Access management includes such measures as limiting the number or establishing minimum spacing between driveways; providing for right-in, right-out only movements; restricting turns to certain intersections; and using non-traversable medians to manage left- and U-turn movements.

Driveway design affects sight distance for both motorists and bicyclists accessing roadways, as well as the speed and care with which drivers enter or leave the roadway. Right-angle connections are best for visibility of approaching traffic, as well as slowing the turning speed for vehicles exiting or entering the roadway. Tighter turn radii at driveways, as well as ramps to sidewalk level, also slow vehicles speeds.

**Paved Shoulders**

The pavement edge line for the paved shoulder provides a separated space for the bicyclist much like a bike lane. Shoulders four feet wide are considered the minimum width to accommodate bicycle traffic. Experienced riders will benefit from shoulder widths as narrow as one to two feet, but these facilities should not be signed for bicyclists. Surface irregularities such as rumble strips, textured paving, and raised lane markers should be avoided on routes intended for bicyclists. Shoulder rumble strips are typically located from 0.5 to one-foot from the road edge and are typically two feet wide. AASHTO recommends that four feet of ride-able surface be present for bicyclists if rumble strips are used on a shoulder.
TRAFFIC CALMING
Traffic calming is a way to lower traffic speeds or volume by using physical and visual cues that induce drivers to travel at lower speeds. The design of the roadway results in the desired effect, without relying on compliance with traffic control devices such as signals and signs, and without enforcement. Traffic calming measures include the following.

- **Mini Traffic Circles.** Mini traffic circles are raised circular islands constructed in the center of residential or local street intersections. The primary benefit to bicyclists is that, like roundabouts, mini circles slow traffic approaching the intersection by forcing motorists to maneuver around them. Most impact studies suggest that mini circles have nominal impact on traffic volumes.

- **Chicanes.** Chicanes create a serpentine, horizontal shifting of the travel lanes, without reducing the number of lanes or lane width, by alternating curb extensions from one side of the roadway to the other. Shifting a travel lane has an effect on travel speeds by interrupting straight stretches of roadway and forcing vehicles to shift laterally.

- **Speed Tables.** Raised devices may provide the greatest impact of traffic calming devices on lowering speeds and may also serve to divert traffic. More gradual and/or longer humps (i.e., speed tables) are less uncomfortable for bicyclists.

- **Visual Narrowing.** Some communities have begun combining traffic calming and other techniques with treatments designed to create a visual perception of a narrow, multi-use roadway in an effort to slow speeds and increase motorist attentiveness.

- **Traffic Diversion.** Traffic diversion techniques are remedies intended primarily to reduce traffic volumes on residential neighborhood streets when traffic calming or other measures have not sufficiently reduced cut-through traffic. The prime beneficiaries of traffic diversion are bicyclists, pedestrians, and those who live on treated streets.

- **Raised Intersections.** A raised intersection is essentially a speed table for the entire intersection. This treatment may improve intersection safety by forcing vehicles approaching the intersection to slow down and could be part of a street-wide traffic calming effort.

ADVANCE STOP LINE/BIKE BOX
The objectives of the advance bike box are to improve the visibility of bicyclists at intersections and to enable them to correctly position themselves for turning movements during the red signal phase by allowing them to proceed to the front of the queue. A bicycle lane leading up to a bike box is located between the motor vehicle stop line and the crosswalk. The bike box should be 12 to 14 feet deep. To increase its effectiveness, a bicycle stencil should be placed in the bicycle box and a contrasting surface color is strongly recommended for the box and the approaching bicycle lane. Instructional signs and separate bicyclists signal heads can be installed in conjunction with the bicycle box.

PAVEMENT MARKING
A variety of pavement markings are available to make bicycling safer. Generally, the markings are for lane separation, indicating an assigned path or correct position for the bicyclist, and for information about upcoming turning and crossing maneuvers. Examples of pavement marking include the striping and identification associated with bike lanes, striping for paved shoulders, turning lanes at intersections, railroad crossings, and drainage grates or other pavement hazards or irregularities. A general guideline for improved bicycle safety is to make sure the markings are durable, visible, and non-skid. Markings are usually done with paint or thermoplastic.
Different symbols are used to indicate the presence of bicycles in the traffic stream. Some techniques to identify bicycle facilities include the following.

- **Colored Bike Lanes/Colored Shoulders.** Colored bike lanes have been a feature of bicycle infrastructure in the Netherlands, Denmark, France, and many other countries for many years. However, in the United States their use has been limited to just a handful or locations. Colored bike lanes/colored shoulders have the added effect of visually narrowing the roadway, which is shown to reduce vehicle speeds and, therefore, enhance safety for bicyclists and pedestrians.

- **Diagonally Striped Bike Lane.** A diagonally striped bike lane could be used to indicate an area of concern for bicyclists due to the opening of car doors. Diagonal arcs placed at regular intervals discourage bicyclists from riding in the “door zone.”

- **Bike Route/Shared Lane Pavement Marking.** The primary purpose of this measure is to provide positional guidance to bicyclists on roadways that are too narrow to be striped with bike lanes. Marking may be placed on the street to inform motorists about the presence of bicyclists and also to inform bicyclists how to position themselves with respect to parked cars and the travel lane.

**Signs**

A consistent system of bicycle wayfinding signs that identify clear routes from origin to destination should be developed and implemented for use in well-defined travel ways. In addition, a sign system for off-street paths that integrates a variety of information such as maps, distances, etiquette, and regulations should be developed and implemented. A variety of signs are available to alert motorists to the presence of bicycles in the traffic stream and to inform bicyclists.

**Signals**

Traffic signals create gaps in traffic flow allowing bicyclists, pedestrians, and motorists to access or cross the street. Signals are particularly important for crossing higher speed roads or highly congested intersections. Besides traditional treatments such as installation of a traffic signal, innovative treatments are also being installed and evaluated throughout the country. These treatments include: separate bicycle signal heads and bicycle and pedestrian crosswalk signals, known as toucan signals.

- **Signal Timing.** Fine-tuning existing traffic detection systems may also improve bicycling conditions. Signal timing should include a minimum green time that allows bicyclists to remount their bikes and travel across the intersection, and yellow/red time that provides a safe bicycle clearance interval. Generally, two to three seconds added to the minimum automobile green time is appropriate; a yellow interval of 3.0 to 6.0 second offers sufficient time for a bicyclist to come to a complete stop or enter an intersection legally; and all red-clearance intervals greater than 2.0 seconds are needed to clear bicycles from most intersections.

- **Bicycle Signals.** A bicycle signal provides a separate signal to direct bicycle traffic through an intersection. Red, amber, and green bicycle indications are installed in addition to the standard red, amber, and green ball and arrow indications.

- **Loop Detector Stencil.** When a bicycle approaches an intersection, there are several means of detecting and facilitating its movements. Most of these innovations are passive detection devices such as loop detectors. The installation of bicycle loop detector stencils would assist bicyclists in placing their bikes appropriately on top of a loop detector so that they will be detected.
Appendix B | Pedestrian and Bicycle Best Practices

- **Bicycle Detection Using Video Cameras.** Video systems are used to activate treatments such as signal timing specifically needed to assist bicyclists in crossing at signalized intersections. This system is useful at signalized intersections where there are dedicated bicycle lanes. The video system uses detectors drawn in video images to sense the presence of bicycles in bicycle lanes at signalized intersections.

- **Bicycle Push Button/Pad/Bar.** The bicyclist activates the signal by pushing a bar or button similar to those used for pedestrians, but the button is installed in a location convenient for bicyclists and the signal timing is set appropriately for bicyclists. The sign plate located above the push button/pad/bar indicates that it is not for the use of pedestrians. The larger the surface of the button, the easier it is for bicyclists to use.

**Support Facilities and Programs**

**Parking and Storage**

Convenient and secure bicycle parking should be provided at the destination end of a trip. Inadequate bicycle parking facilities and fear of theft are major deterrents to bicycle transportation. A sufficient supply of effective bicycle parking requires a properly designed rack in an appropriate location for the type of use.

Racks should be highly visible so bicyclists can spot them immediately when they arrive from the street. A visible location also discourages theft and vandalism. Adequate lighting and surveillance is essential for the security of the bicycles and the users. Bicycle racks and lockers must be well anchored to the ground to avoid vandalism and theft.

Bicycle lockers should be provided at locations such as park and ride lots, parking garages, and employment centers.

Adequate clearance is required around racks to give bicyclists room to maneuver, and to prevent conflicts with pedestrians or parked cars. Racks should not block access to building entrances or fire hydrants.

Bicycle facilities should be designed in accordance with Chapter 2 of the AASHTO Guide. Bicycle parking may be provided in floor, wall, or ceiling mounted racks. Bicycle parking facilities should meet these requirements:

- Holds the bicycle frame, not just a wheel;
- Can be used with a U-shaped shackle lock;
- Accommodates a wide range of bicycle sizes, wheel sizes and types;
- Is covered with material that will not chip the paint of a bicycle that leans against it; and
- Does not have hazards, such as sharp edges.

There are many types of bicycle racks and lockers available. Some are suitable for certain situations but not others, and some designs are unsuitable anywhere. There are two general categories of bicycle parking requirements:
Long-Term (Class I) parking is needed where bicycles will be left for hours at a time. It requires a high degree of security and weather protection, with well-designed racks in covered areas, lockers, storage rooms, or fenced areas with restricted access.

Short-Term (Class II) parking is needed where bicycles will be left for short stops. It requires a high degree of convenience (as close to destinations as possible). At least some short-term bicycle parking should be protected from the weather (a portion can be unprotected, since demand tends to increase during dry weather). This can use an existing overhang or covered walkway, a special covering, weatherproof outdoor bicycle lockers, or an indoor storage area.

The following table provides a guideline for providing parking spaces per land use category for new development or property which requires a change of use permit.

<table>
<thead>
<tr>
<th>Recommended Minimum Bicycle Parking Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of Establishment</strong></td>
</tr>
<tr>
<td>Primary or Secondary School</td>
</tr>
<tr>
<td>College or University Classrooms</td>
</tr>
<tr>
<td>Commercial – Retail or Office</td>
</tr>
<tr>
<td>Sport and Recreation Center</td>
</tr>
<tr>
<td>Movie Theater or Restaurant</td>
</tr>
<tr>
<td>Industrial</td>
</tr>
<tr>
<td>Multi-Unit Housing</td>
</tr>
<tr>
<td>Public Transit Stations</td>
</tr>
</tbody>
</table>
TRANSIT ACCESS
Making transit services more bicycle-friendly can greatly expand opportunities for bicyclists. The most frequent option is an exterior rack mounted on the front of the bus that can accommodate two bicycles; however, other options exist, including interior bike racks or simply allowing bikes onboard when conditions are not crowded.

BICYCLE PERSONAL FACILITIES
Along with secure and convenient bike parking and transit access, another prerequisite for encouraging bicycle commuting is facilities for bicyclists to shower, change clothes, or otherwise “freshen up” once they arrive at the workplace. Ideally, such facilities will be located on or very near the worksite premises and will also include lockers for storing clothing and personal items. Some creative options might be to partner with other nearby businesses to provide facilities or make arrangements with a nearby health club to allow bicyclists to use its facilities for a nominal fee.

MAPS AND WAYFINDING
Even great bikeways can be well-kept secrets if the average rider can’t find them. Although there are several bikeway maps published at a regular basis, there is a need for more comprehensive, widely available maps, especially for visitors. Some bicyclists would like to see maps that more accurately depict terrain and difficulty.

Once on a bikeway, proper signs are needed to direct bicyclists. Particularly in the case of on-street routes, bicyclists may follow Bike Route signs for a while only to find they end abruptly or don’t indicate which way to go at an intersection.

On-street route signs are not just for bicyclists; they should also serve to notify motorists to watch out for bicycles. However, many of the route signs are not easy to see from a car. In addition to signs designating bicycle routes, “Share the Road” signs directed at motorists should be placed along high traffic routes.

A well-designed bike map is typically in high demand and can serve many functions. In addition to showing the best route for getting places, bike maps often contain information or advertising for a variety of resources including a calendar of bike events, location of bike shops, points of interest in the community, laws and local ordinances pertaining to bicycles, and safety tips for the rider and motor vehicle driver. Thus, a good bike map can be a great tool for promoting bicycling, as well as for educating and informing riders and motorists.

Wayfinding pertains to direction signs, distance markers, posted maps, information kiosks, and other aides for getting people places.

AESTHE TICS/LANDSCAPING
Well-designed and well-landscaped bicycle facilities can be an important attraction, especially for the recreational bicyclist. Design of transportation facilities should incorporate the principals of Context Sensitive Design (CSD), which aims to develop a transportation facility that fits its physical setting and preserves scenic, aesthetic, historic, and environmental resources while maintaining safety and mobility.

Landscaping is integral to good design and is important to the overall aesthetic value of the roadway. Well-designed and landscaped facilities are also easier to maintain, lead to fewer safety and security problems, and are more likely to be supported by the neighborhoods and businesses they access.

The 5 E’s
Facilities are only one of several elements essential to building a successful bicycle and pedestrian planning transportation system. With bicycle and pedestrian safety education and training encouraging walking and bicycling, and enforcing the rules of the road as they pertain to bicyclists, pedestrians, and motorists should be combined with facilities development to form a comprehensive approach to bicycle and pedestrian use. The Colorado Guide for the Development of Local and Regional Bicycle and Pedestrian Plans identifies the 5 E’s - Engineering, Education, Encouragement, Enforcement, and Evaluation – as the basis for comprehensive bicycle and pedestrian planning.
**Appendix B | Pedestrian and Bicycle Best Practices**

- **Engineering.** Engineering includes facilities, maintenance, and parking. An adequate bicycle or pedestrian transportation system is one that allows users with varying abilities to safely and efficiently travel from origin to destination. Bicycle facilities include on-street facilities such as bike lanes, bike routes, low-volume roads and roads with adequate shoulders, and off-street facilities such as paths, bridges, overpasses, and underpasses.

- **Education.** Education of the public is the most important element in reducing bicyclist and pedestrian injuries, reducing hostility between the various transportation modes, ensuring that the law is obeyed, and facilities are properly designed and built. Bicyclists, pedestrians, and motorists need safety education. Police officers need education regarding the manner in which to enforce bicycle and pedestrian laws, and engineers and planners need facility design education.

- **Encouragement.** Encouraging bicycling and walking can help mitigate air pollution and traffic congestion, as well as promote healthier, friendlier communities. One-way trips of five miles or less are often suitable for bicycling. Often bicyclists are willing to travel even further distances for commuting trips or recreation. Shorter trips are often suitable for walking. Providing safe, well-designed and maintained facilities encourages bicycling and walking. Annual events, such as Metro Rides Bicycle and Trails Festival, CDOT’s Colorado Bike Month (June), Bike to Work Day, Colorado Pedestrian Month (October), Walk to School Day, and National Trails Day promote bicycling and walking through events and media attention. These events are designed to celebrate non-motorized transportation, encourage people to bicycle or walk, build awareness through safety campaigns in the media, and institutionalize bicycling and walking as viable modes of transportation.

- **Enforcement.** Enforcement goes hand in hand with education. Education is not effective if there is not enforcement to back it up. Therefore, it is important to enforce the rights and responsibilities of all modes of transportation by ticketing motorized and non-motorized transportation users alike. Bicyclists and pedestrians should be expected to be ticketed for traffic offenses the same as motorists.

- **Evaluation:** Evaluation involves monitoring outcomes and documenting trends through data collection before and after transportation improvements. Evaluation includes review of existing policies and standards, monitoring traffic volumes and flow, evaluating crashes, prioritization of future projects and identifying potential funding sources.

**Maintenance**

Broken glass and debris tend to accumulate near curbs where bicyclists ride, resulting in flat tires and accidents. Certain streets become mud-covered after rain, making the riding surface hazardous, while others are prone to icy conditions. Painted lanes delineating bike routes wear off over time and are no longer usable without proper upkeep. During the winter months, snow either gets plowed onto the right-most edge of the roadway (which forces bicyclists to ride father left) or off the roadway and onto the sidewalks.

Consistent upkeep and maintenance of bikeways should be top priority. On-street routes need to be regularly swept of debris. Bike lane lines should be repainted at least as regularly as those on the rest of the street. Weather-related obstacles such as ice and mud cannot be eliminated, but can be minimized through good design practices. Bikeway segments that regularly have these problems should be identified and corrected when and where it is possible. It is recommended that all paths that are part of the bicycle system be paved.

**Transportation Demand Management**

When cost and community or environmental impacts limit expansion of the transportation system, improving the management and utilization of the existing system becomes a primary strategy. Significant growth in residential and business development is projected for the region and will require a balance between transportation improvements and management to serve the growing number of residents, employees, and customers. Transportation Demand Management (TDM) is a general term for strategies that result in more efficient use of transportation resources.
TDM is a set of strategies that manage the demand placed on our transportation system. These strategies or options increase people’s travel choices, offering them the opportunity to choose how, when, and if they will travel by car or in some other way while increasing the efficiency of our transportation facilities. Options can include incentives for utilizing Mountain Metropolitan transit service to more innovative ideas, such as developing localized Transportation Management Organizations (TMOs), teleworking, or parking management programs. These TDM benefits include:

- Improved access to site and business;
- Improved mobility;
- Access to greater pool of employees;
- Improved employee retention;
- Increased parking availability;
- Tax benefits;
- Cost savings to employer; and
- Decrease congestion and air pollution.

Transportation Demand Strategies

Transportation strategies include travel options and/or implementation steps developers, employers, employees, and residents can choose from to customize programs that fit their specific needs. Integration of various elements is the key to creating and maintaining a successful program. Flexibility is essential to the longevity and long-term effectiveness of the City’s TDM program.

Metro Rides (formerly Ridefinders) is the local resource for transportation demand management. Metro Rides has been providing TDM services and advocacy since 1994. Metro Rides is minimally funded through CMAQ grants and has limited the level of projects that staff has been able to provide.

TDM strategies include the following.

**Efficiency Programs**

- **Compressed Work Week** – allows employees to receive a day off each week in exchange for working longer hours on other days each week.
- **Flexible Working Hours** – allows employees to alter their arrival and departure times slightly to accommodate commuting schedules.
- **Staggered Work Hours** – allows employees to regularly arrive and leave at times which can vary from as little as 15 minutes to as much as two hours.
- **Telework Policies** – develops specific personnel policies that permit and encourage the use of teleworking at least twice per month.
- **Marketing Strategies**
- **Bicycle Riders Guide** – a guide for your worksite that includes bike routes, locker and rack locations, and other pertinent information.

**Marketing Strategies**

- **Bike to Work Week** – this regional promotion provides commuters with the incentive to try commuting to work by bicycle for a week.
- **Bus Riders Guide** – includes information on how to read a bus schedule, where to wait for the bus, and how to use the “bikes-on-busses” program.
- **Employee Orientation** – orientation meetings provide new employees with the opportunity to learn more about travel to and from their worksite.
- **Employee Transportation Coordinator** – this is an individual assigned the responsibility of helping employees with their commute to and from work.


**Appendix B | Pedestrian and Bicycle Best Practices**

- **Special Events** – special promotions and events sponsored by the worksite to encourage the use of transportation options for the entire site.
- **Travel Options Marketing** – provides brochures, maps, and other information to commuters either individually or in an information center.

**Incentives Strategies**

- **Bicycle Loan Program** – provides a set of bicycles (to be tracked and maintained by the employer/building owner) for general employee use.
- **Car/Bike Sharing** – cars/bikes that are available for limited short trips by either members of the car/bicycle share program, or for a per-use fee.
- **Commuter Club** – a program similar to “airline miles” by providing points or cash incentives to commuters who use transportation options.
- **Free Bike Accessories** – headlamps and helmets, can improve the safety of bicyclists, and serve to encourage greater use of bicycle commuting.
- **Bus Passes** – provide an incentive for “first time” users to try utilizing transit services to commute to work.
- **Guaranteed Ride Home** – provides a free taxi ride home to those employees who fall ill, have an emergency, or are left stranded at work.
- **Taxation Incentives** – are the federal, state, regional, and local tax rules that offer tax savings for both employees and employers.
- **Transportation Allowance** – provides a fixed allowance per month to be used for whatever mode of travel they choose, including parking spaces.
- **Vanpool Empty Seat Subsidy** – ensures that as vanpools lose riders over time, the other riders maintain a consistent user’s fee.
- **Vanpool Subsidies** – provide financial support to vanpool riders as an incentive to participate in a vanpool.

**Facilities and Design**

- **Bicycle Racks / Lockers** – provided to commuters to secure their bicycles once they have reached their employment site.
- **Bicycle Station** – a dedicated space that provides secure and covered parking for bicycles, as well as facilities for bicyclists to shower and change.
- **Commuter Store** – a dedicated storefront that provides a location for obtaining commuter information, travel services, pass sales, etc.
- **Onsite Amenities** – provide retail and services, such as a cafe or dry cleaners, to employees at the worksite.
- **Protected Walk / Bike Corridors** – separate walking / bike traffic from parking spaces onsite, through separated paths, and landscaping.
- **Showers and Clothes Lockers** – allows for those who wish to walk or bicycle to work to “freshen up” after getting to work.
- **Traveler Friendly Site Design** – a comprehensive design that features bicycle and walking amenities, bus stop accessibility, passenger loading zones, and other design strategies.

**Management and Parking Strategies**

- **Clustered Parking** – parking spaces are limited and built in clusters, providing more space and paths for pedestrians.
- **Incidental Use Parking** – spaces dedicated for use by an occasional driver, such as a transit rider who must drive to work on occasion.
Appendix B | Pedestrian and Bicycle Best Practices

- **Parking Cash Out** – provides employees with a choice: receive a parking space or receive the cash equivalent of the space.

- **Parking Charges** – can be set for cost recovery to the employer or developer, or, be variable based upon time of day and length of parking.

- **Parking Management** – balances the number of parking spaces relative to the availability of transit and other services.

- **Preferential Parking** – provides designated parking spaces for carpoolers and vanpoolers near the front entrances.

- **Unbundled Parking Leases** – spaces are not part of the office lease, with flexibility for the tenant to vary the number of parking spaces rented.

**Transportation Management Organizations**

Besides implementing strategies from the tool kit of options listed above, the development and implementation of TMOs can improve access to employment and retail centers, while reducing traffic congestion and resulting pollution. TMOs are often structured as membership organizations formed to provide flexibility and a forum for employers, developers, building owners, residents, government representatives, and others to work together to establish policies, programs, and services to address their district’s particular transportation issues. Typically, private business associations (they are often initiated by Chambers of Commerce), business associations, developers, or businesses as an economic tool, as well as to address congestion issues. TMOs can be self-supporting and advocate for their region’s transportation needs.

TDM strategies that can be conducted by the TMOs include, but are not limited to:

- Transportation Center / Commuter Store (where transit passes and other commuter information can be obtained)
- Employee Transportation Coordinators
- Employee Shuttle
- Transit Passes
- Transit Shelters/Facilities
- Ridesharing for carpools
- Van Pools
- Bicycling/Walking (incl. showers, lockers, Bike Station, etc.)
- Preferential Parking for carpools and vanpools
- Unbundled Parking Leases
- Transportation Allowance
- TDM Friendly Site Design
- Promotion, Marketing and Education
- Flextime
- Telework