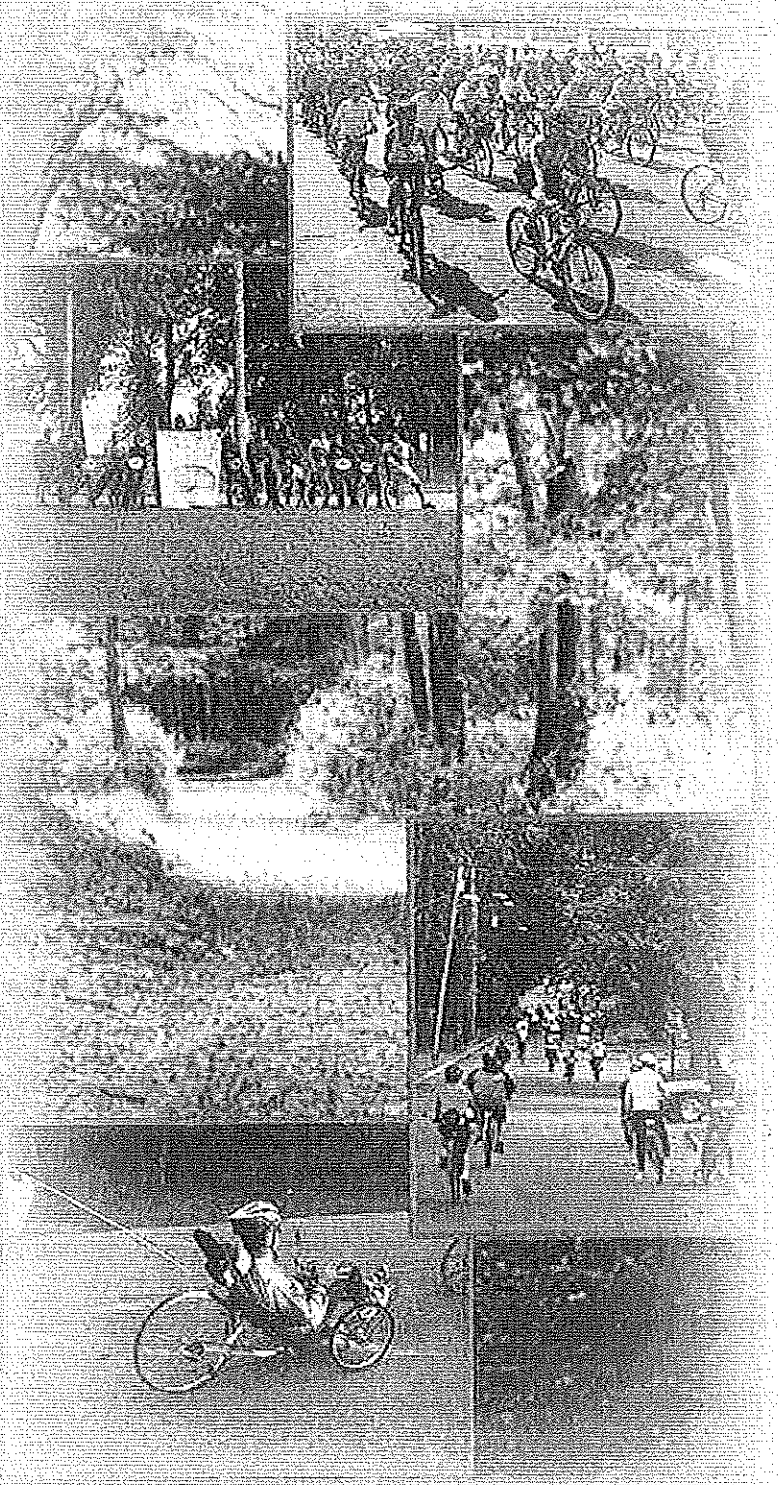
Bicycle and Pedestrian Design Toolbox



Bicycle Facility Description 1.1

SHARED ROADWAY

- A shared roadway accommodates both motor vehicle and bicycle traffic by allowing them to share a lane on the roadway.
- Shared roadways are not specifically marked for bicycle use. The various modes of travel share the route.
- Shared roadways are the most common type of bicycle facility in use today.

SIGNED SHARED ROADWAY

- A shared use road that includes pavement markings and/or signage that indicates the various facilities on the roadway, proper usage of the roadway by each user and directional signage specific to bicycle travel
- Provide continuity to other bicycle facilities as well as designates preferred routes through high demand corridors

BICYCLE LANE

- Designate a portion of the roadway for preferential use by bicyclists.
- Establish with appropriate signage along streets in corridors where there is significant demand and where there are distinct needs that can be served by bike lanes
- Provide for more predictable movements by bicyclists and motor vehicles
- Help to increase total capacity of highways that carry mixed traffic
- Accommodate bicyclists where insufficient space exists for comfortable cycling

SHARED USE PATH

- Serve corridors not served by streets or where wide utility or former railroad rights of way exist
- Separated from motor vehicle traffic by an open space or barrier
- Should offer opportunities not provided by the road system
- Used by bicyclists, pedestrians, skateboarders, the handicapped and others, including occasional motor vehicle traffic for emergencies and maintenance

Bicycle Facility/Design Measure Chart 1.2

SHARED ROADWAYS	SIGNED SHARED ROADWAYS	BICYCLE LANES	SHARED USE PATHS
Paved Shoulder – 1.3.A	Paved Shoulder – 1.3.A	Bike Lane – 1.3.D	Drainage Grates & Utility Manholes – 1.3.I
Shoulder Bike Lane – 1.3.B	Shoulder Bike Lane – 1.3.B	Combination Lane – 1.3.E	Signalization – 1.3.J
Wide Curb Lane – 1.3.C	Wide Curb Lane – 1.3.C	Grade Separation: Overpass – 1.3.G	Signage – 1.3.P
Grade Separation: Overpass – 1.3.G	Bicycle Boulevard – 1.3.F	Grade Separation: Underpass – 1.3.H	Pavement Treatment – 2.2.A
Grade Separation: Underpass – 1.3.H	Grade Separation: Overpass – 1.3.G	Drainage Grates & Utility Manholes – 1.3.I	Intersection Treatments – 2.2.B
Drainage Grates & Utility Manholes – 1.3.I	Grade Separation: Underpass – 1.3.H	Signalization – 1.3.N	
On Street Parking – 1.3.N	Drainage Grates and Utility Manholes – 1.3.I	Pavement Markings – 1.3.K	
Pavement Surface – 1.3.O	Signalization – 1.3.J	Bike Box – 1.3.L	
	On Street Parking – 1.3.N	Bicycle Parking – 1.3.M	
	Pavement Surface – 1.3.O	On Street Parking – 1.3.N	
	Signage – 1.3.P	Pavement Surface – 1.3.O	
		Signage – 1.3.P	

Paved Shoulders 1.3.A

Purpose

- Create travel facilities for bicycles.
- Create separated space for bicyclists.
- Reduce or prevent conflicts with bicyclists overtaking motor vehicles in narrow, congested areas.
- Added benefit: extends service life of road by providing better edge protection, provides breakdown area for motor vehicles.

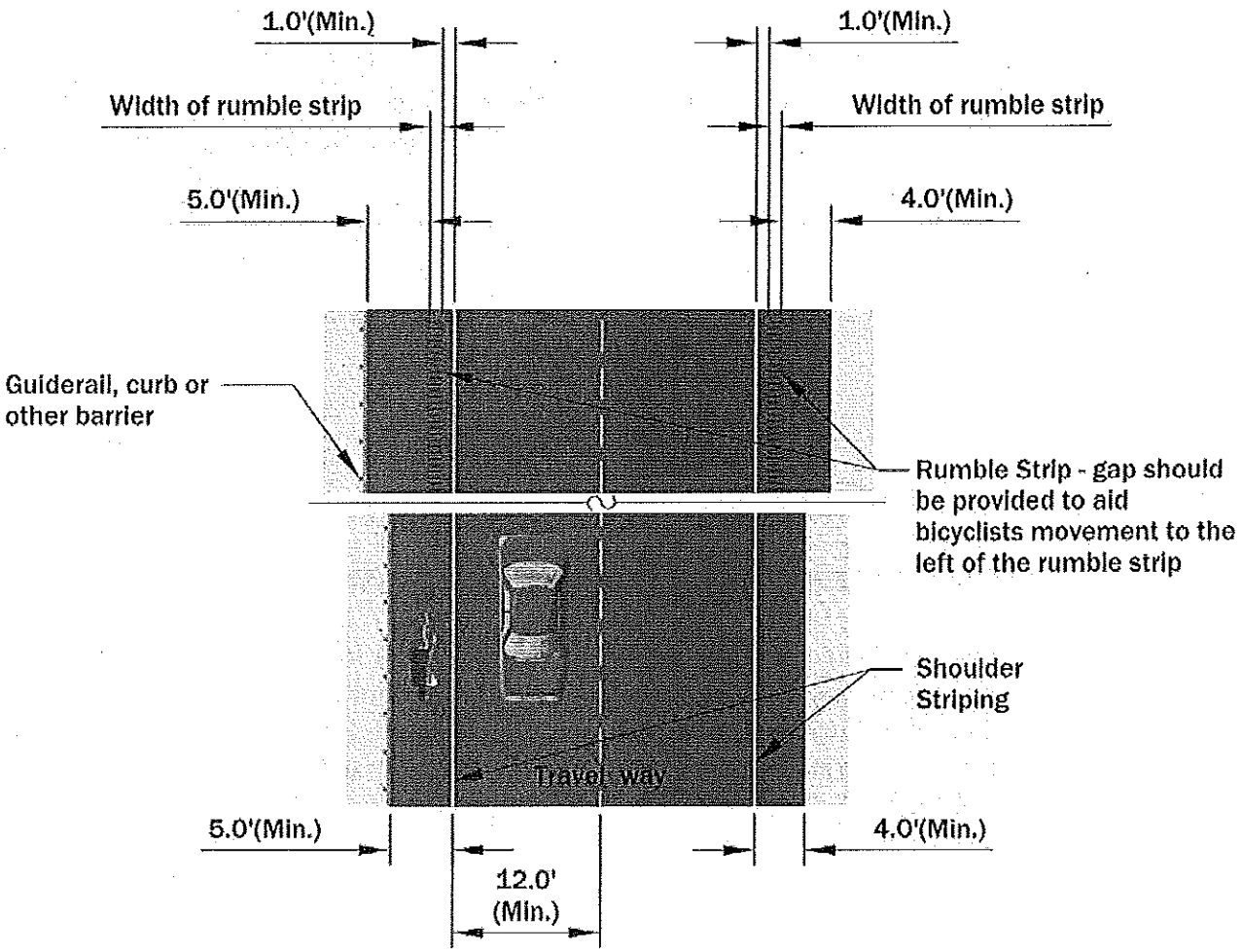
Where to use

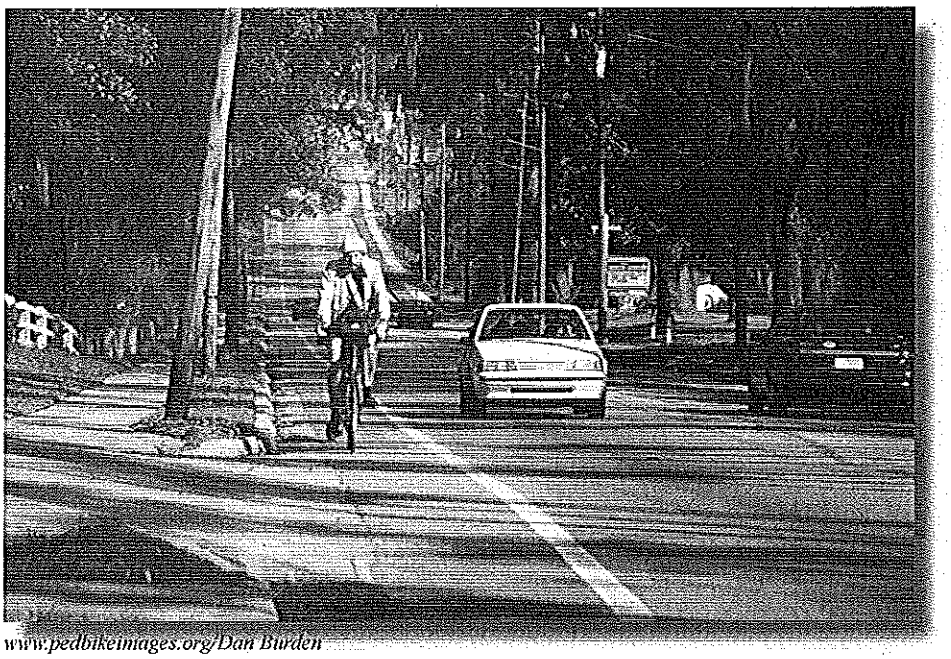
- Rural roads
- Shared roads

Guidelines

- 4 foot wide minimum exclusive of gutter pan unless pan width is 4 foot or greater.
- 5 foot wide minimum recommended from face of guide rail, curb, or other hard barrier.
- Increase widths if heavy bicycle use anticipated or if vehicle speeds exceed 50 mph or percentage of trucks, buses and recreation vehicles is high or if static obstructions exist on right side of road.
- Shoulder must be paved.
- Not recommended if rumble strips or raised pavement markings present in shoulder unless 1 foot minimum clear path between rumble strip and travel way.
- Not designed as a separate bike lane - just a shoulder.
- A gap should be provided to allow bicyclists to move to the left of the rumble strip to avoid debris, other shoulder users or for turning purposes. Exact width and interval to be determined by local or state regulations. Some states recommend gap widths to be 10 feet to 12 feet and intervals ranging from 28 feet to 48 feet or 10 foot wide gaps with 10 foot intervals.

Paved Shoulders 1.3.A





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Shoulder Bicycle Lane 1.3.B

Purpose

- Create travel facilities for bicycles.
- Create separate space for bicyclists.
- Reduce or prevent conflicts with bicyclists overtaking motor vehicles in narrow, congested areas.
- Added benefit: extends service life of road by providing better edge protection, provides breakdown area for motor vehicles.

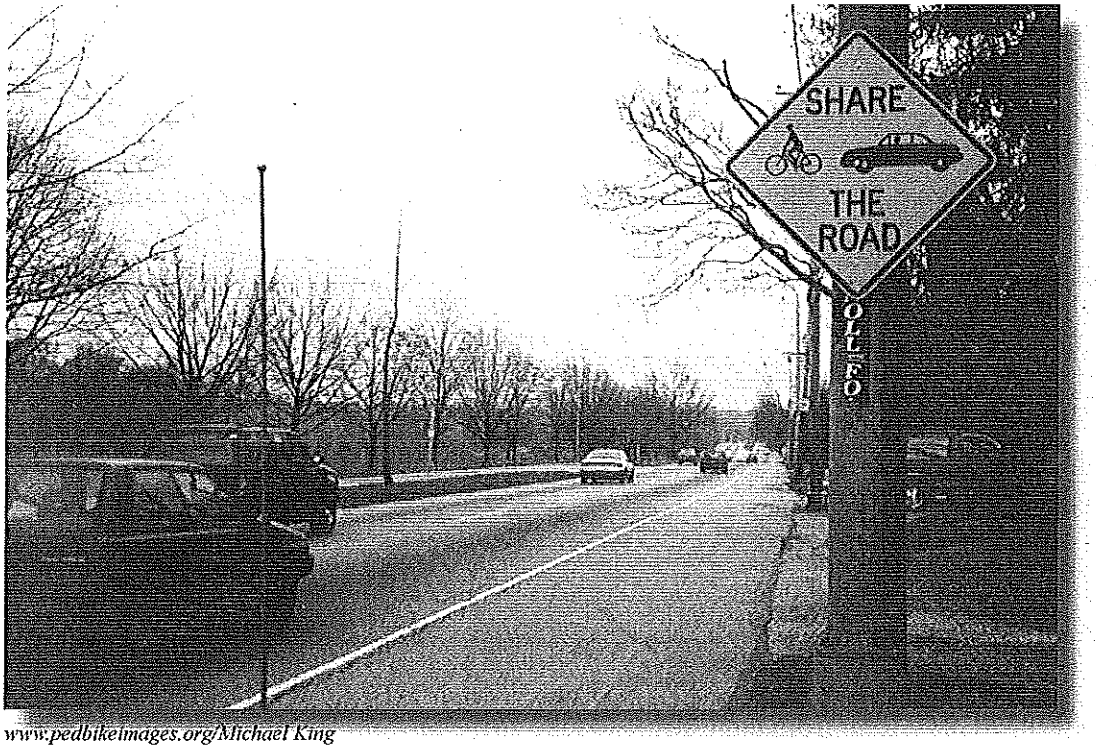
Where to use

- Shared roadways
- Suburban roads

Guidelines

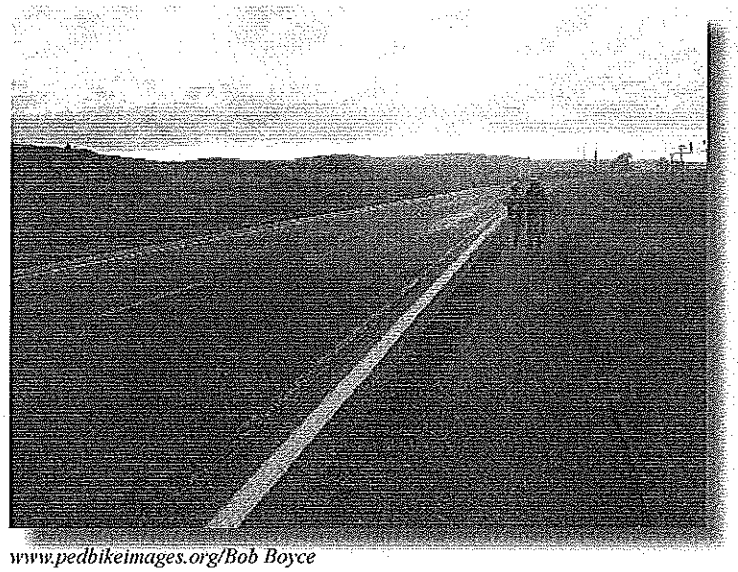
- 4 foot wide minimum exclusive of gutter pan unless pan width is 4 foot wide or greater.
- 5 foot wide minimum recommended from face of guide rail, curb, or other hard barrier.
- Increase widths if heavy bicycle use anticipated or if vehicle speeds exceed 50 mph or percentage of trucks, buses and recreation vehicles is high or if static obstructions exist on right side of road.
- Shoulder must be paved.
- Not recommended if rumble strips or raised pavement markings present in shoulder unless 1 foot minimum clear path between rumble strip and travel way or 5 foot to adjacent guide rail, curb or obstacle.
- Not designated as a separate bike lane - just a shoulder.
- Use standard pavement symbols (see 1.3.K for information) to inform motorists and bicyclists of the presence of a bicycles on he road.
- A gap should be provided to allow bicyclists to move to the left of the rumble strip to avoid debris, other shoulder users or for turning purposes. Exact width and interval to be determined by local or state regulations. Some states recommend gap widths to be 10 feet to 12 feet and intervals ranging from 28 feet to 48 feet or 10 foot wide gaps with 10 foot intervals.
- To increase awareness for vehicles and bicycles consideration should be given to changing the shoulder lane line from solid to dashed before right turn intersections. Reference the AASHTO Guide for the Development of Bicycle Facilities.

Shoulder Bicycle Lane 1.3.B



www.pedbikeimages.org/Michael King

www.pedbikeimages.org/Dan Burden



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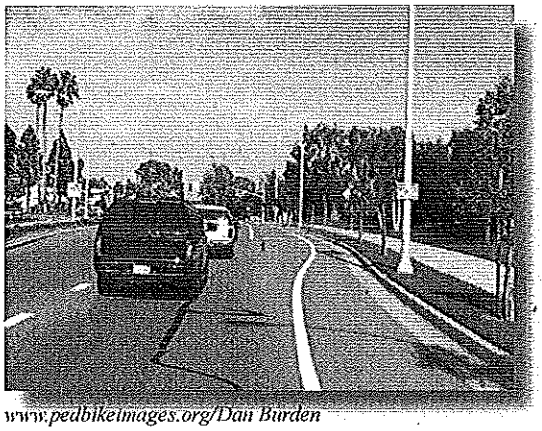

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Wide Curb Lane 1.3.C

Purpose

- Create on street, travel facilities for bicyclists.
- Create lane wide enough so motor vehicles and bicycles can share lane with adequate room for overtaking.
- Encourages bicyclists to behave more like vehicles and leads to more correct positioning at intersections.

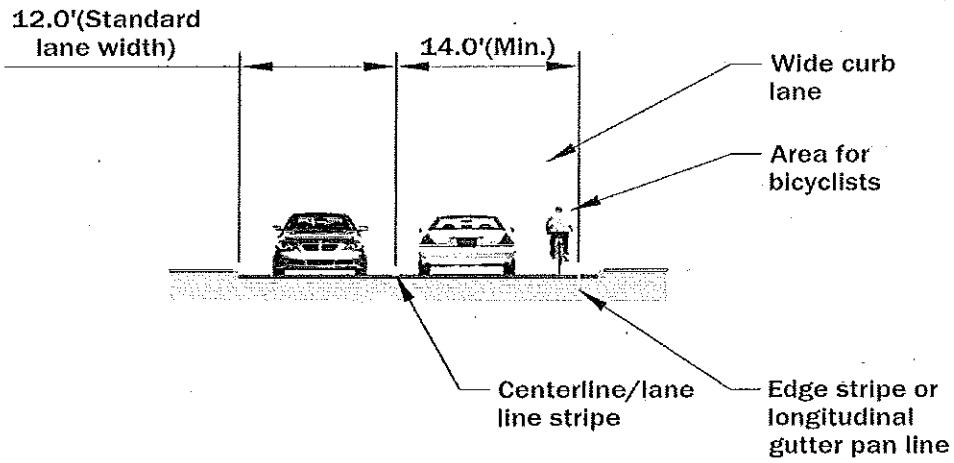
Where to use

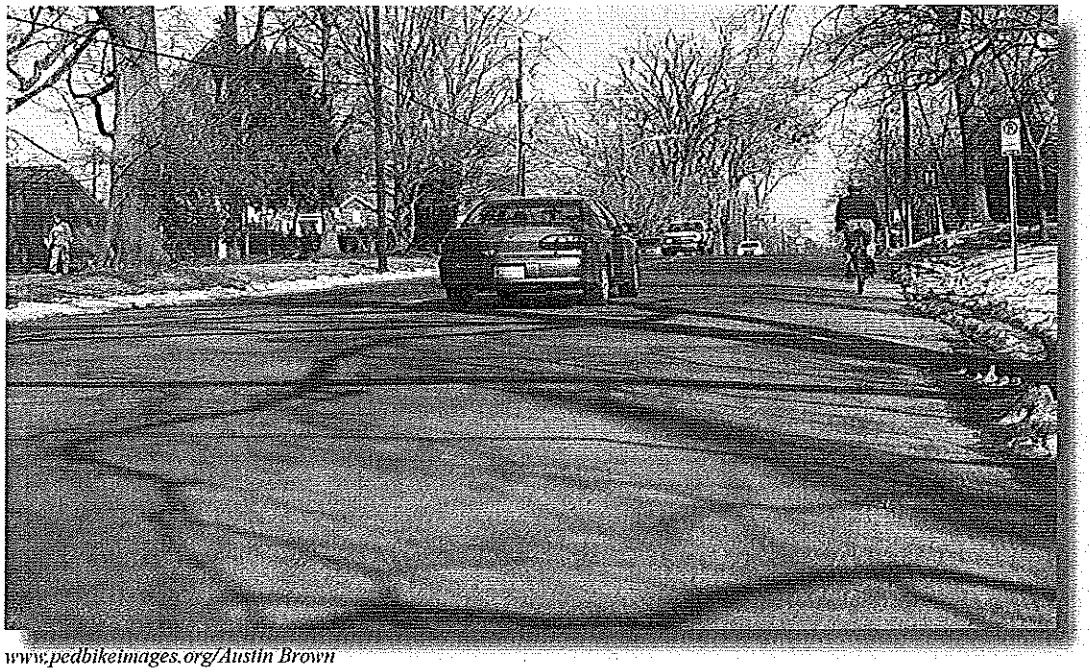
- Suburban roads
- Urban roads
- Areas where truck traffic does not exceed 5% of total motor vehicle traffic.
- Preferred where shoulders are not present.

Guidelines

- 14 foot minimum usable lane width, from edge stripe to lane stripe or from longitudinal joint of gutter pan to lane stripe.
- On roads with steep grades, increase width to 15 foot if possible however, do not increase width continuously along roadway as this may encourage two motor vehicles in one lane.
- If more than 15 foot of pavement width exists, consider striping a bike lane or shoulder (See 1.3.D and 1.3.K).
- Education of users may be needed as wide curb lanes are not marked as bike lanes and many users may not realize they are there.

Wide Curb Lane 1.3.C





www.pedbikeimages.org/Austin Brown

Bike Lane 1.3.D

Purpose

- Create on-street separated travel facilities for bicyclists.
- Provide space for vehicles to safely overtake bicyclists.
- Reduce or prevent problems associated with bicyclists overtaking vehicles in congested or narrow streets.
- To encourage lower motor vehicle speed by narrowing available lanes.

Where to use

- Suburban roads
- Urban roads

Guidelines

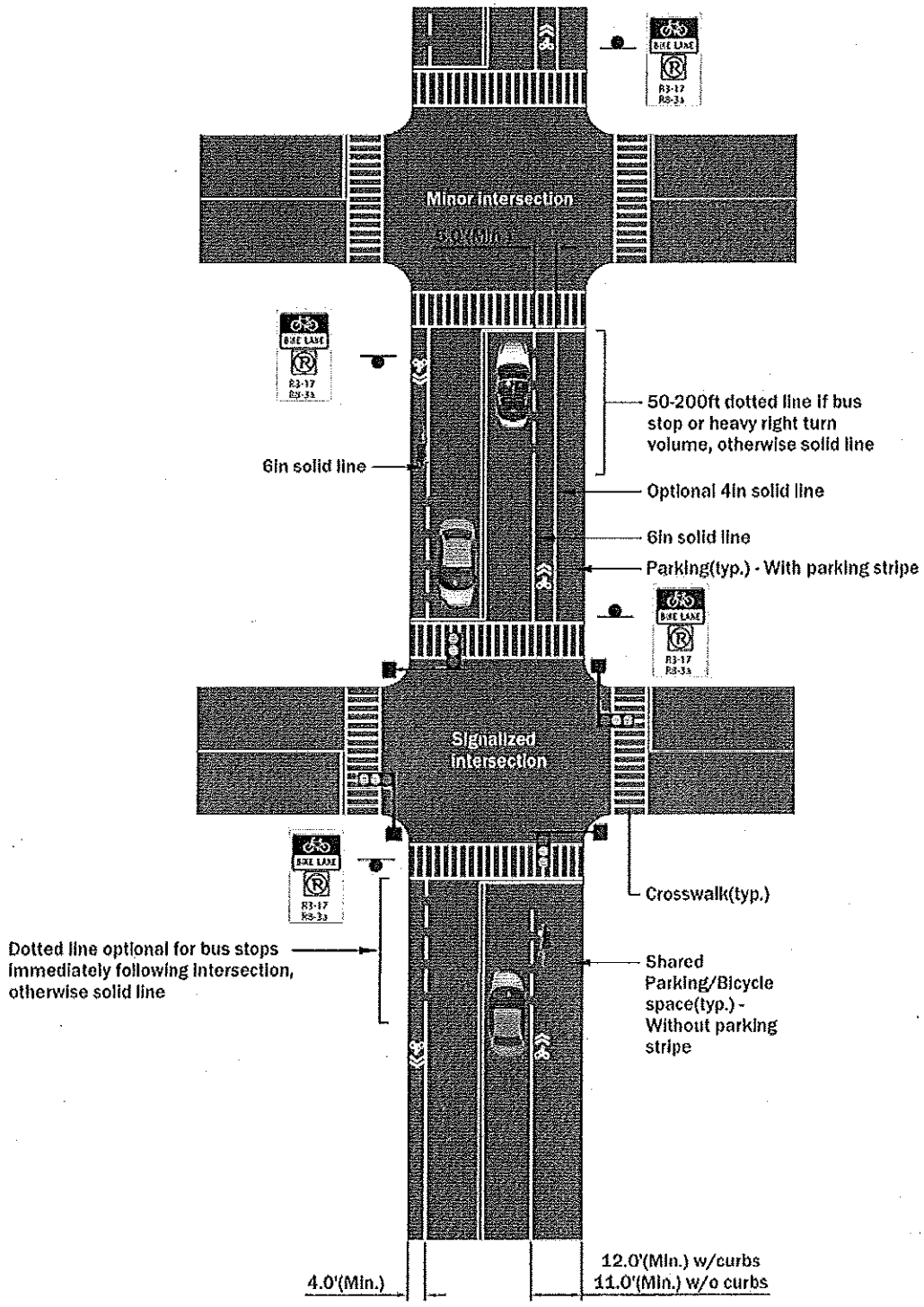
- Bike lanes should be one way facilities carrying bicyclists in the same direction as adjacent traffic and located on the right side of the travel lane.
- Bike lanes generally should be installed in both directions of the roadway. Bike lanes installed on only one side of the roadway may encourage riding in the wrong direction. Depending on the situation an alternate route may need to be considered.
- In some instances, on one way roads, the bike lane may be installed on the left side of the travel lane if this provides better safety to the bicyclist.
- Bike Lane Widths:

  Road with no curb and gutter - 4 foot wide minimum.
  Road with guiderail, curb or other barrier -5 foot wide minimum
  Road with parking - 5 foot wide minimum, placed between parking and travel lane.
  Road with parking but no parking stripe or stall - shared parking/bicycle space 11 foot wide minimum without curbs, 12 foot with curbs.
  NOTE: If parking volumes are substantial or turnover is high then increase above widths by 1 -2 feet.
- Obstructions:

  Do not install drain inlets or covers within space that is 32" - 40" from curb face. Pavement should be smooth in this space. If these structures exist, increase width of bike lane to account for bicyclists swerving.
- Bike lanes in outlying areas with no parking or curbs should be located within the limits of the paved shoulder at the outside edge. Width to be 5 foot but may be 4 foot minimum if area beyond shoulder provides additional room for maneuvering. Increase width beyond 5 foot if substantial truck traffic is present or vehicle speeds exceed 50 mph.
- Railroad crossings should be as close to 90 degrees as possible. (See http://www.oregon.gov/odot/hwy/bikeped/docs/bp_plan_2_ii, PDF for more information on railroad crossings).

Bike Lane 1.3.D

Typical pavement markings for bike lane on a two way street



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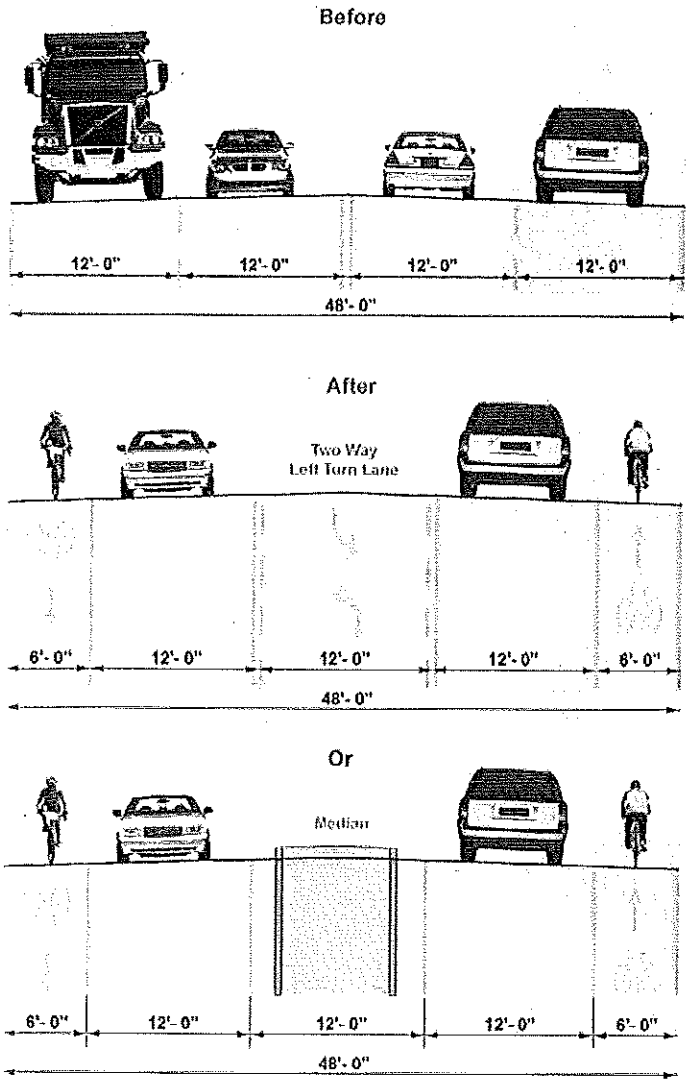
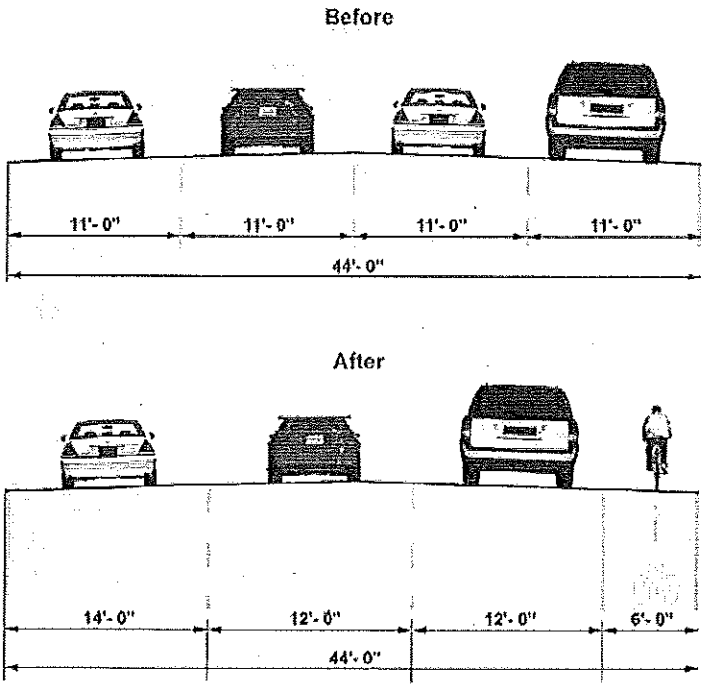
Bike Lane

Travel lane cross sections



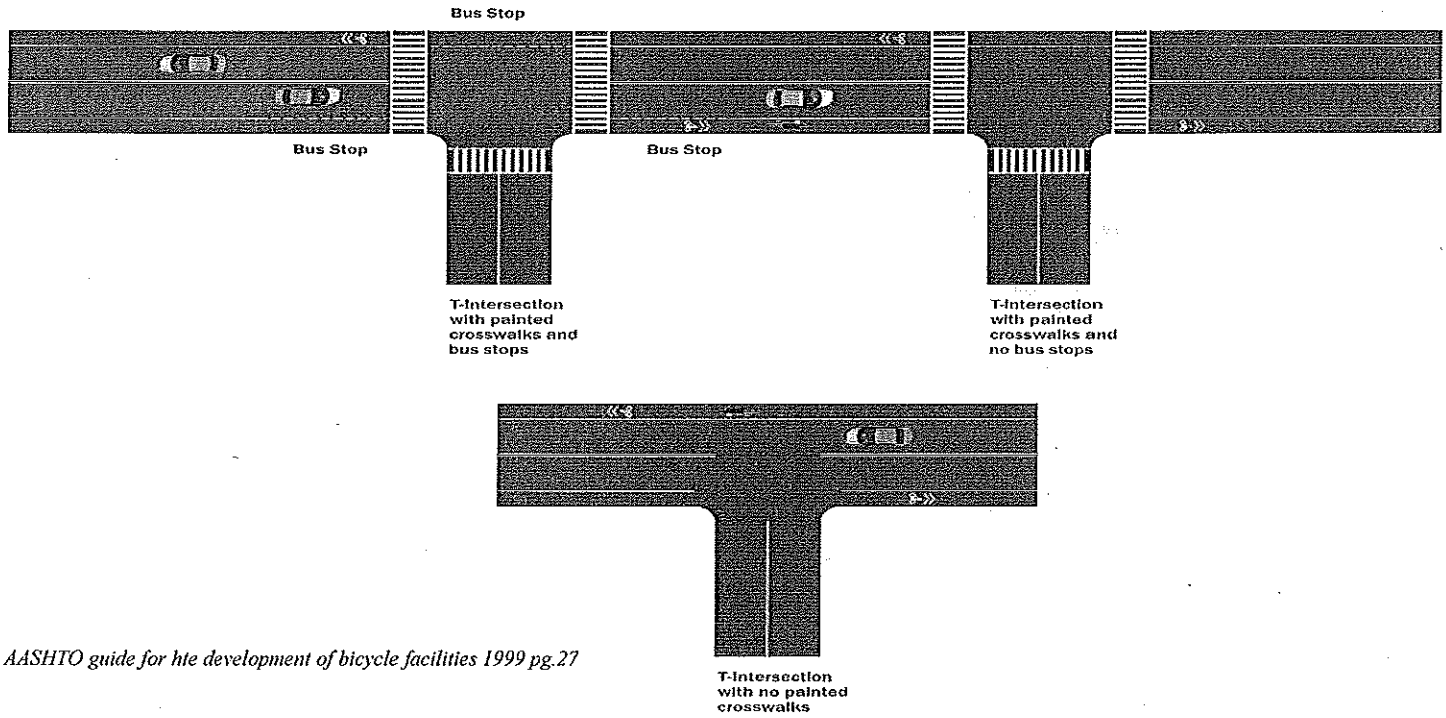
Travel Lanes Reduced from 4 to 2 Lanes with Center Median/Turn Lane



Travel Lanes Reduced from 4 to 3 Lanes - One Way

Bike Lane 1.3.D

Bike lane pavement markings at T-Intersections



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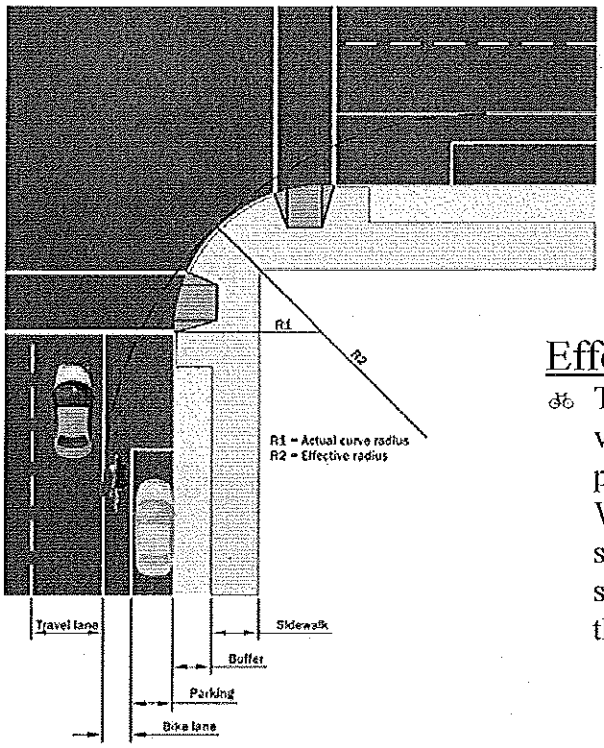
Bike Lane - Effective Radius

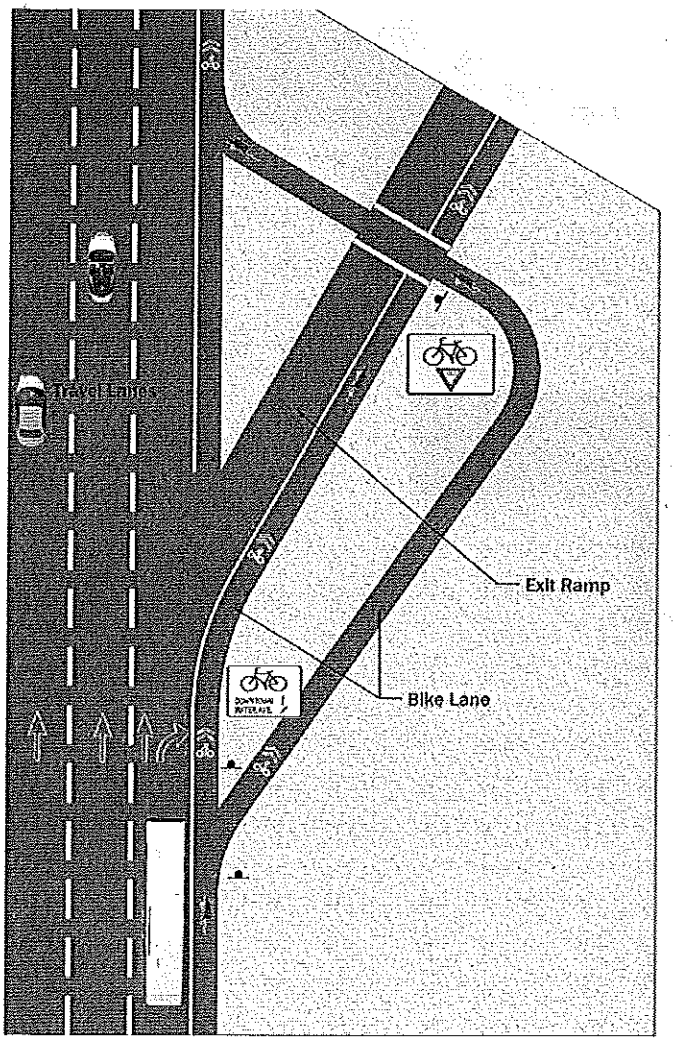


Effective radius

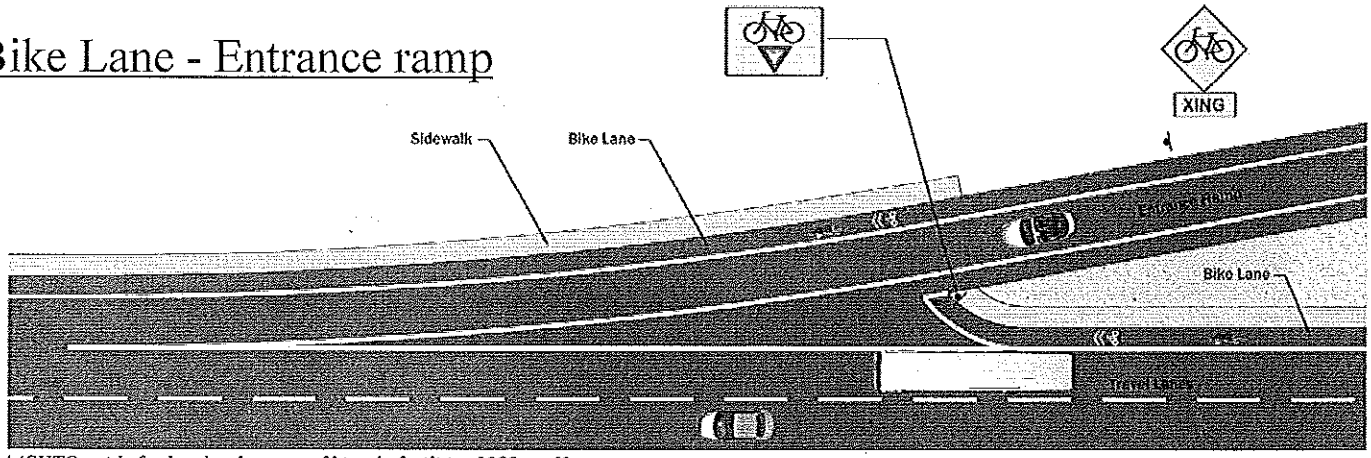
- The effective radius is the radius needed for vehicles to safely navigate the turn without hopping the curb or veering into the adjacent lane. While a smaller curb radius decreases vehicle speed, therefore increasing bicycle safety, consideration must be given to the safety of both the vehicle and the bicycle.

Bike Lane 1.3.D

Bike Lane - Exit ramp



Bike Lane - Entrance ramp



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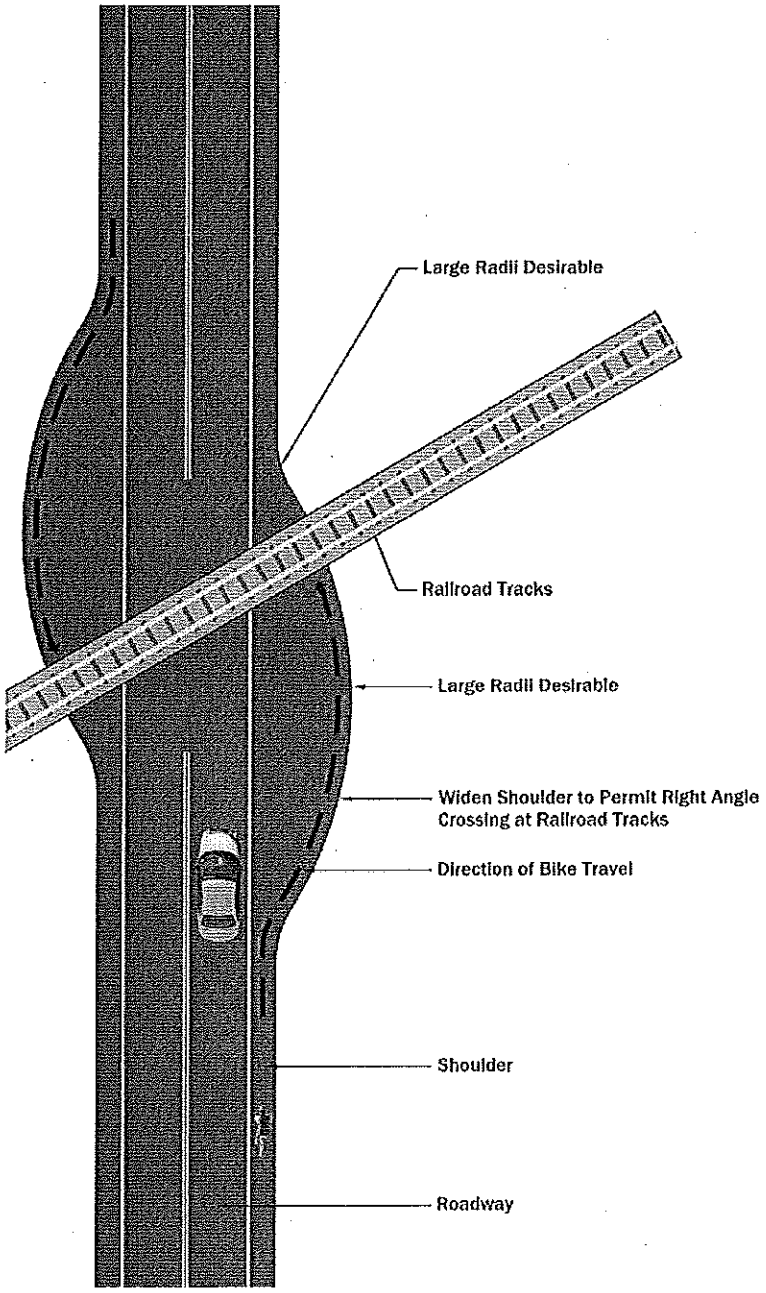
Bike Lane - Railroad crossing



Combination Lanes 1.3.E

Purpose

- To create a separated space for bicyclists in combination with other modes of travel (buses, motor vehicles turning right) in areas where a dedicated bicycle lane is not feasible.

Where to use

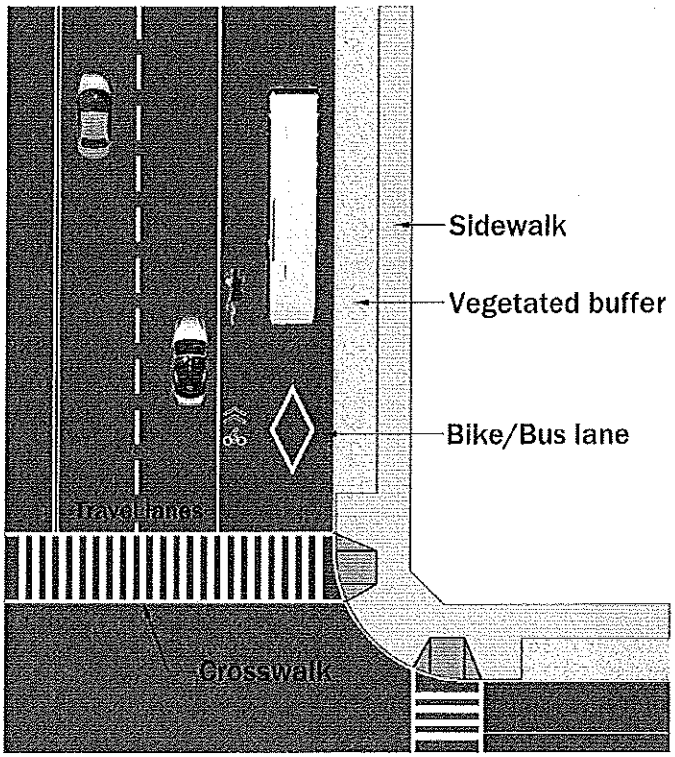
- Urban roads
- Suburban roads
- Transit centers

Guidelines

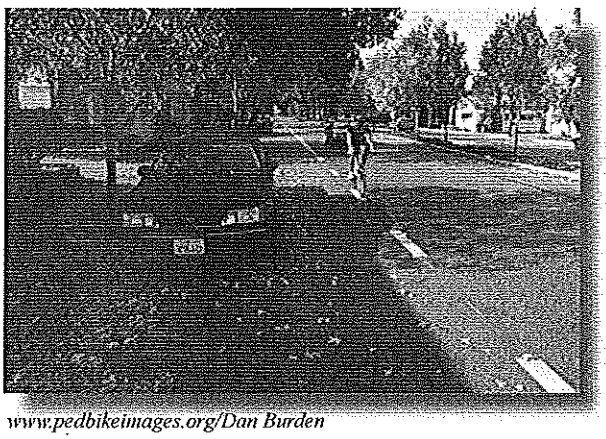
- Appropriate width to be determined based on anticipated users. Refer to Federal Highway Administration BIKESAFE: Bicycle Countermeasure Selection System manual.
- Provide appropriate signage based on anticipated users and desired traffic movement. Examples include: "Bicycles, Buses and Right Turns Only".
- Amount of vehicular uses to be analyzed to determine if combination lanes are warranted. If use is too low then combination lane will become an additional peak hour traffic lane.

Combination Lanes 1.3.E

Bike/bus lane



Bike/parking lane



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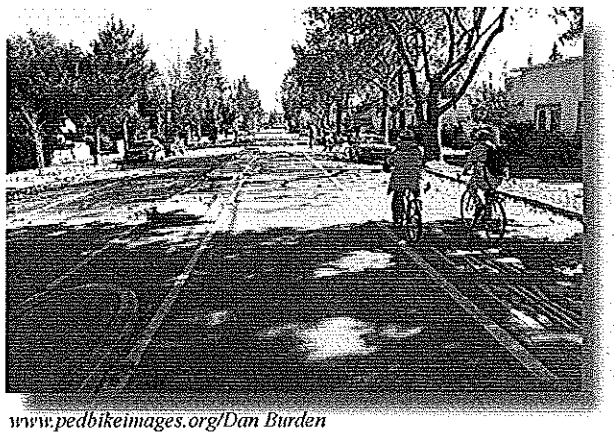

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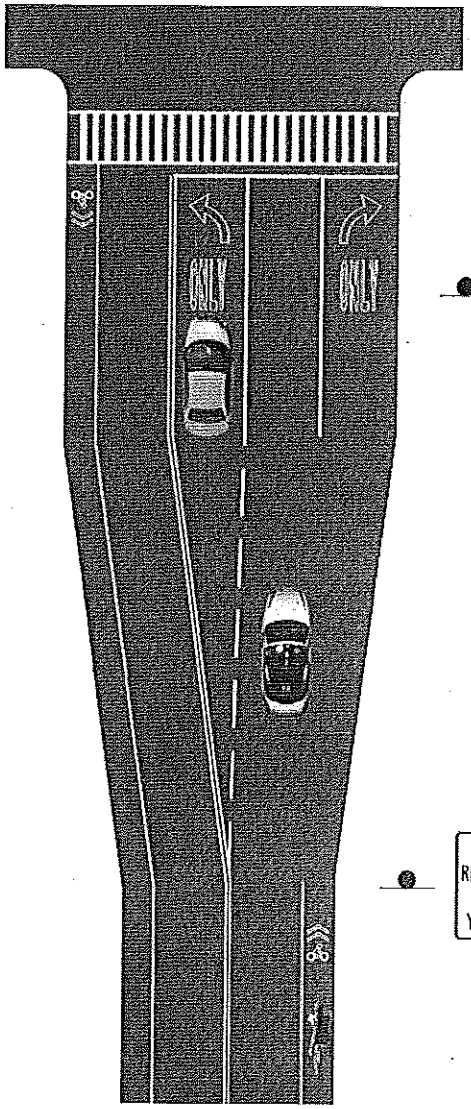
Combination Lanes

1.3.E

Bike lane approaching an intersection with throat widening



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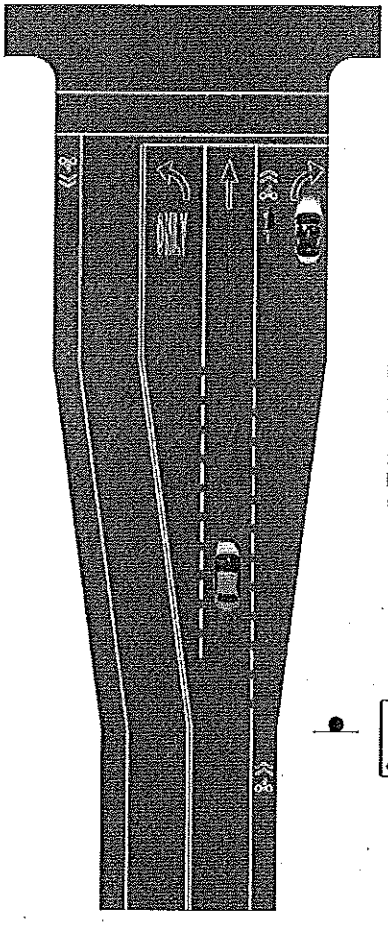
Bike lane approaching right turn only lane

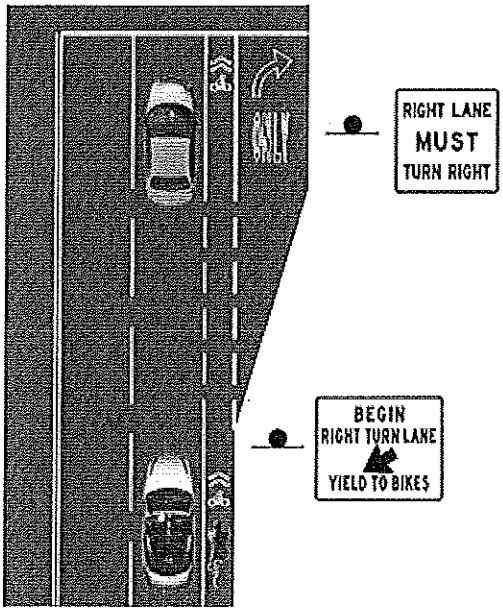


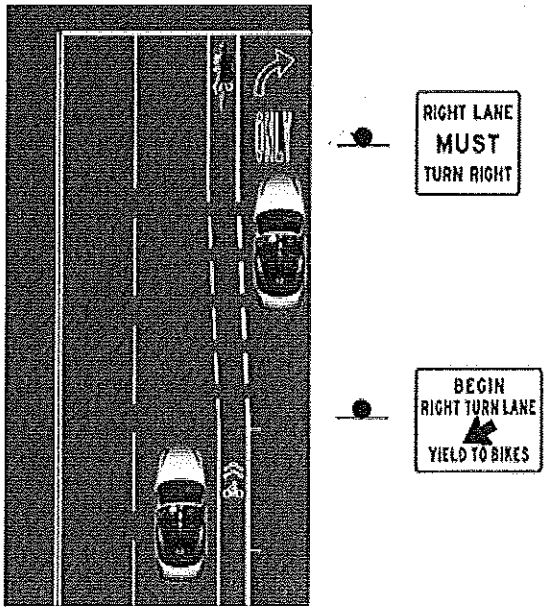
Notes:
1. Through-right turn lane varies up to 15 feet

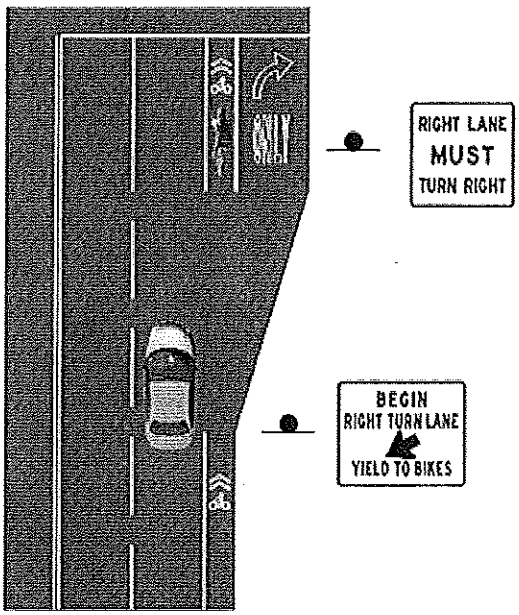
2. Used where there is insufficient width at the stop bar for a bike lane

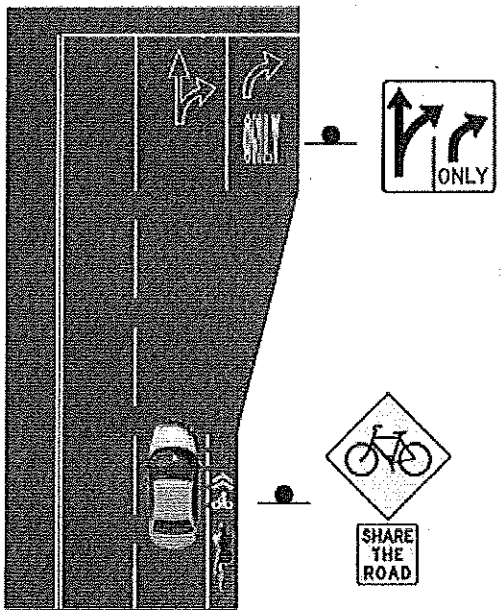
Combination Lanes 1.3.E

Bike lanes approaching right-turn only lanes









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Bicycle Boulevard 1.3.F

Purpose

- To create a shared roadway that is optimized for bicycle use in order to improve safety and circulation.

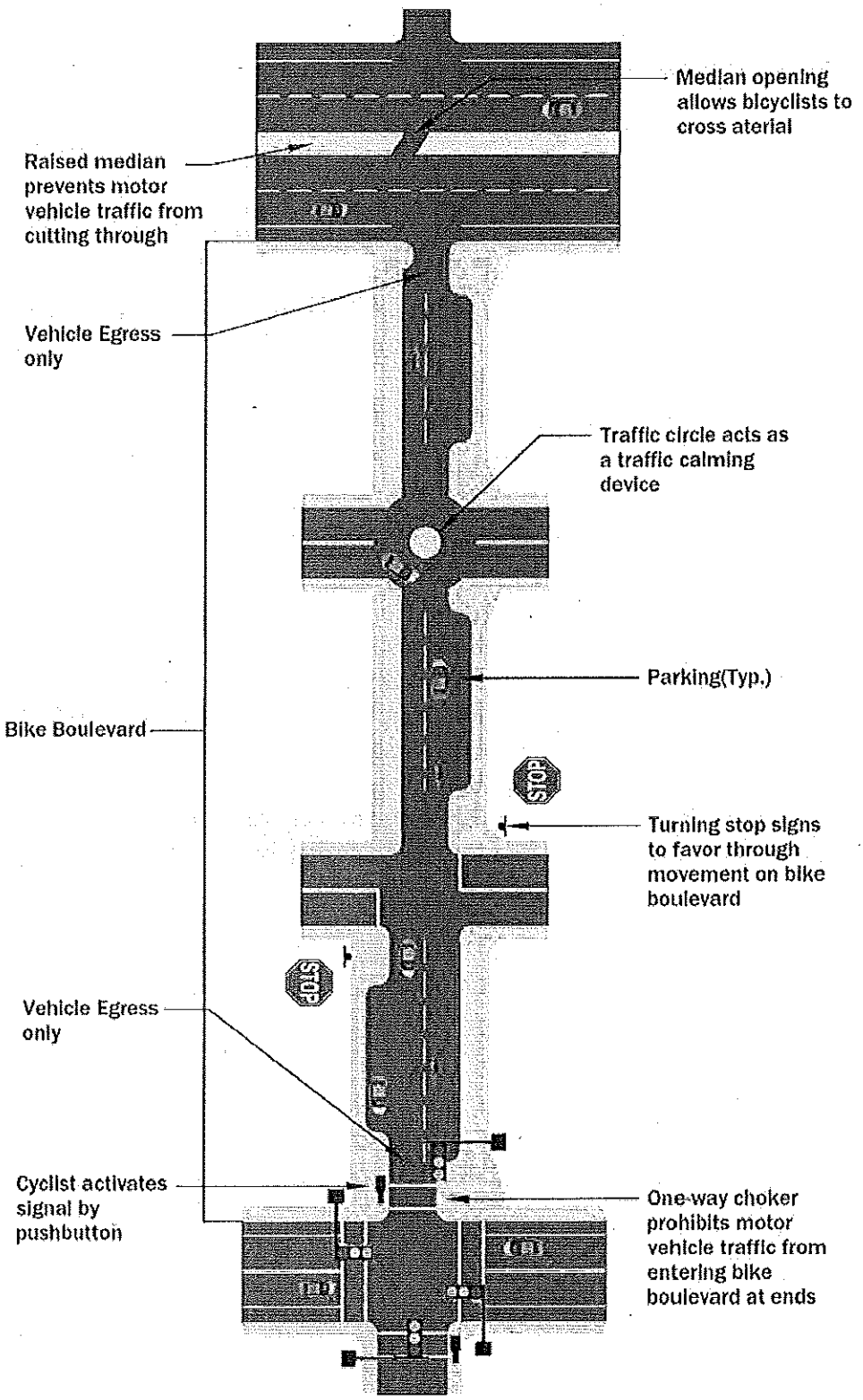
Where to use

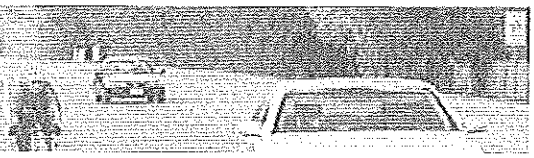
- Local or low volume connector streets
- Suburban roads
- Urban roads

Guidelines

- Bicycle boulevard should be designed to give bicyclists the right of way.
- Bicycle boulevard should be designed as a through street for bicycles with minimal number of stops.
- Use traffic calming techniques to reduce motor vehicle speeds. Be sure traffic calming does not impede bicyclists or emergency vehicles.
- Pavement markings and appropriate signage should be used to warn motor vehicles that they are sharing road with bikes.
- Lane widths will vary from 5' - 12' depending on whether it is a dedicated bicycle lane or shared lane.
- Consider creating rain gardens and biofilters in medians and islands for improved aesthetics and storm-water management.
- Bicycle boulevard should be visually unique in relation to surrounding streets. This will provide for a more enjoyable ride and set the boulevard apart from adjacent typical streets.

Bicycle Boulevard 1.3.F





Grade Separation - Overpass 1.3.G

Purpose

- Provide continuity of access for bicyclists across barriers.
- Provide a safe separated area for bicyclists on existing or proposed bridges

Where to use

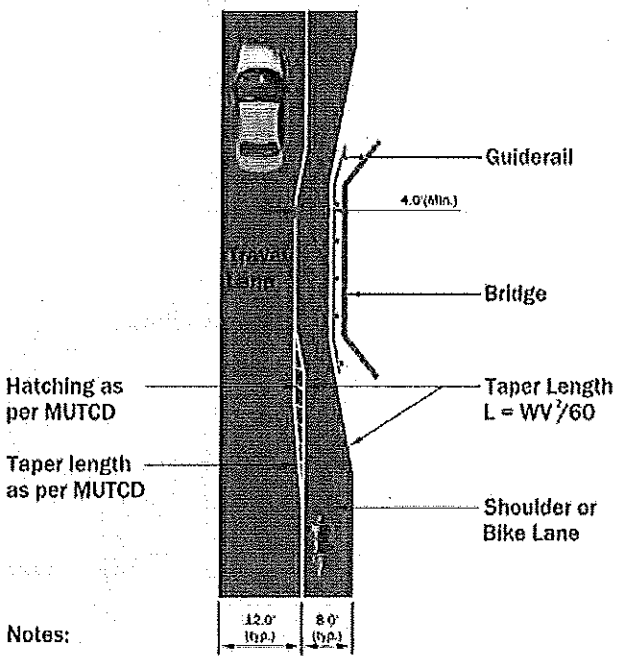
- Routes that must cross unsurpassable barriers (ie: river, major highway, etc.)

Guidelines

- As a minimum, dimensions should be as per section 1.3.D "Bike Lanes".
- Provide extra buffer space above the requirements in section 1.3.D, as necessary to account for "shy distance" from railings or adjacent traffic. Typically extra buffer space is 2 feet or more.
- Clear space to overhead spans or obstructions should be 10 foot minimum.
- Height of railings or barriers to protect bicyclists should be 4.5 feet minimum.
- Provide sidewalk access for bicyclists on bridges only if traffic volumes and/or speeds are high, the bridge is long or there is insufficient roadway space to safely accommodate bicyclists.
- If sidewalk access on overpass is desired for bicyclists then provide bicycle safe ramps for access to sidewalk.

Grade Separation - Overpass 1.3.G

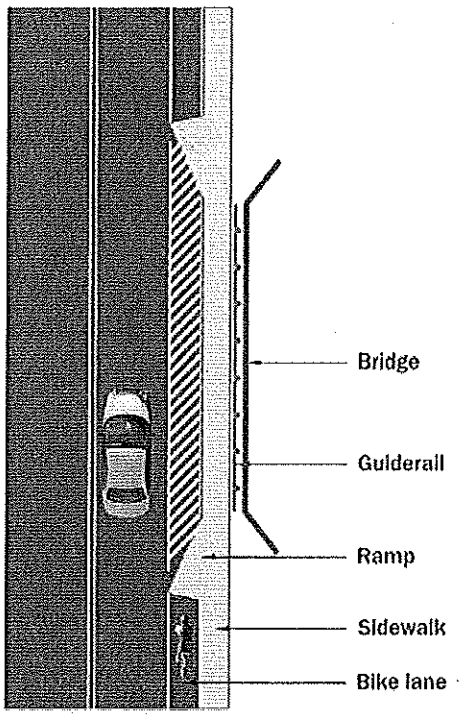
Lane narrowing

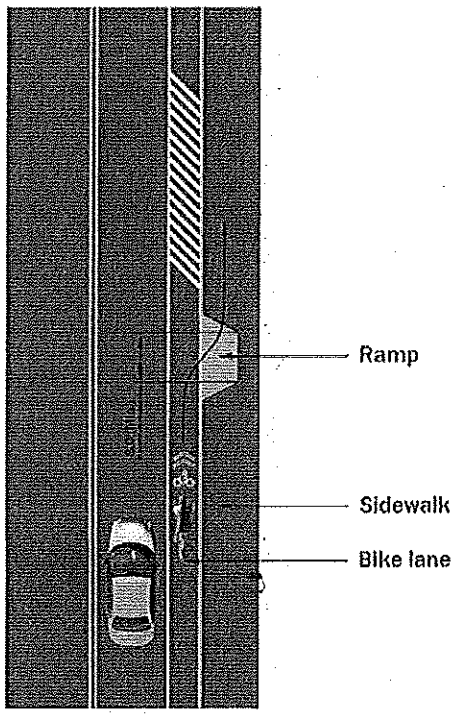


Notes:

To obtain the minimum width to accomodate cyclists(4 feet) it may be necessary to narrow the travel lane(s) or median. It is preferable to narrow all lanes rather than simply the right hand lane

Ramp - Bike lane to sidewalk





Grade Separation(Bicycle) - Underpass 1.3.H

Purpose

- Provide continuity of access for bicyclists across barriers.
- Provide a safe, separated area for bicyclists riding in tunnels or underpasses.

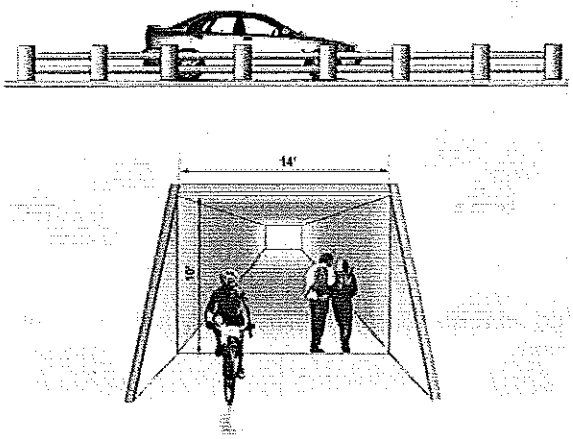
Where to use

- Existing or proposed tunnels that prevent impediment to free movement across unsurpassable barriers (ie: freeways, railways, etc.)

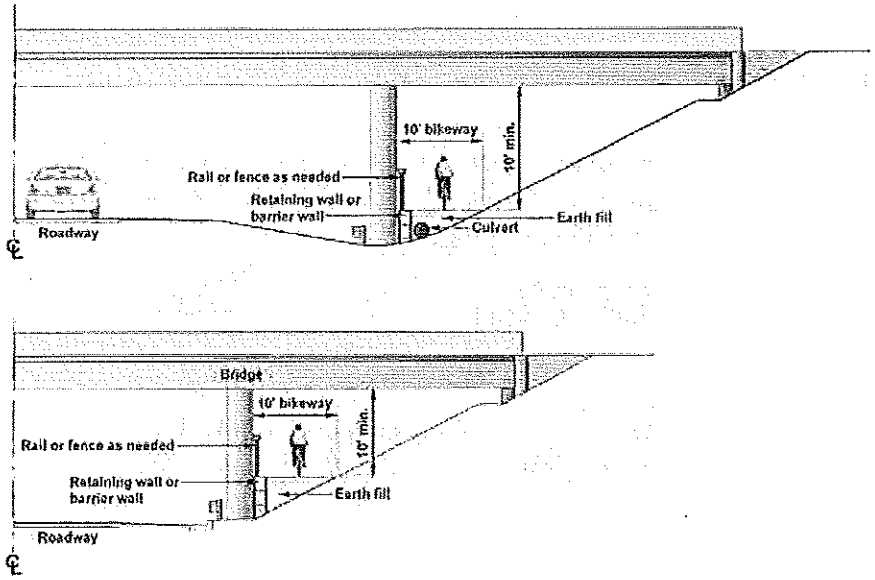
Guidelines

- As a minimum, dimensions should be as per section 1.3.D "Bike Lanes".
- Provide 2 foot or more of extra buffer space, above requirements of section 1.3.D, as necessary to account for "shy distance" from walls or other barriers.
- Clear space to overhead structures should be 10 foot minimum.
- Provide adequate lighting for security as well as viewing the road surface.
- Avoid hidden recesses and dark areas for increased security.
- Provide warnings to motorists that bicyclists are in tunnel such as bicyclist activated, flashing warning signs.
- When possible keep underpasses short as bicyclists prefer to see the end of the tunnel prior to entering.
- Air quality should be considered from bicyclists perspectives and addressed as required to maintain an acceptable level.
- Diversion of water away from tunnel, adequate drainage and non-slip surfaces are necessary to prevent water from becoming a hazard.

Grade Separation(Bicycle) - Underpass 1.3.H



Bicycle and Pedestrian Accommodation at Underpasses and Tunnels



Bikeways under Existing Bridges

www.pedbikeimages.org/Dan Burden

Drainage Grates/Utility Manholes 1.3.I

Purpose

- Stormwater management
- Provide access to utilities for maintenance.

Where to use

- Drainage grates and utility manholes installed as required for stormwater management and utility maintenance.

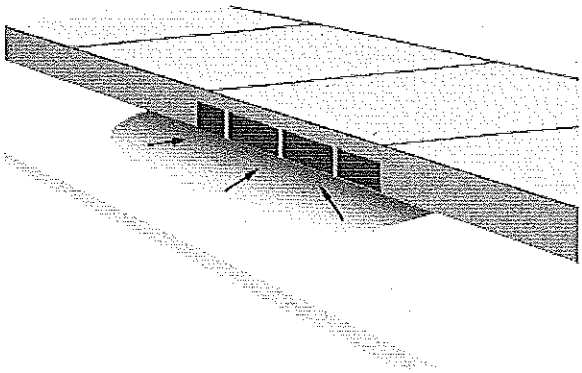
Guidelines

- Drainage Grates
  - Where possible, use curb inlets in place of surface grates.
  - If curb inlets are not possible, use bicycle safe grates or locate grates in areas outside of bike lanes or bicycle use areas.
  - Temporary measure to use non-bicycle safe grates is to weld steel cross straps or bars to grate to create 4 inch maximum openings, center to center.

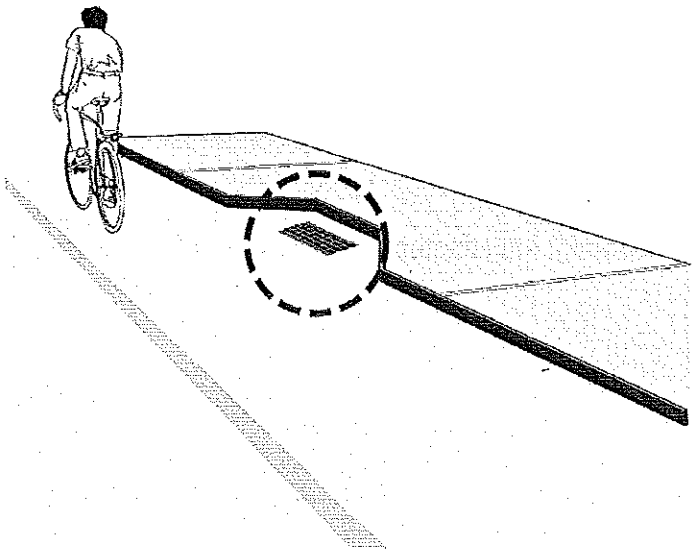
- Utility Manholes
  - Locate new utility manholes outside of bike lanes or bicycle use areas
  - If existing manholes are in bicycle use area and can not be moved, be sure that manholes and frames are bicycle safe and flush with adjacent pavement.

Drainage Grates/Utility Manholes 1.3.I

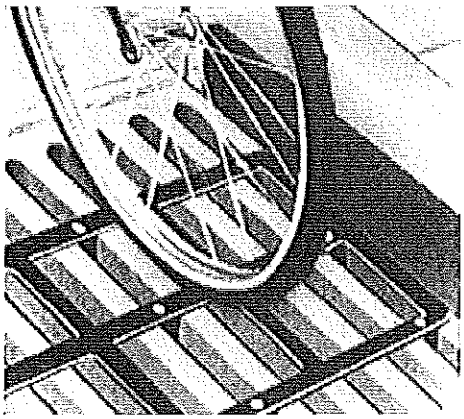
Inlet flush in the curb face

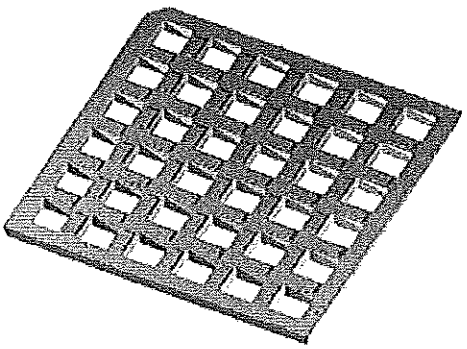


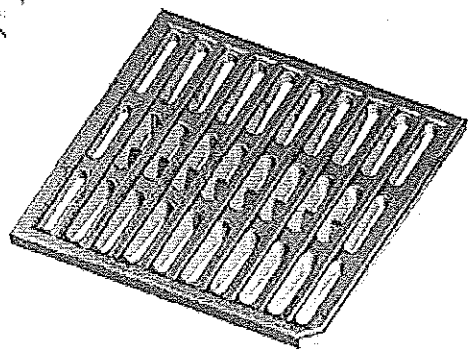
Offset drainage structure



Bike safe drainage grates







Signalization 1.3.J

Purpose

- To improve safety and access for bicyclists.
- To provide intervals in traffic stream to allow bicyclists to cross streets safely.
- Accommodate bicycle and motor vehicle traffic in dense urban areas.

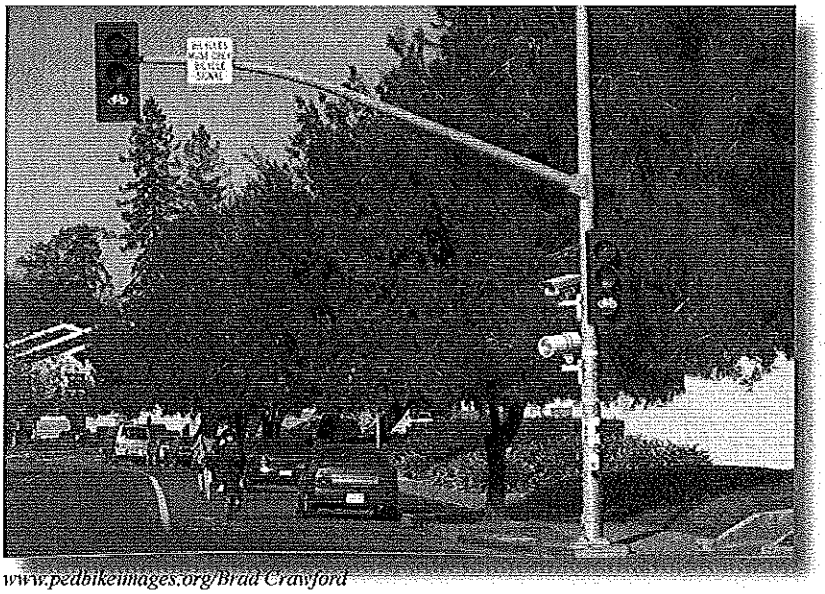
Where to use

- Roadway intersections used by motor vehicles and bicyclists.

Guidelines

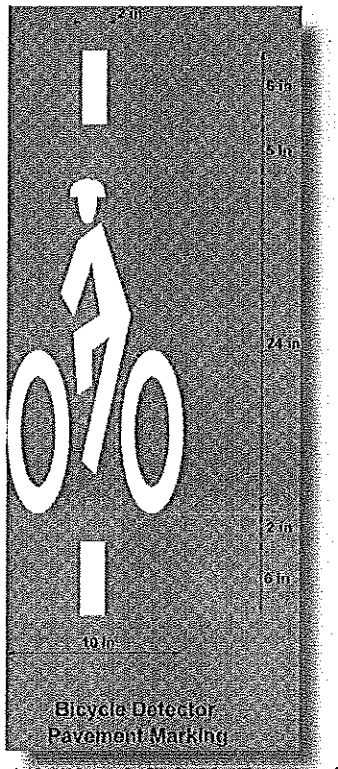
- Time downtown urban traffic signals for speeds of 12-16 mph, which allows bicycles to ride with vehicular traffic.
- In areas of high bicycle traffic, use bicycle signals to reduce conflicts with vehicular traffic. The bicycle signal provides a separate phase for bicycles and pedestrians to cross the street.
- Install bicycle activated detectors in pavement or video detectors to activate bicycle signal. Use pavement markings to direct bicyclists to optimum location to trip signal.
- Install pedestrian/bicyclist activated buttons to activate bicycle signal. Install buttons so bicyclists do not have to dismount or lean to activate.

Signalization 1.3.J

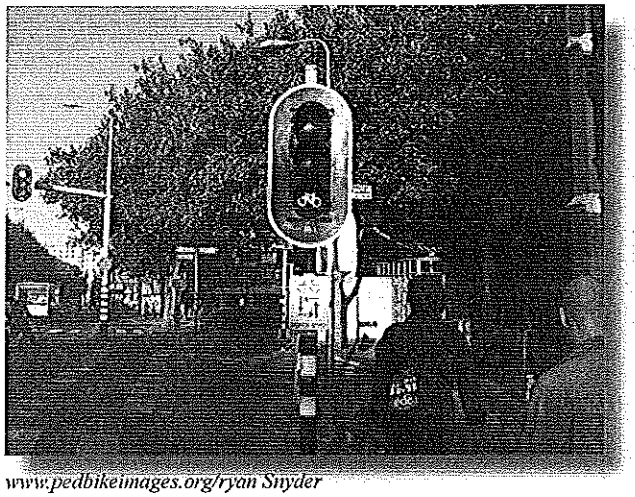


www.pedbikeimages.org/Brad Crawford

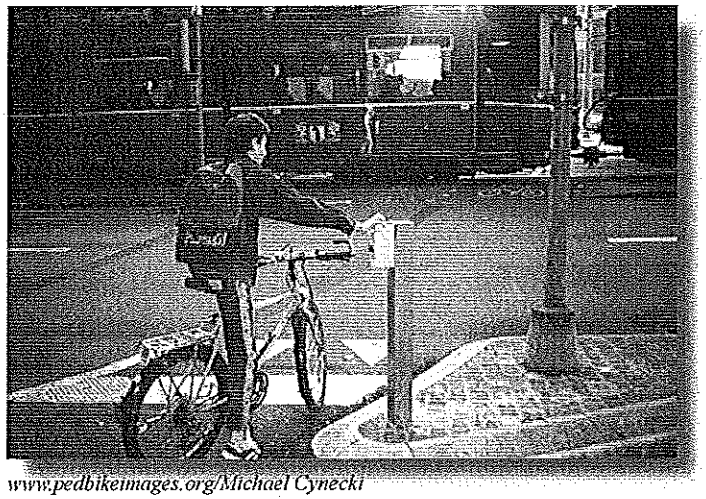
www.pedbikeimages.org/Dan Burden



AASHTO guide for hte development of bicycle facilities 1999 pg.66



www.pedbikeimages.org/ryan Snyder



www.pedbikeimages.org/Michael Cynecki

Pavement Markings 1.3.K

Purpose

- Indicates presence of a bike lane, traffic lane shared by motor vehicles and bicycles, provides information about turning and crossing movements, indicate specialized bicycle facilities.

Where to use

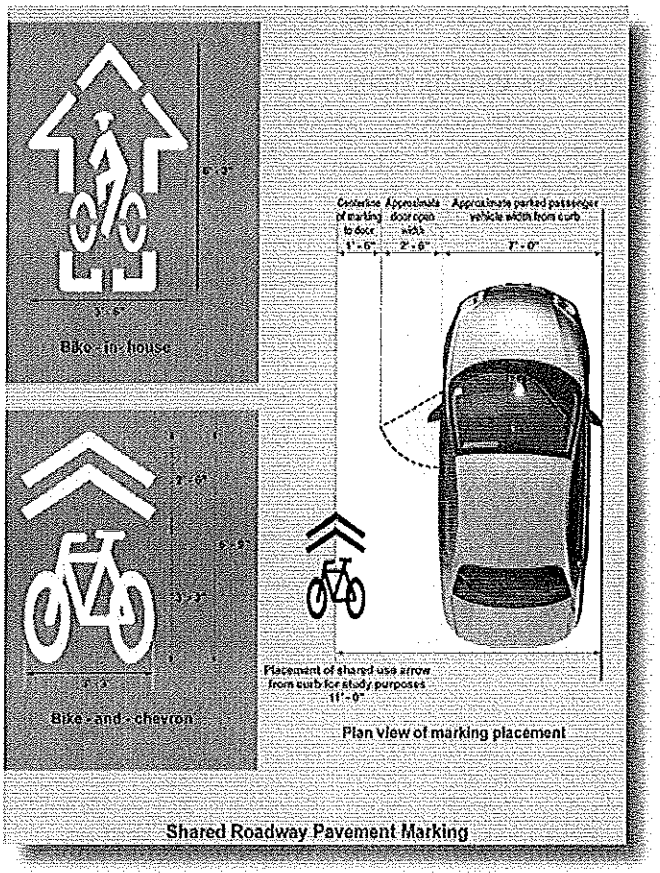
- As required.

Guidelines

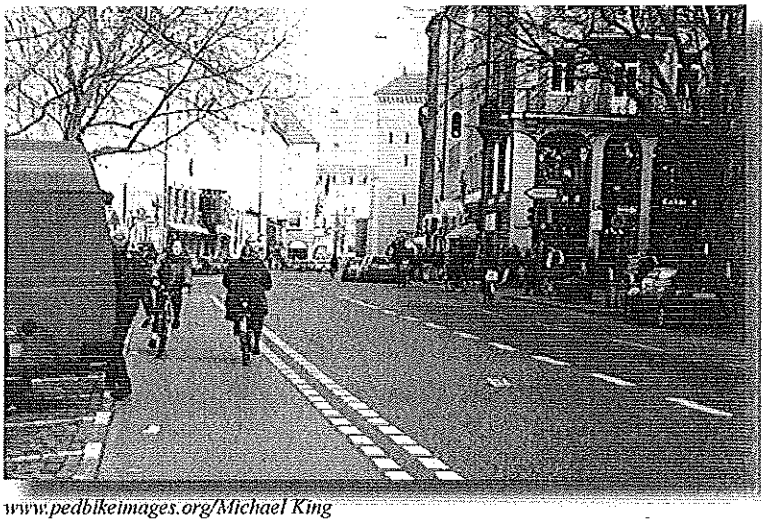
- All markings are to be white and reflectorized. All markings should be durable and non-skid.
- Place markings away from bus and truck traffic and away from driveways to increase longevity.
- Bike lane symbols should be placed on far side of each intersection. Additional markings may be placed on long, uninterrupted sections of road.
- Refer to Manual on Uniform Traffic Control Devices(MUTCD) 2003 Revisions 1 and 2 Incorporated for guidelines.

Pavement Markings

1.3.K

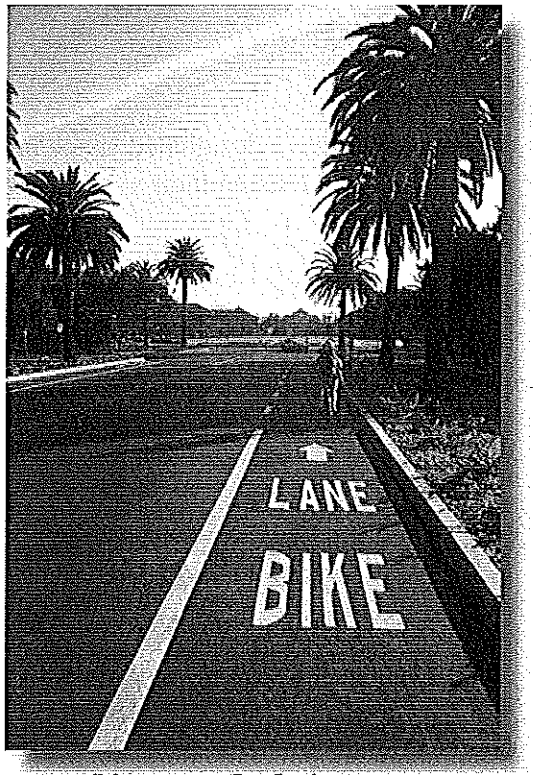


Shared Roadway Pavement Marking



www.pedbikeimages.org/Michael King

www.pedbikeimages.org/Dan Burden



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Bike Box 1.3.L

Purpose

- To prevent crashes between bicyclists going straight and vehicles turning right.
- Increase visibility and awareness of bicyclists.

Where to use

- Roadway intersections both signalized and non-signalized.

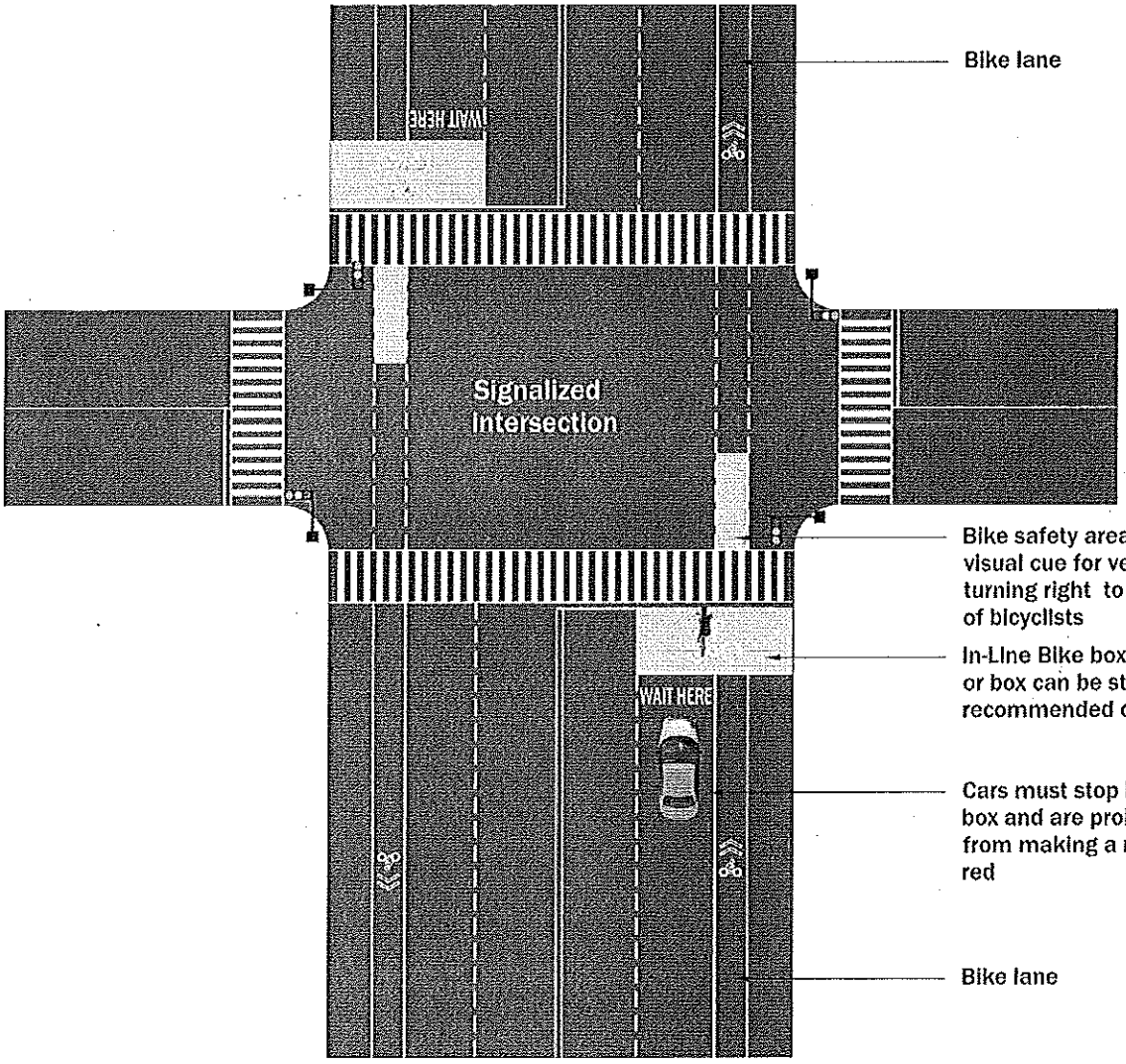
Guidelines

- Cross Street Bike Box
  - Is placed in street after crosswalk.
  - Is applicable only to left turns.
  - Facilitates two point left turn by placing bicyclist ahead of the stop line and to the left of right turning vehicular traffic.

- In-line Bike Box
  - Is located before the crosswalk but after an advanced stop line.
  - Is frequently implemented along with a bike lane so bicyclists have a designated space in which to place themselves ahead of stopped vehicular traffic, thereby increasing their visibility.
  - Prohibits right turn on red for vehicles.

Bike Box

1.3.L


WAIT HERE
Signalized Intersection
WAIT HERE
Bike lane
Bike safety area - provides visual cue for vehicles turning right to be aware of bicyclists
In-Line Bike box - color varies or box can be striped - recommended color -green
Cars must stop behind bike box and are prohibited from making a right turn on red
Bike lane

Bicycle Parking 1.3.M

Purpose

- To promote greater use of bicycles by providing convenient and secure bicycle parking at destinations.

Where to use

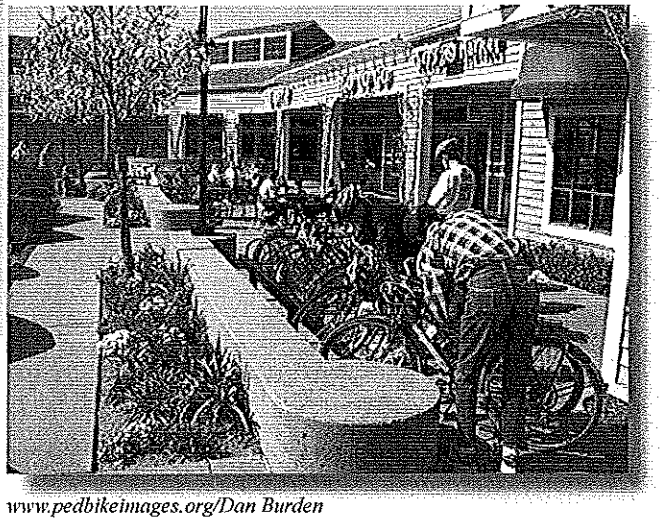
- Destination locations
- Transit centers
- Downtown shopping districts
- Public buildings

Guidelines

- Perform a user survey and/or assess where bicycles are currently parking illegally due to lack of facilities to determine appropriate bicycle parking locations.
- Bicycle parking locations should be in highly visible locations for security and ease of use.
- Bicycle parking areas should be convenient to building entries and street access but out of major pedestrian ways.
- Provide site lighting for safe night time use.
- Protect bicycle parking areas from weather when possible. Building overhangs and covered walkways are some possibilities.
- Separate bicycle parking areas from roads and vehicle parking areas with space and physical barriers to deter theft and minimize conflicts with vehicles.
- Short term parking can be provided with hitching post type structures. Long term parking can be provided with bicycle lockers.

Bicycle Parking 1.3.M

www.pedbikeimages.org/Michael King



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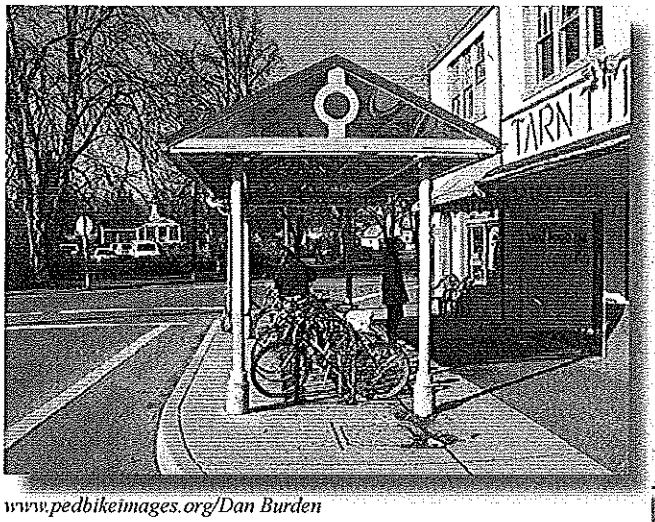
Bicycle shelter



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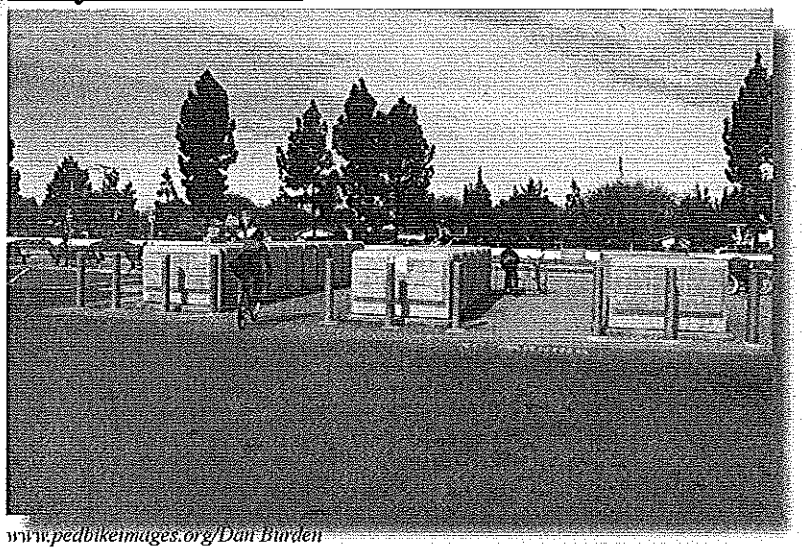
Bicycle lockers



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On-Street Parking 1.3.N

Purpose

- To provide vehicular parking adjacent to bicycling facilities that will be safe for bicyclists and convenient for motor vehicle users.

Where to use

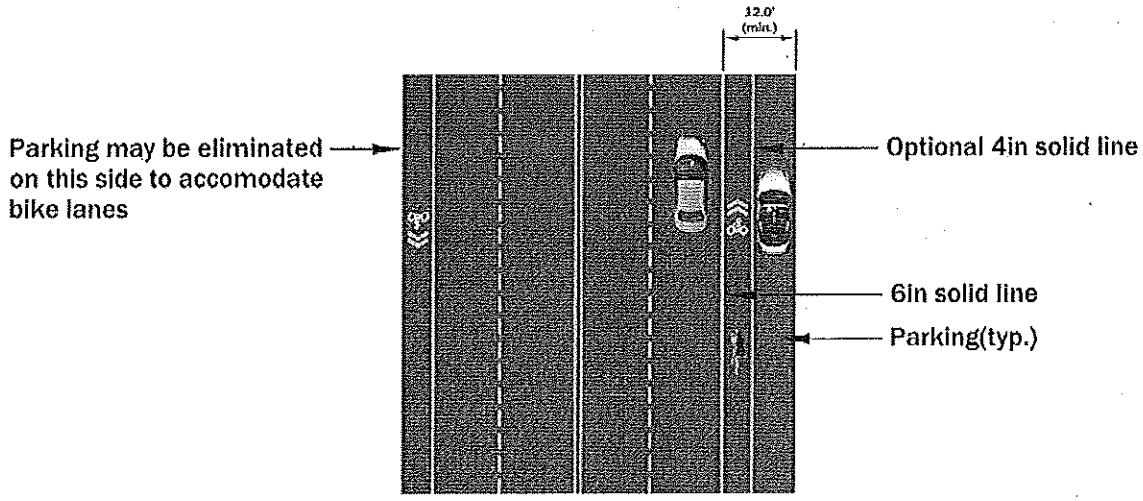
- Urban roads
- Bicycle boulevards
- Shared use roads

Guidelines

- Provide minimum of 12 foot wide combined bicycle travel way and parking space to minimize issues with opening doors, vehicles entering/leaving spaces and extended mirrors.
- Parallel parking is the preferred arrangement for bicycle routes.
- Elimination of parking on one side of road will provide available road space for bicycles.

On-Street parking

1.3.N



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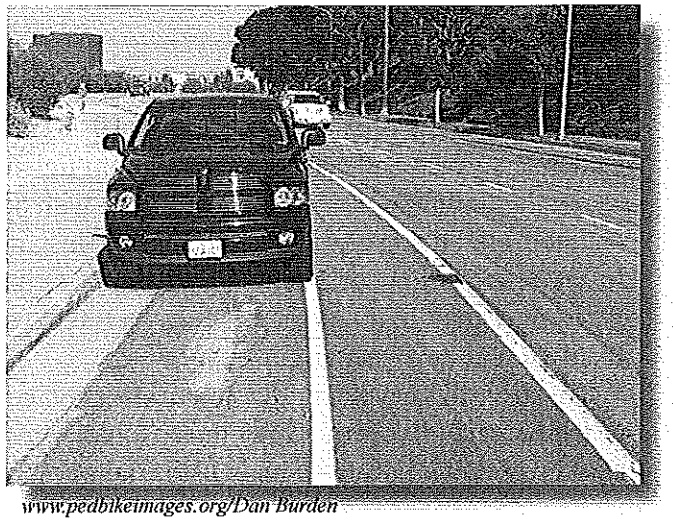

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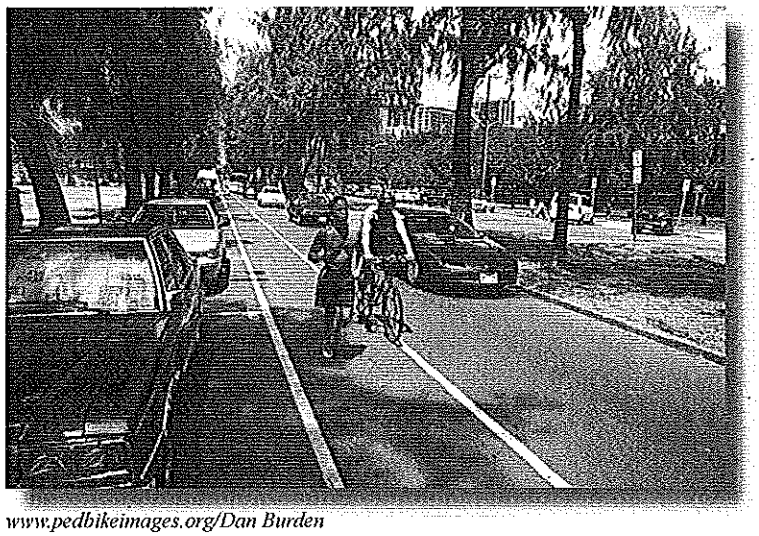

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Pavement Surface of Bicycle Lanes 1.3.O

Purpose

- Provide bicyclists with a smooth, stable and safe surface to ride on.

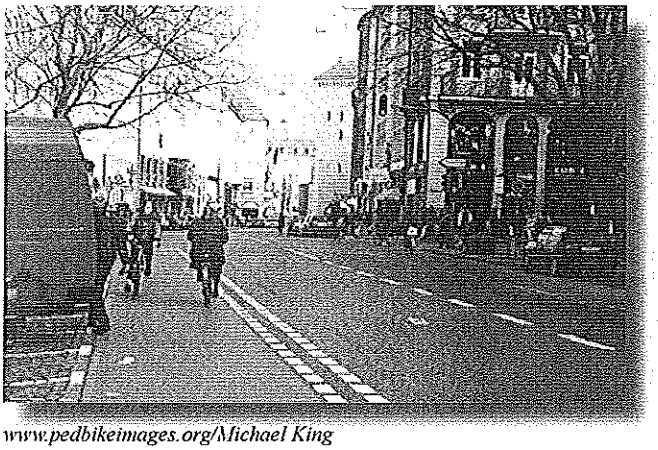
Where to use

- All situations

Guidelines

- Preferred surface is hard, all weather surface such as asphalt or concrete.
- Concrete surface paths should have broom finish surfaces.
- Maintain drain grates and manholes level with adjacent pavement. Drain grates to be bicycle safe, manholes to be non-skid. Where possible, install grates and manholes away from main route of travel.
- Install reflective raised markers and rumble strips outside of the bicyclists travel way.
- Perform regular maintenance checks on travel way to identify hazards, warn users and promptly repair.
- Institute regular sweeping of travel way.
- When repairing pavement due to construction consideration should be given to repairing the entire width of the bicycle travelway rather than a smaller narrow strip that is parallel to the bicycle travel way which could result in a hazard to bicyclist if the pavement is uneven.

Pavement Surface of Bicycle Lanes 1.3.O



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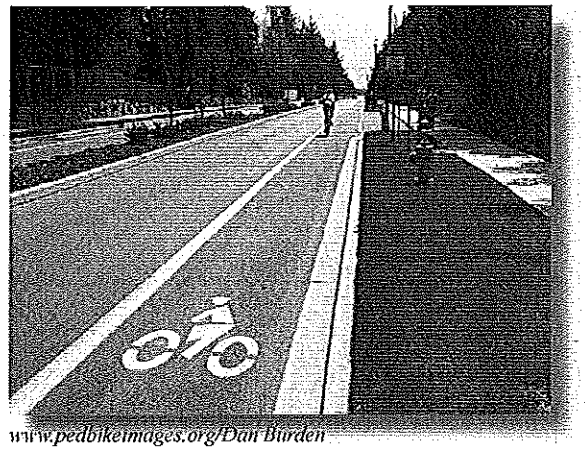

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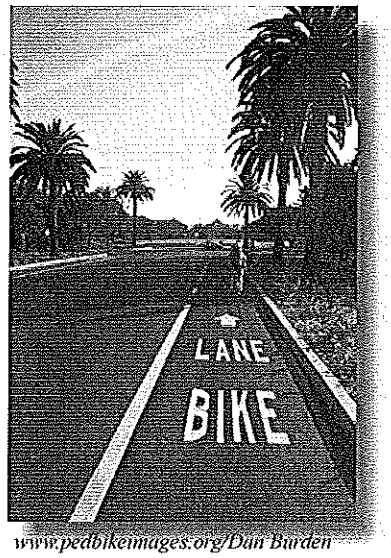

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www.pedbikeimages.org/Michael King

www.pedbikeimages.org/Michael Cynecki

Signage 1.3.P

Purpose

- To provide warning and regulatory messages, directional information and increase motorists awareness of bicyclists on road.

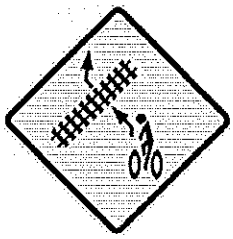
Where to use

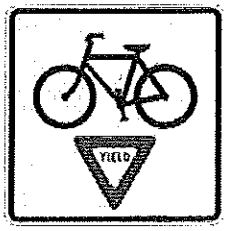
- Shared roadways
- Intersections

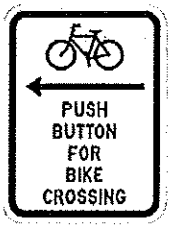
Guidelines

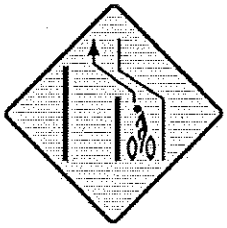
- Signs can improve safety and ease of use if used correctly. Avoid overuse and sign clutter which tends to distract and results in non-compliance.
- On streets with considerable bicycle through traffic, consider eliminating or reducing "right on red turns" to improve safety and traffic flow.
- Use "share the road" signs to alert motorists to the presence of bicyclists and that they have the legal right to use the road.
- Refer to the Manual on Uniform Traffic Control Devices(MUTCD) 2003, revisions 1 and 2 Incorporated for guidelines.

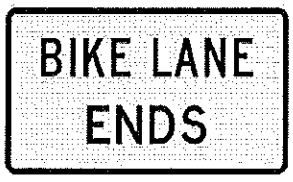
Signage - Examples

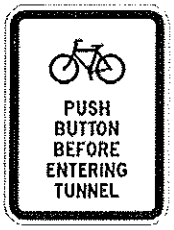












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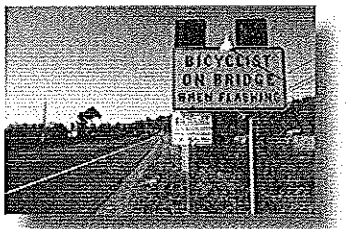

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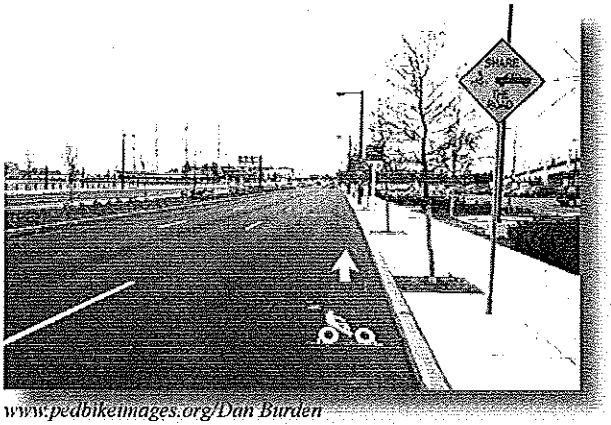

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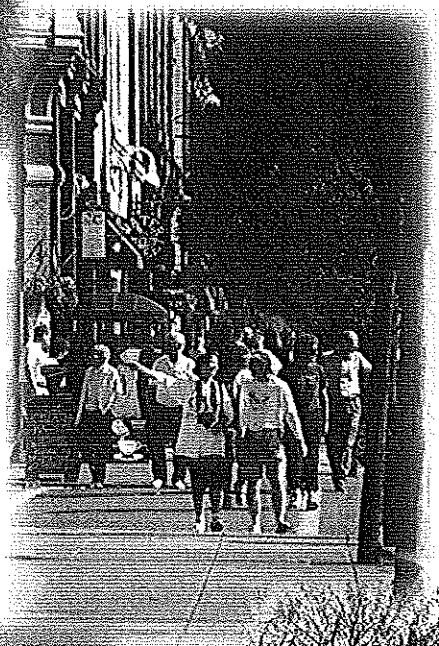
www.pedbikeimages.org/ITE pedestrian Bicycle Council

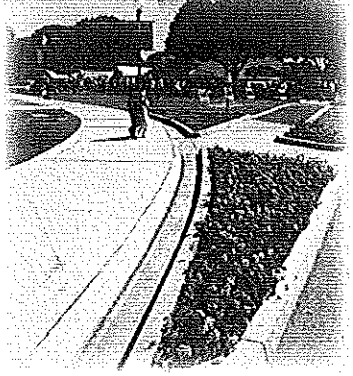
Pedestrian Facility Description 1.4

PEDESTRIAN FACILITY DESIGN

Pedestrian facilities are separated areas specifically for pedestrian use. Pedestrian facilities must be of an adequate size and having a smooth, stable surface adequate for pedestrians to easily travel between destinations. People walk for many reasons health, enjoyment of the outdoors, to get to school or work and to run errands are just a few reasons for people to walk to their destination.

One of the many responsibilities of government is to provide these pedestrian facilities for the use of its citizens and visitors. By providing convenient, safe and accessible pedestrian facilities the public agency is encouraging healthy lifestyles, environmental responsibility and creating a way for people to interact with each other. Increased community pride, a more active downtown area and fewer motor vehicles on the road are just a few of the benefits of a well thought out pedestrian facility plan. Additional but secondary benefits are traffic calming, additional or new gathering areas, increased demand for services and retail stores which will lead to increased tax revenue, reduction of blighted and unused areas in town and an increase in visitors to the area. All in all, improving pedestrian facilities is a win-win situation for everyone.





www.pedbikeimages.org/Dan Burden(All photos on this page)

Sidewalk Design 1.6.A

Purpose

- To improve pedestrian safety by providing appropriate facilities for walking within the public right of way.

Where to use

- Urban roads
- Suburban roads
- Rural Roads

Guidelines

- Sidewalks must be firm, stable and slip resistant.
- New sidewalks and sidewalks being repaired should conform to ADA compliant standards.
- Sidewalks are typically paved (concrete, asphalt, etc) however, crushed stone or gravel may be used if stable.
- Sidewalks should be 5 feet wide minimum, wider in areas near schools, transit stops or other areas with high concentration of pedestrians.
- Provide a buffer zone 4'-6' wide between sidewalks and the street. Buffer zone can be a bicycle lane, row of parked cars, planted strip, rain garden or street furniture zone.

Sidewalk Design

1.6.A

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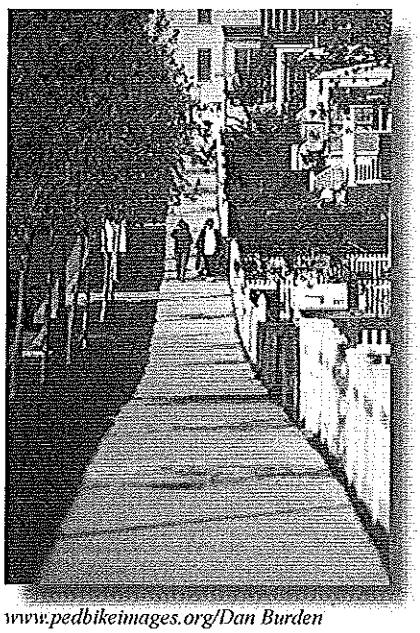

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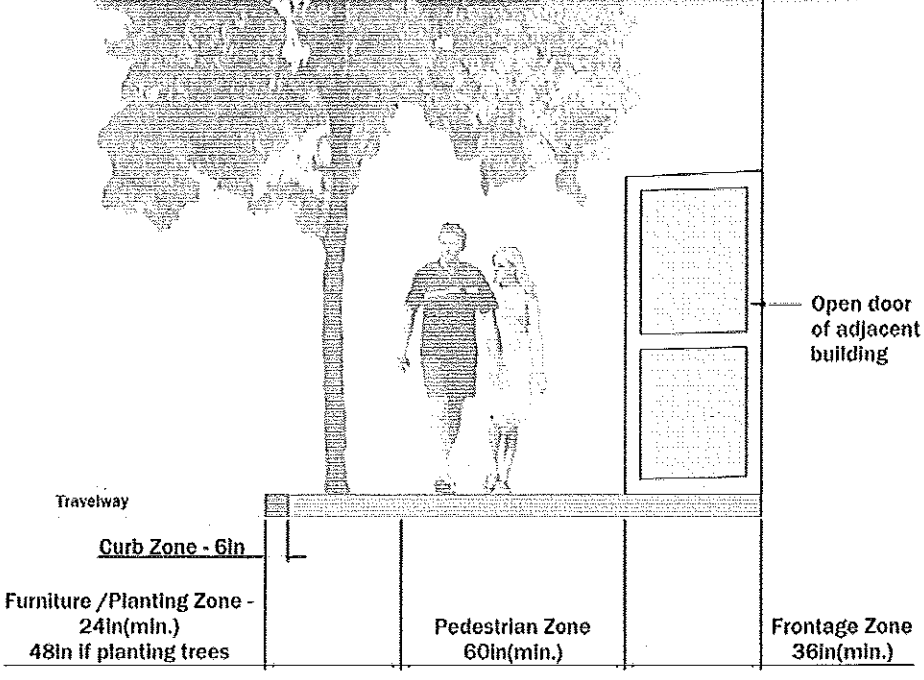


Curb Extensions/Neckdowns/Bulbouts 1.6.B

Purpose

- To increase the safety of pedestrians and motorists at intersections by shortening the crossing distance, increasing visibility and reducing motor vehicle speed. Will encourage pedestrians to cross at designated locations and prevent vehicles from parking on the corner.

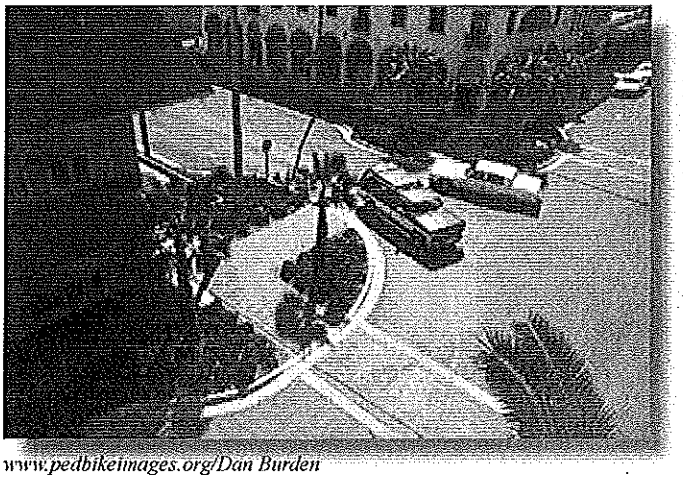
Where to use

- Urban roads
- Suburban roads

Guidelines

- Only use curb extensions where on street parking exists.
- Curb extensions must not encroach on travel lanes, shoulders or bicycle lanes.
- Curb extensions should not extend more than 6 feet from the curb.
- Be sure to consider turning radius of larger vehicles in design.
- Curb extensions can provide space for rain gardens, street furniture and curb ramps. Ensure that nothing obstructs sight lines of pedestrians or vehicles.

Curb Extensions/Neckdowns/Bulbouts 1.6.B



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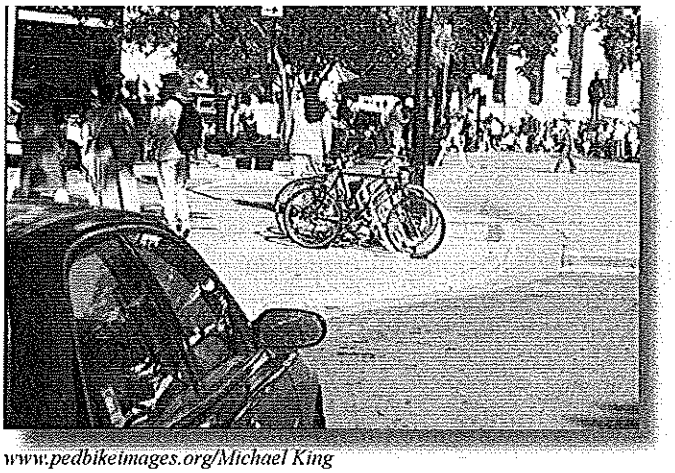

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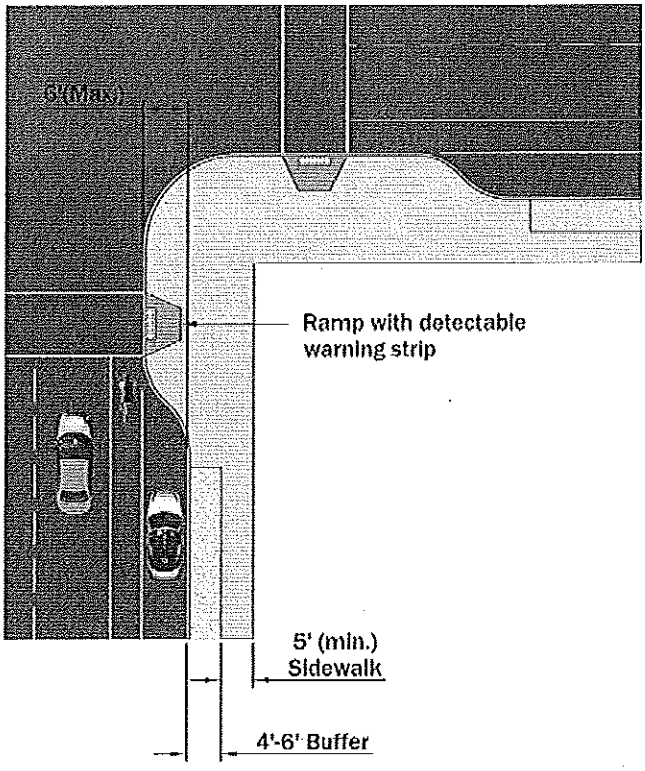
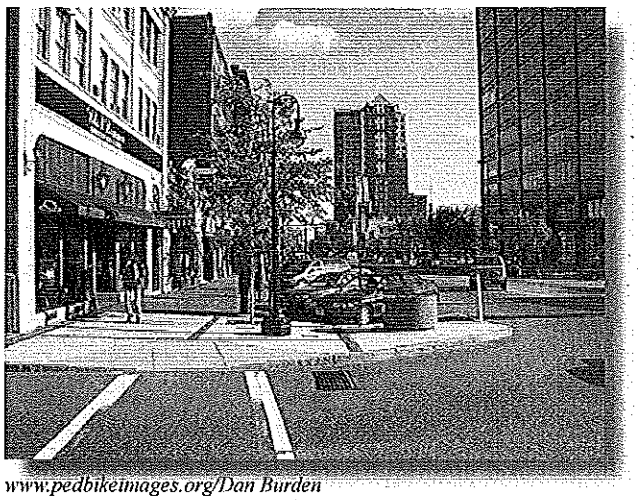




www.pedbikeimages.org/Dan Burden

Curb Ramps/Landings 1.6.C

Purpose

- To provide handicap accessible routes at street crossings.

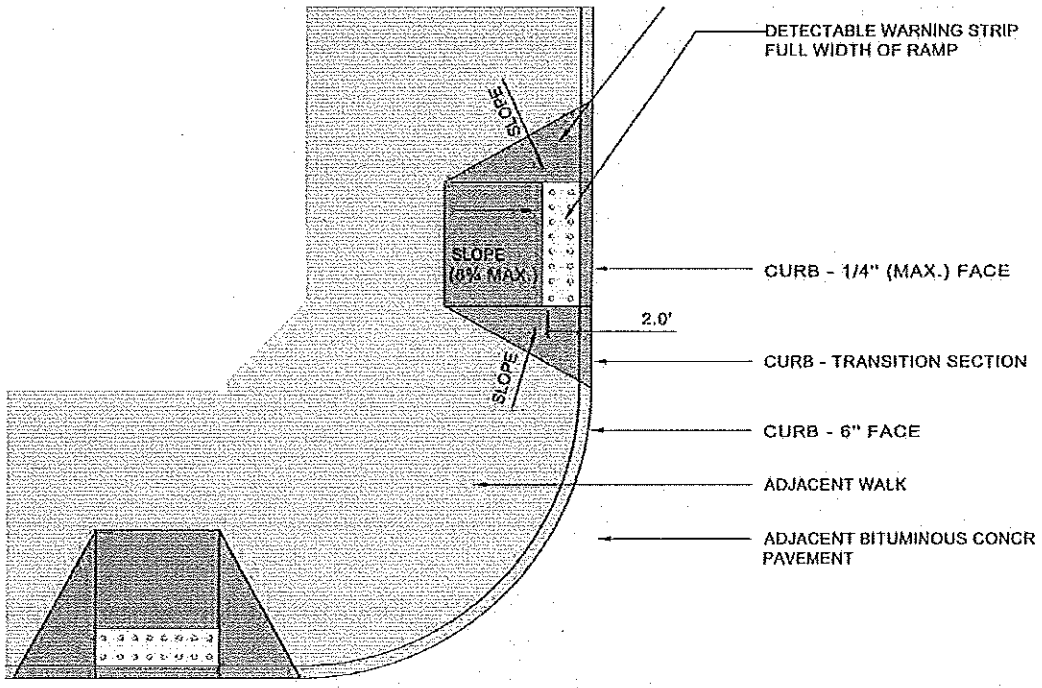
Where to use

- All intersections and mid-block crossings
- Downtown areas
- Transit centers and stops
- Schools
- Parks

Guidelines

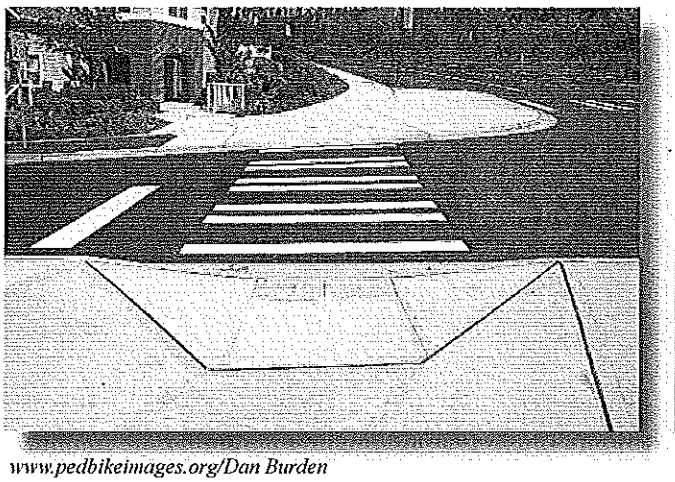
- Curb ramps must be 36 inches wide (minimum) with a maximum slope of 1:12 or 8.3%
- Side flares to have maximum slope of 1:10 or 10%
- Install tactile warning pads at all ramps as required.
- Separate curb ramps should be installed for each crosswalk, instead of one ramp at the corner.
- Review current Americans With Disability Act requirements for additional information.

Curb Ramps/Landings 1.6.C



TYPICAL CURB RAMP INSTALLATION

NOT TO SCALE



www.pedbikeimages.org/Dan Burden

www.pedbikeimages.org/Carl Sundstrom

Raised Median/Refuge Island 1.6.D

Purpose

- Provide a place of refuge for pedestrians crossing a street. Manage vehicular traffic by encouraging slower speeds and providing left hand turning pockets at desired locations. Excellent locations for landscaping and alternative stormwater management practices.

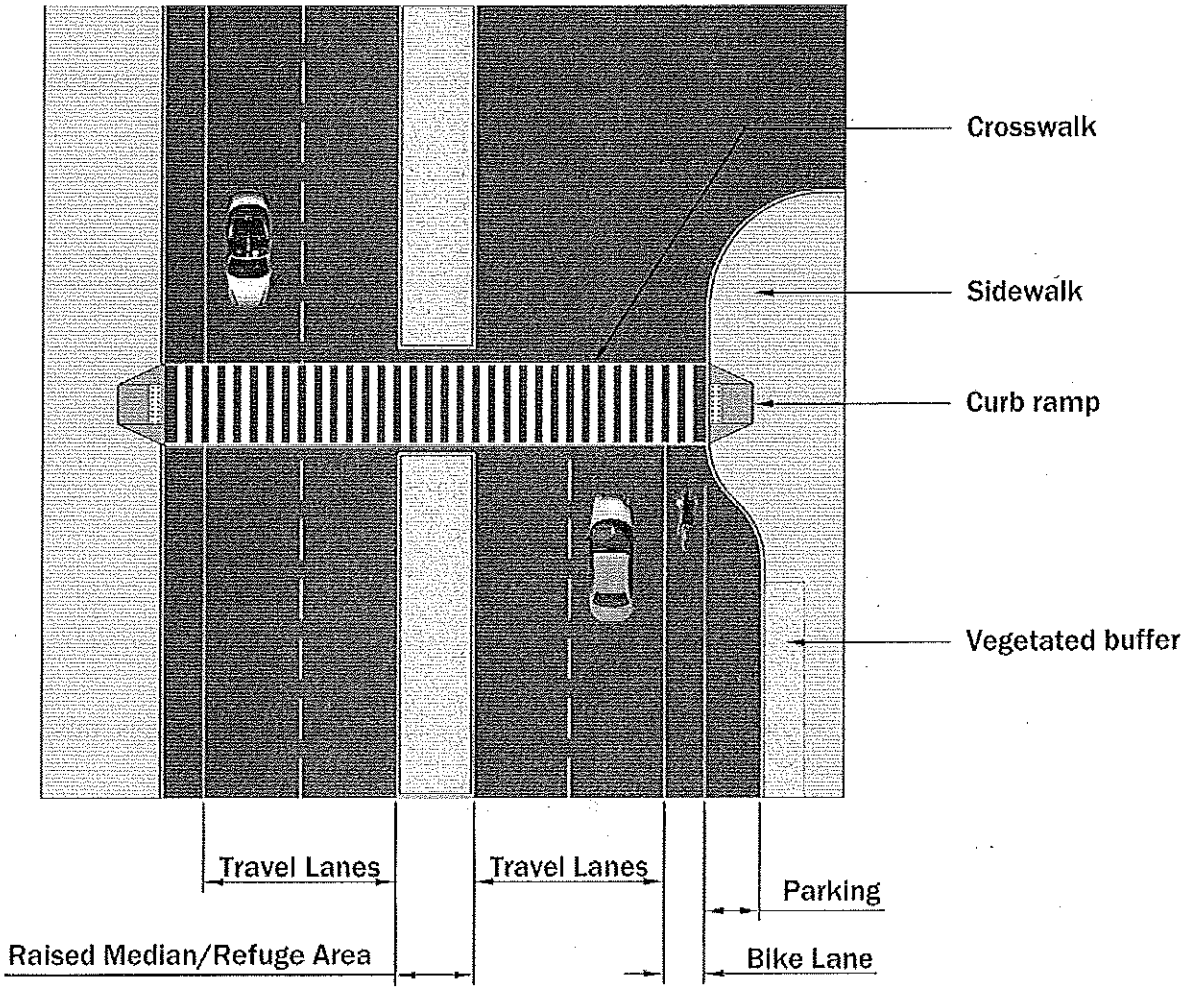
Where to use

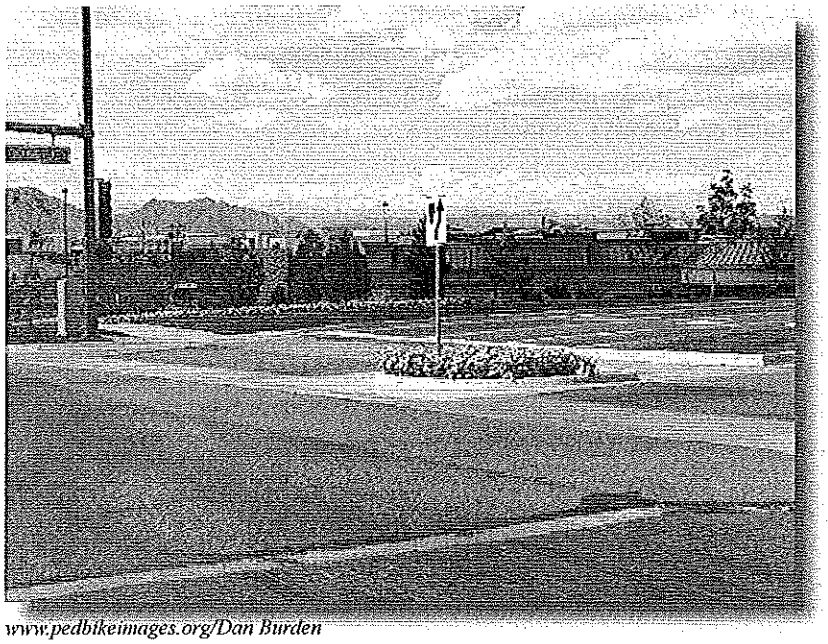
- High volume/high speed roads

Guidelines

- Provide adequate and appropriate left turn pockets so that motorists do not move to inappropriate routes (residential areas, etc).
- Ensure landscaping does not obstruct view of motorists or pedestrians.
- Provide curb ramps where necessary.
- Use medians as bio-filter and rain garden locations to aid in treating runoff from roadway.
- Use of Belgian Block or granite curbing and decorative lighting, where permitted, will add to the character of the street and works particularly well in downtown areas.
- Median refuge areas may either be cut through the median or curb ramps may be installed on either side of the median at the crosswalk.

Raised Median/Refuge Island 1.6.D





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Crosswalk Treatment 1.6.E

Purpose

- Indicate preferred crossing locations for pedestrians and warn motorists to expect pedestrian crossings.

Where to use

- In convenient locations for pedestrians or preferred routes
- Intersections
- Mid-block crossings

Guidelines

- Crosswalks are most effective when used with other measures such as curb extensions, raised medians, roadway narrowing, traffic signals, etc.
- Crosswalks should be enhanced with additional measures when:
  - Speed limit exceeds 40 mph.
  - On a roadway with 4 or more lanes without a crossing island or raised median that has an ADT of 12,000 or greater.
- Enhancements may include but are not limited to plantings, bollards, decorative lighting, trees, etc. Ensure that enhancements do no block sight lines.
- Locate bus stops on far side of crosswalk to maintain line of sight for pedestrian and motorists.
- When using marked crosswalk on uncontrolled multi-lane roads, consider installing a stop bar 30 feet ahead of crosswalk with a "Stop Here for Crosswalk" sign.
- Place crosswalks to include any curb ramps.
- Consider decorative techniques for crosswalks such as stamped asphalt, pavers or stamped concrete with a reflective outline on both sides of the decorative pavement. Ensure that chosen material is smooth, non-slippery and visually contrasting or reflective. Review proposed technique with appropriate governing agency prior to use.
- Typical crosswalk width is 10'-19'.

Crosswalk Treatment 1.6.E

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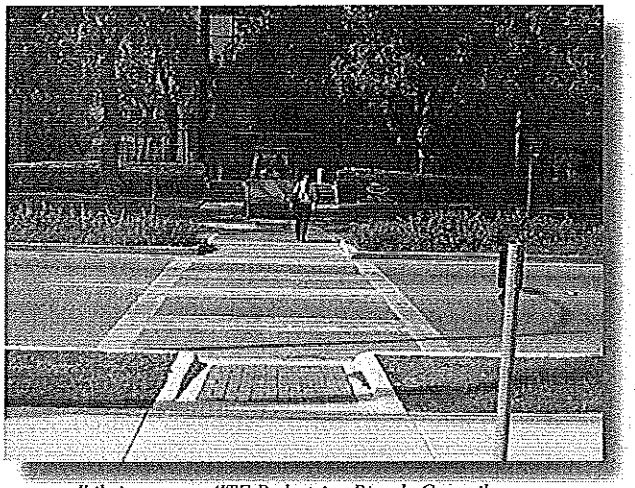
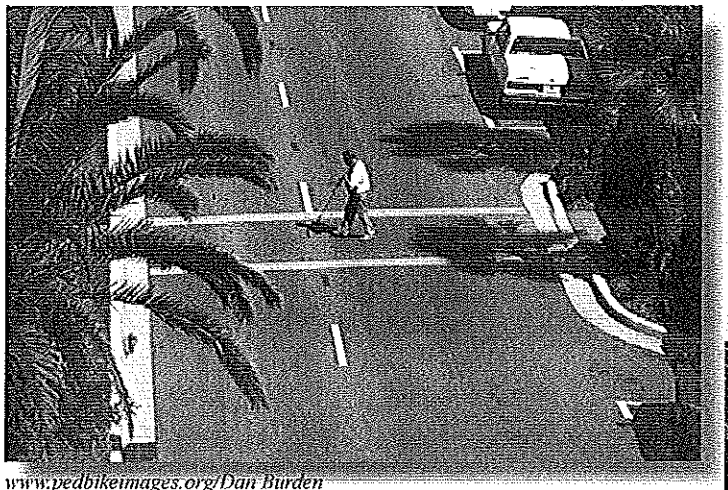


www.pedbikeimages.org/ITE Pedestrian Bicycle Council



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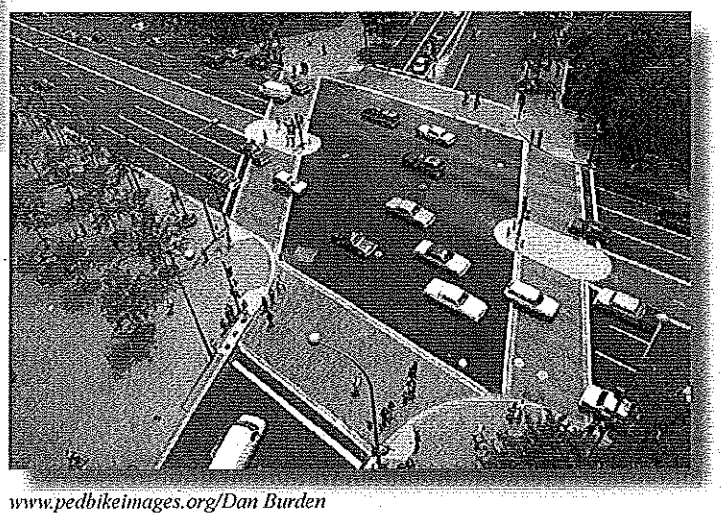

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Raised Pedestrian Crossing 1.6.F

Purpose

- Enhance pedestrian safety and movement by reducing vehicle speeds.

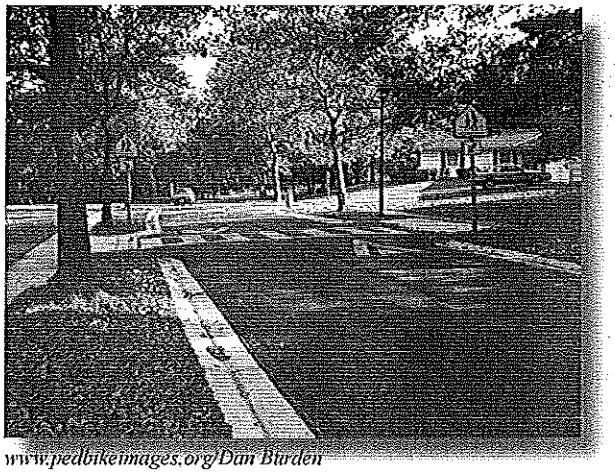
Where to use

- Intersections of streets that are not major bus or emergency vehicle routes.
- Mid-block crossings
- Not for use on high traffic/high speed roads, steep grades or on sharp curves.

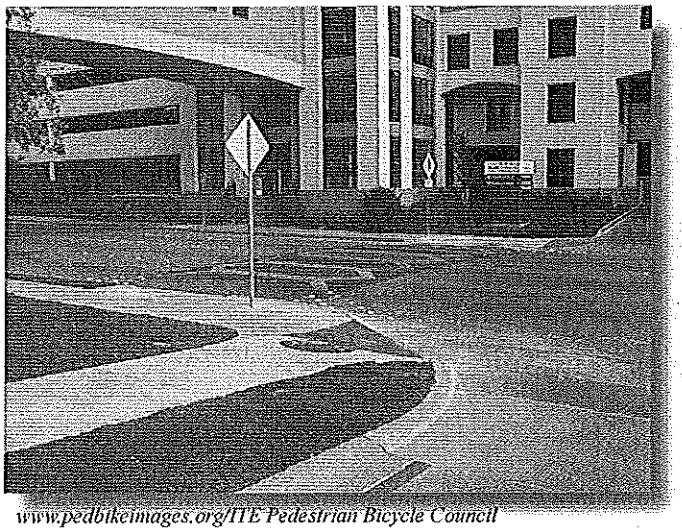
Guidelines

- Finished grade of road pavement is raised to elevation of sidewalk to give priority to pedestrian and eliminate need for curb ramps.
- Road pavement 'ramps' up to elevated section at each approach.
- Install detectable warnings to mark boundary of road and sidewalk for pedestrians.

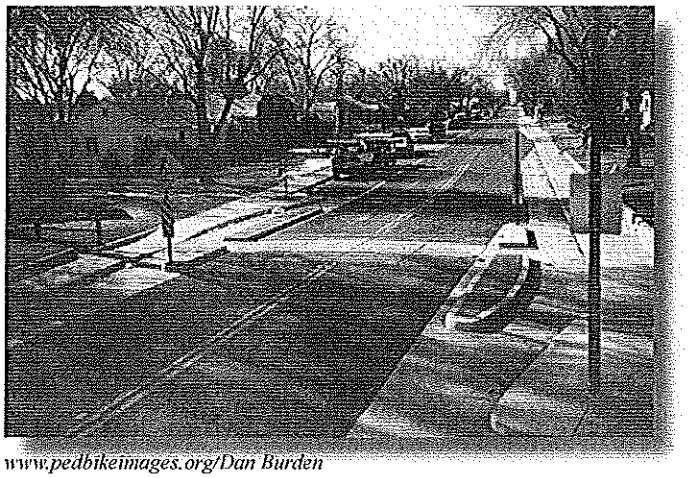
Raised Pedestrian Crossing 1.6.F



www.pedbikeimages.org/Dan Burden



www.pedbikeimages.org/ITE Pedestrian Bicycle Council



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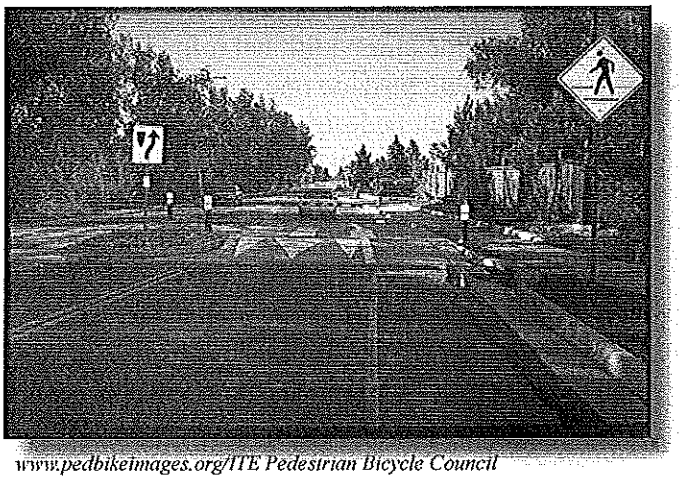
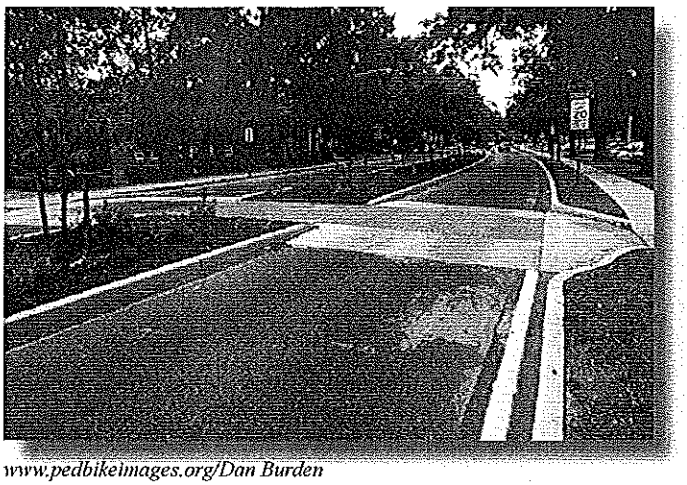


www.pedbikeimages.org/ITE Pedestrian Bicycle Council



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Pedestrian Signal 1.6.G

Purpose

- Alerts pedestrians to the appropriate times to cross the street as well as provides for a pedestrian clearing interval.

Where to use

- All locations with traffic signals when warranted by the Manual on Uniform Traffic Control Devices(MUTCD) 2003, revisions 1 and 2, Incorporated.

Guidelines

- Use of the international pedestrian symbol is preferred to "Walk/Don't Walk".
- Install signals in locations that are visible to pedestrians for entire time in crosswalk.
- When supplementing signal with an audible message, consider the noise effect on the surrounding area.
- Install pedestrian push buttons within easy reach of all pedestrians. Refer to "Americans With Disability Act" guidelines for additional information.
- When possible provide one walk interval for each cycle.
- In areas of high pedestrian volumes, as determined by a traffic engineer, consider the use of a "pedestrian scramble" or "exclusive pedestrian signal/phase" which provides an exclusive pedestrian crossing phase with no conflicting vehicle traffic.
- Fixed-time signal operation is preferred for ease of pedestrian service.
- Use of a "leading pedestrian interval" (LPI) gives the pedestrian several seconds lead time before the motor vehicles are given a green light, increasing safety by making the pedestrian more visible.
- Other signal options are the High Intensity Activated crossWalk(HAWK) system which is controlled by the pedestrian and controls the signal light and an Accessible Pedestrian Signal(APS) which provides pedestrian information in a non visual form such as audible tones, verbal messages and/or vibrating surfaces.

Pedestrian Signal 1.6.G

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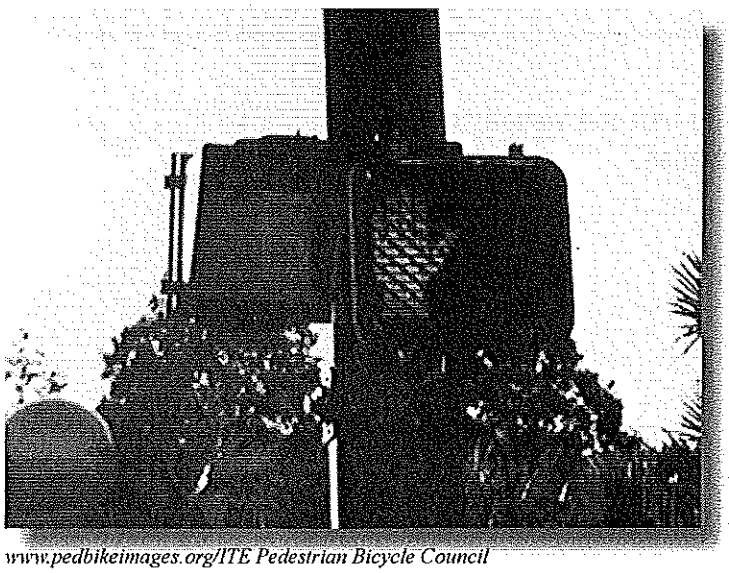
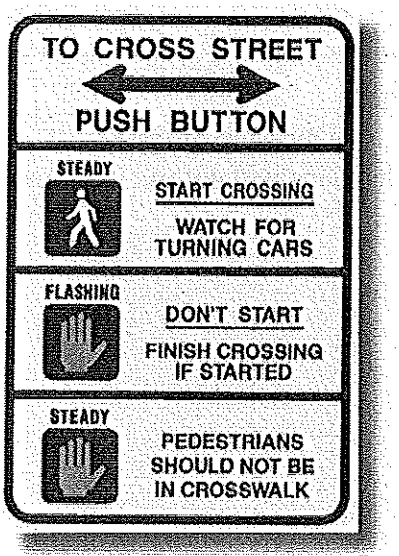


www.pedbikeimages.org/ITE Pedestrian Bicycle Council



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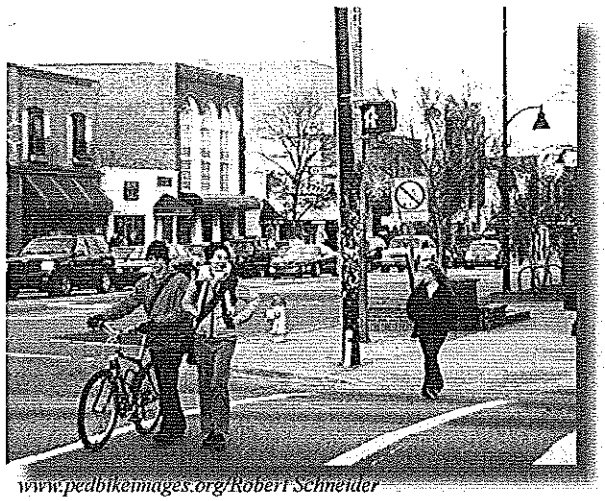


www.pedbikeimages.org/Robert Schneider

Grade Separation(Pedestrian)-Overpass/Underpass 1.6.H

Purpose

- Provide pedestrian crossing, separate from motor vehicle traffic, when no other facility is available.

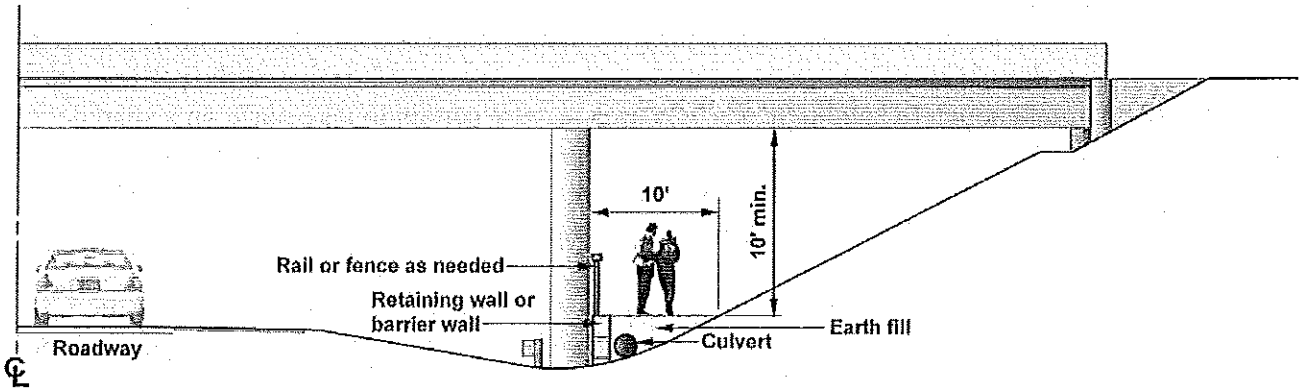
Where to use

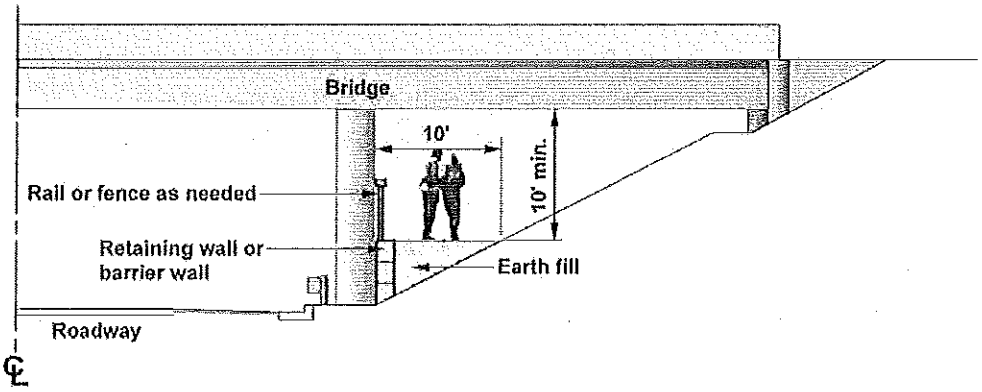
- Over/Under high speed/high volume roads, railroad tracks or natural barriers

Guidelines

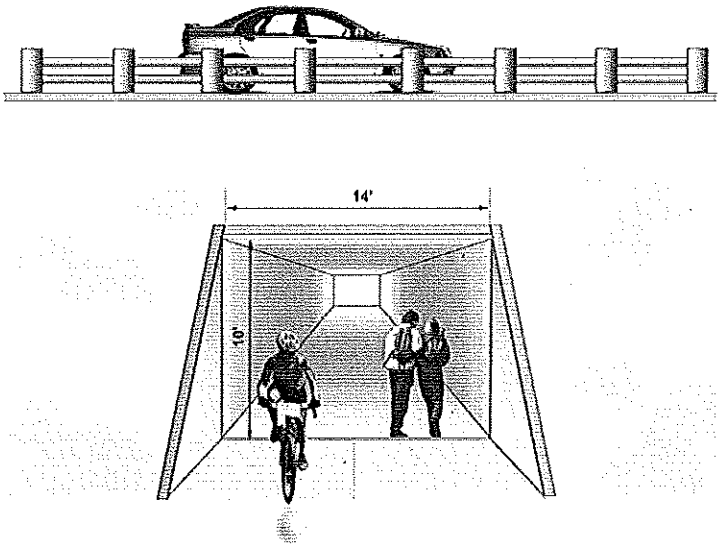
- Use as a measure of last resort. Typically very high cost and visually obtrusive.
- Pedestrians will not use if a more direct route is available.

Grade Separation(Pedestrian)-Overpass/Underpass 1.6.H





Bikeways under Existing Bridges



Bicycle and Pedestrian Accommodation at Underpasses and Tunnels

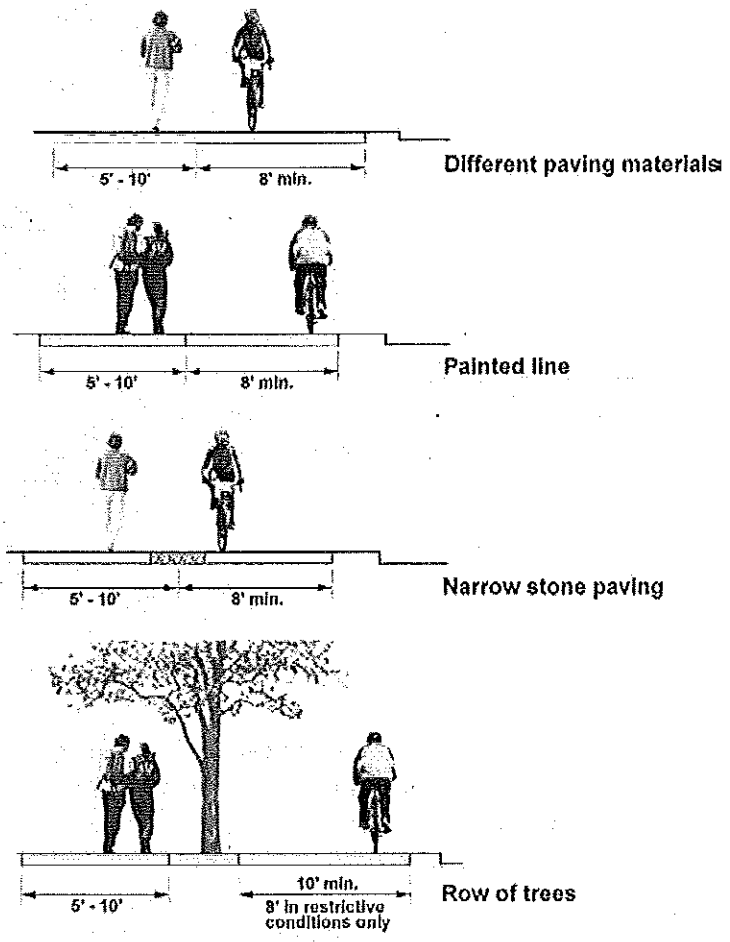
Shared-Use Pathway Description 2.1

Shared use paths provide safe, convenient access to pathways for recreation, commuting and exercise for a number of different users. Bicyclists, pedestrians, skaters, joggers, maintenance and emergency service vehicles are all possible users of a shared use path. This variety of users calls for a pragmatic design of the pathway so that it is large enough and strong enough to handle the various uses that are certain to take place on a shared use trail. In order to maximize its use, a shared use path must be connected to the street network and local destinations as well as take advantage of the natural beauty of the area. A shared use path will never take the place of on-street facilities as it will not have the access to these destinations that on-street facilities will.

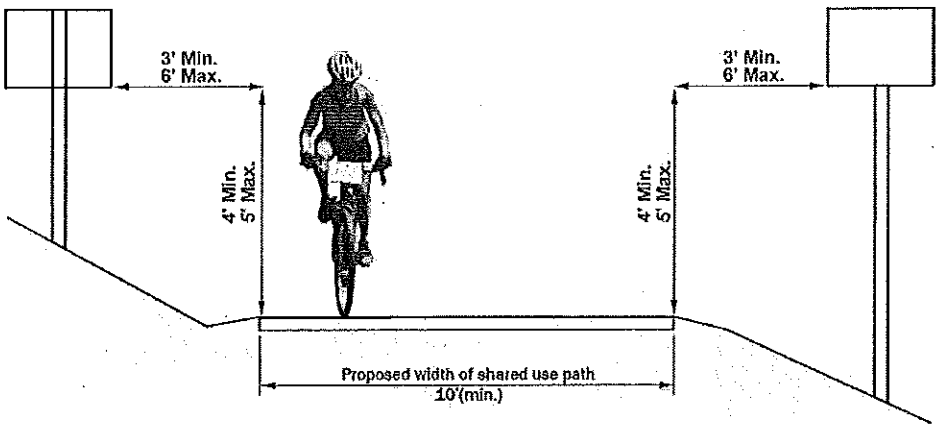
Along with good design practices, an education program may be necessary to promote correct usage of the shared use path and good behavior when sharing the path with diverse users. Appropriate signage and handouts at trail heads can go a long way towards educating the public. Intersection design is one of the biggest challenges when designing a shared use path and one must carefully plan for safe crossings of highways, railroads and other shared use paths.

While many bicyclists will always gravitate towards on street facilities based on their skill level and desired destination, novice bicyclists, hikers and those looking for a more serene trip will appreciate the calmer atmosphere, larger buffers to vehicular traffic and scenic views that are prevalent with shared use pathways.

Shared Use Paths



Typical Path Cross Sections for Pedestrian and Bicycle Traffic Separation



Typical Shared Use Path Cross Section with Sign Placement

AASHTO guide for hte development of bicycle facilities 1999 pg.35

Pavement Treatment of Shared Use Paths 2.2.A

Purpose

- Provide a safe, stable surface of adequate size to accommodate the intended users of the path.

Where to use

- Shared use path
- Areas where off road recreational or community opportunities are desired
- To connect destinations that are inaccessible for bicyclists via the regular road network

Guidelines

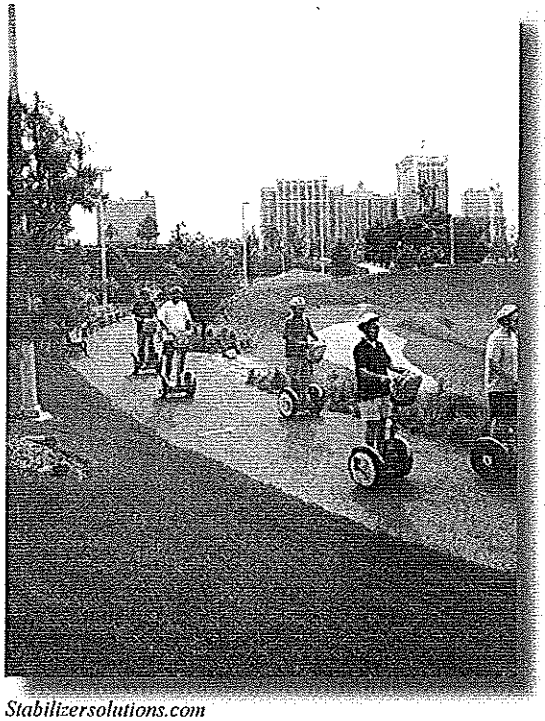
- Surface should be hard, stable, non-slip material such as asphalt or concrete. Stabilized gravel is acceptable but not preferred.
- Design shared use paths for occasional emergency vehicle or maintenance vehicle use. A minimum width of 10 feet will provide additional maneuvering room for bicyclists and lessens edge damage to pavement. - increase to 12 feet or more in areas of heavy use or mixed uses.
- For maximum use, path should be connected to the street network designations.
- Paths should be designed for bi-directional movement.
- When designing pavement cross-section, include occasional use of path by maintenance vehicles and emergency vehicles.
- Unpaved shared use paths should have a paved apron installed that extends 3 feet minimum from the edge of intersecting road.
- Crushed aggregate and stabilized earth paths will provide a lower level of surface however, construction costs are typically less.
- Advantages of a crushed aggregate path are that skaters are discouraged and bicycle speeds are lower making multi-use paths more comfortable for other users.

Pavement Treatment of Shared Use Paths 2.2.A

Bituminous Concrete

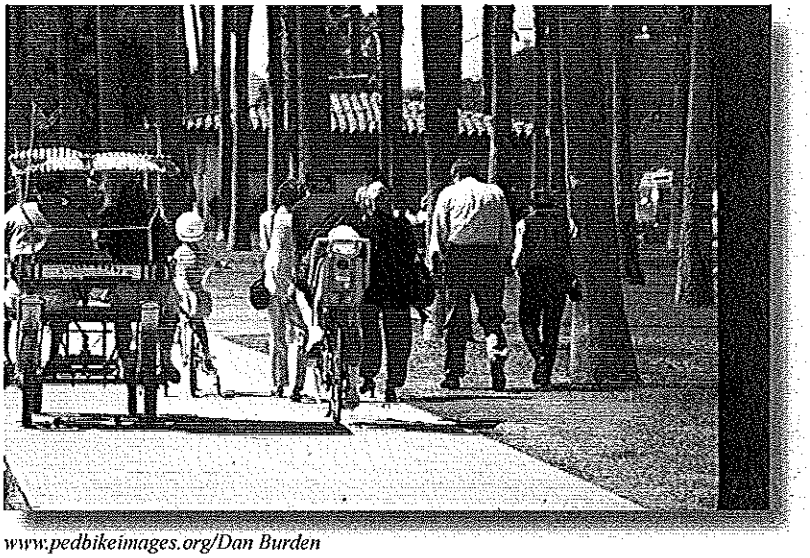
www.pedbikeimages.org/Dan Burden

Stabilized gravel



Stabilizersolutions.com

Concrete



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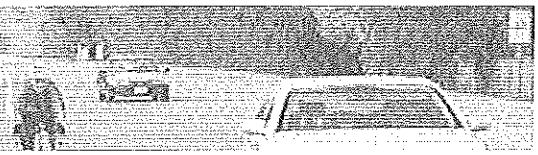


Intersection Treatments 2.2.B

Purpose

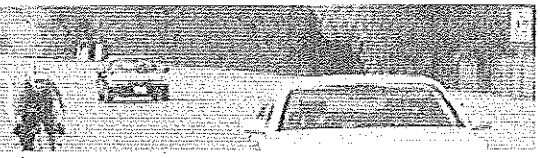
- Facilitate safe crossing of roadways and other corridors by shared use paths.

Where to use

- Intersections of shared use paths with roadways, etc

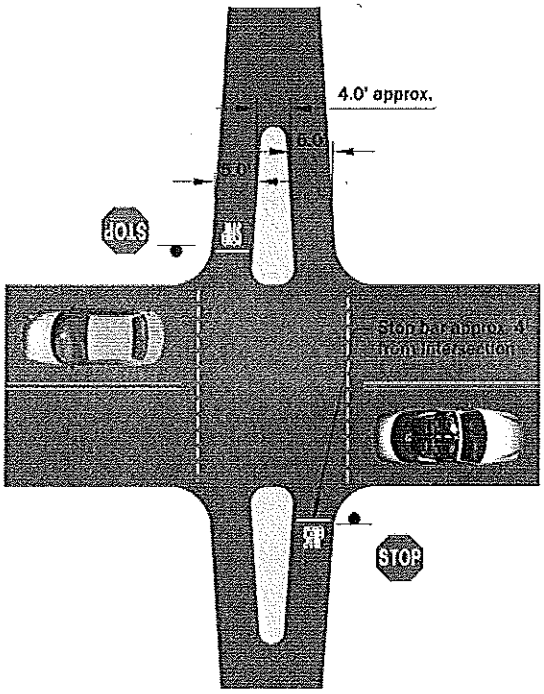
Guidelines

- Design shared use paths with the fewest number of intersections possible
- All intersections should be clearly marked, with signs or pavement markings, to indicate to all users who has the right of way. Use of pavement lights and/or overhead warning lights can also be implemented to warn users.
- Where shared use paths intersect with roads, install bollards or medians to prohibit unauthorized vehicles from accessing the shared use path. Provide for maintenance and emergency vehicle access.
- Refer to sections 1.3 and 1.6 of this toolbox for additional information regarding roadway crossings.

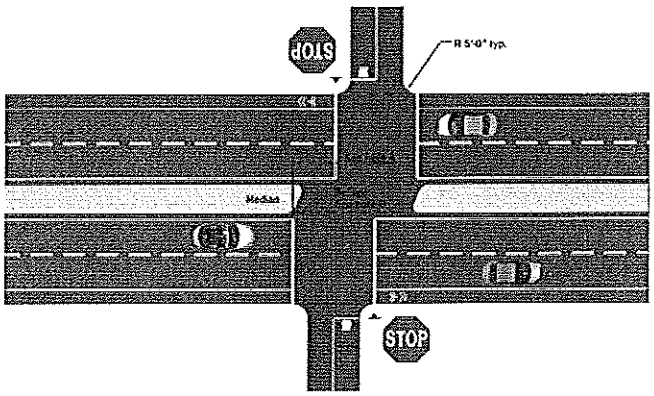


Intersection Treatments 2.2.B

Shared use path



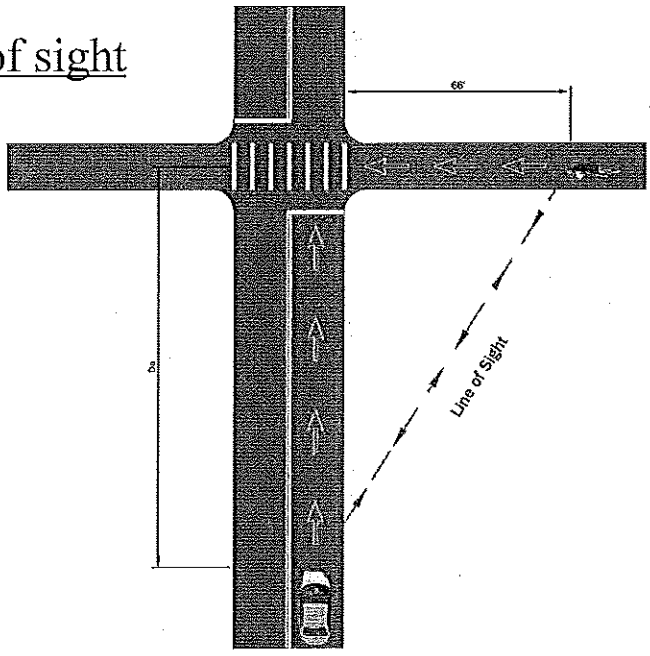
Shared use path - Angled refuge



Notes:

1. Offset distance should be equal or greater than the width of path. Minimum offset is 1/2 of path.
2. Refuge should be raised for drainage purposes and be ADA compliant.

Shared use path -Line of sight



Speed(mph) of Automobile	31	37	43	50	56	62	68
Distance(Da) in feet	131	164	197	230	246	279	295

Transit Stop Treatments 3.1.A

Purpose

- To increase the options available to bicyclists and provide access to more destinations while also promoting the use of mass transit.

Where to use

- Urban areas
- Suburban commuter hubs
- Mass transit stations

Guidelines

- Equip public buses with front mounted bicycle racks.
- Institute policy to allow bicyclists to bring bicycle on bus when not crowded if no rack is available.
- Provide specialized cars on rail transit equipped with interior bike racks.
- Institute policy to allow bicyclists on all rail cars on weekends and off-peak times.
- Direct routes to transit centers for bicyclists should be provided.
- Transit centers should have adequate amount of bike parking facilities such as bike racks or lockers.
- Conduct user surveys to determine demand for need.

Transit Stop Treatments 3.1.B

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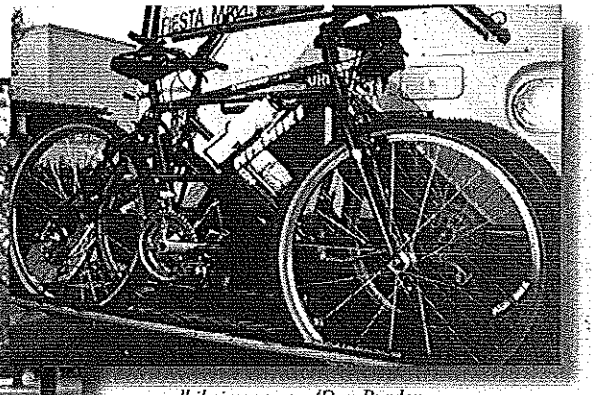

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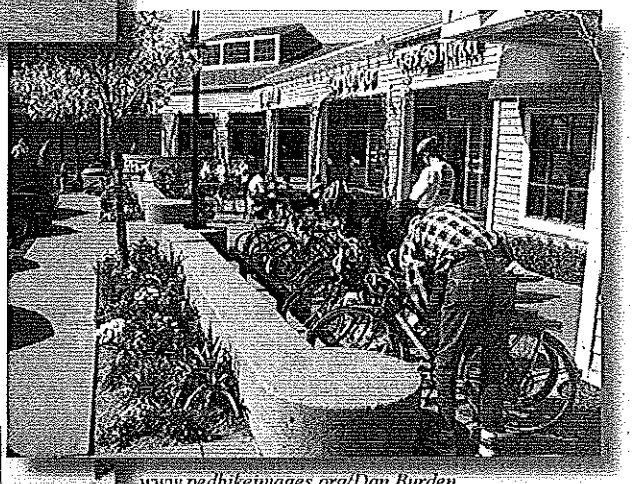

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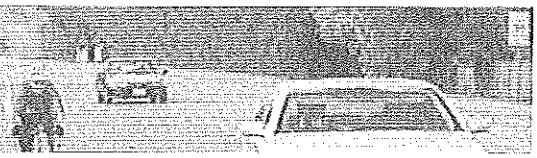


Lighting 3.2.A

Purpose

- Illuminate road or multi-use trail in order to enhance the security and safety of all users.

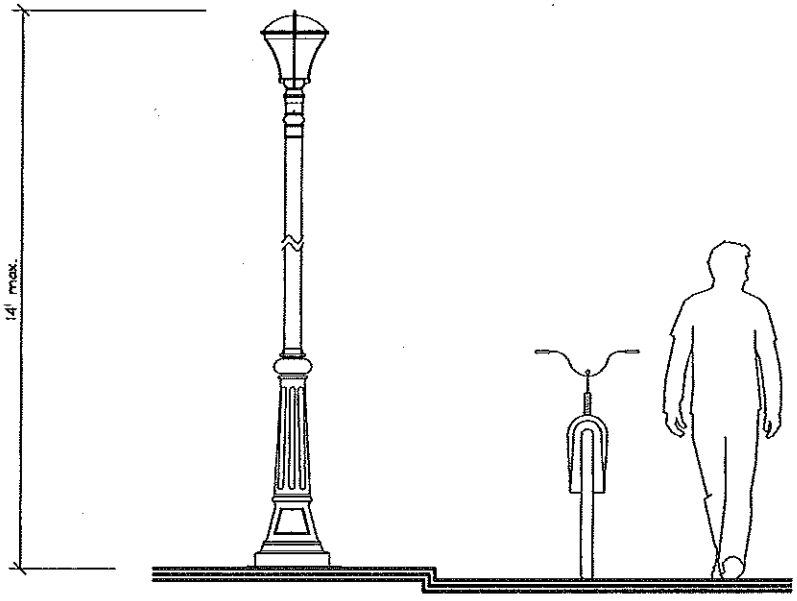
Where to use

- Urban areas
- Suburban areas
- Rural areas
- Intersections
- Commuter routes
- Intersections with multi-use trails
- Underpass/tunnel

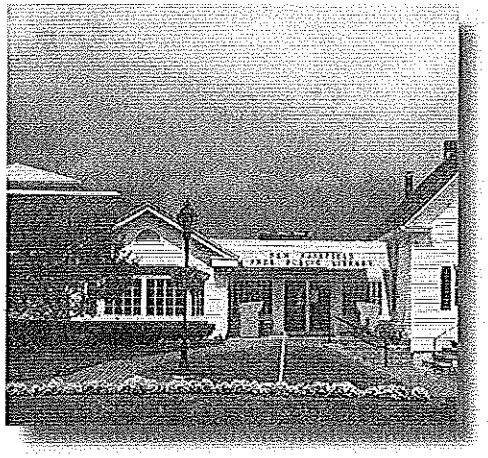
Guidelines

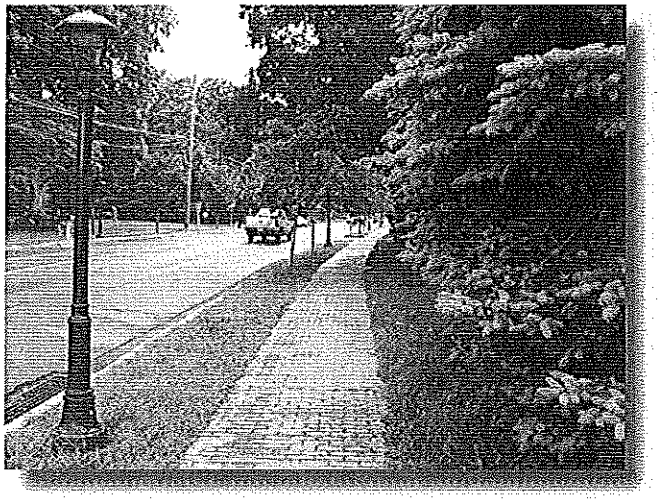
- All new lighting should be dark sky compliant.
- Average maintained horizontal illumination levels should be 5 LUX to 22 LUX depending on site conditions.
- Luminaires and light poles should be at a scale appropriate for pedestrian use.
- Design lighting layout to avoid hot spots and maintain and even illumination.
- Wide roadways should have lighting installed on both sides to be most effective.
- Where available, lighting can be installed in medians to light wide roadways. Medians can also be constructed as bio swales or rain gardens to enhance aesthetics and stormwater management opportunities.

Lighting 3.2.B



STREET-LEVEL PEDESTRIAN LIGHTING
NOT TO SCALE





Street Furniture 3.3.A

Purpose

- Enhance the pedestrian environment and increase community spirit by enlivening downtown areas.

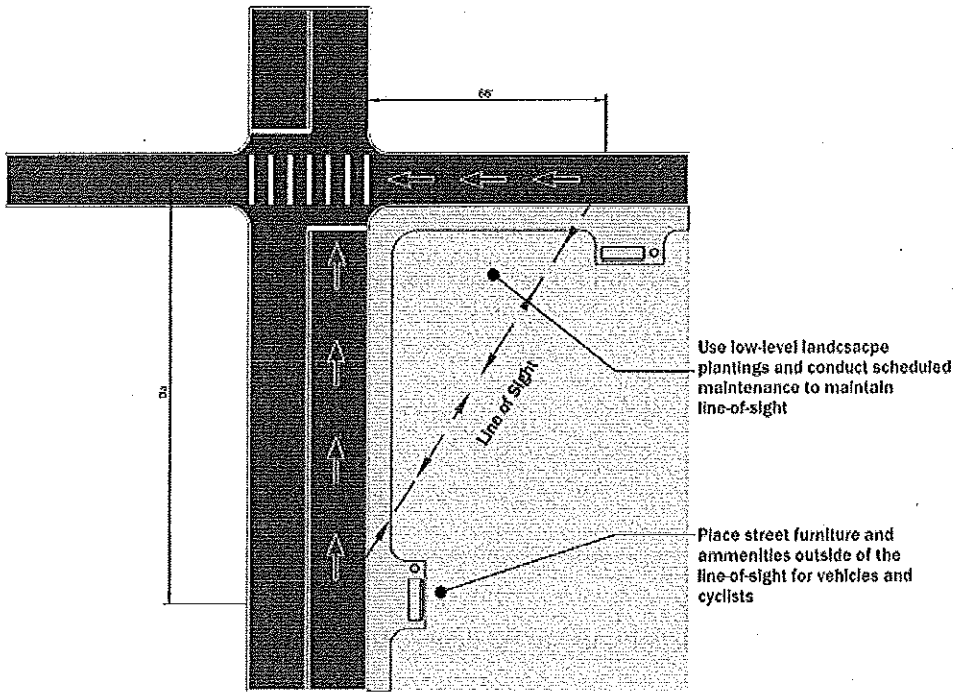
Where to use

- Transit centers
- Plazas
- Downtown areas

Guidelines

- Choose good quality furniture for longer life and less maintenance as well as to increase pride in the community.
- Place furniture out of main walkway route, curb ramps and sight lines. Refer to section 1.6.A for additional information.
- Consider requirements of the handicapped. Verify adequacy of clearances and detectability of protruding items for the visually impaired.
- Encourage store fronts at street level to add to the interest.
- Determine a theme for the overall design of the streetscape and its furniture in order to create a unified, identifiable look.
- Create a maintenance plan and budget for maintenance costs.

Street Furniture 3.3.B



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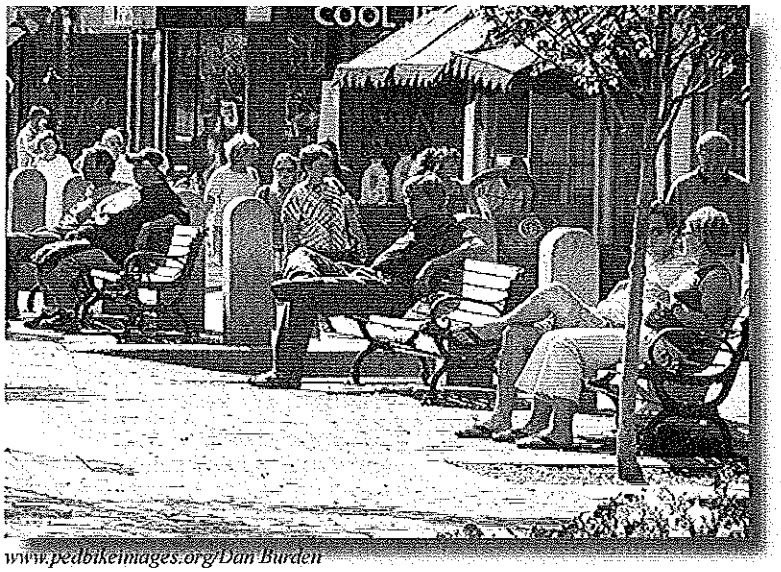

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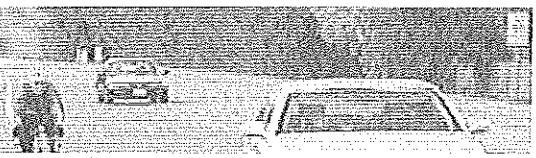


Driveway Improvements 3.4.A

Purpose

- To increase safety by reducing conflicts between those users entering or leaving a corridor and those traveling along the corridor.

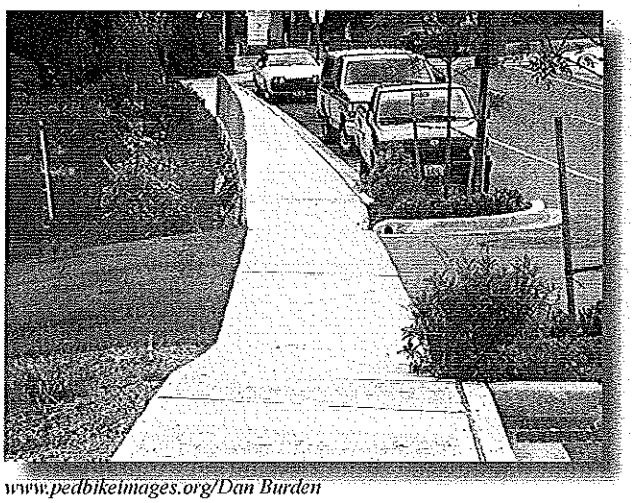
Where to use

- Intersection of bicyclist paths and vehicular driveways.

Guidelines

- Maximize visibility for motorists by using 90 degree intersections and maintaining a clear sight triangle at intersection.
- Reduce vehicle speed when exiting and entering driveway through use of 90 degree intersection.
- Where present, carry finished grade of sidewalks across driveways to reinforce that pedestrians have right of way and to provide through movement of pedestrians.
- Provide curb cuts with adequate flare to allow bicyclists to turn in without entering opposing lane.
- Commercial or public driveways may benefit from use of stop bars, stop signs, etc and avoid creating visual clutter as distraction.
- Restrict movement to right in-right-only to reduce number of conflicts.
- Control left turns and u-turns with non-traversible islands. Islands can be installed as rain gardens to improve aesthetics and stormwater management. Be sure to maintain adequate sight lines.

Driveway Improvements 3.4.B



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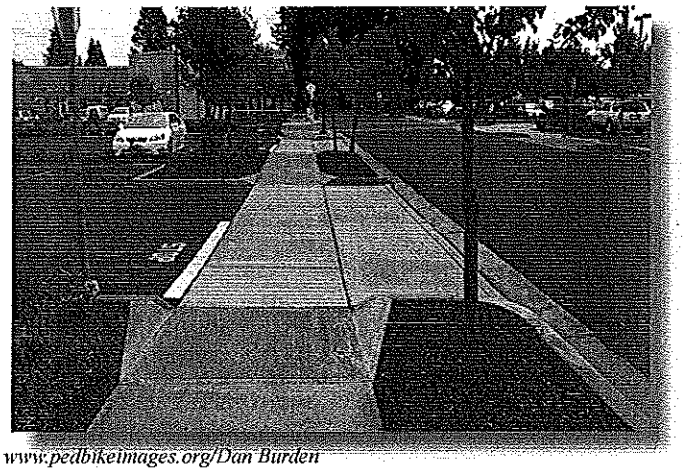

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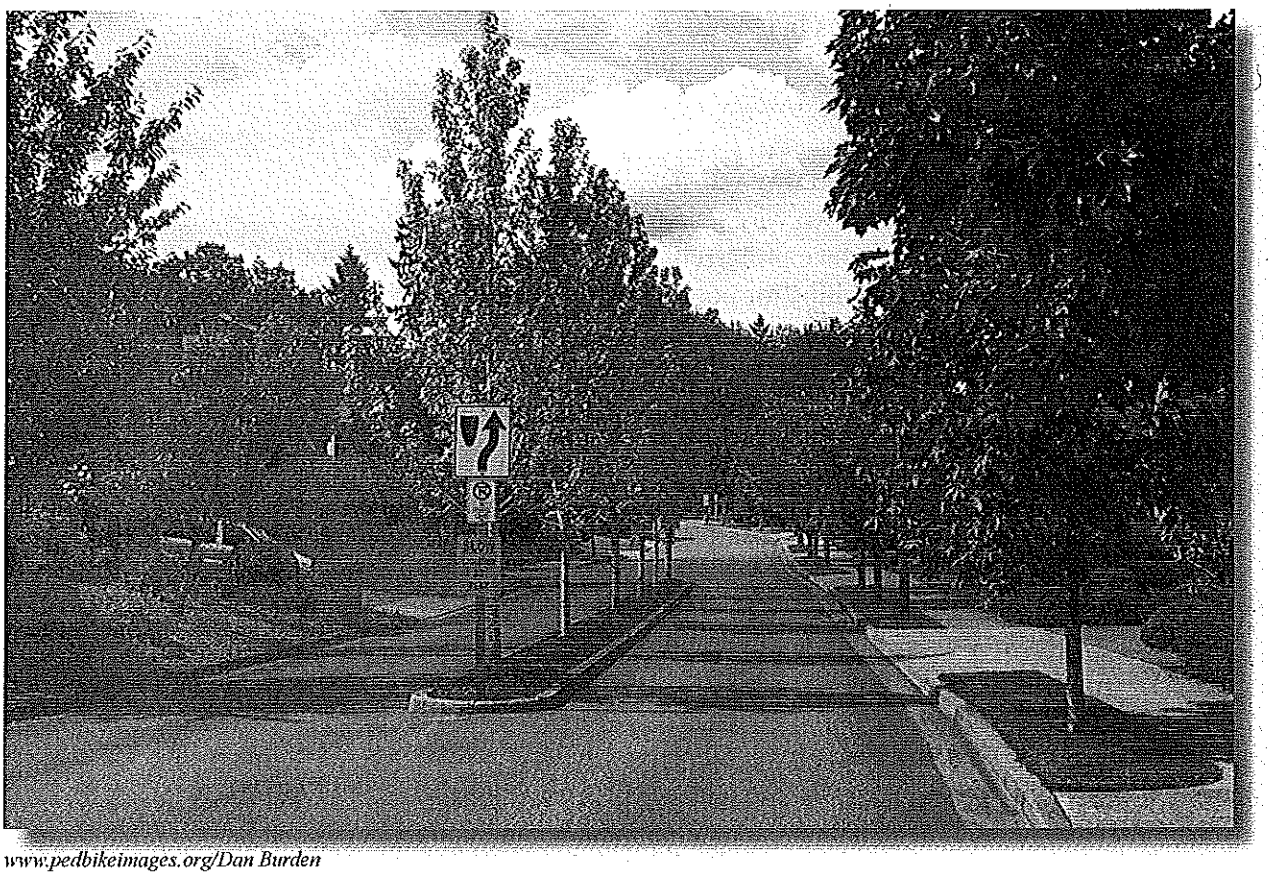

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Equestrian Trails 3.5.A

Purpose

- Provide a safe, stable surface of adequate size to accommodate the intended users of the path.

Where to use

- To provide trails for horse riders
- Multi use trails where horse back riding is desired

Guidelines

- Single or multiple loop trails are acceptable
- Day use trails should be 5 - 25 miles in length
- Clear width: Light use, one way - 8' min
  Heavy use, two way - 12' min.
- Clear height: 10'-12' min
- Tread width: Light use, one way - 2'-4'
  Heavy use, two way - 5'-6'
- Surface: Natural surface preferred. Bituminous or concrete not recommended
  Use wood chips for poor or erodible soils
- Grade: 0%-10% desired
  10% max if grade is sustained for long distance
  20% max if grade shorter than 50 yards
  4% max on outslopes
- Sight distance: Not critical for equestrian trails
  Provide 50'-100' sight distance if trail is two way or a shared use trail
  Warn riders 100'-200' prior to road crossings
- Water crossings: Water crossings should be kept to a minimum
  Bridges to be 8' wide min. with a 5 ton capacity min.
  Ford points should be at slow moving water, 24" depth max. with a stable sand or gravel base
- Parking areas: Provide space for trailers and hitching posts
- Camping areas: Provide corrals and water sources for horses

Equestrian Trails

3.5.B