

Newark Pedestrian & Bicycle Safety Toolbox





SCHOOL BUS

Bank of America

Hub CONSTRUCTION

18026-MA

NO PARKING ANY TIME
NO LOADING UNLOADING
NO STOPPING

SEE SAY
CLASSY COLLE

Table of Contents

1	Introduction	6.3
	Pedestrian Tools	
2	Street Design	
	Sidewalks	6.6
	Street Trees	6.7
	Lighting	6.8
	Bus Stop	6.9
	Pedestrian Fence	6.10
3	Intersection & Crossing Design	
	Curb Ramp	6.12
	Curb Extension	6.13
	Crosswalk	6.14
	Pedestrian Safety Island	6.15
	Pedestrian Signal	6.16
	Rectangular Rapid Flashing Beacon	6.17
	In-Road Stop for Pedestrian Sign	6.18
	Mid-Block Crossing	6.19
	Signal Timing	6.20
	Signage	6.21
4	Speed Control	
	Rumble Strips	6.24
	Speed Humps & Speed Tables	6.25
	Center Median	6.26
	Gateway Treatments	6.27
	Chicanes, Chokers, Diverters & Roundabouts	6.28
	Road Diet	6.29



Bicycle Tools

5 Bicycle Lanes, Paths, & Routes

Shared Roadways	6.32
Bicycle Lane	6.33
Buffered Bicycle Lane	6.34
Contra-Flow Bicycle Lane	6.35
Separated Bicycle Lane – One-Way	6.36
Separated Bicycle Lane – Two-Way	6.37
Off-Street Bicycle Path	6.38
Bicycle Boulevard	6.39

6 Bicycle Intersection Tools

Bike Box	6.42
Bicycle Signal	6.43
Two-Stage Turn Queue Box	6.44
Mixing Zone	6.45
Striping Through the Intersection	6.46

7 Pedestrian & Bicycle Safety Policies

Vision Zero Policy	6.48
Neighborhood Slow Zone	6.48
Arterial Slow Zone	6.49
School Slow Zone	6.49
Right-Turn-on-Red Prohibition	6.50
Reduced Speed Limit on County & State Roads	6.50
Automated Photo Enforcement	6.51
Automated Pedestrian Signals	6.51
Lateral Clearance for Motor Vehicles When Passing Bicyclists	6.52
Police Enforcement	6.52
Education & Outreach	6.53

8 Resources 6.56

Introduction

The Newark Pedestrian and Bicycle Safety Toolbox (Toolbox) presents a comprehensive set of measures that can be utilized to improve pedestrian and bicyclist safety citywide. It includes physical strategies (design and engineering) and policy strategies, which are organized into three main categories:

- [Pedestrian Tools // Chapters 2, 3, and 4 //](#)
- [Bicycling Tools // Chapters 5 and 6 //](#)
- [Pedestrian & Bicycle Safety Policies // Chapter 7 //](#)

Each strategy is described and its benefits, usage considerations, implementation approach and time frame, relative cost and representative locations are provided. It is important to note that the Toolbox is focused on pedestrian and bicyclist safety only and is not intended to be a comprehensive “complete street” or “street design” toolbox.

Two key considerations in applying the Toolbox are 1) which tools to apply where, and 2) how a particular tool is designed and implemented in a particular location. The tools may be applied using both the site analysis approach (in which high-crash locations are targeted) and the systemic approach (in which locations with particular risk factors are targeted) in order to identify locations in need of safety improvements. The Newark Pedestrian and Bicycle Safety Action Plan identifies a high-priority set of such locations. Under either approach, locations are identified and then the most appropriate strategy or combination of strategies from this Toolbox can be selected to mitigate the safety challenges.

The Toolbox is not prescriptive in assigning particular strategies to particular situations or locations. Rather, the range of potential strategies are presented side-by-side so the engineer, planner, or designer can choose the most appropriate measures while taking into consideration site-specific factors, available right-of-way space, cost, speed of implementation and other objectives. Chapter 8 lists other leading resources that provide additional research and design guidance related to the tools and policies contained within the Toolbox.

Each tool includes the following elements:

Title	<div style="text-align: center; border-bottom: 2px solid blue; padding-bottom: 5px;"> Rumble Strips </div> <p><small>Pedestrian // Speed Control //</small></p> <p>Rumble strips are rows of raised pavement markings that produce a rumbling vibration as the tires of a vehicle roll over them. The rumbling vibration is intended to alert drivers that they are approaching a busy pedestrian crossing area and should exercise due care.</p> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div style="width: 60%;"> <p>Benefits</p> <ul style="list-style-type: none"> • Alerts drivers that may be distracted or inattentive. <p>Application</p> <ul style="list-style-type: none"> • Rumble strips should be installed on the approach to key intersections or crossings where inattentive or distracted driving is a concern. • All pavement marking should be consistent with The Manual of Uniform Traffic Control Devices MUTCD. <p>Representative Location</p> <ul style="list-style-type: none"> • Broadway, Newark, NJ </div> <div style="width: 35%; padding-left: 10px;"> <p>Cost \$</p> <p>Time Frame short</p> </div> </div> <div style="text-align: center; margin-top: 10px;">  <p style="font-size: 0.8em; margin-top: 5px;"><i>Rumble strips located on Broadway near Bloomfield Avenue.</i></p> </div>	Description	Cost	Time Frame	Photos
Benefits					
Application					
Representative Location					

Relative Cost	Description	Example
\$	Low cost, generally less than \$10,000	In-road stop for pedestrians sign
\$\$	Moderate cost, between \$10,000 and \$100,000	Shared roadway, bike lane, buffered bike lane
\$\$\$	Medium cost, between \$100,000 and \$1,000,000	Curb extension, new sidewalk
\$\$\$\$	High cost, generally greater than \$1,000,000	Off street bicycle path

Relative Time	Description	Example
Short	Quick to implement, does not require extensive planning, design or construction work.	Street trees, crosswalk, bus stop
Medium	Takes time to plan and design but does not generally require intensive capital construction. Can generally be implemented within six to 18 months.	Pedestrian safety island, separated bike lane
Long	Requires a longer planning, design and construction period, generally over 18 months.	Gateway



Street Design

2



Sidewalks

6.6

Street Trees

6.7

Lighting

6.8

Bus Stop

6.9

Pedestrian Fence

6.10

Sidewalks

Sidewalks provide safe and accessible pedestrian circulation throughout the city. Proper sidewalk widths vary depending on the roadway type, usage, location, and land use, among other factors. The Federal Highway Administration recommends at least 5 feet of unobstructed sidewalk width. If there is enough room, a planted buffer between pedestrians and vehicles is suggested. A majority of Newark’s roadways are equipped with sidewalks on both sides of the street.

Cost
 \$\$\$

Time Frame
 medium

Benefits

- Minimize conflicts between pedestrians and cars.
- Reduce pedestrian crashes.
- Encourage safety and mobility through the city for access and recreation.
- Properly designed sidewalks offer a number of social, economic and environmental benefits by promoting walking and public transit as a transportation mode.
- Sidewalks can improve the shopping experience in retail corridors and enhance the sense of community by encouraging social interaction.

Application

- Throughway, buffer zones and frontage widths will vary based on the road typology (arterial, commercial, residential) and usage.
- Compliance with the most current Americans with Disabilities Act Accessibility Guidelines (ADAAG) as well as the Public Rights-of-Way Accessibility Guidelines (RROWAG) is essential.
- Installing or widening sidewalks often requires relocating curbs and drainage as well as re-striping.

Representative Locations

- Raymond Boulevard
- Ferry Street
- Mt. Prospect Avenue



Arterial street: Raymond Boulevard.



Commercial street: Ferry Street.



Residential street: Mt. Prospect Avenue.

Street Trees

Street trees located between the sidewalk and street are a cost-effective way to enhance aesthetics and improve environmental quality while creating a safer and accessible corridor. Street trees buffer pedestrians from the vehicular traffic and calm traffic by visually narrowing the roadway.

Cost
\$

Time Frame
short

Benefits

- Buffer and protect the sidewalk from the roadway traffic.
- Calm traffic by visually narrowing the roadway.
- In addition to the safety benefits, street trees offer many economic, social and environmental benefits by offering opportunities for urban wildlife habitats, cooling the urban environment, reducing storm water runoff, improve air quality and increasing pavement life by avoiding extreme heat.

Application

- Proper width between the curb and sidewalk is required for planting street trees or heaving or cracked sidewalks may result.
- Trees should be limbed properly and setback from intersections and crossings to maintain proper sight lines.
- Street tree species, form and aesthetic qualities should be determined based on characteristics of the road including cross section, usage, etc. and must meet all city guidelines
- Planting of street trees requires the removal of portions of sidewalk, the digging and preparation of a tree pit and on-going watering and maintenance until the tree is established (generally 1- 2 years).



Flowering trees enclose the roadway on New Street.



Columnar trees buffer pedestrians on Mt. Prospect Avenue.

Representative Locations

- New Street
- Mt. Prospect Avenue

Lighting

Lighting is a key element of the visual environment that allows pedestrians to move about safely and feel more secure after sundown. Well-lit sidewalks and roadways allow drivers to see pedestrians entering the roadway and allow pedestrians to avoid tripping hazards or other sidewalk elements.

Cost
\$\$

Time Frame
medium

Benefits

- Offers a safer environment after dark.
- Increases visibility of pedestrians.
- Reduces tripping hazards.
- Reduces conflicts between bicycles/cars and pedestrians.

Application

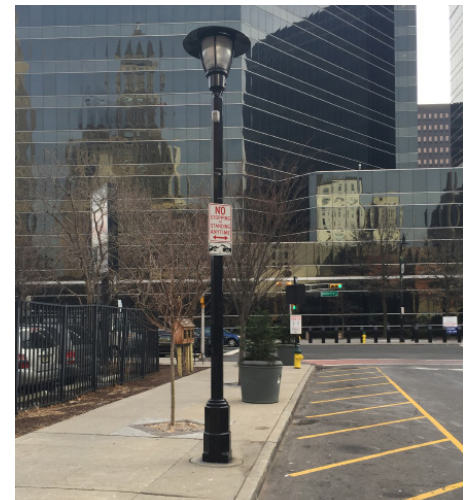
- There are two types of lighting that may be used to illuminate the roadways: Pedestrian-Scale Lighting (12 foot - 16 foot height); and Roadway Lighting (20 foot - 26 foot height).
- Proper light levels vary depending on road typology and usage. For example, areas with high pedestrian traffic, such as commercial corridors, may require pedestrian-scale lighting in addition to standard roadway lighting.
- Light levels of adjacent properties are a contributing factor, as light from these properties may supplement the sidewalk lighting.
- Installation of lighting requires coordination with PSE&G.
- The means, methods, and level of difficulty involved with installing existing lighting varies greatly depending on existing site conditions, such as availability of electricity, existing poles and footings, light level requirements, etc.



Double teardrop style roadway fixture on Broad Street.



Pedestrian-scale double-head fixture on Mulberry Street.



Pedestrian-scale post top fixture on Clinton Street.

Representative Locations

- Broad Street
- Mulberry Street
- Clinton Street

Bus Stop

Bus stops work in combination with other tools to enhance pedestrian safety and accessibility. Bus stops should be located at the far side of intersections, when possible, to maximize pedestrian safety. For additional information on creating a new bus stop or improving a bus stop, refer to the NJTPA's Bus Stop Safety Toolbox.

Cost
\$

Time Frame
short

Benefits

When bus stops are properly located at the far end of the block, they can:

- Reduce traffic at pedestrian crossing intersections.
- Minimize sight distance problems on approaches to intersection.
- Encourage pedestrians to cross behind the bus.
- Create longer deceleration distances for buses.



Standard near side bus stop on Mt. Prospect Avenue.

Application

- The location for a transit stop should be site specific and in relationship to traffic volumes at intersections.
- Placement of transit stops that support pedestrian safety should take into consideration crosswalks and connections opportunities.
- Mid-block stops should be avoided when possible due to reduced visibility.



Mid-block bus and light rail stop at Washington Park.

Representative Locations

- Mt. Prospect Avenue
- Broad Street at Washington Park
- Broad Street at Market Street



Far side bus stop where the curb was extended on Broad Street.

Pedestrian Fence



Pedestrian fences are used as protective barriers where there is an imminent risk to pedestrians due to high traffic volumes, poor sight lines or other factors. Fences should only be used when other, less obtrusive tools have not been effective.

Cost
\$\$

Time Frame
short

Benefits

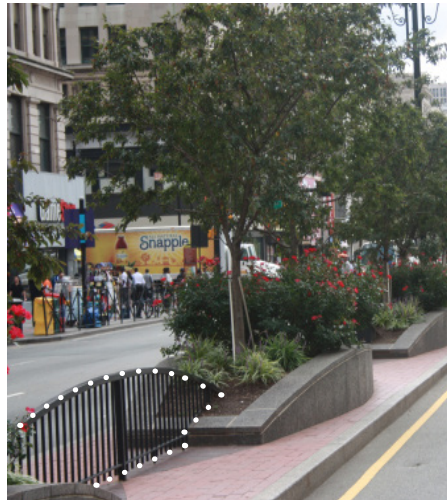
- Minimize conflicts between pedestrians and cars.
- Provide protection from the roadway traffic.
- Encourage pedestrian to use crosswalks or other specific routes.

Application

- Should only be used as a last resort when other, less obtrusive means have not been effective.
- Can have a negative effect on pedestrians that are in the road by preventing them from being able to get on the sidewalk.
- Can cause pedestrians to be trapped in unsafe or overcrowded conditions.
- Need to be high enough to discourage pedestrians from climbing over the fence.

Representative Locations

- Broad Street median
- Broad Street and Raymond Boulevard
- Washington Park Light Rail Stop




Pedestrian fence is used on center median of Broad Street to discourage jaywalking.



Pedestrian fences on the corner of Broad Street and Raymond Boulevard guide pedestrians to the



Pedestrian fences at rail stations to prevent pedestrian from crossing the tracks.



Intersection & Crossing Design

3



Curb Ramp	6.12
Curb Extension	6.13
Crosswalk	6.14
Pedestrian Safety Island	6.15
Pedestrian Signal	6.16
Rectangular Rapid Flashing Beacon	6.17
In-Road Stop for Pedestrian Sign	6.18
Mid-Block Crossing	6.19
Signal Timing	6.20
Signage	6.21

Curb Ramp

Curb ramps are the sloping element of the sidewalk that transitions pedestrians from the sidewalk elevation to the roadway elevation. This transition allows for safe crossing and ADA-compliant accessibility. The design of curb ramps is closely regulated by the city based on New Jersey Department of Transportation guidelines.

Cost
\$\$

Time Frame
short

Benefits

- Provide accessible crossing for pedestrians of all ages and abilities.
- Minimize the need for pedestrians in wheel chairs or pushing strollers to walk in the street.

Application

- All pedestrian crossing areas (corners and mid-block) should be equipped with curb ramps.
- All curb ramps must be installed in compliance with ADAAG and PROWAG standards.



Washington Street and New Street concrete curb ramp.

Representative Locations

- Washington Street and New Street
- Linden Street and Halsey Street
- Broadway Street and Crane Street



Linden Street and Halsey Street Newark Downtown District granite curb ramp.



Broadway and Crane Street concrete curb ramp with brick edge.

Curb Extension

A curb extension, or bump-out, is an area of sidewalk that is widened into the parking lane to reduce crossing distances, slow turning vehicles and improve pedestrian visibility. The additional sidewalk space can function as gathering space, landscaped area or a waiting zone.

Cost
\$\$-\$\$\$

Time Frame
medium

Benefits

- Provide safe crossing at wide intersections.
- Increase pedestrian visibility at intersections.
- Decrease pedestrian exposure to vehicles.
- Make crosswalks more apparent to drivers.
- Reduce traffic speed.
- Increase pedestrian waiting space.
- Reduce turning speed, giving priority to pedestrian crossings.
- Allow for an additional curb ramp, useful at high pedestrian traffic locations.



Curb extension at Market Street and Mulberry Street.

Application

- The installation may reduce the number of curbside parking spaces.
- The site should be reviewed to determine any interference with fire hydrants, snow plows, street sweepers, deliveries, bus stops, etc.
- Depending on the slope of the sidewalk, roadway and road crown, curb extensions may impact roadway and sidewalk drainage. Particular care should be taken to avoid pooling.
- Curb extensions require the installation of new curbing, sidewalks and, in some cases, drainage infrastructure.
- Temporary curb extensions can be implemented using roadway paint and flexible delineators or cones.



Curb extensions on Mt. Prospect Avenue significantly reduce the crossing distance by extending the sidewalk into the angled parking lane.

Representative Locations

- Market Street and Mulberry Street
- Mt. Prospect Avenue

Crosswalk

Crosswalks are used to clearly identify where pedestrians should cross the road. Crosswalks are differentiated from other areas of the roadway by a change in the surface to designate the pedestrian right-of-way. The City of Newark uses white “angled ladder” striped crossings, stamped resin “brick” crosswalks and painted side striping, two parallel lines with no stripes in between.

Cost
\$-\$\$

Time Frame
short

Benefits

- Alert drivers to the presence of pedestrians in the roadway.
- Notify pedestrians of the designated areas to cross the roadway.

Application

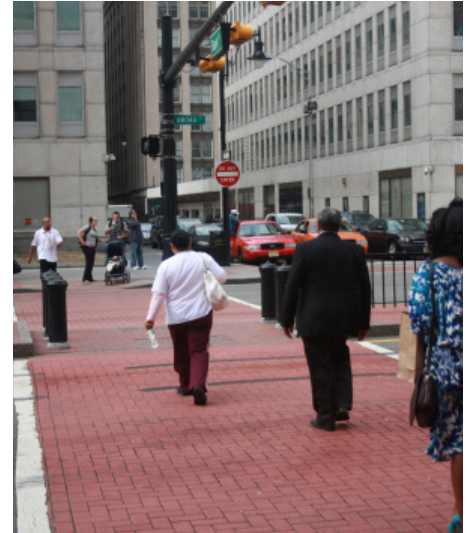
- Crosswalks should be located based on the desired walking paths of pedestrians but should be limited to corners and intersections whenever possible.
- Crosswalks should be aligned perpendicular to the roadway to provide the shortest possible crossing distance.
- Crosswalks should be constructed of either white, thermoplastic striping or brick stamped resin with white thermoplastic edging.
- Brick Stamped Crosswalks should be limited to commercial areas with high pedestrian volumes. Ladder or angled ladder crosswalks should be used on neighborhood streets. Continental crosswalks should be used selectively in areas with high pedestrian volumes that require high visibility crosswalks.

Representative Location

- Newark neighborhood street
- Broad Street
- South Park Street, Montclair, NJ



Angled ladder or ladder crosswalks are used on neighborhood streets.



A brick stamped crosswalk on Broad Street at Bank Street.



Example of continental style crosswalks on South Park Street, Montclair, NJ.

Pedestrian Safety Island

A pedestrian safety island is a segment of roadway median that is used as a refuge for pedestrians that are crossing the road. They are used throughout the city along wide roadways and at multi-modal transit locations.

Cost
\$-\$

Time Frame
medium

Benefits

- Reduces pedestrian crossing distance and the exposure time experienced by the pedestrian crossing a wide roadway.
- Reduces the complexity of crossing multiple lanes of traffic by allowing pedestrians to cross one direction of traffic at a time if needed.
- Provides protection to pedestrian from turning cars.
- Reduces speed of on-coming as well as turning vehicles.

Application

- Can require a significant amount right-of-way.
- Implementation may require lane reductions or other more significant traffic impacts.
- Emergency vehicle access is often impacted and should be considered.
- Visually-impaired pedestrians may be unaware of pedestrian safety island.
- Pedestrian refuge islands require the installation of a curbed island, flush sidewalk zone, tactile paver and bollards. Size and materials may vary greatly depending on location.



Pedestrian refuge integrated into the median on Broad Street.



Pedestrian refuge island Bloomfield Avenue at the intersection of Broadway.



Pedestrian refuge island on Mt. Prospect Avenue at intersection of Verone Avenue.

Representative Locations

- Broad Street
- Bloomfield Avenue
- Mt. Prospect Avenue

Pedestrian Signal

Pedestrian signals work in coordination with traffic signals to choreograph the timing allowed for a pedestrian to cross the roadway. Pedestrian signals give clear priority to pedestrians and regulate pedestrian movement during designated times. All signalized intersections should have countdown timers and fixed signals are preferred over actuated ones. Adding accessible pedestrian signals should be an option.

Cost
\$-\$

Time Frame
medium

Benefits

- Minimize vehicle-pedestrian conflicts by providing pedestrians crossing time at signalized intersections
- Inform pedestrian when it is safer to cross the roadway.
- Inform drivers when the pedestrian has the right of way.
- Reduces the risk of left-turning vehicle conflicts with the opposite crosswalk.

Application

- Should be timed to allow for safe crossing of pedestrians of all ages and abilities. For example, longer crossing times should be considered in areas with higher populations of elderly residents.
- May not be easily understood by school children with limited counting ability.
- Unless an audible signal is installed, the standard pedestrian signal does not benefit pedestrians with impaired vision.

Representative Location

- Market Street and Mulberry Street
- Market Street and McCarter Highway



Pedestrian crossing signal with countdown timer at Market Street and Mulberry Street.



Pedestrian crossing with push button at Market Street and McCarter Highway.

Rectangular Rapid Flashing Beacon

Rectangular rapid flashing beacons (RRFB) are yield-to-pedestrian-signals that can have sensors or be wirelessly synchronized to alert drivers when a pedestrian is entering the crosswalk. In Newark, RRFBs are usually placed at mid-block crossings or on neighborhood main streets where an additional level of pedestrian safety is required.

Cost
\$-\$

Time Frame
short to medium

Benefits

- Visually alerts drivers when pedestrians are entering the crosswalk.
- Can be use at high-speed intersections.
- Extra nighttime and high-fog visibility.
- Ideal for uncontrolled crossings locations like mid-block crossings.

Application

- RRFBs have to be installed in pairs with one on each side of the roadway. If a median or Pedestrian Safety Island is used, then three RRFBs may be needed.



LED light panels located above the arrow will flash when the push-button is activated by a pedestrian, Warren Street.

Representative Locations

- Warren Street (at Greek Village)
- West Market Street and Littleton Avenue



Rectangular rapid flashing beacon shown at West Market Street and Littleton Avenue.

In-Road Stop for Pedestrian Signs

In New Jersey, it is state law that motorists are required to stop for pedestrians crossing at intersections and within marked crosswalks, unless regulated by a traffic control device. A movable, flexible sign can be placed on the center line of the roadway immediately before a crosswalk to remind drivers of this requirement. There are other signs that can be included, such as “Turning Vehicles Yield to Pedestrians” and advanced crosswalk and school crosswalk warning signage.

Cost
\$

Time Frame
short

Benefits

- Reminds drivers that they are required by New Jersey State Law to stop for pedestrians entering the crosswalk.
- Centerline location has a traffic calming effect.
- Location on the approach to crosswalks alert motorists to pedestrians entering the roadway.

Application

- In-road “State Law Stop for Pedestrian” signs should be considered at any crosswalk where pedestrians are having difficulty crossing and/or cars are not stopping for pedestrians.
- The signs should be installed at crosswalk locations on the centerline or median.
- Snow plowing can damage the signs so additional attention is required in the winter season.
- Can be paired with targeted enforcement campaigns.

Representative Location

- Warren Street mid-block at NJIT
- University Avenue at Rutgers University



An in-road stop sign on Warren Street mid-block at NJIT.



An in-road stop sign at Rutgers University, University Avenue.

Mid-Block Crossings

Mid-block crossings are often installed in areas with heavy pedestrian traffic to provide more frequent crossing opportunities. They may also be added near major pedestrian destinations, such as schools, where people might otherwise cross at unmarked locations.

Cost
\$-\$

Time Frame
short to medium

Benefits

- Provide additional opportunities for pedestrians to cross the road.

Application

- Additional pedestrian safety measures such as advanced warning signs, raised crosswalks and curb extensions should be considered at mid-block crossings.
- Stop lines at mid-block crossings should be set back a minimum of 20 feet from the crossing.

Representative Location

- University Avenue
- Warren Street



A mid-block crossing located on the Rutgers Campus on University Avenue.



A mid-block crossing located on the NJIT Campus on Warren Street.

Signal Timing

Signal timing such as leading pedestrian intervals (LPI), lagging left turns and protected turning phases are used to give pedestrians priority at intersections and temporarily separate pedestrian and vehicles at crossings. Crossing speeds of pedestrians should also be considered when retiming traffic signals.

Cost
\$-\$\$

Time Frame
short

Benefits

- Enhance pedestrian visual exposure.
- Reduce overall pedestrian wait times and exposure at intersections.
- LPIs allow pedestrian to begin crossing 3-6 seconds before vehicles traveling in the same direction are given the green light.



A pedestrian signal on Broad Street indicates when pedestrians have the right-of-way and how much time they have left to cross.

Application

- The use of a “No Turn on Red” sign might be necessary to ensure pedestrians gain the full benefit of the LPI.
- Short cycle lengths of 60 - 90 seconds are ideal for urban areas.
- Crossing time should be site specific. Longer crossing times should be considered in areas with higher populations of elderly residents and children.
- The Federal Highway Administration suggest that crossing time should be calculated based on a walking speed no more than 1.065 m/s (3.5 ft/s).

Representative Location

- Broad Street



Signage

Pedestrian warning and wayfinding signage can be used to control speeds, provide information and identify points of interest and destinations throughout the city. All signs should be designed to the Manual on Uniform Traffic Control Devices (MUTCD) standards.

Cost
\$

Time Frame
short

Benefits

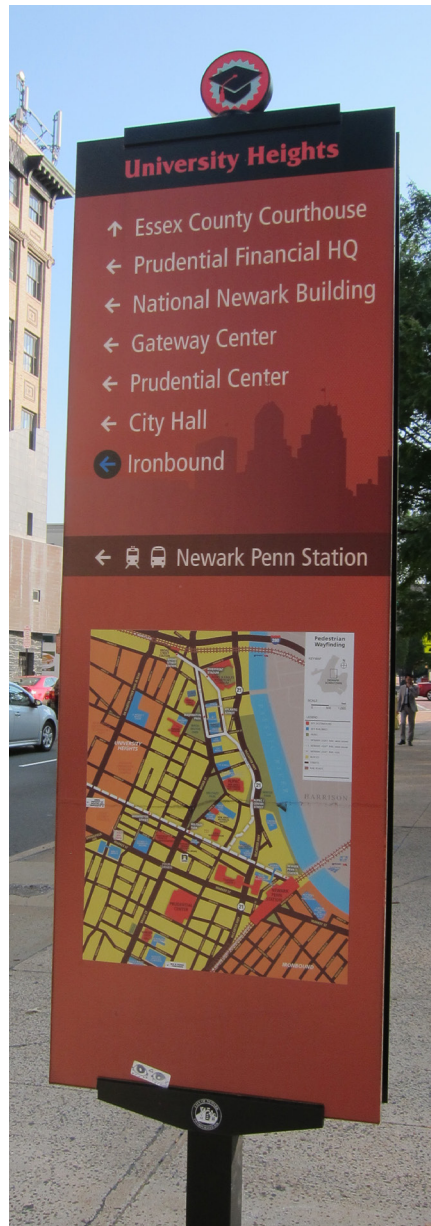
- Provide pedestrians and drivers with information about laws, roadway changes and points of interest.
- Wayfinding signs are used to identify the direction of major destinations and points of interest to both pedestrians and drivers. They facilitate better visitor experiences and can also guide residents unfamiliar with a neighborhood
- Warning signs indicate a hazard ahead in the road that may not be immediately apparent to the driver.

Application

- The use of a “No Turn on Red” sign might be necessary to ensure pedestrians can cross during a Leading Pedestrian Interval.
- Pedestrian wayfind signage should be located in all areas with high pedestrian volumes such as universities, the downtown and commercial corridors.
- Advanced pedestrian warning signage can be used in areas where pedestrian crossings may not be expected by drivers.
- Speed control elements such as a speed hump should be accompanied by the appropriate signage.

Representative Location

- Broad Street
- Warren Street
- Clifton Avenue



Pedestrian wayfinding signage on University Avenue



School crossing ahead warning sign



Warning signage identifying a pedestrian crossing on Crane Street and Broadway



NO TURNS

Market St

NO TURNS



DON'T BLOCK THE BOX

NO TURNS

ABLE

Best
Gas

The Art of Hair

Pizza

Madina

CLUB

COSMETIC HOUSE

NEWPORT

Woman in white top and grey pants walking across the crosswalk.

Man in white shirt and dark pants walking across the crosswalk.

Man in green shirt and dark pants walking across the crosswalk.

Man in purple shirt and dark pants walking across the crosswalk.

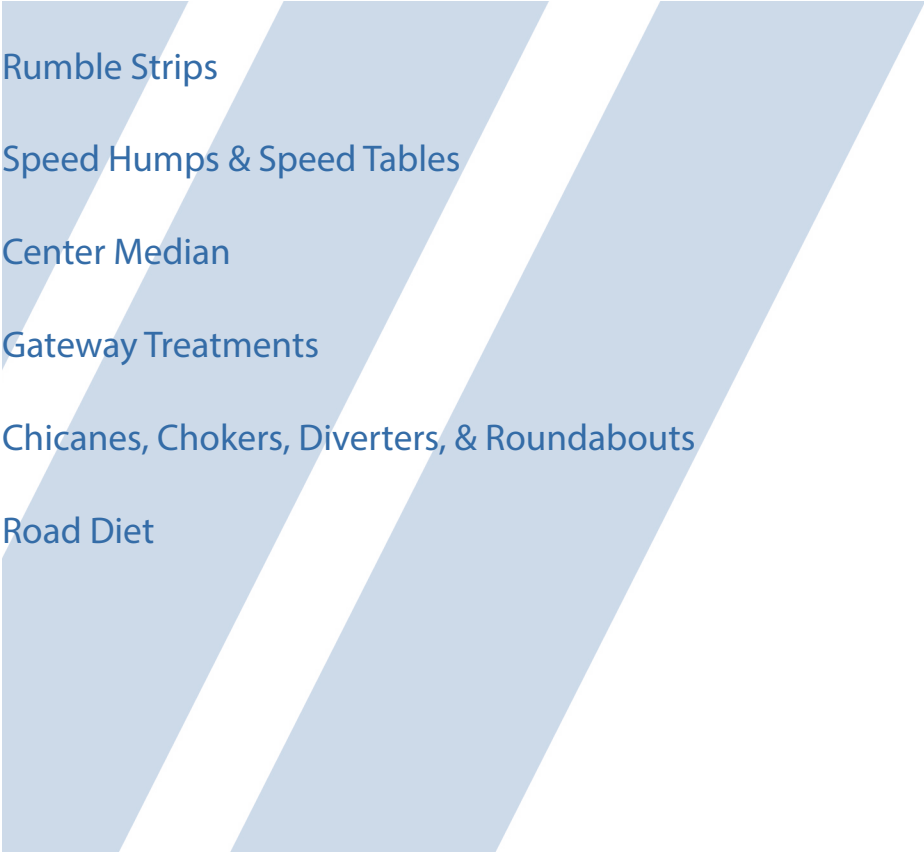
White SUV driving on the street.

Man in light blue shirt standing near the curb.



Speed Control

4



Rumble Strips

6.24

Speed Humps & Speed Tables

6.25

Center Median

6.26

Gateway Treatments

6.27

Chicanes, Chokers, Diverters, & Roundabouts

6.28

Road Diet

6.29

Rumble Strips

Rumble strips are rows of raised pavement markings that produce a rumbling vibration as the tires of a vehicle roll over them. The rumbling vibration is intended to alert drivers that they are approaching a busy pedestrian crossing area and should exercise due care.

Cost
\$

Time Frame
short

Benefits

- Alerts drivers that may be distracted or inattentive.

Application

- Rumble strips should be installed on the approach to key intersections or crossings where inattentive or distracted driving is a concern.
- All pavement marking should be consistent with The Manual of Uniform Traffic Control Devices (MUTCD).

Representative Location

- Broadway
- University Avenue



Rumble strips located on University Avenue.



Rumble strips located on Broadway near Bloomfield Avenue.

Speed Humps & Speed Tables

Speed humps and speed tables are used to slow vehicular traffic and enforce pedestrian-friendly travel speeds. In Newark, these elements are applied along neighborhood streets, school zones and low-speed streets.

Cost
\$\$

Time Frame
short to medium

Benefits

- Speed limit compliance.
- Deter cut-through traffic.

Application

- Speed humps and tables will only be installed on streets that comply with the city's "Policy on Speed Humps and Tables."
- Drainage may be impacted if the element blocks the flow of runoff along the curb line.
- Bicycle volumes should be considered when planning vertical speed control elements since they may not be bicycle friendly.
- Speed tables may be used in coordination with crosswalks to create "tabled crosswalks."
- Vertical speed control elements are generally constructed using asphalt that may be saw cut into the existing roadbed.

Representative Locations

- Irvine Turner Boulevard
- University Avenue



A raised intersection also acts as speed table at Irvine Turner Boulevard and Muhammad Ali Avenue, providing better visibility of pedestrians and calming traffic.



A speed hump located on University Avenue between Bleeker Street and Warren Street.

Center Median

Center medians are used to separate opposing lanes of traffic along wide roadways. Medians can be used to deter mid-block crossing or jaywalking and may also be used to calm traffic by visually reducing the road width, especially if they contain trees and/or landscaping.

Cost
\$\$

Time Frame
medium to long

Benefits

- Deter mid-block crossing.
- Calm traffic along excessively wide roadways.

Application

- Medians may interfere with emergency vehicle access.
- Landscaped medians require long-term maintenance.
- Unlike highway medians, medians installed within the city should be designed to visually narrow the roadway and calm traffic. If not properly designed, medians may inadvertently result in increased travel speeds.
- Medians are constructed in the center of the roadway and consist of a curbed edge and either paved or landscaped center area. Additional elements that may be designed into the median include street lighting, landscape materials, raised planters or fencing.

Representative Locations

- Mt. Prospect Avenue
- Broad Street



Center median located on Mt. Prospect Avenue includes granite cobbles and columnar street trees.



Center median located on Broad Street includes raised planters and pedestrian fences to prevent jaywalking.

Gateway Treatments

Gateway treatments are often used to calm traffic when drivers are transitioning from a higher-speed roadway into a more pedestrian-oriented residential neighborhood or center. They typically involve a decorative sign, landscaping and lighting.

Cost
\$\$

Time Frame
medium to long

Benefits

- Notifies drivers that they are entering a neighborhood and should expect pedestrians to be using the street.
- Calms traffic at neighborhood entry and transitional points.
- Discourages or prohibits through-traffic.
- Defines transitions to low speed, shared streets and pedestrian-friendly areas.

Application

- Gateways should be identified by the community and designed to express the character of the community.
- Gateway designs vary greatly and may incorporate curb extensions, center medians, vertical speed control elements and other tools identified in this manual.

Representative Location

- Bloomfield Avenue at Broadway
- Mt. Prospect Avenue at Verone Avenue



Gateway treatment on Bloomfield Avenue entering the Lower Broadway neighborhood.



Gateway treatment on Mt. Prospect Avenue entering the Forest Hill neighborhood.

Chicanes, Chokers, Diverters & Roundabouts

Chicanes, chokers, diverters and roundabouts are modifications made to the curb line, lanes or traffic flow intended to slow, redirect or block vehicular through-traffic. They are useful tools for deterring speeding and cut-through traffic, particularly on local residential streets.

Cost
 \$\$\$-\$\$\$

Time Frame
 medium to long

Benefits

- Reduce cut-through traffic on neighborhood streets.
- Reinforce speed limit.
- Enhance safety at intersections.

Application

- These improvements have impacts on traffic circulation and therefore traffic volumes and emergency access requirements should be considered.
- Installing these improvements may impact roadway drainage.
- These elements may be installed either permanently or temporarily. Permanent installation requires the construction of concrete curb and a combination of landscape and hardscape materials. Extent of implementation depends on the site specific requirements.



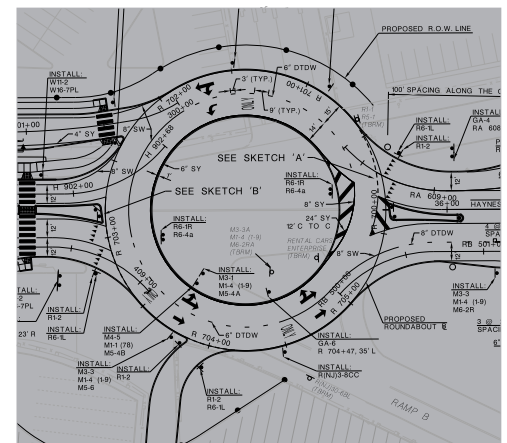
A roundabout in Burlington County, NJ calms traffic and provides safe crossings for pedestrians.

Representative Location

- Burlington County, NJ
- Haynes Avenue, Newark



Picture of Chicane from FHWA Ped Bike Safety Website.



Haynes Avenue, Newark roundabout design

Road Diet

Road diets, also known as a road reconfiguration, refer to a reduction in the amount of space allocated to motor vehicles on a street by eliminating travel lanes or reducing lane widths. This reduction allows the roadway space to be reallocated for other uses such as bike lanes, pedestrian crossing islands or sidewalks.

Cost
\$-\$

Time Frame
medium

Benefits

- Reduce crossing distance for pedestrians.
- Improves speed limit compliance and calms traffic.
- Increase areas dedicated to pedestrians.

Application

- Road diets often have traffic implications. In many cases, a traffic study is required in order to fully understand the impacts.

Representative Locations

- Irvine Turner Boulevard
- Bloomfield Avenue



Irvine Turner Boulevard was converted from two lanes per direction to one lane per direction with a bike lane, a median and left-turn lanes at intersections.



On Bloomfield Avenue, one dedicated turning lane was eliminated and the corner radius was reduced in order to provide a larger pedestrian area, calm traffic and reduce crossing distances.





Bicycle Lanes, Paths, & Routes

5



Shared Roadways	6.32
Bicycle Lane	6.33
Buffered Bicycle Lane	6.34
Contra-Flow Bicycle Lane	6.35
Separated Bicycle Lane – One-Way	6.36
Separated Bicycle Lane – Two-Way	6.37
Off-Street Bicycle Path	6.38
Bicycle Boulevard	6.39

Shared Roadways

A shared roadway is a street that is preferred for bicycle travel as indicated by signs and pavement markings. Shared roadways are used as an interim treatment or to connect to other bicycle facilities but do not provide dedicated roadway space for bicycling.

Cost
\$

Time Frame
short

Benefits

- Shared roadways can be used where other limiting factors, such as roadway width, would not otherwise allow for a connection in the bicycle network. They require no additional street space.
- The use of shared lane markings, or “sharrows,” reinforces the legitimacy of bicyclists on the street and can recommend safer bicyclist positioning.
- Bicycle routes can reduce the rate of sidewalk riding and wrong-way bicycling.



Typical street marking to signify a shared roadway, Raymond Boulevard.



“Share The Road” bicycle signage

Application

- Because they do not provide any protection or separation from vehicular traffic, bicycle routes provide a low level of comfort to bicyclists.
- Requires proper signage and pavement markings.

Representative Location

- Raymond Boulevard
- 1st Street
- Essex Street



A sharrow indicates a shared roadway on a narrow, two-way street, Essex Street.

Bicycle Lane

Bicycle lanes create a dedicated space for bicyclists to ride adjacent to traffic by designating a portion of the roadway for exclusive use by bicyclists using signs, striping and pavement markings. Bicycle lanes are located in the street between the travel lane and the parking lane or curb. Travel is in the direction of traffic.

Cost
\$\$

Time Frame
medium

Benefits

- Bicycle lanes provide dedicated space for bicyclists, increasing safety, comfort and mobility, especially on busy streets.
- Bicycle lanes allow bicyclists to ride at their own pace with minimal pressure or interference from automobile traffic.
- Bicycle lanes foster more predictable behavior and movements between bicyclists and motorists.
- Bicycle lanes, in conjunction with other bicycle infrastructure, encourages more bicycling, creating safety in numbers.



A curbside bike lane on 1st Street between Central Avenue and New Street.

Application

- Standard bicycle lanes provide a low to moderate level of comfort. While they provide dedicated space for bicyclists, this space can be violated by motorists (for example through double-parking or swerving). On higher-speed streets or those with frequent curbside parking and loading activity, bicycle lanes do not provide a low-stress experience for the majority of bicyclists.
- Bicycle lanes require a change to the striping on a street. This may necessitate shifting (or eliminating) travel lanes to accommodate the bicycle lane, plus the addition of street signs alerting motorists to the presence of the lane.

- Costs include roadway markings and signage, and will be higher if it is part of a larger street reconfiguration (e.g. a road diet).

Representative Location

- 1st Street
- Clifton Avenue



A curbside bike lane and signage on Clifton Avenue.

Buffered Bicycle Lane

A buffered bicycle lane is a standard bicycle lane coupled with a striped buffer space separating the bicycle lane from the adjacent travel lane and/or parking lane, enhancing bicyclist comfort.

Cost
\$\$

Time Frame
medium

Benefits

- Buffered bicycle lanes provide greater clearance for bicyclists, allowing them to ride further outside the “door zone” and pass one another without encroaching on the vehicle travel lane.
- Buffered bicycle lanes provide similar benefits as standard bicycle lanes while appealing to a greater number and type of bicyclists.

Application

- Buffered bicycle lanes provide a moderate level of comfort to bicyclists. Less experienced riders may find them more attractive on higher-speed streets than standard bike lanes.
- Buffered bicycle lanes require a change to the striping on a street. This may necessitate shifting (or eliminating) travel lanes to accommodate the buffered bicycle lane, plus the addition of street signs alerting motorists to the presence of the lane.
- Costs include roadway markings and signage, and will be higher if it is part of a larger street reconfiguration (e.g. a road diet).

Representative Location

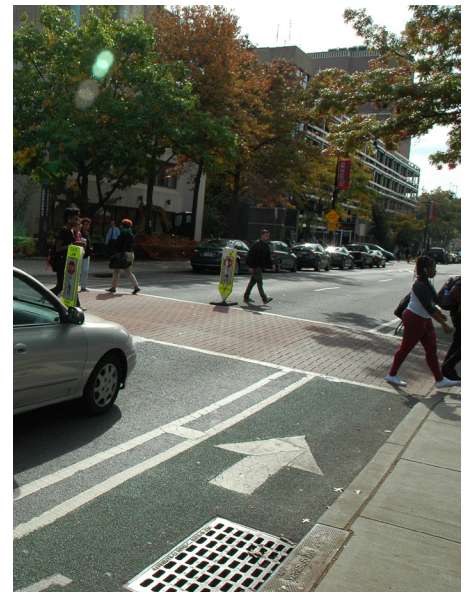
- West Market Street
- Washington Street
- University Avenue



A buffered bicycle lane on West Market Street.



A buffered bicycle lane on Washington Street.



A buffered bicycle lane on University Avenue.

Contra-Flow Bicycle Lane

A contra-flow bicycle lane is a lane that allows bicyclists to ride in the opposite direction of vehicular traffic on what would otherwise be a one-way street. The contra-flow lane allows for shorter connections in the bicycle network that makes bicycling more convenient and, in some cases, safer.

Cost
\$\$

Time Frame
medium

Benefits

- Contra-flow bicycle lanes decrease trip distance and time by creating more direct links in the bicycle network, significantly enhancing bicyclist mobility and convenience.
- When used where they can help bicyclists avoid the need to use high-volume streets and cross multiple intersections, Contra-flow Lanes may also create a safer bicycle network.
- Decreases the incidence of bicyclists riding the wrong way on a street or on the sidewalk.
- Provides connectivity for bicyclists traveling in both directions.



A contra-flow bicycle lane in Chicago, IL.

Application

- Contra-flow bicycle lanes can provide a moderate to high level of comfort depending on where they are sited (e.g. traffic speeds) and how they are designed (e.g. visibility, separation from motor vehicle traffic, intersection treatments).
- The impact of contra-flow bike lanes is greatest in sections of the street network dominated by one-way streets and large or disconnected blocks where bicyclists would have to go far out of their way to legally ride from one point to another.
- Contra-flow bicycle lanes require a change to the striping on a street. This may necessitate shifting (or eliminating) travel lanes to accommodate the contra-flow bicycle lane, plus the addition of street signs alerting motorists to the presence of the lane.



Contra-flow bike lane schematic from the NACTO Urban Bikeway Design Guide.

- Contra-flow bicycle lanes should be used where alternate routes are unsafe, uncomfortable, or are unduly long; bicyclists are already riding the wrong way; a direct connection is made with a key destination; or a two-way connection between other bicycle facilities is needed.
- Because contra-flow bicyclists will be unexpected to motorists, careful consideration should be given to signage alerting motorists to their presence.
- Contra-flow bicycle lanes are best suited for low speed and low volume streets, unless physically protected from vehicular traffic.
- Costs include roadway markings and signage, and will be higher if it is part of a larger street reconfiguration (e.g. a road diet).

Representative Location

- Union Street, Brooklyn, NY

Separated Bicycle Lane — One-Way

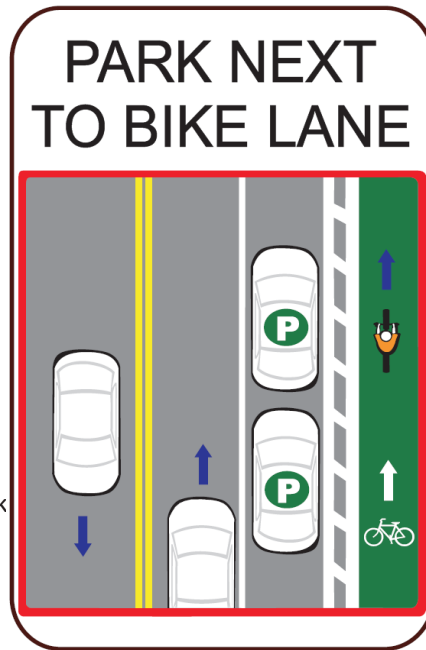
A separated bicycle lane, or cycle track, is an exclusive bicycle facility that combines the user experience of a separated path with the on-street infrastructure of a conventional bicycle lane. A separated bicycle lane is physically separated from motor traffic using a variety of treatments such as on-street parking, raised curbs or medians, bollards, landscaping, planters, concrete barriers and/or distinctive paving.

Cost
\$\$

Time Frame
medium

Benefits

- The dedicated, separated space for bicyclists increases perceived comfort and safety (and, depending on the particular location and design, actual safety), making the facility more attractive to bicyclists of a wide range of abilities and ages.
- Physical separation all but eliminates the risk and fear of a collision with vehicles mid-block.
- Physical separation reduces the risk of being hit by a door, known as dooring
- Physical separation prevents or reduces parking in the bicycle lane.



The protected bicycle lane on Mt. Prospect Avenue uses a painted buffer with plastic flexi-posts to separate the bicycle lane from the parking and travel lanes.



Application

- Separated bicycle lanes provide a moderate to high level of comfort to a wide range of bicyclists, particularly when the separation is a physical barrier.
- While separated bicycle lanes have the potential to provide a superior facility for bicyclists, there are many more design challenges that must be addressed in their implementation. In particular, special consideration must be given to the design at intersections, driveways and transit stops to manage conflicts, improve visibility and maximize awareness for both

bicyclists and motorists.

- The time frame and cost of a separated bicycle lane depends on the type of separation being employed. At its simplest, protection is provided by an off-set parking lane and a striped buffer. This approach can include a painted bicycle lane and/or raised pedestrian islands at crossings. Plastic flexi-posts or bollards can be added to provide more visibility or where there is not enough roadway width to provide for an adequately wide buffer. Concrete (Jersey) barriers or temporary or permanent curbs may be employed where traffic

speeds and volumes warrant.

- Costs include, at a minimum, roadway markings and signage and will be higher if part of a larger street reconfiguration (e.g. a road diet). Depending on the design, additional costs might include physical barriers and new signals.

Representative Location

- Mt. Prospect Avenue

Separated Bicycle Lane — Two-Way

A two-way separated bicycle lane is similar to a standard separated bicycle lane but allows for travel in both directions on one side of the road.

Cost
\$\$

Time Frame
medium

Benefits

- See Benefits of Separated Bicycle Lane – One-Way.
- Can reduce out-of-the-way travel for bicyclists by providing contra-flow movement.
- Typically utilizes less right-of-way than two one-way separated bicycle lanes on either side of the street.

Application

- See Considerations for Separated Bicycle Lane – One-Way.
- Two-way bike lanes introduce more conflicts to intersections and driveways as compared to one-way bike lanes.
- Motorists may not be expecting the presence of contra-flow riders, requiring special attention to planning detail.
- Two-way separated bicycle lanes are well suited for streets that have few conflicts on one side of the street, such as along a park or waterway.

Representative Location

- Kent Avenue, in Brooklyn, NY, runs along the East River waterfront for two miles, providing a key link in the Brooklyn Waterfront Greenway. The two-way separated bicycle lane is on the west side of the street where there are few curb cuts and intersections.



In Brooklyn, NY, the Kent Avenue two-way protected bicycle lane uses a painted buffer and off-set parking to separate the vehicle travel lane from bicyclists.



A mixing zone for vehicles turning left on to S 9th Street from Kent Avenue across the separated bicycle lane. The bicycle lane has its own traffic signal.

Source: flickr user Jacob, <https://flic.kr/p/7be7EX>, <https://flic.kr/p/7dpN9y>

Off-Street Bicycle Path

An off-street bicycle path is a bicycle facility that is completely separated from vehicular traffic (aside from intersection crossings). They can take the form of shared use paths used both by bicyclists and pedestrians and often run through parks.

Cost
\$\$\$-\$\$\$\$

Time Frame
medium to long

Benefits

- The dedicated space for bicyclists increases comfort and safety, making the facility more attractive to bicyclists of a wide range of levels and ages.
- Isolation from vehicular traffic allows for low stress riding and eliminates the risk and fear of being hit by a door or colliding with a vehicle (apart from any intersections).
- Off-street bicycle paths provide an ideal environment to learn to ride a bike in the city or to teach children how to ride.
- Off-street bicycle paths provide recreational and exercise opportunities.



Off-street bicycle paths in Newark's Weequahic Park.

Application

- Off-street bicycle paths provide the highest level of comfort to the full range of bicyclists.
- The planning, design and construction of off-street bicycle facilities can require capital construction work and consequently take a long time, especially when the facility is not being built on an existing right-of-way.
- If implemented as part of a larger street construction project, then off-street bicycle paths need only add a marginal cost.
- Costs could be significantly higher for a standalone project that requires major site preparation and construction work.



A fully separated side-path on Haven Avenue in Ocean City, NJ.

Representative Location

- Weequahic Park
- Haven Avenue, Ocean City, NJ

Bicycle Boulevard

Bicycle boulevards are low-volume neighborhood streets designated and designed to give bicycle travel priority. Through the use of signs, pavement markings and speed and volume management measures, bicycle boulevards discourage vehicular through trips, creating a safe and comfortable bicycling environment.

Cost
\$\$-\$\$\$

Time Frame
medium to long

Benefits

- Bicycle boulevards create quiet, low-speed streets that benefit residents as well as bicyclists.
- Calms vehicular traffic creating safe roads for all levels of user.
- Diverting vehicular traffic from the intended bicycle route as part of the bicycle boulevard design approach can create an exceptionally safe and low-stress bicycling environment.

Application

- Bicycle boulevards provide a high level of comfort to all bicyclists because they are located on side streets.
- Because bicycle boulevards avoid main roads, where many destinations are, they are sometimes less convenient for bicyclists making local (versus through) trips.
- The time required to implement bicycle boulevards depends on which design elements are being used. Speed tables, traffic circles, chicanes and other volume management strategies can be capital-intensive and require partial reconstruction of the roadway.
- Costs range from moderate (i.e. bicycle boulevards implemented primarily through signs, markings and low-cost treatments like speed humps) to high (those involving



This bicycle boulevard on Haven Avenue in Ocean City gives priority to bicyclists with a low speed limit and large road markings.

significant construction work for traffic diverters and landscaping).

Representative Location

- Haven Avenue, Ocean City, NJ





Park Place
↓ ↓

AHEAD



Bicycle Intersection Tools

6



Bike Box

6.42

Bicycle Signal

6.43

Two-Stage Turn Queue Box

6.44

Mixing Zone

6.45

Striping Through the Intersection

6.46

Bike Box

Bike boxes are designated spaces for bicyclists between the stop bar and pedestrian crosswalk at signalized intersections. They allow bicyclists to queue in front of motor vehicles at red lights, either to position themselves to make a left turn or to improve their visibility when proceeding on a green light.

Cost
\$

Time Frame
short

Benefits

- Provides designated space to increase the visibility of queued bicyclists for motorists waiting at red lights.
- Offers bicyclists the ability to enter the intersection in front of motor vehicles when the signal turns green. Entering the intersection at the beginning of a green phase increases bicyclists' visibility to motorists, both behind them and those making turns through the intersection from the opposite direction. This can reduce bicycle-vehicle conflicts at intersections.
- Provides bicyclists with the opportunity to position for a left turn during red phases. On multilane streets, bike boxes that extend across all lanes up to the left turn lane allow left-turning bicyclists to queue in front of left-turning vehicles behind them. This improves the visibility of left-turning bicyclists to motorists.
- Formalizes bicyclist behavior at intersections and encourage bicyclists to move up and in front of stopped motor vehicle traffic to increase their visibility when navigating the intersection during the next green phase.
- Increases the likelihood that motorists stopping at red lights will stop at the stop bar and not protrude into the pedestrian crosswalk.



This bike box, located on the Rutgers University Campus, creates space for bicyclists to make a left turn to head east on Warren Street.

Application

- Provides a moderate improvement to cyclist comfort by facilitating safer and more convenient maneuvers at intersections.
- While bike boxes will benefit a variety of bicyclists, including novices, by allowing them to leapfrog stopped traffic, some users may be uncomfortable navigating an intersection knowing there is vehicular traffic behind them. In some cases these bicyclists may instead choose to pull off to the curb or corner and wait for traffic flow to lessen, or might prefer to make crossings offset from the intersection next to a pedestrian crosswalk.
- Experienced bicyclists are more likely to take advantage of bike boxes to make left turns in front of other turning vehicles using a "vehicular style" left. Less experienced bicyclists may prefer to make a "pedestrian style," two-stage left-turn at all but the most low-volume intersections.
- Requires changes to street markings, including a potential shift in the location of an intersection's stop bar.

Representative Location

- Dr MLK Jr Boulevard at Warren Street

Bicycle Signal

Bicycle signals provide a dedicated indicator for bicyclists proceeding through an intersection. They are used in conjunction with separated bicycle lanes to separate through bicycle phases from the motor vehicle turning phase. For example, for a separated bike lane on the right side of a street, a bike signal would be used to separate the bicycle through phase from the motor vehicle right turn phase.

Cost
\$-\$

Time Frame
medium

Benefits

- Decrease intersection conflicts between bicyclists proceeding straight through an intersection and vehicles making turns across the bike lane.
- Through the use of leading bicycle intervals, bike signals can be timed to provide a green signal for cyclists before motor vehicles receive a green light. This allows bicyclists to enter the intersection earlier and increase their visibility to motorists navigating the intersection.
- Can be used to facilitate complex bicycle movements or help bicyclists navigate complex intersections (i.e. five or six-legged intersections) more safely.
- Provide more clarity for all road users and provide motorists with a better understanding of bicycle movements to anticipate at intersections.

Application

- When used at appropriate locations, bike signals can provide a high level of comfort to bicyclists by providing clarity at intersections for riders of all skill levels. Novice bicyclists will see the most benefit from bike signals.
- By introducing an additional signal phase, bike signals may reduce bicyclist convenience by reducing the amount of green time available to them, potentially increasing signal non-compliance (red



A bicycle signal gives the bicyclist the right of way in Manhattan.

light running) by bicyclists when used at inappropriate locations.

- Signal installation can be capital-intensive and may require the city to evaluate the effects of a new signal phase(s) on existing traffic volumes and flows.
- Depending on whether a new signal pole is necessary, as well as the overall budget for traffic signals, bike signal heads can represent a significant capital and operating and maintenance cost. Most intersections will require two bike signals per direction, one on the near side and one on the far side of the intersection.

Representative Location

- In Manhattan, bike signals are used along 8th Avenue's left-side running protected bike lane. Bicyclists are provided a green light during a portion of the motor vehicle through (and right-turn) phase. When the bike signal turns red, left-turning motorists are provided with a green left arrow while bicyclists are held to prevent conflicts.

Two-Stage Turn Queue Box

Two-stage turn queue boxes allow bicyclists to make left turns across high-volume or multilane intersections from a right-side aligned bike lane (or right turns from a left-side aligned bike lane). A bicyclist uses the queue box as a staging area to divide a difficult turn into two distinct phases with fewer vehicle conflicts.

Cost
\$

Time Frame
short

Benefits

- Formalizes a “pedestrian style” bicyclist turning movement, in which the bicyclist typically crosses a street with through traffic and then waits in the queue box for a signal change to proceed across the intersection with cross street traffic. The refuge area provides bicyclists with a safe location to wait to make the second portion of the maneuver out of the way of other through bicycle and vehicle traffic.
- Bicyclists performing a two-stage turn avoid higher-speed conflicts with vehicles using the intersection.
- Positions bicyclists in front of stopped vehicles at red lights on the second leg of the turning movement, providing the safety benefits associated with bike boxes.
- Provides clear visual cues for bicyclists and reduces uncertainty when navigating an intersection.

Application

- Provides a high level of comfort to less experienced or more risk-averse bicyclists because “pedestrian style” two-stage turns generally require less skill than merging into moving traffic to perform “vehicle style” turns. Painting two-stage queue boxes to formalize the maneuver and to provide a clear refuge location is most useful for bicyclists seeking a low-stress experience.



A two-stage turn queue box on Broadway in Seattle gives bicyclists a safe place to wait for a green light to turn across Broadway and onto Pike Street.

- Depending on the intersection configuration, convenience for motorists may be reduced, as a two-stage turn queue box is typically positioned in the path of vehicles seeking to make a right turn on red. As a result, two-stage turn queue boxes may need to be accompanied by new “No Right Turn on Red” restrictions if such turns are currently allowed.

Representative Location

- In Seattle, two-stage turn queue boxes along the Broadway bicycle facility provide bicyclists with an intermediate refuge when making two-stage turns across a busy arterial street.

Mixing Zone

A mixing zone is an area where bicyclists and turning motor vehicles merge into one travel lane approaching an intersection. Mixing zones require a negotiation between bicyclists and motorists: drivers typically have to yield to bicyclists already in the mixing zone, but bicyclists should proceed behind vehicles that enter first and not attempt to squeeze between the vehicle and the curb.

Cost
\$

Time Frame
short to medium

Benefits

- Provide a design option in which the potential conflict between turning motor vehicles and through bicyclists occurs before the intersection; this reduces the risk of a “right hook” or “left hook” in which a turning vehicle collides with a through cyclist in the intersection.
- May provide the best option in locations without on-street parking and/or with a constrained right-of-way where the roadway width will not accommodate both a bicycle lane and a dedicated turn lane at the intersection. They can also be more appropriate than signal separation on lower-traffic streets so as to balance safety with greater green time for bicyclists and turning motorists.
- Costs less to install than a new bike signal.
- Has a lower impact on multi-modal intersection delay.

Application

- Mixing zones provide low to moderate comfort for bicyclists. Although they simplify vehicle/bicycle conflicts by pushing them in advance of the intersection, most bicyclists (aside from the most experienced) prefer to navigate intersections with dedicated bicycle signals.
- Some novice bicyclists may try to pass between a turning



A mixing zone on 8th Avenue in New York City.

vehicle and the curb rather than proceeding single-file, reducing the mixing zone’s safety benefits. Motorists, too, may not be comfortable with the mixing zone concept until they understand the negotiation process.

- Mixing zones are often used at intersections with turning vehicle volumes that are high enough to result in frequent conflicts, but not high enough to justify the cost of installing separate bicycle signals.

Representative Location

- Eighth Avenue, Manhattan, NY

Striping Through the Intersection

Striping through an intersection guides bicyclists through an intended path. White dashed markings are typically used but can be supplemented by green paint to increase visibility and draw attention to potential conflicts. Similar striping can be applied at driveways and other curb cuts.

Cost
\$

Time Frame
short

Benefits

- Provides a direct path for bicyclists and reduces their uncertainty about how to navigate the intersection. Predictable cycling behavior through an intersection reduces the risks of conflicts with motorists.
- Markings such as dotted lines and green paint are also intended to give motorists an increased awareness of where bicyclists may be positioned. They provide a clear boundary between the paths of through bicyclists and either through or crossing motor vehicles in adjacent lanes, and in doing so alert motorists to the potential presence of bicyclists in the intersection or other traffic conflict areas.
- Striping, especially with colored paint, may increase the likelihood of turning motorists yielding to through bicyclists.
- Creates a more predictable and lower-stress cycling experience.

Application

- Intersections with striping provide a moderate level of comfort to bicyclists, contributing to a more comfortable experience than intersections with no markings at all. However, since the markings offer no physical protection, less experienced cyclists who are uncomfortable riding in mixed traffic may still choose to avoid certain busy intersections, regardless of markings.



Striping through the intersection on Dr. MLK Jr. Boulevard.

Representative Location

- Dr. MLK Jr. Boulevard



Safety Policies

7



Vision Zero Policy	6.48
Neighborhood Slow Zone	6.48
Arterial Slow Zone	6.49
School Slow Zone	6.49
Right-Turn-on-Red Prohibition	6.50
Reduced Speed Limit on County & State Roads	6.50
Automated Photo Enforcement	6.51
Automated Pedestrian Signals	6.51
Lateral Clearance for Motor Vehicles When Passing Bicyclists	6.52
Police Enforcement	6.52
Education & Outreach	6.53

Vision Zero Policy

A Vision Zero policy is a multi-faceted approach to traffic safety that combines roadway engineering, traffic enforcement and education, bringing together government, advocates, and private sector stakeholders, as well as engaging the public to become part of the solution. The policy aims for zero traffic fatalities based on the idea that no level of traffic deaths is acceptable or inevitable. The Federal Highway Administration is committed to eliminating fatalities nationally and local jurisdictions are adopting their own policies. Learn more about the national efforts at <http://safety.fhwa.dot.gov/tzd/>.

Goal

Reduce pedestrian and bicycle injuries and fatalities to zero.

Objectives

1. Assure motorist, pedestrian and bicycle safety by providing high-quality walking environments and increasing mobility.
2. Code enforcement, education and create awareness.
3. Improve streets and dangerous intersections through street design enhancement.

Strategies

- Target high-crash locations
- Reduce vehicle speeds
- Adding crosswalks where people want to cross
- Shorter crossing distances
- Clear pavement markings
- Signalization
- Designated space for all street users
- Reduce the number of traffic lanes to serve all street users while supporting capacity
- Visible crosswalks markings

- Enforcing, expanding and creating stronger laws
- Community involvement

Representative Location

New York City Vision Zero Policy: Making safer streets through street design improvement, legislation such as speed reduction, law enforcement, and outreach, education and awareness.

San Francisco Vision Zero Policy: Making a walkable, sustainable street environment by creating a pedestrian strategy that convenes policies like Great Streets, Complete Streets and Better Street Plan.

Neighborhood Slow Zone

Neighborhood Slow Zones are self-contained areas where the speed limit is reduced to 20 mph and other safety measures are applied to prioritize pedestrian, bicycle and vehicular safety on local streets.

Goal

Reduce the frequency and severity of traffic incidents in residential neighborhoods.

Objectives

1. Enforce speed limit regulation.
2. Reduce cut-through traffic on residential streets.
3. Enhance social quality of the streets.

Strategies

- Gateway treatments
- Pavement markings
- Speed humps
- Signalization
- Traffic calming devices
- Visible crosswalks markings
- Community involvement

Representative Location

New York City Neighborhood Slow Zones Policy: Neighborhood Slow Zones are a community-based program that reduces the speed limit from 25 mph to 20 mph and adds safety measures within a select area in order to change driver behavior. The ultimate goal of the program is to lower the incidence and severity of crashes. Slow Zones also seek to enhance quality of life by reducing cut-through traffic and traffic noise in residential neighborhoods. Neighborhoods that want to participate in the program have to apply. If selected, DOT works with the community to devise a plan to install the Slow Zone.

Arterial Slow Zone

Arterial Slow Zones are major streets where the speed limit is reduced to 20 mph, typically in combination with other safety measures to reduce automobile speeds and improve pedestrian and bicycle safety.

Goal

Reduce the frequency and severity of traffic incidents at intersections.

Objectives

1. Enforce speed limit regulation.

Strategies

- Traffic lights
- Gateway treatments
- Pavement markings
- Signalization
- Traffic calming devices
- Visible crosswalks markings
- Bike-share program
- Awareness

Representative Location

New York City Neighborhood Slow Zones Policy: This policy is part of the Vision Zero Policy, helping to achieve the goal of zero fatalities on roadways. The selection process is based on fatality rates and other criteria.

School Slow Zone

School Slow Zones are encouraged where school crossings have been established in the vicinity of a school with heavy student foot traffic. In the State of New Jersey, the NJ Safe Routes to School Center recommends that school zones cover a half-mile walking distance to school. Generally, the speed limit in school slow zones is posted at 20 mph with a flashing beacon sign.

Goal

Reduce pedestrian and bicycle injuries and fatalities especially at school and surrounding crosswalks.

Objectives

1. Assure motorist, pedestrian and bicycle safety by providing high-quality walking environments and increasing mobility.
2. Promote shared use of the street by supporting children's ability to walk and bike to school.

3. Improve streets and dangerous intersections through street design enhancements.

Strategies

- Complete sidewalks
- Pavement marking
- Signs
- High visibility crosswalks
- Designated space for all street users
- Flashing signals
- Pedestrian activated signals
- Curb extensions
- Pedestrian safety island

Representative Location

Newark School Zone Safety Program: Making safer routes to school through physical improvements.



School Slow Zone on Clifton Avenue.

Right-Turn-on-Red Prohibition

Right-turn-on-red (RTOR) or No-turn-on-red (NTOR) prohibitions are often applied in central business districts and school zones at all times to reduce vehicular conflicts with pedestrians. They can also be applied during certain periods of the day at selected locations throughout the city. RTOR prohibitions are usually implemented where a turning movement is considered to be high-risk and other treatments are insufficient or not possible to implement.

Goal

Reduce the severity and frequency of vehicle-pedestrian and vehicle-bicycle incidents and improve the perception of safety of turning vehicles at intersections by giving priority to pedestrian and bicyclists.

Objectives

1. Encourage placement in school zones and areas with high foot traffic.
2. Encourage placement at reduced visibility intersections.

3. Reduce the speed of turning vehicles.

Strategies

- Signalize intersections
- Channelized island with a turning traffic light

Representative Location

Minneapolis, MN Pedestrian Master Plan: Reduce pedestrian crashes involving turning vehicles at a red light when the pedestrian is crossing with a

WALK signal by adopting an NTOR policy.



NO TURN ON RED at Warren Street and Lock Street

Reduced Speed Limit on County & State Roads

Newark has a city-wide speed limit of 25 mph, however some county and state roads have higher speed limits. Reducing the speed limits on these roads will help reduce the severity of injuries in vehicle-pedestrian and vehicle-bicycle crashes.

Goal

Safer city for pedestrians, cyclists and drivers.

Objectives

1. Reduce the severity of incidents.

Strategies

- Signage
- Code enforcement

Representative Location

New York City Vision Zero Policy: Making safer streets through street design improvement, legislation — such as speed reduction — law enforcement, and outreach, education and awareness campaigns.

Automated Photo Enforcement

Automated photo enforcement can be a cost-effective way to reduce speeds, red light and stop sign running, and crashes. It is particularly effective where roadway geometry or traffic volumes make it difficult to use more traditional methods. Automated photo enforcement employs a detector that, when triggered, takes a photo of the vehicle that is breaking the law. A ticket is then issued to the owner of the vehicle based on the license plate number. New Jersey had a five-year red-light camera pilot program that ended in 2014. The state is studying the results of the pilot and will release a study in 2016, however, in the meantime red-light automatic enforcement is not allowed.

Goal

Safer roads for pedestrians, bicyclists and drivers.

Objectives

1. Reduce the incidence of speeding.
2. Reduce the incidence of running red lights.
3. Reduce the number and rate of speed-related crashes.

Strategies

- Red light automated photo

enforcement

- Stop sign automated photo enforcement
- Speed automated photo enforcement
- Advance warning signs
- Code enforcement

Representative Location

Missouri Automated Traffic Enforcement Policy: The Missouri Department of Transportation aims to mitigate speed related incidents by automating the

enforcement of red-light and speeding violations on the state highway system.

Maryland Speed Safety Programs: The Maryland State Highway Administration, through an automated speed enforcement program involving public education and visible enforcement, seeks to change driving behavior and urge motorists to drive responsibly, stay alert, and follow the posted speed limit.

Newark, NJ Red Light Running Photo Enforcement Program

Automated Pedestrian Signals

All signals throughout the city should have fixed pedestrian signals. The city is in the process of removing actuated buttons on existing poles, with the exception of accessible pedestrian signals. Where appropriate, there should be the provision for automatic pedestrian signals, in which a pedestrian crossing phase is triggered when a sensor detects a pedestrian waiting at the crosswalk. Automated pedestrian signals can help to reduce jaywalking by making crossing with the signal more convenient.

Goal

Reduce pedestrian - and bicyclist - vehicle collision at intersections and mid-block crosswalks.

Objectives

1. Provide controlled pedestrian crossing.
2. Allocate exclusive pedestrian phasing.
3. Provide supplemental non-visual guidance for pedestrians with sensory restrictions.

Strategies

- Pedestrian signals
- Visible crosswalks markings
- Advance warning signs
- Code enforcement

Representative Location

Portland, OR Pedestrian Policy: Adopted to install safe crossing measures for visually impaired pedestrians and people with limited mobility.

Lateral Clearance for Motor Vehicles When Passing Bicyclists

Laws that dictate a minimum safe passing distance for motor vehicles require that motorists leave the required space when passing a bicyclist. Most states with such a law require a minimum passing distance of three feet, though Pennsylvania requires four feet. Several states, including New York, only require a general “safe distance” passing requirement. New Jersey has no specific law for passing a bicyclist.

Goal

Create a safer street environment for both bicyclists and drivers.

Objectives

1. Create a legal framework to protect bicyclists who are hit by a passing motorist.
2. Create a less arbitrary standard.
3. Raise awareness for the importance of safe passing.

Representative Location

Connecticut, CT Bill No. 5746: Adopted to require that motorists give bicyclists at least three feet of clearance when passing.

Pennsylvania, PA House Bill: 170: Adopted to require that motorists pass bicyclists within no less than four feet at a careful and prudent speed.

Strategies

- Police enforcement
- Public awareness
- Driving safety education

Police Enforcement

The success of any safety tool or policy is in many cases dependent on its enforcement by the police. Educating police officers on new street designs and safety laws and new enforcement priorities are critical to making streets safe and welcoming to all users. Politicians, transportation officials and police leadership should coordinate their efforts as part of a holistic approach to street safety.

Goal

Enhance traffic safety through law enforcement, police education and increased partnerships with stakeholders.

Objectives

1. Promote and enforce traffic safety measures

Strategies

- Increase police education
- Traffic law enforcement
- Collaboration with relevant stakeholders

Representative Location

New York City Vision Zero Policy: Making safer streets through street design improvement, legislation, law enforcement, and outreach, education and awareness campaigns.

City of Newark Street Smart NJ Campaign



Police in action during Newark’s Street Smart campaign

Education & Outreach

Like enforcement, education and outreach are critical to supporting safety for all street users. The Street Smart NJ pedestrian safety education campaign is a statewide public education, awareness and behavioral change campaign developed by the North Jersey Transportation Planning Authority (NJTPA). Street Smart NJ has included Newark as a pilot community since 2013. Street Smart NJ in Newark used paid advertising with grassroots public awareness efforts and law enforcement to address pedestrian safety and will continue this approach moving forward. The campaign is a collaborative effort between public, private and non-profit organizations.

Goal

Enhance traffic safety through education and public outreach



Education and outreach during Newark's Street Smart NJ campaign

Objectives

1. Promote and provide education on traffic safety

Strategies

- Increase public awareness
- Educational programs
- Encourage community involvement

Representative Location

Street Smart NJ Safety Campaign: Promotes safe travel behavior by both motorists and pedestrians through a combination of education and enforcement. Provides information to help communities create a pedestrian safety campaign to target specific local issues.





Tool Box
Resources

8



Resources

National Resources

AASHTO Policy on Geometric Design of Highways and Streets (“Green Book”), 6th Edition

Contains current research and practices for highway and street geometric design, provides guidance to engineers and designers and serves as a comprehensive reference manual. Design guidelines are included for freeways, arterials, collectors and local roads, in both urban and rural locations.

Published by the American Association of State Highway and Transportation Officials

AASHTO Guide for the Planning, Design and Operation of Pedestrian Facilities, 1st Edition

Provides guidance on the planning, design, and operation of pedestrian facilities along streets and highways, specifically identifying measures for accommodating pedestrian on public rights-of-way.

Published by the American Association of State Highway and Transportation Officials

AASHTO Guide for the Development of Bicycle Facilities, 4th Edition

Provides information on how to accommodate bicycle travel and operations in most bicycle riding environments. Intended to present guidelines that result in facilities that meet the needs of bicyclists and other highway users.

Published by the American Association of State Highway and Transportation Officials

AASHTO Highway Safety Manual

Provides tools for considering safety in the project development process to help reduce the frequency and severity of crashes. Assists practitioners in selecting countermeasures and prioritizing projects, comparing alternatives and quantifying and predicting the safety performance of roadway elements.

<http://www.highwaysafetymanual.org/Pages/default.aspx>

Published by the American Association of State Highway and Transportation Officials

Manual on Uniform Traffic Control Devices (MUTCD)

Specifies the standards by which traffic signs, road surface markings and signals are designed, installed and used. These specifications include the shapes, colors and fonts used in road markings and signs.

<http://mutcd.fhwa.dot.gov/>

Published by the Federal Highway Administration of the U.S. Department of Transportation

NACTO Urban Street Design Guide

Provides a toolbox and tactics cities can use to make streets safer, more livable and more economically vibrant. Outlines both a vision for complete streets and a basic road map for how to implement them.

<http://nacto.org/usdg/>

Published by the National Association of City Transportation Officials



NACTO Urban Bikeway Design Guide

Provides cities with state-of-the-practice solutions to help create streets that are safe and enjoyable for bicyclists. Designs are based on real-world experience in bicycle-friendly cities and were selected based on their utility in helping cities meet their bicycle transportation goals.

<http://nacto.org/cities-for-cycling/design-guide/>

Published by the National Association of City Transportation Officials

FHWA Separated Bike Lane Planning & Design Guide

Provides a full overview of separated bike lanes (“SBLs”), with best practices for all phases of planning their installation, making design choices on context-sensitive issues like intersection treatment and buffer type selection and subsequent evaluation of their impact from a safety, mobility, economic and quality of life perspective. The guide also includes a contemporary assessment of crash data for before- and after- SBL implementation, best practices for data collection and holistic SBL evaluation and a comprehensive analysis of lessons learned in SBL planning, design and implementation to date in over 30 American cities.

http://www.fhwa.dot.gov/environment/bicycle_pedestrian/publications/separated_bikelane_pdg/page00.cfm

Published by the Federal Highway Administration

PEDSAFE

The Pedestrian Safety Guide and Countermeasure Selection System is intended to provide practitioners with the latest information available for improving the safety and mobility of those who walk. The online tools provide the user with a list of possible engineering, education, or enforcement treatments to improve pedestrian safety and/or mobility based on user input about a specific location.

<http://www.pedbikesafe.org/PEDSAFE/>

Published by the Federal Highway Administration Office of Safety

BIKESAFE

The Bicycle Safety Guide and Countermeasure Selection System is intended to provide practitioners with the latest information available for improving the safety and mobility of those who bike. The online tools provide the user with a list of possible engineering, education, or enforcement treatments to improve bicycle safety and/or mobility based on user input about a specific location.

<http://www.pedbikesafe.org/BIKESAFE/>

Published by the Federal Highway Administration Office of Safety

Desktop Reference for Crash Reduction Factors

Provides the estimates of the crash reduction that might be expected if a specific countermeasure or group of countermeasures is implemented with respect to intersections, roadway departure and other non-intersection crashes and pedestrian crashes.

<http://safety.fhwa.dot.gov/tools/crf/resources/fhwasa08011/>

Published by the U.S. Department of Transportation

Active Design Guidelines

Provides architects and urban designers with a manual of strategies for creating healthier buildings, streets and urban spaces, based on the latest academic research and best practices in the field. Includes urban design strategies for creating neighborhoods, streets and outdoor spaces that encourage walking, bicycling, active transportation and recreation. Addresses building design strategies for promoting active lifestyles through the placement and design of stairs, elevators and indoor and outdoor spaces. Discussion of synergies between active design and sustainable design initiatives.

<http://centerforactivedesign.org/guidelines/>

Published by the Center for Active Design

New Jersey Resources

Newark Complete Streets Policy

Recognizes the city's commitment to creating streets and intersections that safely accommodate all street users of all abilities through the planning, design, construction, maintenance and operation of new and existing transportation facilities. Newark adopted their policy in 2012 after NJDOT adopted its own policy in 2009, which strongly encourages local jurisdictions who apply for funding through local aid programs to adopt a complete streets policy.

Newark's Complete Streets Policy as well as project updates can be found on the Engineering Department section of the City's website under the Newark Complete Streets heading.

Essex County Complete Streets Policy

To ensure consistency in the design and operation of new bicycle and pedestrian infrastructure and transportation systems that are suitable to the needs and character of the county's rural setting. This county level policy may establish a model and provide useful guidelines for local municipalities.

<http://togethernorthjersey.com/?grid-portfolio=essex-county-complete-streets-implementation-plan>

Published by the Essex County Department of Public Works and the North Jersey Transportation Planning Authority

New Jersey DOT Complete Streets Policy

To create and implement a Complete Streets Policy in New Jersey through the planning, design, construction, maintenance and operation of new and retrofit transportation facilities within public rights of way that are federally or state funded, including projects processed or administered through the department's Capital Program. A Complete Street is defined as means to provide safe access for all users by designing and operating a comprehensive, integrated, connected multi-modal network of transportation options.

<http://www.state.nj.us/transportation/eng/completestreets/policy.shtm>

Published by the State of New Jersey Department of Transportation



Bus Stop Safety Toolbox

This toolbox provides guidance for creating a new bus stop or improving an existing bus stop in New Jersey. It includes consideration of bus stop design and location, pedestrian signage/signals, pavement markings and area illumination. It was produced as a follow up to The Pedestrian Safety At and Near Bus Stops Study, which was published by NJTPA in 2011.

http://www.njtpa.org/getmedia/161e37a3-6817-419a-8471-d8c976f87fdd/BusBox_final13.pdf.aspx

Published by North Jersey Transportation Planning Authority

Other Cities' Resources

New York City Street Design Manual

A comprehensive resource for street design guidelines and policies in New York City. Draws from a wide range of resources and experience to present a coherent set of choices for street design, ranging from geometric design to paving materials to lighting and furniture.

<http://www.nyc.gov/html/dot/html/pedestrians/streetdesignmanual.shtml>

Published by the New York City Department of Transportation

Boston Complete Streets Design Guidelines

Provides a road map for retrofitting Boston's streets and sidewalks and includes new street types, guidance on multi-modal intersection design, the integration of transit and bicycling and sustainable and smart design solutions.

<http://bostoncompletestreets.org/>

Published by the Boston Transportation Department

Complete Streets Chicago

Incorporates best practices from around the world and reevaluates how Chicago designs, builds and maintains its streets with primary emphasis on walking, bicycling and public transit. The plan codifies CDOT's efforts to implement the city's 2006 Complete Street Policy.

<http://chicagocompletestreets.org/>

Published by the Chicago Department of Transportation

Philadelphia Complete Streets Handbook

Street design guidance focused on all users and all modes, seeking to achieve balanced street design that accommodates cars while ensuring that pedestrians, cyclists and transit users can travel safely and comfortably.

<http://www.philadelphiastreet.com/complete-streets-handbook/>

Published by the Philadelphia Mayor's Office of Transportation and Utilities