

Pedestrian Safety Toolkit



Pedestrian Refuge Islands

Pedestrian refuge islands and medians create a safe space for pedestrians crossing the street, especially on high-speed roads and streets with multiple travel lanes in one direction. Can be painted or concrete.

Crashes reduced by 56%¹



High Visibility Crosswalk

High-visibility crosswalk styles have been shown to improve yielding behavior.

Crashes reduced by 48%¹



Pedestrian Scramble

Gives pedestrians exclusive access to an intersection by stopping vehicular traffic on all approaches, allowing pedestrians to cross diagonally or conventionally.

Crashes reduced by 35%²



Pedestrian Countdown Signals

Discourages pedestrians from crossing late by showing how much time they have until the light turns.

Crashes reduced by 25%¹



Rapid Flashing Beacons

Pedestrian-activated flashing LEDs accompanied by warning signs at crosswalks. Increase driver awareness of crossing pedestrians at uncontrolled crossings.

50% improvement in driver yielding³



Increased Crossing Time

Children and seniors may need more than the minimum required time (7 seconds) to cross the street safely.

Crashes reduced by 51%¹



Traffic Circles

Neighborhood traffic circles lower traffic speeds at minor, uncontrolled intersections and can help beautify the street.

Crashes reduced by up to 90%, driver speeds reduced by 11%^{4,5}



Daylighting

Removing visual barriers by converting parking spaces to red curbs so that vehicles and pedestrians have a clear view of the intersection. Can be combined with bulb-outs to reinforce daylighting.

Crashes reduced by 30%¹



Painted Bulb-Outs

Effectively widens the sidewalk to shorten pedestrian crossings, increase visibility, and slow turning vehicles.

Turning speeds decreased by 55%⁶



Road Diet

Decreasing the number of through-traffic lanes reduces vehicle conflict and speeds, making pedestrian crossing safer.

Crashes reduced by 50%⁴



Left Turn Traffic Calming

Reducing the speed of drivers' left turns lessens the risk of pedestrian collision.

Decreases left turn speeds by 20%⁷



Raised Crosswalk

A combination of speed tables and high-visibility crosswalks; can be used at midblock or intersections and in controlled or uncontrolled locations.

69-91% improvement in driver yielding*

Reduces vehicle speeds to 20-30 mph⁸



City of
Oakland

Department of
Transportation

Pedestrian Safety Toolkit



Leading Pedestrian Interval

Gives pedestrians a head start when entering an intersection, enhancing visibility and reinforcing their right-of-way over turning vehicles.

Crashes reduced by up to 60%⁹



Intersection Lighting

Installing lighting at intersections allows cars better visibility of pedestrians and bikers at night.

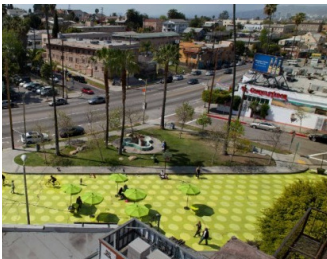
Nighttime vehicle/ pedestrian crashes reduced by 42%¹³



Flashing Arrow Turn Signals

Increases driver awareness of and yielding to pedestrians and bikes when making left turns.

**Yield rate of 70%
Crashes reduced by 10%¹⁰**



Reconfiguring Complex Intersections

Simplifying intersection design can result in more clarity for drivers and more pedestrian space, reducing conflicts.



Traffic Diverters

Reduces cut-through traffic on neighborhood streets reduces total vehicle traffic, slows speeds, and eliminates points of conflict.



Shared Streets

Eliminate distinctions between vehicle, pedestrian, and bike rights-of-way to make roads more comfortable for pedestrian street activity and keep drivers alert, slowing traffic.

Slows vehicle traffic to under 10mph¹¹



Protected Left

Introducing protected left turn signal phasing allows better coordination with pedestrian signals and increase driver awareness.

Reduce total crashes by 99%¹²



Bike Safety Toolkit



Bike Boulevard

Streets with low car traffic volumes and speeds, designated and designed to give bicycle travel priority through use of signs, pavement markings, and speed and volume management.

Crashes reduced by 63%¹⁴



Buffered Bike Lanes

Conventional bicycle lanes paired with a designated buffer space separating the bicycle lane from the adjacent motor vehicle travel lane and/or parking lane.

Injury crashes reduced by 40%*¹⁵



Cycle Track

An exclusive bike facility that feels like a separate path but uses on-street infrastructure of a conventional bike lane.

89% reduction in injury risk¹⁵



Advanced Stop Line (Bike Box)

Pavement marking designed to give priority to bicyclists over vehicles at signalized intersections, while also increasing visibility between motorists and bicyclists.

70% improvement in driver yielding¹⁶



Two-Stage Turn Queue Box

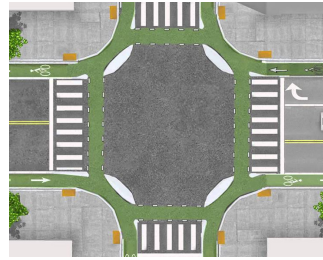
Offers a safe way to make left turns at multi-lane signalized intersections from a right side bike lane, or right turns from a left side bike lane.



Bike Lanes

A portion of the roadway that has been designated by striping, signage, and pavement markings for the preferential or exclusive use of bicyclists.

Improves perception of safety, but actual effectiveness varies.¹⁵



Protected Intersection (Dutch Junction)

Maintains the separation of protected bike lanes through intersections to improve motorist-bicyclist sight lines, slow the speeds of turning vehicles, and to give bicyclists a head-start

Crashes reduced by 63%¹⁵



Contra-flow Bike Lanes

Bike lanes in the opposite direction of vehicle traffic can reduce wrong-way and sidewalk riding on one-way streets and help connect parts of the bike network.

Can reduce sidewalk riding by 20%¹⁷



Back-in Angled Parking

This style of parking is more space-efficient and allows greater visibility of oncoming bike and vehicle traffic.

Shown to reduce vehicle/bicycle crashes.¹⁸

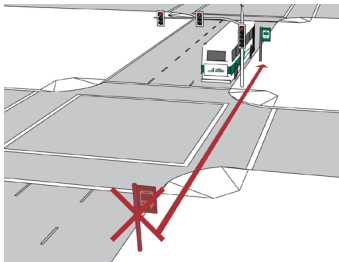


Bicycle Signals

Used in conjunction with bike lanes or other facilities, bike-specific signals can give bicyclists their own signal phase to avoid conflict with cars and increase cyclists' signal compliance.¹⁹



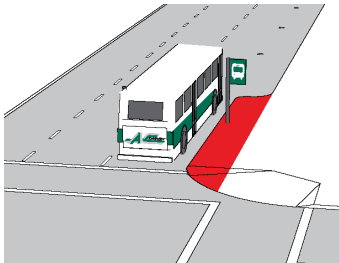
Transit Safety Toolkit



Far-side Bus Stops

Encourage pedestrians to cross behind the bus at stops rather than in front.

Improves visibility between buses and pedestrians²⁰



Bus Bulbs

Allow buses to stop without having to merge back into traffic, decreasing risk of conflict with cars and bikes while making the bus route more efficient. Doubles as pedestrian bulb-out.

Improves bus efficiency while providing safe space for pedestrians.²⁰



Transit-only Lanes

Red-painted transit-only lanes can reduce speeding and lower collision rates.

Injury collisions reduced by 24%²¹



References

1. Toolbox of Countermeasure and Their Potential Effectiveness for Pedestrian Crashes
Pedestrian and Bicycle Information Center
http://www.pedbikeinfo.org/collateral/PSAP%20Training/gettraining_references_pedToolboxofCountermeasures2013.pdf
2. A Review of Pedestrian Safety Research in the United States and Abroad
Federal Highway Administration
<https://www.fhwa.dot.gov/publications/research/safety/pedbike/03042/part3.cfm>
3. Effects of Yellow Rectangular Rapid-Flashing Beacons on Yielding at Multilane Uncontrolled Crosswalks
Federal Highway Administration
<https://www.fhwa.dot.gov/publications/research/safety/pedbike/10043/10043.pdf>
4. Evaluation of Pedestrian-Related Roadway Measures: A Summary of Available Research
Pedestrian and Bicycle Information Center
http://www.pedbikeinfo.org/cms/downloads/PedestrianLitReview_April2014.pdf#page=27&zoom=100,69,330
5. Traffic Circles
City of Seattle
<http://www.seattle.gov/transportation/projects-and-programs/safety-first/neighborhood-traffic-operations/traffic-circles>
6. Three Ways Painted Safety Zones Make People Safer
SFMTA
<https://www.sfmta.com/blog/three-ways-painted-safety-zones-make-people-safer>
7. Left Turn Traffic Calming
NYCDOT
<http://www.nyc.gov/html/dot/html/pedestrians/left-turn-traffic-calming.shtml>
8. Traffic Calming ePrimer
FHWA
https://safety.fhwa.dot.gov/speedmgt/ePrimer_modules/module3pt2.cfm
9. Leading Pedestrian Intervals
NACTO/Van Houten et al/Fayish & Gross
<https://nacto.org/publication/urban-street-design-guide/intersection-design-elements/traffic-signals/leading-pedestrian-interval/>
10. Safety effects of Traffic Signing for Left Turn Flashing Yellow Arrow Signals
Schlatter et al
http://www.cmfclearinghouse.org/study_detail.cfm?stid=432
11. Shared Streets and Alleyways White Paper
Alta Planning/City of Ashland
http://www.ashlandtsp.com/system/datas/98/original/AshlandTSP_SharedStreetsWP_020211.pdf
12. Highway Safety Manual, 1st Edition
AASHTO
http://www.cmfclearinghouse.org/study_detail.cfm?stid=297
13. Handbook of Road Safety Measures
Elvik, R and Vaa, T
<http://www.cmfclearinghouse.org/detail.cfm?facid=436>
14. Cyclist Safety on Bicycle Boulevards and Parallel Arterial Routes in Berkeley, California
Minikel, E.
http://www.cmfclearinghouse.org/study_detail.cfm?stid=221



References

15. Evaluation of Bicycle-Related Roadway Measures: A Summary of Available Research
Pedestrian and Bicycle Information Center
http://www.pedbikeinfo.org/cms/downloads/06%2013%202014%20BIKESAFE%20Lit%20Review_FINAL.pdf
16. Evaluation of Bike Boxes at Signalized Intersections
Dill, J.
https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?referer=https://www.google.com/&httpsredir=1&article=1017&context=usp_fac
17. Oslo: cycling in the opposite direction is not much of a problem
Fietsberaad CROW
<http://www.fietsberaad.nl/index.cfm?lang=en§ion=nieuws&mode=newsArticle&repository=Oslo:+cycling+in+the+opposite+direction+is+not+much+of+a+problem>
18. Back-in Angle Parking Study
Nelson\Nygaard
<http://www.ci.wheatridge.co.us/DocumentCenter/View/3319/S-01-12-Backin-Angle-Parking-Study-Nelson-Nygaard>
19. Bicycle Facility Evaluation
Washington, DC District of Transportation
https://nacto.org/wp-content/uploads/2015/04/bicycle_facility_evaluation_ddot.pdf
20. Pedestrian Safety Guide for Transit Agencies
FHWA
https://safety.fhwa.dot.gov/ped_bike/ped_transit/ped_transguide/ch3.cfm
21. Red Transit-Only Lanes Work: Two New Studies Show Their Benefits
SFMTA
<https://www.sfmta.com/blog/red-transit-only-lanes-work-two-new-studies-show-their-benefits>

