PUGET SOUND REGIONAL COUNCIL

Regional Safety Action Plan

APPENDIX C: COMPREHENSIVE LIST OF STRATEGIES

Puget Sound Regional Council

COMPREHENSIVE LIST OF STRATGIES

PREPARED FOR:

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DATE JANUARY 2, 2024

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LIST OF STRATEGIES

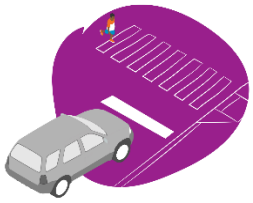
PURPOSE

This appendix provides a complete list of al strategies identified in the Toolbox.

ATTACHMENT D-1: DESIGN / ENGINEERING STRATEGIES

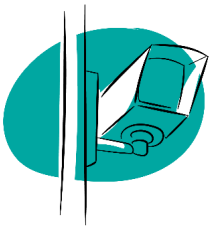
This section includes additional detail on the design and engineering strategies identified in the Toolbox.

Advance Stop Lines



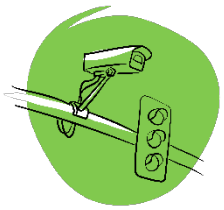
- **Description:** Increase the likelihood that motorists stop for pedestrians and bicyclists at uncontrolled crossings by making the crossings more visible. Best practice recommends that advance stop lines are placed on all approaches with uncontrolled crossings and marked crosswalks. Pairing advance stop lines with a regulatory sign should increase compliance.
- **Crash Types:** Pedestrian
- **CMF**: Pedestrian Crashes: 0.75 (CMF ID: 9017)

Automated Speed Enforcement Cameras



- **Description**: Automated speed enforcement cameras are systems that automatically issue fines for speeding. A variety of system types exist (such as mobile and fixed units), which can be applied based on an analysis of the scope of speeding issues. Signage is typically installed to warn drivers in advance of the first speed camera on a corridor. Prior to installing, a jurisdiction is strongly encouraged to conduct an analysis of that location with respect to equity considerations.[1] Cameras are placed at legal zones and areas defined by state law, such as school speed zones and roadway work zones.[2]
- **Crash Types**: Intersection, Road Departure
- **CMF**: All Crashes: 0.85 (CMF ID: 10648)

Automated Red Light Running Enforcement Cameras



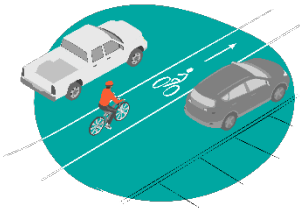
- **Description**: Automated red light running enforcement cameras are systems that automatically issue fines for running red lights. Signage is typically installed to warn drivers in advance of the first red light camera on a corridor. Prior to installing, a jurisdiction is strongly encouraged to conduct an analysis of that location with respect to equity considerations.[3] Cameras are placed at legal zones and areas defined by state law, such as school speed zones and roadway work zones.
- **Crash Types**: Intersection
- **CMF:** All Crashes: 0.75 (CMF ID: 420)

[1] "Automated Traffic Safety Cameras." MRSC. https://mrsc.org/explore-topics/public-safety/traffic-safety/traffic-safety-cameras.
[2] "RCW 46.63.210 Definitions." Washington State Legislature. https://app.leg.wa.gov/RCW/default.aspx?cite=46.63.210
[3] "Automated Traffic Safety Cameras." MRSC. https://mrsc.org/explore-topics/public-safety/traffic-safety/traffic-safety-cameras.

Bike Boxes/Two-Stage Turn Box

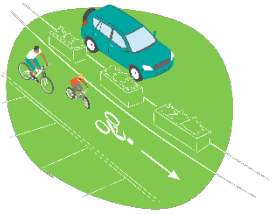
- **Description**: Bike boxes and two-stage turn boxes provide bicyclists with a safe and visible way to position themselves ahead of queuing traffic during the red signal phase, improving their visibility. Bike boxes should be used to separate bicyclists from right-turning vehicles. Two-stage turn boxes offer a clear place for bicyclists to wait when taking a two-stage left. These treatments are primarily installed at signalized intersections and use green pavement markings to deter vehicle encroachment. A bike box should be paired with at least 50 feet of a bicycle lane to ensure a bicyclist does not need to weave through queued traffic to reach it. Bike boxes are often paired with "no turn on red" restrictions to minimize conflicts.
- **Crash Types**: Bicyclist
- **CMF**: Not yet determined

Bike Lane: Conventional



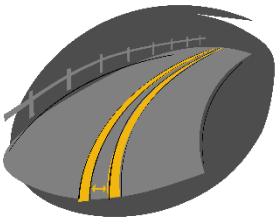
- **Description**: With a conventional bike lane, a portion of the roadway designated for the use of bicyclists using a combination of signage, white striping, and bicycle symbols placed on the lane. Conventional bike lanes are typically provided along the curb or between the curbside parking lane and the right-side travel lanes. Conventional bikeways typically provide adequate space for bicyclists between the travel lane and parked vehicles. Clear sight lines at driveways should be maintained. Best practice is to install conventional bike lanes where traffic speeds and volumes are lower; for higher-volume locations, consider separated bike lanes.
- **Crash Types**: Bicyclist
- **CMF**: Bicyclist Crashes: 0.65 (CMF ID: 10743)

Bike Lane: Separated



- **Description**: Separated bike lanes provide an exclusive on-street space for bicyclists. They are physically separated from motor vehicle traffic via vertical elements and are distinguished from sidewalk space. Vertical separation materials may include plastic bollards, planters, and concrete curbs. One-way, directional separated bike lanes are preferred on most streets with two to four lanes, because two-way lanes on one side of the street can create unexpected conflicts and require signal modifications. Best practice is to combine separated bike lanes with green conflict zone striping and protected intersections.
- **Crash Type**: Bicyclist
- **CMF**: Bicyclist Crashes (Convert Traditional Bike Lane to Separated Bike Lane with Flexi-posts): 0.50 (CMF ID: 11294)

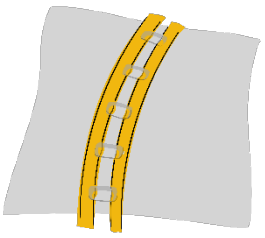
Centerline Buffer Area



- **Description**: Centerline buffer areas provide additional lateral separation between the two solid centerline markings on rural two-lane highways that can reduce head-on crashes.
- **Crash Types**: Lane Departure
- **CMF**: Head-On and Sideswipe Crashes: 0.65 (with 2-foot buffer) (Source: NCHRP)[4]

[4] "Guidelines for Treatments to Mitigate Opposite Direction Crashes." National Cooperative Highway Research Program. https://nap.nationalacademies.org/catalog/26586/guidelines-for-treatments-to-mitigate-opposite-direction-crashes#:~:text=The%20TRB%20National%20Cooperative%20Highway,the%20selection%20of%20cost%20effective.
These guidelines cite a study of centerline buffer treatments on Texas highways, which found they helped reduce opposite direction crashes, especially on two-lane rural highways.

Centerline Rumble Strips

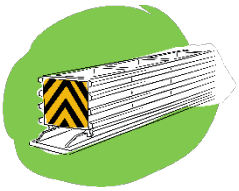


- **Description**: Longitudinal centerline rumble strips are milled or raised elements on the pavement intended to alert drivers through vibration and sound that their vehicle has left the travel lane.
- **Crash Types**: Lane Departure, Road Departure
- **CMFs**:
    - Head-On Crashes: 0.63 (CMF ID: 3355)
    - Fixed Object Crashes: 0.58 (CMF ID: 9840)

Conflict Striping/Bicycle Crossing

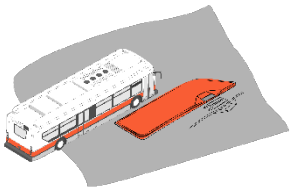
- **Description**: Dashed or solid green striping marked in bicycle lanes to denote where bicycle lanes are crossing an intersection, and signaling to drivers that they are crossing a bicycle facility. Striping denoting a bicycle crossing striping is separate from pedestrian crossings. Can be applied at signalized intersections as well as at minor intersections where bicycles may cross driveways or other points of conflict.
- **Crash Type**: Bicyclist
- **CMF**: Not yet determined

Crash Cushions at Fixed Features



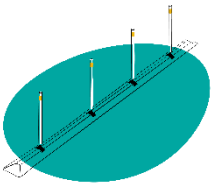
- **Description**: Crash cushions are barriers made from a variety of materials that absorb the energy of crashes and reduce the impact force for drivers. Cushions may be placed in advance of fixed objects such as poles or trees, or in narrow shoulder spaces as a barrier.
- **Crash Type**: Road Departure
- **CMF**: Fixed Object, fatal crashes: 0.31 (CMF ID: 55)

Floating Transit Island



- **Description**: A floating transit island is a raised concrete area located between transit and traffic lanes and bike lanes. Passengers use this area to board and alight transit vehicles. The island eliminates conflicts between transit vehicles and bicyclists, which occur when a bus must pull across a bike lane to access a stop. Transit islands should be applied along streets with bike lanes, and they may involve marked pedestrian crossings or channelized railings to direct transit passengers. Islands may be used at near-side, far-side, and midblock stop locations.
- **Crash Type:** Pedestrian, Bicyclist
- **CMF:** Not yet determined

Hardened Centerline/Turn Hardening



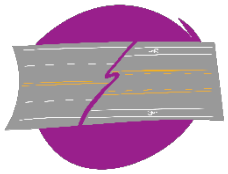
- **Description**: Hardened centerlines are flexible delineators placed between opposing travel lanes. Turn hardening improvements, such as turn wedges, are raised curbs or flexible delineators, with pavement markings on both sides of a crosswalk at an intersection.
- **Crash type**: Pedestrian, Road Departure
- **CMF**: All Crashes: 0.90 (Source: ODOT Crash Reduction Factor Manual, 2023)[5]

[5] Crash Reduction Factor Manual." Oregon Department of Transportation. 2023. https://www.oregon.gov/odot/Engineering/ARTS/CRF-Manual.pdf.
The Oregon Department of Transportation includes hardened centerlines and turn hardening (via corner wedges) as traffic calming treatments for intersections and cites ODOT engineering judgment as the basis for an estimated 10% in reduction in left-turn crashes of all severities.

High-Visibility Crosswalks

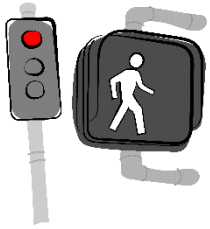
- **Description:** High-visibility crosswalks use parallel markings that motorists see more easily compared with traditional crosswalk markings located perpendicular to the motor vehicle path of travel.
- **Crash Type**: Pedestrian
- **CMF**: Pedestrian Crashes: 0.60 to 0.81 (CMF ID: 4123, 4124)

Lane Reduction or Reconfiguration



- **Description**: Reconfigurations and reductions of lanes can reduce vehicle speeds, and create space for turning lanes and pedestrian and bicycle facilities. Consider conversion of four-lane roadway to three lanes where ADT is less than 25,000 vehicles.[6] Consider combination with other speed-calming features, such as medians or separated bike lanes.
- **Crash Type**: Road Departure, Pedestrian, Bicyclist
- **CMF**: All Crashes: 0.53 (CMF ID: 2841)

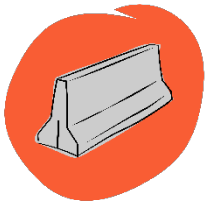
Leading Pedestrian Intervals



- **Description**: Leading pedestrian intervals are adjustments to traffic signals to give pedestrians a 3- to 7-second head start before motorists enter the intersection.
- **Crash Type**: Pedestrian
- **CMF**: Pedestrian: 0.81 (CMF ID: 9903)

6 "Road Diets (Roadway Reconfiguration)." Federal Highway Administration. https://highways.dot.gov/sites/fhwa.dot.gov/files/Road%20Diets_508.pdf.

Median Barriers

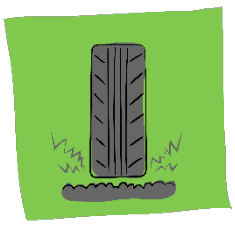


- **Description**: Median barriers are longitudinal barriers that separate opposing traffic on a divided highway and are designed to redirect vehicles striking either side of the barrier. Median barriers significantly reduce the number of cross-median crashes, which are attributed to the relatively high speeds that are typical on divided highways.
- **Crash Type**: Lane Departure
- **CMF**:
    - All Crashes: 1.24 (CMF ID: 44)
    - All Crashes, fatal: 0.47 (CMF ID: 42)

No Right on Red

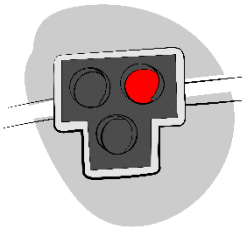
- **Description:** A policy, communicated via traffic sign or signal, used to prohibit motor vehicles from turning right when the traffic signal indication is red.
- **Crash Type**: Pedestrian
- **CMF:** Not yet determined, see Highway Safety Manual (HSM) for more information (CMF ID: 5194)

Pavement Friction Management (High-Friction Surface Treatment)



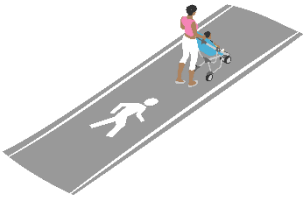
- **Description**: Measuring, monitoring, and maintaining pavement friction—especially at locations where vehicles are frequently turning, slowing, and stopping—can prevent many lane departure and related crashes.
- **Crash Type**: Lane Departure
- **CMF**: Head-On Crashes: 0.50 (CMF ID: 11384)

Pedestrian Hybrid Beacons



- **Description**: Pedestrian hybrid beacons (PHBs) protect pedestrian and bicyclist crossings by stopping traffic via steady and flashing red light phases. They are generally used where traffic is too frequent and fast (speeds higher than 35 mph) for uncontrolled crossings or flashing beacons. PHBs increase motor vehicle yielding and pedestrian visibility and may be paired with a pedestrian waiting area, allowing two-stage crossings for slower pedestrians. PHBs can be installed at intersections or midblock crossings, and best practice is to install PHBs with high-visibility crosswalks and advance stop lines.
- **Crash Type**: Pedestrian
- **CMF**: Pedestrian Crashes: 0.54 (CMF ID: 10607)

Pedestrian Walkways

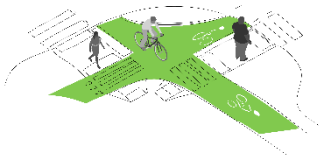


- **Description**: A pedestrian walkway is any type of defined space or pathway for use by a person traveling by foot or using a wheelchair. These may be shared use paths, sidewalks, or roadway shoulders.
- **Crash Type**: Pedestrian
- **CMF**: Pedestrian Crashes: 0.60 (CMF ID: 11246)

Protected Crossing Islands

- **Description:** Protected crossing islands have a cut-out area for pedestrian and bicyclist refuge and are used as a supplement to a crosswalk. Also known as pedestrian refuge islands or raised refuge islands. Protected crossing islands or pedestrian median islands are often installed at uncontrolled intersections or midblock crossings.
- **Crash Type**: Pedestrian
- **CMF**: Pedestrian Crashes: 0.68 (Source: Zegeer et al, (2017)[7])

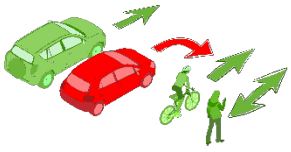
Protected Intersection



- **Description**: A protected intersection uses a combination of concrete floating curb wedges to separate bicyclists and pedestrians from drivers at an intersection, which improves sight lines and reduces conflict points. Protected intersections are best applied at intersections with bicycle infrastructure and combined with countermeasures such as high-visibility crosswalks, conflict striping, directional curb ramps, and leading pedestrian intervals.
- **Crash Type**: Bicyclist
- **CMF**: Not yet determined.

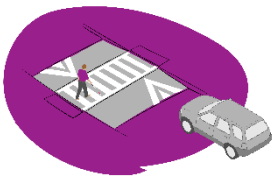
[7] Zegeer, C., C. Lyon, R. Srinivasan, B. Persaud, B. Lan, and S. Smith. 2017. "Development of Crash Modification Factors for Uncontrolled Pedestrian Crossing Treatments." Transportation Research Record: Journal of the Transportation Research Board 2636. Transportation Research Board of the National Academies. Washington, D.C. https://journals.sagepub.com/doi/abs/10.3141/2636-01 .
Median crossing islands were studied in this 2017 analysis, which conducted an empirical analysis of islands and three other types of pedestrian crossing treatments. Data collected from sites at 14 U.S. cities indicated that median islands were associated with a 32% reduction in pedestrian crashes, or a CMF of .68.

Protected Signal Phasing



- **Description:** Protected signal phasing uses green- or red-arrow signals to restrict left or right motorist turning, allowing pedestrians and bicyclists to use crossings without interactions with turning vehicles.
- **Crash Type:** Pedestrian
- **CMF**: All Crashes (change from permissive left-turn phasing to protected only): 0.45 (CMF ID: 4144)

Raised Crossings

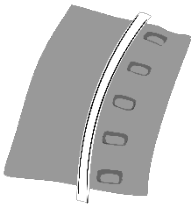


- **Description**: Raised crossings are elevated at least 3 inches above the roadway, up to the sidewalk level.
- **Crash Type**: Pedestrian
- **CMF**: Pedestrian Crashes: 0.55 (CMF ID: 136)

Roundabouts

- **Description:** Roundabouts are circular intersections controlled by yield control rather than a signal or stop. Roundabouts provide safety improvements over other intersection types by reducing the number of potential conflict points and slowing vehicle speeds.
- **Crash Type:** Intersection
- **CMF:** Angle Crashes: 0.17 (CMF ID: 4705)

Shoulder or Edge Line Rumble Strips

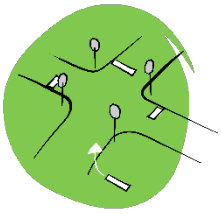


- **Description:** Installation of milled asphalt rumble strips on the outer edge line of a roadway encourages drivers to maintain alertness and reduces instances of leaving the roadway. Care should be taken when applying edge line rumble strips near bicycle facilities, or on shoulders that may be used as a bicycle facility.
- **Crash Type:** Road Departure
- **CMF**: Fixed Object Crashes: 0.56 to 0.80 (CMF ID: 6850, 6946 for shoulder rumble strips)

Speed Feedback Sign

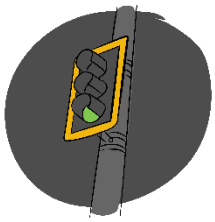
- **Description**: Speed feedback signs are automated sign installations that display recorded speeds for approaching vehicles, to remind them of their actual speed against the stated limit. Feedback signs can be programmed to flash messages such as “Slow Down” if a driver exceeds a certain threshold. Feedback signs may be permanent installations or temporary countermeasures. They may be installed ahead of key safety locations such as school zones, work zones, or horizontal curves.
- **Crash Type**: Road Departure, Lane Departure
- **CMF**: All Crashes (on rural highways): (CMF ID: 6885)

Systemic Application of Multiple Low-Cost Countermeasures at Stop-Controlled Intersections



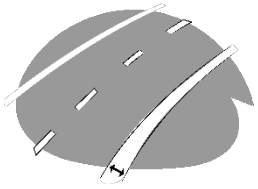
- **Description**: This systemic approach to intersection safety involves deploying a package of multiple low-cost countermeasures, including enhanced signing and pavement markings, at a large number of stop-controlled intersections within a jurisdiction.
- **Crash Type**: Intersection
- **CMF**: Dependent upon selection of countermeasures

Traffic Signal Backplates with Retroreflective Borders



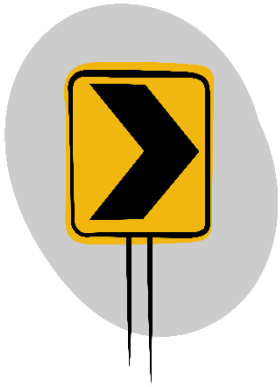
- **Description**: Retroreflective borders on backplates added to traffic signals improve the visibility of the illuminated face of traffic signals in both day and nighttime conditions. This typically involves framing the signal with 1- to 3-inch-wide retroreflective border.
- **Crash Type**: Intersection
- **CMF**: All Crashes: 0.85 (CMF ID: 1410)

Widen Edge Lines



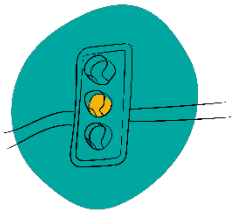
- **Description**: Clearly delineated, wider edge lines improve the visibility of the edge of the roadway for drivers, reducing the likelihood that they will leave the roadway. Consider systemic application along rural highways.
- **Crash Type**: Road Departure
- **CMF**: Fixed Object Crashes: 0.71 (CMF ID: 4764)

Warning Signs at Horizontal Curves



- **Description**: Installation of advance signage elements raises driver awareness of oncoming curves and driver attentiveness. Warning sign treatments should include elements such as advance warning signs, chevron signs within the curve, retroreflective signposts, and delineators. Treatments may be applied in advance of curves and within curves.
- **Crash Type**: Road Departure
- **CMF**: All Crashes: 0.96 (CMF ID: 2436)

Yellow Change Intervals

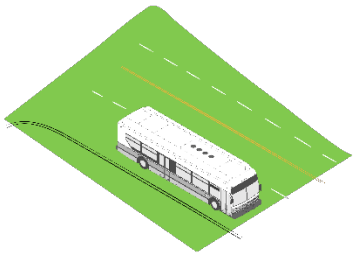


- **Description**: At a signalized intersection, the yellow change interval is the length of time that the yellow signal indication is displayed following a green signal indication. Reviewing and updating traffic signal timing policies and procedures concerning the yellow change interval can reduce red light running.
- **Crash Type**: Intersection
- **CMF**: Ranges, depending upon time of change and relation to Institute of Traffic Engineers (ITE) recommended practice

ATTACHMENT D-2: PLANNING, POLICY, AND PROGRAM STRATEGIES

This section includes additional detail on the planning, policy, and program strategies identified in the Toolbox.

Apply Consistent Transit and Safety Treatments along High-Capacity Transit Corridors Treatment



Description: Ensuring the physical safety of transit passengers while accessing transit facilities is essential for a successful transit system. Passengers often travel by various means, such as driving, walking, or cycling, to reach transit stops. Encouraging transit use can reduce motor vehicle crashes, and providing safe, comfortable access for pedestrians and cyclists to transit stops can help lower the risk of non-motorized crashes.[8]

Applicable Emphasis Areas: High-Frequency Transit Stations

Applicable Crash Types: Pedestrian, Bicyclist, Intersection

Best Practices

- Improve sight lines along transit corridors for transit operators, motorists, pedestrians, and bicyclists, including implementation of restricted parking along transit corridors.
- Restrict parking along transit corridors.
- Systemic placement of transit stops on far side of intersections.
- Systemic crossing improvements at transit stops/hubs.
- Separate pedestrian and bicyclist infrastructure connecting to transit stops/hubs.
- Incorporate technological vehicle safety features in fleet purchasing standards. Safety features are evolving and may include:
- Bus warning lights: Strobes or light bars that light up when bus begins moving or is turning
- Rail features: Car-barriers that prevent visually impaired passengers from mistaking the space between rail cars as

[8] Goughnour, Elissa, Taylor Bonner, Eben Sweetser, and Darrell Smith. "Improving Safety for Pedestrians and Bicyclists Accessing Transit." *Federal Highway Administration*, September. 2022. https://safety.fhwa.dot.gov/ped_bike/ped_transit/fhwasa21130_PedBike_Access_to_transit.pdf.

a doorway and inadvertently stepping off the platform between cars and falling to the track bed

- Collision avoidance and blind spot detection: Technology that alerts drivers to a potential collision or object within the vehicle's blind spot.

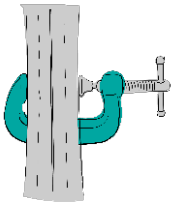
Case Studies

- In October 2020, IndyGO, the Indianapolis Public Transportation Corporation, completed a system-wide bus stop balancing program to enhance system performance. IndyGO had updated its service standards in 2019, with stop spacing becoming a key element across its rapid, frequent, and basic service categories. The new standards acknowledged that wider stop spacing would increase the chances of stops being near signalized or improved crossing points, contributing to a safer pedestrian environment. The maximum additional walking time for transit riders was limited to 5 minutes or less (one quarter-mile).[9]

- The First Last Mile Strategic Plan, released in 2014 by the Los Angeles County Metropolitan Transportation Authority (Metro) and the Southern California Association of Governments (SCAG), aims to improve transit connectivity by addressing the first and last portions of a passenger's trip, often completed on foot, by bike, or other means. The plan introduces the "Pathway," a county-wide network designed to reduce the time and distance it takes to travel between transit stations/mobility hubs and final destinations. To support this, Metro has implemented active transportation improvements like enhanced crosswalks, bulb outs, signal timing for pedestrians and bicyclists, bicycle lanes, and wayfinding signage. Since adopting the plan in 2016, Metro has collaborated with local communities to tailor improvements to the specific conditions of each station area, including infrastructure like real-time transit information and better pedestrian and bicycle facilities. [10]

[9] Goughnour, Elissa, Taylor Bonner, Eben Sweetser, and Darrell Smith. 2022.
[10] Goughnour, Elissa, Taylor Bonner, Eben Sweetser, and Darrell Smith. 2022

Improve Connections Across Arterials, Highways, and Interstates



Description: Barriers such as arterials, highways, and interstates often prevent safe access on foot, by bicycle, or public transit to essential services.

Applicable Emphasis Areas: Urban, Multilane Arterials; Rural Highways; Tribal Areas; High-Frequency Transit Stations; Areas of Lower Income

Applicable Crash Types: Pedestrian, Bicyclist

Best Practices

- Avoiding widening existing roadways, except to create bicycle and pedestrian facilities, to ensure that existing barriers do not become worse.
- On roads that are already wide, with high motor vehicle speeds and traffic volumes, systemic implementation of countermeasures can improve safety outcomes. Countermeasures include gateway treatments at entrances to communities, road diets/roadway reallocation, leading pedestrian intervals, safe crossing treatments such as medians and pedestrian refuges, no turn on red, and HAWK signals at mid-block crossings, and above grade crossings over interstate highways.

Case Studies

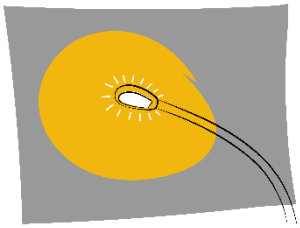
- In June 2021, Wales established a panel to assess the environmental impact of 59 planned road projects aimed at easing congestion.[11] The panel found that these projects would likely increase private car use over time, leading to greater demand for new roads and hindering Wales's goal of achieving net zero emissions by 2050. In the future, new roads will only be allowed to be built if their proponents can prove they will support the transition to non-car travel, to help Wales adapt to the impacts of climate change or improve safety with relatively minor changes. On the flip side, proposals will

[11] Nugent, C. (2023, February 15). Why One Country Wants to Stop Building Roads to Fight Climate Change. Time Magazine. https://time.com/6255769/wales-roads-building-projects-climate-change/

be rejected if they increase capacity for cars or allow cars to travel at higher speeds.[12]

- The City of Lehi, Utah, constructed a bridge to connect the shared use Murdock Canal Trail that previously had an at-grade crossing of a six-lane highway. Prior to the construction there were approximately 45 bicyclist trips recorded in the month July 2019 (~1.5/per day) crossing the highway at grade. After the bridge opened, there were 4,430 bicyclist trips crossing the bridge recorded in the month of July 2021 (~143/per day).[13]

Improve Lighting



Description: Crash analysis suggests that low lighting conditions are a factor in FSI crashes in both rural and urban contexts. Adequate lighting improves visibility for all road users and can improve safety outcomes for the principal types of crashes, including at intersections, pedestrian and bicyclists, and roadway departure.

Applicable Emphasis Areas: Urban, Multilane Arterials; Rural Highways; Tribal Areas; High-Capacity Transit Stations; Areas of Lower Income

Applicable Crash Types: Pedestrian, Bicyclist, Intersection, Lane Departure, Road Departure

Best Practices

- Lighting studies can identify locations where lighting can improve road safety. This may include locations with a history of crashes in dark conditions, at intersections, and where pedestrians walk along roadway shoulders.

Case Studies

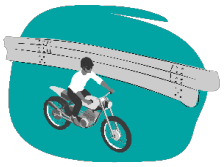
- The Minnesota Department of Transportation (MnDOT) implemented a Street Lighting at Rural Intersections program following a crash data analysis that suggested that approximately 50% of FSI crashes were occurring at rural intersections in dark conditions. MnDOT took a

[12] Nugent, C. (2023, February 15).

[13] DTV Capacity Building, Teije Gorris, Mike West, and Kim Struthers. "Monthly Cycling Webinar: Applying the 5 Design Principles in Lehi City." DTV Capacity Building. February 22, 2023. https://www.youtube.com/watch?v=eRKbbRdhWlE.

systemic approach to addressing this issue by developing a set of criteria of risk factors to help counties to consistently evaluate and install lighting at rural intersections. Counties were also encouraged to include lighting as a strategy in road safety plans. "Since implementing a proactive lighting program, MnDOT has noticed a reduction in nighttime crashes at rural intersection locations; specifically, nighttime-to-daytime crash ratios have been significantly lower at those intersection locations where roadway lighting was installed."[14]

Reduce Risks for Motorcycle Crashes



Description: Riding a motorcycle is riskier than driving a passenger vehicle due to the lack of protective structure and the motorcycle's smaller size, making it less visible and more vulnerable in crashes.[15] In 2021, despite making up only 3.5% of registered vehicles, motorcyclists accounted for 14% of all traffic fatalities and were 24 times more likely to die in crashes than passenger car occupants. Additionally, data suggests that speeding is more prevalent in fatal motorcycle crashes and impaired riding is a factor in fatal crashes, especially at night.[16] The following best practices are aimed at reducing fatal and serious injury risks to motorcyclists through their systematic application.

Applicable Emphasis Areas: Rural Highways; Tribal Areas

Applicable Crash Types: Road Departure, Lane Departure

Best Practices

- High friction treatments to reduce motorcyclist run-off road crashes on curve

[14] Review of Minnesota Department of Transportation's Street Lighting at Rural Intersections (Publication Number FHWA-SA-22-077). n.d. FHWA. https://highways.dot.gov/sites/fhwa.dot.gov/files/2023-03/Minnesota%20Department%20of%20Transportation%27s%20Street%20Lighting%20at%20Rural%20Intersections.pdf.

[15] NHTSA. n.d. "Countermeasures That Work: Motorcycle Safety." https://www.nhtsa.gov/book/countermeasures-that-work/motorcycle-safety.

[16] NHTSA. n.d. "Countermeasures That Work: Motorcycle Safety."

- Use of Motorcycle Protection System (MPS) barriers instead of guard rails to reduce injuries to motorcyclists
- Pave the first 15 feet of gravel driveways that intersect with a roadway to reduce debris on roadway surface.[17]
- Use high friction pavement markings- Pavement marking suppliers should be required to provide friction numbers for all the pavement markings. Road agencies should choose those with higher fraction ratings.[18] Regular maintenance to reduce potholes, uneven pavement conditions, and gravel or debris on roadway. [19]
- During road construction projects, do not allow traffic to run on roads with raised manhole covers and apply friction to steel plate surfaces. Post warning signs for both conditions.[20]
- Post warning signs after chip sealing operations have taken place and sweep loose aggregate off roadway as soon as tar has set[21]
- Awareness campaigns regarding helmet use, reducing impaired driving, and speeding.
- Practical advanced motorcycle safety training programs.

Case Studies

- In Belgium and other places, a common approach is to leave a gap in the road markings, allowing motorcyclists to pass through without experiencing a change in friction.[22]
- Speed is often a factor in motorcycle crashes and run-off road vehicle crashes, especially on curves. The FHWA found that countermeasures such as high-friction surface treatment strategies decrease up to 63 percent of injury

[17] Nicol, David A., Dennis W. Heuer, Dr. Susan T. Chrysler, James S. Baron, Mark J. Bloschock, Keith A. Cota, Paul D. Degges, et al. 2012. "Infrastructure Countermeasures to Mitigate Motorcyclist Crashes in Europe." *FHWA*, August. https://international.fhwa.dot.gov/scan/12028/12028.pdf.

[18] Motorcyclist Advisory Council (MAC). 2020. "Motorcyclist Advisory Council Recommendations to the Secretary of Transportation and the Federal Highway Administration." February 10, 2020. https://highways.dot.gov/sites/fhwa.dot.gov/files/2022-07/mac_report010221.pdf.

[19] Motorcyclist Advisory Council (MAC). 2020.

[20] Motorcyclist Advisory Council (MAC). 2020.

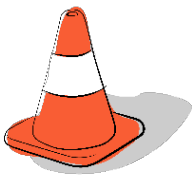
[21] Motorcyclist Advisory Council (MAC). 2020.

[22] Nicol, David A., Dennis W. Heuer, Dr. Susan T. Chrysler, James S. Baron, Mark J. Bloschock, Keith A. Cota, Paul D. Degges, et al. 2012.

crashes at ramps, 48 percent of injury crashes at horizontal curves and 20 percent of total crashes at intersections for all motor vehicles. As part of horizontal curve systemic safety analysis, Rhode Island DOT identified a relationship between horizontal curve radii and motorcycle fatal and serious injury crashes and installed HFST along key locations. Based on the results, Rhode Island is exploring installing HFST at all curved sections with a history of motorcycle crashes. [23]

- Speed is also a factor in motorcycle run-off the road crashes. However, guard rails designed to stop vehicles from exiting the roadway can cause serious injuries or be deadly to motorcyclists because the height is designed to be at a vehicle's bumper. Utah DOT installed Motorcycle Protection System (MPS) barriers along SR 191. Prior to installation, there was an average of one motorcycle injury crash a year. In the three years post-installation, there were no reported motorcycle injury crashes.[24]

Low-Cost, Quick-Build Strategies



Description: Quick-build demonstration projects are temporary street design installations aimed at rapidly enhancing safety and accessibility. They provide an opportunity to test new ideas, such as slowing traffic, creating connections, or encouraging walking and biking, while gathering real-time community feedback. These low-cost projects allow communities to experiment with designs before making permanent infrastructure changes. They also help build public support and partnerships, improving safety and fostering innovation. Additionally, federal funding, such as through the Safe Streets and Roads for All program, is available to support such initiatives, which can lead to safer and more sustainable transportation solutions.

Applicable Emphasis Areas: Urban, Multilane Arterials; Tribal Areas; High-Frequency Transit Stations; Areas of Lower Income

[23] MOTORCYCLE SAFETY NOTEWORTHY PRACTICES: Infrastructure and Engineering FHWA-SA-22-032." 2022. USDOT FHWA. June 2022. https://highways.dot.gov/sites/fhwa.dot.gov/files/2022-07/FHWA_MAC_Recommendations_Project_Noteworthy_Practices.pdf.
[24] "MOTORCYCLE SAFETY NOTEWORTHY PRACTICES: Infrastructure and Engineering FHWA-SA-22-032." 2022.

Applicable Crash Types: Pedestrian, Bicyclist

Best Practices

Incorporate quick-build strategies and demonstration projects for rapid roll-out of safety improvements for pedestrians and bicyclists. As funding becomes available, convert temporary improvements to higher-quality, more durable permanent improvements.

Case Studies

- The City of Emmett, Idaho, (population 6,600) created a three-quarter mile pedestrian lane by extending the road shoulder and installing an extruded curb between the lane and motor vehicle traffic (with periodic cuts to allow for storm drainage) to improve safety for children walking to an elementary school located on a street with no sidewalks. With project costs of 10 percent of a traditional sidewalk, it provided a quick way for the town to improve pedestrian safety in a school zone. Cities in Washington such as Kirkland and Bainbridge Island have installed similar extruded curb protected walkways in school zones.
- The City of Bethel, Vermont (population 2,000) worked with organizations Team Better Block and AARP Vermont, and community volunteers, to install temporary curb extensions and painted crosswalks during a fall festival on the highway that runs through its downtown. The temporary safety improvements were well-received and later made permanent.
- The City of Tacoma, Washington's Vision Zero Action Plan recommends "a quick-build pilot program that includes low-cost traffic-calming measures, prioritizing corridors, crossings, and districts identified for speed reduction or pedestrian safety improvements, particularly in areas with low Equity Index scores."[25] This pilot program incorporates monitoring and evaluation through

[25] "Action Plan." Vision Zero Tacoma. September, 2022. https://cityoftacoma.org/UserFiles/Servers/Server_6/File/cms/PublicWorks/Engineering/VisionZero/FINAL%20Tacoma%20Vision%20Zero%20Action%20Plan%20September%202022.pdf

observations and surveys to complement any crash data that may not be readily available.

- Hoboken, New Jersey's approach to safety improvement implementation includes quick-build infrastructure road safety improvements and then making them permanent as time goes on. The city leverages routine road maintenance work such as repaving to implement low-cost, high-impact safety measures:
    - Daylighting intersections with painted curb extensions and flex posts, bike racks, or bollards.[26]
    - Any road with a high number of crashes and proximity to schools, hospitals, and parks are given wider sidewalks and medians when they are repaved[27]
    - Install high visibility crosswalks
- The Second Avenue protected bike lane in Seattle originally had an 18-month design and implementation timeline. The mayor accelerated the project timeline to accommodate the planned rollout of a new bike sharing system in the fall. The bike lane incorporated features like dedicated bike signal phases. Despite challenges, including a last-minute scramble for parts, the installation was completed in just four months. The successful launch resulted in a tripling of bike volumes along the avenue and spurred further quick-build bike network projects throughout the city.[28]
- Jersey City, New Jersey implemented 10 miles of protected bike lanes in one year using quick-build materials. This is approximately one quarter of the City's planned bicycle network. The City plans to roll out the remaining bike network with similar quick-build materials

[26] John Surico, "It's Been a Deadly Year on US Roads. except in This City.," Bloomberg.com. December 28, 2022, https://www.bloomberg.com/news/features/2022-12-28/it-s-been-a-deadly-year-on-us-roads-except-in-this-city.
[27] Christopher Robbins, "Hoboken Hasn't Had a Traffic Death in 4 Years. What's It Doing Right?," Curbed, June 17, 2022, https://www.curbed.com/2022/06/hoboken-traffic-deaths-none-vision-zero-streets.html.
[28] "QUICK BUILDS for BETTER STREETS: A NEW PROJECT DELIVERY MODEL for U.S. CITIES." People for Bikes. https://nacto.org/wp-content/uploads/2016/05/2016PeoplefoBikes_Quick-Builds-for-Better-Streets.pdf.

while gradually making facilities permanent with higher quality materials.[29]

- Deterred by high costs and lengthy implementation timelines of "gold standard" Dutch and Danish cycling infrastructure, the City of Ghent, Belgium implemented its own circulation plan modeled after the City of Groningen's 1977 plan, to enhance livability and increase bicycle mode share from 22% to 30% by 2030. The plan restricted private vehicle traffic between districts, requiring cars to use the ring road while allowing bicycles and pedestrians direct access, which made bicycling significantly faster. Phase I featured rapid implementation (completed in one weekend) of traffic calming measures, including diverters and automated enforcement cameras, and resulted in a 60% increase in bicycling, achieving the 30% target by 2018. Subsequent phases expanded the bicycle network and constructed numerous pedestrian and bicyclist bridges. Key factors for success included strong political support, public engagement, and a modest initial investment of approximately 5 million euros.[30]

Reduce Vehicle Speeds and Speed Limits

Description: Context appropriate speed limits and streets designed to encourage slower travel speeds are essential in reducing fatal and serious injury crashes. Improved design and infrastructure improvements should always be prioritized over enforcement methods. Multilane arterial streets often have higher vehicle speeds, resulting in more fatal and serious injury crashes on these streets.

Applicable Emphasis Areas: Urban, Multilane Arterials; Rural Highways; Tribal Areas; High-Frequency Transit Stations; Areas of Lower Income

[29] Streetfilms®. 2020. "Jersey City's Quick Build Bike Network." YouTube. December 21, 2020. https://www.youtube.com/watch?v=1mC1l8L5aBA.

[30] Watteuw, Filip, and Marco te Brömmelstroet. 2023. Review of Transforming the Urban Transportation Systm. Cykelcentrum. https://cykelcentrum.vti.se/arkiv/webbinarier/2023-06-02-transforming-the-urban-transportation-system

Applicable Crash Types: Pedestrian, Bicyclist, Road Departure, Lane Departure, Intersection

Safer Speeds Policies

Best Practices

- To set appropriate speed limits and design speeds, the newly updated MUTCD recommends that practitioners consider the following six factors: roadway environment, roadway characteristics, geographic context, crash experience, speed distribution, and analysis of speed trends.[31] As noted in the Federal Register regarding the updated MUTCD, published in December 2023, "The FHWA emphasizes that there is no existing or new requirement that a speed limit must be set at the 85th-percentile speed" and clarifies that "on urban and suburban arterials and rural main streets, the 85th-percentile speed should not be used as the sole consideration in setting speed limits."[32]
- Reevaluate current practices around setting posted speed and consider the approaches laid out in NACTO's "City Limits" guide to holistically evaluate and set speed limits based on context and the safety of all road users.

Case Studies

- Based on a comprehensive speed study of its network, the City of Tacoma, Washington lowered speed limit in 2023 to 20 mph on residential streets and 25 mph on arterial streets in four of the city's Neighborhood Business Districts.[33] It plans to reduce speeds on additional arterials following guidance that was developed as part of the Vision Zero planning effort.

[31] "Federal Register : Request Access." n.d. Unblock.federalregister.gov. https://www.federalregister.gov/documents/2023/12/19/2023-27178/national-standards-for-traffic-control-devices-the-manual-on-uniform-traffic-control-devices-for.
[32] "Federal Register : Request Access." n.d.
[33] Vision Zero." Home - City of Tacoma. https://www.cityoftacoma.org/cms/one.aspx?pageId=190027.

- The City of Hoboken, New Jersey lowered the speed limit to 20 mph on all city streets and 15 mph in school and park zones.[34]

Safer Speeds Design

Best Practices

- Utilize design standards that support speed management strategies that reduce the number of lanes in a street or roadway, narrow lane widths and tighten curb radii to encourage slower motor vehicle speeds.
- Take advantage of resurfacing and restriping projects of highways and major arterials for potential to include road diets/roadway reallocation, for example, converting four- or five-lane roads to three-lane roads and the possibility to include all ages and abilities bicycle facilities in conjunction with these safety improvements. The FHWA's Proven Safety Countermeasures webpage states that traditional road diets can reduce collisions by 19% to 47%, lower vehicle speeds, enhance mobility and access for all road users, and improve overall quality of life by better integrating roadways with their surrounding environments. The FHWA notes roadways with average daily traffic of 25,000 or lower are strong candidates for road diets.[35]
- Adjust traffic signal timing to encourage slower speeds.
- Increase the frequency at which speed limit signs are placed along a corridor.
- Use of traffic signal video analytics to analyze existing traffic camera footage and convert it into flow, speed, and conflict event data.

[34] City of Hoboken. 2022. Review of Hoboken to Reduce Speed Limit to 20 MPH Citywide. July 7, 2022. https://www.hobokennj.gov/news/hoboken-to-reduce-speed-limit-to-20-mph-citywide#:~:text=The%20City%20of%20Hoboken%20today%20announced%20the%20reduction,streets%20for%20all%20users%20and%20modes%20of%20transportation.

[35] "Road Diets (Roadway Reconfiguration)." Federal Highway Administration. https://highways.dot.gov/sites/fhwa.dot.gov/files/Road%20Diets_508.pdfv.

- Implement low-cost gateway treatments to indicate a speed reduction when transitioning from higher speed zones to lower speed zones.

Case Studies

- Cities such as Portland, Oregon and San Francisco, California use traffic signal timing to encourage lower speeds by using a "green wave" where traffic signals are timed to be green for relatively lower consistent speeds. If motorists go above this speed, they will encounter a red light.[36]

- In Los Angeles, California, speed feedback placement signs trigger downstream traffic signals to change to red if the motorist is going above the speed limit.[37]

- In August 2010, the Seattle Department of Transportation implemented a Road Diet on Nickerson Street to enhance pedestrian safety and reduce speeding.[38] The street was reconfigured from two lanes in each direction to one lane per direction with a center turn lane and bicycle lanes. This change, aimed at slowing traffic, resulted in a significant reduction in speeding and collisions, while reintroducing crosswalks and adding safety features like curb bulb-outs and refuge islands. One year later, a study confirmed the road was safer with minimal traffic diversion, and Nickerson Street saw only a 1% decrease in traffic volumes.[39]

- In Genessee County, Michigan the Metropolitan Planning Commission (GCMPC) conducted a county-wide corridor study that evaluated and ranked more than 140 miles of four-lane undivided roads for potential conversion to three lanes ("Road Diets") in 2009.[40] Following the study, the County converted 26.1 linear miles in 11 cities and

[36] National Academies of Sciences, Engineering, and Medicine. 2019. Pedestrian Safety Relative to Traffic-Speed Management. Washington, DC: The National Academies Press. https://doi.org/10.17226/25618

[37] National Academies of Sciences, Engineering, and Medicine. 2019. Pedestrian Safety Relative to Traffic-Speed Management. Washington, DC: The National Academies Press. https://doi.org/10.17226/25618

[38] Federal Highway Administration. Seattle, Washington – Nickerson Street. https://highways.dot.gov/safety/other/road-diets/road-diet-case-studies/seattle-washington-nickerson-street

[39] Federal Highway Administration. . Seattle, Washington – Nickerson Street. https://highways.dot.gov/safety/other/road-diets/road-diet-case-studies/seattle-washington-nickerson-street

[40] Genesee County Metropolitan Planning Commission Prepared by the Genesee County Metropolitan Planning Commission Complete Streets Technical Report." 2009. https://gcmpc.org/wp-content/uploads/pdf/Complete_Streets/Complete_Streets_Technical_Report_Approved_withAppendix.pdf

townships from four-lane to three-lane roads. An analysis of before and after crash data on 18 of these corridors with ADTs ranging from 1,654 to 20,865, suggested an average decrease of 32.1% in all non-alcohol and non-deer related crashes after the conversion from three-lane to four-lane roads. [41]

- The City of Bellevue, Washington adjusted traffic signal operations at 124th Avenue Northeast and Northeast Eighth Street. Using an existing traffic camera, the City conducted before and after video analytics of flow, conflict, and speed data. In addition to identifying conflict hot spots, the video analytics offered rapid insight on whether a countermeasure achieves a favorable outcome. The video analysis suggested there was a 60% decrease in critical conflicts. This quick study (approximately one week of data collection compared to many years of crash report documentation) demonstrated a strong return on investment for the $10,000 cost. Bellevue has since begun using this technology on high-injury corridors, incorporating conflict analytics into road safety assessments to identify and prioritize future safety projects.[42]

- In rural areas, many communities are situated along high-speed roads where speed limits drop significantly, often from 55 mph to 25 mph, as the road enters the town.[43] This reduction is necessary to ensure safety in town centers where pedestrians and cyclists are more common. In 2012, several Iowa communities implemented low-cost traffic calming techniques to reduce speeds on high-speed roads with limits dropping by up to 30 mph. These towns—Hazelton, Quasqueton, Jesup, Ossian, St. Charles, and Rowley—installed five different treatments (Transverse Speed Bars, Colored Speed-Zone Entrance, Temporary Island, LED Flashing Speed Limits Signs, and Speed Feedback Signs) to address speeding and safety concerns. A year later, the measures led to lower average

[41] When doing the corridor crash analysis, only roads which had at least three years of crash data available for the periods before and after conversion were analyzed.

[42] Roadway Safety Foundation. "City of Bellevue, WA: Video Analytics towards Vision Zero Program." https://www.roadwaysafety.org/city-bellevue-wa-video-analytics-towards-vision-zero-program.

[43] Federal Highway Administration. "Speed Management Case Study: Reducing Excessive Speeding in Rural Communities in Iowa." https://safety.fhwa.dot.gov/speedmgt/ref_mats/fhwasa16079/fhwasa16079.pdf. FHWA-SA-16-079

speeds and a significant reduction in excessive speeding (vehicles traveling 15 mph over the limit), improving safety for the communities.[44]

Safer Speeds Education

Best Practices

- Implement awareness and education programs to promote a culture of safety and reduce motor vehicle speeds.
- According to the National Highway Traffic Safety Administration (NHTSA), effective awareness campaigns require time and research to plan, produce, and distribute the campaign. Campaigns should be planned as a part of an overall outreach strategy and paired with other measures that either support its implementation (for example, child car seat awareness campaigns done in conjunction with fire departments that offer to do a free car seat installation check) or with high visibility enforcement activities (for example, impaired-driving prevention).[45]

Case Studies

- As previously described, the City of Tacoma lowered speed limits in 2023 to 20 mph on residential streets and 25 mph on arterial streets in four business districts. Public outreach about the change started prior to the new speed limit taking effect. A city website explained the new policy, gave background about speed and safety, Vision Zero, the safe system approach, and how the new speed limit supports other programs such as Safe Routes to Schools. It also provided links to a map that shows speed limits by street and a fact sheet explaining the new speed limits.[46]
- Additionally, the City of Tacoma's Safe Routes to School program received a grant from the Washington Traffic

[44] Federal Highway Administration. "Speed Management Case Study."

[45] "Mass Media Campaigns." National Highway Traffic Safety Administration. Accessed February 27, 2024. https://www.nhtsa.gov/book/countermeasures-that-work/alcohol-impaired-driving/countermeasures/other-strategies-behavior-change/mass-media.

[46] "20 Is Plenty." City of Tacoma. Accessed February 23, 2024. https://www.cityoftacoma.org/government/city_departments/public_works/vision_zero/20_is_plenty

Safety Commission to implement a driver safety campaign focusing on two districts and one neighborhood in Tacoma: Yard signs and posters available in multiple languages (e.g. Spanish, Russian, Vietnamese, Chinese, etc.) were given to residents in target neighborhoods at community events throughout the summer. Residents were encouraged to "check your speed" by going at or below posted speed limit on residential streets, around schools, and in business districts. Residents could also sign a pledge (on the back of the posters) to go 20 mph or below and to post on their social media channels. Local television news featured the campaign and explained how slower speeds reduce crashes and injuries. [47]

- The San Francisco Department of Public Health created community grant programs targeting neighborhoods in the city's High Injury Network and Communities of Concern to address high fatality rates involving older adults. One program, called the Safe Speeds Campaign, provided community-based organizations with funds for education and outreach to reduce speeding behaviors in neighborhoods.[48]

- The City of Hoboken Vision Zero Plan requires "specialized driver safety training for anyone authorized to drive City of Hoboken fleet vehicles or for hire drivers." Other recommended actions include bicycle safety training in schools, developing educational campaigns about road user safety and empathy directed at residents, businesses, students, and community organizations as well as timing awareness campaigns to coincide with seasonal changes in the fall when daylight decreases.

[47] "Driver Safety Campaign." City of Tacoma. Accessed February 23, 2024. https://www.cityoftacoma.org/government/city_departments/public_works/vision_zero/20_is_plenty/driver_safety_campaign.

[48] Review of Equity Studies for Practitioners. Vision Zero Network. https://visionzeronetwork.org/wp-content/uploads/2017/05/VisionZero_Equity.pdf.

Safer Speeds Enforcement

Best Practices

- Implement equitable enforcement approaches. Recognize the current and historical impacts of traffic enforcement activities on communities of color.
- Studies suggest that automated traffic enforcement cameras (ATE) have a greater potential to reduce motor vehicle speeds more consistently than routine traffic stops while reducing the potential for police bias in traffic stops and police violence that is often associated with traffic stops of Black, Indigenous, and people of color. High numbers of fatal and serious injury crashes in low-income neighborhoods and communities of color may lead cities to focus ATE in these areas. However, underlying causes of these high numbers of crashes, for example historic underinvestment and poor street design, also need to be addressed. [49] To account for this, the National Association of City Transportation Officials recommends this approach when siting ATE cameras:
    - Simultaneously use crash data hotspot analysis to prioritize locations for street improvement projects and ATE; evaluate regularly to determine if cameras are still necessary once the street has been changed.
    - In addition, cities should layer multiple data points into camera placement analysis, including:
        - Fatal and serious injury crashes
        - Presence of schools, daycares, parks, and recreation and senior centers.
        - Performance metrics of ATE should be based on observed reduction in motor vehicle speeds, not number of tickets issued.[50]

[49] "AUTOMATED ENFORCEMENT." National Association of City Transportation Officials. August 21, 2020. https://nacto.org/publication/city-limits/the-right-speed-limits/corridor-speed-limits/determine-best-option-for-speed-management/automated-enforcement/.

[50] AUTOMATED ENFORCEMENT." National Association of City Transportation Officials. August 21, 2020. https://nacto.org/publication/city-limits/the-right-speed-limits/corridor-speed-limits/determine-best-option-for-speed-management/automated-enforcement/.

Case Studies

- New York City's automated speed enforcement program, launched in 2013, expanded to 750 school zones by 2019, with over 2,000 cameras by 2022 and plans to reach 2,220.[51] The program has effectively reduced speeding by 73% at camera locations, with even greater declines in key areas. Revenue from violations goes to the General Fund47, and cameras are placed based on data-driven analysis. High violation rates signal the need for street safety improvements, though long-term redesigns remain essential for preventing traffic-related injuries and deaths. [52]

- New York City's Red Light Camera Program, launched in 1998, aims to enhance safety at intersections by reducing red light running, which is often caused by motorist speeding.[53] Since its inception, violations have steadily declined, with a 73% decrease in Notices of Liability[54] (NOL) as cameras expanded from 30 in 1998 to over 150 by 2010. Right-angle collisions causing injuries dropped by 65%, and rear-end collisions fell by 49% at camera locations. Despite its success, the program covers only 1% of intersections, and community concerns remain about the need for better intersection design alongside camera enforcement.[55]

- The City of Kenmore, Washington's photo enforcement program showed a 90% reduction in speeds.[56]

- Data from the City of Bremerton, Washington suggests that a red light camera at two locations and updated

[51] New York City Department of Transportation. (n.d.). 1 New York City Automated Speed Enforcement Program 2022 Report. https://home.nyc.gov/html/dot/downloads/pdf/speed-camera-report.pdf#:~:text=In%202019,%20the%20New%20York%20State%20Legislature

[52] Cuba, J. (2022, February 14). Analysis: New York's Speed Cameras Aren't Racist — But the City's Road Design Is. Streetsblog. https://nyc.streetsblog.org/2022/02/14/analysis-new-yorks-speed-cameras-arent-racist-but-the-citys-road-design-is

[53] New York City Department of Transportation. (2024). New York City Red Light Camera Program Review 2024 Report [Review of New York City Red Light Camera Program Review 2024 Report]. https://www.nyc.gov/html/dot/downloads/pdf/nyc-red-light-camera-program.pdf

[54] A Notice of Liability in New York City is a flat fee of $50 that is typically much less than a summons issued by a police officer at a traffic stop. Summons may have higher fines based on number of offenses, affect driver's license points, and insurance rates.

[55] Cuba, J. (2022, February 14).

[56] Vicente, J. (2024, May 3). PSRC Regional Safety Action Plan Focus Group (DKS Associates, Interviewer) [Interview]. In LOCAL JURISDICTION POLICY INVENTORY

signal timing (yellow interval) suggests there has been a reduction in angle crashes.[57]

- The City of Everett, Washington recently installed speed cameras in school zones. In one school zone violations per day reduced from 676 10+mph to around 160 violations per day during the warning period.[58]

[57] Weber, S. (2024, May 3). PSRC Regional Safety Action Plan Focus Group (DKS Associates, Interviewer) [Interview]. In LOCAL JURISDICTION POLICY INVENTORY.

[58] Unknown (2024, May 3). PSRC Regional Safety Action Plan Focus Group (DKS Associates, Interviewer) [Interview]. In LOCAL JURISDICTION POLICY INVENTORY