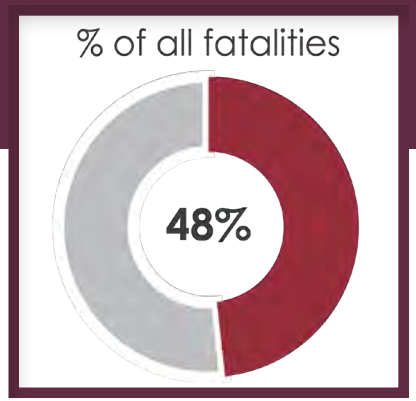
Crash Type

Certain types of vehicle crashes are more serious for drivers and other road users. The data show that crashes that involve lane departure and intersections are top priorities.

Lane Departure



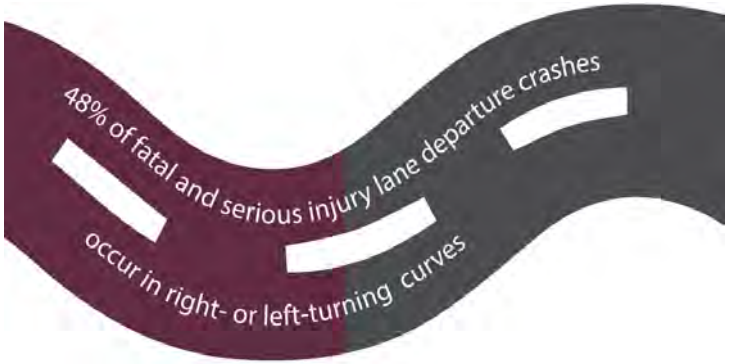
Lane departure crashes involve a vehicle unintentionally leaving its lane of travel. This includes both vehicles leaving a lane to the right (run-off-the-road crashes) as well as vehicles leaving a lane to the left (either opposite-direction crashes or run-off-the-road crashes).

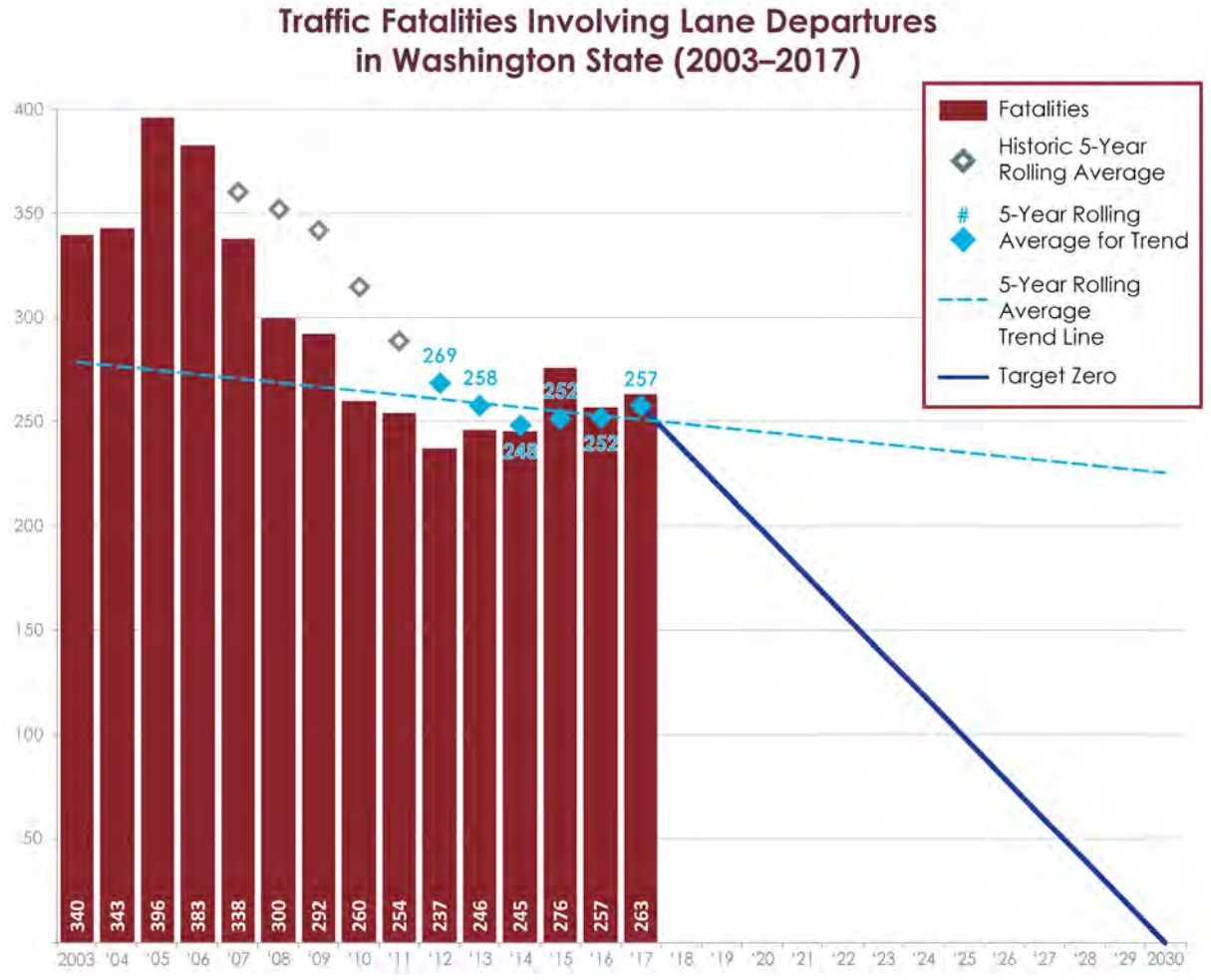
Key Issues for Lane Departures

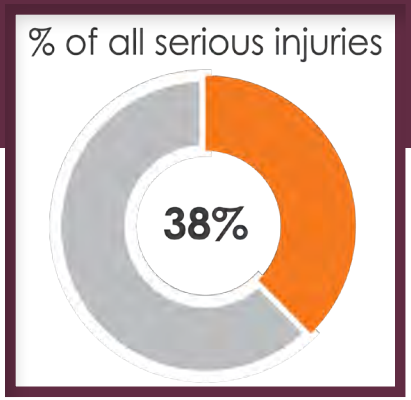
Roadside conditions. Nearly two-thirds of all fatal or serious injury lane departure crashes involve a vehicle leaving the road and hitting a fixed object.

Horizontal (left- or right-turn) curves. Nearly half of all fatal or serious injury lane departure crashes involve a vehicle traveling in a left- or right-turning curve.

Nighttime and lighting conditions. Nearly half of all fatal or serious injury lane departure crashes (44%) happen at night. Twenty-five percent happen during darkness where no roadside lighting is present. This is despite the fact that the majority of driving, and of all crashes, occurs during daylight hours.





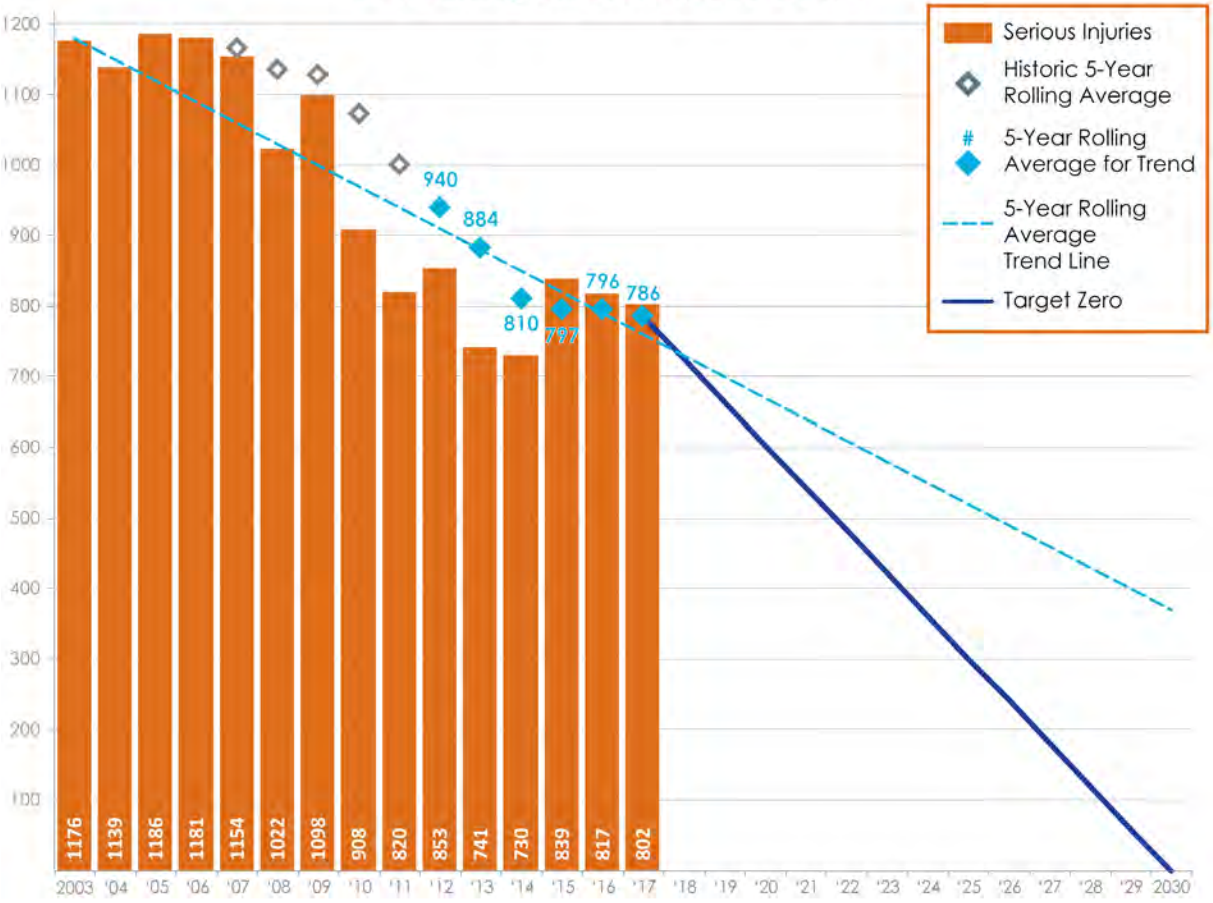


Priority 1

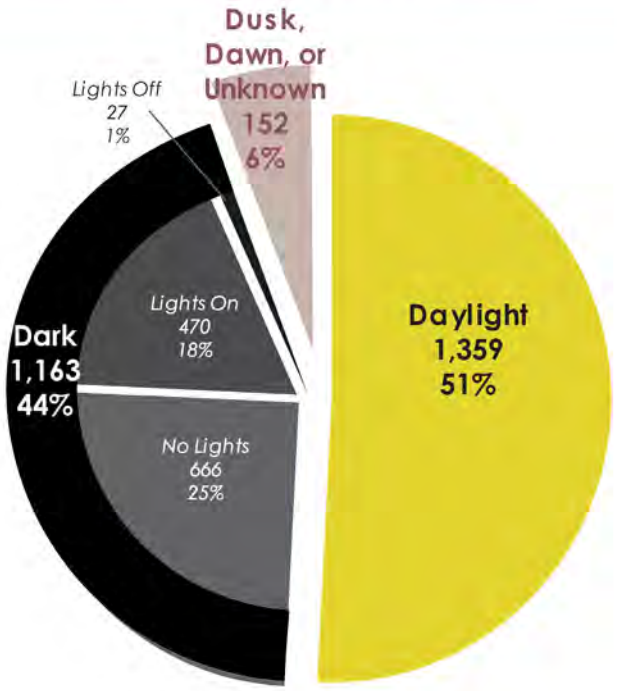
Key Countermeasures for Lane Departures Include:

- Local Road Safety Plans
- High friction surface treatments
- Improved roadway visibility

Traffic Serious Injuries Involving Lane Departures in Washington State (2003–2017)



Light Conditions for Lane Departure Fatality and Serious Injury Crashes
Washington State 2015–2017



BETWEEN 2015–2017 THERE WERE

796 FATALITIES AND 2,458 SERIOUS INJURIES

INVOLVING A LANE DEPARTURE

FATALITIES INVOLVING LANE DEPARTURES OFTEN INVOLVE OTHER FACTORS

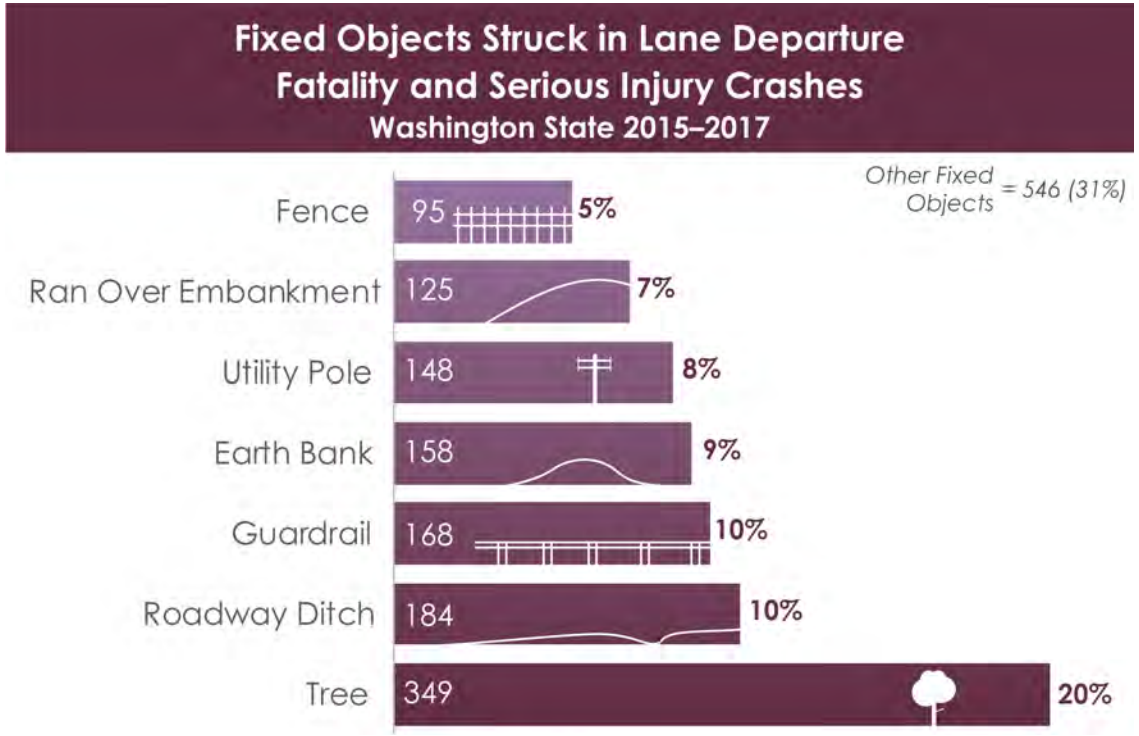
The top two factors that overlap with Lane Departures are **IMPAIRMENT** and **SPEEDING**

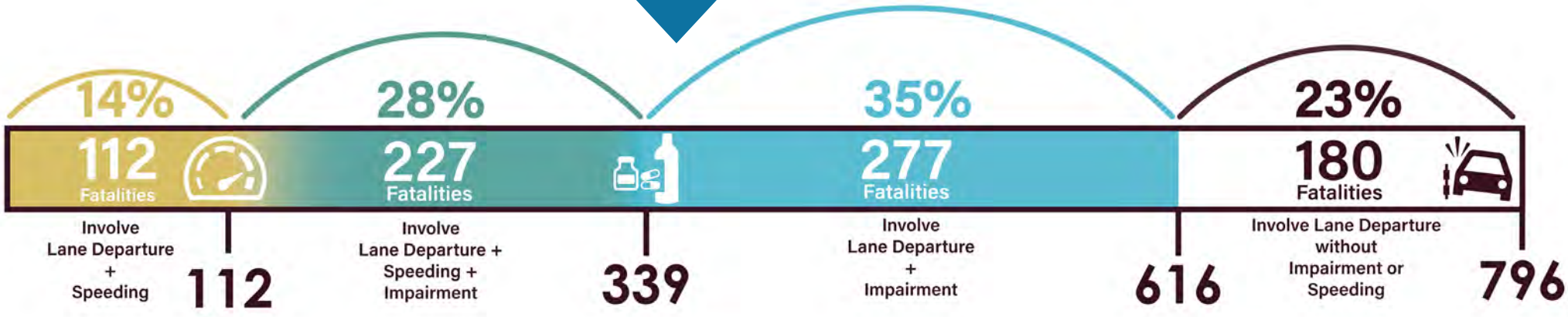
OUT OF **796 FATALITIES**:

63% also involved IMPAIRMENT

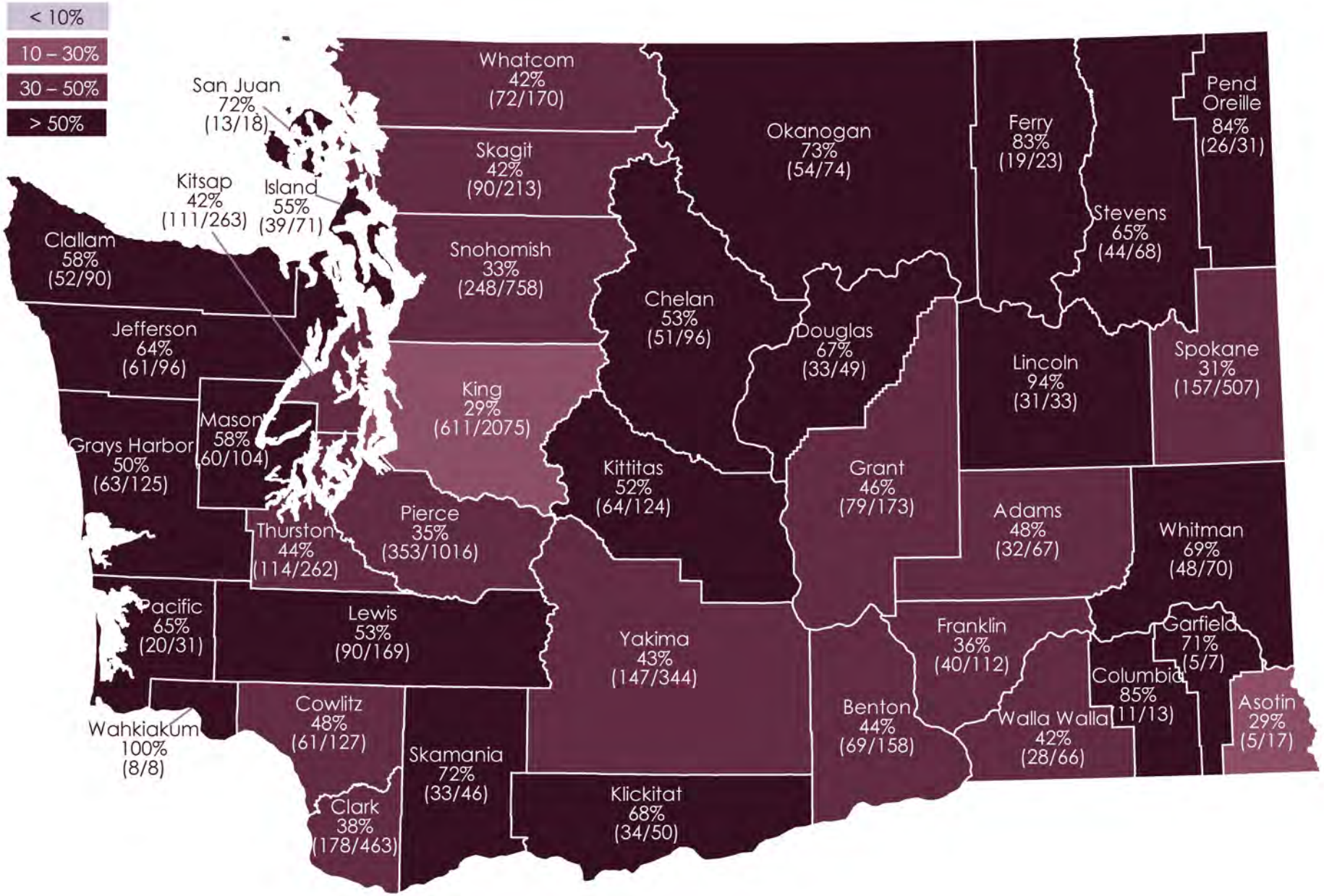
43% also involved SPEEDING

and 28% involved a combination of both





Percent of All Fatal and Serious Injury Crashes That Involved Lane Departures, by County (2015–2017)



Key Countermeasures for the 2019 Plan

Local Road Safety Plans

These plans use a systemic approach to identifying priority locations to be addressed. The plans identify the most common roadway and operational factors associated with fatal and serious injury crashes – for example, posted speeds, traffic volumes, horizontal curves, and roadside condition – and then prioritize locations that have the greatest number of these factors present.

This systemic analysis helps to prioritize investments, which can be difficult due to the scattered nature of actual lane departure crashes. With over 39,000 centerline miles on county roads alone, in addition to state highways and city streets, it can be difficult to isolate specific locations based solely on crash data. Investing in these systemic locations has the greatest potential to prevent future fatal or serious injury crashes from occurring.

Local Road Safety Plans have been developed by 85% of the counties in Washington. In addition, more than 20 cities have developed these plans (or Vision Zero plans) as well.

Local Road Safety Plans are relatively recent developments in our state. The majority of county plans were developed in 2014 and updated in 2017; most city plans were developed in 2018. While it is too early to draw any conclusions from the deployment of countermeasures identified in these plans, the initial trends on county roads look promising. For instance, there have been greater decrease in fatal and serious injury crashes on county roads than for roads owned by other jurisdictions; early 2018 data indicate that county roads have experienced a ~12% drop compared to 2017, while other roadway types increased slightly.

High Friction Surface Treatments

This specialized road surface treatment involves putting down a thin, strong epoxy (glue) with a very sharp rock layer that greatly increases the friction between vehicle tires and the roadway. The treatment stays in place for many years without needing to be reapplied. High Friction Surface Treatment (HFST) is one of the best methods to keep vehicles on the roadway, especially in horizontal curves and when roadway and tire friction are typically low, such as during wet weather.

HFST has been deployed by at least eight counties and two cities in Washington, as well as on WSDOT-maintained roads. Some of these entities have done a single project/section, while others have addressed a large number of areas – for example, King County has installed HFST in 49 locations. The majority of the locations addressed have been horizontal curves, with some work on ramps and at intersections.

HFST projects in Washington have only recently been deployed – most have been constructed in the past three years. In addition, many of the locations where they have been deployed have been based on Local Road Safety Plans, which use roadway and operational factors to determine which locations to address. Therefore, it may take a while to determine the crash reduction benefits. However, other states with longer histories of using HFST have shown significant benefits. According to information available in the Crash Modification Factor (CMF) Clearinghouse, HFST shows a 24% reduction in total crashes, with a 52% reduction in crashes on wet roads.

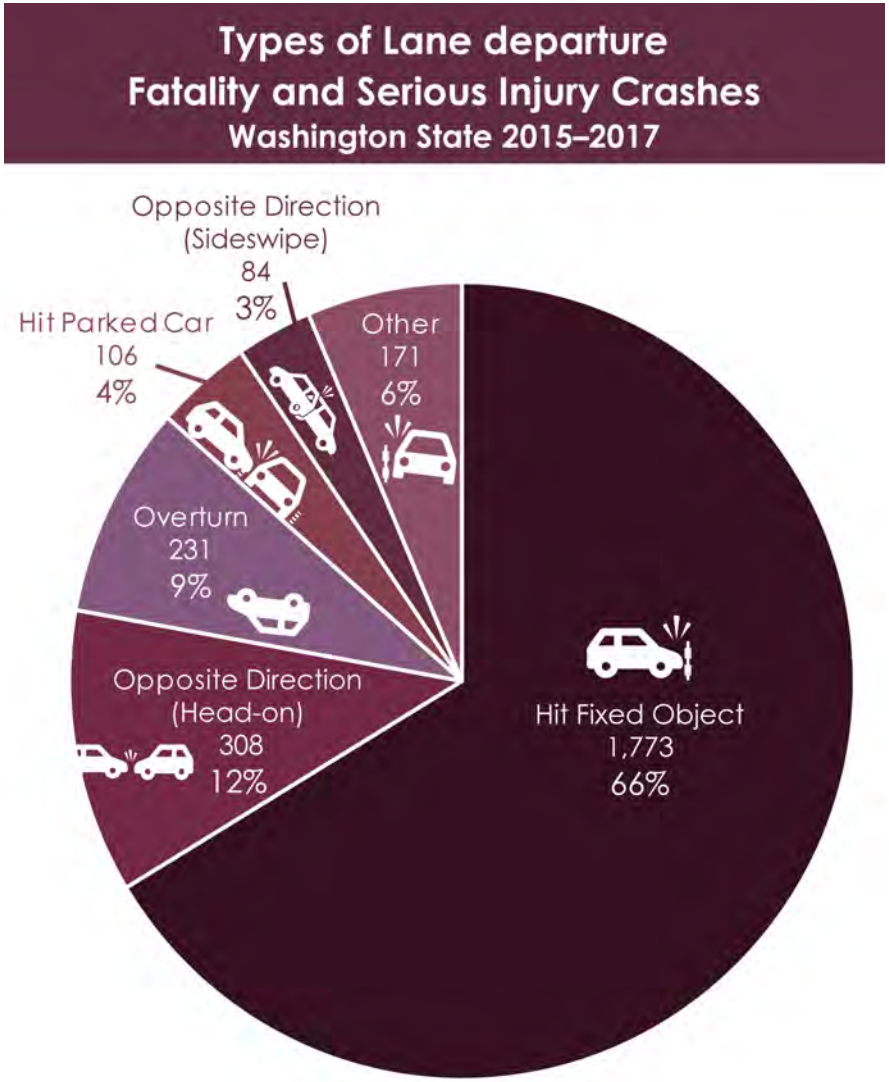
Improved Roadway Visibility

Nearly half of the fatal or serious injury roadway departure crashes in Washington occur during low-visibility conditions. Because of this, deploying countermeasures that increase visibility during all conditions can be very effective at keeping vehicles on the road. Roadway visibility modifications could include upgraded signing, pavement markings, roadway lighting, and delineation. Examples include flexible guideposts and reflective markers on guardrail.

A large number of agencies all across Washington have made visibility additions to the roadway network. This is especially true in the case of additional or larger signing, particularly on horizontal curves, with nearly a decade of significant investment in this countermeasure by both WSDOT and many counties.

There are a variety of studies and measures of effectiveness available in the CMF Clearinghouse for different roadway visibility contexts and visibility related modifications, both in Washington and nationally. While not all the studies indicate the same level of change, some examples include:

- Installing a combination of chevron signs, curve warning signs, and flashing beacons on horizontal curves has shown a 40% reduction in crashes.
- Installing a combination of edge lines, center lines, and flexible guideposts has shown a 45% reduction in injury crashes.
- Installing illumination has shown a 30% reduction in injury crashes.



Strategies for Reducing Lane Departure (LDX) Fatalities and Serious Injuries		
Objective	**Strategies**	**Implementation Areas**
LDX.1. Analyze lane departure data to prioritize safety investments.	LDX.1.1 Develop and implement a Local Road Safety Plan. (P, WSDOT)	Engineering, Leadership
	LDX.1.2 Inventory horizontal curves and gather data to support development of programs and projects to reduce the severity of lane departure crashes. (R, WSDOT)	Evaluation
	LDX.1.3 Locate and inventory fixed objects inside the clear zone to support development of programs and projects to reduce the severity of lane departure crashes. (R, WSDOT)	Evaluation
LDX.2. Reduce opposite direction crashes.	LDX.2.1 Install centerline rumble strips. (P, CMF)	Engineering
	LDX.2.2 Install raised medians or median barriers. (P, CMF)	Engineering
	LDX.2.3 Install raised pavement markers or profiled center lines. (R, CMF)	Engineering
LDX.3. Reduce the number of vehicles leaving the roadway.	LDX.3.1 Install chevron signs, curve warning signs, and/or sequential flashing beacons in curves. (P, CMF)	Engineering
	LDX.3.2 Improve pavement friction using high friction surface treatments. (P, CMF)	Engineering
	LDX.3.3 Install center and/or bicycle-friendly edge line rumble strips. (P, CMF)	Engineering
	LDX.3.4 Install lighting. (R, CMF)	Engineering
	LDX.3.5 Install edge lines, especially on curves, where adequate shoulders exist. (R, CMF)	Engineering
	LDX.3.6 Install wider edge lines. (R, CMF)	Engineering
	LDX.3.7 Install delineation on fixed objects that cannot be removed from the clear zone, such as guardrails and other roadway hardware. (U)	Engineering
	LDX.3.8 Install edge line rumble stripes and profiled center and bicycle-friendly edge lines. (U)	Engineering
	LDX.3.9 Install dynamic curve warning signs. (U)	Engineering
LDX.4. Minimize the consequences of leaving the roadway.	LDX.4.1 Increase distance to roadside features on high-speed roadways by removing/ relocating fixed objects, such as trees and utility poles, in the clear zone. (P, CMF)	Engineering
	LDX.4.2 Flatten side slopes to reduce the potential for rollover crashes. (P, CMF)	Engineering
	LDX.4.3 Install roadside safety hardware such as guardrail, cable barrier, or concrete barrier. (P, CMF)	Engineering
	LDX.4.4 Install safety edge treatment to reduce edge drop-off crashes. (P, CMF)	Engineering
	LDX.4.5 Implement roadway design to be consistent with the surrounding context. (R, NCHRP)	Engineering
	LDX.4.6 Remove or replace existing barrier that is damaged or non-functional. (R, FHWA)	Engineering
P: Proven R: Recommended U: Unknown		

For additional strategies affecting Lane Departure, refer to the Impairment, Speeding, and Distraction chapters.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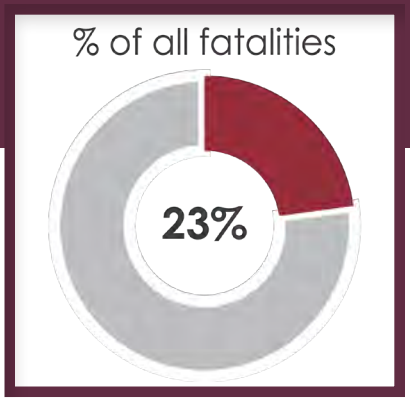
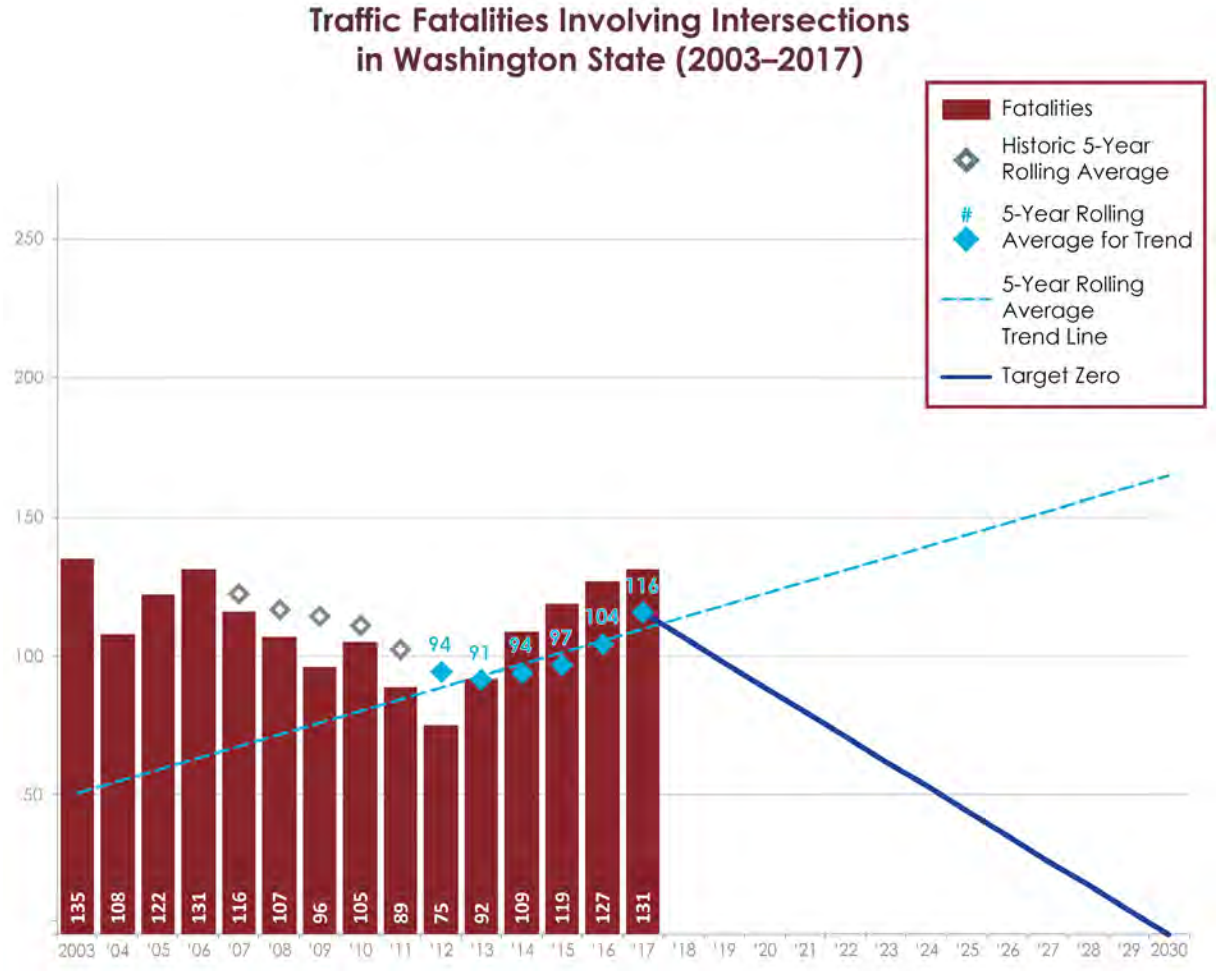
Intersections

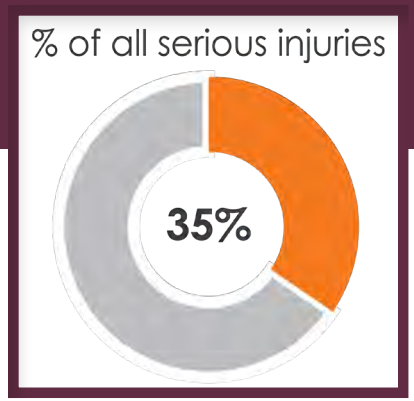


Intersections are a conflict point for traffic. Because of this, when people make mistakes at these locations, it often results in a crash. One of the major objectives of addressing intersection-related crashes is to reduce the severity of those crashes when they occur.

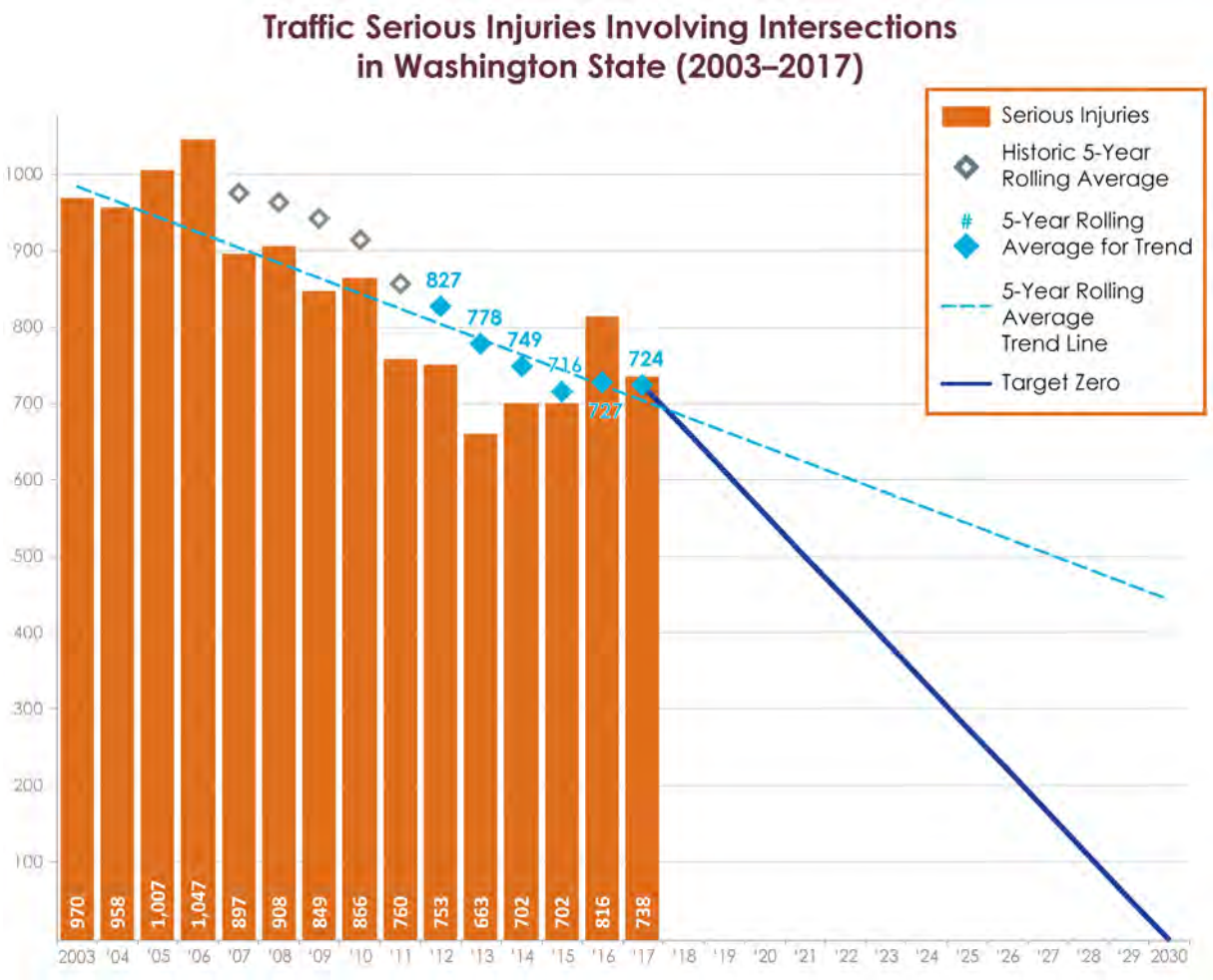
Key Issues for Intersections

- **Angle crashes.** Almost half of all fatal or serious injury intersection-related crashes involve an angle crash. This involves a vehicle being hit in a T-bone style crash, either turning left in front of oncoming traffic (one-third of fatal or serious injury angle crashes), or entering from a side street and pulling out in front of oncoming traffic (two-thirds).
- **Nighttime conditions.** More than one-third of all fatal or serious injury intersection-related crashes happen at night. This condition disproportionately impacts pedestrians, as less than one-fifth of daylight-hour fatal and serious injury intersection crashes involve a pedestrian, but more than one-third of nighttime crashes do.
- **Bicyclist and pedestrian crashes.** Nearly one-third of all fatal or serious injury intersection-related crashes involve a pedestrian or bicyclist. Refer to the Pedestrians and Bicyclists chapter page 120 for more information.





Priority 1



Key Countermeasures for Intersections Include:

- Roundabouts
- Improved intersection visibility
- Signal operations improvements

BETWEEN 2015–2017 THERE WERE

377 FATALITIES AND 2,256 SERIOUS INJURIES

INVOLVING AN INTERSECTION

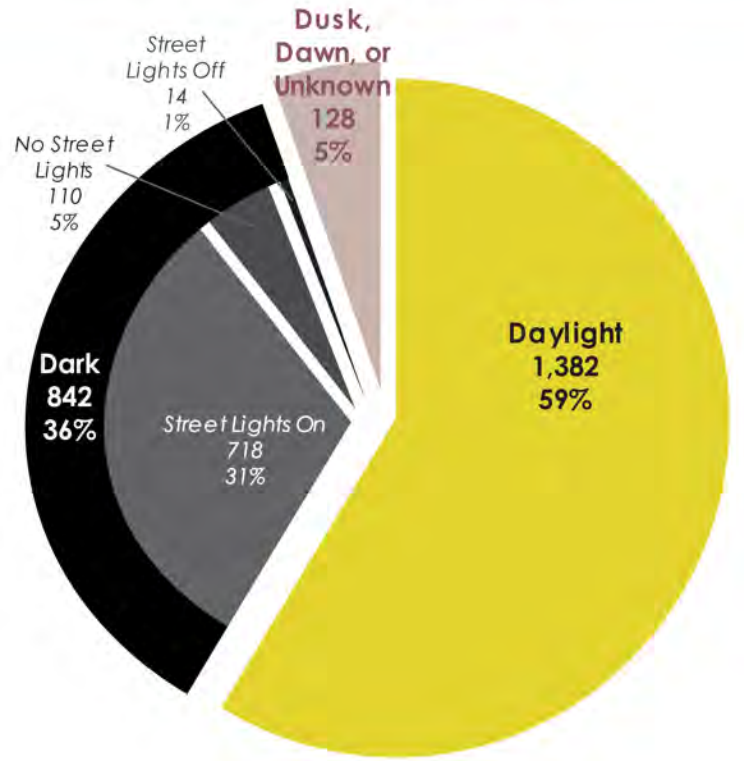
FATALITIES INVOLVING INTERSECTIONS OFTEN INVOLVE OTHER FACTORS

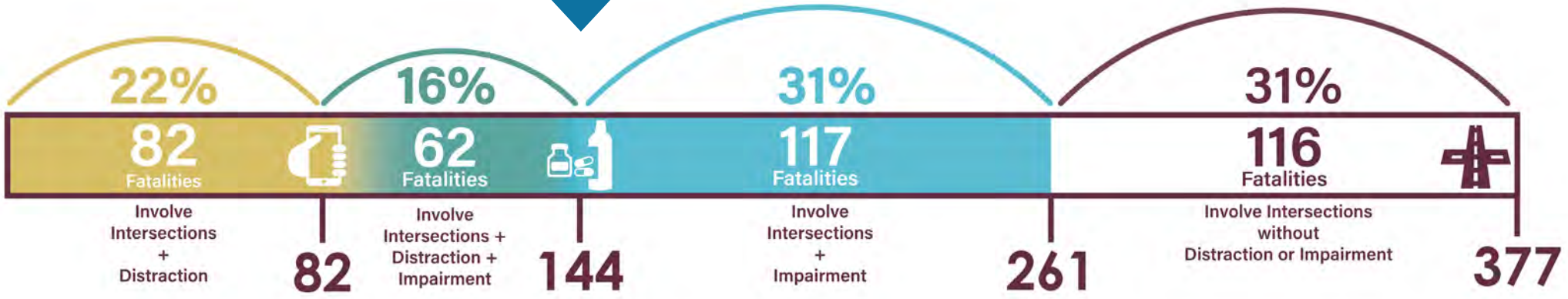
The top two factors that overlap with Intersections are **DISTRACTION** and **IMPAIRMENT**

OUT OF **377 FATALITIES**:

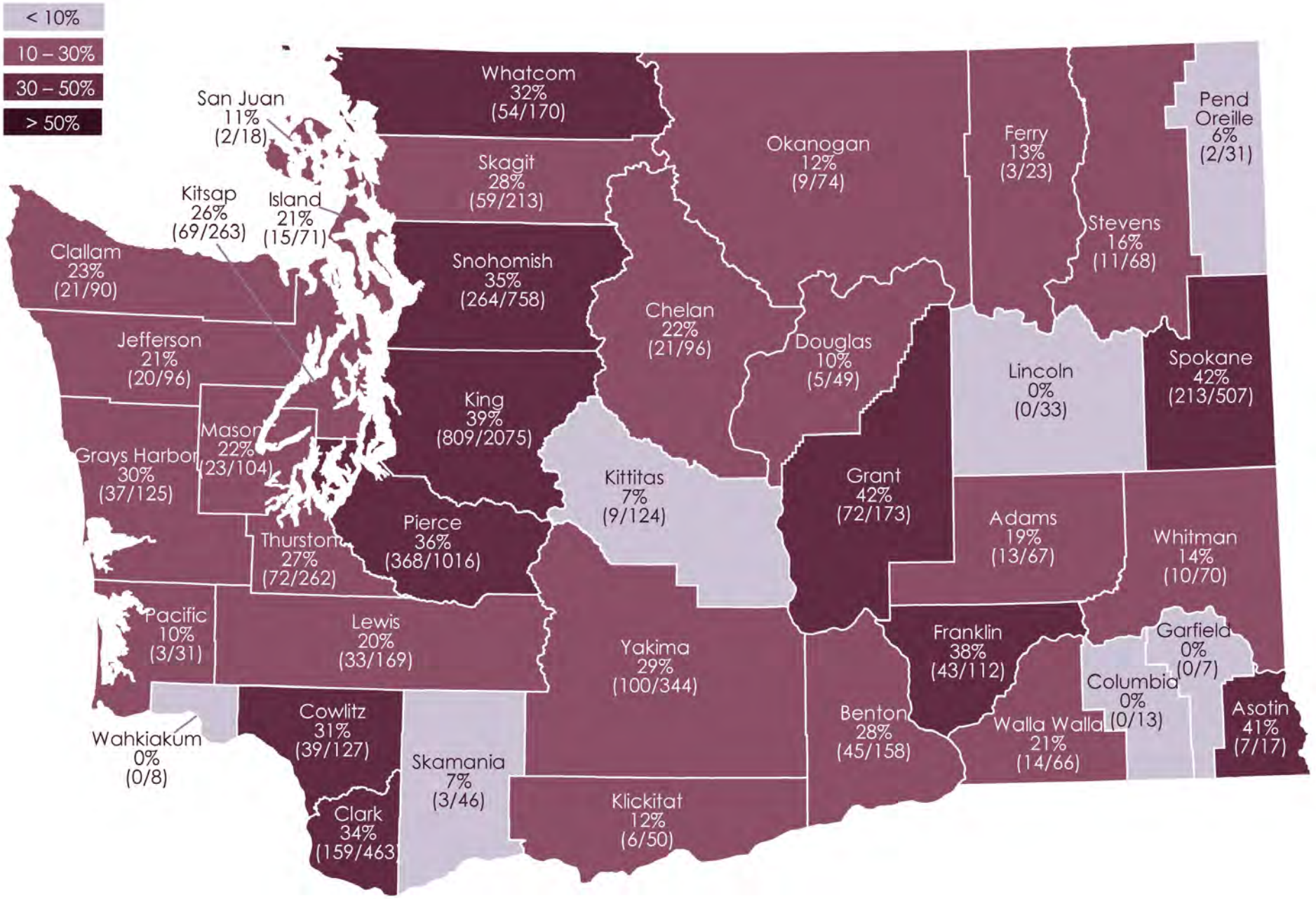
38% also involved DISTRACTION
47% also involved IMPAIRMENT
and 16% involved a combination of both

Light Conditions for Fatality and Serious Injury Crashes at Intersections
Washington State 2015–2017





Percent of All Fatal and Serious Injury Crashes That Involved Intersections, by County (2015–2017)



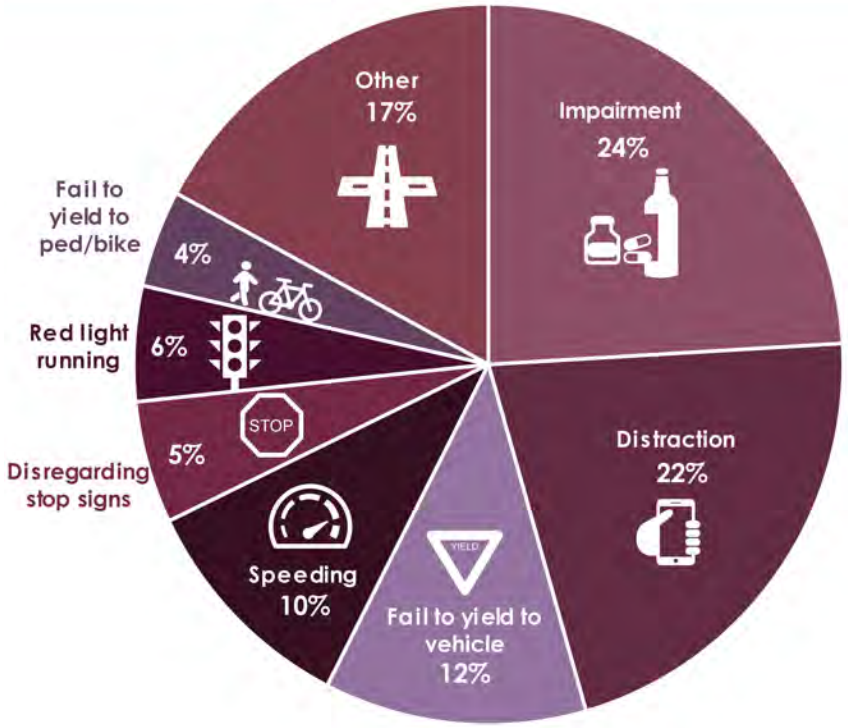
Roundabouts

Beyond being a great countermeasure at reducing intersection-related fatal and serious injury crashes overall, roundabouts are especially effective at reducing angle crashes. First, they create a low speed environment. Perhaps more importantly, the physical channeling of vehicles almost entirely eliminates angle crashes: drivers cannot "run" a roundabout like they do a red light or a stop sign. In addition, there are no left-turn movements at a roundabout, as exiting drivers are always making a through or right-turn move. This can be particularly helpful for older drivers (see page 152).

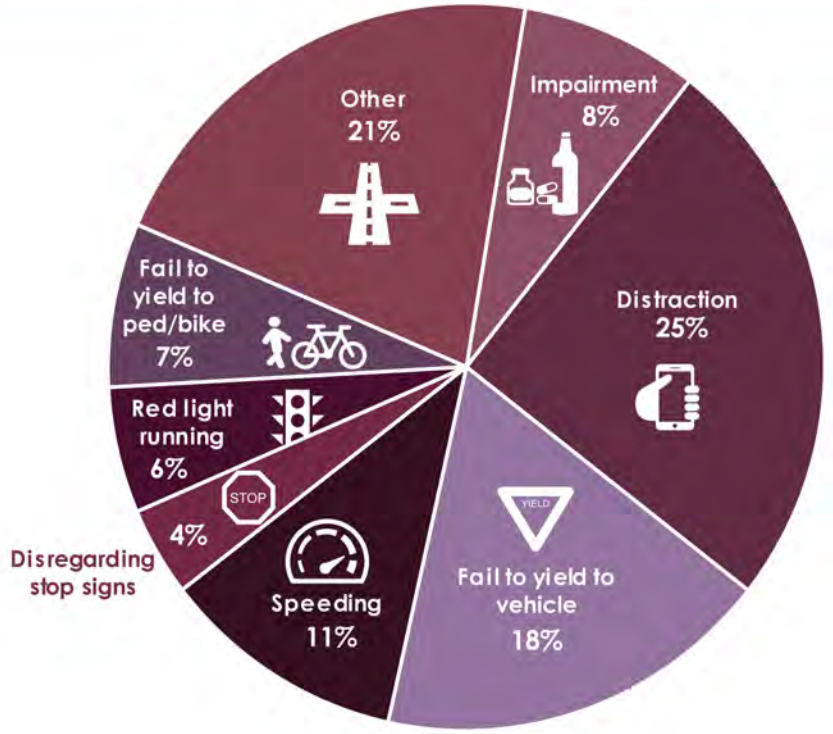
Washington has more than 400 roundabouts on the state and local system. Of 39 counties in the state, 24 (62%) have at least one roundabout.

According to information from the Crash Modification Factors (CMF) Clearinghouse, both in Washington and nationally, significant safety benefits result from deploying roundabouts. Most studies (depending on previous conditions) put the reduction in fatal or serious injury crashes at 50–100%.

Fatal Crashes at Intersections
(% of Driver Contributing Circumstances)
Washington State 2015–2017



Serious Injury Crashes at Intersections
(% of Driver Contributing Circumstances)
Washington State 2015–2017



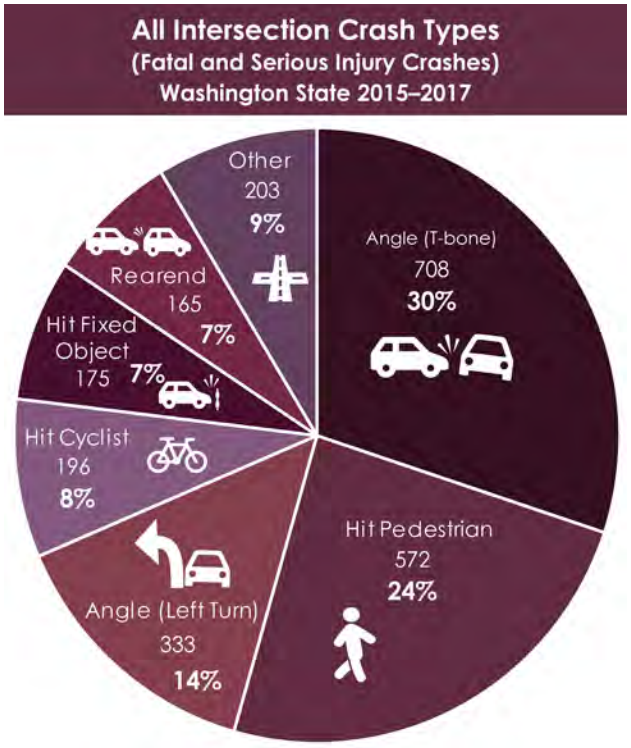
Improved Intersection Visibility

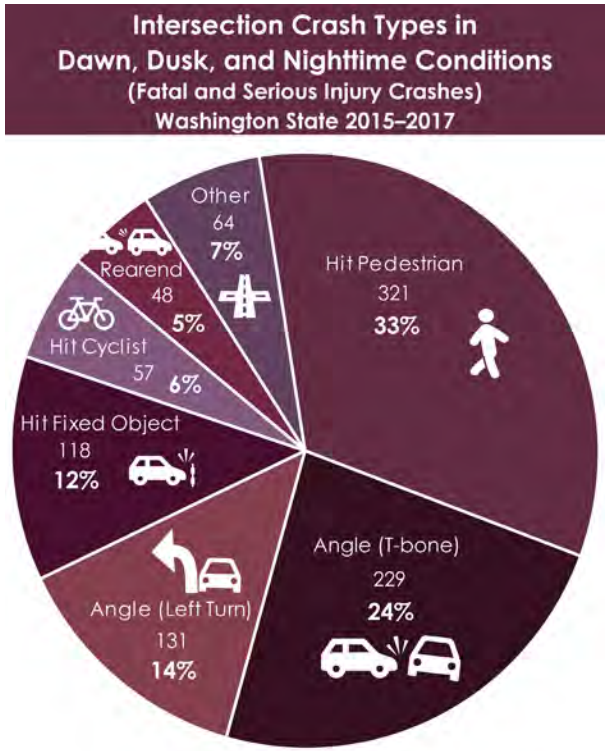
Improved intersection visibility starts with roadway lighting and markings. However, many of the nighttime intersection crashes already occur at lighted intersections. Additional visibility and driver recognition of moving through an intersection is also needed, especially to help combat distracted driving. These include upgraded signing, targeted lighting, and delineation such as reflective markings on signals and on sign posts.

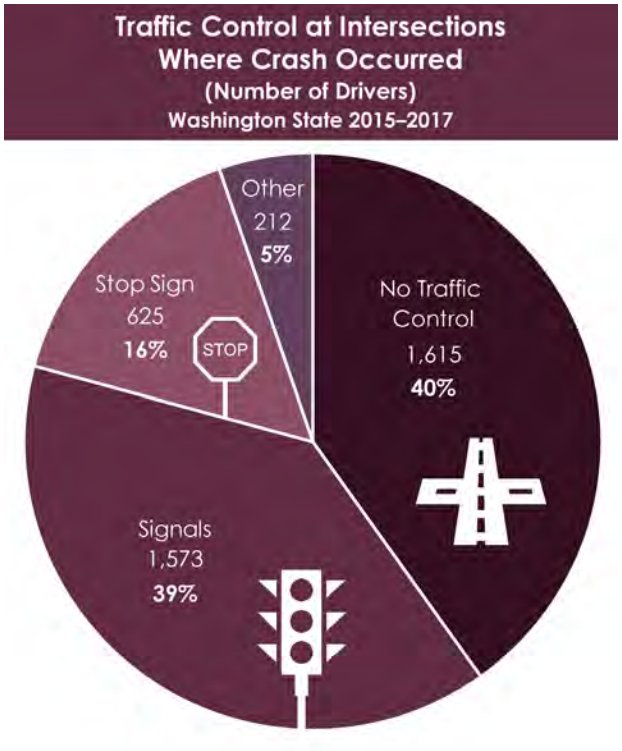
City, county, and state engineers have been implementing best practices for visibility modifications on roadways around the state.

The CMF Clearinghouse includes a variety of studies and measures of effectiveness for different roadway visibility countermeasures in different roadway contexts, both in Washington and nationally.

- Intersection lighting leads to a approximately 40% reduction in nighttime crashes.
- Signing and marking improvements at stop-controlled intersections lead to approximately 10% reduction in fatal and injury crashes (25% in rural areas).
- Signing and visibility improvements at signalized intersections lead to approximately 10% reduction in fatal and injury crashes (15% in urban areas).
- Reflective markings on signals lead to approximately 15% reduction in crashes.







Signal Operations Improvements

Roughly 40% of crashes related to intersections occur at intersections equipped with traffic signals. Making operational changes to traffic signals may offer reduction in crash potential to a variety of users of the intersection, especially pedestrians. Those modifications include leading pedestrian intervals, protected-only left-turn movements, and restricting turn movements (left or right).

A few agencies have begun widespread implementation of leading pedestrian intervals for their signalized network. Restricting turning movements and limiting left turns to protected-only movements have been done by many agencies, but only on a site-by-site basis — there has been no coordinated, statewide implementation campaign.

While widespread implementation of leading pedestrian intervals is very recent in Washington, studies from the CMF Clearinghouse have shown a 59% decrease in pedestrian crashes at locations implementing this treatment. Eliminating or restricting turning movements has the potential to almost completely prevent certain crash types. As an example, national studies show a 99% decrease in left-turning crashes in locations where protected-only left turns are implemented.

RELATED AREA: Vehicle-Train Crashes

The train data in Target Zero is limited to fatal and serious crash events between trains and motor vehicles at highway-rail grade crossings.

Between 2015 and 2017, there were 12 fatalities and four serious injuries involving trains and vehicles at railroad crossings. Railroad crossings are intersections used by two very different modes of transportation. The crossings are multi-jurisdictional, meaning both roadway and railroad authorities are responsible for different aspects of design and maintenance.

The Washington Utilities and Transportation Commission (UTC) has regulatory authority over safety at most public railroad crossings. The UTC's Rail Safety Program oversees rail operations in the state, inspects railroad crossings, resolves complaints received from the public and other stakeholders, and funds rail safety projects. The commission also promotes public awareness in partnership with the national nonprofit Operation Lifesaver Program.

The UTC is working to prevent train and vehicle crashes by:

- Providing Operation Lifesaver outreach and education in communities across the state.
- Funding projects to improve railroad safety at public crossings by administering grants through the Grade Crossing Protective Fund.
- Routinely inspecting safety and maintenance at railroad crossings.
- Identifying opportunities to upgrade safety at crossings in partnership with road authorities and railroads.

For more information, please visit the UTC website (www.utc.wa.gov/publicSafety/railsafety).

Strategies for Reducing Intersection (INT) Fatalities and Serious Injuries		
Objective	Strategies	Implementation Areas
INT.1. Reduce crashes at intersections.	INT.1.1 Develop and implement a Local Road Safety Plan. (P, WSDOT)	Engineering, Leadership
	INT.1.2 Install or convert intersections to roundabouts. (P, CMF)	Engineering
	INT.1.3 Convert four-lane roadways to three-lane roadways with center turn lane (road diet). (P, CMF)	Engineering
	INT.1.4 Convert permitted left turns to protected left turns at signals. (P, CMF)	Engineering
	INT.1.5 Install left turn lanes. (P, CMF)	Engineering
	INT.1.6 Install intersection conflict warning systems (real time warning) to warn drivers on mainline or side streets of conflicting vehicle traffic at rural intersections. (P, CMF)	Engineering
	INT.1.7 Increase pavement friction using high friction surface treatments. (P, CMF)	Engineering
	INT.1.8 Remove unwarranted signals. (P, CMF)	Engineering
	INT.1.9 Modify signal phasing to implement a leading pedestrian interval. (P, CMF)	
	INT.1.10 Install lighting. (R, CMF)	Engineering
	INT.1.11 Coordinate arterial signals. (R, CMF)	Engineering
	INT.1.12 Convert to flashing yellow arrows at signals. (R, CMF)	Engineering
	INT.1.13 Optimize traffic signal clearance intervals. (R, CMF)	Engineering
	INT.1.14 Restrict or eliminate turning maneuvers at intersections. (R, NCHRP)	Engineering
	INT.1.15 Implement restricted access to properties/driveways adjacent to intersections using closures or turn restrictions. (R, NCHRP)	Engineering
	INT.1.16 Implement systemic signing, marking, and visibility improvements at intersections. (R, CMF)	Engineering
INT.2. Improve driver compliance at intersections.	INT.2.1 Install red light cameras (automated enforcement) at locations with angle crashes. (P, CMF)	Enforcement, Engineering, Leadership
	INT.2.2 Implement automated speed enforcement cameras for approach speeds. (P, CMF)	Enforcement, Engineering, Leadership
	INT.2.3 Provide targeted stop sign/signal enforcement at intersections and intersection approaches. (R, NCHRP)	Enforcement
	INT.2.4 Implement automated enforcement for “block the box” violations. (U)	Enforcement, Engineering, Leadership
P: Proven R: Recommended U: Unknown		

Strategies for Reducing Intersection (INT) Fatalities and Serious Injuries		
Objective	**Strategies**	**Implementation Areas**
INT.3. Improve driver awareness of intersections.	INT.3.1 Add retroreflective borders to signal back plates. (P, CMF)	Engineering
	INT.3.2 Install transverse rumble strips on rural stop-controlled approaches. (P, CMF)	Engineering
	INT.3.3 Provide advanced dilemma zone detection (real time warning) for high speed approaches at rural signalized intersections. (R, CMF)	Engineering
	INT.3.4 Increase sight distance (visibility) of intersections on approaches. (R, CMF)	Engineering
	INT.3.5 Increase visibility of signals and signs at intersections. (R, NCHRP)	Engineering
	INT.3.6 Provide targeted public information and education about crash-contributing factors found at specific intersections. (R, NCHRP)	Education
P: Proven R: Recommended U: Unknown		

For additional strategies affecting Intersections, refer to the Impairment, Distraction, and Pedestrians and Bicyclists chapters.