CITY SAFETY PLAN

FEBRUARY 2022

PREPARED FOR THE CITY OF LA CENTER

PREPARED BY DKS ASSOCIATES

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RTC Southwest Washington Regional Transportation Council

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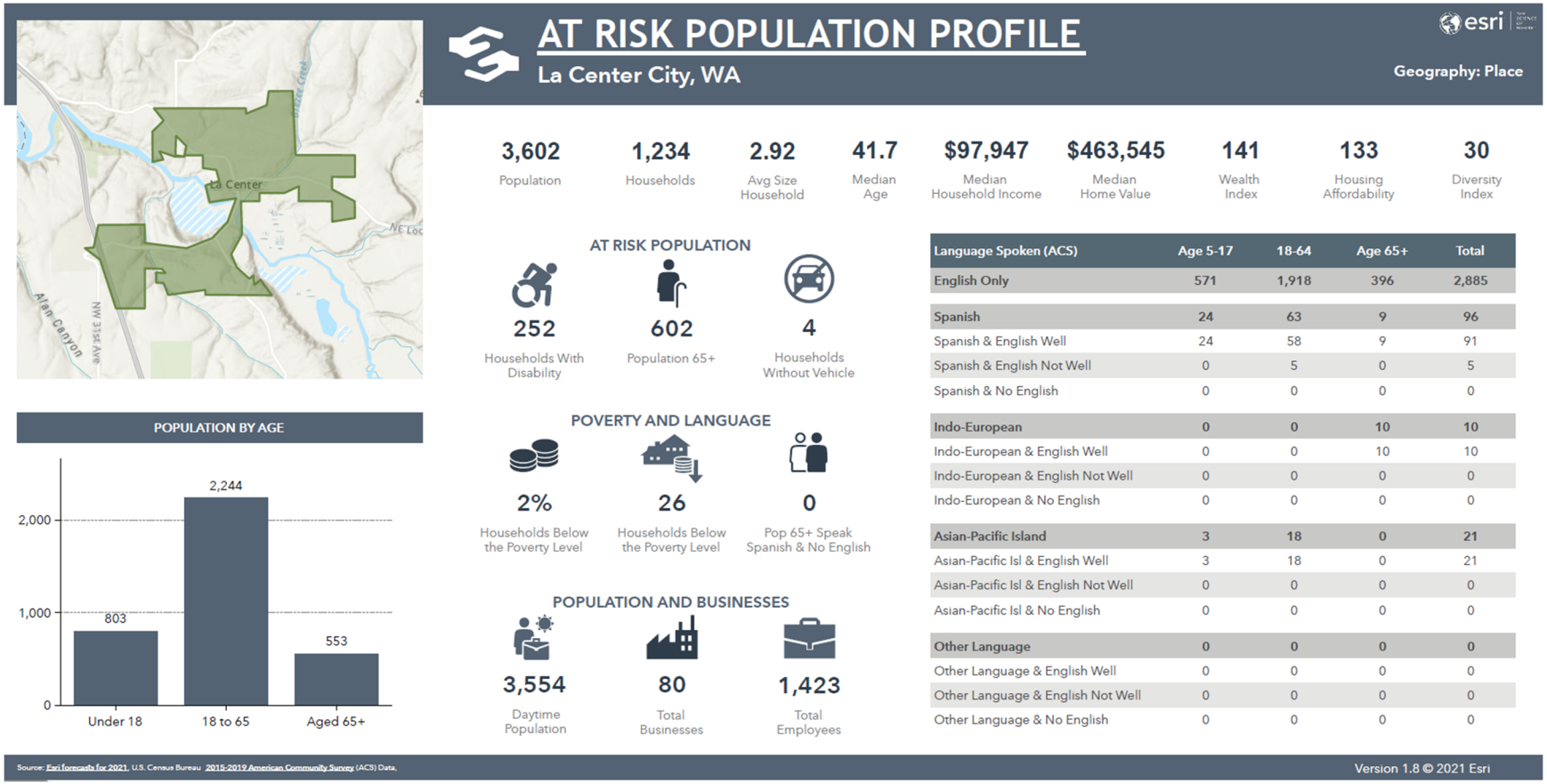
INTRODUCTION

The City of La Center is located in the northeastern portion of Clark County and east of Interstate 5. La Center is home to approximately 3,600 residents with more than 80 businesses within the city limits. The following 'At Risk Population Profile' provides key population and equity statistics based on 2021 data.[1]



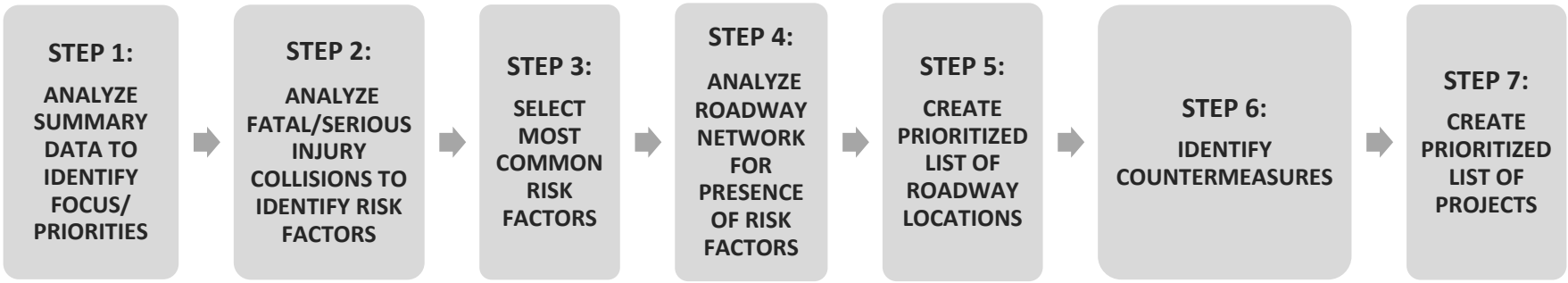
Language Spoken (ACS)	Age 5-17	18-64	Age 65+	Total
English Only	571	1,918	396	2,885
Spanish	24	63	9	96
Spanish & English Well	24	58	9	91
Spanish & English Not Well	0	5	0	5
Spanish & No English	0	0	0	0
Indo-European	0	0	10	10
Indo-European & English Well	0	0	10	10
Indo-European & English Not Well	0	0	0	0
Indo-European & No English	0	0	0	0
Asian-Pacific Island	3	18	0	21
Asian-Pacific Isl & English Well	3	18	0	21
Asian-Pacific Isl & English Not Well	0	0	0	0
Asian-Pacific Isl & No English	0	0	0	0
Other Language	0	0	0	0
Other Language & English Well	0	0	0	0
Other Language & English Not Well	0	0	0	0
Other Language & No English	0	0	0	0

[1]Source: ESRI Business Analysis Tool. https://storymaps.arcgis.com/stories/52764a9948074c4b9d527a390aefdc67

CITY SAFETY PLAN PROCESS

The purpose of the City Road Safety Plan is to analyze crash data from within the City in order to effectively identify trends, contributing factors, associated risk factors and deficiencies present in the City's road network. Following this approach allows for the effective identification of appropriate, low cost countermeasures to be implemented for the purpose of crash reduction. The following plan includes a summary of existing safety conditions in La Center, identification of safety needs, and recommended treatments to address high-priority collision types and locations.

The sections below describe the process of collecting and analyzing available data and identifying safety needs from that analysis.



The data used and process followed are consistent with WSDOT's guidelines from the 2022 City Safety Program. The recommended safety countermeasures are limited to infrastructure-based treatments eligible for one or more of the following grant programs:[2]

- WSDOT grant programs: City Safety, Safe Routes to School, Bicycle-Pedestrian, and Railway-Highway Grade Crossings
- Transportation Improvement Board (TIB) grants, including Complete Streets
- Several RTC grants

Appendix A, Safety Countermeasure Toolbox, includes a description of each treatment, when it should be used, estimated costs, and crash modification factor.

The sections below describe the process of collecting and analyzing available data and identifying safety needs from that analysis.

STEP 1: ANALYZE SUMMARY DATA TO IDENTIFY FOCUS/PRIORITIES

The study team worked with the City of La Center, Southwest Washington Regional Transportation Council (RTC), and WSDOT Transportation Data to acquire the following data sets.

- WSDOT database of all collisions on City of La Center streets, Jan 2016 - Dec 2020 (provided by WSDOT Transportation Data)
- City of La Center Citizen Feedback (provided by Tony Cooper, City of La Center)

The study team reviewed the quality and accuracy of the data sets, communicated with WSDOT on discrepancies, and solicited and received the desired data from the State.

[2] Additional details regarding available grant programs are available in Appendix B, Grant Programs.

DATA ANALYSIS OVERVIEW

As illustrated in Figure 1, over the past five years, there were no reported fatal collisions and one serious injury collision on city streets in La Center. The suspected injury collision was a roadway departure collision that was reported on August 15, 2019, at 10:23 am. It involved a 22-year-old male on a motorcycle who lost control along NW La Center Rd 500 feet west of NW 18th Ave.

The number of all reported collisions (regardless of severity) has ranged between 9 and 23, as shown in Figure 2. In the most recent year of data available, 2020, the city experienced 18 reported crashes (a 14% decline from 2016). The impacts of the COVID-19 pandemic response and associated travel patterns likely had a significant influence on crash frequency and severity in 2020.

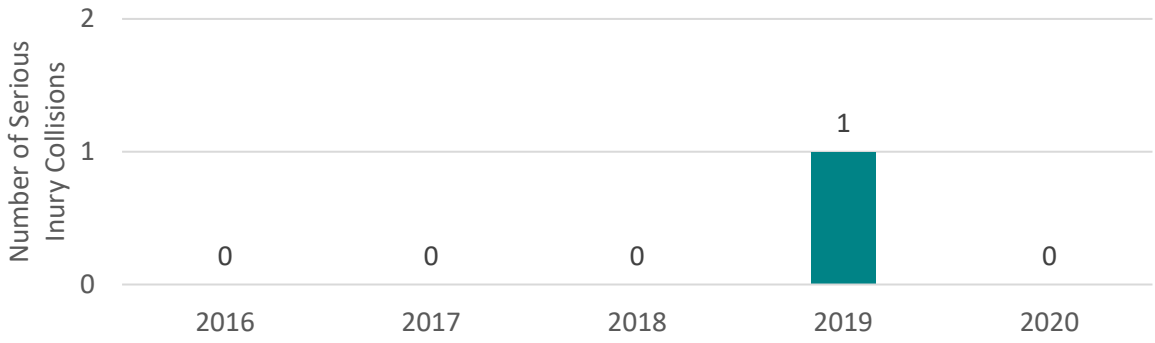


Figure 1. Serious Injury Collisions in La Center, 2016-2020.

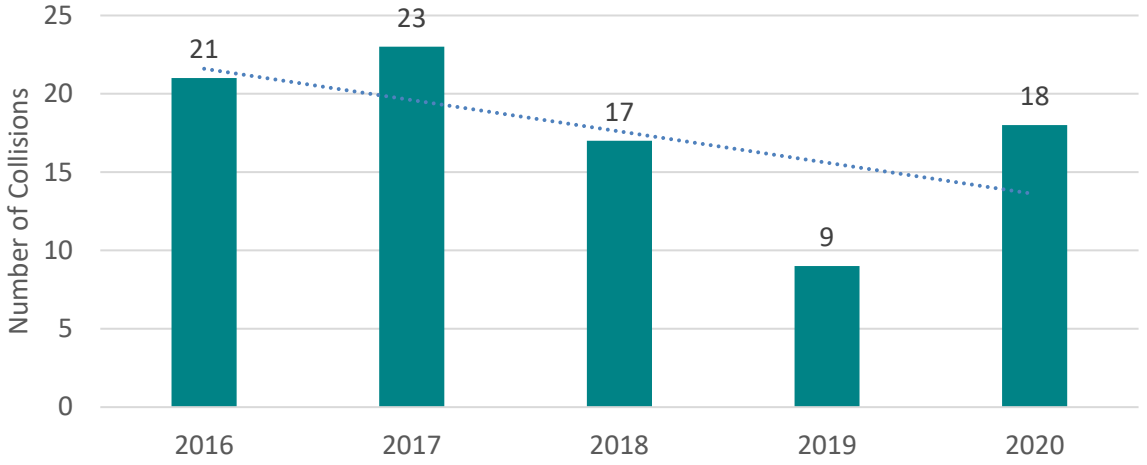


Figure 2. All Reported Collisions in La Center, 2016-2020.

Figure 3 shows the location of the serious injury collision. Figure 4 provides a heat map of all reported collisions that occurred on City-owned streets in La Center during the study period.

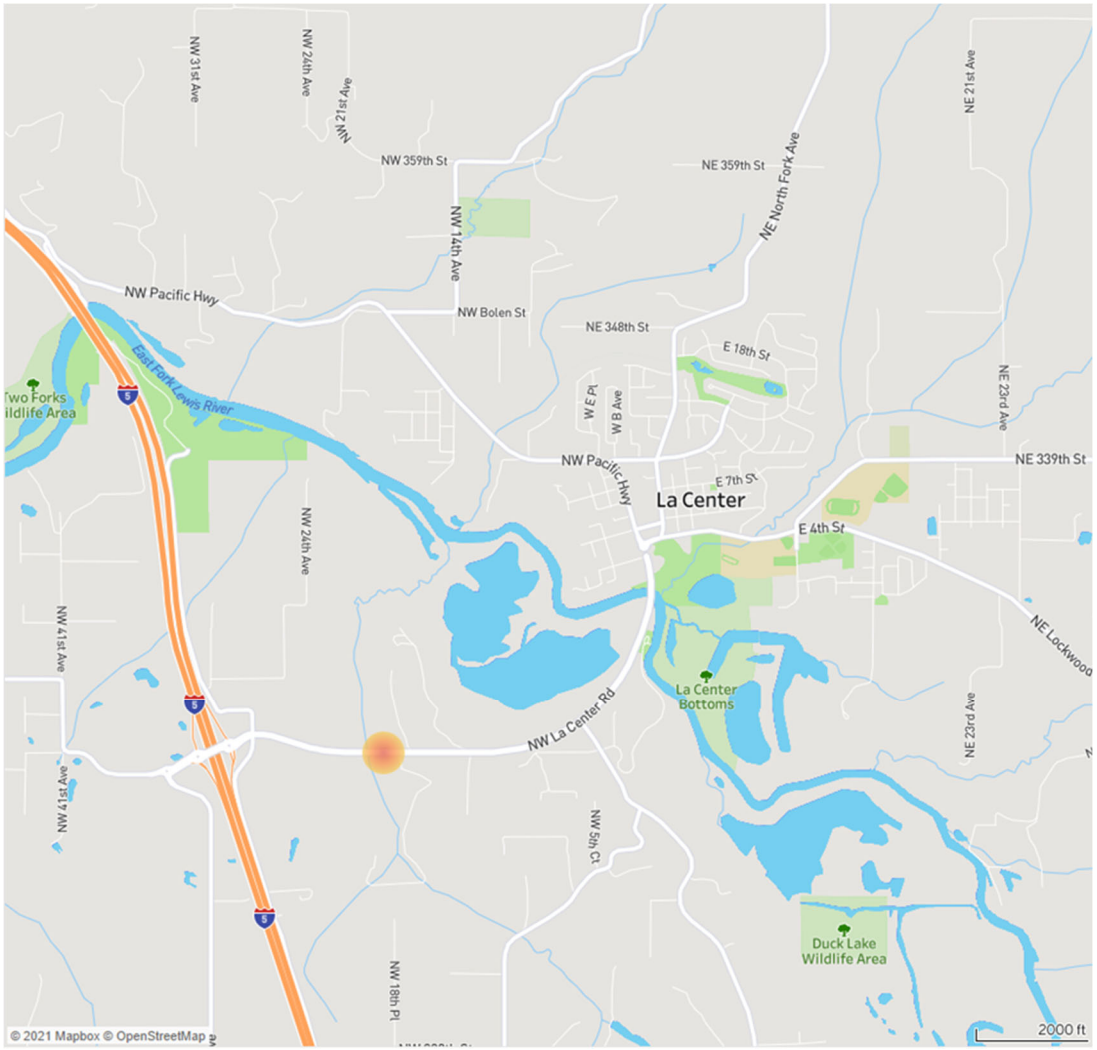


Figure 3. Heat Map of Serious Injury Collisions in La Center, 2016-2020.

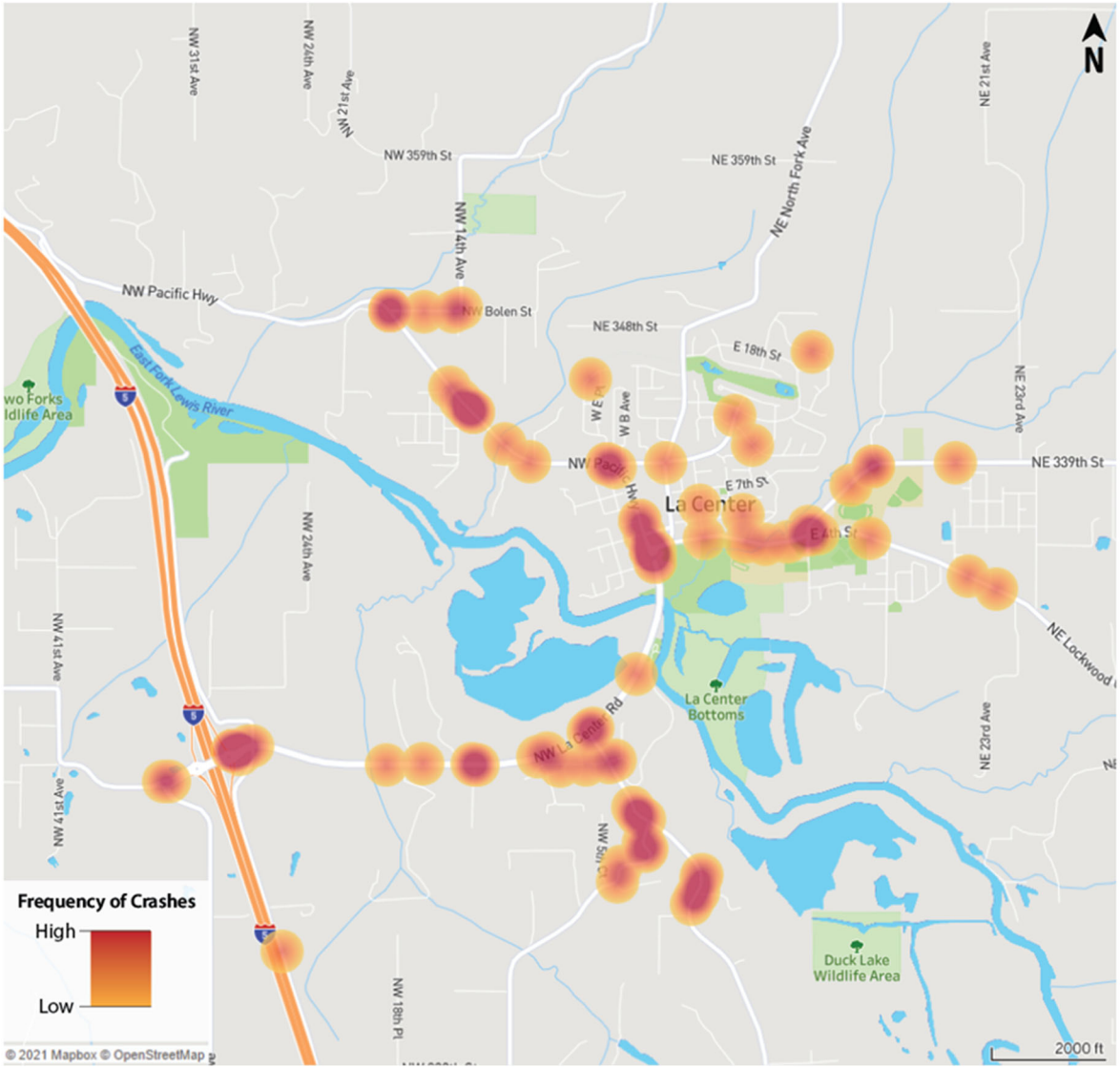


Figure 4. Heat Map of All Reported Collisions in La Center, 2016-2020

CITIZEN FEEDBACK

Citizens of the city are an important source for traffic safety concerns. They have a vested interest in keeping travel safe for themselves and their families, and they bring their first-hand experience. In particular, citizens sometimes identify issues occurring at night and on weekends that agency staff may not identify during typical daytime reviews.

The City of La Center provided a few of the safety-related citizen requests made over the past few years. Following is a sampling of those requests.

- A citizen was concerned about eastbound traffic turning left at W 4th St and Aspen Ave. They requested that an enhanced pedestrian crossing be implemented at the intersection to inform drivers of pedestrians crossing.

- A citizen expressed his concern for increasing traffic along Pacific Highway between the Riverside Estates. They stated their concern on the lack of infrastructure for pedestrians and bicyclists commuting downtown.

- A citizen was concerned with the design of the Pacific Highway and Lockwood Creek Rd Corridors. They expressed that the road was built for faster design speeds and that is why cars speed. They also requested that the road be designed to arterial standards.

STEP 2: ANALYZE SERIOUS INJURY COLLISIONS TO IDENTIFY RISK FACTORS (COLLISION ATTRIBUTES)

The City studied each risk factor (collision attribute) to determine those most likely to contribute to future serious injury collisions in La Center. Table 1 shows some of the most common attributes present in collisions that occur on City-owned streets. Collision attributes with a notably higher percentage of serious injury collisions versus all-severity collisions have an increased likelihood of contributing to serious injury crashes.

TABLE 1. MOST COMMON COLLISION ATTRIBUTES, LA CENTER, 2016-2020

Data Element	Collision Attribute	Total Collisions	Serious Injury Collisions (SI)	Percent of all La Center Collisions with this Attribute (1)	Percent of SI Ridgefield Collisions with this Attribute (2)
Citywide	*Any*	*88*	*1*		
Collision Type	Roadway Departure	34	1	39%	100%
	Head-On	0	0	0%	0%
	Entering at Angle	16	0	18%	0%
Contributing Circumstance (For at least one vehicle)	Exceeding Reasonable Safe Speed or Exceeding Stated Speed Limit	14	0	16%	0%
	Alcohol-Impaired (3)	6	0	7%	0%
	Drug-Impaired (3)	2	0	2%	0%
	Inattention / Distraction	17	1	20%	100%
Motor Type Involved	Motorcycle	1	1	1%	100%
	Heavy Vehicle	16	0	18%	0%

Data Element	Collision Attribute	Total Collisions	Serious Injury Collisions (SI)	Percent of all La Center Collisions with this Attribute (1)	Percent of SI Ridgefield Collisions with this Attribute (2)
Lighting Condition	Dark/Dusk/Dawn	21	0	24%	0%
Intersection	At Intersection or Intersection Related	35	0	39%	0%
	Signalized Intersection	0	0	0%	0%
	Unsignalized Intersection	35	0	39%	0%
Road User	Pedestrian Involved	2	0	2%	0%
	Cyclist Involved	1	0	1%	0%
Roadway Surface	Wet	31	0	36%	0%
	Ice	1	0	1%	0%
Age	Driver Age 16 to 25 Involved	35	1	40%	100%
	Driver Over Age 65 Involved	11	0	13%	0%
Restraint (Seat Belt) Usage	No Restraints Used	3	1 (motorcycle)	3%	100%

(1) For example, in La Center 39% of all collisions involved roadway departure.
(2) For example, in La Center 100% of all serious injury collisions were roadway departure.
(3) As of this writing, WSDOT has identified an issue with 2020 impaired driving data and is looking into the details.

The study team identified the following notable trends from this analysis:

- Intersections are the most common type of location for collisions (all severities) to occur. Of intersection collisions, the most common sub-type was entering at an angle (16 of 35).
- Roadway departure collisions are the most common collision type (34 of 88 total collisions).
- Young drivers (age 16 to 25) were involved in nearly half of all collisions.

STEP 3: SELECT MOST COMMON RISK FACTORS (COLLISION ATTRIBUTES)

Based on the findings of Step 1 and Step 2, the study team identified the following collision attributes correlated with the highest frequency or severity of collisions. These collision attributes are the focus of the network analysis in Step 4:

1. Roadway Departure
2. At Intersection or Intersection Related
3. Wet Roadway Surface Conditions
4. Dark/Dusk/Dawn Lighting Conditions
5. Inattention/ Distraction
6. Exceeding Reasonable Safe Speed or Exceeding the Speed Limit

Pedestrian and Bicycle Safety. Only 3 of the 88 reported collisions during the study period involved a pedestrian or bicyclists, and none of those reported crashes resulted in a serious injury. To identify locations for potential infrastructure treatments under the WSDOT City Safety Program, at least one fatal or serious injury collision must be present in the database. However, citizen feedback included concerns for pedestrian safety, especially for people walking or biking to or from downtown La Center. Some of this feedback mentions pedestrian and bicycle safety concerns along Pacific Highway, E 4th St/Lockwood Creek Rd and the E 4th St & Aspen Ave intersection. The study team will keep an eye on any additional pedestrian-related issues in subsequent project tasks to identify potential policy-level or systemic treatments related to pedestrian and bicyclist safety.

Lighting Conditions. Based on preliminary findings, there are limited streetlights present outside of the downtown area. In particular, NW Timmen Rd and NW Spencer Rd there are narrow roadways with no shoulder and low hanging tree canopy that can impact sight distance and visibility around the horizontal curves.

STEP 4: ANALYZE ROADWAY NETWORK FOR PRESENCE OF RISK FACTORS

Following WSDOT's recommended procedure,[3] the City applied the most common risk factors in serious injury crashes to the entire network using frequency of collisions based on the most common risk factors / collision attributes.

The City mapped crash frequency based on the most common risk factors in serious injury crashes. The maps in **Appendix C** illustrate the locations of crashes with these attributes.

STEP 5: CREATE PRIORITIZED LIST OF ROADWAY LOCATIONS

Table 2 lists intersections ranked by the number of risk factors / collision attributes that the study team identified. Table 3 lists corridors ranked by the number of risk factors / collision attributes that the study team identified. A location received a "point" for a risk factor if it experienced a relatively high frequency of crashes with that attribute compared to the rest of the City of La Center roadway network. Additional points were added for the following:

- The location experienced at least one serious injury crash during the study period. This is required for the location to be eligible for a spot location treatment under the WSDOT City Safety Program.
- The location was identified as a citizen concern.

[3] WSDOT Local Road Safety Plans Guidance, https://www.wsdot.wa.gov/sites/default/files/2014/02/27/LP_Local-Road-Safety-Plans.pdf

TABLE 2. PRIORITIZED INTERSECTION SAFETY NEEDS BY NUMBER OF RISK FACTORS

Intersection	Roadway Departure	Wet Road Surface	Dark/Dusk/ Dawn	Distracted/ Inattention	Speeding	At Least 1 Serious Injury Crash	Citizen Request	Total
NW Pacific Hwy and NW Bolen St	✓	✓	✓	✓	✓	-	-	**5**
NW Pacific Hwy and NW Larsen Dr	✓	✓	-	-	-	-	-	**2**
NW Pacific Hwy and W 4th St	-	✓	-	✓	-	-	-	**2**
NW Pacific Hwy and W 10th St	✓	✓	-	-	-	-	-	**2**
NW Timmen Rd and NW Pollock Rd/NW 319th St	✓	-	✓	-	-	-	-	**2**
Highland Rd and E 4th St	-	✓	-	-	-	-	-	**2**
NW Pacific Hwy and W D Ave	-	✓	-	-	✓	-	-	**2**

TABLE 3. PRIORITIZED CORRIDOR SAFETY NEEDS BY NUMBER OF RISK FACTORS

Segment	Roadway Departure	Wet Road Surface	Dark/Dusk/ Dawn	Distracted/ Inattention	Speeding	At Least 1 Serious Injury Crash	Citizen Request	Total
NW Spencer Rd from NW Timmen Rd to NW 5th Ct	✓	✓	✓	✓	✓	-	✓	**6**
NW Pacific Hwy (from La Center Downtown to 16th Ave)	✓	✓	✓	-	✓	-	✓	**5**
NE Timmen Rd from NW Pollock Rd to NW 309th Cir	✓	✓	✓	✓	✓	-	-	**5**
E 4th St / NE Lockwood Creek Rd from Highland Rd to NE 24th Ave	-	✓	✓	✓	-	-	✓	**4**
NW La Center Rd from McCormick Creek to NW 13th Ave	-	✓	✓	✓	-	✓	-	**4**
E 4th St from NW Pacific Hwy to Highland Rd	✓	✓	-	-	✓	-	✓	**4**
Curve of NW 14th Ave and NW Bolen St (very wide curve and a stop sign)	✓	-	-	✓	✓	-	-	**3**
Highland Rd from E 4th St to NE 23rd Ave	-	✓	✓	-	✓	-	-	**3**

STEPS 6 & 7: IDENTIFY COUNTERMEASURES TO ADDRESS PRIORITIZED LOCATIONS AND DEVELOP A PRIORITIZED LIST OF PROJECTS

The City compared the list of prioritized intersections and corridors identified in Step 5 to recent and already-funded projects to identify the most pressing safety current needs, and then analyzed collision data and existing conditions at the following locations:

TABLE 4. COMBINED PRIORITIZED SAFETY NEEDS BY LOCATION

Location	Roadway Departure	Wet Road Surface	Dark/Dusk / Dawn	Distracted/ Inattention	Speeding	At Least 1 Serious Injury Crash	Citizen Request
Intersection: NW Pacific Hwy and NW Bolen St	✓	✓	✓	✓	✓	-	-
Segment: 4th Street from Cedar Avenue to Highland Road	✓	✓	-	-	✓	-	✓
Segment: NW Pacific Hwy (from downtown to 16th Ave)	✓	✓	✓	-	✓	-	✓
Segment: NW Spencer Rd (from NW Timmen Rd to NW 5th Ct)	✓	✓	✓	✓	✓	-	✓
Intersection: NW Timmen Rd and NW Pollock Rd/NW 319th St	✓	-	✓	-	-	-	-

Upon completion of that analysis and identification of potential countermeasures, the City selected the priority spot location and systemic safety projects shown below.

TABLE 5. SAFETY PROJECTS TO PURSUE

Prioritized Location or Systemic Collision Type	Safety Project	Next Step
1. Systemic Roadway Departure	• Citywide Horizontal Curve Signing • Low-cost Roadway Departure Treatments on select corridors	Apply for 2022 WSDOT City Safety Program grant funding
2. 4th Street from Cedar Avenue to Highland Road	Road widening; buffered bike lanes; sidewalk in-fill, signalized intersection at Highland Road; ped crossing treatments	Apply for Safe Routes to School, Ped/Bike grant funding
3. Systemic Stop-controlled Intersections	Low-cost signing and pavement marking treatments	Implement low-cost treatments with City forces
4. Segment: NW Pacific Highway (from downtown to 16th Avenue)	Shoulders, rumble strips, and lighting	Consider future grant applications
5. Intersection: NW Pacific Highway and NW Bolen Street	Horizontal curve signing; Intersection Warning Signs; Pavement Marking improvements (County coordination required)	Consider future grant applications
6. Intersection: Timmen Road and La Center Road	Roundabout; Traffic Study	Consider future grant applications

The following sections detail existing conditions, countermeasures, and estimated project costs, monetary value of estimated safety benefits, and the estimated benefit/cost ratio of each recommended safety project.

PRIORITY 1: SYSTEMIC ROADWAY DEPARTURE

Roadway Departure collisions were the most common type to result in and serious injuries in La Center with the one serious injury collision during the study period including a vehicle departing its lane. Additionally, 39% of all collisions (regardless of severity) involved roadway departure. Figure 5 illustrates the frequency and density of roadway departure collisions.

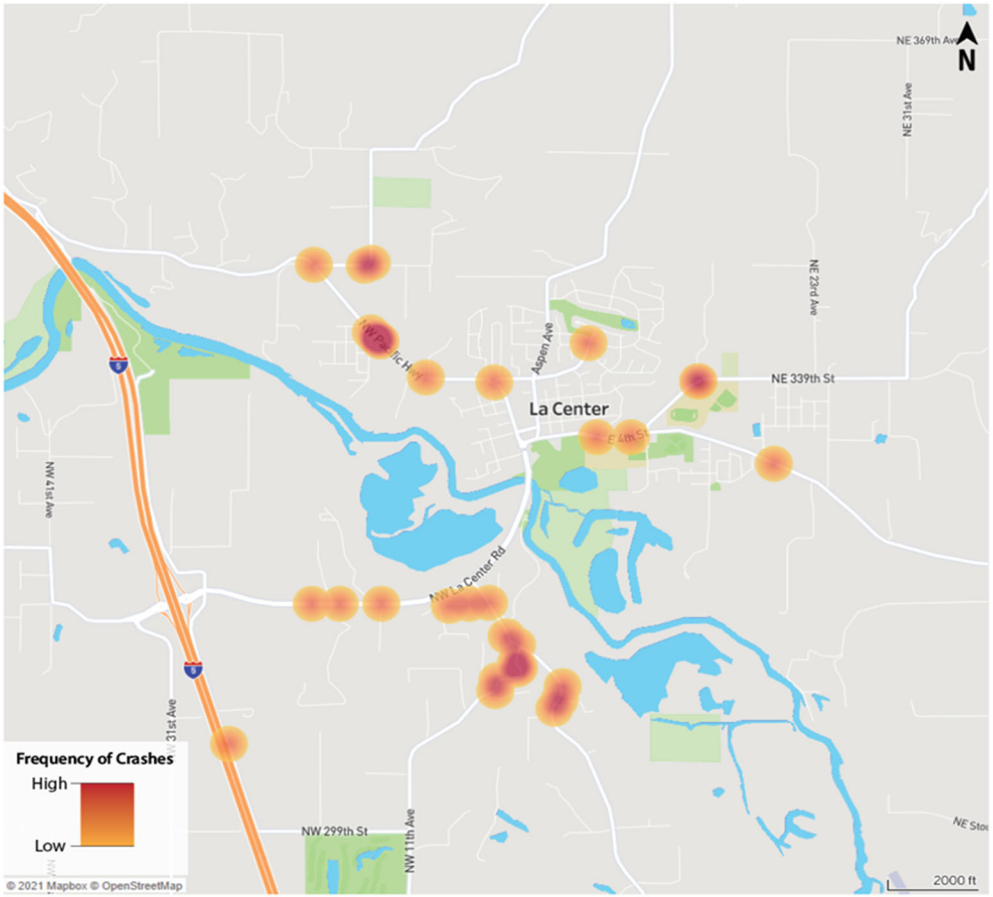


Figure 5. Roadway Departure Collisions, La Center, 2016-2020.

1.1 Citywide Horizontal Curve Safety Improvements

The City proposes horizontal curve safety improvements for two important reasons. First, motorists are more than three times as likely to be involved in a collision on a curve than a tangent section. Second, the most recent MUTCD (2009) included a legal requirement for every publicly-owned road with 1,000+ vehicles per day to meet horizontal curve requirements by December 31, 2019.

This safety project will provide current MUTCD standard curve warning signs at all horizontal curves on arterials and major collectors in the city limits (approximately 20 curves).

- Conduct a horizontal curve inventory study and posted speed limit study to assess existing conditions
    - Collect advisory speed data for each curve and turn
    - Collect operating speeds near each curve and turn, then analyze that data using current methodologies to determine the most appropriate posted speed limit.[4]
    - Calculate the difference between advisory speed and posted speed limit (per MUTCD)
- Design signing treatments
    - Determine the required (shall) and recommended (should) sign package for each curve per MUTCD Table 2C-5 (e.g., advanced warning sign, advisory speed plaque, chevrons, and/or one direction large arrow).
    - Confirm sign placement feasibility via field review
    - Produce plans, specifications, and estimates (PS&E) for curve signing
- Install horizontal curve warning signs

[4] Experts have identified potential "too low" posted speed limits in La Center that have, as a result, reduced the horizontal curve warning sign requirements, since that requirement is tied directly to the posted speed limit per the MUTCD.

La Center: Citywide Horizontal Curve Safety Improvements

Project Description

Provide current MUTCD standard curve warning signs or enhanced warning treatments at all horizontal curves and turns on arterials and major collectors

Cost Estimate

$263,000

Benefit / Cost Ratio

1.10

Time Frame

Medium-term

Crash Reduction [5]

15% injury

7% PDO

History: 32 curve crashes observed from 2016-2020.

Expected Benefit: 0.53 fewer curve crashes per year

1.2 Combined Roadway Departure Treatments Along Select Corridors

Low-cost roadway departure treatments focus primarily on keeping vehicles on the road and in their lane, and since motorists can depart the roadway at an infinite number of locations (versus the finite number of intersections in a jurisdiction), blanketing an entire corridor with roadway departure treatments can prevent future collisions, even at locations that have not experienced one in the past. The following treatments should be considered along select corridors.

- ***Enhanced Curve Safety Package.*** On top of the minimum requirements, horizontal curve signing will be enhanced to provide additional warning for motorists: doubled-up signs, oversized signs fluorescent yellow sheeting, chevrons alignment signs, flexible delineators, flashers, speed feedback warning, and pavement marking. Additionally, High Friction Surface Treatment may be appropriate at select curves.
- ***Rumble Strips or Profiled Pavement Marking.*** Provide visual, tactile, and auditory feedback to drivers - either via rumble strips or profiled pavement marking - depending on the surrounding land use.

[5] WSDOT Crash Modification Factor

- ***Nighttime Delineation.*** Provide delineation via vertical delineators or products added to current appurtenances (e.g., guardrail) to improve visibility of roadway alignment in dark conditions.
- ***Fixed Object Treatments.*** For each fixed object within the right-of-way (with priority for those objects in the clear zone), address each using the following hierarchy per FHWA:
    a. Remove the obstacle.
    b. Redesign the obstacle so it can be safely traversed.
    c. Relocate the obstacle to a point where it is less likely to be struck.
    d. Reduce impact severity by using an appropriate breakaway device.
    e. Shield the obstacle with a longitudinal traffic barrier designed for redirection or use a crash cushion.
    f. Delineate the obstacle if the previous alternatives are not appropriate.

The City has identified these priority corridors for systemic roadway departure treatments:

- NW Spencer Rd from NW Timmen Rd to NW 5th Ct
- NW Pacific Hwy from Downtown to 16th Ave
- NW La Center Rd from Interstate 5 to W 3rd Street
- NE/NW Timmen Road from NE 309th Circle to NW La Center Road
- NE Highland Ave / NE 339th Street from E 4th Street to NE 24th Avenue

Following is a summary of the identified safety needs along these corridors.

NW Spencer Rd from NW Timmen Rd to NW 5th Ct. This 0.3-mile segment of road includes four horizontal curves with an advisory speed of 20 mph. The roadway is narrow with no shoulders, edge drop-off is common, and subgrade failure is present at some locations (see Figure 6). The collision history showed most crashes were "over embankment - no guardrail present," and the City also reported a high frequency of guardrail hits, which can be assumed were unreported collisions.

Figure 6. NW Spencer Road

NW Pacific Highway from Downtown to 16th Avenue. This 0.5-mile segment (from the end of sidewalk west of West D Avenue) runs west, then northwest to W 16th Avenue just outside the downtown area of La Center. It is sometimes used as an Interstate bypass, including by over-sized vehicles. Traveling westbound at the curve, there is a visual trap that may cause some motorists to see the roadway continuing straight into the driveway (see Figure 7).

Revised posted speed limits, more frequent posting of the speed limit, and speed feedback (i.e., "Your Speed Is") signs can reduce operating speeds along the segment, which in turn can reduce the frequency and severity of roadway departure collisions.

Figure 7. NW Pacific Highway, westbound horizontal curve with visual trap

NW La Center Road from Interstate 5 to W 3rd Street. NW La Center Road runs east from the Interstate 5 interchange and is the primary access from the freeway to downtown. This segment experienced the City's serious injury collision during the study period, which involved a motorcyclist who lost control 500 feet west of NW 18th Ave.

NE/NW Timmen Road from NE 309th Circle to NW La Center Road. This segment of Timmen Road (NE Timmen Road on the south end of this segment, then NW Timmen Road to the north) is a 1.3-mile segment with significant horizontal curvature throughout. It connects NW La Center Road to Ridgefield.

NE Highland Ave / NE 339th Street from E 4th Street to NE 24th Avenue. This segment of NE Highland Ave / NE 339th Street includes two predominant curves – one near the E 4th Street intersection and Holley Park, and the other at La Center High School. The segment is a tangent section east of the school along La Center Cemetery, and it serves as the north boundary of the city limit.

La Center: Systemic Roadway Departure Along Select Corridors

Project Description

Install enhanced safety treatments, profiled pavement markings, nighttime delineation, and/or fixed object treatments along these corridors.

Cost Estimate

$585,000

Benefit / Cost Ratio

6.00

Time Frame

Medium-term

Crash Reduction [6]

~40%

Combined reduction for the treatments described.

History: 23 roadway departure collisions along the select corridors from 2016-2020

Expected Benefit: 2 fewer crashes per year

[6] Combination of CMFs from several roadway departure treatments

PRIORITY 2: 4TH STREET FROM CEDAR AVENUE TO HIGHLAND ROAD

Figure 8. 4th Street west of La Center Elementary School

Identified Safety Needs. Located at the east end of La Center, adjacent to the La Center Elementary School, this 0.35-mile segment includes significant pedestrian and bicycle usage of students and their families walking and biking to and from school. As illustrated in the figure, the segment lacks sidewalks along the north side of 4th Street at some locations. During the study period (2016-2020) both pedestrian-involved and bicyclist-involved collisions have occurred along the corridor.

Potential Safety Treatments. Analysis has recently been completed as part of the *4th Street Widening Project*, and design is complete as well. To address the identified needs at this intersection, the City proposes the following safety countermeasures:

- Widen the roadway to comply with the City's Complete Streets ordinance, including the addition of a buffered bicycle lane on each side of 4th Street.
- Install a traffic signal at the Highland Road intersection.
- Complete sidewalk in-fill along 4th Street where none exists and ensure ADA-compliance crossings at each marked crossing.
- Install enhanced pedestrian treatments at the Stonecreek Drive intersection, including RRFBs and pedestrian median refuge.

PRIORITY 3: SYSTEMIC STOP-CONTROLLED INTERSECTIONS

Identified Safety Needs. In La Center, intersection and intersection-related collisions are the most common type (tied with roadway departure) to occur for all crash severities, with 39% of all collisions occurring at intersections.

Potential Safety Treatments. Low-cost systemic safety countermeasures at unsignalized intersections consist primarily of signing and pavement marking. Treatments include doubled-up signs, additional pavement marking, fluorescent yellow sign sheeting, advance warning signs, and oversized signs.

To address the safety risks at intersections and the low cost of the recommended treatments, the City will consider a combination of these treatments at the following stop-controlled intersections (and others with similar features):

- NW La Center Rd and NW Timmen Rd
- NW Pacific Hwy and W 3rd St
- NW Pacific Hwy and W 5th St
- NW Pacific Hwy and W D Ave
- W 10th St and Aspen Ave
- E 4th St and Highland Rd/E Ivy Ave

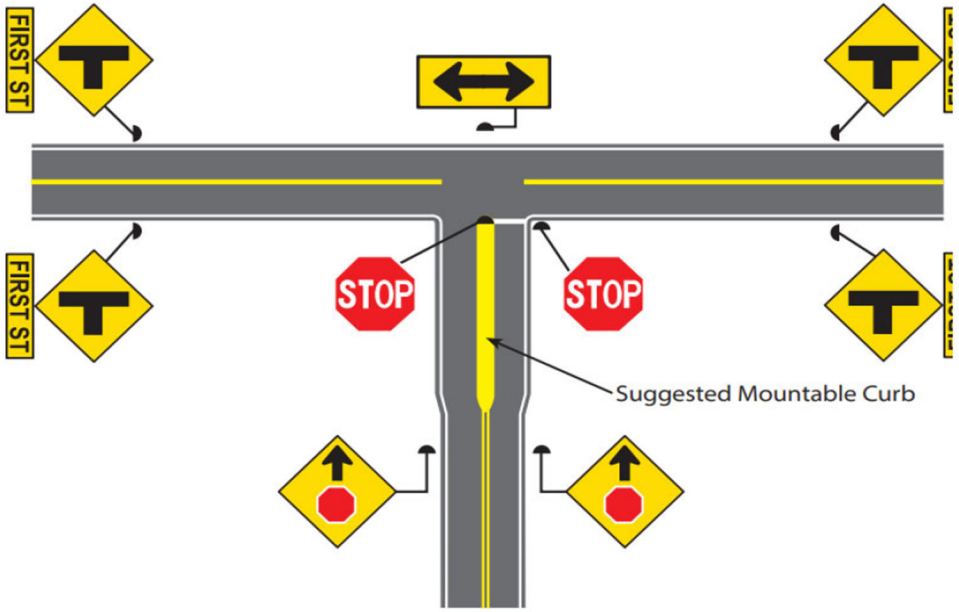


Figure 9. Typical Low-cost Intersection Treatments

PRIORITY 4: NW PACIFIC HIGHWAY FROM DOWNTOWN TO 16TH AVENUE

Identified Safety Needs. The roadway is narrow, and shoulders are either narrow or non-existent throughout this corridor. Most collisions along the segment during the study period were roadway departure events in dark conditions.

Potential Safety Treatments. On top of the roadway departure systemic treatments identified above, this segment of NW Pacific Highway may benefit from additional spot location treatments.

Figure 10. Northwest-bound on Pacific Highway

- ***Shoulder Widening.*** Increasing the shoulder width along the segment provides additional recovery area for vehicles that depart their lane, reducing the frequency and severity of collisions.
- ***Speed Feedback Signs.*** Revised posted speed limits, more frequent posting of the speed limit, and speed feedback (i.e., "Your Speed Is") signs can reduce operating speeds along the segment, which in turn can reduce the frequency and severity of roadway departure collisions.
- ***Lighting.*** Due to most (six of seven) reported collisions occurring in dark conditions, highway lighting may be appropriate on this segment to reduce the risk of future nighttime collisions.

PRIORITY 5. NW PACIFIC HIGHWAY AND NW BOLEN STREET INTERSECTION

Identified Safety Needs. Located at the northwest edge of the City Limits, this intersection serves residential neighborhoods on both sides of NW Pacific Hwy. Just northwest of the intersection is a horizontal curve that limits sight distance for southeast-bound motorists on NW Pacific Hwy and side street traffic on NW Bolen St. Horizontal curve signing is inconsistent in this area.

The intersection itself is skewed, impacting visibility for NW Bolen St motorists looking north and south for approaching vehicles. Common collision attributes include roadway departure, dark conditions, and speeding.

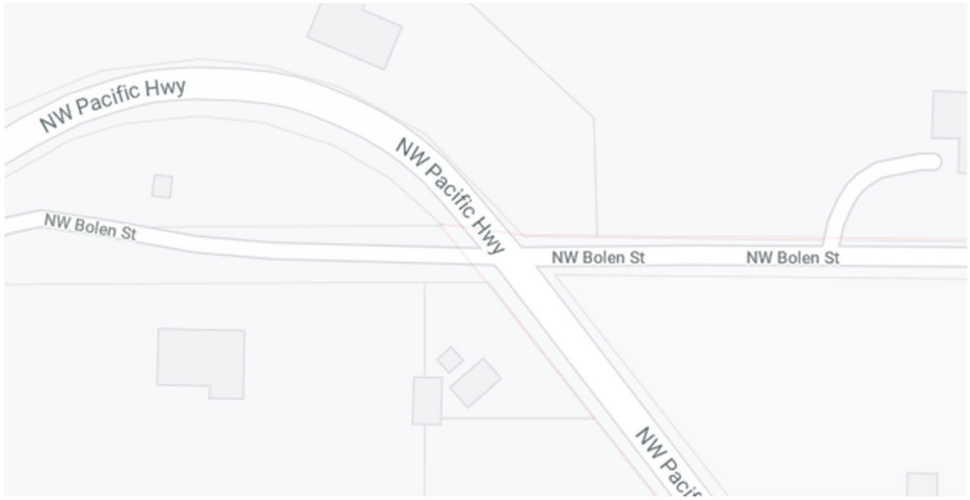


Figure 11. Skewed intersection geometry and nearby horizontal curve

Figure 12. Horizontal curve approaching the intersection

Potential Safety Treatments. To address the identified needs at this intersection, the City will consider the following safety countermeasures:

- ***Enhanced Horizontal Curve Signing and Marking.*** Horizontal curve warning signs for the southeast-bound NW Pacific Highway approach, including advance curve warning, advisory speed plaques, and chevron alignment signs, provide additional information to drivers at curves and turns. Additional pavement marking may further provide guidance to approaching drivers.
- ***Intersection Warning Signs and Pavement Marking.*** Intersection Ahead warning signs for eastbound and westbound approaches on NW Bolen St provide additional notice about an upcoming intersection. Stop Ahead signing, transverse rumble strips, and enhanced Stop sign (oversized, double-up, retroreflective post sleeve, channelization, painted stop bar) help increase Stop sign compliance for NW Bolen St drivers.

PRIORITY 6. TIMMEN ROAD AND LA CENTER ROAD INTERSECTION

Identified Safety Needs. La Center Road connects I-5 to downtown La Center, and Timmen Road is the first major intersection east of the Interstate. It is a large T-intersection with nearby horizontal curves on each side that can limit sight distance for mainline and side street motorists. The mainline speed limit is 50 mph.

Only three collisions occurred in the study period, two of which occurred in wet conditions. None resulted in a serious injury.

In 2022 a truck crashed through the guardrail on the north side of the intersection; it will be replaced with a citywide guardrail repair project later in the year.

Figure 13. Eastbound La Center Road at Timmen Road

Potential Safety Treatments. This project is TIF eligible, and it will be designed when there are warrants following a traffic study. The City should conduct a traffic study at this location to determine the best intersection control for future operations and safety, including the feasibility of a roundabout.

APPENDICES

APPENDIX A: Safety Countermeasures Toolbox

APPENDIX B: Grant Programs

APPENDIX C: Collision Heat Maps

Appendix A Countermeasures Toolbox

Signalized Intersections

S1. Improve Intersection Lighting

A permanent source of artificial light applied to signalized intersections that have a disproportionate number of night-time crashes and do not currently provide sufficient lighting at the intersection or at its approaches.

Benefit-Cost

» Implementation of this treatment reduces nighttime injury crashes by 38% and nighttime pedestrian crashes by 42%. (WSDOT)

» 20 years of expected life

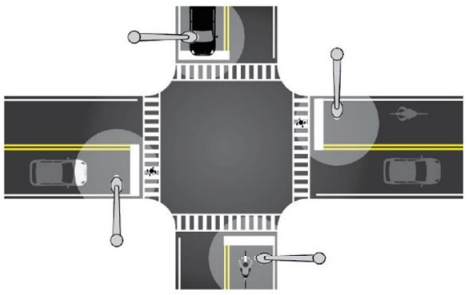
» Estimated $75,000

» The provision of lighting involves both a fixed cost for lighting installation and an ongoingmaintenance and power cost which results in a moderate to high cost.

Sources: CA-Local Roadway Safety Manual, FHWA, WSDOT

EXISTING CONDITION

IMPLEMENTATION



S2. Improve Signal Hardware (lenses, back-plates, mounting, size, number of heads)

Applicable at signalized intersections with a high frequency of right-angle and rear-end crashes because drivers are unable to see traffic signals sufficiently in advance to safely negotiate the intersection being approached. Examples include increasing the size of indications from 8 in. to 12 in. and adding supplemental heads (e.g., side-mount, near-side mount).

Benefit-Cost

» Implementation of this treatment can reduce crashes by 3-7% (WSDOT).

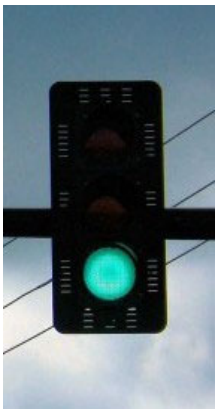
» 10 years of expected life

» Estimated $40,000 per intersection

» Cost varies based on size/number of signal heads.

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITION



IMPLEMENTATION

S3. Improve Signal Timing (coordination, phasing, clearance intervals)

EXISTING CONDITION

Effective at locations that have a crash history at multiple signalized intersections. Signalization improvements may include adding phases, lengthening clearance intervals, eliminating or restricting higher-risk movements, and coordinating signals at multiple locations. This treatment addresses all types of crashes that occur on the approaches / influence area of the new signal timing. For projects coordination signals along a corridor, the crashes related to side-street movements should not be applied.

Benefit-Cost

» Implementation of this treatment reduces all crashes by 16%, and particularly angle crashes by 32% (WSDOT).

» 10 years of expected life

» Estimated $1,000 per intersection

» Cost variation based on number of signal heads and number of movements.

IMPLEMENTATION

Sources: CA-Local Roadway Safety Manual

S4. Install Left-turn Lane and Add Turn Phase

EXISTING CONDITION

Installed at signalized intersections that have a significant crash problem and the only alternative is to change the nature of the intersection itself. This treatment addresses all type of crashes and the measure can be very effective at intersection with complex geometry and intersection with frequent left-turn movements. A properly timed protected left-turn phase can also help reduce rear-end, broadside, and sideswipe crashes between left-turning vehicles and the through vehicles as well as vehicles behind them. This countermeasure only applies to crashes occurring on the approaches / influence area of the new left turn phases.

Benefit-Cost

» Implementation of this treatment reduces all crashes by 35% and head on crashes by 69% (WSDOT).

» 20 years of expected life

» Estimated $12,000 per intersection

» If the existing traffic signal only requires a minor modification to allow for a protected left-turnphase, then the cost would also be low (installation is short because no actual construction). In-house signal maintainers can perform this operation once the proper signal phasing is determined so the cost is low.

IMPLEMENTATION

Sources: CA-Local Roadway Safety Manual

S5. Pavement Marking and RPMs through Intersection

Raised Pavement Markers (RPMs) and pavement marking installed in intersections where the lane designations are not clearly visible to approaching motorists. Can also be applied at intersections noted as being complex and experiencing crashes that could be attributed to a driver's unsuccessful attempt to navigate the intersection.

Benefit-Cost

» Implementation of this treatment reduces run off road, opposite direction and night crashes by 21% (WSDOT).

» 10 years of expected life

» Estimated $2,000 per installation

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITION

IMPLEMENTATION

S6. Improve Pavement Friction (High Friction Surface Treatment

Improvement for signalized Intersections noted as having crashes on wet pavements or under dry conditions when the pavement friction available is significantly less than needed for roadway approach speeds. This treatment is intended to target locations where skidding and failure to stop is determined to be a problem in wet or dry conditions and the target vehicle is unable to stop due to insufficient skid resistance. In addition, treatment also addresses night crashes all other crashes. This treatment does not apply to standard chip-seal or open-graded maintenance projects for long segments of corridors or structure repaving projects intended to fix failed pavement.

Benefit-Cost

» Implementation of this treatment reduces crashes by 40% (WSDOT).

» 10 years of expected life

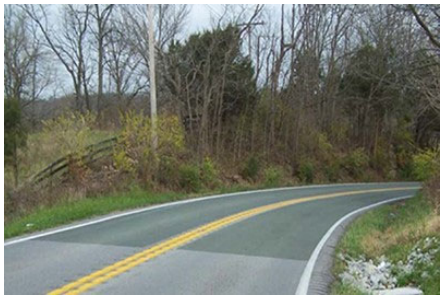
» Estimated $5,000 per intersection for materials and equipment

» Cost variation based on size of intersection and material (Estimated $30/sq.yd.).

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITION

IMPLEMENTATION



S7. Add Median Openings to Allow or Restrict Left-turns and U-turns

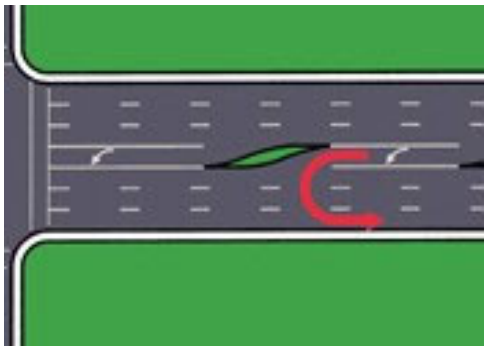
Install medians to reduce crashes related to turning maneuvers include angle, rear-end, pedestrian, and sideswipe (involving opposing left turns) type crashes. This treatment only applies to crashes occurring in the intersection/influence area of the new directional openings.

EXISTING CONDITION

Benefit-Cost

- Implementation of this treatment reduces crashes by 51% (WSDOT).
- 20 years of expected life
- Estimated $75,000 per installation
- The cost of this strategy will depend on the treatment.

IMPLEMENTATION



Sources: CA-Local Roadway Safety Manual

S8. Install Right-turn Lane

Setting up right-turn lane may be appropriate in situations where there are an unusually high number of rear-end collisions on a single major road approach. The need for right turn lanes should be assessed on an individual approach basis. It is also important to ensure that the right-turn lanes are of sufficient length to allow vehicles to decelerate and "queue up" before turning, ideally without affecting the flow of through traffic. This treatment addresses read-end crashes. When considering new right-turn lanes, potential impacts to non-motorized user should be considered and mitigated as appropriate.

EXISTING CONDITION

Benefit-Cost

- Implementation of this treatment reduces crashes by up to 8% for all crashes and 17% for fatal/injury crashes (WSDOT).
- 20 years of expected life
- Estimated $300,000 per right turn lane
- Installing right turn lanes require substantial time for development and construction that canvary the cost.

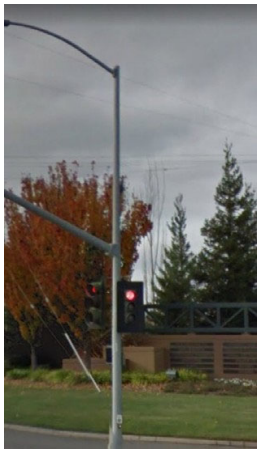
IMPLEMENTATION

Sources: CA-Local Roadway Safety Manual

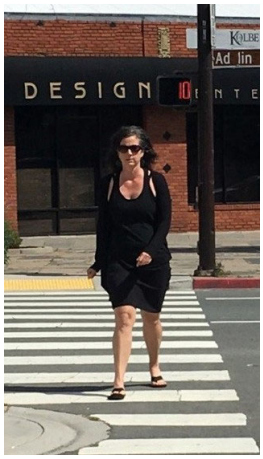
S9. Install Pedestrian Countdown Signal Heads

Install at signals that have signalized pedestrian crossing with WALK / DON'T WALK indications and where there have been pedestrian-vehicle crashes. The countermeasure addresses both pedestrian and bicycle collisions. This countermeasure only applies to "Ped & Bike" crashes occurring in the intersection/crossing with the newcountdown heads.

EXISTING CONDITION



IMPLEMENTATION



Benefit-Cost

- Implementation of this treatment reduces pedestrian crashes by 70% (WSDOT).
- 20 years of expected life
- Estimated $1,500 per signal head (does not include push button or pole cost)
- Costs and time of installation will vary based on the number of intersections included in this strategy and if it requires new signal controllers capable of accommodating the enhancement. This countermeasure can be effectively and efficiently implemented using a systematic approach with numerous locations, resulting in moderate cost projects that are more appropriate to seek stateor federal funding.

Sources: CA-Local Roadway Safety Manual

S10. Flashing Yellow Arrow Left Turn Signal

Flashing yellow arrow (FYA) traffic signals feature a flashing yellow arrow in addition to the standard red, yellow, and green arrows. When illuminated, the flashing yellow arrow allows waiting motorists to make a left-hand turn after yielding to oncoming traffic.

A national study demonstrated that drivers found flashing yellow left-turn arrows more understandable than traditional yield-on-green indications (green ball). Flashing yellow arrow treatment at signalized intersections can reduce the likelihood of left-turn crashes during permissive left-turn phasing. They can be used in either permissive-only or protected-permissive left-turn phasing schemes.

EXISTING CONDITION

IMPLEMENTATION

Benefit-Cost

- Implementation of this treatment reduces left turn crashes by 19% (WSDOT).
- 10 years of expected life
- Estimated $200,000 per intersection (assuming 4 new installations)
- Depending on the existing signal heads, signal controller, and signal cabinet, this treatment may require a controller replacement, which would increase the cost of installation.

Sources: FHWA, NACTO, Minnesota DOT

S11. Leading Pedestrian Interval

A leading pedestrian interval (LPI) gives pedestrians the opportunity to enter the crosswalk at an intersection 3-7 seconds before vehicles are given a green indication. Using this "head start," pedestrians can better establish their presence in the crosswalk before vehicles have priority to turn right or left.

LPIs provide increased visibility of crossing pedestrians and increased likelihood of motorists yielding to pedestrians. This results in reduced conflicts between vehicles and pedestrians, improving intersection safety. LPI is particularly useful at signalized intersections with a high volume of turning movements.

Benefit-Cost

» Implementation of this treatment reduces pedestrian-vehicle crashes by 13-48% (FHWA, WSDOT, City of Seattle).

» 10-20 years of expected life

» Estimated $200-10,000 (based on whether existing controller can accommodate the change)

Sources: FHWA, City of Seattle, WSDOT

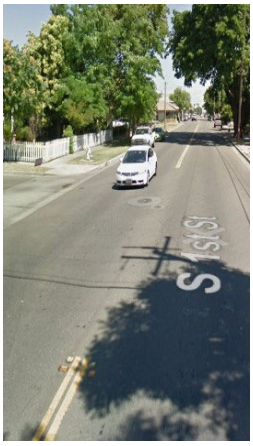
IMPLEMENTATION

Countermeasures for Non-Signalized Intersections

NS1. Add Intersection Lighting

Effective at unsignalized intersections that have a disproportionate number of nighttime crashes and do not currently have lighting. This treatment improves the safety of the intersection during nighttime by making drivers more aware of the surroundings at the intersection, enhancing driver'savailable sight distances and improving the visibility of non- motorists. This countermeasure only applies to nightcrashes (all types) occurring within limits of the proposed roadway lighting 'engineered' area.

EXISTING CONDITION



IMPLEMENTATION

Benefit-Cost

- Implementation of this treatment reduces nighttime injury crashes by 38% and nighttime pedestrian crashes by 42% (WSDOT).
- 20 years of expected life
- Estimated $8,000 per intersection
- Cost variation based on cost for lighting installation and an ongoing maintenance and powercost.

Sources: CA-Local Roadway Safety Manual

NS2. Convert to All-way Stop Control

Applicable at unsignalized intersection locations (currently with two-way stop control or two-way yield control) with a crash history and have no controls on the major roadway approaches. The all-way stop control is suitable only at intersections with moderate and relatively balanced volume levels on the intersection approaches. This treatment addresses to all type of crashes and only applies to crashes occurring in the intersection and /or influence area ofthe new control. All-way stop warrant should be considered.

EXISTING CONDITION

IMPLEMENTATION

Benefit-Cost

- Implementation of this treatment reduces crashes by 18-75% (ODOT).
- 10 years of expected life.
- Estimated $5,000 per intersection.
- Cost variation based on numbers of locations.

Sources: CA-Local Roadway Safety Manual

NS3. Install Roundabout

Effective at intersections that have a high frequency of right-angle and left-turn type crashes, primarily at unsignalized intersections with moderate-volumes. This countermeasure only applies to crashes occurring inthe intersection and/or influence area of the new control and is not eligible for use at existing all-waystop intersections.

Benefit-Cost

» Implementation of this treatment at 2-way stop controlled intersection reduces crashes by 25% and fatal/injury crashes by 35% (WSDOT).

» 20 years of expected life.

» Estimated $750,000 per intersection.

» Cost variation based on the environmental process, right-of-way acquisition and implementationunder an agency's long-term capital improvement program.

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITION

IMPLEMENTATION

NS4. Implement Unsignalized Intersection Signing and Marking Improvements

Target unsignalized intersections with patterns of rear-end, right- angle, or turning collisions related to lack of driver awareness of the presence of the intersection. The set of low-cost countermeasures is designed to increase drivers' alertness to the presence of the intersection and reduce potential conflicts with other entering vehicles. These treatments can include advanced intersection warning signs, oversized signs, doubled-up signs, stop ahead signs or painted on side street to supplement STOP sign.

Benefit-Cost

» Implementation of this treatment reduces crashes by 25% (WSDOT).

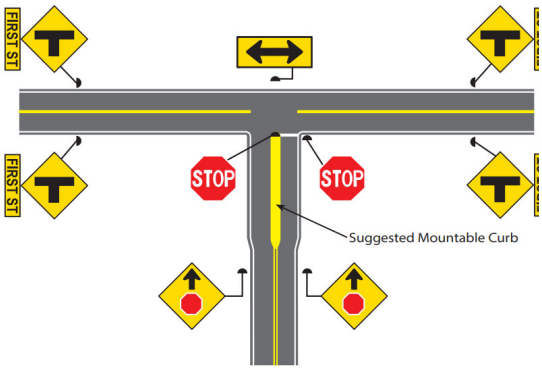
» 10 years of expected life.

» Estimated $700 per intersection.

» Cost variation based on the number of signs.

Sources: CA-Local Roadway Safety Manual

IMPLEMENTATION



NS5. Install Transverse Rumble Strips

Transverse rumble strips are installed in the travel lane for providing an auditory and tactile sensation for each motorist approaching the intersection. They can be used at any stop or yield approachintersection, often in combination with advance signing to warn of the intersection ahead. This countermeasure applies to all crashes occurring on the approach / influence area of the new rumble strips.

Benefit-Cost

- Implementation of this treatment reduces all crashes by up to 6% and fatal/injury crashes by 7% (WSDOT).
- 10 years of expected life.
- Estimated $5,000 per intersection.
- Cost variation based on the length of the rumble strips.

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITION

IMPLEMENTATION

NS6. Install Raised Median

Used at Intersections noted as having turning movement crashes near the intersection as a result of insufficient access control. Application of this countermeasure should be based on current crash data and a clearly defined need to restrict or accommodate the movement. Angle crashes are addressed through this countermeasure. When agencies opt to install landscaping in conjunction with new raised medians, these locations must be excluded from their federally funded HSIP application scope. This countermeasure only applies to crashes occurring on the approaches / influence area of the new raised median.

Benefit-Cost

- Implementation of this treatment reduces all crashes by up to 39% and fatal/injury crashes by 44% (WSDOT).
- 20 years of expected life.
- Estimated $200,000+ (depends on length, right-of-way, and surface treatment).
- Cost variation based on the size of the new median.

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITION

IMPLEMENTATION

NS7. Install Right-turn Lane

Applicable when many collisions at unsignalized intersections are related to right-turn maneuvers. This countermeasure provides exclusive right-turn lanes, particularly on high-volume and high-speed major-roadapproaches to minimizing the collisions and applies to crashes occurring on the approaches / influence area of the new right-turn lanes.

Benefit-Cost

» Implementation of this treatment reduces all crashes by up to 8% and fatal/injury crashes by 17% (WSDOT).

» 20 years of expected life.

» Estimated $200,000 per intersection.

» Cost variation based on how wide the new right lane.

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITION

IMPLEMENTATION

NS8. Install Enhanced Pedestrian Crossing wish Advanced Features

Applicable at non-signalized intersections without a marked crossing, where pedestrians are known to cross, that involve significant vehicular traffic. They are important at school crossings and intersections with right and/or left turns pockets. Rectangular rapid flashing beacons (RRFBs), overhead flashing beacons, curb extensions, advanced stop or yield lines and other safety features should be added to complement the standard crossing elements. This countermeasure reduced pedestrian crashes occurring in the crossing (influence area) with the new enhanced safety features.

Benefit-Cost:

» Implementation of this treatment reduces pedestrian crashes by 40% (WSDOT).

» 20 years of expected life

» Estimated $ 50,000 per intersection

» Cost variation based on the length of the pedestrian crossing and the amount of safety signs.

Sources: CA-Local Roadway Safety Manual

IMPLEMENTATION

NS9. Install Pedestrian Crossing (signs and markings only)

Applicable when many collisions at unsignalized intersections are related to left-turn maneuvers. This countermeasure provides exclusive left-turn lanes, particularly on high-volume and high-speed major-road approaches to minimizing the collisions. This countermeasure applies to crashes occurring on the approaches /influence area of the new left- turn lanes, but is not eligible for use at existing all-way stop intersections.

Benefit-Cost

- Implementation of this treatment reduces pedestrian crashes by 40% (WSDOT).
- 20 years of expected life
- Estimated $200,000 per intersection
- Cost variation based on how wide the new left lane.

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITION

IMPLEMENTATION

Countermeasures for Roadway Segments

R1. Add Segment Lighting

Applied to night-time crashes. In particular, patterns of rear-end, right-angle, turning or roadway departure collisions on the roadways may indicate that night-time drivers can be unaware of the roadway characteristics. This treatment addresses only to all night type crashes.

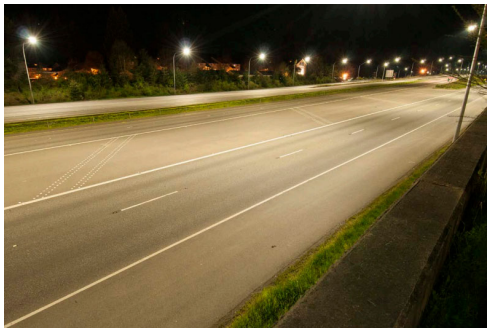
Benefit-Cost

- Implementation of this treatment reduces injury crashes by 28% (HSM).
- 20 years of estimated life
- Estimated $8,000 per installation
- Cost variation depending if lighting connected to signal box.

Sources: CA-Local Roadway Safety Manual, Highway Safety Manual

EXISTING CONDITION

IMPLEMENTATION



R2. Remove or Relocate Fixed Objects

Applicable to known locations or roadway segments prone to collisions with fixed objects such as utility poles, drainage structures, trees, and other fixed objects, such as the outside of a curve, end of lane drops, and in traffic islands. This treatment addresses fixed object crashes that occur within the current clear zone.

Benefit-Cost

- Implementation on this treatment reduces run off road crashes by 38% (WSDOT).
- 20 years of expected life
- Varies. Up to estimated $50,000 per deployment
- Costs will generally be low, assuming that in most cases the objects to be removed are within the right-of-way.

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITION

IMPLEMENTATION

R3. Install Guardrail

Guardrail is installed to reduce the severity of lane departure crashes. This treatment addresses fixed object and run-off road crashes. Its value in reducing collisions should only be applied to locations where past crash data or engineering judgement suggests the guardrail may result in a few or less severe crashes because the guardrail itself is a fixed object.

Benefit-Cost

- Implementation on this treatment reduces run off road crashes by 7-34% (ODOT).
- 20 years of expected life
- Estimated $50,000 per installation

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITION

IMPLEMENTATION

R4. Install Roadside Impact Attenuators

Impact attenuators are typically used to shield rigid roadside objects such as concrete barrier ends, steel guardrail ends and bridge pillars from oncoming automobiles. This treatment addresses fixed object and run-off road that occur with the limits of the new attenuators. This countermeasure and corresponding collision reduction benefits should only be applied to locations where past crash data or engineering judgement applied to existing conditions suggests the upgraded attenuators may result in a few or less severe crashes.

Benefit-Cost

- Implementation of this treatment reduces crashes by 25%.
- 10 years of expected life
- Estimated $5,000 for steel railing, $2,500 for traffic barrels
- Costs depending on the scope of the project, type(s) used, and associated ongoing maintenance costs.

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITION

IMPLEMENTATION

R5. Add 2 ft Paved Shoulder

Installed in roadways that have a frequent incidence of vehicles leaving the travel lane resulting in an unsuccessful attempt to reenter the roadway. The probability of a safe recovery is increased if an errant vehicle is provided with an increased paved area in which to initiate such a recovery. This type of countermeasure addresses Fixed object, Run-off Road, and Sideswipe collisions.

Benefit-Cost

- Implementation on this treatment reduces crashes by 5-13% (ODOT).
- 20 years of expected life.
- Estimated $150,000 (cost depends on need for right-of-way or if roadside modification isneeded).
- Shoulder widening costs would depend on whether new right-of-way is required and whether extensive roadside modification is needed. Since shoulder widening can be a relatively expensive treatment, one of the keys to creating a cost-effective project with at least a medium B/C ratio is targeting higher-hazard roadways.

EXISTING CONDITION

IMPLEMENTATION

Sources: CA-Local Roadway Safety Manual

R6. Add Unpaved Shoulder

Appropriate to roadways with a frequent incidence of vehicles leaving the travel lane resulting inan unsuccessful attempt to reenter the roadway. This countermeasure addressed all types of crashes. Unless shoulder widening requires additional right-of-way and environmental impacts, these treatments can be implemented in a relatively short timeframe. This countermeasure only applies to crashes occurring within the limits of the new shoulder.

Benefit-Cost

- Implementation on this treatment reduces crashes by 3-6% (ODOT).
- 20 years of expected life
- Estimated $50,000 (varies)
- The cost of adding a navigable non-paved shoulder would depend whether extensive roadside modification and shoulder stabilization are required.

IMPLEMENTATION

Sources: CA-Local Roadway Safety Manual

R7. Install Chevron Signs on Horizontal Curves

IMPLEMENTATION

Set up on roadways that have an unacceptable level of crashes on relatively sharp curves during periods of light and darkness. Ideally this type of safety countermeasure would be combined with other sign evaluations and upgrades (install warning signs, delineators, markers, beacons, and relocation of existing signs per MUTCD standards). This treatment can address all types of crashes; but, specifically, run-offroad crashes occurring near curves. This treatment only applies to crashes occurring within the influence area of the new signs (i.e. only through the curve).

Benefit-Cost:

- Implementation of this treatment reduces crashes by 64% (WSDOT).
- 10 years of expected life.
- Estimated $1,000 per curve
- Costs for implementing this strategy are nominal and depend on the number of signs. When considered at a single location, these low-cost improvements are usually funded through localfunding by local maintenance crews. However, this treatment can be effectively and efficientlyimplemented using a systematic approach with numerous locations, resulting in moderate cost projects that are more appropriate to seek state or federal funding.

Sources: CA-Local Roadway Safety Manual

R8. Add Speed Feedback Signs

IMPLEMENTATION

This type of treatment addresses all crashes caused by motorist traveling too fast, including horizontal curves. Before choosing this treatment, the agency needs to confirm the ability to provide power to the site (solar may be an option).

Benefit-Cost

- Implementation on this treatment reduces crashes by 46% (WSDOT).
- 10 years of expected life
- Estimated $20,000-100,000
- Cost varies by type of implementation.

Sources: CA-Local Roadway Safety Manual

IMPLEMENTATION

R9. Install Edge Line and Centerline Pavement Marking

Applicable on any road with a history of run-off-road right, head-on, opposite-direction-sideswipe, or run-off-road-left crashes is a candidate for this treatment. This treatment addresses all types, specifically impacts head-on and run-off road crashes. It only applies to crashes occurring within the limits of the new centerlines and/or edge lines. The treatment is not intended to be used for general maintenance activities (i.e. the replacement of existing striping) and must include upgraded safety features over the existing striping. For two lane roadways allowing passing, a striping audit must be done to ensure the passing limits meeting the MUTCD standards. Both the centerline and edge lines are expected to be upgraded.

Benefit-Cost

» Implementation on this treatment reduces run off road, opposite direction and nighttime crashes by 21% (WSDOT).

» 10 years of expected life

» Estimated $4,000 (depends on number and length of segment, as well as striping material)

» Costs for implementing this strategy are nominal and depend on the number and length of segment as well as the striping material (paint, thermoplastic, etc.). This countermeasure can be effectively implemented using a systemic approach with numerous and long locations.

Sources: CA-Local Roadway Safety Manual

IMPLEMENTATION

R10. Install No Passing Zone

Installed on roadways that have a high percentage of head-on crashes suggesting that many head-on crashes may relate to failed passing maneuvers. No Passing Zones should be installed where drivers' "passing sight distance" is not available due to horizontal or vertical obstructions. This treatmentaddresses all types of crashes that occur when drivers cannot differentiate the centerline markings between passing and no-passing area. This treatment only applies to crashes occurring within the limits of the new or extended no-passing zones.

Benefit-Cost

» Implementation of this treatment reduces crashes by 45%.

» 10 years of expected life

» Estimated $2,000 (varies)

» When considered at a single location, these low cost improvements are usually funded through local funding by local maintenance crews. However, This treatment can be effectivelyand efficiently implemented using a systematic approach with numerous and long locations, resulting in low to moderate cost projects that are more appropriate to seek state or federalfunding.

R11. Install Centerline Rumble Strips/Stripes

IMPLEMENTATION

Center Line rumble strips/stripes should be used on segments with a history of head-on crashes. This treatment addresses head-on and opposite-direction side-swipe crashes by alerting drivers who travel into the oncoming travel lane.

Benefit-Cost

- Implementation of this treatment reduces crashes by 20%.
- 10 years of expected life
- Estimated $3,000 per mile
- Costs for implementing this strategy are nominal and depend on the number and length oflocations.

Sources: CA-Local Roadway Safety Manual

R12. Install Edge Line Rumble Strips/Stripes

IMPLEMENTATION

Shoulder and edge line milled rumble strips/stripes should be used on roads with a history of roadway departure crashes. This treatment addresses run-off road crashes by providing an auditory and tactile warning when driven on, alerting drivers drifting outside their travel lanes.

Benefit-Cost

- Implementation of this treatment reduces opposite direction crashes by 40% and fatal/injury crashes by 8%.
- 10 years of expected life
- Estimated $3,000 per mile
- Costs for implementing this strategy are nominal and depend on the number and length oflocations.

Sources: CA-Local Roadway Safety Manual

R13. Rail Crossing Treatments

IMPLEMENTATION

Four Quadrant Gates extend across all roadway lanes on both the approach and the departure side of the crossing. Unlike two-quadrant gate systems, four-quadrant gates provide additional visual constraints and inhibit most traffic movements over the crossing after the gates have been lowered. Safe guards are put in place to ensure vehicles are not trapped on the tracks.

Four Quadrant Gate

Wayside Horns can be used as an adjunct to train-activated crossing warning systems to provide audible warning of an approaching train for traffic on each approach to the highway-rail crossing. A wayside horn system consists of a horn or series of horns located at a public highway-rail crossing and directed at oncoming motorists. The wayside horn system simulates a train horn and sounds at a minimum of 15 seconds prior to the train's arrival at the highway-rail crossing, until the lead locomotive has traversed the crossing. It is typically used at locations where the train horn is not sounded.

Wayside Horn

Benefit-Cost

- Quantified benefits unknown.
- 10 Years of expected life
- Estimated $700,000 for four quadrant gate system
- Estimated $500,000 for wayside horn system

Sources: FHWA, FRA

R14. No Passing Zone Signs

IMPLEMENTATION

A No Passing Zone, indicated by a solid yellow line on the left side of the driver's direction of travel, indicates a zone through which sight distance is restricted or where other conditions make overtaking and passing inappropriate. No Passing Zones are regulatory and legally enforceable.

In situations where head-on collision history is observed, a NO PASSING ZONE pennant can provide additional information to drivers at the beginning of the No Passing Zone, discouraging passing maneuvers. The NO PASSING ZONE sign is installed on the left side of the roadway.

Additionally, DO NOT PASS signs can be added as a supplement to No Passing Zone pavement markings to emphasize the restriction on passing. It can be installed at the beginning of, and at intervals within, the No Passing Zone.

Benefit-Cost

- Quantified benefits unknown.
- 10 Years of expected life
- Estimated $200 per sign

Sources: FHWA

Figure Links

S1a https://www.aaroads.com/california/ca-238.html S1b https://www.aaroads.com/california/ca-262.html
S2a https://safety.fhwa.dot.gov/provencountermeasures/lighting.cfm
S2b http://wishtv.com/2016/02/16/new-traffic-signals-aim-to-reduce-crashes/
S3a http://www.k-state.edu/roundabouts/ada/news/USNews.htm
S3b https://parade.com/19072/marilynvossavant/what-would-traffic-light-synchronization-cost/
S4a https://www.fhwa.dot.gov/publications/research/safety/09036/index.cfm
S4b http://www.madriverunion.com/samoa-boulevard-traffic-light-system-changed-up/
S5a https://dohanews.co/qatars-civil-defense-junction-is-now-a-proper-intersection/
S5b http://www.gulf-times.com/story/461946/Ashghal-opens-signal-controlled-intersection-on-New-Rayyan-Road
S6a http://www.cochraneeagle.com/article/Cochrane-familes-celebrate-cultural-diversity-20170803
S6b https://rspcb.safety.fhwa.dot.gov/noteworthy/html/edccasestudy_ky.aspx
S7a https://bouldercolorado.gov/transportation/median-maintenance
S7b Unknown
S8a Google Streetview
S8b https://nacto.org/publication/urban-bikeway-design-guide/intersection-treatments/through-bike-lanes/
S9a Google Streetview
S9b Google Streetview
S10 https://www.sacbee.com/news/local/article239121918.html
S11 https://safety.fhwa.dot.gov/provencountermeasures/lead_ped_int.cfm

NS1a Google Streetview
NS1b Google Streetview
NS2a Google Streetview
NS2b http://www.ite.org/uiig/types.asp
NS3a https://www.flickr.com/photos/repowers/2933707788/
NS3b Google Streetview
NS4a https://alchemistsdiary.wordpress.com/2017/07/22/
NS4b https://safety.fhwa.dot.gov/intersection/other_topics/fhwasa09020/fhwasa09020.pdf
NS5a http://www.cleveland.com/berea/index.ssf/2012/11/berea_changes_stop_sign_parkin.html
NS5b https://radiobintangsembilan.com/2016/03/07/hindari-kecelakaan-anak-sekolah-warga-minta-garis-kejut/
NS6a http://www.jurist.org/hotline/2014/03/zachary-heiden-maine-panhandling.php
NS6b https://www.edmonton.ca/transportation/on_your_streets/neighbourhood-traffic-concerns.aspx
NS7a Google Streetview
NS7b https://ux.stackexchange.com/questions/42867/how-does-the-projection-angle-of-road-arrows-change-drivers-expectations-of-the
NS8a https://en.wikipedia.org/wiki/Uncontrolled_intersection
NS8b https://safety.fhwa.dot.gov/provencountermeasures/crosswalk-visibility.cfm
NS9a Google Streetview
NS9b https://nacto.org/publication/urban-bikeway-design-guide/bicycle-boulevards/major-street-crossing/

R1a https://www.shutterstock.com/nb/video/clip-9830723-4k-driving-car-on-highway-roadway-night
R1b https://www.wsdot.wa.gov/research/reports/fullreports/847.1.pdf
R2a Google Streetview
R2b Google Streetview
R3a Google Streetview
R3b https://www.reddit.com/r/funny/comments/4zcplq/a_local_plumbers_truck_decal/
R4a Unknown
R4b http://lslee.com/attenuators/Impact-Attenuators
R5a Unknown
R5b https://safety.fhwa.dot.gov/ped_bike/tools_solve/fhwasa11018/
R6b https://www.fhwa.dot.gov/publications/research/safety/15030/009.cfm

R7b https://safety.fhwa.dot.gov/provencountermeasures/enhanced_delineation.cfm
R8b https://www.fhwa.dot.gov/publications/research/safety/15030/009.cfm
R9b https://www.fhwa.dot.gov/publications/research/safety/15030/009.cfm
R10b https://www.shutterstock.com/nb/search/double+yellow+lines
R11b https://safety.fhwa.dot.gov/roadway_dept/pavement/rumble_strips/bike_ig/
R12b https://safety.fhwa.dot.gov/roadway_dept/pavement/rumble_strips/bike_ig/
R13a https://cms.cityoftacoma.org/PublicWorks/RR_Crossing/Dome_OldTown/Option4_S_C_St_Poster_1of2.pdf
R13b https://safety.fhwa.dot.gov/hsip/xings/com_roaduser/fhwasa18040/
R14a https://safety.fhwa.dot.gov/older_users/fhwasa15088/ch4.cfm
R14b https://driving-tests.org/road-signs/do-not-pass-sign/

Appendix B Grant Programs

Based on the projects included in the City Safety Plan, the City may be eligible to submit projects to the following grant programs.

WSDOT City Safety Program

WSDOT Local Programs sends out a call for projects each even-numbered year. This program's funding is for projects enhancing safety on city streets by reducing the severity of crashes and utilizing transportation engineering improvements and countermeasures.
https://wsdot.wa.gov/LocalPrograms/Traffic/CitySafetyProgram

WSDOT Pedestrian and Bicycle Program

WSDOT Active Transportation Program sends out a call for projects each even-numbered year. The Pedestrian and Bicycle Program objective is to improve the transportation system to enhance safety and mobility for people who choose to walk or bike.
https://wsdot.wa.gov/LocalPrograms/ATP/funding.htm

WSDOT Safe Routes to School Program

WSDOT sends out calls early in even numbered years for project awards in the following biennium. The purpose of the Safe Routes to Schools program is to improve safety and mobility for children by enabling and encouraging them to walk and bicycle to school. Funding from this program is for projects within two-miles of primary, middle and high schools (K-12).
https://wsdot.wa.gov/LocalPrograms/SafeRoutes/funding.htm

WSDOT Railway-Highway Crossings Program

Open call for projects depends on future federal funding and Washington State priorities. This program's funding is for projects enhancing safety at public grade crossings by reducing the severity of crashes and installing or upgrading protective mechanisms at railroad crossings.
https://wsdot.wa.gov/localprograms/traffic/railway-crossings-program

Transportation Improvement Board (TIB) Complete Streets

The Complete Streets Award is a funding opportunity for local governments that have an adopted complete streets ordinance. Board approved nominators may nominate an agency for showing practice of planning and building streets to accommodate all users, including pedestrians, access to transit, cyclists, and motorists of all ages and abilities.
http://www.tib.wa.gov/grants/grants.cfm?inav=3#other2

Surface Transportation Block Grant (STBG) - Urban

STBG – Urban is for jurisdictions above 5,000 population. The grant is approximately $6 million per year, with grant applications due in July and grant awards in September. Previous funded projects include bringing urban roads and intersections up to urban standards. Projects need to have a balance of capacity, safety, and economic development to get funding.
https://www.rtc.wa.gov/programs/tip/docs/tipcrit21.pdf

STBG - Rural

STBG – Rural is for smaller jurisdictions and rural areas awards approximately $1 million every other year (even-numbered years). Selection occurs with applications due in July and grant awards in September. Criteria are less stringent than urban, but support capacity, safety, and economic development. It has funded downtown improvements in smaller cities and for arterial preservation/safety on county road arterials that access cities.
https://www.rtc.wa.gov/programs/tip/call/

Congestion Mitigation and Air Quality (CMAQ) Improvement Program

This is available for projects that improve air quality. Available funding is approximately $3 million per year, with applications due in July and September grant awards. CAQ has the same criteria as STBG-Urban, but air quality points are tripled. Mostly funded projects are signalized intersections and transit-related projects.
https://www.rtc.wa.gov/programs/tip/call/

Transportation Alternatives (TA)

Approximately $1.3 million available every odd year (2023, 2025, etc.). Grant application due in April with grant awards in July. Criteria and process is outlined in https://www.rtc.wa.gov/programs/tap/docs/taGuidebook.pdf. Has funded pedestrian/bicycle improvements.

APPENDIX C: COLLISION HEAT MAPS

Following WSDOT's recommended procedure, the study team applied the most common attributes present in serious injury collisions to the entire network by mapping collisions based on those attributes.

Figures C1 through C5 show the locations of crashes with these attributes.

Figure C1 illustrates that roadway departure collisions are most common along NW Spencer Road and NW Pacific Highway with some clustering also present in the southern area of the city.

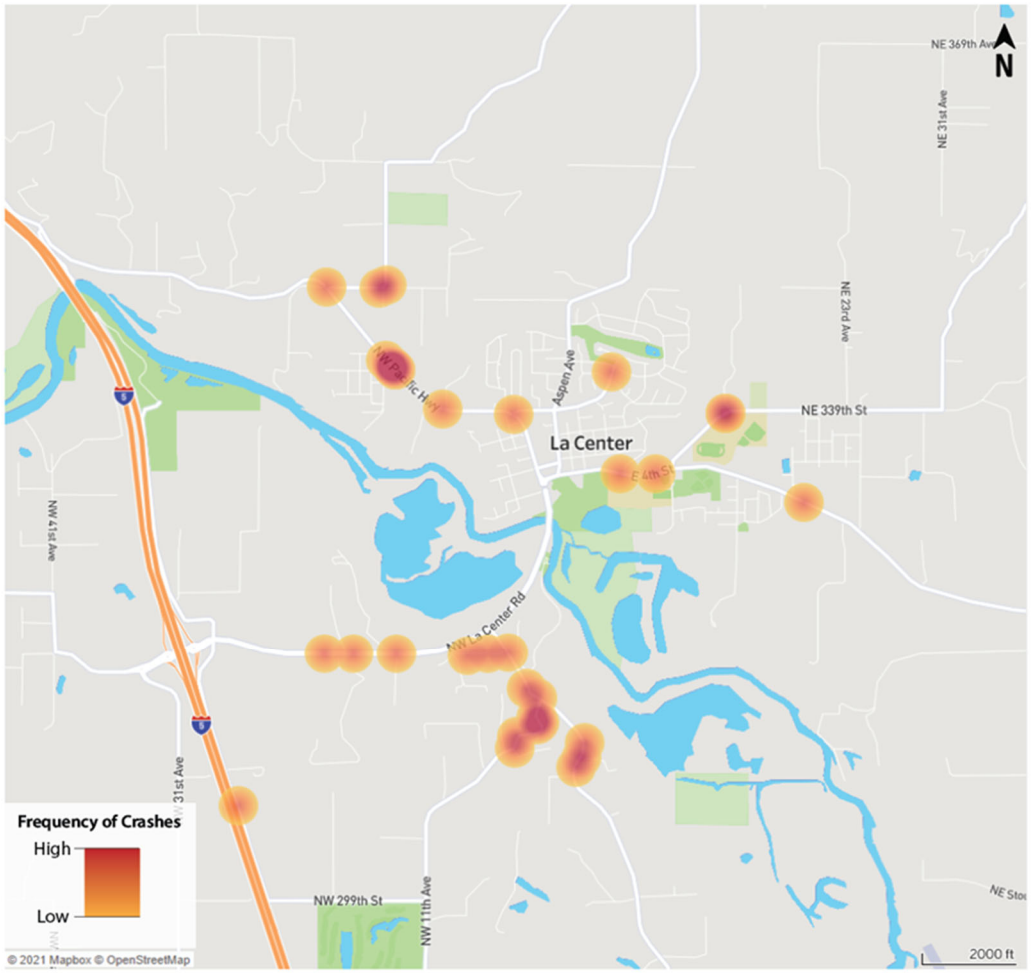


Figure C1. Roadway Departure Collisions, La Center, 2016-2020.

Figure C2 shows some hot spots of intersection collisions at the following locations:

- NW La Center Rd and NB I-5 Ramp Roundabout
- W 4th Street and NW La Center Road Roundabout
- NW Pacific Highway and NW Bolen Street

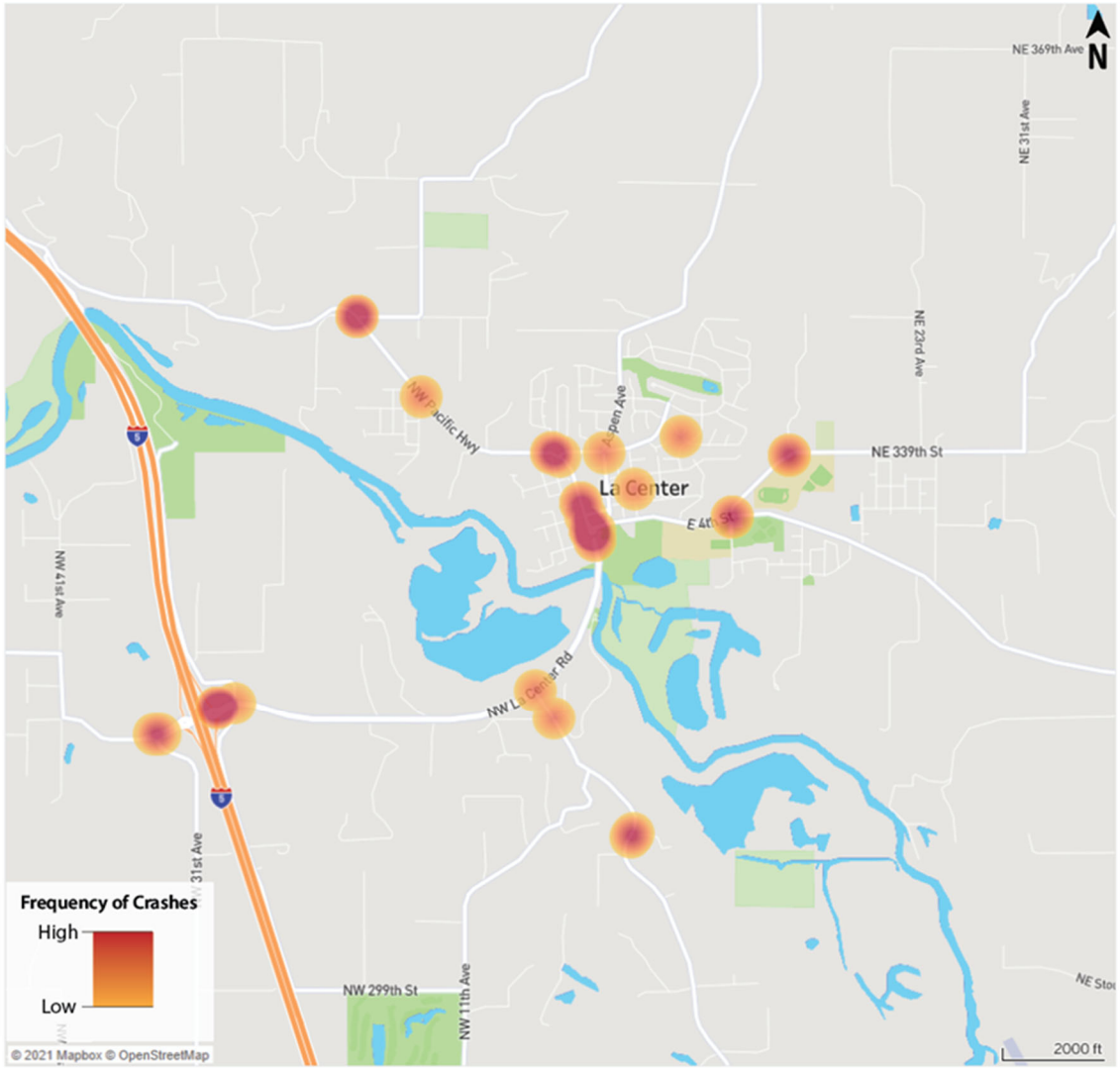


Figure C2. At Intersection or Intersection Related Collisions, La Center, 2016-2020.

Figure C3 presents the heat map of all the collisions that occurred during dark, dusk or dawn lighting conditions. The majority of these collisions occurred along two corridors that do not have lighting:

- NE Timmen Road
- NW Pacific Highway between NW 9th Avenue and NW Bolen Street

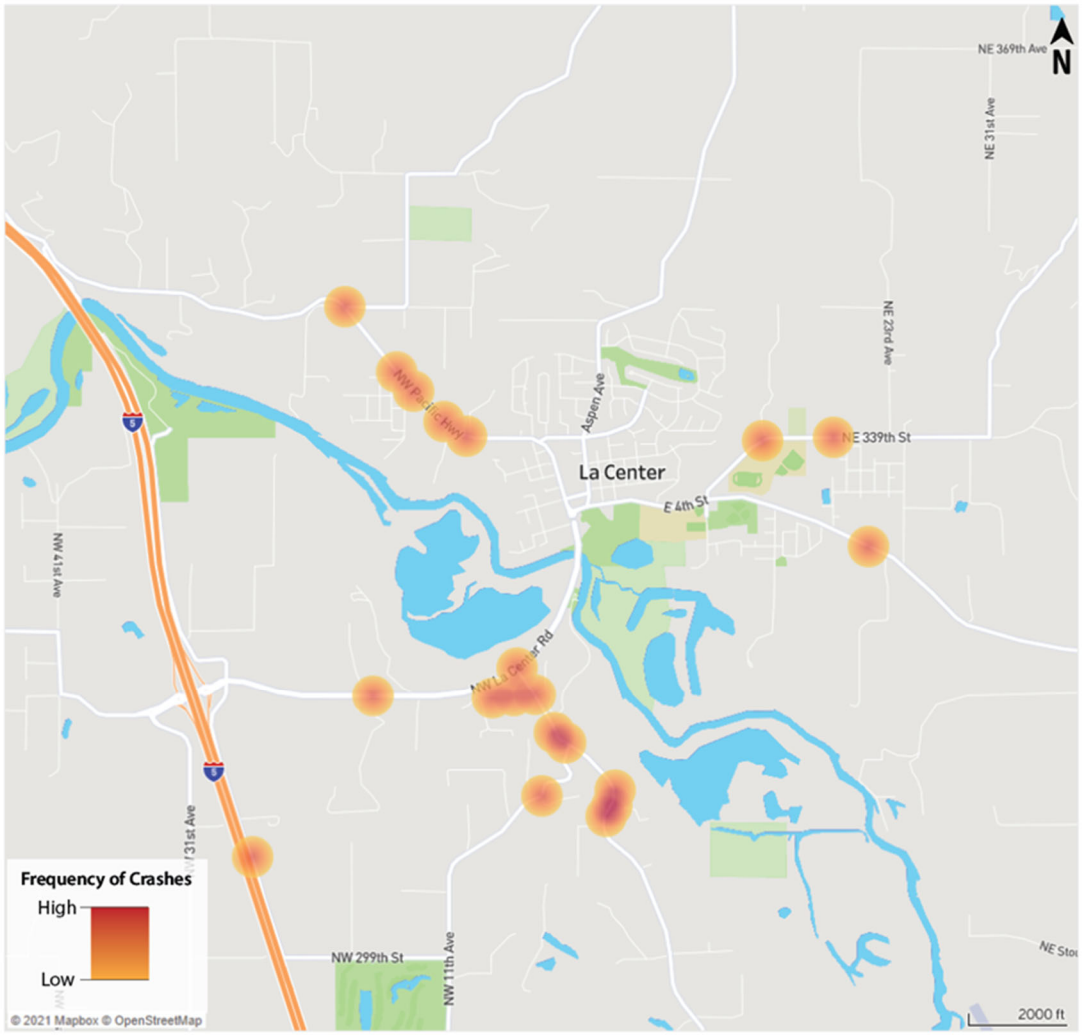


Figure C3. Dark/Dusk/Dawn Collisions, La Center, 2016-2020

There are several clusters of collisions that occurred due to distraction or inattention, as shows in Figure C4. Examples include segments and intersections along NW Pacific Highway, NW Timmen Road, and NW Spencer Road.

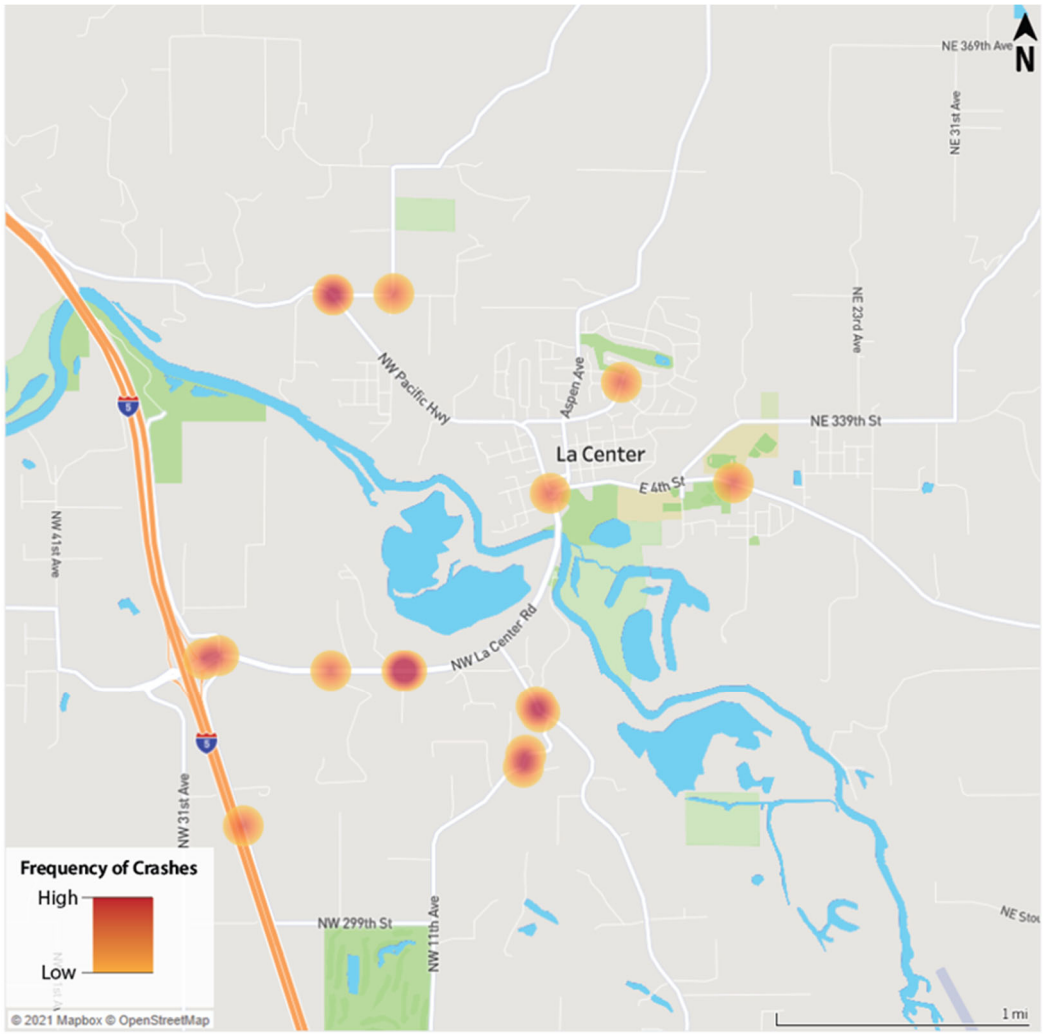


Figure C4. Distraction/Inattention Collisions, La Center, 2016-2020.

There are three main clusters of speeding related collisions show in Figure C5:

- NW Timmen Road from NW La Center Road to NW Spencer Road
- E 4th St from NW Pacific Highway to E Ivy Avenue
- NW Pacific Highway from NW Larsen Drive to NW 11th Court

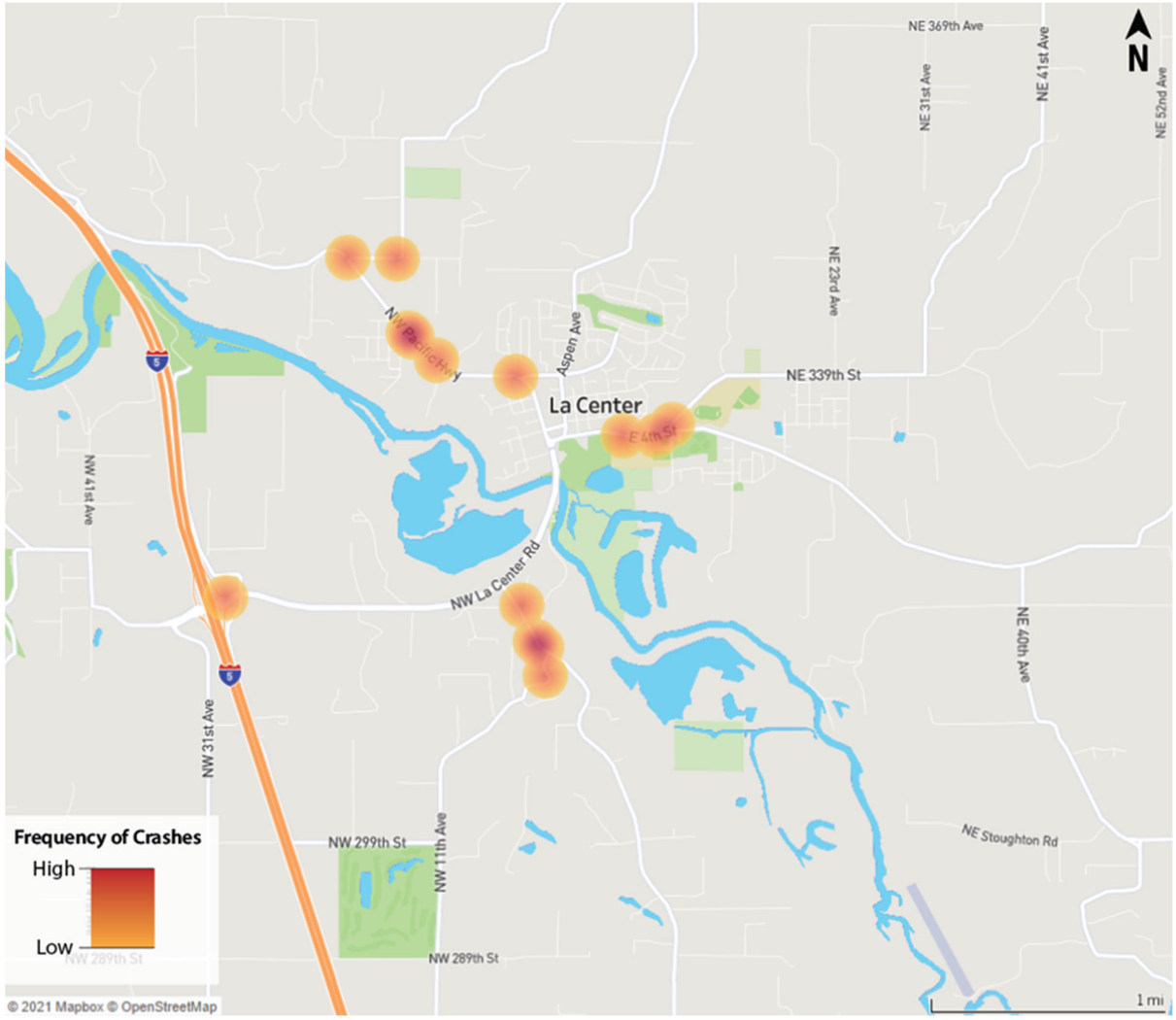


Figure C5. Speeding Related Collisions, La Center, 2016-2020.