CITY OF RICHLAND

COMPREHENSIVE SAFETY ACTION PLAN

2024

PREPARED FOR THE CITY OF RICHLAND

PREPARED BY DKS ASSOCIATES

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INTRODUCTION

The City of Richland is located on the east side of Benton County, Washington, and lies at the confluence of the Yakima River and Columbia River. It is home to over 60,000 residents and is one of the fastest growing areas in Washington State. As the community grows, it is important to ensure that the transportation system is safe for all its users. The City supports the Washington State Strategic Highway Safety Plan (Target Zero) and seeks to reduce the number and severity of crashes in the City. To address transportation safety, Richland has created a Comprehensive Safety Action Plan (CSAP) that uses a data-driven, proactive approach to identify prioritized risk facts and apply systemic improvements across the City's transportation network.

LEADERSHIP COMMITMENT AND GOAL SETTING

Richland City Council passed a resolution endorsing Vision Zero, setting a target date for achieving zero roadway fatalities and serious injuries on Richland streets by 2035. This goal is founded on the Safety System Approach principle that deaths and serious injuries are unacceptable, and crashes can be prevented through engineering, education, and enforcement, and post-crash care projects and strategies. This Vision Zero policy will be incorporated into the City's future management plans and traffic safety planning.

PLANNING STRUCTURE

The City formed a Comprehensive Safety Action Plan (CSAP) Committee that includes representatives from Public Works, Emergency Services and Fire, and Police. Committee selection is inclusive of engineering, post-crash care, enforcement, and education. The committee is charged with CSAP development, implementation, monitoring, and stakeholder engagement.

DEMOGRAPHICS AND EQUITY

To develop a plan that serves all road users in Richland, the strong relationship between transportation and equity must be acknowledged and addressed. Transportation planning decisions affect development patterns, in turn impacting accessibility, employment, and economic activity. Transportation facilities demand significant public resources, such as tax funding and road

rights-of-way. Allocating these resources often favors some people over others; for example, roads without multimodal infrastructure inhibit travelers who do not use private vehicles, reducing their social and economic opportunities.

INCLUSIVE AND REPRESENTATIVE PROCESSES

CSAP Committee. The City developed a Comprehensive Safety Action Plan Committee that extends engagement beyond engineering staff to the Richland Police Department and Richland Fire Department.

Community Engagement. City of Richland staff connected with the Benton Franklin Community Action Committee to inform them of the CSAP process and seek their feedback on draft materials. The City also conducted extensive public engagement to encourage participation by a wide variety of community members, including those who have been historically underserved by in-person open house events. The project team developed social media posts that were shared across City platforms, media press releases, and email blasts to promote the project website. The project website provided links to the interactive comment map (Social Pinpoint). The Social Pinpoint map provided language assistance (via Google Translate in 50 different languages) that would automatically update all text to the user's preferred language.

EQUITY DATA ANALYSIS

Equity and population demographics data regarding socioeconomic status, racial and ethnic minorities, access to private vehicles, disabilities, senior populations, and linguistically isolated populations were analyzed. The city uses census tract and census block data to identify potential infrastructure improvements for the Community Development Block Grant (CDBG) program.

Figure 1 and **Figure 2** display low- and medium-income census tracts and census blocks.

Those CDBG infrastructure improvements typically consist of sidewalk gap projects, ADA ramp upgrades, and enhanced crosswalk installations (e.g., RRFBs). Similarly, the City has used demographic and socioeconomic data from the Richland School District (e.g., students receiving free/reduced lunch) as well as maps of potential student walkers to help identify suitable crosswalk or sidewalk projects near elementary and middle schools.

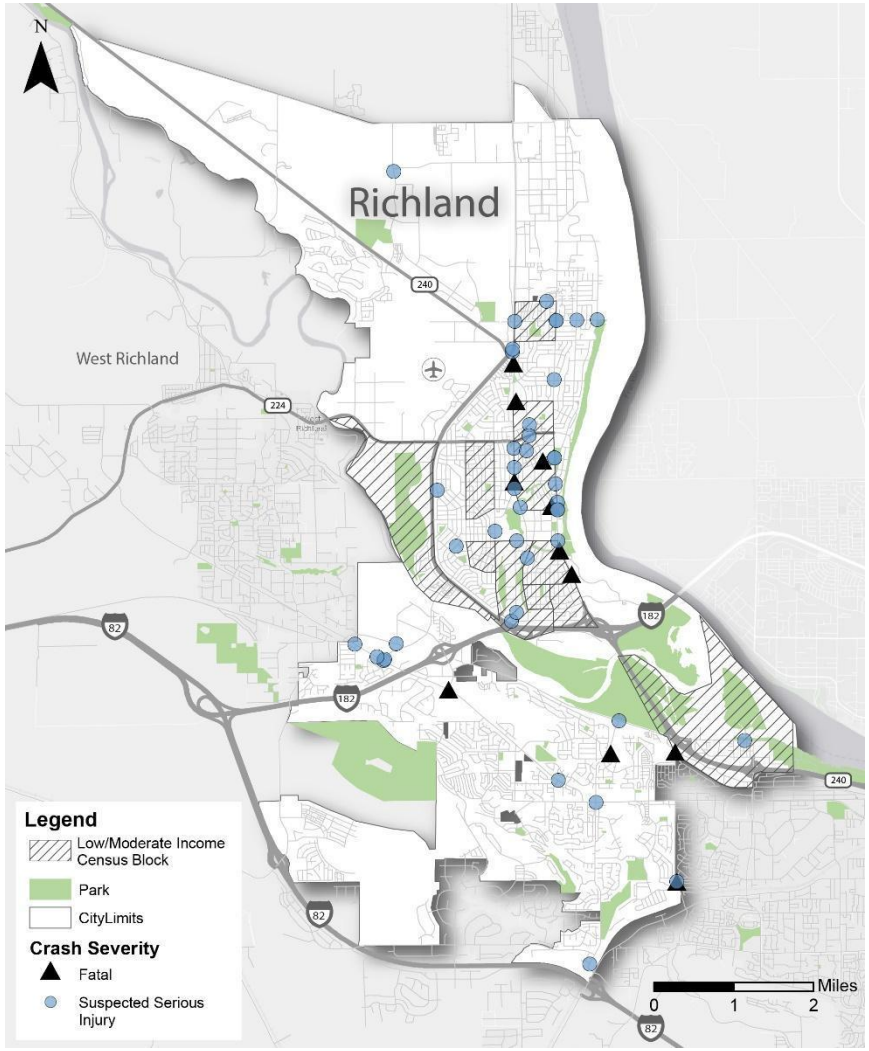


Figure 1. Low- and Moderate-Income Census Tracts/Blocks alongside Fatal and Serious Injury Crashes (2018-2022).

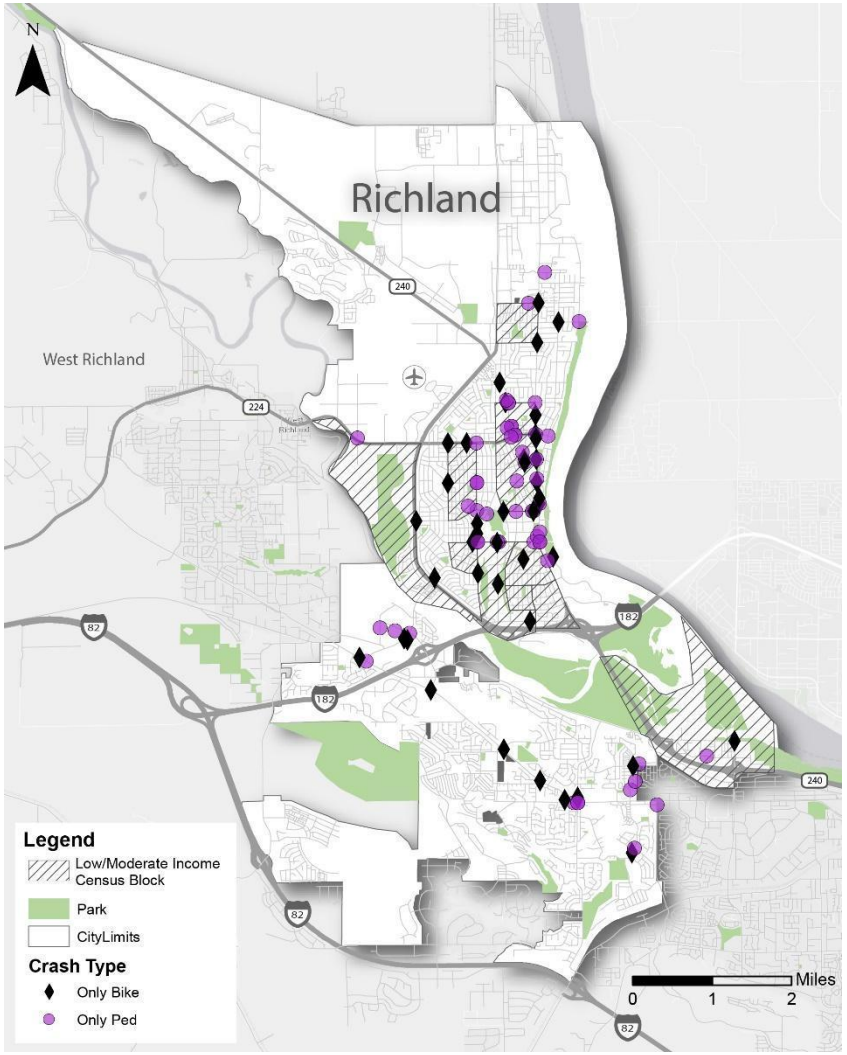
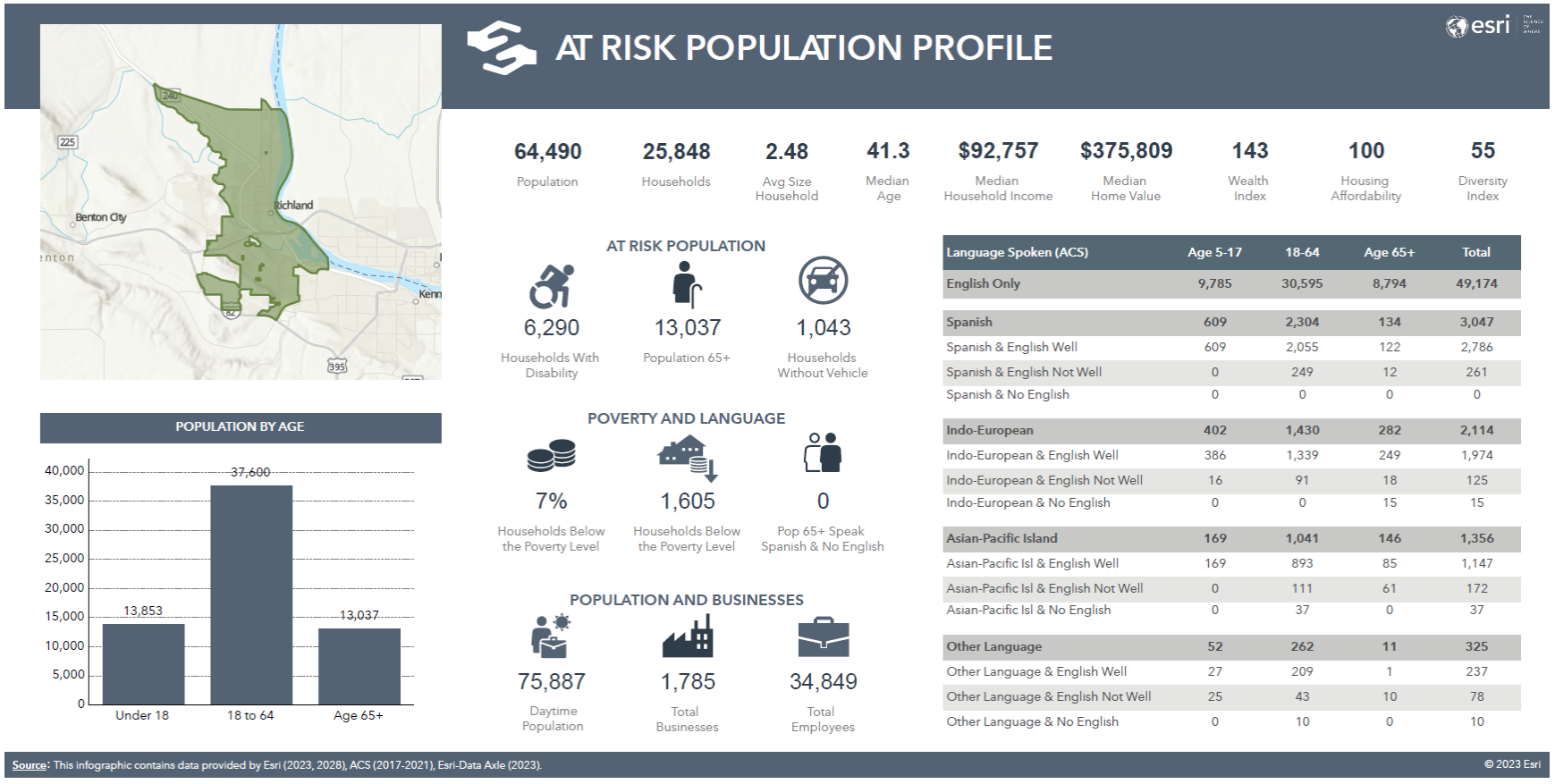


Figure 2. Low- and Moderate-Income Census Tracts/Blocks alongside Bike and Pedestrian-involved Crashes (2018-2022).

The 'At Risk Population Profile' in **Figure 3** provides additional population and equity statistics based on 2022 data.



Language Spoken (ACS)	Age 5-17	18-64	Age 65+	Total
English Only	9,785	30,595	8,794	49,174
Spanish	609	2,304	134	3,047
Spanish & English Well	609	2,055	122	2,786
Spanish & English Not Well	0	249	12	261
Spanish & No English	0	0	0	0
Indo-European	402	1,430	282	2,114
Indo-European & English Well	386	1,339	249	1,974
Indo-European & English Not Well	16	91	18	125
Indo-European & No English	0	0	15	15
Asian-Pacific Island	169	1,041	146	1,356
Asian-Pacific Isl & English Well	169	893	85	1,147
Asian-Pacific Isl & English Not Well	0	111	61	172
Asian-Pacific Isl & No English	0	37	0	37
Other Language	52	262	11	325
Other Language & English Well	27	209	1	237
Other Language & English Not Well	25	43	10	78
Other Language & No English	0	10	0	10

Source: This infographic contains data provided by Esri (2023, 2028), ACS (2017-2021), Esri-Data Axle (2023).

Figure 3. At-risk population profile of Richland, WA – including total population, median household income, population age and ability, poverty levels and languages spoken at home.

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

COMPREHENSIVE SAFETY ACTION PLAN: PURPOSE AND NEED

This Comprehensive Safety Action Plan (CSAP) has been developed in response to two separate but related safety programs that introduce varying requirements.

SAFE STREETS AND ROADS FOR ALL

The **Safe Streets and Roads for All (SS4A)** program, administered by the US Department of Transportation (USDOT) directly, supports Secretary of Transportation Pete Buttigieg's National Roadway Safety Strategy and the USDOT's goal of zero deaths and serious injuries on our nation's roadways.[1] SS4A is available to local, regional, and Tribal entities, and participation requires a Safety Action Plan that includes the following elements:

- Leadership commitment and goal setting to eliminate roadway fatalities and serious injuries
- Planning structure through a committee or task force
- Safety analysis of existing conditions
- Engagement and collaboration with the public and relevant stakeholders
- Equity considerations in the process and data analysis
- Policy and process assessments and potential improvements
- Strategy and project selections
- Progress measurement methods based on outcome data

An eligible CSAP is required for the City to pursue an Implementation Grant under SS4A. This document serves as the City of Richland's 2024 Comprehensive Safety Action Plan.

CITY SAFETY PROGRAM

The **Washington State Department of Transportation (WSDOT) City Safety Program** distributes federal Highway Safety Improvement Program (HSIP) funding to local agencies. The goal of this program is to reduce fatal and serious injury crashes on city streets using engineering improvements and countermeasures. The program seeks to target fatal and serious collisions by determining the typical crash types and conditions specific to a jurisdiction, evaluating the causative factors in those crash types,

[1] USDOT Safe Streets and Roads for All Grant Program https://www.transportation.gov/grants/SS4A

identifying the best locations and risk factors to address, and then selecting a prioritized list of mitigation strategies to address these collisions. The program includes two subprograms, defined by WSDOT as follows:[2]

- **Spot Location:** Projects must be at a specific intersection(s), spot or mid-block location(s), or corridor(s) and must address at least one fatal or serious injury crash in the most recent five-year period.
- **Systemic:** Projects are identified through a city/town's local road safety plan that identifies and prioritizes projects based on the top crash type(s) in the city/town. Projects can be at intersection(s), spot or mid-block location(s), and/or on corridor(s) throughout a city/town or over wide areas within a city/town.

This document serves as the City of Richland's 2024 Local Road Safety Plan.

GUIDING ALL TRANSPORTATION PROJECTS

To address both SS4A and WSDOT City Safety Program needs, and to be eligible for both HSIP and SS4A funding, this CSAP includes a prioritized list of safety projects.

Alongside addressing safety grant program requirements, this plan also serves as a guiding document to staff in the design and development of future projects and programs. Every year, City public works staff develop a variety of transportation-related projects, many of which are capital improvements or maintenance to existing facilities where there are opportunities for both operational and safety enhancements. This plan, by outlining a set of key mitigation strategies and programs, will help City staff to develop safety projects that take advantage of appropriate City and grant-funded transportation improvements to improve the overall safety of Richland's transportation network. By doing so, we are making a concerted effort to help meet Washington State's Target Zero program goals of reducing traffic fatalities and serious injuries on Washington's roadways to zero by the year 2030.

[2] WSDOT Support for Local Programs: Highway Safety Improvement Program. https://wsdot.wa.gov/business-wsdot/support-local-programs/funding-programs/highway-safety-improvement-program

COMPREHENSIVE SAFETY ACTION PLAN PROCESS

The development of a Comprehensive Safety Action Plan is centered on the analysis of citywide crash data in order to effectively identify safety 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 safety countermeasures to be implemented for the purpose of crash reduction. The following plan, shown in **Figure 4**, includes a summary of existing safety conditions in Richland, identification of safety needs, and recommended treatments to address high-priority collision types and locations.

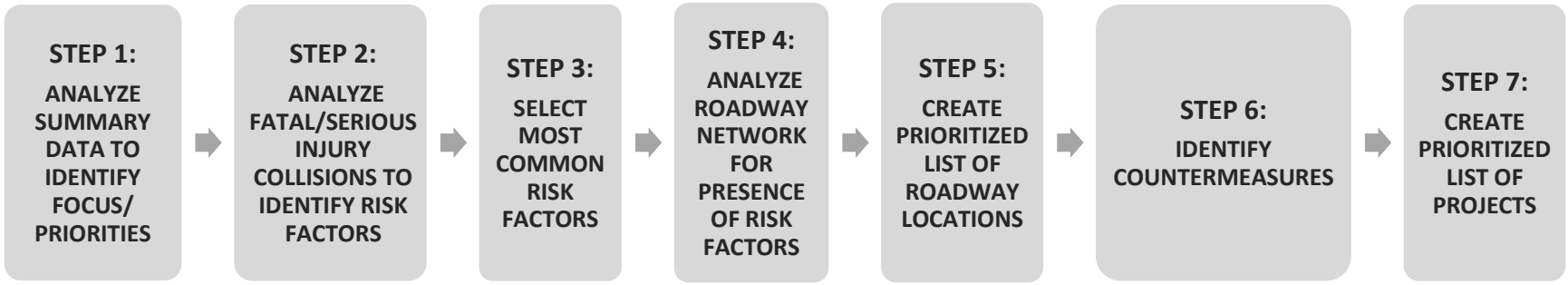


Figure 4. Comprehensive Safety Action Plan summary graphic.

This 7-step process used for the City's previous Local Road Safety Plan was modified for the SS4A-required 2023 Comprehensive Safety Action Plan update with the following enhancements, and information from these steps remain in the 2024 plan to ensure it meets both USDOT and WSDOT requirements:

- **Step 1:** Engaged with the public and relevant stakeholders and incorporated feedback into the process.
- **Step 2:** Incorporated analysis of demographic information into the previous crash history data analysis
- **Step 7:** Added time ranges for project/strategy deployment to the prioritized list.
- **Additional Activities:**
    - Assessed current policies, plans, guidelines, and standards to identify opportunities to improve how processes prioritize safety. Considered implementation through adoption of revised or new policies.
    - Added progress measurement content to the plan that includes output and outcome measures.

The data used and the process followed are consistent with WSDOT's guidelines from the most recent City Safety Program and the SS4A program. The recommended safety projects and strategies are also eligible for one or more of the following grant programs, which are further described in **Appendix A**:

- WSDOT grant programs: City Safety, Safe Routes to School, Bicycle-Pedestrian, and Railway-Highway Grade Crossings
- Transportation Improvement Board (TIB) grants, including Complete Streets
- Programs specific to the Benton-Franklin Council of Governments
- USDOT Safe Streets and Roads for All (SS4A)

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 City of Richland and its consultant worked with WSDOT Transportation Data, WSDOT Local Programs, other City staff, and a third-party provider to acquire and analyze the following data sets.

- WSDOT database of all collisions on City of Richland streets, Jan 2018 - Dec 2022 (provided by WSDOT Transportation Data)
- Summary crash data from WSDOT Local Programs with comparisons to Statewide Average, City Average, and Eastside City Average proportions of several collision types and other contributors
- Third-party database provided (MS2) for data aggregation

DATA ANALYSIS OVERVIEW

During the 5-year study period (2018-2022), the City of Richland had 3,296 total crashes on City maintained roads.[3] The number of all reported collisions (regardless of severity) has ranged between 484 and 777, as shown in **Figure 5**. In the most recent year of data available, 2022, the city experienced 700 reported collisions. The significant drop in the number of collisions in 2020 could be explained by the impact of COVID-19, where there were significant declines in traffic exposure. On March 24, 2020, Governor Inslee enacted the "Stay Home, Stay Healthy" order that required every Washingtonian to stay home (except for essential activities) and closed all non-essential businesses. Based on the 2020 Washington Annual Traffic Safety Report,[4] the highway traffic volumes were reduced to 60% of the volume from 2019.
Increased crash frequency in 2021 and 2022 is consistent with state and national trends.

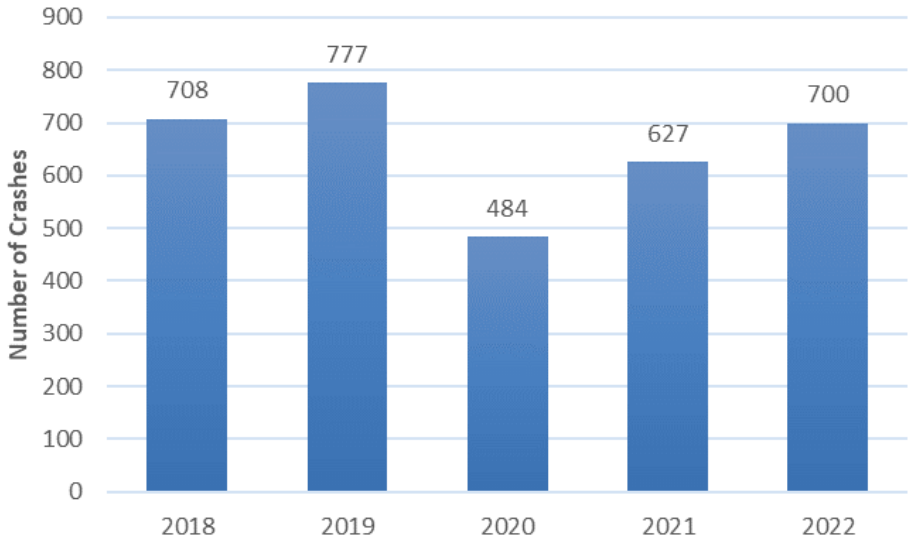


Figure 5. Total Number of Crashes per year (2018-2022).

[3] Database note: Richland crash data does not include crashes that occurred on State Routes. There may be a discrepancy with WSDOT data, which may include some State Routes that are maintained by the City.

[4] 2020 Washington Annual Report: https://wtsc.wa.gov/wp-content/uploads/dlm_uploads/2020/08/FFY2020WashingtonAnnualReport12.17.20.pdf

As illustrated in **Figure 6**, over the past five years there were a total of 12 fatal collisions and 43 serious injury collisions in the City of Richland. The frequency of combined fatal and serious injury collisions in 2022 was 19, an increasing trend over the past five years and more than double the eight that occurred in 2018.
Based on 2022 Washington Annual Report,[5] there are several cultural and societal changes that may have contributed to the increase in traffic fatalities and serious injuries. After the COVID-19 lockdown, there have been increases in behavioral health challenges faced by many, which includes increases in substance use and abuse. There were also significant impacts to law enforcement staffing and procedures. Overall, Washington State has one of the fewest commissioned officers per capita in the nation. The Richland Police Department is actively seeking officers for the Traffic Safety Unit to focus on reducing the number and severity of traffic collisions through engineering, education, and enforcement. Richland's Chief of Police is committed to building and maintaining public trust while partnering with the community to keep Richland a safe place to live, work and play. [6]

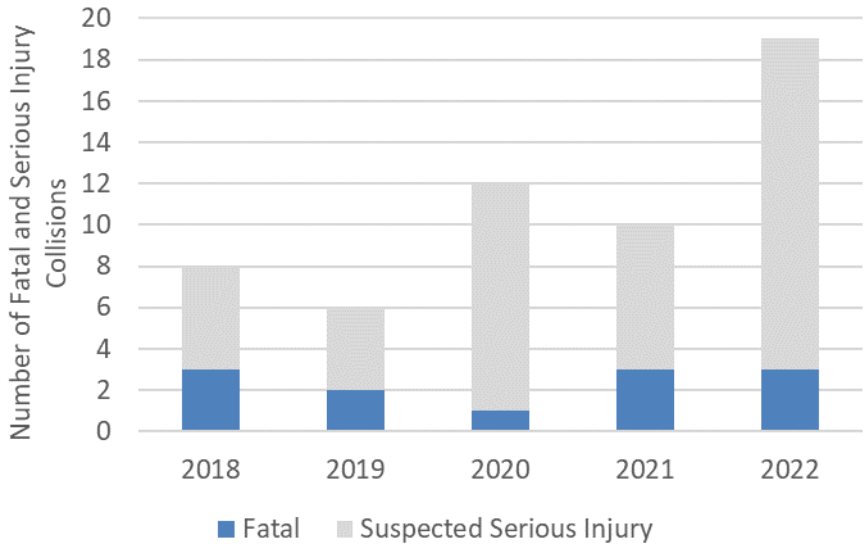


Figure 6. Number of Fatal and Suspected Serious Injury Crashes per year (2018-2022).

Figure 7 shows the heat map of fatal and serious injury collisions that occurred on City-owned streets over the five-year study period (2018-2022). **Figure 8** provides a heat map of all reported collisions that occurred on City-owned streets in Richland during the same study period.

[5] 2020 Washington Annual Report: https://wtsc.wa.gov/wp-content/uploads/dlm_uploads/2023/02/FFY-2022-Washington-Annual-Report-FINAL-1.pdf

[6] 2022 Richland Policy Department Annual Report: https://www.ci.richland.wa.us/home/showpublisheddocument/14619/638138771703330000

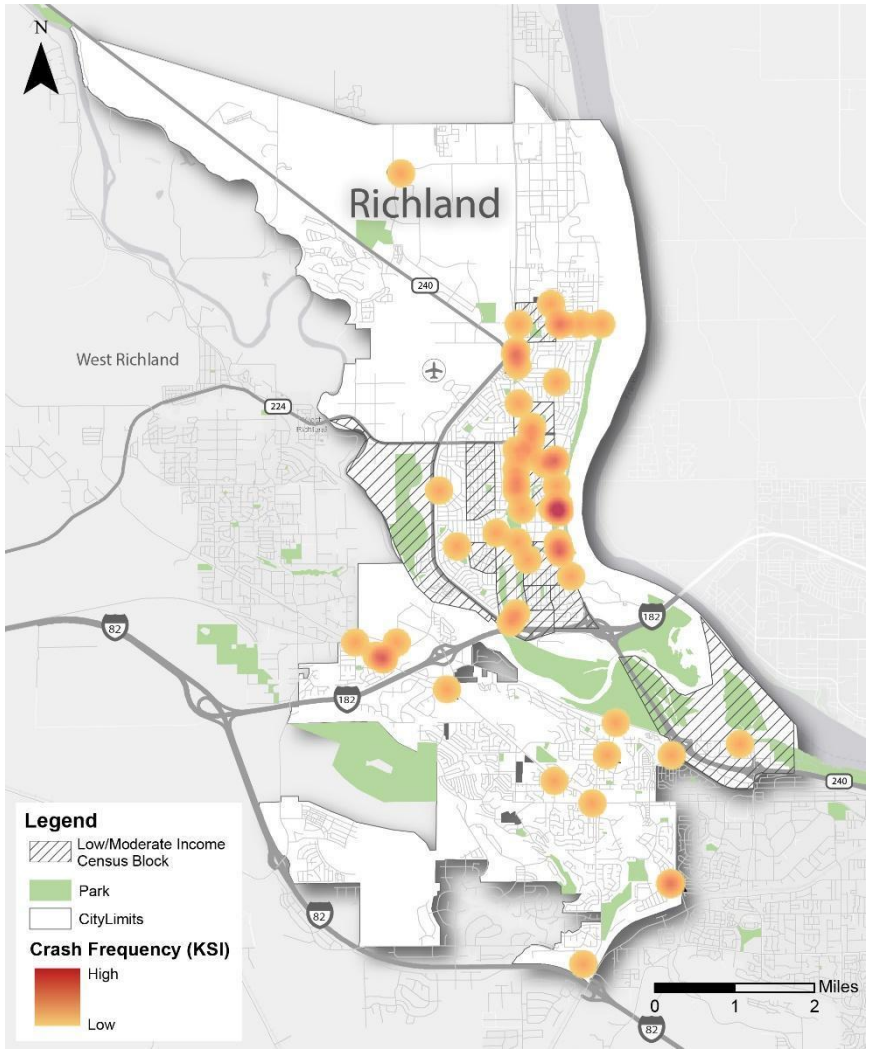


Figure 7. Heat Map of Fatal and Serious Injury Collisions (KSI) on City-owned streets in Richland (2018-2022).

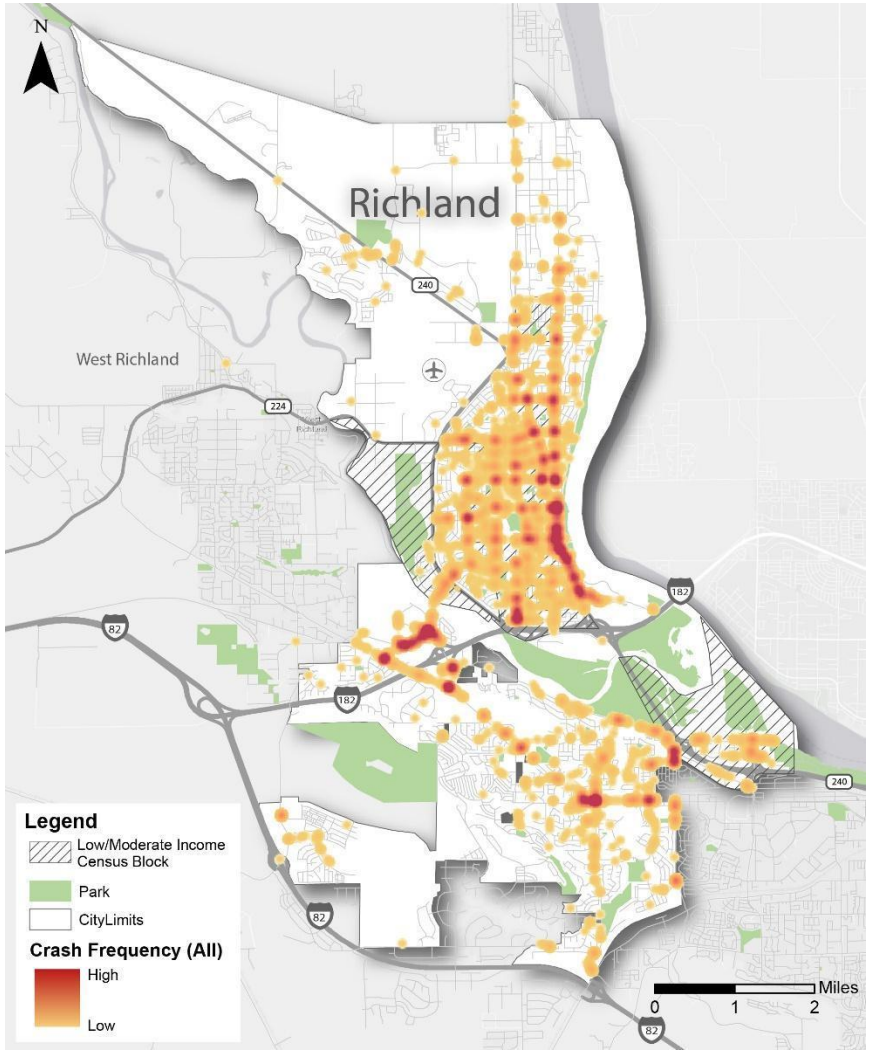


Figure 8. Heat Map of All Reported Collisions on City-owned streets in Richland (2018-2022).

PUBLIC FEEDBACK

To solicit feedback from the public, the City of Richland developed and maintained a project-specific website for the Comprehensive Safety Action Plan:

https://cleargov.com/washington/benton/city/richland/projects/8437/comprehensive-safety-action-plan

The website provided project-related information, materials, contact details and a timeline of events for the public to utilize. It included a link to download the 2022 Local Road Safety Plan and highlighted key findings from the crash data analysis. The public could also sign up to subscribe to project updates through the website and were encouraged to provide their feedback using Social Pinpoint.

Social Pinpoint is an interactive mapping tool embedded within the project website that allows participants to provide location-specific comments and include images for the project team to reference. Additionally, users were able to like or dislike comments and include images for the project team to reference. The Social Pinpoint site can automatically translate all the text on the website into 103 different languages. Users of the interactive mapping tool were offered five different types of comments that they could leave on the map including: Bicycle Comment, Ideas and Suggestions, Safety Comment, Something I Like, Pedestrian Comment, and Other Comment. The distribution of comment types received can be shown in **Figure 9**. The site was promoted on the city website, social media, email blasts and press releases.

Between February 9th to March 14th, 2023, the Social Pinpoint page was visited over **2,400 times by 900 unique participants who provided 358 comments**. A screenshot of the Social Pinpoint site is shown in **Figure 10**.

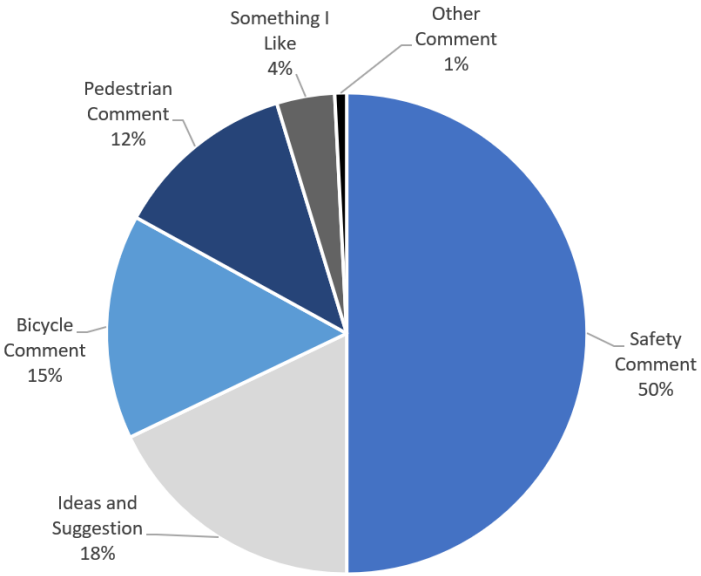
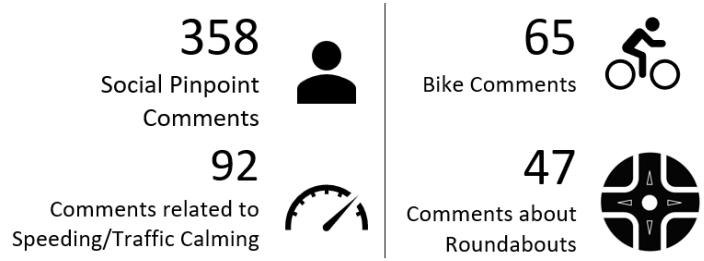


Figure 9. Distribution of comment types shared on Social Pinpoint (Feb-Mar 2023).



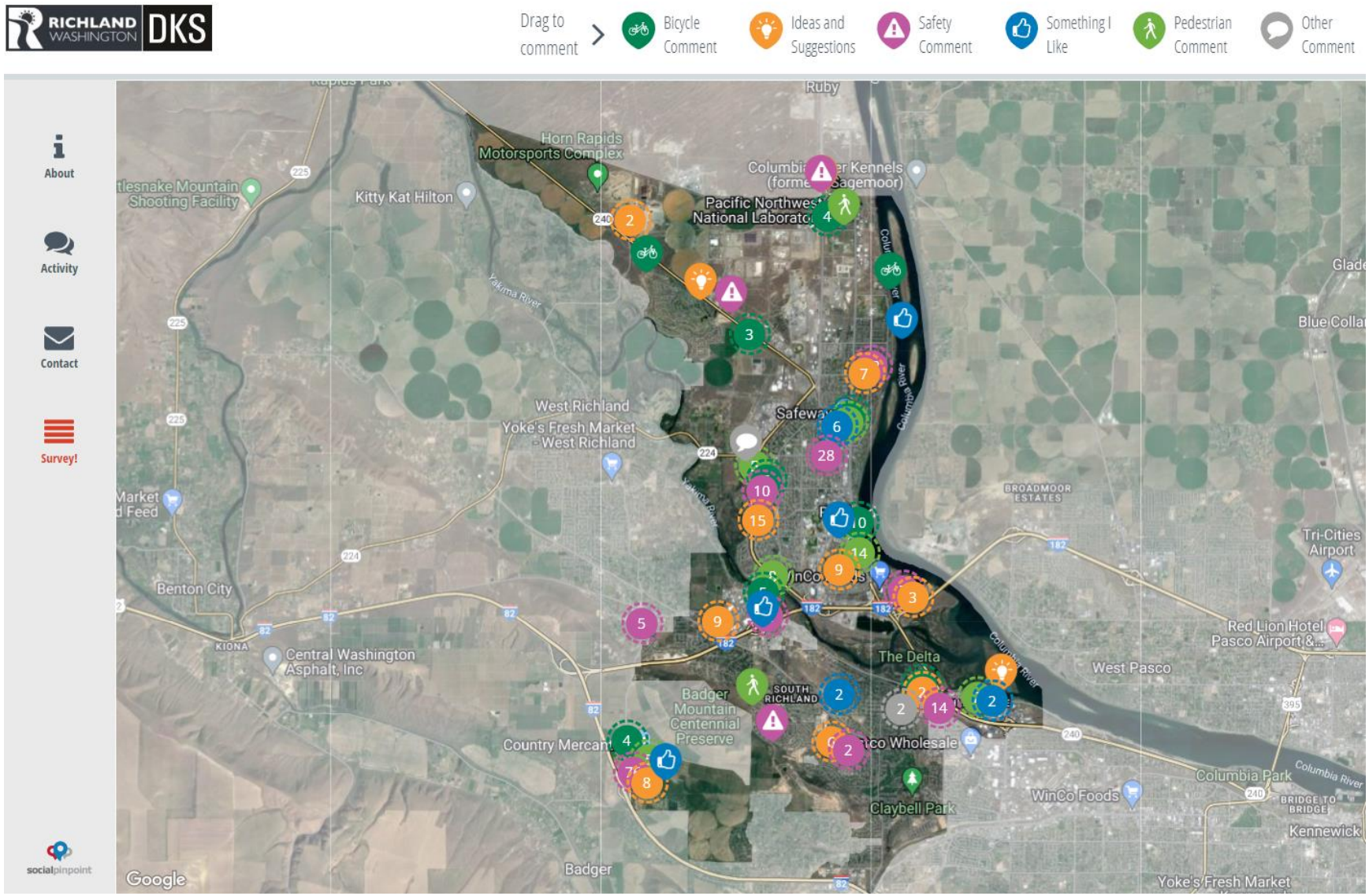


Figure 10. Screenshot of Social Pinpoint Used to Solicit Public Feedback, February – March 2023.

PUBLIC FEEDBACK SURVEY & RESULTS

To gather more insights and public feedback, the public was also encouraged to complete a survey. The survey was available on the city website and the Social Pinpoint page from February 9th to March 14th, 2023. The survey was a total of eight questions and could be completed in under five minutes. A total of 217 survey respondents were collected and 11% of respondents indicated that they use active transportation (biking and walking) as their primary mode of transportation. **Figure 11** and **Figure 12** highlight some of the key findings from the survey.

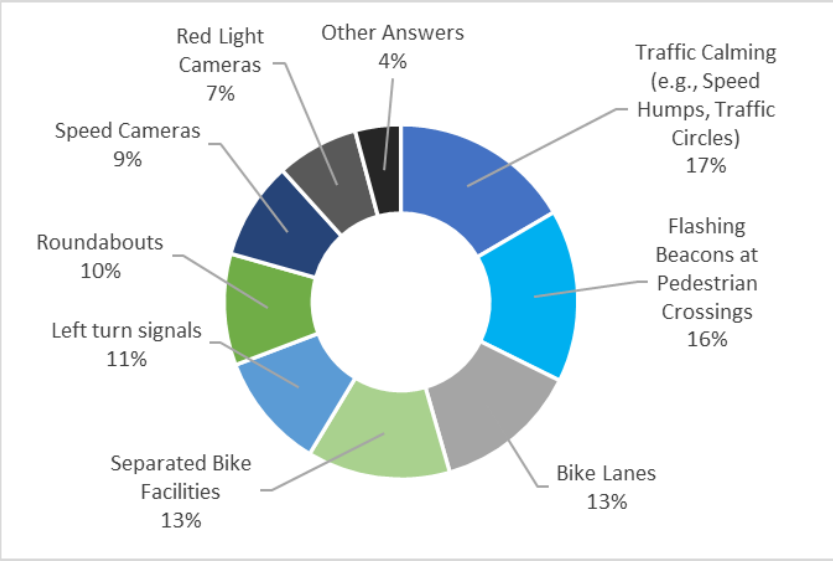


Figure 11. Roadway Features the Public Would Like to See.

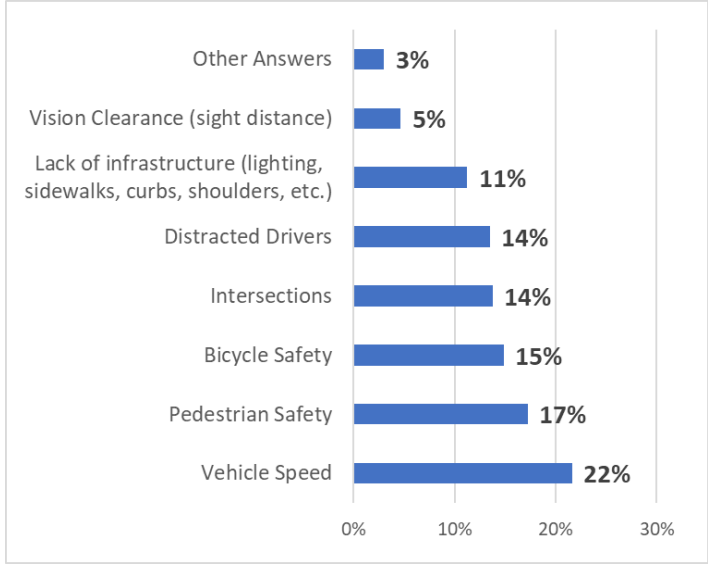


Figure 12. Identified Roadway Safety Issues.

Frequent Comments and Suggestions:

- Improve bike facilities with separated bike lanes
- More pedestrian and bike facilities downtown
- Consider more bus routes and higher frequency
- Concerns regarding speeding and potentially adding more speed enforcement
- Strong support for more roundabouts (evaluate potential new ones along Jadwin Ave and George Washington Way)

PUBLIC OUTREACH EFFORTS & AFFECTING OTHER PROJECTS

The public outreach effort will inform projects and strategies in the CSAP, and the City plans to use it in the future for ongoing maintenance and capital projects. For example, while developing pavement marking plans for upcoming citywide microsurfacing, City staff reviewed the Social Pinpoint database of recent public concerns to identify potential safety issues that could be addressed with striping. The City will continue to incorporate public comments throughout the different projects.

STEP 2: ANALYZE FATAL/SERIOUS INJURY COLLISIONS TO IDENTIFY RISK FACTORS

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

Table 1. Most Common Collision Attributes, Richland (2018-2022).

Data Element	Collision Attribute	Total Collisions	Fatal Collisions (K)	Serious Injury Collisions (SI)	Percent of all Richland Collisions with this Attribute (X)	Percent of KSI Richland Collisions with this Attribute (Y)
Citywide	*Any*	*3,296*	*12*	*43*		
Collision Type	Lane Departure[7]	614	4	12	19%	29%
	Roadway Departure at Curves	95	3	2	3%	9%

[7] In 2023, WSDOT updated their definition for Lane Departure and created an automated "flag" in the collision database.

Table 1. Most Common Collision Attributes, Richland (2018-2022) (cont.).

Data Element	Collision Attribute	Total Collisions	Fatal Collisions (K)	Serious Injury Collisions (SI)	Percent of all Richland Collisions with this Attribute [X]	Percent of KSI Richland Collisions with this Attribute [Y]
Collision Type	Head-On	17	1	2	<1%	6%
	Entering at Angle	993	1	9	30%	18%
Contributing Circumstance (For at least one vehicle)	Exceeding Reasonable Safe Speed or Exceeding Stated Speed Limit	197	4	5	6%	16%
	Alcohol-Impaired [Z]	156	1	5	5%	11%
	Drug-Impaired [Z]	47	0	2	1%	4%
	Inattention / Distraction	625	2	7	19%	16%
Motor Type Involved	Motorcycle	50	4	7	2%	20%
	Heavy Vehicle	82	0	0	3%	0%
Lighting Condition	Dark/Dusk/Dawn	936	7	14	28%	38%
Intersection	At Intersection or Intersection Related	1,772	8	22	54%	55%
	Signalized Intersection (for at least one approach)	897	6	9	27%	27%
	Unsignalized (No Traffic Control, Yield, Stop Sign)	875	2	13	27%	27%

Table 1. Most Common Collision Attributes, Richland (2018-2022) (cont.).

Data Element	Collision Attribute	Total Collisions	Fatal Collisions (K)	Serious Injury Collisions (SI)	Percent of all Richland Collisions with this Attribute (X)	Percent of KSI Richland Collisions with this Attribute (Y)
Road User	Pedestrian Involved	54	1	8	2%	16%
	Cyclist Involved	42	1	3	1%	7%
Roadway Surface	Wet	263	2	2	8%	7%
	Ice	97	0	0	3%	0%
Age	Driver Age 16 to 25 Involved	1406	5	16	43%	38%
	Driver Over Age 65 Involved	651	1	9	20%	18%
Restraint (Seat Belt) Usage	No Restraints Used	44	1	3	1%	7%

(X) For example, in Richland 30% of all collisions involved a vehicle entering at an angle.

(Y) For example, in Richland 29% of all fatal and serious injury collisions involved lane departure.

(Z) As of this writing, WSDOT has identified an issue with 2020 impaired driving data and is looking into the details.

The City identified the following notable trends from this analysis:

- 54% of all collisions and 55% of fatal and serious injury collisions occurred at intersections, making intersections the most common type of location for collisions to occur.
- 27% of fatal and serious injury collisions occurred at **signalized** intersections.
- 27% of fatal and serious injury collisions occurred at **unsignalized** intersections.
- 30% of all collisions and 18% of fatal and serious injury collisions were caused by vehicles entering at an angle, making it the most common collision type.
- 38% of fatal injury collisions occurred in dark conditions (including dusk and dawn).
- Young drivers (age 16 to 25) were involved in 43% of all collisions and 38% of fatal or serious injury collisions.
- While pedestrians and bicyclists were involved in only 3% of all reported collisions, pedestrians or bicyclists were involved in 23% of fatal or serious injury collisions.
- Similarly, motorcyclists were involved in only 3% of all reported collisions, but 20% of fatal or serious injury collisions.
- Lane departure crashes made up 19% of all collisions and 29% of fatal or serious injury collisions. In particular, 3 of the 17 head on crashes (18%) resulted in a fatality or serious injury.

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

Based on the findings of STEP 1 and STEP 2, the project team identified the following collision attributes correlated with the highest frequency or severity of collisions.[8] These collision attributes are the focus of the network analysis for STEP 4:

- Vulnerable Users Involved [Pedestrians or Bicyclists]
- Occurred at Signalized Intersection [9]
- Occurred at Unsignalized Intersections
- Entering at Angle
- Lane Departure
- Dusk/Dark/Dawn Lighting Conditions
- Motorcyclist Involved

STEP 4: ANALYZE ROADWAY NETWORK FOR PRESENCE OF RISK FACTORS

Following WSDOT's recommended procedure,[10] the City applied the most common risk factors in fatal/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 seven most common risk factors in fatal and serious injury crashes. The heat maps in **Appendix B** illustrate the locations of crashes with these attributes.

[8] There were no significant risk factor changes from the 2023 Comprehensive Safety Action Plan.

[9] The City previously received funding for systemic signal project starting in March 2022. The project includes reflectorized backplates, Flashing Yellow Arrow conversions, completion of our Audible Pedestrian Systems (APS), new calculated clearance times and addition of Leading Pedestrian Intervals.

[10] WSDOT Local Road Safety Plans Guidance, https://wsdot.wa.gov/sites/default/files/2021-10/LP-Local-Road-Safety-Plan.pdf

STEP 5: CREATE PRIORITIZED LIST OF ROADWAY LOCATIONS

5.1 INTERSECTION AND SEGMENT PRIORITIZATION

Table 2 and **Table 3** list the intersections and segments, respectively, ranked by the number of risk factors/collision attributes that the City identified. A location received 1, 2, or 3 "points" (shown in the first column, "Weighting Factors")[11] for a risk factor if it experienced a relatively high frequency of crashes with that attribute compared to the rest of the City of Richland's roadway network.

An additional two points were added at locations that experienced at least one fatal or serious injury crash during the study period. This is required for the location to be eligible for a spot location treatment under the WSDOT 2023 City Safety Program.

[11] Weighting Factors were developed by the City to further prioritize certain items: roadway departure crashes, pedestrian- and bicyclist-involved crashes, locations with a history of fatal and serious injury crashes, and the supplemental EDPO and Crash Rate calculations.

Table 2. Prioritized Intersection Safety Needs by Number of Risk Factors (intersection-related crashes).

Weighting Factor	1	1	3	1	2	
Intersection	Entering at Angle	Dark Conditions	Ped/Bike	Motorcycle	At Least 1 Fatal or Serious Injury Crash	Weighted Total
George Washington Way and Symons Street*	✓	✓	✓	✓	✓	**8**
Gage Boulevard and Leslie Road	✓	✓	✓	✓	✓	**8**
Jadwin Avenue and Symons Street*	✓	✓	✓	-	✓	**7**
Keene Road and Queensgate Drive*	✓	✓	✓	-	✓	**7**
Keene Road and Duportail Street	✓	✓	✓	-	✓	**7**
Keene Road and Kapalua Avenue (new)	✓	-	✓	-	✓	**6**
N Steptoe Street and Tapteal Drive (new)*	✓	✓	-	✓	✓	**5**
Jadwin Avenue and McMurray Street	✓	✓	✓	-	-	**5**

Table 2. Prioritized Intersection Safety Needs by Number of Risk Factors (intersection-related crashes). (cont.)

Weighting Factor	1	1	3	1	2	
Intersection	Entering at Angle	Dark Conditions	Ped/Bike	Motorcycle	At Least 1 Fatal or Serious Injury Crash	Weighted Total
Jadwin Avenue and Swift Boulevard*	✓	✓	✓	-	-	**5**
George Washington Way and Jadwin Avenue*	✓	✓	-	✓	✓	**5**
George Washington Way and Swift Boulevard (new)*	✓	✓	-	✓	✓	**5**

**Intersections with projects that are funded and planned for construction within the next 2 years.*

Table 3. Prioritized Segment Safety Needs by Number of Risk Factors (non-intersection related crashes).

Weighting Factor	1	2	1	3	1	2	
Segment	Entering at Angle	Lane Departure	Dark Conditions	Ped/Bike	Motorcycle	At Least 1 Fatal or Serious Injury Crash	Weighted Total
George Washington Way: Jadwin Avenue to McMurray Street	✓	✓	✓	✓	✓	✓	**10**
Duportail Street: Keene Road to Queensgate Drive	✓	✓	✓	✓	✓	✓	**10**
Keene Road: Kennedy Road to Duportail Street	✓	✓	✓	✓	-	✓	**9**
Jadwin Avenue: Swift Boulevard to Torbett Street (new)	✓	✓	-	✓	-	✓	**8**
Lee Boulevard: Thayer Drive to Stevens Drive (new)	✓	✓	-	✓	-	✓	**8**
Aaron Drive: Bypass Highway to Goethals Drive	✓	✓	✓	-	✓	✓	**7**
Stevens Drive: Saint Street to Vantage Hwy Pathway (new)	-	✓	✓	-	✓	✓	**6**

5.2 SYSTEMIC SAFETY NEEDS

The City identified the following safety needs for potential systemic safety improvements.

1. **Unsignalized Intersections.** In Richland, intersection collisions (signalized and unsignalized) are the most common types to occur. Unsignalized intersections (typically stop-controlled, but also including roundabouts and intersections with no traffic control devices) have experienced the following proportions: 27% of all collisions and 27% of all intersection-related fatal and serious injury collisions. The City has recently completed a systemic project to address needs at signalized intersections and has a current project in the design stage to address several unsignalized intersection locations. The City will also continue to look to find funding opportunities for additional intersections that did not make the funding list in the current project.
2. **Pedestrian Crossings.** Pedestrians were involved in only 2% of all collisions in the city, but 16% of fatal and serious injury collisions. The City has an active project to address systemic needs at unsignalized pedestrian crossings, while also looking for opportunities to provide similar pedestrian improvements within the scope of other capital projects. This project would also help address bicycle collisions as well, which share a high rate of fatal and serious injury collisions relative to overall collisions. The City will also continue to seek funding opportunities for additional intersections that did not make the funding list in the current project.
3. **Right-turn Treatments at Signalized Intersections**. The City would like to make improvements to right-turn movements at key intersections, working to improve overall efficiency while explicitly providing better protection for all users. Leading Pedestrian Intervals have already been implemented throughout Richland, and intersections with right-turn lanes could benefit from advanced treatments like the flashing yellow arrow for right-turns, on-street markings like sharrows or shared turn lanes, and specialized pedestrian signage at intersections (e.g., Turning Vehicles Stop for Pedestrians). These signs are an MUTCD standard and can include a lighted border that is activated by pushbutton. The treatment could also be used selectively for left turns as well. The City plans to seek funding for this systemic treatment.
4. **Lane Departure.** Collisions involving vehicles that leave their lane were one of the most common collision types citywide. The City has experienced lane departure in the following proportions: 19% of all collisions and 29% of fatal and serious injury collisions. Systemic treatments addressing lane departure also help reduce the potential for future head-on collisions. Also, further analysis revealed that 9% of all fatal and serious injuries involved roadway departure that occurred at a curve. The

City is working to develop a plan to address signage for all horizontal curves to make sure that signing is up to date. The City is also considering funding sources for guardrail improvements along a rural section of Columbia Park Trail.

5. **Appropriate Speed Limits.** The City has undertaken a citywide traffic speed study to develop a revised speed limit setting policy and a customized tool for implementing the policy. The policy will help Richland move away from practices of weighting the 85th percentile speed too heavily and move towards a policy that sets regulatory speeds using recent research regarding context. Once this study is complete the City will undertake a systematic review and modify existing speed limits as appropriate.
6. **Citywide School Safety Program Analysis**. Student school safety while walking or biking to school is important for any community. The City will be partnering with the School District to perform audits at all schools to identify potential gaps or improvements that can be made to school walk routes. The audit will be used to update and enhance existing school walk route maps as well as identify important projects, both large and small, to prioritize funding for improvements.
7. **Pedestrian and Bicycle Improvements.** To meet our Complete Streets objectives, the City is looking to make improvements every year by taking advantage of the roadway surfacing programs. This program often provides updated curb ramps while also providing bicycle lanes and possibly turn lanes as well by utilizing road diets or roadway configurations.
8. **Traffic Calming Improvements**. The City has undertaken a new program called the Neighborhood Traffic Safety (NTS) Program that aims to control traffic speeds, reduce cut-through traffic, and mitigate transportation safety issues in residential neighborhoods. The NTS program goal is to install traffic calming devices at requested locations based on a quantitative evaluation of safety needs and potential treatments.

STEP 6: IDENTIFY COUNTERMEASURES TO ADDRESS PRIORITIZED LOCATIONS

6.1 LOCATIONS FOR FURTHER ANALYSIS

The City compared the list of prioritized intersections and corridors identified in STEP 5 to recent and already-funded projects to pinpoint the most pressing safety needs. Collision data and existing conditions were further analyzed at the following locations shown in **Table 4**.

Table 4. Prioritized Safety Study Locations for Further Analysis.

Location	Primary Crash Patterns	Fatal or Serious Injury Collision History	Potential Countermeasures
Signalized Intersection: George Washington Way and Symons Street | Jadwin Avenue and Symons Street	Rear-end, pedestrian-related, left-turns	George Washington Way: 2 Serious injury, including 1 pedestrian-related. Jadwin Avenue: 1 Fatal, pedestrian-related	One-way couplet planned, Intersection Lighting, Signal Visibility Upgrades, Left-turn Signal Upgrades, Pedestrian Signal Upgrades
Signalized Intersection: George Washington Way and Jadwin Avenue	Congestion-related rear-ends, lane-changing sideswipes, entering at angle	2 Fatal crashes including one overturning crash involving speeding and one hitting a street light pole	Signal Coordination, Lane Use Control Upgrades, Protected-only left turn phasing
Segment: Gage Boulevard from Leslie Road to Keene Road	Entering at angle, left turn (40%)	1 Serious injury. 3 pedestrian crashes.	Access management (reduce the left turns at driveways). Additional Lighting for the driveway access (including pedestrian scale lighting).

Table 4. Prioritized Safety Study Locations for Further Analysis. (cont.)

Location	Primary Crash Patterns	Fatal or Serious Injury Collision History	Potential Countermeasures
Segment: Aaron Drive: SR 240 Bypass Highway to Goethals Drive	Rear-end, angle, sideswipe, sight distance limitations	1 Serious injury overturning crash.	Curve warning signs, sight distance improvements. Flyover for Southbound traffic and roundabout for the rest.
Pedestrian Crossing: Bellerive Drive: Gage Boulevard to Canyon Street	Vehicle-Pedestrian conflicts near trail crossing in a residential area	0 Fatal or serious injury crashes.	Enhanced warning signs, RRFB, Raised crosswalk
Uncontrolled Intersection: Keene Road and Kapalua Avenue (new)	Making left turn, vehicle-pedalcyclist involved	1 Serious injury involving a cyclist.	Add bicycle lane or green pavement markings for the minor approach, mini roundabout
Segment: Gage Boulevard from Leslie Road to Keene Road	Entering at angle, left turn (40%)	1 Serious injury crash. 3 pedestrian crashes.	Access management (reduce the left turns at driveways). Additional lighting for the driveway access (including pedestrian scale lighting). Full segment corridor study.
Segment: Stevens Road from Jadwin Ave to Saint Street (the northeast leg)	Rear-end	2 Serious injury crashes.	Speed management. Additional lighting.

STEP 7: DEVELOP A PRIORITIZED LIST OF PROJECTS AND STRATEGIES

Upon completion of the crash data analysis, identification of potential countermeasures, and comparison with recently completed and planned project locations, the City selected safety projects shown in **Table 5** to be prioritized. This list includes corridor projects, systemic projects covering larger areas of the city, spot projects and transportation/traffic studies, and code updates.

2024 UPDATE: Several systemic stop-controlled intersections and systemic pedestrian crossings were funded by grant programs. This is noted in the Current Status column in **Table 5** below.

Table 5. Richland Prioritized Safety Projects to Pursue.

Prioritized Location or Systemic Collision Type	Safety Project	Current Status	Next Steps
Corridor Project - Downtown Connectivity	Convert 1.2-mile parallel corridors of George Washington Way and Jadwin Avenue from 5 lane arterials to one-way couplet with three lanes on each street to include new bicycle facilities and pedestrian enhancements.	2023 CSAP New Project Fully Funded with TIB Urban Arterial Program, Transportation Alternatives funds, Carbon Reduction funds, and USDOT SS4A Program.	Move forward with Design. Planned 2025 Construction.
Systemic Stop-controlled Intersections	Low-cost signing and pavement marking improvements; Advanced Intersection Warning System; low-cost curb extensions; mini roundabouts.	6 out of 12 locations funded by WSDOT City Safety Program.	Apply for additional 2024 WSDOT City Safety Program grant funding for the remaining 6 intersections
Systemic Pedestrian Crossings	Marked crosswalks, advanced warning signs, Rectangular Rapid Flashing Beacons (RRFBs)	6 out of 16 locations funded by WSDOT City Safety Program 3 out of 16 locations funded by TIB Complete Streets	Apply for 2024 WSDOT City Safety Program grant funding for 10 more locations

Table 5. Richland Prioritized Safety Projects to Pursue. (cont.)

Prioritized Location or Systemic Collision Type	Safety Project	Current Status	Next Steps
Systemic - Right-turn Treatments	Consider Right-turn Flashing Yellow Arrow treatments and/ or pedestrian pushbutton activated signage at select signalized intersections to better separate pedestrians in time and space. Consider marking treatments for bicycles.	2023 CSAP New Project 8 locations	Apply for 2024 WSDOT City Safety Program grant funding
Systemic Roadway Departure: Citywide Horizontal Curves	Citywide Horizontal Curve Signing and Select Guardrail Treatments	Not Funded in 2022 WSDOT City Safety Program	Apply for 2024 WSDOT City Safety Program grant funding
Future Transportation Studies	The City plans to undertake speed zoning studies once a new speed limit policy is developed. The City plans to develop a new Traffic Calming policy to better respond to the needs of citizens.	2023 CSAP New Project	Consider for future grant opportunities as appropriate
Citywide School Safety Program Analysis & Study	The City will partner with the School District to perform audits at all elementary and middle schools to identify potential gaps or improvements that can be made to school walk routes. The audit will be used to update and improve existing school walk route maps as well as identify important projects, both large and small, for funding prioritization.	2023 CSAP New Project	Consider for future grant opportunities using Safe Routes to School, Pedestrian and Bicycle Program, and the Washington Traffic Safety Commission Programs.

Table 5. Richland Prioritized Safety Projects to Pursue. (cont.)

Prioritized Location or Systemic Collision Type	Safety Project	Current Status	Next Steps
Corridor - Dallas Road Roundabouts	Roundabout Corridor with multi-lane roundabouts planned at both I-82 Ramp terminals, Trowbridge Boulevard, and Ava Way. These projects were highly requested during our community outreach survey.	2023 CSAP New Project	Primarily development driven and funded by the TIF and developer. Trowbridge Boulevard and Ava Way Roundabouts in Design. Planned 2024 construction.
Corridor - Duportail Street Roundabouts	Install two roundabouts along Duportail Street. One at Kennedy Road and the second at a major commercial driveway surveying Walmart, Home Depot, Target as well as numerous restaurants and strip commercial outlets. The roundabouts would allow for access management medians along the corridor.	Construction is to begin in 2025 at the Kennedy location, but the major driveway roundabout is still unfunded.	Consider future grant opportunities to address the rest of the corridor
Spot - SR-240 Bypass at Aaron Drive	Build a Flyover ramp for eastbound traffic on SR-240. This will leave only the remaining turning movements to be served by a new roundabout at grade. Project to include key bicycle & pedestrian connections as well.	2023 CSAP New Project	Consider for future grant opportunities and legislative action.

The following sections detail existing conditions, countermeasures, estimated project costs, monetary value of estimated safety benefits, and the estimated benefit/cost ratio of the top three recommended safety projects. The projects are organized by City priority, with the highest-priority project first.

7.1 CORRIDOR PROJECT - DOWNTOWN CONNECTIVITY: JADWIN AVENUE & GEORGE WASHINGTON WAY

The City of Richland has been working since the early 2000s to improve the Central Business District, and several planning studies have been completed to develop and advance this priority. In 2018, the City Council adopted an update to its Strategic Leadership Plan with six focus areas. One of the focus areas, Increase Economic Vitality, includes an objective to improve streets by enhancing walkability in the core downtown area. The 2019 City budget included funds to advance this walkability objective with a Downtown Connectivity Study. [12] Its purpose was to advance the City Council's vision for a pedestrian-friendly waterfront and downtown, while maintaining or enhancing the vehicular travel flow through the area (see **Figure 13**).

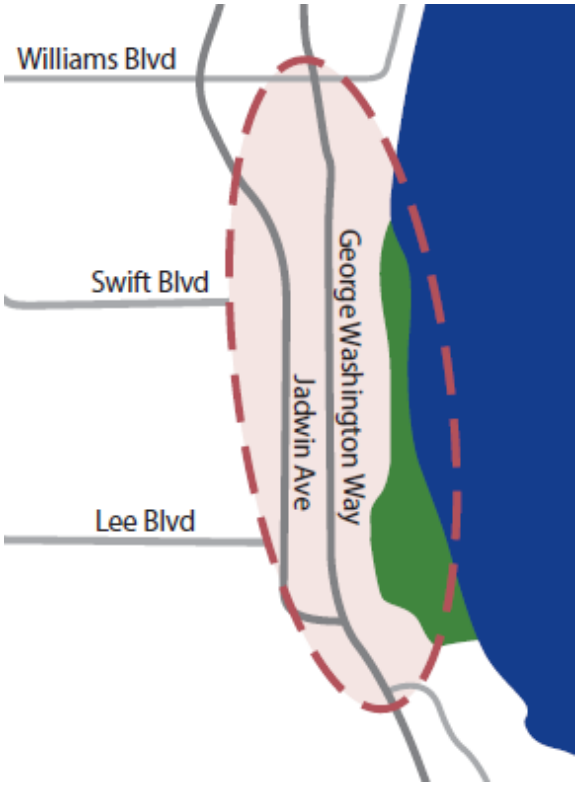


Figure 13. Project area for pedestrian-friendly waterfront and downtown Richland.

[12] https://cleargov.com/washington/benton/city/richland/projects/785/downtown-connectivity-study

The project team developed, evaluated, and prioritized street improvements downtown. The findings and recommendation formed the basis of a City Council decision to convert George Washington Way and Jadwin Avenue to one-way streets between Symons Street on the north and the George Washington Way/Jadwin Avenue intersection on the south. Reconfiguring the roadways to one-way streets enables repurposing of a portion of the existing right of way for barrier-separated two-way bike facilities, wider sidewalks, on-street parking, and pedestrian crossing enhancements throughout the project area. Reducing the street width and converting the intersections to a single-approach direction shortens and reduces the complexity of pedestrian crossings, time spent in the street, and conflict points for pedestrians. Traffic signal coordination, and addition of bike signals on the one-way couplet system, helps to limit operating speeds and provide protected bicycle and pedestrian movements for enhanced comfort and safety. The project requires geometric changes to several intersections, reconfigures and adds and subtracts traffic signals to support the one-way operation, pedestrian crossings, and bike lanes. The project also includes upgrades to street lighting and pedestrian scale lighting.

In 2022, the City began design of the project which enabled successful grant awards from the USDOT Safe Streets and Roads for All Program, Washington State Transportation Improvement Board Urban Arterial Program, and Benton Franklin Council of Governments' Transportation Alternative and Carbon Reduction funding. The City plans to complete design and environmental review in 2024 to be prepared for construction in 2025.

7.2 SYSTEMIC PROJECTS

7.2.1 SYSTEMIC STOP-CONTROLLED INTERSECTIONS

Identified Safety Needs. In Richland, intersection collisions (at or related to signalized and unsignalized intersections) are the most common type to occur for all crash severities. Approximately 27% of fatal and serious injury collisions occurred at unsignalized intersections or were intersection-related, and 27% of all collisions occurred at intersections or were intersection-related. In particular, a considerable number of two-way stop-controlled (TWSC) intersections experience a reasonably high collision frequency and rate in the City of Richland. **Table 6** provides a list of stop-controlled intersections in Richland to be treated, the type of treatment(s) that would be most appropriate, and the funding status.

Potential Safety Treatments. Some of the low-cost systemic treatments that may mitigate these issues include:

- Doubled-up stop signs
- Retroreflective post sleeves
- "Cross Traffic Does Not Stop" plaques under the stop signs
- Additional pavement marking
- Double-wide stop bars
- Fluorescent yellow sign sheeting
- Advance intersection warning signs with street name plaques
- Oversize warning and regulatory signs
- Raised median on the side street

At some locations, more advanced safety needs may necessitate one or more of the following enhanced treatments:

- Advance Intersection Warning System
- Low-cost Mini-roundabouts
- Low-cost Curb extensions (signs, delineators, "tough curb")

Figure 14 illustrates low-cost curb extension that provides space for moving stop signs closer to the road and reduces crossing distances for pedestrians.

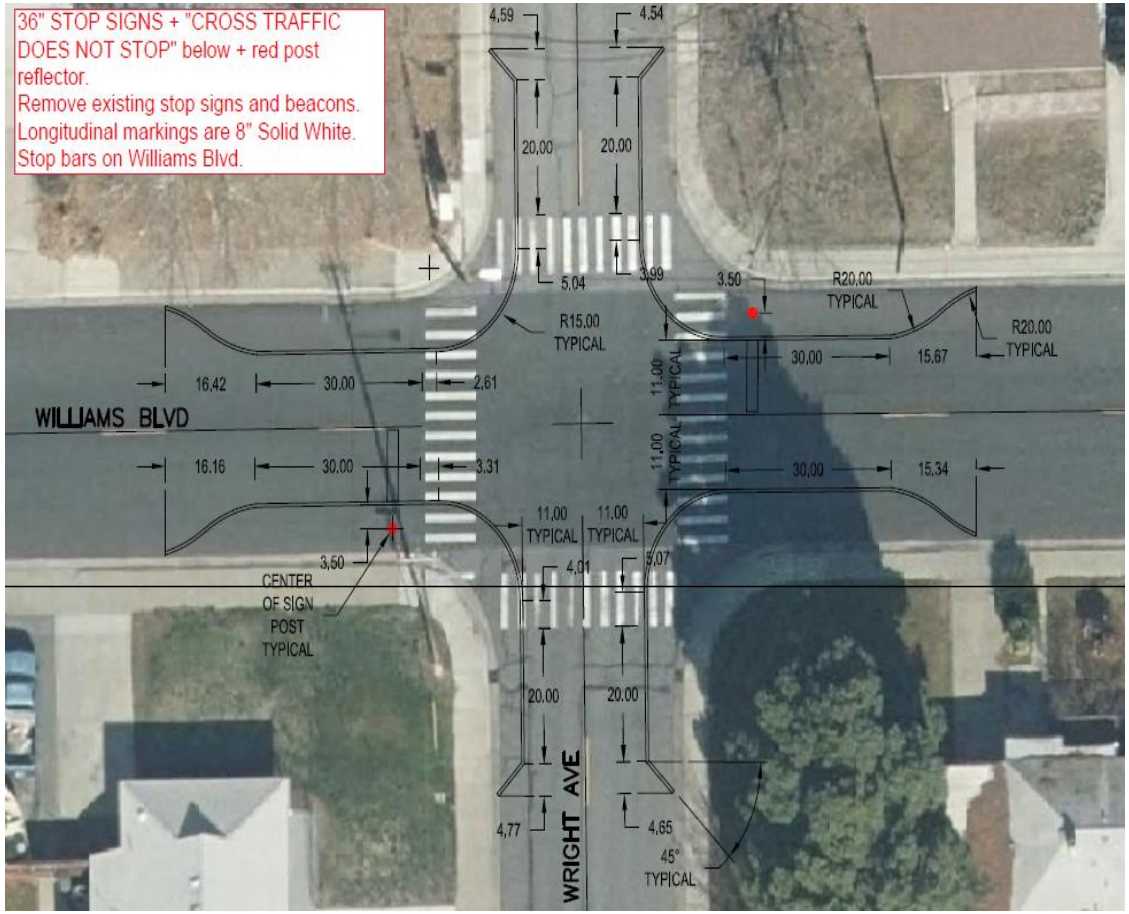


Figure 14. Low-cost Signing and Marking Treatments with Low-cost Curb Extensions.

Another critical component for stop-controlled intersections is to make sure that the necessary sight distance triangles are maintained, and that vegetation does not obstruct the necessary sight lines or signage. The City of Richland has recently updated the intersection Sight Distance Code (RMC Chapter 12.11) and has included a new section to cover the obstruction of traffic control devices.

Mini Roundabouts. Available pavement at select locations make it feasible for a mini roundabout installation. Roundabouts are a proven countermeasure to reduce the frequency and severity of intersection crashes by reducing operating speeds and flattening the angle of conflict. It will be important for this design to accommodate truck and transit vehicle movements.

The City proposes installation of mini roundabouts at the following locations:

- Thayer Drive and Symons Street
- Canyon Street and Bellerive Drive/Status Street

To address the safety risks at intersections and the low cost of the recommended treatments, the City proposes a combination of treatments at the stop-controlled intersections listed below. The locations are prioritized by calculating crash rates per total entering volume and Equivalent Property Damage Only (EPDO) weighted crash frequency.

Figure 15 shows the locations of the stop-controlled intersections in **Table 6**.

Table 6. Systemic Stop-controlled Treatment Locations.

Location		Treatments				
		Low-cost Signing and Pavement Marking	Actuated Advanced Intersection Warning	Mini Roundabout	Low-cost Curb Extensions	Funded
1	Columbia Park Trail and Leslie Road	✓	✓			
2	Thayer Drive and Symons Street	✓		✓	✓	
3	Canyon Street and Bellerive Drive/Satus Street	✓		✓		
4	Steptoe Street and Canyon Street	✓	✓			

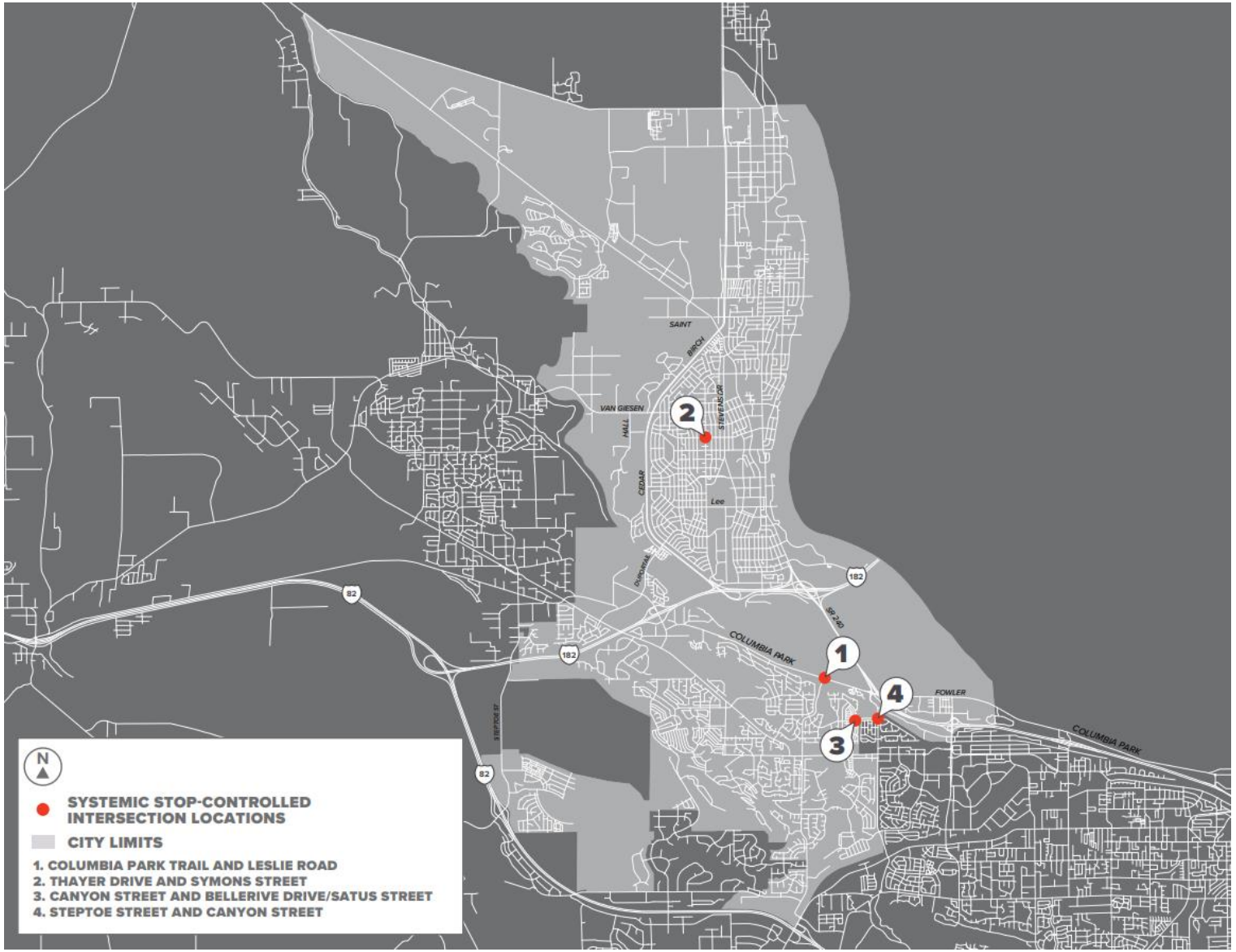


Figure 15. Systemic Stop-Controlled Intersection Locations in Richland, WA.

Richland Systemic Stop-Controlled Intersection Safety Countermeasures and Two Mini Roundabouts

Project Description

Install upgraded signing and pavement marking. Add Actuated Advance Warning Beacons or Low-Cost Curb Extensions at select locations.

Add mini roundabouts at two select locations.

Cost Estimate

$1,602,000

Benefit / Cost Ratio

6.49

Time Frame

Short-term

Medium-term

Crash Reduction

~70%

Combined reduction for the treatments described.

History: 49 intersection collisions at the selected intersections from 2018-2022, including 1 suspected serious injury.

Expected Benefit: 7 fewer crashes per year

7.2.2 SYSTEMIC PEDESTRIAN CROSSINGS

Pedestrians are the most vulnerable users of the transportation system, especially when crossing the street. While pedestrian-involved collisions in Richland comprised only 2% of all crashes, 16% of fatal and serious injury collisions during the study period involved a pedestrian.

Potential Safety Treatments. All intersections have legal crosswalks, marked or not (unless posted otherwise), and the treatments selected for these crosswalks vary. Several enhanced treatments (e.g., signing, striping, flags, medians) are used in Richland. The City uses guidance from the Federal Highway Administration (FHWA on selection of treatments as well as crosswalk warrant information developed by the City of Boulder, Colorado and implemented by many other agencies to make decisions about crosswalks and crosswalk treatments.

Typical treatments are striping, signing, protective medians, or Rectangular Rapid Flashing Beacons (RRFB). Pedestrian Hybrid Beacons (PHBs) are an even higher level pedestrian crossing that provides more positive pedestrian control at higher volume locations while also being capable of integrating into a coordinated traffic signal system. The City considers a variety of treatments and when those treatments may be most appropriate based on pedestrian volumes, vehicle volumes, transit volumes, number of lanes crossed, travel speed, and roadway functional classification. It should also ensure that proper lighting is considered for crosswalks. At this time, the City is reviewing crosswalk locations on surfacing projects to decide if all crosswalks will be replaced or if some will be consolidated. The City is also aggressively pursuing crosswalk upgrades, typically RRFB installation via grant projects and capital projects, an example of which can be noted in **Figure 16**.

Figure 16. Example Pedestrian Crossing Treatment used in Richland, WA.

For the 2024 City Safety Program, Richland proposes pedestrian crossing treatments at the following locations. See **Appendix C** for the full pedestrian crossing ranking matrix and individual site details, and **Figure 7** below for a vicinity map of these crossings.

1. George Washington Way at Torbett Street
2. Van Giesen Street and Birch Avenue
3. Thayer Drive and Lawless Drive
4. Swift Boulevard and Cottonwood Drive
5. Gage Boulevard and Peachtree Lane
6. McMurray Street and Pike Avenue
7. Knight Street at The Parkway
8. Bellerive Drive at Keene Path Crossing
9. Stevens Drive north of Swift Boulevard
10. Leslie Road and Canyon Avenue

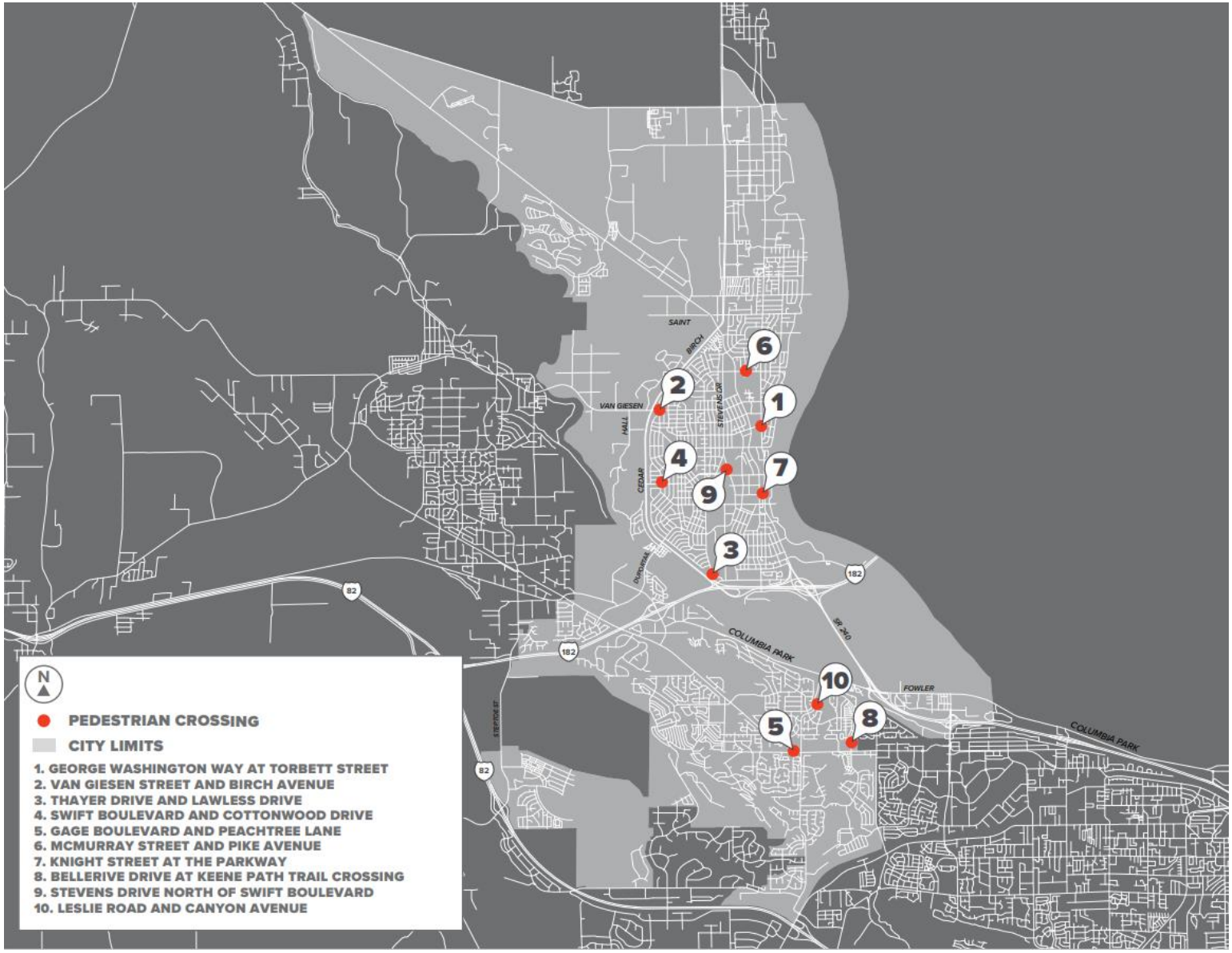


Figure 17. Systemic Pedestrian Crossing Locations in Richland, WA.

Richland: Systemic Pedestrian Crossing Countermeasures

Project Description

Install upgraded signing and pavement marking and Rectangular Rapid Flashing Beacons (RRFBs). Add street lighting at eight selected locations.

Cost Estimate

$1,571,000

Benefit / Cost Ratio

0.68

Time Frame

Medium-term

Crash Reduction

~14%

Reduction in pedestrian collisions.

History: 1 pedestrian collision and 12 dark/dusk/dawn collisions at the selected crossings from 2018-2022.

Expected Benefit: 1 fewer crash per year

7.2.3 SYSTEMIC ROADWAY DEPARTURE: HORIZONTAL CURVE SIGNING

Between 2018 and 2022, there were 95 roadway departure collisions that reported a roadway characteristic of "curve & level", "curve & grade", or "curve at hillcrest". Three of the 95 collisions resulted in a fatal crash. Additionally, Richland experienced a higher proportion of crashes occurring on horizontal curves than other Eastside Cities, as follows in **Table 7**:

Table 7. Horizontal Curve Proportion Comparison: Richland to Eastside Cities.

	Fatal/Serious Injury Crash Proportion		Total Crash Proportion	
	Eastside Cities	Richland	Eastside Cities	Richland
Curve & Grade	3.46%	3.64%	2.21%	3.25%
Curve & Level	8.48%	10.91%	4.45%	5.61%
Curve at Hillcrest	1.78%	1.82%	0.19%	0.21%
Curve in Sag	0.10%	0.00%	0.09%	0.06%

The City of Richland has captured advisory speeds (e.g., "ball bank speeds") for all city streets, so this safety project will provide current MUTCD standard curve warning signs at all horizontal curves on arterials and major collectors within city limits.

- Assess Existing Conditions
  - Calculate the difference between previously-collected advisory speed and the posted speed limit (per the MUTCD)
- Design signing treatments
  - Determine the required (shall) and recommended (should) sign package for each curve per the MUTCD.
  - Confirm sign placement feasibility via field review

    - Produce plans, specifications, and estimates (PS&E) for curve signing
- Install horizontal curve warning signs

7.2.4 SYSTEMIC RIGHT TURN TREATMENTS

Right-turn Treatments at Signalized Intersections. The City would like to make improvements to right-turn movements at key intersections, working to improve overall efficiency while explicitly providing better protection for all users. Leading Pedestrian Intervals have already been implemented throughout Richland, and intersections with right-turn lanes could benefit from advanced treatments like the flashing yellow arrow for right-turns, on-street markings like sharrows or shared turn lanes, and specialized pedestrian signage at intersections (e.g., Turning Vehicles Stop for Pedestrians). These signs are an MUTCD standard and can include a lighted border that is activated by pushbutton. The treatment could also be used selectively for left turns as well. The City plans to seek funding for this systemic treatment.

The City is currently undergoing different processes to determine which locations would benefit most from systemic right turn treatments.

7.3 NON-INFRASTRUCTURE STRATEGIES

Richland Police Department (RPD) conducts educational outreach programs and events to get the word out about roadway safety. RPD activities should continue and be supplemented with additional support, as funding allows. The following are some of the safety programs.

Teen Target Zero (*formerly called "Every 15 Minutes"*). Officers speak directly to area high school students about the dangers of drinking/drugs and driving. The sessions last approximately 1-2 hours and cover a range of topics that talk about strategies to reduce young driver crashes. The conversations are designed to help young drivers gain valuable experience, while mitigating their risk by keeping them out of dangerous situations.

Neighborhood Watch Programs. Richland PD visits several neighborhood watch meetings throughout the year to discuss a myriad of topics. The most common concern from neighborhoods is typically traffic-related, providing an opportunity for RPD to discuss area-specific issues. Officers typically spend time talking about the 3-Es of traffic safety (Education, Engineering, and Enforcement)

and how that affects their neighborhood and Richland as a whole. RPD will often bring in neighborhood-specific data obtained from its speed monitoring devices to support the discussion.

Richland School District Crosswalk Guard Training. RPD's Traffic Safety Unit spends time at the school districts in the late summer to prepare district employees for crosswalk guard duties. The training includes great conversations with the employees who will provide their real world experiences of traffic violations near schools.

Hanford Area Outreach. RPD's Traffic Safety Unit is often called upon to provide traffic safety training for Hanford area companies, such as Hanford Mission Integration Solutions (HMIS) and Pacific Northwest National Laboratory (PNNL). Discussion topics include speeds and aggressive driving on the Bypass Highway/Stevens Drive, safety driving during inclement weather and dark conditions, and the importance of having a safety kit in the vehicle. This is also a great opportunity to talk about schools and the children these employees may encounter on their way to work.

Radio and Television Media. RPD conducts numerous TV and radio bits throughout the year to talk about traffic safety. The topics are timely and relevant. For example, in the spring, RPD may cover motorcycle awareness, teens racing, and impaired driving. In the fall and winter, officers will cover inclement weather, tires, speeding, and impairment.

Social Media. RPD has a good following in social media. The Department takes advantage of this exposure by sharing relevant traffic safety material, much of which comes from the Washington State Traffic Safety Commission.

POLICY ASSESSMENT

The City of Richland assessed current policies, plans, guidelines, and standards to identify opportunities to improve how agency processes prioritize transportation. The following is a summary of that assessment and plans to revise or develop new policies, guidelines, or standards in four key areas: Speed Limit Setting, Traffic Calming, Complete Streets, and ADA.

SPEED LIMIT SETTING

The City has traditionally used guidance under WAC 468-95-045 to establish speed limits on City Streets as authorized under RCW 46.61.415. City streets that differ from the Basic Rule speed as established in RCW 46.61.400 are listed in the Richland Municipal Code under Chapter 11.08, Speed Regulations.

In 2023, the City solicited consultant support to assess and update the current speed limit policies based on some of the most recent research on the topic, including the following sources and tools:

- FHWA USLMITS2
- NCHRP Report 966: Posted Speed Limit Setting Procedure and Tool
- NACTO City Limits: Setting Safe Speed Limits on Urban Streets

The study will include a revised speed limit policy and a customized tool for implementing the policy on any corridor in Richland.

TRAFFIC CALMING

The City of Richland has a limited history in the use of Traffic Calming devices, with approximately 10-12 traffic circles and speed humps deployed throughout the city. Many of those are recent installations in new subdivisions conditioned as a preemptive measure for traffic safety and to mitigate potential citizen concerns.

The City adopted a Neighborhood Traffic Safety (NTS) program in 2023. The City of Richland's NTS program aims to improve neighborhood safety by reducing traffic speeds, reducing cut-through traffic, and mitigate transportation safety issues in existing residential neighborhoods. The NTS program accomplishes this goal by installing traffic calming devices and other safety countermeasures at selected locations based on a quantitative evaluation and available project funding. The NTS program is intended to serve existing residential local and collector streets.

COMPLETE STREETS

In the 7 years since the adoption of the City's Complete Streets Policy (RMC 12.06)[13] in 2017, City staff have aggressively pursued bicycle and pedestrian improvements to be included in capital projects, all roadway resurfacing projects, and stand-alone grant or safety-funded projects. In addition, the staff has worked closely with Ben Franklin Transit to help cite bus stops and facilities within and adjacent to the City right-of-way. As the types and scale of active transportation projects have grown along with funding opportunities, the City will consider updates to this policy soon, to incorporate the latest best practices.

ADA TRANSITION PLAN

The City of Richland's *ADA Transition Plan for the Public Rights-of-Way*[14] focuses exclusively on the public rights-of-way maintained by the Public Works Department. The plan was adopted by City Council through Resolution No. 2022-27 on February 15, 2022. The plan addresses the following requirements:

- Identifies physical obstacles in the City's facilities that limit the accessibility of its programs or activities to individuals with disabilities;
- Describes in detail the methods that will be used to make facilities accessible;
- Specifies the schedule for taking the steps necessary to achieve compliance with this section and identifies steps that will be taken each year; and
- Indicates the official responsible for implementation of the plan.

[13] https://www.codepublishing.com/WA/Richland/#!/Richland12/Richland1206.html%2312.06

[14] https://cleargov.com/resource/cleargov-prod/projects/documents/f7e43f6797daf93111af.pdf

PROGRESS MEASUREMENT AND EVALUATION

It is important to ensure ongoing transparency with stakeholders and the public regarding the progress of projects and strategies in this plan and their effects. The City has developed a method to measure progress over time during the implementation of this Comprehensive Safety Action Plan and future updates, looking at both outputs and outcomes.

PROJECT PROGRESS: OUTPUTS

Outputs are the direct projects and strategies implemented as a result of this safety plan. Each is evidence that activities were performed toward the goal of reducing the number and severity of collisions in Richland. Examples can include progress toward completion of:

- Safety projects (new pedestrian crossing upgrades, installation of a new mini-roundabout)
- Policy revisions (speed limit setting, neighborhood traffic calming)

For projects, this progress includes securing federal or state grant funding; completion of plans, specifications, and estimates; and construction of the project on the street. For policy revisions or additions, steps include assessment and analysis of a current policy, draft and final versions of revisions submitted to City Council, and implementation of the new policy that may lead to a safer roadway system. The City will develop and maintain a public Safety Projects and Strategies Progress Dashboard to update current and upcoming safety efforts.

PROJECT EFFECTIVENESS: OUTCOMES

Beyond tracking each action and activity, it is important to know how effective those projects, strategies, and policy changes are to the ultimate outcome - improving safety in Richland. The most common outcome measures in traffic safety are the number, type, and severity of roadway collisions.

- The number of people killed and seriously injured
- Rate of fatal and serious injury crashes, often normalized by population or vehicle miles traveled

The City will develop and maintain a publicly accessible Safety Outcomes Dashboard that displays available collision data, including at a minimum the number, type, and severity of crashes occurring in Richland. The City will update this dashboard at least bi-annually, as WSDOT updates and provides information to the City as part of the City Safety Program.

The City will also begin tracking the effectiveness of each project and strategy, using data available based on the type of implementation. For example, before-and-after crash data can be used to study the change in annual collisions at an intersection or along a corridor. For behavior-based strategies, studying the public's awareness of a campaign or their self-identified behavior in a survey can indicate the benefits of outreach and engagement.

APPENDICES

APPENDIX A: GRANT PROGRAMS

APPENDIX B: COLLISION HEAT MAPS

APPENDIX C: PEDESTRIAN CROSSING RANKING MATRIX

APPENDIX D: SAFETY COUNTERMEASURES TOOLBOX

APPENDIX E: DEFINITIONS

APPENDIX F: BENEFIT/COST RATIO SPREADSHEETS

APPENDIX A: GRANT PROGRAMS

Cities may be eligible to submit projects based on this safety analysis 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

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 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). Benton-Franklin Council of Governments (BFCG) funds a variety of projects in both urban and rural areas of Benton and Franklin Counties. The flexibility inherent in STBG means that most types of transportation projects. Project sponsors eligible to receive STBG funds include cities, counties, and Ben Franklin Transit. Roadway projects must be located on federal-aid routes. Projects located on rural minor collectors and local roads are ineligible. Eligible safety-related projects include bicycle and pedestrian facilities (including trails), modification of sidewalks to comply with the Americans with Disabilities Act, highway and transit safety projects, hazard eliminations, and railway/highway grade crossings. https://bfcog.us/wp-content/uploads/2020/01/2020-Call-for-Projects-Guidebook.pdf

STBG Set-Aside / Transportation Alternatives Program (TAP). BFCG will consider all eligible project types equally in this TAP grant process. However, BFCG typically has invested TAP funds in bicycle and pedestrian projects and programs. Eligible projects and activities include:

- Planning, design, and construction of on-road and off-road trail facilities for pedestrians, bicyclists, and other non-motorized forms of transportation, including sidewalks, bike infrastructure, pedestrian and bicycle signals, traffic calming techniques, lighting, and other safety-related infrastructure, and transportation projects to achieve compliance with the Americans with Disabilities Act of 1990.
- Planning, design, and construction of infrastructure-related projects and systems that will provide safe routes for non-drivers, including children, older adults, and individuals with disabilities to access daily needs.

https://bfcog.us/wp-content/uploads/2020/01/2020-Call-for-Projects-Guidebook.pdf

USDOT Safe Streets and Roads for All (SS4A). The United States Department of Transportation administers the Safe Streets and Roads for All (SS4A) discretionary program with $5 billion in appropriated funds over 5 years (FY2023-2027). The SS4A program funds regional, local, and Tribal initiatives through grants to prevent roadway deaths and serious injuries. It supports the U.S. Department of Transportation's National Roadway Safety Strategy and the USDOT's goal of zero roadway deaths. SS4A includes two grant types. https://www.transportation.gov/grants/SS4A

- **Planning and Demonstration Grants** provide Federal funds to develop, complete, or supplement a comprehensive safety action plan that includes a well-defined strategy to prevent roadway fatalities and serious injuries. It also funds supplemental planning and/or demonstration activities that inform the development of a new or existing Action Plan.
- **Implementation Grants** provide Federal funds to implement projects and strategies identified in an Action Plan to address a roadway safety problem. Projects and strategies can be infrastructure, behavioral, and/or operational activities. Applicants must have an eligible Action Plan to apply for Implementation Grants.

APPENDIX B: COLLISION HEAT MAPS

Figure B1 illustrates that **Entering at Angle Collisions** occur at most intersections in the city. There are several clusters of collisions of locations where this collision type occurred the most often. Examples include:

- Swift Boulevard and Jadwin Avenue intersection
- Williams Boulevard and Jadwin Avenue intersection
- Duportail Street: Keene Road to Queensgate Drive
- Gage Boulevard from Leslie Road to Keene Road
- North Steptoe Street and Canyon Street

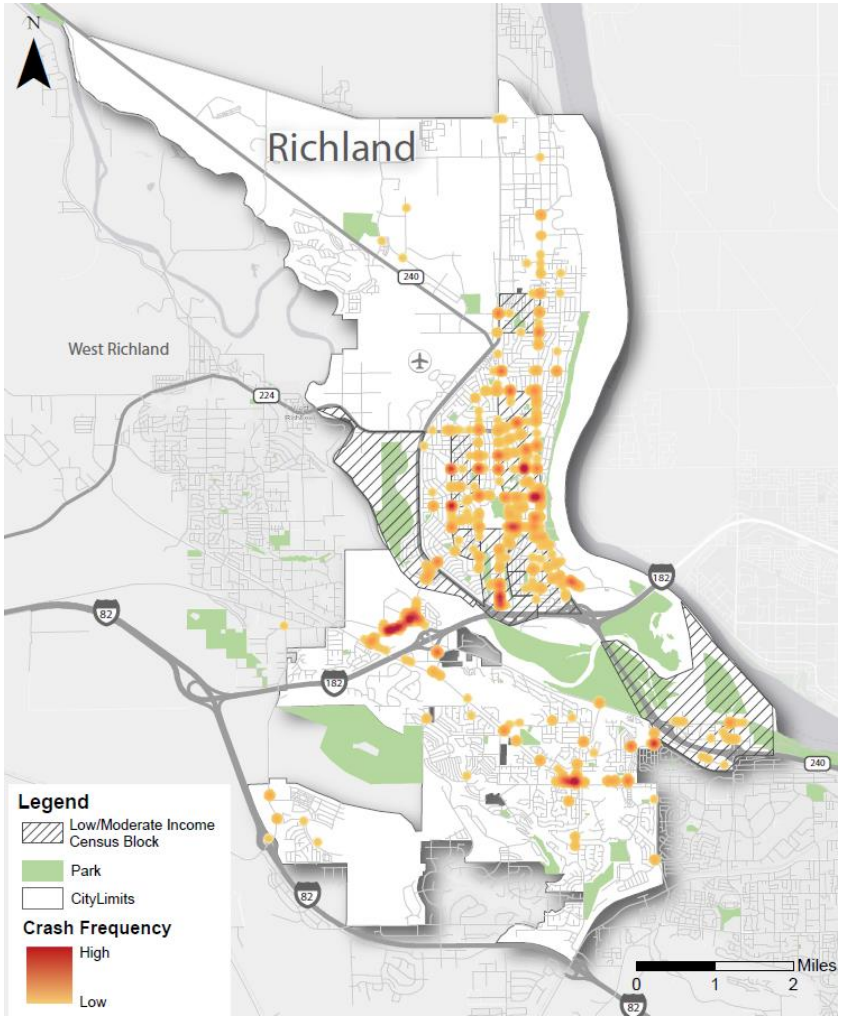


Figure B1. Heat Map of Entering at Angle Collisions at intersections, Richland (2018-2022).

The City of Richland maintains and operates 54 signalized intersections within the city limits.

Figure B2 shows the priority locations with the highest frequency of collisions at signalized intersections in the city.

- Swift Boulevard and Jadwin Avenue
- Swift Boulevard and George Washington Way
- Williams Boulevard and Jadwin Avenue
- Gage Boulevard and Leslie Road
- Keene Road and Duportail Street
- Keene Road and Queensgate Drive
- Queensgate Drive and Duportail Street
- Aaron Drive and Wellsian Way
- Jadwin Avenue and Lee Boulevard
- Saint Street and George Washington Way

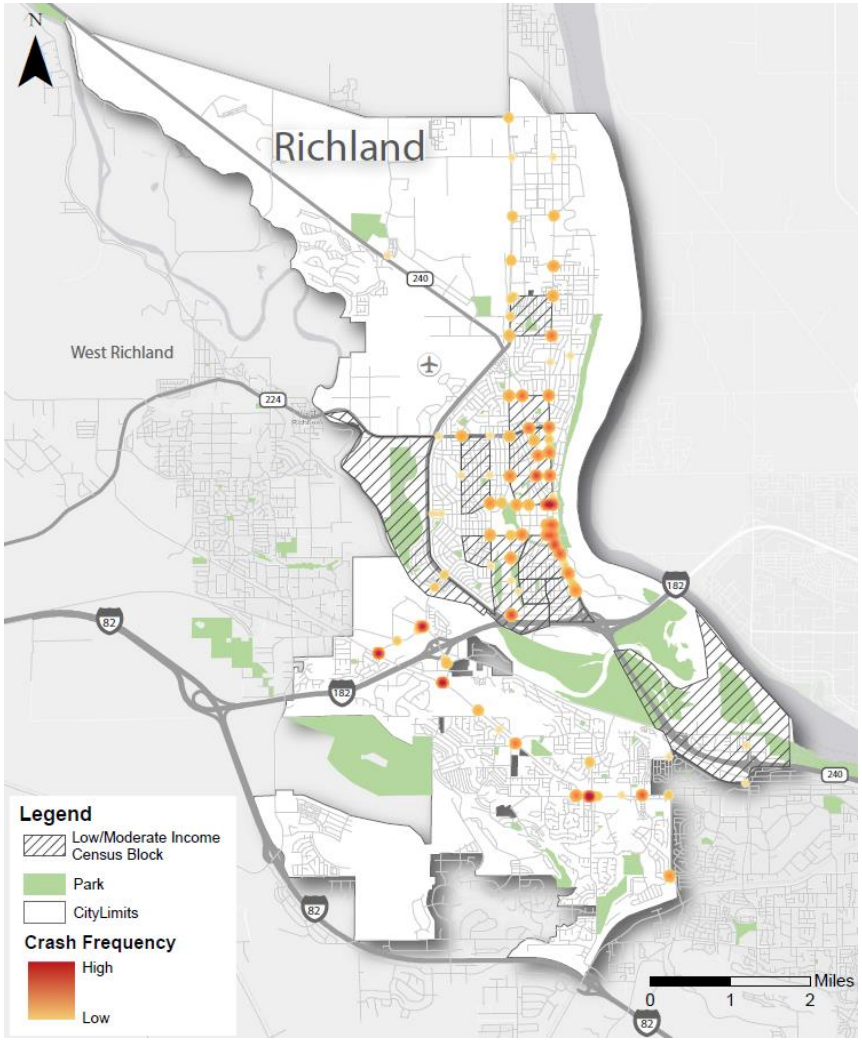


Figure B2. Heat Map of Collisions at Signalized Intersections, Richland(2018-2022).

Figure B3 shows the areas in Richland where roadway departure collisions occurred at the greatest frequency while navigating a curve based on roadway characteristics. Several locations show clusters of roadway departure collisions, including these intersections and segments.

- Jadwin Avenue from George Washington Way to approximately 450’ feet west of George Washington Way
- N Steptoe Street and Tapteal Drive intersection
- Queensgate Drive and Columbia Park Trail Roundabout
- Columbia Pt Drive between George Washington Way and Bradley Blvd
- George Washington Way from Gowen Avenue and Hains Avenue
- Stevens Drive and Catskill Street

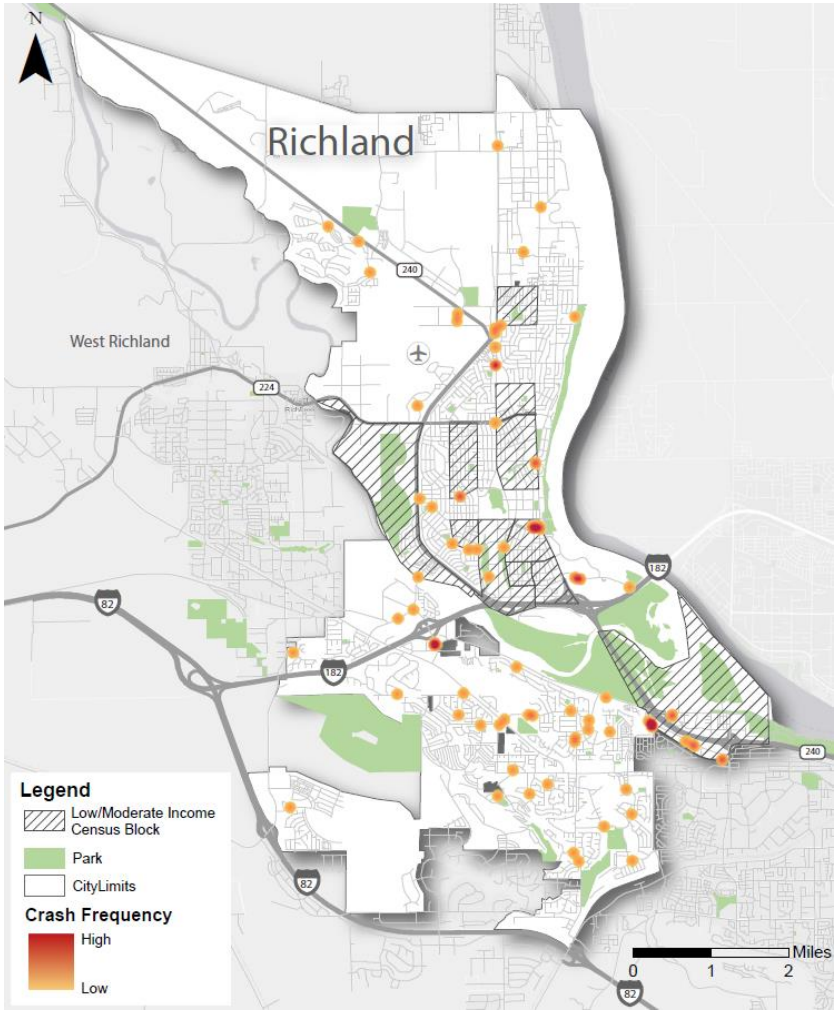


Figure B3. Heat Map of ‘Roadway Departure at Curves’ Collisions, Richland (2018-2022).

Figure B4 presents the heat map of all the collisions occurring in dark, dusk, or dawn conditions. There was a high concentration of dark crashes at the following intersections and along these corridors, among others.

- Duportail Street from Keene Road and Queensgate Drive
- Queensgate Drive and Keene Road Intersection
- Leslie Road and W Gage Boulevard
- George Washington Way from Colombia Pt Drive to Symons Street
- Gage Boulevard and Bellerive Drive Intersection
- Stevens Drive between Snyder Street and Vantage Highway

The City is completing a street lighting retrofit in 2022 that includes a consistent lighting standard.

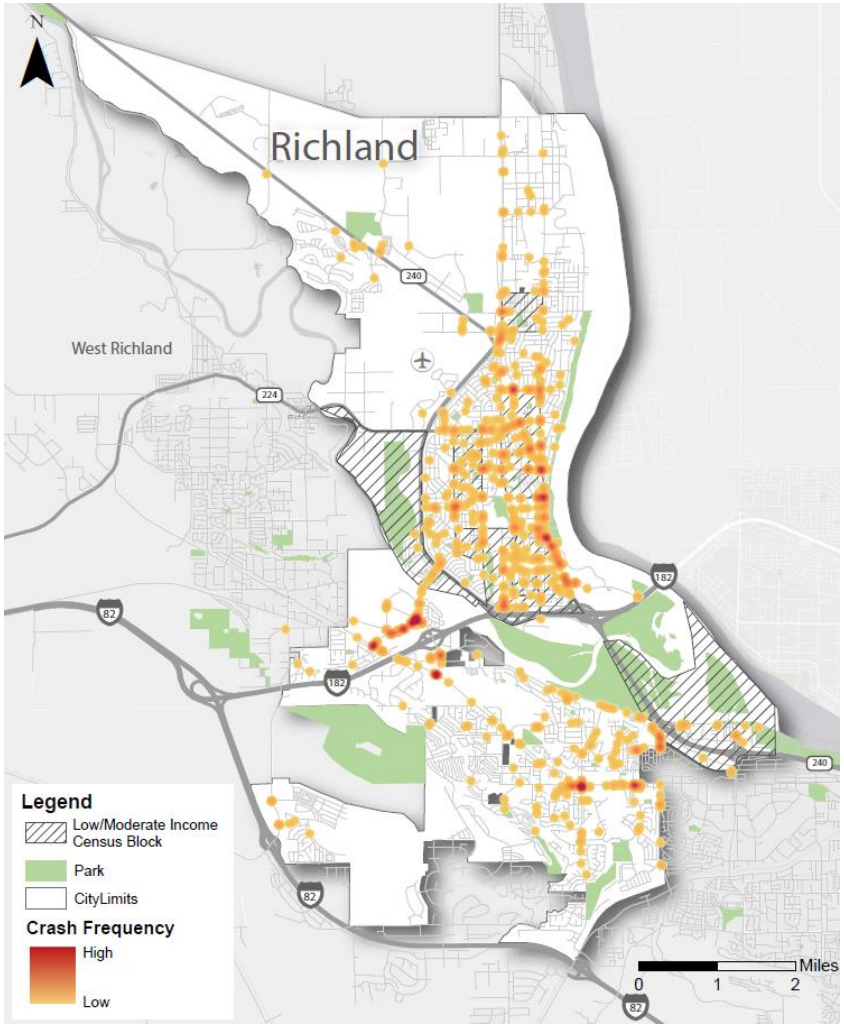


Figure B4. Heat Map of Collisions in Dark, Dusk, or Dawn Conditions, Richland (2018-2022).

There were 54 pedestrian-involved collisions and 41 bicyclist-involved collisions during the study period. Figure B5 displays a heat map of all the pedestrian-involved collisions to help identify areas where they occur most often. Figure B6 displays a heat map of bicyclist-involved collisions for the same purpose. The following locations are a sample of those that experienced the most pedestrian or bicyclist collisions in Richland.

- Gage Boulevard and Leslie Road
- Lee Boulevard and Wellsian Way
- Jadwin Avenue and Swift Boulevard
- Wilson Street and Jadwin Avenue intersection
- Jadwin Avenue and McMurray Street intersection
- George Washington Way: Falley Street to McMurray Street
- Thayer Drive and Lee Boulevard
- Williams Boulevard and Thayer Drive

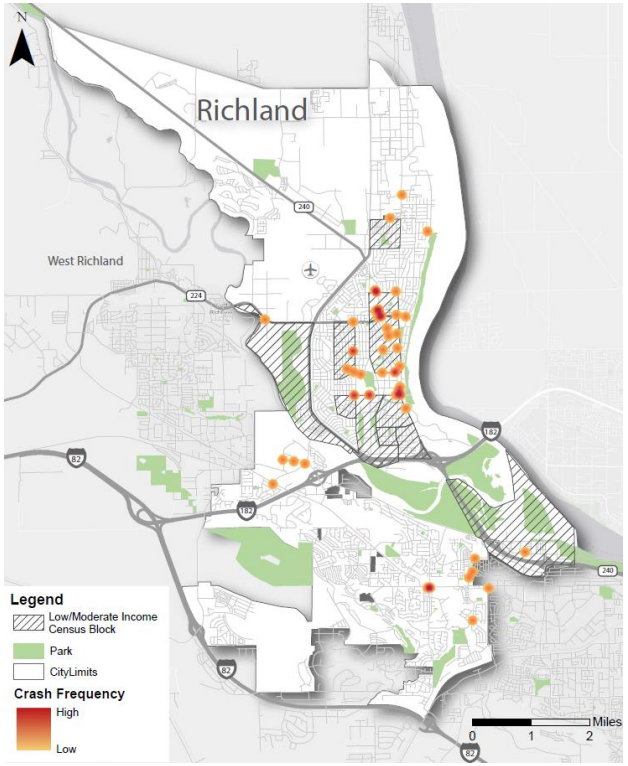


Figure B5. Heat Map of Collisions Involving Pedestrians, Richland (2018-2022).

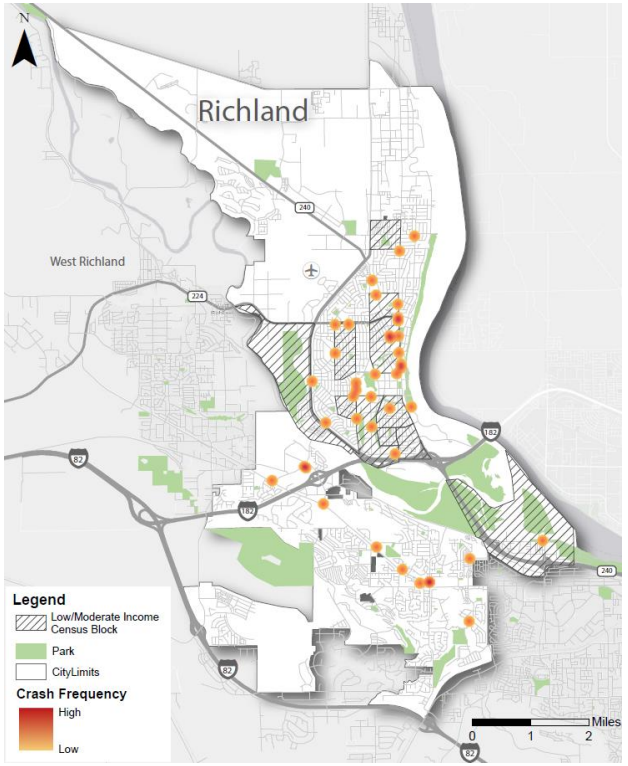


Figure B6. Heat Map of Collisions Involving Bicyclists, Richland (2018-2022).

There were 50 motorcyclist-involved collisions during the study period. Figure B7 displays a heat map of all motorcyclist-involved collisions to identify intersections and segments with a high frequency of this attribute. The most common locations for motorcycle-involved crash events were the following:

- Jadwin Avenue and George Washington Way intersection
- George Washington Way: Falley Street to University Drive
- Gage Boulevard and Leslie Road Intersection
- Wellsian Way from Lawless Drive to Aaron Drive
- N Steptoe Street: Canyon Street to Tapteal Drive
- Williams Boulevard to Stevens Drive

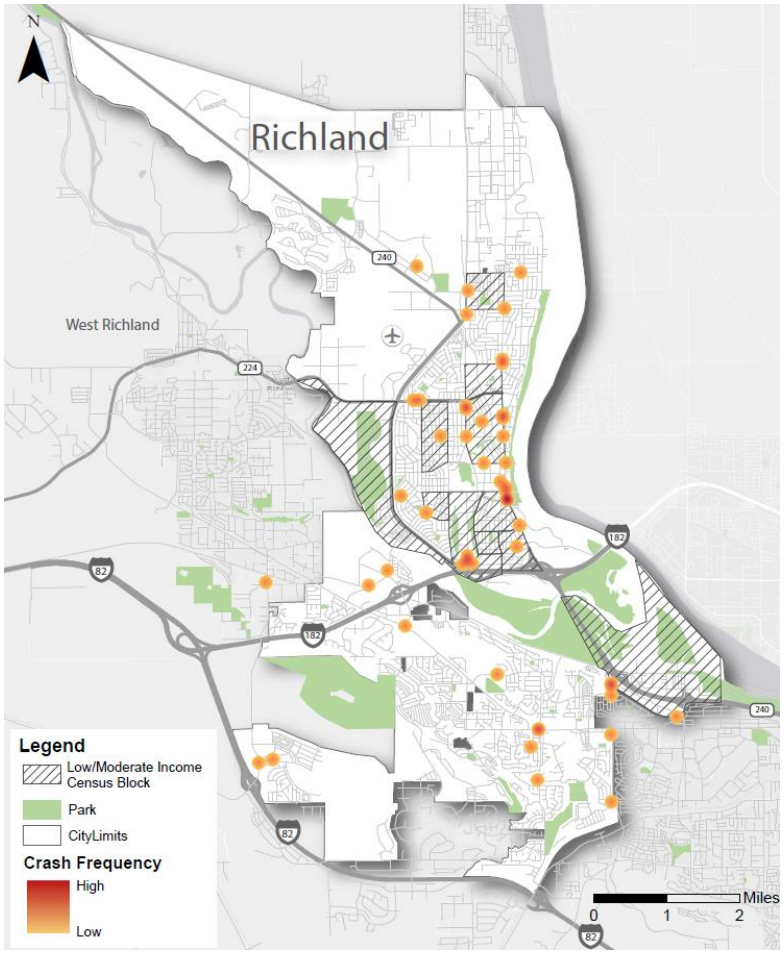


Figure B7. Heat Map of Collisions Involving Motorcyclists, Richland (2018-2022).

APPENDIX C: PEDESTRIAN CROSSING RANKING MATRIX

The City has developed a ranking system for pedestrian crossing the incorporates Average Daily Traffic (ADT), posted speed limit, number of lanes, collision history, potential curves or other distractions, and the proximity to destinations: transit stops, paths, schools, or other public facilities. The list below is the current ranking (updated in December 2023).

Table D1. RRFB Ranking Matrix Developed by the City of Richland (Ped/Bike Crash Data from 2018-2022).

RRFB Ranking Matrix		ADT			Speed			Lanes			Ped/Bike Related Crashes	Transit Stops	Low-Moderate Income	Public Facility, Path or School	Curve or Other Distraction	Point Total
		<9,000	9,000-15,000	>15,000	≤30	35	≥40	2	3	4+						
Location/Weighted Points Scale	**Status**	**0**	**1**	**2**	**0**	**1**	**2**	**0**	**1**	**2**	**3**	**2**	**1**	**2**	**2**	
George Washington north of Uptown (Torbett)				X		X				X	X		X	X		11
Van Giesen & Birch			X			X			X		X	X		X		10
Thayer & Lawless		X			X			X			X		X	X	X	8
Swift & Cottonwood			X		X			X			X	X		X		8
Gage & Peachtree				X	X					X		X			X	8
McMurray & Pike		X			X			X			X		X	X		6
Knight at Parkway		X			X			X				X		X	X	6
Bellerive at Keene Path Crossing		X			X			X			X			X		5
Stevens north of Swift (Hospital)		X			X			X				X	X	X		5
Leslie & Canyon			X			X			X						X	5
Queensgate - Btwn Alla Vista and Tuscany (Park Access)		X			X			X						X	X	4
Thayer at Torbett		X			X			X				X	X			3
Thayer at Symons		X			X			X				X	X			3
Thayer at Carmichael		X			X			X					X	X		3
Venus at Keene Path Crossing		X			X			X					X	X		3
Fowler & Georgia		X			X			X					X	X		3
Knight at Northgate Transit Center		X			X			X						X		2
Lee Crosswalk west of Collum			X		X			X					X			2
Long by Christ the King		X			X			X						X		2

APPENDIX D: SAFETY COUNTERMEASURES TOOLBOX

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

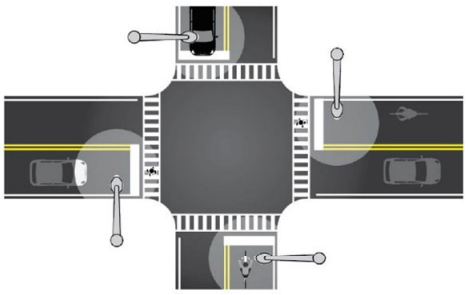
» Estimated $75,000

» 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).

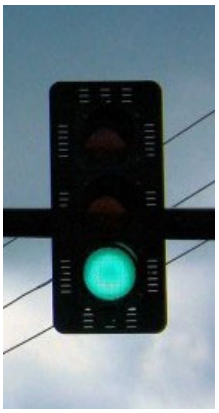
» 10 years of expected life

» 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)

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.

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITION

IMPLEMENTATION

S4. Install Left-turn Lane and Add Turn Phase

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.

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITION

IMPLEMENTATION

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

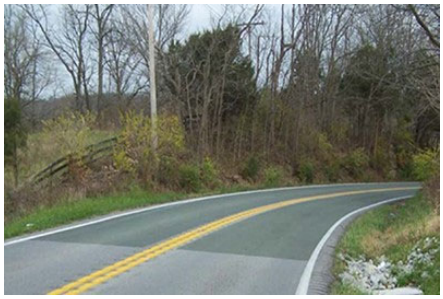
» Estimated $5,000 per intersection for materials and equipment

» 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.

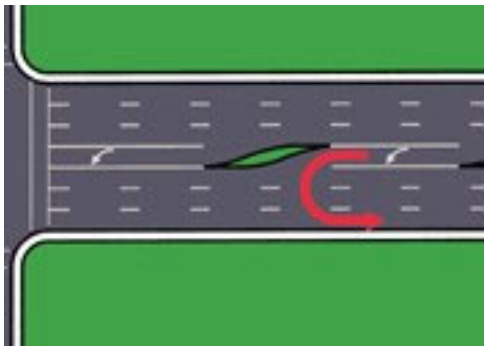
Benefit-Cost

- 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.

Sources: CA-Local Roadway Safety Manual

EXISTING CONDITION

IMPLEMENTATION



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.

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.

Sources: CA-Local Roadway Safety Manual

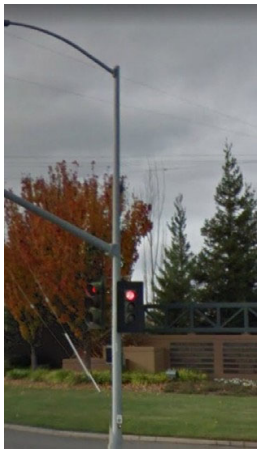
EXISTING CONDITION

IMPLEMENTATION

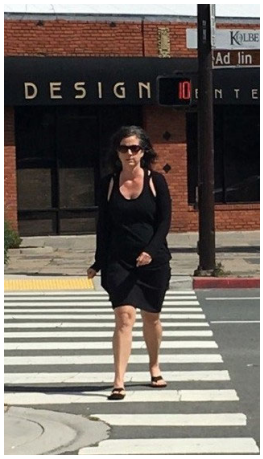
S9. Install Pedestrian Countdown Signal Heads

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

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.

IMPLEMENTATION

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

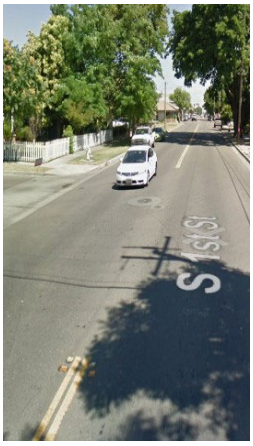
IMPLEMENTATION

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

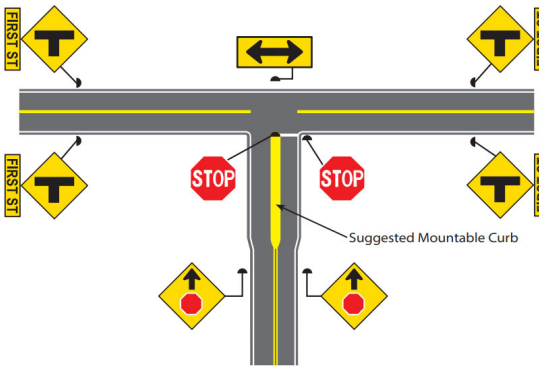
Target unsignalized intersections with patterns of rear-end, right- angle, or turning collisions related to lack of driver awareness of the presence of the intersection. The set of low-cost countermeasures is designed to increase drivers' alertness to the presence of the intersection and reduce potential 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.

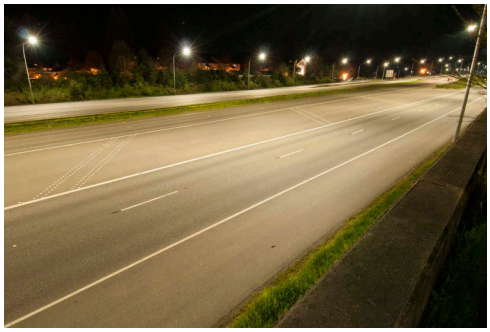
Benefit-Cost

- 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

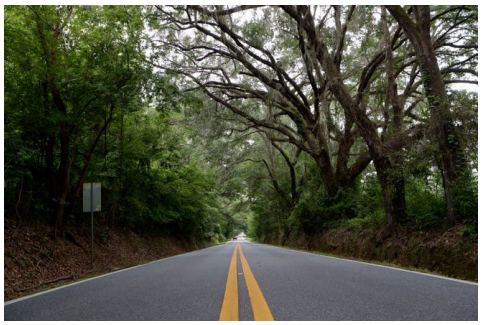
R5. Add 2 ft Paved Shoulder

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 E: DEFINITIONS

Intersection Related Crashes	This includes crashes that reported a junction relationship of “At Driveway within Major Intersection”, “At Intersection and Not Related”, “At Intersection and Related”, “At Roundabout but not Related”, “Circulating Roundabout”, “Entering Roundabout”, “Exiting Roundabout”,” Intersection Related but Not at Intersection”, “Roundabout Related but not at Roundabout” and “Traffic Calming Circle”.
Signalized Intersection	This includes intersection related crashes that reported a traffic control of “Signals” for at least one vehicle involved. This does not include any crashes that overlap with Unsignalized Intersections.
Unsignalized Intersection	This includes intersection related crashes that reported no traffic control of “Signals” for any vehicle involved. This does not include any crashes that overlap with Signalized Intersections.
Lane Departure	Lane departure crashes involve a vehicle unintentionally leaving its lane of travel. It is based on the WSDOT Target Zero Flag that includes crashes of indicator: • Boulder (stationary) • Bridge Rail - Face • Building • Concrete Barrier/Jersey Barrier - Face • Earth Bank or Ledge • Fence • Fire Hydrant • Garbage / Recycle Containers (Out for PU) • Guardrail - Face • Guardrail - Leading End • Guardrail - Through, Over or Under • Linear Curb • Mailbox • Metal Sign Post • Other Objects • Over Embankment - No Guardrail Present

	• Retaining Wall (concrete, rock, brick, etc.) • Roadway Ditch • Signal Pole • Snow Bank • Street Light Pole or Base • Traffic Island • Trailer Parked (Legally or Not) • Tree or Stump (stationary) • Utility Box • Utility Pole • Vehicle overturned • Wood Sign Post
Roadway Departure at Curves	This flag was created to identify roadway departure crashes that occurred along a curve. This includes all the crashes that were classified as "Lane Departure" and also reported the following roadway characteristic: • Curve & Grade • Curve & level • Curve & Hillcrest • Curve in Sag
Distracted Driver	Based on WSDOT Target Zero Flags, this includes crashes that are reported: • Inattention • Unknown Distraction • Disregard Stop and Go Light • Other Driver Distractions Inside Vehicle • Distractions Outside Vehicle • None • Improper Turn/Merge • Under Influence of Alcohol

	• Driver Interacting with Passengers, Anim • Operating Other Electronic Devices (comp • Operating Handheld Cell Phone • Eating or Drinking • Other Contributing Circ Not Listed • Did Not Grant R/W to Non Motorist • Other Distractions • Distracted by Other Occupant • Distracted by Adjusting Vehicle Cntrls • Did Not Grant RW to Vehicle • Lost in Thought / Day Dreaming • Operating Hands-Free Cell Phone • Exceeding Stated Speed Limit • Exceeding Reas. Safe Speed • Disregard Yield Sign - Flashing Yellow • Driver Adjusting Audio or Entertainment • Operating Defective Equipment • Follow Too Closely • Improper U-Turn • Under Influence of Drugs • Apparently Fatigued • Smoking • Apparently Asleep or Fatigued

APPENDIX F: BENEFIT/COST RATIO SPREADSHEETS

WSDOT Safety Program Benefit/Cost Worksheet

For Crash Reduction

Project name:	Systemic Stop Controlled Intersections: Tier 1
Application year:	2024
Agency:	City of Richland
Improvement:	Low Cost Stop Control Intersection Treatments, Actuated Intersection Warning Beacons, Mini Roundabouts, and Curb Extensions
Evaluator:	Houssam Ghandour, Sheida Carugati, Veronica Sullivan **Date:** 1/29/2024

1a. Initial Total Project Cost, I: **$1,602,000** **1b. Year 11 Cost, J:** $0

2. Annual Op. Costs, H: **$0**

3. Annual Safety Benefits in Number of Collisions:

Crash Type	Existing Raw #	Existing Calculated	After Raw #	After Calculated	Difference
a) Fatal injury	0	0.00	0.00	0.00	0.00
b) Suspected serious injury	1	0.20	0.73	0.15	0.05
c) Suspected minor injury	7	1.40	1.57	0.31	1.09
d) Possible Injury	13	2.60	3.69	0.74	1.86
e) Property damage only	28	5.60	8.64	1.73	3.87
Totals	49.00		14.63		6.87

4. Societal Costs Per Crash:

Crash Type	Cost
a) Fatality (K)	$3,423,400
b) Suspected serious injury (A)	$3,423,400
c) Suspected minor injury (B)	$237,400
d) Possible Injury (C)	$142,300
e) Property damage only (O)	$14,800

5. Annual Safety Benefits by Costs of Crashes:

Benefit
$0
$184,864
$257,794
$264,947
$57,309

Yearly Benefits= **$764,913**

7. Salvage Value, T

Feature	Cost		Factor	
a) Right of Way (from cost estimate)	$0	x	0.45 =	$0
b) Grading & Drainage (from cost estimate)	$0	x	0.40 =	$0
c) Structures (from cost estimate)	$0	x	0.43 =	$0
			d) Total, T:	**$0**

8. Present Worth of Costs (PWOC) = I + .68J + 13.59H - T:	$1,602,000
9. Present Worth of Benefits (PWOB) = 13.59 x Yearly Benefits:	$10,395,163
10. Net Benefit = PWOB-PWOC:	$8,793,163
11. Benefit Cost Ratio, B/C = PWOB/PWOC:	**6.49**

WSDOT Safety Program Benefit/Cost Worksheet

For Crash Reduction

Project name:	Systemic Pedestrian Crossings				
Application year:	2024				
Agency:	City of Richland				
Improvement:	RRFBs				
Evaluator:	Houssam Ghandour, Sheida Carugati, Veronica Sullivan			**Date:**	1/29/2024
1a. Initial Total Project Cost, I:	**$1,571,000**		**1b. Year 11 Cost, J:**	$0	
2. Annual Op. Costs, H:	**$0**				

3. Annual Safety Benefits in Number of Collisions:

Crash Type	Existing Raw #	Existing Calculated	After Raw #	After Calculated	Difference
a) Fatal injury	0	0.00	0	0.00	0.00
b) Suspected serious injury	1	0.20	0.93	0.19	0.01
c) Suspected minor injury	7	1.40	6.68	1.34	0.06
d) Possible Injury	6	1.20	5.93	1.19	0.01
e) Property damage only	28	5.60	23.3924	4.68	0.92
Totals	42.00		36.93		1.01

4. Societal Costs Per Crash:

Crash Type	Cost
a) Fatality (K)	$3,423,400
b) Suspected serious injury (A)	$3,423,400
c) Suspected minor injury (B)	$237,400
d) Possible Injury (C)	$142,300
e) Property damage only (O)	$14,800

5. Annual Safety Benefits by Costs of Crashes:

Benefit
$0
$47,928
$15,194
$1,992
$13,638

Yearly Benefits= **$78,752**

7. Salvage Value, T

Feature	Cost		Factor	
a) Right of Way (from cost estimate)	$0	x	0.45 =	$0
b) Grading & Drainage (from cost estimate)	$0	x	0.40 =	$0
c) Structures (from cost estimate)	$0	x	0.43 =	$0
			d) Total, T:	**$0**

8. Present Worth of Costs (PWOC) = I + .68J + 13.59H - T:	$1,571,000
9. Present Worth of Benefits (PWOB) = 13.59 x Yearly Benefits:	$1,070,238
10. Net Benefit = PWOB-PWOC:	($500,762)
11. Benefit Cost Ratio, B/C = PWOB/PWOC:	**0.68**