Local Roadway Safety Plan

Prepared by

City of Jurupa Valley

March 2022

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ACKNOWLEDGEMENTS

The 2022 Jurupa Valley Local Roadway Safety Plan was funded through a Local Roadway Safety Plan (LRSP) grant provided by the California Department of Transportation (Caltrans). The City of Jurupa Valley developed the plan to evaluate safety for all users of the right-of-way within Jurupa Valley. The study was prepared by the Jurupa Valley Department of Public Works with assistance from HR Green Pacific. Input was sought from the various stakeholders listed in this report and the public through the Jurupa Valley Traffic Safety Committee.

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By signing and stamping this Local Roadway Safety Plan report, the engineer is attesting to this report's technical information and engineering data upon which local agency's recommendations, conclusions, and decisions are made.

Section 148 of Title 23, United States Code
REPORTS DISCOVERY AND ADMISSION INTO EVIDENCE OF CERTAIN REPORTS, SURVEYS, AND INFORMATION — Notwithstanding any other provisions of law, reports, surveys, schedules, lists, or data compiled or collected for any purpose relating to this section, shall not be subject to discovery or admitted into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at the location identified or addressed in the reports, surveys, schedules, lists, or other data.

Section 1.
Introduction

In the City of Jurupa Valley, improvements to public safety on city streets is a priority. As part of meeting the City of Jurupa Valley's 2017 General Plan mobility goals of:

"…support the creation and maintenance of transportation networks (e.g., multi-use equestrian, pedestrian and bicycle trails, complete streets, sidewalks, airport, rail, and public transit) that are safe, attractive, and efficient and provide connectivity to meet the diverse needs for the movement of people and goods."

To support the goals of having thriving residents, safe communities, sustainable environment, and a robust economy, this Local Road Safety Plan (LRSP) identifies goals and implementation strategies to improve transportation safety in the City of Jurupa Valley.

"Transportation safety" implies the following: protection of life and property through regulation, management, and technology development of all forms of transportation. With collision data provided by the California Highway Patrol (CHP) and the Riverside County Crossroads database incident reports in the time period between 2016 and 2020, Jurupa Valley engineering staff was able to identify various factors that were a primary cause leading to roadway collisions. Jurupa Valley faces many challenges in improving road safety with a combinations numerous older narrow streets connecting its denser new denser suburban communities. In addition, many streets in the city were built to wider County of Riverside standards that have promoted faster speed and undesirable driving behavior. Behavioral driving habits tend to be a contributing factor in the majority of collisions in Jurupa Valley.

The purpose of this safety plan is to increase transportation safety awareness among the residents and visitors of Jurupa Valley, build and maintain working relationships with stakeholders to assist in the efforts of public outreach regarding transportation safety, while implementing engineering and behavioral safety improvements on the city's mobility network. The Local Roadway Safety Plan (LRSP) program will also be used to support requests for grant requests through the Highway Safety Improvement Program (HSIP) to provide funding for the implementation of safety improvements that will increase local road safety. HSIP grants, as well as motor fuel tax revenue, will be the primary sources to implement the strategies identified in this plan. Through a collaborative effort between safety stakeholders in engineering, enforcement, education, and emergency services, the city hopes to see a reduction in fatalities and serious injuries to meet its goals.

In the past 5 years, 1% of collisions in Jurupa Valley have resulted in fatalities, while about 1.7% of collisions have resulted in serious injuries. The city is targeting to reduce fatalities and serious injuries in the future.

Federal highway safety laws require the state to create this crash database for use in obtaining federal safety improvement funds. Under Section 409 of Title 23 of the United States Code, crash data is prohibited from use in any litigation against state, tribal or local government that involves the location(s) mentioned in the crash data.

Local Roadway Safety Plan Process

The LRSP process identifies four primary steps to follow for developing and implementing the local plan. These include 1) Identify Stakeholders, 2) Use Safety Data, 3) Choose Proven Countermeasures, and 4) Implement Solutions. This process is illustrated in **Figure 1**.

Figure 1 – Local Roadway Safety Plan Process

Section 2.
Overview

Vision & Goals

The vision and goals of the City of Jurupa Valley align with those in the California Strategic Highway Safety Plan. Those include the following:

> Vision: Safe public roads for all users.
> The vision emphasizes that safety on all public roads across the state is critical to serve the needs of the diverse population and system of California.
>
> Mission: Ensure safety for all modes of travel.
> The mission expands on the vision by acknowledging that safety on all public roads includes all modes of travel. California has an active and diverse population that utilizes a variety of modes that share common space on public roads.
>
> Goal: toward Zero fatalities and serious injuries.
> Expanding on the national Toward Zero Deaths (TZD) goal, the goal encourages setting realistic and achievable steps for California to move toward zero fatalities and serious injuries.
>
> *Source: California Safe Roads, 2020-2024 Strategic Highway Plan. Caltrans, 2020.*

The Jurupa Valley Local Road Safety Plan also aligns itself with the Mission of the Jurupa Valley General Plan of *"…support the creation and maintenance of transportation networks (e.g., multi-use equestrian, pedestrian and bicycle trails, complete streets, sidewalks, airport, rail, and public transit) that are safe, attractive, and efficient and provide connectivity to meet the diverse needs for the movement of people and goods,"* and more specifically with the strategic goal of maintaining Safe Communities.

Safety Partners

- Jurupa Valley City Council
- Riverside County Sheriff's Office
- County of Riverside
- Riverside County Fire Department (Cal Fire)
- Jurupa Unified School District
- Jurupa Area Recreation and Parks District
- Riverside University Health System
- California Department of Transportation (Caltrans)
- Residents of Jurupa Valley

Process

1. Collected city collision data for 2016 through 2020 *(last full years available at time of analysis)*
2. Data was analyzed by the engineering department
3. Identification of stakeholders
4. Stakeholder meeting(s)
    a. Held an initial meeting with the various Local Road Safety Plan stakeholders to:
        i. Discuss improving local road safety through the 4 E's (engineering,
        ii. enforcement, education, and emergency services)
        iii. Note existing efforts
        iv. Define emphasis areas using incident data and anecdotal evidence

    b. Follow-up meetings will be held to:
        i. Identification of safety countermeasures
        ii. Prioritization of investments

Ongoing Efforts

5. Continue to refine counter measures an update collision data each year
6. Linking projects/funding with planned investments

Existing Efforts

City of Jurupa Valley Department of Public Works

Jurupa Valley incorporates and/or considers safety in all maintenance and construction programs and projects. City staff annually reviews and maintains signing and traffic markings.

In June 2014, the California Manual on Uniform Traffic Control Devices (CAMUTCD) mandated agencies to implement a method to maintain minimum levels of roadside sign retroreflectivity by assessment and management. The city has implemented a program of checking sign retroreflectivity by measuring sign retroreflectivity with a portable retroreflectometer and comparing to the Minimum Maintained Retroreflectivity Levels (Table 2A-3 of the CAMUTCD). The management of sign retroreflectivity is Expected Sign Life. The goal is to replace identified signs occurs before the retroreflective sheeting has degraded below minimum standards. Typically, signs are replaced before the end of their expected sign life of 10 years. Replacement is based on average sheeting life and disregards differential degradation due to environmental conditions.

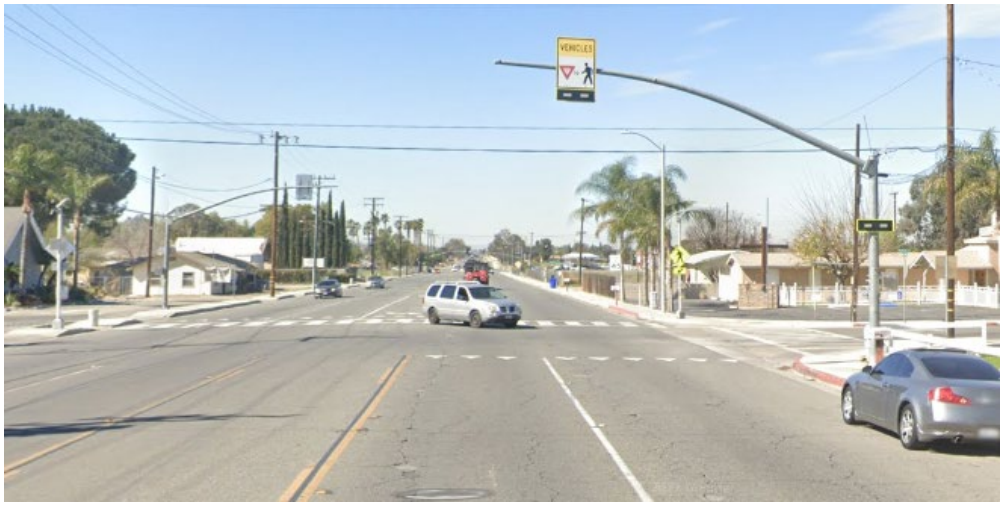
Engineering has also added safety enhancements through various public works projects. These enhancements include:

- Road Diet – Jurupa Road and Pyrite Street: Road diet projects were developed on sections of both streets that modified four-lane street section to two-lane section with a median turn lane and bike lanes on both sides.
- Sidewalks and ADA Ramps – New sidewalks have been added to several streets as part of infill projects and near schools. These projects have provided several miles of sidewalks to encourage students to walk to/from school and move pedestrians off from the shoulders of streets to safer spaces. ADA corner ramps have been updated in many parts of the city to provide better pedestrian accessibility.

Pyrite Street Road Diet and Sidewalks

- Bike Lanes – Bik lanes have been added as part of new development projects and several street resurfacing projects. These projects have created nearly 10 miles of new bike lanes in the city.
- Rectangular Rapid Flash Beacons (RRFBs) – RRFBs have been added at several uncontrolled crosswalks in the city, including at Limonite Avenue and Hudson Street.

Jurupa Road Bike Lanes



Limonite Avenue and Hudson Street RRFB

- Pedestrian Hybrid Beacon (PHB or HAWK) – A PHB was installed at the intersection of Limonite Avenue and Marlatt Street to accommodate pedestrian crossings to access the RTA bus stops on each side of Limonite Avenue.


Limonite/Marlatt Hybrid Beacon

- Pole-Top Flashers and Signpost Covers – The visibility of some signs was enhanced by adding pole-top flashers or reflective covers to signposts.

Reflective Signpost Covers and Pole-Top Flashers for Enhanced Sign Visibility

- High Visibility Sidewalks – The city has established that all crosswalks on controlled intersection approaches in areas with regular pedestrian activity shall be marked with ladder-type high visibility crosswalks.

Public Works annually restripes roadways in city on a rotational basis. As needed, reflective raised pavement markers are also added/refreshed in areas where there is limited street lighting.

Areas of Emphasis

Bikeway and Sidewalk Development – New construction projects or developments include bikeways on streets identified in the city's bicycle and pedestrian master plan and provide sidewalks on streets that will connect with the surrounding sidewalk system or provide new connections between desirable pedestrian origins and destinations. Capital projects include sidewalk infill where possible and stripe bike lanes and/bike routes when street restriping or resurfacing projects are being completed.

Roadside Hazard – New construction or road reconstruction includes improving the clear/recovery zones to the extent that available right of way and funding allows. New city street design standards are to be developed that consider the placement of roadside objects, limit the number of objects placed in the right-of-way, and locate fixed objects farther from the travel lane to reduce collisions with fixed objects.

System-Wide Signing Review – Staff shall review all street signs in the city to ensure they are compliant with CAMUTCD requirements for retroreflectivity, size and placement, and eliminate signs that are not needed to limit the number of roadside objects.

System-wide Striping Enhancements – The city currently refreshes roadway striping and markings on a rotational basis. Staff shall continue to review the performance of the materials being used for striping and marking and determine when longer lasting

material, such as thermoplastic in lieu of paint, should be used and at what intervals raised pavement markers should be removed and replaced to maintain suitable reflectivity.

Maintain and Enhance Public Reporting Portal – The city currently maintains a public portal for the general public to report directly to Public Works any concerns related to road maintenance in order for maintenance crews to respond on a priority basis. The city should continue to enhance this system to provide multiple methods for the public to report important issues and concerns.

Street Closure and Public Works Project Notices – The city keeps the public notified of many upcoming and current road closures through postings on the city's webpage. The webpage features regular updates of ongoing and new road closures due to weather, construction projects, or other unforeseen events. However, the information can often become 'stale' with timely updates not being provided, or by some not being removed in a timely manner. The city shall continue to develop and enhance a system for providing better real-time public updates of street closures and incidents to allow motorists to avoid problem areas.

Safe Routes to School (SRTS) Programs – These programs use a comprehensive approach to make school routes safer for children to walk and bike to school. Safe Routes to School programs are a sustained effort that involves identifying the issues and finding ways to improve and make walking or biking to school safer. By making it safer to walk or bike to school, Safe Routes to School programs promotes healthy, active lifestyles and creates the foundation for a more vibrant community.

Capital Improvement Projects with Safety Countermeasures

The city includes safety counter measures in capital projects whenever possible.
Current and recent projects that include(d) features to improve traffic safety for the previous Table 1.

Table 1 - City of Jurupa Valley Capital Projects to Improve Safety

Project Type	*Location*	*Measures*
HSIP Guardrail Project	Various Locations	Replacing dated guardrails in the city with current Midwest Guardrail design systems.
Bike Lanes	Wineville Avenue, Etiwanda Avenue, Bellegrave Avenue, Cantu-Galleano Ranch Road, Jurupa Road, Pyrite Street, Sierra Avenue	Install buffered bike lanes to provide segregated space for motor vehicles and bicyclists.
Bike Route	Lucretia Avenue	Install bike sharrows to designate bike route.
Road Diet	Pyrite Street and Jurupa Road	Reduced four-lane streets to three lane streets (two lanes plus median), plus bike lanes.
Sidewalks	Jurupa Valley High School, Rubidoux High School, Troth Elementary School, Glen Avon Elementary School, Camino Real Elementary School, Sunnyslope Elementary School	New sidewalks were or are being added as part of Active Transportation Program grants under the Safe Route to School program. Sidewalks are being added a minimum or ¼ mile from the schools with some extending up to about ½ mile.
Pedestrian Hybrid Beacon (PHB or HAWK)	Limonite Avenue and Marlatt Street intersection.	The beacon was added at the uncontrolled crossing of Limonite Avenue to facilitate access tot eh RTA bus stops located at the intersection.
Rectangular Rapid Flash Beacons (RRFBs)	Limonite Avenue/Hudson Street, Pyrite Street/Cassidy Circle	RRFBs were installed at active school crossings that are manned by crossing guards during school ingress and egress but are not controlled during other hours.
Add Left-Turn Lanes	Mission Boulevard, Jurupa Road	New painted median left-turn lanes were added to move left-turning vehicles out of the through lanes on these busy streets.

County of Riverside

The city has partnered with the County of Riverside on several major infrastructure projects and considers them to be an important partner in achieving the long-range safety goals. Projects the County has led for the city include:

- Pyrite Street Safe Route to School Road Diet
- Troth Street Safe Route to School Road Diet
- Van Buren Boulevard Resurfacing Project – Phase 1
- Limonite and I-15 Interchange Reconstruction Project
- Jurupa Road Grade Separation Project
- Market Street Bridge Replacement Project
- Mission Boulevard Bridge Replacement Project

The city also contracts with the County of Riverside Transportation Department Traffic Signal Shop to provide traffic signal maintenance services for the city.

Riverside County Sheriff's Department

The Riverside County Sheriff's Department (RCSD) is the contract law enforcement agency for the city. They provide policing services for general law enforcement, traffic enforcement, and commercial vehicle enforcement. The Sheriff's Office also partners with other local agencies to provide DUI and commercial vehicle checkpoints. Some of these services are funded by grants through the California Office of Traffic Safety (OTS).

Riverside University Health System (RUHS)

RUHS has partnered with the city on several initiatives including providing non-infrastructure support several Safe Route to School projects and supporting Healthy Community Element. For the SRTS projects RUHS conducted walk audits at various schools, provided parent education on walking and biking safety, and conducted outreach to the community to obtain important survey information.

Under the Healthy Communities Element, the effort is an element of the County of Riverside General Plan that speaks of the importance of promoting a healthy living environment for all residents. The Healthy Communities Element provides a framework for translating the General Plan vision for a healthy Riverside County into reality by identifying policies to achieve that vision. The Healthy Communities Element addresses areas where public health and planning intersect, including transportation and active living, access to nutritious foods, access to health care, mental health, quality of life, and environmental health.

Jurupa Valley City Council

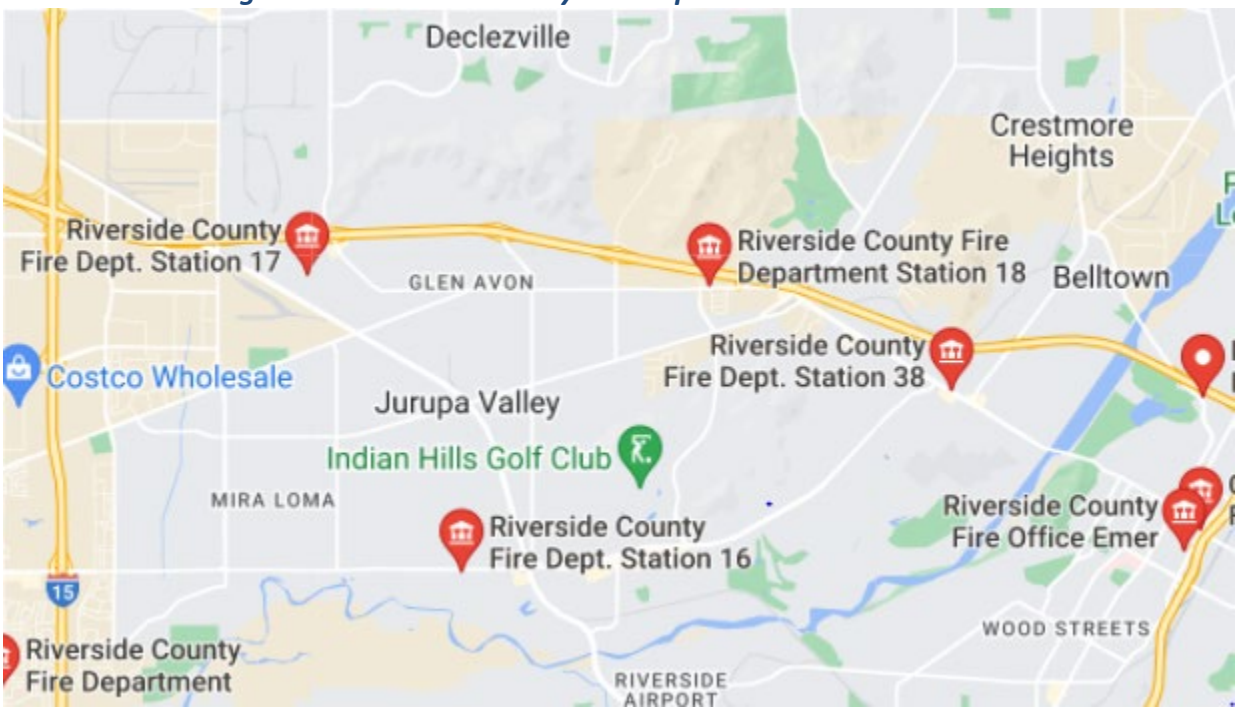
In addition to setting and adopting the polices and establishing programs for the various departments within the City of Jurupa Valley, the council members serve their constituents by gathering information on current issues happening within their district. Working with the Council, other city departments, and local residents, the City's Public Works Department obtains information on public concerns regarding road safety.

Riverside County Fire Department (Cal Fire)

The Riverside County Fire Department (RCFD) provides emergency services to the residents of Jurupa Valley. As a critical line of defense providing emergency services, road safety that will allow the department to provide services in a safe and efficient manner throughout the city over an increasingly congested street system remains a challenge. During the past few years there have been several collisions between the public and fire

and ambulance vehicles. There are four RCFD located within Jurupa Valley. They are station 16, 17, 18, and 38. The locations of these stations are shown in **Figure 1**.

Figure 1 – Riverside County Fire Department Station Locations



The city has installed emergency vehicle preemption (EVP) equipment at most of its traffic signals and the installation of up-to-date EVP equipment is required in all new traffic systems. The long-term goal to assist with RCFD response times is to develop an interconnected traffic signal system that will be able to provide real-time traffic information to responders so that any congested locations can be avoided or cleared to reduce response times and improve safety.

The department has a website (https://www.rvcfire.org) and various social media platforms as avenues for public outreach in sharing safety tips for fire prevention and hazard awareness. Additional efforts with public outreach over social media could include sharing training videos on vehicle extrication of individuals involved in motor vehicle collisions. to reduce the potential for future collisions with RCFD vehicles, the city modified the traffic signal system at the location in issue and modified the EVP detection system to address potential future problems. City staff works regularly with RCFD staff on development reviews and safety mitigation efforts to make the streets in Jurupa Valley safer for residents, visitors, and emergency responders.

Section 3.
Data Summary

Data obtained in this study is a combination of data gathered by city staff from the California Highway Patrol Statewide Incident Traffic Reporting System (SWITRS) reports and collision data stored in the countywide Crossroads database.

Roadway Inventory

There are currently about 400 centerline miles of public streets in the City of Jurupa Valley. However, the city continues to rapidly grow in size and population.

Study Period

The collisions data review period covered 2016 through 2020, as those were the five most recent years that full-year collision data was available. As the LRSP program is updated each year, collision data will be updated as new data becomes available.

Total Collisions

During the study period there were a total of 4,826 collisions on city streets. These included 3,019 collisions at intersections and 1,807 non-intersection collisions, as listed in **Table 2**. Intersection-related collisions are those that occur within 150 feet of an intersection.

The data indicates that collisions at intersections are more likely to result in non-fatal injuries than non-intersections collisions, but the non-intersection collisions generally result in more fatalities.

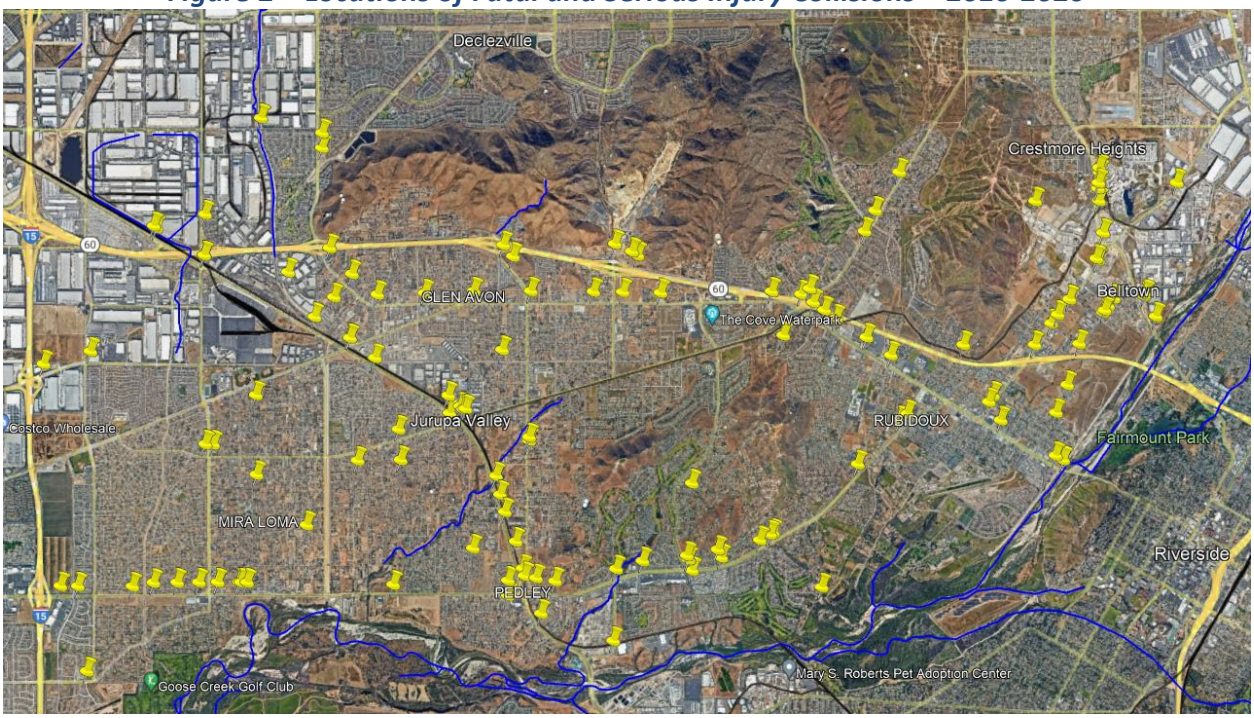
Table 2 – Intersection versus Non-Intersection Collisions

Collision Location / Severity	2016	2017	2018	2019	2020	total	%
Intersection – Fatal	2	2	11	2	5	22	43%
Non-Intersection / Mid-Block - Fatal	5	8	6	4	6	29	57%
Intersection – Serious Injury	8	9	7	12	12	48	58%
Non-Intersection / Mid-Block - Serious Injury	10	11	4	3	7	35	42%
Intersection – All Injury w/o Fatal	171	196	210	229	178	984	57%
Non-Intersection / Mid-Block – All Injury w/o Fatal	146	136	156	151	142	731	43%
Intersection – Property Damage Only	415	400	390	448	360	2,013	66%
Non-Intersection / Mid-Block – Property Damage Only	261	224	181	211	170	1,047	34%
Intersection – All Collisions	588	598	611	679	543	3,019	63%
Non-Intersection / Mid-Block – All Collisions	412	368	343	366	318	1,807	37%
Source: SWTRS and Riverside County Crossroads database, 2021							

Mapped Fatal and Serious Injury Collisions in Jurupa Valley (2016-2020)

The locations of fatal and serious injury collisions from 2016 and 2020 in the City of Jurupa Valley are shown in **Figure 2**. As expected, most of these collisions are clustered along the higher volume corridors in the city, including Limonite Avenue, Mission Boulevard, Rubidoux Boulevard, and Van Buren Boulevard.

Figure 2 – Locations of Fatal and Serious Injury Collisions – 2016-2020



Section 4.
Existing Conditions

Collisions by Injury Severity

The Federal Highway Administration (FHWA) classifies injury codes according to severity scale which differs from each State. For California, the KABC injury codes follow this convention and description:

K – Fatal Injury: Death because of injuries sustained in a collision or an injury resulting in death within 30 days of the collision.

A – Severe Injury: An injury other than a fatal injury which results in broken bones, dislocated or distorted limbs, severe lacerations, or unconsciousness at or when taken from the collision scene.

B – Other Visible Injury: This includes bruises (discolored or swollen); places where the body has received a blow (black eyes and bloody noses); and abrasions (areas of the skin where surface is roughened or blotchy by scratching or rubbing which includes skinned shins, knuckles, knees, and elbows).

C – Complaint of Pain: This classification could contain authentic internal or other nonvisible injuries and fraudulent claims of injury. Includes 1.) Persons who seem dazed confused, or incoherent [unless behavior attributed to intoxication, extreme age, illness, or mental infirmities]. 2.) Persons who are limping but do not have visible injuries. 3.) A person who is known to have been unconscious as a result of the collision, although it appears he/she has recovered. 4.) Persons who say they want to be listed as injured but do not appear to be so.

O – Property Damage Only – Non-Injury collisions

Total Fatalities and Serious Injuries

There were 138 total fatality and serious injury collisions representing 2.9% of total collisions on Jurupa Valley roads occurring from 2016-2020 as shown on **Table 3**.

Table 3 – Collisions by Severity

Injury Severity	*2016*	*2017*	*2018*	*2019*	*2020*	*Total*	*%*
Fatal (K)	7	10	17	6	12	52	1.1%
Serious Injury (A)	18	20	11	15	22	86	1.8%
Other Visible Injury (B)	75	73	66	69	68	351	7.3%
Complaint of Pain (C)	200	209	260	266	188	1,123	23.3%
Property Damage Only (O)	700	654	600	689	571	3,214	66.6%
Totals	1,000	966	954	1,045	861	4,826	
Source: SWITRS collision data, 2021.							

Pedestrians and Bicyclists

Walking and cycling is an activity for recreation or as a means of transportation within Jurupa Valley that is increasing in use. The older areas of Jurupa Valley were developed without sidewalks. All new developments include sidewalks; however, they may not connect to an external sidewalk system. **Figure 3** shows the areas within the city that do not have sidewalks.

There were 113 total collisions involving pedestrian, or 2.3% of all collisions, in the five-year analysis period. Of those 113 collisions, 89% resulted in a fatality or some level of injury. Only 12 of the 113 collisions did not result in some level of injury. Pedestrian violation were cited as a primary cause of the collision in 55 were a result of a pedestrian violation (e.g., crossing when it was not safe or at a mid-block location) while 58 involved a motorist violation (e.g., speeding or failure to yield when turning).

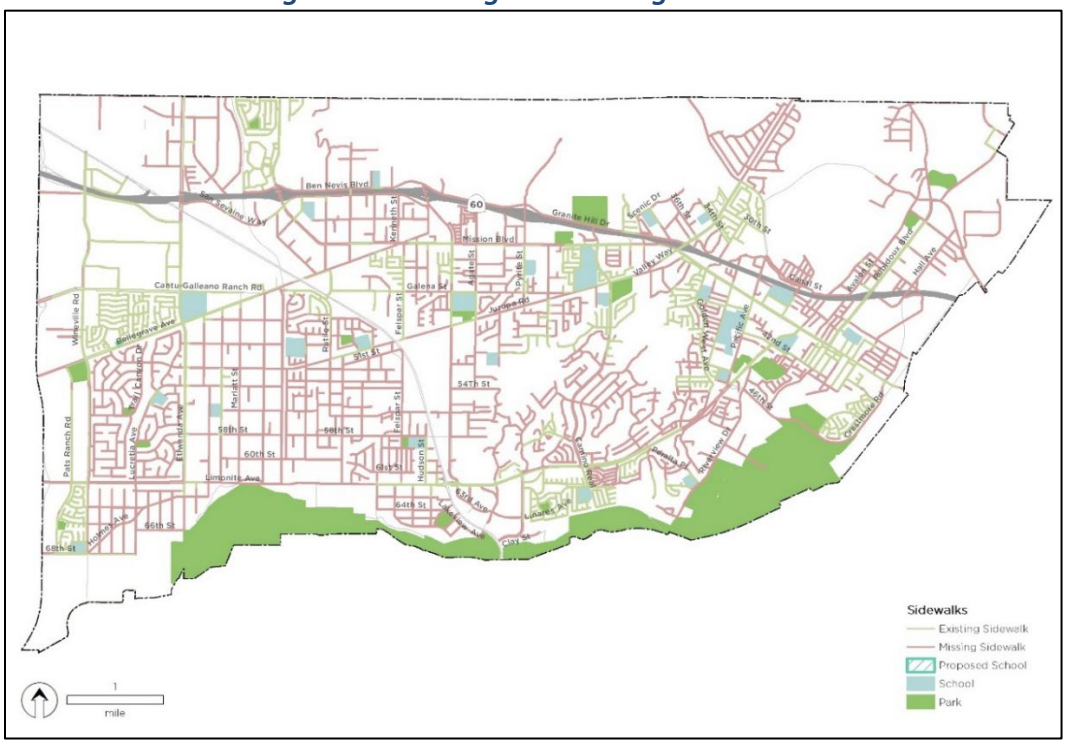
There was a total of 78 bicycle-involved collisions, or 1.6% or all collisions, during the five-year analysis period. Of those collisions, 77% resulted in either a fatality or some level of injury with including 6 serious injuries and 3 collisions resulting in the cyclist's death. Only 18 bicycle collisions resulted in property damage only.

The chances of an injury or death to a pedestrian involved in a 40mph collision is exponentially higher than a pedestrian involved in a 20 mph collision

Because pedestrians and bicyclists are particularly vulnerable, as most collisions with pedestrians or bicyclists results in some level of injury, it is important to

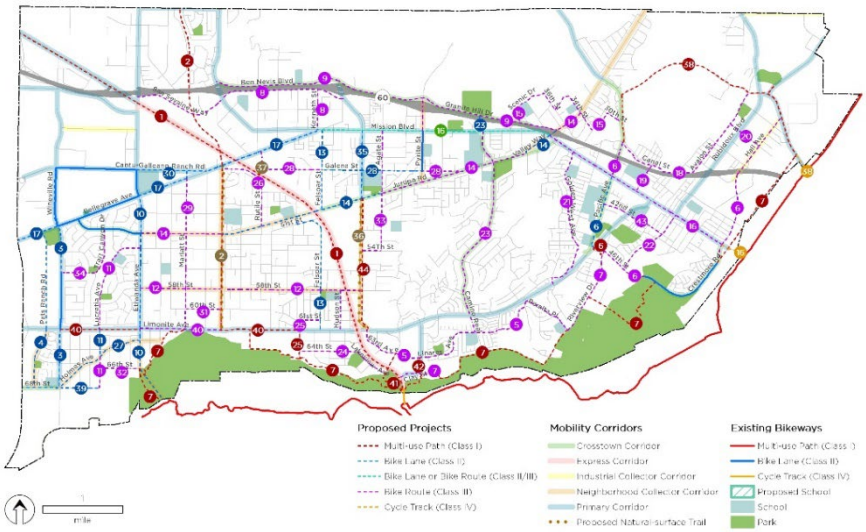
separate the right-of-way for these users versus motor vehicles i.e., sidewalks and buffered bike lanes or off-street trails). **Figure 4** illustrates the locations where bicycle facilities are currently developed along with the locations where future bicycle lane/route projects have been identified.

Figure 3 – Existing and Missing Sidewalks



Source: Jurupa Valley Citywide Master Plan for Bicyclists and Pedestrians, June 2018

Figure 4 - Existing and Future Bicycle Facilities



Source: Jurupa Valley Citywide Master Plan for Bicyclists and Pedestrians, June 2018

Collision Factors and Types

Observing the frequent primary collision factors (probable cause of the collision) among all traffic collisions from 2016- 2020 as seen in **Table 3**, the County and its stakeholders have identified these particular emphasis areas:

1. Improper Turning
2. Unsafe Speed
3. Auto Right-of-Way Violations (Failure to Yield the Right-of-Way), and
4. Driving Under the Influence (DUI)

These factors make up just over 76% of all collisions in Jurupa Valley. A contributing factor to each collision factor can also include distracted driving, especially at intersections and driveways of conflict points. Improved technology in consumer electronics and advancements in automobiles have created a potential increase of distracted driving in the former while unsafe speeding more likely in the latter. The collision data includes a data field indicating if a hands-free cellular device was being used. However, the determination of that may rely on the admission of the driver and not by the responding officer. The data indicated that for the 5-year analysis period the use of a cellular device was listed in only 38 collisions.

The types of collisions showed four predominant collision types. Those are 1) rear end collisions {27.2%}, 2) broadside collisions {26.8%}, 3) hit objects {18.1%}, and 4) sideswipe collisions {17.0%}. **Table 4** lists the various collision types by year.

Table 5 lists the collisions by what the vehicle collided with. As expected, the most common collision involvement was with another moving vehicle (64.5%), while the second most common was with a fixed object (17.1%) followed by parked vehicles (10.5%).

Table 3 - Primary Collision Factor 2016-2020

Contributing Cause	***2016***	***2017***	***2018***	***2019***	***2020***	***total***	***%***
Auto Right-of-Way Violation	172	118	114	161	67	632	**13.1%**
Brakes	0	0	0	0	1	1	0.0%
Driving Under the Influence	57	46	61	75	100	339	**7.0%**
Following too Close	17	12	5	7	4	45	0.9%
Impeding Traffic	3	0	2	0	1	6	0.1%
Improper Passing	25	25	16	15	14	95	2.0%
Improper Turning	291	312	286	275	248	1,412	**29.3%**
Lights	1	1	0	0	0	2	0.0%
Not Stated	5	8	0	27	111	151	3.1%
Other Equipment	0	0	0	1	1	2	0.0%
Other Hazardous Movement	38	24	26	28	10	126	2.6%
Other Improper Driving	4	4	5	10	4	27	0.6%
Other Than Driver	14	11	12	8	6	51	1.1%
Pedestrian Violation	12	9	16	18	10	65	1.3%
Pedestrian or Other Under the Influence	1	0	0	0	0	1	0.0%
Traffic Signal or Sign	36	66	55	52	29	238	4.9%
Unknown	14	13	20	17	16	80	1.7%
Unsafe Lane Change	2	8	4	6	0	20	0.4%
Unsafe Speed	253	262	279	294	201	1,289	**26.7%**
Unsafe Starting or Backing	45	39	47	40	32	203	4.2%
Wong Side of the Road	10	8	6	11	6	41	0.8%
total	1,000	966	954	1,045	861	4,826	

Source: SWITRS collision data, 2021.

Table 4 – Collisions Type by Year

Collision Type	*2016*	*2017*	*2018*	*2019*	*2020*	*Total*	*%*
Broadside	268	275	238	282	231	1,294	**26.8%**
Head-On	32	38	50	48	55	223	4.6%
Hit Object	173	155	175	185	187	875	**18.1%**
Other	42	23	21	13	8	107	2.2%
Overturned	17	8	10	9	10	54	1.1%
Rear-End	283	265	267	292	207	1,314	**27.2%**
Sideswipe	163	172	161	188	137	821	**17.0%**
Vehicle-Ped	15	24	30	26	24	119	2.5%
Not Stated / Blank	7	6	2	2	2	19	0.4%
Total	1,000	966	954	1,045	861	4,826	
Source: SWITRS collision data, 2021.							

Table 5 – Collisions Involved With by Year

Vehicle Collision With	*2016*	*2017*	*2018*	*2019*	*2020*	*Total*	*%*
Animal	3	3	7	1	3	17	0.4%
Bicycle	24	15	17	11	11	78	1.6%
Pedestrian	14	22	28	24	25	112	2.3%
Fixed Object	156	157	167	170	177	827	**17.1%**
Other Object	31	7	17	24	17	96	2.0%
Parked Motor Vehicle	107	107	103	90	101	508	**10.5%**
Non-Collision	8	7	7	2	7	31	0.6%
Not Stated	11	12	8	10	1	42	0.9%
Train	1	1	0	0	0	2	0.0%
Other Motor Vehicle - (same and other roadway)	645	635	600	713	519	3,113	**64.5%**
Total	1,000	966	954	1,045	861	4,826	
Source: SWITRS collision data, 2021.							

Section 5.
Emphasis Areas

Based on the collision data review, the following 4 emphasis areas were identified.

1. Improper Turning
2. Unsafe Speed
3. Right-of-Way Violation / Failure to Yield
4. Driving Under the Influence / Distracted Driving

The following provides the strategies and goals for each of the four each of the four emphasis areas.

Improper Turning Collisions

Collisions involving improper turning typically involve failure to yield the right-of-way to either oncoming or crossing traffic. That failure to yield can be to other motorists, pedestrians, or bicyclists. These types of collisions can also result in roadway departures of vehicles for various reasons. Vehicles departing the roadway can become overturned, strike fixed objects along the roadway, or can include head-on and sideswipe collisions with other vehicles. Intersections and street access, such as driveways, may or may not always be a factor in improper turning collisions, though often improper turning at intersections can result in more severe collisions due to vehicle speeds and the presence of pedestrians and bicyclists crossing the street. A challenge for law enforcement is to determine if an improper turning collision was from distracted driving or other factor since narratives without any other neutral observer may not indicate cell phone or electronic device usage prior to collision.

Other notes from the collision data on improper turning collisions include:

- Nearly 30%of all crashes from 2016-2020 were improper turning crashes
- 63% of all crashes from 2016-2020 occurred within 150’ of an intersection (Table 2)

Strategies for Emphasis Area 1:

- Education
  - Engagement with Sheriff, RUHS, JUSD, community groups, and Public Works to share materials and knowledge to increase public awareness of road safety.

- Target the distractions created by cell phone or electronic device use while operating a motor vehicle, and the likelihood of anyone being involved in a collision due to cell phone/electronic device usage.
- Encourage the public to report incidents of failing to stop at stop sign and traffic signals to collect statistical data on high violation areas.

- Enforcement
  - Saturated patrols to areas susceptible to distracted driving or where collision or traffic report data indicates regular incidents of failure to yield collisions, including failing to stop for stop signs and signals.

- Engineering
  - Public Works add improved signage retroreflectivity, add left turn lane pockets, guardrail improvements, improved thermoplastic striping and markings, clearing of roadside obstacles, intersection improvements, provide appropriate width travel lanes to control speeds, and widening shoulders in an incremental systemic approach. Whenever possible widen shoulders at least 4-6 feet to provide improved access to bicycles.
  - Public Works provide improved clear zone/sight distance, left turn pockets, and/or roundabouts along high incidents streets including Limonite Avenue, Mission Boulevard, and Rubidoux Boulevard.
  - Close the median opening at the Van Buren Boulevard and 56th Street intersection to prohibit uncontrolled left turns and extend the southbound acceleration and deceleration lanes.
  - Complete the five-lane cross-section of Rubidoux Boulevard between 20th Street and 30th Street.
  - Install larger mast arm left-turn signs at signalized intersections where collisions have been identified, especially for protected-permissive left turn locations.
  - Review intersection lighting at high-incident locations.

- Emergency Services
  - Ensure Opticom systems are updated and operating correctly at all signalized intersections.
  - Review need for signals at fire station driveways.

<u>Goals for Emphasis Area 1:</u>

- Reduce the percentage of all improper turning and failure-to-yield collisions by 15-20% and reduce the number of collisions resulting in death or serious injury by 10% by 2027.

- Reduce property damage to city assets by 20% due to collisions by 2025.
- Work with RCSD and community groups on promoting driver safety information and training/defensive driving courses for residents to increase safe driving habits.

Unsafe Speeds Collisions

Speeding is an issue that results in multiple collision types and is manifested on various types of streets. In low speed residential neighborhoods unsafe speed can result in sideswiping of parked cars, striking roadside objects, collisions with pedestrians and bicyclists, and broadside collisions with vehicles entering and existing side streets and driveways. On higher speed arterials, collisions involving unsafe speeds with typically result in more severe injuries and fatalities. These collisions involve roadway departures with vehicle rollovers or collisions with fix objects. As traffic volumes increase in the region, congestion has resulted in diverting overflow traffic from congested Caltrans freeways during peak hours onto the connecting city streets. Drivers then attempt to make up lost time by speeding along city streets.

A national trend however is the increase in aggressive driving combined with excessive speed. This has contributed to more collisions with both increased severity and ancillary damages. As driving is a goal-oriented activity, with the purpose of arriving at a destination quickly, when combined with technology making automobiles more comfortable and powerful than ever before this has contributed to increased collisions. Traffic collisions that occur close to intersections also could indicate instances of excessive speeding and/or distracted driving and the increased likelihood of a roadway lane departure, rear-end or head-on collisions.

Strategies for Emphasis Area 2:

- Education
    - All stakeholders have open discussions with targeted groups likely to exhibit forms of unnecessary risky driving (young drivers).
    - Obtain safety materials published by Caltrans, Federal Highway Administration (FHWA), the National Highway Traffic Safety Administration (NHTSA) and other organizations and post information on the city's website and distribute to other organizations and community groups promoting slower vehicle speeds and the hazards of speeding, especially to targeted drivers (young drivers).
    - Work with RCSD and JUSD on promotion of responsible driving to school-aged drivers.

- Enforcement
  - High Visibility Enforcement / Saturated Patrols
  - Assist with identifying specific travel corridors with unsafe speeding and passing through citation history

- Engineering
  - Identify corridors where excessive speeding and unsafe passing is likely to take place through RCSD citation history, roadway evidence (such as skid marks for rapid breaking, pavement rutting on the outside of curves, worn centerline markings, or high incidences of sign knockdowns or guardrail/fencing strikes), and concerned input through citizen/elected officials.
  - Review high incident corridors, especially school areas, for implementation of traffic calming and traffic control devices for reducing speeds.
  - Prepare new street section standards that incorporate narrower streets and Local Street and intersection traffic calming.
  - Identify locations for pilot project mini roundabouts, speed humps, and chicanes to reduce traffic speeds.
  - Install sidewalks in areas where travel speeds are incompatible with pedestrian activity.
  - Public Works to provide improved clear zone/sight distance, left turn pockets, reduce the number of roadside objects and hazards, improve/provide guardrails in areas with departure issues, and/or roundabouts along high incidents streets including Limonite Avenue, Mission Boulevard, and Rubidoux Boulevard.
  - Work with Caltrans on expansion of ramp areas to provide necessary capacity to limit diversion of overflow traffic to city streets.
  - Public Works to review traffic management options, including traffic signal synchronization programs, and search for available funding to implement programs that allow for effective traffic flow yet reduce instances of aggressive driving.
  - Incorporate traffic calming feature and Complete Streets designs into all new development activity.
  - Review the Capital Improvement Program (CIP) to identify priority locations based on collision and citation data.

- Emergency Services
  - Work with staff to identify high citation locations for identification and implementation of speed reduction measures.
  - Assist in identifying options for enforcement of speeds in residential neighborhoods.

Goals for Emphasis Area 2:

- Circulate informational material on distracted & aggressive driving to promote safe driving practices in Jurupa Valley by 2025.
- Observe a reduction of unsafe speed / right of way collisions resulting in death or serious injury by 15% by 2027.
- Increase awareness of aggressive driving habits through a collaborative public awareness campaign.
- Improve driver perceptions of safety through reviewing Yolo County Public Works capital improvement projects.

Right-of-Way / Failure to Yield Collisions

These types of collisions are similar to the improper turning collisions discussed above in Emphasis Area 1. These collisions, however, do not involve the violating vehicle turning or changing streets. They are most often the at-fault driver running a stop sign or traffic signal or failing to yield to another driver backing out of a driveway. These collisions are often exacerbated by excessive or unsafe speeds by the drivers and/or a lack of attention to their surroundings or distracted driving. Collison reduction strategies can include increasing the conspicuity of others at high collision locations and of roadside objects and hazards. Reducing driver overload is also important. When drivers have too much information to process they often can miss key information that would allow them to avoid a collision.

Strategies for Emphasis Area 3:

- Education
    - Engage stakeholders in open discussions with targeted groups likely to exhibit forms of unnecessary risky driving (especially young drivers).
    - Provide materials prepared by FHWA, NHTSA, and other sources on the dangers of aggressive and distracted driving to community groups.

- Enforcement
    - High Visibility Enforcement / Saturated Patrols
    - Assist with identifying specific locations with a citation and/or collision history.

- Engineering
    - Identify corridors and intersections where excessive vehicle right-of-way collisions occur by annually reviewing the top collision locations in the city.

- Identify and document unreported collision locations by identifying roadway evidence such as skid marks, damage on the outside of curves, worn centerline markings, or high incidences of sign and signal knockdowns or guardrail/fencing strikes.
- Public Works provide regular maintenance of vegetation blocking sight lines at intersection and signs or signals.
- Maintain and refresh signs and pavement markings at or approaching intersections.
- Review sight lines at intersections and restrict on-street parking near intersections that will restrict adequate visibility.
- Review development plans and construction and update development standards to ensure that driveways are not placed too close to intersections so as to limit sight distances.
- Use corner bumpouts at Collector and Local Street intersections to increase the visibility of pedestrians preparing to cross the street.
- Use colored bike lane boxed near intersection to alert motorists that the travel paths of bicyclists may cross with turning vehicles.
- Provide pedestrian-actuated crossing controls at uncontrolled high activity crossings. Use leading pedestrian intervals at signalized intersections where there is regular pedestrian activity.
- Use larger-than-standard mast arm signage at signalized intersections that have protected-permissive left-turn operations.

Goals for Emphasis Area 3:

- Circulate informational material on distracted & aggressive driving to promote safe driving practices in Jurupa Valley through Riverside County Sheriff's Department, the city website, social and religious groups, businesses serving alcohol in the city, and social networks.
- Observe a reduction of unsafe speed/right-of-way collisions resulting in death or serious injury by 15% by 2025.
- Increase awareness of aggressive driving habits through a collaborative public awareness campaign.
- Reduce property damage to city assets by 20% due to collisions by 2025.

Driving Under the Influence and Distracted Driving Collisions

In multiple locations, driving under the influence of alcohol and drugs, both recreational and prescription, has remained a challenge in traffic safety. As a primary collision factor, DUIs also will typically involve dangerous secondary collision factors. In reviewing DUI collision incidents in Jurupa Valley, the percentage of DUI collisions represents the

amount of collisions involving DUI over the total number of collisions for each type for that year.

BLOOD ALCOHOL CONTENT (BAC)
Table for Male (M) / Female (F)

Number of Drinks		Body Weight in Pounds								Driving Condition
		100	120	140	160	180	200	220	240	
0	M	.00	.00	.00	.00	.00	.00	.00	.00	Only Safe Driving Limit
	F	.00	.00	.00	.00	.00	.00	.00	.00	
1	M	.06	.05	.04	.04	.03	.03	.03	.02	Driving Skills Impaired
	F	.07	.06	.05	.04	.04	.03	.03	.03	
2	M	.12	.10	.09	.07	.07	.06	.05	.05	
	F	.13	.11	.09	.08	.07	.07	.06	.06	
3	M	.18	.15	.13	.11	.10	.09	.08	.07	
	F	.20	.17	.14	.12	.11	.10	.09	.08	Legally Intoxicated
4	M	.24	.20	.17	.15	.13	.12	.11	.10	
	F	.26	.22	.19	.17	.15	.13	.12	.11	
5	M	.30	.25	.21	.19	.17	.15	.14	.12	
	F	.33	.28	.24	.21	.18	.17	.15	.14	

Subtract .01% for each 40 minutes that lapse between drinks.
1 drink = 1.5 oz. 80 proof liquor, 12 oz. 5% beer, or 5 oz. 12% wine.
Fewer than 5 persons out of 100 will exceed these values.

Of the DUI related collisions between 2016 and 2020:

- 26.9% (22/82) of all injury (KABC) collisions
- 15.9% of all fatal/serious injury collisions (22/138)
- Occur primarily on weekends (Friday-Sunday)
- The number of DUI involved collisions has doubled in the last 5 years from a low of 46 in 2017 to 100 collisions in 2020.

<u>Strategies for Emphasis Area 4:</u>

- Education
  - All stakeholders continued support of education, emergency, and enforcement efforts with the RCSD and the Office of Traffic Safety for grants to bring DUI and distracted driving education to local schools.
  - Support of mandatory treatment programs, peer group counseling for prior DUI offenders.
  - Continued efforts to describe adverse effects of alcohol and drug abuse and its consequences on the roads.
  - Circulate informational material on distracted & impaired driving to promote safe driving practices in Jurupa Valley through Riverside County Sheriff's Department, the city website, social and religious groups, businesses serving alcohol in the city, and social networks.
  - Work with RUHS and Jurupa Unified School District on the distribution of materials to teens on the effects and consequences of DUI and distracted driving and riding with impaired/distracted drivers.

- Enforcement
  - Continue high-visibility enforcement.
  - Support RCSD efforts to obtain OTS grants for DUI checkpoints.

- Engineering
  - Increasing the clear recovery zones, when funding and right of way is available, could reduce the severity of collisions by providing an area clear of fixed objects if a vehicle leaves the roadway.
  - Adding or upgrading guardrail and end treatments.
  - Improved marking and signage especially on curves.
  - Improved lighting at intersections or horizontal curves.

Goals for Emphasis Area 4:

- Reduce the number of persons killed and seriously injured in alcohol/drug-involved collisions to less than 5% of all collisions by 2025.
- Prepare and provide driver educational materials on the city website and via handouts for distribution to stakeholders to community groups.
- Identify locations where concentrations of alcohol and/or drug-impaired drivers have been cited or involved in collisions.

Section 6.
PROVEN COUNTERMEASURES

FHWA's Proven Safety Countermeasures initiative (PSCi) is a collection of countermeasures and strategies effective in reducing roadway fatalities and serious injuries on our Nation's highways. Transportation agencies are strongly encouraged to consider widespread implementation of PSCs to accelerate the achievement of local, State, and National safety goals. More information on the proven countermeasures can be obtained through the FHWA's website at https://safety.fhwa.dot.gov/provencountermeasures/. Summary sheets with detailed descriptions of each of the various countermeasures are included in the Appendix. The proven countermeasures are classified by general areas as follows:

SPEED MANAGEMENT

- Safety Cameras
- Variable Speed Limits
- Appropriate Speed Limits for All Road Users

ROADWAY DEPARTURE

- Wider Edge Lines
- Enhanced Delineation for Horizontal Curves
- Longitudinal Rumble Strips and Stripes
- Roadway SafetyEdge
- Roadside Design Improvements
- Median Barriers

INTERSECTIONS

- Backplates with reflective borders
- Corridor Access Management
- Reduce Left-Turn Conflicts at Intersections
- Roundabouts
- Yellow Change Intervals
- Systemic Application of Multiple Low-Cost Countermeasures at Stop-Controlled Intersections

PEDESTRIAN/BICYCLIST

- Crosswalk Visibility Enhancements
- Bicycle Lanes
- Rectangular Rapid Flash Beacons
- Leading Pedestrian Intervals

- Medians and Pedestrian Refuge Islands
- Pedestrian Hybrid Beacons
- Road Diets / Roadway Reconfiguration
- Walkways

CROSSCUTTING

- Pavement Friction Management
- Lighting
- Roadway Safety Audits

The PSCIs are specific types of measures that have been studies to determine their effectiveness of reducing collisions by identifying collision reduction factors (CRFs). Those CRFs are used to calculate the expected benefit that will be achieved with the implementation of such measures. That is compared to the projected cost to implement each measure so that a benefit-cost ratio (BCR) can be developed. Based on the ranking of BCRs projects can be compared and a determination made as to which projects will provide the best return on investment and address the most serious safety issues.

Section 7.
IMPLEMENTATION OF COUNTERMEASURES

This penultimate step of the safety plan is determining and implementing the identification of specific projects and their priority for implementation of each project, or subsequently additional or modified projects.

Prioritization Strategy

The prioritization of the projects and initiatives identified in this report will be developed through a multi-tasked approach. Some initiatives will be implemented through changes to policies and standards along with regular reporting mechanisms. Others will be through programmed capital projects and companion efforts with area development and redevelopment projects. Yet others will be via grant-funded opportunities and can be advanced as funding is provided.

Through the collision data, and statistical evidence (e.g. RCSD incident reports, and an expectation of higher traffic volume locations) staff can identify where our safety stakeholders can focus implementation of safety countermeasures in engineering, enforcement, education, and emergency services.

Recommended Projects Incorporating Proven Countermeasures

Based on the strategies for the emphasis areas and the countermeasures listed in the previous sections, the projects/efforts listed in **Table 6** are recommended to reduce collisions and provide for safer streets for all users.

The timing and priority of these projects will be determined based on the availability of implementation funding, opportunities to combine activities with new development and/or other capital projects, and the regular review of the plan's effectiveness.

Capital Improvement Projects

The City of Jurupa Valley Capital Improvement Program (CIP) has many upcoming projects that aim to improve public safety on its road infrastructure network. Some of these projects either include or have the potential to include traffic safety devices and proven countermeasures to assist in addressing the issues identified in the previous report sections. A copy of the current CIP infrastructure program is included in the Appendix.

Key CIP and development-related projects that implement various street improvements and countermeasures include the following:

CIP Projects

Market Street Bridge Replacement

Replace the Santa Ana River bridge and widen Market Street to four lanes plus left turn lanes from north of Rivera Street in Riverside to north of 24th Street/Via Cerro. Provide wider shoulders and a pedestrian walkway.

Mission Boulevard Bridge Replacement

Replace the bridge over the Santa Ana River east of Crestmore Road and add a Class IV cycle track to the south side of the bridge and provide raised median.

HSIP Citywide Fiber Optic and Reflective Border Signal Backing Plate Modification Project

Develop citywide fiberoptic interconnect between traffic signals to allow for adaptive traffic signal interconnect and add reflective border traffic signal backing plates on all traffic signals.

HSIP Citywide Guardrail Upgrade Project

Replace out-of-date existing guardrails in various locations within the city with current Caltrans standard Midwest Guardrail Design sections and attenuators.

Development Projects

Rubidoux Boulevard and 20th Street/Market Street Intersection Modification

Add second turn lanes, remove freeflow right-turn lane, and remove median-mounted traffic signal poles and setback corner poles to reduce roadside hazards.

High Visibility Crosswalk Installation

As a requirement for various development project significant impacts existing crosswalks will be replaced with ladder-type high visibility striping and pedestrian-actuated flashers at select locations.

Rubidoux Boulevard Guardrail Project

The CalPortland Company is contributing to a project to install new guardrail along the east side of Rubidoux Boulevard between Production Circle and Castellano Road. The city will partner with CalPortland to complete the project.

Table 6 – Implementation Projects

Programs / Project / Countermeasure	Location	Discussion
PROGRAMS / STANDARDS		
CATEGORY: SPEED MANAGEMENT		
Appropriate Speed Limits for All Users – Identify locations where reduced speed limits may be warranted based on collision data or other appropriate metrics per AB 43.	Citywide	In 2014, the city reduced the speed limits on about 68% of surveyed (non-local) streets by 5 miles per hour. In 2021, AB 43 changed the rules for how speed limits are set in California. However, the rule changes do not take effect until June 2024 or until the Judicial Council completes additional steps.
Review residential neighborhood locations for radar speed feedback signs at selected locations.	Citywide	Prepare guidelines for analyzing the conditions suitable for the placement of speed feedback cameras to use in evaluating locations on the city street system to install speed feedback signs where speeding is an issue.
Install traffic calming measures on Local Streets in new development and on selected Neighborhood Collector streets.	Residential neighborhoods	In neighborhoods where there is curb and gutters installed, review options for installing traffic calming devices to slow traffic on selected neighborhood collector streets and those with a documented history of speeding problems.
Reduce the standard Local Street width from 40 feet to no more than 36 feet, unless there will be Class II bike lanes provided.	Local Streets	The city's typical local street cross-section is a 40-foot wide street in a 60-foot right-of-way. The wider street cross-section encourages speeding even when there is on-street parking present. Local Street standard cross-sections should be reduced to no more than 36 feet wide regardless of the right-of-way width unless Class II bike lanes are being included. Develop design standards that incorporate Complete Streets criteria and components to accommodate all potential users of the right-of-way.
Reduce Collector and Arterial Street through lane widths to 11 feet wide. Reduce select left-turn lanes to 10 feet if a raised median is installed and limited truck traffic is expected.	New development	Reducing lane widths will assist in reducing traffic speeds, will reduce crossing widths for pedestrians at intersections, and will reduce the amount of impermeable roadway surface and runoff. Narrower streets will also allow for wider runoff areas to create additional recovery area.
Reduce travel lanes by adding buffered bike lanes on Master Plan identified corridors.	Streets identified in the Citywide Master Plan for Bicyclists and Pedestrians	Reduce travel lane widths and stripe bike lanes on streets identified in the Bicycle and pedestrian master plan. On Camino Real between Jurupa Road and Limonite Avenue study the option to install a road diet and reduce the 4-lane cross-section to a 3-lane cross-section with bike lanes.
CATEGORY: ROADWAY DEPARTURE		
Wider Edge Lines	Citywide	Develop citywide striping and marking standards using 6" lines for regular line work and 8" line for wide lines. Establish when to use thermoplastic materials and when to use water-based paint. Establish standard markings for bike lanes and crosswalks. Install wider lines with all new and maintenance restriping.
Enhanced Delineation for Horizontal Curves	Citywide	Add W8-1 chevron signs to curves where there is either demonstrated roadway departure incidents or engineer's review of a documented design issue or roadside hazard. Add full-length pole reflective covers to all curve warning signs.
Longitudinal Rumble Strips and Stripes	Citywide	Review rural streets with limited lighting for the application of edge line rumble strips. Apply to streets with a history of run off the road collisions. Priority application to those streets with a posted speed of 45 miles per hour or higher. Install 6" edge lines on streets with a posted speed of over 40 miles per hour with limited street lighting.
Roadway SafetyEdge	Citywide	On all streets with no curb and gutter and a posted speed limit of 35 miles per hour and above install an FHWA SafetyEdge during all reconstruction and resurfacing projects and include with any new development where no curb and gutter, dike, or berm will be installed.
Roadside Design Improvements	Citywide	Remove unnecessary roadside features (signs, furniture, fixed landscaping, etc.) and relocate others farther from the travel lanes to improve clear zones. Locate/relocate all new and replacement traffic signal, flasher, and street light poles farther from the travel lane when possible to limit the potential for vehicle strikes, especially by trucks.
Median Barriers	Citywide	Install raised medians on major and arterial streets to limit turning activity to select controlled locations, reduce left-turn conflicts, and limit mid-block pedestrian crossings.
CATEGORY: INTERSECTIONS		
Traffic Signal Backplates with reflective borders	Citywide	Replace all traffic signal backing plates with reflective yellow perimeter plates to enhance signal visibility.
Corridor Access Management	Citywide	Consolidate development driveways where possible and install raised medians with spaced left-turn/U-turn locations to reduce turning movement conflicts. Have developments access directly onto side streets instead of arterials to reduce turning movement conflicts at driveways.

Table 6 – Implementation Projects

Programs / Project / Countermeasure	Location	Discussion
Roundabouts	Citywide	Install mini roundabouts along neighborhood collector streets to reduce travel speeds and eliminate stop sign violations. Identify locations along two-lane collector and secondary streets for the placement of roundabouts in lieu of traffic signals or all-way stop sign control.
Yellow Change and All-Red Intervals	Signalized intersections	Evaluate all traffic signals to ensure that appropriate yellow and all-red intervals are in place. Identify locations where the installation of yellow or red time extensions would reduce yellow and red light running.
CATEGORY: PEDESTRIANS / BICYCLES		
Crosswalk Visibility Enhancements	Intersections	Prepare citywide standards for crosswalk design and placement. Prepare an annual plan for crosswalk replacement with high a visibility design.
Bicycle Lanes	Locations identified in the Bicycle and pedestrian master plan	Install bike lanes per the city's bicycle and pedestrian master plan and allocate an annual budget to install new bike lanes. Develop standards for installing bicycle facilities as part of all development and CIP projects. Create a bicycle facilities capital fund for development impact contributions that will support bicycle facilities development.
Rectangular Rapid Flash Beacons (RRFBs)	Select uncontrolled crosswalks	Identify locations that would be suitable for the installation of RRFBs and identify funding programs. Locations would concentrate on Safe Route to School corridors and access to parks and community facilities.
Leading Pedestrian Intervals	Signalized intersections with regular pedestrian activity	At all traffic signals where there is regular pedestrian activity install leading pedestrian intervals to all pedestrians to begin crossing the street before the associated vehicle approach is released.
Medians and Pedestrian Refuge Islands	Locations with regular pedestrian crossing activity	Identify locations with regular pedestrian activity where pedestrians must either cross more than four total lanes (through and turning) or at midblock locations where pedestrians may be crossing at a slower pace and review for the installation of median refuge islands to reduce the unprotected crossing distance for pedestrians.
Road Diets / Roadway Reconfiguration	Select four-lane streets with traffic volumes not requiring four lanes	Road diets will reduce the street width without significantly the street capacity, especially when there are regular turning volumes at driveways or intersecting streets. Road diets will also reduce travel speeds, reduce the crossing distance for pedestrians, and can provide width needed to install bike lanes or buffers between travel lanes and parked vehicles.
Sidewalks / Walkways	Citywide per locations in the bicycle and pedestrian master plan, all new development, and safe route to school corridors.	Develop an annual program for the installation of new sidewalk on streets, especially near schools, parks, and community facilities.
CATEGORY: CROSSCUTTING		
Bi-Annual Road Safety Audit	Citywide	Conduct a bi-annual safety audit of city streets to identify higher incident locations and potential in-fill locations for missing infrastructure. Coordinate with incoming and on-going development projects and identify public-private partnerships for to expedite safety improvements.
PROJECTS		
CORRIDORS		
Install radar speed feedback signs	- Rubidoux Boulevard between: SR-60 and Mission Boulevard and between 24th Street and 30th Street - Agate Street between Galena Street and Mission Boulevard - Tyrolite Street between Whitney Drive and Mission Boulevard	Collision data, RCSD records, and Traffic Safety Committee proceedings have identified several corridors where excessive vehicle speeds are a regular issue. The installation of speed feedback signs along these corridors will assist in reminding drivers to watch their speed when traveling on these streets. In combination with other safety features and enforcement the signs will be part of a combined effort to improve safety and lower vehicle speeds.
Guardrails, edge line rumble strips, and wide edge line	Rubidoux Boulevard between Production Circle and Castellano Road	This segment of Rubidoux Boulevard has had a regular history of run-off-the-road crashes over the years. As noted in the previous section, CalPortland Company has agreed to partner with the city on funding the installation of guardrail along this section of Rubidoux Boulevard. In addition to the guardrail, the city should install wide edge lines and install outside shoulder rumble strips to alert drivers that they are straying from travel lane.
Install Road Diet to reduce existing four-lane section to three lanes with median left-turn lane.	- San Sevaine Way between Etiwanda Avenue and Mission Boulevard	San Sevaine Way has a history of drivers exceeding the speed limit and street racing. The installation of a road diet would eliminate the ability of drivers to drive side-by-side and provide a median left-turn lane for vehicles turning into the driveways and side streets along San Sevaine Way.

Table 6 – Implementation Projects

Programs / Project / Countermeasure	Location	Discussion
	- Camino Real between Whitney Drive and Limonite Avenue - Bellegrave Avenue between Etiwanda Avenue and Bain Street	The section of Camino Real between Whitney Drive and limonite Avenue has four-lanes with no left-turn lane, but has residential driveways along its entire length. There are no sidewalks along much of Camino Real, even though it is regularly used by students waking to and from the area schools. The wide street regularly has speeding issues which creates a safety problem. The road diet would allow for the development of sidewalks along Camino Real and/or bike lanes to improve safety. Bellegrave Avenue between Etiwanda Avenue and Bain Street has four lanes with no turn lanes. It also has a substantial volume of school-related traffic from Jurupa Valley High School. A road diet to reduce the street three lane along with the extension of Cantu-Galleano Ranch Road between Bellegrave Avenue and Etiwanda Avenue would divert most through traffic away from this segment of Bellegrave Avenue and improve both traffic and pedestrian safety.
Install traffic signals and restripe to a five-lane cross-section	Rubidoux Boulevard between 20th Street and 30th Street	Rubidoux Boulevard between 20th Street and 28th Street is mostly striped as four lanes with side street stop control at 26th and 28th Streets. The installation of traffic signals at 24th and 26th Streets along with restriping the street to five lanes will allow for progressive traffic signal timings to be installed to control the speed and volume of traffic on the street and allow for turning traffic to not stop in the through lanes when waiting turn.
Install Bike Lanes	Etiwanda Avenue between Limonite Avenue and Bellegrave Avenue	Install the bike lanes on Etiwanda Avenue per the prepared engineered plan through lane width reductions and reductions in some on-street parking.
Prepare traffic signal coordination plans.	- Limonite Avenue between Camino Real and Beach Street - Rubidoux Boulevard between 20th Street and Mission Boulevard - Mission Boulevard between Crestmore Road and Valley Way	Traffic signal progression can be used to control both corridor speeds and volumes by metering traffic through signalized intersections at a specific rate. These corridors have had various levels of traffic signal progression in the past. With the implementation of the citywide fiber optic project there will be more opportunity to implement adaptive traffic signal timings that can assist with moving traffic along streets at a safer and more efficient pace.
Install raised medians	- Mission Boulevard between Bellegrave Avenue and San Sevaine Way - Mission Boulevard between Valley Way and Pedley Road - Limonite Avenue between Pats Ranch Road and Etiwanda Avenue - Limonite Avenue between Etiwanda Avenue and Corey Street - Rubidoux Boulevard between El Rivino Road and 24th Street - Sierra Avenue from north of Karen Lane to Woodbriar Drive	These corridors are all five-lane streets that would benefit from the provision of raised medians to both separate opposing flows of traffic, but also provide access control and limit turning movements to controlled locations reducing the potential for collisions. Some segments of these streets have existing raised medians and some sections are being improved as part of ongoing development projects. In intermediate segments where there is no project to install raised median, capital projects need to be identified to finalize the median infill. These median projects could be funded through development impact fees or partially through grant funding if combined with other safety elements.
INTERSECTIONS		
Install yellow reflective edge traffic signal backing plates	All traffic signals	Complete the HSIP Cycle 5 grant-funded project to install reflective yellow edge backing plates on all traffic signals heads.
Remove northbound left-turn lane at intersection.	Van Buren Boulevard / 56th Street	With the development of a new signal-controlled median opening on Van Buren Boulevard at 52nd Street there is no need to maintain the uncontrolled left-turn access at the Van Buren Boulevard and 56th Street intersection. The connection of 56th Street to Van Buren Boulevard can be retained as a right-in/right-out access with expanded deceleration and acceleration lanes, but the new 52nd Street intersection will provide a safer access location.
Install leading pedestrian interval at traffic signals.	Mission Boulevard and Pedley Road and Mission Boulevard and Glen Street	To allow pedestrians to begin their crossing maneuver without vehicles beginning to start moving, install leading pedestrian intervals at signalized intersections that have regular pedestrian activity. The leading pedestrian interval will initiate a walk light for pedestrian a few moments before the adjacent through traffic is released. This will hold any conflicting turn traffic that would conflict with the pedestrian's path until after the pedestrian has begun crossing.

Table 6 – Implementation Projects

Programs / Project / Countermeasure	Location	Discussion
Install adaptive traffic signal controls with yellow and red light extensions, leading pedestrian intervals, and larger mast arm signage	Mission Boulevard between Crestmore Road and Valley Way	The signalized intersections in this segment of Mission Boulevard have regular pedestrian activity along with increasing vehicle volumes. The adaptive traffic signal timings along with leading pedestrian intervals will allow the traffic signals to adapt to changing traffic volumes during the day. The yellow and red light extensions are programming tools that allow the traffic signals to extend yellow and all-red light intervals if it appears that a driver may not get through an intersection before the conflicting traffic is released. The larger signage will provide a clearer and more prominent message to drivers, especially aging drivers and those with poorer eyesight.
Install traffic signals and left-turn lanes	Intersections of Rubidoux Boulevard with 24th Street and 26th Street	The installation of traffic signals along with striping left-turn lanes will allow for safer controlled turns at these intersections and allow for the implementation of progressive traffic signal timings that can be used to control speeds and meter traffic volumes along Rubidoux Boulevard.
Install mini roundabouts	- Intersection of Tyrolite Street and Halbrook Terrace - Intersection of Skyview Road and Sharon Way	These intersections have been used in the past as test cases for the effectiveness of lane striping on controlling vehicle speeds. Both have shown that additional traffic calming measures are required and the installation of all-way stop sign control has led to drivers just running the stop signs due to low off-peak traffic volumes. Mini roundabouts will provide speed control along the street without requiring vehicle to stop. As test locations, the successful implantation of these devices would support the installation of mini roundabouts at other problematic local and collector streets in the city.

Section 8.
EVALUATION & PLAN UPDATES

This final step of the safety plan is determining and implementing the process that will be used to evaluate the success of the plan, ensure implementation, and determine when an update is needed.

The City will continue to host meetings with stakeholders at least once a year to discuss implementation of the plan and strategies for each emphasis area.

- The plan will be evaluated every three years starting in 2025 to see how many goals have been reached or need to be adjusted.
- The plan-initiated projects will be evaluated for effectiveness five years after their implementation to determine their effectiveness.
- Every two years on opposite years as the application year for HSIP grant applications the plan will be reviewed to ensure it is current for locations where grant funding will be requested.

This LRSP is a living document that is recommended to be updated on a regular basis in order to utilize the latest data and detect trends. Collision data can be used to evaluate the success of the plan. The Jurupa Valley Department of Public Works will be the primary department responsible for updating this LRSP and will host stakeholder meetings to discuss implementation of the plan and strategies for each emphasis area.

APPENDIX

A. Fatal and Serious Injury Collision Locations – Intersections
B. Fatal and Serious Injury Collision Locations – Midblock
C. List of Proven Counter Measures
D. Jurupa Valley Capital Improvement Program List

Appendix A: Fatal and Serious Injury Collision Locations - Intersections

Rank	Intersection	Collisions		Rank	Intersection	Collisions
2016						
1	58th Street at Dodd Street	1		6	Kim Lane at Pedley Road	1
2	Canal Street at Mission Boulevard	1		7	Limonite Avenue at Peralta Place	1
3	Cantu Galleano Ranch Road at I-15 NB Off-Ramp	1		8	Mission Boulevard at Sikh Temple Way	1
4	Cantu Galleano Ranch Road at Wineville Road	1		9	Mission Boulevard at Pacific Avenue	1
5	Felspar Street at Mission Boulevard	1		10	Riverview Drive at Vista De Oro	1
2017						
1	63rd Street at Archer Street	1		7	El Palomino Drive at Limonite Avenue	1
2	Avon Street at Galena Street	1		8	Eucalyptus Avenue at Limonite Avenue	1
3	Ben Nevis Boulevard at Pedley Road	1		9	Grapevine Street at Philadelphia Avenue	1
4	Camino Real at Limonite Avenue	1		10	Lakeside Drive at Live Oak Drive	1
5	Country Village Rd at Oak Leaf Way	1		11	Mission Boulevard at Valley Way	1
6	De La Vista at Riverview Drive (E)	1		12	SR-60 WB On-Ramp at Valley Way	1
2018						
1	Bellegrave Avenue at Van Buren Boulevard	2		10	Jurupa Road at Mission Boulevard	1
2	26th Street at Hall Avenue	1		11	Jurupa Road at Van Buren Boulevard	1
3	28th Street at Rubidoux Boulevard	1		12	Limonite Avenue at Ridgeview Avenue	1
4	53rd Street at Beach Street	1		13	Limonite Avenue at Pats Ranch Road	1
5	56th Street at Van Buren Boulevard	1		14	Limonite Avenue at Peralta Place	1
6	Camino Montura at Union Street	1		15	Lindsay Street at Mission Boulevard	1
7	Clay Street at General Road	1		16	Mission Boulevard at Vernon Avenue	1
8	Clay Street at Limonite Avenue	1		17	Mountain Shadow Drive at Winncliff Drive	1
9	El Rio Avenue at Hall Avenue	1				
2019						
1	24th Street at Rubidoux Boulevard	2		8	Limonite Avenue at Pats Ranch Road	1
2	30th Street at Rubidoux Boulevard	1		9	Limonite Avenue at Lucretia Avenue	1
3	Archer Street at Limonite Avenue	1		10	Limonite Avenue at Van Buren Boulevard	1
4	Bellegrave Avenue at Van Buren Boulevard	1		11	Mission Boulevard at Pedley Road	1
5	Ben Nevis Boulevard at Mission Boulevard	1		12	Mission Boulevard at Opal Street	1
6	Etiwanda Avenue at Van Buren Boulevard	1		13	Mission Boulevard at Twining Street	1
7	Jurupa Road at Van Buren Boulevard	1				
2020						
1	24th/Market Street at Via Cerro	2		10	Beach Street at Jurupa Road	1
2	Etiwanda Avenue at Van Buren Boulevard	2		11	Camino Real at Limonite Av	1
3	20th Street at Rubidoux Boulevard	1		12	Country Village Road at Wagon Way	1
4	26th Street at Hall Avenue	1		13	Etiwanda Avenue at Jurupa Road	1
5	34th Street at Daly Avenue	1		14	Galena Street at Kingsbridge Lane	1
6	36th Street at Rubidoux Boulevard	1		15	Granite Hill Drive at Pyrite Street	1
7	53rd Street at Steve Avenue	1		16	Limonite Avenue at Ridgeview Avenue	1
8	56th Street at Van Buren Boulevard	1		17	Mission Boulevard at Pedley Road	1
9	Armstrong Road at Sierra Avenue	1		18	Studio Place at Van Buren Boulevard	1

Source: Riverside County Crossroads Database, 2022.

Appendix B: Fatal and Serious Injury Collision Locations – Midblock

Rank	Intersection	Collisions		Rank	Intersection	Collisions
2016						
1	Rubidoux Boulevard: Production Circle to Castellano Road	2		9	Granite Hill Drive: Camino Real to Pyrite Street	1
2	Felspar Street: 59th Street to 61st Street	1		10	68th St: Holmes Avenue to Carnelian Street	1
3	Hall Avenue: 28th Street to SR-60 W	1		11	Limonite Avenue: Beach Street to Bain Street	1
4	Rubidoux Boulevard: 26th Street to 28th Street	1		12	Limonite Avenue: Mann Avenue to Etiwanda Avenue	1
5	Wallace Street: Hall Avenue to 34th Street	1		13	Limonite Avenue: Etiwanda Avenue to Lucretia Avenue	1
6	Rubidoux Boulevard: 28th Street to 29th Street	1		14	Mission Boulevard: SR-60 WB On-ramp to Island Avenue	1
7	Canal Street: Alta Street to La Rue Street	1		15	Limonite Avenue: Lucretia Avenue to Wineville Avenue	1
8	Riverview Drive: Vista De Oro to Limonite Avenue	1		16	Pacific Avenue: Mission Boulevard to Rustic Lane	1
2017						
1	Van Buren Boulevard: Holladay Street to 56th Street	1		11	Pedley Road: Bravo Estates to Ben Nevis Boulevard	1
2	Rubidoux Boulevard: 26th Street to 28th Street	1		12	Jurupa Road: Mizar Way to Eclipse Avenue	1
3	Mission Boulevard: End to Crestmore Rd	1		13	Van Buren Boulevard: 56th Street to Jurupa Road	1
4	Rubidoux Boulevard 36th Street to Wilcox Square Alley	1		14	Van Buren Boulevard: Bellegrave Avenue to Etiwanda Avenue	1
5	Armstrong Road: Sierra Av to 30th Street	1		15	San Sevaine Way: RCFD Station 17 Driveway to Wacker Drive	1
6	Granite Hill Drive: Camino Real to Pyrite Street	1		16	Philadelphia Avenue: Chardoney Way to Grapevine Street	1
7	Live Oak Drive: Frazer Drive to Lakeside Drive	1		17	Troth Street: 48th Street to 50th Street	1
8	Camino Real: Parkland Club Drive to Limonite Avenue	1		18	Troth Street: 54th Street to 56th Street	1
9	Mission Boulevard: Tyrolite Street to Pyrite Street	1		19	Etiwanda Avenue: Iberia Street to SR-60 WB Off-ramp	1
10	Rubidoux Boulevard: Production Circle to Castellano Road	1		20	Pedley Road: Kim Lane to Golondrina Street	1
2018						
1	Limonite Avenue: Mann Avenue to Etiwanda Avenue	2		9	Market Street: End to 24th Street	1
2	Limonite Avenue: Peralta Pl to Camino Real	1		10	Riverview Drive: Kern Drive to Avenue Juan Diaz	1
3	Hall Avenue: Bell Avenue to El Rio Avenue	1		11	Limonite Avenue: Pats Ranch Rd to I-15 NB Off-ramp	1
4	Hall Avenue: El Rio Avenue to 26th Street	1		12	Jurupa Rd: Felspar Street to Van Buren Boulevard	1

Appendix B: Fatal and Serious Injury Collision Locations – Midblock

Rank	Intersection	Collisions		Rank	Intersection	Collisions
5	Hall Avenue: 26th Street to 28th Street	1		13	Van Buren Boulevard: Jurupa Road to Rutile Street	1
6	Rubidoux Boulevard: Avalon St to Production Circle	1		14	Van Buren Boulevard: Rutile Street to Bellegrave Avenue	1
7	Rubidoux Boulevard: 26th Street to 28th Street	1		15	Mission Boulevard: Lindsay St to His Way	1
8	Limonite Avenue: Pacific Av to Limonite Frontage	1		16	Mission Boulevard: Canal Street to Jurupa Road	1
2019						
1	Limonite Avenue: Etiwanda Avenue to Lucretia Avenue	1		6	20th Street: End to End	1
2	Van Buren Boulevard: Jurupa Road to Rutile Street	1		7	24th Street: Hall Avenue to Rubidoux Boulevard	1
3	Van Buren Boulevard: Holladay Street to 56th Street	1		8	Agua Mansa Rd: Brown Avenue to Wilson Street	1
4	Van Buren Boulevard: Limonite Avenue to Holladay Street	1		9	Market St: End to 24th Street	1
5	Limonite Avenue: Morton Avenue to Van Buren Boulevard	1				
2020						
1	Mission Boulevard: SR-60 EB Onramp to Soto Avenue	2		11	Camino Real: Limonite Avenue to Canyon Terrace Drive	1
2	Mission Boulevard: End to Crestmore Road	2		12	Mission Boulevard: SR-60 WB On-ramp to Island Avenue	1
3	Granite Hill Drive: Pyrite Street to Quartz Canyon Road	1		13	Van Buren Boulevard: Holladay Street to 56th Street	1
4	Rubidoux Boulevard: Production Circle to Castellano Road	1		14	Jurupa Road: Hill Place to Cedar Street	1
5	Rubidoux Boulevard: 36th Street to Wilcox Square Aly	1		15	Mission Boulevard: Hunter Street to Campbell Street	1
6	Armstrong Road: Gillam Street to Karen Lane	1		16	Jurupa Rd: Beach Street to Rutile Street	1
7	Sierra Avenue: Armstrong Road to Karen Lane	1		17	Mission Boulevard: His Way to Conning Street	1
8	Mission Boulevard: Canal Street to Jurupa Road	1		18	Limonite Avenue: Troth Street to Ridgeview Avenue	1
9	Fairbanks Avenue: Sedona Drive to Jurupa Road	1		19	Limonite Avenue: Ridgeview Avenue to Mann Avenue	1
10	Market Street: End to 24th Street	1		20	Limonite Avenue: Peralta Place to Camino Real	1

Source: Riverside County Crossroads Database, 2022.

Appendix C: List of FHWA Proven Counter Measures

U.S. Department of Transportation
Federal Highway Administration

Safety Benefits:

Flatten sideslope from 1V:3H to 1V:4H:

8%

reduction for single-vehicle crashes.[2]

Flatten sideslope from 1V:4H to 1V:6H:

12%

reduction for single-vehicle crashes.[2]

Increase the distance to roadside features from 3.3 ft to 16.7 ft:

22%

reduction for all crashes.[3]

Increase the distance to roadside features from 16.7 ft to 30 ft:

44%

reduction for all crashes.[3]

For more information on this and other FHWA Proven Safety Countermeasures, please visit https://safety.fhwa.dot.gov/provencountermeasures/ and https://safety.fhwa.dot.gov/roadway_dept/countermeasures/safe_recovery/clear_zones/.

FHWA-SA-21-029

Roadside Design Improvements at Curves

Horizontal curves account for 27 percent of all fatal crashes and 80 percent of all fatal crashes at curves are roadway departure crashes.[1] Roadside design improvements at curves is a strategy encompassing several treatments that target the high-risk roadside environment along the outside of horizontal curves. These treatments can reduce roadway departure fatalities and serious injuries by giving vehicles the opportunity to recover safely and by reducing crash severity.

Roadside design improvements can be implemented alone or in combination, and are particularly recommended at horizontal curves—where data indicates a higher risk for roadway departure fatalities and serious injuries.

Roadside Design Improvements to Provide for a Safe Recovery

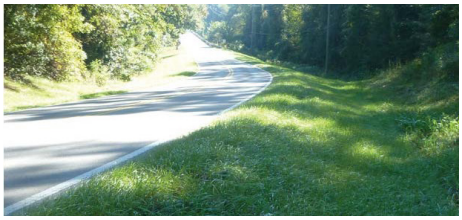
In cases where a vehicle leaves the roadway, having strategic roadside design elements, including an added or widened shoulder, flattened sideslopes, or a widened clear zone can provide drivers with an opportunity to regain control and re-enter the roadway in their lane or come to a safe stop before rolling over or encountering a fixed object.

- A **clear zone** is an unobstructed, traversable roadside area that allows a driver to stop safely or regain control of a vehicle that has left the roadway. Agencies should avoid adding new fixed objects such as trees and utility cabinets or poles in the clear zone. AASHTO's *Roadside Design Guide* details the clear zone width adjustment factors to be applied at horizontal curves.
- **Slope flattening** reduces the steepness of the sideslope to increase drivers' ability to keep the vehicle stable, regain control of the vehicle, and avoid obstacles. Slopes of 1V:4H or flatter are considered recoverable (i.e., drivers can retain control of a vehicle by slowing or stopping). Slopes between 1V:3H and 1V:4H are generally considered traversable, but non-recoverable (i.e., errant vehicle will continue to the bottom of the slope).
- **Adding or widening shoulders** gives drivers more recovery area to regain control in the event of a roadway departure.

Roadside Design Improvements to Reduce Crash Severity

Since not all roadside hazards can be removed, relocated, or redesigned at curves, installing roadside barriers to shield unmovable objects or steep embankments may be an appropriate treatment. Three common types of roadside barriers are:

- **Cable barrier** is a flexible barrier made from steel cables mounted on weak steel posts. Flexible barriers are more forgiving and have the most deflection.
- **Metal-beam guardrail** is a semi-rigid barrier where a W-beam or box-beam is mounted on steel or timber posts. These deflect less than cable barriers, so they can be located closer to objects where space is limited.
- **Concrete barrier** is a rigid barrier that has little to no deflection.



Clear zone provided on the outside of the curve. Source: FHWA.

1 Fatality Analysis Reporting System.
2 NCHRP Report 617: Accident Modification Factors for Traffic Engineering and ITS Improvements, (2008).
3 Elvik, R., and Vaa, T. Handbook of Road Safety Measures, (2004).

U.S. Department of Transportation
Federal Highway Administration

Safety Benefits:

RCUT
Two-Way Stop-Controlled to RCUT:

54%
reduction in fatal and injury crashes.[2]

Signalized Intersection to Signalized RCUT:

22%
reduction in fatal and injury crashes.[3]

Unsignalized Intersection to Unsignalized RCUT:

63%
reduction in fatal and injury crashes. [4]

MUT

30%
reduction in intersection-related injury crash rate.[5]

For more information on this and other FHWA Proven Safety Countermeasures, please visit https://safety.fhwa.dot.gov/provencountermeasures/ and https://safety.fhwa.dot.gov/intersection/rltci/index.cfm.

FHWA-SA-21-030

Reduced Left-Turn Conflict Intersections

Reduced left-turn conflict intersections are geometric designs that alter how left-turn movements occur. These intersections simplify decision-making for drivers and minimize the potential for higher severity crash types, such as head-on and angle. Two highly effective designs that rely on U-turns to complete certain left-turn movements are known as the Restricted Crossing U-turn (RCUT) and the Median U-turn (MUT).

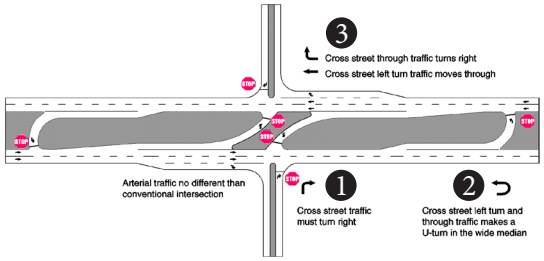
Restricted Crossing U-turn

The RCUT intersection, also known as a J-Turn, Superstreet, or Reduced Conflict Intersection, modifies the direct left-turn and through movements from cross-street approaches. Minor road traffic makes a right turn followed by a U-turn at a designated location—either signalized or unsignalized—to continue in the desired direction. The RCUT is suitable for and adaptable to a wide variety of circumstances, ranging from isolated rural, high-speed locations to urban and suburban high-volume, multimodal corridors. It is a competitive and less costly alternative to constructing an interchange. RCUTs work well when consistently used along a corridor, but also can be used effectively at individual intersections. Studies have shown that installing an RCUT can result in a 30-percent increase in throughput and a 40-percent reduction in network intersection travel time.[1]

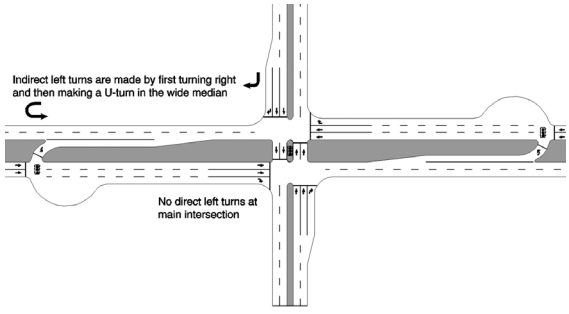
Median U-turn

The MUT intersection modifies direct left turns from the major approaches. Vehicles proceed through the main intersection, make a U-turn a short distance downstream, followed by a right turn at the main intersection. The U-turns can also be used for modifying the cross-street left turns, similar to the RCUT.

The MUT is an excellent choice for intersections with heavy through traffic and moderate left-turn volumes. Studies have shown a 20- to 50-percent improvement in intersection throughput for various lane configurations as a result of implementing the MUT design. When implemented at multiple intersections along a corridor, the efficient two-phase signal operation of the MUT can reduce delay, improve travel times, and create more crossing opportunities for pedestrians and bicyclists.



Example of a unsignalized RCUT intersection. Source: FHWA



Example of a MUT intersection. Source: FHWA

1 Hugher and Jagannathan. Restricted Crossing U-Turn Intersection. FHWA-HRT-09-059, (2009).
2 Edara et al. Evaluation of J-turn Intersection Design Performance in Missouri. MoDOT, (2013).
3 Hummer and Rao. Safety Evaluation of a Signalized Restricted Crossing U-Turn. FHWA-HRT-17-082, (2017).
4 Hummer et al. Superstreet Benefits and Capacities. FHWA/NC/2009-06, NC State University, (2010).
5 Synthesis of the Median U-Turn Treatment, Safety, and Operational Benefits, FHWA-HRT-07-033, (2007).

U.S. Department of Transportation
Federal Highway Administration

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

This systemic approach to intersection safety involves deploying a package of multiple low-cost countermeasures, including enhanced signing and pavement markings, at a large number of stop-controlled intersections within a jurisdiction. These countermeasures increase driver awareness and recognition of the intersections and potential conflicts.

Safety Benefits:

10%
reduction of fatal and injury crashes at all locations/types/areas.

15%
reduction of nighttime crashes at all locations/types/areas.

27%
reduction of fatal and injury crashes at rural intersections.

19%
reduction of fatal and injury crashes at 2-lane by 2-lane intersections.

Average Benefit-Cost Ratio

12:1

For more information on this and other FHWA Proven Safety Countermeasures, please visit https://safety.fhwa.dot.gov/provencountermeasures/ and https://safety.fhwa.dot.gov/intersection/stop/fhwasa18047.pdf.

There are several benefits to systemically applying multiple low-cost countermeasures at stop-controlled intersections, including,

- Resources are maximized because the treatments are low cost.
- A high number of intersections can receive treatment.
- Improvements are highly cost-effective, with an average benefit-cost ratio of 12:1, even assuming a conservative 3-year service life.

Example of countermeasures on the through approach.
Source: South Carolina DOT

Example of countermeasures on the stop approach.
Source: South Carolina DOT

The low-cost countermeasures for stop-controlled intersections generally consist of the following treatments:

On the Through Approach

- Doubled-up (left and right), oversized advance intersection warning signs, with supplemental street name plaques (can also include flashing beacon).
- Retroreflective sheeting on sign posts.
- Enhanced pavement markings that delineate through lane edge lines.

On the Stop Approach

- Doubled-up (left and right), oversized advance "Stop Ahead" intersection warning signs (can also include flashing beacon).
- Doubled-up (left and right), oversized Stop signs.
- Retroreflective sheeting on sign posts.
- Properly placed stop bar.
- Removal of vegetation, parking, or obstructions that limit sight distance.
- Double arrow warning sign at stem of T-intersections.

Source: T. Le et al. "Safety Effects of Low-Cost Systemic Safety Improvements at Signalized and Stop-Controlled Intersections," 96th Annual Meeting of the Transportation Research Board, Paper Number 17-05379, January 2017.

FHWA-SA-21-031

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Safety Benefits:

13%

reduction in pedestrian-vehicle crashes at intersections.[1]

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. Pedestrians can better establish their presence in the crosswalk before vehicles have priority to turn right or left.

LPIs provide the following benefits:

- Increased visibility of crossing pedestrians.
- Reduced conflicts between pedestrians and vehicles.
- Increased likelihood of motorists yielding to pedestrians.
- Enhanced safety for pedestrians who may be slower to start into the intersection.

FHWA's Handbook for ***Designing Roadways for the Aging Population*** recommends the use of the LPI at intersections with high turning vehicle volumes. Transportation agencies should refer to the ***Manual on Uniform Traffic Control Devices*** for guidance on LPI timing and ensure that pedestrian signals are accessible for all users. Costs for implementing LPIs are very low when only signal timing alteration is required.

An LPI allows a pedestrian to establish a presence in the crosswalk before vehicles are given a green indication. Source: FHWA

LPIs reduce potential conflicts between pedestrians and turning vehicles. Source: FHWA

For more information on this and other FHWA Proven Safety Countermeasures, please visit https://safety.fhwa.dot.gov/provencountermeasures/ and https://safety.fhwa.dot.gov/ped_bike/step/resources/docs/fhwasa19040.pdf.

FHWA-SA-21-032

1 Goughnour, E., D. Carter, C. Lyon, B. Persaud, B. Lan, P. Chun, I. Hamilton, and K. Signor. "Safety Evaluation of Protected Left-Turn Phasing and Leading Pedestrian Intervals on Pedestrian Safety." Report No. FHWA-HRT-18-044. Federal Highway Administration. (October 2018)

U.S. Department of Transportation
Federal Highway Administration

Safety Benefits:

Agencies have experienced the following benefits after LRSP implementation:

25%
reduction in county road fatalities in Minnesota.

17%
reduction in fatal and serious injury crashes on county-owned roads in Washington State.

35%
reduction in severe curve crashes in Thurston County, WA.

For more information on this and other FHWA Proven Safety Countermeasures, please visit https://safety.fhwa.dot.gov/provencountermeasures/ and https://safety.fhwa.dot.gov/LRSPDIY/.

FHWA-SA-21-033

Local Road Safety Plans

A local road safety plan (LRSP) provides a framework for identifying, analyzing, and prioritizing roadway safety improvements on local roads. The LRSP development process and content are tailored to local issues and needs. The process results in a prioritized list of issues, risks, actions, and improvements that can be used to reduce fatalities and serious injuries on local roads. FHWA has developed several resources including an LRSP Do-It-Yourself website which further explains the process and includes resources local agencies and their partners need to create and implement an LRSP.[1]

Approximately 75 percent of rural roads are owned by local agencies.[2] While local roads are less traveled than State highways, they have a much higher rate of fatal and serious injury crashes.[2] Developing an LRSP is an effective strategy to improve local road safety for all road users and support the goals of a State's overall Strategic Highway Safety Plan (SHSP).

Although the development process and resulting plan can vary depending on the local agency's needs, available resources, and targeted crash types, aspects common to LRSPs include:

- Stakeholder engagement representing the 4E's: engineering, enforcement, education, and emergency medical services.
- Collaboration among municipal, county, Tribal, State, and/or Federal entities to leverage expertise and resources.
- Identification of target crash types and crash risk with corresponding recommended proven safety countermeasures.
- Timeline and goals for implementation and evaluation.

Local road agencies should consider developing an LRSP to be used as a tool for reducing roadway fatalities, injuries, and crashes.[3] LRSPs can help agencies create a prioritized list of improvements. LRSPs are also a proactive risk management technique to demonstrate an agency's responsiveness. The plan should be viewed as a living document that can be updated to reflect changing local needs and priorities.

Infographic showing the LRSP process. Source: FHWA

1 https://safety.fhwa.dot.gov/LRSPDIY/
2 Anderson et al. Noteworthy Practices: Addressing Safety on Locally-Owned and Maintained Roads A Domestic Scan, FHWA-SA-09-019, (2010).
3 Developing Safety Plans: A Manual for Local Rural Road Owners, FHWA-SA-12-017, provides guidance on developing an LRSP.

U.S. Department of Transportation
Federal Highway Administration

Safety Benefits:

Chevron Signs

25% reduction in nighttime crashes.[1]

16% reduction in non-intersection fatal and injury crashes.[2]

Oversized Chevron Signs

15% reduction in fatal and injury crashes.[3]

Sequential Dynamic Chevrons

60% reduction in fatal and injury crashes.[3]

In-Lane Curve Warning Pavement Markings

35 - 38% reduction in all crashes.[4,5]

New Fluorescent Curve Signs or Upgrade Existing Curve Signs to Fluorescent Sheeting

18% reduction in non-intersection, head-on, run-off-road, and sideswipe in rural areas.[1]

For more information on this and other FHWA Proven Safety Countermeasures, please visit https://safety.fhwa.dot.gov/provencountermeasures/ and https://safety.fhwa.dot.gov/roadway_dept/countermeasures/horicurves/.

FHWA-SA-21-035

Enhanced Delineation for Horizontal Curves

Enhanced delineation at horizontal curves includes a variety of potential strategies that can be implemented in advance of or within curves, in combination, or individually.

Potential Strategies	In Advance of Curve	Within Curve
Pavement markings (standard width or wider)	✓	✓
In-lane curve warning pavement markings	✓	
Retroreflective strips on sign posts	✓	✓
Delineators		✓
Chevron signs		✓
Enhanced Conspicuity (larger, fluorescent, and/or retroreflective signs)	✓	✓
Dynamic curve warning signs (including speed radar feedback signs)	✓	
Sequential dynamic chevrons		✓

Enhanced delineation treatments can alert drivers to upcoming curves, the direction and sharpness of the curve, and appropriate operating speed.

Agencies can take the following steps to implement enhanced delineation strategies:

1. Review signing practices and policies to ensure they comply with the Manual on Uniform Traffic Control Devices (MUTCD) principles of traffic control devices. Consistent practice for similar curves sets the appropriate driver expectancy.
2. Use the systemic approach to identify and treat problem curves. For example, Minnesota uses risk factors that include curve radii between 500 and 1,200 ft, traffic volumes between 500 and 1,000 vehicles per day, intersection in the curve, and presence of a visual trap.[1]
3. Match the appropriate strategy to the identified problem(s), considering the full range of enhanced delineation treatments. Once the MUTCD requirements and recommendations have been met, an incremental approach is often beneficial to avoid excessive cost.

Chevron signs with retroreflective strips on sign posts installed along a curve. Source: FHWA

1 Albin et al. Low-Cost Treatments for Horizontal Curve Safety 2016. FHWA-SA-15-084, (2016).
2 Srinivasan et al. Safety Evaluation of Improved Curve Delineation. FHWA-HRT-09-045, (2009).
3 Lyon et al. Safety Evaluation of Two Curve Warning Treatments: In-Lane Curve Warning Pavement Markings and Oversized Chevron Signs. Presented at the 96th TRB Annual Meeting, Paper No. 17-00432, (2017).
4 Hallmark, S. Evaluation of Sequential Dynamic Chevrons on Rural Two-lane Highways. FHWA, (2017).
5 Donnell et al. Reducing Roadway Departure Crashes at Horizontal Curve Sections on Two-lane Rural Highways. FHWA-SA-19-005, (2019).

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Longitudinal Rumble Strips and Stripes

Longitudinal rumble strips are milled or raised elements on the pavement intended to alert drivers through vibration and sound that their vehicle has left the travel lane. They can be installed on the shoulder, edge line, or at or near the center line of an undivided roadway.

Rumble stripes are edge line or center line rumble strips where the pavement marking is placed over the rumble strip. This can increase the visibility and durability of the pavement marking during wet, nighttime conditions, and can improve the durability of the marking on roads with snowplowing operations.

Safety Benefits:

Center Line Rumble Strips

44-64%

reduction in head-on fatal and injury crashes on two-lane rural roads.[4]

Shoulder Rumble Strips

13-51%

reduction in single vehicle, run-off-road fatal and injury crashes on two-lane rural roads.[4]

With roadway departure crashes accounting for more than half of the fatal roadway crashes annually in the United States, rumble strips and stripes are designed to address these crashes by alerting distracted, drowsy, or otherwise inattentive drivers who drift from their lane. They are most effective when deployed systemically.

Transportation agencies should consider milled center line rumble strips (including in passing zone areas) and milled edge line or shoulder rumble strips with bicycle gaps for systemic safety projects, location-specific corridor safety improvements, as well as reconstruction or resurfacing projects.

Considerations

- Rumble strips are relatively low-cost, and economic analyses have indicated benefit/cost ratios that exceed 100.[1]
- Where rumble strips cannot be placed due to noise concerns, agencies may consider a design using an oscillating sine wave pattern (also known as "mumble strips") that reduces noise outside of the vehicle. However, the safety benefits of this design need more study.[2]
- Maintenance concerns:
  - Where rumble strips are placed along a pavement joint, there are typically no issues with joint stability if the pavement structure and joint was already in good condition.
  - Studies have shown no evidence of issues related to snow, ice, or rain build-up in the rumble strip.[3]

Shoulder rumble strips and center line rumble stripes are installed on this roadway. Source: FHWA

Example of an edge line rumble stripe. Source: Missouri DOT

For more information on this and other FHWA Proven Safety Countermeasures, please visit https://safety.fhwa.dot.gov/provencountermeasures/ and https://safety.fhwa.dot.gov/roadway_dept/pavement/rumble_strips/.

FHWA-SA-21-036

1 Himes, S., and McGee, H. Decision Support Guide for the Installation of Shoulder and Center Line Rumble Strips on Non-Freeways. Federal Highway Administration Report No. FHWA-SA-16-115. (August 2016).
2 Bedsole et al. *Did You Hear That?* Public Roads Magazine, Volume 80, No. 4. FHWA Publication No. FHWA-HRT-17-002, (2017).
3 NCHRP Synthesis 339: Centerline Rumble Strips – A Synthesis of Highway Practices, (2005).
4 NCHRP Report 641: Guidance for the Design and Application of Shoulder and Centerline Rumble Strips, (2009).

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8%

of all fatalities on divided highways are due to head-on crashes.[1]

Safety Benefits:

Median Barriers Installed on Rural Four-Lane Freeways

97%

reduction in cross-median crashes.[2]

Median Barriers

Median barriers are longitudinal barriers that separate opposing traffic on a divided highway and are designed to redirect vehicles striking either side of the barrier. Median barriers significantly reduce the number of cross-median crashes, which are attributed to the relatively high speeds that are typical on divided highways. AASHTO's ***Roadside Design Guide*** (RDG) recommends guidelines for the use of median barriers on high-speed, fully controlled-access roadways for locations where the median is 30 ft in width or less and the average daily traffic (ADT) is greater than 20,000 vehicles per day (vpd). For locations with median widths greater than 50 ft and where the ADT is less than 20,000 vpd, a median barrier is optional. For locations where the median is between 30 and 50 feet, the RDG suggests an analysis to determine the cost effectiveness of median barrier installation. Median barriers can be cable, metal-beam, or concrete.

- **Cable barriers** are flexible barriers, made from steel cables mounted on weak steel posts, resulting in less occupant impact force as it absorbs energy from the crash, capturing or redirecting the vehicle. Due to larger deflection, median width is an important consideration. These barriers are more adaptable to slopes typically found in medians. Cable barriers tend to require more frequent maintenance and repair than other barrier types.
- **Metal-beam guardrails** are considered semi-rigid barriers, where the W-beam or box-beam is mounted to steel or timber posts. When impacted, they are designed to deform and deflect, absorbing some of the crash energy and redirecting the vehicle. Metal-beam guardrails often do not require maintenance after minor impacts. They deflect less than cable barriers, so they can be located closer to objects where space is limited.
- **Concrete barriers** are usually rigid and result in little to no deflection. They redirect rather than absorb energy from the impact. Rigid concrete barriers seldom require repair or maintenance. Some agencies have used portable concrete barriers as median barriers. These barriers require repositioning after an impact but are typically less maintenance than a post mounted barrier.

To reduce cross-median crashes, transportation agencies should review their head-on crash history on divided highways to identify hot spots. Agencies should also consider implementing a systemic approach to median barrier placement based on cross-median crash risk factors. Potential risk factors include:

- Traffic volumes.
- Vehicle classifications.
- Median crossover history.
- Crash incidents.
- Vertical and horizontal alignment.
- Median terrain configurations.

Median cable barrier prevents a potential head-on crash.
Source: Washington State DOT

For more information on this and other FHWA Proven Safety Countermeasures, please visit https://safety.fhwa.dot.gov/provencountermeasures/ and https://safety.fhwa.dot.gov/roadway_dept/countermeasures/reduce_crash_severity/.

1 Fatality Analysis Reporting System.
2 NCHRP Report 794: Median Cross-Section Design for Rural Divided Highways, (2011).

FHWA-SA-21-037

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OFFICE OF SAFETY

Proven Safety Countermeasures

SafetyEdge℠

The SafetyEdge℠ technology shapes the edge of the pavement at approximately 30 degrees from the pavement cross slope during the paving process. This safety practice eliminates the potential for vertical drop-off at the pavement edge, has minimal effect on project cost, and can improve pavement durability by reducing edge raveling of asphalt.

Safety Benefits:

11%
reduction in fatal and injury crashes.[2]

21%
reduction in run-off-road crashes.[2]

19%
reduction in head-on crashes.[2]

Benefit-Cost Ratio Range[3]

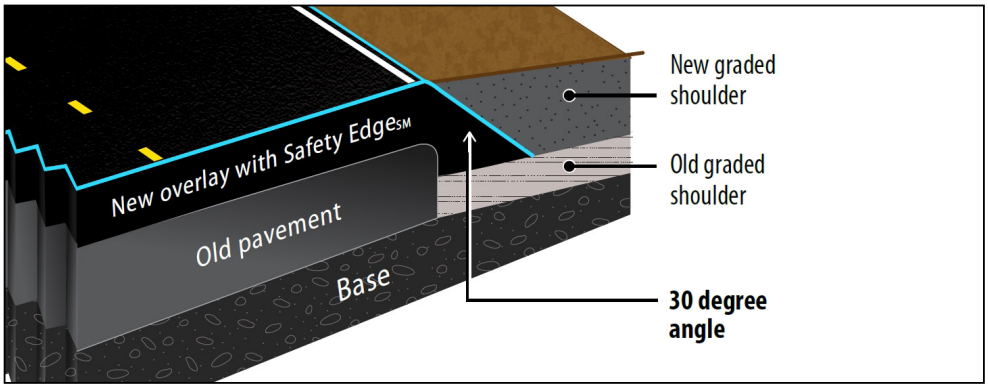
700:1 to 1,500:1

Rural road crashes involving edge drop-offs are 2-4 times more likely to include a fatality than other crashes on similar roads.[1] Vehicles may leave the roadway for various reasons ranging from distracted driver errors to low visibility, or to the presence of an animal on the road. Exposed vertical pavement edges can cause vehicles to become unstable and prevent their safe return to the roadway. The SafetyEdge℠ gives drivers the opportunity to return to their travel lane while maintaining control of their vehicle.

The SafetyEdge℠ technology only requires adding one of several commercially available devices to the screed or endgate when placing hot-mix asphalt. Forms for shaping the edge of concrete pavement are simpler and can be made on site by the contractor. Some agencies allow the SafetyEdge℠ to remain exposed while a segment is under construction, unlike conventional pavement edges. However, before construction ends, agencies should bring the adjacent roadside flush with the top of the pavement for both the SafetyEdge℠ and traditional pavement edge. Over time, regardless of the edge type, the edge may become exposed due to settling, erosion, and tire wear. When this occurs, the gentle slope provided by the SafetyEdge℠ is preferred versus the traditional vertical pavement edge.

Transportation agencies should develop standards for implementing the SafetyEdge℠ systemwide on all new asphalt paving and resurfacing projects where curbs and/or guardrail are not present, while also encouraging standard application for concrete pavements.

Example of the SafetyEdge℠ after backfill material settles or erodes. Source: FHWA



Cross-section view of an overlay with the SafetyEdge℠. Source: FHWA-SA-17-044

For more information on this and other FHWA Proven Safety Countermeasures, please visit https://safety.fhwa.dot.gov/provencountermeasures/ and https://safety.fhwa.dot.gov/safetyedge/.

1 Hallmark et al. Safety Impacts of Pavement Edge Drop-offs, (Washington, DC: AAA Foundation for Traffic Safety: 2006), p 93.
2 Donnell et al. Development of Crash Modification Factors for the Application of the SafetyEdge℠ on Two-Lane Rural Roads. FHWA-HRT-17-081, (2017).
3 Safety Effects of the SafetyEdge℠, FHWA-SA-17-044, (2017).

ZERO IS OUR GOAL
A SAFE SYSTEM IS HOW WE GET THERE

FHWA-SA-21-038

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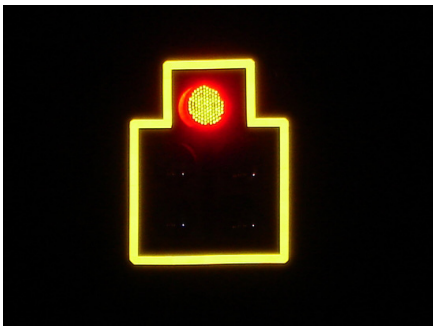
Backplates with Retroreflective Borders

Backplates added to a traffic signal head improve the visibility of the illuminated face of the signal by introducing a controlled-contrast background. The improved visibility of a signal head with a backplate is made even more conspicuous by framing it with a 1- to 3-inch yellow retroreflective border. Signal heads that have backplates equipped with retroreflective borders are more visible and conspicuous in both daytime and nighttime conditions.

Safety Benefits:

15%
reduction in total crashes.[1]

This treatment is recognized as a human factors enhancement of traffic signal visibility, conspicuity, and orientation for both older and color vision deficient drivers. This countermeasure is also advantageous during periods of power outages when the signals would otherwise be dark, providing a visible cue for motorists to stop at the intersection ahead.



Retroreflective borders are highly visible during the night. Source: South Carolina DOT

Considerations

Transportation agencies should consider backplates with retroreflective borders as part of their efforts to systematically improve safety performance at signalized intersections. Adding a retroreflective border to an existing signal backplate is a very low-cost safety treatment. This can be done by either adding retroreflective tape to an existing backplate or purchasing a new backplate with a retroreflective border already incorporated. The most efficient means of implementing this proven safety countermeasure is to adopt it as a standard treatment for signalized intersections across a jurisdiction or State.

Implementation challenges include minimizing installation time, accessing existing signal heads, and structural limitations due to added wind load in instances where an entire backplate is added. Agencies should consider the design of the existing signal support structure to determine if the design is sufficient to support the added wind load.

Signal backplate framed with a retroreflective border. Source: FHWA

For more information on this and other FHWA Proven Safety Countermeasures, please visit https://safety.fhwa.dot.gov/provencountermeasures/ and https://rosap.ntl.bts.gov/view/dot/42807.

1 Sayed, T., Leur, P., and Pump, J., "Safety Impact of Increased Traffic Signal Backboards Conspicuity." 2005 TRB 84th Annual Meeting: Compendium of Papers CD-ROM, Vol. TRB#05-16, Washington, D.C., (2005).

FHWA-SA-21-039

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Safety Benefits:

Reducing driveway density

5-23%
reduction in total crashes along 2-lane rural roads.[3]

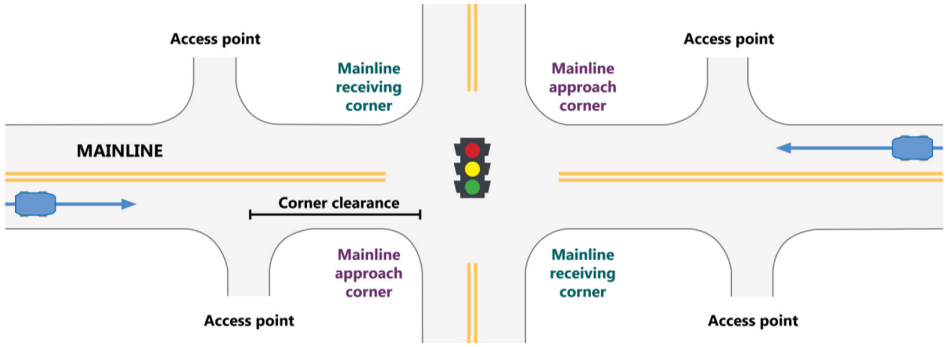
25-31%
reduction in fatal and injury crashes along urban/ suburban arterials.[4]

For more information on this and other FHWA Proven Safety Countermeasures, please visit https://safety.fhwa.dot.gov/provencountermeasures/ and https://safety.fhwa.dot.gov/intersection/cam/index.cfm.

FHWA-SA-21-040

Corridor Access Management

Access management refers to the design, application, and control of entry and exit points along a roadway. This includes intersections with other roads and driveways that serve adjacent properties. Thoughtful access management along a corridor can simultaneously enhance safety for all modes, facilitate walking and biking, and reduce trip delay and congestion.



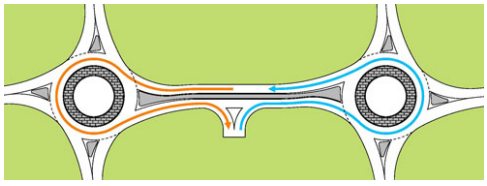
Schematic of an intersection and adjacent access points. Source: FHWA

Every intersection, from a signalized intersection to an unpaved driveway, has the potential for conflicts between vehicles, pedestrians, and bicyclists. The number and types of conflict points—locations where the travel paths of two users intersect—influence the safety performance of the intersection or driveway. FHWA developed corridor-level crash prediction models to estimate and analyze the safety effects of selected access management techniques for different area types, land uses, roadway variables, and traffic volumes.[1]

The following access management strategies can be used individually or in combination with one another:

- Reduce density through driveway closure, consolidation, or relocation.
- Manage spacing of intersection and access points.
- Limit allowable movements at driveways (such as right-in/ right-out only).
- Place driveways on an intersection approach corner rather than a receiving corner, which is expected to have fewer total crashes.[2]
- Implement raised medians that preclude across-roadway movements.
- Utilize designs such as roundabouts or reduced left-turn conflicts (such as restricted crossing U-turn, median U-turns, etc.).
- Provide turn lanes (i.e., left-only, right-only, or interior two-way left).
- Use lower speed one-way or two-way off-arterial circulation roads.

Successful corridor access management involves balancing overall safety and mobility for all users along with the needs of adjacent land uses.



Tandem roundabouts with a continuous raised median eliminates left-turn and across-roadway conflicts. Source: FHWA

1 Gross et al. Safety Evaluation of Access Management Policies and Techniques. FHWA-HRT-14-057, (2018).
2 Le et al. Safety Evaluation of Corner Clearance at Signalized Intersections. FHWA-HRT-17-084, (2018).
3 Harwood et al. Prediction of the Expected Safety Performance of Rural Two-Lane Highways. FHWA-RD-99-207, (2000).
4 Elvik, R. and Vaa, T., Handbook of Road Safety Measures. Oxford, United Kingdom, Elsevier, (2004).

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Dedicated Left- and Right-Turn Lanes at Intersections

Auxiliary turn lanes—either for left turns or right turns—provide physical separation between turning traffic that is slowing or stopped and adjacent through traffic at approaches to intersections. Turn lanes can be designed to provide for deceleration prior to a turn, as well as for storage of vehicles that are stopped and waiting for the opportunity to complete a turn.

Safety Benefits:

Left-Turn Lanes

28-48%

reduction in total crashes.[1]

Positive Offset Left-Turn Lanes

36%

reduction in fatal and injury crashes.[2]

Right-Turn Lanes

14-26%

reduction in total crashes.[1]

Left- and right-turn lanes on a two-lane road. Source: City of Greeley, CO

For more information on this and other FHWA Proven Safety Countermeasures, please visit https://safety.fhwa.dot.gov/provencountermeasures/ and https://www.fhwa.dot.gov/publications/research/safety/02103/02103techbrief.pdf.

FHWA-SA-21-041

While turn lanes provide measurable safety and operational benefits at many types of intersections, they are particularly helpful at two-way stop-controlled intersections. Crashes occurring at these intersections are often related to turning maneuvers. Since the major route traffic is free flowing and typically travels at higher speeds, crashes that do occur are often severe. The main crash types include collisions of vehicles turning left across opposing through traffic and rear-end collisions of vehicles turning left or right with other vehicles following closely behind. Turn lanes reduce the potential for these types of crashes.

Installing left-turn lanes and/or right-turn lanes should be considered for the major road approaches for improving safety at both three- and four-leg intersections with stop control on the minor road, where significant turning volumes exist, or where there is a history of turn-related crashes. Pedestrian and bicyclist safety and convenience should also be considered when adding turn lanes at an intersection. Specifically, offset left- and right-turn lanes will lengthen crossing distances for pedestrians.

Offset Turn Lanes

Providing offset of left- and right-turn lanes to increase visibility can provide added safety benefits, and is preferable in many situations, particularly at locations with higher speeds, or where free-flow or permissive movements are possible.

At turn lanes with zero or negative offset, turning vehicles can block sightlines. For left-turn lanes, this usually involves opposing left-turning vehicles occupying the turn lanes at the same time. For right-turn lanes, this typically involves right-turning vehicles from the major road and vehicles entering the intersection from the minor road. In both scenarios, adding positive offset to turn lanes enhances the sight distance to approaching vehicles that conflict with the turning movement. Offset turn lanes should be considered when there is a high frequency of these types of conflicts in order to reduce the likelihood of a severe crash.

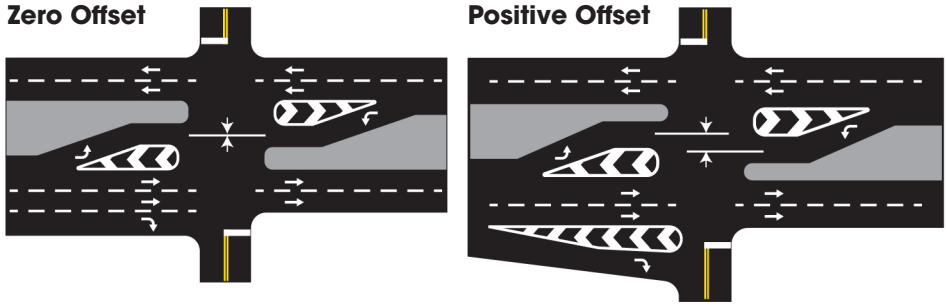

Illustration comparing zero offset to positive offset of left- and right-turn lanes. Source: FHWA

1 Harwood et al. Safety Effectiveness of Intersection Left- and Right-Turn Lanes. FHWA-HRD-02-089, (2002).
2 Persaud et al. Safety Evaluation of Offset Improvements for Left-Turn Lanes. FHWA-HRT-09-035, (2009).

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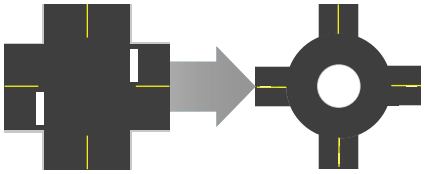
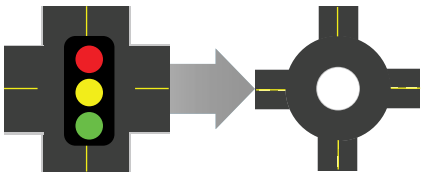
Safety Benefits:

Two-Way Stop-Controlled Intersection to a Roundabout



82%
reduction in fatal and injury crashes.[1]

Signalized Intersection to a Roundabout



78%
reduction in fatal and injury crashes.[1]

For more information on this and other FHWA Proven Safety Countermeasures, please visit https://safety.fhwa.dot.gov/provencountermeasures/ and https://safety.fhwa.dot.gov/intersection/roundabouts/index.cfm.

FHWA-SA-21-042

Roundabouts

The modern roundabout is an intersection with a circular configuration that safely and efficiently moves traffic. Roundabouts feature channelized, curved approaches that reduce vehicle speed, entry yield control that gives right-of-way to circulating traffic, and counterclockwise flow around a central island that minimizes conflict points. The net result of lower speeds and reduced conflicts at roundabouts is an environment where crashes that cause injury or fatality are substantially reduced.

Roundabouts are not only a safer type of intersection; they are also efficient in terms of keeping people moving. Even while calming traffic, they can reduce delay and queuing when compared to other intersection alternatives. Furthermore, the lower vehicular speeds and reduced conflict environment can create a more suitable environment for walking and bicycling.

Roundabouts can be implemented in both urban and rural areas under a wide range of traffic conditions. They can replace signals, two-way stop controls, and all-way stop controls. Roundabouts are an effective option for managing speed and transitioning traffic from high-speed to low-speed environments, such as freeway interchange ramp terminals, and rural intersections along high-speed roads.

Illustration of a multilane roundabout. Source: FHWA

Example of a single-lane roundabout. Source: FHWA

1 AASHTO. The Highway Safety Manual, American Association of State Highway Transportation Professionals, Washington, D.C., (2010).

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Safety Benefits:

36-50%
reduction in red light running.[2]

8-14%
reduction in total crashes.[2]

12%
reduction in injury crashes.[2]

Yellow Change Intervals

At a signalized intersection, the yellow change interval is the length of time that the yellow signal indication is displayed following a green signal indication. The yellow signal confirms to motorists that the green has ended and that a red will soon follow.

Since red-light running is a leading cause of severe crashes at signalized intersections, it is imperative that the yellow change interval be appropriately timed. Too brief an interval may result in drivers being unable to stop safely and cause unintentional red-light running. Too long of an interval may result in drivers treating the yellow as an extension of the green phase and invite intentional red-light running. Factors such as the speed of approaching and turning vehicles, driver perception-reaction time, vehicle deceleration, and intersection geometry should all be considered in the timing calculation.

Transportation agencies can improve signalized intersection safety and reduce red-light running by reviewing and updating their traffic signal timing policies and procedures concerning the yellow change interval. Agencies should institute regular evaluation and adjustment protocols for existing traffic signal timing. Refer to the *Manual on Uniform Traffic Control Devices* for basic requirements and further recommendations about yellow change interval timing. As part of strategic signal system modernization and updates, incorporating automated traffic signal performance measures (ATSPMs) is a proven approach to improve on traditional retiming processes. ATSPMs provide continuous performance monitoring capability and the ability to modify timing based on actual performance, without requiring expensive modeling or data collection.[1]

Appropriately timed yellow change intervals can reduce red-light running and improve overall intersection safety. Source: FHWA

For more information on this and other FHWA Proven Safety Countermeasures, please visit https://safety.fhwa.dot.gov/provencountermeasures/ and https://safety.fhwa.dot.gov/intersection/signal/fhwasa13027.pdf.

FHWA-SA-21-043

1 Federal Highway Administration. "Automated Traffic Signal Performance," (2020).
2 NCHRP Report 731: Guidelines for Timing Yellow and All-Red Intervals at Signalized Intersections, (2011).

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Medians and Pedestrian Refuge Islands in Urban and Suburban Areas

A **median** is the area between opposing lanes of traffic, excluding turn lanes. Medians in urban and suburban areas can be defined by pavement markings, raised medians, or islands to separate motorized and non-motorized road users.

A **pedestrian refuge island** (or crossing area) is a median with a refuge area that is intended to help protect pedestrians who are crossing a road.

Safety Benefits:

Median with Marked Crosswalk

46%

reduction in pedestrian crashes.[2]

Pedestrian Refuge Island

56%

reduction in pedestrian crashes.[2]

Pedestrian crashes account for approximately 17 percent of all traffic fatalities annually, and 74 percent of these occur at non-intersection locations.[1] For pedestrians to safely cross a roadway, they must estimate vehicle speeds, determine acceptable gaps in traffic based on their walking speed, and predict vehicle paths. Installing a median or pedestrian refuge island can help improve safety by allowing pedestrians to cross one direction of traffic at a time.

Transportation agencies should consider medians or pedestrian refuge islands in curbed sections of urban and suburban multilane roadways, particularly in areas with a significant mix of pedestrian and vehicle traffic, traffic volumes over 9,000 vehicles per day, and travel speeds 35 mph or greater. Medians/refuge islands should be at least 4-ft wide, but preferably 8 ft for pedestrian comfort. Some example locations that may benefit from medians or pedestrian refuge islands include:

- Mid-block crossings.
- Approaches to multilane intersections.
- Areas near transit stops or other pedestrian-focused sites.

Example of a road with a median and pedestrian refuge islands. Source: City of Charlotte, NC

Median and pedestrian refuge island near a roundabout. Source: www.pedbikeimages.org / Dan Burden

For more information on this and other FHWA Proven Safety Countermeasures, please visit https://safety.fhwa.dot.gov/provencountermeasures/ and https://safety.fhwa.dot.gov/ped_bike/step/docs/techSheet_PedRefugeIsland2018.pdf.

1 National Center for Statistics and Analysis. (2020, March). Pedestrians: 2018 data (Traffic Safety Facts. Report No. DOT HS 812 850). National Highway Traffic Safety Administration
2 Desktop Reference for Crash Reduction Factors, FHWA-SA-08-011, September 2008, Table 11.

FHWA-SA-21-044

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Safety Benefits:

55%
reduction in pedestrian crashes.[2]

29%
reduction in total crashes.[3]

15%
reduction in fatal and serious injury crashes.[3]

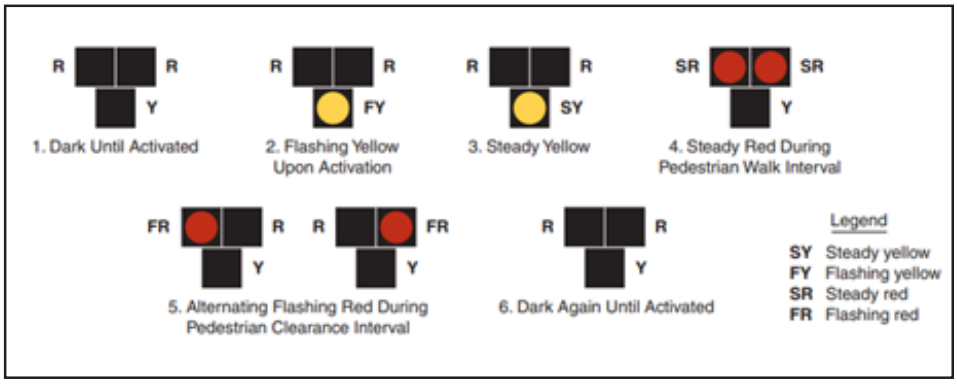
Example of PHBs mounted on a mast arm. Source: FHWA

For more information on this and other FHWA Proven Safety Countermeasures, please visit https://safety.fhwa.dot.gov/provencountermeasures/ and https://safety.fhwa.dot.gov/ped_bike/step/resources/docs/fhwasa18064.pdf.

FHWA-SA-21-045

Pedestrian Hybrid Beacons

The pedestrian hybrid beacon (PHB) is a traffic control device designed to help pedestrians safely cross higher-speed roadways at midblock crossings and uncontrolled intersections. The beacon head consists of two red lenses above a single yellow lens. The lenses remain "dark" until a pedestrian desiring to cross the street pushes the call button to activate the beacon, which then initiates a yellow to red lighting sequence consisting of flashing and steady lights that directs motorists to slow and come to a stop, and provides the right-of-way to the pedestrian to safely cross the roadway before going dark again.



Sequence for a PHB. Source: MUTCD 2009 Edition, p. 511, FHWA

Nearly 74 percent of pedestrian fatalities occur at non-intersection locations, and vehicle speeds are often a major contributing factor.[1] As a safety strategy to address this pedestrian crash risk, the PHB is an intermediate option between a flashing beacon and a full pedestrian signal because it assigns right of way and provides positive stop control. It also allows motorists to proceed once the pedestrian has cleared their side of the travel lane(s), reducing vehicle delay.

Transportation agencies should refer to the *Manual on Uniform Traffic Control Devices* (MUTCD) for information on the application of PHBs.

In general, PHBs are used where it is difficult for pedestrians to cross a roadway, such as when gaps in traffic are not sufficient or speed limits exceed 35 miles per hour. They are very effective at locations where three or more lanes will be crossed or traffic volumes are above 9,000 annual average daily traffic. Installation of a PHB must also include a marked crosswalk and pedestrian countdown signal. If PHBs are not already familiar to a community, agencies should conduct appropriate education and outreach as part of implementation.

1 National Center for Statistics and Analysis. (2020, March). Pedestrians: 2018 data (Traffic Safety Facts. Report No. DOT HS 812 850). National Highway Traffic Safety Administration
2 Zegeer et al. NCHRP Report 841: Development of Crash Modification Factors for Uncontrolled Pedestrian Crossing Treatments. TRB, (2017).
3 Fitzpatrick, K. and Park, E.S. Safety Effectiveness of the HAWK Pedestrian Crossing Treatment, FHWA-HRT-10-042, (2010).

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Safety Benefits:

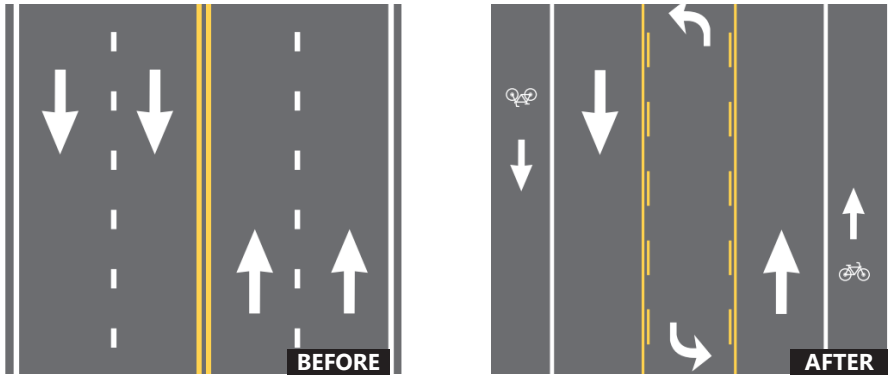
4-Lane to 3-Lane Road Diet Conversions

19-47%

reduction in total crashes.[1]

Road Diets (Roadway Reconfiguration)

A Road Diet, or roadway reconfiguration, can improve safety, calm traffic, provide better mobility and access for all road users, and enhance overall quality of life. A Road Diet typically involves converting an existing four-lane undivided roadway to a three-lane roadway consisting of two through lanes and a center two-way left-turn lane (TWLTL).



Before and after example of a Road Diet. Source: FHWA

Benefits of Road Diet installations may include:

- Reduction of rear-end and left-turn crashes due to the dedicated left-turn lane.
- Reduced right-angle crashes as side street motorists cross three versus four travel lanes.
- Fewer lanes for pedestrians to cross.
- Opportunity to install pedestrian refuge islands, bicycle lanes, on-street parking, or transit stops.
- Traffic calming and more consistent speeds.
- A more community-focused, Complete Streets environment that better accommodates the needs of all road users.

A Road Diet can be a low-cost safety solution when planned in conjunction with a simple pavement overlay, and the reconfiguration can be accomplished at no additional cost. Typically, a Road Diet is implemented on a roadway with a current and future average daily traffic of 25,000 or less.

Road Diet project in Honolulu, Hawaii. Source: Leidos

For more information on this and other FHWA Proven Safety Countermeasures, please visit https://safety.fhwa.dot.gov/provencountermeasures/ and https://safety.fhwa.dot.gov/road_diets/.

1 *Evaluation of Lane Reduction "Road Diet" Measures on Crashes*, FHWA-HRT-10-053, (2010).

FHWA-SA-21-046

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Safety Benefits:

Sidewalks

65-89%

reduction in crashes involving pedestrians walking along roadways.[3]

Paved Shoulders

71%

reduction in crashes involving pedestrians walking along roadways.[3]

Walkways

A walkway is any type of defined space or pathway for use by a person traveling by foot or using a wheelchair. These may be pedestrian walkways, shared use paths, sidewalks, or roadway shoulders.

With more than 6,200 pedestrian fatalities and 75,000 pedestrian injuries occurring in roadway crashes annually,[1] it is important for transportation agencies to improve conditions and safety for pedestrians and to integrate walkways more fully into the transportation system. Research shows people living in low-income communities are less likely to encounter walkways and other pedestrian-friendly features.[2]

Well-designed pedestrian walkways, shared use paths, and sidewalks improve the safety and mobility of pedestrians. Pedestrians should have direct and connected network of walking routes to desired destinations without gaps or abrupt changes. In some rural or suburban areas, where these types of walkways are not feasible, roadway shoulders provide an area for pedestrians to walk next to the roadway, although these are not preferable.

Transportation agencies should work towards incorporating pedestrian facilities into all roadway projects unless exceptional circumstances exist. It is important to provide and maintain accessible walkways along both sides of the road in urban areas, particularly near school zones and transit locations, and where there is a large amount of pedestrian activity. Walkable shoulders should also be considered along both sides of rural highways when routinely used by pedestrians.

Example of a sidewalk in a residential area. Source: pedbikeimages.org / Burden

Paved shoulder used as a walkway. Source: pedbikeimages.org / Burden

For more information on this and other FHWA Proven Safety Countermeasures, please visit https://safety.fhwa.dot.gov/provencountermeasures/ and http://www.pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=1.

FHWA-SA-21-047

1 National Center for Statistics and Analysis. (2020, March). Pedestrians: 2018 data (Traffic Safety Facts. Report No. DOT HS 812 850). National Highway Traffic Safety Administration.
2 Gibbs, et all. Income Disparities in Street Features that Encourage Walking. Bridging the Gap, (2012, March).
3 Gan et al. Update of Florida Crash Reduction Factors and Countermeasures to Improve the Development of District Safety Improvement Projects. Florida DOT, (2005).

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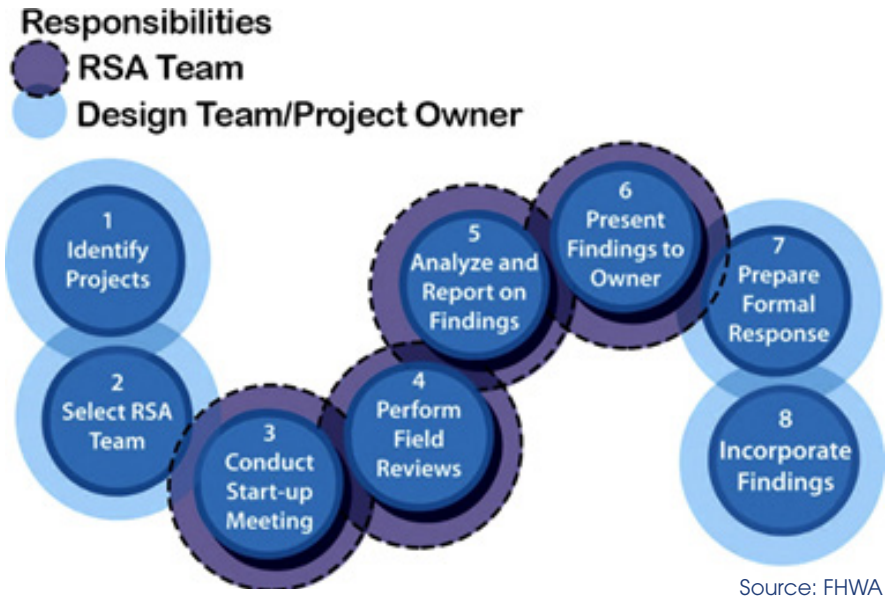
Safety Benefits:

10-60%
reduction in total crashes.[1]

Road Safety Audit

While most transportation agencies have established traditional safety review procedures, a road safety audit (RSA) or assessment is unique. RSAs are performed by a multidisciplinary team independent of the project. RSAs consider all road users, account for human factors and road user capabilities, are documented in a formal report, and require a formal response from the road owner. (See the eight steps for conducting an RSA below.)



Source: FHWA

RSAs provide the following benefits:

- Reduced number and severity of crashes due to safer designs.
- Reduced costs resulting from early identification and mitigation of safety issues before projects are built.
- Increased opportunities to integrate multimodal safety strategies and proven safety countermeasures.
- Expanded ability to consider human factors in all facets of design.
- Increased communication and collaboration among safety stakeholders.
- Objective review by independent multidisciplinary team.

RSAs can be performed in any phase of project development, from planning through construction. Agencies may focus RSAs specifically on motorized vehicles, pedestrians, bicyclists, motorcyclists, or a combination of these roadway users. Agencies are encouraged to conduct an RSA at the earliest stage possible, as all roadway design options and alternatives are being explored.

Multidisciplinary team performs field review during an RSA. Source: FHWA

For more information on this and other FHWA Proven Safety Countermeasures, please visit https://safety.fhwa.dot.gov/provencountermeasures/ and https://safety.fhwa.dot.gov/rsa/.

1 Road Safety Audits: An Evaluation of RSA Programs and Projects, FHWA-SA-12-037; and FHWA Road Safety Audit Guidelines, FHWA-SA-06-06.

FHWA-SA-21-048

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Appropriate Speed Limits for All Road Users

There is broad consensus among global roadway safety experts that speed control is one of the most important methods for reducing fatalities and serious injuries. Speed is an especially important factor on non-limited access roadways where vehicles and vulnerable road users mix.

A driver may not see or be aware of the conditions within a corridor, and may drive at a speed that feels reasonable for themselves but may not be for all users of the system, especially vulnerable road users, including children and seniors. A driver traveling at 30 miles per hour who hits a pedestrian has a 45 percent chance of killing or seriously injuring them.[1] At 20 miles per hour, that percentage drops to 5 percent.[1] A number of cities across the United States, including New York, Washington, Seattle and Minneapolis, have reduced their local speed limits in recent years in an effort to reduce fatalities and serious injuries, with most having to secure State legislative authorization to do so.

States and local jurisdictions should set appropriate speed limits to reduce the significant risks drivers impose on others—especially vulnerable road users—and on themselves. Addressing speed is fundamental to the Safe System Approach to making streets safer, and a growing body of research shows that speed limit changes alone can lead to measurable declines in speeds and crashes.[2]

Safety Benefits:

Traffic fatalities in the City of Seattle decreased 26 percent after the city implemented comprehensive, city-wide speed management strategies and countermeasures inspired by Vision Zero. This included setting speed limits on all non-arterial streets at 20 mph and 200 miles of arterial streets at 25 mph.[5]

One study found that on rural roads, when considering other relevant factors in the engineering study along with the speed distribution, setting a speed limit no more than 5 mph below the 85th-percentile speed may result in fewer total and fatal plus injury crashes, and lead to drivers complying closely with the posted speed limit.[6]

For more information on this and other FHWA Proven Safety Countermeasures, please visit https://safety.fhwa.dot.gov/provencountermeasures/ and https://safety.fhwa.dot.gov/speedmgt/ref_mats/.

Applications

Posted speed limits are often the same as the legislative statutory speed limit. Agencies with designated authorities to set speed limits, which include States, and sometimes local jurisdictions, can establish non-statutory speed limits or designate reduced speed zones, and a growing number are doing so. While non-statutory speed limits must be based on an engineering study, conducted in accordance with the *Manual on Uniform Traffic Control Devices* (MUTCD) involving multiple factors and engineering judgment, FHWA is also encouraging agencies to use the following:[3]

- Expert Systems tools.
  - USLIMITS2.
  - NCHRP 966: Posted Speed Limit Setting Procedure and Tool.
- Safe System approach.

Based on international experience and implementation in the United States, the use of 20 mph speed zones or speed limits in urban core areas where vulnerable users share the road environment with motorists may result in further safety benefits.[4]

Considerations

When setting a speed limit, agencies should consider a range of factors such as pedestrian and bicyclist activity, crash history, land use context, intersection spacing, driveway density, roadway geometry, roadside conditions, roadway functional classification, traffic volume, and observed speeds.

To achieve desired speeds, agencies often implement other speed management strategies concurrently with setting speed limits, such as self-enforcing roadways, traffic calming, and speed safety cameras. Additional information is in the following FHWA resources:

- FHWA Speed Management website.
- Self-Enforcing Roadways: A Guidance Report.
- Noteworthy Speed Management Practices.
- Jurisdiction Speed Management Action Plan Development Package.
- Traffic Calming ePrimer.

1 Reducing the speed limit to 20 mph in urban areas: Child deaths and injuries would be decreased.
2 Lowering the speed limit from 30 to 25 mph in Boston: effects on vehicle speeds.
3 FHWA's Methods and Practices for Setting Speed Limits: An Informational Report, (2012).
4 Recommendations of the Academic Expert Group for the 3rd Global Ministerial Conference on Road Safety.
5 https://safety.fhwa.dot.gov/speedmgt/ref_mats/fhwasa20047/sec8.cfm#foot813
6 Safety and Operational Impacts of Setting Speed Limits below Engineering Recommendations.

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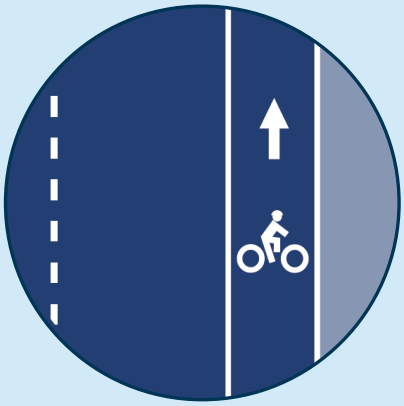

Bicycle Lanes

Most fatal and serious injury bicyclist crashes occur at non-intersection locations. Nearly one-third of these crashes involve overtaking motorists[1]; the speed and size differential between vehicles and bicycles can lead to severe injury. To make bicycling safer and more comfortable for most types of bicyclists, State and local agencies should consider installing bicycle lanes. These dedicated facilities for the use of bicyclists along the roadway can take several forms. Providing bicycle facilities can mitigate or prevent interactions, conflicts, and crashes between bicyclists and motor vehicles, and create a network of safer roadways for bicycling. Bicycle Lanes align with the Safe System Approach principle of recognizing human vulnerability—where separating users in space can enhance safety for all road users.

Safety Benefits:

Bicycle Lane Additions can reduce crashes up to:

49%
for total crashes on urban 4-lane undivided collectors and local roads.[6]

30%
for total crashes on urban 2-lane undivided collectors and local roads.[6]

Separated bicycle lane in Washington, DC. Source: Alex Baca, Washington Area Bicyclist Association

Separated bicycle lanes may provide further safety benefits. FHWA is anticipating completion of research in Fall 2022.

For more information on this and other FHWA Proven Safety Countermeasures, please visit https://safety.fhwa.dot.gov/provencountermeasures/ and https://safety.fhwa.dot.gov/ped_bike/tools_solve/docs/fhwasa18077.pdf.

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Applications

FHWA's *Bikeway Selection Guide* and *Incorporating On-Road Bicycle Networks into Resurfacing Projects* assist agencies in determining which facilities provide the most benefit in various contexts. Bicycle lanes can be included on new roadways or created on existing roads by reallocating space in the right-of-way.

In addition to the paint stripe used for a typical bicycle lane, a lateral offset with painted buffer can help to further separate bicyclists from vehicle traffic. State and local agencies may also consider physical separation of the bicycle lane from motorized traffic lanes through the use of vertical elements like posts, curbs, or vegetation.[2] Based on international experience and implementation in the United States, there is potential for further safety benefits associated with separated bicycle lanes. FHWA is conducting research on separated bicycle lanes, which includes the development of crash modification factors, to be completed in 2022 to address significant interest on this topic.

Considerations

- City and State policies may require minimum bicycle lane widths, although these can differ by agency and functional classification of the road.
- Bicycle lane design should vary according to roadway characteristics (e.g., motor vehicle volumes and speed) in order to maximize the facility's suitability for riders of all ages and abilities and should consider the travel needs of low-income populations likely to use bicycles. The *Bikeway Selection Guide* is a useful resource.
- While some in the public may oppose travel lane narrowing if they believe it will slow traffic or increase congestion, studies have found that roadways did not experience an increase in injuries or congestion when travel lane widths were decreased to add a bicycle lane.[3]
- Studies and experience in US cities show that bicycle lanes increase ridership and may help jurisdictions better manage roadway capacity without increased risk.
- In rural areas, rumble strips can negatively impact bicyclists' ability to ride if not properly installed. Agencies should consider the dimensions, placement, and offset of rumble strips when adding a bicycle lane.[4]
- Strategies, practices, and processes can be used by agencies to enhance their ability to address equity in bicycle planning and design.[5]

1 Thomas et al. Bicyclist Crash Types on National, State, and Local Levels: A New Look. Transportation Research Record 673(6), 664-676, (2019).
2 Separated Bike Lane Planning and Design Guide. FHWA-HEP-15-025, (2015).
3 Park and Abdel-Aty. "Evaluation of safety effectiveness of multiple cross sectional features on urban arterials". Accident Analysis and Prevention, Vol. 92, pp. 245-255, (2016).
4 FHWA Tech Advisory Shoulder and Edge Line Rumble Strips, (2011).
5 Sandt et al. Pursuing Equity in Pedestrian and Bicycle Planning. FHWA, (2016).
6 Avelar et al. Development of Crash Modification Factors for Bicycle Lane Additions While Reducing Lane and Shoulder Widths. FHWA, (2021).

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Crosswalk Visibility Enhancements

Poor lighting conditions, obstructions such as parked cars, and horizontal or vertical roadway curvature can reduce visibility at crosswalks, contributing to safety issues. For multilane roadway crossings where vehicle volumes are in excess of 10,000 Average Annual Daily Traffic (AADT), a marked crosswalk alone is typically not sufficient. Under such conditions, more substantial crossing improvements could prevent an increase in pedestrian crash potential.

Three main crosswalk visibility enhancements help make crosswalks and the pedestrians, bicyclists, wheelchair and other mobility device users, and transit users using them more visible to drivers. These include high-visibility crosswalks, lighting, and signing and pavement markings. These enhancements can also assist users in deciding where to cross. Agencies can implement these features as standalone or combination enhancements to indicate the preferred location for users to cross.

Safety Benefits:

High-visibility crosswalks can reduce pedestrian injury crashes up to:

40% [1]

Intersection lighting can reduce pedestrian crashes up to:

42% [2]

Advance yield or stop markings and signs can reduce pedestrian crashes up to:

25% [3]

High-visibility crosswalks

High-visibility crosswalks use patterns (i.e., bar pairs, continental, ladder) that are visible to both the driver and pedestrian from farther away compared to traditional transverse line crosswalks. They should be considered at all midblock pedestrian crossings and uncontrolled intersections. Agencies should use materials such as inlay or thermoplastic tape, instead of paint or brick, for highly reflective crosswalk markings.

Improved Lighting

The goal of crosswalk lighting should be to illuminate with positive contrast to make it easier for a driver to visually identify the pedestrian. This involves carefully placing the luminaires in forward locations to avoid a silhouette effect of the pedestrian.

Enhanced Signing and Pavement Markings

On multilane roadways, agencies can use "YIELD Here to Pedestrians" or "STOP Here for Pedestrians" signs 20 to 50 feet in advance of a marked crosswalk to indicate where a driver should stop or yield to pedestrians, depending on State law. To supplement the signing, agencies can also install a STOP or YIELD bar (commonly referred to as "shark's teeth") pavement markings.

In-street signing, such as "STOP Here for Pedestrians" or "YIELD Here to Pedestrians" may be appropriate on roads with two- or three-lane roads where speed limits are 30 miles per hour or less.

Source: FHWA

For more information on this and other FHWA Proven Safety Countermeasures, please visit https://safety.fhwa.dot.gov/provencountermeasures/ and https://safety.fhwa.dot.gov/ped_bike/step/docs/techSheet_VizEnhancemt2018.pdf.

1 Chen, L., C. Chen, and R. Ewing. The Relative Effectiveness of Pedestrian Safety Countermeasures at Urban Intersections - Lessons from a New York City Experience. (2012).
2 Elvik, R. and Vaa, T. Handbook of Road Safety Measures. Oxford, United Kingdom, Elsevier, (2004).
3 Zeeger et al. Development of Crash Modification Factors for Uncontrolled Pedestrian Crossing Treatments, FHWA, (2017).

FHWA-SA-21-049

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Proven Safety Countermeasures

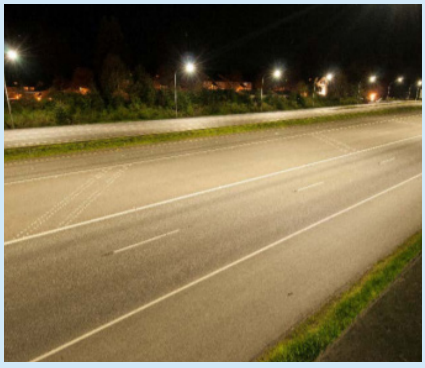
Safety Benefits:

Lighting can reduce crashes up to:

42%
for nighttime injury pedestrian crashes at intersections.[1]

33-38%
for nighttime crashes at rural and urban intersections.[1]

28%
for nighttime injury crashes on rural and urban highways.[1]



Source: WSDOT

For more information on this and other FHWA Proven Safety Countermeasures, please visit https://safety.fhwa.dot.gov/provencountermeasures/ and https://safety.fhwa.dot.gov/roadway_dept/night_visib/roadwayresources.cfm.

FHWA-SA-21-050

Lighting

The number of fatal crashes occurring in daylight is about the same as those that occur in darkness. However, the nighttime fatality rate is three times the daytime rate because only 25 percent of vehicle miles traveled (VMT) occur at night. At nighttime, vehicles traveling at higher speeds may not have the ability to stop once a hazard or change in the road ahead becomes visible by the headlights. Therefore, lighting can be applied continuously along segments and at spot locations such as intersections and pedestrian crossings in order to reduce the chances of a crash.

Adequate lighting (i.e., at or above minimum acceptable standards) is based on research recommending horizontal and vertical illuminance levels to provide safety benefits to all users of the roadway environment. Adequate lighting can also provide benefits in terms of personal security for pedestrians, wheelchair and other mobility device users, bicyclists, and transit users as they travel along and across roadways.

Applications

Roadway Segments

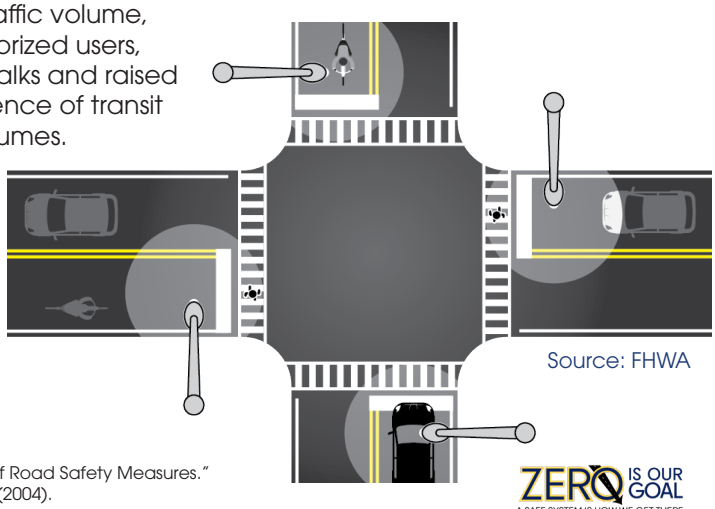
Research indicates that continuous lighting on both rural and urban highways (including freeways) has an established safety benefit for motorized vehicles.[1] Agencies can provide adequate visibility of the roadway and its users through the uniform application of lighting that provides full coverage along the roadway and the strategic placement of lighting where it is needed the most.

Intersections and Pedestrian Crossings

Increased visibility at intersections at nighttime is important since various modes of travel cross paths at these locations. Agencies should consider providing lighting to intersections based on factors such as a history of crashes at nighttime, traffic volume, the volume of non-motorized users, the presence of crosswalks and raised medians, and the presence of transit stops and boarding volumes.

Considerations

Most new lighting installations are made with breakaway features, shielded, or placed far enough from the roadway to reduce the probability and/or severity of fixed-object crashes. Modern lighting technology gives precise control with minimal excessive light affecting the nighttime sky or spilling over to adjacent properties. Agencies can equitably engage with underserved communities to determine where and how new and improved lighting can most benefit the community by considering their priorities, including eliminating crash disparities, connecting to essential neighborhood services, improving active transportation routes, and promoting personal safety.



Source: FHWA

1 Elvik, R. and Vaa, T., "Handbook of Road Safety Measures." Oxford, United Kingdom, Elsevier, (2004).

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Safety Benefits:

HFST can reduce crashes up to:

63%
for injury crashes at ramps.[2]

48%
for injury crashes at horizontal curves.[2]

20%
for total crashes at intersections.[3]

Automated application of HFST.
Source: FHWA

For more information on this and other FHWA Proven Safety Countermeasures, please visit https://safety.fhwa.dot.gov/provencountermeasures/ and https://safety.fhwa.dot.gov/roadway_dept/pavement_friction/high_friction/.

FHWA-SA-21-052

Pavement Friction Management

Friction is a critical characteristic of a pavement that affects how vehicles interact with the roadway, including the frequency of crashes. Measuring, monitoring, and maintaining pavement friction—especially at locations where vehicles are frequently turning, slowing, and stopping—can prevent many roadway departure, intersection, and pedestrian-related crashes.

Pavement friction treatments, such as High Friction Surface Treatment (HFST), can be better targeted and result in more efficient and effective installations when using continuous pavement friction data along with crash and roadway data.

Continuous Pavement Friction Measurement

Friction data for safety performance is best measured with Continuous Pavement Friction Measurement (CPFM) equipment. Spot friction measurement devices, like locked-wheel skid trailers, cannot safely and accurately collect friction data in curves or intersections, where the pavement polishes more quickly and adequate friction is so much more critical. Without CPFM equipment, agencies will assume the same friction over a mile or more.

CPFM technology measures friction continuously at highway speeds and provides both network and segment level data. Practitioners can analyze the friction, crash, and roadway data to better understand and predict where friction-related crashes will occur to better target locations and more effectively install treatments.[1]

High Friction Surface Treatment

HFST consists of a layer of durable, anti-abrasion, and polish-resistant aggregate over a thermosetting polymer resin binder that locks the aggregate in place to restore or enhance friction and skid resistance. Calcined bauxite is the aggregate shown to yield the best results and should be used with HFST applications.

Applications

HFST should be applied in locations with increased friction demand, including:

- Horizontal curves.
- Interchange ramps.
- Intersection approaches.
  - Higher-speed signalized and stop-controlled intersections.
  - Steep downward grades.
- Locations with a history of rear-end, failure to yield, wet-weather, or red-light-running crashes.
- Crosswalk approaches.

Considerations

- HFST is applied on existing pavement, so no new pavement is added.
- If the underlying pavement structure is unstable, then the HFST life cycle may be shortened, resulting in pre-mature failure.
- The automated installation method is preferred as it minimizes issues often associated with manual installation: human error due to fatigue, inadequate binder mixing, improper and uneven binder thickness, delayed aggregate placement, and inadequate aggregate coverage.
- The cost can be reduced when bundling installations at multiple locations.

1 Izeppi et al. Continuous Friction Measurement Equipment as a Tool for Improving Crash Rate Prediction: A Pilot Study. Virginia Department of Transportation, (2016).
2 Merritt et al. Development of Crash Modification Factors for High Friction Surface Treatments. FHWA, (2020).
3 NCHRP Report 617: Accident Modification Factors for Traffic Engineering and ITS Improvements, (2008).

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Rectangular Rapid Flashing Beacons (RRFB)

A marked crosswalk or pedestrian warning sign can improve safety for pedestrians crossing the road, but at times may not be sufficient for drivers to visibly locate crossing locations and yield to pedestrians. To enhance pedestrian conspicuity and increase driver awareness at uncontrolled, marked crosswalks, transportation agencies can install a pedestrian actuated Rectangular Rapid Flashing Beacon (RRFB) to accompany a pedestrian warning sign. RRFBs consist of two, rectangular- shaped yellow indications, each with a light-emitting diode (LED)-array-based light source.[1] RRFBs flash with an alternating high frequency when activated to enhance conspicuity of pedestrians at the crossing to drivers.

For more information on using RRFBs, see the Interim Approval in the *Manual on Uniform Traffic Control Devices (MUTCD)*.[1]

Safety Benefits:

RRFBs can reduce crashes up to:

47%

for pedestrian crashes.[4]

RRFBs can increase motorist yielding rates up to:

98%

(varies by speed limit, number of lanes, crossing distance, and time of day).[3]

RRFBs used at a trail crossing.
Source: LJB

Applications

The RRFB is applicable to many types of pedestrian crossings but is particularly effective at multilane crossings with speed limits less than 40 miles per hour.[2] Research suggests RRFBs can result in motorist yielding rates as high at 98 percent at marked crosswalks, but varies depending on the location, posted speed limit, pedestrian crossing distance, one- versus two-way road, and the number of travel lanes.[3] RRFBs can also accompany school or trail crossing warning signs.

RRFBs are placed on both sides of a crosswalk below the pedestrian crossing sign and above the diagonal downward arrow plaque pointing at the crossing.[1] The flashing pattern can be activated with pushbuttons or passive (e.g., video or infrared) pedestrian detection, and should be unlit when not activated.

Considerations

Agencies should:[2]

- Install RRFBs in the median rather than the far-side of the roadway if there is a pedestrian refuge or other type of median.
- Use solar-power panels to eliminate the need for a power source.
- Reserve the use of RRFBs for locations with significant pedestrian safety issues, as over-use of RRFB treatments may diminish their effectiveness.

Agencies shall not:[2]

- Use RRFBs without the presence of a pedestrian, school or trail crossing warning sign.
- Use RRFBs for crosswalks across approaches controlled by YIELD signs, STOP signs, traffic control signals, or pedestrian hybrid beacons, except for the approach or egress from a roundabout.

For more information on this and other FHWA Proven Safety Countermeasures, please visit https://safety.fhwa.dot.gov/provencountermeasures/ and https://safety.fhwa.dot.gov/ped_bike/step/docs/techSheet_RRFB_2018.pdf.

1 *MUTCD* Interim Approval 21 - RRFBs at Crosswalks.
2 "Rectangular Rapid Flash Beacon" in PEDSAFE: Pedestrian Safety Guide and Countermeasure Selection System. FHWA, (2013).
3 Fitzpatrick et al. "Will You Stop for Me? Roadway Design and Traffic Control Device Influences on Drivers Yielding to Pedestrians in a Crosswalk with a Rectangular Rapid-Flashing Beacon." Report No. TTI-CTS-0010. Texas A&M Transportation Institute, (2016).
4 NCHRP Research Report 841 Development of Crash Modification Factors for Uncontrolled Pedestrian Crossing Treatments, (2017).

FHWA-SA-21-053

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Speed Safety Cameras

Safe Speeds is a core principle of the Safe System Approach since humans are less likely to survive high-speed crashes. Enforcing safe speeds has been challenging; however, with more information and tools communities can make progress in reducing speeds. Agencies can use speed safety cameras (SSCs) as an effective and reliable technology to supplement more traditional methods of enforcement, engineering measures, and education to alter the social norms of speeding. SSCs use speed measurement devices to detect speeding and capture photographic or video evidence of vehicles that are violating a set speed threshold.

Safety Benefits:

Fixed units can reduce crashes on urban principal arterials up to:

54% for all crashes.[4]

47% for injury crashes.[4]

P2P units can reduce crashes on urban expressways, freeways, and principal arterials up to:

37% for fatal and injury crashes.[2]

Mobile units can reduce crashes on urban principal arterials up to:

20% for fatal and injury crashes.[5]

In New York City, fixed units reduced speeding in school zones up to 63% during school hours.[6]

For more information on this and other FHWA Proven Safety Countermeasures, please visit https://safety.fhwa.dot.gov/provencountermeasures/ and https://safety.fhwa.dot.gov/speedmgt/.

FHWA-SA-21-070

Applications

Agencies should conduct a network analysis of speeding-related crashes to identify locations to implement SSCs. The analysis can include scope (e.g., widespread, localized), location types (e.g., urban/suburban/rural, work zones, residential, school zones), roadway types (e.g., expressways, arterials, local streets), times of day, and road users most affected by speed-related crashes (e.g., pedestrians, bicyclists).

SSCs can be deployed as:

- **Fixed units**—a single, stationary camera targeting one location.
- **Point-to-Point (P2P) units**—multiple cameras to capture average speed over a certain distance.
- **Mobile units**—a portable camera, generally in a vehicle or trailer.

The table below describes suitable circumstances for SSC deployment.[1]

Considerations

- SSCs can produce a crash reduction upstream and downstream, thus generating a spillover effect.[2]
- Public trust is essential for any type of enforcement. With proper controls in place, SSCs can offer fair and equitable enforcement of speeding, regardless of driver age, race, gender, or socio-economic status. SSCs should be planned with community input and equity impacts in mind.
- Using both overt (i.e., highly visible) and covert (i.e., hidden) enforcement may encourage drivers to comply with limits everywhere, not only at sites they are aware are enforced.
- Agencies should conduct evaluations regularly to determine if SSCs are accomplishing safety goals and whether changes in strategy, scheduling, communications, or public engagement are necessary.
- Agencies should conduct a legal and policy review to determine if SSCs are authorized within a jurisdiction and how the authorization and other traffic laws will affect a SSC program.
- Agencies should develop an SSC program plan with consideration of the USDOT SSC guidelines for planning, public involvement, stakeholder coordination, implementation, maintenance, evaluation, etc.[3]

Considerations for Selection	Fixed	P2P	Mobile
Problems are long-term and site-specific.	X	X	—
Problems are network-wide, and shift based on enforcement efforts.	—	—	X
Speeds at enforcement site vary largely from downstream sites.	—	X	X
Overt enforcement is legally required.	X	X	X
Sight distance for the enforcement unit is limited.	X	X	—
Enforcement sites are multilane facilities.	X	X	—

1 Thomas et al. Speed Safety Camera Program Planning and Operations Guide. FHWA, (2021).
2 Montella et al. "Effects on speed and safety of point-to-point speed enforcement systems". Accident Analysis and Prevention, Vol. 75, (2015). Note that this is an international study.
3 Speed Enforcement Camera Systems Operational Guidelines. NHTSA, (2008).
4 Shin et al. "Evaluation of the Scottsdale Loop 101 automated speed enforcement demonstration program." Accident Analysis and Prevention, Vol. 41, (2009).
5 Li et al. "A Before-and-After Empirical Bayes Evaluation of Automated Mobile Speed Enforcement on Urban Arterial Roads." Presented at the 94th Annual Meeting of the Transportation Research Board, Paper No. 15-1563, Washington, D.C., (2015). Note that this is an international study.
6 Automated Speed Enforcement Program Report 2014-2017. New York City DOT, (2018).

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Variable Speed Limits

Selecting appropriate speed limits on roadways is important in maintaining a safe and efficient transportation network. Speed limits are established with an engineering study based on inputs like traffic volumes, operating speeds, roadway characteristics, and crash history. However, conditions on the roadway are susceptible to change in a short amount of time (e.g., congestion, crashes, weather). Drivers typically determine their operating speeds under normal weather conditions on a straight roadway section with good pavement quality and adequate sight distances. If ideal conditions do not exist and the roadway does not meet the driver's expectations, there is a greater chance that a driver error could result in a crash. Providing variable speeds limits (VSLs) capable of adapting to changing circumstances could reduce crash frequency and severity.

Speed management strategies, including VSLs, are integral to the Safe Speeds element of the Safe System Approach. Because humans are unlikely to survive high-speed crashes, VSLs reduce speeds so that human injury tolerances are accommodated in three ways: improving visibility, providing additional time for drivers to stop, and reducing impact forces.

Safety Benefits:

VSLs can reduce crashes on freeways up to:

34%
for total crashes.[1]

65%
for rear-end crashes.[1]

51%
for fatal and injury crashes.[1]

Benefit/Cost Ratios range between[1]

9:1 - 40:1

Applications

VSLs use prevailing information on the roadway, like traffic speed, volumes, weather, and road surface conditions, to determine appropriate speeds and display them to drivers. This strategy improves safety performance and traffic flow by reducing speed variance (i.e., improving speed harmonization). VSLs may also improve driver expectation by providing information in advance of slowdowns and potential lane closures, which could reduce the probability for secondary crashes. VSLs can mitigate adverse weather conditions or to slow faster-moving traffic as it approaches a queue or bottleneck.

Agencies can implement VSLs for the following applications:


CONGESTION


INCIDENTS


WORK ZONES


INCLEMENT WEATHER

Considerations

- Particularly effective on urban and rural freeways and high-speed arterials with posted speed limits greater than 40 mph.
- Often implemented as part of Active Traffic Management (ATM) plans or incorporated into existing Road Weather Information Systems.
- When used with ATM, VSLs can mitigate rear-end, sideswipe, and other crashes on high-speed roadways.
- May be implemented as a regulatory and/or an advisory system.
- Can be applied to an entire roadway segment or individual lanes.

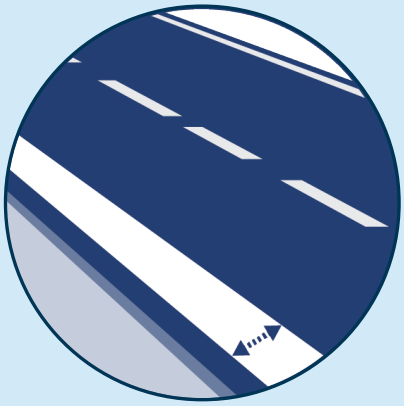
Source: WSDOT

For more information on this and other FHWA Proven Safety Countermeasures, please visit https://safety.fhwa.dot.gov/provencountermeasures/ and https://safety.fhwa.dot.gov/speedmgt/ref_mats/.

1 Avelar et al. Developing Crash Modification Factors for Variable Speed Limit. FHWA, (2020).

FHWA-SA-21-054

U.S. Department of Transportation
Federal Highway Administration



Wider Edge Lines

Roadway departures account for over half of all traffic fatalities in the United States. If drivers cannot clearly identify the edge of the travel lanes and see the road alignment ahead, the risk of roadway departure may be greater. Wider edge lines enhance the visibility of travel lane boundaries compared to traditional edge lines. Edge lines are considered "wider" when the marking width is increased from the minimum normal line width of 4 inches to the maximum normal line width of 6 inches.[1]

Safety Benefits:

Wider edge lines can reduce crashes up to:

37%
for non-intersection, fatal and injury crashes on rural, two-lane roads.[2]

22%
for fatal and injury crashes on rural freeways.[3]

Benefit Cost Ratio
25:1
for fatal and serious injury crashes on two-lane rural roads.[4]

Applications

Wider edge lines increase drivers' perception of the edge of the travel lane and can provide a safety benefit to all facility types (e.g., freeways, multilane divided and undivided highways, two-lane highways) in both urban and rural areas.[2] Wider edge lines are most effective in reducing crashes on rural two-lane highways, especially for single-vehicle crashes.[3] Agencies should also consider implementing a systemic approach to wider edge line installation based roadway departure crash risk factors. Potential risk factors for two-lane rural roads include:

- Pavement and shoulder widths.
- Presence of curves.
- Traffic volumes.
- History of nighttime crashes.

Considerations

- Wider edge lines are relatively low cost.
- Wider edge lines can be implemented using existing equipment during maintenance procedures like re-striping and resurfacing, with the only cost increase being the additional material.
- Paint may have a lower initial cost, but more durable materials (e.g., thermoplastic) may result in a lower life cycle cost based on their longer service life.
- As the number of automated vehicles increases on roadways, wider edge lines may provide better guidance for these vehicles' sensors.

Source: Texas Transportation Institute

For more information on this and other FHWA Proven Safety Countermeasures, please visit https://safety.fhwa.dot.gov/provencountermeasures/ and https://safety.fhwa.dot.gov/roadway_dept/night_visib/pavement-markings.cfm.

1 Manual on Uniform Traffic Control Devices, Section 3A.06. FHWA, (2009).
2 Park et al. "Safety effects of wider edge lines on rural, two-lane highways." Accident Analysis and Prevention Vol. 48, pp.317-325, (2012).
3 Potts et al. Benefit/Cost Evaluation of MoDOT's Total Striping and Delineation Program: Phase II. Missouri Department of Transportation, (2011).
4 Abdel-Rahim et al. Safety Impacts of Using Wider Pavement Markings on Two-Lane Rural Highways in Idaho. Idaho Transportation Department, (2018).

FHWA-SA-21-055

Appendix D: Jurupa Valley Capital Improvement Program List

CITY OF JURUPA VALLEY

CAPITAL IMPROVEMENT PROGRAM

FISCAL YEAR 2021/22—2025/26

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TRANSMITTAL MESSAGE

Honorable Mayor, Members of the City Council and Residents of Jurupa Valley:

On behalf of the City of Jurupa Valley staff I am proud to transmit the FY 2021-2022 to FY 2025-2026 Capital Improvement Program (CIP). This document is the result of several internal review meetings and previous City Council direction. All projects presented in this budget have been carefully examined to ensure the community's capital improvement needs are met both now and in the future. You will find this CIP has been developed with a balance between the infrastructure needs of the community and the City's financial capacity.

The CIP is a five-year planning instrument used to identify and coordinate the financing and timing of public improvements. The first year of this program is the capital budget you will see in the City's overall operating budget. Projects slated for subsequent years in the program are for planning purposes only and do not receive expenditure authority until they are allocated funding in a future capital budget.

The City's goal in providing a CIP budget is to develop a multi-year plan for capital improvement, update it annually and follow through with all capital improvements in accordance with the plan. In determining the relative merit of a proposed project, key management team members evaluate projects for feasibility, community enhancement, infrastructure preservation and safety.

City staff identified the community's capital needs for each fiscal year, evaluated anticipated funding availability and presents a proposed CIP for the City Council's consideration and direction to staff. The focus of the CIP is to combine a comprehensive planning document that identifies revenues with the capital projects expenditure budget. The document also augments the existing capital projects budget information and facilitates the long-range capital projects planning process.

The CIP includes a total of $127,597,526 in identified capital projects, with available funding of $64,398,726. There is $63,198,800 in "Unspecified" project funding, indicating that a revenue source has not been identified for these projects. There are 35 projects which are scheduled to begin design, construction and/or be completed in FY 2021-2022. These projects are intended to enhance the safety and quality of life for all citizens in the City of Jurupa Valley. The following is a list of some highlighted projects contained in the CIP:

- Van Buren Blvd. Widening, Santa Ana River to Limonite
- Jurupa Rd. and Van Buren Blvd. Grade Separation
- Sunnyslope Area SR2S Sidewalk Gap Closure
- Market St. Widening, Santa Ana River to Rubidoux
- Citywide Guardrail Replacement
- Mission Blvd. Pavement Rehabilitation – Ph. 1 and 2, Bellegrave to Valley Way
- Riverside Dr. Widening, I-15 to Wineville

The revenue estimates, although conservative, are strictly estimates. The actual amount of funds available for construction will vary based upon the state of the economy. The City Council will be updated throughout the year on the status of projects and corresponding revenue sources.

The FY 2021-2022 to FY 2025-2026 Capital Improvement Program is a result of a total team effort of both City staff and City Council. I would like to thank staff and the City Council for all of the contributions that were made in developing the capital budget that will serve as the blueprint for Jurupa Valley's future.

Sincerely,

Rod Butler
City Manager

PROJECT SUMMARY

PROJECT NUMBER	PROJECT NAME	SOURCE OF FUNDS	PROJECTED CARRYOVER	21/22 PROJECTED	22/23 PROJECTED	23/24 PROJECTED	24/25 PROJECTED	25/26 PROJECTED AND FUTURE YEARS	COST TO COMPLETE
13-H.1	MARKET ST. BRIDGE, CROSSING SANTA ANA RIVER	TUMF	**$ 502,200**	**$ -**	**$ 2,000,000**	**$ 2,750,000**	**$ 2,704,198**	**$ -**	**$ 7,956,398**
13-H.2	MISSION BLVD. BRIDGE, CROSSING SANTA ANA RIVER	Measure 'A'	**$ 566,621**	**$ 265,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 831,621**
	BAIN ST. PAVEMENT REHABILITATION, 54TH TO BELLEGRAVE	Measure 'A'	$ 135,000	$ -	$ -	$ -	$ -	$ -	$ 135,000
		Gas Tax	$ -	$ -	$ -	$ -	$ -	$ -	$ -
16-A.2		RMRA	$ 73,537	$ -	$ -	$ -	$ -	$ -	$ 73,537
		Unspecified	$ -	$ -	$ -	$ -		$ 650,000	$ 650,000
		TOTAL	**$ 208,537**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 650,000**	**$ 858,537**
16-C.2	TRAFFIC SIGNAL INSTALLATION, PEDLEY AND JURUPA	DIF (Signals)	**$ 20,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 20,000**
16-F	CERTIFICATES OF PARTICIPATION (COP) SERIES 2016A - DEBT SERVICE	Measure 'A'	**$ -**	**$ 1,057,800**	**$ 1,060,000**	**$ 1,055,800**	**$ 1,059,250**	**$ 2,119,000**	**$ 6,351,850**
	VAN BUREN BLVD. WIDENING, SANTA ANA RIVER TO LIMONITE	TUMF	$ -	$ 5,525,000	$ -	$ -	$ -	$ -	$ 5,525,000
17-B.1		DIF (Trans.)	$ 150,000	$ -	$ -	$ -	$ -	$ -	$ 150,000
		TOTAL	**$ 150,000**	**$ 5,525,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 5,675,000**
	LIMONITE AVE. WIDENING, BAIN TO HOMESTEAD	TUMF	$ -	$ 400,000	$ 850,000	$ -	$ -	$ -	$ 1,250,000
		DIF (Trans.)	$ 99,000	$ -	$ -	$ -	$ -	$ -	$ 99,000
17-B.2		Unspecified	$ -	$ -	$ -	$ -	$ -	$ 7,500,000	$ 7,500,000
		TOTAL	**$ 99,000**	**$ 400,000**	**$ 850,000**	**$ -**	**$ -**	**$ 7,500,000**	**$ 8,849,000**
	RUBIDOUX BLVD. AND SR60 INTERCHANGE IMPROVEMENTS	DIF (Rialto)	$ 183,000	$ -	$ -	$ -	$ -	$ -	$ 183,000
		TUMF	$ -	$ 617,000	$ -	$ 1,542,914	$ -	$ -	$ 2,159,914
17-B.3		Unspecified	$ -	$ -	$ -	$ -	$ -	$ 40,000,000	$ 40,000,000
		TOTAL	**$ 183,000**	**$ 617,000**	**$ -**	**$ 1,542,914**	**$ -**	**$ 40,000,000**	**$ 42,342,914**
17-B.5	JURUPA RD. AND VAN BUREN BLVD. GRADE SEPARATION	SB 132	**$ -**	**$ 100,000**	**$ 100,000**	**$ -**	**$ -**	**$ -**	**$ 200,000**
18-C.1	MISSION BLVD. AND VALLEY WAY INTERSECTION IMPROVEMENTS	DIF (Signals)	**$ 155,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 155,000**
19103	GRANITE HILL DR. PAVEMENT REHABILITATION, PYRITE TO EDGEWOOD POINT	RMRA	**$ 445,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 445,000**
	PACIFIC AVE. PEDESTRIAN AND BICYCLE IMPROVEMENTS, 42ND TO MISSION	CDBG	$ 60,000	$ -	$ -	$ -	$ -	$ -	$ 60,000
19106		Unspecified	$ -	$ -	$ -	$ -	$ -	$ 670,000	$ 670,000
		TOTAL	**$ 60,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 670,000**	**$ 730,000**
	SUNNYSLOPE AREA SR2S SIDEWALK GAP CLOSURE	ATP	$ 312,000	$ 2,466,000	$ -	$ -	$ -	$ -	$ 2,778,000
19107		Measure 'A'	$ 34,500	$ 274,000	$ -	$ -	$ -	$ -	$ 308,500
		TOTAL	**$ 346,500**	**$ 2,740,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 3,086,500**
19108	MARKET ST. WIDENING, SANTA ANA RIVER TO RUBIDOUX	TUMF	**$ 140,000**	**$ 566,000**	**$ 3,417,000**	**$ -**	**$ -**	**$ -**	**$ 4,123,000**

PROJECT SUMMARY

PROJECT NUMBER	PROJECT NAME	SOURCE OF FUNDS	PROJECTED CARRYOVER	21/22 PROJECTED	22/23 PROJECTED	23/24 PROJECTED	24/25 PROJECTED	25/26 PROJECTED AND FUTURE YEARS	COST TO COMPLETE
19109	MISSION BLVD. AND RUBIDOUX BLVD. INTERSECTION IMPROVEMENTS	DIF (Signals)	**$ 189,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 189,000**
	MASTER PLAN OF STREETS	DIF (Trans.)	$ 77,500	$ -	$ -	$ -	$ -	$ -	$ 77,500
19110		Unspecified	$ -	$ -	$ -	$ -	$ -	$ -	$ -
		TOTAL	**$ 77,500**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 77,500**
19111	TRAFFIC SIGNAL INSTALLATION, BEN NEVIS AND PEDLEY	DIF (Signals)	**$ 322,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 322,000**
	CITYWIDE GUARDRAIL REPLACEMENT	Measure 'A'	$ -	$ -	$ -	$ -	$ -	$ -	$ -
		Gas Tax	$ -	$ 65,000		$ -	$ -	$ -	$ 65,000
19112		HSIP	$ -	$ 509,200		$ -	$ -	$ -	$ 509,200
		TOTAL	**$ -**	**$ 574,200**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 574,200**
20102	2020-2021 CDBG - MISSION BLVD. ADA IMPROVEMENTS, BEN NEVIS TO VALLEY WAY	CDBG	**$ 25,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 25,000**
	MISSION BLVD. PAVEMENT REHABILITATION - PH. 1, PYRITE TO VALLEY WAY	RMRA	$ 1,300,000	$ -	$ -	$ -	$ -	$ -	$ 1,300,000
20103		Measure 'A'	$ 200,000	$ -	$ -	$ -	$ -	$ -	$ 200,000
		TOTAL	**$ 1,500,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 1,500,000**
20106	2020-2021 MISC. TRAFFIC SIGNAL UPGRADES, LOCATIONS TBD	DIF (Signals)	**$ 180,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 180,000**
20107	2020-2021 CDBG - PACIFIC AVE.STREET IMPROVEMENT PROJECT, MISSION TO SR60	CDBG	**$ 450,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 450,000**
	LOCAL ROAD SAFETY PLAN (LRSP)	LRSP	$ 36,000	$ -	$ -	$ -	$ -	$ -	$ 36,000
20108		Measure 'A'	$ 4,000	$ -	$ -	$ -	$ -	$ -	$ 4,000
		TOTAL	**$ 40,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 40,000**
	2021-2022 CITYWIDE PAVEMENT REHABILITATION, RUBIDOUX BLVD. - SR60 TO 29TH, LIMONITE AVE. - FELSPAR TO PEDLEY, JURUPA RD. - AGATE TO GALENA	RMRA	$ -	$ 1,000,000	$ -	$ -	$ -	$ -	$ 1,000,000
21101		Measure 'A'	$ -	$ 500,000	$ -	$ -	$ -	$ -	$ 500,000
		TOTAL	**$ -**	**$ 1,500,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 1,500,000**
21102	2021-2022 CDBG - OLD MIRA LOMA PAVEMENT REHABILITATION - PH. 1, 50TH, 48TH, MARTIN, TROTH, MARLATT, DODD	CDBG	**$ -**	**$ 946,406**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 946,406**
	MISSION BLVD. PAVEMENT REHABILITATION - PH. 2, BELLEGRAVE TO PYRITE	RMRA	$ -	$ 1,400,000	$ -	$ -	$ -	$ -	$ 1,400,000
21103		Measure 'A'	$ -	$ 300,000	$ -	$ -	$ -	$ -	$ 300,000
		TOTAL	**$ -**	**$ 1,700,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 1,700,000**
21104	2021-2022 MISC. TRAFFIC SIGNAL UPGRADES, LOCATIONS TBD	DIF (Signals)	**$ -**	**$ 250,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 250,000**
21105	2021-2022 MISC. DRAINAGE REPAIRS, LOCATIONS TBD	Gas Tax	**$ -**	**$ 150,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 150,000**
	CANTU GALLEANO RANCH RD. GAP CLOSURE	TUMF	$ -	$ 76,000	$ -	$ -	$ -	$ -	$ 76,000
21106		Unspecified	$ -	$ -	$ -	$ -	$ -	$ 600,000	$ 600,000
			$ -	**$ 76,000**	**$ -**	**$ -**	**$ -**	**$ 600,000**	**$ 676,000**

PROJECT SUMMARY

PROJECT NUMBER	PROJECT NAME	SOURCE OF FUNDS	PROJECTED CARRYOVER	21/22 PROJECTED	22/23 PROJECTED	23/24 PROJECTED	24/25 PROJECTED	25/26 PROJECTED AND FUTURE YEARS	COST TO COMPLETE
	BELLEGRAVE AVE. WIDENING - CANTU GALLEANO RANCH TO VAN BUREN	TUMF	$ -	$ 140,000	$ -	$ -	$ -	$ -	$ 140,000
21107		Unspecified	$ -	$ -	$ -	$ -	$ -	$ 675,000	$ 675,000
			$ -	**$ 140,000**	**$ -**	**$ -**	**$ -**	**$ 675,000**	**$ 815,000**
21108	RIVERSIDE DR. WIDENING - I-15 TO WINEVILLE	MLRBBD	**$ -**	**$ 1,850,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 1,850,000**
21109	2021-2022 CITYWIDE SLURRY SEAL, LOCATIONS TBD	Measure 'A'	**$ -**	**$ 350,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 350,000**
	MISSION BLVD. PAVEMENT REHABILITATION - PH. 3, BEN NEVIS TO BELLEGRAVE	RMRA	$ -	$ -	$ 1,400,000	$ -	$ -	$ -	$ 1,400,000
21110		Measure 'A'	$ -	$ 80,000	$ 400,000	$ -	$ -	$ -	$ 480,000
		TOTAL	**$ -**	**$ 80,000**	**$ 1,800,000**	**$ -**	**$ -**	**$ -**	**$ 1,880,000**
	VAN BUREN BLVD. PAVEMENT REHABILITATION - PH. 3, BELLEGRAVE TO ETIWANDA	RMRA	$ -	$ -	$ -	$ 2,100,000	$ -	$ -	$ 2,100,000
21111		Measure 'A'	$ -	$ 90,000	$ -	$ -	$ -	$ -	$ 90,000
		TOTAL	**$ -**	**$ 90,000**	**$ -**	**$ 2,100,000**	**$ -**	**$ -**	**$ 2,190,000**
	CITYWIDE TRAFFIC SIGNAL COORDINATION AND SAFETY UPGRADES	HSIP		$ 125,000	$ 2,228,800	$ -	$ -	$ -	$ 2,353,800
21112		Unspecified		$ 125,000	$ 2,228,800	$ -	$ -	$ -	$ 2,353,800
		TOTAL	**$ -**	**$ 250,000**	**$ 4,457,600**	**$ -**	**$ -**	**$ -**	**$ 4,707,600**
21113	MISSION BLVD. STREET IMPROVEMENTS, PYRITE TO ROUGHLY 1,300' EAST	Unspecified	$ -	$ -	$ -	$ -	$ -	$ 2,000,000	**$ 2,000,000**
22101	2022-2023 CITYWIDE SLURRY SEAL, LOCATIONS TBD	Measure 'A'	**$ -**	**$ -**	**$ 300,000**	**$ -**	**$ -**	**$ -**	**$ 300,000**
	2022-2023 CITYWIDE PAVEMENT REHABILITATION, LOCATIONS TBD	Measure 'A'	$ -	$ -	$ 700,000	$ -	$ -	$ -	$ 700,000
22102		RMRA	$ -	$ -	$ 550,000	$ -	$ -	$ -	$ 550,000
		TOTAL	**$ -**	**$ -**	**$ 1,250,000**	**$ -**	**$ -**	**$ -**	**$ 1,250,000**
	2022-2023 CDBG - OLD MIRA LOMA PAVEMENT REHABILITATION - PH. 2, 58TH, 56TH, 54TH, RIDGEVIEW, TROTH, MARLATT, DODD	CDBG	$ -	$ -	$ 850,000	$ -	$ -	$ -	$ 850,000
22103		RMRA	$ -	$ -	$ 100,000	$ -	$ -	$ -	$ 100,000
		TOTAL	**$ -**	**$ -**	**$ 950,000**	**$ -**	**$ -**	**$ -**	**$ 950,000**
22104	2022-2023 MISC. TRAFFIC SIGNAL UPGRADES, LOCATIONS TBD	DIF (Signals)	**$ -**	**$ -**	**$ 250,000**	**$ -**	**$ -**	**$ -**	**$ 250,000**
22105	2022-2023 MISC. DRAINAGE REPAIRS, LOCATIONS TBD	Gas Tax	**$ -**	**$ -**	**$ 150,000**	**$ -**	**$ -**	**$ -**	**$ 150,000**
	SIERRA AVE, ARMSTRONG TO CITY LIMITS AND/OR ARMSTRONG RD, SIERRA TO CITY LIMITS ROUNDABOUT STUDY AND INSTALLATION	Gas Tax	$ -	$ -	$ 100,000	$ -	$ -	$ -	$ 100,000
22106		Unspecified	$ -	$ -	$ -	$ 250,000	$ -	$ -	$ 250,000
		TOTAL	**$ -**	**$ -**	**$ 100,000**	**$ 250,000**	**$ -**	**$ -**	**$ 350,000**
23101	2023-2024 CITYWIDE SLURRY SEAL, LOCATIONS TBD	Measure 'A'	**$ -**	**$ -**	**$ -**	**$ 300,000**	**$ -**	**$ -**	**$ 300,000**
23102	2023-2024 CDBG - GLEN AVON AREA PAVEMENT REHABILITATION, LOCATIONS TBD	CDBG	**$ -**	**$ -**	**$ -**	**$ 875,000**	**$ -**	**$ -**	**$ 875,000**

PROJECT SUMMARY

PROJECT NUMBER	PROJECT NAME	SOURCE OF FUNDS	PROJECTED CARRYOVER	21/22 PROJECTED	22/23 PROJECTED	23/24 PROJECTED	24/25 PROJECTED	25/26 PROJECTED AND FUTURE YEARS	COST TO COMPLETE
23103	2023-2024 MISC. TRAFFIC SIGNAL UPGRADES, LOCATIONS TBD	DIF (Signals)	$ -	$ -	$ -	$ 250,000	$ -	$ -	$ 250,000
23104	2023-2024 MISC. DRAINAGE REPAIRS, LOCATIONS TBD	Gas Tax	$ -	$ -	$ -	$ 150,000	$ -	$ -	$ 150,000
23105	2023-2024 CITYWIDE PAVEMENT REHABILITATION, LOCATIONS TBD	Measure 'A'	$ -	$ -	$ -	$ 900,000	$ -	$ -	$ 900,000
24101	2024-2025 CITYWIDE SLURRY SEAL, LOCATIONS TBD	Measure 'A'	$ -	$ -	$ -	$ -	$ 300,000	$ -	$ 300,000
24102	2024-2025 CITYWIDE PAVEMENT REHABILITATION, LOCATIONS TBD	RMRA	$ -	$ -	$ -	$ -	$ 2,150,000	$ -	$ 2,150,000
		Measure 'A'	$ -	$ -	$ -	$ -	$ 900,000	$ -	$ 900,000
		TOTAL	$ -	$ -	$ -	$ -	$ 3,050,000	$ -	$ 3,050,000
24103	2024-2025 CDBG - COUNTRY VILLAGE RD. PAVEMENT REHABILITATION, GRANITE HILL TO SAN SEVAINE CHANNEL	CDBG	$ -	$ -	$ -	$ -	$ 900,000	$ -	$ 900,000
24104	2024-2025 MISC. TRAFFIC SIGNAL UPGRADES, LOCATIONS TBD	DIF (Signals)	$ -	$ -	$ -	$ -	$ 250,000	$ -	$ 250,000
24105	2024-2025 MISC. DRAINAGE REPAIRS, LOCATIONS TBD	Gas Tax	$ -	$ -	$ -	$ -	$ 150,000	$ -	$ 150,000
25101	2025-2026 CITYWIDE SLURRY SEAL, LOCATIONS TBD	Measure 'A'	$ -	$ -	$ -	$ -	$ -	$ 300,000	$ 300,000
25102	2025-2026 CITYWIDE PAVEMENT REHABILITATION, LOCATIONS TBD	Measure 'A'	$ -	$ -	$ -	$ -	$ -	$ 900,000	$ 900,000
		RMRA	$ -	$ -	$ -	$ -	$ -	$ 2,200,000	$ 2,200,000
		TOTAL	$ -	$ -	$ -	$ -	$ -	$ 3,100,000	$ 3,100,000
25103	2025-2026 CDBG - SAN SEVAINE WAY PAVEMENT REHABILITATION, ETIWANDA TO MISSION	CDBG	$ -	$ -	$ -	$ -	$ -	$ 925,000	$ 925,000
25104	2025-2026 MISC. TRAFFIC SIGNAL UPGRADES, LOCATIONS TBD	DIF (Signals)	$ -	$ -	$ -	$ -	$ -	$ 250,000	$ 250,000
25105	2025-2026 MISC. DRAINAGE REPAIRS, LOCATIONS TBD	Gas Tax	$ -	$ -	$ -	$ -	$ -	$ 150,000	$ 150,000
TBD	VALLEY WAY AND JURUPA RD. REALIGNMENT	Unspecified	$ -	$ -	$ -	$ -	$ -	$ 1,500,000	$ 1,500,000
TBD	58TH ST. GAP CLOSURE	Unspecified	$ -	$ -	$ -	$ -	$ -	$ 1,500,000	$ 1,500,000
TBD	CAMINO REAL WIDENING/INTERSECTION IMPROVEMENTS, JURUPA RD. TO 700' SOUTH	Unspecified	$ -	$ -	$ -	$ -	$ -	$ 3,000,000	$ 3,000,000
TBD	DALY AVE. STORM DRAIN IMPROVEMENTS	Unspecified	$ -	$ -	$ -	$ -	$ -	$ 1,500,000	$ 1,500,000
TBD	PACIFIC AVE. STORM DRAIN IMPROVEMENTS	Unspecified	$ -	$ -	$ -	$ -	$ -	$ 1,000,000	$ 1,000,000
		TOTAL	$ 5,659,358	$ 19,227,406	$ 16,684,600	$ 10,173,714	$ 8,413,448	$ 67,439,000	$ 127,597,526

FUNDING SUMMARY

PROJECT NUMBER	PROJECT NAME	PROJECTED CARRYOVER	21/22 PROJECTED	22/23 PROJECTED	23/24 PROJECTED	24/25 PROJECTED	25/26 PROJECTED AND FUTURE YEARS	COST TO COMPLETE
ACTIVE TRANSPORTATION PROGRAM (ATP)								
19107	SUNNYSLOPE AREA SR2S SIDEWALK GAP CLOSURE	$ 312,000	$ 2,466,000	$ -	$ -	$ -	$ -	$ 2,778,000
		$ 312,000	**$ 2,466,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 2,778,000**
COMMUNITY DEVELOPMENT BLOCK GRANT (CDBG)								
19106	PACIFIC AVE. PEDESTRIAN AND BICYCLE IMPROVEMENTS, 42ND TO MISSION	$ 60,000	$ -	$ -	$ -	$ -	$ -	$ 60,000
20102	2020-2021 CDBG - MISSION BLVD. ADA IMPROVEMENTS, BEN NEVIS TO VALLEY WAY	$ 25,000	$ -	$ -	$ -	$ -	$ -	$ 25,000
20107	2020-2021 CDBG - PACIFIC AVE. STREET IMPROVEMENT PROJECT, MISSION TO SR60	$ 450,000	$ -	$ -	$ -	$ -	$ -	$ 450,000
21102	2021-2022 CDBG - OLD MIRA LOMA PAVEMENT REHABILITATION - PH. 1, 50TH, 48TH, MARTIN, TROTH, MARLATT, DODD	$ -	$ 946,406	$ -	$ -	$ -	$ -	$ 946,406
22103	2022-2023 CDBG - OLD MIRA LOMA PAVEMENT REHABILITATION - PH. 2, 58TH, 56TH, 54TH, RIDGEVIEW, TROTH, MARLATT, DODD	$ -	$ -	$ 850,000	$ -	$ -	$ -	$ 850,000
23102	2023-2024 CDBG - GLEN AVON AREA PAVEMENT REHABILITATION, LOCATIONS TBD	$ -	$ -	$ -	$ 875,000	$ -	$ -	$ 875,000
24103	2024-2025 CDBG - COUNTRY VILLAGE RD. PAVEMENT REHABILITATION, GRANITE HILL TO SAN SEVAINE CHANNEL	$ -	$ -	$ -	$ -	$ 900,000	$ -	$ 900,000
25103	2025-2026 CDBG - SAN SEVAINE WAY PAVEMENT REHABILITATION, ETIWANDA TO MISSION	$ -	$ -	$ -	$ -	$ -	$ 925,000	$ 925,000
		$ 535,000	**$ 946,406**	**$ 850,000**	**$ 875,000**	**$ 900,000**	**$ 925,000**	**$ 5,031,406**
DEVELOPMENT IMPACT FEES - RIALTO SETTLEMENT								
17-B.3	RUBIDOUX BLVD. AND SR60 INTERCHANGE IMPROVEMENTS	$ 183,000	$ -	$ -	$ -	$ -	$ -	$ 183,000
		$ 183,000	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 183,000**
DEVELOPMENT IMPACT FEES - SIGNALS								
16-C.2	TRAFFIC SIGNAL INSTALLATION, PEDLEY AND JURUPA	$ 20,000	$ -	$ -	$ -	$ -	$ -	$ 20,000
18-C.1	MISSION BLVD. AND VALLEY WAY INTERSECTION IMPROVEMENTS	$ 155,000	$ -	$ -	$ -	$ -	$ -	$ 155,000
19109	MISSION BLVD. AND RUBIDOUX BLVD. INTERSECTION IMPROVEMENTS	$ 189,000	$ -	$ -	$ -	$ -	$ -	$ 189,000
19111	TRAFFIC SIGNAL INSTALLATION, BEN NEVIS AND PEDLEY	$ 322,000	$ -	$ -	$ -	$ -	$ -	$ 322,000
20106	2020-2021 MISC. TRAFFIC SIGNAL UPGRADES, LOCATIONS TBD	$ 180,000	$ -	$ -	$ -	$ -	$ -	$ 180,000
21104	2021-2022 MISC. TRAFFIC SIGNAL UPGRADES, LOCATIONS TBD	$ -	$ 250,000		$ -	$ -	$ -	$ 250,000
22104	2022-2023 MISC. TRAFFIC SIGNAL UPGRADES, LOCATIONS TBD	$ -	$ -	$ 250,000	$ -	$ -	$ -	$ 250,000
23103	2023-2024 MISC. TRAFFIC SIGNAL UPGRADES, LOCATIONS TBD	$ -	$ -	$ -	$ 250,000	$ -	$ -	$ 250,000
24104	2024-2025 MISC. TRAFFIC SIGNAL UPGRADES, LOCATIONS TBD	$ -	$ -	$ -	$ -	$ 250,000	$ -	$ 250,000
25104	2025-2026 MISC. TRAFFIC SINAL UPGRADES	$ -	$ -	$ -	$ -	$ -	$ 250,000	$ 250,000
		$ 866,000	**$ 250,000**	**$ 250,000**	**$ 250,000**	**$ 250,000**	**$ 250,000**	**$ 2,116,000**
DEVELOPMENT IMPACT FEES - TRANSPORTATION								
17-B.1	VAN BUREN BLVD. WIDENING, SANTA ANA RIVER TO LIMONITE	$ 150,000	$ -	$ -	$ -	$ -	$ -	$ 150,000
17-B.2	LIMONITE AVE. WIDENING, BAIN TO HOMESTEAD	$ 99,000	$ -	$ -	$ -	$ -	$ -	$ 99,000
19110	MASTER PLAN OF STREETS	$ 77,500	$ -	$ -	$ -	$ -	$ -	$ 77,500
		$ 326,500	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 326,500**

FUNDING SUMMARY

PROJECT NUMBER	PROJECT NAME	PROJECTED CARRYOVER	21/22 PROJECTED	22/23 PROJECTED	23/24 PROJECTED	24/25 PROJECTED	25/26 PROJECTED AND FUTURE YEARS	COST TO COMPLETE
GAS TAX								
16-A.2	BAIN ST. PAVEMENT REHABILITATION, 54TH TO BELLEGRAVE	$ -	$ -	$ -	$ -	$ -	$ -	$ -
19112	CITYWIDE GUARDRAIL REPLACEMENT	$ -	$ 65,000	$ -	$ -	$ -	$ -	$ 65,000
21105	2021-2022 MISC. DRAINAGE REPAIRS, LOCATIONS TBD	$ -	$ 150,000	$ -	$ -	$ -	$ -	$ 150,000
22105	2022-2023 MISC. DRAINAGE REPAIRS, LOCATIONS TBD	$ -	$ -	$ 150,000	$ -	$ -	$ -	$ 150,000
22106	SIERRA AVE, ARMSTRONG TO CITY LIMITS AND/OR ARMSTRONG RD, SIERRA TO CITY LIMITS ROUNDABOUT STUDY AND INSTALLATION	$ -	$ -	$ 100,000	$ -	$ -	$ -	$ 100,000
23104	2023-2024 MISC. DRAINAGE REPAIRS, LOCATIONS TBD	$ -	$ -	$ -	$ 150,000	$ -	$ -	$ 150,000
24105	2024-2025 MISC. DRAINAGE REPAIRS, LOCATIONS TBD	$ -	$ -	$ -	$ -	$ 150,000	$ -	$ 150,000
25105	2025-2026 MISC. DRAINAGE REPARS, LOCATIONS TBD	$ -	$ -	$ -	$ -	$ -	$ 150,000	$ 150,000
		$ -	**$ 215,000**	**$ 250,000**	**$ 150,000**	**$ 150,000**	**$ 150,000**	**$ 915,000**
HIGHWAY SAFETY IMPROVEMENT PROGRAM (HSIP)								
19112	CITYWIDE GUARDRAIL REPLACEMENT	$ -	$ 509,200	$ -	$ -	$ -	$ -	$ 509,200
21112	CITYWIDE TRAFFIC SIGNAL COORDINATION AND SAFETY UPGRADES	$ -	$ 125,000	$ 2,228,800	$ -	$ -	$ -	$ 2,353,800
		$ -	**$ 634,200**	**$ 2,228,800**	**$ -**	**$ -**	**$ -**	**$ 2,863,000**
LOCAL ROADWAY SAFETY PLAN (LRSP)								
20108	LOCAL ROADWAY SAFETY PLAN (LRSP)	$ 36,000	$ -	$ -	$ -	$ -	$ -	$ 36,000
		$ 36,000	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 36,000**
MEASURE 'A'								
13-H.2	MISSION BLVD. BRIDGE, CROSSING SANTA ANA RIVER	$ 566,621	$ 265,000	$ -	$ -	$ -	$ -	$ 831,621
16-A.2	BAIN ST. PAVEMENT REHABILITATION, 54TH TO BELLEGRAVE	$ 135,000	$ -	$ -	$ -	$ -	$ -	$ 135,000
16-F	CERTIFICATES OF PARTICIPATION (COP) SERIES 2016A - DEBT SERVICE	$ -	$ 1,057,800	$ 1,060,000	$ 1,055,800	$ 1,059,250	$ 2,119,000	$ 6,351,850
19107	SUNNYSLOPE AREA SR2S SIDEWALK GAP CLOSURE	$ 34,500	$ 274,000	$ -	$ -	$ -	$ -	$ 308,500
19112	CITYWIDE GUARDRAIL REPLACEMENT	$ -	$ -	$ -	$ -	$ -	$ -	$ -
20103	MISSION BLVD. PAVEMENT REHABILITATION - PH. 1, PYRITE TO VALLEY WAY	$ 200,000	$ -	$ -	$ -	$ -	$ -	$ 200,000
20108	LOCAL ROADWAY SAFETY PLAN (LRSP)	$ 4,000	$ -	$ -	$ -	$ -	$ -	$ 4,000
21101	2021-2022 CITYWIDE PAVEMENT REHABILITATION, RUBIDOUX BLVD. - SR60 TO 29TH, LIMONITE AVE. - FELSPAR TO PEDLEY, JURUPA RD. - AGATE TO GALENA	$ -	$ 500,000	$ -	$ -	$ -	$ -	$ 500,000
21103	MISSION BLVD. PAVEMENT REHABILITATION - PH.2, BELLEGRAVE TO PYRITE	$ -	$ 300,000	$ -	$ -	$ -	$ -	$ 300,000
21109	2021-2022 CITYWIDE SLURRY SEAL, LOCATIONS TBD	$ -	$ 350,000	$ -	$ -	$ -	$ -	$ 350,000
21110	MISSION BLVD. PAVEMENT REHABILITATION - PH.3, BEN NEVIS TO BELLEGRAVE	$ -	$ 80,000	$ 400,000	$ -	$ -	$ -	$ 480,000
21111	VAN BUREN BLVD. PAVEMENT REHABILITATION - PH.3, BELLEGRAVE TO ETIWANDA	$ -	$ 90,000	$ -	$ -	$ -	$ -	$ 90,000
22101	2022-2023 CITYWIDE SLURRY SEAL, LOCATIONS TBD	$ -	$ -	$ 300,000	$ -	$ -	$ -	$ 300,000
22102	2022-2023 CITYWIDE PAVEMENT REHABILITATION, LOCATIONS TBD	$ -	$ -	$ 700,000	$ -	$ -	$ -	$ 700,000
23101	2023-2024 CITYWIDE SLURRY SEAL, LOCATIONS TBD	$ -	$ -	$ -	$ 300,000	$ -	$ -	$ 300,000

FUNDING SUMMARY

PROJECT NUMBER	PROJECT NAME	PROJECTED CARRYOVER	21/22 PROJECTED	22/23 PROJECTED	23/24 PROJECTED	24/25 PROJECTED	25/26 PROJECTED AND FUTURE YEARS	COST TO COMPLETE
23105	2023-2024 CITYWIDE PAVEMENT REHABILITATION, LOCATIONS TBD	$ -	$ -	$ -	$ 900,000	$ -	$ -	$ 900,000
24101	2024-2025 CITYWIDE SLURRY SEAL, LOCATIONS TBD	$ -	$ -	$ -	$ -	$ 300,000	$ -	$ 300,000
24102	2024-2025 CITYWIDE PAVEMENT REHABILITATION, LOCATIONS TBD	$ -	$ -	$ -	$ -	$ 900,000	$ -	$ 900,000
25101	2025-2026 CITYWIDE SLURRY SEAL, LOCATIONS TBD	$ -	$ -	$ -	$ -	$ -	$ 300,000	$ 300,000
25102	2025-2026 CITYWIDE PAVEMENT REHABILITATION, LOCATIONS TBD	$ -	$ -	$ -	$ -	$ -	$ 900,000	$ 900,000
		$ 940,121	**$ 2,916,800**	**$ 2,460,000**	**$ 2,255,800**	**$ 2,259,250**	**$ 3,319,000**	**$ 14,150,971**
MIRA LOMA RBBD (MLRBBD)								
21108	RIVERSIDE DR. WIDENING - I-15 TO WINEVILLE	$ -	$ 1,850,000	$ -	$ -	$ -	$ -	$ 1,850,000
		$ -	**$ 1,850,000**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 1,850,000**
ROAD MAINTENANCE AND REHABILITATION ACCOUNT (RMRA)								
16-A.2	BAIN ST. PAVEMENT REHABILITATION, 54TH TO BELLEGRAVE	$ 73,537	$ -	$ -	$ -	$ -	$ -	$ 73,537
19103	GRANITE HILL DR. PAVEMENT REHABILITATION, PYRITE TO EDGEWOOD POINT	$ 445,000	$ -	$ -	$ -	$ -	$ -	$ 445,000
20103	MISSION BLVD. PAVEMENT REHABILITATION - PH. 1, PYRITE TO VALLEY WAY	$ 1,300,000	$ -	$ -	$ -	$ -	$ -	$ 1,300,000
21101	2021-2022 CITYWIDE PAVEMENT REHABILITATION, RUBIDOUX BLVD. - SR60 TO 29TH, LIMONITE AVE. - FELSPAR TO PEDLEY, JURUPA RD. - AGATE TO GALENA	$ -	$ 1,000,000	$ -	$ -	$ -	$ -	$ 1,000,000
21111	VAN BUREN BLVD. PAVEMENT REHABILITATION - PH.3, BELLEGRAVE TO ETIWANDA	$ -	$ -	$ -	$ 2,100,000	$ -	$ -	$ 2,100,000
21103	MISSION BLVD. PAVEMENT REHABILITATION - PH. 2, BELLEGRAVE TO PYRITE	$ -	$ 1,400,000	$ -	$ -	$ -	$ -	$ 1,400,000
21110	MISSION BLVD. PAVEMENT REHABILITATION - PH.3, BEN NEVIS TO BELLEGRAVE	$ -	$ -	$ 1,400,000	$ -	$ -	$ -	$ 1,400,000
22102	2022-2023 CITYWIDE PAVEMENT REHABILITATION, LOCATIONS TBD	$ -	$ -	$ 550,000	$ -	$ -	$ -	$ 550,000
22103	2022-2023 CDBG - OLD MIRA LOMA PAVEMENT REHABILITATION - PH. 2, 58TH, 56TH, 54TH, RIDGEVIEW, TROTH, MARLATT, DODD	$ -	$ -	$ 100,000	$ -	$ -	$ -	$ 100,000
24102	2024-2025 CITYWIDE PAVEMENT REHABILITATION, LOCATIONS TBD	$ -	$ -	$ -	$ -	$ 2,150,000	$ -	$ 2,150,000
25102	2025-2026 CITYWIDE PAVEMENT REHABILITATION, LOCATIONS TBD	$ -	$ -	$ -	$ -	$ -	$ 2,200,000	$ 2,200,000
		$ 1,818,537	**$ 2,400,000**	**$ 2,050,000**	**$ 2,100,000**	**$ 2,150,000**	**$ 2,200,000**	**$ 12,718,537**
SENATE BILL 132								
17-B.5	JURUPA RD. AND VAN BUREN BLVD. GRADE SEPARATION	$ -	$ 100,000	$ 100,000	$ -	$ -	$ -	$ 200,000
		$ -	**$ 100,000**	**$ 100,000**	**$ -**	**$ -**	**$ -**	**$ 200,000**
TUMF								
13-H.1	MARKET ST. BRIDGE, CROSSING SANTA ANA RIVER	$ 502,200	$ -	$ 2,000,000	$ 2,750,000	$ 2,704,198	$ -	$ 7,956,398
17-B.1	VAN BUREN BLVD. WIDENING, SANTA ANA RIVER TO LIMONITE	$ -	$ 5,525,000	$ -	$ -	$ -	$ -	$ 5,525,000
17-B.2	LIMONITE AVE. WIDENING, BAIN TO HOMESTEAD	$ -	$ 400,000	$ 850,000	$ -	$ -	$ -	$ 1,250,000
17-B.3	RUBIDOUX BLVD. AND SR60 INTERCHANGE IMPROVEMENTS	$ -	$ 617,000	$ -	$ 1,542,914	$ -	$ -	$ 2,159,914
19108	MARKET ST. WIDENING, SANTA ANA RIVER TO RUBIDOUX	$ 140,000	$ 566,000	$ 3,417,000	$ -	$ -	$ -	$ 4,123,000
21106	CANTU GALLEANO RANCH RD. GAP CLOSURE	$ -	$ 76,000	$ -	$ -	$ -	$ -	$ 76,000
21107	BELLEGRAVE AVE. WIDENING, CANTU GALLEANO RANCH TO VAN BUREN	$ -	$ 140,000	$ -	$ -	$ -	$ -	$ 140,000
		$ 642,200	**$ 7,324,000**	**$ 6,267,000**	**$ 4,292,914**	**$ 2,704,198**	**$ -**	**$ 21,230,312**

FUNDING SUMMARY

PROJECT NUMBER	PROJECT NAME	PROJECTED CARRYOVER	21/22 PROJECTED	22/23 PROJECTED	23/24 PROJECTED	24/25 PROJECTED	25/26 PROJECTED AND FUTURE YEARS	COST TO COMPLETE
UNSPECIFIED								
16-A.2	BAIN ST. PAVEMENT REHABILITATION, 54TH TO BELLEGRAVE	$ -	$ -	$ -	$ -	$ -	$ 650,000	$ 650,000
17-B.2	LIMONITE AVE. WIDENING, BAIN TO HOMESTEAD	$ -	$ -	$ -	$ -	$ -	$ 7,500,000	$ 7,500,000
17-B.3	RUBIDOUX BLVD. AND SR60 INTERCHANGE IMPROVEMENTS	$ -	$ -	$ -	$ -	$ -	$ 40,000,000	$ 40,000,000
19106	PACIFIC AVE. PEDESTRIAN AND BICYCLE IMPROVEMENTS, 42ND TO MISSION	$ -	$ -	$ -	$ -	$ -	$ 670,000	$ 670,000
19110	MASTER PLAN OF STREETS	$ -	$ -	$ -	$ -	$ -	$ -	$ -
21106	CANTU GALLEANO RANCH RD. GAP CLOSURE	$ -	$ -	$ -	$ -	$ -	$ 600,000	$ 600,000
21107	BELLEGRAVE AVE. WIDENING, CANTU GALLEANO RANCH TO VAN BUREN	$ -	$ -	$ -	$ -	$ -	$ 675,000	$ 675,000
21112	CITYWIDE TRAFFIC SIGNAL COORDINATION AND SAFETY UPGRADES	$ -	$ 125,000	$ 2,228,800	$ -	$ -	$ -	$ 2,353,800
21113	MISSION BLVD. STREET IMPROVEMENTS, PYRITE TO ROUGHLY 1,300' EAST	$ -	$ -	$ -	$ -	$ -	$ 2,000,000	$ 2,000,000
22106	SIERRA AVE, ARMSTRONG TO CITY LIMITS AND/OR ARMSTRONG RD, SIERRA TO CITY LIMITS ROUNDABOUT STUDY AND INSTALLATION	$ -	$ -	$ -	$ 250,000	$ -	$ -	$ 250,000
TBD	VALLEY WAY AND JURUPA RD. REALIGNMENT	$ -	$ -	$ -	$ -	$ -	$ 1,500,000	$ 1,500,000
TBD	58TH ST. GAP CLOSURE	$ -	$ -	$ -	$ -	$ -	$ 1,500,000	$ 1,500,000
TBD	CAMINO REAL WIDENING/INTERSECTION IMPROVEMENTS, JURUPA RD. TO 700' SOUTH	$ -	$ -	$ -	$ -	$ -	$ 3,000,000	$ 3,000,000
TBD	DALY AVE. STORM DRAIN IMPROVEMENTS	$ -	$ -	$ -	$ -	$ -	$ 1,500,000	$ 1,500,000
TBD	PACIFIC AVE. STORM DRAIN IMPROVEMENTS	$ -	$ -	$ -	$ -	$ -	$ 1,000,000	$ 1,000,000
		$ -	**$ 125,000**	**$ 2,228,800**	**$ 250,000**	**$ -**	**$ 60,595,000**	**$ 63,198,800**
	TOTAL	**$ 5,659,358**	**$ 19,227,406**	**$ 16,684,600**	**$ 10,173,714**	**$ 8,413,448**	**$ 67,439,000**	**$ 127,597,526**