LOCAL ROAD SAFETY PLAN

NOVEMBER 2022

Acknowledgements

City of Brawley

Guillermo Silla, Public Works Director/City Engineer

Safety Partners

Brawley Police Department

John Tang, Sergeant

Brawley Fire Department

Michael York, Fire Chief

Brawley Elementary School District

Rauna Fox, Superintendent

Consultant Team

STC Traffic

Jason Stack, Principal Manager
Stephen Manganiello, Project Manager
Ashley Adamos, Project Engineer
Myles Baidy, Project Engineer
Ivan Gonzalez, Associate Engineer
Miguel Lomeli, Assistant Engineer

Local Road Safety Plan Governance

The Brawley Local Road Safety Plan (LRSP) was prepared within the governance of **United States Code Title 23, Section 148 – Highway Safety Improvement Program (h) (4):** "DISCOVERY AND ADMISSION INTO EVIDENCE OF CERTAIN REPORTS, SURVEYS, AND INFORMATION.- Notwithstanding any other provision 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 a location identified or addressed in the reports, surveys, schedules, lists, or other data." [23 U.S.C. §148(h) (4)]

United States Code Title 23, Section 409 – Discovery and Admission of Evidence of Certain Reports and Surveys: "Notwithstanding any other provision of law, reports, surveys, schedules, lists, or data compiled or collected for the purpose of identifying, evaluating, or planning the safety enhancement of potential accident sites, hazardous roadway conditions, or railway-highway crossings, pursuant to sections 130, 144, and 148 of this title or for the purpose of developing any highway safety construction improvement project which may be implemented utilizing Federal-aid highway funds 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 a location mentioned or addressed in such reports, surveys, schedules, lists, or data." [23 U.S.C. §409]

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ADA ..... Americans with Disabilities Act

BCR ..... Benefit Cost Ratio

CA ..... California

CalSTA ..... California State Transportation Agency

Caltrans ..... California Department of Transportation

CHP ..... California Highway Patrol

CMF ..... Crash Modification Factor

CRF ..... Crash Reduction Factor

DRE ..... Drug Recognition Evaluation

DUI ..... Driving Under the Influence

DVMT ..... Daily Vehicle Miles Travelled

EPDO ..... Equivalent Property Damage Only

EVPE ..... Emergency Vehicle Pre-emption

FHWA ..... Federal Highway Administration

GIS ..... Geographic Information System

GPS ..... Global Positioning System

HAWK ..... High-Intensity Activated Crosswalk Beacon

HSIP ..... Highway Safety Improvement Program

IR ..... Infrared

LED ..... Light Emitting Diode

LRSM ..... Local Roadway Safety Manual

LRSP ..... Local Road Safety Plan

NACE ..... National Association of County Engineers

NHTSA ..... National Highway Traffic Safety Administration

OTS ..... Office of Transportation Safety

PCF ..... Primary Collision Factor

PDO ..... Property Damage Only

PSC ..... Proven Safety Countermeasure

PTSC ..... Public / Traffic Safety Commission

RRFB ..... Rectangular Rapid Flashing Beacon

SHSP ..... Strategic Highway Safety Plan

SR .....State Route

SRTS .....Safe Routes to School

SWITRS ..... Statewide Integrated Traffic Records System

TIMS ..... Transportation Injury Mapping System

TNC ..... Transportation Network Company

TSM ..... Traffic Safety Marketing

USDOT ..... United States Department of Transportation

V2I ..... Vehicle-to-Infrastructure

V2P ..... Vehicle-to-Pedestrian

V2V ..... Vehicle-to-Vehicle

1 Introduction

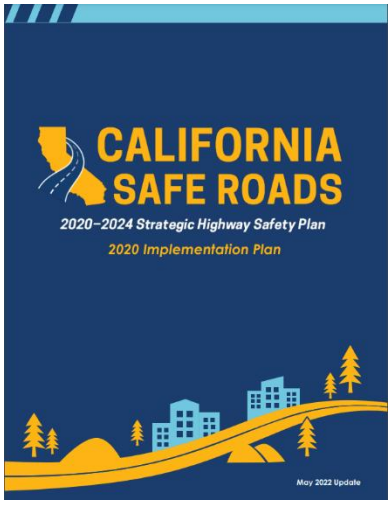
The California Department of Transportation (Caltrans) established the Local Road Safety Plan (LRSP) program in 2019 to support local agencies in developing a framework to systemically identify and analyze safety problems and prioritizing roadway safety improvements. The LRSP program was designed to enable jurisdictions to address their unique safety needs while contributing to the success of the California Strategic Highway Safety Plan (SHSP), which is a statewide, comprehensive, data-driven effort to reduce fatal and serious injury crashes across all travel modes and on all public roads. The 2020-2024 California SHSP includes strategies based on the 5E's of traffic safety (Engineer, Enforcement, Education, Emergency Response, and Emerging Technologies), a strategic Implementation Plan, and addresses 16 challenge areas. There are 6 challenge areas designated as high priority for having the greatest opportunity to reduce fatalities and serious injuries on public roads. The remaining 10 challenge areas are designated as focus areas.

High Priority Areas

- Pedestrians
- Bicyclists
- Impaired Driving
- Intersections
- Lane Departures
- Speed Management/ Aggressive Driving

Focus Areas

- Aging Drivers (>65)
- Commercial Drivers
- Distracted Driving
- Driver Licensing
- Emergency Response
- Emerging Technologies
- Motorcyclists
- Occupant Protection
- Work Zones
- Young Drivers (15-20)



The 2020-2024 SHSP and 2020-2024 SHSPS Implementation Plan were recently updated in May 2022 to incorporate new guiding principles based on a pivot towards a bolder, more focused approach to combating the rise in fatalities and serious injuries that have occurred on California roads. The 2020-2024 SHSP Pivot guiding principles include:

- **Integrate Equity:** Include equity in all aspects to address institutional and systemic biases and ensure that processes, strategies, and outcomes will serve all, but particularly vulnerable and traditionally underserved populations
- **Double Down on What Works:** Implement proven safety countermeasures that are highly effective in reducing fatalities and severe injuries
- **Accelerate Advanced Technology:** Encourage the use of advanced technology in and on roadways by forming new partnerships with technology providers, health and safety groups, manufacturers, and government partners to prioritize safety
- **Implement a Safe System Approach:** Include the Federal Highway Administration (FHWA)'s holistic view of the road system to eliminate fatal and serious injuries by placing additional responsibility on agencies to account for human error with the design and operation of roadways:

  - Death/serious injury is unacceptable
  - Humans make mistakes
  - Humans are vulnerable
  - Responsibility is shared
  - Safety is proactive
  - Redundancy is crucial

HSIP

The City of Brawley was awarded grant from Caltrans to develop a Local Road Safety Plan. Development of the Brawley LRSP will qualify the City to meet eligibility requirements for Highway Safety Improvement Program (HSIP) grant funding, which is required for the current Cycle 11 call-for-projects due September 12, 2022.

1.1 City of Brawley Setting

The City of Brawley is centrally located in Imperial County, approximately 6 miles southeast of the City of Westmorland, 9 miles south of the City of Calipatria, 9 miles and 12 miles north of the Cities of Imperial and El Centro respectively, and 21 miles north of Calexico, situated along the Mexico border, as illustrated in **Figure 1-1**. According to 2020 Census estimates, Brawley has a population of 26,416 and is the third largest City in Imperial County. Brawley encompasses 8.12 square miles, 104 miles paved lane miles of public roads, and is traversed by California State Route 86 (SR-86) in the western portion of the City, California State Route 111 (SR-111) in the northeastern area of the City, and the Union Pacific Railroad which runs north-south through the heart of the City. There are 16 signalized intersections within the City of Brawley, including eight along SR-86 that are owned and operated by the Caltrans. **Figure 1-2** illustrates the project study area.

Figure 1-1: Vicinity Map

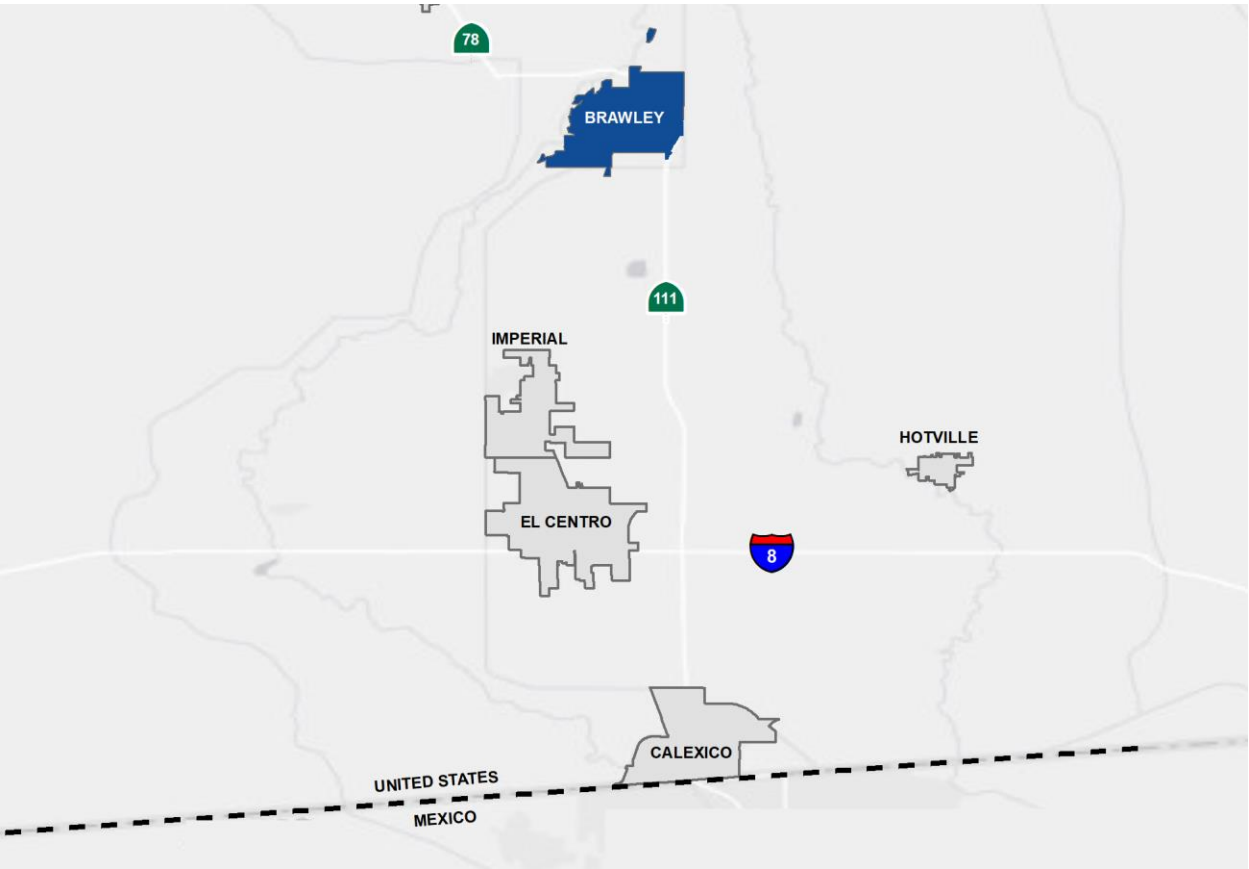
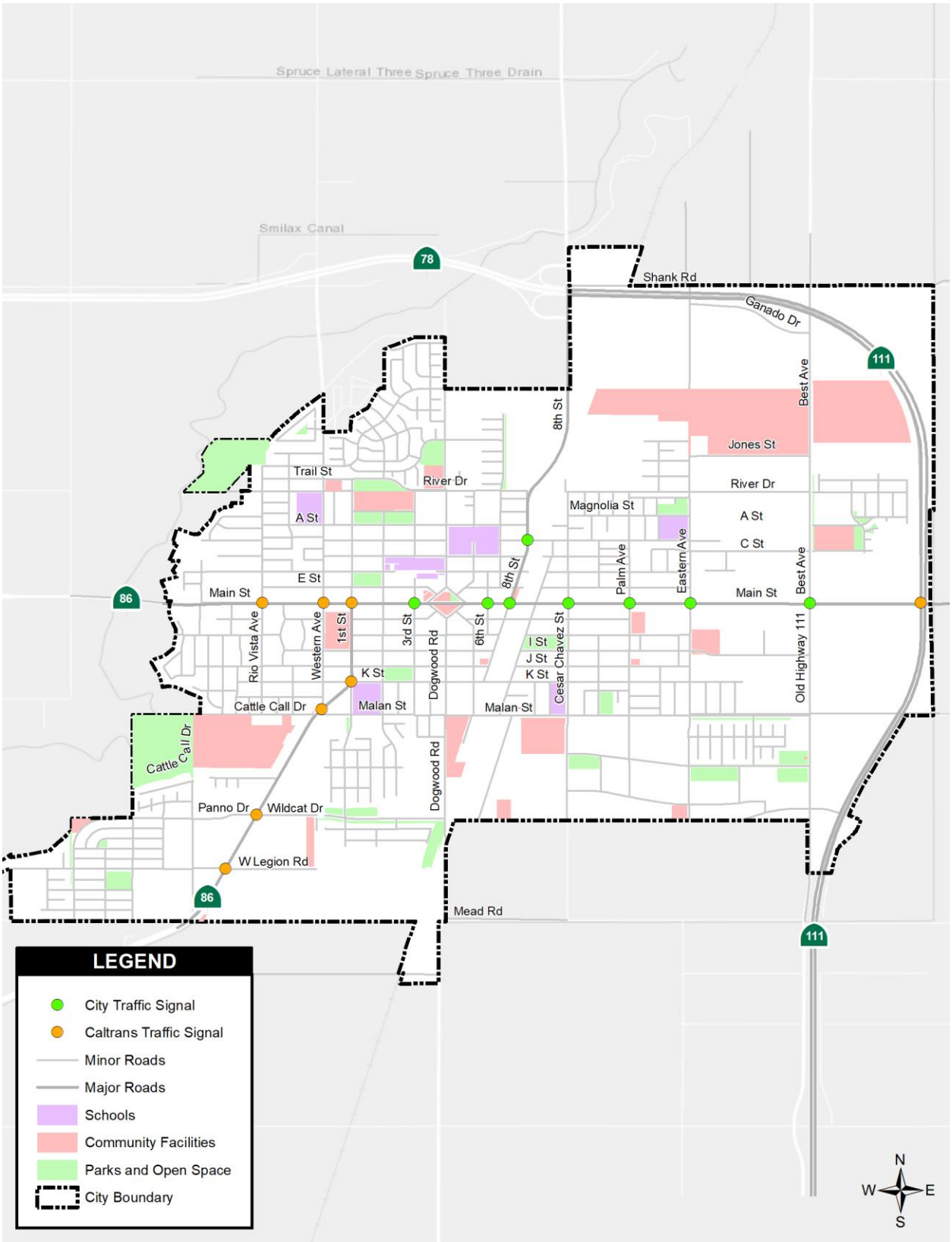


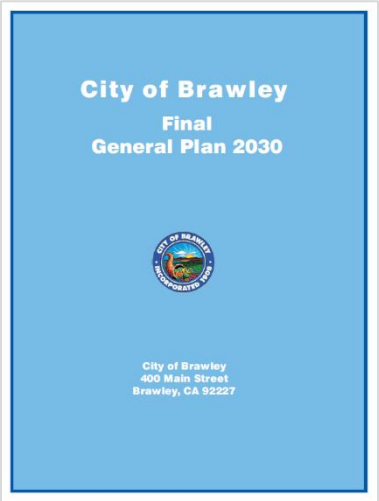
Figure 1-2: Study Area



1.2 City Initiatives

The Brawley LRSP is consistent with applicable City plans, programs, and policies that provide a safe roadway network including the Brawley General Plan, Infrastructure Element, Non-Motorized Transportation Plan, and Specific Plans. Findings, recommendations, and other information applicable to the development of the Brawley LRSP are summarized.

1.2.1 Brawley General Plan – Infrastructure Element



The most recent version of the City of Brawley's General Plan 2030 was adopted in September 2008. The General Plan, which serves as the City's blueprint for future growth and development, includes an Infrastructure Element that includes the circulation system (roadways, public transportation, and bicycle and pedestrian routes), the water treatment and distribution system, the sewage and collection and treatment system, and the power/communication (electricity transmission, natural gas, voice, and data). The purpose of the Infrastructure Element is to plan for safe, efficient, and adequate infrastructure facilities and to coordinate new development with the provision of required facilities. Circulation Element goals, objectives, and policies that are applicable to the LRSP include:

IE Goal 1: Provide for Adequate and Safe Local Thoroughfares and Transportation Routes

- **IE Objective 1.1:** Provide a system of streets that meets the needs of current and future inhabitants and facilitates the safe and efficient movement of people and goods
- **IE Policy 1.1.5:** Develop a program to identify, monitor and make recommendations for improvements to roadways and intersections that are approaching, or have approached, unacceptable levels of service, or are experiencing higher than expected accident rates
- **IE Policy 1.1.12:** Minimize pedestrian and vehicular conflicts through street design and well-marked pedestrian crossings
- **IE Policy 1.1.17:** Direct through traffic from local streets to collectors and arterials to reduce traffic on local streets, and improve neighborhood safety and environmental quality
- **IE Policy 1.1.18:** Develop a capital improvements program that includes reconstruction of existing curbs, gutters, and sidewalks along streets, where needed

IE Goal 4: Encourage Transportation System Management and Transportation Demand Management

- **IE Objective 4.1:** Maximize the efficiency of the circulation element through the use of transportation system management and demand management strategies
- **IE Policy 4.1.1:** Implement traffic signal coordination on arterial streets to the maximum extent practical, integrate signal coordination efforts with those of adjacent jurisdictions, and implement other operational measures where possible to maximize the efficiency of the existing circulation system and to minimize delay and congestion
- **IE Policy 4.1.2:** Implement intersection capacity improvements where feasible
- **IE Policy 4.1.4:** Implement traffic signage coordination on residential and collector streets to the maximum extent feasible

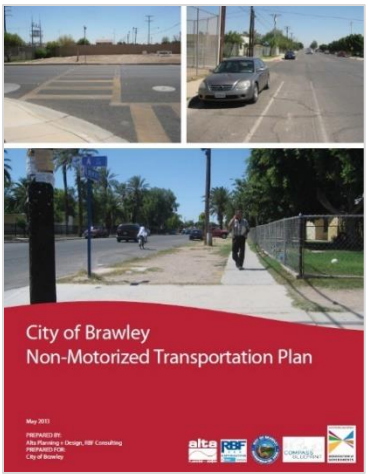
IE Goal 5: Provide Alternatives to the use of Motorized Vehicles

- **IE Objective 5.1:** Support development of an appropriate public transportation system that provides mobility to City inhabitants and encourages use of public transportation as an alternative to automobile travel
- **IE Policy 5.1.2:** Ensure accessibility of public transportation for elderly and disabled
- **IE Policy 5.1.5:** Encourage the provision of safe transit stops
- **IE Objective 5.2:** Increase the use of bicycle and pedestrian facilities
- **IE Policy 5.2.1:** Promote the safety of pedestrians and bicyclists by adhering to uniform standards and practices, including designation of bicycle lanes, proper signage, and adequate sidewalks, bicycle lanes, and off-road bicycle trains
- **IE Policy 5.2.2:** Maintain existing pedestrian facilities and require new development to provide pedestrian walkways between developments, schools, and public facilities
- **IE Policy 5.2.3:** Ensure accessibility of pedestrian facilities to the elderly and disabled
- **IE Policy 5.2.5:** Develop programs that encourage the safe utilization of easements and/or right-of-ways along flood control channels, public utility right-of-ways, and street right-of-ways wherever possible for the use of bicycles and/or pedestrian/equestrian trails
- **IE Policy 5.2.6:** Encourage retrofit installation of sidewalks in existing industrial districts and require sidewalks for new industrial areas

IE Goal 5: Provide Alternatives to the use of Motorized Vehicles (Continued)

- **IE Policy 5.2.7:** Support and coordinate the development and maintenance of bikeways and trails in conjunction with the master plans of the appropriate agencies
- **IE Policy 5.2.8:** Encourage safe biking by supporting safety clinics/courses sponsored by various local and state agencies
- **IE Policy 5.2.9:** Provide for a non-vehicular circulation system that encourages bicycle transportation and pedestrian circulation

1.2.2 Brawley Non-Motorized Transportation Plan

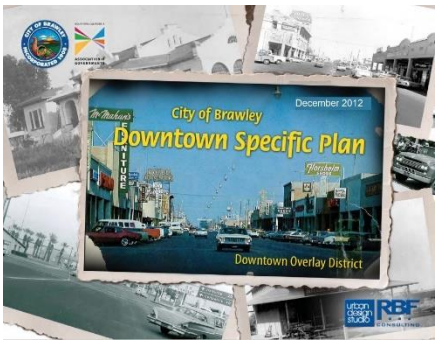


The City of Brawley's Non-Motorized Transportation Plan (NMTP) was created to aid the development of a comprehensive bicycle and pedestrian network and any supporting programs. The primary goals of the NMTP are to develop a recommended bicycle and pedestrian network, improve safety for bicyclists and pedestrians, improve multi-modal connections, and promote bicycling and walking as an important public health issue through education and encouragement. NMTP infrastructure improvements and programs that are applicable to the Brawley LRSP include:

- Provide a system of streets that meets the needs of current and future Bikeway network comprised of Class I multi-use paths, Class II bike lanes, and Class II shared lanes
- Signal detection for bicyclists
- Short/long-term bicycle parking
- Trip-end facilities
- Wayfinding signage
- Pedestrian network of Class I shared-use paths and sidewalk infill
- Intersection improvements
- High visibility crosswalk markings
- Countdown signal heads
- Signal timing
- Audible pedestrian signals
- Curb extensions/bulbouts

- Flashing beacons
- Pedestrian refuge islands
- Curb ramp improvements
- Streetscape enhancements
- Safe Routes to School/Transit
- Traffic calming
- Road diets
- Children's bicycle safety clinics
- Public awareness campaigns
- Biking and walking map/guides
- Wrong way riding campaign/program
- Speed radar trailers
- Speed feedback signs
- Targeted walking/biking enforcement
- Targeted driving enforcement
- Bicycle patrol units

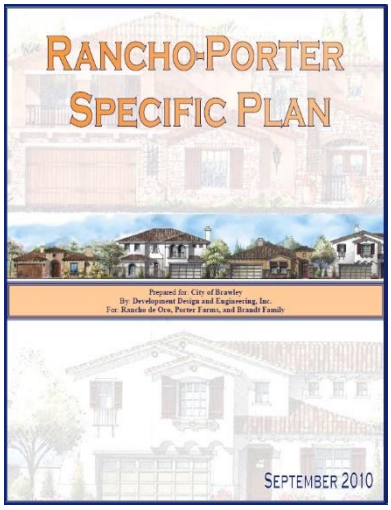
1.2.3 City of Brawley's Downtown Specific Plan



The Downtown Specific Plan guides and facilitates the development and redevelopment of approximately 110 acres of land within Downtown Brawley, generally around Plaza Park and Main Street, into a more cohesive central business district. One of the main specific plan goals is to increase connectivity and safety for pedestrians, bicyclists, motorists and transit users within Downtown Brawley and the larger region. The visions and concepts related to the Brawley LRSP include:

- Converting vacant land along the railroad tracks to a multi-purpose trail that connects Downtown to northern and southern parts of the City. This trail would be used by walkers, runners, and bicyclists
- Access to transit stops and a Downtown bus depot
- Providing safe, comfortable and attractive pedestrian environments by creating a stronger pedestrian focus through crosswalks and bulbouts
- Creating a pedestrian-friendly Downtown that aims to slow traffic through a progressive reduction in travel lanes, integration of crosswalk bulbouts, and roundabouts in strategic locations
- Creating dedicated bicycle lanes along Main Street and Plaza Street

1.2.4 Rancho-Porter Specific Plan



Rancho-Porter is a residential community located east of the City of Brawley, within the City's existing Sphere of Influence, with mini/linear parks, two neighborhood parks, commercial and mixed-use areas, including retail, office commercial, and multi-family residential. The Rancho-Porter Specific Plan goals and objectives rely on the Principles of Smart Growth. The objective is to ensure a higher quality of life, safer travel for pedestrians, and less reliance on automobiles. The following Smart Growth goals were identified as applicable to the Brawley LRSP for roadway safety:

1.4.1 Goal – Mix Land Use Areas that:

- Assure a safe, healthy and aesthetically pleasing community for residents and businesses
- Contain streetlights as needed for safety as determined by the City Engineer

1.4.4 Goal – Create Walkable Neighborhoods where:

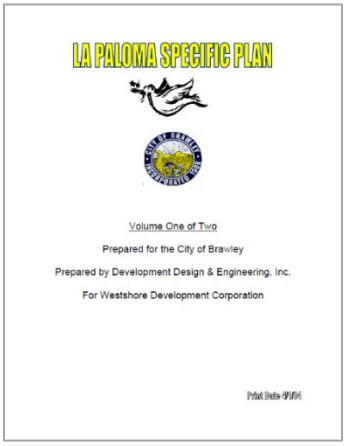
- Pedestrian linkages promote safe walking within the planned area. These links will provide safe pedestrian access to and from the project's public amenities
- The Rancho-Porter Community may incorporate raised crosswalks increasing pedestrian visibility and safety
- The amount, scale, intensity, and quality of lighting will be considered to promote pedestrian safety
- Pedestrian access to all transit stops shall be provided

1.4.7 Goal – Provide a Variety of Transportation Choices including:

- Class I and Class II bicycle routes within the major circulation corridors
- Incorporating the location of transit and bicycle facilities into the location and design of pedestrian facilities

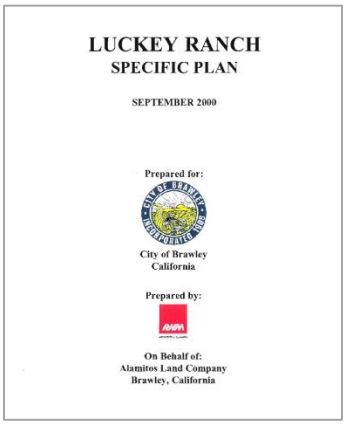
1.2.5 La Paloma Specific Plans

La Paloma is a master planned residential community located within the southeastern boundary of the City of Brawley. The community is comprised of single-family and multi-family residential, commercial, retail, industrial, schools, and parks. The La Paloma Specific Plan includes project conformance with various Brawley General Plan Infrastructure Element goals that are relevant to the Brawley LRSP including:



- Provide streets and improvements that will provide safe and efficient movement
- Extend Panno Road east of the project area to SR-111
- Ceasar Chavez Street, Eastern Avenue, and Palm Street will traverse north/south
- Panno Road will be designed as a east/west corridor to accommodate truck and major traffic
- Incorporate a major arterial, an 80-foot central corridor, secondary arterials, and a collector throughout the project. Each roadway will be designed to City standards with pedestrian amenities such as pedestrian links. Alternative modes are encouraged. Bike lanes are planned for the major roadways
- Include road improvements and signalization of major intersections

1.2.6 Luckey Ranch Specific Plan


LUCKEY RANCH
SPECIFIC PLAN

SEPTEMBER 2000

Prepared for:

City of Brawley
California

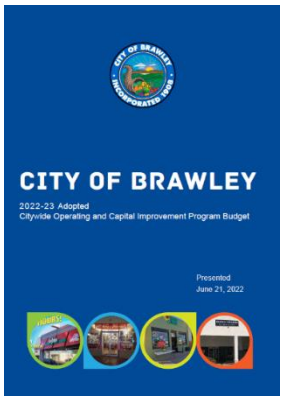
Prepared by:

On Behalf of:
Alamitos Land Company
Brawley, California

Luckey Ranch is a master planned residential community located on the eastern boundary of the City of Brawley that includes a diverse mix of industrial, light industrial, business park, commercial, residential, school, park, and open space areas. The Luckey Rancho Specific Plan meets a variety of Brawley General Plan Infrastructure Element Circulation goals that are applicable to the Brawley LRSP including:

- Provide safe and convenient vehicular and pedestrian circulation between residential, educational, recreational, commercial, light industrial/business park and industrial areas
- Provide access to adjacent existing and planned arterial roadways, SR-78/111 Brawley By-Pass, the Southern Pacific Railroad line, and the Brawley Municipal Airport to provide convenient transportation access
- Create a community open space system that ties the residential areas together, connects community features, and encourages pedestrian and bicycle circulation to reduce motorized traffic

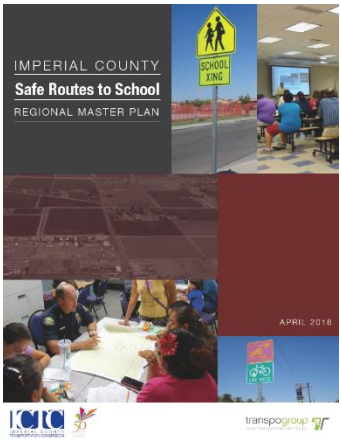
1.2.7 Brawley Capital Improvement Program



The Brawley Capital Improvement Program (CIP) includes infrastructure projects that are focused on ensuring the delivery of essential utility services and enhancing transportation and public right-of-ways through the City. The current 2022-2023 CIP budget includes 12 projects for water, wastewater, road and pedestrian improvements, and heavy equipment purchase. Current CIP projects that are applicable to the Brawley LRSP include:

- Annual ADA Improvements
- C Street from 1st Street to Imperial Avenue Street Resurfacing / Rehabilitation
- Ocotillo Springs Sidewalk Construction
- Traffic Synchronization & Intelligent Transportation System

1.2.8 Imperial County Safe Routes to School Regional Master Plan



The Imperial County Safe Routes to School (SRTS) Master Plan was created as a guide to help improve active transportation safety at all public schools within Imperial County. The primary goal of the SRTS Plan is to make it safer for students to walk and bike to school, as well as increase the number of students who are willing to walk and bike. The SRTS Plan includes results of public workshops where local stakeholders identified safety issues and other barriers that discourage more students from walking or bicycling to the schools in Imperial County. It also includes a plan for each school to make roadway and intersection improvements such as new sidewalks or bikeways, at critical locations identified by stakeholders. Several schools in the Brawley Elementary School District and Brawley Union High School District were identified in the Safe Routes to School Plan including:

- **Barbara Worth Junior High School**
- **Brawley Union High School**
- **Desert Valley High School**

- J.W. Oakley Elementary School
- Miguel Hidalgo Elementary School
- Myron D. Witter Elementary School
- Phil D. Swing Elementary School

1.3 LRSP Process

Development of the Brawley's LRSP follows Caltrans guidelines, which are based on the United States Department of Transportation (USDOT) Federal Highway Administration (FHWA)'s cyclical six-step process:

1 - ESTABLISH LEADERSHIP
Local partnerships with representatives from the 5E's of traffic safety: engineering, enforcement, education, emergency response, and emerging technologies
Define the Brawley LRSP Vision, Mission, and Goals
2 - ANALYZE SAFETY DATA
Crash and Roadway Data Collection
Crash Data Analysis
Roadway Network Screening
3 - DETERMINE EMPHASIS AREAS
Identify priority areas based on crash data analysis and roadway network screening
4 - IDENTIFY STRATEGIES
Identify safety countermeasures and strategies
Develop countermeasure toolbox
5 - PRIORITIZE & INCORPORATE STRATEGIES:
Apply countermeasures and strategies to develop safety projects
Evaluate and prioritize safety projects by benefit cost ratio
Implement roadway safety improvement projects and programs
6 - EVALUATE AND UPDATE:
Monitor progress of roadway safety improvement projects and programs
Evaluate success of countermeasure toolbox, projects, and programs
Review LRSP and update to reflect local changing needs and priorities

1.4 LRSP Vision, Mission, and Goals

The Brawley Local Road Safety Plan was developed based on alignment with the California SHSP, Caltrans LRSP and HSIP programs, feedback from safety partners from the 5E's of traffic safety (Engineering, Enforcement, Education, Emergency Response, and Emerging Technologies), and the City's existing safety plans, policies, and efforts. The Plan is guided by the core principles that strive to alleviate traffic congestion, reduce traffic fatalities and severe injuries, and provide a safe roadway system for all roadway users including vehicles, pedestrians, and bicyclists. The following sub-section identifies the key Vision, Mission, and Goals set forth in the Braley LRSP.

VISION

Provide a comprehensive, rational, equitable, and safe roadway network for all Brawley users including vehicles, pedestrians, and bicyclists

MISSION

Systemically implement proven safety countermeasures based on the 5E's of traffic safety (engineering, enforcement, education, emergency response, and emerging technologies) for infrastructure and non-infrastructure projects to improve safety and reduce crashes on the Brawley roadway network

GOALS

- Reduce fatal and severe injury crashes towards zero
- Reduce collision severity by reducing crashes that involve pedestrians, bicyclists, and alcohol or drug impairment
- Reduce collisions that involve hit object, rear end, and broadside
- Reduce collisions that are primarily caused by improper turning, driving or bicycling under the influence of alcohol or drugs, traffic signals and signs, and automobile right-of-way violations
- Engage with City Departments, Safety Partners from the 5E's of traffic safety, and Brawley residents to create a culture that promotes, plans, designs, and implements roadway safety strategies identified in the Brawley LRSP

2 Collision Analysis

2.1 Crash Data and Methodology

Crash data was obtained from the California Statewide Integrated Traffic Records System (SWITRS) database and the University of California, Berkeley, Transportation Injury Mapping System (TIMS) database. The most recent five (5) years of crash data were obtained from January 1, 2017 to December 31, 2021. Crashes were cross-referenced and geolocated to the local street network in a Geographic Information System (GIS) to create a comprehensive data set. There were 319 total collisions during the study period, which includes 7 fatal collisions, 96 injury collisions and 216 Property Damage Only (PDO) collisions. Analysis of the crash data was conducted to identify citywide crash patterns and trends for:

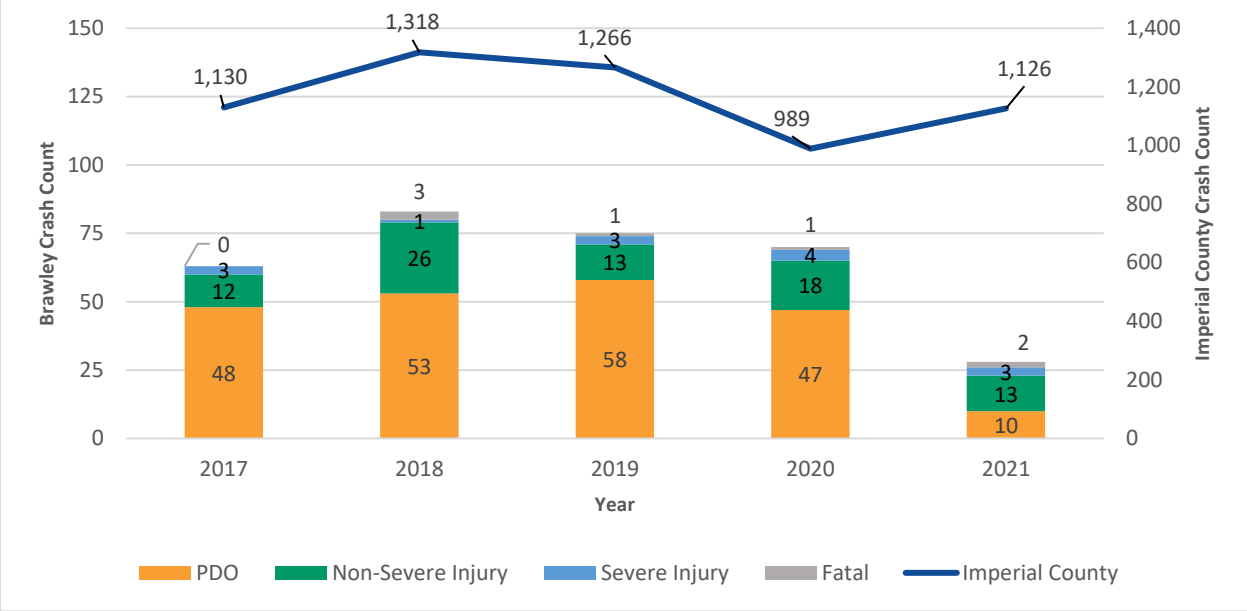
- Annual Trends
- California Office of Transportation Safety (OTS) Citywide Traffic Rankings
- Location Type
- Severity
- Crash Type
- Primary Collision Factor
- Roadway User Involvement

2.1.1 Annual Trends

The total number of crashes per year in the City of Brawley from 2017 to 2021 for fatal, severe injury, non-severe injury, and property damage only (PDO) collisions is shown below in **Figure 2-1**. The trendline shows the total number of crashes in Imperial County by year. The City's annual crash trends generally follow a similar pattern to the County's crash trends, which show an increase in overall crashes between the years 2017 and 2018, followed by an decrease in collisions from the years 2019 to 2020. The City of Brawley has shown a consistent number of combined fatal and severe injury collisions from 2017 - 2021, while the non-severe injury collision fluctuate year to year.

In the year 2020, total crashes in the County decreased by 25% and in the City of Brawley by 7%. The Covid-19 pandemic significantly affected travel patterns throughout the region and country due to emergency stay-at-home orders, resulting in a significant decrease of average daily traffic. However, as stay-at-home orders were lifted, traffic patterns began to return to pre-pandemic levels on a county level. However, crash tends for Brawley in the year 2021 do not correspond with the pre-pandemic years. In 2021, the overall crashes in the County increased by 14% while the City of Brawley decreased by 60%.

Figure 2-1: Annual Crash Trends (2017-2021)



2.1.2 California Office of Traffic Safety Citywide Traffic Rankings

The California Office of Traffic Safety (OTS) maintains a ranking system to compare traffic safety statistics among similarly sized California cities. Citywide rankings are based on population, daily vehicle miles traveled (DVMT), crash records, and crash trends from data collected by SWITRS, Caltrans, the California Department of Justice, and the Department of Finance. A ranking of one (1) in a category indicates the lowest possible traffic safety performance in relation to other similarly sized cities. A comparison of California OTS rankings allows cities to identify local trends relative to their peers.

The City of Brawley is in "Group D" which consists of cities with populations between 25,001 and 50,000 people. **Table 2-1** summarizes how Brawley compares to other Group D peer cities from 2017 to 2019. Due to fluctuations in populations, Brawley was one of 94 Group D cities in 2017 and 2019, and one of 97 Group D cities in 2018.

Table 2-1: Brawley OTS Crash Rankings (2017-2019)

OTS CATEGORY	2017 OTS RANKING (1 = LOWEST)	2018 OTS RANKING (1 = LOWEST)	2019 OTS RANKING (1 = LOWEST)
Total Fatal and Injury	90/94	57/97	86/94
Alcohol Involved	66/94	**40/97**	58/94
Had Been Drinking Driver < 21	**50/94**	46/97	**35/94**
Had Been Drinking Driver 21 – 34	59/94	82/97	49/94
Motorcycles	84/94	58/97	53/94
Pedestrians	87/94	51/97	77/94
Pedestrians < 15	71/94	**43/97**	**36/94**
Pedestrians 65+	69/94	**41/97**	76/94
Bicyclists	65/94	71/97	72/94
Bicyclists < 15	**33/94**	62/97	56/94
Composite	82/94	79/97	74/94
Speed Related	89/94	92/97	80/94
Nighttime (9:00pm – 2:59am)	90/94	77/97	89/94
Hit and Run	67/94	73/97	83/94
DUI Arrests*	**26/92**	56/97	**35/94**

*The number of cities ranked against may be different from the number of cities in other OTS categories. Not all cities report DUI arrests to the Department of Justice

Table 2-2 summarizes how Brawley compares to Calexico and El Centro, other local Group D peer cities in Imperial County based on the most recent OTS rankings available from 2019. Data tables for the OTS rankings are provided in **Appendix A**.

Table 2-2: Peer City OTS Crash Rankings (2017-2019)

OTS CATEGORY	BRAWLEY OTS RANKING (1 = LOWEST)	CALEXICO OTS RANKING (1 = LOWEST)	EL CENTRO OTS RANKING (1 = LOWEST)
Total Fatal and Injury	86/94	64/94	**17/94**
Alcohol Involved	58/94	90/94	19/94
Had Been Drinking Driver < 21	**35/94**	**47/94**	73/94
Had Been Drinking Driver 21 – 34	49/94	59/94	22/94
Motorcycles	53/94	63/94	52/94
Pedestrians	77/94	69/94	18/94
Pedestrians < 15	**36/94**	88/94	27/94
Pedestrians 65+	76/94	**20/94**	90/94
Bicyclists	72/94	48/94	**15/94**
Bicyclists < 15	56/94	79/94	24/94
Composite	74/94	82/94	32/94
Speed Related	80/94	66/94	36/94
Nighttime (9:00pm – 2:59am)	86/94	87/94	**16/94**
Hit and Run	58/94	79/94	44/94
DUI Arrests*	**35/94**	**12/94**	47/94

*The number of cities ranked against may be different from the number of cities in other OTS categories. Not all cities report DUI arrests to the Department of Justice

Key OTS Crash Ranking findings include:

- Top 3 lowest 2017 OTS rankings for Brawley were: DUI arrests, bicyclists < 15, had been drinking driver < 21
- Top 3 lowest 2018 OTS rankings for Brawley were: alcohol involved, pedestrian 65+, and pedestrians <15
- Top 3 lowest 2019 OTS rankings for Brawley were: had been drinking driver 21 – 34, pedestrians <15, and DUI arrests
- OTS categories for collisions where a driver less than 21 had been drinking and DUI arrests were in the top 3 lowest rankings for Brawley for the years 2017 and 2019
- Brawley has improved year over year in the OTS rankings involving bicyclists
- Brawley has fallen year over year in the OTS rankings involving pedestrian less than 15, motorcycles, where a driver less than 21 had been drinking, and as an overall composite score
- Brawley outperformed El Centro in 12 of the 15 OTS categories in 2019
- Brawley outperformed Calexico in only 5 of the 15 OTS categories in 2019

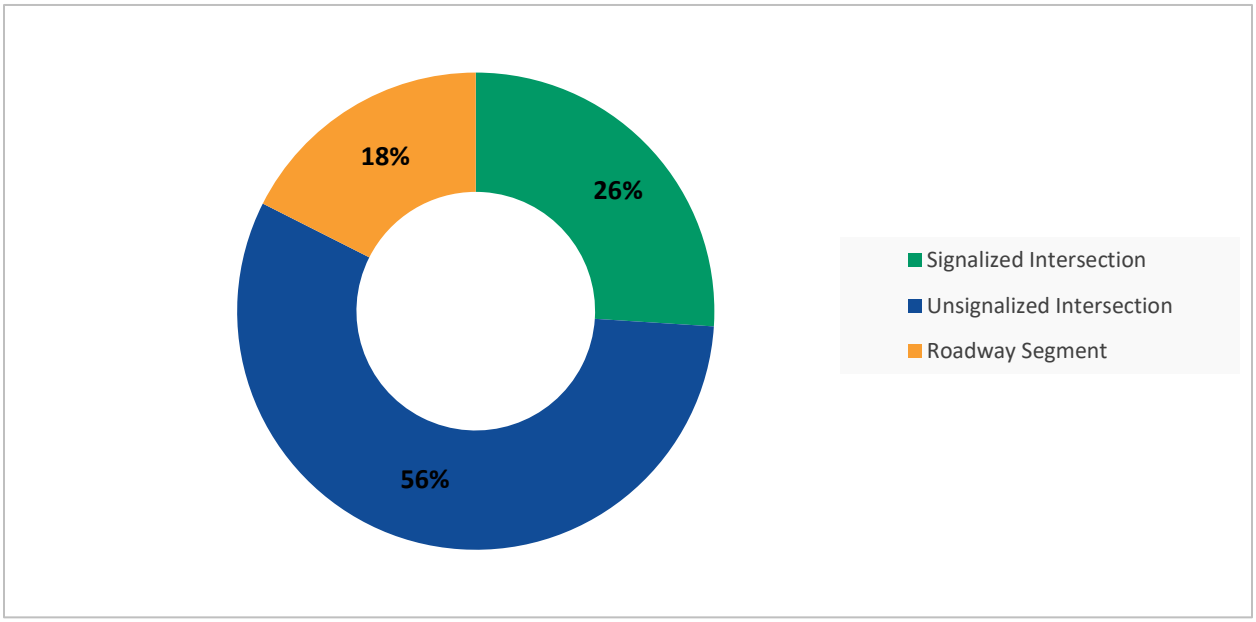
2.1.3 Location Type

Table 2-3 and **Figure 2-2** summarize the proportion of citywide crashes by location type, which includes signalized intersections, unsignalized intersections, and roadway segments. Unsignalized intersections were classified as any at-grade junction of two or more public roads that are not controlled by a traffic signal, including uncontrolled, yield-control, and stop-controlled intersections. For signalized and unsignalized intersections, a sphere of influence of 250 feet was used to consider if an accident was attributed to an intersection. Crashes that occurred outside of the intersection spheres of influence were considered attributed to a midblock roadway segment. Most crashes occurred at intersections (82%) which includes unsignalized intersections (56%) and signalized intersections (26%).

Table 2-3: Citywide Collisions by Location Type (2017-2021)

LOCATION TYPE	TOTAL (%)
Signalized Intersection	83 (26%)
Unsignalized Intersection	180 (56%)
Roadway Segment	56 (18%)
Total Crashes	**319**

Figure 2-2: Citywide Collisions by Location Type (2017-2021)



2.1.4 Severity

Table 2-4 and **Figure 2-3** summarize the proportion of citywide crashes by severity for fatal, severe injury, and non-severe injury collisions, which include other visible injury and complaint of pain. Most collisions resulted in property damage only (68%) followed by non-severe injuries (26%), severe injuries (4%), and fatalities (2%).

Table 2-4: Citywide Collisions by Crash Severity (2017-2021)

SEVERITY	TOTAL (%)
Fatal	7 (2%)
Severe Injury	14 (4%)
Other Visible Injury	31 (10%)
Complaint of Pain	51 (16%)
Property Damage Only	216 (68%)
Total Crashes	**319**

Figure 2-3: Citywide Collisions by Crash Severity (2017-2021)

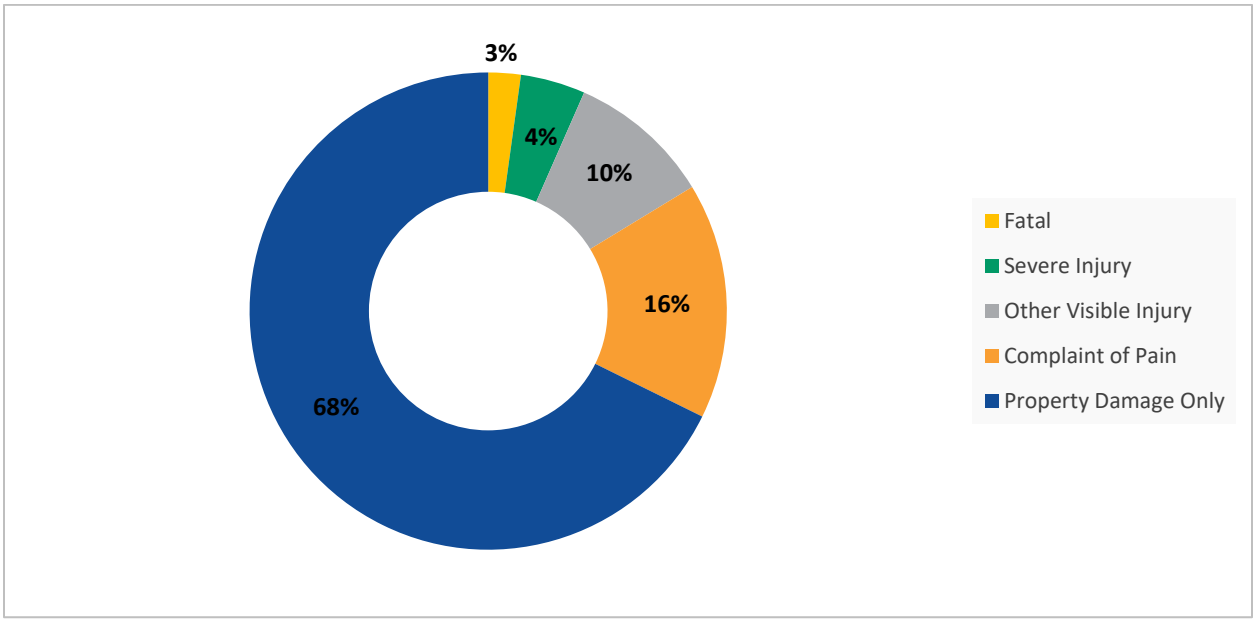


Table 2-5 summarizes the proportion of crash severity by location for signalized intersections, unsignalized intersections, and roadway segments. Unsignalized intersection and roadway segment collisions resulted in the most fatal and severe injuries with unsignalized intersections experiencing 2 fatal and 8 severe injury collisions and roadway segments experiencing 3 fatal and 3 severe injury collisions. Signalized intersections accounted for 2 fatal collisions and 3 severe collisions during the same time period. **Figure 2-4** illustrates where these fatal and severe collisions have occurred.

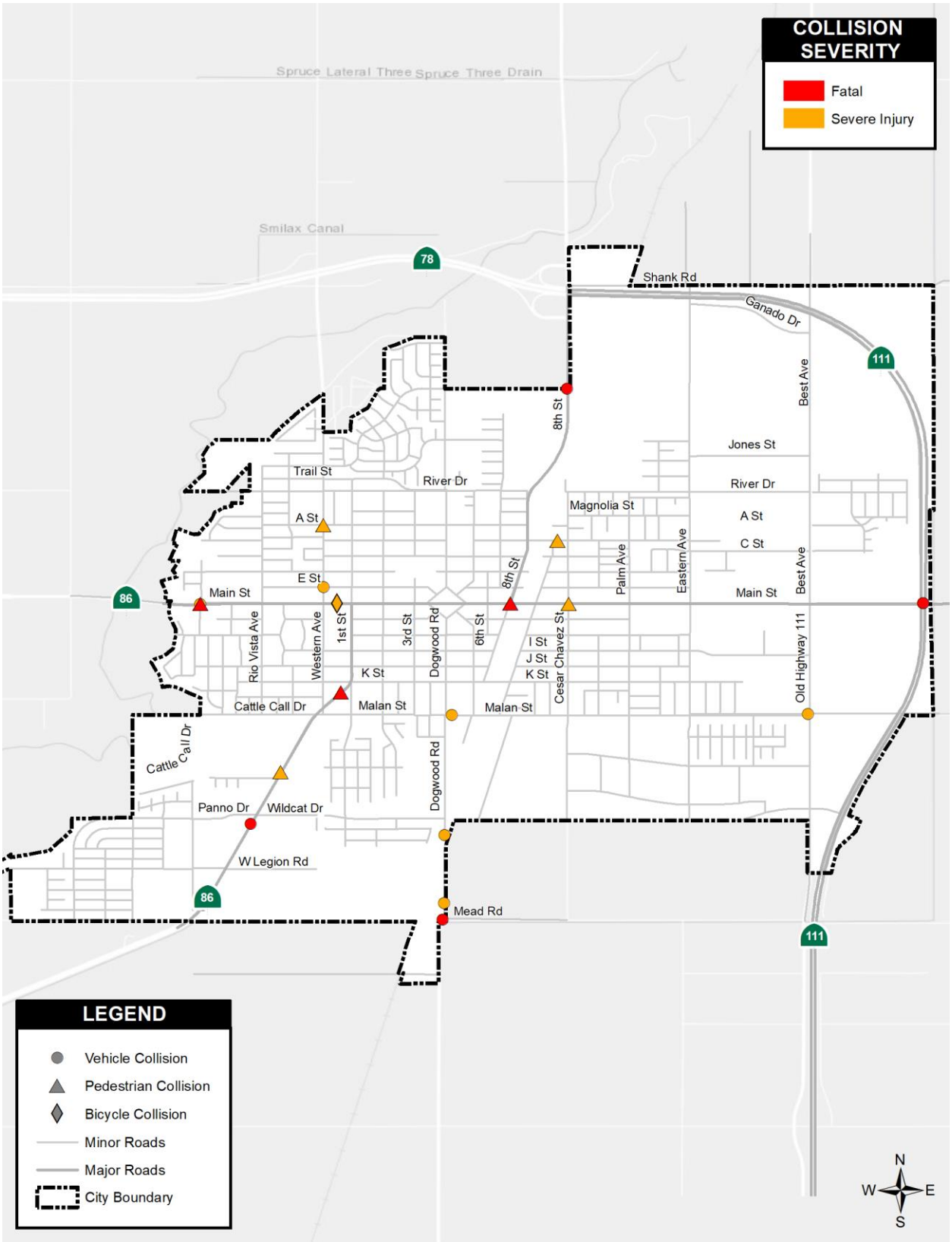
While the number of fatal and severe injury collisions that occurred at each location type is a smaller percentage in comparison with the number of overall collisions, roadway segments were over-represented in the number of fatal collisions and unsignalized intersections were over-represented in the number of severe injury collisions. Roadway segments represented 42% of the 7 total fatal collisions and 21% of the 14 total severe injury collisions. Unsignalized intersections represented 29% of the 7 total fatal collisions and 57% of the 14 total severe injury collisions. Signalized intersections represented 29% of the 7 total fatal collisions and 21% of the 14 total severe injury collisions.

Table 2-5: Citywide Collisions by Crash Severity (2017-2021)

SEVERITY	SIGNALIZED INTERSECTION	UNSIGNLIZED INTERSECTION	ROADWAY SEGMENT	TOTAL (%)
Fatal	2 (2%) (29%)*	2 (1%) (29%)*	3 (5%) (42%)*	7 (2%)
Severe Injury	3 (4%) (21%)*	8 (4%) (57%)*	3 (5%) (21%)*	14 (4%)
Other Visible Injury	10 (12%)	16 (9%)	5 (9%)	31 (10%)
Complaint of Pain	15 (18%)	28 (16%)	8 (14%)	51 (16%)
Property Damage Only	53 (64%)	126 (70%)	37 (66%)	216 (68%)
Total Crashes	**83 (26%) (24%)***	**180 (56%) (48%)***	**56 (18%) (29%)***	**319**

*Represents the percentage of Fatal and/or Severe collisions occurring at each location type.

Figure 2-4: Citywide Fatal and Severe Collisions (2017-2021)



2.1.5 Crash Type

Table 2-6 and **Figure 2-5** summarize the proportion of all crashes by crash type, which include head-on, sideswipe, rear end, broadside, hit object, overturned, vehicle / pedestrian, other, and not stated collisions. The three most common crash types that occurred are broadside (27%), rear end (24%), and sideswipe (16%). These crash types account for 67% of total crashes reported.

Table 2-6: Citywide Collisions by Crash Type (2017-2021)

CRASH TYPE	TOTAL (%)
Broadside	86 (27%)
Rear End	76 (24%)
Sideswipe	52 (16%)
Hit Object	41 (13%)
Other / Not Stated	21 (7%)
Head-On	19 (6%)
Vehicle / Pedestrian	18 (6%)
Overturned	6 (2%)
Total Crashes	**319**

Figure 2-5: Citywide Collisions by Crash Type (2017-2021)

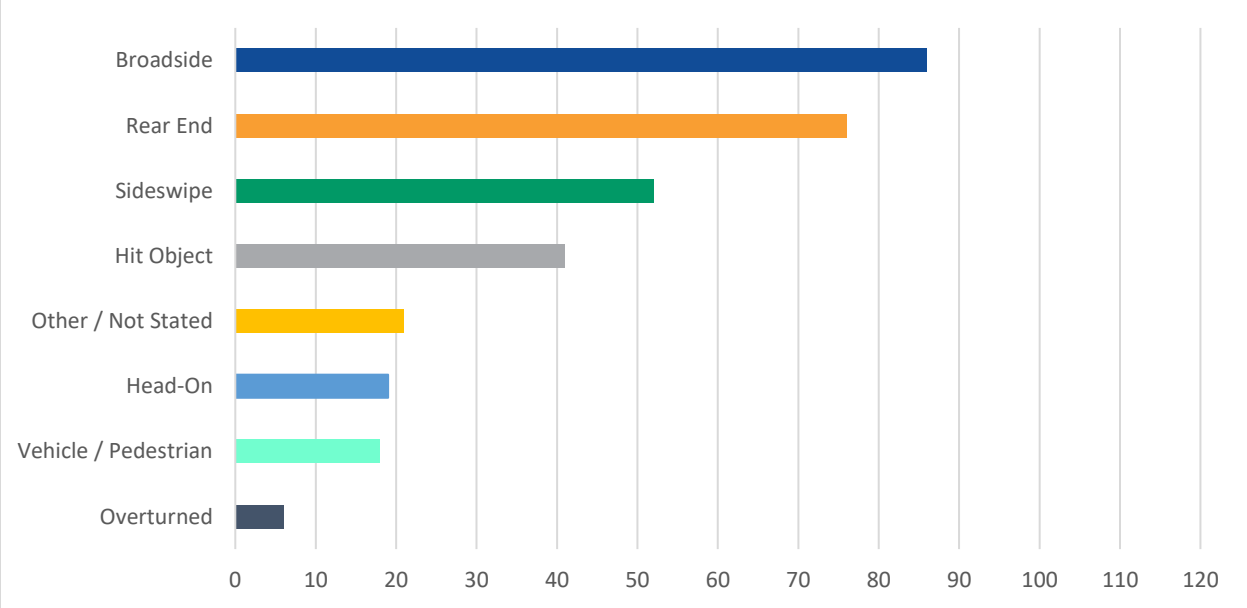


Table 2-7 summarizes the proportion of all crash types by severity. The crash types that resulted in the most fatal and severe injuries are listed below:

- Broadside (14% fatal and 36% severe injury)
- Vehicle / Pedestrian collisions (43% fatal and 29% severe injury)
- Hit Object (14% fatal and 14% severe injury)
- Head-On (29% fatal)

Table 2-7: Citywide Crash Type by Severity (2017-2021)

CRASH TYPE	FATAL	SEVERE INJURY	OTHER VISIBLE INJURY	COMPLAINT OF PAIN	PROPERTY DAMAGE ONLY	TOTAL (%)
Broadside	1 (14%)	5 (36%)	9 (29%)	25 (49%)	46 (21%)	86 (27%)
Rear End	0 (0%)	0 (0%)	5 (16%)	13 (25%)	58 (27%)	76 (24%)
Sideswipe	0 (0%)	0 (0%)	2 (6%)	2 (4%)	48 (22%)	52 (16%)
Hit Object	1 (14%)	2 (14%)	4 (13%)	1 (2%)	33 (15%)	41 (18%)
Head-On	2 (29%)	0 (0%)	2 (6%)	4 (8%)	10 (5%)	18 (6%)
Vehicle / Pedestrian	3 (43%)	4 (29%)	6 (19%)	2 (4%)	4 (2%)	19 (6%)
Overturned	0 (0%)	1 (7%)	2 (6%)	1 (2%)	2 (1%)	6 (2%)
Other / Not Stated	0 (0%)	2 (14%)	1 (3%)	3 (6%)	15 (7%)	21 (7%)
Total Crashes	**7 (2%)**	**14 (4%)**	**31 (10%)**	**51 (16%)**	**216 (68%)**	**319**

Table 2-8 summarizes the proportion of all crash types by location for signalized intersections, unsignalized intersections, and roadway segments. A summary of the results is provided below:

- The most common crash types at signalized intersections were rear end (34%), broadside (31%), and sideswipe (16%)
- The most common crash types at unsignalized intersections were broadside (28%), rear end (21%) , and sideswipe (16%)
- The most common crash types at roadway segments were hit object (23%), rear-end (18%), broadside (18%), and sideswipe (18%)

Table 2-8: Citywide Crash Type by Location (2017-2021)

CRASH TYPE	SIGNALIZED INTERSECTION	UNSIGNALIZED INTERSECTION	ROADWAY SEGMENT	TOTAL (%)
Broadside	26 (31%)	50 (28%)	10 (18%)	86 (27%)
Rear End	28 (34%)	38 (21%)	10 (18%)	76 (24%)
Sideswipe	13 (16%)	29 (16%)	10 (18%)	52 (16%)
Hit Object	6 (7%)	22 (12%)	13 (23%)	41 (13%)
Head-On	3 (4%)	11 (6%)	4 (7%)	18 (6%)
Vehicle / Pedestrian	4 (5%)	14 (8%)	1 (2%)	19 (6%)
Overturned	1 (1%)	3 (2%)	2 (4%)	6 (2%)
Other / Not Stated	2 (2%)	13 (7%)	6 (11%)	21 (7%)
Total Crashes	**83 (26%)**	**180 (56%)**	**56 (18%)**	**319**

2.1.6 Primary Collision Factor

Table 2-9 and **Figure 2-6** summarize the Primary Collision Factor (PCF) of crashes by the California vehicle code violation categories. PCF violation categories that represented less than 3% of citywide collisions were graphically combined into a single category. A summary of the results is provided below:

The top primary collision factors (excluding Unknown/Not Stated category) were:

- **Improper turning (14%)**
- **Driving or bicycling under the influence of alcohol or drugs (12%)**
- **Automobile right-of-way (8%)**

The top primary collision factors listed above account for 34% of total crashes reported.

Table 2-9: Citywide Collisions by Primary Collision Factor (2017-2021)

PRIMARY COLLISION FACTOR VIOLATION CATEGORY	TOTAL (%)
Unknown/Not Stated	104 (33%)
Improper Turning	46 (14%)
Driving or Bicycling Under the Influence of Alcohol or Drug	39 (12%)
Automobile Right of Way	26 (8%)
Traffic Signals and Signs	25 (8%)
Unsafe Speed	25 (8%)
Following Too Closely	12 (4%)
Pedestrian Right of Way	11 (3%)
Unsafe Starting or Backing	9 (3%)
Pedestrian Violation	7 (2%)
Other Improper Driving	5 (2%)
Wrong Side of Road	3 (1%)
Improper Passing	2 (1%)
Unsafe Lane Change	2 (1%)
Hazardous Parking	1 (<1%)
Other Than Driver (or Pedestrian)	1 (<1%)
Other Hazardous Violation	1 (<1%)
Total	**319**

Figure 2-6: Citywide Collisions by Primary Collision Factor (2017-2021)

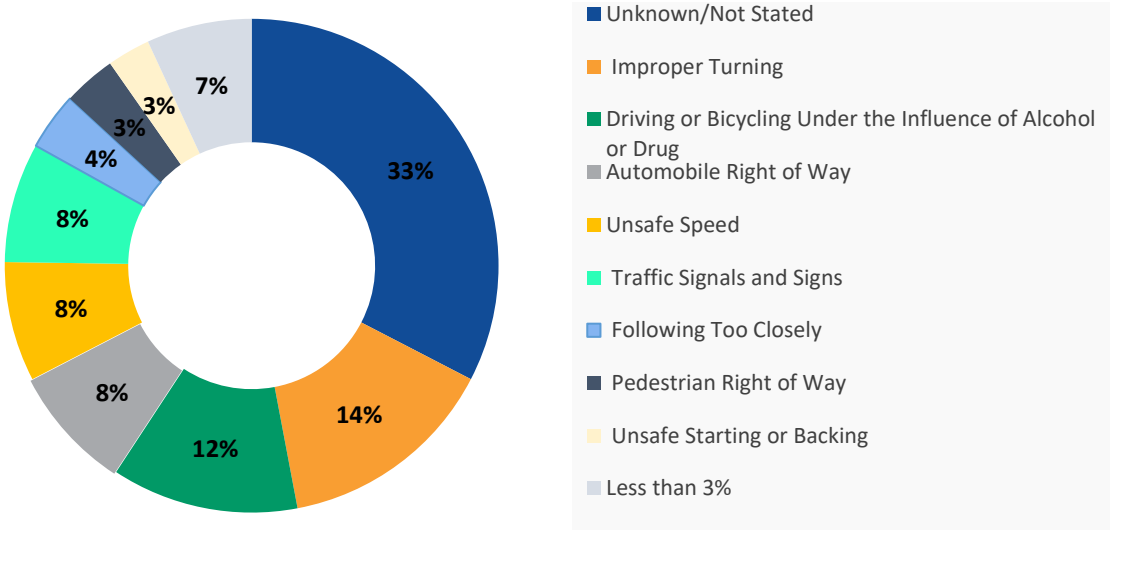


Table 2-10 summarizes the proportion of primary collision factor by severity. The primary collision factors that resulted in the most fatal and severe injuries were:

- **Improper turning (14% fatal and 29% severe injury)**
- **Driving or bicycling under the influence of alcohol or drugs (14% fatal and 14% severe injury)**
- **Unsafe speed (14% fatal and (7% severe injury)**
- **Pedestrian violation (43% fatal and 7% severe injury)**
- **Combined, these primary collision factors account for 36% of total crashes**

Table 2-10: Primary Collision Factor by Severity (2017-2021)

PRIMARY COLLISION FACTOR VIOLATION CATEGORY	FATAL	SEVERE INJURY	OTHER VISIBLE INJURY	COMPLAINT OF PAIN	PROPERTY DAMAGE ONLY	TOTAL (%)
Unknown/Not Stated	0 (0%)	1 (7%)	3 (10%)	5 (5%)	95 (44%)	104 (33%)
Improper Turning	1 (14%)	4 (29%)	5 (16%)	6 (12%)	30 (14%)	46 (14%)
Driving or Bicycling Under the Influence of Alcohol or Drug	1 (14%)	2 (14%)	2 (6%)	3 (6%)	31 (14%)	39 (12%)
Automobile Right of Way	0 (0%)	1 (7%)	5 (16%)	11 (22%)	9 (4%)	26 (8%)
Traffic Signals and Signs	1 (14%)	1 (7%)	3 (10%)	14 (27%)	6 (3%)	25 (8%)
Unsafe Speed	1 (14%)	1 (7%)	4 (13%)	4 (8%)	15 (7%)	25 (8%)
Following Too Closely	0 (0%)	0 (0%)	2 (6%)	5 (10%)	5 (2%)	12 (4%)
Pedestrian Right of Way	0 (0%)	2 (14%)	5 (16%)	0 (0%)	4 (2%)	11 (3%)
Unsafe Starting or Backing	0 (0%)	1 (7%)	0 (0%)	0 (0%)	8 (4%)	9 (3%)
Pedestrian Violation	3 (43%)	1 (7%)	1 (3%)	1 (2%)	1 (<1%)	7 (2%)
Other Improper Driving	0 (0%)	0 (0%)	0 (0%)	0 (0%)	5 (2%)	5 (2%)
Wrong Side of Road	0 (0%)	0 (0%)	0 (0%)	2 (4%)	1 (<1%)	3 (1%)
Improper Passing	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (1%)	2 (1%)
Unsafe Lane Change	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (1%)	2 (1%)
Hazardous Parking	0 (0%)	0 (0%)	1 (3%)	0 (0%)	0 (0%)	1 (<1%)
Other Than Driver (or Pedestrian)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (<1%)	1 (<1%)
Other Hazardous Violation	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (<1%)	1 (<1%)
Total Crashes	**7 (2%)**	**14 (4%)**	**31 (10%)**	**51 (16%)**	**216 (68%)**	**319**

Table 2-11 summarizes the proportion of primary collision factor violation categories by location for signalized intersections, unsignalized intersections, and roadway segments. A summary of the results is provided below:

- **The top three PCFs at signalized intersections were traffic signals and signs (16%), improper turning (14%), and following too closely (8%)**
- **The top three PCFs at unsignalized intersections were driving or bicycling under the influence of alcohol or drugs (14%), improper turning (13%), and automobile right of way (9%)**
- **The top three PCFs at roadway segments were improper turning (20%), driving or bicycling under the influence of alcohol or drugs (14%), and unsafe speed (14%)**

Table 2-11: Citywide Primary Collision Factor by Location (2017-2021)

PRIMARY COLLISION FACTOR VIOLATION CATEGORY	SIGNALIZED INTERSECTION	UNSIGNLIZED INTERSECTION	ROADWAY SEGMENT	TOTAL (%)
Unknown/Not Stated	24 (29%)	61 (34%)	19 (34%)	104 (33%)
Improper Turning	12 (14%)	23 (13%)	11(20%)	46 (14%)
Driving or Bicycling Under the Influence of Alcohol or Drug	5 (6%)	26 (14%)	8 (14%)	39 (12%)
Automobile Right of Way	7 (8%)	16 (9%)	3 (5%)	26 (8%)
Traffic Signals and Signs	13 (16%)	11 (6%)	1 (2%)	25 (8%)
Unsafe Speed	6 (7%)	11 (6%)	8 (14%)	25 (8%)
Following Too Closely	7 (8%)	3 (2%)	2 (4%)	12 (4%)
Pedestrian Right of Way	2 (2%)	9 (5%)	0 (0%)	11 (3%)
Unsafe Starting or Backing	1 (1%)	6 (3%)	2 (4%)	9 (3%)
Pedestrian Violation	3 (4%)	3 (2%)	1 (2%)	7 (2%)
Other Improper Driving	2 (2%)	3 (2%)	0 (0%)	5 (2%)
Wrong Side of Road	0 (0%)	3 (2%)	0 (0%)	3 (1%)
Improper Passing	0 (0%)	2 (1%)	0 (0%)	2 (1%)
Unsafe Lane Change	1 (1%)	0 (0%)	1 (1%)	2 (1%)
Hazardous Parking	0 (0%)	1 (1%)	0 (0%)	1 (<1%)
Other Than Driver (or Pedestrian)	0 (0%)	1 (1%)	0 (0%)	1 (<1%)
Other Hazardous Violation	0 (0%)	1 (1%)	0 (0%)	1 (<1%)
Total Crashes	**83 (26%)**	**180 56%**	**56 18%**	**319**

2.1.7 Roadway User Involvement

Table 2-12 and **Figure 2-7** summarize the proportion of citywide crashes by roadway user type involved which includes automobiles, motorcycles, bicycles, and pedestrians. Most collisions involved motorized roadway users including automobiles (90%) and motorcycles (2%). Non-motorized roadway users were involved in 8% of total collisions, including bicycles (3%) and pedestrians (5%). **Figure 2-8** and **Figure 2-9** illustrate where pedestrian and bicycle crashes, respectively, have occurred by severity.

Table 2-12: Citywide Collisions by Roadway User Involvement (2017-2021)

ROADWAY USER	TOTAL (%)
Automobiles	287 (90%)
Motorcycles	5 (2%)
Bicycles	11 (3%)
Pedestrians	16 (5%)
Total Crashes	**319**

Figure 2-7: Citywide Collisions by Roadway User Involvement (2017-2021)

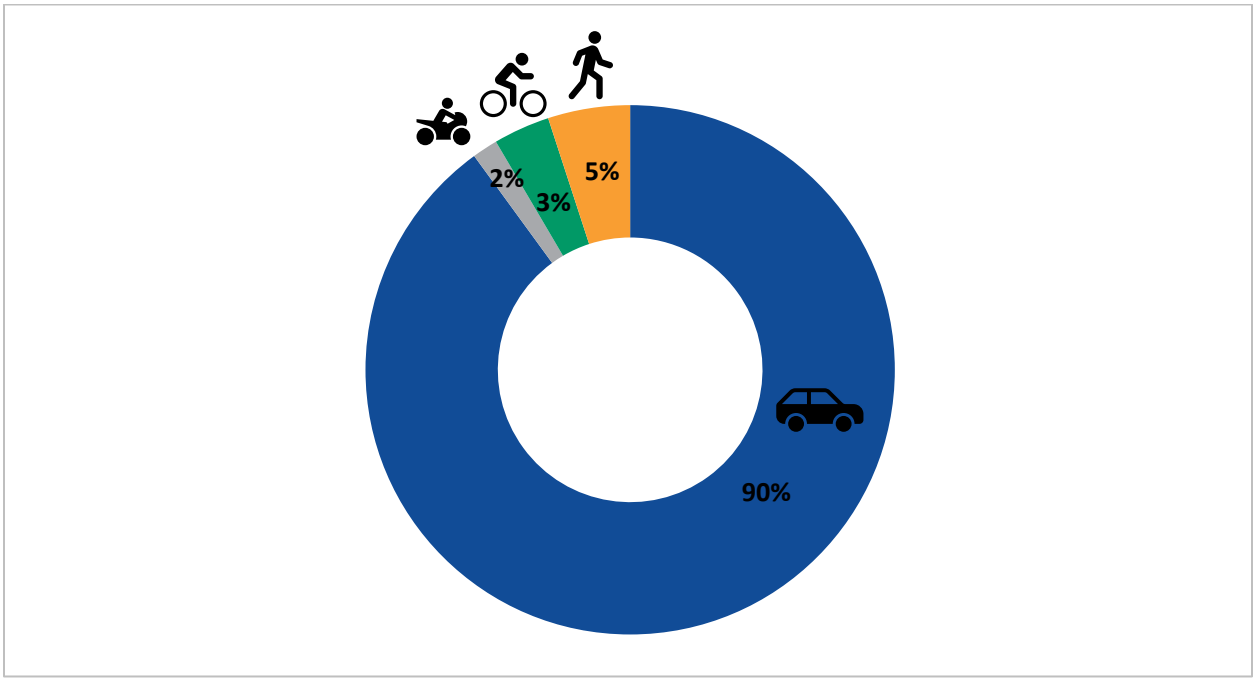


Figure 2-8: Citywide Pedestrian Collisions by Severity (2017-2021)

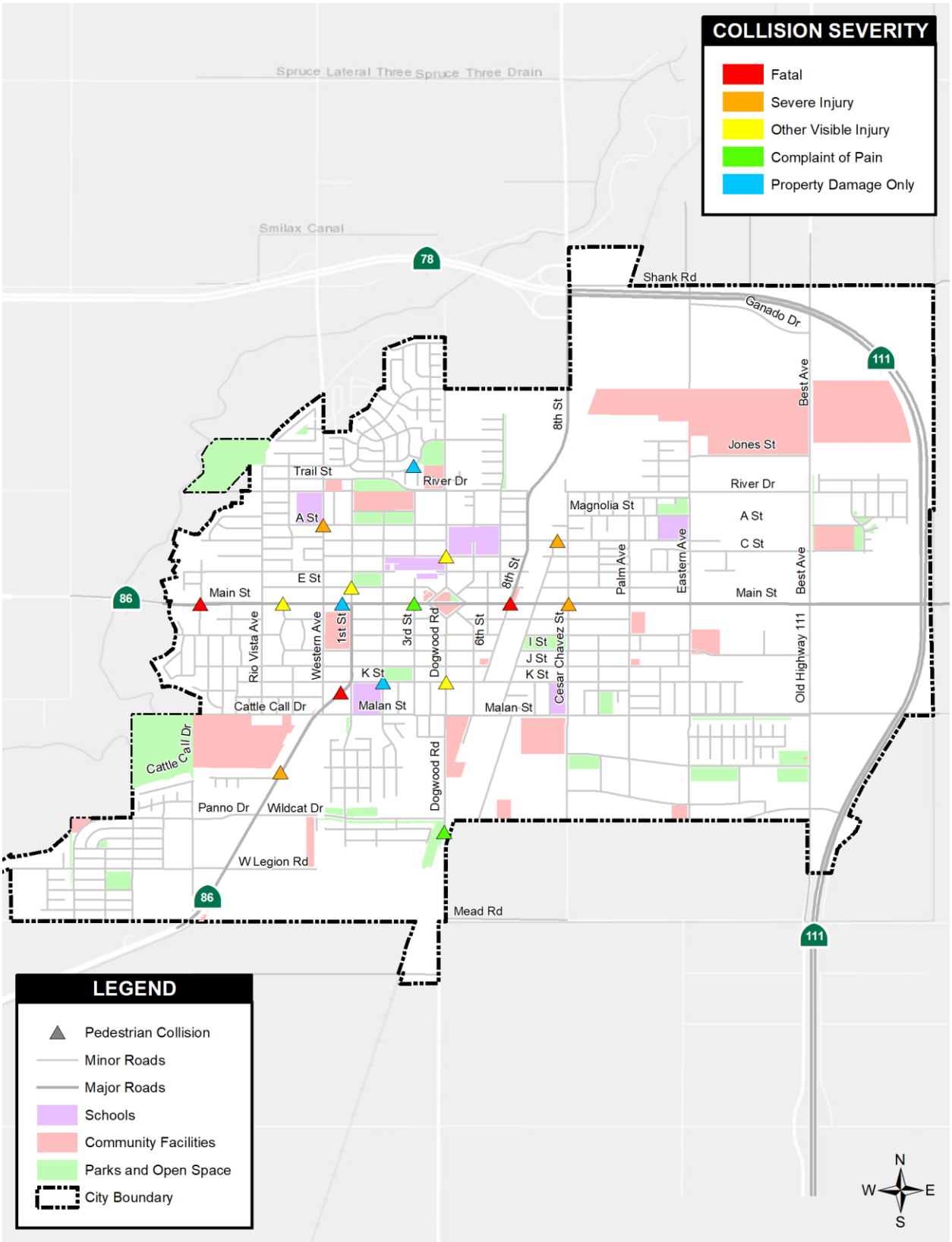


Figure 2-9: Citywide Bicycle Collisions by Severity (2017-2021)

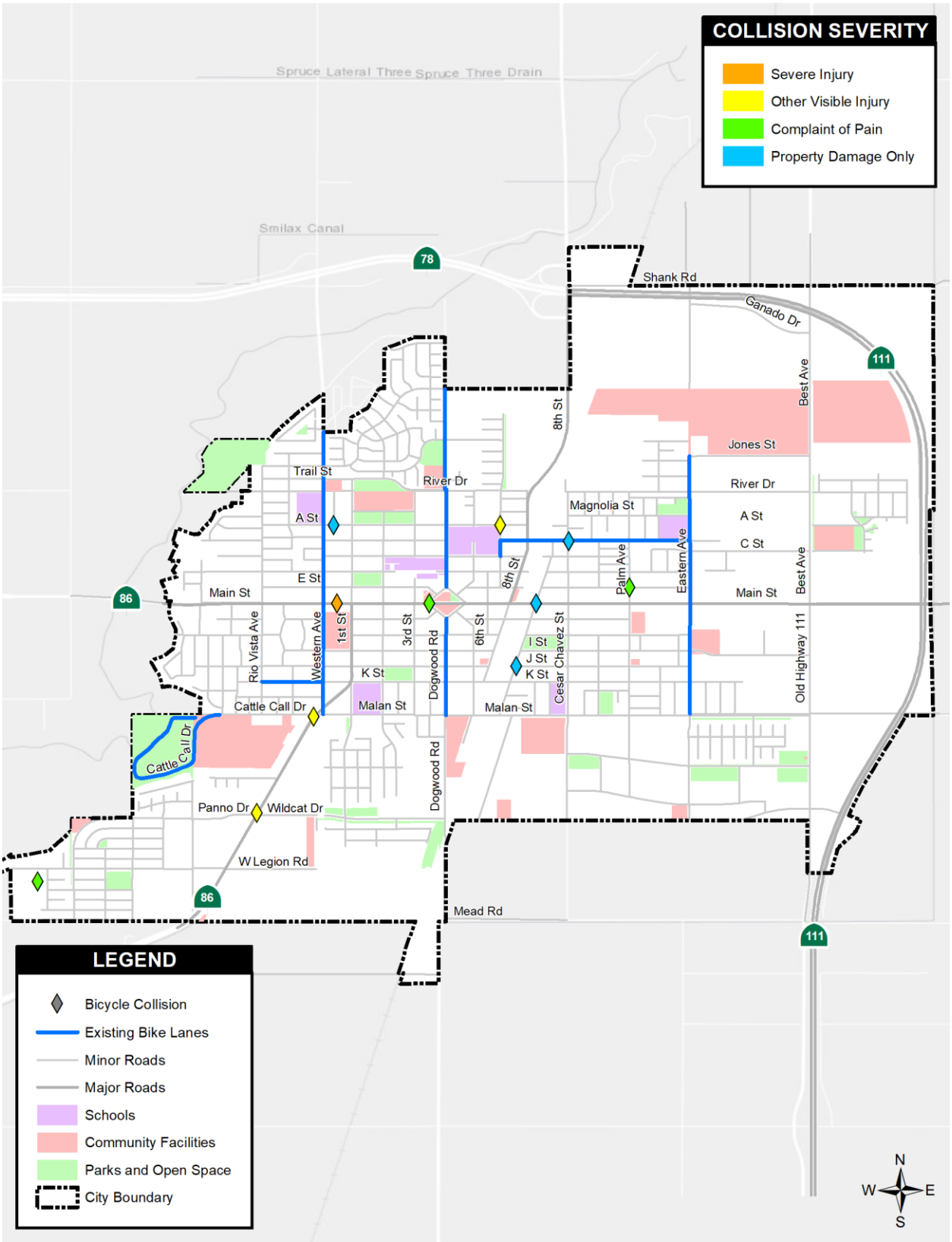


Table 2-13 and **Figure 2-10** summarize the proportion of roadway user type by severity. A summary of the results is provided below:

- Of the total collisions, 90% involved automobiles only and 72% of those collisions resulted in property damage only.
- Automobile only collisions represented 57% of total fatal and 49% of total severe injury collisions.
- Approximately 5% of all automobile collisions resulted in a fatality or severe injury.
- Approximately 80% of all motorcycle collisions resulted in non-severe injuries.
- Bicycle collisions represented 7% of total severe injury crashes
- Approximately 9% of all bicycle collisions resulted in a severe injury
- Pedestrian collisions represented 43% of total fatal and 25% of total severe injury collisions
- Approximately 44% of all pedestrian collisions resulted in a fatality or severe injury

Table 2-13: Roadway User Involvement by Severity (2017-2021)

ROADWAY USER	FATAL	SEVERE INJURY	OTHER VISIBLE INJURY	COMPLAINT OF PAIN	PROPERTY DAMAGE ONLY	TOTAL (%)
Automobiles	4 (2%)	9 (3%)	21 (7%)	45 (16%)	208 (72%)	287 (90%)
Motorcycles	0 (0%)	0 (0%)	3 (60%)	1 (20%)	1 (20%)	5 (2%)
Bicycles	0 (0%)	1 (9%)	3 (27%)	3 (27%)	4 (36%)	11 (3%)
Pedestrians	3 (19%)	4 (25%)	4 (25%)	2 (13%)	3 (19%)	16 (5%)
Total Crashes	**7 (2%)**	**14 (4%)**	**31 (10%)**	**51 (16%)**	**216 (68%**	**319**

Figure 2-10: Roadway User Involvement by Severity (2017-2021)

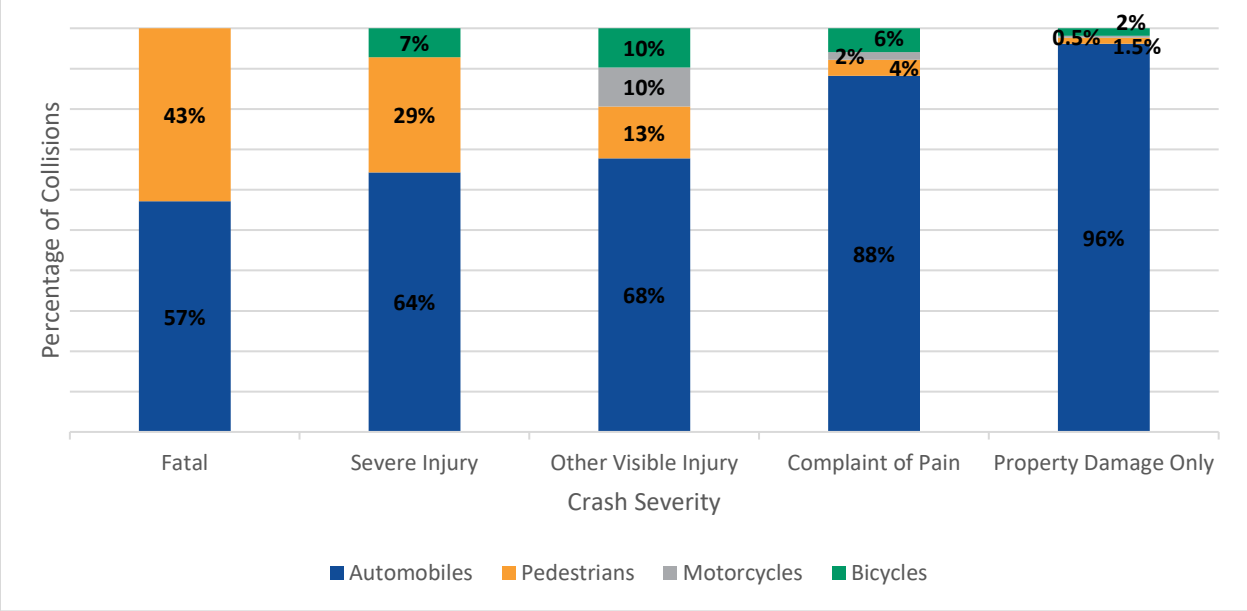
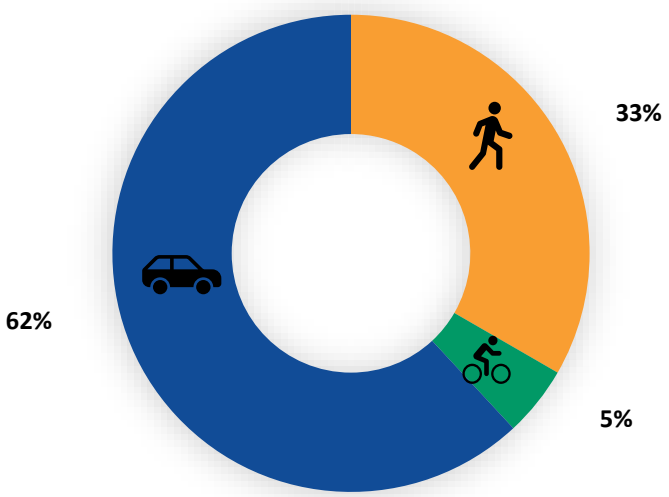


Figure 2-11 summarizes the proportion of roadway user types for fatal and severe injury collisions. A summary of the results is provided below:

- **Although pedestrians make up a small percentage of total crashes (5%), they are over-represented in the number of fatal and severe injury collisions (33%), which indicates that they are vulnerable roadway user (VRU)**
- **Motorcycles and bicycles were involved in 0% and 5%, respectively, of total fatal and severe injury collisions, which was representative of the 2% and 5% of total collisions that motorcycles and bicycles, respectively, were involved in**

Pedestrians, bicyclists, and motorcycle users are more prone to high-risk injury due to the lack of external protective devices that could absorb the impact of a roadway crash. Additionally, the smaller profiles of pedestrians, motorcycles and cyclists make it more difficult for these groups to be seen by vehicular operators.

Figure 2-11: Fatal & Severe Injury Collisions by Roadway User (2017-2021)



2.1.8 Alcohol Involved Collisions

The City of Brawley's top three lowest OTS categories from 2017 to 2019 consistently included alcohol involved crashes. In 2017 and 2019, Brawley was the 50th and 35th, respectively, of 94 cities included in Group D where alcohol was involved with drivers aged less than 21. In 2018, Brawley was the 40th of 94 cities in collisions in alcohol involved collisions. This section presents additional analysis related specifically to crashes involving drivers under the influence of alcohol (DUI).

DUI related collisions were evaluated from 12:00 AM to 11:59 PM to identify time of day crash patterns. There were 39 collisions that occurred during the study period, which represents 12% of the total collisions in the City. **Figure 2-12** shows a summary of total alcohol related crashes and severity by time of day. Below is a summary of the findings:

- **There were 5 DUI related collision that occurred during the daytime (7:00 AM to 5:00 PM) and 34 DUI related collisions during the nighttime (6:00 PM to 6:00 AM)**
- **The highest number of DUI crashes in a given hour occurred from 2:00 AM to 3:00 AM, with 6 total crashes including two non-severe injury collisions**
- **One DUI related fatal collisions occurred between 1:00 AM and 2:00 AM**

Figure 2-12: DUI Collisions by Time of Day and Severity (2017-2021)

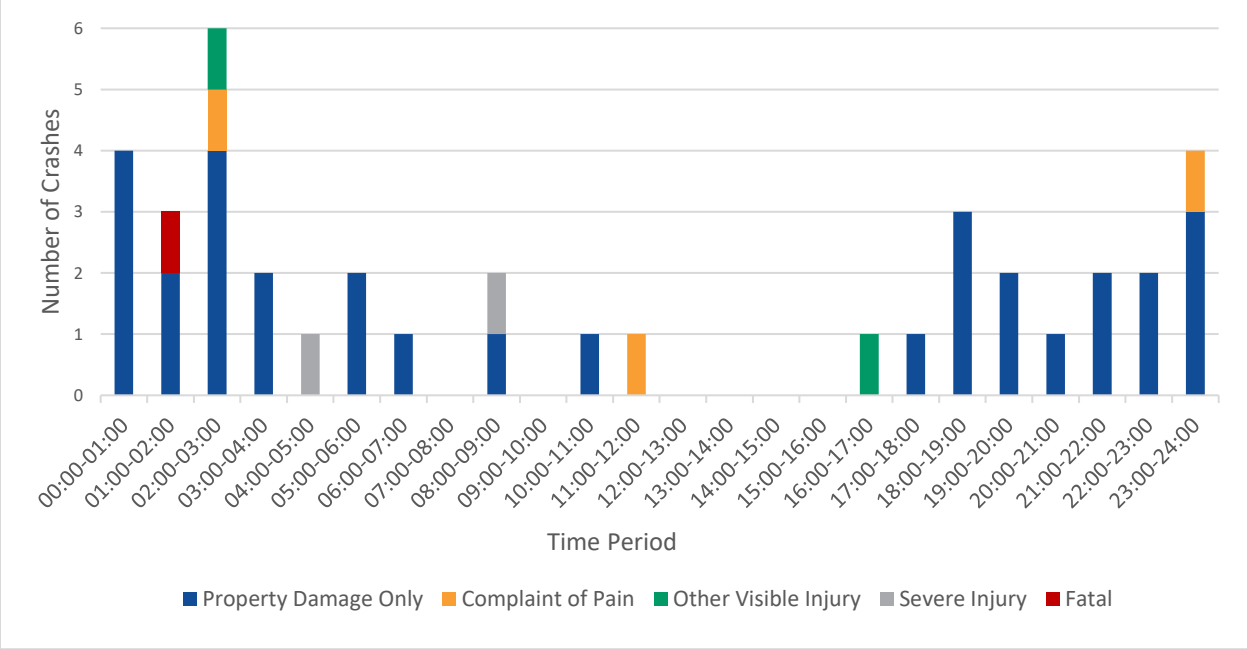


Table 2-14 summarizes the proportion of crashes involving alcohol by crash type and location for signalized intersections, unsignalized intersections, and roadway segments. A summary of the results is provided below:

- Most crashes occurred at unsignalized intersections (67%)
- The most common crash type at signalized intersections were rear end (40%) and Hit Object (40%)
- The top three most common crash types at unsignalized intersections were rear end (31%), sideswipe (23%), and hit object (19%)
- The most common crash types at roadway segments were hit object (38%)
- The two most common crash types observed across all three location types were hit object (26%) and rear end (28%)

Table 2-14: Alcohol Involved Crash Type by Location and Crash Type (2017-2021)

CRASH TYPE	SIGNALIZED INTERSECTION	UNSIGNALIZED INTERSECTION	ROADWAY SEGMENT	TOTAL (%)
Broadside	0 (0%)	4 (15%)	0 (0%)	4 (10%)
Rear End	2 (40%)	8 (31%)	1 (13%)	11 (28%)
Sideswipe	0 (0%)	6 (23%)	1 (13%)	7 (18%)
Hit Object	2 (40%)	5 (19%)	3 (38%)	10 (26%)
Head-On	0 (0%)	2 (8%)	1 (13%)	3 (8%)
Overturned	0 (0%)	0 (0%)	1 (13%)	1 (3%)
Other	0 (0%)	0 (0%)	1 (13%)	1 (3%)
Not Stated	1 (20%)	1 (4%)	0 (0%)	2 (5%)
Total Crashes	**5 (13%)**	**26 (67%)**	**8 (21%)**	**39**

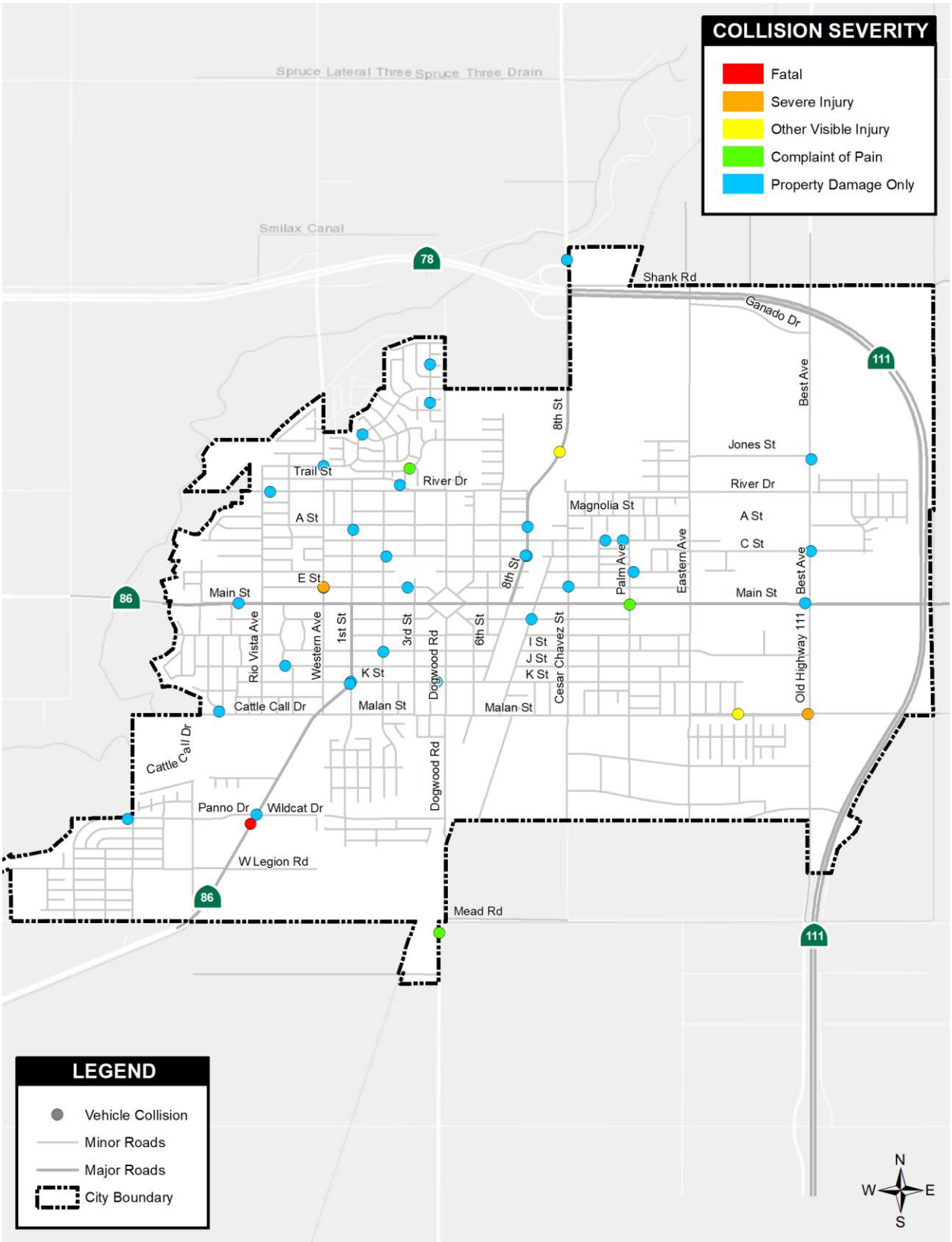
Table 2-15 summarizes the proportion of DUI crashes by severity and roadway user type. **Figure 2-13** illustrates where the DUI related collisions occurred throughout the City of Brawley. A summary of the results is provided below:

- **Of the total collisions where DUI was the primary collision factor, 100% involved automobiles only, the majority of which resulted in property damage only**
- **Fatal and severe injury related collisions accounted for 8% of the total automobile collisions**

Table 2-15: DUI Roadway User Involvement by Severity (2017-2021)

ROADWAY USER	FATAL	SEVERE INJURY	OTHER VISIBLE INJURY	COMPLAINT OF PAIN	PROPERTY DAMAGE ONLY	TOTAL (%)
Automobiles	1 (3%)	2 (5%)	2 (5%)	3 (8%)	31 (79%)	39 (100%)
Motorcycles	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Bicycles	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Pedestrians	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total Crashes	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Figure 2-13: Citywide DUI Collisions by Severity (2017-2021)



2.2 Equivalent Property Damage Only (EPDO) Scoring

Equivalent Property Damage Only (EPDO) scoring per the Highway Safety Manual (HSM) was utilized to analyze crash data and evaluate roadway network performance. Crashes were assigned weighting factors relative to property damage only collisions based on crash costs from the Highway Safety Improvement Program (HSIP) Local Roadway Safety Manual (LRSM) for California Local Road Owners v1.6. The weighting factor generally reflects an order of magnitude difference between the societal costs of fatal and severe injury collisions versus non-severe injury collisions. EPDO score is calculated by multiplying each crash severity total by its associated weight and summing the results, using the following formula:

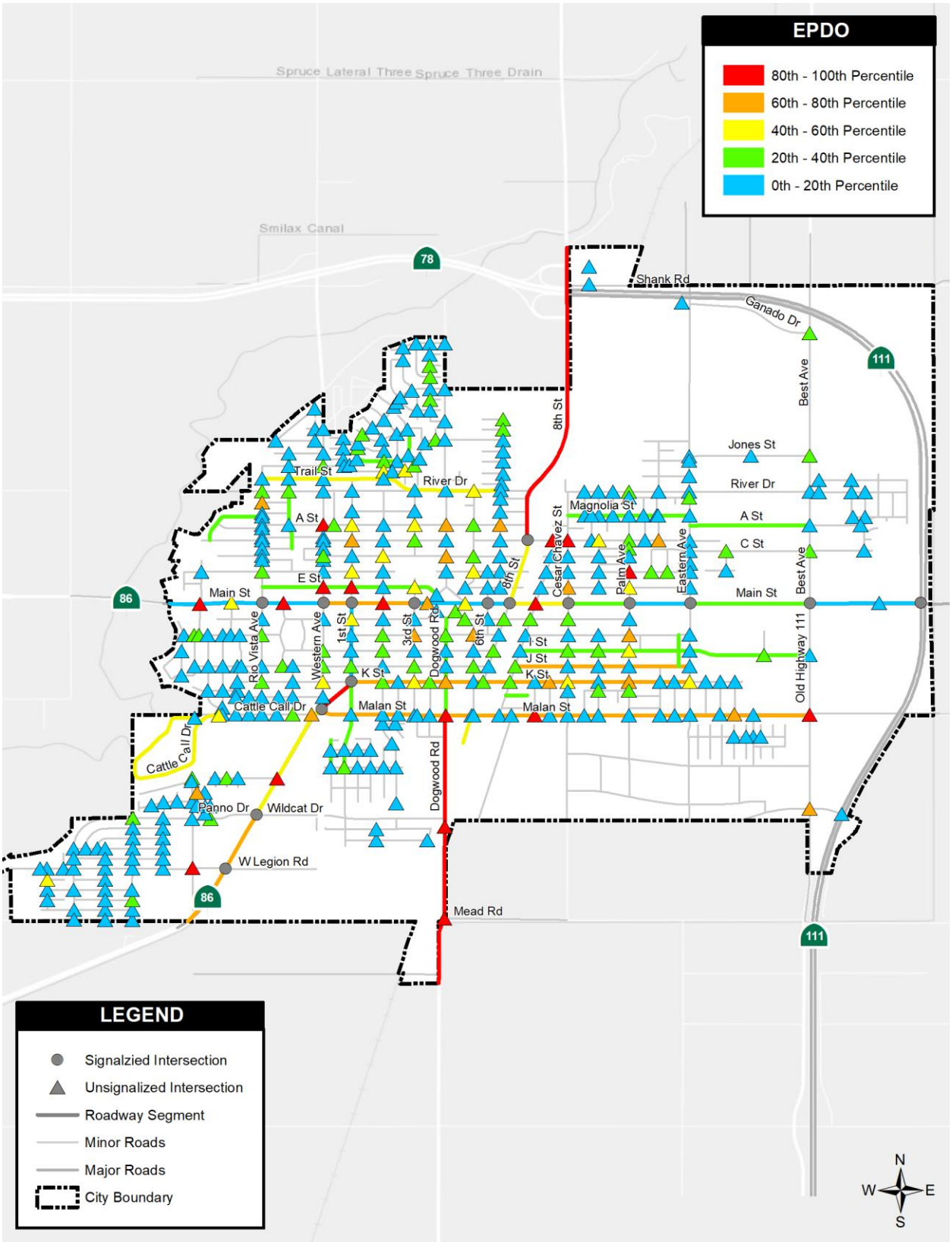
> ***EPDO Score = (Fatal Weight x Number of Fatal Crashes) + (Severe Injury Weight x Number of Severe Injury Crashes) + (Other Visible Injury Weight x Number of Other Visible Injury Crashes) + (Complaint of Pain Injury Weight x Number of Complaint of Pain Injury Crashes) + Property Damage Only Crashes***

EPDO scoring was conducted for signalized intersections, non-signalized intersections, and roadway segments. EPDO scores were organized by quintile and displayed graphically by heat maps. The top quintiles identified priority locations with the highest EPDO scores and corresponds with the highest crash frequency and severity. **Table 2-16** summarizes the crash cost and EPDO score associated with an individual collision by location type and severity. **Figure 2-14** shows the citywide EPDO scoring by quintile for signalized intersections, non-signalized intersections, and roadway segments.

Table 2-16: Crash Weights by Severity and Location Type

LOCATION TYPE	CRASH WEIGHTS BY SEVERITY							
	FATAL AND SEVERE INJURY		OTHER VISIBLE INJURY		COMPLAINT OF PAIN INJURY		PROPERTY DAMAGE ONLY	
	EPDO SCORE	CRASH COST	EPDO SCORE	CRASH COST	EPDO SCORE	CRASH COST	EPDO SCORE	CRASH COST
Signalized Intersection	119.9	$1.79m	10.7	$159,900	6.1	$90,900	1	$14,900
Unsignalized Intersection	190.8	$2.84m						
Roadway	165.2	$2.46m						

Figure 2-14: Citywide EPDO Scoring



2.2.1 Signalized Intersections

Figure 2-15 shows the citywide EPDO scoring by quintile for signalized intersections. The quintiles and corresponding EPDO score ranges are as follows:

- 80 – 100th Percentile: 53.40 – 383.60
- 60 – 80th Percentile: 16.20 – 53.39
- 40 – 60th Percentile: 14.70 – 16.19
- 20 – 40th Percentile: 7.10 – 14.69
- 0 – 20th Percentile: 1.00 – 7.09

The top ten signalized intersection locations based on EPDO scores are shown in **Table 2-17** and graphically on **Figure 2-16**. Based on roadway classifications in City of Brawley General Plan Infrastructure Element, most of the top quintile signalized intersection locations are along arterial and major corridors.

Table 2-17: Top Ten Signalized Intersections by EPDO Score

RANK	LOCATION	JURISDICTION	TOTAL COLLISIONS	EPDO SCORE
1	SR-78 & SR-111	Caltrans	7	383.6
2	Main St & Cesar Chavez St	Brawley	7	145.3
3	Main St & 8th St	Brawley	5	129
4	SR-86 & Western Ave/Malan St	Caltrans	9	53.4
5	SR-86 & Panno Dr/Wildcat Dr	Caltrans	9	23.8
6	Main St & 3rd St	Brawley	5	19.8
7	Main St & Western Ave	Caltrans	6	16.2
8	Main St & 1st St	Caltrans	11	16.1
9	Main St & Palm Ave	Brawley	5	15.2
10	Main St & Best Ave / Old Highway 111	Brawley	5	14.7

Figure 2-15: Signalized Intersections EPDO Scoring

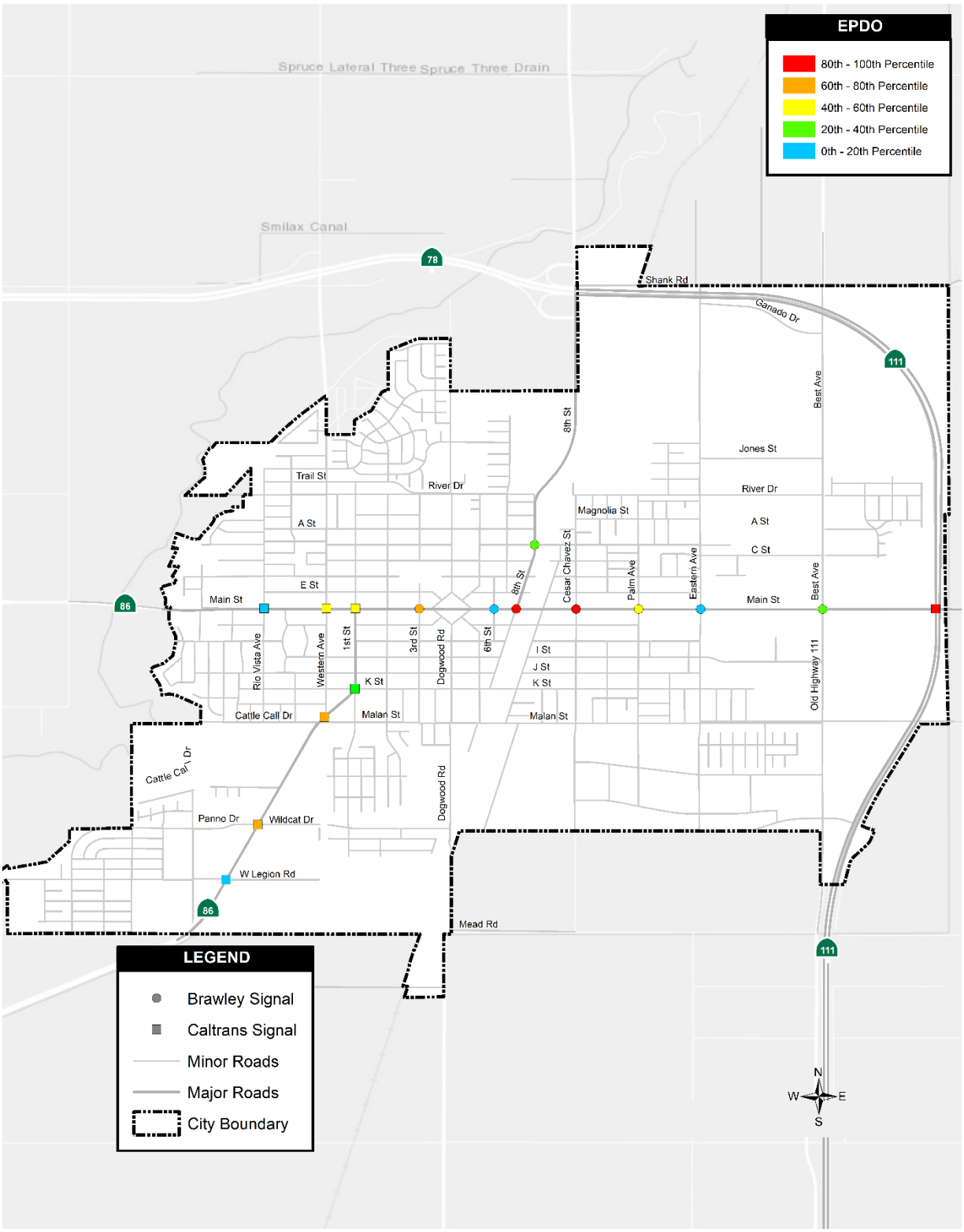
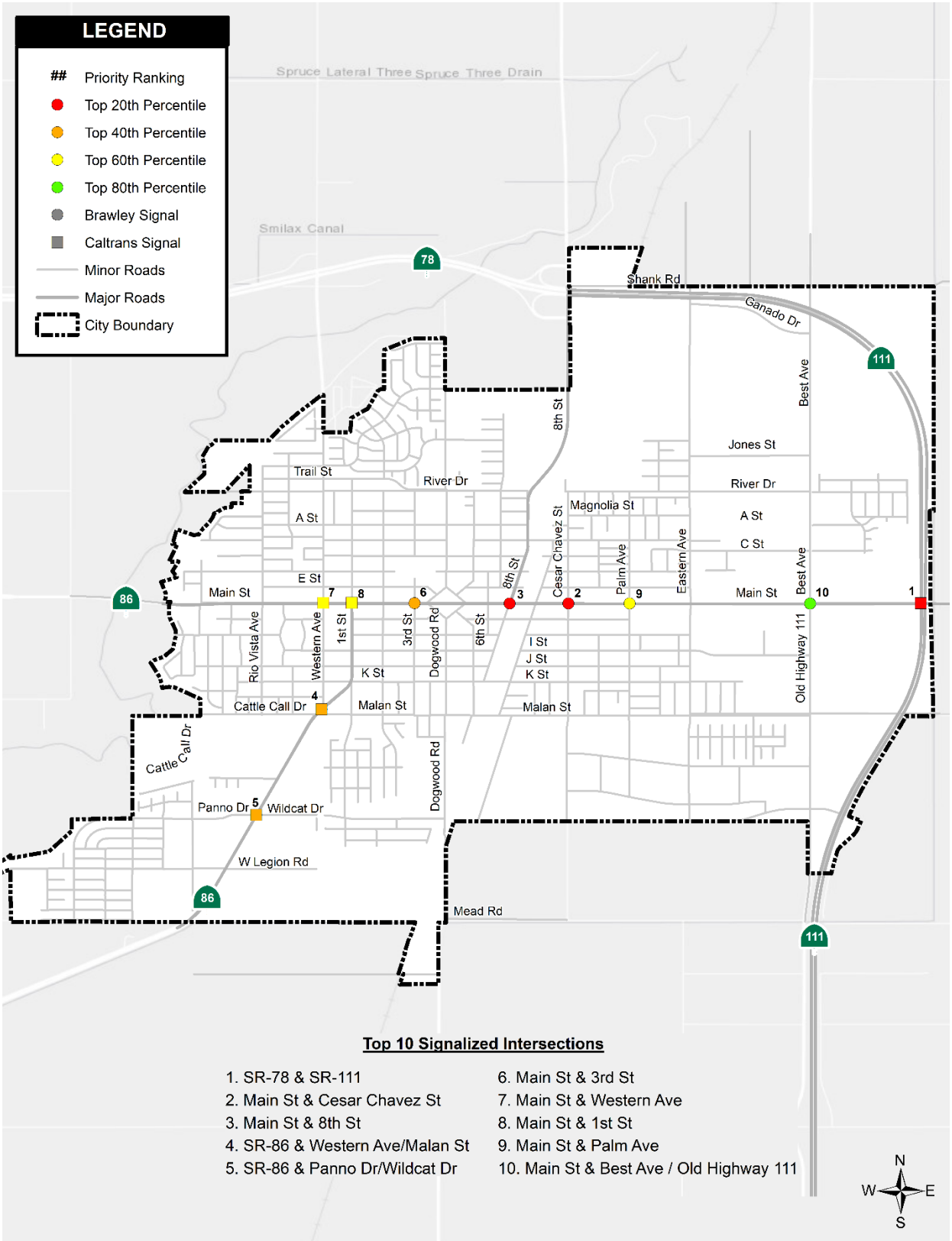


Figure 2-16: Priority Signalized Intersections



2.2.2 Unsignalized Intersections

Figure 2-17 shows the citywide EPDO scoring by quintile for unsignalized intersections. Unsignalized intersections that did not collisions that occurred within the study period were excluded from the analysis. The quintiles and corresponding EPDO score ranges are as follows:

- **80 – 100th Percentile: 11.70 – 381.60**
- **60 – 80th Percentile: 6.10 – 11.69**
- **40 – 60th Percentile: 1.00 – 6.09**
- **20 – 40th Percentile: 0.01 – 0.99**
- **0 – 20th Percentile: 0.00**

The top ten unsignalized intersection locations based on EPDO scores are shown in **Table 2-18** and graphically on **Figure 2-18**. Based on roadway classifications in the Brawley's General Plan Infrastructure Element, the majority priority unsignalized intersections are primarily located on arterial and major corridors with fewer top quintile intersections located on lower-order secondary, collector, and local roadways.

Table 2-18: Top Ten Unsignalized Intersections by EPDO Score

RANK	LOCATION	JURISDICTION	TOTAL COLLISIONS	EPDO SCORE
1	Main St & Las Flores Dr	Caltrans	2	381.6
2	N Western Ave & A St	Brawley	4	198.9
3	N Western Ave & E St	Brawley	3	197.9
4	S Imperial Ave & Monterey St	Brawley	2	196.9
5	Dogwood Rd & Mead Rd	Brawley	4	193.8
6	Malan St & S Imperial Ave	Brawley	3	192.8
7	SR-86 & Julia Dr	Caltrans	2	191.8
8	B St & N 9th St	Brawley	1	190.8
9	S Best Ave & Malan St	Brawley	1	190.8
10	Main St & S El Centro Dr	Caltrans	2	16.8

Figure 2-17: Unsignalized Intersections EPDO Scoring

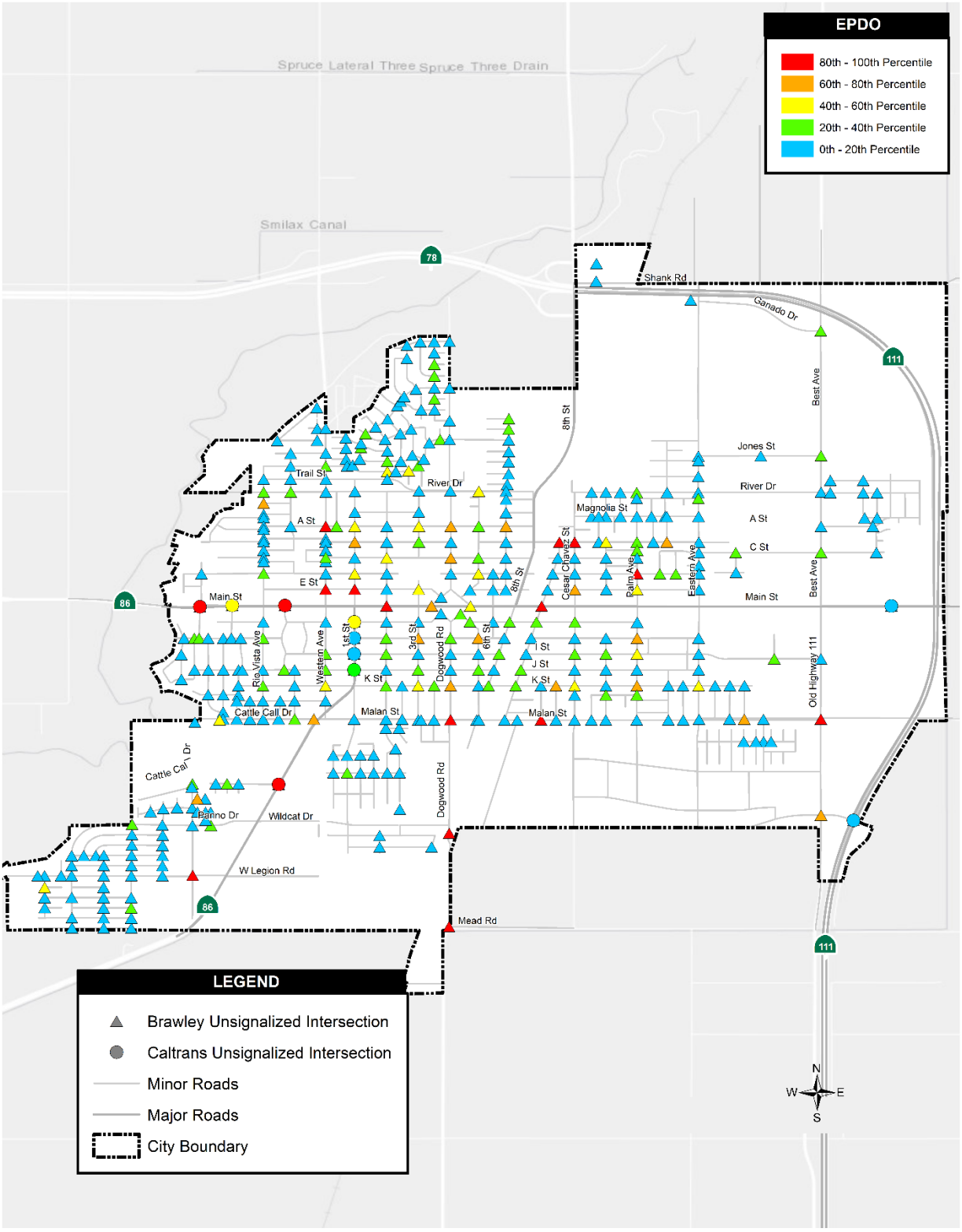
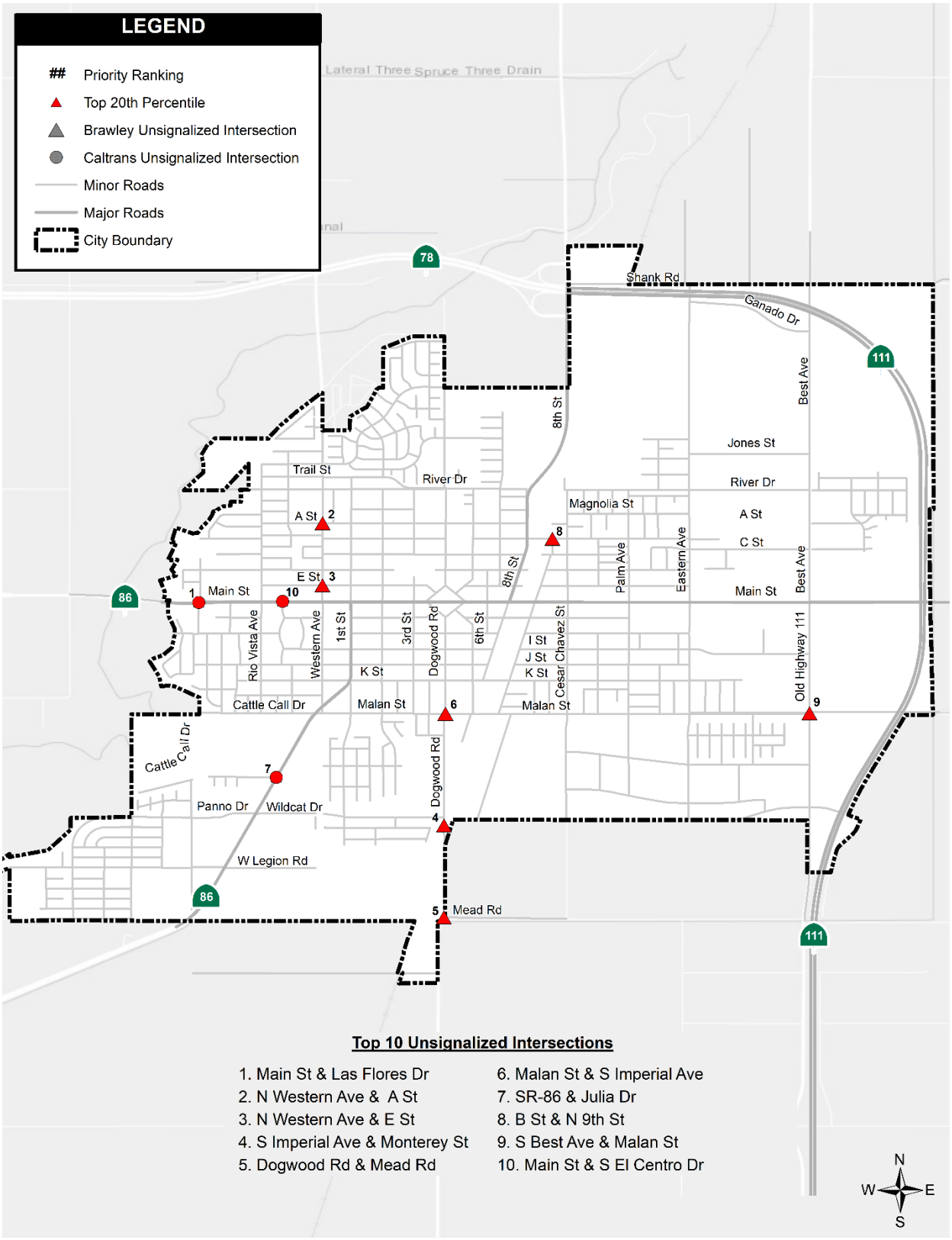


Figure 2-18: Priority Unsignalized Intersections



2.2.3 Roadway Segments

Figure 2-19 shows the citywide EPDO scoring by quintile for roadway segments. Roadways that did not have collisions that occurred within the study period were excluded from the analysis. The quintiles and corresponding EPDO score ranges are as follows:

- **80 – 100th Percentile: 165.20 – 225.70**
- **60 – 80th Percentile: 4.00 – 165.19**
- **40 – 60th Percentile: 1.00 – 3.99**
- **20 – 40th Percentile: 0.01 – 0.99**
- **0 – 20th Percentile: 0.00**

The top ten quintile roadway segment locations based on EPDO scores are shown in **Table 2-19** and graphically on **Figure 2-20**. Based on roadway classifications in the City of Brawley's General Plan Infrastructure Element, the majority of the priority roadway segments are arterial, major, and secondary corridors with fewer located on lower-order roadways.

Table 2-19: Top Ten Roadway Segments by EPDO Score

RANK	CORRIDOR	SEGMENT	JURISDICTION	TOTAL COLLISIONS	EPDO SCORE
1	N 8th St	B St to Northern City Limits	Brawley	12	225.7
2	Dogwood Rd	Southern City Limits to Malan St	Brawley	4	173.3
3	SR-86	Western Ave/Malan St to K St	Caltrans	2	166.2
4	Main St	Western Ave to 1st St	Caltrans	1	165.2
5	SR-86	Legion Rd to Panno Rd/Wildcat Dr	Caltrans	1	165.2
6	SR-86	Southern City Limits to Legion Rd	Caltrans	1	165.2
7	J St	9th St to Eastern Ave	Brawley	2	21.4
8	K St	SR-86 to Eastern Ave	Brawley	2	7.1
9	Main St	1st St to 3rd St	Brawley	1	6.1
10	Malan St	SR-86 to Old Highway 111	Brawley	1	6.1

Figure 2-19: Roadway Segments EPDO Scoring

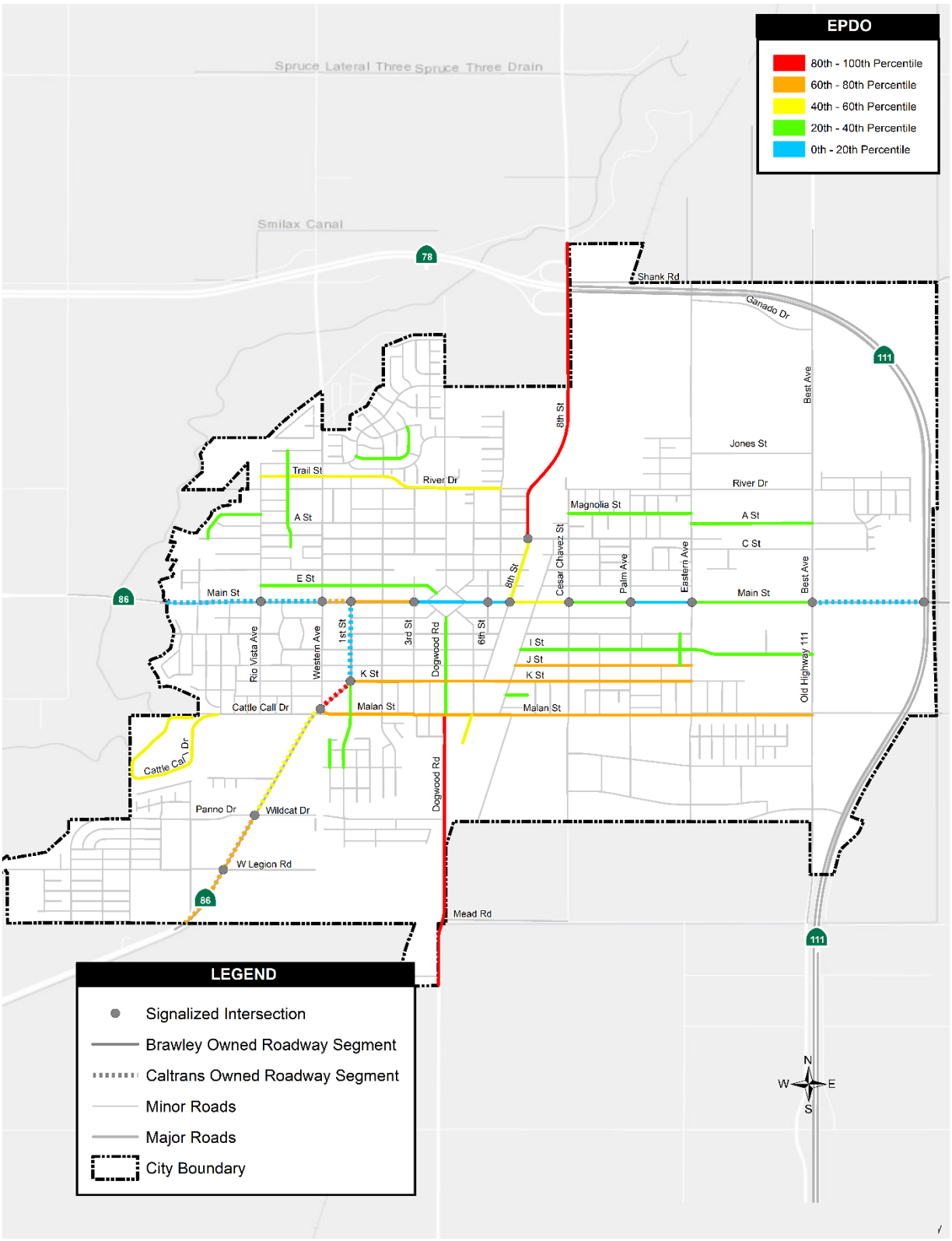
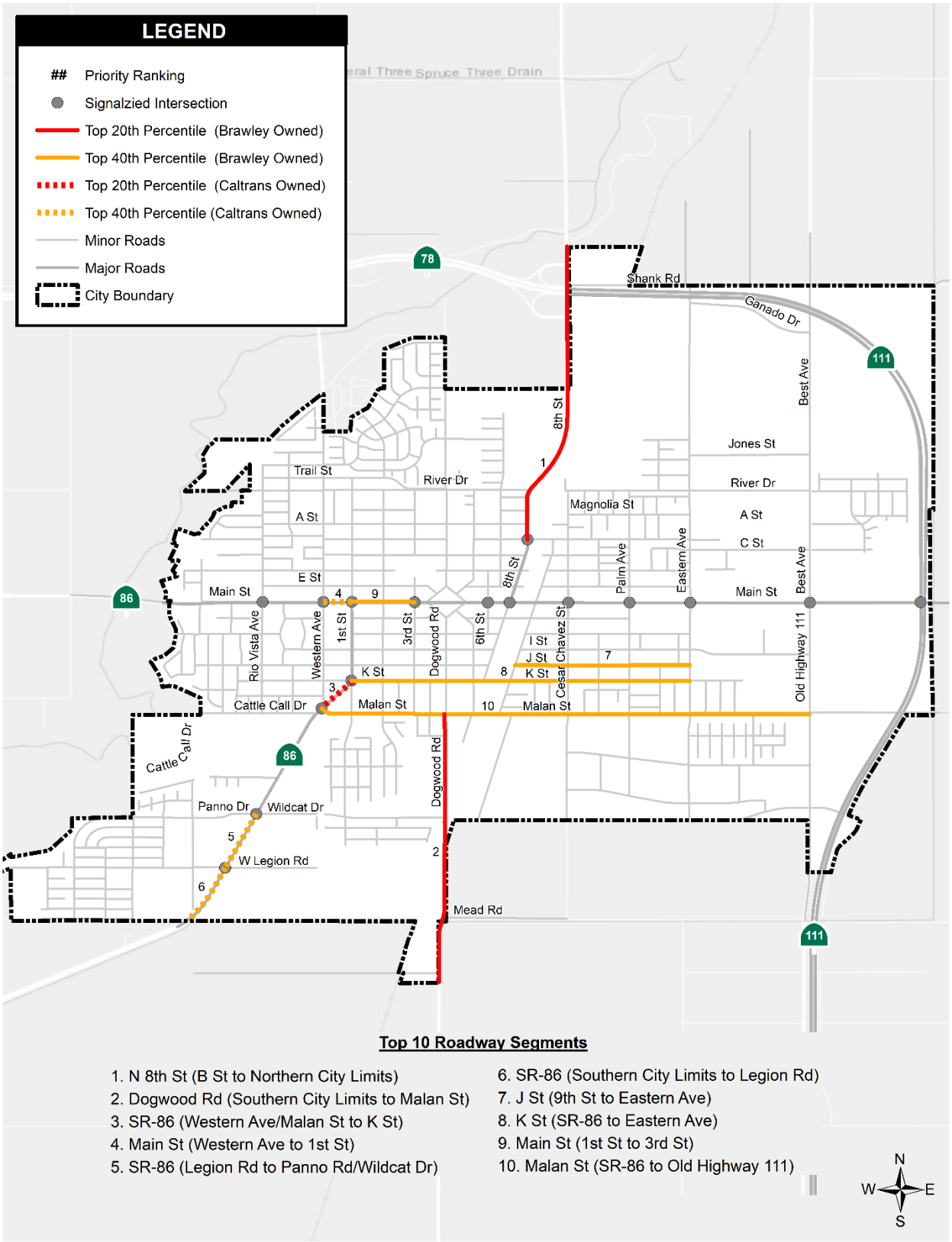


Figure 2-20: Priority Roadway Segments



2.3 Key Findings

Trends based on the crash data analysis include:

- Majority of crashes occurred at intersections including signalized (26%) and unsignalized (56%)
- Majority of injury related crashes resulted in property damage only (68%) and non-severe injury (26%)
- Top three crash types include broadside (27%), rear end (24%), and sideswipe (16%)
- Top three primary collision factors include improper turning (14%), driving or bicycling under the influence of alcohol or drugs (12%), and automobile right-of-way violations (8%)
- Majority of crashes involved automobiles only (90%)
- There were 39 DUI related collisions, representing 12% of the total collisions
- The highest number of DUI crashes in a given hour occurred from 2:00 AM to 3:00 AM, with 6 total crashes including two non-severe injury collisions

3 Safety Partners

Outreach was conducted to local safety partners that represent the 5E's of traffic safety (engineering, enforcement, education, emergency response, and emerging technologies) to collaboratively address roadway safety in Brawley. Participants included:

- **Brawley Public Works Department**
- **Brawley Police Department**
- **Brawley Fire Department**
- **Brawley Elementary School District**

3.1 Outreach Survey Results

Outreach survey packets were distributed to the safety partners which included an overview of the LRSP; background information for LRSP program resources and relevant City documents; references for roadway safety infrastructure improvements and public safety programs; results of the citywide crash analysis and roadway network screening; identified priority locations; and survey areas for the safety partners to respond. **Appendix B** contains

the safety partner outreach survey responses, which are generally summarized in the following sections.

3.1.1 Priority Locations

The citywide crash analysis identified priority locations for the top ten signalized intersections, unsignalized intersections, and roadway segments throughout Brawley based on crash frequency and severity. Based on the safety partner feedback, the top 3 priority locations in each category, the following were identified as the top priorities based on the total number of responses:

Top Priority Signalized Intersections

- Main Street & 8th Street (Brawley)
- Main Street & 3rd Street (Brawley)
- Main Street & Cesar Chavez Street (Brawley)

Top Priority Unsignalized Intersections

- Main Street & Las Flores Drive (Caltrans)
- Malan Street & South Imperial Avenue (Brawley)
- State Route 86 & Julia Drive (Caltrans)
- North Western Avenue & A Street (Brawley)
- North Western Avenue & E Street (Brawley)

Top Priority Roadway Segments

- K Street: State Route 86 to Eastern Avenue (Brawley)
- North 8th Street: B Street to Northern City Limits (Brawley)
- Malan Street: State Route 86 to Old Highway 111 (Brawley)

3.1.2 Other Locations Not Identified from Crash Analysis

Feedback for additional signalized intersection, unsignalized intersection, and roadway segment locations not identified as priority locations was collected. Generally, feedback included locations where traffic signal and stop-sign installations were requested, areas with high pedestrian traffic, particularly due to school traffic, unsafe pedestrian crossings, areas that lack street lighting, and areas where vehicle speeding is frequently observed.

3.1.3 Locations Near Schools

Feedback was collected for known roadway safety issues near Brawley schools. Priority locations identified based on the total number of responses include:

Top Priority Schools

- **Brawley Union High School**
- **J.W. Oakley Elementary School**
- **Myron D. Witter Elementary School**

Feedback received generally included a need for 4-way stop signs, school zone signs, crosswalks that need to be repainted, and that that high pedestrian traffic combined with major through-road traffic creates back-ups and unsafe pedestrian crossing conditions.

3.1.4 Locations Near Parks

Feedback was collected for known roadway safety issues near Brawley parks. Priority locations identified based on the total number of responses include:

Top Priority Parks

- **Hinojosa Park**
- **Meserve Park**
- **Gonzalez Park**

Feedback received generally included a need for 4-way stop signs and crosswalks markings and to address safety for parks near schools that have a history of vagrancy and drug use.

3.1.5 Pedestrian and Bicycle Safety Concerns

Feedback was collected for additional locations that have safety concerns for pedestrians and bicyclists. Generally, feedback included areas where pedestrian collision have been observed, where vehicles don't stop for crosswalks, where pedestrian crossing is dangerous due to vehicular speeding, where the school zone and crosswalk striping needs to be refreshed, and where 4-way stop signs are needed.

3.1.6 Safety Countermeasures and Programs

Feedback was collected on desired infrastructure countermeasures and programs for pedestrian, bicycle, and general roadway safety. The top priorities based on the total number of responses were:

Pedestrian Countermeasures:

- Pedestrian crossing enhancements (audible push buttons, countdown signal heads, high visibility crosswalks, wayfinding signage)
- New sidewalks, multi-use paths, and trails
- Intersection Safety Lighting

Bicycle Countermeasures:

- New bicycle lanes
- Bicycle lane enhancements (buffers between vehicle and bicycle lanes, high visibility / green pavement markings, wayfinding signage)
- Bicycle safety training workshops / bike rodeos
- Public bicycle facilities (bike racks, shelters, and lockers; bike repair stations / public bicycle pumps)

Roadway Countermeasures:

- Intersection / Street Lighting
- Edgelines and Centerlines
- Safe Routes to School Programs

Generally, the feedback demonstrated that roadway infrastructure improvements and public facilities were desired above public education workshops and volunteer programs, with the exception for Safe Routes to School programs.

4 Countermeasure Toolbox

A Countermeasure Toolbox was developed based on the results of the citywide crash analysis, roadway network screening, and guidance provided by the United States Department of Transportation (USDOT), Federal Highway Administration (FHWA), National Highway Traffic Safety Administration (NHTSA), and California Department of Transportation (Caltrans) for countermeasure effectiveness including:

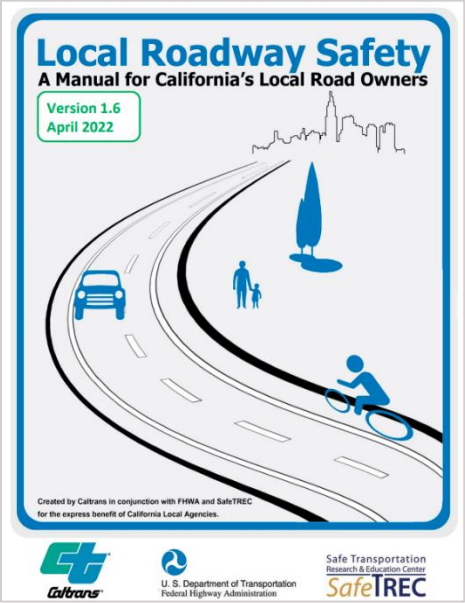
- **USDOT FHWA Safe System Approach**
- **USDOT FHWA Proven Safety Countermeasures**
- **USDOT FHWA Crash Modification Factors (CMF Clearinghouse)**
- **USDOT NHTSA Countermeasures that Work**
- **California Strategic Highway Safety Plan (SHSP) and Implementation Plan**
- **Caltrans Local Roadway Safety Manual (LRSM) for California Local Road Owners**

Countermeasures are organized based on the 5E's of traffic safety from the CA SHSP which include the following key overarching strategies to improve traffic safety:

ENGINEERING
Implement effective infrastructure-oriented roadway safety treatments
EDUCATION
Educate all roadway users on safe behaviors
ENFORCEMENT
Enforce actions that reduce high-risk behaviors
EMERGENCY RESPONSE
Improve emergency response times and post-crash actions
EMERGING TECHNOLOGIES
Apply emerging technologies to roadways, vehicles, and roadway users

The Countermeasure Toolbox establishes the foundation for countermeasures that can be applied to address crashes that occur on the local Brawley roadway network. With consideration for Caltrans requiring cities to adopt LRSPs for in the current Highway Safety Improvement Program (HSIP) Cycle 11 call-for-projects, this toolbox was developed with a focus on engineering countermeasures that are eligible for HSIP funding. The Brawley LRSP is a living document and will be updated based on Caltrans standards for maintaining HSIP funding eligibility. Future LRSP updates will include increased development of the countermeasure toolbox for non-engineering countermeasures and strategies that can be locally funded or are eligible for other roadway infrastructure and safety grant programs.

4.1 Engineering



Engineering countermeasures for infrastructure safety improvements were selected from the 2022 Caltrans Local Roadway Safety Manual (LRSM) for California Local Road Owners (v1.6) based on the results of the citywide crash analysis and City of Brawley roadway infrastructure priorities. Countermeasures can be applied to signalized intersections (S), non-signalized intersections (NS), and roadways (R) for grant funding applications through the Caltrans Highway Safety Improvement Program (HSIP). Countermeasures are summarized based on the LRSM for countermeasure number, type, crash types that the countermeasure addresses, the crash reduction factor (CRF) or multiplicative factor that indicates the proportion of crashes expected after implementing the countermeasure, the percentage of HSIP funding eligibility, and the opportunity for systemic approach based on the ability to apply the countermeasure to multiple crash locations, corridors, or geographic areas.

A summary of the countermeasures that can be applied to signalized intersections is included in **Table 3-1**. A summary of countermeasures that can be applied to non-signalized intersections is included in **Table 3-2**. A summary of countermeasures that can be applied to roadway segments is included in **Table 3-3**.

Appendix C contains detailed information for each engineering countermeasure including:

- Caltrans LRSM countermeasure reference
- HSIP funding eligibility
- Crash types addressed
- Crash reduction factor (CRF)
- Expected design life
- Planning-level approximate cost
- Example countermeasure image
- Description of the countermeasure
- Caltrans LRSM description of where to use the countermeasure
- Caltrans LRSM description of why the countermeasure works

Table 4-1: Signalized Intersection Countermeasures

LRSM CM #	TYPE	COUNTERMEASURE NAME	CRASH TYPE	CRASH REDUCTION FACTOR	HSIP FUNDING ELIGIBILITY	SYSTEMIC APPROACH OPPORTUNITY
S1	Lighting	Add intersection lighting (S.I.)	Night	40%	90%	Medium
S2	Signal Mod	Improve signal hardware: lenses, back-plates with retroreflective borders, mounting, size, and number	All	15%	90%	Very High
S3	Signal Mod	Improve signal timing (coordination, phases, red, yellow, or operation)	All	15%	50%	Very High
S5	Signal Mod	Install emergency vehicle pre-emption systems	Emergency Vehicle	70%	90%	High
S7	Signal Mod	Provide protected left turn phase (left turn lane already exists)	All	30%	90%	High
S10	Operation/ Warning	Install flashing beacons as advance warning (S.I.)	All	30%	90%	Medium
S11	Operation/ Warning	Improve pavement friction (High Friction Surface Treatments)	All	55%	90%	Medium
S12	Operation/ Warning	Install raised median on approaches (S.I.)	All	25%	90%	Medium
S13PB	Geometric Mod	Install pedestrian median fencing on approaches	Ped & Bike	35%	90%	Low
S16	Geometric Mod	Convert intersection to roundabout (from signal)	All	Varies	90%	Low
S17PB	Ped and Bike	Install pedestrian countdown signal heads	Ped & Bike	25%	90%	Very High
S18PB	Ped and Bike	Install pedestrian crossing (S.I.)	Ped & Bike	25%	90%	High
S21PB	Ped and Bike	Modify signal phasing to implement a Leading Pedestrian Interval (LPI)	Ped & Bike	60%	90%	Very High

Table 4-2: Unsignalized Intersection Countermeasures

LRSM CM #	TYPE	COUNTERMEASURE NAME	CRASH TYPE	CRASH REDUCTION FACTOR	HSIP FUNDING ELIGIBILITY	SYSTEMIC APPROACH OPPORTUNITY
NS1	Lighting	Add intersection lighting (NS.I.)	Night	40%	90%	Medium
NS3	Control	Install signals	All	30%	90%	Low
NS4	Control	Convert intersection to roundabout (from all way stop)	All	Varies	90%	Low
NS5mr	Control	Convert intersection to mini-roundabout	All	30%	90%	Medium
NS6	Operation/ Warning	Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs	All	15%	90%	Very High
NS7	Operation/ Warning	Upgrade intersection pavement markings (NS.I.)	All	25%	90%	Very High
NS8	Operation/ Warning	Install Flashing Beacons at Stop-Controlled Intersections	All	15%	90%	High
NS9	Operation/ Warning	Install flashing beacons as advance warning (NS.I.)	All	30%	90%	High
NS11	Operation/ Warning	Improve sight distance to intersection (Clear Sight Triangles)	All	20%	90%	High
NS12	Operation/ Warning	Improve pavement friction (High Friction Surface Treatments)	All	55%	90%	Medium
NS14	Geometric Mod	Install raised median on approaches (NS.I.)	All	25%	90%	Medium
NS17	Geometric Mod	Install right-turn lane (NS.I.)	All	20%	90%	Low
NS18	Geometric Mod	Install left-turn lane (where no left-turn lane exists)	All	35%	90%	Low
NS19PB	Ped and Bike	Install raised medians / refuge islands (NS.I.)	Ped & Bike	45%	90%	Medium
NS20PB	Ped and Bike	Install pedestrian crossing at uncontrolled locations (new signs and markings only)	Ped & Bike	25%	90%	High
NS21PB	Ped and Bike	Install/upgrade pedestrian crossing at uncontrolled locations (with enhanced safety features)	Ped & Bike	35%	90%	Medium
NS22PB	Ped and Bike	Install Rectangular Rapid Flashing Beacon (RRFB)	Ped & Bike	35%	90%	Medium
NS23PB	Ped and Bike	Install Pedestrian Signal (including Pedestrian Hybrid Beacon (HAWK))	Ped & Bike	55%	90%	Low

Table 4-3: Roadway Countermeasures

LRSM CM #	TYPE	COUNTERMEASURE NAME	CRASH TYPE	CRASH REDUCTION FACTOR	HSIP FUNDING ELIGIBILITY	SYSTEMIC APPROACH OPPORTUNITY
R1	Lighting	Add segment lighting	Night	35%	90%	Medium
R3	Remove/ Shield Obstacles	Install Median Barrier	All	25%	90%	Medium
R4	Remove/ Shield Obstacles	Install Guardrail	All	25%	90%	High
R8	Geometric Mod	Install raised median	All	25%	90%	Medium
R10PB	Geometric Mod	Install pedestrian median fencing on approaches	Ped & Bike	35%	90%	Low
R11	Geometric Mod	Install acceleration/ deceleration lanes	All	25%	90%	Low
R14	Geometric Mod	Road Diet (Reduce travel lanes from 4 to 3 and add a two way left-turn and bike lanes)	All	30%	90%	Medium
R15	Geometric Mod	Widen shoulder	All	30%	90%	Medium
R16	Geometric Mod	Curve shoulder widening (Outside Only)	All	45%	90%	Medium
R17	Geometric Mod	Improve horizontal alignment (flatten curves)	All	50%	90%	Low
R18	Geometric Mod	Flatten crest vertical curve	All	25%	90%	Low
R21	Geometric Mod	Improve pavement friction (High Friction Surface Treatments)	All	55%	90%	High
R22	Operation/ Warning	Install/Upgrade signs with new fluorescent sheeting (regulatory or warning)	All	15%	90%	Very High
R25	Operation/ Warning	Install curve advance warning signs (flashing beacon)	All	30%	90%	High
R26	Operation/ Warning	Install dynamic/variable speed warning signs	All	30%	90%	High
R28	Operation/ Warning	Install edge-lines and centerlines	All	25%	90%	Very High
R30	Operation/ Warning	Install centerline rumble strips/stripes	All	20%	90%	High
R31	Operation/ Warning	Install edgeline rumble strips/ stripes	All	15%	90%	High
R32PB	Ped and Bike	Install bike lanes	Ped & Bike	35%	90%	High
R33PB	Ped and Bike	Install Separated Bike Lanes	Ped & Bike	45%	90%	High
R34PB	Ped and Bike	Install sidewalk/pathway (to avoid walking along roadway)	Ped & Bike	80%	90%	Medium
R35PB	Ped and Bike	Install/upgrade pedestrian crossing (with enhanced safety features)	Ped & Bike	35%	90%	Medium

LRSM CM #	TYPE	COUNTERMEASURE NAME	CRASH TYPE	CRASH REDUCTION FACTOR	HSIP FUNDING ELIGIBILITY	SYSTEMIC APPROACH OPPORTUNITY
R36PB	Ped and Bike	Install raised pedestrian crossing	Ped & Bike	35%	90%	Medium
R37PB	Ped and Bike	Install Rectangular Rapid Flashing Beacon (RRFB)	Ped & Bike	35%	90%	Medium

4.2 Education

Based on the Brawley Non-Motorized Transportation Plan (NMTP), the Imperial County Safe Routes to School Master Plan (SRTS), and the Imperial County Transportation Commission (ICTC) Regional Active Transportation Plan, the following roadway safety education programs are recommended:

4.2.1 Parent's and Children's Bicycle Safety Clinics

Individual events that help parents and students become aware of regulations and protocols for safe walking or bicycling and help children develop basic bicycling techniques and safety skills through the use of a bicycle safety course. The clinics use playgrounds or parking lots and are set-up to simulate the roadway environment. Students receive instructions on how to maneuver, observe stop signs, and look for on-coming traffic before proceeding through intersections. Clinics also allow instructors to provide education on bicycle maintenance and ensure helmets and bicycles are properly sized and safe to use.

4.2.2 Pedestrian and Bike Traffic Safety Public Awareness Fairs/Campaigns

Bicyclists and pedestrians often come into conflict with other modes of transportation. A public awareness fair and/or campaign can increase consideration of bicyclists and pedestrians and highlight the rights and responsibilities of all road users. A campaign in Brawley that educates the public on the presence of bicyclists and pedestrians can reduce potential conflicts and create a more bicycle- and pedestrian-friendly city. The campaign should be conducted using a wide range of media to reach a diverse population.

4.2.3 Biking and Walking Map/Guide

An effective way to increase awareness of bicycling and walking as a transportation alternative is to distribute infrastructure maps and guides. A map can demonstrate the ease in accessing different parts of the community by biking and walking and highlight unique areas, shopping districts, or recreational areas. Brawley could develop and regularly update a city-wide map, which could be available on paper and/or online. The City could distribute the maps and guides to residents by mail to reach a broader population.

Schools may create specialized biking and walking maps to direct students to walk and bicycle along the safest routes to school. These specialized maps may include arrows to

indicate the routes and show stop signs, traffic signals, crosswalks, sidewalks, trails, overcrossings, and crossing guard locations surrounding the school. The maps could focus on the attendance boundary of a particular school. Routes should take advantage of low volume residential streets and off-street facilities such as bike paths, sidewalks, and pedestrian bridges.

Four schools in Brawley – Oakley Elementary School, Hidalgo Elementary School, Witter Elementary School, and Phil Swing Elementary School – have suggested pedestrian routes to school maps. The maps display walking routes for children and parents wishing to access the schools. Information is presented in both English and Spanish.

4.2.4 Informational Website

A common statement from bicyclists and pedestrians is that they are unfamiliar with the rules and regulations regarding non-motorized transportation, as well as the locations of effective bikeways, walkways, and support facilities. The City of Brawley should host a webpage through its website dedicated to bicycling and walking issues. The webpage can include general bicycle- and pedestrian-related California Vehicle Code regulations, Municipal Code ordinances, excerpts from the Bicycle and Pedestrian Master Plan, news about upcoming events, and other relevant topics. The City could also work with local advocacy groups to post information on their websites.

4.2.5 Wrong Way Riding Campaign/Program

The City of Brawley's Police Department should develop a campaign to increase enforcement of bicyclists riding the wrong way and educate bicyclists as to why it is dangerous. This campaign could include installing signage with a specific bicycle graphic. These signs are posted on the back of poles so that bicyclists riding the wrong way are informed that this is not an appropriate cycling route.

4.2.6 Rides and Races

The Imperial Valley is host to several bicycle clubs, including Imperial Valley Velo Club. In 2012, the Imperial Valley Velo Club hosted the 7th annual Imperial Valley Classic Bike Race at the Brawley Cattle Call Rodeo Arena to raise money for the Cancer Resource Center of the Desert and the Family Treehouse in Imperial. The criterium included a Health Fair, a bicycle rodeo, two jumpers for children, a 5K run, and a kid's bike race. The club has plans to begin a youth cycling program.

4.2.7 Safe Routes to Transit

Brawley is currently served by Imperial Valley Transit routes 50, 200, 600 and 550 (service only by request). Many transit users begin and end their trip on foot, therefore pedestrian access to transit is a critical component of a successful transit system. The City of Brawley

should work with Imperial Valley Transit to enhance the transit stop environment for existing and future stops and stations. This Plan should be updated accordingly as stops and stations are added. Key components include:

- **Convenient and direct pedestrian links to transit stops**
- **Paved landing pad to safely accommodate wheelchair boardings**
- **Covered passenger shelters**
- **Seating areas**
- **Posted system map, route map and schedule (additional options include real-time information display of upcoming bus arrivals)**
- **Lighting**
- **Trash receptacles**

4.2.8 Commuter Incentive Programs

Commuter Incentive Programs encourage commuting by non-motorized transportation by increasing public awareness of bicycling and walking as practical modes of transportation. Example programs include Commute for Cash Challenge, Rideshare Month, Bike to Work Week, and Walk to School Week. As part of a commuter incentive program, the City could also set up a commuter matching program to address residents' concerns about safety while biking and walking. This could be an online message board or an interactive mapping exercise to help put interested residents in contact with one another.

Additional education strategies that should be considered in the development of future Brawley LRSP updates include:

- **International Walk-to-School Day:** An event held in October where children and adults from around the world to celebrate walking and bicycling to school.
- **Open Streets Events:** Events where local streets are closed to vehicle traffic for a short period of time, so residents and visitors can experience this public space in a new way.
- **Park and Walks:** Designate specific parking lots to act as meeting areas for families who drive and then park and walk the remaining distance to school.
- **Principal, Mayor, and/or Teacher-led walks:** Single day events where key community leaders lead walks in the community outside of school hours to encourage walking.
- **Student/classroom walk/bike competitions with prizes:** Make walking and biking fun by providing a competition between students and/or classrooms to see who can walk/bike the most miles in a given time period. Children track their progress and get a small gift or a chance to win a prize after they reach a certain goal.
- **Walk and roll Wednesdays:** Designate a day where students are encouraged to ride their bicycles or walk together to school and/or for short trips.

4.2.9 California Office of Traffic Safety (OTS) Grants

California Office of Traffic Safety (OTS) grants are administered through the California State Transportation Agency (CalSTA) and funded by the Federal Highway Safety Program. The program seeks to prevent serious injury and death resulting from motor vehicle crashes by addressing the behavioral factors that impact roadway safety. OTS grants for priority program areas related to education include:

- **Motorcycle Safety:** Hands-on skill-building trainings, promotion of wearing protective gear, and educating the public on how to interact with motorcycles
- **Occupant Protection:** Education of parents and guardians on child safety seat laws, proper use and installation of car seats, child safety seat check-ups, promoting teens and adult seat belt use, and providing child safety seats to families in need
- **Pedestrian and Bicycle Safety:** Education on traffic rules, rights, responsibilities of drivers, pedestrians and bikes, education for high-risk populations (youth and elderly), bicycle and walking youth trainings, and promotion of safer driving, bicycling, and walking behaviors
- **Public Relations, Advertising, and Marketing Programs:** Monthly and year-round education campaigns that focus on youth, teens, and young adults for impaired driving, distracted driving, and pedestrian safety through the "Go Safely, California" campaign

4.2.10 Traffic Safety Marketing (TSM)

Traffic Safety Marketing (TSM) is provided by the National Highway Traffic Safety Administration (NHTSA) through the United States Department of Transportation (USDOT). TSM provides communication resources that can be utilized by local roadway safety advocates for traffic safety campaigns and marketing tools through both traditional and online media. Future Brawley LRSP updates should include consideration of additional NHTSA TSM education-related campaigns for child safety, motorcycle safety, older drivers, seat belts, school bus safety, teen safety, and vehicle safety.

4.3 Enforcement

4.3.1 Brawley Police Department

The City of Brawley's Police Department routinely enforces bicycle-related infractions for improper lighting and other inadequate safety equipment. At local events, the Police Department has conducted bicycle rodeos, which are bicycle safety courses for children. The Police Department also manages a bicycle licensing program. The fee for a new or replacement bicycle license is five dollars. Bicycle licenses help the Police Department return stolen bicycles and identify victims of collisions.

4.3.2 Speed Radar Trailer/Speed Feedback Signs

Speed radar trailers can help reduce traffic speeds and enforce speed limits in areas with speeding problems. Police set up an unmanned trailer that displays the speed of approaching motorists along with speed limit sign. Speed trailers may be effective on busier arterial roads without bikeway facilities or near schools with reported speeding.

Speed trailers work as both an educational and enforcement tool. By itself, the unmanned trailer educates motorists about their current speed in relation to the speed limit. Speed trailers can transport easily to streets where local residents complain about speeding problems.

The Brawley Police Department should station officers near the trailer to issue speeding citations when speeding continues to occur. It is recommended that City staff provide the management role for this program, working with the public to determine which locations are in most need. This program can be administered randomly, cyclically, or as demand necessitates because of the speed trailers' portability.

4.3.3 Targeted Bicycling/Walking Enforcement

Traffic enforcement agencies enforce laws pertaining to bicyclists and pedestrians as part of their responsible normal operations. Directed enforcement is one way to publicize non-motorized transportation laws in a highly visible and public manner. Examples include:

- **Intersection patrols**
- **Handing out informational sheets to motorists**
- **Bicyclists and pedestrians**
- **Enforcing speed limits and right-of-way**
- **Pedestrian decoy programs**
- **Crossing guards/ Corner captains**
- **Neighborhood watch programs**

Traffic enforcement agencies can also partake in the "caught being good" encouragement program where law enforcement officers distribute "tickets" to students and/or citizens who are following safety rules. The "tickets" typically contain coupons for discounts at local businesses and can help encourage citizens to follow safety protocols by rewarding safe behaviors.

4.3.4 Targeted Driving Enforcement

Much like directed enforcement for bicyclists, police departments can target enforcement of motorists for bicycle- and pedestrian-related violations. Common actions of drivers that create potential conflicts with bicyclists and pedestrians include parking in bike lanes, not sharing the road, and not yielding to people crossing the street. Directing enforcement at these actions can create a safer non-motorized transportation environment in Brawley and address residents' concerns about motorist behavior.

4.3.5 Bicycle Patrol Units

On-bike officers are an excellent tool for community and neighborhood policing because they are more accessible to the public and able to mobilize in areas where patrol cars cannot. Bike officers undergo special training in bicycle safety and bicycle-related traffic laws and are therefore especially equipped to enforce laws pertaining to bicycling. Bicycle officers help educate bicyclists and motorists through enforcement and also serve as excellent outreach personnel to the public at parades, street fairs, and other gatherings.

Additional enforcement strategies that should be considered in future Brawley LRSP updates to support local enforcement efforts include:

4.3.6 4.3.1 California Alcoholic Beverage Control (ABC) Grants

California Alcoholic Beverage Control (ABC) grants are administered through the Alcohol Policing Partnership (APP) Program and funded by the California Office of Traffic Safety (OTS)

through the National Highway Traffic Safety Administration (NHTSA). The APP program focuses on high levels of law enforcement service and public safety through a combination of licensing, education, and enforcement strategies. Program components include:

- **Training:** Receive training from experienced ABC Agents on ABC law, alcohol enforcement strategies and tactics, administrative license revocation procedures, and community resources. The Alcohol Policing Partnership Program Unit can investigate problem outlets and prepare cases for appropriate criminal, administrative, or civil action
- **Community Involvement:** Community partnership through public outreach/trainings
- **Prevention Strategies:** Utilize existing ABC prevention and education programs such as LEAD (Licensee Education on Alcohol and Drugs) and IMPACT (Informed Merchants Preventing Alcohol-Related Crime Tendencies) as a prelude to enforcement action
- **Enforcement Strategies:** ABC's Special Operations Unit work with local law enforcement agencies and the community to identify problem alcohol outlets. Enforcement strategies include various programs for Citizen's Arrest, Cops in Shops, Minor Decoy, Shoulder Tap, and Retail Operating Standards Task Force (ROSTF)
- **Records Management and Data Systems:** Improve systems to gather, track, and maintain alcohol-related data and crime at licensed outlets, and report to ABD district offices
- **Building Liaison:** Build close working partnerships with the local ABC District office
- **Media:** Effectively publicize activities that reduce alcohol-related crime. Media coverage helps with voluntary compliance among licensees who may be unaware of alcohol laws

The program is designed to put bad operators out of business, keep alcohol away from minors, and bring penalties such as fines, suspensions, or revocations against businesses that violate the law. ABC grants award funding to local law enforcement agencies to increase public safety by combating underage drinking and educating licensees about alcoholic beverage laws. ABC agents have expertise in alcoholic beverage laws and work with local police officers to help reduce alcohol-related community problems.

4.3.7 Traffic Safety Marketing (TSM)

Traffic Safety Marketing (TSM) is provided by the National Highway Traffic Safety Administration (NHTSA) through the United States Department of Transportation (USDOT). TSM provides communication resources that can be utilized by local roadway safety advocates for traffic safety campaigns and marketing tools through both traditional and online media. Future updates to the Brawley LRSP should include consideration of NHTSA TSM enforcement-related campaigns for law enforcement appreciation and seat belts.

4.4 Emergency Response

Strategies for improving emergency response that support the Brawley LRSP include improving emergency response times to reduce fatalities, preventing secondary crashes from occurring, and enhancing post-crash care. Future LRSP updates shall include consideration of additional emergency response strategies based on feedback received from the Brawley Police and Fire Departments:

4.4.1 Caltrans Local Roadway Safety Manual (LRSM V1.6) Countermeasure S5: Install Emergency Vehicle Pre-Emption Systems

The Caltrans Highway Safety Improvement Program (HSIP) includes a countermeasure for installing and / or upgrading existing emergency vehicle preemption (EVPE) systems at signalized intersections to address crashes that have involved emergency vehicles. This countermeasure includes utilization for both traditional infrared (IR) transmitter systems that rely on line-of-sight between the emergency response vehicle and traffic signals, as well as the latest global position system (GPS) preemption systems. The GPS-based EVPE systems transmit the emergency vehicle's speed, direction, and turn signal status which provides more efficient clearance of intersections along the route and improves emergency response times. Additionally, GPS-based EVPE systems eliminate disruptions to traffic signal operations, including traffic signal coordination, by eliminating the use of illegal emitters.

4.4.2 4.4.2 California Office of Traffic Safety (OTS) Grants

California Office of Traffic Safety (OTS) grants are administered through the California State Transportation Agency (CalSTA) and funded by the Federal Highway Safety Program. The OTS grant program seeks to prevent serious injury and death resulting from motor vehicle crashes by addressing the behavioral factors that impact roadway safety. OTS grants for priority program areas related to enforcement include:

- **Emergency Medical Services:** Upgrading extrication equipment and replacing outdated equipment that is critical for reaching victims quickly and increasing their survivability
- **Occupant Protection:** Education of parents and guardians on child safety seat laws, proper use and installation of car seats, child safety seat check-ups, promoting teens and adult seat belt use, and providing child safety seats to families in need

4.4.3 Traffic Safety Marketing (TSM)

Traffic Safety Marketing (TSM) is provided by the National Highway Traffic Safety Administration (NHTSA) through the United States Department of Transportation (USDOT). TSM provides communication resources that can be utilized by local roadway safety advocates for traffic safety campaigns and marketing tools through both traditional and

online media. Future Brawley LRSP updates should include consideration of NHTSA TSM emergency response-related campaigns for first responder safety, vehicle safety, child safety, and seat belts.

4.5 Emerging Technologies

Strategies for integrating emerging technology were identified from the 2020-2024 California Strategic Highway Safety Plan (SHSP) challenge area, which focuses on the use of technology to prevent, identify, and respond to crashes as well as reduce the frequency or severity of crashes. Emerging technologies includes roadway, vehicle, and driver applications. Examples include autonomous of connected vehicles, vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communications which aim to eliminate human error, the use of Transportation Network Companies (TNCs) for cars, bikes, or scooters, advancements in safety devices in vehicles, mobile applications, and improvements to emergency response from drones or roadway videos. The CA SHSP identifies six (6) general categories for emerging technology within transportation safety:

- **Alerting Drivers at Risk:** Technology that alerts drivers to the risk of being involved in a collision, reduces crash risk by monitoring speed and blind spots, and alerts drivers to the situation with visual and / or audible alerts so the driver can act accordingly
- **Assisting Drivers at Risk:** Technology that can assist a driver when a collision is imminent. For example, lane keeping assist technology helps drivers stay in their designated lane and alerts the driver through visual, audible, and / or tactile warnings when lane departure begins
- **Protecting Vehicle Occupants:** Vehicle manufacturer technology that protects vehicle occupants through safety features for seat belts, air bags, and vehicle structure features
- **Communication with Drivers and the Environment:** Technology that communicates between the drivers and their environment to support alerting drivers to risk and then providing assistance. Example categories and applications include, but are not limited to, vehicle-to-vehicle (V2V) for blind spot detection, vehicle-to-infrastructure (V2) for roadway condition warning alerts, and vehicle-to-pedestrian (V2P) for forward collision warning alerts that a pedestrian is in the crosswalk ahead
- **Vehicle Performing as Designated:** Once vehicles enter the roadway, it is essential that they perform as designated for their full lifespan. This can be accomplished through vehicle upkeep, maintenance, and record keeping. An example of a supporting technology is the vehicle oil change indicator light, which alerts drivers to a potential need for an oil change

- **Mobile Technology and Applications:** There are a variety of mobile phone technology and applications that enhance roadway safety. Examples include applications which restrict texting and / or mobile application use while driving, which can reduce distracted driving, and Transportation Network Companies (TNC) mobile applications for ride share such as Uber and Lyft, which can reduce DUI crash risk

4.6 20-24 California Strategic Highway Safety Plan Implementation Plan

The California Strategic Highway Safety Plan (SHSP) is the State's comprehensive, data-driven plan to reduce fatalities and serious injuries across all travel modes and on all public roads in California. Following the adoption of the 2020-2024 CA SHSP, state transportation leaders recognized that a bolder and more focused approach to combatting roadway safety. The March 2021 revision, referred to as "The Pivot", was adopted which includes new guiding principles for:

- **Integrating Equity:** Everyone has the right to travel safely on California public roads regardless of race, socioeconomic status, gender, age, and ability. Implementation should integrate equity, which considers historical, present-day, and systemic biases that impact roadway safety for all groups, particularly the most vulnerable and traditionally underserved populations. Equity must be integrated in all of the 5E's of traffic safety
- **Doubling Down on What Works:** Identify and utilize the strategies and actions that are the most effective in reducing fatalities and serious injuries, implementing proven countermeasures, and encouraging innovative solutions
- **Protecting Vehicle Occupants:** Vehicle manufacturer technology that protects vehicle occupants through safety features for seat belts, air bags, and vehicle structure features
- **Accelerating Advanced Technology:** Encouraging advanced technology in and on our roadways by forming new partnerships with technology providers, health and safety groups, manufacturers, and government partners to prioritize roadway safety
- **Implementing a Safe System Approach:** The FHWA recently adopted a "Safe System Approach" which aims to eliminate fatal and serious injuries of all roadway users by embracing a more holistic view of the roadway system. Additional responsibility is placed on agencies to account for human error with the design and operation of roadways and the principles include:
    - Death and serious injury is unacceptable
    - Humans make mistakes
    - Humans are vulnerable
    - Responsibility is shared
    - Redundancy is crucial
    - Safety is proactive, not reactive

The revision also included the first-ever SHSP Implementation Plan, which identifies and summarizes detailed actions for each challenge area. The Brawley LRSP Countermeasure Toolbox has been primarily developed to comply with the revised CA SHSP and corresponding Implementation Plan. However, actions for several challenge areas / focus areas that are relevant to the LRSP, such as motorcycles, emergency response, emerging technologies, are still be developed. The 2020-2024 SHSP Implementation Plan is a living document and will be updated bi-annually or annually as new actions are developed and approved. Future updates to the Brawley LRSP updates should include any new countermeasures and strategies for the 5E's of traffic from future SHSP Implementation Plan and FHWA Safe System Approach updates.

5 Priority Projects

Potential safety projects were evaluated based on the City of Brawley's roadway needs, crash data analysis, roadway network screening, stakeholder feedback, and countermeasure toolbox. Two priority projects and one HSIP funding set-aside project were identified for development of a preliminary project scope, cost estimate, and benefit cost ratio (BCR) analysis utilizing the most recent Cycle 11 HSIP Analyzer. In order to supplement local funds while proactively implementing roadway safety, the priority projects were developed based on eligibility for Highway Safety Improvement Program (HSIP) grant funding.

5.1 Dogwood Road Roadway Improvements

The Dogwood Road is north-south roadway that runs from the southern city border to Main Street in the center of the City. The roadway is mostly straight for its entire length except for an "S" curve that appears in the roadway as a vehicle nears the intersection of Mead Road. The roadway during this "S" curve currently has no shoulder, street lighting, nor guardrails to protect a motorist from plunging into Rockwood except for a few temporary barricades at southeast corner of the intersection. Under these conditions during the period of 2017-2021, the roadway has experienced two fatalities, one severe injury, and one complaint of pain injury due to drivers running off the road, hitting an object, or driving under the influence. The roadway enhancements that will be included as part of this project include installing LED safety street lighting, installing guardrails, and widening the shoulder along the roadway curve. These safety enhancements will aim to make the roadway appear more visible to roadway users while creating a recovery area in which a driver can regain control of a vehicle if it departs from the main roadway. If a vehicle is unable to regain control after it departs the roadway, the guardrails will help protect the motorist from further departing the roadway and entering the canal.

5.2 Citywide Unsignalized Pedestrian Crossing Upgrades

Pedestrian crossings at 13 unsignalized intersections throughout the City will be upgraded with enhanced safety features such as high visibility crosswalk striping, advanced warning signs and pavement markings, ADA curb ramps, curb extensions, and rectangular rapid flashing beacons (RRFBs). Intersections near schools were prioritized based information provided in the Imperial County Safe Routes to School Master Plan, safety needs, and feedback from the Safety Partners.

5.3 Funding Set-Asides

The Caltrans Highway Safety Improvement Program (HSIP) includes two application categories – Benefit Cost Ratios (BCR) and Funding Set-Asides (SA). Set-aside applications

differ from the benefit cost ratio applications in that narrative responses related to crash history, collision analysis, and benefit cost ratio calculations are not required. A portion of each HSIP funding cycle is dedicated set-aside applications. In the most recent call for projects, Cycle 11, an estimated $36 million in funding is available for five (5) set-aside categories. The HSIP Cycle 11 set-aside categories and funding limits per agency are summarized in **Table 5-1** below. Agencies can submit one (1) application for each set-aside category.

Table 5-1 HSIP Cycle 11 Set-Aside Application Categories

#	DESCRIPTION	FUNDING LIMIT (PER AGENCY)
1	Guardrail Upgrades	$1 million
2	Pedestrian Crossing Enhancements	$250,000
3	Bike Safety Improvements	$250,000
4	Installing Edgelines	$250,000
5	Tribes	$250,000

5.3.1 Main Street & 8th Street Signalized Pedestrian Crossing Upgrade

The City of Brawley is prioritizing a Pedestrian Crossing Enhancements Set-Aside project for the intersection of Main Street and 8th Street. The project will upgrade the signalized intersection crossings by providing curb extensions, pedestrian countdown heads, APS pushbuttons, and high visibility crosswalks.

5.3.2 Imperial Ave & D St Pedestrian School Crossing Upgrade

Based on information provided in the Imperial County Safe Routes to School Master Plan, a Pedestrian Crossing Enhancements Set-Aside project was identified for the intersection of Imperial Avenue and D Street. The project will upgrade the pedestrian school crossings adjacent to the Barbara Worth Junior High School by providing curb extensions, a median refuge island, RRFBs, high visibility crosswalks, and advanced warning signs and pavement markings.

Based on HSIP Cycle 11, set-aside project selection is prioritized based on:

- Agencies who did not have any projects awarded in HSIP Cycles 9 & 10
- Agencies who did not have projects awarded under the same set-aside in HSIP Cycles 9 & 10
- Agencies who have completed a Local Road Safety Plan (LRSP)
- Agencies who have had more Fatal & Severe Injury (F+SI) crashes with the boundaries of their jurisdiction in the last three years with data available from California Highway Patrol (CHP) Statewide Integrated Traffic Records System (SWITRS). The applicant does not need to provide this number as the Caltrans District Local Assistance (DLA) will obtain the data from SWITRS if needed

5.3.3 Guardrail Upgrades

Eligible project work under the guardrail upgrades set-aside funding category includes work related to the upgrade of existing guardrails and end treatments. New guardrail installations and bridge rail upgrades are not eligible.

5.3.4 Pedestrian Crossing Enhancements

Eligible project work under the pedestrian crossing enhancements set-aside funding category includes work consistent with the following LRSM safety countermeasures:

- S17PB: Install pedestrian countdown signal heads
- NS22PB/R37PB: Install Rectangular Rapid Flashing Beacon (RRFB)
- NS21PB: Install/upgrade pedestrian crossing at uncontrolled locations (with enhanced safety features)
- R35PB: Install/upgrade pedestrian crossing (with enhanced safety features)

Work related to pedestrian crossings/signs, advanced yield lines/signs, and other signs/striping are eligible. Other work related to pedestrian crossing enhancements may be allowed provided the cost is less than 20% of the total project cost. Agencies will be responsible to any non-safety related project costs such as decorative items.

5.3.5 Bike Safety Improvements

During the HSIP Cycle 11 call for projects, a new SA category, bike safety improvements, was announced. Eligible project work under the bike safety improvements set-aside funding category includes work consistent with the LRSM safety countermeasures of R32PB: Installing bike lanes and R33PB: Installing separated bike lanes. A maximum of $5 million in funding is available for this SA with a $250,000 maximum award per agency.

5.3.6 Installing Edgelines

Eligible project work under the installing edgelines set-aside funding category includes the installation of edgelines along roadways and other work, such as signs and other pavement striping or marking, provided the additional cost is less than 20% of the total project cost.

5.3.7 Tribes

In HSIP Cycle 11, $2 million is available to federally recognized tribes in California with a maximum of $250,000 awarded per tribe. No tribes set-aside applications were submitted or awarded during the previous HSIP Cycle 10.

Table 5-2 provides a summary of the priority projects for HSIP benefit cost ratio projects by HSIP LRSM (v1.6) countermeasures and the BCR ranking and for HSIP set-aside projects. **Appendix D** provides more detailed priority project summaries which include:

- LRSM Countermeasure Description
- Project Description
- Map and Table of Project Locations
- Crash Analysis Summary by Severity, Collision Type, and Primary Collision Factor
- Cost Estimate for Construction Items
- Cost Estimate for Preliminary Engineering (PE), Right-of-Way (ROW), and Construction (CON) project phases
- Total Expected Benefit
- Total Project Cost
- Benefit Cost Ratio

Table 5-2 Priority Projects

#	PROJECT DESCRIPTION	LRSM CM	BCR
1	**Dogwood Road Roadway Improvements (BCR)** Roadway enhancements include installing LED safety street lighting, installing guardrails, and widening the shoulder	R01, R04, R16	22.09
2	**Unsignalized Pedestrian Crossing Upgrades (BCR)** Pedestrian crossing upgrades at 13 locations to include installing ADA curb ramps, curb extensions, high-visibility crosswalks, advanced school zone signs and pavement markings, and rectangular rapid flashing beacons (RRFBs)	NS21PB	17.52
3	**Signalized Pedestrian Crossing Upgrades (SA)** Pedestrian crossing upgrades at Main Street & 8th Street including curb extentions, high visibility crosswalk striping, countdown pedestrian heads, APS push buttons, and ADA compliant pedestrian ramps	SA	N/A
4	**Pedestrian School Crossing Upgrades (SA)** Project improvements at Imperial Avenue & D Street to include installing ADA curb ramps, curb extensions, high-visibility crosswalks, advanced school zone signs and pavement markings, and RRFBs	SA	N/A

6 Implementation and Evaluation

The process for implementing the Brawley LRSP, evaluating the application of the countermeasure toolbox and priority projects, and recommendations for future LRSP report updates based on the USDOT FHWA's Implementing A Local Road Safety Plan (July 2020) and the Caltrans LRSM v1.6 (April 2022) are described in the following section.

6.1 Implementation

Implementation of the LRSP demonstrates the City of Brawley's commitment to proactively addressing roadway network safety needs for all users. The USDOT FHWA's Implementing A Local Road Safety Plan outlines six steps for successful LRSP implementation which includes:

1. MAINTAIN BUY-IN AND SUPPORT

LRSP implementation is strengthened by the support of key City officials and safety partners from the 5E's of traffic safety (Engineering, Enforcement, Education, Emergency Response, and Emerging Technologies)

2. IDENTIFY FUNDING MECHANISMS

Funding for LRSP projects will be identified through local capital improvement projects and public/private development projects, regional MPO grant opportunities, State grant opportunities, and Federal grant opportunities

3. IDENTIFY AND PRIORITIZE PROJECTS

Projects will be prioritized based on a combination of benefit-cost ratio analyses, crash histories, and roadway risk factors. Priority projects will be implemented based on City needs, local resources, and available grant funding opportunities through the HSIP and other roadway safety infrastructure/non-infrastructure programs. Where appropriate, private development will be leveraged to strategically implement safety countermeasures and/or components of priority projects

4. DETERMINE PROJECT DELIVERY METHODS

Project delivery will be determined following security of project funding and prior to design. Where appropriate, projects will be bundled to decrease the City's financial and management burdens

5. EVALUATE EFFECTIVENESS

LRSP countermeasure and project implementation effectiveness will be evaluated based on reductions in severity, for fatalities and severe injuries, and in overall crash frequency. See LRSP Section 5.2 for further details

6. CONTINUE COMMUNICATION AND COORDINATION

Active communications and coordination between key City officials, safety partners from the 5E's of traffic safety, and the public will ensure that there is synergy in overall LRSP implementation

6.2 Evaluation

Following the implementation of priority projects and application of countermeasures, the City will evaluate the success of LRSP strategies based on Section 7 of the Caltrans LRSM Version 1.6 for Evaluation of Improvements. A database will be developed to track countermeasure installations, crash history, and field assessments on an annual basis. Feedback from the public, safety partners and City maintenance crews should be included to provide a comprehensive evaluation.

Effective monitoring of the success of a project should take place after a project has been implemented for 3 to 5 years to ensure sufficient crash data for before / after studies and to reduce the effect of the random nature of roadway crashes. The before / after studies should compare crash data and community feedback on the safety countermeasure being evaluated. The Caltrans LRSM provides an example countermeasure deployment history database that the City should refer to when conducting this assessment. The database will provide the City of Brawley with the necessary information to make informed decisions on whether countermeasures from the toolbox contribute to an increase in safety, whether they should be installed at other locations through the City, and which factors may have contributed to the countermeasure's success.

The evaluation should also track whether the City's LRSP goals are being met and if they continue to align with the 5E's of traffic safety (Engineering, Enforcement, Education, Emergency Response, and Emerging Technologies). As the City grows and further develops, the LRSP goals should conform to any new or modified safety plans, policies, and efforts set forth by the City.

Future LRSP Updates

The Brawley LRSP is considered a living document and must be updated every five (5) years at minimum to maintain compliance with Caltrans HSIP eligibility requirements. It is recommended that the City update the LRSP every two (2) years to maintain alignment with the standard Caltrans HSIP call-for-projects and LRSM updates. This allows the City to ensure the LRSP continually reflects the most recent crash data, crash trends, countermeasures, and the most competitive benefit cost ratio (BCR) calculations for any HSIP grant applications the City may seek to pursue. Between LRSP updates, City staff should annually monitor crashes, identify locations with high crash frequency and severity, match locations with the strategies identified in the countermeasure toolbox, and implement projects in coordination with the City's current CIP and development opportunities.

Future updates should revisit the LRSP's Vision, Mission, and Goals based on evaluation of safety projects and programs that were implemented and evaluated during the current LRSP. Additionally, future updates to the LRSP will include expansion of the City of Brawley's Countermeasure Toolbox in relation to the other traffic safety E's for Enforcement, Education, Emergency Response, and Emerging Technologies. To maximize City resources, the toolbox in this LRSP was primarily developed for HSIP-eligible engineering infrastructure improvements that could be applied to priority locations identified through the collision analysis EPDO scoring and roadway characteristics screening.

Future LRSP updates for priority project development should include a reevaluation of collision history to determine if any infrastructure recommendations included in the Imperial County Safe Routes to School Master Plan would be competitive for funding through HSIP grant applications or other roadway safety grant programs. **Table 6-1** contains a summary of infrastructure improvements identified in the Imperial County Safe Routes to School Master Plan and applicable HSIP LRSM countermeasures.

Table 6-1: Infrastructure Improvements for Future Priority Projects Development

#	PROJECT LOCATION	DESCRIPTION	HSIP LRSM Countermeasure
1	Near J.W Oakley Elementary School	Add racks for 10 bicycles and an additional 10 racks for skateboards/scooters.	N/A
2	Near Miguel Hidalgo Elementary School	Add racks for 10 bicycles and an additional 10 racks for skateboards/scooters.	N/A
3	2nd Street from K Street to J Street	Install approximately 380' of new sidewalk.	R34PB

#	PROJECT LOCATION	DESCRIPTION	HSIP LRSM Countermeasure
4	J Street from 2nd Street to 3rd Street	Install approximately 670' of new sidewalk.	R34PB
5	3rd Street from J Street to K Street	Install approximately 370' of new sidewalk.	R34PB
6	Near Myron D. Witter Elementary School	Add racks for 10 bicycles and an additional 10 racks for skateboards/scooters.	N/A
7	Phil D. Swing Elementary School	Add racks for 10 bicycles and an additional 10 racks for skateboards/scooters.	N/A
8	Near Brawley Union High School	Add racks for 30 bicycles and an additional 30 racks for skateboards/scooters.	N/A
9	Near Desert Valley High	Add racks for 30 bicycles and an additional 30 racks for skateboards/scooters.	N/A
10	2nd Street from Magnolia Street to A Street	Install approximately 330' of new sidewalk on the west side of 2nd Street.	R34PB
11	Magnolia Street from 1st Street to 2nd Street	Install approximately 420' of new sidewalk on the south side of Magnolia Street.	R34PB
12	Magnolia Street from 1st Street to 3rd Street	Install approximately 1340' of new sidewalk on the north side of Magnolia Street.	R34PB
13	3rd Street from Magnolia Street to A Street	Install approximately 320' of new sidewalk on the west side of 3rd Street.	R34PB

It is also recommended that future LRSP updates include considerations for new grant programs established by the Bipartisan Infrastructure Investment and Jobs Act (IIJA), which is also known as the Bipartisan Infrastructure Law (BIL). For example, inclusion of public outreach and analysis for underserved communities and equity in the next LRSP update would make the Brawley LRSP an eligible "Action Plan" under the Safe Streets and Roads for All (SS4A) grant program. This would qualify priority projects identified in the LRSP to be eligible for "Implementation Grant" funding.

Guidelines for developing and implementing Local Road Safety Plans are continually being updated by the FHWA and Caltrans. For example, FHWA recently conducted a webinar on November 22, 2021, that featured an update on FHWA's proven safety countermeasure initiative. The webinar featured nine new proven safety countermeasures (PSC) which included speed safety cameras, variable speed limits, appropriate speed limits for all road users, wider edge lines, crosswalk visibility enhancements, bicycle lanes, rectangular rapid flashing beacons, pavement friction management, and lighting. While these countermeasures were not included in this version of the LRSP, they should be evaluated and incorporated into future countermeasure toolbox and LRSP updates. It is anticipated that future Caltrans updates to the LRSM and HSIP programs will reflect the FHWA's updated PSCs. Additionally, future updates to the LRSP should include reviewing the following resources to ensure the latest best-practices are followed:

- **FHWA Local Road Safety Plan Do-It-Yourself Website**
- **FHWA Proven Safety Countermeasures List**
- **FHWA Local and Rural Road Safety Program**
- **FHWA Local and Rural Road Safety Briefing Sheets**
- **FHWA Developing Safety Plans: A Manual for Local and Rural Roads**
- **FHWA Implementing A Local Road Safety Plan**
- **FHWA Safe System Approach**
- **USDOT National Roadway Safety Strategy**
- **National Association of County Engineers (NACE) – A Template for Local Road Safety Plans**
- **California Strategic Highway Safety Plan**
- **Caltrans LRSP and HSIP Programs**
- **Caltrans Local Roadway Safety Manual (LRSM)**

APPENDIX A

California Office of Traffic Safety Rankings

Agency	Year	County	Group	Population (Avg)	DVMT
Brawley	2017	IMPERIAL COUNTY	D	27073	142753

TYPE OF CRASH	VICTIMS KILLED & INJURED	OTS RANKING
Total Fatal and Injury	21	90/94
Alcohol Involved	4	66/94
Had Been Drinking Driver < 21	0	50/94
Had Been Drinking Driver 21 – 34	1	59/94
Motorcycles	0	84/94
Pedestrians	1	87/94
Pedestrians < 15	0	71/94
Pedestrians 65+	0	69/94
Bicyclists	2	65/94
Bicyclists < 15	1	33/94
Composite	8	82/94

TYPE OF CRASH	FATAL & INJURY CRASHES	OTS RANKING
Speed Related	2	89/94
Nighttime (9:00pm – 2:59am)	0	90/94
Hit and Run	1	67/94

TYPE OF ARRESTS	ARRESTS	OTS RANKING*
DUI Arrests	33	26/92

Agency	Year	County	Group	Population (Avg)	DVMT
Brawley	2018	IMPERIAL COUNTY	D	27229	166379

TYPE OF CRASH	VICTIMS KILLED & INJURED	OTS RANKING
Total Fatal and Injury	49	57/97
Alcohol Involved	7	40/97
Had Been Drinking Driver < 21	0	46/97
Had Been Drinking Driver 21 – 34	0	82/97
Motorcycles	2	58/97
Pedestrians	5	51/97
Pedestrians < 15	1	43/97
Pedestrians 65+	1	41/97
Bicyclists	2	71/97
Bicyclists < 15	0	62/97
Composite	12	79/97

TYPE OF CRASH	FATAL & INJURY CRASHES	OTS RANKING
Speed Related	2	92/97
Nighttime (9:00pm – 2:59am)	2	77/97
Hit and Run	1	73/97

TYPE OF ARRESTS	ARRESTS	OTS RANKING*
DUI Arrests	52	56/97

Agency	Year	County	Group	Population (Avg)	DVMT
Brawley	2019	IMPERIAL COUNTY	D	27494	166710

TYPE OF CRASH	VICTIMS KILLED & INJURED	OTS RANKING
Total Fatal and Injury	23	86/94
Alcohol Involved	5	58/94
Had Been Drinking Driver < 21	0	35/94
Had Been Drinking Driver 21 – 34	1	49/94
Motorcycles	2	53/94
Pedestrians	2	77/94
Pedestrians < 15	1	36/94
Pedestrians 65+	0	76/94
Bicyclists	1	72/94
Bicyclists < 15	0	56/94
Composite	11	74/94

TYPE OF CRASH	FATAL & INJURY CRASHES	OTS RANKING
Speed Related	4	80/94
Nighttime (9:00pm – 2:59am)	1	89/94
Hit and Run	0	83/94

TYPE OF ARRESTS	ARRESTS	OTS RANKING*
DUI Arrests	40	35/94

Agency	Year	County	Group	Population (Avg)	DVMT
Calexico	2019	IMPERIAL COUNTY	D	40814	209030

TYPE OF CRASH	VICTIMS KILLED & INJURED	OTS RANKING
Total Fatal and Injury	49	64/94
Alcohol Involved	1	90/94
Had Been Drinking Driver < 21	0	47/94
Had Been Drinking Driver 21 – 34	1	59/94
Motorcycles	2	63/94
Pedestrians	4	69/94
Pedestrians < 15	0	88/94
Pedestrians 65+	3	20/94
Bicyclists	4	48/94
Bicyclists < 15	0	79/94
Composite	14	82/94

TYPE OF CRASH	FATAL & INJURY CRASHES	OTS RANKING
Speed Related	9	66/94
Nighttime (9:00pm – 2:59am)	2	87/94
Hit and Run	1	79/94

TYPE OF ARRESTS	ARRESTS	OTS RANKING*
DUI Arrests	17	12/94

Agency	Year	County	Group	Population (Avg)	DVMT
El Centro	2019	IMPERIAL COUNTY	D	45509	314170

TYPE OF CRASH	VICTIMS KILLED & INJURED	OTS RANKING
Total Fatal and Injury	158	17/94
Alcohol Involved	18	19/94
Had Been Drinking Driver < 21	0	73/94
Had Been Drinking Driver 21 – 34	4	22/94
Motorcycles	4	52/94
Pedestrians	16	18/94
Pedestrians < 15	2	27/94
Pedestrians 65+	0	90/94
Bicyclists	13	15/94
Bicyclists < 15	2	24/94
Composite	68	32/94

TYPE OF CRASH	FATAL & INJURY CRASHES	OTS RANKING
Speed Related	21	36/94
Nighttime (9:00pm – 2:59am)	18	16/94
Hit and Run	7	44/94

TYPE OF ARRESTS	ARRESTS	OTS RANKING*
DUI Arrests	69	47/94

APPENDIX B

Safety Partners Feedback

#	RESPONDENT	RESPONSE
Top 3 Priority Signalized Intersections		
1.1	Respondent 1, Brawley Public Works	Main Street & 8th Street (Brawley) Main Street & 3rd Street (Brawley) Main Street & 1st Street (Caltrans)
1.2	Respondent 2 Brawley Public Works	Main Street & 3rd Street (Brawley) Main Street & 8th Street (Brawley) Main Street & Cesar Chavez Street (Brawley) SR-86 & Panno Drive/Wildcat Drive (Caltrans) Main Street & Palm Avenue (Brawley)
1.3	Respondent 4 Brawley Public Works	Main Street & Cesar Chavez Street (Brawley) Main Street & 8th Street (Brawley) Main Street & 3rd Street (Brawley) Main Street & Palm Avenue (Brawley) Main Street & 1st Street (Caltrans)
1.4	Respondent 5 Brawley Public Works	Main Street & 8th Street (Brawley) Main Street & 3rd Street (Brawley) Main Street & Best Avenue/Old Highway 111 (Brawley)
1.5	John Tang, Sergeant, Brawley Police Department	Main Street & Cesar Chavez Street (Brawley) SR-86 & Panno Drive/Wildcat Drive (Caltrans) Main Street & 1st Street (Caltrans)
1.6	Michael York, Fire Chief, Brawley Fire Department	Main Street & 8th Street (Brawley) SR-86 & Western Avenue/Malan Street (Caltrans) Main Street & Best Avenue/Old Highway 111 (Brawley)
1.7	Rauna Fox, Superintendent Brawley Elementary School District	Main Street & 3rd Street
Other Signalized Intersections Not on the Priority List		
2.1	John Tang, Sergeant, Brawley Police Department	Malan St & Cesar Chavez St: Should have a stop light. Vehicles travel north and south at a high rate of speed.
2.2	Michael York, Fire Chief, Brawley Fire Department	N Imperial Ave & A Street: Consider for 4-way traffic signal. High pedestrian traffic from schools combined with major through-roads creates traffic back-ups and unsafe pedestrian crossing
2.3	Rauna Fox, Superintendent Brawley Elementary School District	K Street & 1st Street SR-86 & Brawley Ave

#	RESPONDENT	RESPONSE
Top 3 Priority Unsignalized Intersections		
3.1	Respondent 1 Brawley Public Works	Main Street & Las Flores Drive (Caltrans) Malan Street & S Imperial Avenue (Brawley) S Best Avenue & Malan Street (Brawley)
3.2	Respondent 2 Brawley Public Works	Malan Street & S Imperial Avenue (Brawley) Main Street & Las Flores Drive (Caltrans) B Street & N 9th Street (Brawley) N Western Avenue & E Street (Brawley) N Western Avenue & A Street (Brawley)
3.3	Respondent 4 Brawley Public Works	Main Street & Las Flores Drive (Caltrans) N Western Avenue & E Street (Brawley) SR-86 & Julia Drive (Caltrans)
3.4	Respondent 5 Brawley Public Works	S Imperial Avenue & Monterey Street (Brawley) SR-86 & Julia Drive (Caltrans) S Best Avenue & Malan Street (Brawley)
3.5	John Tang, Sergeant, Brawley Police Department	Dogwood Road & Mead Road (Brawley) Malan Street & S Imperial Avenue (Brawley) SR-86 & Julia Drive (Caltrans)
3.6	Michael York, Fire Chief, Brawley Fire Department	N Western Avenue & A Street (Brawley) S Imperial Avenue & Monterey Street (Brawley) Dogwood Road & Mead Road (Brawley)
3.7	Rauna Fox, Superintendent Brawley Elementary School District	Main Street & Las Flores Drive (Caltrans) N Western Avenue & A Street (Brawley) N Western Avenue & A Street (Brawley)
Other Unsignalized Intersections Not on the Priority List		
4.1	Respondent 1 Brawley Public Works	Main St & S 2nd St: Accidents with pedestrians before
4.2	Respondent 4 Brawley Public Works	W Main St & S Las Flores Dr Malan St & S 1st St: Too dark at night
4.3	Respondent 5 Brawley Public Works	Main St & N Plaza St (West) Main St & N Plaza St (East)
4.4	John Tang, Sergeant, Brawley Police Department	- Western Ave & Park View Dr: Vehicles travelling at a high rate of speed from southbound 78 - 2nd St & Malan St: Needs a 4-way stop - I St & 9th St: Needs a 4-way stop - B St & 13th St: Need crosswalk for northbound pedestrian crossing

#	RESPONDENT	RESPONSE
4.5	Rauna Fox, Superintendent Brawley Elementary School District	K St & 2nd St: School Crossing Malan St & 1st St: School Crossing K St & Cesar Chavez St: School Crossing B St & Palm Ave: School Crossing Palm Ave & Magnolia St: School Crossing C St & N Imperial Ave: School Crossing
Top 3 Priority Roadway Segments		
5.1	Respondent 1 Brawley Public Works	Dogwood Rd: Southern City Limits to Malan St (Brawley/Imperial County) K St: SR-86 to Eastern Ave (Brawley) Malan St: SR-86 to Old Highway 111 (Brawley)
5.2	Respondent 2 Brawley Public Works	Main St: 1st St to 3rd St (Brawley) N 8th St: B St to Northern City Limits (Brawley) SR-86: Legion Rd to Panno Rd/Wildcat Dr (Caltrans) SR-86: Southern City limits to Legion Rd (Caltrans) J St: 9th St to Eastern Ave (Brawley) K St: SR-86 to Eastern Ave (Brawley)
5.3	Respondent 4) Brawley Public Works	J St: 9th St to Eastern Ave (Brawley) K St: SR-86 to Eastern Ave (Brawley)
5.4	Respondent 5 Brawley Public Works	K St: SR-86 to Eastern Ave (Brawley)
5.5	John Tang, Sergeant, Brawley Police Department	N 8th St: B St to Northern City Limits (Brawley) SR-86: Legion Rd to Panno Rd/Wildcat Dr (Caltrans) K St: SR-86 to Eastern Ave (Brawley)
5.6	Michael York, Fire Chief, Brawley Fire Department	N 8th St: B St to Northern City Limits (Brawley) K St: SR-86 to Eastern Ave (Brawley) Malan St: SR-86 to Old Highway 111 (Brawley)
5.7	Rauna Fox, Superintendent Brawley Elementary School District	SR-86: Western Ave/Malan St to K St (Caltrans) K St: SR-86 to Eastern Ave (Brawley) Malan St: SR-86 to Old Highway 111 (Brawley)
Other Roadway Segments Not on the Priority List		
6.1	Respondent 4 Brawley Public Works	Best Rd from Main St to Ganado Dr
6.2	Respondent 5 Brawley Public Works	N Best Rd W D St from N Rio Vista Ave to N 1st St Bryant Rd from Malan St to City Limits N 7th St from A St to River Dr S 2nd St from Main St to K St

#	RESPONDENT	RESPONSE
6.3	John Tang, Sergeant, Brawley Police Department	Western Ave at Park View Dr: Vehicles travelling at a high rate of speed from Hwy 78
6.4	Michael York, Fire Chief, Brawley Fire Department	Western Ave at Park View Dr: Vehicles traveling at a high rate of speed from Hwy 78
Top 3 Schools		
7.1	Respondent 1 Brawley Public Works	Phil D. Swing Elementary School Miguel Hidalgo Elementary School J.W. Oakley Elementary School
7.2	Respondent 2 Brawley Public Works	J.W. Oakley Elementary School Myron D. Witter Elementary School Barbara Worth Junior High School Brawley Union High School Desert Valley High School Phil D. Swing Elementary School
7.3	Respondent 3 Brawley Public Works	Myron D. Wittier Elementary School Brawley Union High School Phil D. Swing Elementary School
7.4	Respondent 4 Brawley Public Works	Phil D. Swing Elementary School J.W. Oakley Elementary School Myron D. Wittier Elementary School Brawley Union High School Barbara Worth Junior High School
7.5	Respondent 5 Brawley Public Works	J.W. Oakley Elementary School Barbara Worth Junior High School Brawley Union High School
7.6	John Tang, Sergeant, Brawley Police Department	J.W. Oakley Elementary School Myron D. Witter Elementary School Brawley Union High School
7.7	Michael York, Fire Chief, Brawley Fire Department	J.W. Oakley Elementary School Myron D. Witter Elementary School Brawley Union High School
7.8	Rauna Fox, Superintendent Brawley Elementary School District	Phil D. Swing Elementary School Miguel Hidalgo Elementary School J.W. Oakley Elementary School Myron D. Witter Elementary School Barbara Worth Junior High School Brawley Union High School

#	RESPONDENT	RESPONSE
Locations Near Schools with High-Risk Behaviors or Safety Concerns		
8.1	Respondent 3 Brawley Public Works	C St & N 3rd St C St & N 1st St A St & N 3rd St River Dr & W 3rd St N Eastern Ave & C St S Eastern Ave & I St S Imperial & I St
8.2	John Tang, Sergeant, Brawley Police Department	J.W. Oakley Elementary School: Western Ave at B St, Driftwood Pl, and C St need stop signs. Eastbound and westbound traffic currently have yield signs.
8.3	Michael York, Fire Chief, Brawley Fire Department	J.W. Oakley Elementary School: Western Ave at B St, Driftwood Pl, and C St need stop signs. Brawley Union High School: N Imperial Ave & A St should be considered for 4-way traffic signals. High pedestrian traffic from schools combined with major through-roads creates traffic back-ups and unsafe pedestrian crossings.
Top 3 Parks		
9.1	Respondent 1 Brawley Public Works	Alyce Gereaux Park Gonzalez Park Hinojosa Park
9.2	Respondent 2 Brawley Public Works	Gonzalez Park Meserve Park Alyce Gereaux Park Volunteer Park Hinojosa Park Pat Williams Park Guadalupe Park
9.3	Respondent 3 Brawley Public Works	Meserve Park Blake Davis Skate Park Hinojosa Park
9.4	Respondent 4 Brawley Public Works	Hinojosa Park Gonzalez Park Meserve Park
9.5	Respondent 5 Brawley Public Works	Blake Davis Skate Park Gonzalez Park Plaza Park

#	RESPONDENT	RESPONSE
9.6	John Tang, Sergeant, Brawley Police Department	Cattle Cal Rodeo Park Hinojosa Park Meserve Park
9.7	Michael York, Fire Chief, Brawley Fire Department	Hinojosa Park Meserve Park Volunteer Park
9.8	Rauna Fox, Superintendent Brawley Elementary School District	Gonzalez Park Pat Williams Park Meserve Park
Locations Near Parks with High-Risk Behaviors or Safety Concerns		
10.1	John Tang, Sergeant, Brawley Police Department	Need stop signs and cross walks at all intersections near parks
10.2	Michael York, Fire Chief, Brawley Fire Department	Need stop signs and crosswalks at intersections near parks
10.3	Rauna Fox, Superintendent Brawley Elementary School District	Gonzalez Park, Pat Williams Park, and Meserve Park: proximity to schools with history of homeless population with drug use
Areas with Pedestrian Safety Concerns or Challenges		
11.1	Respondent 1 Brawley Public Works	Main St & S 2nd St: Pedestrian collision S Cesar Chavez St & H St: Drivers don't stop for crosswalks S Cesar Chavez St & I St: Drivers don't stop for crosswalks
11.2	Respondent 3 Brawley Public Works	Malan St & S 2nd St K St & S 2nd St 1st St & C St
11.3	Respondent 4 Brawley Public Works	1st St & SR-86 / Main St: too dangerous for kids to cross N 7th St & D St: cars drive too fast
11.4	Respondent 5 Brawley Public Works	Plaza St: Pedestrian Crossings D St & N 5th St: School Kids A St & N Imperial Ave: School Kids
11.5	John Tang, Sergeant, Brawley Police Department	N Imperial Ave & N Plaza St: needs the School Zone and Crosswalk to be repainted River Dr & N Imperial Ave: crosswalk needs to be repainted Jones St & N Imperial Ave: needs 4-way stop sign Flammang Ave & N Imperial Ave: needs 4-way stop sign
11.6	Michael York, Fire Chief, Brawley Fire Department	N Imperial Ave & N Plaza St: needs the School Zone and Crosswalk to be repainted River Dr & N Imperial Ave: crosswalk needs to be repainted Jones St & N Imperial Ave: needs 4-way stop sign

#	RESPONDENT	RESPONSE
		Flammang Ave & N Imperial Ave: needs 4-way stop sign
11.7	Rauna Fox, Superintendent Brawley Elementary School District	C St & Imperial Ave: School Crossing Western Ave & A St: School Crossing K St & 3rd St: School Crossing K St & Cesar Chavez St: School Crossing B St & Palm Ave: School Crossing
Top 3 Pedestrian Safety Countermeasures		
12.1	Respondent 1 Brawley Public Works	- Intersection safety lighting - New sidewalks, multi-use paths, and trails - Pedestrian crossing enhancements (audible push buttons, countdown signal heads, high visibility crosswalks, wayfinding signage)
12.2	Respondent 2 Brawley Public Works	- Intersection safety lighting - New sidewalks, multi-use paths, and trails - Pedestrian crossing enhancements (audible push buttons, countdown signal heads, high visibility crosswalks, wayfinding signage)
12.3	Respondent 3 Brawley Public Works	- Intersection safety lighting - New sidewalks, multi-use paths, and trails - Pedestrian crossing enhancements (audible push buttons, countdown signal heads, high visibility crosswalks, wayfinding signage)
12.4	Respondent 4 Brawley Public Works	- Intersection safety lighting - Pedestrian crossing enhancements (audible push buttons, countdown signal heads, high visibility crosswalks, wayfinding signage) - Pedestrian safety training workshops
12.5	Respondent 5 Brawley Public Works	- Pedestrian crossing enhancements (audible push buttons, countdown signal heads, high visibility crosswalks, wayfinding signage) - Pedestrian safety training workshops - Volunteer programs (safety patrol, walking school bus)
12.6	John Tang, Sergeant, Brawley Police Department	- New sidewalks, multi-use paths, and trails - Pedestrian crossing enhancements (audible push buttons, countdown signal heads, high visibility crosswalks, wayfinding signage) - Volunteer programs (safety patrol, walking school bus)

#	RESPONDENT	RESPONSE
12.7	Michael York, Fire Chief, Brawley Fire Department	- New sidewalks, multi-use paths, and trails - Pedestrian crossing enhancements (audible push buttons, countdown signal heads, high visibility crosswalks, wayfinding signage) - Volunteer programs (safety patrol, walking school bus)
12.8	Rauna Fox, Superintendent Brawley Elementary School District	- Intersection safety lighting - New sidewalks, multi-use paths, and trails - Pedestrian crossing enhancements (audible push buttons, countdown signal heads, high visibility crosswalks, wayfinding signage)
Areas with Bicycle Safety Concerns or Challenges		
13.1	Respondent 5 Brawley Public Works	School areas
13.2	John Tang, Sergeant, Brawley Police Department	- Main St does not have a bike lane - Bike lane on N Eastern Ave and Main St traveling northbound needs to be repainted - Existing bike lanes are faded and needs to be repainted
13.3	Michael York, Fire Chief, Brawley Fire Department	- Main St does not have a bike lane - Bike lane on N Eastern Ave and Main St traveling northbound needs to be repainted - Existing bike lanes are faded and needs to be repainted
13.4	Rauna Fox, Superintendent Brawley Elementary School District	Streets that surround schools: K St, Malan St, B St, Palm Ave, Weston Ave, A St, C St, and Imperial Ave
Top 3 Bicycle Safety Countermeasures		
14.1	Respondent 1 Brawley Public Works	- New bicycle lanes - Bicycle lane enhancements (buffers between vehicle and bicycle lanes, high visibility / green pavement markings, wayfinding signage) - Public bicycle facilities (bike racks, shelters, and lockers; bike repair stations / public bicycle pumps)
14.2	Respondent 2 Brawley Public Works	- New bicycle lanes - Bicycle lane enhancements (buffers between vehicle and bicycle lanes, high visibility / green pavement markings, wayfinding signage) - Public bicycle facilities (bike racks, shelters, and lockers; bike repair stations / public bicycle pumps)

#	RESPONDENT	RESPONSE
14.3	Respondent 3 Brawley Public Works	- New bicycle lanes - Bicycle lane enhancements (buffers between vehicle and bicycle lanes, high visibility / green pavement markings, wayfinding signage) - Bicycle safety training workshops / bike rodeos
14.4	Respondent 4 Brawley Public Works	- New bicycle lanes - Bicycle lane enhancements (buffers between vehicle and bicycle lanes, high visibility / green pavement markings, wayfinding signage) - Public bicycle facilities (bike racks, shelters, and lockers; bike repair stations / public bicycle pumps)
14.5	Respondent 5 Brawley Public Works	- New bicycle lanes - Bicycle safety training workshops / bike rodeos
14.6	John Tang, Sergeant, Brawley Police Department	- New bicycle lanes - Bicycle lane enhancements (buffers between vehicle and bicycle lanes, high visibility / green pavement markings, wayfinding signage) - Bicycle safety training workshops / bike rodeos
14.7	Michael York, Fire Chief, Brawley Fire Department	- New bicycle lanes - Bicycle lane enhancements (buffers between vehicle and bicycle lanes, high visibility / green pavement markings, wayfinding signage) - Bicycle safety training workshops / bike rodeos
14.8	Rauna Fox, Superintendent Brawley Elementary School District	- New bicycle lanes - Bicycle lane enhancements (buffers between vehicle and bicycle lanes, high visibility / green pavement markings, wayfinding signage) - Public bicycle facilities (bike racks, shelters, and lockers; bike repair stations / public bicycle pumps)
Additional Areas with Safety Concerns or Challenges for Roadway Users		
15.1	Respondent 3 Brawley Public Works	Best Rd from E Main St to SR-111 / SR-78 Bypass
15.2	Rauna Fox, Superintendent Brawley Elementary School District	Cattle Call Dr & Cotton Rosser Rd
Important Safety Countermeasures		
16.1	Respondent 1 Brawley Public Works	- Intersection / Street Lighting - Safe Routes to School Programs

#	RESPONDENT	RESPONSE
16.2	Respondent 2 Brawley Public Works	- Intersection / Street Lighting - Improve Sight Distance at Intersections - Edgelines and Centerlines - Safe Routes to School Programs
16.3	Respondent 3 Brawley Public Works	- Intersection / Street Lighting - Roundabout -Edgelines and Centerlines
16.4	Respondent 4 Brawley Public Works	- Intersection / Street Lighting - Improve Sight Distance at Intersections - Edgelines and Centerlines - Safe Routes to School Programs
16.5	Respondent 5 Brawley Public Works	- Intersection / Street Lighting - Safe Routes to School Programs - Other: Vehicle Code Enforcement (Speeding)
16.6	John Tang, Sergeant, Brawley Police Department	- Intersection / Street Lighting - Edgelines and Centerlines - Alcohol-Drug Awareness Programs - DUI Enforcement Programs
16.7	Michael York, Fire Chief, Brawley Fire Department	- Emergency Vehicle Pre-Emption Systems - Intersection / Street Lighting - Edgelines and Centerlines - Alcohol-Drug Awareness Programs
16.8	Rauna Fox, Superintendent Brawley Elementary School District	- Intersection / Street Lighting - Edgelines and Centerlines - Safe Routes to School Programs - Alcohol-Drug Awareness Programs - DUI Enforcement Programs

APPENDIX C

Engineering Countermeasure Toolbox

TABLE OF CONTENTS

SIGNALIZED INTERSECTION COUNTERMEASURES

S01: Add Intersection Lighting (S.I.)

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
S1	90%	Night

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
40%	20 YEARS	$1,000 PER LIGHT

Countermeasure Description:

Adding intersection lighting to signalized intersections helps improve visibility of the intersection and helps reduce potential conflicts. Adequately illuminated intersections increase driver awareness of crossing pedestrians for approaching motorists and assists pedestrians navigating the crosswalks.

Where to Use:

Signalized intersections that have a disproportionate number of night-time crashes and do not currently provide lighting at the intersection or at its approaches. Crash data should be studied to ensure that safety at the intersection could be improved by providing lighting. This strategy would be supported by a significant number of crashes that occur at night. This countermeasure can only be applied to night crashes that occur within the limits of the proposed lighting area.

Why It Works:

Providing lighting at the intersection itself, or both at the intersection and on its approaches, improves the safety of an intersection during nighttime conditions by (1) making drivers more aware of the surroundings at an intersection, which improves drivers' perception-reaction times, (2) enhancing drivers' available sight distances, and (3) improving the visibility of non-motorists. Intersection lighting is of particular benefit to non-motorized users. Lighting not only helps them navigate the intersection, but also helps drivers see them better.

S02: Improve Signal Hardware: Lenses, Back-Plates with Retroreflective Borders, Mounting, Size, and Number

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
S2	90%	All

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
15%	10 years	$1,500 per signal head

Countermeasure Description:

Improving signal hardware enhances the visibility of the signalized intersection to allow drivers proper reaction time to maneuver accordingly and/or avoid conflicts. This countermeasure does not apply to improvements like battery backup systems.

Where to Use:

Signalized intersections with a high frequency of right-angle and rear-end crashes occurring because drivers are unable to see traffic signals sufficiently in advance to safely negotiate the intersection being approached. Signal intersection improvements include new LED lighting, signal back plates, retro-reflective tape outlining the back plates, or visors to increase signal visibility, larger signal heads, relocation of the signal heads, or additional signal heads.

Why It Works:

Providing better visibility of intersection signals aids the drivers' advance perception of the upcoming intersection. Visibility and clarity of the signal should be improved without creating additional confusion for drivers.

S03: Improve Signal Timing (Coordination, Phases, Red, Yellow, or Operation)

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
S3	50%	All

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
15%	10 years	$4,000 per intersection

Countermeasure Description:

Optimizing traffic signal timing helps improve mobility at an intersection for vehicles and pedestrians. Through proper coordination, corridors can reduce overall delay time at an intersection and provide better progression of traffic flow.

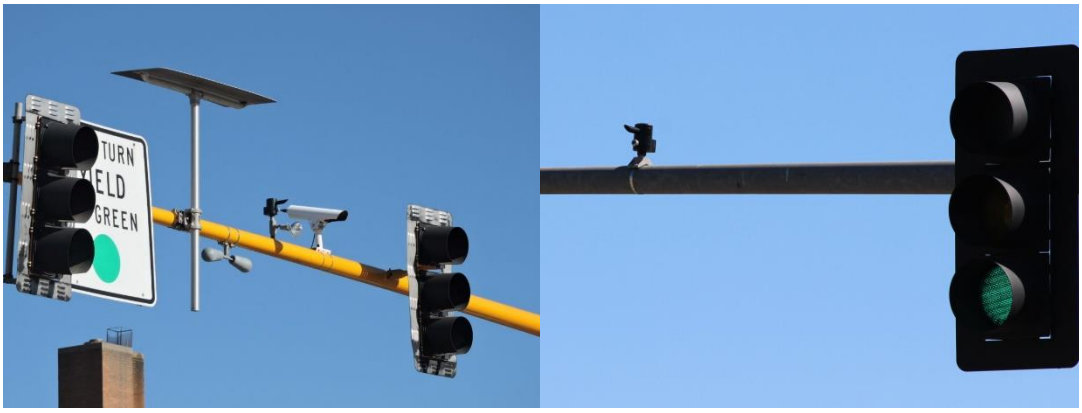
Where to Use:

Locations that have a crash history at multiple signalized intersections. Signalization improvements may include adding phases, lengthening clearance intervals, eliminating or restricting higher-risk movements, and coordinating signals at multiple locations. Understanding the corridor or roadway's crash history can provide insight into the most appropriate strategy for improving safety.

Why It Works:

Certain timing, phasing, and control strategies can produce multiple safety benefits. Sometimes capacity improvements come along with the safety improvements and other times adverse effects on delay or capacity occur. Corridor improvements often have the highest benefit but may take longer to implement. Projects focused on capacity improvements (without a separate focus on signal timing safety needs) may not result in a reduction in future crashes.

S05: Install Emergency Vehicle Pre-Emption Systems



LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
S5	90%	Emergency Vehicle - only

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
70%	10 years	$10,000-$20,000 per intersection

Countermeasure Description:

The installation of emergency vehicle pre-emption systems allows emergency vehicles to disrupt a normal signal cycle to proceed through the intersection in a more quick and safer manner. Signal pre-emption systems can help reduce driver confusion through the sudden appearance of an emergency vehicle and help lower overall emergency response times.

Where to Use:

Corridors that have a history of crashes involving emergency response vehicles. The target of this strategy is signalized intersections where normal traffic operations impede emergency vehicles and where traffic conditions create a potential for conflicts between emergency and nonemergency vehicles. These conflicts could lead to almost any type of crash, due to the potential for erratic maneuvers of vehicles moving out of the paths of emergency vehicles.

Why It Works:

Providing emergency vehicle preemption capability at a signal or along a corridor can be a highly effective strategy in two ways; any type of crash could occur as emergency vehicles try to navigate through intersections and as other vehicles try to maneuver out of the path of the emergency vehicles. In addition, a signal preemption system can decrease emergency vehicle response times therefore decreasing the time in receiving emergency medical attention, which is critical in the outcome of any crash. When data is not available for past crashes with emergency vehicles, an agency may consider combining the E.V. pre-emption improvements into a comprehensive project that also makes significant signal hardware and/or signal timing improvements.

S06: Install Left-Turn Lane and Add Turn Phase (signal has no left-turn lane or phase before)

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
S06	90%	All

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
90%	20 years	$100,000 per approach

Countermeasure Description:

The installation of a left-turn lane with a protected left-turn phase where none exists can result in a high Crash Reduction Factor and is often highly effective. At some locations, left-turn lanes can be quickly installed simply by restriping the roadway. At other locations, widening of the roadway, acquisition of additional right-of-way, and extensive environmental processes may be needed. Such projects require a substantial time for development and construction. Costs are highly variable and range from very low to high.

Where to Use:

Intersections that do not currently have a left turn lane or a related left-turn phase that are experiencing a large number of crashes. Many intersection safety problems can be traced to difficulties in accommodating left-turning vehicles, in particular where there is currently no accommodation for left turning traffic. A key strategy for minimizing collisions related to left-turning vehicles (angle, rear-end, sideswipe) is to provide exclusive left-turn lanes and the appropriate signal phasing, particularly on high-volume and high-speed major-road approaches.

Why It Works:

Left-turn lanes allow separation of left-turn and through-traffic streams, thus reducing the potential for rear-end collisions. Left-turn phasing also provides a safer opportunity for drivers to make a left-turn. The combination of left-turn storage and a left turn signal has the potential to reduce many collisions between left-turning vehicles and through vehicles and/or non-motorized road users.

S07: Provide Protected Left Turn Phase (Left Turn Lane Already Exists)

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
S7	90%	All

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
30%	20 years	$100,000 per intersection

Description:

The installation of protected left-turn phasing eliminates conflicts between left-turning vehicles and opposing through vehicles and pedestrians that are present under permissive phasing.

Where to Use:

Signalized intersections (with existing left turns pockets) that currently have a permissive left-turn or no left-turn protection that have a high frequency of angle crashes involving left turning, opposing through vehicles, and non-motorized road users. A properly timed protected left-turn phase can also help reduce rear-end and sideswipe crashes between left-turning vehicles and the through vehicles as well as vehicles behind them. Protected left-turn phases are warranted based on such factors as turning volumes, delay, visibility, opposing vehicle speed, distance to travel through the intersection, presence of non-motorized road users, and safety experience of the intersections. Agencies need to document their consideration of the MUTCD, Section 4D.19 guidelines; the section on implementing protected left-turn phases.

Why It Works:

Left turns are widely recognized as the highest-risk movements at signalized intersections. Providing Protected left-turn phases (i.e., the provision for a specific phase for a turning movement) for signalized intersections with existing left turn pockets significantly improve the safety for left-turn maneuvers by removing the need for the drivers to navigate through gaps in oncoming/opposing through vehicles. Where left turn pockets are not protected, the pedestrian and bicyclist crossing phase often conflicts with these left turn maneuvers. Drivers focused on navigating the gaps of oncoming cars may not anticipate and/or perceive the non-motorized road users.

S10: Install Flashing Beacons as Advance Warning (S.I.)

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
S10	90%	All

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
30%	10 years	$12,000 per assembly

Countermeasures Description:

Advance flashing beacons can be used to supplement and call a driver's attention to intersection control signs. This treatment involves installing flashing beacons, mounted on a post, or mounted on a mast arm, in advance of the intersection. Most advance warning flashing beacons can be powered by solar, thus reducing the issues relating to a power source.

Where to Use:

At signalized intersections with crashes that are a result of drivers being unaware of the intersection or are unable to see the traffic control device in time to comply.

Why It Works:

Increased driver awareness of an approaching signalized intersection and an increase in the driver's time to react. Driver awareness of both downstream intersections and traffic control devices is critical to intersection safety. Crashes often occur when the driver is unable to perceive an intersection, signal head or the back of a stopped queue in time to react. Advance flashing beacons can be used to supplement and call driver attention to intersection control signs. Most advance warning flashing beacons can be powered by solar, thus reducing the issues relating to power source.

S11: Improve Pavement Friction (High Friction Surface Treatments)

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
S11	90%	All

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
55%	10 years	$50 per square yd

Countermeasure Description:

High friction surface treatment (HFST) involves the application of high-quality aggregate to the pavement using a polymer binder to restore pavement friction at intersections that have less friction than is needed for the roadway approach speeds and/or geometry. HFST aids motorists in maintaining better control in dry and wet driving conditions.

Where to Use:

Nationally, this countermeasure is referred to as "High Friction Surface Treatments" or HFST. Signalized Intersections noted as having crashes on wet pavements or under dry conditions when the pavement friction available is significantly less than needed for the actual roadway approach speeds. This treatment is intended to target locations where skidding and failure to stop is determined to be a problem in wet or dry conditions and the target vehicle is unable to stop due to insufficient skid resistance.

Why It Works:

Improving the skid resistance at locations with high frequencies of wet-road crashes and/or failure to stop crashes can result in reductions of 50 percent for wet-road crashes and 20 percent for total crashes. Applying HFST can double friction numbers, e.g. low 40s to high 80s. This CM

represents a special focus area for both FHWA and Caltrans, which means there are extra resources available for agencies interested in more details on High Friction Surface Treatment projects.

S12: Install Raised Median on Approaches (S.I.)

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
S12	90%	All

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
25%	20 years	$30 per linear foot

Countermeasure Description:

Raised medians help prevent accidents caused by crossover traffic, reduce headlight glare distraction and separate left-turning traffic from through lanes when combined with left-turn lanes. This treatment involves installing raised median at intersection approaches directly over existing pavement. This method does not require excavation of the existing pavement.

Where to Use:

Intersections noted as having turning movement crashes near the intersection as a result of insufficient access control. Application of this CM should be based on current crash data and a clearly defined need to restrict or accommodate the movement.

Why It Works:

Raised medians next to left-turn lanes at intersections offer a cost-effective means for reducing crashes and improving operations at higher volume intersections. The raised medians prohibit left turns into and out of driveways that may be located too close to the functional area of the intersection.

S13PB: Install Pedestrian Median Fencing on Approaches

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
S13	90%	Pedestrian and Bicycle

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
35%	20 years	$50-$75 per linear foot

Countermeasure Description:

The installation of pedestrian median fencing along approaches helps direct pedestrians to a preferred formal crossing point and discourages pedestrians from making dangerous crossing movements where visibility may be limited.

Where to Use:

Signalized Intersections with high pedestrian-generators nearby (e.g. transit stops) may experience a high volumes of pedestrians J-walking across the travel lanes at mid-block locations instead of walking to the intersection and waiting to cross during the walk-phase. When this safety issue cannot be mitigated with signal timing and shoulder/sidewalk treatments, then installing a continuous pedestrian barrier in the median may be a viable solution.

Why It Works:

Adding pedestrian median fencing has the opportunity to enhance pedestrian safety at locations noted as being problematic involving pedestrians running/darting across the roadway outside the intersection crossings. Pedestrian median fencing can significantly reduce this safety issue by creating a positive barrier, forcing pedestrians to the designated pedestrian crossing.

S16: Covert Intersection to Roundabout (From Signal)

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
S16	90%	All

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
Varies	20 years	$400,000 - $800,000 (for traffic signal removal and construction of roundabout). Cost for roadway widening may be higher/vary

Countermeasure Description:

A roundabout reduces the number and severity of conflict points making it a significantly safer type of intersection. This treatment involves converting a signalized intersection to a roundabout and does not include application of mini-roundabouts.

Where to Use:

Signalized intersections that have a significant crash problem and the only alternative is to change the nature of the intersection itself. Roundabouts can also be very effective at intersections with complex geometry and intersections with frequent left-turn movements.

Why It Works:

The types of conflicts that occur at roundabouts are different from those occurring at conventional intersections; namely, conflicts from crossing and left-turn movements are not present in a roundabout. The geometry of a roundabout forces drivers to reduce speeds as they proceed through the intersection. This helps keep the range of vehicle speed narrow, which helps reduce the severity of crashes when they do occur. Pedestrians only have to cross one direction of traffic at a time at roundabouts, thus reducing their potential for conflicts.

S17PB: Install Pedestrian Countdown Signal Heads

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
S17PB	90%	Pedestrian and Bicycle

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
25%	20 years	$300 - $1,000 per ped head

Countermeasure Description:

This treatment involves installing new or upgrading the pedestrian signal head to a countdown signal head. The countdown signal head has a timer that shows the amount of time left in the pedestrian phase.

Where to Use:

Signals that have signalized pedestrian crossing with walk/don't walk indicators and where there have been pedestrian vs. vehicle crashes.

Why It Works:

A pedestrian countdown signal contains a timer display and counts down the number of seconds left to finish crossing the street. Countdown signals can reassure pedestrians who are in the crosswalk when the flashing "DON'T WALK" interval appears that they still have time to finish crossing. Countdown signals begin counting down either when the "WALK" or when the flashing "DON'T WALK" interval appears and stop at the beginning of the steady "DON'T WALK" interval. These signals also have been shown to encourage more pedestrians to use the pushbutton rather than jaywalk.

S18PB: Install Pedestrian Crossing (S.I.)

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
S18PB	90%	Pedestrian and Bicycle

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
25%	20 years	$5,000 per approach

Countermeasure Description:

This treatment involves reducing the risk for pedestrians attempting to cross the road by providing a clearly defined point where pedestrians are 'expected' to cross.

Where to Use:

Signalized Intersections with no marked crossing and pedestrian signal heads, where pedestrians are known to be crossing intersections that involve significant turning movements. They are especially important at intersections with (1) multiphase traffic signals, such as left-turn arrows and split phases, (2) school crossings, and (3) double-right or double-left turns. At signalized intersections, pedestrian crossings are often safer when the left turns have protected phases that do not overlap the pedestrian walk phase.

Why It Works:

Adding pedestrian crossings has the opportunity to enhance pedestrian safety at locations noted as being problematic. Nearly one-third of all pedestrian-related crashes occur at or within 50 feet of an intersection. Of these, 30 percent may involve a turning vehicle. Another 22 percent of pedestrian crashes involve a pedestrian either running across the intersection or darting out in front of a vehicle whose view was blocked just prior to the impact. Finally, 16 percent of these intersection-related crashes occur because of a driver violation (e.g., failure to yield right-of-way). When agencies opt to install aesthetic enhancement to intersection crosswalks like stamped concrete/asphalt, the project design and construction costs can significantly increase. For HSIP applications, these costs must be accounted for in the B/C calculation, but these costs (over standard crosswalk markings) must be tracked separately and are not federally reimbursable and will increase the agency's local-funding share for the project costs.

S21PB: Modifying Signal Phasing to Implement a Leading Pedestrian Interval (LPI)

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
S21PB	90%	Pedestrian and Bicycle

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
60%	10 years	$2,500 per intersection

Countermeasure Description:

This treatment provides pedestrians a 3-7 second "head start" to start crossing a signalized intersection before the vehicles are given a green phase to proceed through the intersection. This head start increases the visibility of pedestrians and helps to reduce conflicts between pedestrians and turning vehicles.

Where to Use:

Intersections with signalized pedestrian crossing that have high turning vehicles volumes and have had pedestrian vs. vehicle crashes.

Why It Works:

A leading pedestrian interval (LPI) gives pedestrians the opportunity to enter an intersection 3-7 seconds before vehicles are given a green indication. With this head start, pedestrians can better establish their presence in the crosswalk before vehicles have priority to turn left. LPIs provide (1) increased visibility of crossing pedestrians; (2) reduced conflicts between pedestrians and vehicles; (3) Increased likelihood of motorists yielding to pedestrians; and (4) enhanced safety for pedestrians who may be slower to start into the intersection.

UNSIGNALIZED INTERSECTION COUNTERMEASURES

NS01: Add Intersection Lighting (NS.I.)

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
NS1	90%	Night

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
40%	20 years	$10,000 per light

Countermeasure Description:

Adding intersection lighting to unsignalized intersections helps improve visibility of the intersection and helps reduce potential conflicts. Adequately illuminated intersections increase driver awareness of crossing pedestrians for approaching motorists and assists pedestrians navigating the crosswalks.

Where to Use:

Non-signalized intersections that have a disproportionate number of night-time crashes and do not currently provide lighting at the intersection or at its approaches. Crash data should be studied to ensure that safety at the intersection could be improved by providing lighting (this strategy would be supported by a significant number of crashes that occur at night).

Why It Works:

Providing lighting at the intersection itself, or both at the intersection and on its approaches, improves the safety of an intersection during nighttime conditions by (1) making drivers more aware of the surroundings at an intersection, which improves drivers' perception-reaction times, (2) enhancing drivers' available sight distances, and (3) improving the visibility of non-motorists. Intersection lighting is of particular benefit to non-motorized users as lighting not only helps them navigate the intersection, but also helps drivers see them better.

NS03: Install Signals

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
NS3	90%	All

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
30%	20 years	$400,000

Countermeasure Description:

This treatment involves removing existing control at an unsignalized intersection (stop, yield or uncontrolled) and installing a traffic signal. Installation may require modification to lane geometry to facilitate more efficient and safer intersection operations. Application of this countermeasure for HSIP funding requires that all new traffic signals meet MUTCD "safety" warrants 4, 5 and/or 7.

Where to Use:

Traffic signals can be used to prevent the most severe type crashes (right-angle, left-turn). Consideration to signalize an unsignalized intersection should only be given after (1) less restrictive forms of traffic control have been utilized as the installation of a traffic signal often leads to an increased frequency of crashes (rear-end) on major roadways and introduces congestion and (2) signal warrants have been met. Refer to the CA MUTCD, Section 4C.01, Studies and Factors for Justifying Traffic Control Signals.

Why It Works:

Traffic signals have the potential to reduce the most severe type crashes but will likely cause an increase in rear-end collisions. A reduction in overall injury severity is likely the largest benefit of traffic signal installation.

NS04: Convert Intersection to Roundabout (From All Way Stop) and NS05: Convert Intersection to Roundabout (From Stop or Yield Control on Minor Road)

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
NS4 & NS5	90%	All

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
Varies	20 years	$400,000 - $800,000 Cost for roadway widening may be higher/vary

Countermeasure Description:

Roundabouts provide an alternative to signalization. This treatment involves removing stop and yield control on major and/or minor roads and constructing a roundabout with yield control on all approaches.

Where to Use:

Intersections that have a high frequency of right-angle and left-turn type crashes. Whether such intersections have existing crash patterns or not, a roundabout provides an alternative to signalization. The primary target locations for roundabouts should be moderate-volume unsignalized intersections. Roundabouts may not be a viable alternative in many suburban and urban settings where right-of-way is limited.

Why It Works:

Roundabouts provide an important alternative to signalized and all-way stop-controlled intersections. Modern roundabouts differ from traditional traffic circles in that they operate in such a manner that traffic entering the roundabout must yield the right-of-way to traffic already in it. Roundabouts can serve moderate traffic volumes with less delay than all-way stop-controlled intersections and provide

fewer conflict points. Crashes at roundabouts tend to be less severe because of the speed constraints and elimination of left-turn and right-angle movements.

NS05mr: Convert Intersection to Mini-Roundabout

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
NS5mr	90%	All

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
30%	20 years	$300,000 - $600,000 Cost for roadway widening may be higher/vary

Countermeasure Description:

Roundabouts provide an alternative to signalization. This treatment involves converting a non-signalized intersection to a mini-roundabout.

Where to Use:

Mini-roundabouts are characterized by a small diameter (45-90 ft) and traversable islands (central island and splitter islands). Mini-roundabouts offer most of the benefits of regular roundabouts with the added benefit of a smaller footprint. They are best suited to environments where speeds are already low and environmental constraints would preclude the use of a larger roundabout. Mini-roundabouts are most effective in lower speed environments in which all approaching roadways have posted speed of 30 mph or less and an 85th-percentile speed of less than 35 mph near the proposed yield and/or entrance line. For any location with an 85th-percentile speed above 35 mph, the mini-roundabout can be included as part of a broader system of traffic calming measures to achieve an appropriate speed environment.

Why It Works:

Mini-roundabouts may be an optimal solution for a safety or operational issue at an existing intersection where there is insufficient right-of-way for a standard roundabout installation. The

benefits of mini-roundabouts are the compact size, operational efficiency, traffic safety improvement and traffic Calming.

NS06: Install / Upgrade Larger or Additional Stop Signs or Other Intersection Warning / Regulatory Signs

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
NS6	90%	All

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
15%	10 years	$500 per sign

Countermeasure Description:

This treatment involves replacing the existing stop sign with larger sign and/or installing additional stop sign at other location and/or installing warning/regulatory signs at the intersection or in advance of the intersection approach.

Where to Use:

The target for this strategy should be approaches to unsignalized intersections with patterns of rear-end, right-angle, or turning collisions related to lack of driver awareness of the presence of the intersection.

Why It Works:

The visibility of intersections and, thus, the ability of approaching drivers to perceive them can be enhanced by installing larger regulatory and warning signs at or prior to intersections. A key to success in applying this strategy is to select a combination of regulatory and warning sign techniques appropriate for the conditions on a particular unsignalized intersection approach.

NS07: Upgrade Intersection Pavement Markings (NS.I)

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
NS7	90%	All

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
25%	10 years	$3,000 per intersection

Countermeasure Description:

Pavement markings can communicate information to road user related to roadway alignment, vehicle positioning, and other important driving-related tasks. This treatment involves installing advance warning pavement markings such as "Stop Ahead". The upgrade of pavement markings also involves installing centerlines and stop bars.

Where to Use:

Unsignalized intersections that are not clearly visible to approaching motorists, particularly approaching motorists on the major road. The strategy is particularly appropriate for intersections with patterns of rear-end, right-angle, or turning crashes related to lack of driver awareness of the presence of the intersection. Also at minor road approaches where conditions allow the stop bar to be seen by an approaching driver at a significant distance from the intersection. Typical improvements include "Stop Ahead" markings and the addition of Centerlines and Stop Bars.

Why It Works:

The visibility of intersections and, thus, the ability of approaching drivers to perceive them can be enhanced by installing appropriate pavement delineation in advance of and at intersections will provide approaching motorists with additional information at these locations. Providing visible stop bars on minor road approaches to unsignalized intersections can help direct the attention of drivers to the presence of the intersection. Drivers should be more aware that the intersection is coming up, and therefore make safer decisions as they approach the intersection.

NS08: Install Flashing Beacons at Stop-Controlled Intersections

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
NS8	90%	All

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
15%	10 years	$2,000 per assembly

Countermeasure Description:

This treatment involves installing flashing beacon at the intersection which can be either mounted on a post or mounted on a mast arm. The flashing beacon supplements the stop signs at the intersection to call the attention of the driver.

Where to Use:

Flashing beacons can reinforce driver awareness of the Non-Signalized intersection control and can help mitigate patterns of right-angle crashes related to stop sign violations. Post-mounted advanced flashing beacons or overhead flashing beacons can be used at stop-controlled intersections to supplement and call driver attention to stop signs.

Why It Works:

Flashing beacons provide a visible signal to the presence of an intersection and can be very effective in rural areas where there may be long stretches between intersections as well as locations where night-time visibility of intersections is an issue.

NS09: Install Flashing Beacons as Advance Warning (NS.I)

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
NS9	90%	All

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
30%	10 years	$12,000 per assembly

Countermeasure Description:

Advance flashing beacons can be used to supplement and call a driver's attention to intersection control signs. This treatment involves installing flashing beacons, mounted on a post, or mounted on a mast arm, in advance of the intersection. Most advance warning flashing beacons can be powered by solar, thus reducing the issues relating to a power source.

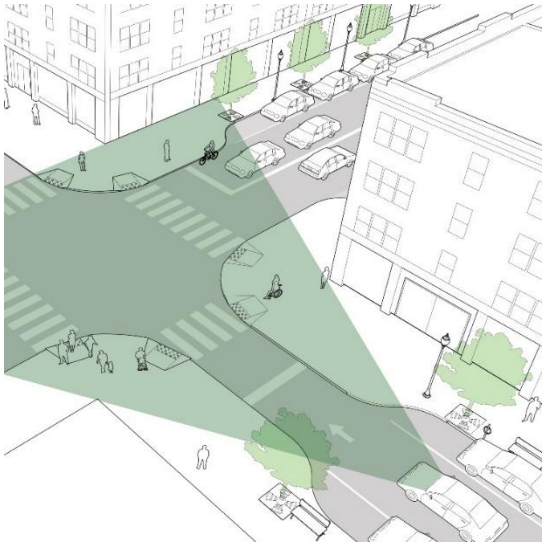
Where to Use:

Non-Signalized Intersections with patterns of crashes that could be related to lack of a driver's awareness of approaching intersection or controls at a downstream intersection.

Why It Works:

Advance flashing beacons can be used to supplement and call driver attention to intersection control signs. Flashing beacons are intended to reinforce driver awareness of the stop or yield signs and to help mitigate patterns of crashes related to intersection regulatory sign violations. Most advance warning flashing beacons can be powered by solar, thus reducing the issues relating to power source.

NS11: Improve Sight Distance to Intersection (Clear Sight Triangles)



LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
NS12	90%	All

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
55%	10 years	Varies if obstructions are easily removable/moveable or if private property owners are involved

Countermeasure Description:

This treatment involves clearing roadside obstructions to provide sight distance triangles. Costs are generally low, assuming objects removed are within the right-of-way and easily removable/moveable. When federal safety funding is used to remove vegetation that has the potential to grow back, local agencies are expected to maintain the improvement for a minimum of 10 years.

Where to Use:

Unsignalized intersections with restricted sight distance and patterns of crashes related to lack of sight distance where sight distance can be improved by clearing roadside obstructions without major reconstruction of the roadway.

Why It Works:

Adequate sight distance for drivers at stop or yield-controlled approaches to intersections has long been recognized as among the most important factors contributing to overall safety at unsignalized intersections. By removing sight distance restrictions (e.g., vegetation, parked vehicles, signs, buildings) from the sight triangles at stop or yield-controlled intersection approaches, drivers will be able see approaching vehicles on the main line, without obstruction and therefore make better decisions about entering the intersection safely.

NS12: Improve Pavement Friction (High Friction Surface Treatments)

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
NS12	90%	All

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
55%	10 years	$50 per square yard

Countermeasure Description:

High friction surface treatment (HFST) involves the application of high-quality aggregate to the pavement using a polymer binder to restore pavement friction at intersections that have less friction than is needed for the roadway approach speeds and/or geometry. HFST aids motorists in maintaining better control in dry and wet driving conditions.

Where to Use:

Nationally, this countermeasure is referred to as "High Friction Surface Treatments" or HFST. Non-signalized Intersections noted as having crashes on wet pavements or under dry conditions when the pavement friction available is significantly less than needed for the actual roadway approach speeds. This treatment is intended to target locations where skidding and failure to stop is determined to be a problem in wet or dry conditions and the target vehicle is unable to stop due to insufficient skid resistance.

Why It Works:

Improving the skid resistance at locations with high frequencies of wet-road crashes and/or failure to stop crashes can result in reductions of 50 percent for wet-road crashes and 20 percent

for total crashes. Applying HFST can double friction numbers, e.g. low 40s to high 80s. This CM represents a special focus area for both FHWA and Caltrans, which means there are extra resources available for agencies interested in more details on High Friction Surface Treatment projects.

NS14: Install Raised Median on Approaches (NS.I.)

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
NS14	90%	All

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
25%	20 years	$30 per linear foot

Countermeasure Description:

Raised medians help prevent accidents caused by crossover traffic, reduce headlight glare distraction and separate left-turning traffic from through lanes when combined with left-turn lanes. This treatment involves installing raised median at intersection approaches directly over existing pavement. This method does not require excavation of the existing pavement.

Where to Use:

Where related or nearby turning movements affect the safety and operation of an intersection. Effective access management is key to improving safety at, and adjacent to, intersections. The number of intersection access points coupled with the speed differential between vehicles traveling along the roadway often contributes to crashes. Any access points within 250 feet upstream and downstream of an intersection are generally undesirable.

Why It Works:

Raised medians with left-turn lanes at intersections offer a cost-effective means for reducing crashes and improving operations at higher volume intersections. The raised medians also prohibit left turns into and out of driveways that may be located too close to the functional area of the intersection.

NS17: Install Right-Turn Lane (NS.I.)

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
NS17	90%	All

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
20%	20 years	$30,000 - $70,000

Countermeasure Description:

At intersections with substantial right-turn movements, a dedicated right-turn lane segregates these cars from through traffic and increases the capacity of the road. This treatment provides a right-turn lane that allows for vehicles to decelerate and a make a right-turn movement.

Where to Use:

Many collisions at unsignalized intersections are related to right-turn maneuvers. A key strategy for minimizing such collisions is to provide exclusive right-turn lanes, particularly on high-volume and high-speed major-road approaches. When considering new right-turn lanes, potential impacts to non-motorized users should be considered and mitigated as appropriate. When considering new right-turn lanes, potential impacts to non-motorized users should be considered and mitigated as appropriate.

Why It Works:

The strategy is targeted to reduce the frequency of rear-end collisions resulting from conflicts between vehicles turning right and following vehicles and vehicles turning right and through vehicles coming from the left on the cross street. Right-turn lanes also remove slow vehicles that are decelerating to turn right from the through-traffic stream, thus reducing the potential for rear-end collisions. Right-turn lanes can increase the length of the intersection crossing and create an additional potential conflict point for non-motorized users.

NS18: Install Left-Turn Lane (Where No Left-Turn Lane Exists)

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
NS18	90%	All

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
35%	20 years	$30,000 - $70,000

Countermeasure Description:

This treatment provides greater safety for drivers making a left-turn movement by eliminating conflicts between through vehicles and vehicles slowing to make a left-turn through the addition of a left-turn lane.

Where to Use:

Many collisions at unsignalized intersections are related to left-turn maneuvers. A key strategy for minimizing such collisions is to provide exclusive left-turn lanes, particularly on high-volume and high-speed major-road approaches. When considering new left-turn lanes, potential impacts to non-motorized users should be considered and mitigated as appropriate.

Why It Works:

Adding left-turn lanes remove vehicles waiting to turn left from the through-traffic stream, thus reducing the potential for rear-end collisions. Because they provide a sheltered location for drivers to wait for a gap in opposing traffic, left-turn lanes may encourage drivers to be more selective in choosing a gap to complete the left-turn maneuver. This strategy may reduce the potential for collisions between left-turn and opposing through vehicles.

NS19PB: Install Raised Medians / Refuge Islands (NS.I.)

HSIP COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
NS19PB	90%	Pedestrian and Bicycle

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
45%	20 years	$40,000 per location

Countermeasure Description:

This treatment can be applied to intersections that have long pedestrian crossing distances. The raised medians/refuge islands reduce the conflict between the non-motorized user and motorized users. This treatment also allows pedestrians to focus on one direction of traffic at a time because the refuge island provides a protected space between the two directions of travel.

Where to Use:

Intersections that have a long pedestrian crossing distance, a higher number of pedestrians, or a crash history. Raised medians decrease the level of exposure for pedestrians and allow pedestrians to concentrate on (or cross) only one direction of traffic at a time.

Why It Works:

Raised pedestrian refuge islands, or medians at crossing locations along roadways, are another strategy to reduce exposure between pedestrians and motor vehicles. Refuge islands and medians that are raised (i.e., not just painted) provide pedestrians more secure places of refuge during the street crossing. They can stop partway across the street and wait for an adequate gap in traffic before completing their crossing.

NS20B: Install Pedestrian Crossing at Uncontrolled Locations (New Signs and Markings Only)

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
NS20PB	90%	Pedestrian and Bicycle

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
25%	10 years	$7,000

Description:

This treatment involves the installation of a pedestrian crossing with new pavement markings and signs at unsignalized intersections to address pedestrian and bicycle collisions.

Where to Use:

Non-signalized intersections without a marked crossing, where pedestrians are known to be crossing intersections that involve significant vehicular traffic. They are especially important at school crossings and intersections with right and/or left turns pockets. See Zegeer study (Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations) for additional guidance regarding when to install a marked crosswalk.

Why It Works:

Pedestrian crossings enhance pedestrian safety through pavement markings and signs that delineate a designated portion of the roadway for pedestrians to cross. The use of enhanced markings at uncontrolled crossings can also increase both pedestrian and driver awareness to the increased exposure at the crossing. Incorporating advanced "stop" or “yield" markings provides an extra safety buffer and can reduce the 'multiple-threat' danger to pedestrians. Nearly one-third of all pedestrian-related crashes occur at or within 50 feet of an intersection. Of these, 30 percent involve a turning vehicle. There are several types of pedestrian crosswalks, including: continental, ladder, zebra, and standard. When agencies opt to install aesthetic enhancement to intersection crosswalks like stamped concrete/asphalt, the project design and construction costs can significantly increase. For HSIP applications, these costs must be accounted for in the B/C

calculation, but costs over standard crosswalk markings must be tracked separately and are not federally reimbursable and will increase the agency's local-funding share for the project costs.

NS21PB: Install/Upgrade Pedestrian Crossing at Uncontrolled Locations (With Enhanced Safety Features)

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
NS21PB	90%	Pedestrian and Bicycle

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
35%	20 years	$50,000 - $100,000 per location

Description:

This treatment involves installing pedestrian crossings with enhanced features such curb extensions, advanced "stop" or "yield" markings, flashing beacons, and other safety features that complement the standard pedestrian crossing elements.

Where to Use:

Non-signalized intersections with or without a marked crossing, where pedestrians cross intersections that involve significant vehicular traffic. They are especially important at school crossings and intersections with turn pockets. Flashing beacons, curb extensions, advanced "stop" or "yield" markings, and other safety features should be added to complement the standard crossing elements.

Why It Works:

Adding pedestrian crossings that include enhances safety features has the opportunity to enhance pedestrian safety at locations noted as being especially problematic. The enhanced safety elements help delineate a portion of the roadway that is designated for pedestrian crossing. Incorporating advanced "yield" markings provide an extra safety buffer and can be effective in reducing the 'multiple-threat' danger to pedestrians. Nearly one-third of all pedestrian-related crashes occur at or within 50 feet of an intersection. When agencies opt to install aesthetic enhancement to intersection crosswalks like stamped concrete/asphalt, the project design and construction costs can significantly increase. For HSIP applications, these costs must be accounted for in the B/C calculation, but these costs (over standard crosswalk markings) must be tracked separately and are not federally reimbursable and will increase the agency's local-funding share for the project costs.

NS22PB: Install Rectangular Rapid Flashing Beacon (RRFB)

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
NS22PB	90%	Pedestrian and Bicycle

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
35%	20 years	$12,000 per assembly

Countermeasure Description:

This treatment involves installing Rectangular Rapid Flashing Beacons (RRFB) including pedestrian-activated flashing lights and additional signage at a pedestrian crossing.

Where to Use:

Rectangular Rapid Flashing Beacon (RRFB) includes pedestrian-activated flashing lights and additional signage that enhance the visibility of marked crosswalks and alert motorists to pedestrian crossings. It uses an irregular flash pattern that is similar to emergency flashers on police vehicles. RRFBs are installed at unsignalized intersections and mid-block pedestrian crossings.

Why It Works:

RRFBs can enhance safety by increasing driver awareness of potential pedestrian conflicts and reducing crashes between vehicles and pedestrians at unsignalized intersections and mid-block pedestrian crossings. The addition of RRFB may also increase the safety effectiveness of other treatments, such as crossing warning signs and markings.

NS23PB: Install Pedestrian Signal (Including Pedestrian Hybrid Beacon (HAWK)

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
NS23PB	90%	Pedestrian and Bicycle

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
55%	20 years	$250,000

Countermeasure Description:

This treatment involves installing a pedestrian signal or a pedestrian hybrid beacon (PHB) which is also known as a high-intensity activated crosswalk beacon (HAWK) with associated signs and markings at a pedestrian crossing.

Where to Use:

Intersections noted as having a history of pedestrian vs. vehicle crashes and in areas where the likelihood of the pedestrian presence is high. Corridors should also be assessed to determine if there are adequate safe opportunities for non-motorists to cross and if a pedestrian signal, or a Pedestrian Hybrid Beacon (PHB) (also called High-Intensity Activated crosswalk beacon (HAWK)) are needed to provide an active warning to motorists when a pedestrian is in the crosswalk.

Why It Works:

Adding a pedestrian signal has the opportunity to greatly enhance pedestrian safety at locations noted as being problematic. Nearly one-third of all pedestrian-related crashes occur at or within 50 feet of an intersection. In combination with this CM, better guidance signs and markings for non-motorized and motorized roadway users should be considered, including: sign and markings directing pedestrians and cyclists on appropriate/legal travel paths and signs and markings warning motorists of non-motorized uses of the roadway that should be expected.

ROADWAY COUNTERMEASURES

R01: Add Segment Lighting

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
R1	90%	Night

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
35%	20 years	$10,000 per street light

Countermeasure Description:

Adding intersection lighting to roadway segments helps improve visibility throughout the roadway and helps reduce potential conflicts. Adequately illuminated intersections increase driver awareness of crossing pedestrians for approaching motorists and assists pedestrians navigating the crosswalks.

Where to Use:

Where to use: Noted substantial patterns of nighttime crashes. In particular, patterns of rear-end, right-angle, turning or roadway departure collisions on the roadways may indicate that night-time drivers can be unaware of the roadway characteristics.

Why It Works:

Providing roadway lighting improves the safety during nighttime conditions by (1) making drivers more aware of the surroundings, which improves drivers' perception-reaction times, (2) enhancing drivers' available sight distances to perceive roadway characteristic in advance of the change, and (3) improving non-motorist's visibility and navigation.

R03: Install Median Barrier

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
R3	90%	All

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
25%	20 years	$50-$500 per linear foot

Countermeasure Description:

This treatment installs a median barrier between vehicles traveling in opposite directions to reduce cross median crashes by redirecting vehicles that strike either side of the barrier. Costs vary based on barrier used including cable barriers, guardrail, and concrete barriers. Concrete median barriers are most commonly used.

Where to Use:

Areas where crash history indicates drivers are unintentionally crossing the median and the cross-overs are resulting in high severity crashes. The installation of median barriers can increase the number of PDO and non-severe injuries. The net result in safety from this countermeasure is connected more to reducing the severity of crashes not the number of crashes. It is recommended to review the warrants as outlined in Chapter 7 of the Caltrans Traffic Manual when considering whether to install median barriers.

Why It Works:

This strategy is designed to prevent head-on collisions by providing a barrier between opposing lanes of traffic. The variety of median barriers available makes it easier to choose a site-specific solution. The main advantage is the reduction of the severity of the crashes. The key to success would be in selecting an appropriate barrier based on the site, previous crash history, maintenance needs, and median width.

R04: Install Guardrail

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
R4	90%	All

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
25%	20 years	$50-$250 per linear foot

Countermeasure Description:

The installation of guardrail is an effective method for protecting drivers from drop-offs or colliding with fixed objects on the median or roadside. Guardrails can be installed very quickly and in a fast manner.

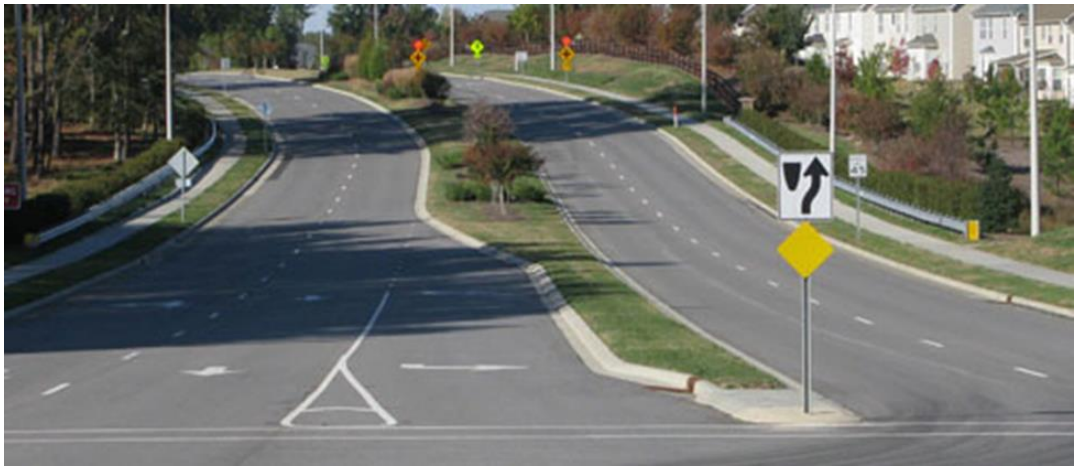
Where to Use:

Guardrail is installed to reduce the severity of lane departure crashes. However, guardrail can reduce crash severity only for those conditions where striking the guardrail is less severe than going down an embankment or striking a fixed object. Guardrail should only be installed where it is clear that crash severity will be reduced, or there is a history of run-off-the-road crashes at a given location that have resulted in severe crashes. New and upgraded guardrail and end-treatments must meet current safety standards; see Method for Assessing Safety Hardware (MASH) for more information. Caltrans (or other national accepted guidance) slope/height criteria need to be considered and documented.

Why It Works:

Guardrail redirects a vehicle away from embankment slopes or fixed objects and dissipates the energy of an errant vehicle.

R08: Install Raised Median



LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
R8	90%	All

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
25%	20 years	$30 per linear foot

Countermeasure Description:

Raised medians help prevent accidents caused by crossover traffic, reduce headlight glare distraction and separate left-turning traffic from through lanes when combined with left-turn lanes. This treatment involves installing raised median within roadway segments directly over existing pavement. This method does not require excavation of the existing pavement.

Where to Use:

Areas experiencing head-on collisions that may be affected by both the number of vehicles that cross the centerline and by the speed of oncoming vehicles. Installing a raised median is a more restrictive approach in that it represents a more rigid barrier between opposing traffic. Application of raised medians on roadways with higher speeds is not advised -instead a median barrier should be considered. Including landscaping in new raised medians can be counterproductive to the HSIP safety goals and should only be done in ways that do not increase drivers' exposure to fixed objects and that will maintain driver's sight distance needs throughout the life of the proposed landscaping. Agencies need to consider and document impacts of additional turning movements at nearby intersections.

Why It Works:

Adding raised medians is a particularly effective strategy as it adds to or reallocates the existing cross section to incorporate a buffer between the opposing travel lanes and reinforces the limits of the travel lane. Raised median may also be used to limit unsafe turning movements along a roadway.

R10PB: Install Pedestrian Median Fencing on Approaches

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
R10PB	90%	Pedestrian and Bicycle

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
35%	20 years	$50-$75 per linear foot

Countermeasure Description:

The installation of pedestrian median fencing along approaches helps direct pedestrians to a preferred formal crossing point and discourages pedestrians from making dangerous crossing movements where visibility may be limited.

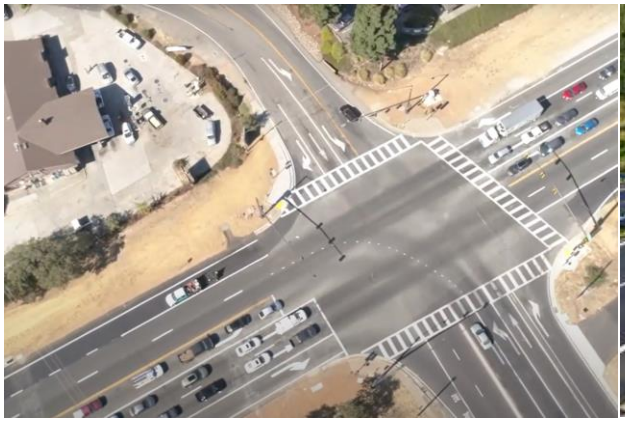
Where to Use:

Roadway segments with high pedestrian-generators and pedestrian-destinations nearby (e.g. transit stops) may experience a high volume of pedestrians J-walking across the travel lanes at mid-block locations instead of walking to the nearest intersection or designated mid-block crossing. When this safety issue cannot be mitigated with shoulder, sidewalk and/or crossing treatments, then installing a continuous pedestrian barrier in the median may be a viable solution.

Why It Works:

Adding pedestrian median fencing has the opportunity to enhance pedestrian safety at locations noted as being problematic involving pedestrians running/darting across the roadway outside designated pedestrian crossings. Pedestrian median fencing can significantly reduce this safety issue by creating a positive barrier, forcing pedestrians to the designated pedestrian crossing.

R11: Install Acceleration / Deceleration Lanes



LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
R11	90%	All

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
25%	20 years	$30,000 - $70,000

Countermeasure Description:

The installation of acceleration/deceleration lanes helps reduce conflict between slow speed and higher speed vehicles. Acceleration/deceleration lanes allow drivers to speed up or slow down in a space not used by high-speed through traffic.

Where to Use:

Areas proven to have crashes that are the result of drivers not being able to turn onto a high speed roadway to accelerate until the desired roadway speed is reached and areas that do not provide the opportunity to safety decelerate to negotiate a turning movement. This CM can also be used to improve the safety of merging vehicles at a lane-drop location.

Why It Works:

A lane that does not provide enough deceleration length and storage space for turning traffic may cause the turn queue to back up into the adjacent through lane. This can contribute to rear-end and sideswipe crashes. An acceleration lane is an auxiliary or speed-change lane that allows vehicles to accelerate to highway speeds (high speed roadways) before entering the through-traffic lanes of a highway. Additionally, if acceleration by entering traffic takes place directly on the traveled way, it may disrupt the flow of through-traffic and cause rear-end and sideswipe collisions.

R14: Road Diet (Reduce Travel Lanes From 4 to 3 and Add a Two Way Left-Turn and Bike Lanes)

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
R14	90%	All

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
30%	20 years	$50,000 - $150,000 per mile

Countermeasure Description:

A road diet reconfiguration involves the conversion of an undivided four lane roadway to a three-lane undivided roadway made up of two through lanes, a center two-way left-turn lane, and bike lanes. The reduction of lanes allows the roadway cross section to be reallocated for other uses such as bike lanes, pedestrian refuge islands, transit uses, and/or parking.

Where to Use:

Areas noted as having a higher frequency of head-on, left-turn, and rear-end crashes with traffic volumes that can be handled by only 2 free flowing lanes. Using this strategy in locations with traffic volumes that are too high could result in diversion of traffic to routes less safe than the original four-lane design. It may also result in congestion levels that contribute to other crashes.

Why It Works:

The application of this strategy usually reduces the roadway segment speeds and serious head-on crashes. In many cases the extra pavement width can be used for the installation of bike lanes. In addition to increasing bicycle safety, these bike lanes can improve the safety of on-street parking.

R15: Widen Shoulder

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
R15	90%	All

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
30%	20 years	Varies by Project Scope

Countermeasure Description:

This treatment involves the addition/widening of a shoulder lane to provide space that allows drivers to get out of the travel lane and avoid crashes. By widening the shoulders or providing a shoulder where one previously did not exist, drivers have more recovery area to regain control in the event of a roadway departure. A minimum of 2 feet width must be added and the new/resulting shoulders must be a minimum of 4 feet wide.

Where to Use:

Roadways that have a frequent incidence of vehicles leaving the travel lane resulting in an unsuccessful attempt to reenter the roadway. The probability of a safe recovery is increased if an errant vehicle is provided with an increased paved area in which to initiate such a recovery.

Why It Works:

Based on the best available research, adding shoulder or widening an existing shoulder provides a greater area to regain control of a vehicle, as well as lateral clearance to roadside objects such as guardrail, signs and poles. They may also provide space for disabled vehicles to stop or drive slowly, provide increased sight distance for through vehicles and for vehicles entering the roadway, and in some cases reduce passing conflicts between motor vehicles and bicyclists and pedestrians. The likely safety benefits for adding or widening an existing shoulder generally increase as the widening width increases -practitioners should refer to NCHRP Report 500 Series, the CMF Clearinghouse or other references for more details.

R16: Curve Shoulder Widening (Outside Only)

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
R16	90%	All

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
45%	20 years	Varies by Project Scope

Countermeasure Description:

This treatment involves the addition/widening of the outside of the horizontal curve and enables drivers to get out of the travel lane and avoid crashes or regain control. A minimum of 2-4 feet width must be added to the outside of horizontal curves and the new traversable shoulder must be a minimum of 4 feet wide.

Where to Use:

Roadway curves noted as having frequent lane departure crashes due to inadequate or no shoulders, resulting in an unsuccessful attempt to reenter the roadway. The probability of a safe recovery is increased if an errant vehicle is provided with an increased paved area in which to initiate such a recovery.

Why It Works:

Adding shoulders (outside only) creates a recovery area in which a driver can regain control of a vehicle, as well as lateral clearance to roadside objects. They may also provide space for disabled vehicles to stop or drive slowly, provide increased sight distance for through vehicles and for vehicles entering the roadway, and in some cases reduce passing conflicts between motor vehicles and bicyclists and pedestrians. The likely safety benefits for adding or widening an existing shoulder generally increase as the widening width increases

R17: Improve Horizontal Alignment (Flatten Curves)

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
S17	90%	All

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
50%	20 years	Varies by Project Scope

Countermeasure Description:

This treatment is used to reduce roadway departure crashes and usually involves total reconstruction of the roadway. It also may require acquisition of additional right-of-way and an environmental review. This countermeasure is not eligible unless done as the last step of an "incremental approach".

Where to Use:

Roadways with horizontal curves that have experienced lane departure crashes as a result of a roadway segment having compound curves or a severe radius. This strategy should generally be considered only when less expensive strategies involving clearing of specific sight obstructions or modifying traffic control devices have been tried and have failed to ameliorate the crash patterns.

Why It Works:

Increasing the radius of a horizontal curve can be very effective in improving the safety performance of the curve. Curve modification reduces the likelihood of a vehicle leaving its lane, crossing the roadway centerline, or leaving the roadway at a horizontal curve; and minimizes the adverse consequences of leaving the roadway. Horizontal alignment improvement projects are expected to include standard/improved superelevation elements, which should be considered part of this CM and not an additional CM.

R18: Flatten crest vertical curve

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
S18	90%	All

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
25%	20 years	Varies by Project Scope

Countermeasure Description:

This treatment is used to change the horizontal and / or vertical alignment to provide additional sight distance. This countermeasure only applies to crashes that occur within the limits of the improved alignment. This countermeasure is not eligible unless done as the last step of an "incremental approach". Projects that utilize this countermeasure are typically quite extensive, expensive, and take several years to accomplish – particularly if additional right-of-way is required or environmental impacts are expected. The key to creating a cost effective project with a competitive benefit cost ratio (BCR) for the HSIP program is to target using the countermeasure at higher-hazard locations.

Where to Use:

The target for this strategy is usually unsignalized intersections with restricted sight distance due to vertical geometry and with patterns of crashes related to that lack of sight distance that cannot be ameliorated by less expensive methods. This strategy should generally be considered only when less expensive strategies involving clearing of specific sight obstructions or modifying traffic control devices have been tried and have failed to ameliorate the crash patterns.

Why It Works:

Adequate sight distance for drivers at stopped approaches to intersections has long been recognized as among the most important factors contributing to overall intersection safety. Vertical alignment improvement projects are expected to include standard/improved superelevation elements, which should be considered part of this CM and not an additional CM.

R21: Improve Pavement Friction (High Friction Surface Treatments)

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
R21	90%	All

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
55%	10 years	$50 per square yd

Countermeasure Description:

High friction surface treatment (HFST) involves the application of high-quality aggregate to the pavement using a polymer binder to restore pavement friction at intersections that have less friction than is needed for the roadway approach speeds and/or geometry. HFST aids motorists in maintaining better control in dry and wet driving conditions.

Where to Use:

Nationally, this countermeasure is referred to as "High Friction Surface Treatments" or HFST. Areas as noted having crashes on wet pavements or under dry conditions when the pavement friction available is significantly less than actual roadway speeds; including but not limited to curves, loop ramps, intersections, and areas with short stopping or weaving distances. This treatment is intended to target locations where skidding is determined to be a problem, in wet or dry conditions and the target vehicle is one that runs (skids) off the road or is unable to stop due to insufficient skid resistance.

Why It Works:

Improving the skid resistance at locations with high frequencies of wet-road crashes and/or failure to stop crashes can result in a reduction of 50 percent for wet-road crashes and 20 percent for total crashes. Applying HFST can double friction numbers, e.g. low 40s to high 80s. This CM represents a special focus area for both FHWA and Caltrans, which means there are extra resources available for agencies interested in more details on High Friction Surface Treatment projects.

R22: Install/Upgrade Signs with New Fluorescent Sheeting (Regulatory or Warning)

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
R22	90%	All

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
15%	10 years	$300 per sign

Countermeasure Description:

This treatment involves installing new or upgrading existing regulatory or warning signs with new florescent sheeting to increase visibility. This countermeasure is not eligible unless it is done as part of a larger sign audit project.

Where to Use:

The target for this strategy should be on roadway segments with patterns of head on, nighttime, non-intersection, run-off road, and sideswipe crashes related to lack of driver awareness of the presence of a specific roadway feature or regulatory requirement. Ideally this type of safety CM would be combined with other sign evaluations and upgrades (install chevrons, warning signs, delineators, markers, beacons, and relocation of existing signs per MUTCD standards.)

Why It Works:

This strategy primarily addresses crashes caused by lack of driver awareness (or compliance) roadway signing. It is intended to get the drivers attention and give them a visual warning by using fluorescent yellow sheeting (or other retroreflective material).

R23, Install Chevron Signs on Horizontal Curves

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
R23	90%	All

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
40%	10 years	$300 per sign

Countermeasure Description:

Making curves more visible to drivers using curve warning signs can reduce crashes at these locations. Adequately placed signs can delineate the curve to alert drivers and show them how sharp it is. This countermeasure can be effectively and efficiently implemented using a systematic approach with numerous locations, resulting in moderate cost projects.

Where to Use:

This countermeasure is effective on roadways that have an unacceptable level of crashes on relatively sharp curves during periods of light and darkness. Ideally this type of countermeasure would be combined with other sign evaluations and upgrades (install warning signs, delineators, markers, beacons, and relocation of existing signs per MUTCD standards).

Why It Works:

This strategy primarily addresses crashes caused by lack of driver awareness (or compliance) roadway signing. It is intended to get the drivers attention and give them a visual warning by using fluorescent yellow sheeting (or other retroreflective material).

R24: Install Curve Advance Warning Signs

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
R24	90%	All

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
25%	10 years	$300 per sign

Countermeasure Description:

Curve advance warning signs provide a visual cue to drivers that they are approaching a horizontal curve. This treatment is appropriate for locations where relatively sharp curves have resulted in crashes. This treatment should be installed in combination with additional treatments such as chevron signs, delineators, and pavement markers to provide increased awareness of the curved roadway alignment.

Where to Use:

This countermeasure is effective on roadways that have an unacceptable level of crashes on relatively sharp curves during periods of light and darkness. Ideally this type of countermeasure would be combined with other sign evaluations and upgrades (install warning signs, delineators, markers, beacons, and relocation of existing signs per MUTCD standards).

Why It Works:

This strategy primarily addresses problem curves, and serves as an advance warning of an unexpected or sharp curve. It provides advance information and gives drivers a visual warning that their added attention is needed

R25: Install Curve Advance Warning Signs (Flashing Beacon)

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
R25	90%	All

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
30%	10 years	$500 per sign

Countermeasure Description:

Curve advance warning signs provide a visual cue to drivers that they are approaching a horizontal curve. This treatment is appropriate for locations where relatively sharp curves have resulted in crashes. This treatment should be installed in combination with additional treatments such as chevron signs, delineators, and pavement markers to provide increased awareness of the curved roadway alignment.

Where to Use:

Roadways that have an unacceptable level of crashes on relatively sharp curves. Flashing beacons in conjunction with warning signs should only be used on horizontal curves that have an established severe crash history to help maintain their effectiveness.

Why It Works:

This strategy primarily addresses problem curves, and serves as an enhanced advance warning of an unexpected or sharp curve. It provides advance information and gives drivers a visual warning that their added attention is needed. Flashing beacons are an added indication that a curve may be particularly challenging.

R26: Install Dynamic/Variable Speed Warning Signs

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
R26	90%	All

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
30%	10 years	$8,000 per sign

Countermeasure Description:

Dynamic/variable speed warning signs can be implemented on roadways with a high frequency of unsafe speed crashes or run off road crashes on curvilinear segments. The speed warning signs alert drivers to their current travel speed and give a visual warning once drivers exceed the recommended speed for a segment or curve. Dynamic/variable speed warning signs can be powered by solar, thus reducing the issues relating to a power source. This countermeasure does not apply to dynamic regulatory speed warning signs.

Where to Use:

Curvilinear roadways that have an unacceptable level of crashes due to excessive speeds on relatively sharp curves.

Why It Works:

This strategy primarily addresses crashes caused by motorists traveling too fast around sharp curves. It is intended to get the drivers attention and give them a visual warning that they may be traveling over the recommended speed for the approaching curve. Care should be taken to limit the placement of these signs to help maintain their effectiveness.

R27: Install Delineators, Reflectors and/or Object Markers

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
R27	90%	All

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
15%	10 years	$500 per delineator

Countermeasure Description:

Delineators, Reflectors and/or Object Markers can be implemented on roadways with a high frequency of fixed object crashes or run off road crashes on curvilinear segments. The signs warn drivers of an approaching curve or fixed object that cannot easily be removed. This countermeasure can be effectively and efficiently implemented using a systematic approach with numerous locations, resulting in low to moderate cost projects that are more appropriate to seek state or federal funding.

Where to Use:

Roadways that have an unacceptable level of crashes on curves (relatively flat to sharp) during periods of light and darkness and any road with a history of fixed object crashes.

Why It Works:

Delineators, reflectors and/or object markers are intended to warn drivers of an approaching curve or fixed object that cannot easily be removed. They are intended to provide tracking information and guidance to the drivers. They are generally less costly than Chevron Signs as they don't require posts to place along the roadside, avoiding an additional object with which an errant vehicle can crash into.

R28: Install Edge-Lines and Centerlines

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
R28	90%	All

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
25%	10 years	$4 per linear foot

Countermeasure Description:

This treatment helps drivers to better understand the limits of roadway. Depending on the width of the roadway, various combinations of edge line and/or center line pavement markings may be most appropriate.

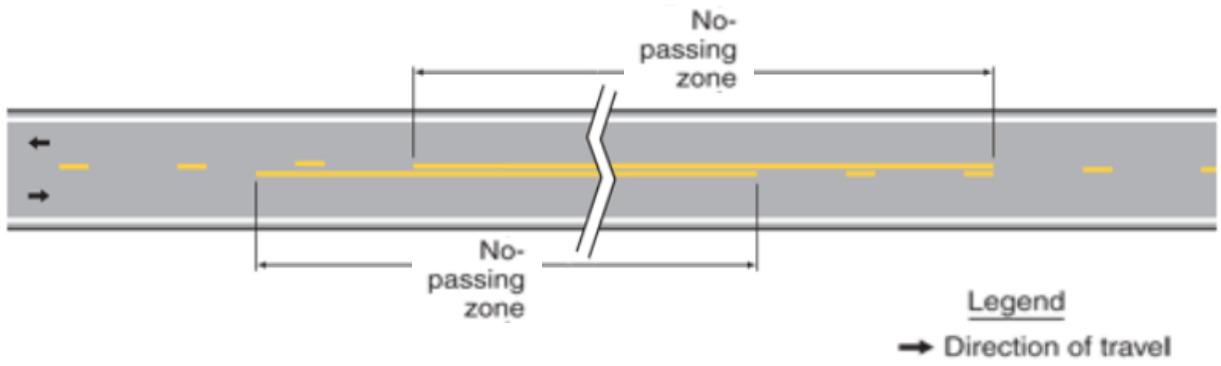
Where to Use:

Any road with a history of run-off-road right, head-on, opposite-direction-sideswipe, or run-off-road-left crashes is a candidate for this treatment -install where the existing lane delineation is not sufficient to assist the motorist in understanding the existing limits of the roadway. Depending on the width of the roadway, various combinations of edge line and/or center line pavement markings may be the most appropriate. Incorporating raised/reflective pavement markers (RPMs) into centerlines (and edge-lines) should be considered as it has been shown to improve safety.

Why It Works:

Installing edge-lines and centerlines where none exists or making significant upgrades to existing lines (paint to thermoplastic, adding audible disks/bumps in the thermoplastic stripes, or adding RPMs) are intended/designed to help drivers who might leave the roadway because of their inability to see the edge of the roadway along the horizontal edge of the pavement or crossover the centerline of the roadway into oncoming traffic. New pavement marking products tend to be more durable, are all-weather, more visible, and have a higher retroreflectivity than traditional pavement markings.

R29: Install No-Passing Line



LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
R29	90%	Head-on, Side-swipe

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
45%	10 years	$4 per linear foot

Countermeasure Description:

This treatment requires striping of the center line in the roadway to distinguish between safer passing places and places where passing is not advised. This helps drivers to better understand the limits of roadway and will assist them to determine where passing maneuvers can be completed safely.

Where to Use:

Roadways that have a high percentage of head-on crashes suggesting that many head-on crashes may relate to failed passing maneuvers. No-passing lines should be installed where drivers "passing sight distance" is not available due to horizontal or vertical obstructions. General restriping projects can be good opportunities to reevaluate and incorporate new no-passing zones limits. The incorporation 'No Passing Zone' pennants should also be considered when reevaluating the limits of no-passing zones. Installing no-passing limits in areas that are not warranted may reduce the overall safety of the corridor as drivers may become frustrated and attempt passing maneuvers at other locations without the necessary sight distance.

Why It Works:

When the centerline markings do not differentiate between passing and no-passing areas, drivers may have difficulty determining where passing maneuvers can be completed safely. Providing clear and engineered passing and no-passing areas can encourage drivers to wait patiently for safe passing areas and avoid aggressively looking for passing opportunities

R30: Install Centerline Rumble Strips / Stripes

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
R30	90%	All

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
20%	10 years	$1-$3 per linear foot

Countermeasure Description:

Centerline rumble strips/stipes are installed at or near the center line of an undivided roadway, and may be comprised of either a single or double line of rumbles. This treatment is intended to alert inattentive drivers through vibration and sound that their vehicles have left the travel lane.

Where to Use:

Center Line rumble strips/stripes can be used on virtually any roadway – especially those with a history of head-on crashes. It is recommended that rumble strips/stripes be applied systematically along an entire route instead of only at spot locations. For all rumble strips/stripes, pavement condition should be sufficient to accept milled rumble strips. Care should be taken when considering installing rumble strips in locations with residential land uses or in areas with high bicycle volumes.

Why It Works:

Rumble strips provide an auditory indication and tactile rumble when driven on, alerting drivers that they are drifting out of their travel lane, giving them time to recover before they depart the roadway or cross the center line. Additionally, rumble stripes (pavement marking in the rumble itself) provide an enhanced marking, especially in wet dark conditions.

R31: Install Edgeline Rumble Strips / Stripes

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
R31	90%	All

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
15%	10 years	$1-$3 per linear foot

Countermeasure Description:

Edge line rumble strips are placed at the edge of the travel lane in line with the edge line pavement marking. This treatment is intended to alert inattentive drivers through vibration and sound that their vehicles have left the travel lane. It is recommended that rumble strips/stripes be applied systematically along an entire route instead of only at spot locations.

Where to Use:

Shoulder and edge line milled rumble strips/stripes should be used on roads with a history of roadway departure crashes. It is recommended that rumble strips/stripes be applied systematically along an entire route instead of only at spot locations. For all rumble strips/stripes, pavement condition should be sufficient to accept milled rumble strips. Special requirements may apply and care should be taken when considering installing rumble strips in locations with residential land uses or in areas with high bicycle volumes.

Why It Works:

Rumble strips provide an auditory indication and tactile rumble when driven on, alerting drivers that they are drifting out of their travel lane, giving them time to recover before they depart the roadway or cross the center line. Additionally, rumble stripes (pavement marking in the rumble itself) provide an enhanced marking, especially in wet dark conditions.

R32PB: Install Bike Lanes

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
R32PB	90%	Pedestrian and Bicycle

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
35%	20 years	$4 per linear foot of striping

Countermeasure Description:

This treatment involves installing Class II bicycle lanes to address crashes between bicycles and vehicles. Adding striped bicycle lanes can range from the simply restriping the roadway and minor signing to projects that require roadway widening, right-of-way, and environmental impacts.

Where to Use:

Roadway segments noted as having crashes between bicycles and vehicles or crashes that may be preventable with a buffer/shoulder. Most studies suggest that bicycle lanes may provide protection against bicycle/motor vehicle collisions. Striped bike lanes can be incorporated into a roadway when is desirable to delineate which available road space is for exclusive or preferential use by bicyclists.

Why It Works:

Most studies present evidence that bicycle lanes provide protection against bicycle/motor vehicle collisions. Bicycle lanes provide marked areas for bicyclist to travel along the roadway and provide for more predictable movements for both bicyclist and motorist. Evidence also shows that riding with the flow of vehicular traffic reduces bicyclists' chances of collision with a motor vehicle. Locations with bicycle lanes have lower rates of wrong-way riding. In combination with this CM, better guidance signs and markings for non-motorized and motorized roadway users should be considered, including: sign and markings directing cyclists on appropriate/legal travel paths and signs and markings warning motorists of non-motorized uses of the roadway that should be expected.

R33PB: Install Separated Bike Lanes

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
R33PB	90%	Pedestrian and Bicycle

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
45%	20 years	$8 per linear foot of striping

Countermeasure Description:

This treatment involves installing separated bike paths or bike lanes on streets with high volumes of bicycle traffic and/or high bicycle-vehicle collisions in urban or suburban areas. Separation types range from simple, painted buffers and flexible delineators, to more substantial separation including raised curbs, grade separation, bollards, planters, and parking lanes.

Where to Use:

Separated bikeways are most appropriate on streets with high volumes of bike traffic and/or high bike-vehicle collisions in urban or suburban areas. Separation types range from painted buffers and flexible delineators to more substantial separation with raised curbs, grade separation, bollards, planters, and parking lanes. Additional space may also be provided where pedestrian and bicyclists interact, such as the parking buffer, or loading zones, or extra bike lane width for cyclists to pass one another. Options will range due to roadway characteristics, space, and cost.

Why It Works:

Separated bike lanes provide increased safety and comfort for bicyclists beyond conventional bicycle lanes. By separating bicyclists from motor traffic, “protected” or physically separated bike lanes can offer a higher level of comfort and are attractive to a wider spectrum of the public. Intersections and approaches must be carefully designed to promote safety and facilitate left-turns for bicyclists from the primary corridor to cross street. In combination with this CM, better guidance signs and markings for non-motorized and motorized roadway users should be considered, including: sign and markings directing cyclists on appropriate/legal travel paths and signs and markings warning motorists of non-motorized uses of the roadway that should be expected.

R34PB: Install Sidewalk/Pathway (To Avoid Walking Along Roadway)

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
R34PB	90%	Pedestrian and Bicycle

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
80%	20 years	$35 per linear foot

Countermeasure Description:

This treatment involves installing new sidewalks or pathways to address pedestrian crashes related to people walking along the roadway. This countermeasure cannot be used to replace an existing sidewalk with a wider one unless prior Caltrans approval is included. A walkway is any type of defined space or pathway for use by a person travelling on foot or using a wheelchair.

Where to Use:

Areas noted as not having adequate or no sidewalks and a history of walking along roadway pedestrian crashes. In rural areas asphalt curbs and/or separated walkways may be appropriate.

Why It Works:

Sidewalks and walkways provide people with space to travel within the public right-of-way that is separated from roadway vehicles. The presence of sidewalks on both sides of the street has been found to be related to significant reductions in the “walking along roadway” pedestrian crash risk compared to locations where no sidewalks or walkways exist. Reductions of 50 to 90 percent of these types of pedestrian crashes. In combination with this CM, better guidance signs and markings for non-motorized and motorized roadway users should be considered, including: sign and markings directing pedestrians and cyclists on appropriate/legal travel paths and signs and markings warning motorists of non-motorized uses of the roadway that should be expected.

R35PB: Install/Upgrade Pedestrian Crossing (With Enhanced Safety Features)

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
R35PB	90%	Pedestrian and Bicycle

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
35%	20 years	$50,000 - $100,000 per location

Countermeasure Description:

At many locations, a marked crosswalk alone may not be sufficient to adequately protect non-motorized users. This treatment involves the installation of flashing beacons, curb extensions and other safety features in order to complement the standard crossing elements.

Where to Use:

Roadway segments with no controlled crossing for a significant distance in high-use midblock crossing areas and/or multilane roads locations. Based on a Zegeer study, a marked crosswalk alone may not be sufficient to adequately protect non-motorized users. In these cases, flashing beacons, curb extensions, medians and pedestrian crossing islands and/or other safety features should be added to complement the standard crossing elements.

Why It Works:

Adding pedestrian crossings with enhanced safety features can greatly enhance pedestrian safety. Enhanced safety elements may include curb extensions, pedestrian crossing islands, beacons, and lighting. Combined with pavement markings, this delineates the portion of the roadway designated for pedestrian crossing. Care must be taken to warn drivers of pedestrians crossing the roadway. Guidance signs and markings for non-motorized and motorized roadway users should be considered, including sign and markings directing pedestrians and cyclists on appropriate/legal travel paths and signs. When agencies opt to install aesthetic enhancement to crossing like stamped concrete/asphalt, the project costs can significantly increase. For HSIP applications, these costs must be accounted for in the B/C calculation, but costs over standard crosswalk markings must be tracked separately and are not federally reimbursable.

R36PB: Install Raised Pedestrian Crossing

LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
R36PB	90%	Pedestrian and Bicycle

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
35%	20 years	$25,000 - $50,000

Countermeasure Description:

Raised pedestrian crossings enhanced marked crossing locations by providing a raised crossing that vehicles must navigate over. This treatment should be used in lower-speed roadways and emergency vehicle access should be considered as part of any evaluation of the treatment.

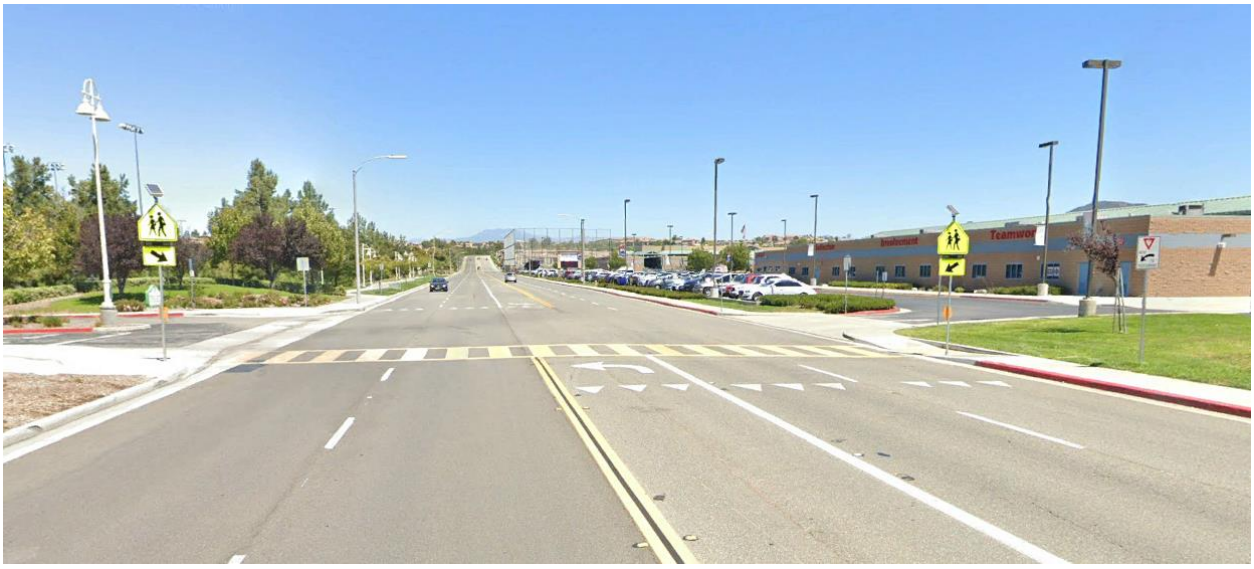
Where to Use:

On lower-speed roadways, where pedestrians are known to be crossing roadways that involve significant vehicular traffic. Based on the Zegeer study (Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations) at many locations, a marked crosswalk alone, may not be sufficient to adequately protect non-motorized users. In these cases, raised crossings can be added to complement the standard crossing elements. Special requirements may apply and extra care should be taken when considering installing raised crossings to ensure unintended safety issues are not created, such as: emergency vehicle access or truck route issues.

Why It Works:

Adding a raised pedestrian crossing has the opportunity to enhance pedestrian safety at locations noted as being especially problematic. The raised crossing encourages motorists to reduce their speed and provides improved delineation for the portion of the roadway that is designated for pedestrian crossing. In combination with this CM, better guidance signs and markings for non-motorized and motorized roadway users should be considered, including: sign and markings directing pedestrians and cyclists on appropriate/legal travel paths.

R37PB: Install Rectangular Rapid Flashing Beacon



LRSM COUNTERMEASURE	FEDERAL FUNDING ELIGIBILITY	CRASH TYPES ADDRESSED
R37PB	90%	Pedestrian and Bicycle

CRASH REDUCTION FACTOR	EXPECTED LIFE	APPROXIMATE COST
35%	20 years	$12,000 per assembly

Countermeasure Description:

This treatment involves installing Rectangular Rapid Flashing Beacons (RRFB) including pedestrian-activated flashing lights and additional signage at mid-block pedestrian crossings.

Where to Use:

Rectangular Rapid Flashing Beacon (RRFB) includes pedestrian-activated flashing lights and additional signage that enhance the visibility of marked crosswalks and alert motorists to pedestrian crossings. It uses an irregular flash pattern that is similar to emergency flashers on police vehicles. RRFBs are installed at unsignalized intersections and mid-block pedestrian crossings.

Why It Works:

RRFBs can enhance safety by increasing driver awareness of potential pedestrian conflicts and reducing crashes between vehicles and pedestrians at unsignalized intersections and mid-block pedestrian crossings. The addition of RRFB may also increase the safety effectiveness of other treatments, such as crossing warning signs and markings.

APPENDIX D

Priority Projects

TABLE OF CONTENTS

DOGWOOD ROAD ROADWAY IMPROVEMENTS

LRSM Countermeasures

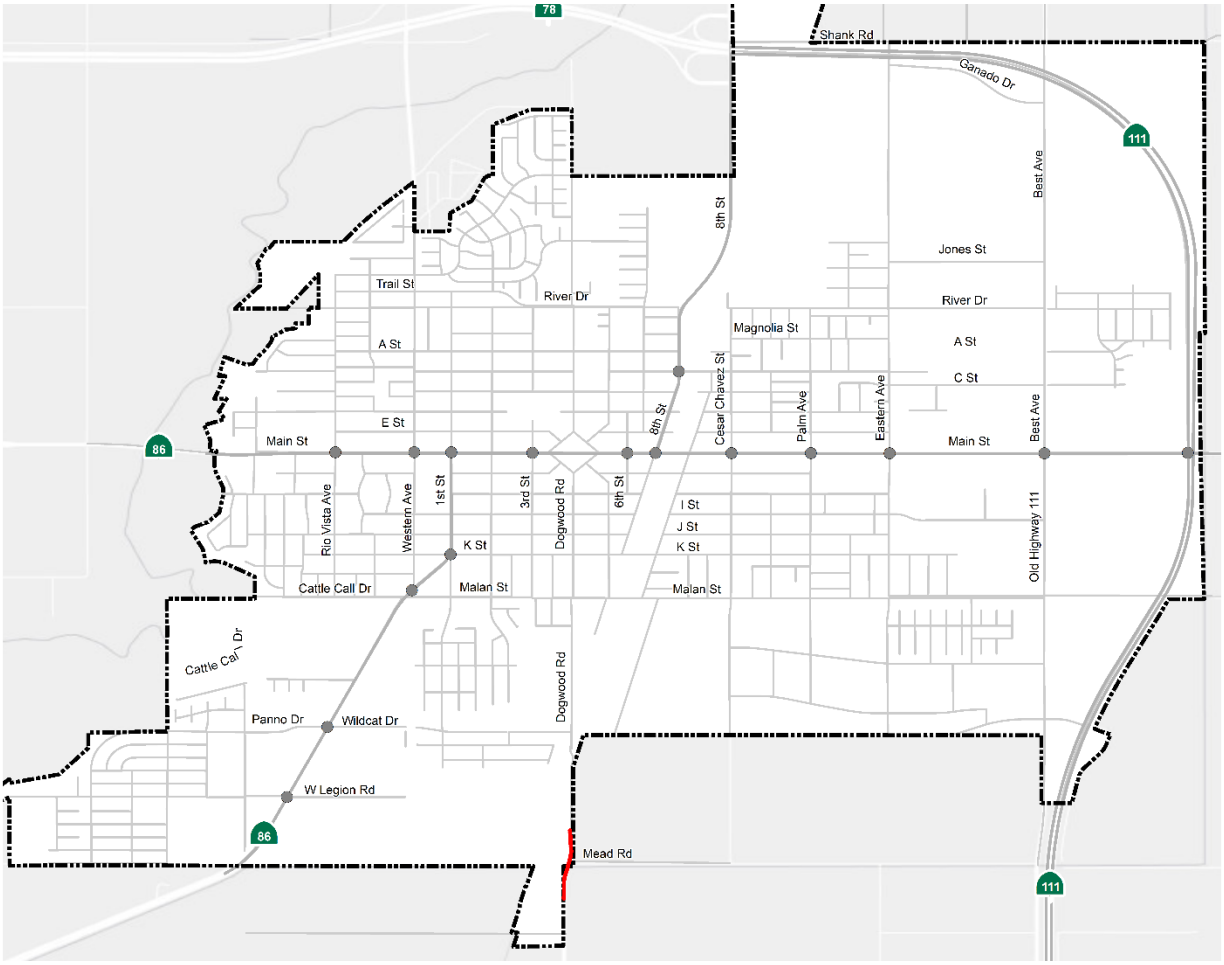
R01 – Add Segment Lighting, R04 – Install Guardrail, R16 – Curve Shoulder Widening (Outside Only)

Project Description

Roadway enhancements that will be included as part of this project include installing LED safety street lighting, installing guardrails, widening the shoulder along the roadway curve, curve warning signage, and edgeline rumble strips.

Project Location

Dogwood Road from 550' south of Mead Road to 750' North of Mead Road



Existing Conditions Photos

Dogwood Rd North of Mead Rd Looking Southbound

Unsignalized intersection lacking lighting on approaches, and safety guardrails.

Dogwood Rd South of Mead Rd Looking Northbound

Unisgnalized intersection lacking lighting on approaches, and safety guardrails.

Crash Analysis

R01: 2 total collisions occurred during the nighttime period along the corridor (2018-2020).

R04/R16: 3 total collisions occurred along the project corridor (2018-2020).

SEVERITY									
FATAL		SEVERE INJURY		OTHER VISIBLE INJURY		COMPLAINT OF PAIN		PROPERTY DAMAGE ONLY	
R01	R04/R16	**R01**	R04/R16	**R01**	R04/R16	**R01**	R04/R16	**R01**	R04/R16
1	1	0	1	0	0	1	1	0	0

COLLISION TYPE									
HEAD-ON		SIDESWIPE		REAR END		BROADSIDE		HIT OBJECT	
R01	R04/R16	**R01**	R04/R16	**R01**	R04/R16	**R01**	R04/R16	**R01**	R04/R16
0	0	0	0	0	0	0	0	1	0
OVERTURNED		VEHICLE/PED		OTHER		NOT STATED			
R01	R04/R16	**R01**	R04/R16	**R01**	R04/R16	**R01**	R04/R16	**R01**	R04/R16
0	1	0	0	1	1	0	0	0	0

PRIMARY COLLISION FACTOR									
DUI		IMPEDING TRAFFIC		UNSAFE SPEED		FOLLOWING TOO CLOSELY		WRONG SIDE OF ROAD	
R01	R04/R16	**R01**	R04/R16	**R01**	R04/R16	**R01**	R04/R16	**R01**	R04/R16
1	1	0	0	1	1	0	0	0	0
IMPROPER PASSING		UNSAFE LANE CHANGE		IMPROPER TURNING		AUTO ROW VIOLATION		PED ROW VIOLATION	
R01	R04/R16	**R01**	R04/R16	**R01**	R04/R16	**R01**	R04/R16	**R01**	R04/R16
0	0	0	0	0	1	0	0	0	0
PED VIOLATION		TRAFFIC SIGNALS AND SIGNS		HAZARDOUS PARKING		LIGHTS		BRAKES	
R01	R04/R16	**R01**	R04/R16	**R01**	R04/R16	**R01**	R04/R16	**R01**	R04/R16
0	0	0	0	0	0	0	0	0	0
OTHER		UNSAFE STARTING OR BACKING		PED OR OTHER DUI		FELL ASLEEP		UNKNOWN OR NOT STATED	
R01	R04/R16	**R01**	R04/R16	**R01**	R04/R16	**R01**	R04/R16	**R01**	R04/R16
0	0	0	0	0	0	0	0	0	0

HSIP Analyzer Detailed Engineer's Estimate for Construction Items

No.	Item Description	Unit	Quantity	Unit Cost	Total	% for CMs	% for OS*	% for NS**
1	Mobilization	LS	1	$30,000	$30,000	0%	0%	0%
2	Traffic Control	LS	1	$20,000	$20,000	0%	0%	0%
3	Water Pollution Control Plan	LS	1	$25,000	$25,000	0%	0%	0%
4	Signing & Striping Improvements	LS	1	$36,640	$36,640	100%	0%	0%
5	Furnish & Install Street Light w/ LED Luminaire and Foundation Complete (includes Conduit and Wiring)	EA	8	$15,000	$120,000	100%	0%	0%
6	Furnish & Install Service Pedestal on New Foundation	EA	1	$7,000	$7,000	100%	0%	0%
7	Topographic Survey	LS	1	$15,000	$15,000	0%	0%	0%
8	Install Rumble Strips	LF	2,685	$2.00	$5,370	0%	100%	0%
9	Install Midwest Guardrail System with 31" Rail Height	LF	195	$80.00	$15,600	100%	0%	0%
10	Alternative In-Line Terminal System	EA	4	$8,000	$32,000	100%	0%	0%
11	Unclassified Excavation (As Required for Roadway and Shoulder Work)	CY	1,040	$40.00	$41,600	100%	0%	0%
12	Class 2 Aggregate Base	CY	780	$140	$109,200	100%	0%	0%
13	Place Asphalt Concrete	TON	510	$130.00	$66,300	100%	0%	0%
14	Rubber Polymer Modified Slurry	SF	38,520	$1.00	$38,520	100%	0%	0%
				Weighted Average (%)		99%	1%	
				Total ($)	$562,230			
*Cost % for Other Safety-Related components; **Cost % for Non Safety-Related components								
				Contingencies, as % of the above "Total" of the construction items	20%	$110,759			
				Total construction cost (rounded up to the nearest hundreds)		$673,000			

HSIP Analyzer Project Cost Estimate

Description	Total Cost	HSIP / TOTAL (%)	HSIP Funds	Local / Other Funds
Preliminary Engineering (PE) Phase				
Environmental	$20,000	90%	$18,000	$2,000
PS&E	$140,000	90%	$126,000	$14,000
Subtotal – PE	$160,000	90%	$144,000	$16,000
Right of Way (ROW) Phase				
Right of Way Engineering	$6,700	90%	$6,030	$670
Appraisals, Acquisitions & Utilities	$60,300	90%	$54,270	$6,030
Subtotal – Right of Way (ROW)	$67,000	90%	$60,300	$6,700
Construction (CON) Phase				
Construction Engineering (CE)	$100,000	90%	$90,000	$10,000
Construction Items	$673,000	90%	$605,700	$67,300
Subtotal – Construction	$773,000	90%	$695,700	$77,300
Project Total	**$1,000,000**	**90%**	**$900,000**	**$100,000**

Project Summary

TOTAL EXPECTED BENEFIT	TOTAL PROJECT COST	BENEFIT COST RATIO
22,090,064	$900,000	22.09

CITYWIDE UNSIGNALIZED PEDESTRIAN CROSSING UPGRADES

LRSM Countermeasures

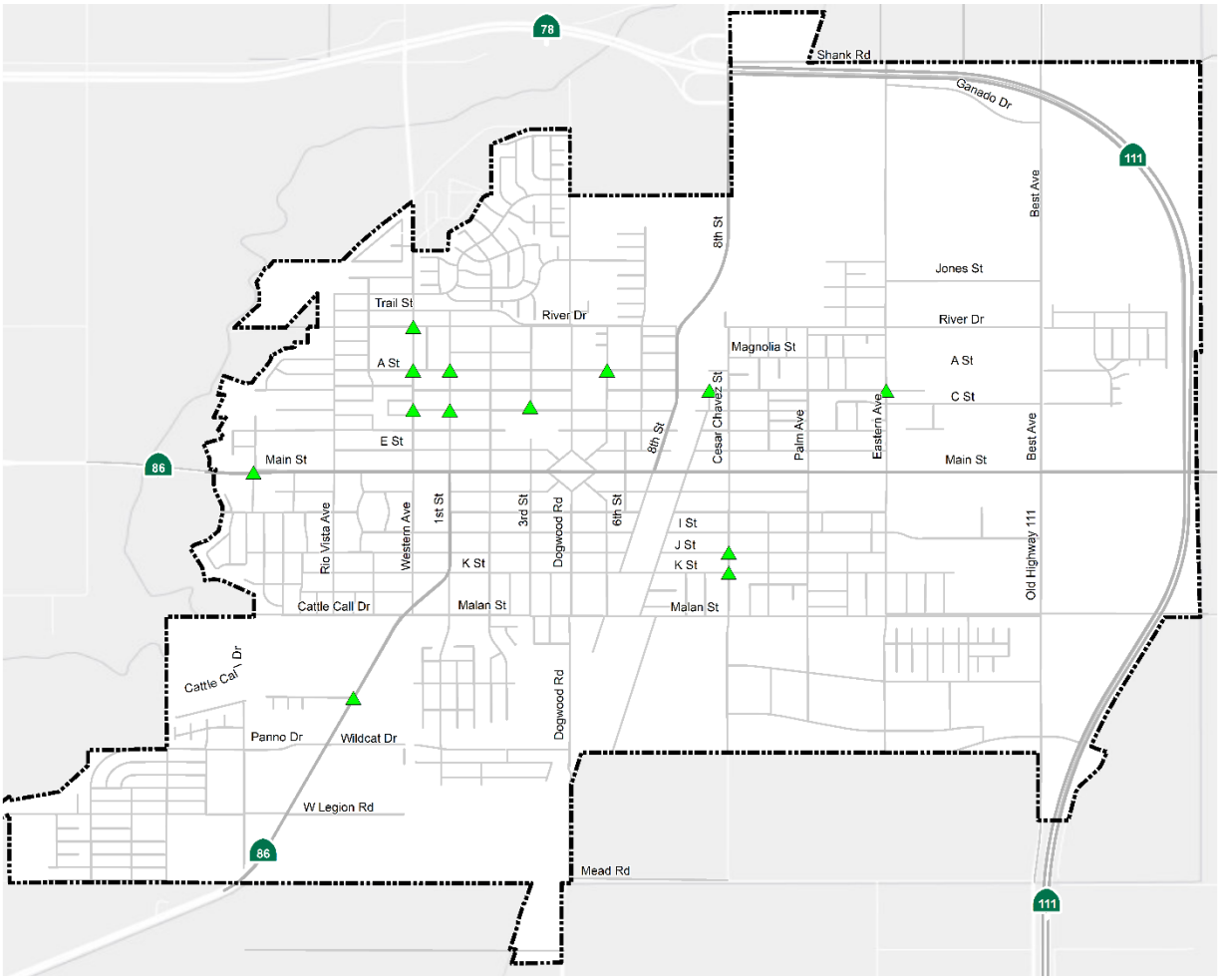
NS21PB – Install/upgrade pedestrian crossing at uncontrolled locations (with enhanced safety features)

Project Description

Project improvements at 13 unsignalized intersection will include installing ADA curb ramps, curb extensions, high-visibility crosswalks, advanced school zone signs and pavement markings, and rectangular rapid flashing beacons (RRFBs).

Project Location

13 unsignalized locations citywide.

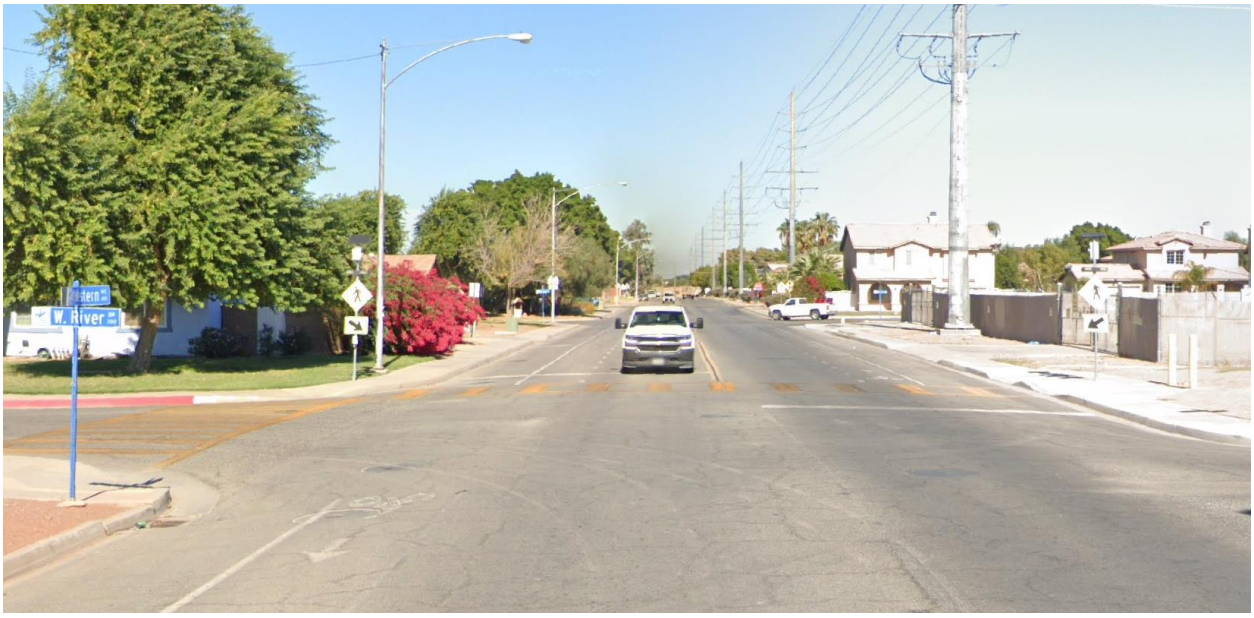


#	Unsignalized Intersection	Proposed Improvement					
		ADA Ramp	High Visibility Crosswalk	Curb Extension	RRFB	School Crossing Sign	AWS / PMs[1]
1	C Street & 1st Street	4	3	0	2	2	2
2	C Street & 3rd Street	3	2	0	2	2	2
3	Western Avenue & C Street	2	1	0	0	0	0
4	Eastern Avenue & B Street	4	4	0	0	0	0
5	Cesar Chavez Street & K Street	4	4	0	0	0	0
6	Cesar Chavez Street & J Street	4	3	0	0	0	0
7	Western Avenue & A Street	4	4	0	0	0	0
8	Western Avenue & River Drive / River Way	3	2	2	2	2	2
9	A Street & 1st Street	4	4	0	2	2	2
10	A Street & 5th Street	3	2	0	2	2	2
11	B Street & N 9th Street	2	1	0	0	0	0
12	SR-86 & Julia Drive	2	1	0	0	0	0
13	Main Street & Las Flores Drive	2	2	0	2	2	2
	Total	**45**	**36**	**2**	**13**	**12**	**12**

[1] Advance Warning Signs & Pavement Markings

Existing Conditions Photos

Western Ave South of River Dr Looking Northbound



Unsignalized intersection lacking ADA compliant pedestrian ramps, RRFBs, curb extentions, and high visibility continental striping.

C St West of 3rd St Looking Eastbound

Unsignalized intersection lacking ADA compliant pedestrian ramps, RRFBs, curb extentions, and high visibility continental striping.

Crash Analysis

NS21PB: 4 total collision involving pedestrians and bicyclists that at unsignalized intersections (2017-2021).

SEVERITY				
FATAL	SEVERE INJURY	OTHER VISIBLE INJURY	COMPLAINT OF PAIN	PROPERTY DAMAGE ONLY
2	0	0	0	0

COLLISION TYPE				
HEAD-ON	SIDESWIPE	REAR END	BROADSIDE	HIT OBJECT
0	0	0	0	0
OVERTURNED	VEHICLE/PED	OTHER	NOT STATED	
0	4	0	0	

PRIMARY COLLISION FACTOR				
DUI	IMPEDING TRAFFIC	UNSAFE SPEED	FOLLOWING TOO CLOSELY	WRONG SIDE OF ROAD
0	0	0	0	0
IMPROPER PASSING	UNSAFE LANE CHANGE	IMPROPER TURNING	AUTO ROW VIOLATION	PED ROW VIOLATION
0	0	0	0	1
PED VIOLATION	TRAFFIC SIGNALS AND SIGNS	HAZARDOUS PARKING	LIGHTS	BRAKES
2	0	0	0	0
OTHER	UNSAFE STARTING OR BACKING	PED OR OTHER DUI	FELL ASLEEP	UNKNOWN OR NOT STATED
0	1	0	0	0

HSIP Analyzer Detailed Engineer's Estimate for Construction Items

No.	Item Description	Unit	Quantity	Unit Cost	Total	% for CMs	% for OS*	% for NS**
1	Mobilization	LS	1	$30,000	$30,000	0%	0%	0%
2	Traffic Control	LS	1	$20,000	$20,000	0%	0%	0%
3	Signing & Striping Improvements	LS	1	$116,000	$116,000	100%	0%	0%
4	Install ADA Curb Ramp	EA	41	$6,000	$246,000	100%	0%	0%
5	Install Curb Bulb-Out (includes Demo)	EA	2	$25,000	$50,000	100%	0%	0%
6	Install Rectangular Rapid Flashing Beacon	EA	10	$20,000	$200,000	100%	0%	0%
				Weighted Average (%)		100%	0%	
				Total ($)	$649,000			
*Cost % for Other Safety-Related components; **Cost % for Non Safety-Related components								
				Contingencies, as % of the above "Total" of the construction items	10%	$64,900			
				Total construction cost (rounded up to the nearest hundreds)		$713,900			

HSIP Analyzer Project Cost Estimate

Description	Total Cost	HSIP / TOTAL (%)	HSIP Funds	Local / Other Funds
Preliminary Engineering (PE) Phase				
Environmental	$5,000	90%	$4,500	$500
PS&E	$92,500	90%	$83,250	$9,250
Subtotal – PE	$97,500	90%	$87,750	$9,750
Right of Way (ROW) Phase				
Right of Way Engineering	$0	90%	$0	$0
Appraisals, Acquisitions & Utilities	$0	90%	$0	$0
Subtotal – Right of Way (ROW)	$0	90%	$0	$0
Construction (CON) Phase				
Construction Engineering (CE)	$97,500	90%	$87,750	$9,750
Construction Items	$713,900	90%	$642,510	$71,390
Subtotal – Construction	$811,400	90%	$730,260	$81,140
Project Total	**$908,900**	**90%**	**$818,010**	**$90,890**

Project Summary

TOTAL EXPECTED BENEFIT	TOTAL PROJECT COST	BENEFIT COST RATIO
15,920,804	$908,900	17.52

MAIN ST & 8TH ST SIGNALIZED PEDESTRIAN CROSSING UPGRADE

HSIP Set-Aside

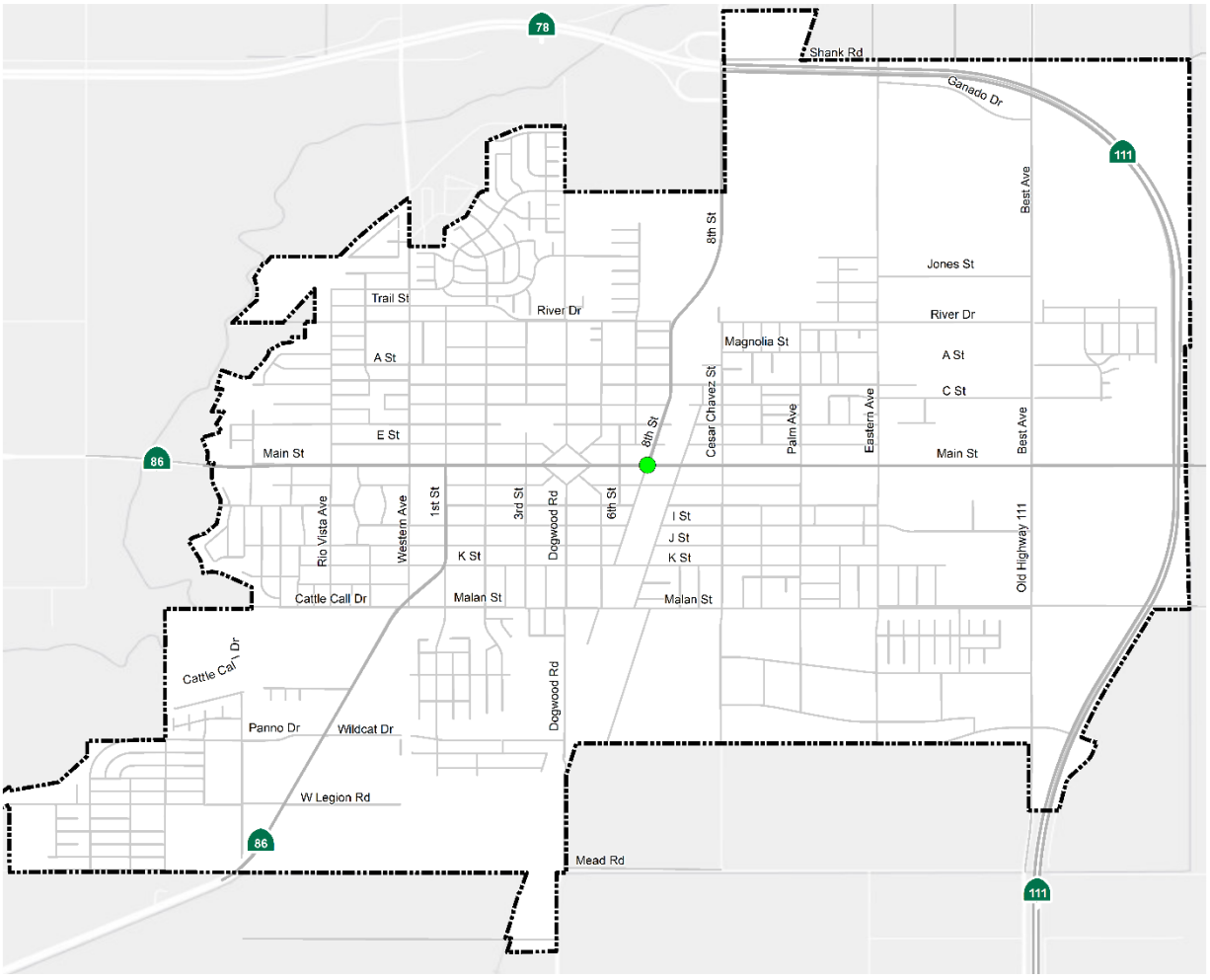
Pedestrian Crossing Enhancements

Project Description

Pedestrian crossing upgrades including curb extentions, pedestrian countdown signal heads, LED lighting, upgraded traffic signal mast arm assembly, and high visibility crosswalk striping.

Project Location

Main Street & 8th Street



Existing Conditions Photos

8th St North of Main St Looking Southbound

Signalized intersection lacks ADA compliant curb ramps, high-visibility crosswalks and LED safety lighting.

8th St South of Main St Looking Northbound

Signalized intersection lacks ADA compliant curb ramps, high-visibility crosswalks and LED safety lighting.

Crash Analysis

Not applicable for HSIP Funding Set-Aside projects

HSIP Analyzer Detailed Engineer's Estimate for Construction Items

No.	Item Description	Unit	Quantity	Unit Cost	Total	% for SA	% for OS*	% for NS**
1	Mobilization	LS	1	$30,000	$30,000	0%	0%	0%
2	Traffic Control	LS	1	$20,000	$20,000	0%	0%	0%
3	Storm Water Pollution Prevention Plans & Best Management Practices	LS	1	$3,000	$3,000	0%	0%	0%
4	Signing & Striping Improvements	LS	1	$15,000	$15,000	100%	0%	0%
5	RS Existing Traffic Signal Equipment	LS	1	$10,000	$10,000	100%	0%	0%
6	RS Existing Safety Light Fixture. Furnish & Install LED Safety Light Fixture	EA	2	$1,250	$2,500	100%	0%	0%
7	Furnish and Install 24-3-100 Pole (30' Ht.), 35' Sig MA, 15' Lum MA w/ LED Fixture, Equipment per Plan.	EA	1	$35,000	$35,000	100%	0%	0%
8	Demo Median Curb & Install New Median Curb Nose	LS	1	$7,000	$7,000	100%	0%	0%
9	Install ADA Pedestrian Curb Ramp	EA	4	$7,500	$30,000	100%	0%	0%
10	Install Curb Bulb-Out (Includes Demo)	LS	1	$30,000	$30,000	100%	0%	0%
			Weighted Average (%)			100%		
					$182,500			
*Cost % for Other Safety-Related components; **Cost % for Non Safety-Related components								
			Contingencies, as % of the above "Total" of the construction items	10%	$18,500			
			Total construction cost (rounded up to the nearest hundreds)		$200,800			

HSIP Analyzer Project Cost Estimate

Description	Total Cost	HSIP / TOTAL (%)	HSIP Funds	Local / Other Funds
Preliminary Engineering (PE) Phase				
Environmental	$2,900	90%	$2,610	$290
PS&E	$44,000	90%	$39,600	$4,400
Subtotal – PE	$46,900	90%	$42,210	$4,670
Right of Way (ROW) Phase				
Right of Way Engineering	$0	90%	$0	$0
Appraisals, Acquisitions & Utilities	$0	90%	$0	$0
Subtotal – Right of Way (ROW)	$0	90%	$0	$0
Construction (CON) Phase				
Construction Engineering (CE)	$30,000	90%	$27,000	$3,000
Construction Items	$200,800	90%	$180,720	$20,080
Subtotal – Construction	$230,800	90%	$207,720	$23,080
Project Total	**$277,700**	**90%**	**$249,930**	**$27,770**

IMPERIAL AVE & D ST PEDESTRIAN SCHOOL CROSSING UPGRADE

HSIP Set-Aside

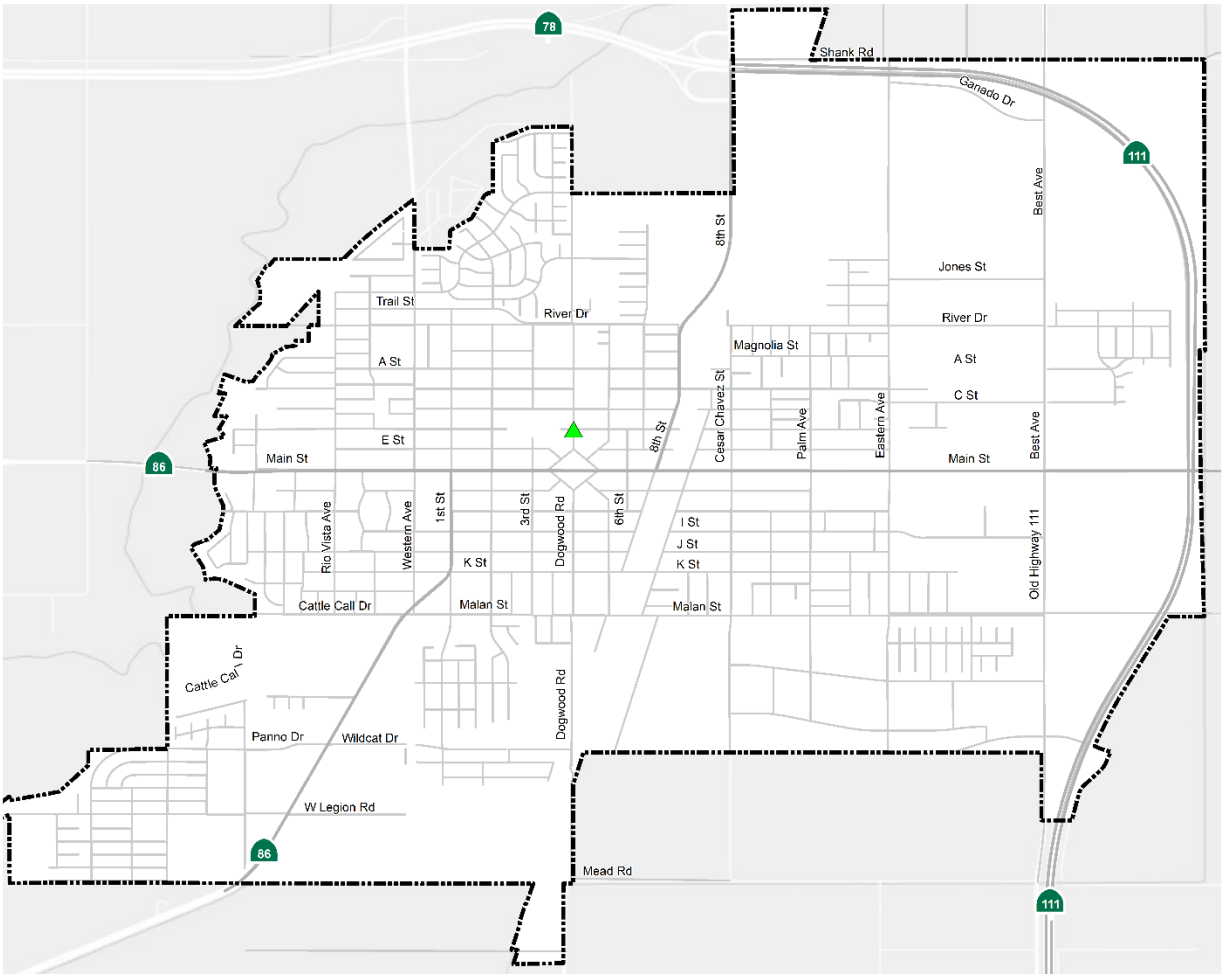
Pedestrian Crossing Enhancements

Project Description

Project improvements to include installing ADA curb ramps, curb extensions, high-visibility crosswalks, advanced school zone signs and pavement markings, and RRFBs.

Project Location

Imperial Avenue & D Street



Existing Conditions Photos

Imperial Ave South of D St Looking Northbound

Unisgnalized intersection lacking ADA compliant pedestrian ramps, RRFBs, curb extentions, pedestrian refuge island, and high visibility continental striping.

Imperial Ave North of D St Looking Southbound

Unisgnalized intersection lacking ADA compliant pedestrian ramps, RRFBs, curb extentions, pedestrian refuge island, and high visibility continental striping.

Crash Analysis

Not applicable for HSIP Funding Set-Aside projects

HSIP Analyzer Detailed Engineer's Estimate for Construction Items

No.	Item Description	Unit	Quantity	Unit Cost	Total	% for SA	% for OS*	% for NS**
1	Mobilization	LS	1	$30,000	$30,000	0%	0%	0%
2	Traffic Control	LS	1	$20,000	$20,000	0%	0%	0%
3	Signing & Striping Improvements	LS	1	$10,000	$10,000	100%	0%	0%
4	Install ADA Curb Ramp	EA	4	$6,000	$24,000	100%	0%	0%
5	Install Curb Bulb-Out (includes Demo)	EA	2	$25,000	$50,000	100%	0%	0%
6	Install Rectangular Rapid Flashing Beacon	EA	10	$20,000	$60,000	100%	0%	0%
7	Install Pedestrian Refuge Island	EA	1	$25,000	$25,000	100%	0%	0%
				Weighted Average (%)		100%	0%	
				Total ($)	$194,000			
*Cost % for Other Safety-Related components; **Cost % for Non Safety-Related components								
				Contingencies, as % of the above "Total" of the construction items	10%	$19,400			
				Total construction cost (rounded up to the nearest hundreds)		$213,400			

HSIP Analyzer Project Cost Estimate

Description	Total Cost	HSIP / TOTAL (%)	HSIP Funds	Local / Other Funds
Preliminary Engineering (PE) Phase				
Environmental	$2,500	90%	$2,250	$250
PS&E	$32,500	90%	$29,250	$3,250
Subtotal – PE	$35,000	90%	$31,500	$3,500
Right of Way (ROW) Phase				
Right of Way Engineering	$0	90%	$0	$0
Appraisals, Acquisitions & Utilities	$0	90%	$0	$0
Subtotal – Right of Way (ROW)	$0	90%	$0	$0
Construction (CON) Phase				
Construction Engineering (CE)	$29,100	90%	$26,190	$2,910
Construction Items	$213,400	90%	$192,060	$21,340
Subtotal – Construction	$242,500	90%	$218,250	$24,250
Project Total	**$277,500**	**90%**	**$249,750**	**$27,750**