

City of San Bernardino

LOCAL ROADWAY SAFETY PLAN

NOVEMBER 2022

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1.0 EXECUTIVE SUMMARY

The California Department of Transportation (Caltrans) established a program for cities to prepare a Local Roadway Safety Plan (LRSP) to identify safety needs and recommend projects to address these needs. This document serves as the LRSP for the City of San Bernardino.

1.1 OVERVIEW

An LRSP analyzes collision data, assesses infrastructure deficiencies through an inventory of roadway system elements, and identifies roadway safety solutions on a citywide basis. The LRSP was created by the State to help local agencies develop safety projects that can be submitted for funding by the Highway Safety Improvement Program (HSIP). HSIP cycles require an LRSP or equivalent plans such as a Vision Zero Plan or System Safety Analysis Report. This document will guide roadway safety measures that can be achieved through a variety of funding sources, including but not limited to HSIP.

This report has been prepared per Caltrans LRSP guidelines and the *Caltrans Local Roadway Safety Manual* (LRSM) version 1.6 dated June 2022. The general content of this LRSP report follows this outline:

- Crash data source and analysis techniques
- Crash data analysis results and highest occurring crash types
- High-risk corridor and intersection analysis and safety countermeasures
- Cost estimates of recommended improvements
- Prioritization of projects based on cost-benefit ratio and effectiveness of safety improvement
- Strategies for safety project implementation
- Traffic safety analysis based on Office of Traffic Safety (OTS) data

The LRSP fulfills the following purposes:

- Identify the highest occurring collision types and the roadway characteristics contributing to the collisions.
- Identify high-risk corridors and intersections.
- Propose safety countermeasures to address the safety issues.
- Prioritize safety improvement projects based on benefit/cost ratio and other considerations.

1.2 PROMINENT COLLISION PATTERNS

The collision trend analysis draws from the five years of data obtained from SWITRS collision records. From January 1, 2016 to December 31, 2020, 8,855 collisions occurred in the City of San Bernardino, inclusive of collisions on both City streets and state highways (such as SR-66 or SR-18) within the City. Collisions on the Interstate system and grade separated state highways (such as I-215 or SR/I-210) were not included; collisions at the intersection of highway ramps and a local street were included. These collisions occurred on alignments that are grade-separated from City streets, and not part of the scope of this analysis or in the immediate jurisdiction of the City. Out of the collisions within the City's jurisdiction, 311 resulted in fatal or severe injuries.

Five years of collision records were utilized from January 2016 to December 2020, adhering to the maximum period permitted by the HSIP for a safety infrastructure project application for federal funding. The collisions were categorized by severity, collision type, Primary Collision Factor (referred to as "PCF", is the probable, main factor that contributing to the cause of the collision, as determined by the officer

taking the collision report.), involved parties, lighting conditions, and facility type (signalized intersections, non-signalized intersections, and mid-block locations). The following summarizes the collision patterns within the City:

- The most common collision types were broadside, rear-end, sideswipe, and hit object.
- Pedestrian-related collisions accounted for approximately 6% of total collisions, but about 33% of fatal and severe injury collisions.
- The most common Primary Collision Factors (PCFs) for broadside collisions are automobile right-of-way violations and signals/signage violations.
- The most common Primary Collision Factor (PCF) for rear-end collisions is unsafe speed.

1.3 SAFETY EMPHASIS AREAS

The following transportation safety emphasis areas were identified based on the collision data analysis:

- Pedestrian Safety
- Unsafe Speeds
- Intersection Safety
- Driving Under the Influence
- School Collisions

The LRSP recommends engineering and non-engineering countermeasures which help to address the identified emphasis areas derived from the collision analysis. Concerns and recommended improvements were discussed with City staff and stakeholders, including law enforcement and the fire department, Omnitrans, Caltrans, school districts and neighborhood association representatives.

Some of the engineering countermeasures recommended for multiple locations in the City include:

- Upgrade intersection pavement markings
- Improve signal hardware: lenses, back-plates with retroreflective borders, mounting, size, and number
- Install pedestrian crossing at uncontrolled locations
- Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs

Additionally, engineering analysis recommended other safety countermeasures to address high collision locations on a location by location basis. Funding for engineering countermeasures listed in the LRSP are available from the Highway Safety Improvement Program (HSIP) and funding sources listed below.

In addition to the infrastructure improvements mentioned above, non-engineering safety measures address traffic safety concerns through education, encouragement, and enforcement. Several state and federal grant programs offer funds for non-engineering roadway safety projects, listed below:

- CTC Active Transportation Program
- SCAG Sustainable Communities Grant Program
- USDOT Safe Streets and Roads for All
- CA Office of Traffic Safety Grants (Non-engineering countermeasures)

In addition to these programs, the 2021 Infrastructure Investment and Jobs Act (IIJA) has begun to program additional discretionary grant and formula funding programs focused on roadway safety, active transportation and mobility technology improvements. These programs should be considered as they are programmed and incorporated into the City's infrastructure funding strategies.

2.0 INTRODUCTION

KOA Corporation (KOA) has been retained by the City of San Bernardino to develop a Local Roadway Safety Plan (LRSP). Traditionally, agencies have selected safety projects based on historical crash records, focusing on sites with a concentration of recent severe collisions. By contrast, the LRSP shares a similar framework with the California Statewide Strategic Highway Safety Plan (SHSP), which focuses on engineering and non-engineering solutions to roadway safety issues. The LRSP identifies the most common collision categories across a roadway network to target projects that address the factors associated with those categories. By focusing on causal factors rather than collisions, the LRSP allows agencies to assess risks before a collision occurs. Systemic improvements target a broader geography than the traditional spot location improvements. The systemic project selection favors the broad implementation of cost-effective countermeasures.

2.1 FOUR E'S OF SAFETY

The LRSP not only focuses on engineering improvements to mitigate crashes, but also addresses other safety improvements in key areas that include enforcement, education, and emergency services. According to the SHSP 2020-2024, two-thirds of all crashes are the result of aggressive driving. Male drivers are more likely to be at fault in aggressive driving-related crashes regardless of age. Making roadways safer requires the Four E's to be involved (Engineering, Enforcement, Education, and Emergency Services). Working together with the Four E's at the jurisdiction level will help make city roads safer through a comprehensive. Recently, Federal and State agencies have also considered Emerging Technologies and Equity as additional E's to improve traffic safety. For instance, considering the use of emerging technologies such as "smart" traffic signal equipment can serve to connect vehicles and traffic control systems to enhance traffic safety.

2.2 PURPOSE OF THE LRSP

The LRSP systematically identifies and analyzes safety problems and recommends safety improvements. Preparing the LRSP facilitates collaboration through the development of partnerships between San Bernardino and stakeholders, which includes the city's Police and Fire Departments, school districts serving the City, relevant transportation agencies, the County of San Bernardino Public Health Department, and community groups such as the San Bernardino Neighborhood Council. The results of the LRSP are summarized with a set of systemic recommendations to be implemented citywide, and a prioritized list of improvements and actions at specific locations. The LRSP offers a proactive approach to addressing roadway safety needs in San Bernardino.

2018 SYSTEMIC SAFETY ANALYSIS REPORT (SSAR)

In 2018, the City completed a Systemic Safety Analysis Report, which undertook similar analytical approach to analyzing crash patterns in San Bernardino. The SSAR was also focused on assessing the sign and signal infrastructure in the City, and provided a limited set of recommendations, including:

- Sign replacements to improve retro-reflectivity
- Advanced dilemma detection and signal timing improvements on five major arterials
- Various traffic signal hardware improvements citywide

The SSAR also had less focus on stakeholder outreach and policy or programming recommendations.

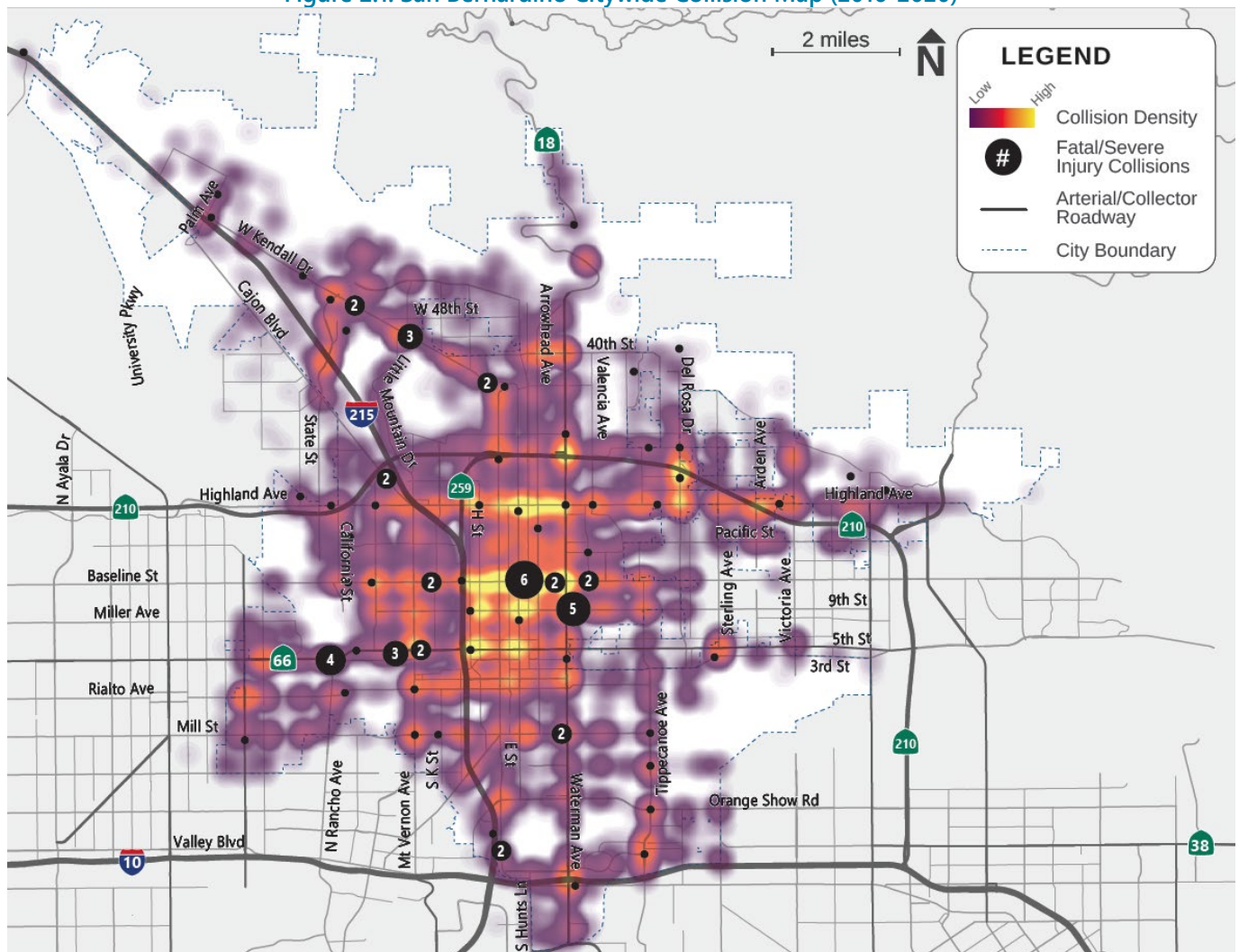
Nonetheless, the City was awarded \$9.8 million in HSIP funds to implement many of the SSAR’s recommended improvements.

2.3 CITY OF SAN BERNARDINO

San Bernardino is the largest incorporated city in, and county seat of, San Bernardino County, California. According to the 2010 US Census, San Bernardino had a population of 222,101; the US Census estimated the 2021 population at 222,203.

Based on the Statewide Integrated Traffic Records System (SWITRS) database, from 2016 to 2020, a total of 8,855 collisions occurred in the City of San Bernardino, inclusive of collisions on both City streets and state highways (such as SR-66 or SR-18) within the City. Collisions on the Interstate system and grade separated state highways (such as I-215 or SR/I-210) were not included; collisions at the intersection of highway ramps and a local street were included. These collisions occurred on alignments that are grade-separated from City streets, and not part of the scope of this analysis or in the immediate jurisdiction of the City. Out of these collisions, 311 resulted in fatal or severe injuries. Figure 2.1 is a heat map of all collisions citywide, and locations counts of where collisions resulted in serious injury or death.

Figure 2.1: San Bernardino Citywide Collision Map (2016-2020)



2.4 LRSP OVERVIEW

The following sections include a brief description of the tasks associated with the development of this LRSP, with a more detailed description of each task in subsequent sections of this document.

2.4.1 DATA COLLECTION

A comprehensive Geographic Information Systems (GIS) project database was developed by utilizing the following data:

- Five years (1/1/2016 to 12/31/2020) of collision data collected via the SWITRS collision database
- Traffic count information
- Base map with street centerlines, traffic signal locations, and other contextual information

2.4.2 SAFETY DATA ANALYSIS

Following collection of data, the collision data was analyzed for San Bernardino. Collisions were compared to the safety emphasis areas as defined in the California SHSP. The safety data analysis is summarized in Section 4 of this document. The transportation emphasis areas are identified based on the collision data analysis and are discussed in Section 5 of this document.

High Priority Challenge Areas:

- Pedestrian Safety
- Unsafe Speed
- Intersection Safety
- Driving Under the Influence
- School Collisions

2.4.3 IDENTIFY SAFETY MEASURES

In coordination with city staff, a list of engineering-related safety countermeasures and non-engineering safety measures were developed for use as recommendations in this LRSP. These countermeasures are discussed in Section 6 and Section 7 of this document.

2.4.4 DEVELOP SAFETY PROJECTS & COST ESTIMATES

Roadways and intersections were ranked based on the collision frequency and EPDO (equivalent property damage only) scores. The top locations of interest were investigated to determine appropriate safety improvements. The improvements include new traffic signals, additional signal heads at existing signalized intersections, and new bicycle facilities. Planning-level cost estimation are provided for each safety project. The list of safety projects are prioritized based on the following considerations:

- Benefit/Cost Ratio (for engineering solutions only)
- Funding availability for engineering and non-engineering programs
- Stakeholder input
- Other factors recommended by city staff

The safety projects and cost estimates are discussed in Section 8 of this document.

2.5 POLICY AND PROGRAMMING SUMMARY

The following section includes a information about the various planning and policy documents that

support increased roadway safety in the City of San Bernardino. Several of them are in the process of being updated at the time of the LRSP's writing (General Plan Elements, SRTS Phase IV Implementation). All page numbers reference the individual plan documents, several of which employ section page numbering, instead of a standard page numbering sequence.

2.5.1 CITY OF SAN BERNARDINO GENERAL PLAN – CIRCULATION ELEMENT (2005)

The purpose of the Circulation Element is to “design and improve a circulation system to meet the current and future needs of all its residents” (p. 6-1). Its Vision Statement includes a desire to “expand the safety of our streets and neighborhoods” (p. 6-3).

The Element is heavily reliant on Level of Service (LOS) standards as they relate to traffic congestion (p. 6-15). The City considers minimum acceptable levels of service as “C” for roadways and “D” for intersections (p. 6-16). Mitigation measures in the Element prioritize LOS improvement (p. 6-19).

Mobility Priorities

The Element outlines the following vision as the basis for safe travel in San Bernardino:

Our street system needs to be safe, not only for vehicular travel, but for pedestrians and bicyclists too. Our street system needs to accommodate more than cars. Pedestrians, bicyclists, as well as landscaping, signs, gateways, and infrastructure all need to coexist within our street right-of-ways in a manner that is safe and aesthetically pleasing. Advanced technologies in traffic control and operations should be employed to maximize the capacity and efficiency of the arterial system (p. 6-23).

Goals and Policies

Circulation Element goals that are consistent with roadway safety include:

- **Goal 6.1:** Provide a well-maintained street system. (p. 6-23)
- **Goal 6.3:** Provide a safe circulation system. (p. 6-24)
- **Goal 6.5:** Develop a transportation system that reduces conflicts between commercial trucking, private/public transportation, and land uses. (p. 6-27)
- **Goal 6.6:** Promote a network of multi-modal transportation facilities that are safe, efficient, and connected to various points of the City and the region. (p. 6-28)

City policies that are consistent with roadway safety include:

- **Policy 6.1.1:** Maintain and rehabilitate all components of the circulation system, including roadways, sidewalks, bicycle facilities and pedestrian facilities. (p. 6-23)
- **Policy 6.2.5:** Design roadways, monitor traffic flow, and employ traffic control measures (e.g. signalization, access control, exclusive right and left turn-turn lanes, lane striping, and signage) to ensure City streets and roads continue to function safely within our Level of Service standards. (p. 6-24)
- **Policy 6.2.6:** Improve intersection operations by modifying signal timing at intersections and coordinating with other signals, as appropriate. (p. 6-24)
- **Policy 6.2.7:** Install new signals as warranted. (p. 6-24)
- **Policy 6.3.2:** Discourage high speeds and through traffic on local streets through traffic control devise such as signage, speed bumps, etc. as acceptable by the local neighborhood. (p. 6-25)

- **Policy 6.3.5:** Limit direct access from adjacent private properties to arterials to maintain an efficient and desirable quality of traffic flow. (p. 6-25)
- **Policy 6.3.6:** Locate new development and their access points in such a way that traffic is not encouraged to utilize local residential streets and alleys. (p. 6-25)
- **Policy 6.3.7:** Require that adequate access be provided to all developments in the City including secondary access to facilitate emergency access and egress. (p. 6-25)

2.5.2 CITY OF SAN BERNARDINO GENERAL PLAN – PUBLIC FACILITIES AND SERVICES ELEMENT (2005)

This Element intends to promote “high quality public services and facilities such as fire protection, law enforcement, libraries, and schools [which] significantly influence the health and viability of our residential, commercial, and industrial communities” (7-2).

It also notes: “Our two major educational institutions, California State University, San Bernardino and the San Bernardino Valley College, must be fully integrated with the rest of the City through physical linkages...” (p. 7-2)

Goals and Priorities

Policies consistent with roadway safety include:

- **Policy 7.2.2:** Assess the effects of increases in development density and related traffic congestion on the provision of adequate facilities and services ensuring that new development will maintain fire protection services of acceptable levels. (p 7-7)

2.5.3 SAN BERNARDINO ACTIVE TRANSPORTATION PLAN (2022)

The City of San Bernardino Active Transportation Plan (adopted by Council in July 2022) promotes a walkable and bikeable future for the City of San Bernardino. It establishes a number of goals and recommendations that seek safety improvements for pedestrians and cyclists using roadways in the City, and lays out a roadmap for the implementation of active transportation facilities, programs and policy change recommendations. The ATP’s proposed network, which includes multi-modal corridors, school routes, and community connectors, is shown in **Figure 2.2**.

Goals (p. 44)

- **Connectivity:** Improve the walkability and bikeability of the City of San Bernardino by creating a local network of connected bicycle and pedestrian facilities.
- **Local Access & Mobility:** Provide the City of San Bernardino residents greater access to transit, jobs, goods, services, schools, and parks without the need to drive a car.
- **Safety:** Improve the overall safety of people walking, biking, and riding public transportation in the City of San Bernardino through infrastructure and programming strategies.
- **Health & Environment:** Prioritize strategies that will improve public health conditions and reduce the impacts of driving on the environment in the City of San Bernardino.
- **Funding & Implementation:** Provide strategies to fund and implement infrastructure and non-infrastructure programs that support Plan recommendations.

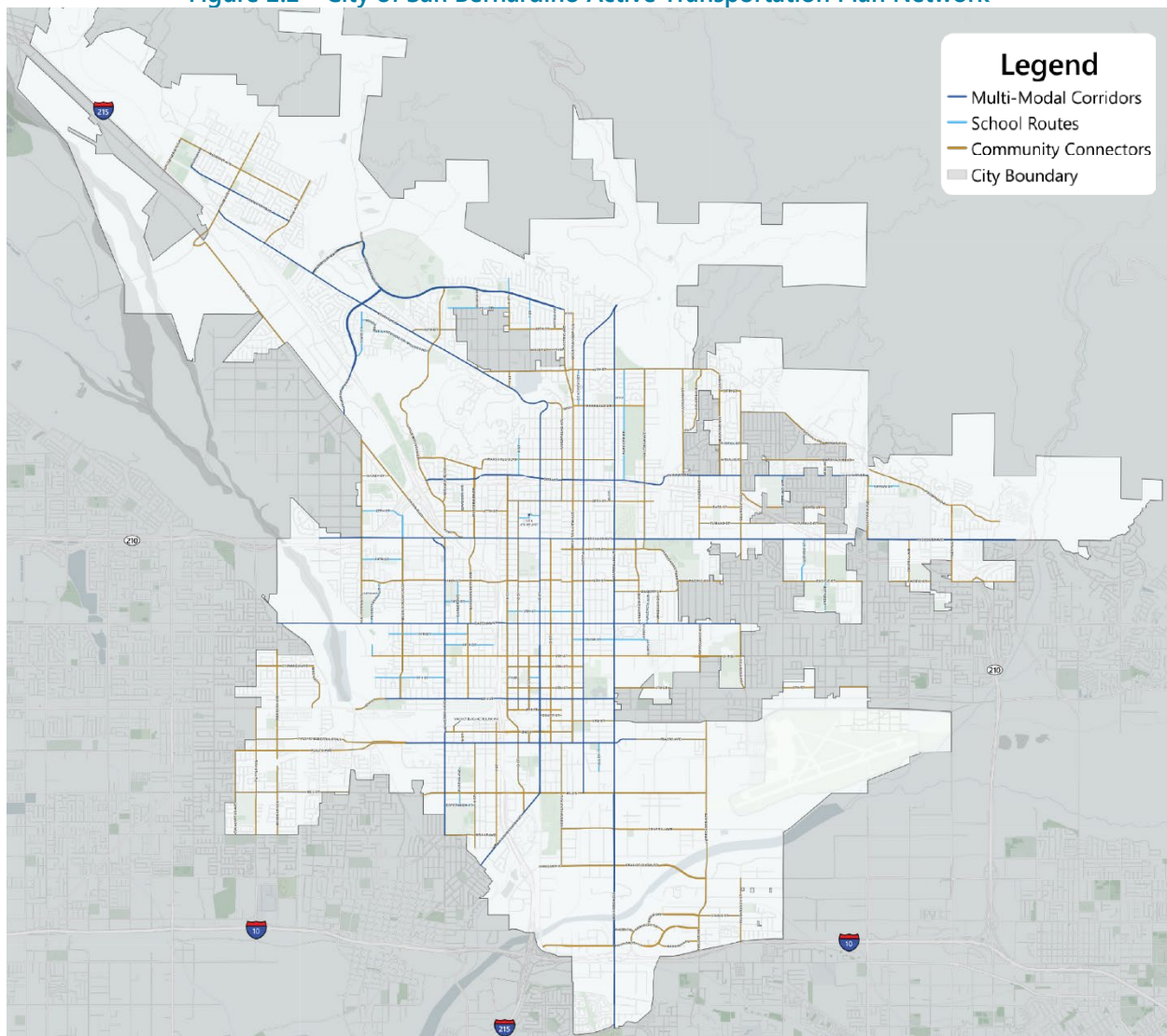
Strategies (p. 44)

The Plan recommends a number of strategies within each goal; the following strategies pertain to

roadway safety:

- **Strategy 1.3:** Develop Standard Plans for common active transportation infrastructure such as sidewalks, driveways, curb ramps, crosswalks, pedestrian-scale lighting, and bike facilities.
- **Strategy 2.6:** Develop a comprehensive citywide streetscape plan.
- **Strategy 3.2:** Provide traffic calming infrastructure improvements and identify opportunities to update signal timing and phasing at locations with high collision frequencies across the city. Reference the Local Road Safety Plan for projects.
- **Strategy 3.3:** Conduct a study to re-evaluate speeds along the City’s roadways in response to Assembly Bill 43, Traffic Safety.
- **Strategy 3.4:** Assess and implement enhanced crossing treatments to reduce pedestrianautomobile collisions at multi-lane crossings, including median refuge islands, rapid-rectangular flashing beacons, pedestrian hybrid beacons, raised crosswalks, and other treatments.
- **Strategy 3.6:** Develop a program to review traffic signal locations with prohibited pedestrian crossings and where feasible and appropriate, modify to restore prohibited crossings.

Figure 2.2 – City of San Bernardino Active Transportation Plan Network



2.5.4 SAN BERNARDINO COUNTY REGIONAL SAFE ROUTES TO SCHOOL PLAN (2015, 2017)

The San Bernardino County Regional Safe Routes to School Plan establishes a strategic vision for the safety and accessibility of non-motorized transportation networks around San Bernardino County schools. Phase I was completed in 2015, and Phase II was completed in 2017. Among the listed objectives of Phases I and II of the Plan are:

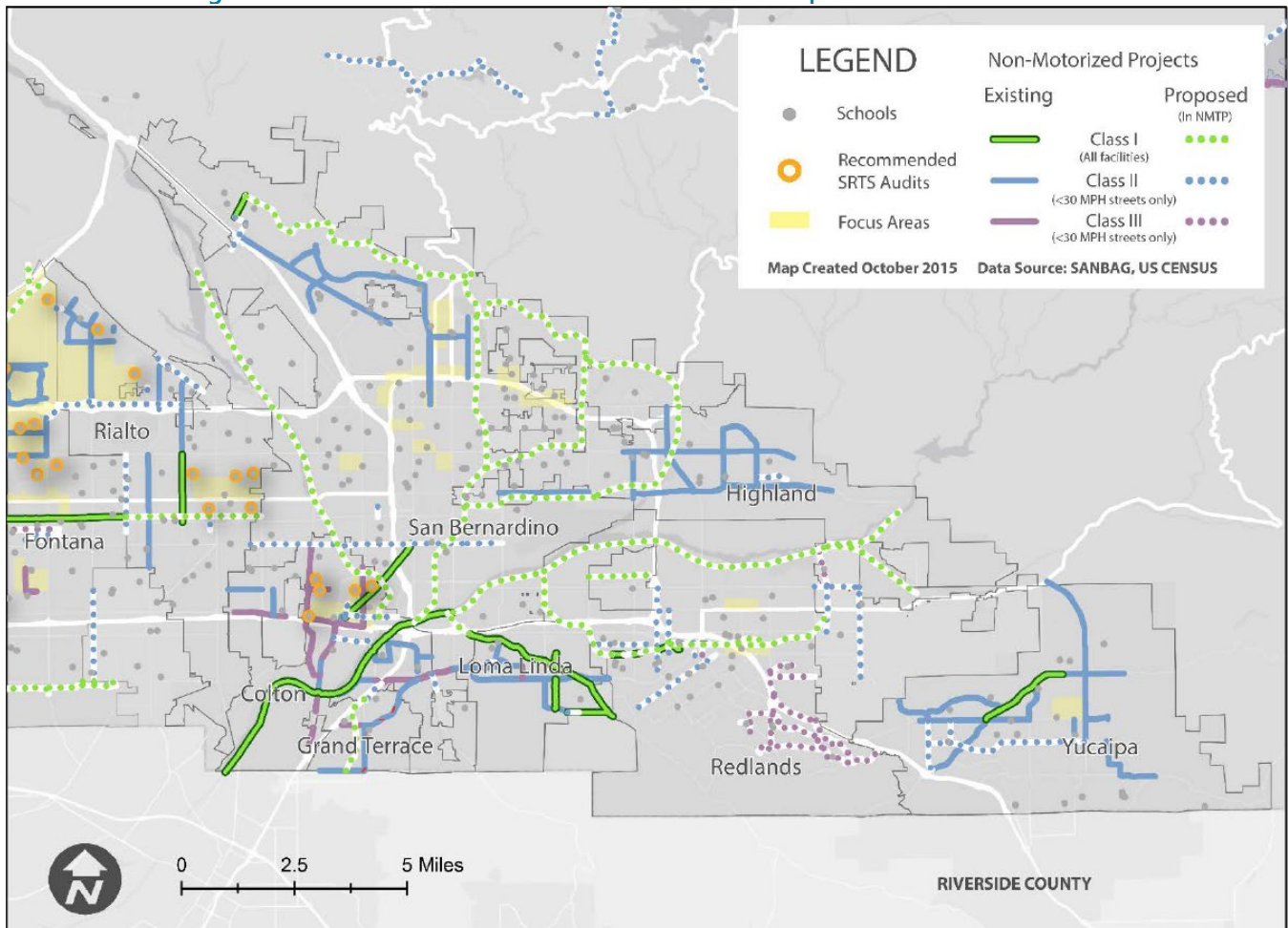
- Integrate Safe Routes to School corridors with Countywide active transportation efforts including the other components of the [County] Active Transportation Plan.
- Address both actual and perceived safety concerns, together with strategies that could significantly decrease bicycle and pedestrian fatalities and injuries.
- Define a series of possible implementation efforts to identify and remove barriers, over time, to active transportation for all of the schools in the County.
- Develop a student data collection strategy to document the benefits of active transportation in order to leverage more SRTS funding for local jurisdictions.

Pertaining to roadway safety and interaction with other documents in place, the Plan notes:

- Many of the Non-Motorized Transportation Plan (NMTP) proposed facilities are bike lanes or routes on major roads, which are considered unsuitable for children getting to school, due to high vehicular speeds and volumes.
- Five schools noted significant barriers to implementing SRTS programs at their schools. Reasons cited include parents, guardians, and babysitters that choose to not follow the traffic rules or pick up/drop off guidelines, a lack of sidewalks, parental concerns about trip distances and traffic safety, liability concerns about walk to school programs, and not knowing about the options.

Figure 2.3 below shows the SRTS focus areas and the long-term approach to an active transportation school commute network. Class II and Class III facilities are only considered acceptable for school trip usage if the streets are below 30 mph. Phase III of the SRTS implemented SRTS Education, Encouragement, Enforcement, and Evaluation programming at 25 priority schools; Phase IV will continue Phase III's work at the remaining 33 schools, adding an Equity programming category to the implementation plan.

Figure 2.3: Safe Routes to School Focus Areas and Proposed Commute Network



2.5.5 SBCTA NON-MOTORIZED TRANSPORTATION PLAN (2018)

The 2018 San Bernardino County Transportation Authority Non-Motorized Transportation Plan (NMTP) seeks to develop a “cohesive, integrated plan” to expand the network of active transportation infrastructure throughout the entirety of San Bernardino County.

Goals (NTMP p. ES-4)

- **Increased bicycle and pedestrian access** - Expand bicycle and pedestrian facilities and access within and between neighborhoods, to employment centers, shopping areas, schools, and recreational sites.
- **Increased travel by cycling and walking** - Make the bicycle and walking an integral part of daily life in San Bernardino County, particularly (for bicycle) for trips of less than five miles, by implementing and maintaining a bikeway network, providing end-of-trip facilities, improving bicycle/transit integration, encouraging bicycle use, and making bicycling safer and more convenient.
- **Routine accommodation in transportation and land use planning** - Routinely consider bicyclists and pedestrians in the planning and design of land development, roadway, transit, and other transportation facilities, as appropriate to the context of each facility and its surroundings.

- **Improved bicycle and pedestrian safety** - Encourage local and statewide policies and practices that improve bicycle and pedestrian safety.
- Improvement of the pedestrian environment on major regional arterials and at regional activity centers. (NTMP p. ES-9)

System Recommendations

- Develop a better “sense of a [bicycle] system” through improved signage, markings, and way-finding for both cyclists and pedestrians. (p. ES-8)
- Generally speaking, bike paths that cross roadways with Average Daily Trips (ADTs) over 15,000 vehicles will require signalization, grade separation, flashing LED beacons, crossing islands, other devices, or a combination of such features. Roundabouts can provide desirable treatment for a bike path intersecting with roadways where the bike path is not next to a parallel street. (p. 6-4)
- Lighting should be provided where commuters will likely use the bike path in the evenings. (p. 6-5)
- Bike boxes as a traffic-calming measure (p. 6-22)
- Completion of local sidewalk systems (p. 6-31)

Figure 2.4: City of San Bernardino Bicycle Facilities, Planned and Existing



Source: SBCTA Non-Motorized Transportation Plan, 2018

2.5.6 OTHER PLANNING DOCUMENTS

San Bernardino Countywide Transportation Plan (2015)

The purpose of the San Bernardino Countywide Transportation Plan (CTP) is to lay out a strategy for long term investment in and management of San Bernardino County's transportation assets, with the following stated goals and objectives:

- Improve safety and mobility for all modes of travel in San Bernardino County by residents, businesses, employees, students and visitors. (p. ES-5)
- Reduce collision rates (p. ES-6)
- Encourage local and statewide policies and practices that improve bicycle and pedestrian safety (p. II-33)
- Improving pedestrian safety and access through more adequate transportation infrastructure and inclusive land use (p. II-36)
- Vehicle to vehicle communication technology (as a long-term future consideration) (p. VI-7)

SCAG Connect SoCal Plan (2020)

The purpose of the Southern California Association of Governments (SCAG) Connect SoCal Plan is to establish a long-term cohesive regional vision for the build-out of the transportation network within the SCAG region (which includes San Bernardino County). It notes the following about traffic safety:

- Unsafe speed is the primary collision factor in the SCAG region, accounting for about 30 percent of collisions. (p. 36)
- Approximately 90 percent of collisions are occurring in urban areas, with most taking place on local roads, not highways. (p. 36)
- 65% of fatalities and serious injuries occur on less than 1.5% of the region's roadway network (p. 37)
- The active transportation investments in Connect SoCal are allocated across a range of active transportation strategies that address planning, policy making and implementation for both short and regional trips. Additionally, they are designed to improve environmental justice outcomes and enhance the safety and comfort of people walking and bicycling. (p. 68)

Waterman + Baseline Specific Plan (2015)

This specific plan establishes a land use and development framework, identifies transportation and infrastructure improvements, and serves as a marketing tool for attracting developers to key sites and for boosting economic development in Central San Bernardino.

It identifies the following issues in the Waterman-Baseline area (p. 6-2):

- Sidewalks are not continuous or wheelchair accessible
- Drivers don't watch for pedestrians
- Cars travel at unsafe speeds
- More lighting is needed

It also identifies the following as potential countermeasures (p. 6-2):

- New street signage
- Improve sidewalks

- Reduce speeding through curb bulb-outs and other traffic calming measures

San Bernardino County Regional Greenhouse Gas Reduction Plan (2014)

This plan, adopted in 2014, summarizes the actions that each city has selected in order to reduce GHG emissions, state-mandated actions, GHG emissions avoided in 2020 associated with each local and state action, and each city's predicted progress towards their selected GHG reduction goal. The plan mostly addresses energy sources and VMT reduction, but includes some information pertaining to safety:

- Develop and implement a bicycle safety education program to teach drivers and bike riders the laws, riding protocols, routes, safety tips, and emergency maneuvers to increase confidence, safety, and frequency of use for new and existing bike riders. (p. 4-17)

The plan states that travel modes should shift away from the automobile, but avoids specific countermeasures and design elements to promote such changes.

3.0 METHODOLOGY

3.1 COLLISION DATA SOURCES

This analysis was supported by collision data from the California Highway Patrol's Statewide Integrated Traffic Records System (SWITRS), which documented collisions within the City of San Bernardino between January 1, 2016 and December 31, 2020. Additionally, the California Office of Traffic Safety Rankings (OTS) most currently available collision ranking for year 2019 was reviewed.

3.1.1 SWITRS

The California Highway Patrol's SWITRS collects and processes data on reported collisions throughout the state of California. The online SWITRS application provides geographically- and temporally-targeted collision reports in an electronic format. KOA used SWITRS to evaluate data on collisions in the City of San Bernardino between 2016 and 2020, both in aggregate and classified by control type (signalized, non-signalized, and mid-block locations).

3.1.2 OTS

The California Office of Traffic Safety (OTS) Safety Rankings compare traffic safety statistics among cities in California with similar populations, with a focus on the number of collisions where people are killed or seriously injured (KSI). Cities can use these comparisons to see the areas in which they are improving traffic safety outcomes, and where they can make improvements. In the OTS Collision Ranking system, San Bernardino belongs to Group B, which contains 59 cities (58 cities in 2017) with a population between 100,001 and 250,000. The LRSP drew on 2017-2019 OTS Safety Rankings to help inform the development of safety emphasis areas.

3.2 STAKEHOLDER OUTREACH

In addition to using analytical methods to identify locations for treatments and make recommendations, the LRSP also focuses on partnerships with the community to give input into this process and provide feedback on areas that the LRSP should focus on. Stakeholder meetings took place on December 14, 2021 and July 19, 2022. These meetings were attended by representatives from the San Bernardino Police Department, San Bernardino City Unified School District, and representatives from the San Bernardino Neighborhood Association Council, which consists of 34 active Neighborhood Associations representing different communities within the City of San Bernardino. The stakeholder outreach process also analyzed reports from the City's Services Request System that involved residents reporting roadway safety issues

3.2.1 SAN BERNARDINO POLICE DEPARTMENT

San Bernardino Police Department (San Bernardino PD) considers speeding a major safety issue in the City, especially along State Route 18, Tippecanoe Avenue, and 5th Street. San Bernardino PD also cites street racing and "street takeovers" as a major issue, particularly affecting the south side of the City. Baseline Street is considered a major focus area for both pedestrian safety and DUI activity. San Bernardino PD uses OTS grants to fund some of their enforcement and education programs. San Bernardino PD uses SWITRS guidelines for traffic collision data collection and does not collect data on non-injury incidents.

3.2.2 SAN BERNARDINO CITY UNIFIED SCHOOL DISTRICT (SBCUSD)

The San Bernardino City Unified School District (SBCUSD) supports pedestrian hybrid beacon (HAWK) installations at various locations. Some SBCUSD schools (e.g. Pacific High School) have in-ground pedestrian beacons, but SBCUSD noted that they were often ineffective at busy school crossings, and not well adhered-to by drivers. SBCUSD has its own Police Department, which uses OTS grants for enforcement-type activities such as crosswalk violations. SBCUSD also uses OTS grants for educational programs, informational banners, and events such as Walk to School Day.

Although some SBCUSD students use school buses, the vast majority are responsible for their own travel to and from school, which consists of a mix of travel modes between walking, biking, and being dropped off by car. SBCUSD also noted that driving for pick-up and drop-off is more common than in prior generations, which walked and biked more. Top concerns cited by parents include speeding and illegal parking. Top locations of concern include Lynwood Drive, between Sterling Avenue and Del Rosa Avenue, and 48th Street (full corridor).

SBCUSD also expressed interest in developing a better understanding the patterns of collisions related to school trips. This can be studied further through analysis and field observations or walk audits around specific school sites, potentially as an evaluative component of the Regional SRTS Plan.

3.2.3 SAN BERNARDINO NEIGHBORHOOD ASSOCIATIONS COUNCIL

The North End Neighborhood Association cited Waterman Avenue and 30th Street as an area of safety concern due to high traffic volumes. Other intersections mentioned by various Neighborhood Associations include Waterman Avenue and Marshall Boulevard, Mountain View Avenue and Marshall Boulevard, Kendall Drive and University Parkway, Kendall Drive and Little Mountain Drive, the CA-210 offramp onto Waterman Avenue, I-10 off ramps at Waterman Avenue and Tippecanoe Avenue, and the Kendall Drive to E Street transition.

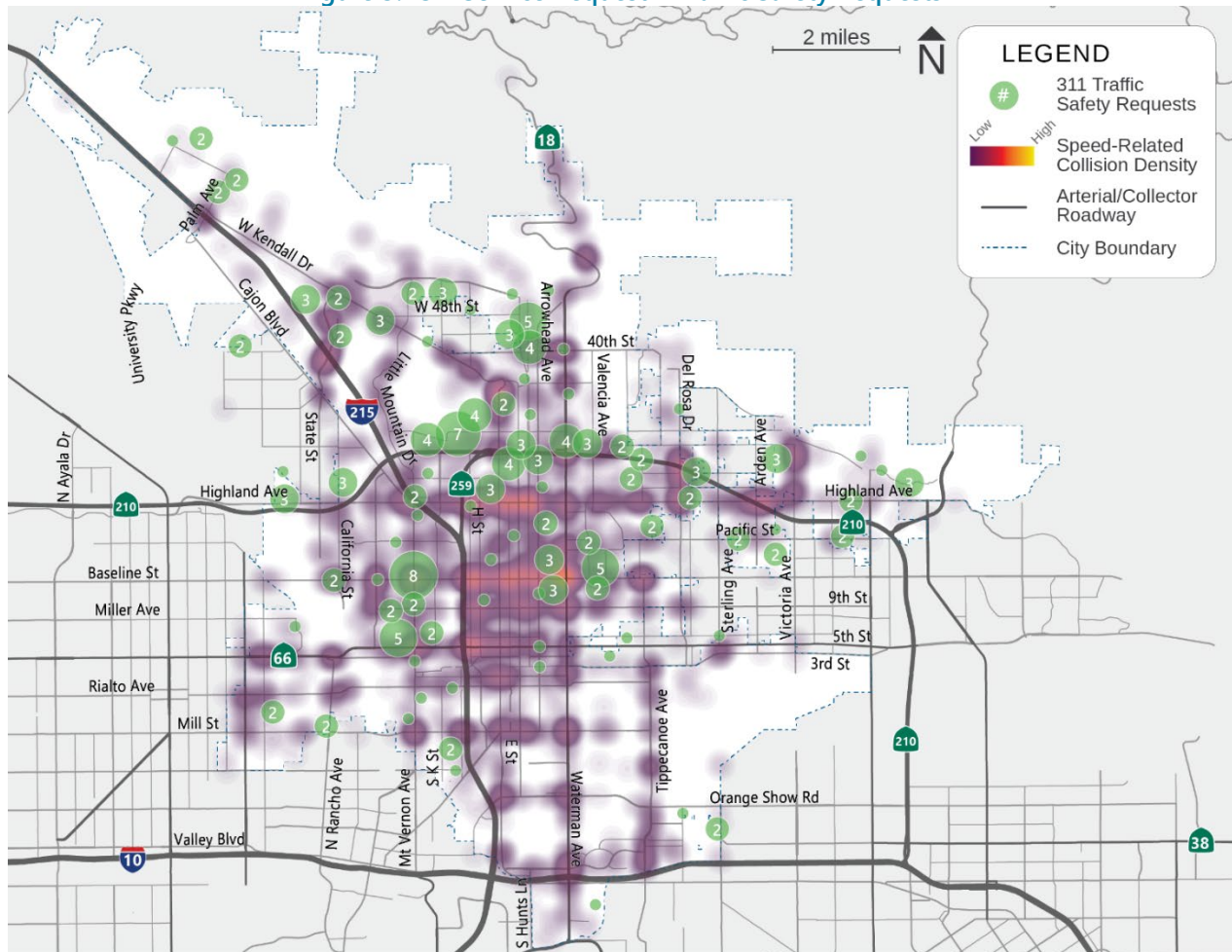
Other issues mentioned include semi-trailer trucks parking on residential streets, excessive potholes and roads in need of resurfacing, and storm drains unable to keep up with rainfall during rainstorms. They also considered it important to look to speeding and unsafe driving countermeasures beyond signage, supporting an end goal of changing driver behavior when possible.

The Neighborhood Associations Council has proposed collaboration with Davidson Elementary School to make walking safer and more desirable around the school.

3.2.4 CITY SERVICES REQUEST SYSTEM

City staff provided anonymized data from the City's Services Request System that included complaints related to excessive speeding, requests for speed bump installation, and other general traffic safety requests, between 2017-2021. Service requests are submitted by either calling the City directly, or with the GO SBCity mobile application. The 196 request locations were geocoded to the intersection level, then aggregated to show areas of overlap with high frequencies of collisions where the primary collision factor was coded as Unsafe Speed in the SWITRS database. See Figure 3.1, which shows the two datasets overlapping to identify focus areas for speeding-related countermeasures.

Figure 3.1 311 Service Request – Traffic Safety Requests



3.3 IDENTIFYING LOCATIONS FOR ENGINEERING COUNTERMEASURES

Crash data analysis for this LRSP was conducted using collision data from the SWITRS collision database. The collision records include a variety of information about each collision, including the location, date, time of the day, crash type, crash severity, primary violation category, transportation mode of the involved parties, and movement of the involved parties prior to the collision. Per California state law, motor vehicle collisions must be reported when vehicle or property damage exceeds \$1,000, or when any of the parties suffer an injury or fatality. Collisions with no injured parties or little property damage might not be reported and, therefore, are not included in the collision database.

Caltrans' *Local Roadway Safety, A Manual for California's Local Road Owners*¹ (LRSM) encourages a proactive rather than reactive approach to safety issue identification. Traditionally, agencies using a reactive approach have located and implemented safety projects solely based on recent crashes, specific crash concentrations, or safety issues raised by stakeholders. A pro-active approach is preferred, according to the LRSM, because with traditional methods, "crash concentrations and crash trends may be missed if

¹ Version 1.6, April 2022

local agencies rely exclusively on these identifiers for their roadway safety effort.” A pro-active approach would identify safety improvements by analyzing the safety of the entire roadway network. For this document, the process for identifying candidate locations for safety improvements considers any one of the following three factors:

- An extensive crash history at high-collision frequency locations providing insight into which roadway characteristics are associated with certain types of crashes
- Professional engineering judgment regarding the availability of feasible engineering countermeasures to fix the safety issues
- Applicability of the engineering countermeasures at other locations with roadway characteristics associated with similar types of crashes regardless of their crash history

The LRSM guidelines require analyzing at least three to five years of the most recent crash data. Five years-worth of collision data from January 2016 to December 2020 was reviewed for the San Bernardino LRSP. Five years of crash data usage adheres to the maximum threshold permitted by the Highway Safety Improvement Program (HSIP) for a safety infrastructure project application for federal funding.

3.3.1 RANKING FUNCTION

A candidate intersection or roadway segment for safety improvements does not necessarily need to demonstrate a history of high or severe collisions to be considered for further evaluation. However, locations with high numbers of collisions are often good starting points for safety analysis due to the rich information provided by the collision history. Three ranking methods were utilized to identify high collision frequency intersections and roadway segments: Average Crash Frequency, Crash Rate, and Equivalent Property Damage Only (EPDO) scores. A brief description of each of the methods is provided in the following sections.

3.3.2 AVERAGE CRASH FREQUENCY

Average Crash Frequency is the most basic method for assessing collision incidence. The analysis tallies the numbers of collisions at each location in the roadway network, both in aggregate and by a category of interest (e.g. level of severity, collision type, and others). The analysis then ranks intersections or roadway segments based on the collisions’ frequency.

3.3.3 CRASH RATE

The Crash Rate method goes a step beyond average crash frequency, normalizing facilities’ crash frequency by the amount of vehicle traffic or travel. This method divides the number of collisions (or collisions in a particular category) by the quantity of Million Entering Vehicles (for intersections) or 100 Million Vehicle Miles Traveled (for roadway segments). While the Crash Rate method accounts for differences in facilities’ length and traffic volume, it may instead unduly favor low-volume and low-collision roadways where countermeasures produce the lowest net benefit for travelers.

3.3.4 EPDO SCORE WEIGHTS

Equivalent Property Damage Only (EPDO) scores assign weighting factors to crashes by severity relative to property damage only (PDO) collisions. The weight generally reflects an order of magnitude difference between the cost of fatal/severe injury crashes and non-severe injury collisions. The weights by crash severity come from the 2022 Local Roadway Safety Manual.

Table 3.1: Collision Crash Values and EPDO Score

Collision Severity	Location Type	Crash Cost	EPDO Score Value
Fatality (K) and Severe Injury (A)	Signalized Intersection	\$1,787,000	119.93
	Non-Signalized Intersection	\$2,843,000	190.81
Combined (KA)	Roadway	\$2,461,000	165.17
Evident Injury - Other Visible (B)	Any	\$159,900	10.73
Possible Injury–Complaint of Pain (C)	Any	\$90,900	6.10
Property Damage Only (O)	Any	\$14,900	1.00

Source: Appendix D of the Caltrans LRSM, 2022

EPDO scores are useful for a benefit-to-cost analysis as collision costs can be translated into measurable benefits from installing improvements that reduce the collisions in question. However, EPDO scores may place undue weight on the injury outcomes of previous collisions rather than overall trends suggested by collision patterns regardless of injury outcome. Furthermore, a location’s EPDO score could be inflated by a fatal or severe collision caused by DUI or other factors that cannot be remedied by engineering countermeasures alone.

3.4 PROPOSING ENGINEERING COUNTERMEASURES

After ranking the intersections and roadway segments, the following steps were used to propose engineering countermeasures:

- Develop citywide collision maps for dominant collision types. Identify high-risk locations by collision type.
- Review crash details (party involved, movement before the crash, primary collision factor, violation code, time of the day, and others) at high-risk locations. Obtain detailed police reports from the City and reviewed for all the fatal and severe injury collisions.
- Manually create collision diagrams for high-risk locations. Review field conditions through physical site visits in the City. Assess the nature of prevalent crash types with respect to the intersection’s control type, geometrical features, and signal phasing/timing.
- Evaluate and screen countermeasures from the LRSM or Crash Modification Factor (CMF) Clearinghouse (<http://www.cmfclearinghouse.org/>), a searchable database that can be easily queried to identify CMFs and Crash Reduction Factors (CRFs).
- Identify intersections/roadway segments that do not have a demonstrated crash history but resemble other locations with documented crash history and risk factors. Once identified, these locations can be analyzed through the steps mentioned above.

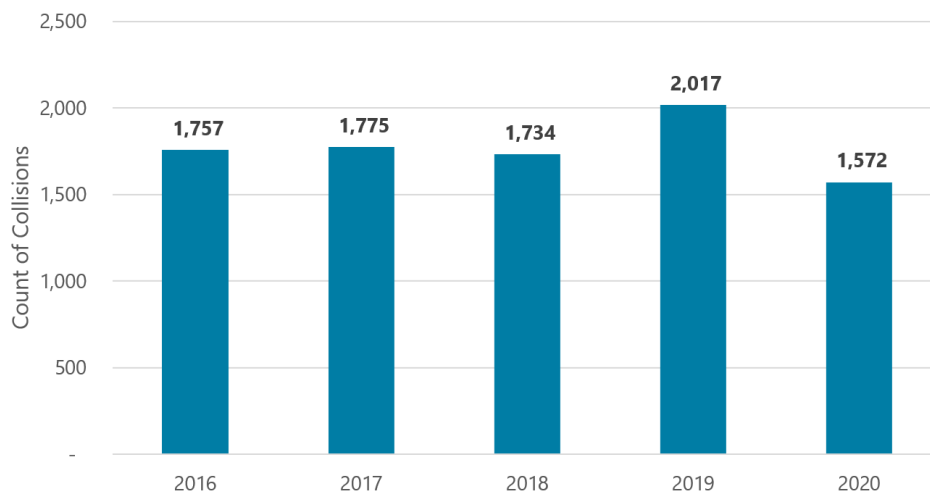
4.0 SYSTEMIC SAFETY ANALYSIS: COLLISION TRENDS AND PATTERNS

4.1 TOTAL COLLISIONS AND COLLISION MODES

The collision trend analysis draws from the five years of data obtained from the SWITRS database. From January 1, 2016 to December 31, 2020, 8,855 collisions occurred in the City of San Bernardino, inclusive of collisions on both City streets and state highways (such as State Route 66 or 18) within the City. Collisions on the Interstate system and grade separated state highways (such as I-215 or SR/I-210) were not included; collisions at the intersection of highway ramps and a local street were included. These collisions occurred on alignments that are grade-separated from City streets, and not part of the scope of this analysis or in the immediate jurisdiction of the City. Out of these collisions, 311 resulted in fatal or severe injuries.

Figure 4.1 highlights the annual number of collisions per year over the five-year period from January 1, 2016 to December 31, 2020). Overall, collision totals remained relatively consistent between 2016 and 2018. Starting in 2019, collisions increased by 16% to 2,017, but then declined by 22% in 2020 to 1,572, the lowest value for the entire collision analysis period. This sharp decline may be related to several factors, but one explanation is that the reduced rates of travel related to the COVID-19 pandemic reduced the overall collision risk in the City. However, many other cities in California also saw an increase in traffic collisions in 2020, so the cause should not be assigned solely to this reason alone.

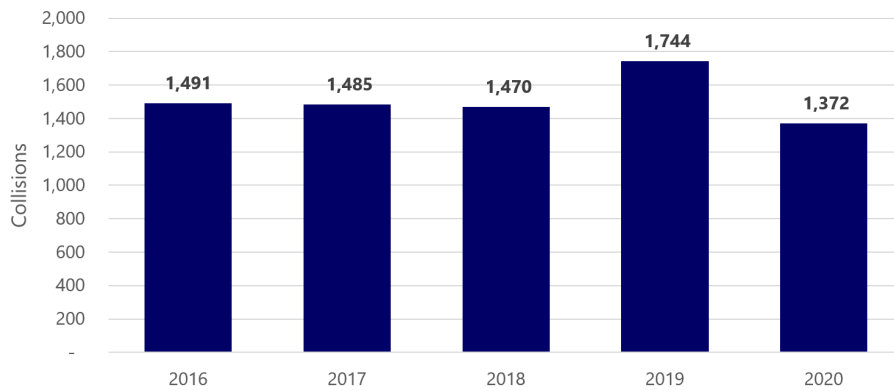
Figure 4.1: Total Collisions by Year



Source: SWITRS, 2016-2020

Figure 4.2 shows year-by-year totals of automobile collisions, which were by far the most common collision mode, and were the primary driver of the pattern as overall collisions, including their largest decline in 2020.

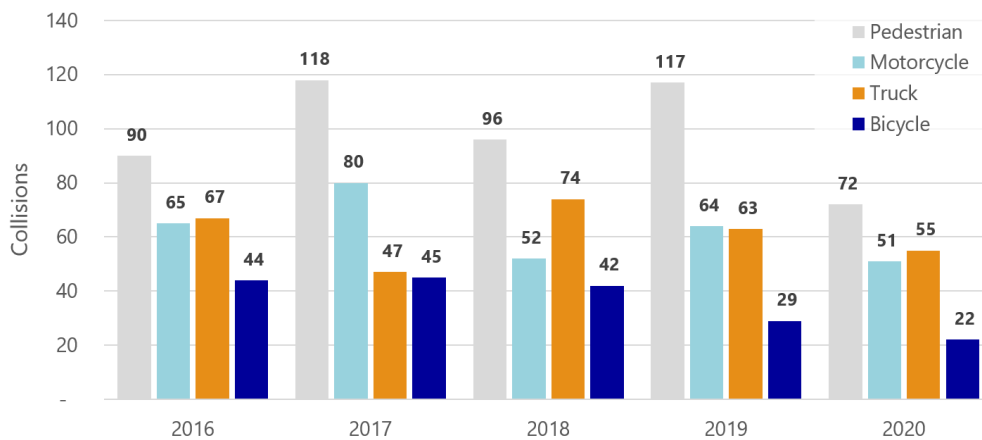
Figure 4.2: Automobile Collisions by Year



Source: SWITRS, 2016-2020

Figure 4.3 highlights pedestrian, bicycle, motorcycle, and truck-involved collisions per year. Pedestrian collisions fluctuated up and down between 2016 and 2020 by as much as 38% year on year, but overall declined to a low of 72 by 2020. Pedestrian collisions were by far the highest non-automobile collision type, with a total of 493 over the analysis period. Truck and motorcycle collisions also saw large fluctuations year to year. Truck collisions hit their high of 74 in 2018, and followed a decline by 2020. Motorcycle collisions, experienced an increase from 2016 to 2017, followed by a general decline as well, with their lowest year in 2020. Bicycle collisions saw a general decline overall from 2016 to 2020, with a low of 22 in 2020.

Figure 4.3: Pedestrian, Bicycle, and Truck Collisions by Year



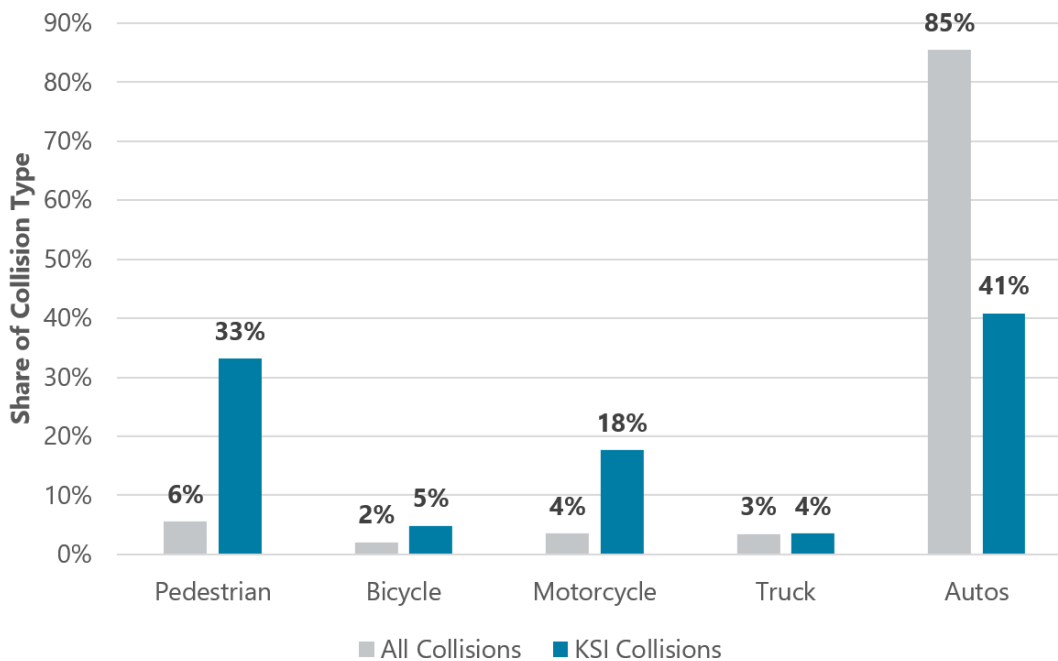
Source: SWITRS, 2016-2020

Figure 4.4 illustrates the collision percentages by mode relative to the share of fatal and severe injury (KSI) collisions. The difference between the two values demonstrates that these more vulnerable mobility groups (people walking, biking, or riding motorcycles) are likelier to have a disproportionately higher injury and fatality rate compared to drivers. The highest number of collisions by mode are automobile related at 85%, however, this mode was less than half of KSI collisions (41%); when compared to pedestrian collisions that accounted for only 6% of the collisions regardless of severity, but 33% of KSI collisions. Motorcycles collisions were a small share of all collisions (4%), but accounted for 18% of KSI collisions. These stark differences in KSI vs all collisions demonstrate that people walking and riding

motorcycles have a much higher risk of being killed or severely injured in a collision. While those modes have less protection than someone driving (lack of airbags, vehicle frame, and other safety features found in autos), additional infrastructure to increase the safety for those modes can help to offset the existing increased risk.

Bicycle collisions demonstrated a smaller relative risk compared to pedestrians, which is unusual. While the share of KSI collisions (5%) is still higher than for any severity of collision (2%), it is much lower than the differential for pedestrian collisions. However, what this may demonstrate is not that the risk for people riding bicycles is low, and therefore not an area of concern, but rather the risk for people walking is so much higher, and should be addressed immediately.

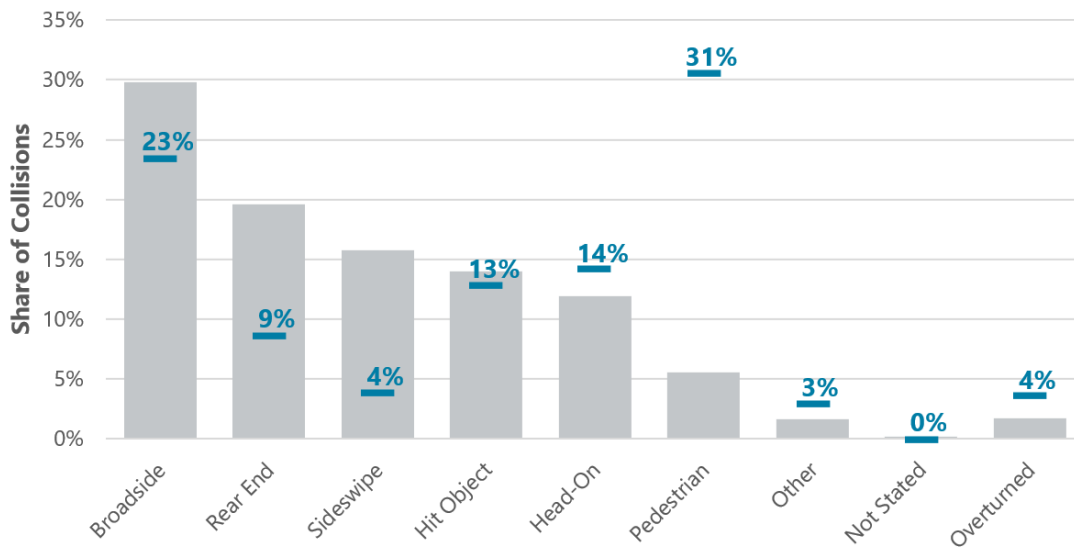
Figure 4.4: Collision Share by Mode, All Collisions and KSI Collisions



Source: SWITRS, 2016-2020

Figure 4.5 summarizes all collisions by type, as well as each collision type’s share of KSI collisions. Broadside collisions are the most frequent type, accounting for approximately 30% of the total collisions, it represents only an 11% share of the KSI collisions. Collision types that have a higher chance of being a fatal or causing severe injury are: head-on, (14%), pedestrian (31% KSI), and overturned vehicle (4%) collisions. The highest disparity between the number of total collisions and KSI collision share corresponds to pedestrian collisions, which make up only 6% of the total collisions but are 31% of the KSI collisions. Head-on collisions had a slightly higher frequency of KSI to total collisions (14% vs 12%), as did overturned vehicle (2% vs 4%), but these collision types are due to the type and forces of impact between two vehicles, rather than the increased risk to the human body that is hit by a moving vehicle.

Figure 4.5: Collision Share by Type, Total Collisions and KSI Collisions

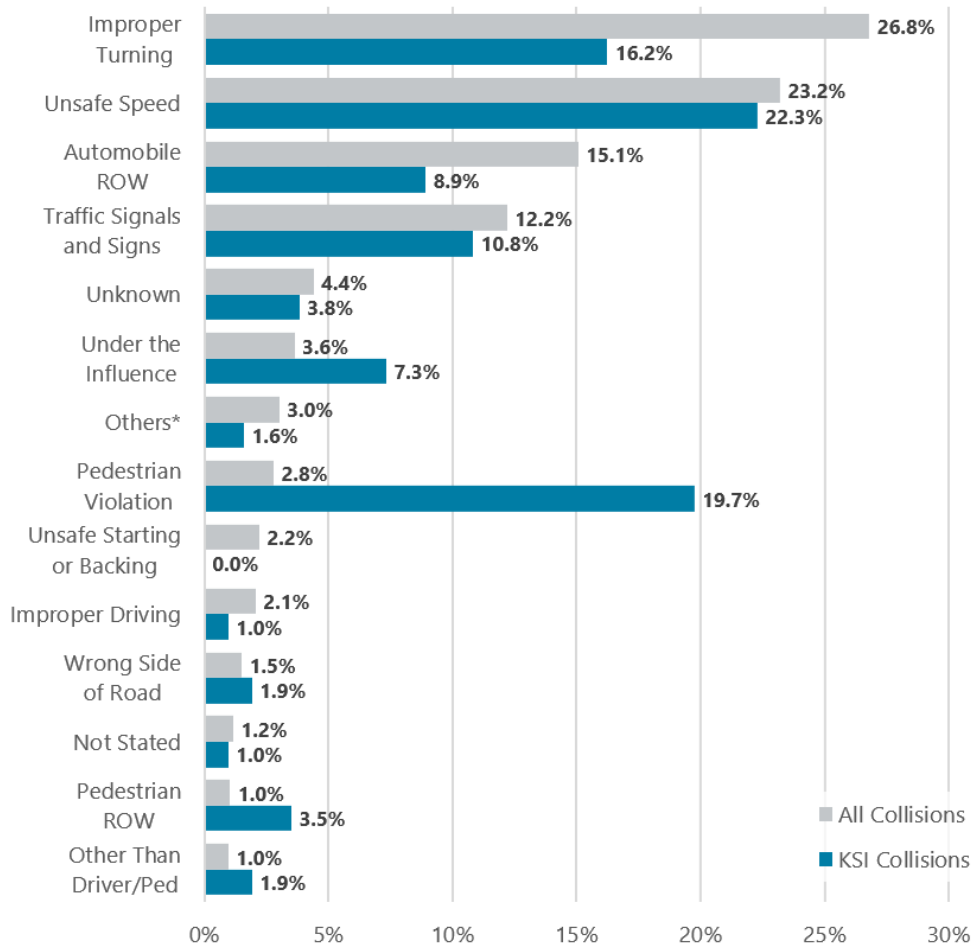


Source: SWITRS, 2016-2020

Figure 4.6 summarizes the Primary Collision Factor (PCF) for all collisions over the past five years based on a 14 PCF categories. The PCF is the leading cause of the collision based on the opinion of the officer who completed the collision report at the scene. Among all collisions, improper turning (26%), unsafe speed (23%), automobile right-of-way (15%) and traffic sign or signal violations (12%) were the top four primary collision factors.

However, when comparing the share of total collisions to the share of collisions where a person was killed or severely injured (KSI), several specific categories stand out. If the level of risk for all roadway users was equal, it would be expected that the share of KSI collisions would be roughly equal for various PCFs, regardless of mode. However, since non-automotive roadway users are more vulnerable to injury and death than people in vehicles (due to the presence of multiple safety systems in most vehicles, including seatbelts, airbags, and the vehicle frame and body which absorb impact forces), some PCFs will carry a higher share of KSI collisions versus all collisions. Pedestrian violation collisions comprise only 2.8% of all collisions, but are 19.7% of KSI collisions, indicating that there is a higher risk of injury or death for people walking; a ratio of nearly 7:1 for KSI collisions. Second to pedestrian violations in the ratio of KSI collisions (3.5%) to all collisions (1%) is the Pedestrian ROW PCF. While not truly interchangeable with the Pedestrian Violation PCF, this also indicates a need for a safer walking experience in the City.

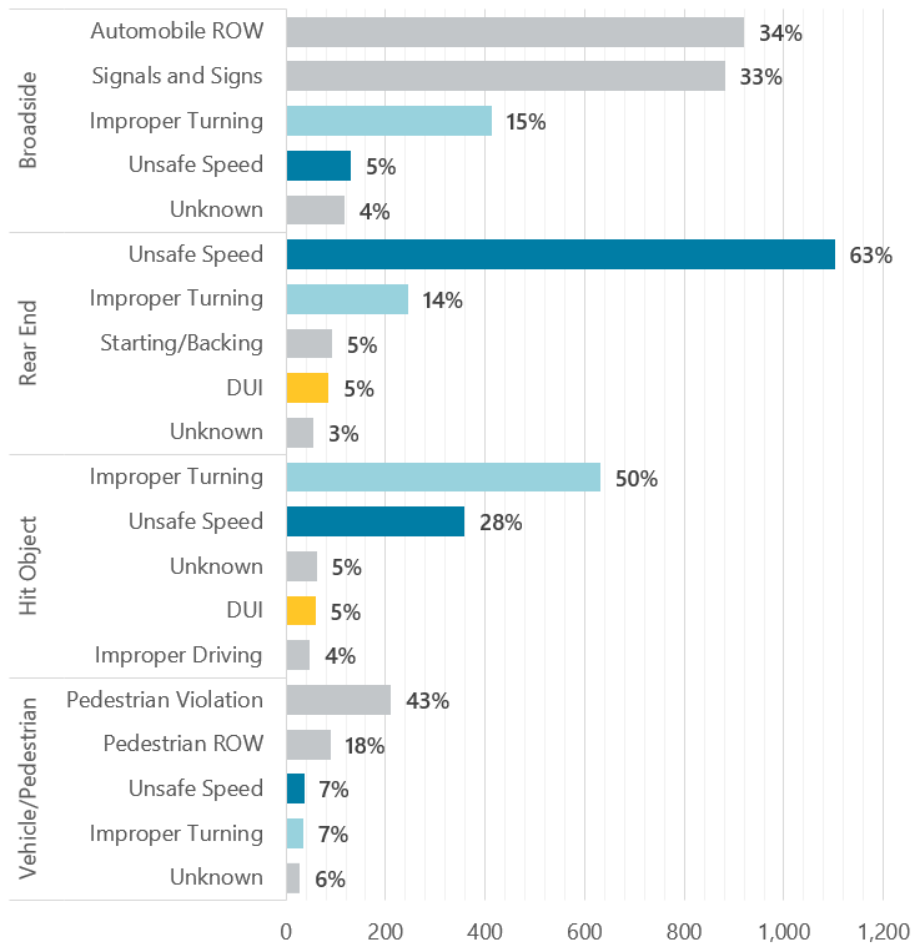
Figure 4.6: Collisions by Primary Collision Factor (PCF)



Source: SWITRS, 2016-2020

Figure 4.7 outlines the primary collision factors linking to San Bernardino’s top four collision types (broadside, rear end, hit object, and vehicle/pedestrian, respectively). The top cause of broadside collisions are due to right-of-way violations and not following traffic signs or signals properly, and a smaller share due to improper turning. The majority of these collisions occurred at signalized intersections (58%), which is consistent with the collision type and primary cause. Countermeasures that address turning movements are most appropriate for this combination, which accounts for 20% of all collisions citywide. Rear end collisions are overwhelmingly caused by unsafe speeds (63%), and 65% of all rear end collisions occurred at signalized intersections. Reducing intersection approach speeds can help address this, as well as including the causes of distracted driving in collision reports. Of the 8,855 collisions from 2016 to 2020, only 5% of the collision records included information about driver inattention.

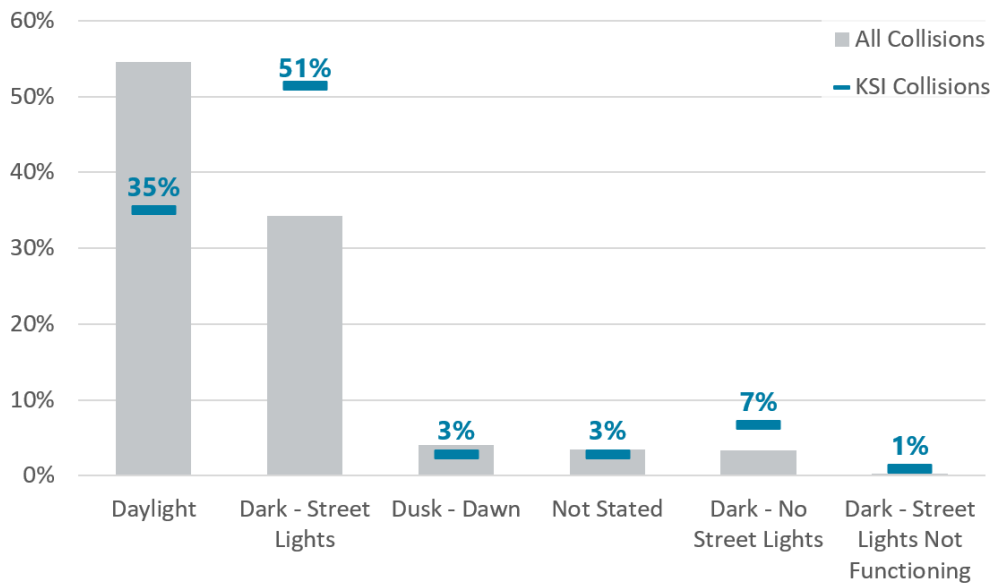
Figure 4.7: Top Collision Types and Primary Collision Factors



Source: SWITRS, 2016-2020

Figure 4.8 compares the roadway lighting conditions versus the percentage of KSI collisions. As presented, the majority of collisions (55%), but only 35% of KSI collisions, occur during the daytime. However, much greater share of KSI collisions occur at night (59%), even when street lights are present (51%). Even though there are fewer hours in a day for nighttime driving, and being a much smaller overall share of all collisions (34%), there is a higher risk of a KSI collision occurring when it is dark. This may indicate the need for additional review of high-frequency collisions areas where street lighting is present, and determining if there is a need to adjust the spacing or brightness of the existing street lights.

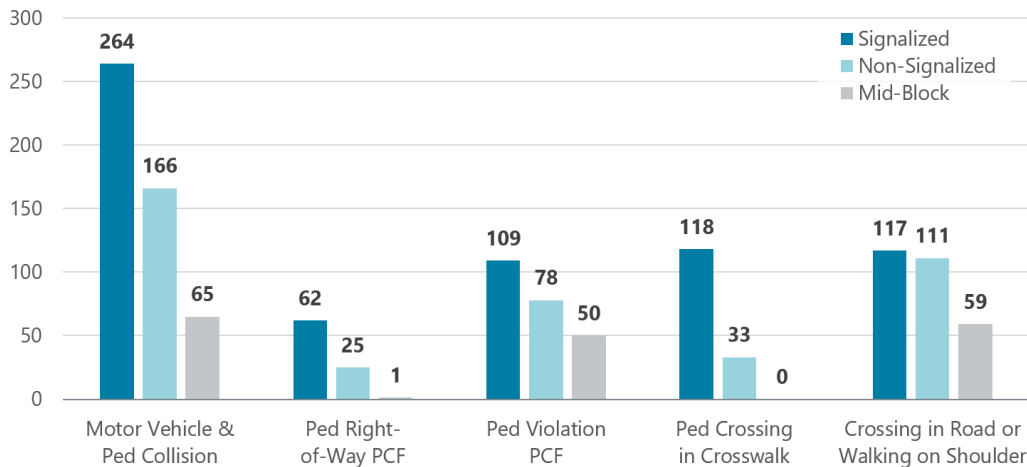
Figure 4.8: Collisions by Lighting Conditions



Source: SWITRS, 2016-2020

Figure 4.9 shows pedestrian-vehicle collisions by facility type. The high rate of pedestrian collisions at signalized intersections (53%), regardless of other collision factors, could indicate a need to review and enhance pedestrian protection at intersections.

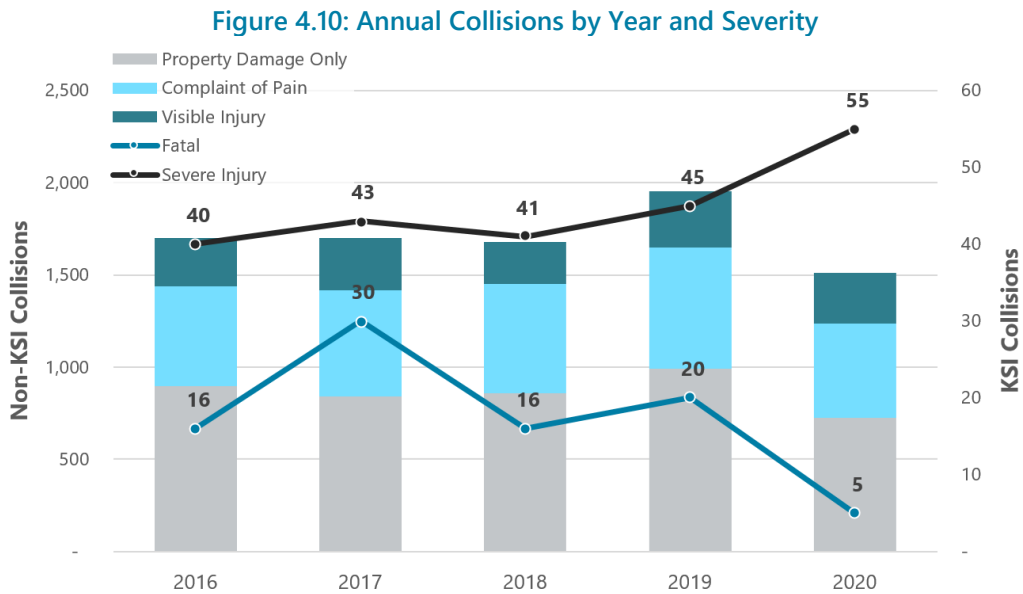
Figure 4.9: Pedestrian and Bicyclist Collisions by Facility Type



Source: SWITRS, 2016-2020

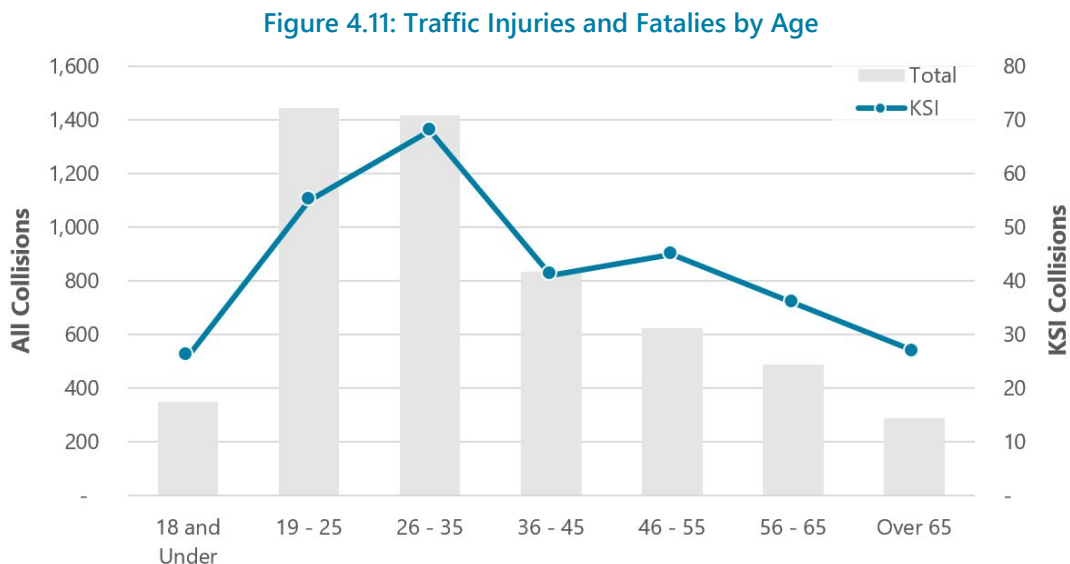
Figure 4.10 illustrates the severity of traffic collisions over the five-year period. Fatal collisions fluctuated between 2016 and 2018, and ultimately declined to their lowest annual number (5 collisions) in 2020. Collisions that resulted in a severe injury did the opposite, and steadily increased from 2016 (40 collisions) to 2020 (55 collisions). Injury, complaint of pain, and property damage only (PDO) collisions stayed relatively consistent across the analysis period, never increasing by more than 10%, with the exception of 2019, which saw an overall increase in collisions regardless of severity. In 2019, injury collisions increased by 34%, however complaint of pain and property damage only (PDO) collisions only

increased 10% and 16%, respectively.



Source: SWITRS, 2016-2020

Figure 4.11 presents a summary of traffic collisions and fatal or severe injury collisions (KSI) by age group. While there is a large variability in the *total* number of collisions versus KSI collisions for each age group, the proportion of collisions to KSI is relatively consistent for each age group, with deaths making up approximately 5-7% of the combined collisions over the five-year period. Younger (18 years and younger) and older victims (56 years and older) have slightly elevated risk of collisions resulting in severe injury or death (7-9%), which may be more related to the risk of traumatic injury at those ages than any infrastructure, engineering, or other traffic safety programming.



Source: SWITRS, 2016-2020

4.2 COLLISIONS BY FACILITY TYPE

Collision patterns by facility type (intersections vs. mid-block locations) were analyzed by using SWITRS data from 2016 to 2020. This analysis was used to determine the effect of access control and intersection geometry on collision frequency. Intersections are defined as any location where two streets cross, excluding unnamed alleys and non-signalized driveways. The analysis classifies collisions by facility type as follows:

- Collisions that occurred within 250 feet of signalized intersections are considered signalized intersection collisions;
- Collisions that occurred within 150 feet of non-signalized intersections are considered non-signalized intersection collisions; and
- Collisions that occur more than 250 feet away from any signalized intersection and more than 150 feet away from any non-signalized intersection are classified as mid-block collisions.

These definitions are consistent with the definition of intersections in the Caltrans Local Roadway Safety Manual, and are also consistent with the accepted statewide methodology for calculating the equivalent property damage only (EPDO) value for used to calculate the benefit-cost ratio of proposed safety countermeasures.

Table 4.1 shows the total number of collisions associated with each type of facility. 49% of all collisions occurred at signalized intersections, 37% occurred at non-signalized intersections, and only 15% occurred at mid-block locations. The high share of collisions occurring at signalized intersections is not unusual, where there is often elevated risk where major streets cross. The high rate of collisions at intersections, regardless of control type, could be reduced by systemic countermeasures across the city that slow speeds and clarify users' right of way when proceeding through intersections. This is supported by the review of collision PCFs across the city, which indicated that unsafe speeds, unsafe turning, and right of way violations were the most common factors that could be countered by changes thoughtful changes in intersection design infrastructure. Speed reduction measures in particular would increase safety for all modes, which is a major factor in KSI collisions involving pedestrians.

Table 4.1: Collision Share by Facility Type

Category	Signalized		Non-Signalized		Mid-Block		Total
	Collisions	%	Collisions	%	Collisions	%	
All Collisions	4,311	49%	3,258	37%	1,286	15%	8,855
Pedestrian Collisions	259	53%	167	34%	67	14%	493
Bicycle Collisions	91	50%	63	35%	28	15%	182
Motorcycle Collisions	138	44%	121	39%	53	17%	312
Truck Collisions	161	53%	98	32%	47	15%	306

Source: SWITRS, 2016-2020

Table 4.2 shows how the collision type share varies by location. Broadside collisions comprise the largest share of collisions at signalized and non-signalized intersections (36% and 28%, respectively). Rear-end collisions are the second most common (33%) at signalized intersections, which are typically along

arterial corridors with higher speeds, and the third most common at non-signalized intersections (19%). Non-signalized intersections see a slightly different trend, with sideswipes being the second most common (18%) after broadsides. At mid-block locations, hit object collisions (23%) are most prevalent, while sideswipe and rear-end collisions comprise the second- and third-largest categories (19% for both).

Table 4.2: Collision Types by Facility Type

Collision Type	Signalized		Non-Signalized		Mid-Block		Total	
	Collisions	%	Collisions	%	Collisions	%	Collisions	Share
Broadside	1,532	36%	914	28%	192	15%	2,638	30%
Rear End	948	22%	536	16%	249	19%	1,733	20%
Sideswipe	560	13%	595	18%	239	19%	1,394	16%
Hit Object	399	9%	542	17%	301	23%	1,242	14%
Head-On	510	12%	381	12%	161	13%	1,052	12%
Vehicle/Pedestrian	268	6%	164	5%	58	5%	490	6%
Overtaken	43	1%	50	2%	55	4%	148	2%
Other	46	1%	71	2%	28	2%	145	2%
Not Stated	5	0%	5	0%	2	0%	12	0%
Total	4,311	100%	3,258	100%	1,285	100%	8,854	100%

Source: SWITRS, 2016-2020

Table 4.3 compares Primary Collision Factors (PCFs) by facility type. Regardless of location, unsafe speed and improper turning are the most significant factors in the City's collision data, followed by the combination of various intersection-related factors, which include automobile right of way, and traffic signs and signals. These account for between 43% and 64% of collisions based on the facility type, and 50% of all collisions in the city. At mid-block locations, the high rates of unsafe speed and improper turning may indicate that there are right of way or visibility issues at driveway locations, which should be evaluated at high-frequency locations.

Table 4.3: Primary Collision Factor by Facility Type

PCF Category	Signalized		Non-Signalized		Mid-Block		Total
	Collisions	%	Collisions	%	Collisions	%	
Improper Turning	871	20%	1,032	32%	462	36%	2,365
Unsafe Speed	1,013	23%	709	22%	342	27%	2,064
Automobile Right of Way	658	15%	584	18%	98	8%	1,340
Traffic Signals and Signs	874	20%	196	6%	13	1%	1,083
Unknown	187	4%	147	5%	57	4%	391
Under the Influence	149	3%	107	3%	58	5%	314
Pedestrian Violation	118	3%	79	2%	51	4%	248
Unsafe Starting or Backing	48	1%	98	3%	50	4%	196
Other Improper Driving	79	2%	60	2%	32	2%	171
Wrong Side of Road	43	1%	60	2%	31	2%	134
Not Stated	38	1%	46	1%	17	1%	101

Pedestrian Right of Way	66	2%	26	1%	1	0%	93
Other Than Driver (or Pedestrian)	24	1%	31	1%	29	2%	84
Unsafe Lane Change	39	1%	27	1%	14	1%	80
Improper Passing	15	0%	30	1%	13	1%	58
Following Too Closely	42	1%	10	0%	4	0%	56
Other Hazardous Violation	39	1%	6	0%	7	1%	52
Hazardous Parking	4	0%	6	0%	2	0%	12
Other Equipment	1	0%	2	0%	2	0%	5
Impeding Traffic	2	0%	1	0%	1	0%	4
Brakes	1	0%	1	0%	1	0%	3
Lights	-	0%	-	0%	1	0%	1
Total	4,311	100%	3,258	100%	1,286	100%	8,855

Table 4.4 shows the relationship between street lighting conditions and facility type. At all location types, most collisions occurred in daylight (55% of all collisions). Most collisions that occurred in the dark were in the presence of functioning street lights (34% of all collisions), and at signalized intersections. 51% of all KSI collisions occurred at night where street lights were present, with the majority of those collisions (78 out of 160) occurring at signalized intersections.

Table 4.4: Street Lighting by Facility Type

	Signalized		Non-Signalized		Mid-Block		Total	
	Collisions	%	Collisions	%	Collisions	%	Collisions	%
Daylight	2,429	56%	1,769	54%	634	49%	4,832	55%
Dark - Street Lights	1,502	35%	1,086	33%	446	35%	3,034	34%
Dusk - Dawn	168	4%	135	4%	55	4%	358	4%
Not Stated	152	4%	118	4%	38	3%	308	3%
Dark - No Street Lights	49	1%	141	4%	105	8%	295	3%
Dark - Street Lights Not Functioning	11	0%	9	0%	8	1%	28	0%
Total	4,311	100%	3,258	100%	1,286	100%	8,855	100%

Source: SWITRS, 2016-2020

As shown in Table 4.2, broadside collisions were the most common collision type in San Bernardino from 2016 to 2020. Automobile right-of-way, signs/signals, and improper turning violations were the highest-occurring primary collision factor (PCF) in broadside collisions. Table 4.5 provides a summary of broadside collisions with these “intersection factor” PCFs by facility type. 83% of broadside collisions resulted from intersection factors, with the highest share of those at signalized intersections (84% of). Additionally, 38% of broadside collisions were left turn related, and 58% of those were also at signalized intersections.

Table 4.5: Broadside Collisions by Facility Type

Facility	Broadside Collision	Broadside Collision w/ Intersection Factor*	% Intersection Factor	% Left-Turn Related
Signalized	1,532	1,289	84%	36%
Non-Signalized	914	767	84%	44%
Mid-Block	192	135	70%	50%

Source: SWITRS, 2016-2020

Rear-end collisions were the second most-prevalent collision type (20% of all collisions). Typically, rear-end collisions are a result of a motorists traveling at unsafe speeds as the primary collision factor, with additional secondary factors such as distracted driving or following too closely, a statement supported by collision data. Table 4.6 tabulates rear-end collisions, and of those, collisions caused by unsafe travel speeds. Rear-end collisions resulting from unsafe travel speeds was highest (76%) at signalized intersections, with non-signalized and mid-block collisions at just under 50%. Second to speeding was improper turning (14%), which is related to individual behavioral choices rather than roadway design or infrastructure. Other common contributing factors such as unsafe starting/backing, or driving under the influence were much lower, causing no more than 5% of all rear-end collisions.

Table 4.6: Rear-End Collisions by Facility Type

Facility	Rear End	Rear End and Unsafe Speed	% Unsafe Speed	Distracted Driver	Alcohol-Involved
Signalized	948	717	76%	18	163
Non-Signalized	536	258	48%	10	97
Mid-Block	249	117	47%	4	47

Source: SWITRS, 2016-2020

4.3 CITY OF SAN BERNARDINO VS. COUNTY OF SAN BERNARDINO

SWITRS data was extracted for the entire County of San Bernardino using the same five-year period from January 2016 to December 2020 to compare the characteristics of injury and fatality collisions in the County of San Bernardino with the City of San Bernardino. In order to make a meaningful comparison of the two datasets, collisions on State highways were excluded from the County data, so that it was consistent with the City data. Highway speeds and operating conditions are significantly different from those on local roadways, with fewer turning movements, bicycle and pedestrian prohibitions, and an overall higher design and travel speed. As shown in Table 4.7, between 2016 and 2020, the City had a total of 8,855 collisions on local streets. With a 2020 population of 222,101, this amounts to 7,974 collisions per million residents, per year over the five-year period. In all of San Bernardino County during the same period, there were a total of 140,083 collisions, at a rate of 12,842 collisions per one million residents per year. Thus, the City had a substantially lower collision rate than the County.

Table 4.7: Total Collision Comparison, San Bernardino City vs. County

Measure	City of San Bernardino	County of San Bernardino
Population (2020 Census)	222,101	2,181,654
Total Collisions	8,855	140,083
Annual Collisions per Million Residents	7,974	12,842
KSI Collisions	311	5,127
KSI (% of Total)	3.5%	3.7%
Pedestrian Collisions	493	2,878
Pedestrian (% of Total)	5.6%	2.1%
Bicycle Collisions	182	1,589
Bicycle Collisions (% of Total)	2.1%	1.1%

Source: SWITRS, 2016-2020. U.S. Decennial Census

The City had a slightly lower percentage of KSI collisions (3.5% vs. 3.7%), but pedestrian-involved collision percentages were nearly double in the City (5.6% vs. 2.1%). Bicycle KSI collision share was also higher in the City (2.1% and 1.1%, respectively).

Table 4.8 focuses on the KSI collision share differences between the City and County. While the City did have a lower rate of KSI collisions per million residents compared to the County, both had an equal share of fatal collisions (1%) from total collisions, as well as nearly equal rates of severe injury collisions (2.6% and 2.7% respectively). In addition, both pedestrian and bicycle KSI collision shares in the City were double than the County (1.2%/0.2% vs 0.6%/0.1%, respectively). The City did have a lower rate of KSI collisions for pedestrian collisions (20% vs 29%), however this is significantly higher than the KSI share of all collisions regardless of mode, which was only 3.5% citywide (see Table 4.7). The same trend was true for bicycle KSI collisions, which was 1% lower in the City, but at 8.8%, still much higher than the 3.5% share for all collisions citywide. These results indicate that while the City has a lower rate of KSI collisions than the County, it still needs to evaluate and implement countermeasures to improve safety for people walking and riding bicycles.

Table 4.8: KSI Collision Comparison, San Bernardino City vs. County

Measure	City of San Bernardino	County of San Bernardino
Population (2020 Census)	222,101	2,181,654
Fatal & Severe Collisions (KSI)	8,855	140,083
Annual KSI Collisions per Million Residents	7,974	12,842
Fatal Collisions	88	1,381
Fatal (% of KSI)	1.0%	1.0%
Severe Injury Collisions	227	3,746
Severe Injury (% of KSI)	2.6%	2.7%
Pedestrian KSI Collisions	103	850
Pedestrian (% of KSI)	1.2%	0.6%
Pedestrian KSI Collisions (% of All Pedestrian Collisions)	20.9%	29.5%
Bicycle KSI Collisions	16	148

Bicycle KSI Collisions (% of KSI)	0.2%	0.1%
Bicycle KSI Collisions (% of All Bicycle Collisions)	8.8%	9.3%

Source: SWITRS, 2016-2020

Table 4.9 summarizes the SWITRS data by collision type for the City and County. Both the City and County had similar rates of occurrence for most collision types. However, there was a much higher share of head-on collisions in the City (4.6% greater), and a higher share of pedestrian collisions (2.7% higher).

Table 4.9: Collision Type Comparison, San Bernardino City vs. County

Collision Type	City of San Bernardino	County of San Bernardino	Difference
Broadside	29.7%	29.9%	-0.2%
Rear End	19.5%	24.3%	-4.8%
Sideswipe	15.8%	15.3%	0.5%
Hit Object	14.1%	15.0%	-0.9%
Head-On	11.8%	7.2%	4.6%
Vehicle/Pedestrian	5.5%	2.8%	2.7%
Overtaken	1.7%	2.2%	-0.5%
Other	1.7%	1.8%	-0.1%
Not Stated	0.1%	1.5%	-1.3%

Source: SWITRS, 2016-2020

Table 4.10 compares PCFs for the City and the County. As with collision type, the most frequent PCF categories in the City is mostly aligned with that of the County. In both geographies, unsafe speed, automobile right-of-way, and improper turning comprise the top three PCF categories. Improper turning factors are 7.4% higher in the City than the County, and a slightly higher rate of traffic sign/signal violation- collisions (2.6% higher). The City has a lower share of DUI collisions (4.4 % lower), but there is no immediate factor in the collision data that explains that difference.

Table 4.10: PCF Comparison, San Bernardino City vs. County

Collision Type	City of San Bernardino	County of San Bernardino	Difference
Improper Turning	27.1%	19.6%	7.4%
Unsafe Speed	23.5%	25.6%	-2.1%
Automobile Right of Way	15.2%	17.5%	-2.2%
Traffic Signals and Signs	12.3%	9.7%	2.6%
Unknown	4.4%	3.7%	0.7%
Driving or Bicycling Under the Influence of Alcohol or Drug	3.7%	8.0%	-4.4%
Pedestrian Violation	2.8%	1.4%	1.4%
Unsafe Starting or Backing	2.2%	3.2%	-1.0%
Other Improper Driving	2.1%	0.8%	1.3%
Wrong Side of Road	1.5%	2.8%	-1.3%
Pedestrian Right of Way	1.0%	0.7%	0.3%
Other Than Driver (or Pedestrian)	1.0%	1.3%	-0.3%
Unsafe Lane Change	0.9%	2.5%	-1.5%
Improper Passing	0.7%	1.3%	-0.6%

Collision Type	City of San Bernardino	County of San Bernardino	Difference
Following Too Closely	0.6%	0.9%	-0.3%
Other Hazardous Violation	0.6%	0.6%	-
Hazardous Parking	0.1%	0.2%	-
Other Equipment	0.1%	0.1%	-
Impeding Traffic	-	0.1%	-
Brakes	-	-	-
Lights	-	-	-

Source: SWITRS, 2016-2020

4.4 SAN BERNARDINO VS. SIMILARLY SIZED CITIES

In the State of California's OTS Collision Ranking system, San Bernardino is part of Group B. This group consists of 59 cities (58 in 2017) in the state of California with a population between 100,001 and 250,000. Table 4.11 shows the City's 2019 fatal and severe injury collisions ranking among the cities in Group B (1 being the highest/worst and 59 being the lowest/best). The City's traffic safety indicators ranks higher than the County's in several areas based on the OTS rankings over time, when compared to the citywide crash analysis results.

- The City ranked 2nd for underage, alcohol-involved collisions that led to fatal or injured parties in 2019, which was a significant increase from previous years. It is ranked 29th for all alcohol-involved collisions for ages 21-34, but more than half (57%) of all alcohol-involved collisions in the City were the fault of people 34 or younger.
- The City was ranked in the top ten for motorcycle (8th) and pedestrian (7th) collisions. This is in line with the share of KSI collisions for those modes in the citywide analysis, where they comprised 51% of all KSI collisions.
- Pedestrian collisions involving children and seniors were also ranked very high, worsening over the past three years of data, indicating that additional protection for these vulnerable groups is needed.
- Speed related collisions during the nighttime (9:00 PM – 2:59 AM) ranked 3rd overall, and hit and run collisions were ranked highest in the entire Group B.
- The OTS ranking for bicycle collisions is 51/59, and 55/59 for bicyclists under the age of 15, one of the best rankings for Group B, and a general improvement since 2017.

Compared to the collisions rankings from the previous two years (2017 and 2018), the categories that rank higher over time are underage DUI collisions, motorcycle, and pedestrian collisions were ranked the same or worse by 2019. Total fatal or injury collisions also worsened in 2019, up 175 from 2017. DUI arrests also decreased between 2017 and 2019, but the City was still ranked 12th for their group of cities. The City's rate of fatal/injury collisions per million miles traveled also increased from 2017 to 2019, from 622 to 752 collisions.

Table 4.11: 2017-19 OTS Rankings, City of San Bernardino

Categories	2017		2018		2019	
	Collisions	Rank	Collisions	Rank	Collisions	Rank
Total Fatal and Injury	1,429	14/58	1,353	17/59	1,604	7/59
Alcohol Involved	138	13/58	154	9/59	157	8/59
Had Been Drinking Driver < 21	4	32/58	6	16/59	8	2/59
Had Been Drinking Driver 21 – 34	32	29/58	40	18/59	18	29/59
Motorcycles	82	5/58	48	29/59	53	8/59
Pedestrians	120	7/58	98	15/59	117	7/59
Pedestrians < 15	4	52/58	13	9/59	11	11/59
Pedestrians 65+	5	44/58	9	26/59	14	13/59
Bicyclists	44	35/58	42	40/59	24	51/59
Bicyclists < 15	4	44/58	4	38/59	1	55/59
Composite	703	12/58	637	15/59	749	8/59
Collision Types						
Speed Related	198	19/58	168	31/59	218	12/59
Nighttime (9:00pm – 2:59am)	177	3/58	134	14/59	176	3/59
Hit and Run	154	2/58	135	8/59	172	1/59
Other Measures						
DUI Arrests	276	12/58	288	16/59	238	12/59
Daily VMT	2,297,620		2,250,310		2,132,450	
Fatal/Injury Collisions per million miles	622		601		752	

Source: OTS 2017, 2018, 2019

5.0 TRANSPORTATION SAFETY EMPHASIS AREAS

Transportation safety emphasis areas provide a strategic framework for developing and implementing the Local Roadway Safety Plan (LRSP). The emphasis areas provide the City of San Bernardino the areas to focus on when developing projects and programs based on the LRSP. The implementation of the emphasis areas should directly relate to the goals, policies, and strategies of the LRSP.

Based on the collision data analysis conducted for the City and trends in the OTS rankings, the following transportation safety emphasis areas were identified:

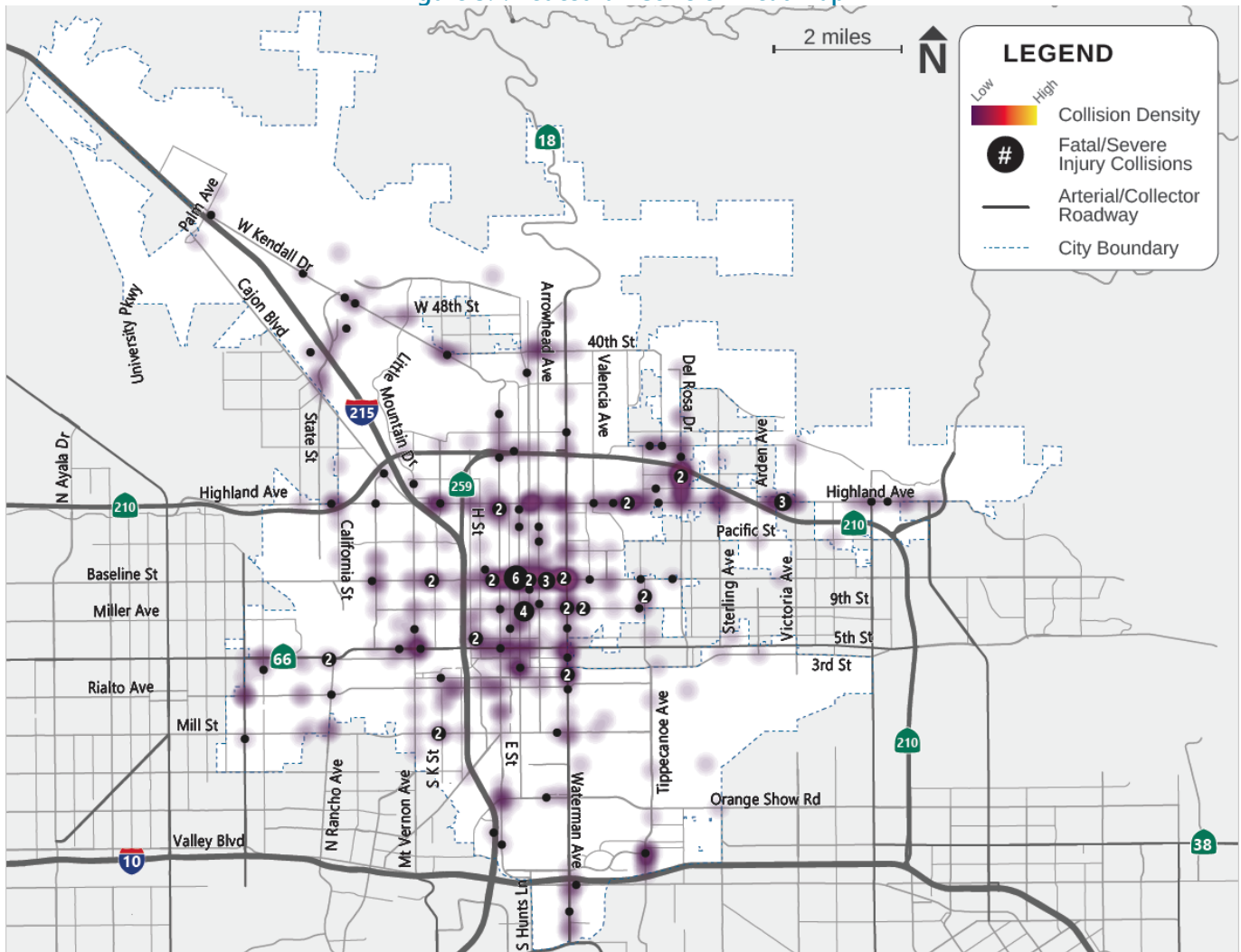
- Pedestrian Safety
- Unsafe Speed
- Intersection Safety
- Driving Under the Influence
- School Collisions

The following section explains how each area was selected based on the aforementioned collision analysis.

5.1 PEDESTRIAN SAFETY

Pedestrians are among the most vulnerable roadway users. Pedestrian commuters in suburban communities are often too young or old to drive, or lack the means to purchase a car. Broad streets with narrow sidewalks, long crossing distances, and limited crossing opportunities can make walking not only uncomfortable, but especially unsafe when people are crossing the street. Unsafe speeds can also increase the likelihood of death or serious injury if a cyclist or pedestrian is struck by a vehicle. A pedestrian or cyclist getting hit by a car traveling at 35+ mph is at a very high risk for fatal injury. Vehicles traveling at unsafe speeds increase the energy of an impact, and also result in a motorist having less reaction time and ability to avoid a collision due to increased stopping distance and greater risk of losing control of the vehicle. While pedestrian-involved collisions comprised only 6% of total collisions in San Bernardino, they accounted for 33% of KSI collisions.

Figure 5.1: Pedestrian Collision Heat Map

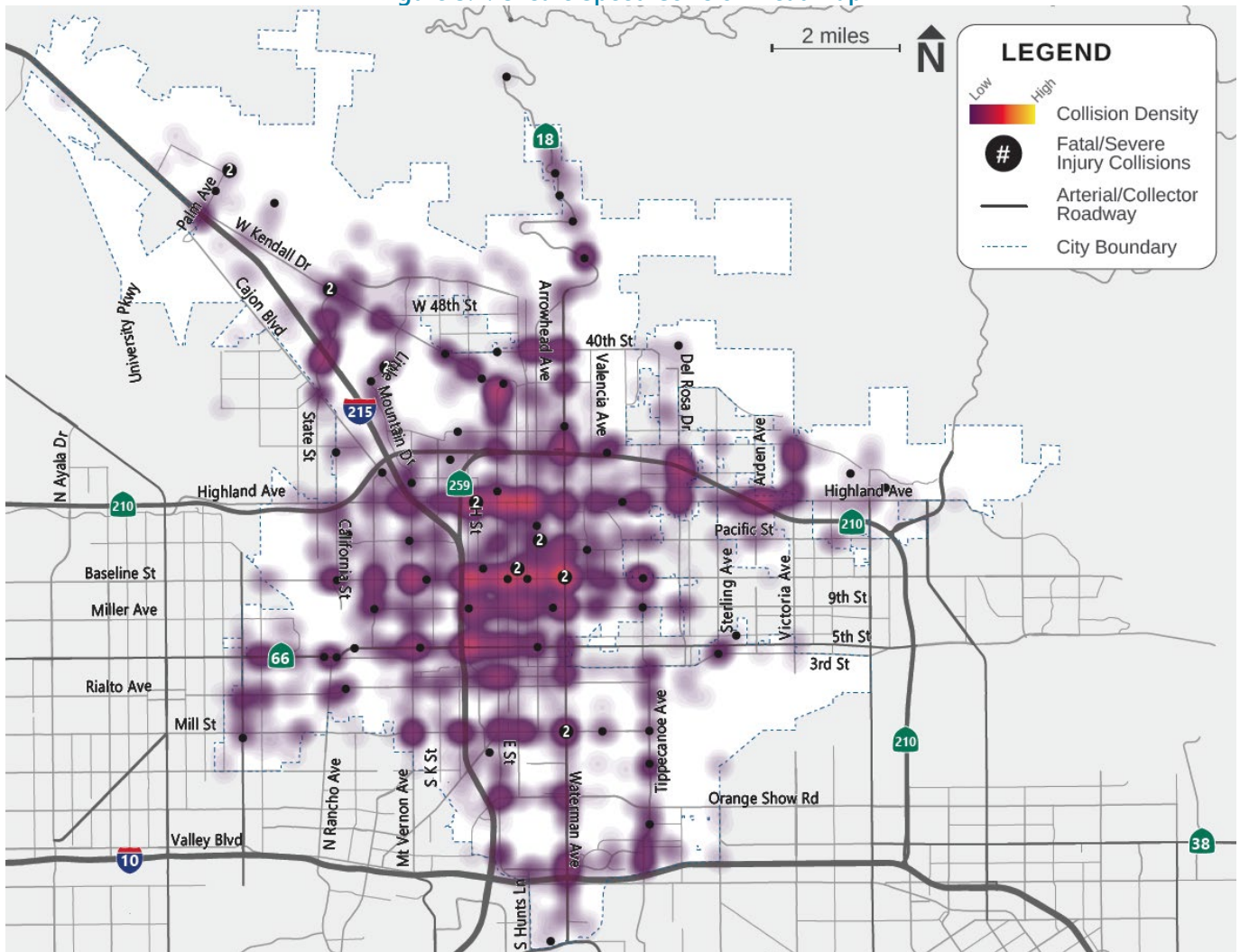


5.2 UNSAFE SPEEDS

Speeding-involved collisions are the second-most frequent collision factor city-wide, with the majority of rear-endings (the most common PCF across all collisions) being caused by speeding.

The level of risk for injury when vehicles are traveling above 35 miles per hour increases dramatically, even with a “slight” increase in speed (5-10 MPH). Speed-related collision reductions could be achieved with a combination of traffic calming countermeasures, speed limit reductions where permitted under state and local guidance, and education or enforcement campaigns that focus on corridors with a high frequency of speeding (based on collision history, outreach and police citation data). Vehicles traveling at unsafe speeds create an elevated level of risk for all roadway users, but especially people walking or bicycling, whose safety is an overarching emphasis area for this entire LRSP. In addition to the above approaches, roadway and intersection design that re-allocates the roadway cross section to different travel modes (motor vehicle, pedestrians, bicyclists) can provide redundancy to elevated vehicle speeds; this can also be combined with vertical separation elements like bollards, medians, or raised pavement.

Figure 5.2: Unsafe Speed Collision Heat Map



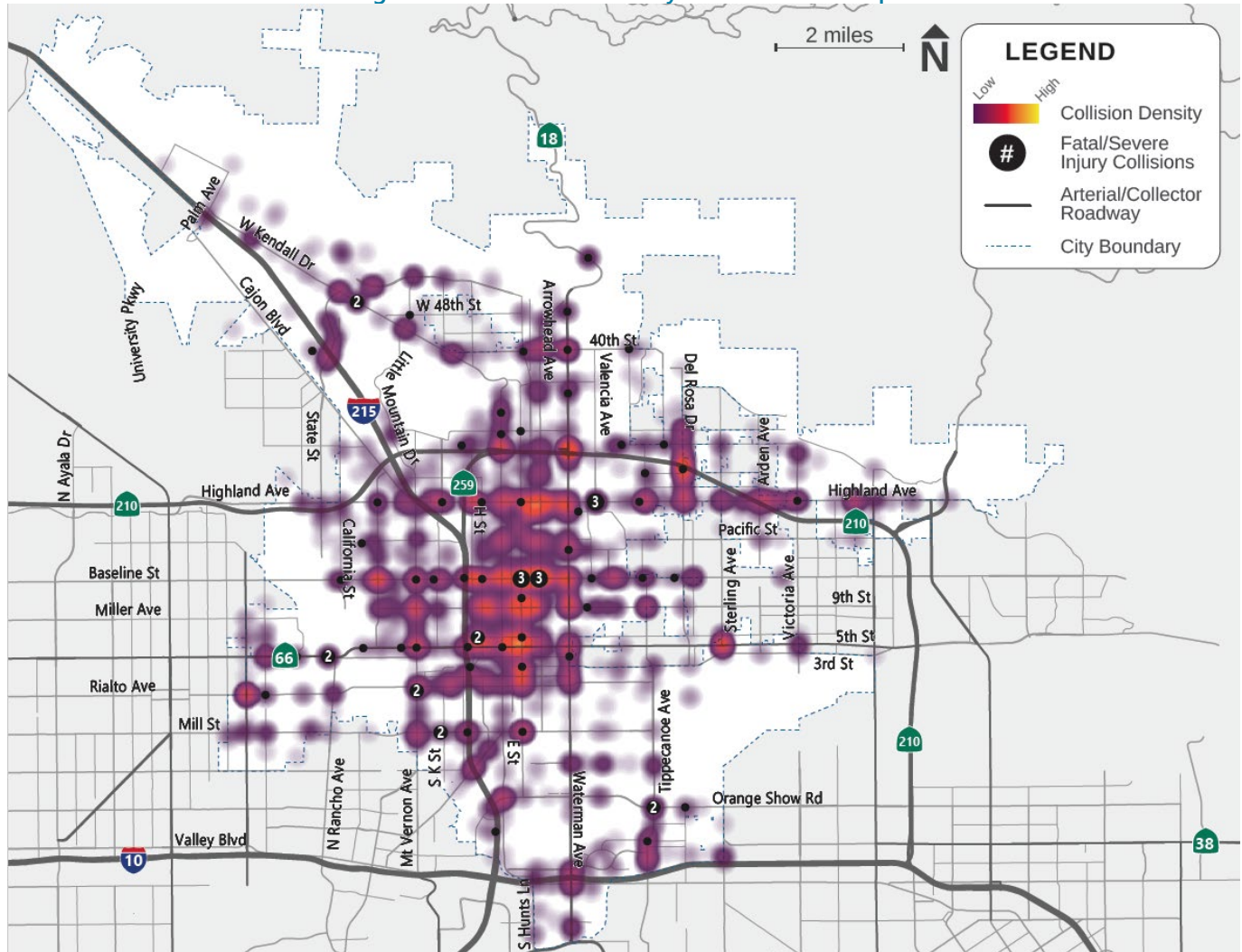
5.3 INTERSECTION SAFETY

The improper turning and automobile ROW collision factors are present across many of the collision types in the City, and carry a higher risk of injury or death if it results in broadside collision.

Both a systemic review of all intersections, and a focused review of turning-related collisions at signalized intersections will indicate where additional protected turning movements, warning signage, leading pedestrian intervals, or other countermeasures could be implemented. For all of these countermeasures, the goal should be to separate modes in time and space, thus removing conflict points, and improve safety, especially for pedestrians and turning vehicles. Where there are high frequencies of pedestrian or bicycle collisions, curb radii at intersections can be decreased to reduce turning speeds and increase pedestrian visibility, prohibiting right-turn-on-red where intersection operation permits it, and striping conflict zones at intersections and approaches to clearly indicate space for people walking or riding. Other design changes like stop bar set-backs, bicycle boxes, and two-stage turn queue boxes can also enhance bicycle safety at intersections. Countermeasures like these would complement the emphasis

area focused on pedestrian and bicycle safety, and improving intersection safety for all modes and users.

Figure 5.3: Intersection Safety Collision Heat Map

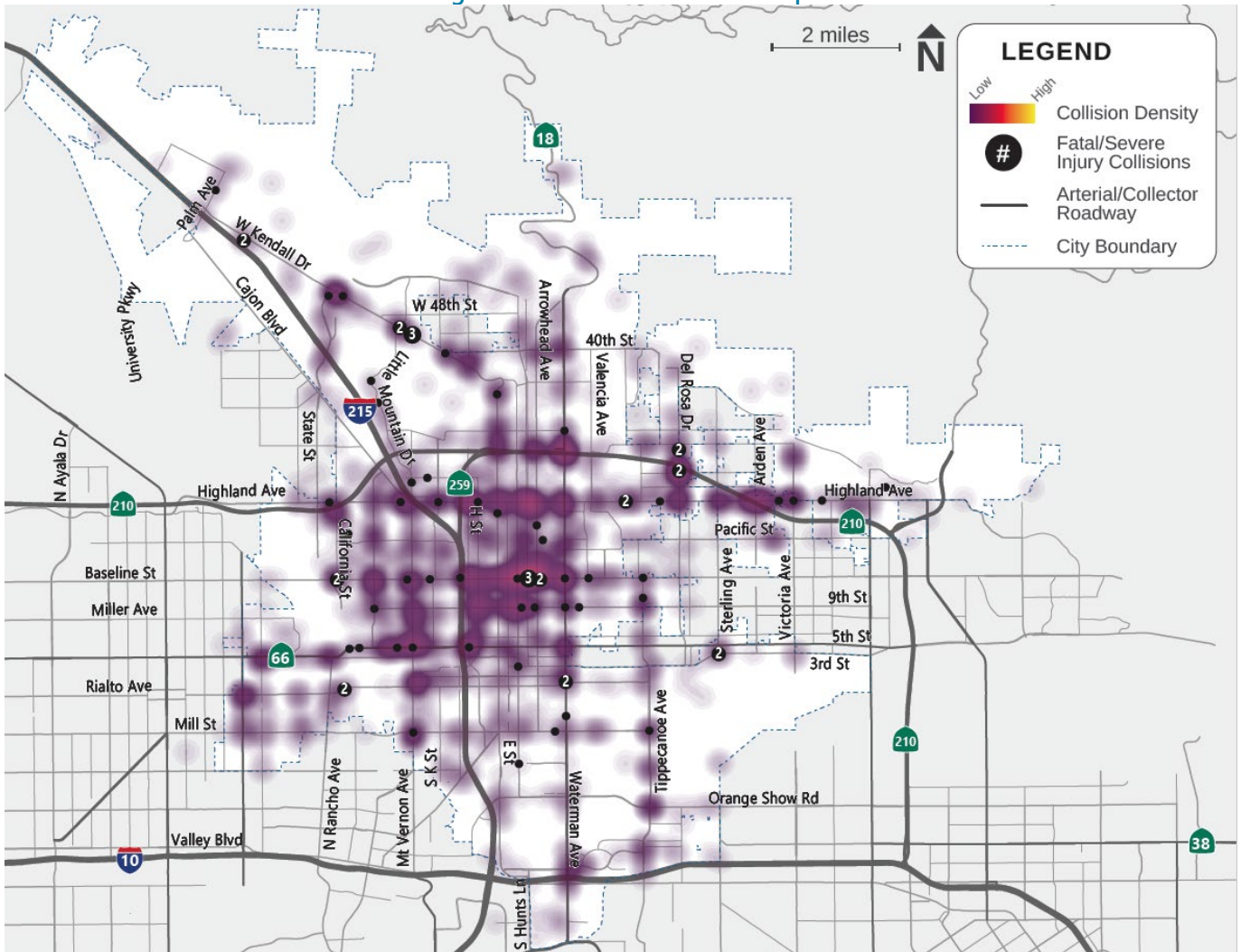


5.4 DRIVING OR BICYCLING UNDER THE INFLUENCE

Driving under the influence (DUI) is responsible for 3.6% of collisions in the City and 7.3% of KSI collisions. DUI collisions are consistently present in the PCF cause for two of the four most common collision types (rear-end and hit object), reinforcing the trend that DUIs play an outsized role in causing traffic collisions, especially KSI collisions. Figure 5.4 shows the locations of DUI-related collisions in the City, with notable concentrations occurring in the downtown areas along Baseline Street and Highland Avenue, as well as a high concentration along Mt. Vernon Avenue north of 5th Street.

In the California OTS rankings, from 2017 to 2019, San Bernardino ranked 13th, 9th, and 8th among Group B cities (out of 59) for alcohol-involved collisions. In 2019, the City ranked 2nd in collisions where people under 21 had been drinking. Reducing DUI collisions will require a long-term strategy to educate a broad spectrum of stakeholders. This could include education programs for drivers, funding “ride-home” programs in partnership with local businesses that serve alcohol, and DUI checkpoints on weekends and in the evenings, when these collisions most frequently occur.

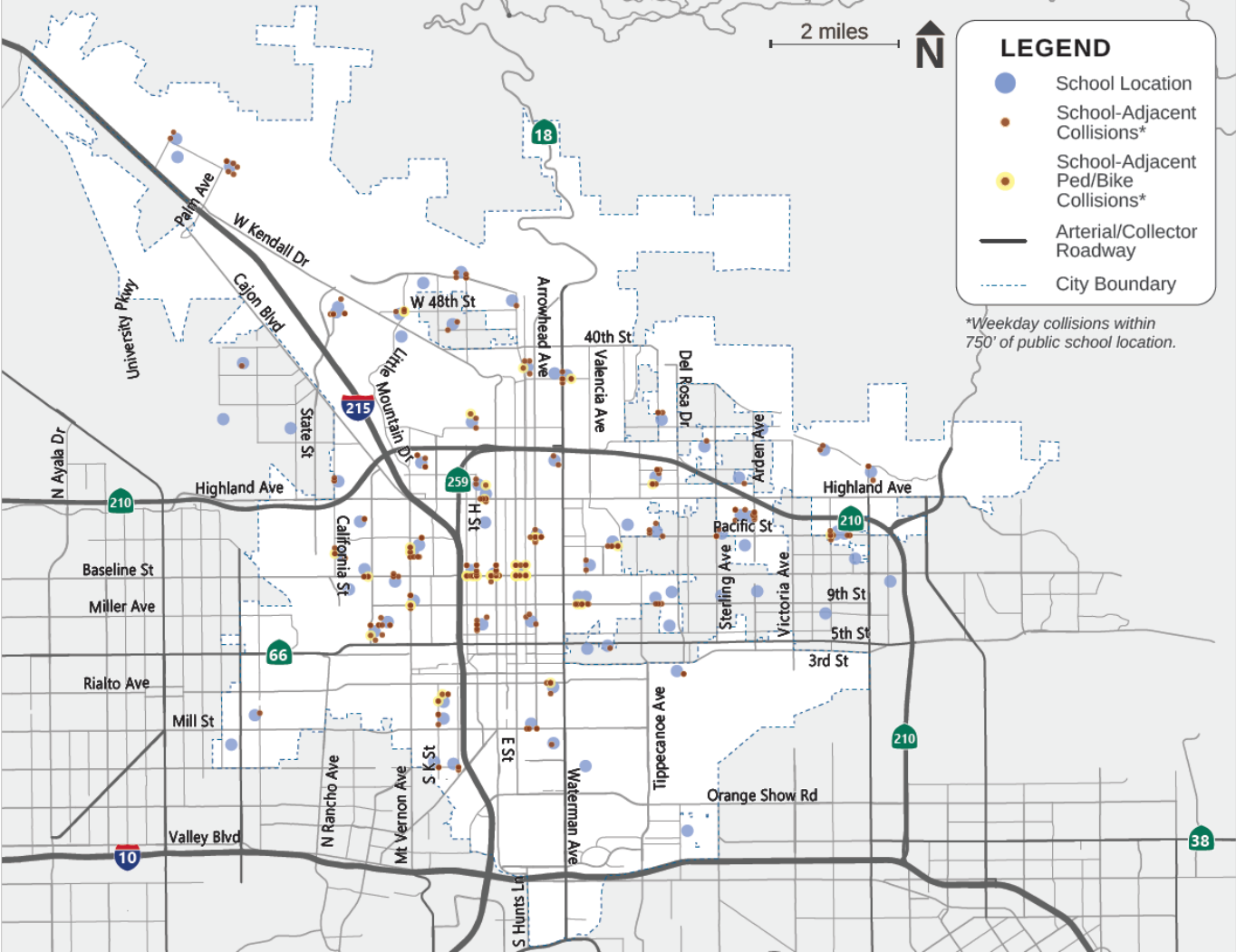
Figure 5.4: DUI Collision Heat Map



5.5 SCHOOL COLLISIONS

The final Safety Emphasis Area consists of collisions near schools, particularly affecting travel to and from schools. While specific destination data is not readily available in SWITRS or OTS databases, certain filters can help with narrowing collision records to place a greater emphasis on school collisions. 515 collisions met the criteria of occurring within 750 feet of a public school and taking place on a weekday. Within these geographic areas, 96.8% (515 of 532) collisions took place on weekdays. Of the 515 weekday collisions, 50 collisions (9.7%) met the additional criteria of involving a pedestrian and/or cyclist. Countermeasures such as upgraded pedestrian crossings and Rectangular Rapid Flashing Beacons (RRFBs) can mitigate these types of collisions. Figure 5.5 shows the locations of schools within the city, and the school-adjacent collisions (and highlighting non-motorized user collisions within that group).

Figure 5.5: School Collision Map



5.6 TOP COLLISION LOCATIONS

This is a general process for identifying potential locations by ranking intersections and roadway segments based on Crash Frequency and EPDO score. The ranking is a quantitative method used to evaluate a particular corridor segment and compare it with other segments. This tool is intended to streamline the collision analysis and the selection process for potential locations, but is by no means the sole determining factor.

Table 5.1: Top 10 Collisions for Intersections

ID	Intersection	Grand Total	Fatal	Severe Injury	Visible Injury	Complaint of Pain	Property Damage	Broadside	Rear End	Sideswipe	Hit Object	Head-On	Vehicle/Pedestrian	Overturned	Other	EPDO Score	Collision Frequency Rank
1	30th St & Waterman Ave	55	0	1	6	26	22	25	9	7	3	7	3	1	0	364.94	1
2	Waterman Ave & 40th St	44	0	1	10	17	16	18	9	10	4	2	0	0	1	346.96	2
3	Highland Ave & Arden Ave	39	0	0	6	11	22	15	11	8	3	1	0	0	1	153.50	3
4	E St & Orange Show Rd	33	0	0	6	9	18	15	7	4	1	2	3	0	1	137.30	4
5	Foothill Blvd & Meridian Ave	30	0	0	10	15	5	11	10	3	2	1	3	0	0	203.83	5
6	E St & Mill St	26	0	0	5	9	12	6	10	4	2	3	1	0	0	120.56	6
7	SR-18 & Old Waterman Canyon Rd	24	0	2	9	7	6	7	0	2	8	2	0	3	2	385.15	7
8	Highland Ave & Eucalyptus Dr	23	0	0	4	14	5	9	8	2	0	2	2	0	0	133.34	8
9	E St & 16th St	21	0	0	0	9	12	10	2	6	3	0	0	0	0	66.91	9
10	Rancho Ave & Foothill Blvd	20	2	2	6	6	4	8	2	4	4	1	1	0	0	584.72	10

Table 5.2: Top 10 Collisions for Non-Signalized Intersections

ID	Intersection	Grand Total	Fatal	Severe Injury	Visible Injury	Complaint of Pain	Property Damage	Broadside	Rear End	Sideswipe	Hit Object	Head-On	Vehicle/Pedestrian	Overturned	Other	EPDO Score	Collision Frequency Rank
1	21st St & Mountain View Ave	17	0	0	3	10	4	14	0	2	0	0	0	1	0	97.20	1
2	E St & 36th St	16	0	1	1	5	9	5	0	1	10	0	0	0	0	241.04	2
3	J St & Rialto Ave	16	0	0	3	8	5	7	0	2	1	6	0	0	0	86.00	2
4	D St & 10th St	15	0	0	4	6	5	5	0	4	3	3	0	0	0	84.53	4

ID	Intersection	Grand Total	Fatal	Severe Injury	Visible Injury	Complaint of Pain	Property Damage	Broadside	Rear End	Sideswipe	Hit Object	Head-On	Vehicle/Pedestrian	Overturned	Other	EPDO Score	Collision Frequency Rank
5	Waterman Ave & 29th St	15	0	0	1	9	5	7	2	3	0	3	0	0	0	70.64	4
6	Highland Ave & Rockford Ave	14	0	2	3	5	4	7	3	0	0	3	1	0	0	448.31	6
7	Dallas Ave & Foothill Blvd	14	0	0	2	6	6	3	4	1	3	2	1	0	0	64.07	6
8	6th St & Sierra Way	14	0	0	2	6	6	7	1	4	1	0	0	0	1	64.07	6
9	Waterman Ave & I-10	13	0	0	2	7	4	7	1	1	0	4	0	0	0	68.17	9
10	Cajon Blvd & Medical Center Dr	9	1	1	0	2	5	2	2	0	2	2	1	0	0	398.81	10

Table 5.3: Top 10 Collisions for Roadway Segments

ID	Roadway	From	To	Grand Total	Fatal	Severe Injury	Visible Injury	Complaint of Pain	Property Damage Only	Collisions per Mile	Broadside	Rear End	Sideswipe	Hit Object	Head-On	Vehicle - Pedestrian	Overturned	Other	EPDO Score	Collision Frequency Rank
13	Baseline St	Pepper Ave	Tippecanoe Ave	745	12	28	107	279	319	274	235	174	95	74	74	71	10	12	7,967	1
10	Waterman Ave	28th St	Washington Ave	562	6	12	83	218	243	423	172	144	84	49	61	43	4	5	4,622	2
5	Highland Ave	Waterman Ave	Palm Ave	456	4	16	61	177	198	164	157	99	66	44	48	34	1	7	4,331	3
3	9th St	G St	Del Rosa Dr	345	5	11	73	121	135	64	134	80	50	18	33	18	5	7	3,576	4
7	Sierra Wy	40th St	4th St	313	1	9	61	101	141	78	115	65	49	27	30	16	4	7	2,611	5
4	Rialto Ave	Pepper Ave	Tippecanoe Ave	297	2	4	68	99	124	97	111	34	42	26	52	20	7	5	2,177	6
1	Kendall Dr	University Pkwy	E St	178	8	6	35	57	72	44	46	36	22	26	32	8	5	3	2,474	7
6	Tippecanoe Ave	Baseline St	Orange Show Rd	165	3	4	37	52	69	178	51	33	24	33	16	5	2	1	1,623	8
9	Mill St	G St	Tippecanoe Ave	153	3	4	20	47	79	70	41	37	20	27	20	3	2	3	1,420	9
11	Victoria Ave	Lynwood Dr	Highland Ave	70	0	1	7	36	26	11	15	29	9	2	10	4	0	1	441	10
2	Little Mountain Dr	Kendall Dr	Edgehill Rd	62	1	6	11	19	25	83	13	4	5	13	14	0	11	2	1,098	11

6.0 ENGINEERING COUNTERMEASURES

The recommended Engineering Countermeasures (improvements to enhance transportation safety) address the emphasis areas on bicyclists, speeding/rear-end collisions and emergency medical services. Five years of collision data from January 2016 to December 2020 were utilized to conduct a more in-depth review of the collision data. Safety countermeasures for the identified candidate locations were selected based on the following collision patterns:

- Collision severity
- Lighting conditions
- Involved parties, especially bicyclists and pedestrians
- Type of collision
- Primary collision factor
- Movements of the involved parties preceding the occurrence of the collision

Table 6.1 summarizes the list of safety countermeasures included in the LRSM and applied to the LRSP as a set of primary recommendations. The table summarizes each countermeasure's applicable crash types, crash reduction factor (CRF), project life of the recommended improvement, maximum reimbursement percentage, and the opportunity for a systemic approach.

Table 6.1: Safety Countermeasures Applied to San Bernardino LRSP

CM No.	Countermeasure Name	Crash Type	CRF	Expected Life (Years)	HSIP Eligibility	Systemic Opportunity?
S01	Add intersection lighting (NS.I.)	Night	40%	20	90%	Medium
S02	Improve signal hardware: lenses, back-plates with retroreflective borders, mounting, size, and number	All	15%	10	90%	Very High
S03	Improve signal timing (coordination, phases, red, yellow, or operation)	All	15%	10	50%	Very High
S06	Install left-turn lane and add turn phase (signal has no left-turn lane or phase before)	All	55%	20	90%	Low
S07	Provide protected left turn phase (left turn lane already exists)	All	30%	20	90%	High
S09	Install raised pavement markers and striping (Through Intersection)	All	10%	10	90%	Very High
S18PB	Install pedestrian crossing (S.I.)	P & B	25%	20	90%	High
S21PB	Modify signal phasing to implement a Leading Pedestrian Interval (LPI)	P&B	60%	10	90%	Very High
NS01	Add intersection lighting	Night	40%	20	90%	Medium
NS03	Install signals	All	30%	20	90%	Low
NS06	Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs	All	15%	10	90%	Very High

CM No.	Countermeasure Name	Crash Type	CRF	Expected Life (Years)	HSIP Eligibility	Systemic Opportunity?
NS07	Upgrade intersection pavement markings (NS.I.)	All	25%	10	90%	Very High
NS09	Install flashing beacons as advance warning (NS.I.)	All	30%	10	90%	High
NS14	Install raised median on approaches (NS.I.)	All	25%	20	90%	Medium
NS18	Install left-turn lane (where no left-turn lane exists)	All	35%	20	90%	Low
NS19PB	Install raised median (refuge islands)	P&B	45%	20	90%	Medium
NS20PB	Install pedestrian crossing at uncontrolled locations (new signs and markings only)	P & B	25%	10	90%	High
NS21PB	Install/upgrade pedestrian crossing at uncontrolled locations (with enhanced safety features)	P & B	35%	20	90%	Medium
NS23PB	Install Pedestrian Signal (including Pedestrian Hybrid Beacon (HAWK))	P & B	55%	20	90%	Low
R08	Install raised median	All	25%	20	90%	Medium
R14	Road Diet (Reduce travel lanes and add a two way left-turn and bike lanes)	All	35%	20	90%	Medium
R21	Improve pavement friction (High Friction Surface Treatments)	All	55%	10	90%	High
R22	Install/Upgrade signs with new fluorescent sheeting (regulatory or warning)	All	15%	10	90%	Very High
R28	Install edge-lines and centerlines	All	25%	10	90%	Very High
R31	Install edgeline rumble strips/stripes	All	15%	10	90%	High
R32PB	Install bike lanes	P&B	35%	20	90%	High
R33PB	Install separated bike lanes	P&B	45%	20	90%	High
R34PB	Install sidewalk/pathway (to avoid walking along roadway)	P&B	80%	20	90%	Medium

Source: Local Roadway Safety Manual, Version 1.6 April 2022

The countermeasure numbers ("CM No." column) in Table 6.1 represent the ID number for the types of improvements that are eligible for HSIP funding, and correspond to the countermeasure IDs used in the 2022 LRSM. Throughout this document, countermeasures that are referenced from LRSM will be accompanied by an ID number, and those that are not referenced from the LRSM will be described only.

The City of San Bernardino is also in the project delivery phase of a multi-year HSIP Cycle 9 funding award implementation to improve 224 signalized intersections and multiple corridors across the city,

including new signal heads, pedestrian countdown signals and pushbuttons, advanced dilemma zone detection and other related intersection improvements. In order to not duplicate these improvements with similar recommendations from the LRSP's analysis, those locations were not included for new improvements in the identified project locations. This will also allow for an appropriate post-construction evaluation of the Cycle 9 improvements; future LRSP updates may assess the potential need for additional improvements at these recently improved locations.

6.1 IDENTIFIED PROJECT LOCATIONS

The lists below of roadway segment and intersection project recommendations are the results of the collision analysis, development of safety emphasis areas, incorporation of stakeholder feedback and alignment with supporting City, regional, and state policies. The recommendations may change once in-depth engineering and feasibility review is completed, funding potential assessed, or additional stakeholder feedback is received. Once they are presented to residents and community members and reviewed by other City departments, final design and implementation may differ from what is presented in the LRSP.

6.1.1 IDENTIFIED ROADWAY SEGMENTS

According to the City's Circulation Element of the General Plan, all roadways within the City are classified into the following categories of roadways: Freeways, Major Arterials, Secondary Arterials, Collector Streets, and Local Streets.

Six roadway segments of various categories were selected for focused analysis, and subsequent development of safety improvement recommendations:

1. Kendall Drive (between University Parkway and H Street)
2. 9th Street (between Waterman Avenue and Del Rosa Drive)
3. Rialto Avenue (between Pepper Avenue and Muscott Street)
4. Meridian Avenue (between Etiwanda Street and Rialto Avenue)
5. E Street (between CA-210 overcrossing and Fairway Drive)
6. Lynwood Drive (between San Gabriel Street and Cedar Street)

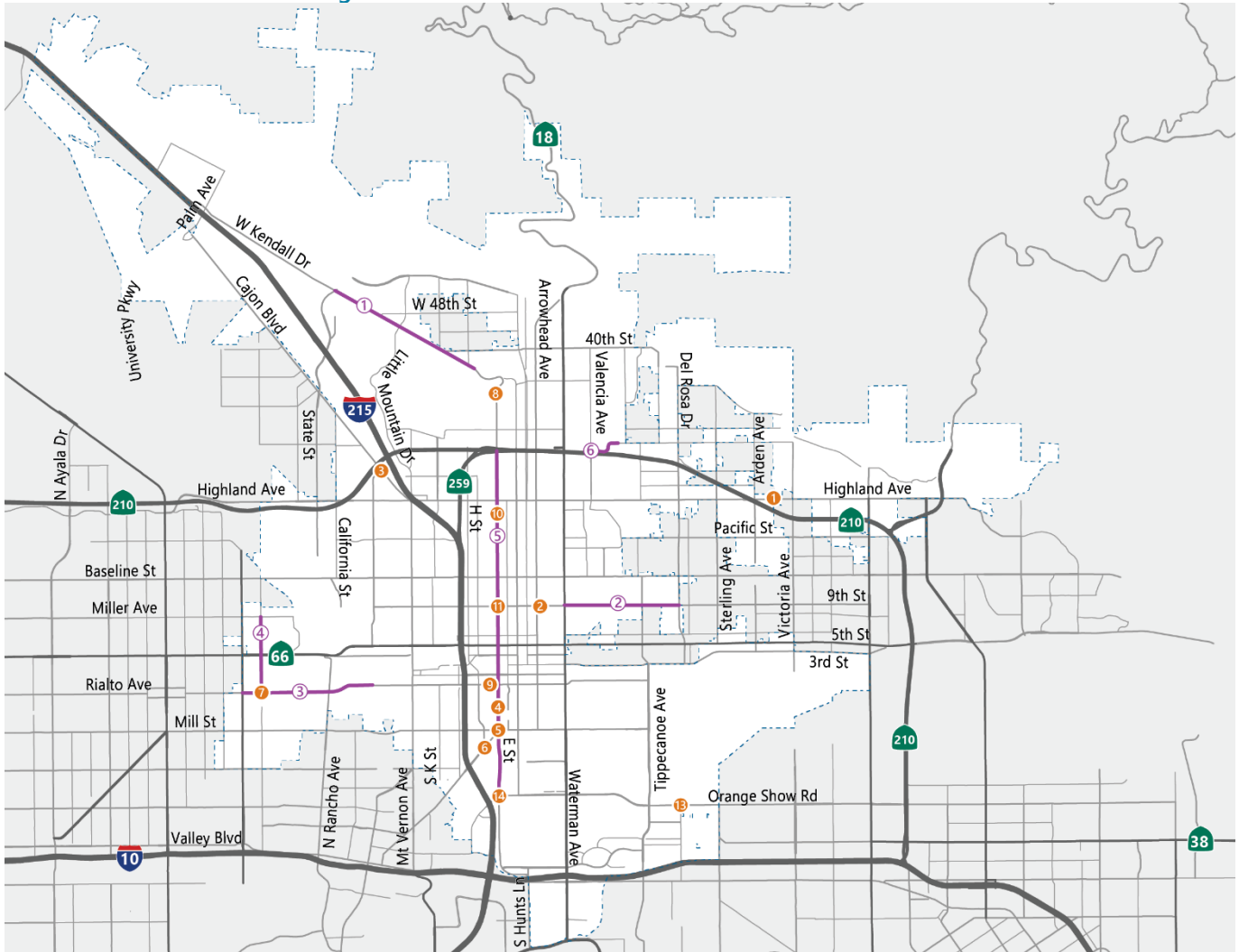
6.1.2 IDENTIFIED INTERSECTIONS

All intersections located on City streets in the public right-of-way were included in the safety analysis, and were reviewed using industry standard crash frequency and "EPDO" methods. 14 intersections were identified as having opportunities for roadway safety countermeasures:

1. Highland Avenue and Eucalyptus Drive
2. 9th Street and Sierra Way
3. Cajon Boulevard and Medical Center Drive
4. E Street and Valley Street
5. E Street, Inland Center Drive, and Mill Street
6. G Street and Inland Center Drive
7. Meridian Avenue and Rialto Avenue
8. E Street and Kendall Drive
9. Rialto Avenue and F Street
10. E Street and 21st Street

11. E Street and 9th Street
12. 5th Street and Victoria Avenue
13. Richardson Street and San Bernardino Avenue
14. E Street and Orange Show Road

Figure 6.1 – Recommendation Corridors & Intersections



6.2 ROADWAY SEGMENT RECOMMENDATIONS

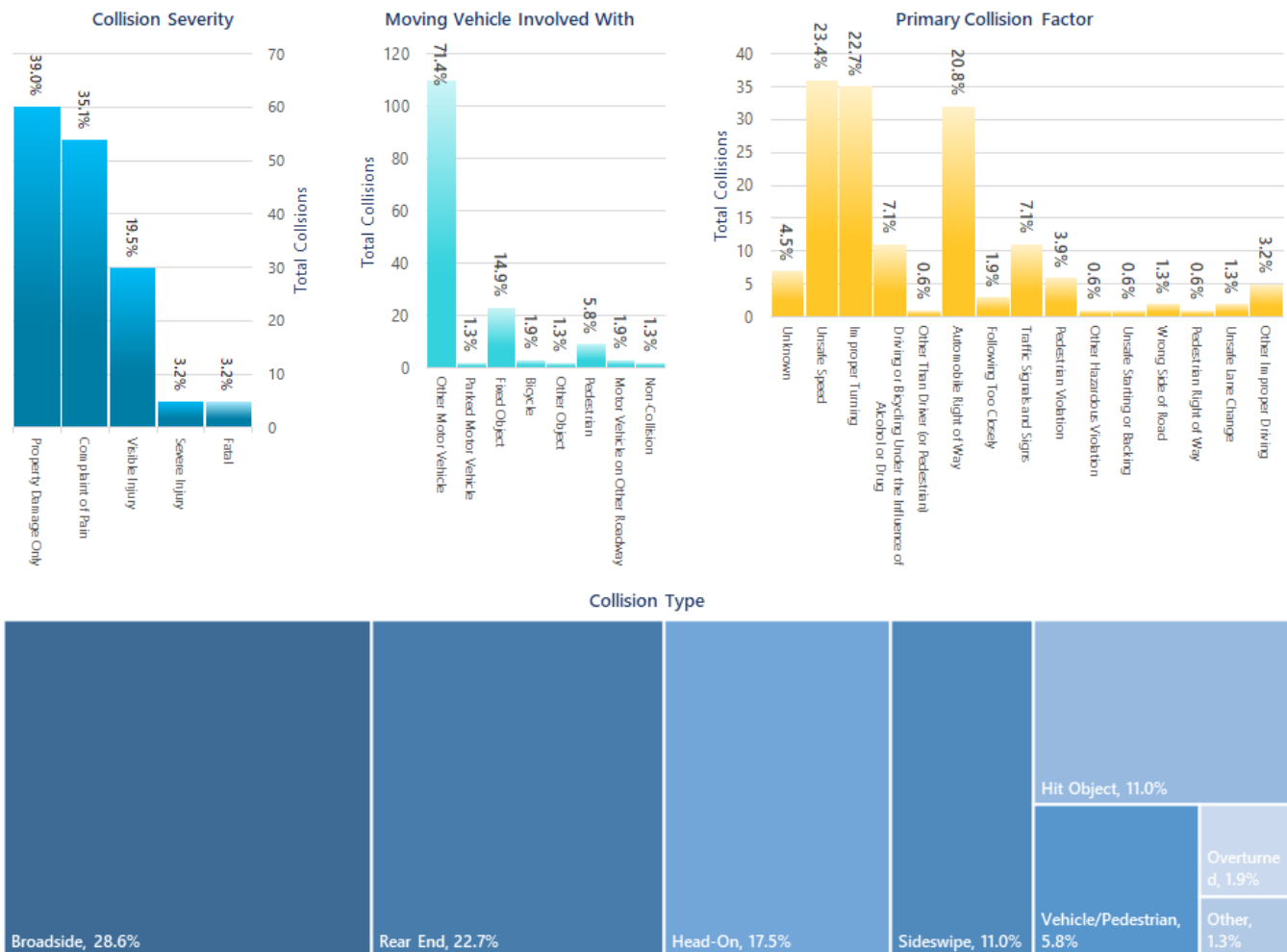
6.2.1 KENDALL DRIVE (UNIVERSITY PARKWAY TO H STREET)

This segment on Kendall Drive between University Parkway and H Street is approximately 2.0 miles long. The average daily traffic (ADT) of the segment was 14,458 in 2021. The width of the segment is approximately 75 feet wide along most of the length, widening to 80 feet near the southern end south of Little Mountain Road. The roadway carries four lanes and a two-way left-turn lane, with a speed limit of 50 mph. This segment serves as a major connection between communities in north San Bernardino, (including Kendall Hills, Verdermont, Shandin Hills, and Arrowhead Farms) with Downtown and other parts of the city. It is also a major access corridor for California State University, San Bernardino. The segment is primarily residential frontage along the northern half, and a mix of retail businesses and

residential uses along the southern half. Between F Street and H Street, there are no bike lanes, and there is a sidewalk on the south side; the north side has a curb and mainly consists of driveways, parking lots, and vegetation. Between 40th Street and F Street, there are sidewalks on both sides of the roadway, with no bike lanes. Between Little Mountain Drive and 40th Street, there are bike lanes on both sides and a continuous sidewalk on the south side, while the north sidewalk is intermittent. Between University Parkway and Little Mountain Drive, there are sidewalks on both sides and one bike lane on the north side.

154 collisions in total have occurred on this segment from January 2016 to December 2020, with ten resulting in either fatality or severe injury. 44 collisions (28.6%) were broadside, 35 collisions (22.7%) were rear-end, and 27 collisions (17.5%) were head-on. Unsafe speeds were the most common Primary Collision Factor, with 36 collisions (23.4%), followed by improper turning at 33 collisions (22.7%) and automobile right-of-way violation at 31 collisions (20.8%). The segment of Kendall Drive between University Parkway and E Street, which this segment (University Parkway to H Street) mostly encompasses, ranks at 7th in collision frequency and 6th in EPDO score among roadway segments in the City.

Figure 6.1: Kendall Drive Collision History



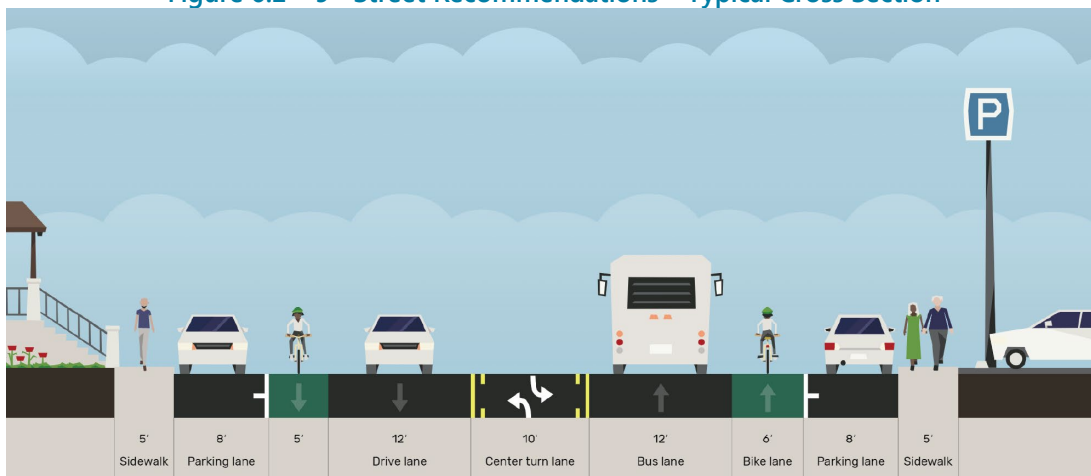
The following countermeasures are recommended for this corridor:

- **R33PB²**: Install Class IV separated bike lanes with parking protection along both sides of the corridor.
 - o Remove center two-way left turn lane (TWLT) to create space along the roadway.
 - o Create left-turn pockets and receiving pockets where necessary.
- **R34PB**: Install a new sidewalk on the north side of Kendall Drive between 4th Avenue and Mountain Drive, and south of Western Avenue, along existing gaps where no sidewalk currently exists.
- **NS21PB**: Upgrade to continental crosswalks along entire corridor at all existing marked crossings, and install amber crosswalks at locations along school routes.
- **NS03**: Signalize intersection of Kendall Drive and Lakewood Drive to shorten the un-signalized segment, providing speed control and create a safer pedestrian crossing opportunity.
- **NS14**: Prohibit left turns from southbound 3rd Avenue to eastbound Kendall Drive with a directional median on 3rd Avenue.
- Install green bicycle conflict striping at driveways and through intersections.
- Evaluate the potential to lower speed limits along the corridor in tandem with other design changes
 - o Install additional speed limit signs along each roadway segment if the operating speed limit is lowered
 - o Assembly Bill 43 (CA) allows a 5-10 mph reduction in speed limits along higher-density commercial or residential corridors, or corridors with “vulnerable users, such as children, seniors, people with mobility issues, or the unhoused”.

6.2.2 9TH STREET (WATERMAN AVENUE TO DEL ROSA DRIVE)

This segment is approximately 1.0 miles long. The curb-to-curb width is approximately 68 feet at the easternmost portion, with narrows to approximately 64 feet at the bridge crossing East Twin Creek, and maintains this width to Waterman Avenue. The roadway is four lanes wide with a two-way center left turn lane along the entire extent. Parking is currently permitted on both sides of the entire segment, except for the portion in front of Sierra High School.

Figure 6.2 – 9th Street Recommendations – Typical Cross Section



There are no bicycle facilities along this segment. Sierra High School and Robertson Elementary School both have their parking lots and pick-up/drop-off areas on this street. The segment also contains

² If applying for HSIP funds, this would not count as countermeasure R14-Road Diet, which specifies a two-way left turn lane and travel lane reductions.

commercial uses and light industrial uses which include automotive services and a school bus yard, as well as an apartment complex, mobile home parks, and an RV park.

148 collisions in total have occurred along this segment, including nine resulting in fatality or severe injury. 57 collisions (38.5%) were broadside, 35 collisions (23.6%) were rear-end, and 21 collisions (14.2%) were sideswipe. The four most common Primary Collision Factors are improper turning at 33 collisions (22.3%), unsafe speeds at 31 collisions (20.9%), automobile right-of-way violation at 26 collisions (17.6%), and traffic signals/signs at 24 collisions (16.2%).

Figure 6.2: 9th Street Collision History



The following countermeasures are recommended for this corridor:

- **R14:** Reduce one travel lane in each direction, install class II bike lanes (**R32PB**), retain current parking configuration.
- Install green bicycle conflict striping at driveways and through intersections.
- Install cross-hatched edge line striping wherever parking is currently prohibited to maintain lane widths and bike lane space.

At the intersection of 9th Street and Preston Street:

- **NS23PB:** Install pedestrian hybrid beacon (HAWK) crosswalk along west leg of the intersection.

- **NS19PB:** Install concrete pedestrian refuge island to protect pedestrians using HAWK crosswalk.
- Install green bicycle conflict striping at driveways and through intersections.

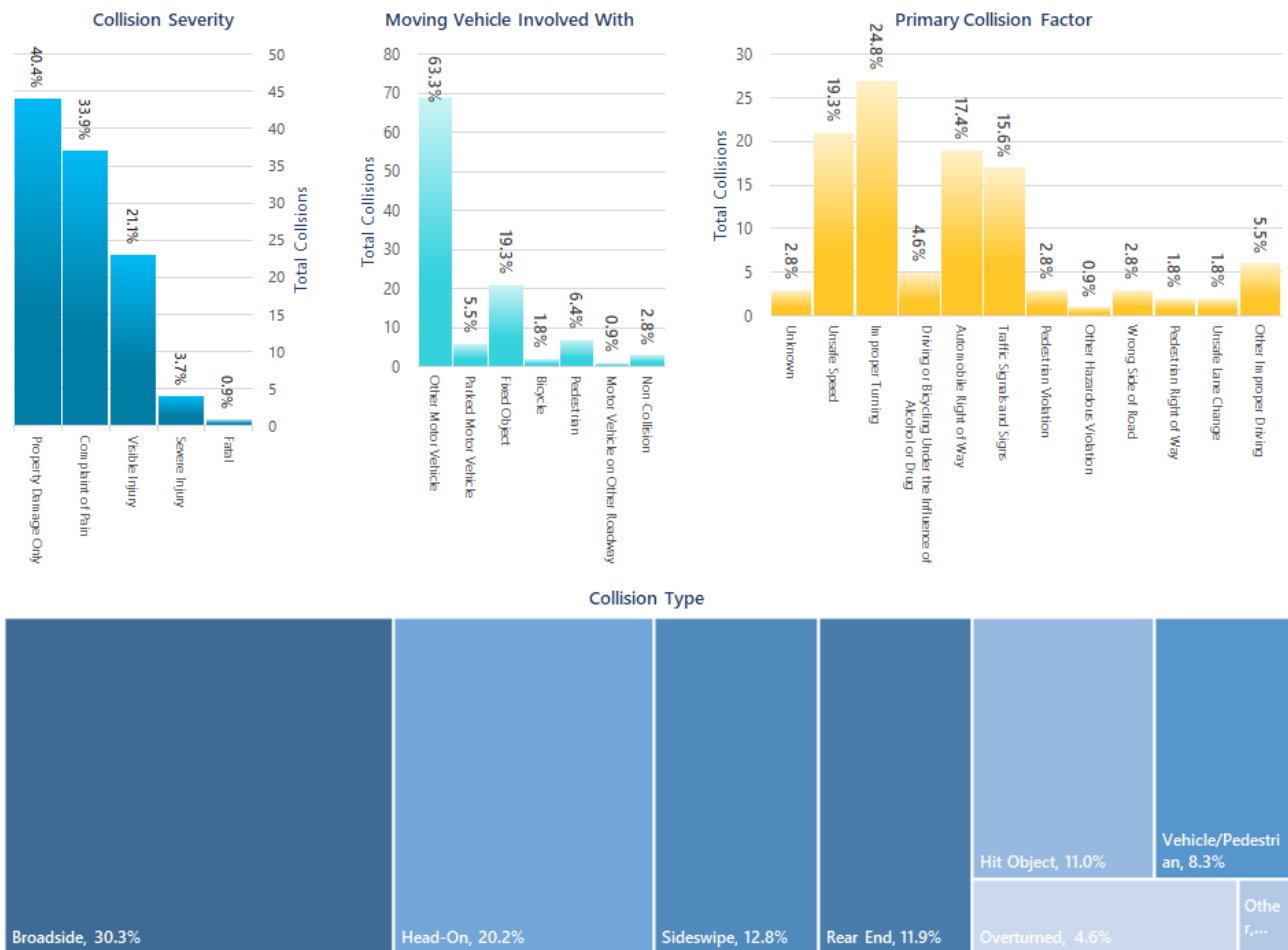
See Appendix A for a complete concept drawing of the improvements proposed on 9th Street.

6.2.3 RIALTO AVENUE (BETWEEN PEPPER AVENUE AND MUSCOTT STREET)

This segment is approximately 1.75 miles long. Rialto Avenue has four lanes along most of this segment, with the exception of a 0.5-mile segment between Meridian Avenue and Macy Street which is two lanes. The segment passes through residential, commercial, and industrial areas, including an at-grade crossing of BNSF rail right-of-way and a bridge over a BNSF railyard. The segment does not have consistent sidewalk coverage.

A total of 109 collisions have taken place on this corridor, including five resulting in fatality or severe injury. The most common Primary Collision Factors (PCFs) are improper turning (24.8%), unsafe speed (19.3%), automobile right-of-way violation (17.4%) and traffic signals and signs (15.6%). The most common collision types are broadside (30.3%) and head-on (20.2%).

Figure 6.4: Rialto Avenue Collision History

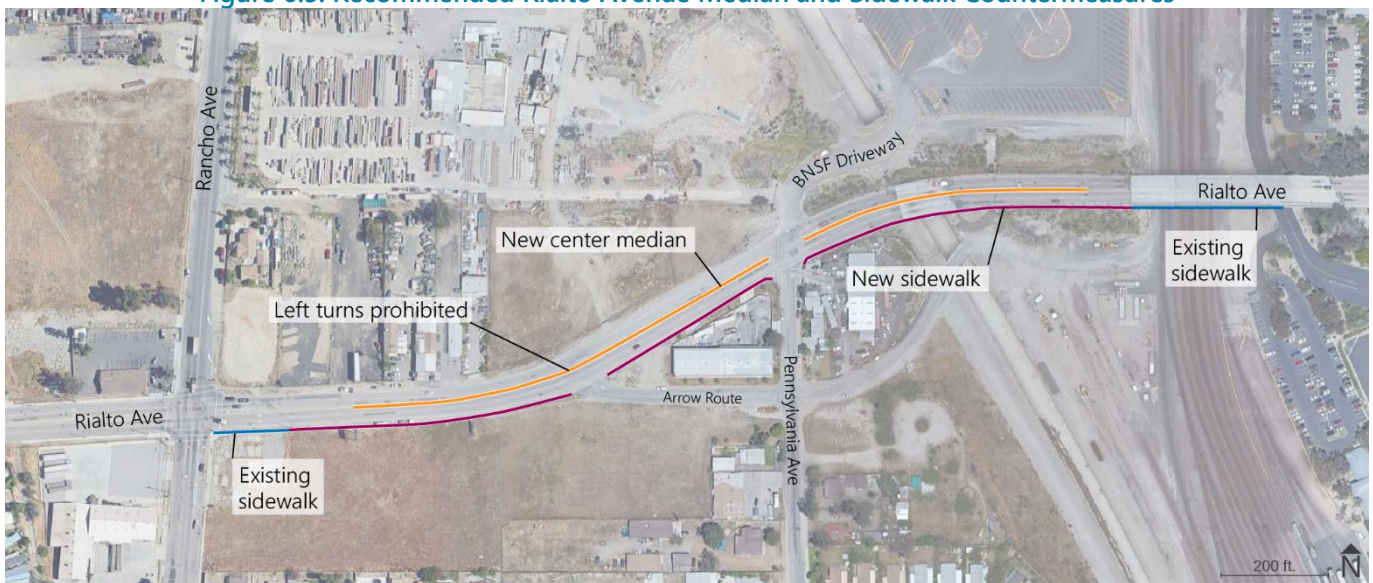


The following countermeasures are recommended for this corridor:

- **R32PB:** Add bike lanes eastbound (Class IV) and westbound (Class II)

- Bi-directional Class IV lanes are possible but would require adjusting intersection approach striping or providing additional intersection striping to delineate Class IV path across intersections.
- **R31** (Optional): If bicycle infrastructure will require more advanced planning/engineering, install edgeline/rumble strips to delineate lane boundaries.
- **R34PB**: Install new sidewalk along the south side of Rialto Avenue to fill sidewalk gaps between Pepper Avenue and Muscott Street.
 - At Rancho Ave/Rialto Ave, direct pedestrians to cross and walk along the southern sidewalk only, which will align with existing railroad overcrossing's sidewalk, and avoid conflicts with intermodal facilities on north side of Rialto Avenue (between Rancho Avenue and Pico Avenue)
 - Consider restricting parking on the south side of Rialto Avenue between Pepper Avenue and Rancho Avenue, to limit demand (and associated conflicts) for crossing to large mobile home parks on the north side, and to create adequate ROW for bicycle facilities or sidewalks. Crossings are limited in this area, with pedestrians potentially crossing midblock to avoid inconveniently diverting to a marked crossing.
- **R08**: Install median along Rialto Avenue, running from 400 feet E of Rancho Avenue and ending 575 feet E of Pennsylvania Avenue.
 - Include a break in the median for the Rialto Avenue and Pennsylvania Avenue intersection.
 - Do not include a break at Rialto Avenue and Arrow Route intersection (restrict traffic to right-on/right-off only, as left turning vehicles can use Pennsylvania Avenue for access).
- **R31**: Install edge-line rumble strips between Rancho Avenue and Muscott Street to address head-on, hit-object, and run off road collisions.

Figure 6.5: Recommended Rialto Avenue Median and Sidewalk Countermeasures



6.2.4 MERIDIAN AVENUE (BETWEEN ETIWANDA STREET AND RIALTO AVENUE)

This segment is approximately 1.0 miles long. The roadway segment has one travel lane in each direction, serving primarily residential areas and providing a connection to the commercial corridor along Foothill Boulevard to the south, approaching Baseline Road to the north, and access to Myers Elementary School north of Etiwanda Street.

A total of 68 collisions have taken place on this corridor, including two resulting in severe injury. The most common Primary Collision Factors (PCFs) are improper turning (29.4%), unsafe speed (22.1%), and

automobile right-of-way violation (14.7%). The most common collision types are broadside (27.9%) and rear end (23.5%).

Figure 6.6: Meridian Avenue Collision History



The corridor provides an opportunity to link to the Caltrans Route 66 Complete Streets project, which is currently in the design phase. The following countermeasures are recommended:

- **NS20PB:** Install continental crosswalks across Meridian at 6th Street (ADA curb ramps), midblock crossing at Nicholson Park, 2nd Street, Rialto Avenue, 7th Street.
 - o **NS08/NS09:** Consider advance flashing beacons at these intersections to warn motorists of stop controls.
- **S01:** Improve intersection lighting at Etiwanda Avenue.
- Reduce speed limit from 40 mph to 35 mph through California Assembly Bill 43 regulations.

6.2.5 E STREET (BETWEEN CA-210 OVERCROSSING AND FAIRWAY DRIVE)

This segment is approximately 5.3 miles long and passes through various neighborhoods within the City of San Bernardino, including Downtown. The segment crosses several major arterial roads at signalized intersections, as well as minor crossings and commercial or residential driveways.

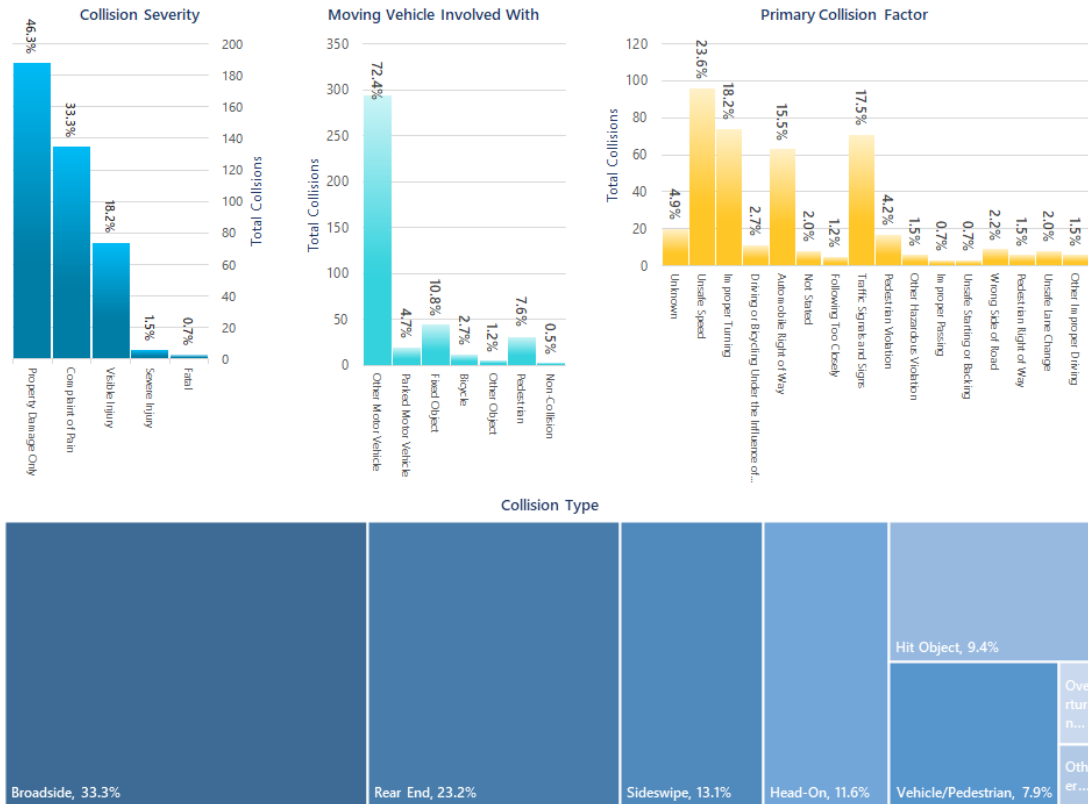
A total of 406 collisions have taken place on this corridor, including 9 resulting in fatality or severe injury. The most common Primary Collision Factors (PCFs) are unsafe speed (23.6%), improper turning (18.2%), traffic signals and signs (17.5%), and automobile right-of-way violation (15.5%). The most common

collision types are broadside (33.3%) and rear end (23.2%).

The following countermeasures are recommended for this corridor:

- **NS20PB:** Stripe continental crosswalks at all arterial and collector street intersections along E Street for major crossings in all directions.
 - o Stripe continental crosswalks at Mall Way and the Orange Show Event Center entrance.

Figure 6.7: E Street Collision History



6.2.6 LYNWOOD DRIVE/30TH STREET (BETWEEN SAN GABRIEL STREET AND CEDAR STREET)

This segment is approximately ¼ mile long. The roadway is named 30th Street as it approaches from the west; as it intersects with Lynwood Drive, it assumes the name Lynwood Drive as it continues eastward. The roadway is four lanes with a center yellow line and has an approximate width of 65 feet. The segment contains sharp corners and signage warning to approach the turns with caution.

A total of 16 collisions have occurred on this corridor, including two that resulted in fatality or severe injury. The most common Primary Collision Factors (PCFs) are unsafe speeds (31.3%), automobile right-of-way violation (25.0%), and improper turning (25.0%). The most common collision types are hit object (37.5%) and broadside (31.3%).

The following countermeasures are recommended for this corridor:

- **R21:** Improve pavement friction to reduce stopping distances for vehicles that would otherwise depart the roadway or hit an object if they are unable to stop in time.
- **R28:** Install/upgrade edgelines and centerlines

- Install raised pavement markers to warn motorists when they are approaching the outside edge of the lane, and narrow the outside lane where possible (it is currently 20' wide in both directions)
- Upgrade centerline to double-yellow with hatching in the middle to separate vehicles traveling in opposite directions. Include raised pavement markers along the edge of each double yellow centerline to warn motorists when they are approaching the inside edge of the lane.

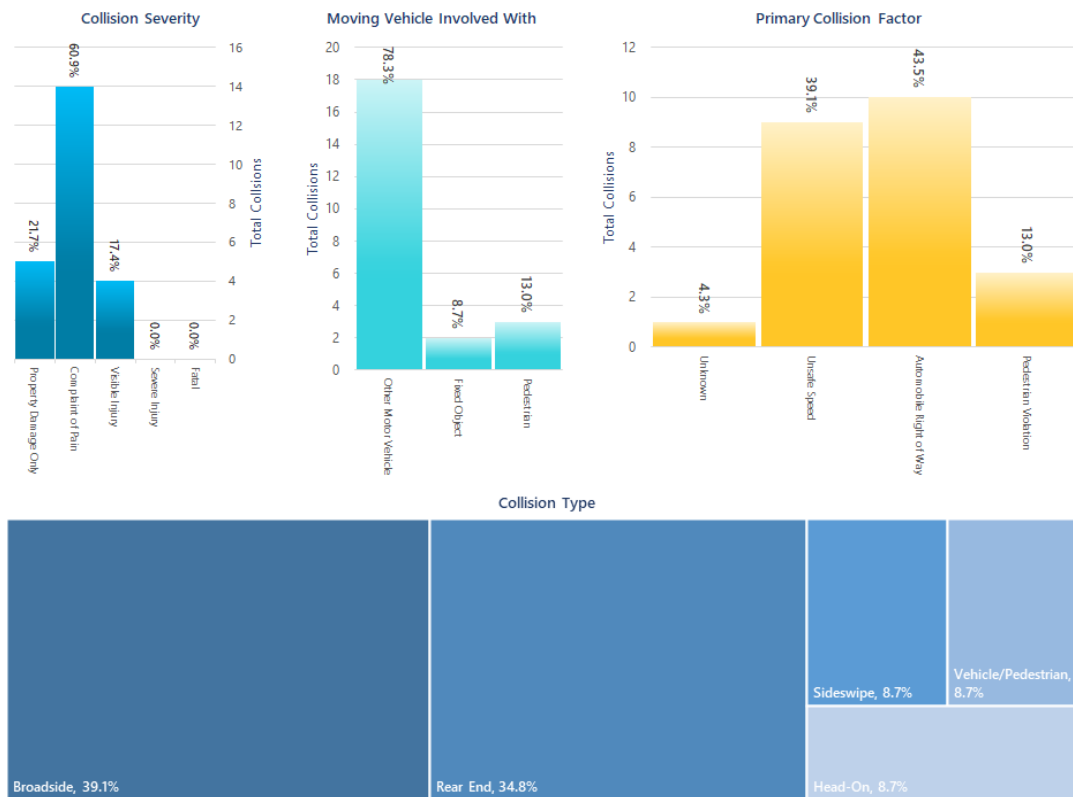
6.3 INTERSECTION RECOMMENDATIONS

6.3.1 HIGHLAND AVENUE AND EUCALYPTUS DRIVE

This location is a non-signalized three-way intersection between a major arterial road and a minor road. Highland Avenue is a four-lane arterial road with a two-way left-turn lane. The south sidewalk extends 370 feet west of the intersection to the CA-210 offramp and 400 feet east of the intersection to a private lot, and then continues eastward intermittently. The north sidewalk begins at the intersection and continues eastward. There is no sidewalk in front of the vacant lot northwest of the intersection, but there is a dirt path connecting to the nearest sidewalk. Eucalyptus Drive is a two-lane minor road that leads to a residential neighborhood; a sidewalk exists on the east side that faces a commercial shopping center, but ends at the end of that lot. Both sides of Highland Avenue have commercial uses fronted by parking lots.

23 collisions in total have occurred at this intersection. The two most common collision types are broadside at 9 collisions (55.3%) and rear-end at 8 collisions (34.8%). The two most common Primary Collision Factors are automobile right-of-way violation at 10 collisions (43.5%) and unsafe speeds at 9 collisions (55.3%).

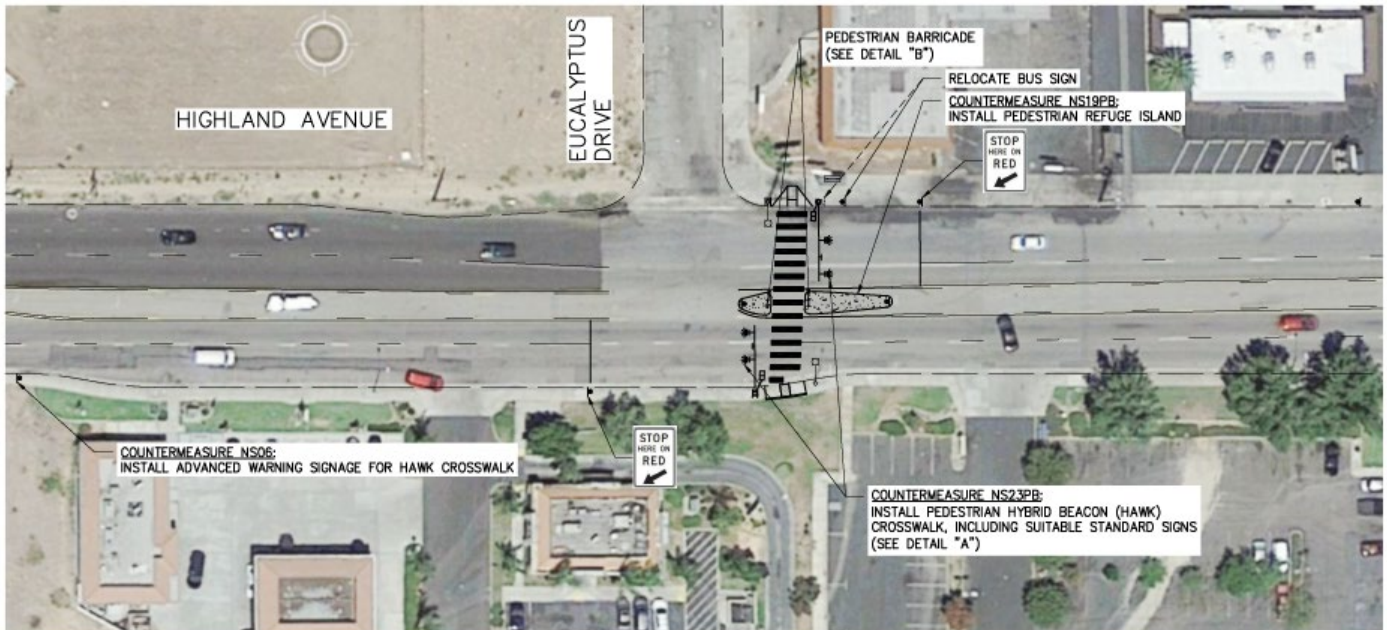
Figure 6.8: Highland Avenue And Eucalyptus Drive Collision History



The following countermeasures are recommended for this intersection:

- **NS23PB:** Install pedestrian hybrid beacon (HAWK) crosswalk – Install at NE corner of Eucalyptus Drive and 450' east of I-210 southbound off-ramp, at the end of the curb taper.
 - o Will require new pole and mast arm for beacon installation in each direction.
 - o Include pedestrian push buttons and warning signage on new pole and mast arm.
 - o Will require minor relocation of transit stop signs to provide clear
- **NS19PB:** Install concrete pedestrian refuge island to protect pedestrians using HAWK crosswalk.
 - o Allow sufficient clearance for left turns onto Highland Avenue from southbound Eucalyptus Drive and northbound shopping center driveway
- **NS06:** Install new advance warning signage for new HAWK crosswalk (pedestrian crossing, indicator arrow, stop here on red, etc.) as advance warning to prepare drivers to stop.
 - o **NS09 (Optional):** Provide enhanced protection by installing advance warning beacons with warning signage, and synchronize HAWK beacon and advance warning beacons operation.
- Relocate bus stop signage as needed to accommodate the above improvements

Figure 6.9: Highland Avenue And Eucalyptus Drive Design Concept



6.3.2 9TH STREET AND SIERRA WAY

This location is a signalized intersection of two arterial roads. 9th Street has four travel lanes and a two-way left-turn lane. Sierra Way is two lanes with left turn pockets at the intersection. Left turns are protective-permissive in the north-south direction and fully protected in the east-west direction. Sidewalks and standard crosswalks exist on all sides of the intersection. The area around the intersection is primarily residential, with some commercial uses adjacent to the intersection.

Two collisions have taken place at this intersection, one of them being a broadside collision between a motor vehicle and a bicycle which resulted in visible injury, and the other being a sideswipe collision between a motor vehicle and a bicycle which occurred at night, resulting in a complaint of pain.

The following countermeasures are recommended for this intersection:

- **S01:** Add intersection lighting with luminaire lighting and mast arm
- Relocate existing push buttons to new push button posts.
- **S02** (Optional): Install nearside signals eastbound and westbound on 9th Street

Figure 6.10: 9th Street and Sierra Way Design Concept

6.3.3 CAJON BOULEVARD AND MEDICAL CENTER DRIVE

This location is a non-signalized three-way intersection between two two-lane roads. Stop controls exist on Medical Center Drive, while traffic on Cajon Boulevard does not stop. The intersection is located in a primarily rural and industrial area, with approaches in each direction coming from long straightaways with little by the side of each road. There are no sidewalks, bike lanes, or crosswalks in the vicinity of the intersection.

A total of 9 collisions have occurred at this intersection. The most common Primary Collision Factors (PCFs) are automobile right-of-way violation and improper turning, at 33% each, and the most common collision types are broadside, rear-end, head-on, and hit object, all at 22% each.

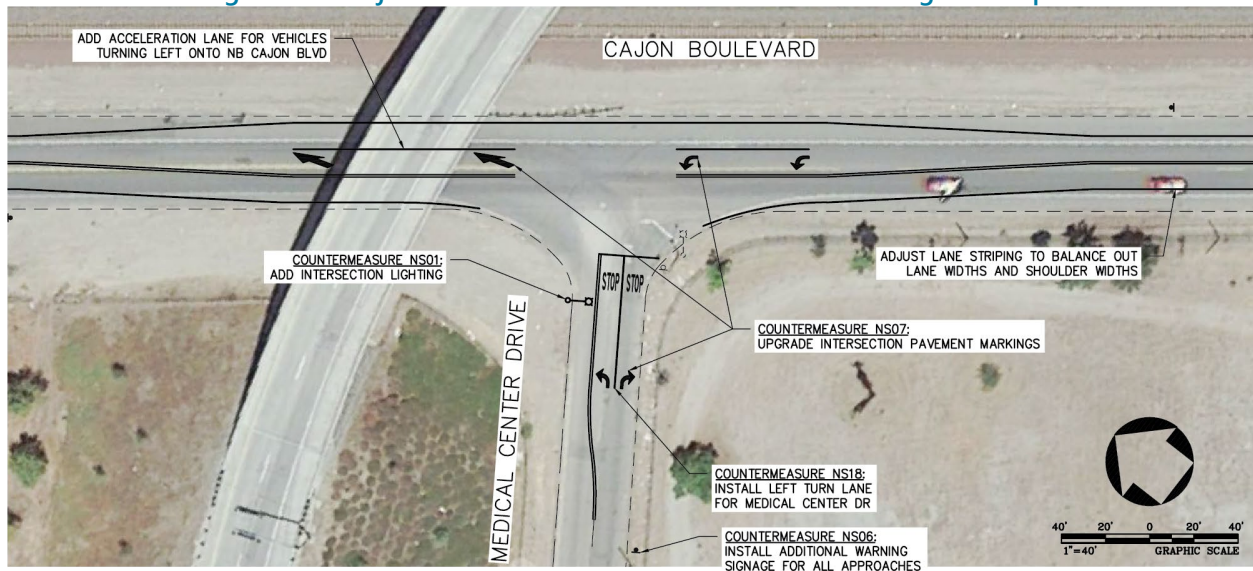
Figure 6.11: Cajon Boulevard and Medical Center Drive Collision History



The following countermeasures are recommended for this location:

- **NS01:** Add intersection lighting to northeast or northwest corner.
- **NS18:** Install left turn lane for Medical Center Drive.
- **NS06:** Install additional warning signage for all approaches.
- **NS07:** Upgrade intersection pavement markings.
- Adjust lane striping to balance out lane widths and shoulder widths.

Figure 6.12: Cajon Boulevard and Medical Center Drive Design Concept



6.3.4 E STREET AND VALLEY STREET

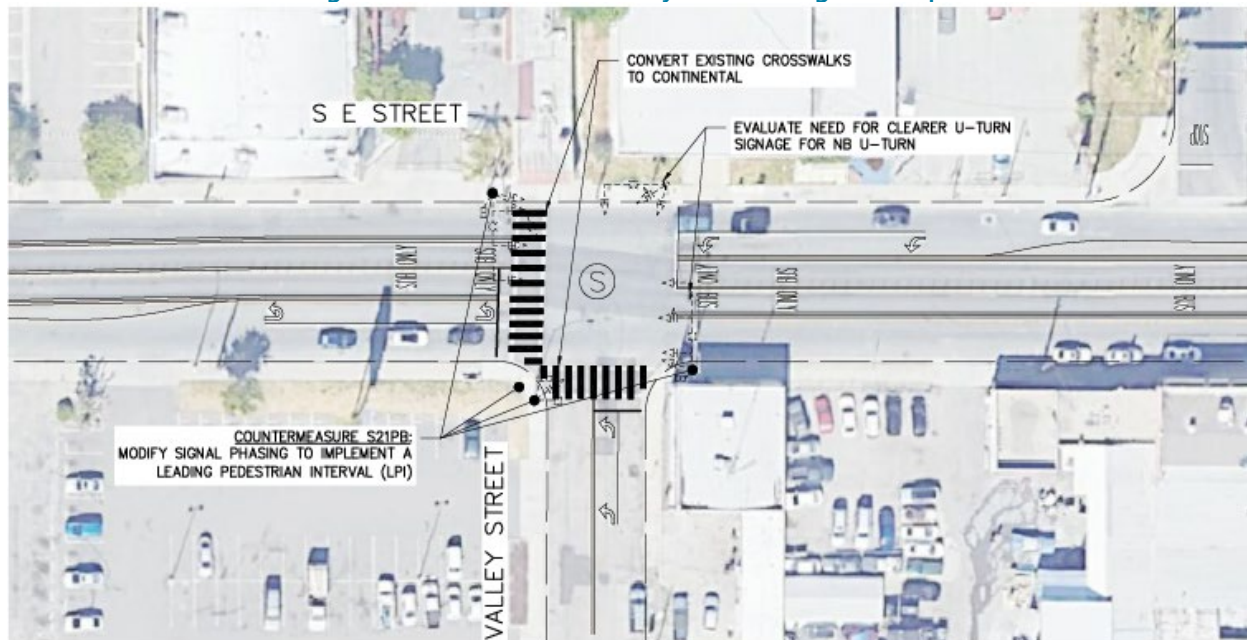
This is a three-way signalized intersection. Both roads carry one lane of traffic in each direction with dedicated left-turn lanes. E Street contains the sBX bus rapid transit corridor in its median, which is separated from general traffic and is a part of the signal phasing. Traffic on nearby driveways along E Street cannot cross the sBX corridor. Left turns are protected for southbound traffic. Northbound traffic on E Street has a dedicated U-turn lane and signal phase (which contains standard left-turn signal heads). The intersection contains standard crosswalks on the south and east legs of the intersection.

A total of two collisions have occurred at this intersection. Both were vehicle-pedestrian collisions resulting in a complaint of pain.

The following countermeasures are recommended for this location:

- **S21PB:** Implement a Leading Pedestrian Interval (LPI)
- **S02:** Install nearside vehical signal heads with retroreflective yellow borders
- Convert existing crosswalks to continental striping
- (Optional) Replace northbound left-turn signal head with a U-turn signal head

Figure 6.13: E Street and Valley Street Design Concept

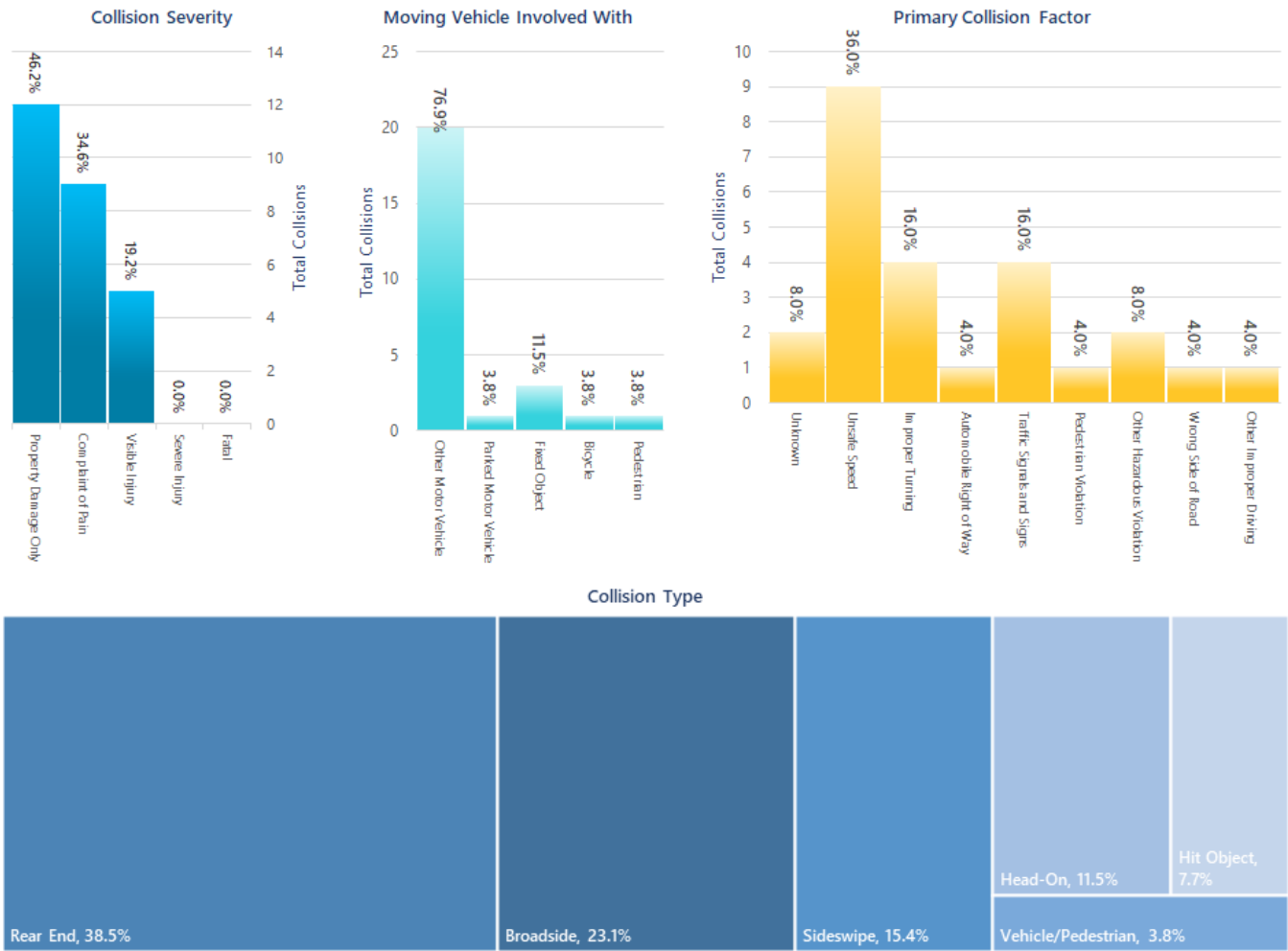


6.3.5 E STREET / INLAND CENTER DRIVE AND MILL STREET

This is a five-way signalized intersection between major roads. All streets are four lanes, with Inland Center Drive and Mill Street containing two-way left turn lanes. E Street contains the sBX bus rapid transit corridor in the median, which is separated from general traffic and is a part of the signal phasing. Traffic on nearby driveways along E Street cannot cross the sBX corridor. Left turns are protected in all directions. This intersection contains standard crosswalks on the north, west, and east legs of the intersection.

A total of 26 collisions have occurred at this location. The most common Primary Collision Factors (PCFs) are unsafe speed (36.0%), improper turning (16.0%), and traffic signals and signs (16.0%). This collision history indicates that the location could benefit from greater clarity in signage and lane markings. The most common collision types are rear end (38.5%) and broadside (23.1%).

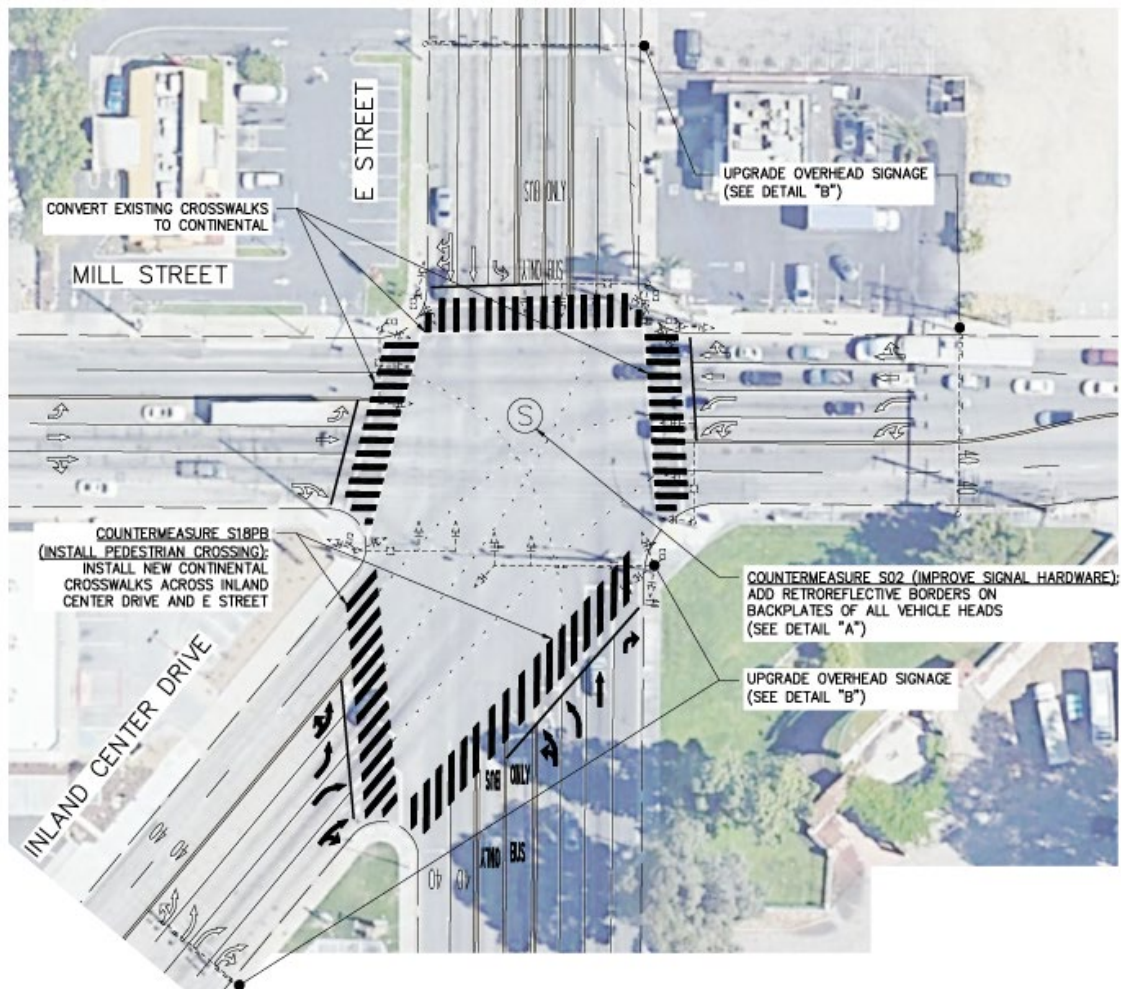
Figure 6.14: E Street, Inland Center Drive, and Mill Street Collision History



The following countermeasures are recommended for this location:

- **S18PB:** Install pedestrian crossings in the southeast corner across Inland Center Drive and across E Street.
- **S02:** Upgrade vehicle signal heads with retroreflective yellow borders.
- Upgrade all existing crosswalks to continental striping.
- (Optional) Upgrade overhead signage at intersection approaches to indicate which streets each lane leads to.

Figure 6.15: E Street, Inland Center Drive, and Mill Street Design Concept



6.3.6 G STREET AND INLAND CENTER DRIVE

This location is a four-way signalized intersection between a major and minor road that also includes an access point to the Inland Center Mall parking lot. Inland Center Drive has four lanes, a median barrier, and dedicated left turn lanes. G Street has two lanes and a center two-way left-turn lane. Left turns are protective-permissive along Inland Center Drive and fully permissive along G Street and for traffic exiting Inland Center mall. G Street contains Class II bike lanes in each direction, while Inland Center drive has a two-way pedestrian and bicycle path that originates from the intersection and continues southwest. Aside from the path, there are no sidewalks on either street.

A total of 11 collisions have occurred at this location. The most common Primary Collision Factors (PCFs) are automobile right-of-way violation (36.4%) and traffic signals and signs (27.3%). The most common collision type is overwhelmingly broadside (72.7%).

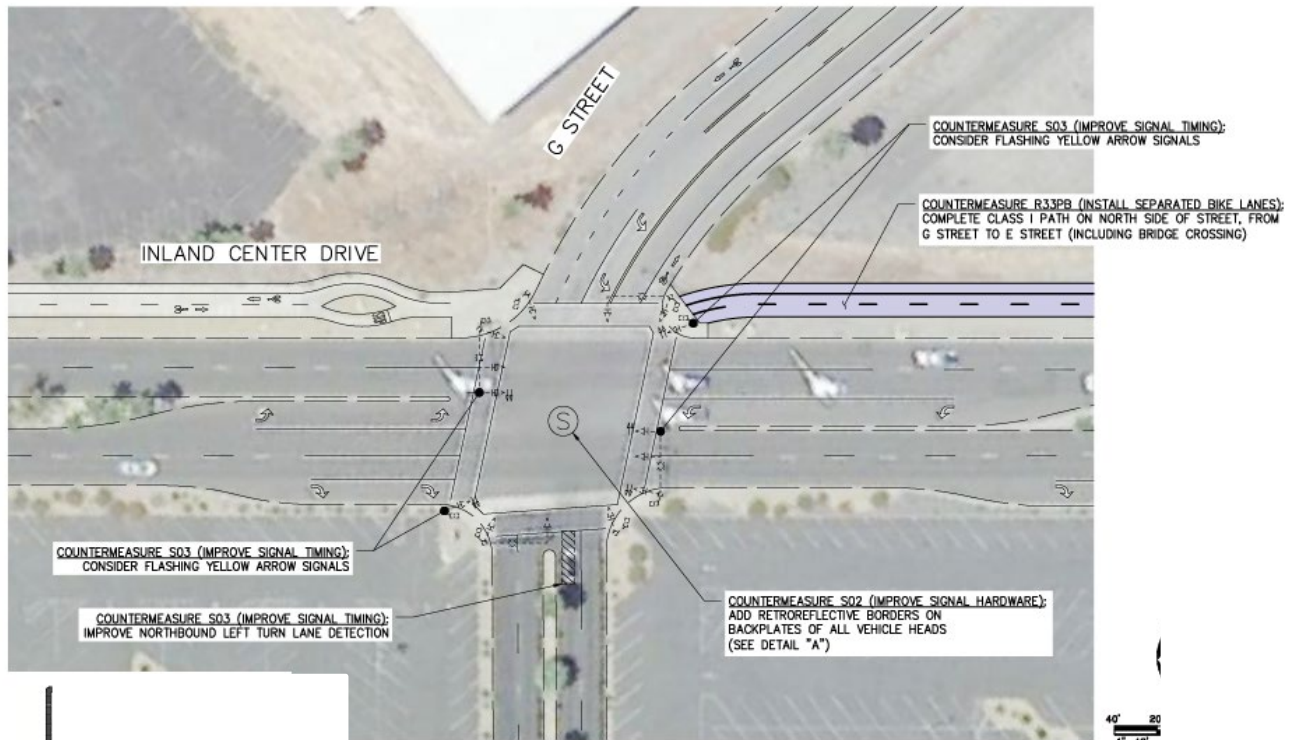
Figure 6.16: G Street and Inland Center Drive Collision History



The following countermeasures are recommended for this location:

- **S03:** Improve northbound left turn lane detection.
 - o Consider flashing yellow arrow signals in all directions.
- **S02:** Upgrade vehicle signal heads with retroreflective yellow borders.
- **R33PB:** Extend Class I path on the north side of the street, from G Street to E Street (including bridge crossing).
- Upgrade all existing crosswalks to continental striping.

Figure 6.17: G Street and Inland Center Drive Design Concept

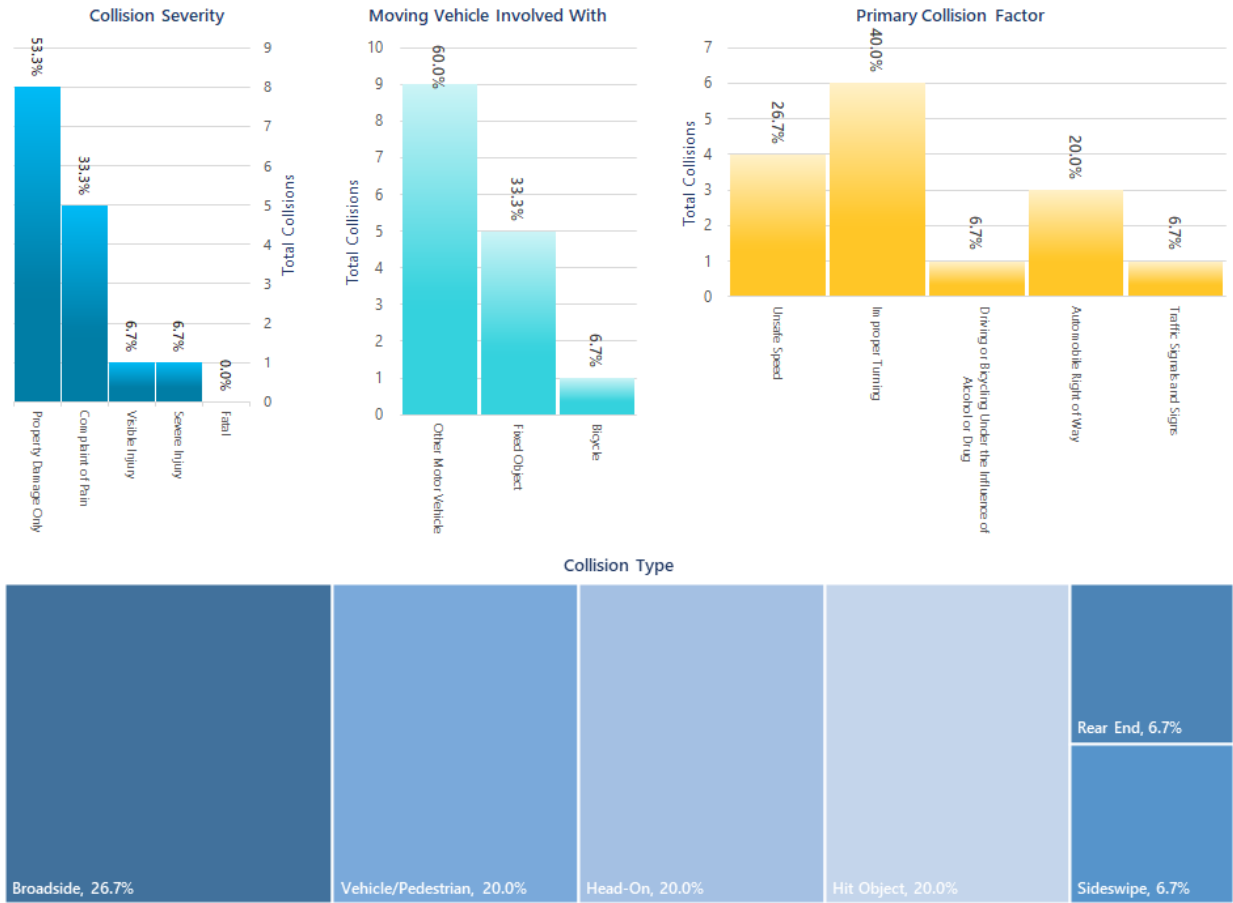


6.3.7 MERIDIAN AVENUE AND RIALTO AVENUE

This location is a four-way signalized intersection. Rialto Avenue has two lanes and a two-way left-turn lane, with a 45 mph speed limit. Meridian Avenue has two lanes and a center yellow line on the northbound and southbound approaches to the intersection. Left turns are protective-permissive for east-west traffic on Rialto Avenue and fully permissive for north-south traffic on Meridian Avenue. The intersection contains standard crosswalks on all legs. Sidewalks only exist on one side of each street; sidewalks originate from the northwest and southeast corners, while sidewalks do not exist on the other corners or on either street's approach to those corners. The uses surrounding the neighborhood are almost exclusively residential, with a shopping center approximately 750 feet west of the intersection.

A total of 15 collisions have occurred at this location, with one resulting in severe injury. The most common Primary Collision Factors (PCFs) are improper turning (40.0%) and unsafe speed (26.7%). The most common collision types are broadside (26.7%), vehicle/pedestrian (20.0%), head-on (20.0%), and hit object (20.0%).

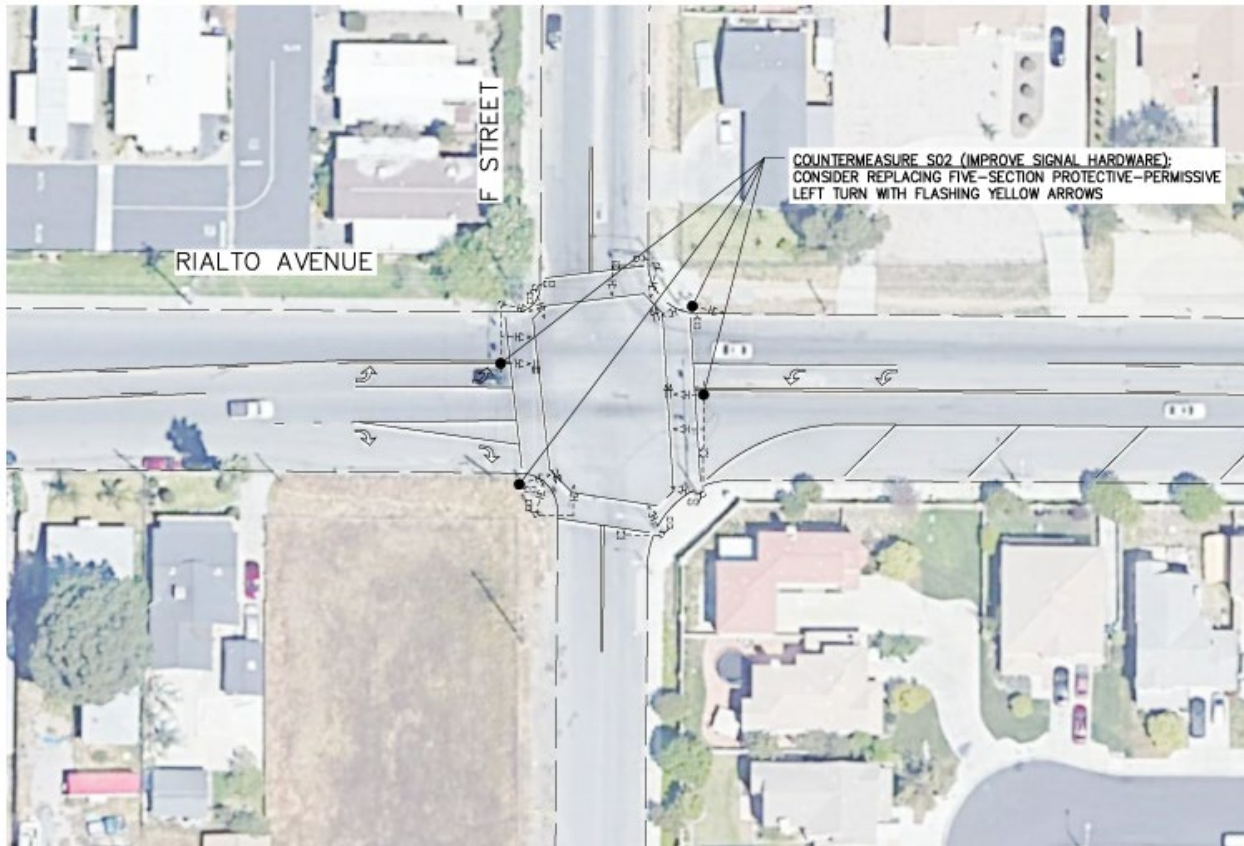
Figure 6.18: Meridian Avenue and Rialto Avenue Collision History



The following countermeasures are recommended for this location:

- **S02:** Consider replacing five-section protective-permissive left turn with flashing yellow arrows.
- **S03:** Improve signal timing. Review yellow and all-red timing parameters.

Figure 6.19: Meridian Avenue and Rialto Avenue Design Concept

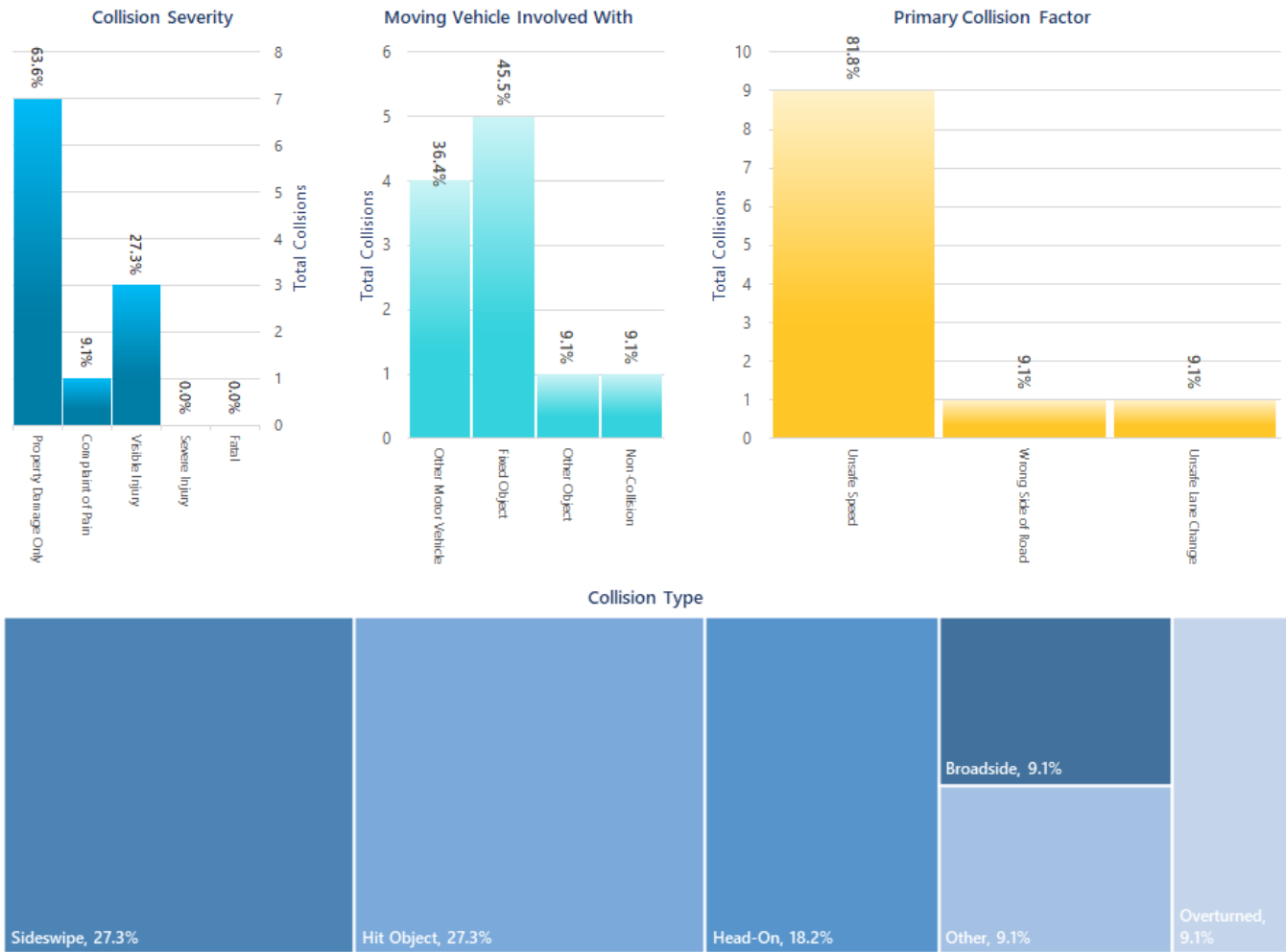


6.3.8 E STREET AND KENDALL DRIVE (NORTH OF 36TH STREET)

This is a non-signalized three way intersection between a major arterial road and a minor street. Kendall Drive has four lanes and a left-turn pocket for northbound traffic. Southbound traffic approaches downhill after climbing over the Shadin Hills. From the northwest corner, E Street is a minor, two-lane residential street. Kendall Drive assumes the name of E Street as it continues south from the intersection. Kendall Drive/E Street does not have edge lines as it tracks through the intersection. There are no marked crosswalks at this intersection. Uses around the intersection are primarily residential.

A total of 11 collisions have occurred at this location. The most common Primary Collision Factor (PCF) is overwhelmingly unsafe speed (81.8%). The most common collision types are sideswipe and hit object, at 27.3% each.

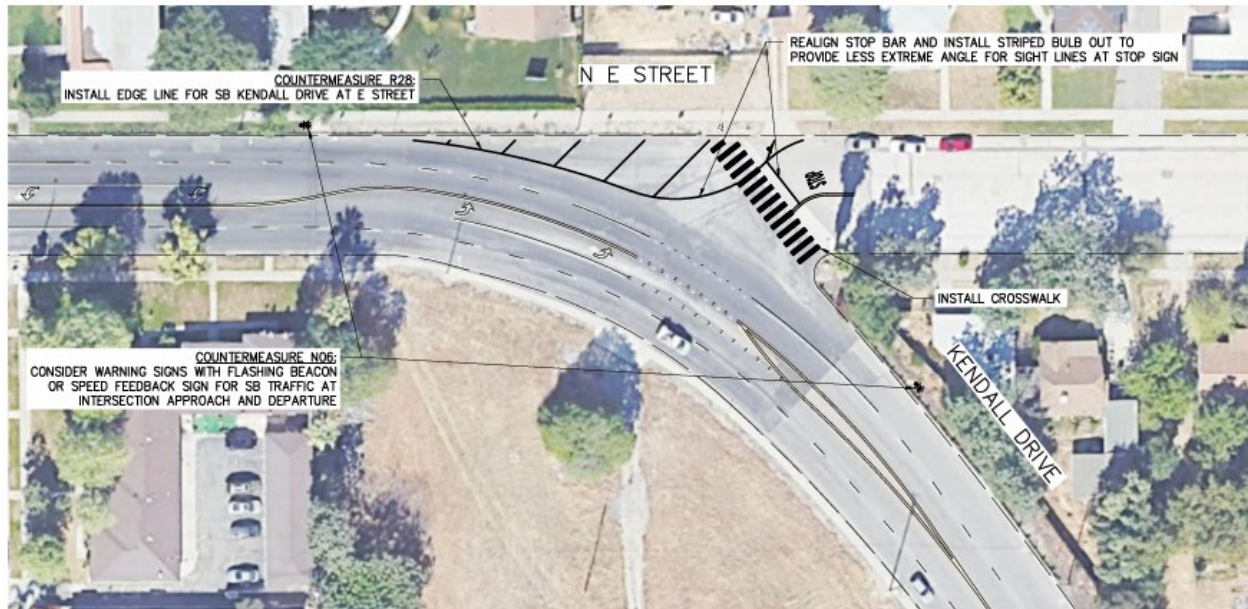
Figure 6.20: E Street and Kendall Drive Collision History



The following countermeasures are recommended for this location:

- **NS07:** Restripe southbound E Street approach and stop bar to be perpendicular to centerline of Kendall Drive.
 - o Install a striped bulb out on the west edge of the intersection to orient traffic to the new stop bar and provide better sightline angles.
- **R28:** Provide an edge line for southbound Kendall Drive through the curve as it approaches and departs the intersection.
- **NS06:** Consider warning signs with flashing beacon or a speed feedback sign for southbound traffic at the intersection approach and departure from the intersection.

Figure 6.21: E Street and Kendall Drive Design Concept



6.3.9 RIALTO AVENUE AND F STREET

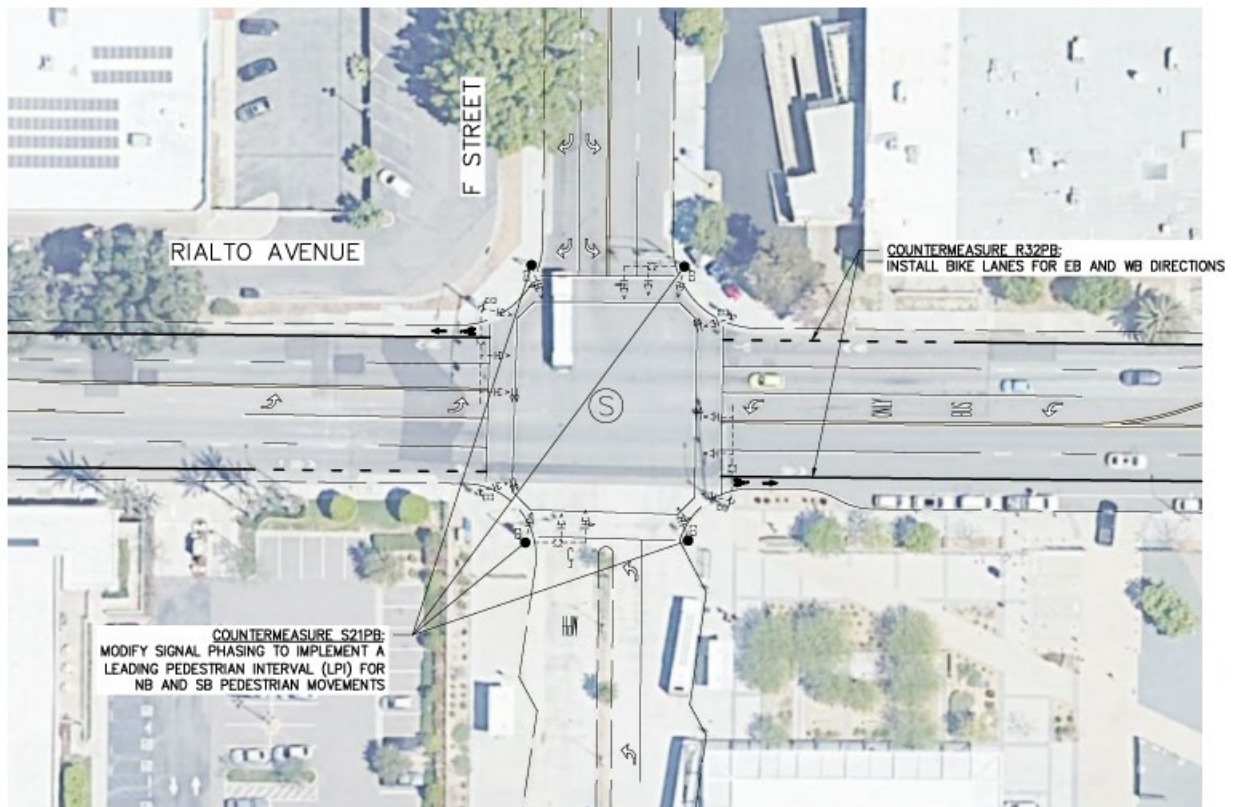
This is a three-way signalized intersection that includes a bus-only fourth leg that serves as the entrance and exit for the San Bernardino Transit Center. Both roads are four lanes wide; Rialto Avenue also includes a two-way left-turn lane. Left turns are protective-permissive for east-west traffic. Both roads have sidewalks on both sides, and there are standard crosswalks on all legs of the intersection. There are no bike lines on either street, but Rialto Avenue is marked with shared lane markings. This location, in Downtown San Bernardino, is surrounded by almost exclusively commercial uses.

A total of 7 collisions have occurred at this intersection. The most common Primary Collision Factors (PCFs) are automobile right-of-way violation (42.9%) and pedestrian violation (28.6%). The most common collision types are vehicle/pedestrian (42.9%) and broadside (28.6%).

The following countermeasures are recommended for this location:

- **R32PB:** Add bike lanes along Rialto Avenue
- **S21PB:** Implement Leading Pedestrian Intervals (LPIs) for northbound and southbound pedestrian movements
 - o (Optional) Install curb bulb-outs
- (Optional) Upgrade existing crosswalks to continental striping.

Figure 6.22: Rialto Avenue and F Street Design Concept



6.3.10 E STREET AND 21ST STREET

This is a non-signalized four-way intersection with a 75-foot offset as 21st Street crosses E Street. E Street is a major arterial road with four lanes of traffic. 21st Street is a minor residential street. Traffic on 21st Street has stop controls, while traffic on E Street does not stop. The intersection is approximately 250 feet south of an sBX bus rapid transit stop. The area around the intersection is residential with commercial corridors along E Street and nearby Highland Avenue, which is approximately 350 feet north. San Bernardino High School is ¼ mile south of the intersection. There are no marked crosswalks at this intersection.

A total of 9 collisions have taken place at this intersection, including two resulting in severe injury. The most common Primary Collision Factors (PCFs) are pedestrian violation (33%) and improper turning (22%). The most common collision types are broadside (44%) and vehicle/pedestrian (33%).

The following countermeasures are recommended for this location:

- **NS06:** Add new warning signage prohibiting pedestrians crossing E Street at 21st Street, directing pedestrians to cross at Highland Avenue to the north or at 20th Street to the south

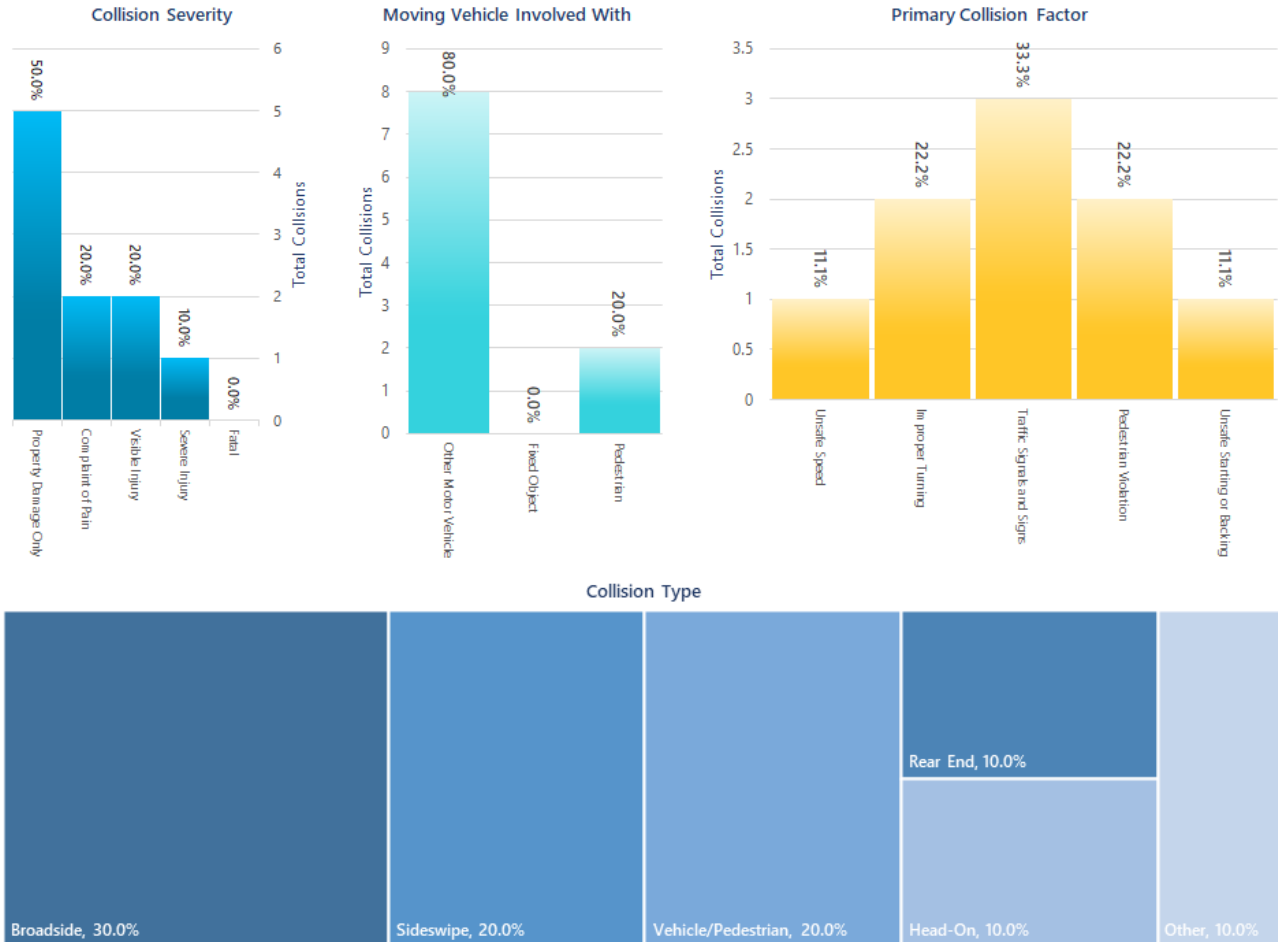
6.3.11 E STREET AND 9TH STREET

This is a four-way signalized intersection between two major roads. E Street contains two lanes of general traffic with dedicated left turn lanes, while 9th Street contains four lanes and a two-way left-turn lane. E Street contains the sBX bus rapid transit corridor in its median, which is separated from general traffic

and is a part of the signal phasing. Traffic on nearby driveways along E Street cannot cross the sBX corridor. Left turns are protective-permissive for east-west traffic on 9th Street and fully protected for north-south traffic on E Street. There are currently standard crosswalks on all legs of the intersection.

A total of 10 collisions have taken place at this location, including one resulting in severe injury. The most common Primary Collision Factors (PCFs) are traffic signals and signs (33%), pedestrian violation (22%), and improper turning (22%). The most common collision types are broadside (30%), sideswipe (20%), and vehicle/pedestrian (20%).

Figure 6.23: E Street and 9th Street Collision History



The following countermeasures are recommended for this location:

- **S21PB:** Modify signal phasing to implement a Leading Pedestrian Interval (LPI)
 - o Northbound and southbound crossings are highly recommended, but all four crossings can be considered.
- Upgrade existing crosswalks to continental striping.

6.3.12 5TH STREET AND VICTORIA AVENUE

This is a four-way signalized intersection between two major roads. Victoria Avenue contains four lanes

of traffic without left turn lanes, while 5th Street contains two lanes of traffic as it approaches from the west, and four lanes of traffic with a two-way left-turn lane as it approaches from the east. Left turns are fully permissive in all directions. There are currently standard crosswalks on all legs of the intersection, with inconsistent sidewalk coverage nearby. 5th Street has Class II bike lanes. The intersection is located in a primarily industrial area with some residential uses nearby.

If 5th Street between Victoria Avenue and Roberts Street will be widened to accommodate additional logistics facilities on the north and south, it is critical that those improvements be paid through development fees and delivered by the City, or as part of the facility’s construction.

A total of 10 collisions have taken place at this location, with the most common Primary Collision Factor (PCF) being automobile right-of-way violation (40.0%). The most common collision type is overwhelmingly broadside (80.0%).

Figure 6.24: 5th Street and Victoria Avenue Collision History



The following countermeasures are recommended for this location:

- **S06:** Install northbound and southbound left turn lanes.
- **S07:** Provide protected left turn phase for eastbound and westbound traffic.
- **S02:** Improve signal heads (increased size, retroreflective back plates, near side signal heads for left turns).

6.3.13 E STREET AND ORANGE SHOW ROAD

This location is a four-way signalized intersection between major arterial roadways. E Street contains two lanes of general traffic with dedicated left-turn lanes, while Orange Show Road contains four lanes and a two-way left-turn lane as it approaches from the east, and four lanes from the west that are joined by two left-turn lanes and a dedicated right-turn lane. E Street contains the sBX bus rapid transit corridor in its median, which is separated from general traffic and sBX operations are incorporated into the corridor's signal phasing. Traffic on nearby driveways along E Street cannot cross the sBX corridor. Left turns are fully protected in the intersection. There are currently standard crosswalks on all legs of the intersection.

A total of 33 collisions have taken place at this location. The most common Primary Collision Factors (PCFs) are unsafe speed and automobile right-of-way violation (24.2% each). The most common collision types are broadside (45.5%), rear end (21.2%), and sideswipe (12.1%).

Figure 6.26: E Street and Orange Show Road Collision History



The following countermeasures are recommended for this location:

- **S21PB:** Evaluate potential for LPI across all legs; examine need for complementary right turn on red (RTOR) restriction.
- **S09:** Add guidance striping across the intersection for BRT lanes; consider using high-visibility, colored striping to clearly delineate lane assignment at the intersection approach and crossing the intersection.
 - o Consider guidance striping for northbound/southbound left turn lanes on Orange Show Road to help vehicles avoid accidentally entering the BRT lanes.
- **S02:** Upgrade vehicle signal heads with retro-reflective yellow borders, increased signal lens sizes, etc.
- Upgrade existing crosswalks to continental striping

7.0 NON-ENGINEERING SAFETY MEASURES

This section presents the non-infrastructure solutions to San Bernardino’s roadway safety needs. The programs will promote safe behavior in each plan’s identified transportation safety emphasis areas through education, law enforcement, and encouragement.

7.1 DRIVING UNDER THE INFLUENCE

Driving Under the Influence (DUI) remains a major issue in the City of San Bernardino, ranking 8th in collisions involving DUI among cities of similar size in California, and ranking 2nd in collisions involving DUI with a driver under the age of 21. Therefore, education and enforcement meant to address DUI should work to target underage drinking but also address DUIs from drivers of all age groups.

7.1.1 EDUCATION

- The San Bernardino City Unified School District can consider incorporating Every 15 Minutes³ into the curriculum. The Every 15 Minutes program is a two-day program focusing on high school juniors and seniors. The program challenges them to think about drinking, driving, personal safety, the responsibility of making decisions, and the impact their decisions have on their family, friends, and community. The program is funded through OTS grants and California Highway Patrol mini-grants.
- The California Department of Alcoholic Beverage Control (ABC) operates the Licensee Education on Alcohol and Drugs (LEAD) training program for store managers and employees on how to sell alcohol safely, responsibly, and legally, with an emphasis on preventing sales to minors and clearly intoxicated customers⁴. This program is voluntary and free through OTS grants.
- Collaborate with Mothers Against Drunk Driving (MADD) to implement their Teen Influencer Institute Program for San Bernardino, which trains middle and high school students on how to be effective peer-to-peer educators.

7.1.2 ENFORCEMENT

- Provide training to San Bernardino Police Department for finding DUIs and other driving behaviors.
- Monitor local liquor stores and bars suspected of selling alcohol to minors.
- Set up police checkpoints at night to enforce DUI and California’s Graduated Licensing Law. The Graduated Licensing Law prohibits children under age 18 from driving with someone under the age of 21 between 11 pm and 5 am without an adult (25 years or older) supervising.

7.1.3 FUNDING SOURCES

Table 7.1 presents potential funding sources for the programs addressing Driving Under the Influence.

³ <https://www.chp.ca.gov/programs-services/programs/youth-programs/every-15-minutes>

⁴ <https://www.abc.ca.gov/education/lead-training/>

Table 7.1: Driving Under the Influence Program Funding Sources

Description	Responsible Agency	Funding Source
EDUCATION		
Establish and stage an Interactive Simulation program for high school students – Every 15 Minutes. The Interactive Simulation program aims to challenge high school juniors and seniors about drinking, driving, and mature decision-making.	San Bernardino City Unified School District	OTS Grants
Promote Licensee Education on Alcohol and Drugs (LEAD) certification for store managers and employees on how to sell alcohol safely, responsibly, and legally.	City of San Bernardino Department of Community and Economic Development, City of San Bernardino Department of Parks, Recreation & Community Services	OTS Grants
Collaborate with Mothers Against Drunk Driving (MADD) to implement peer-to-peer education among middle and high school students through MADD's Teen Influencer Institute Program.	San Bernardino City Unified School District	OTS Grants
ENFORCEMENT		
Monitor local liquor stores and bars suspected of selling alcohol to minors.	San Bernardino Police Department	OTS Grants
Set up police checkpoints at night to enforce DUIs and California's Graduated Licensing Law.	San Bernardino Police Department	OTS Grants

7.2 SPEEDING

Speeding contributes significantly to crash frequency and severity. For instance, a car hitting a pedestrian is eight times more likely to kill that pedestrian when moving at 40 miles per hour than when moving at 20 miles per hour. San Bernardino ranked 12th in speed-related collisions among cities with similar sizes in California. Unsafe speeds were responsible for 23.2% of all collisions and 22.3% of KSI collisions in the City between 2016 and 2020, which makes it the number-one most-common Primary Collision Factor for collisions resulting in fatality and/or severe injury.

The following safety (non-engineering) programs or program elements can be considered to address rear ends and speeding-related crashes.

7.2.1 EDUCATION

- Create a social media campaign to help drivers become more aware of how their speed impacts the risk of death for vulnerable road users. This campaign could be led by the City of San Bernardino Department of Public Works or the San Bernardino Police Department.

7.2.2 ENFORCEMENT

- Deploy San Bernardino Police Department officers equipped with radar or LIDAR technology at strategic locations to ticket speeding drivers.

7.2.3 FUNDING SOURCES

Table 7.2 presents potential funding sources for the programs addressing speeding.

Table 7.2: Speeding Program Funding Sources

Description	Responsible Agency	Funding Source
EDUCATION		
Create a social media campaign warning of the dangers of speeding.	City of San Bernardino Department of Public Works, San Bernardino Police Department	OTS Grants
ENFORCEMENT		
Deploy police officers equipped with radar or LIDAR technology at strategic locations to ticket speeding drivers.	San Bernardino Police Department	OTS Grants

7.3 PEDESTRIANS AND BICYCLISTS

Pedestrians and cyclists are a highly vulnerable set of road users, particularly at night. San Bernardino ranked 7th in pedestrian-involved collisions among cities of similar size in California. The City also ranked 3rd in nighttime collisions among the same group. While motorists have a responsibility to drive safely, pedestrians and cyclists can also take steps to enhance their own safety through increased awareness and measures to make themselves more visible.

The following safety (non-engineering) programs or program elements can be considered to address pedestrian and bicycle crashes:

7.3.1 EDUCATION

- Implement a “See and Be Seen” pedestrian and cyclist safety campaign which includes signal wrap artwork and signage.
- Support adult bicycle rider skills classes, such as those offered by the League of American Bicyclists.
- Offer student pedestrian and bicycle traffic safety education in schools. Lessons related to walking can include the danger of walking with distractions, while bicycle lessons can include helmet and bicycle fit, hand signals, and riding safely with traffic.
- The City can collaborate with community-based organizations to hold events where safety equipment is distributed to the public, especially for outreach in low-income communities and bilingual/trilingual communities.
- Create a partnership between local agencies and SCAG to launch a Go Human campaign, which encourages drivers to slow down and watch for people walking and biking. SCAG co-brands its Go Human safety advertisements with partner logos and provides them at no cost. Local jurisdictions, agencies, non-profits, and community-based organizations can request print or digital material.

7.3.2 ENFORCEMENT

- Offer diversion classes for bicycle riders who have been cited for traffic violations. These classes would help bicyclists learn about rights and responsibilities without issuing punitive consequences that adversely affect their driving record.

7.3.3 FUNDING SOURCES

Table 7.3 presents potential funding sources for the programs addressing pedestrian and bicycle safety.

Table 7.3: Pedestrian and Bicycle Program Funding Sources

Description	Responsible Agency	Funding Source
EDUCATION		
Implement a "See and Be Seen" campaign for pedestrians and cyclists	City of San Bernardino Department of Community and Economic Development, City of San Bernardino Department of Parks, Recreation & Community Services	OTS Grants
Support adult bicycle rider skills classes.	City of San Bernardino, League of American Bicyclists	OTS Grants
Offer student pedestrian and bicycle traffic safety education.	San Bernardino City Unified School District	OTS Grants
Partner with SCAG <i>Go Human</i> campaign to encourage drivers to slow down and watch for people walking and biking.	City of San Bernardino Department of Public Works, City of San Bernardino Department of Public Health, SCAG	SCAG*
ENFORCEMENT		
Offer diversion classes for bicycle riders.	City of San Bernardino	OTS Grants

*Resources are offered free of charge.

7.4 SCHOOL COLLISIONS

While trips to and from school are not specifically measured in SWITRS or OTS data, the available data is comprehensive enough to make inferences about school trips. As mentioned in Section 3, a total of 515 collisions met the criteria of occurring within 750 feet of a public school and taking place on a weekday, which accounts for 5.8% of all collisions within the City. Additionally, the City ranks 11th in collisions involving pedestrians under the age of 15 among cities of similar size in California.

The following safety (non-engineering) programs or program elements can be considered to address school trip collisions:

7.4.1 EDUCATION

- Expand the existing "I Drive 25 or Less" campaign held by the San Bernardino City Unified School District to increase awareness of speed limits in school zones. The current campaign includes vehicle bumper stickers. The program can be expanded to include signage and more large-scale media campaigns.
- Implement Walking School Buses and Bike Trains, which are regularly-held gatherings where adults accompany students on a pre-planned walking or biking route to school. By gathering in groups, students may be less likely to be involved in a vehicle collision than when walking alone.

- Implement a program that solicits feedback on safety issues encountered by students and parents while traveling to and from school, which could be funded through the SCAG Sustainable Communities Program under the category of Civic Engagement, Equity, and Environmental Justice.

7.4.2 ENFORCEMENT

- Offer Deploy police officers equipped with radar or LIDAR technology at locations near schools where speeding is prevalent and ticket speeding drivers.

7.4.3 FUNDING SOURCES

Table 7.4 presents potential funding sources for the programs addressing Speeding.

Table 7.4: Pedestrian and Bicycle Program Funding Sources

Description	Responsible Agency	Funding Source
EDUCATION		
Expand existing "I Drive 25 or Less" campaign.	San Bernardino City Unified School District	OTS Grants
Implement Walking School Buses and Bike Trains.	San Bernardino City Unified School District	OTS Grants
Implement a program that solicits feedback on safety issues encountered by students and parents while traveling to and from school.	San Bernardino City Unified School District, San Bernardino County Department of Public Health, SCAG	SCAG
ENFORCEMENT		
Deploy police officers equipped with radar or LIDAR technology at locations near schools where speeding is prevalent and ticket speeding drivers.	San Bernardino Police Department	OTS Grants

7.5 EMERGENCY VEHICLES

A total of 182 collisions were related to an emergency vehicle in San Bernardino from 2016 to 2020. The City of San Bernardino has its own Police Department. Since 2016, the City has used San Bernardino County Fire Department for its fire services.

Emergency Vehicle Preemption (EVP) systems may not be provided at all major intersections in the City. Signal preemption allows emergency vehicles to interrupt a normal signal cycle in order to proceed through the intersection more quickly and under safer conditions. An EVP system may assist emergency vehicles traveling through traffic prone areas when responding to an emergency call. Implementation of the EVP system citywide may improve the emergency response team's response time.

8.0 SAFETY PROJECTS

This chapter provides the project scope, collision reduction benefits calculation, cost estimation, and Benefit to Cost (B/C) ratio analysis. It will also outline the project prioritization process based on the State's HSIP Analyzer tool used to evaluate HSIP grant applications.

8.1 PROJECT SCOPES AND BENEFIT CALCULATIONS

The development of project scopes involves identifying one or more specific countermeasures at potential locations for safety improvements. Expected benefits are derived by applying the proposed countermeasures and corresponding Crash Reduction Factors (CRFs) to the expected crashes. This involves:

- Identifying the current number of crashes without treatment
- Applying CRFs by type and severity
- Applying a benefit value by crash severity
- Calculating the annual collision reduction benefits and multiplying by the project life in years

Caltrans has established some key requirements and procedures for its calls-for-projects to allow agencies maximum flexibility in combining countermeasures and locations into a single project while ensuring all projects can be consistently ranked on a statewide basis. These include:

- Only a maximum of three individual countermeasures can be utilized in the B/C ratio for a project's location type (e.g. three signalized countermeasures and one non-signalized countermeasure is acceptable for a systemic project).

An engineer determining the benefits of newly installed infrastructure first determines the number of collisions with the potential to be prevented by the improvement. The engineer then applies the CRF, which gives the rough percentage of crashes that would be prevented. The next step in estimating the overall benefit of a proposed improvement project is multiplying the expected reduction in crashes by a generally accepted value for the "cost" of crashes. The expected "benefit" value for a project is the expected "reduction in costs" value from reducing future crashes. The values weights by crash severity come from the 2022 Local Roadway Safety Manual.

Table 3.1: Collision Crash Values and EPDO Score

Collision Severity	Location Type	Crash Cost	EPDO Score Value
Fatality (K) and Severe Injury (A)	Signalized Intersection	\$1,787,000	119.93
	Non-Signalized Intersection	\$2,843,000	190.81
Combined (KA)	Roadway	\$2,461,000	165.17
Evident Injury - Other Visible (B)	All Location Types	\$159,900	10.73
Possible Injury—Complaint of Pain (C)		\$90,900	6.10
Property Damage Only (O)		\$14,900	1.00

Source: Appendix D, Caltrans Local Roadway Safety Manual, 2022

The final step in calculating the total safety project benefits is to divide the benefits by the number of years the collision data was collected (five years for this project) and multiply this value by the project life in years.

The safety project scopes are listed in Table 8.1, including the applicable countermeasure category for each improvement and benefits calculated according to the method above.

It is important to note that while the HSIP cost/benefit ratio process provides a well-documented and rigorous approach for developing and prioritizing projects, it is not the only way that a project or location can be prioritized to assess systemic safety improvements. Nor do agencies have to limit their funding source to HSIP alone. Many of the projects described in Section 6.0 would be eligible for funding from several of the grant programs listed in Section 8.5.

8.2 COST ESTIMATE

Planning-level cost estimates were developed for each countermeasure. Cost estimates were prepared based on recent bid tabulations and estimates of current construction costs consisting of unit-based cost estimates and contingencies. The costs include construction costs and include estimates engineering and administrative costs. A contingency is added to the construction cost of each project depending on the complexity of the scope. The engineering and administration cost is assumed to be 25 percent of the total construction cost, including the contingency. While some projects only utilize planning level costs to determine their BCR, with pre-determined costs for each countermeasure, more detailed design concepts and cost estimates were completed as examples of projects that could be transformative for locations with particularly high collision frequencies or unique circumstances. Those more detailed cost estimates, along with the project concepts, can be found in Appendix A.

8.3 BENEFIT/COST RATIO

A Benefit/Cost Ratio (BCR) is the ratio of a project's benefits relative to its costs, and both are expressed in monetary terms. The BCR is calculated by taking a project's overall benefit and dividing it by the overall project cost. Projects with a higher BCR mean greater benefits relative to costs, while a lower BCR means fewer benefits than costs. All project costs, from planning and design through construction completion are included when calculating the BCR.

Based on Caltrans's need for a fair, data-driven, statewide project selection process for HSIP call-for-projects, the benefit and cost calculations were completed using the same process shown in the HSIP Analyzer to calculate the B/C ratio of the project. The B/C ratios were used to identify the projects with high cost-effectiveness that may have a greater chance of receiving federal funding in Caltrans call-for-projects. Table 8.2 summarizes the B/C ratio proposed safety projects. The benefit/cost ratio is calculated according to the HSIP Analyzer from the HSIP grant application. Appendix B includes a full summary of each project countermeasure and associated costs. Note that, while BCR is the primary selection criteria for HSIP applications, the City can always turn to other funding sources that use different selection criteria entirely.

Table 8.2: Benefits/Cost Ratio Analysis by Safety Project

Location	CM #	Collision Reduction Benefits	Project Cost Estimate	Benefit/Cost Ratio (BCR)
Cajon Boulevard & Medical Center Drive	NS01, NS18, NS06, NS07	\$17,669,540	\$9,820.00	1,799.34
E Street & 21st Street	NS06	\$1,848,990	\$2,700.00	684.81
9th Street & Sierra Way	S01, S02	\$4,686,270	\$8,780	533.74
9th Street & Preston Street/Valencia Avenue	NS23PB, NS19PB	\$25,026,400	\$99,895	250.53
E Street (CA-210 to Fairway Drive)	NS20PB	\$1,838,450	\$7,430.00	247.44
E Street & 9th Street	NS20PB, S21PB	\$4,017,270	\$23,530	170.73
E Street & Valley Street	S21PB, S02	\$2,237,490	\$23,800	94.01
Highland Avenue & Eucalyptus Drive/Rockford Avenue	NS23PB, NS19PB, NS06	\$30,690,800	\$352,752.00	87.00
30th Street (San Gabriel Street to Cedar Street)	R21, R28	\$13,988,440	\$162,819.60	85.91
Meridian Avenue & Rialto Avenue	S02, S03	\$900,090	\$14,700	61.23
9th Street (Waterman Avenue to Del Rosa Drive)	R14, R32PB	\$47,038,880	\$919,272.00	51.17
E Street, Inland Center Drive, & Mill Street	S18PB, S02	\$1,068,140	\$26,480	40.34
Rialto Avenue (Pepper Avenue to Muscott Street)	R32PB, R34PB, R08, R31	\$32,865,280	\$858,467.43	38.28
Rialto Avenue & F Street	R32PB, S21PB	\$1,739,380	\$47,421.02	36.68
Meridian Avenue (Etiwanda Street to Rialto Avenue)	NS20PB, NS09	\$3,518,500	\$107,150.00	32.84
E Street & Orange Show Road	S21PB, S09, S02	\$1,515,690	\$57,330	26.44
Kendall Drive (University Drive to H Street)	R34PB, NS21PB, NS03, NS14, R33PB	\$65,378,060	\$2,645,900.00	24.71
N. E Street & Kendall Drive	NS07, R28, NS09	\$717,470	\$32,485.80	22.09
Richardson Street & San Bernardino Avenue	S02, R22	\$702,090	\$32,180	21.82
G Street & Inland Center Drive	S03, R33PB, S02	\$2,476,170	\$122,086	20.28
5th Street & Victoria Avenue	S06, S07, S02	\$4,639,800	\$1,132,700	4.10

8.4 FUNDING SOURCES

Several state and federal grant programs offer to fund engineering and non-engineering roadway safety projects. The California Department of Transportation's (Caltrans) Active Transportation Program (ATP) encourages bicycle and pedestrian use in the state by funding programs that increase bike or pedestrian mode share or improve bicycle or pedestrian safety. Caltrans also administers the Sustainable Communities Grant Program, which awards grants to municipal projects that reduce greenhouse gas emissions and support multi-modal transportation. The Sustainable Communities Program prioritizes projects that solicit stakeholder and community engagement and support state policies like the 2040 California Transportation Plan. The California Office of Traffic Safety awards grants for projects addressing any one or more of ten priority areas, including Driving Under the Influence, Distracted Driving, Pedestrian and Bicycle Safety, Police Enforcement, Safety Data Collection, and Marketing/Publicity Campaigns.

At the federal level, the Safe Streets and Roads For All program (SS4A) the primary goal to support increased roadway safety through proven countermeasures and program deployment. The Advanced Transportation Technologies & Innovative Mobility Deployment Program (ATTAIN) funds technology to promote safety and efficiency in the transportation system, which can be used to deploy extensive signal system interconnections and upgrades that increase safety on major arterials. The Highway Safety Improvement Program (HSIP) funds roadway safety improvements on any public roadway, which is distributed through State and local programs (California swaps federal HSIP funds with State highway funds, so HSIP funded projects are almost completely funded with State, rather than federal funds, reducing the administrative burden). In addition to these programs, the 2021 Infrastructure Investment and Jobs Act (IIJA) has begun to program additional discretionary grant and formula funding programs focused on roadway safety, active transportation and mobility technology improvements. These programs, and others that stem from new or re-purposed revenue streams in the State, should be considered as they are programmed and incorporated into the City's infrastructure funding strategies. Table 8.3 provides a list of eligible programs and the funding sources for related to transportation safety.

Table 8.3: Transportation Safety Funding Sources Summary

Oversight Agency	Source	Eligible Programs	Areas Addressed
Federal Highway Administration (FHWA)	Highway Safety Improvement Program (HSIP)	Any work on public roads, bikeways and pedestrian paths/trails "that improves the safety for its users". For the most part, only engineering projects are eligible, but the FAST act also permits funding for data collection by law enforcement ^{1, 2} . Funding awards are administered by the State through a bi-annual funding call for projects.	Data Collection, Countermeasure Implementation
Federal Highway Administration (FHWA)	Advanced Transportation Technologies & Innovative Mobility Deployment (ATTAIN)	Funds advanced transportation and congestion management technologies to improve safety, efficiency and performance. Examples of funded project types include advanced traveler information systems and data collection and analysis efforts ³ . The City can partner with the County or SCAG on innovation-focused projects that support the goals of the ATTIMD program.	Digital Enforcement; Technology Partnerships
Federal Highway Administration (FHWA)	Surface Transportation Block Grant Program (STBG)	Provides flexible funding that may be used by States and localities for projects to preserve and improve the conditions and performance on any Federal-aid highway, bridge and tunnel projects on any public road, pedestrian and bicycle infrastructure, and transit capital projects, including intercity bus terminals ⁴ .	Active Transportation
US Department of Transportation	Safe Streets and Roads for All (SS4A)	The purpose of SS4A grants is to improve roadway safety by significantly reducing or eliminating roadway fatalities and serious injuries through safety action plan development and implementation focused on all users, including pedestrians, bicyclists, public transportation users, motorists, personal conveyance and micromobility users, and commercial vehicle operators.	Roadway Safety, Active Transportation, Planning & Design, Education and Enforcement, Data Collection
California Department of Transportation (Caltrans)	Active Transportation Program (ATP)	Local government projects that improve the safety or increase the mode share of bicycling and walking. Additional program objectives include reducing emissions and enhancing public health ⁵ .	Bicycle and Pedestrian Education and Enforcement
California Department of Transportation (Caltrans)	Sustainable Communities Grant Program	The program awards "Competitive Grants" to local governments. These grants prioritize projects that reduce Greenhouse Gas Emissions, support multi-modal transportation, involve stakeholder/ community engagement and support related plans like the California Transportation Plan and California Complete Streets Framework ⁶ .	Active Transportation, Speed, Education

Oversight Agency	Source	Eligible Programs	Areas Addressed
San Bernardino County Transportation Authority (SBCTA)	Measure I Transportation Funds	Measure I is the half-cent sales tax collected throughout San Bernardino County for transportation improvements, including major arterial projects, grade separations, and local street improvements. The City of San Bernardino can designate safety projects for inclusion in their annual Measure I capital project plans.	Countermeasure Implementation, Active Transportation, Preventative Maintenance
California Office of Traffic Safety	Office of Traffic Safety (OTS) Grants	Programs should address one of ten priority areas (eight are listed to the right). Grant recipients should expect to wait up to 90 days before being reimbursed/funded, and should be able to provide traffic safety data to justify funded programs ⁷ .	Alcohol-Impaired Driving, Drug-Impaired Driving, Police Traffic Services, Roadway Safety and Traffic Records, Emergency Medical Services, Occupant Protection, Pedestrian and Bicycle Safety, Public Relations/Advertising/Marketing
California Air Resources Board	Sustainable Transportation Equity Program (STEP)	Aims to address community residents' transportation needs, increase access to key destinations, and reduce greenhouse gas emissions by funding planning, clean transportation, and supporting projects particularly in disadvantaged and low-income communities via two types of grants: Planning and Capacity Building Grants and Implementation Grants.	Countermeasure Implementation

Sources:

1. *Highway Safety Improvement Program Guidelines, September 2021*
2. *Highway Safety Improvement Program, Pub. L. No. 148, 23 US Code (2015)*. <https://www.law.cornell.edu/uscode/text/23/148>.
3. *Federal Highway Administration. Bipartisan Infrastructure Law Funding Programs*. <https://www.fhwa.dot.gov/bipartisan-infrastructure-law/attain.cfm>
4. *Federal Highway Administration. Surface Transportation Block Grant Program (STBG)*. <https://www.fhwa.dot.gov/specialfunding/stp/>
5. *California Transportation Commission. 2023 Active Transportation Program Guidelines. March 16, 2022. Resolution G-22-30.*
6. *California Department of Transportation. Sustainable Transportation Planning Grant Program 2022-23 Grant Application Guide. September 2021.*
7. *California Office of Traffic Safety Grant Manual for Federal Fiscal Year 2022. October 2021.*

APPENDIX A

PRIORITY PROJECT CONCEPTS & DETAILED COST ESTIMATES

APPENDIX B

BENEFIT/COST RATIO ANALYSIS

APPENDIX C

LOCAL ROADWAY SAFETY MANUAL COUNTERMEASURE INDEX

APPENDIX D

PCF GLOSSARY