MERCED COUNTY ASSOCIATION OF GOVERNMENTS

Merced Multijurisdictional Local Roadway Safety Plan

September 19, 2024

Attachment 1

Acknowledgements

This Local Roadway Safety Plan (LRSP) would not be possible without the involvement and support of:

Merced County Association of Governments (MCAG) Governing Board

Member Jurisidictions

City of Atwater
City of Dos Palos
City of Gustine
City of Livingston
City of Los Banos
City of Merced

Local Roadway Safety Plan Stakeholder Group

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Introduction, Vision, and Goals

Merced County Association of Governments (MCAG) and its six incorporated city members: Atwater, Dos Palos, Gustine, Livingston, Los Banos, and Merced, are committed to prioritizing transportation safety and eliminating traffic-related deaths and serious injuries on their roadways.

The development of this Local Roadway Safety Plan (LRSP) is being led and funded by MCAG. As the metropolitan planning organization (MPO) for Merced County, MCAG will take a regional leadership role in roadway safety, and spearhead the implementation of this LRSP. This LRSP covers each of the six incorporated cities in Merced County: Atwater, Dos Palos, Gustine, Livingston, Los Banos, and Merced. The unincorporated areas of Merced County are undergoing a separate planning process being led by the County.

As a regional plan covering six different communities, this LRSP is divided into two volumes. Volume One covers the regional and policy aspects of the plan, including project vision and goals, funding strategies, potential countermeasures, and a Safety Action Plan that will act as a roadmap for MCAG and its member agencies to implement this LRSP. Volume Two includes a collision analysis, collision profiles of emphasis, conceptual projects, and project lists for each of the six cities

Merced County is part of the Central Valley region of California, with a long heritage of agricultural production that continues today. Of the more than 1.2 million acres it encompasses, 81 percent of available land in Merced County is dedicated to agricultural uses. The population is concentrated in its six incorporated cities and a number of unincorporated communities. Merced County's population, which currently numbers 280,000, is expected to grow significantly in the coming years. The MCAG 2022 Regional Transportation Plan estimates the County will grow by approximately 82,000 in population by 2046, and add 27,000 jobs. The current population for each of the six cities covered by this LRSP are listed in **Figure 0.1**.

Figure 0.1 Population of Cities in Merced County

Source: US Census Bureau American Community Survey (ACS) 2017-2021 5-Year data

Community	Population
Atwater	31,401
Dos Palos	5,651
Gustine	5,990
Livingston	14,078
Los Banos	44,421
Merced	85,993

Roadway safety is a pressing issue facing the region today. According to 2017-2021 data from the Fatality Analysis Reporting System (FARS) maintained by the federal government, Merced County as a whole had a fatality rate of 20.48 fatalities per 100,000 inhabitants, the seventh-highest among the 58 counties of California and among the highest across the entire country.

A number of factors contribute to the problem. The region's roadway infrastructure is often outdated in terms of design, with older roadways lacking many newer safety features. The design of older, rural roadways are also becoming mismatched with new residential and commercial land uses, and are becoming strained amidst continued rapid growth and development in the region.

Moreover, roadways old and new in the region are often designed with wide cross-sections and large turn radii that are designed to accommodate larger vehicles, such as freight vehicles associated with the region's industrial and agricultural uses, which can enable higher speeds and riskier driving behaviors at the expense of overall safety, especially for vulnerable users such as bicyclists and pedestrians. This tension between minimizing vehicle delay and slower speeds to improve safety is particularly acute on many of the region's state highways. These state highways often serve a dual purpose as a community main street with multimodal local traffic and high volumes of through vehicular traffic.

The poor safety outcomes in the region also reflect its legacy of historic underinvestment and marginalization. Most of the region and most areas within the six cities covered by this LRSP are identified as disadvantaged by the various criteria used by the state and federal governments.

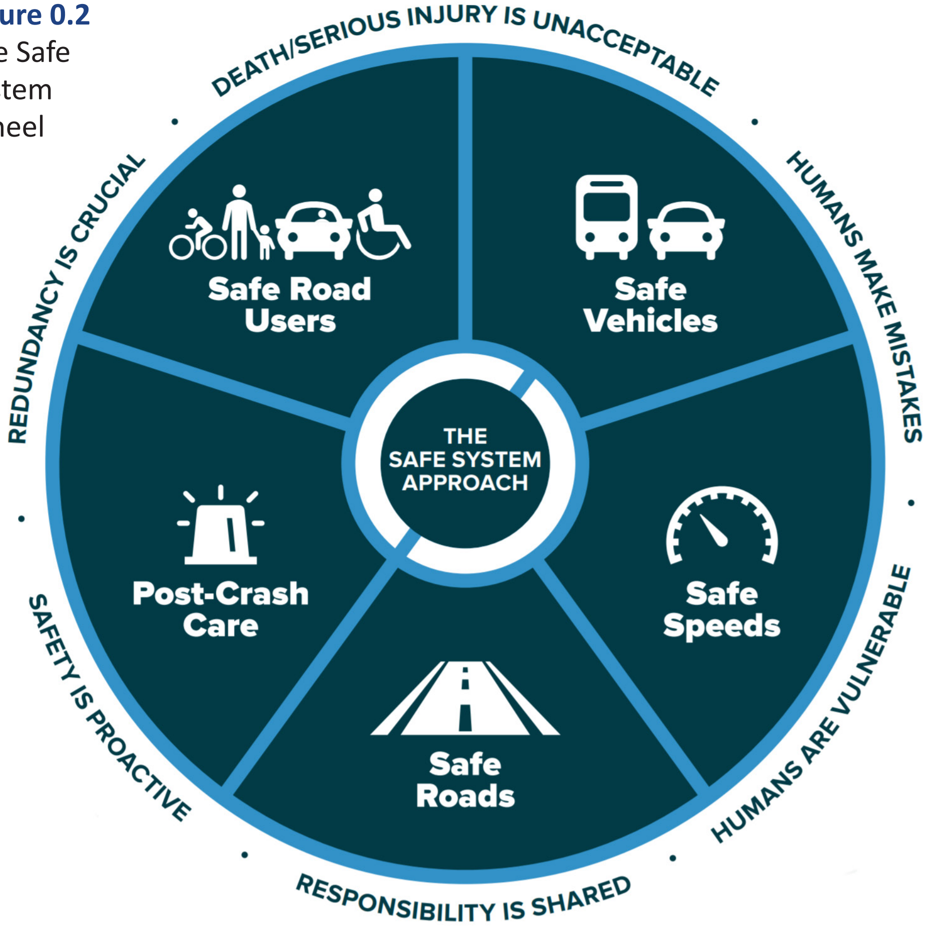
This LRSP commits MCAG and its city partners to the goal of eliminating fatalities and serious injuries on the roadway network. To accomplish this goal, the LRSP builds on existing and ongoing efforts by MCAG and these six cities to proactively identify and evaluate systemic risk factors for roadway safety. It also identifies proven countermeasures that can be implemented through roadway design changes, as well as non-infrastructure programmatic measures through key partnerships with safety stakeholders. Also included is an Action Plan, led by MCAG, and built to monitor the efforts made towards eliminating deaths and serious injuries on a yearly basis to track progress made. The Action Plan applies the Safe System Approach, an international, national, and state best practice framework, as the foundation for improving roadway safety.

The Safe System Approach

Crashes can irreversibly change the course of human lives, touching victims, their families and loved ones, and society as a whole. Through collective action on the part of all roadway system stakeholders— from system operators and vehicle manufacturers to law enforcement and everyday users—MCAG, and agencies across the US, are moving to a Safe System Approach that anticipates human mistakes, with the goal of eliminating fatal and serious injuries for all road users.

A Safe System acknowledges the vulnerability of the human body—in terms of the amount of kinetic energy transfer a body can withstand—when designing and operating a transportation network to minimize serious consequences of crashes. According to the World Health Organization, the goal of a Safe System is to ensure that if crashes occur, they

Figure 0.2
The Safe System Wheel



"do not result in serious human injury."[1] The Safe System Approach to road safety started internationally as part of the Vision Zero proclamation that death and serious injury on the roadway system is unacceptable.[2 3]

As shown in **Figure 0.2**, the Safe System Approach is founded on several principles, two of which acknowledge humans make mistakes and humans are vulnerable. As a result, a proactive, redundant system is needed to prevent death and serious injuries.[4]

Countries that have adopted the Safe System Approach have had success reducing highway fatalities, with reductions in fatalities between 50% and 70%.[5] The Safe System Approach is the foundation for the National Safety Strategy

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1 World Health Organization (2011). Decade of Action for Road Safety 2011-2020. Retrieved from https://www.who.int/roadsafety/decade_of_action/plan/plan_en.pdf, p. 9

2 Johansson, R. (2009). Vision Zero- Implementing a policy for traffic safety. Safety Science, 47, 826-831

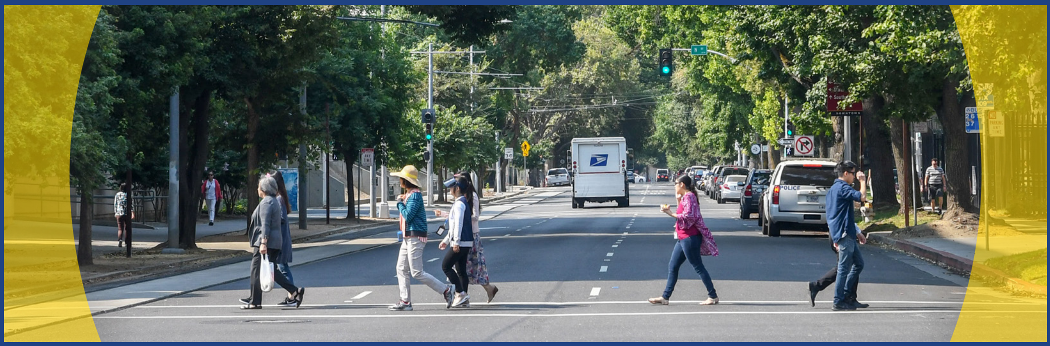
3 Tingvall, C., & Haworth, N. (1999). An Ethical Approach to Safety and Mobility. Paper presented at the 6th ITE International Conference Road Safety and Traffic Enforcement. 6-7 September 1999, Melbourne, Australia

4 Belin, M.-Å., Tillgren, P., & Vedung, E. (2012). Vision Zero- a road safety policy innovation. International Journal of Injury Control and Safety Promotion, 19, 171-179.

5 World Resources Institute (2018). Sustainable and Safe: A Vision and Guidance for Zero Road Deaths. Retrieved from https://www.wri.org/publication/ sustainable-and-safe-vision-and-guidance-zero-road-deaths.

Figure 0.3
Pedestrian Crash Survival as a Factor of Vehicle Speed

PEDESTRIAN STRUCK BY VEHICLE GOING **20 MPH**



DEATH RISK
10%

PEDESTRIAN STRUCK BY VEHICLE GOING **30 MPH**

DEATH RISK
50%

PEDESTRIAN STRUCK BY VEHICLE GOING **40 MPH**

DEATH RISK
90%

released by the United States Department of Transportation (USDOT) in 2022. Caltrans has also adopted both a Safe System Approach and a Vision Zero goal as part of their Strategic Highway Safety Plan. The Institute of Transportation Engineers (ITE) and the Road to Zero Coalition's Safe Systems Explanation and Framework articulate that to anticipate human mistakes, a Safe System seeks to:

- Separate users in a physical space (e.g., sidewalks, dedicated bicycle facilities)
- Separate users in time (e.g., pedestrian scramble, dedicated signal turn phases)
- Alert users to potential hazards
- Accommodate human injury tolerance through interventions that reduce speed and/or impact force

Creating a Safe System means shifting a major share of the responsibility for preventing collisions from road users to those who design the road transport system. "Individual road users have the responsibility to abide by laws and regulations"[6] and do so by exhibiting due care and proper behavior on the transportation system. While road users are responsible for their own behavior, this is a shared responsibility with those who design, operate, and maintain the transportation network: including the automotive industry, law enforcement, elected officials, and government bodies.[7] In a Safe System, roadway system designers and operators take on the highest level of ethical responsibility.

ITE Safe System Framework: Focus on Safe Speeds

The ITE Safe System Framework provides important context for the focus on safe speeds within a Safe System Approach. For all road users, especially those who walk or bike, speed is a determining factor in survivability.

As shown in **Figure 0.3**, increased speeds narrow sightline visibility of the roadway, and a human's chance of surviving after being struck by a vehicle increases from 10% at 40 miles per hour to 50% at 30 miles per hour to 90% at 20 miles per hour.

Reducing speed in the presence of vulnerable users is a key Safe System strategy. Approaches include:

- Physical roadway designs (reduced width, horizontal alignment) to limit speeds
- Traffic calming treatments that induce slower speeds
- Traffic signal timing that minimizes high speed flow
- Traditional or automated enforcement (currently not legal in California) that discourages speeding

6 World Health Organization (2011). Decade of Action for Road Safety 2011-2020. Retrieved from https://www.who.int/ roadsafety/decade_of_action/plan/plan_en.pdf.

7 Federal Highway Administration (2020). Integrating the Safe System Approach with the Highway Safety Improvement Program. Report No. FHWA-SA-20-018. Retrieved from https://safety.fhwa.dot.gov/hsip/docs/fhwasa2018.pdf.


MERCED COUNT

The Merced Multijurisdictional Local Roadway Safety Plan Vision Statement and Guiding Principles commits MCAG and the six cities covered to the goal of eliminating fatalities and serious injuries on the roadway network, and provide an overaching framework to progressing towards achieving this goal.

Vision

> *Using the Safe System Approach to eliminate traffic deaths and severe injuries on roadways in Merced County by 2050.*

Guiding Principles

Safety is the highest priority.
Deaths and serious injuries on our region's public roadways are preventable.

Safety is a shared responsibility.
Everyone is a key partner in roadway safety, and we want to create a system where users, roadway designers, and others work together to create redundancy and reinforce safety.

People make mistakes.
We must anticipate human mistakes by designing and managing our road infrastructure in a way that lowers the risk of mistakes and, by reducing kinetic energy involved in collisions, lowers the risk of mistakes that do occur resulting in a fatality or serious injury.

Our transportation network must be equitable.
The effort to improve roadway safety outcomes in the region must be cognizant of and address the legacy of disinvestment in our communities and their transportation infrastructure.

A data-driven approach.
MCAG will use ongoing evaluation to prioritize projects and programs that aim to eliminate fatal and severe injury collisions. MCAG will work with local jurisdictions to proactively and reactively make data-driven engineering decisions to manage roadways and reduce the severity of collisions.

Roadway safety will be accountable and transparent.
MCAG strives to be transparent in its communication of progress with stakeholders and the public. MCAG also aims to be accountable to prioritizing safety and eliminating fatal and severe injury collisions when considering policy, programming, and project related decisions.

2

Existing Policy Landscape

In recent years, leaders at the federal and state levels have taken bold and consistent steps to acknowledge the persistent and unacceptable level of severe injuries and fatalities on our roadways, commit to eliminating these occurrences, and follow international best practices and public health fundamentals to form a new safety paradigm in the US. This has specifically involved embracing the Vision Zero goal of safe mobility for all and adopting the Safe System Approach as the way to get there.

The Safe System Approach is a significant evolution in how roadway safety is conceptualized. The Safe System Approach acknowledges that mistakes are inevitable while also asserting that severe injuries and fatalities are avoidable on our roadways. This is a shift in thinking on how to improve roadway safety; instead of a primary focus on shifting behavior through education campaigns or enforcement, it encourages roads, vehicles, and policies that are intentionally designed to prioritize safety. It involves building layers of redundancy that function as safety nets for users – even if someone makes a mistake on the roadway, the system as a whole minimizes the risk of serious injury through such measures as decreased speeds, advanced vehicle safety technologies, separation among roadway users in time and space, and better post-crash care in the case of injuries. Some crashes will still happen, but under the Safe System Approach, they won't be nearly as devastating.

This Safety Action Plan has been developed to align with the pivot to the Safe System Approach. This chapter summarizes the primary reference documents and policy considerations that influenced the direction, decisions, and priorities in this LRSP.

Acknowledging this fundamental pivot leads to some basic shifts in perspective in this LRSP. First, conventionally, a safety plan has been organized by the Es of safety: education, enforcement, engineering, and emergency services. This Plan shifts away from the silos of those Es, and focuses instead on cross-cutting "new Es": energy, exposure, and equity. This Plan focuses on addressing kinetic energy risk through an assessment of speed, mass, and exposure that is inherently proactive and systemic.

Second, the most impactful way to address kinetic energy risk is by acknowledging and systematically addressing socioeconomic and land use factors that create the systemic risk, followed by understanding and enhancing built environment factors, and then considering passive and active safety tools. This Plan presents a holistic assessment of the needs and opportunities for enhancing safety consistent with this framing and priority order.

Finally, this Plan aspires to make safety the default choice: the easy choice for people as they move about and the easy choice for roadway design decisions. This Plan identifies the opportunities to streamline decision making to prioritize safety and improve internal alignment in programs, practices, and policies consistent with the Safe System Approach.

Federal Policy Considerations

The United States Department of Transportation (USDOT) incorporated the Safe System Approach as part of its most recent National Roadway Safety Strategy (NRSS), adopted in January 2022. This NRSS is the first national commitment to the goal of zero fatalities on America's roadways, and names the Safe System Approach as the way to accomplish that goal. Federal transportation officials have since unveiled a number of policies and programs geared towards the application and implementation of the Safe System Approach at the state and local levels.

Safe Streets and Roads for All (SS4A)

The Safe Streets and Roads for All (SS4A) grant program was established by the Bipartisan Infrastructure Law in 2022, centered around USDOT's National Roadway Safety Strategy and its goal of zero deaths and serious injuries on America's roadways. It will provide $5 billion in grant funding over its five-year duration to develop and implement safety plans and projects.

The SS4A grant program provides funding for local agencies to create Comprehensive Safety Action Plans (CSAPs). It also provides funding to implement safety projects, but only to those agencies that have an adopted CSAP or an equivalent. In order to qualify as a CSAP (and allow an agency to be eligible for implementation planning grant funding), a plan must meet a nine-point criteria as set forth by the USDOT. They include an official commitment and goal to eliminate roadway fatalities and serious injuries; the creation of a standing task force or working group that will lead and monitor the implementation of the plan; data-driven safety analysis; public engagement and inter-governmental collaboration; consideration of equity in the planning process; assessment of current policies and guidelines to identify changes that will better prioritize safety; identification of a comprehensive set of projects and strategies that address safety issues; posting of the plan online along with description of how future progress will be measured; and that the plan will be updated every five years.

This Plan is designed to meet all of these criteria. The complete list of these criteria is included in **Appendix D**.

Safe System Roadway Design Hierarchy

The Safe System Roadway Design Hierarchy, created by the Federal Highway Administration (FHWA) in 2024, provides guidance in contextualizing and assessing infrastructure-based countermeasures and strategies on their alignment with the principles of the Safe System Approach.

The Hierarchy classifies countermeasures into four tiers, from most to least aligned with Safe System principles. These tiers are:

1. Removing severe conflicts, which can act to eliminate high-risk conditions that involve users with different speeds or moving in different directions sharing space. This tier can include countermeasures that remove potential points of conflicts (for example, removing conflicting turning movements), and those that separate vulnerable users from vehicles in space (for example, protecting people biking through a separated bike lane).

2. Reducing vehicle speeds, which reduces the kinetic energy present within systems and thereby reduces the severity of crashes that do occur. As driver behavior, especially when it comes to speed, is highly influenced by roadway features, countermeasures that reduce prevailing speeds can include lane narrowing and features that channelize vehicle traffic such as median islands.

3. Managing conflicts in time, which covers instances (such as intersections) where space needs to be shared between different types of users, but where they can be separated in time. An example is the Leading Pedestrian Interval, which allows people walking to have a "head start" interval at a signalized intersection before conflicting vehicle traffic enters the crosswalk.

4. Increasing attentiveness and awareness, which involves alerting users to conflicts and potential risks, can involve such countermeasures as intersection daylighting and warning signage.

Crucially, the Hierarchy prioritizes improvements and countermeasures that make physical changes to the system for the whole population as more effective than measures that rely on roadway users and individual decisions. This is consistent with the Safe System Approach's central premise that humans make mistakes, and that the roadway system should be designed to accommodate them through redundant and proactive interventions.

In addition to presenting this tiered hierarchy as a framework for understanding countermeasures as they relate to the principles of the Safe System Approach, the guidance also presents examples of both common and novel countermeasures that fall under each tier.

Safe System Approach for Speed Management

Vehicular speeding continues to be one of the leading causes of collisions across the country, especially those causing fatalities and severe injuries, and the relationship between higher speeds and increased collision severity is well-documented. The FHWA's 2023 report on the Safe System Approach for Speed Management provides targeted recommendations around speed management. The report notes the need for agencies to place safety and the prevention of injury collisions (as opposed to throughput or travel times) as the highest priority when it comes to speed setting on roadways, and highlights the need to change the physical design and context of the roadway beyond merely changing regulatory speed limits in order to achieve target speeds.

The report outlines a five-stage framework to speed management that is consistent with the Safe System Approach. The process begins with establishing a vision and building consensus within the community to manage speeds; the creation of a strategic safety plan, such as a Vision Zero plan or LRSP, can serve this purpose. Second, speed data should be collected and analyzed, which can help guide the rest of the process and provide the backing to build public support. Third, locations for speed management should be prioritized proactively, taking into account both collision and speeding history as well as contextual factors (such as the presence of vulnerable users or traffic generators such as schools and commercial areas). Countermeasures can then be selected for prioritized locations. Finally, ongoing monitoring and evaluation should be conducted to ensure efficacy and allow for flexibility and adjustment. The report also provides real-world case studies of how these principles were applied in practice.

Primer on Safe System Approach for Pedestrians and Bicyclists

The Primer, released by the FHWA in 2021, emphasizes the importance of protecting pedestrians and bicyclists, as vulnerable users, under the Safe System Approach. The Primer details the considerations surrounding pedestrians and bicyclists under each of the five elements of the Safe System Approach – Safe Speeds, Safe Roads, Safe Vehicles, Safe Road Users, and Post-Crash Care. It also provides strategies and actions that can be taken at the federal, state, and local levels towards implementing the Safe System Approach. Also included is an appendix on benchmarking policies, programs, and practices for Safe System consistency.

Safe System-Based Framework and Analytical Methodology for Assessing Intersections

This report, released by the FHWA in 2021, outlines a Safe System method for Intersections (SSI) that practitioners can apply in the course of the typical project development process with commonly-available data to produce quantifiable measures of effectiveness (MOEs) that then allow for comparisons across alternative designs for an intersection. The focus of the report is to align with the Safe System principle of limiting and managing kinetic energy in the transportation system, and the metrics produced by the SSI method can be used to quantify kinetic energy transfer, number of conflict points, and complexity of movements to identify designs that align best with that principle.

Improving Pedestrian Safety on Urban Arterials: Learning from Australasia

The Improving Pedestrian Safety on Urban Arterials: Learning from Australasia report, part of FHWA's Global Benchmarking Program, was released in 2023 to document lessons learned from FHWA researchers' review of literature and practices and tour of its case studies in Australia, New Zealand, and adjacent islands (collectively referred to as "Australasia" in the report). These jurisdictions have operated under a Safe System framework since the early 2000's, and the report provides key takeaways that can be learned in the American context.

A primary shift in mindset is that treating walking as the elemental form of transportation foundational to the transportation system also centers human well-being, and improves outcomes for all modes. Another key takeway is the interconnectedness between movement and place, that planning for land uses that are accommodating for active transportation modes and transit can create places that are less autocentric and safer. Finally, there is an emphasis on the interdisciplinary nature of planning for pedestrian safety – as there is in the Safe System Approach – that in order to generate effective, cross-cutting solutions, transportation issues must not be siloed.

Other National Guidance

In addition to policy and guidance from federal agencies, other national-level documents provide additional guidance towards applying and implementing the Safe System Approach for local agencies.

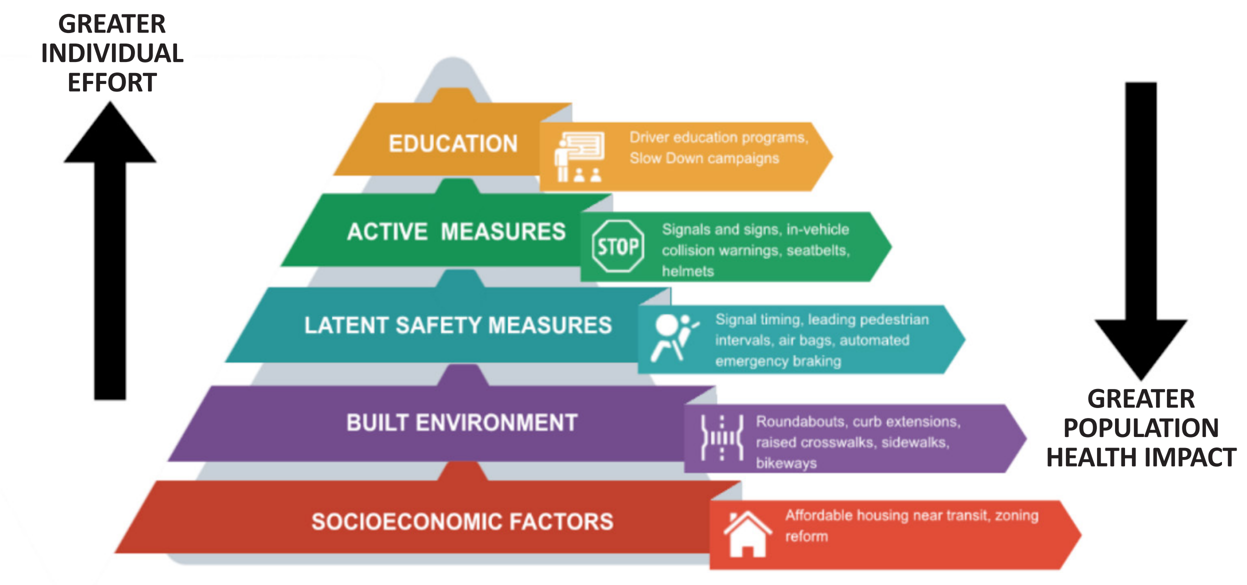
The Safe Systems Pyramid

The Safe Systems Pyramid is a new framework for traffic safety proposed in a 2023 paper by David Ederer of the Center for Disease Control (CDC), along with his co-authors Rachael Thompson Panik, Nisha Botchwey, and Kari Watkins, which adapts the Health Impact Pyramid framework into the Safe Systems Pyramid for roadway safety practitioners. Building on established public health practice, the Safe Systems Pyramid illustrates how interventions that have the largest reach and require the least personal effort will be the most impactful. In addition to identifying the kinetic energy transfer as the cause of injury, the Safe Systems Pyramid also relates energy to exposure. It explains how the many possible safety interventions differ in their effectiveness at reducing risk in the transportation system by prioritizing interventions that reduce exposure to kinetic energy transfer at the system level. Those that require more individual effort, such as driver education programs, have the least impact on improving system-wide safety. Meanwhile, those that change the quality of people's lives and the built environment in which they travel more broadly, such as affordable housing near transit, zoning reform, traffic calming, and limiting crossing distances at intersections, have the largest impacts on safety.

At the top of the Safe System Pyramid is education, which generally corresponds to Tier 4 of the Safe System Hierarchy, and encompasses driver education programs and campaigns – for example, asking drivers to slow down and obey the speed limit. As the authors of the paper note, "the need to urge behavioral change is symptomatic of failure to establish contexts in which healthy choices are default actions," and education programs are thus considered to be most reliant on individual behavior and therefore least effective in producing improvements.

Figure 0.4
The Safe Systems Pyramid

Source: Vision Zero Network



Below education on the Pyramid are active and latent safety measures, which generally correspond to Tier 3 of the Hierarchy. Active safety measures encompass such countermeasures as warning signals and signs, as well as in-vehicle devices such as seatbelts and collision warnings. These safety measures are effective when used, but rely on individual opt-in (for example, for a driver to react to signage or to a collision warning) to function. Latent safety measures encompass countermeasures such as signal timing modifications such as leading pedestrian intervals (LPIs) that create redundancy, as well as vehicle features such as lane departure prevention and automated emergency braking. Latent measures are considered more effective than active measures, as they require less individual opt-in, but their efficacy is still limited by the fact that they are applied individually. For example, while automated braking is superior to a warning signal that warns the driver to manually brake, only those who choose and have the means to drive a vehicle with the feature will have access to this technology.

Further down the pyramid is the built environment level, which corresponds to Tiers 1 and 2 of the Hierarchy, and refers to physical alterations to the roadway that promote slower speeds, physically separate vulnerable users, and reduce the number of high-risk conflicts. Such interventions can also improve the experience for walking and biking, and reduce the number of vehicle trips by encouraging mode shift. Unlike the higher levels of the pyramid, changes to the environment creates contexts that encourage safer user behaviors (for example, narrower lanes that induce lower speeds), and are thus less dependent on active user participation and thereby more effective.

Finally, the socioeconomic factors level lies at the base of the pyramid. Typically, roadway safety interventions do not go beyond the roadway infrastructure, but today's safety outcomes are inexorably linked by socioeconomic factors of the places that our roadways serve. Across the country, communities of color and low-income communities are disproportionately exposed to the most dangerous roadways that feature high speeds, high traffic volumes, and outdated design and safety features. Moreover, many communities across the country are also trapped by a lack of viable alternative transportation options as a result of car dependency, a crisis that is likely going to persist as the national phenomenon of the suburbanization of poverty continues. These are overarching socioeconomic factors that dictate urban form and the built environment, which in turn dictate safety outcomes. This category of interventions is often considered outside the traditional purview of transportation professionals, as they must come in the form of policy around land use, zoning, and economics that go beyond (but work in tandem with) transportation policy. However, they also must be considered when attempting to address roadway safety, as these socioeconomic factors form the root causes of roadway safety issues.

The pyramid should be seen as a structure for prioritizing the roadway design and operations tools that will have the most impact for safety while also collaborating outside the safety silo with other agency and community stakeholders to engage in upstream and more wide-ranging root cause topics.

NCHRP 1036: Roadway Cross-Section Reallocation Guide

The National Cooperative Highway Research Program (NCHRP)'s Report 1036, the Roadway Cross-Section Reallocation Guide, was developed in 2023 as a tool for practitioners to use in the development of roadway cross-sections that better assesses the tradeoffs involved in the allocation of the limited width of a roadway. The guide begins with the premise that roadway space is scarce and trade-offs are inevitable, and provides guidance for planning roadway cross-sections that center community priorities for that limited space. The guidelines also infuse Safe System considerations by establishing minimum floors for safety standards, such as the provision of pedestrian and bike facilities and minimum widths for sidewalks and bike lanes. Finally, the guide discusses approaches for community engagement and operational analysis to facilitate the decision-making process consistent with the goals and minimum standards outlined in the guide. The guide also includes a companion Excel spreadsheet that can be used for new roadway and retrofit planning.

A Safe System Guide for Transportation: Sharing this Approach to Lead your Community to Action

This technical report, commissioned by the AAA Foundation for Traffic Safety, serves as a resource for advocates, practitioners, and stakeholders at the local community level implementing the Safe System Approach. Specifically, it offers guidance on how to communicate the contents, importance, and benefits of the new approach to both key stakeholders and the public at large, and is a primary resource for creating culture shifts in agencies and communities towards Safe System practices and building capacity within agency staff and elected officials to institutionalize these practices in day-to-day operations.

Institute of Transportation Engineers (ITE) Resources

The Institute of Transportation Engineers (ITE) has developed a number of technical briefs that provide guidance on how the Safe System Approach fits into specific disciplines within transportation planning and engineering.

Two ITE briefs from 2022 and 2023 explore the ways in which big data sources, such as near-miss, hard-braking, and speeding data, can be used to bolster safety analyses. They augment traditional data sources such as collision data, which tend to be reactive in nature and can suffer from small sample sizes. The briefs offer case studies on how big data sources can be leveraged in roadway safety planning, and provide guidance around how to use these sources responsibly and informedly.

The 2022 brief, entitled "Essential Components of Incorporating Safety in Transportation Impact Analysis", provides guidance around institutionalizing the Safe System Approach in transportation impact analyses (TIAs) by moving beyond the traditional model of using vehicle throughput and delay times as the primary quantifiers of transportation impacts, and instead prioritize vulnerable users such as bicyclists and pedestrians. This produces TIA processes that integrate safety considerations and helps promote land uses that are conducive to safety for all modes of travel.

The 2023 brief on "Institutionalizing the Safe System Approach in Local Road Safety Plans" provides guidance for aligning the older, pre-Safe System Approach adoption Local Roadway Safety Plan (LRSP) program with Safe System standards. The brief matches the components to the LRSP with the their counterparts in the CSAP requirements outlined in the SS4A program, and identifies locations where the Safe System Approach can be incorporated in the roadmap to creating an LRSP.

California Policy Considerations

The California Department of Transportation (Caltrans), like federal authorities, has also adopted the Safe System Approach and committed to Vision Zero. Similarly, recent California legislation has supported prioritization and cross-department collaboration consistent with the Safe Systems Pyramid strategies and hierarchy. As outlined in this section, several Caltrans Deputy Directives (DD) and Directors' Policies (DPs) as well as State Senate and Assembly Bills have been essential policy building blocks to support the ongoing Safe System Pivot in California.

DP 36

In Caltrans Director's Policy (DP) 36, effective February 2022, the agency committed to eliminating fatal and serious injury crashes by 2050, and committed to achieving this goal through the application of the Safe System Approach.

DP 37

DP 37, issued December 2021, establishes creating complete streets that support people walking, biking, taking transit, and accessing passenger rail. It recognizes these priorities as a means of advancing state goals in climate and the environment, in public health, and in equity and repairing harm to underserved communities. It also recognizes complete streets as valuable community spaces that can boost economic vitality and resiliency. To these ends, it directs that "all transportation projects funded or overseen by Caltrans will provide comfortable, convenient, and connected complete streets facilities for people walking, biking, and taking transit or passenger rail unless an exception is documented and approved."

DIB 94

Caltrans Design Information Bulletin (DIB) 94, entitled "Complete Streets: Contextual Design Guidance", is a set of design implementation guidance for complete streets projects on the State Highway System that integrates the Safe System Approach and reflects the Safe System Hierarchy. DIB 94 was published in January 2024, and applies DP 37 with an eye towards specific implementation.

DIB 94 is applicable to state highways located in an urban area, suburban area, or that act as a rural main street, where posted speeds do not exceed 45 MPH, and where at least one bicycle, pedestrian, or transit facility is present. As such, DIB 94 is applicable to many of the state highway facilities in the region that feature sizable collision histories or collision risk factors as identified by this Plan.
For each of the contexts that it covers – city centers, other urban areas, suburban areas, and rural main streets, DIB 94 sets minimum expectations for the provision of complete streets facilities such as crosswalks, sidewalks, bike facilities, and others. These expectations are set with the surrounding context in mind, and include instructions, guidance, and recommendations on implementing specific complete streets features and countermeasures, ranging from pedestrian beacons to lane narrowing. Caltrans intends for DIB 94 guidance to create "context-sensitive facilities that serve travelers of all ages and abilities."

AB 43

California Assembly Bill (AB) 43 was passed in 2021 to provide additional flexibility to local jurisdictions to set speed limits on their roadways. Specifically, it offers them a means to lower speed limits on additional corridors. Cities will have increasing flexibility starting in 2024 to enforce context-sensitive speed limits. AB 43 features the following five major components, focused on giving local jurisdictions more flexibility in setting speed limits, especially regarding vulnerable road users:

- Engineering & Traffic Survey (E&TS)
  An option to extend enforceable time period
- Post E&TS
  An agency can elect to retain current or immediately prior speed limit
- Speed Limit Reduction
  Reduction of additional 5 mph based on several factors, including designation of local "Safety Corridors"
- Prima Facie Speed Limits
  Options for 15 and 25 mph in certain areas depending on context
- Business Activity Districts
  Option for 20 or 25 mph

In particular, the designation of "Safety Corridors" could be applied to roadways where the highest number of serious injury and fatality crashes occur, identifying specific locations or corridor-level segments with high crash occurrences and stratified by mode. These designations must be approved by a professional engineer.

SB 743

Senate Bill (SB) 743, passed by the California legislature in 2013, represented a sweeping policy change in the state's environmental review process for transportation. Under SB 743, transportation impacts are no longer quantified in terms of congestion caused as measured by Level of Service (LOS) during CEQA review, but rather in terms of the amount of driving as measured by Vehicle Miles Travelled (VMT). This shift is intended to better align the quantification of transportation impacts with the state's climate goals, as the shift towards using VMT as a metric under SB 743 is intended to induce more infill and mixed-use developments as opposed to auto-centric sprawl, which is in turn intended to promote non-auto modes of transportation and reduce greenhouse gas emissions.

This shift is important to roadway safety on two fronts. First, the impact of SB 743 will likely lead to shifts in land-use patterns in the state that are more compact and conducive to walking, biking, and transit use, which aligns with the broad socioeconomic and built environment changes most effective in improving safety outcomes in the Safe Systems Pyramid. Second, the replacement by VMT of LOS will shift focus away from vehicle speed, capacity, and throughput in the design of the transportation network, which allows for roadway safety considerations to be better prioritized.

Speed Safety Camera Pilot Program

Automated enforcement through the use of cameras is an effective tool to improving roadway safety outcomes. Deployment of automated red light and speed enforcement cameras in jurisdictions around the country have had positive results in terms of their ability to reduce violations, crashes, injuries, and fatalities. These results exceed the efficacy of traditional enforcement as cameras can operate at all times, and do not require the presence of on-duty personnel, which can be especially helpful during times when law enforcement agencies are short-staffed. Automated enforcement also eliminates instances of bias in enforcement based on arbitrary characteristics. Thus, on the Safe Systems Pyramid, automated enforcement is categorized into a higher level of efficacy – as a latent measure – than traditional enforcement, which is categorized as an active measure.

Historically, automated red light cameras are permitted in California, while automated speed enforcement cameras are not. However, Assembly Bill (AB) 645, which came into effect in 2023, legalized speed enforcement cameras on a pilot basis for six cities across the state – Los Angeles, Long Beach, Glendale, Oakland, San Francisco, and San Jose – for use in school zones, designated safety corridors, high-injury intersections, and known street racing corridors.

Regional Policy

In addition to a review of federal and state policy, the development of this LRSP included a review of current and recent studies completed by MCAG and its jurisdictions to benchmark the region against Safe System best practices.

Making a commitment to zero traffic deaths means addressing all aspects of safety through the elements that together create the holistic approach with redundancy and layers of protection for roadway users. As such, the benchmark assessment identifies instances where MCAG is achieving Safe System best practices, where challenges may exist, and where MCAG can take action to meet the benchmark. Also identified are several areas where implementation is more suited to actions by individual member jurisdictions, but where MCAG may be able to provide technical assistance or funding support.

The matrix that documents the results of this benchmarking assessment is included as **Appendix A**.

3

Engaging The Community

MCAG has engaged with stakeholders around the region as well as the public throughout the development of this LRSP. The engagement process has sought insights from stakeholder groups and the community at large to ensure that the resulting LRSP creates a vision for improving the region's roadways that aligns with the community's values.

Stakeholder Group

A group of stakeholders was convened for the preparation of this LRSP, which comprised of representatives of staff from each of the six local jurisdictions, as well as officials from Merced County and Caltrans. Also invited were school officials, officials from Merced College and UC Merced, and active transportation advocates. Over the course of the development of the LRSP, the stakeholder group met three times. During the first meeting, groups discussed the initial collision data analysis. Working group members shared information about ongoing safety related projects or policies taking place within their jurisdiction or by their organization. During the second meeting, the groups reviewed the collision profiles and the countermeasures identified for them, and discussed the effectiveness of the profiles in capturing the most significant challenges in the region. During the final meeting, groups reviewed and provided feedback on the conceptual projects and the draft LRSP.

Community Survey and Interactive Webmap

A website was developed for the LRSP to collect public feedback, consisting of an interactive webmap and a community survey. With the webmap, users can identify specific locations within the region where they have roadway safety concerns, and tag them by mode of travel (i.e. walking, biking, driving, etc.), while the survey asks more general questions of respondents around their perceptions of and visions for roadway safety in the region. Both the webmap and the survey were open for public response from March to June of 2024, and both were made available in English and Spanish. The website was promoted through MCAG's existing public-facing channels, including newsletters and social media. Materials promoting the website were also handed out during in-person public outreach.

The webmap saw a total of 127 locations tagged. A map and log of all tags are included in **Appendix B**.

The community survey saw a total of 198 responses. The key takeaways from these responses are summarized in the following section. A full log of all responses is included in **Appendix B**.

Community Survey Results

The results of the community survey show that there is plenty of room for improvement when it comes to roadway safety in the region. As shown in **Figure 0.5**, there continues to be a lack of perception of comfort and safety when it comes to walking and biking around the region. Less than 20% of respondents thought walking in their community is comfortable, compared to just under 40% of respondents having a neutral perception, and over 40% of respondents being either uncomfortable or very uncomfortable. Biking fared even worse, with well over half of respondents believing that biking around in their community is uncomfortable or very uncomfortable. **Figure 0.6** shows the primary roadway safety concerns for respondents that contribute to such perceptions. As shown, poor roadway conditions and maintenance is top of mind, followed by drivers ignoring traffic laws, distracted and aggressive driving, and high vehicular speeds.

Figure 0.5
Community Survey Results: People Are Not Comfortable Walking and Biking

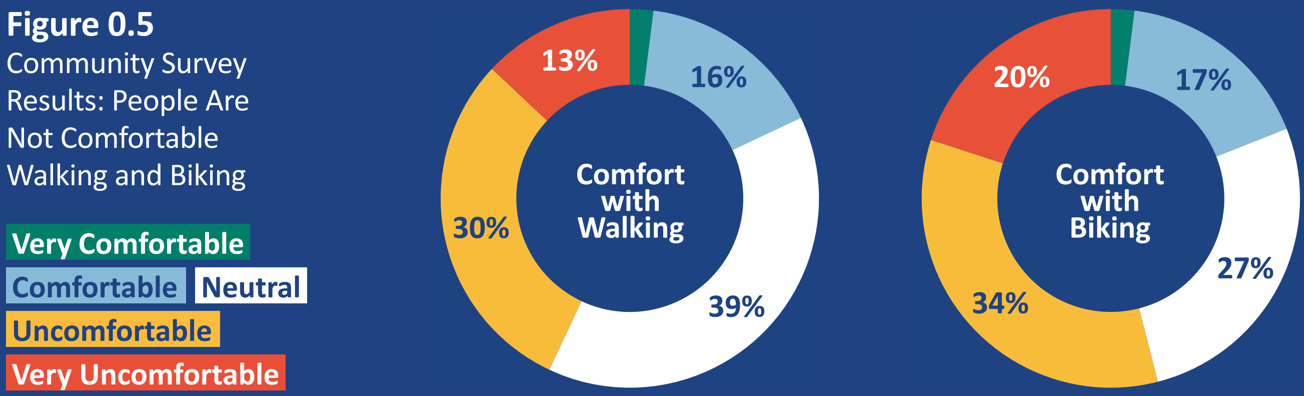
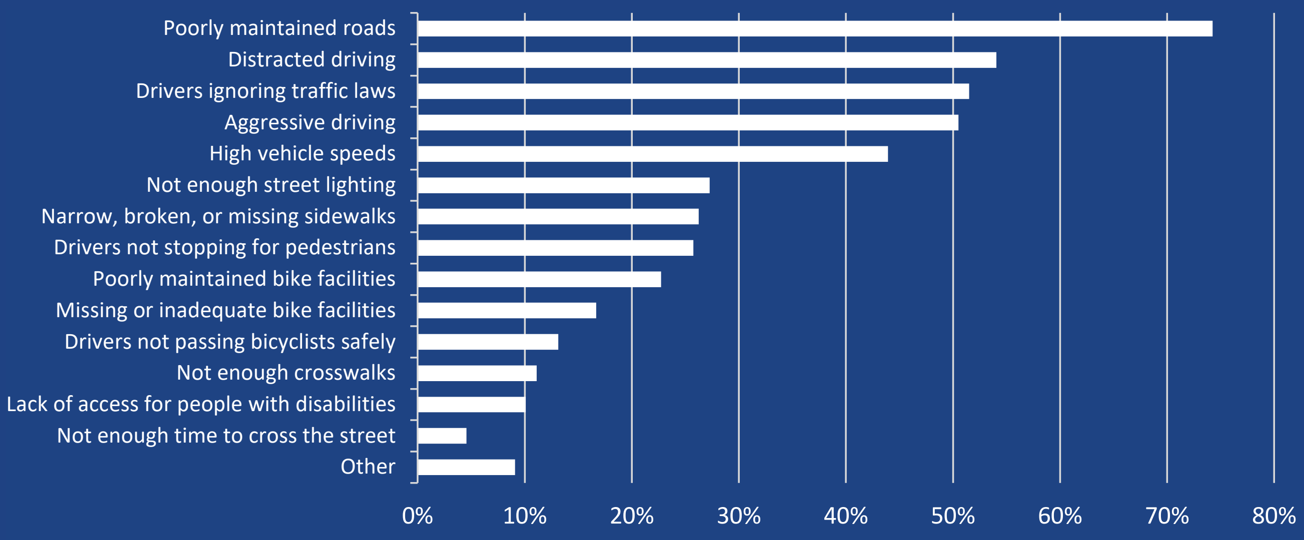


Figure 0.6
Community Survey Results: Roadway Safety Concerns

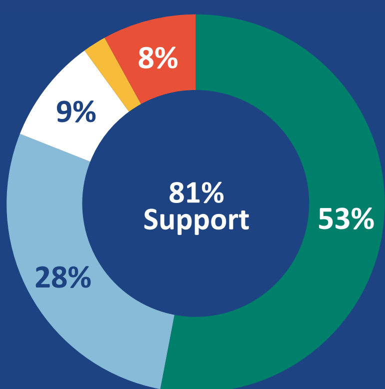


However, the survey results also reflected strong community consensus around the vision towards safer roadways in the region. As shown in **Figure 0.7**, significant majorities of respondents agreed with each the roadway safety strategies and priorities presented to them. Respondents overwhelmingly agreed that people's safety is the top priority consideration in roadway design, that roadway safety should be prioritized over roadway throughput, that creating space for pedestrians and bicyclists should be prioritized over parking, and that speed limits should be lowered to 20 MPH where children or seniors are present.

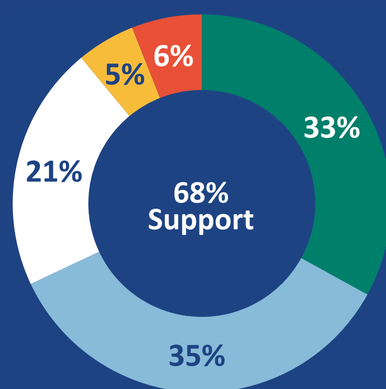
Figure 0.7
Community Survey Results:
People Agree That Roadway Safety is a Top Priority

Strongly Agree | Agree | Neutral | Disagree | Strongly Disagree

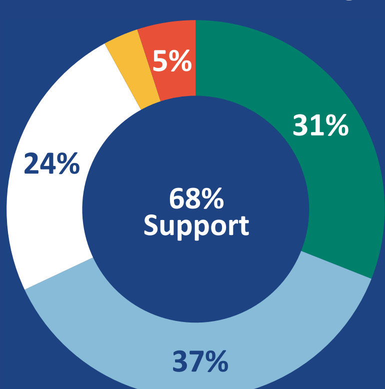
When making decisions about road or street design, safety should be the top priority.



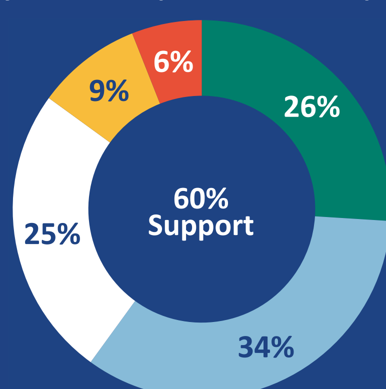
In areas where children or elderly may be present, the roadway should be designed for cars to drive 20 mph or slower



Intersection changes reducing the possibility of crashes should be prioritized over those reducing delay



In downtowns or commercial corridors, space to walk, bike, and cross the street safely should be prioritized over parking



In-Person Outreach

Supplementing stakeholder engagement and online engagement, MCAG's project team also conducted in-person outreach around the region. To meet people where they are, rather than requiring them to come to a meeting specifically for the LRSP, project staff hosted booths at local events whenever available. These events provided the opportunity for the engagement of a broader cross-section of the public than that which would attend a typical project-specific public meeting.

The team tabled at two major community events, the Merced County Spring Fair in Los Banos from May 1-5 of 2024, and the Merced County Fair from June 5-9 of 2024. These fairs saw thousands in attendance coming from across the region. The team also tabled at local events, including the Merced Mercado Night Market in the City of Merced on May 2, 2024, and the Livingston Music In The Park event on May 20, 2024. At each outreach session, staff was available to inform the public about this LRSP, its purpose and vision, and direct interested members of the public to provide their input via the website or paper copies of the community survey.


Where Are Your Roadway Safety Concerns?


THE BUS
ED COUNTY RESIDENTS
WIN A
OLAKIDS
SCOOTER
Haden Law Office


LOCAL ROADWAY SAFETY PLAN

4

Proven Safety Countermeasures

This chapter presents a toolbox of safety countermeasures that can be deployed to address collision trends and systemic factors. Systemic improvements, both engineering and non-engineering related, were identified for implementation. Engineering countermeasures are physical, infrastructure-based improvements that can be made to roadways to reduce likelihood of collisions. In addition to engineering and design strategies, there are non-engineering strategies that can be implemented to improve safety on the region's roads. These countermeasures introduce education, enforcement, and other policy instruments as means of encouraging safer roadways through user behavior, and they can be used to tackle traffic safety problems such as alcohol and drug impaired driving, distracted driving, speeding and speed management, and pedestrian and bicycle safety.

The Ninth Edition of Countermeasures That Work: A Highway Safety Countermeasure Guide for State Highway Safety Offices, published by the National Highway Traffic Safety Administration (NHTSA) in 2017, served as a resource for the non-engineering countermeasures presented in this section. Non-engineering countermeasures are given effectiveness ratings based on these guidelines, if data is available. **Figure 0.4** shows the scale for these ratings.

Figure 0.8
Effectiveness Ratings for Non-Engineering Countermeasures

Source: National Highway Traffic Safety Administration

Demonstrated to be effective by several high-quality evaluations with consistent results

Demonstrated to be effective in certain situations

Likely to be effective based on balance of evidence from high-quality evaluations or other sources

Effectiveness still undetermined as different methods of implementation produce different results

Limited or no high-quality evaluation evidence

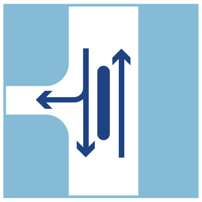
Engineering Countermeasures

The following presents a set of candidate tools for improving road safety performance in the region. Many of these countermeasures are recommended for the ten collision profiles of emphasis included in this report. Most of the countermeasures are included in the 2020 Caltrans Local Roadway Safety Manual (LRSM) and can be advantageous for use in Caltrans Highway Safety Improvement Program (HSIP) grant funding applications. There are many effective safety countermeasures beyond those listed in the LRSM, and several are included in this toolbox.

What You'll See in This Toolbox

Countermeasure Category — **INTERSECTIONS & ROADWAYS**

Countermeasure Icon



Countermeasure Title — **Median Barrier**

Countermeasure Description — Barrier in the center of the roadway that physically separates opposing vehicular traffic. Median barriers can also help control access to and from side streets and driveways, reducing the number of conflict points.

Countermeasure cost (excluding ROW costs) and the availability of low cost/quick build alternatives*
$ = less than $10k
$$ = from $10k to $100k
$$$ = greater than $100k

Cost **$$$**
Low Cost / Quick Build alternative available

Countermeasure code in LRSM (if applicable) — **LRSM ID** **R03**

Additional reference information (if applicable) — **Other Reference Information**
FHWA Manual for Selecting Safety Improvements on High Risk Rural Roads

Safe System Hierarchy tier(s) — **Safe System Hierarchy**

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			


COLLEGE
EST. 1962

BIKEWAYS

Shared-Use Path

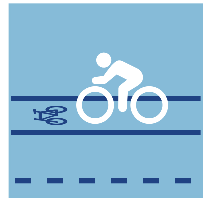
Shared-use paths or trails are off -street facilities that provide exclusive use for nonmotorized travel, including bicyclists and pedestrians. They could be located alongside a roadway, or exist in a separate right-of-way. Bike paths have minimal cross flow with motorists and can be utilized for both recreational and commute trips.

Cost **$**
Low Cost / Quick Build alternative available

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			

BIKEWAYS



Bike Lane

Bike lanes designate an exclusive space for bicyclists using pavement markings and signage. The bike lane is located adjacent to motor vehicle travel lanes and flows in the same direction as motor vehicle traffic. Bike lanes are typically on the right side of the street, between the adjacent travel lane and curb, road edge, or travel lane.

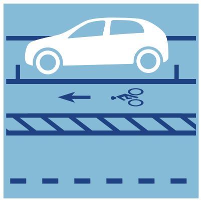
Cost **$$**
Low Cost / Quick Build alternative available

LRSM ID **R32PB**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			

BIKEWAYS



Buffered Bike Lane

Buffered Bike Lanes are standard bike lanes paired with a designated horizontal buffer space, separating the bicycle lane from the adjacent motor vehicle travel lane and/or parking lane. This type of bikeway provides greater distance between vehicles and bicycles; provides space for bicyclists to pass each other; provides greater space for bicycling without making the bike lane appear so wide that it might be mistaken for a travel lane; and encourages bicycling by contributing to the perception of safety.

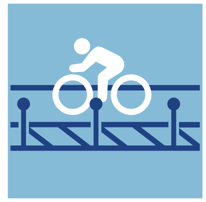
Cost **$$**
Low Cost / Quick Build alternative available

LRSM ID **R32PB**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			

BIKEWAYS



Separated Bikeway

A separated bikeway, also called a cycletrack, provides dedicated street space, typically adjacent to outer vehicle travel lanes, with physical separation from vehicle traffic, designated lane markings, pavement legends, and signage. Physical separation may consist of plastic posts, parked vehicles, raised median, or a curb (if the separated bike lane is raised to sidewalk level). Separated bikeways reduce conflicts between people biking and motorists. They also provide more physical protection that further reduces the risk of severe conflicts between bicycles and vehicles on the road. Separated bike lanes can also help manage or reduce vehicle speeds as some of the design features can have a traffic calming effect.

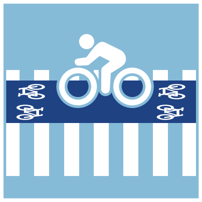
Cost **$$$**
Low Cost / Quick Build alternative available

LRSM ID **R33PB**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			

BIKEWAYS



Bicycle Crossing (Solid Green Paint)

Solid green paint across an intersection signifies the path of the bicycle crossing. Increases visibility of bicyclists' anticipated path of travel through an intersection.

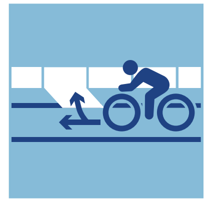
Cost **$**

Low Cost / Quick Build alternative available

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	**Tier 4**
			Increase Attentiveness and Awareness

BIKEWAYS



Bicycle Ramp

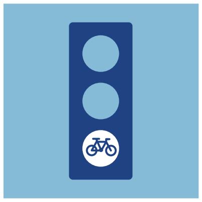
A ramp that connects bicyclists from the road to the sidewalk or a shared use path.

Cost **$**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			

BIKEWAYS



Bicycle Signal/Exclusive Bike Phase

A traffic signal directing bicycle traffic across an intersection. Separates in time bicycle movements from conflicting motor vehicle, streetcar, light rail, or pedestrian movements. May be applicable for Class IV facilities when the bikeway is brought up to the intersection.

Cost **$$$**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts		Manage Conflicts in Time	

BIKEWAYS

Bicycles May Use Full Lane Sign

A sign placed on roads with lanes that are too narrow to allow safe side-by-side in-lane passing of a bicyclist by a motorist - signs indicate that bicyclists may occupy the full lane. Intended to encourage motorists to provide ample space between side of the vehicle and an adjacent bicyclist when passing.

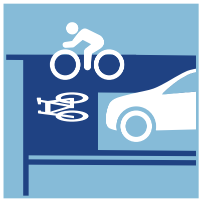
Cost **$**

Low Cost / Quick Build alternative available

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
			Increase Attentiveness and Awareness

BIKEWAYS



Bike Box

A designated area between crosswalk and vehicle stop bar at a signalized intersection that is often painted green where bicyclists can wait during a red signal phase. Use of the bike box, places bicyclists in a location where they are more visible to motorists.

Cost **$**

Low Cost / Quick Build alternative available

LRSM ID **S20PB**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts		Manage Conflicts in Time	Increase Attentiveness and Awareness

BIKEWAYS

Bike Detection

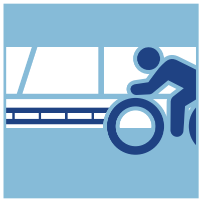
Technology used at signalized intersections, either through use of push-buttons, in-pavement loops, or by video or infrared cameras, to call a green light for bicyclists and reduce delay for bicycle travel. Discourages red light running by bicyclists and increases convenience of bicycling.

Cost **$$**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
		Manage Conflicts in Time	

BIKEWAYS



Bike-Friendly Drain

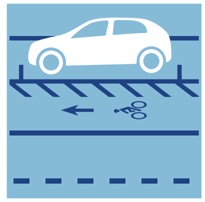
Drains that avoid placing grating in the right-of-way that may pose a hazard to bicyclists by increasing their risk of falling.

Cost **$$**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			

BIKEWAYS



Door Zone Markings

Pavement markings denoting door zone of parked vehicles to raise awareness of bicyclists and motorists of that conflict area where an open car door could obstruct the path of a passing bicyclist.

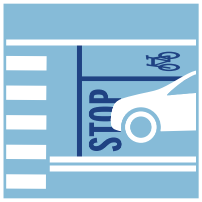
Cost **$**

Low Cost / Quick Build alternative available

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
			Increase Attentiveness and Awareness

BIKEWAYS



Extend Bike Lane to Intersection

In locations where a bike lane is dropped due to the addition of a right turn pocket, the intersection approach may be restriped to allow for bicyclists to move to the left side of right turning vehicles ahead of reaching the intersection.

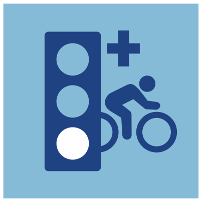
Cost **$**

Low Cost / Quick Build alternative available

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			Increase Attentiveness and Awareness

BIKEWAYS



Extend Green Time For Bikes

Prolongs the green phase when bicyclists are present to provide additional time for bicyclists to clear the intersection. Can occur automatically in the signal phasing or when prompted with bicycle detection. Topography should be considered in clearance time.

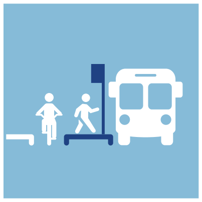
Cost **$**

LRSM ID **S03**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
		Manage Conflicts in Time	

BIKEWAYS



Floating Transit Island or Bus Boarding Island

Transit boarding island that is designed to allow bicycles to pass between the sidewalk and island thereby avoiding a bus-bike conflict when the bus stops at the boarding island. Can be used in combination with a bike lane, bufferred bike lane, or separated bike lane. Teh treatment can also reduce vehicle speeds as the island itself visually narrows the roadway and can have a traffic calming effect.

Cost **$$**

Low Cost / Quick Build alternative available

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts	Reduce Vehicle Speeds		

BIKEWAYS

Green Conflict Striping

Green conflict striping is green pavement markings in a dashed pattern that extend across bike lanes approaching an intersection and/or going through an intersection. Green conflict striping improves increases the visibility bicyclists and potential conflict points so motorists and bicyclists can use caution when traveling toward and through an intersection.

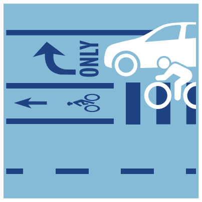
Cost **$**

Low Cost / Quick Build alternative available

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
			Increase Attentiveness and Awareness

BIKEWAYS



Mixing Zone

When a suggested bike lane is within the inside portion of a dedicated motor vehicle turn lane. Lane markings delineate space for bicyclists and motorists within the same lane and indicate the intended path for bicyclists to reduce conflict with turning motor vehicles.

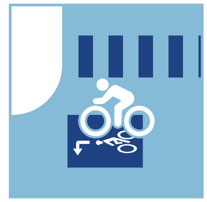
Cost **$**

Low Cost / Quick Build alternative available

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
			Increase Attentiveness and Awareness

BIKEWAYS



Two-Stage Turn Queue Bike Box

This roadway treatment provides bicyclists with a means of making a left turn at a multi-lane signalized intersection from a bike lane or cycle track on the far right side of the roadway. In this way, bicyclists are removed from the flow of traffic while waiting to turn. Use of this treatment could be mirrored for right-turns from a one-way street with a left-side bikeway.

Cost **$**

Low Cost / Quick Build alternative available

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts		Manage Conflicts in Time	Increase Attentiveness and Awareness

INTERSECTIONS & ROADWAYS

All-Way Stop Control

An all-way stop-controlled intersection requires all vehicles to stop before crossing the intersection. An all-way stop controlled intersection reduces the risk of severe conflicts as long as all road users see and obey the stop signs. MUTCD includes information on when and how to implement "All Way" Or "Multi-Way" stop control intersections.

Cost **$**

LRSM ID **NS02**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts	Reduce Vehicle Speeds	Manage Conflicts in Time	Increase Attentiveness and Awareness

INTERSECTIONS & ROADWAYS

Centerline Hardening

Centerline hardening involves placing durable plastic bollards, flex posts, and/or rubber curbs along the centerline. When used at intersections, they can be effective at requiring motorists to make left-turn movements at a 90-degree angle thereby slowing vehicle speeds and improving motorists' visibility of the crosswalks across which they travel when turning. When used along a roadway segment, they can be effective at generally slowing vehicle speeds and preventing undesirable left-turning and/or U-turns between intersections.

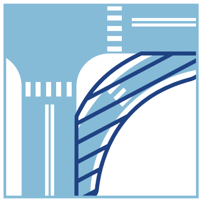
Cost **$**

Low Cost / Quick Build alternative available

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
	Reduce Vehicle Speeds		Increase Attentiveness and Awareness

INTERSECTIONS & ROADWAYS



Close Slip Lane

Modifies the corner of an intersection to remove the sweeping right turn lane for vehicles. Results in shorter crossings for pedestrians, reduced speed for turning vehicles, better sight lines, and space for landscaping and other amenities.

Cost $$$

Other Reference Information
FHWA Pedestrian Safety Guide and Countermeasure Selection System. http://www.pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=24

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts	Reduce Vehicle Speeds		

INTERSECTIONS & ROADWAYS

Directional Median Openings to Restrict Left Turns

A directional median opening restricts specific turning movements, such as allowing a left-turn from a major street but not from a minor street. A directional median opening to restrict left turn improves safety by reducing the number of conflict points.

Cost $$
Low Cost / Quick Build alternative available

LRSM ID **S14**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			

INTERSECTIONS & ROADWAYS

Guardrail

Guardrail redirects a vehicle away from embankment slopes or fixed objects and dissipates the energy of an errant vehicle. Guardrail is installed to reduce the severity of lane departure crashes. However, guardrail can reduce crash severity only for those conditions where striking the guardrail is less severe than going down an embankment or striking a fixed object.

Cost **$$**

LRSM ID **R04**

Other Reference Information
FHWA Manual for Selecting Safety Improvements on High Risk Rural Roads

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			

INTERSECTIONS & ROADWAYS

Improved Pavement Friction

High friction surface treatments improve a vehicles' ability to stay on the roadway as well as come to a stop over a shorter distance. The treatment can be used to help address roadway departure crashes and/or intersection crashes on approach to unsignalized intersections.

Cost **$$**

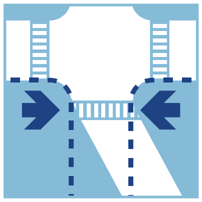
LRSM ID **R21**

Other Reference Information
FHWA Manual for Selecting Safety Improvements on High Risk Rural Roads

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts	Reduce Vehicle Speeds		

INTERSECTIONS & ROADWAYS



Intersection Reconstruction and Tightening

Intersections that intersect at a skewed angle or angle notably different than 90-degrees have a greater likelihood of collisions. Squaring up the intersection helps reduce the likelihood of collisions. “Squaring up” an intersection as close to 90 degrees as possible involves intersection reconstruction and approach realignment to provide better visibility for all road users, also reducing high speed turns, reducing length exposure for vehicles and/or bikes passing through the intersection, and reducing pedestrian crossing length.

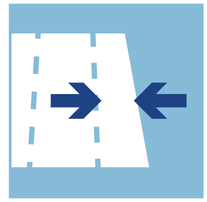
Cost **$$$**

Low Cost / Quick Build alternative available

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts	Reduce Vehicle Speeds		Increase Attentiveness and Awareness

INTERSECTIONS & ROADWAYS



Lane Narrowing

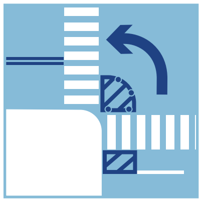
Lane narrowing reduces the width of the marked vehicle lanes to encourage motorists to travel at slower speeds. Lane narrowing can also help reallocate existing roadway space to other road users.

Cost **$**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
	Reduce Vehicle Speeds		

INTERSECTIONS & ROADWAYS



Left Turn Enhanced Daylighting/Slow Turn Wedge

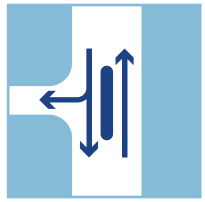
Uses paint and bollards to extend the curb and slow left turns at intersections of one-way to one-way or two-way streets. Widening the turning radii of left-turning vehicles expands the field of vision for drivers and increases the visibility of pedestrians.

Cost **$**
Low Cost / Quick Build alternative available

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
	Reduce Vehicle Speeds		Increase Attentiveness and Awareness

INTERSECTIONS & ROADWAYS



Median Barrier

Barrier in the center of the roadway that physically separates opposing vehicular traffic. Median barriers can also help control access to and from side streets and driveways, reducing the number of conflict points.

Cost **$$$**
Low Cost / Quick Build alternative available

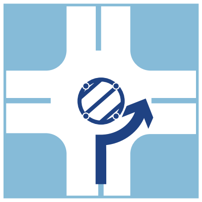
LRSM ID **R03**

Other Reference Information
FHWA Manual for Selecting Safety Improvements on High Risk Rural Roads

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			

INTERSECTIONS & ROADWAYS



Neighborhood Traffic Circle

Neighborhood traffic circles are circular intersections similar to roundabouts, but are stop controlled on the approach and intended for smaller intersections. Typically, they supplement existing stop-controlled intersections with a circular island in the center that is designed to slow traffic and eliminates severe conflict points (such as conflicting left-turn movements).

Cost **$**

Low Cost / Quick Build alternative available

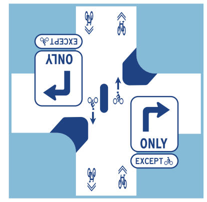
Other Reference Information

FHWA Pedestrian Safety Guide and Countermeasure Selection System. http://www.pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=34

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts	Reduce Vehicle Speeds		

INTERSECTIONS & ROADWAYS



Partial Closure/Diverter

A roadway treatment that restricts through vehicle movements using physical diversion while allowing bicyclists and pedestrians to proceed through an intersection in all directions.

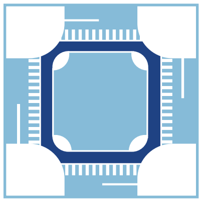
Cost **$**

Low Cost / Quick Build alternative available

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			

INTERSECTIONS & ROADWAYS



Protected Intersection

Protected intersections use corner islands, curb extensions, and colored paint to delineate bicycle and pedestrian movements across an intersection. Slower driving speeds and shorter crossing distance increase safety for pedestrians. Separates bicycles from pedestrians as well as moving vehicles.

Cost **$$$**
Low Cost / Quick Build alternative available

Other Reference Information
Evolution of the Protected Intersection, Alta Planning and Design, December 2015. https://altaplanning.com/wp-content/uploads/Evolution-of-the-Protected-Intersection_ALTA-2015.pdf

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts	Reduce Vehicle Speeds		

INTERSECTIONS & ROADWAYS

Raised Crosswalk

A Raised Crosswalk is a pedestrian crosswalk that is typically elevated 3-6 inches above the road or at sidewalk level. A Raised Crosswalk improves increases crosswalk and pedestrian visibility and slows down motorists.

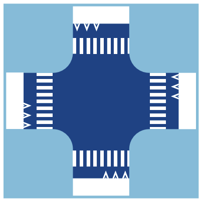
Cost **$$**

LRSM ID **R36PB**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
	Reduce Vehicle Speeds		Increase Attentiveness and Awareness

INTERSECTIONS & ROADWAYS



Raised Intersection

Elevates the intersection to bring vehicles to the sidewalk level. Serves as a traffic calming measure by extending the sidewalk context across the road.

Cost $$$

Other Reference Information

Note: some studies in CMF Clearinghouse show an increase in crashes. See additional source below showing decrease. (1) Perkins+Will Consultant Team. "Pedestrians at Multi-Modal Intersections." Better Market Street Existing Conditions & Best Practices, Part Two: Best Practices 36-58, City & County of San Francisco, San Francisco. http://www.bettermarketstreetsf.org/about-reports-existing-conditions.html (2) Bhatt, Shailen, Natalie Barnhart, Mark Luszcz, Tom Meyer, & Michael Sommers. "Delaware Traffic Calming Design Manual." Delaware Department of Transportation, State of Delaware, Dover, DE. https://nacto.org/wp-content/uploads/2015/04/DE-Trafc-Calming-Manual_2012.pdf (3) King, Michael R, Jon A Carnegie, and Reid Ewing. "Pedestrian Safety through a Raised Median and Redesigned Intersections." Journal of the Transportation Research Board 1828 (1), 56-66, Transportation Research Board, Washington, DC. https://trid.trb.org/view/663867 (4) Fitzpatrick, Kay, Mark D Wooldridge, and Joseph D Blaschke. "Urban Intersection Design Guide: Volume 1–Guidelines." Texas Transportation Institute, Texas A&M University System, Texas Department of Transportation, Austin, TX. https://static.tti.tamu.edu/tti.tamu.edu/documents/0-4365-P2.pdf

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
	Reduce Vehicle Speeds		Increase Attentiveness and Awareness

INTERSECTIONS & ROADWAYS

Raised Median

Curbed sections in the center of the roadway that are physically separated from vehicular traffic. Raised medians can also help control access to and from side streets and driveways, reducing conflict points.

Cost $$

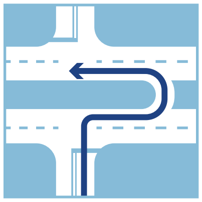
Low Cost / Quick Build alternative available

LRSM ID **S12/NS14/R08**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts	Reduce Vehicle Speeds		

INTERSECTIONS & ROADWAYS



Reduced Left-Turn Conflict Intersection

Geometric designs that alter how left-turn movements occur can simplify decisions and minimize the potential for left-turn related crashes. Two designs that rely on U-turns to complete certain left-turn movements are known as the restricted crossing U-turn (RCUT) and the median U-turn (MUT). Both designs require some out of direction travel for vehicles.

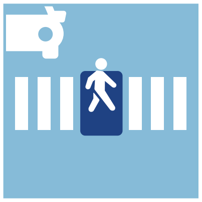
Cost **$$$**

LRSM ID **NS16**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			

INTERSECTIONS & ROADWAYS



Refuge Island

A Raised Median, or Refuge Island, is a raised barrier in the center of the roadway that can restrict certain turning movements and provide a place for pedestrians to wait if they are unable to finish crossing the intersection. A Raised Median reduces the number of potential conflict points with designated zones for vehicles to turn, and a pedestrian refuge island reduces the exposure for pedestrians crossing the intersection. Pedestrian refuge areas constructed from paint and plastic may be implemented as part of a low-cost/quick build project.

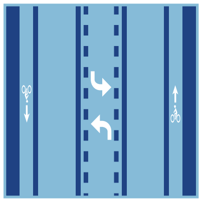
Cost **$$**
Low Cost / Quick Build alternative available

LRSM ID **NS19PB**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts	Reduce Vehicle Speeds		

INTERSECTIONS & ROADWAYS



Road Diet

A Road Diet reduces roadway space dedicated to vehicle travel lanes to create room for bicycle facilities, wider sidewalks, or center turn lanes. A Road Diet ireduces vehicle speeds and creates designated space for all road users.

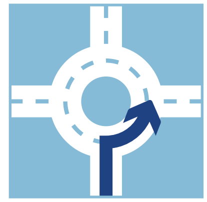
Cost **$$**
Low Cost / Quick Build alternative available

LRSM ID **R14**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts	Reduce Vehicle Speeds		

INTERSECTIONS & ROADWAYS



Roundabout

A roundabout is a type of circular intersection in which road traffic is permitted to flow in one direction around a central island, and priority is typically given to traffic already in the junction. The types of conflicts that occur at roundabouts are different from those occurring at conventional intersections; namely, severe conflicts from crossing and left-turn movements are not present in a roundabout. The geometry of a roundabout forces drivers to reduce speeds as they proceed through the intersection; the range of vehicle speeds is also narrowed, reducing the severity of crashes when they do occur. Pedestrians also only have to cross one direction of traffic at a time at roundabouts, thus reducing exposure to vehicle traffic.

Cost **$$$**
Low Cost / Quick Build alternative available

LRSM ID **S16/NS04**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts	Reduce Vehicle Speeds		

INTERSECTIONS & ROADWAYS

Rumble Strips

Rumble strips create noise and vibration inside the vehicle that alert a driver as they cross the centerline or edge line. Treatment can help with lane keeping instances where a driver is distracted or drowsy. Rumble strips also alert drivers to the lane limits when conditions such as rain, fog, snow, or dust reduce driver visibility.

Cost **$**

LRSM ID **R30/R31**

Other Reference Information
FHWA Manual for Selecting Safety Improvements on High Risk Rural Roads

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	**Tier 4**
			Increase Attentiveness and Awareness

INTERSECTIONS & ROADWAYS

Safety Edge

When a vehicle leaves the traveled way and encounters a pavement-shoulder drop-off, it can be difficult for the driver to return safely to the roadway. A safety edge is a treatment intended to minimize the severity of roadway or lane departure crashes. With this treatment, the shoulder pavement edge is sloped at an angle (30-35 degrees) to make it easier for a driver to safely reenter the roadway after inadvertently driving onto the shoulder. This treatment could be incorporated as a standard practice in overlay or roadway resurfacing projects.

Cost **$**

Other Reference Information
FHWA Manual for Selecting Safety Improvements on High Risk Rural Roads

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			

INTERSECTIONS & ROADWAYS

Signal

Traffic signals at intersections control the flow of traffic by assigning right-of-way to different movements at different times. Some traffic signal phasing is more effective at reducing the likelihood of severe injury collisions. For example, protected left-turn signal phasing reduces the likelihood of severe left-turn collisions more effectively than permitted left-turn signal phasing.

Cost $$$

LRSM ID NS03

Other Reference Information

Currently the CMF Clearinghouse has only one reference for ped/vehicle collisions which indicates an increase in crash likelihood. However, a majority of references for all crash types show a decrease in collisions. See additional reference: FHWA Manual for Selecting Safety Improvements on High Risk Rural Roads

Safe System Hierarchy

Tier 1	Tier 2	**Tier 3**	Tier 4
		Manage Conflicts in Time	

INTERSECTIONS & ROADWAYS

Speed Hump or Speed Table

These traffic calming devices use vertical defection to raise the entire wheelbase of a vehicle and encourage motorists to travel at slower speeds .

Cost $

Safe System Hierarchy

Tier 1	**Tier 2**	Tier 3	**Tier 4**
	Reduce Vehicle Speeds		Increase Attentiveness and Awareness

INTERSECTIONS & ROADWAYS

Splitter Island

A raised area that separates the two directions of travel on the minor street approach at an unsignalized intersection or roundabout. Helps channelize traffic in opposing directions of travel. Also helps improve the visibility of an intersection when approaching it. Provides a refuge for pedestrians.

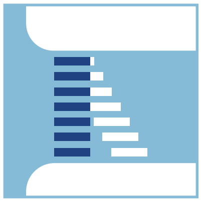
Cost **$$**
Low Cost / Quick Build alternative available

LRSM ID **NS13**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts	Reduce Vehicle Speeds		Increase Attentiveness and Awareness

INTERSECTIONS & ROADWAYS



Straighten Crosswalk

Straightening crosswalks improves sight lines, making pedestrians more visible to oncoming drivers, and may shorten the crossing distance, reducing the length of time required for pedestrians to cross an intersection.

Cost **$**
Low Cost / Quick Build alternative available

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			Increase Attentiveness and Awareness

INTERSECTIONS & ROADWAYS

Superelevation at Horizontal Curve Locations

Superelevation is the rotation of the pavement on the approach to and through a horizontal curve and is intended to assist the driver in negotiating the curve by counteracting the lateral acceleration produced by tracking. In other words, the road is designed so that the pavement rises as it curves, offsetting the horizontal sideways momentum of the approaching vehicle. Superelevation can help vehicles stay on the roadway. Superelevation can also inadvertently make it easier for drivers to drive at higher than desirable speeds. Consider the target or desired speed for a roadway and relevant design guidance when selecting appropriate superelevation.

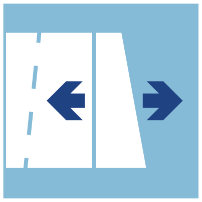
Cost **$$**

Other Reference Information
FHWA Manual for Selecting Safety Improvements on High Risk Rural Roads

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			

INTERSECTIONS & ROADWAYS



Widen/Pave Shoulder

Widened and paved shoulders, which may also include flattening the slopes along the sides of the roadway, create a separated space for bicyclists, create space for a driver to safely recover if they inadvertently depart the travel lane, and also provides space for inoperable vehicles to pull out of the travel lane. The addition of a paved shoulder to an existing road can help to reduce run-off-road crashes. Benefits can be realized for high risk rural roads without paved shoulders, regardless of existing lane pavement width. Adding paved shoulders within horizontal curve sections may help agencies maximize benefits of the treatment while minimizing costs as opposed to adding paved shoulders to an entire corridor.

Cost **$$**

LRSM ID **R15**

Other Reference Information
FHWA Manual for Selecting Safety Improvements on High Risk Rural Roads

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			

PEDESTRIAN FACILITIES

Add Sidewalk

Adding sidewalks provides a separated and continuous facility for people to walk along the roadway.

Cost $$

LRSM ID R34PB

Other Reference Information

Data in the CMF Clearinghouse is currently limited to bicycle/vehicle collisions. See additional reference: FHWA Pedestrian Safety Guide and Countermeasure Selection System. http://www.pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=1

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			

PEDESTRIAN FACILITIES

Audible Push Button Upgrade

Push buttons must comply with the Americans with Disability Act (ADA) standards for accessibility. Pushbuttons should be visible and conveniently located for pedestrians waiting at a crosswalk. Accessible pedestrian signals, including audible push buttons, improve access for pedestrians who are blind or have low vision. DIB 82-06 includes accessibility design guidance.

Cost $

Other Reference Information

Audible Push Button Upgrade and Extended Time Pushbutton: FHWA Pedestrian Safety Guide and Countermeasure Selection System. http://www.pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=52

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
		Manage Conflicts in Time	Increase Attentiveness and Awareness

PEDESTRIAN FACILITIES

Co-Locate Bus Stops and Pedestrian Crossings

Place bus stops and pedestrian crossings in close proximity to allow transit riders to cross the street at well-designed crossing locations.

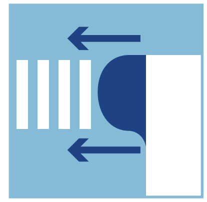
Cost **$**

Low Cost / Quick Build alternative available

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
			Increase Attentiveness and Awareness

PEDESTRIAN FACILITIES



Curb Extensions

A curb extension is a traffic calming measure which widens the sidewalk for a short distance to enhance the pedestrian crossing. This reduces the crossing distance and allows pedestrians and drivers to see each other when parked vehicles would otherwise block visibility. Paint and plastic curb extensions are a low-cot/quick build option.

Cost **$$**

Low Cost / Quick Build alternative available

LRSM ID **NS21PB**

Other Reference Information

(1) Application of Pedestrian Crossing Treatments for Streets and Highways, NCHRP, 2016. https://www.nap.edu/catalog/24634/application-of-pedestrian-crossing-treatments-for-streets-and-highways (2) Development of Crash Modification Factors for Uncontrolled Pedestrian Crossing Treatments, NCHRP, 2017. https://www.nap.edu/catalog/24627/development-of-crash-modifcation-factors-for-uncontrolled-pedestrian-crossing-treatments (3) Evaluation of Pedestrian-Related Roadway Measures, Pedestrian and Bicycle Information Center, 2014. http://www.pedbikeinfo.org/cms/downloads/PedestrianLitReview_April2014.pdf

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
	Reduce Vehicle Speeds		Increase Attentiveness and Awareness

PEDESTRIAN FACILITIES

Extend Time Push Button

A push button that can be pressed to request extra time for using the crosswalk, beyond the standard crossing time. Ideal near senior-serving land uses.

Cost **$**

Other Reference Information
Audible Push Button Upgrade and Extended Time Pushbutton: FHWA Pedestrian Safety Guide and Countermeasure Selection System. http://www.pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=52

Safe System Hierarchy

Tier 1	Tier 2	**Tier 3**	Tier 4
		Manage Conflicts in Time	

PEDESTRIAN FACILITIES

High-Visibility Crosswalk

A high-visibility crosswalk has a striped pattern with ladder markings made of high-visibility material, such as thermoplastic tape, instead of paint. A high-visibility crosswalk improves the visibility of marked crosswalks and provides motorists a cue to slow down and yield to pedestrians.

Cost **$**
Low Cost / Quick Build alternative available

LRSM ID **S18/NS20**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	**Tier 4**
			Increase Attentiveness and Awareness

PEDESTRIAN FACILITIES

Install/Upgrade Pedestrian Crossing at Uncontrolled Locations (Signs and Markings Only)

A pedestrian crossing at an intersection or on a segment provides a formalized location for people to cross the street, reducing the risk of people crossing outside crosswalks where drivers are not expecting them. Crosswalk striping, signs, and other enhanced features alert drivers that there may be a pedestrian crossing.

Cost **$**
Low Cost / Quick Build alternative available

LRSM ID **R35PB**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
			Increase Attentiveness and Awareness

PEDESTRIAN FACILITIES

Landscape Buffer

Separating drivers from bicyclists and pedestrians using landscaping provides more space between the modes and can produce a traffic calming effect by encouraging drivers to drive at slower speeds, lowering the risk of crashing.

Cost **$$**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts	Reduce Vehicle Speeds		

PEDESTRIAN FACILITIES

Leading Pedestrian Interval and Pedestrian Recall

At intersection locations that have a high volume of turning vehicle and have high pedestrian vs. vehicle crashes, a leading pedestrian interval gives pedestrians the opportunity to enter an intersection 3 - 7 seconds before vehicles are given a green indication. With this head start, pedestrians can better establish their presence in the crosswalk before vehicles have priority to turn left or right.

Cost **$**

LRSM ID **S21PB**

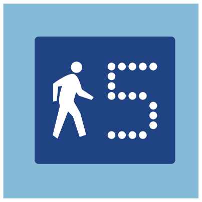
Other Reference Information

Pedestrian Phase Recall: Evaluation of Pedestrian-Related Roadway Measures, Pedestrian and Bicycle Information Center, 2014. http://www.pedbikeinfo.org/cms/downloads/PedestrianLitReview_April2014.pdf

Safe System Hierarchy

Tier 1	Tier 2	**Tier 3**	Tier 4
		Manage Conflicts in Time	

PEDESTRIAN FACILITIES



Pedestrian Countdown Timer

Displays "countdown" of seconds remaining on the pedestrian signal. Countdown indications improve safety for all road users, and are required for all newly installed traffic signals where pedestrian signals are installed.

Cost **$$**

LRSM ID **S17PB**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	**Tier 4**
			Increase Attentiveness and Awareness

PEDESTRIAN FACILITIES

Pedestrian Detection

An intersection treatment that relies on sensors to detect when a pedestrian is waiting at a crosswalk and automatically triggers the pedestrian “WALK” phase. Reduces crossings at inappropriate times while providing sufficient time for pedestrians to cross the roadway.

Cost $$

Other Reference Information
FHWA Pedestrian Safety Guide and Countermeasure Selection System. http://www.pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=11

Safe System Hierarchy

Tier 1	Tier 2	**Tier 3**	Tier 4
		Manage Conflicts in Time	

PEDESTRIAN FACILITIES

Pedestrian Hybrid Beacon

A pedestrian-hybrid beacon (PHB) is used at unsignalized intersections or mid-block crosswalks to notify oncoming motorists to stop with a series of red and yellow lights. Unlike a traffic signal, the PHB rests in dark until a pedestrian activates it via pushbutton or other form of detection.

Cost $$$

LRSM ID NS23PB

Safe System Hierarchy

Tier 1	Tier 2	**Tier 3**	**Tier 4**
		Manage Conflicts in Time	Increase Attentiveness and Awareness

PEDESTRIAN FACILITIES

Rectangular Rapid Flashing Beacon

A rectangular rapid flashing beacon (RRFB) is a pedestrian-activated flashing light with additional signage to alert motorists of a pedestrian crossing. An RRFB increases the visibility of marked crosswalks and provides motorists a cue to slow down and yield to pedestrians.

Cost **$$**

LRSM ID **NS22PB**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
			Increase Attentiveness and Awareness

PEDESTRIAN FACILITIES

Remove Crossing Prohibition

Removes existing crossing prohibitions and provides marked crosswalk and other crossing enhancements for pedestrians to cross the street.

Cost **$**

Low Cost / Quick Build alternative available

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
			Increase Attentiveness and Awareness

PEDESTRIAN FACILITIES

Restripe Crosswalk

Periodic restriping of crosswalks is necessary to maintaing visibility of the traffic markings. Crosswalk may be restriped with high visibility markings.

Cost **$**

Low Cost / Quick Build alternative available

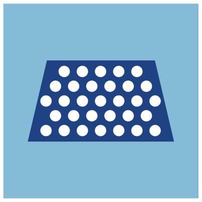
Other Reference Information

FHWA Pedestrian Safety Guide and Countermeasure Selection System. http://www.pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=4

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
			Increase Attentiveness and Awareness

PEDESTRIAN FACILITIES



Upgrade Curb Ramp

Tactile warning devices must be detectable to visually impaired pedestrians. Curb ramps must follow the DIB 82-06 design guidelines.

Cost **$$**

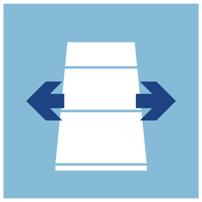
Other Reference Information

FHWA Pedestrian Safety Guide and Countermeasure Selection System. http://www.pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=3

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			Increase Attentiveness and Awareness

PEDESTRIAN FACILITIES



Widen Sidewalk

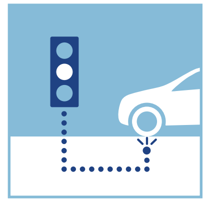
Widening sidewalks provides a more comfortable space for pedestrians, particularly in locations with high volumes of pedestrians, and provides space to accommodate people in wheelchairs. Widening sidewalks reduces the likelihood of collisions with pedestrians walking in the road.

Cost $$

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			

SIGNALS



Advanced Dilemma Zone Detection

The Advanced Dilemma-Zone Detection system adjusts the start time of the yellow-signal phase (i.e. earlier or later) based on observed vehicle locations and speeds. The Advanced Dilemma-Zone Detection system minimizes the number of drivers that are faced with the dilemma of determining if they should stop at the intersection or drive through the intersection based on their speed and distance from the intersection.

Cost $$

LRSM ID S04

Other Reference Information
FHWA Manual for Selecting Safety Improvements on High Risk Rural Roads

Safe System Hierarchy

Tier 1	Tier 2	**Tier 3**	Tier 4
		Manage Conflicts in Time	

PEDESTRIAN FACILITIES

Restripe Crosswalk

Periodic restriping of crosswalks is necessary to maintaing visibility of the traffic markings. Crosswalk may be restriped with high visibility markings.

Cost $

Low Cost / Quick Build alternative available

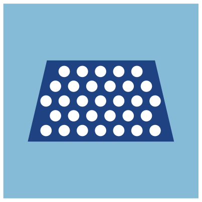
Other Reference Information

FHWA Pedestrian Safety Guide and Countermeasure Selection System. http://www.pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=4

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	**Tier 4**
			Increase Attentiveness and Awareness

PEDESTRIAN FACILITIES



Upgrade Curb Ramp

Tactile warning devices must be detectable to visually impaired pedestrians. Curb ramps must follow the DIB 82-06 design guidelines.

Cost $$

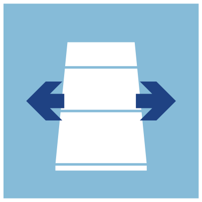
Other Reference Information

FHWA Pedestrian Safety Guide and Countermeasure Selection System. http://www.pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=3

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	**Tier 4**
Remove Severe Conflicts			Increase Attentiveness and Awareness

PEDESTRIAN FACILITIES



Widen Sidewalk

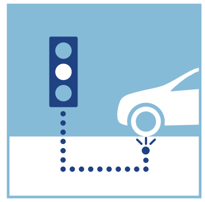
Widening sidewalks provides a more comfortable space for pedestrians, particularly in locations with high volumes of pedestrians, and provides space to accommodate people in wheelchairs. Widening sidewalks reduces the likelihood of collisions with pedestrians walking in the road.

Cost $$

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			

SIGNALS



Advanced Dilemma Zone Detection

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Cost $$

LRSM ID S04

Other Reference Information
FHWA Manual for Selecting Safety Improvements on High Risk Rural Roads

Safe System Hierarchy

Tier 1	Tier 2	**Tier 3**	Tier 4
		Manage Conflicts in Time	

SIGNALS

Extend Pedestrian Crossing Time

Increases time for pedestrian walk phases, especially to accommodate vulnerable populations, such as children and the elderly.

Cost **$**

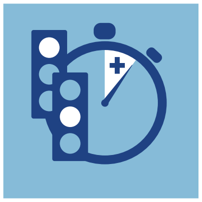
Low Cost / Quick Build alternative available

LRSM ID **S03**

Safe System Hierarchy

Tier 1	Tier 2	**Tier 3**	Tier 4
		Manage Conflicts in Time	

SIGNALS



Extend Yellow and All Red Time

Extending yellow and all red time increases the time allotted for the yellow and red lights during a signal phase. Extending yellow and all red time allows drivers and bicyclists a few additional seconds of time at the end of a signal phase to cross through a signalized intersection before conflicting traffic movements are permitted to enter the intersection.

Cost **$**

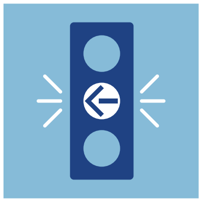
Low Cost / Quick Build alternative available

LRSM ID **S03**

Safe System Hierarchy

Tier 1	Tier 2	**Tier 3**	Tier 4
		Manage Conflicts in Time	

SIGNALS



Flashing Yellow Turn Phase

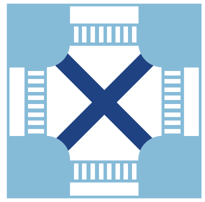
Flashing yellow turn arrow alerts drivers to proceed with caution and decide if there is a sufficient gap in oncoming traffic to safely make a turn. To be used only when a pedestrian walk phase is not called. Protected-only phases should be used when pedestrians are present.

Cost $$

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	**Tier 4**
			Increase Attentiveness and Awareness

SIGNALS



Pedestrian Scramble

A form of pedestrian “WALK” phase at a signalized intersection in which all vehicular traffic is required to stop, allowing pedestrians to cross through the intersection in any direction, including diagonally.

Cost $

LRSM ID S03

Safe System Hierarchy

Tier 1	Tier 2	**Tier 3**	Tier 4
Remove Severe Conflicts		Manage Conflicts in Time	

SIGNALS

Prohibit Left Turn

Prohibitions of left turns at locations where a turning vehicle may conflict with pedestrians in the crosswalk or where opposing traffic volume is high. Reduces pedestrian interaction with vehicles when crossing.

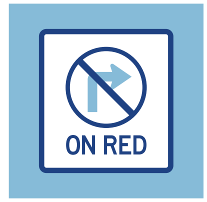
Cost **$**
Low Cost / Quick Build alternative available

LRSM ID **S15/NS16**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts		Manage Conflicts in Time	

SIGNALS



Prohibit Right-Turn-on-Red

Prohibiting right-run-on-red movements should be considered at skewed intersections, or where exclusive pedestrian “WALK” phases, Leading Pedestrian Intervals (LPIs), sight distance issues, or high pedestrian volumes are present. Can help prevent crashes between vehicles turning right on red from one street and through vehicles on the cross street, and crashes involving pedestrians.

Cost **$**
Low Cost / Quick Build alternative available

Other Reference Information
Currently the CMF Clearinghouse does not include specific studies; however, permitting right-turns-on-red shows an increase in ped/vehicle crashes. Additional information is available at the FHWA Pedestrian Safety Guide and Countermeasure Selection System. http://www.pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=49

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts		Manage Conflicts in Time	

SIGNALS

Prohibit Turns During Pedestrian Phase

Restricts left or right turns during the pedestrian crossing phase at locations where a turning vehicle may conflict with pedestrians in the crosswalk. This restriction may be displayed with a blank-out sign.

Cost $

Safe System Hierarchy

Tier 1	Tier 2	**Tier 3**	Tier 4
		Manage Conflicts in Time	

SIGNALS

Protected Left Turns

A protected left turn can be implemented at signalized intersections (with existing left turns pockets) that currently have a permissive left-turn or no left-turn protection. Providing protected left-turn phases for signalized intersections removes the need for the drivers to navigate through gaps in oncoming/opposing through vehicles.

Cost $$

LRSM ID S06/S07

Safe System Hierarchy

Tier 1	Tier 2	**Tier 3**	Tier 4
Remove Severe Conflicts		Manage Conflicts in Time	

SIGNALS

Retroreflective Tape on Signals

Retroreflective borders enhance the visibility of traffic signals for aging and color vision impaired drivers enabling them to understand which signal indication is illuminated. Retroreflective borders may also alert drivers to signalized intersections during periods of power outages when the signals would otherwise be dark, and non–reflective signal heads and backplates would not be visible.

Cost **$**
Low Cost / Quick Build alternative available

LRSM ID **S02**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	**Tier 4**
			Increase Attentiveness and Awareness

SIGNALS

Separate Right-Turn Phasing

Provides a green arrow phase for right-turning vehicles. Avoids conflicts between right-turning traffic and bicyclists or pedestrians crossing the intersection on their right.

Cost **$$$**

Other Reference Information

(1) Evaluation of Pedestrian-Related Roadway Measures, Pedestrian and Bicycle Information Center, 2014. http://www.pedbikeinfo.org/cms/downloads/PedestrianLitReview_April2014.pdf (2) FHWA Manual for Selecting Safety Improvements on High Risk Rural Roads

Safe System Hierarchy

Tier 1	Tier 2	**Tier 3**	Tier 4
		Manage Conflicts in Time	

SIGNALS

Shorten Cycle Length

Traffic signal cycle lengths have a significant impact on the quality of the urban realm and consequently, the opportunities for bicyclists, pedestrians, and transit vehicles to operate effectively along a corridor. Long signal cycles, compounded over multiple intersections, can make crossing a street or walking even a short distance prohibitive and frustrating. Short cycle lengths of 60–90 seconds are ideal for urban areas.

Cost **$**
Low Cost / Quick Build alternative available

Other Reference Information
FHWA Pedestrian Safety Guide and Countermeasure Selection System. http://www.pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=45

Safe System Hierarchy

Tier 1	Tier 2	**Tier 3**	Tier 4
		Manage Conflicts in Time	

SIGNALS

Signal Interconnectivity and Coordination / Green Wave

The emphasis of improving signal coordination for this countermeasure is to provide an opportunity for slow speed signal coordination. Coordinating signals to allow for bicyclist progression, also known as a ‘green wave,’ gives bicyclists and pedestrians more time to cross through the ‘green wave’ intersections. It also slows vehicle speeds helping to reduce the likelihood of severe collisions.

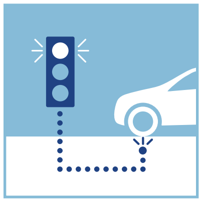
Cost **$$**

LRSM ID **S03**

Safe System Hierarchy

Tier 1	**Tier 2**	Tier 3	Tier 4
	Reduce Vehicle Speeds		

SIGNALS



Speed Sensitive Rest in Red Signal

At certain hours (e.g. late night) a signal remains red for all approaches or certain approaches until a vehicle arrives at the intersection. If the vehicle is going faster than the desired speed, the signal will not turn green until after vehicle stops. If the vehicle is going the desired speed the signal will change to green before the vehicle arrives. This signal timing provides operational benefit to drivers traveling at the desired speed limit. Can be paired with variable speed warning signs.

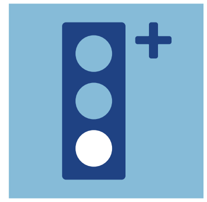
Cost $$

LRSM ID R26

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
	Reduce Vehicle Speeds	Manage Conflicts in Time	

SIGNALS



Supplemental Signal Heads

Additional signal heads allow drivers to anticipate signal changes farther away from intersections. Supplemental traffic signals may be placed on the near side of an intersection, far-left, far-right, or very high.

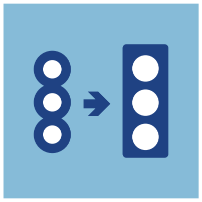
Cost $$

LRSM ID S02

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
			Increase Attentiveness and Awareness

SIGNALS



Upgrade Signal Head

Upgrading Signal Heads replaces existing 8-inch signal heads with 12-inch signal heads to comply with the California MUTCD's 2014 guidelines. Upgrading signal heads provides better visibility of intersection signals and by aiding drivers' advanced perception of upcoming intersections.

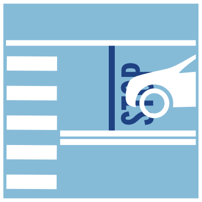
Cost $

LRSM ID **S02**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
			Increase Attentiveness and Awareness

SIGNING & STRIPING



Advance Stop Bar

An advanced stop bar is a horizontal stripe painted ahead of the crosswalk at stop signs and signals to indicate where drivers should stop. An advanced stop bar reduces instances of vehicles encroaching on the crosswalk. Creating a wider stop bar or setting the stop bar further back may be appropriate for locations with known crosswalk encroachment issues.

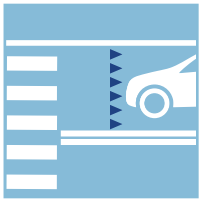
Cost $
Low Cost / Quick Build alternative available

LRSM ID **S20PB**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
			Increase Attentiveness and Awareness

SIGNING & STRIPING



Advance Yield Markings

Yield lines are placed 20 to 50 feet in advance of multi-lane pedestrian crossings to increase visibility of pedestrians. They can reduce the likelihood of a multiple-threat crash.

Cost **$**
Low Cost / Quick Build alternative available

Safe System Hierarchy

Tier 1 | Tier 2 | Tier 3 | **Tier 4**

Tier 4: Increase Attentiveness and Awareness

SIGNING & STRIPING

Chevron Signs on Horizontal Curves

Post-mounted chevrons are intended to warn drivers of an approaching curve and provide tracking information and guidance to the drivers.

Cost **$**
Low Cost / Quick Build alternative available

LRSM ID **R23**

Other Reference Information
FHWA Manual for Selecting Safety Improvements on High Risk Rural Roads

Safe System Hierarchy

Tier 1 | Tier 2 | Tier 3 | **Tier 4**

Tier 4: Increase Attentiveness and Awareness

SIGNING & STRIPING

Curve Advance Warning Sign

A curve advance warning sign notifies drivers of an approaching curve and may include an advisory speed limit as drivers navigate around the curve. This warning sign is ideally combined with other infrastructure that alerts drivers of the curve, such as chevron signs, delineators, and flashing beacons. A curve advance warning sign provides drivers additional time to slow down for the curve.

Cost **$**
Low Cost / Quick Build alternative available

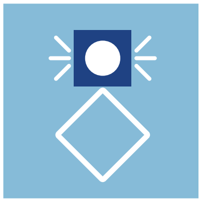
LRSM ID **R24**

Other Reference Information
FHWA Manual for Selecting Safety Improvements on High Risk Rural Roads

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	**Tier 4**
			Increase Attentiveness and Awareness

SIGNING & STRIPING



Flashing Beacon as Advance Warning

A flashing beacon as Advanced Warning is a blinking light with signage to notify motorists of an upcoming intersection or crosswalk. A flashing beacon improves provides motorists more time to be aware of and slow down for an intersection or yield to pedestrians crossing a crosswalk.

Cost **$$**

LRSM ID **S10**

Other Reference Information
FHWA Manual for Selecting Safety Improvements on High Risk Rural Roads

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	**Tier 4**
			Increase Attentiveness and Awareness

SIGNING & STRIPING

LED-Enhanced Sign

An LED-Enhanced Sign has LED lights embedded in the sign to outline the sign itself or the words and symbols on the sign. The LEDs may be set to flash or operate in a steady mode. An LED-enhanced sign improves the visibility of signs at locations with visibility limitations or with a documented history of drivers failing to see or obey the sign (e.g. at STOP signs).

Cost **$**
Low Cost / Quick Build alternative available

LRSM ID **NS08**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	**Tier 4**
			Increase Attentiveness and Awareness

SIGNING & STRIPING

Painted Centerline and Raised Pavement Markers at Curves on Residential Streets

A raised pavement marker is a small device attached to the road and used as a positioning guide for drivers.

Cost **$**
Low Cost / Quick Build alternative available

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	**Tier 4**
			Increase Attentiveness and Awareness

SIGNING & STRIPING

Speed Feedback Sign

A speed feedback sign notifies drivers of their current speed, usually followed by a reminder of the posted speed limit. A speed feedback sign provides a cue for drivers to check their speed and slow down, if necessary.

Cost **$**
Low Cost / Quick Build alternative available

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	**Tier 4**
			Increase Attentiveness and Awareness

SIGNING & STRIPING

Speed Legends on Pavement at Neighborhood Entries

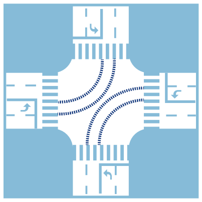
Speed legends are numerals painted on the roadway indicating the current speed limit in miles per hour. They are usually placed near speed limit signposts.

Cost **$**
Low Cost / Quick Build alternative available

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	**Tier 4**
			Increase Attentiveness and Awareness

SIGNING & STRIPING



Striping Through Intersection

Adding clear pavement markings can guide motorists through complex intersections. Intersections where the lane designations are not clearly visible to approaching motorists and/or intersections noted as being complex and experiencing crashes that could be attributed to a driver's unsuccessful attempt to navigate the intersection can benefit from this treatment.

Cost **$**
Low Cost / Quick Build alternative available

LRSM ID **S09**

Safe System Hierarchy

Tier 1 | Tier 2 | Tier 3 | **Tier 4**

Increase Attentiveness and Awareness

SIGNING & STRIPING

Time-Based Turn Restriction

Restricts left-turns or right-turns during certain time periods when there may be increased potential for conflict (e.g., peak periods, school hours).

Cost **$**
Low Cost / Quick Build alternative available

Safe System Hierarchy

Tier 1 | Tier 2 | **Tier 3** | Tier 4

Manage Conflicts in Time

SIGNING & STRIPING

Upgrade Intersection Pavement Markings

Upgrading intersection pavement marking can include "Stop Ahead" markings and the addition of centerlines and stop bars. Upgrading intersection pavement markings can increase the visibility of intersections for drivers approaching and at the intersection.

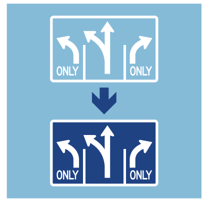
Cost **$**
Low Cost / Quick Build alternative available

LRSM ID **NS07**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	**Tier 4**
			Increase Attentiveness and Awareness

SIGNING & STRIPING



Upgrade Signs with Fluorescent Sheeting

Upgrading signs with fluorescent sheeting replaces existing signs with new signs that can clearly display warnings by reflecting headlamp light back to vehicles. Upgrading signs with fluorescent sheeting improves visibility of signs to drivers at night.

Cost **$**
Low Cost / Quick Build alternative available

LRSM ID **R22**

Other Reference Information
FHWA Manual for Selecting Safety Improvements on High Risk Rural Roads

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	**Tier 4**
			Increase Attentiveness and Awareness

SIGNING & STRIPING

Upgrade Striping

Restripe lanes with reflective striping to improve striping visibility and clarify lane assignment, especially where the number of lanes changes.

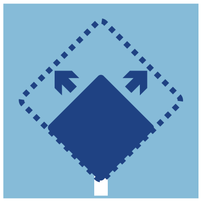
Cost **$**

Low Cost / Quick Build alternative available

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	**Tier 4**
			Increase Attentiveness and Awareness

SIGNING & STRIPING



Upgrade to Larger Warning Signs

Upgrading to larger warning signs replaces existing signs with physically larger signs with larger warning information. Upgrading to larger warning signs increases the visibility of the information provided, particularly for older drivers.

Cost **$**

Low Cost / Quick Build alternative available

LRSM ID **NS06**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	**Tier 4**
			Increase Attentiveness and Awareness

SIGNING & STRIPING

Wayfinding

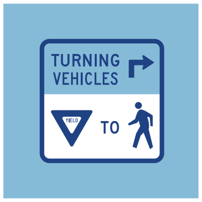
A network of signs that highlight nearby pedestrian and bicycle facilities. Can help to reduce crossings at locations with poor sight distance or limited crossing enhancements.

Cost **$**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
			Increase Attentiveness and Awareness

SIGNING & STRIPING



Yield To Pedestrians Sign

"Yield Here to Pedestrians" signs alert drivers about the presence of pedestrians. These signs are required with advance yield lines. Other sign types can be placed on the centerline in the roadway.

Cost **$**
Low Cost / Quick Build alternative available

LRSM ID **NS06**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
			Increase Attentiveness and Awareness

OTHER

Access Management/ Close Driveway

Vehicles entering and exiting driveways may conflict with pedestrians and with vehicles on the main road, especially at driveways within 250 feet of intersections. Driveway consolidation reduces conflict points along a segment and/or near intersections.

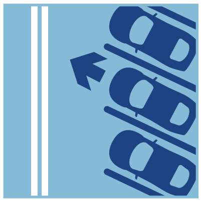
Cost $$

Other Reference Information
The CMF Clearinghouse has limited research related to vehicle/pedestrian crashes. See additional reference: FHWA Pedestrian Safety Guide and Countermeasure Selection System. http://www.pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=20

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			

OTHER



Back-In Angled Parking

Back-In Angled Parking requires motorists to back into an angled on-street parking spot and to drive forward when exiting a parking spot. Back-in angled parking increases the visibility of passing vehicles and bicycles while exiting a spot, particularly if large adjacent vehicles obstruct sight, and allows trunk unloading to happen on the curb instead of in the street.

Cost $
Low Cost / Quick Build alternative available

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	**Tier 4**
			Increase Attentiveness and Awareness

OTHER

Create or Increase Clear Zone

A clear zone is an unobstructed, traversable roadside area that allows a driver to stop safely or regain control of a vehicle that has left the roadway. The width of the clear zone is informed by roadway context, desired vehicle speeds, and agency design standards.

Cost $$

Other Reference Information
FHWA Manual for Selecting Safety Improvements on High Risk Rural Roads

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	**Tier 4**
			Increase Attentiveness and Awareness

OTHER

Curbside Management

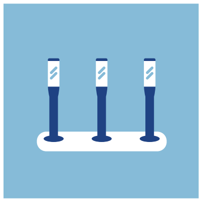
Curbside management helps prioritize different uses that would otherwise be in conflict with one another such as location of bus stops, bicycle infrastructure, freight deliveries, passenger pick-ups/drop-offs, green stormwater infrastructure, public spaces, and parking management.

Cost $

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			

OTHER



Delineators, Reflectors, and/or Object Markers

Delineators, reflectors and/or object markers are intended to warn drivers of an approaching curve or fixed object that cannot easily be removed. They are generally less costly than Chevron Signs as they don't require posts to place along the roadside.

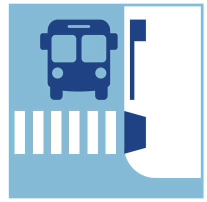
Cost **$**
Low Cost / Quick Build alternative available

LRSM ID **R27**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	**Tier 4**
			Increase Attentiveness and Awareness

OTHER



Far-Side Bus Stop

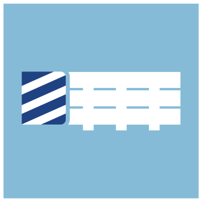
Far-side bus stops are located immediately after an intersection, allowing the bus to pass through the intersection before stopping for passenger loading and unloading. Far-side stops encourage pedestrians to cross behind the bus for greater visibility and can improve transit service reliability.

Cost **$**

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	**Tier 4**
			Increase Attentiveness and Awareness

OTHER



Impact Attenuators

Impact attenuators bring an errant vehicle to a more-controlled stop or redirect the vehicle away from a rigid object. Impact attenuators are typically used to shield rigid roadside objects such as concrete barrier ends, steel guardrail ends and bridge pillars from oncoming automobiles. Attenuators tend to be installed where it is impractical for the objects to be removed.

Cost **$$**

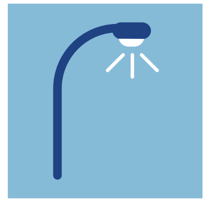
LRSM ID **R05**

Other Reference Information
FHWA Manual for Selecting Safety Improvements on High Risk Rural Roads

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			Increase Attentiveness and Awareness

OTHER



Intersection Lighting

Adding intersection and/or pedestrian-scale lighting at intersections increases the visibility of all road users. This countermeasure is most effective at reducing or preventing collisions at intersections at night or in low light conditions. When lighting pedestrian crosswalks, it is helpful to use lighting analysis to avoid designs that inadvertently introduce glare or backlight pedestrians making it hard for motorists to see them.

Cost **$$**

LRSM ID **NS01**

Other Reference Information
Pedestrian-Level Lighting: FHWA Pedestrian Safety Guide and Countermeasure Selection System. http://www.pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=8

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
			Increase Attentiveness and Awareness

OTHER

Median Guardrail

The installation of median guardrail is most suitable for use in traversable medians having no or little change in grade and cross slope. While these systems may not reduce the frequency of crashes due to roadway departure, they can help prevent a lane-departure crash from becoming a head-on collision.

Cost $$

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			

OTHER

Red Light Camera

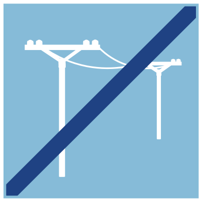
A red light camera enforces traffic signal compliance by capturing the image of a vehicle that has entered an intersection in spite of the traffic signal indicating red. The automatic photographic evidence is used by authorities to enforce traffic laws and issue traffic violation tickets.

Cost $$

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	**Tier 4**
			Increase Attentiveness and Awareness

OTHER



Relocate Select Hazardous Utility Poles

Relocating or removing utility poles from within the clear zone alleviates the potential for fixed-object crashes. If utility poles cannot be completely eliminated from within the clear zone, efforts can be made to either relocate the poles to a greater offset from the road or delineated.

Cost **$$**

Other Reference Information
FHWA Manual for Selecting Safety Improvements on High Risk Rural Roads

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
Remove Severe Conflicts			

OTHER

Remove Obstructions For Sightlines

Remove objects that may prevent drivers and pedestrians from having a clear sightline. May include installing red curb at intersection approaches to remove parked vehicles (also called “daylighting”), trimming or removing landscaping, or removing or relocating large signs.

Cost **$**
Low Cost / Quick Build alternative available

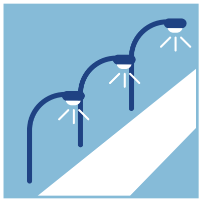
LRSM ID **NS11**

Other Reference Information
FHWA Manual for Selecting Safety Improvements on High Risk Rural Roads

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	**Tier 4**
			Increase Attentiveness and Awareness

OTHER



Segment Lighting

Providing roadway lighting increases driver awareness and can improve visibility of other road users and/or objects in the roadway.

Cost $$

LRSM ID R01

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
			Increase Attentiveness and Awareness

OTHER

Speed Limit Reduction

As an industry, there is a consistent movement away from setting speed limits solely based on 85th percentile vehicle speeds. Roadway characteristics, adjacent land use context, as well as the risk higher speeds create for all road users are now considered. Where separate space is not available for vulnerable road users and/or severe conflicts (e.g., crossing or turning conflicts) are present between motorvehicles speeds of 25 mph are preferable to reduce the risk of severe collisions. Where separated space is provided for vulnerable road users and severe conflicts between vehicles are managed, speed limits above 25 mph can be considered.

Cost $

Other Reference Information

TRB Study on Setting Speed Limits; also Richard, C. M., Magee, K., Bacon-Abdelmoteleb, P., & Brown, J. L. (2018, April). Countermeasures that work: A highway safety countermeasure guide for State Highway Safety Offices, Ninth edition (Report No. DOT HS 812 478). Washington, DC: National Highway Traffic Safety Administration.

Safe System Hierarchy

Tier 1	Tier 2	Tier 3	Tier 4
	Reduce Vehicle Speeds		Increase Attentiveness and Awareness


SIXTH
NO PARKING
BIKE
LANE

Nonengineering Countermeasures

Education & Public Awareness Campaigns Targeted at Speeding, Driving Under the Influence, and Increasing Awareness of People Walking and Biking

Coordinate with member agencies to use existing social media accounts (e.g. Facebook, NextDoor, Twitter, etc.) to establish an ongoing public education campaign focused on safe and responsible driving, discouraging drinking and driving, and increasing awareness of pedestrians and bicyclists. Campaigns could also involve collaborating with local radio stations to disseminate safety messages in English and Spanish. Additionally, campaigns could collaborate with community-based organizations and direct service providers to vulnerable populations.

Pedestrian Crossing Campaign
San Francisco Municipal Transportation Agency's (SFMTA) "Be Nice, Look Twice" Pedestrian Safety Campaign aims to increase driver awareness of pedestrians in crosswalks and encourage proper yielding behavior.
Source: SFMTA

Resources
The OTS Go Safely California campaign has free resources for local agencies to use in implementing public awareness campaigns.

Lead Agency
- MCAG
- Member agency Police Departments

Partners
- Member agency Communications Departments
- Member agency Public Health Departments
- Community-based organizations
- Local media outlets
- OTS Go Safely California Campaign

Funding Sources
California Office of Traffic (OTS) grants

Context
Regional

Effectiveness
Mass Media Campaigns on DUI

★★★☆☆

Turning Campaign
"Safety - It's Your Turn", an SFMTA campaign, encourages safe left-turn behavior through social media, billboard, and bus poster messaging, disseminated in multiple languages.
Source: SFMTA

Public Health Partnerships on DUI Prevention

Prevention and education policies focus on mobilizing and educating the community and intervening before driving under the influence takes place. According to NHTSA research, alcohol problem assessment and treatment programs, as well as alcohol intervention in settings such as a doctor's office, are highly effective strategies for improving safety outcomes.

To help residents with alcohol treatment, the Merced County Substance Use Disorder (SUD) Division provides services that include treatment and education. The County's Department of Public Health could partner with the member agency Police Departments to share information and conduct screenings.

Resources
- Behavior Change Campaigns to Improve Traffic Safety Toolkit
- Countermeasures that Work, 10th Edition

Lead Agency
- Merced County Substance Use Disorder (SUD) Division
- Merced County Department of Public Health

Partners
- Medical offices/centers
- Member agency Police Departments
- California Highway Patrol (CHP)

Funding Sources
California Office of Traffic (OTS) grants

Context
Regional, focused on DUI crash hotspots

Effectiveness
Alcohol Screening & Brief Intervention

★★★★★

High-Visibility Enforcement for DUI

Deterrence policies, such as high visibility enforcement, focus on raising the actual and perceived risk of high-risk behaviors. Member agency Police Departments should continue their use of high visibility enforcement for DUIs to deter and increase awareness of the risks of this behavior.

High visibility enforcement for driving under the influence, such as publicized sobriety checkpoints and saturation patrols, has been found to be effective to improve safety outcomes. Since speeding and driving aggressively are moving violations, officers can focus their efforts along corridors with a history of speeding-related collisions and speeding violations since they must observe driving behavior on the road.

Based on the evaluation evidence gathered by NHTSA in Countermeasures that Work, the findings have been inconclusive on the effectiveness of high-visibility enforcement efforts focused on speeding and driving aggressively. Some studies found these efforts produced safety-related benefits while other studies found these efforts produced no benefits or even negative outcomes (e.g. an increase in crashes).

Integrated enforcement would include coordination with Public Awareness Campaigns. For example, widespread dissemination of multi-lingual educational messaging and promotion of safe rides home programs in advance of major DUI enforcement efforts will help to mitigate equity concerns about disproportionate impacts of fines/fees on lower income residents.

Resources

Massachusetts Saving Lives – Enforcement Strategies, https://solutions.edc.org/solutions/prevention-solutions

This program combines community engagement events, high-visibility enforcement including sobriety checkpoints, and media communication to discourage DUI.

Lead Agency

Law Enforcement Officials

Partners

- MCAG
- California Office of Traffic Safety (OTS)

Funding Sources

California Office of Traffic (OTS) grants

Context

Regional, focused on DUI crash hotspots

Effectiveness

Publicized Sobriety Checkpoints

★★★★★

High-Visibility Saturation Patrols

★★★★☆

Safe Ride Home Program

Develop partnerships between the member agencies' public works and police departments, TNC operators, MCAG, and local businesses to offer promotional codes for free or discounted rides home from establishments or events throughout the county to reduce the potential for DUI, drowsy driving, or distracted driving.

Resources

Portland Bureau of Transportation Safe Ride Home Program, https://www.portlandoregon.gov/transportation/76611

PBOT partnered with the Portland Police Bureau, TriMet, Old Town Hospitality Group, and Portland cab companies Radio Cab, Broadway Cab, New Rose City Cab and United Independent Cab, as well as transportation network companies Lyft and Uber to provide promo codes for discounted rides. The program is funded by a 50-cent fee charged for every taxi and TNC ride in Portland.

Lead Agency

Member agency Police Departments

Partners

- Member agency Public Works Departments
- MCAG
- Local businesses
- TNC operators

Funding Sources

User Fees (taxi and TNC fares)

Context

Regional, during weekends, holidays, and other special events

Effectiveness:

Alternative Transportation

★★★☆☆

Rapid Response Safety Communication Protocol and Multi-Disciplinary Team

Employ an internal, multi-departmental communication strategy in response to severe and fatal collisions. The protocol should outline a path forward for transportation planning and engineering staff to be a part of the immediate on-the ground-response to an investigation of severe and fatal collisions, ensuring a multi-disciplinary response team focused both on the behavioral and engineering elements of a collision. Development of this multi-disciplinary team can also support timely data sharing among County departments.

The development of an integrated database with law enforcement collision data and injury surveillance provides can also improve communication protocol. Data integration can help practitioners estimate actual injury costs and costs of treatments for future planning efforts.

Lead Agency

Office of Emergency Services

Partners

- MCAG
- Member agency Police Departments
- Merced County Sheriff's Department
- California Highway Patrol (CHP)
- Merced County Department of Public Health
- Merced County Fire Department
- Merced County Public Works
- Emergency medical service providers

Funding Sources

- Merced County
- California Office of Traffic Safety (OTS) grants

Context

Regional

Pedestrian Safety and Unhoused Services

Unhoused services provide temporary residence for unhoused individuals and families. In jurisdictions with a large unsheltered population, unsheltered people are often disproportionately represented in pedestrian collisions. Unsheltered people have a relatively high level of traffic exposure as they may stand in medians, cross roadways outside of designated pedestrian crossings, and/or frequent parking lots.

Lead Agency
Merced County Department of Public Health

Partners
- Member agency Police Departments
- Merced County Sheriff's Department
- Member agency Public Works Departments
- California Highway Patrol (CHP)
- Housing organizations

Funding Sources
County Funds

Public-private partnerships

Context
Regional, focused on areas with higher unhoused populations

Effectiveness
High-visibility Saturation Patrols

★★★★☆

Integrated Enforcement

★★★☆☆

Enforcement Priorities Mandate

Use crash history and emphasis area corridors as criteria to direct enforcement efforts, with a focus on the three "Ds" identified by the Member agency Police Departments: Driving Under the Influence, Distracted Driving, and Dangerous Driving. This may require additional police department funding.

Resources
- Behavior Change Campaigns to Improve Traffic Safety Toolkit
- Countermeasures that Work, 10th Edition

Lead Agency
Law Enforcement Agencies

Partners
- MCAG
- Member agency Public Works Departments

Funding Sources
California Office of Traffic (OTS) grants

Context
Hot spot corridors and locations with DUIs, distracted driving, and dangerous driving

Effectiveness
Communications and Outreach Supporting Enforcement

★★★☆☆

High-Visibility Cell Phone and Text Messaging Enforcement

★★★☆☆

Pair Education with Engineering Countermeasures

Educational materials can be used to teach people how to use new and unfamiliar safety countermeasures, such as rectangular rapid flashing beacons (RRFB), roundabouts, or protected bikeways. These materials can consist of informational signs or demonstration videos, and should be presented in multiple languages, including English and Spanish.

Resources

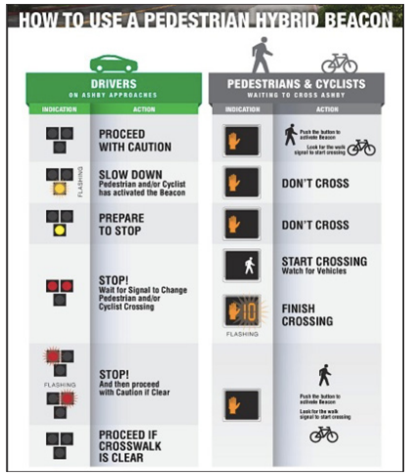
City of Sacramento Bicycling Videos

The City of Sacramento has used demonstration videos to engage residents in bicycling safety procedures. The videos on their website feature a series of safety improvements such as protected bike lanes, bike boxes, and bike signals, and inform residents how to use these new roadway features, both as a bicyclist and a driver.

City of San Francisco Informational Signs

The San Francisco Municipal Transportation Agency (SFMTA) posted signs with a brief explanation next to a newly installed protected bike lane in multiple languages as part of their Vision Zero SF initiative. This approach was also applied to educate people about pedestrian scrambles and bulb outs.

San Francisco Municipal Transportation Agency's (SFMTA) signage explaining newly-installed protected bike lanes. Source: SFMTA



The City of Berkeley's flyer explaining its newly-installed PHBs.

Source: City of Berkeley

City of Berkeley "How to Use a Pedestrian Hybrid Beacon" Flyer

This informational flyer was paired with the installation of a new PHB and includes both driver and pedestrian instruction for properly using the new countermeasure.

City of Los Angeles Education through Pop-Up Installations

As part of Bike to Work Day in 2019, LADOT used temporary pop-up installations to introduce safety improvements in specific neighborhoods. In addition to introducing safety improvements, pop-up installations can bring out emergency vehicles to ensure the vehicles can navigate around roundabouts or curb extensions.

Lead Agency

- Member agency Police Departments
- Merced County Department of Public Health

Partners

Office of Traffic Safety

Funding Sources

- California Office of Traffic (OTS) grants
- Local funds

Context

High Injury Network or other locations where new engineering countermeasures are implemented.

Speed Limit Modification

California Assembly Bill (AB) 43 was passed in 2021 to provide a means to lower speed limits on additional corridors. Cities will have increasing flexibility starting in June 2024 to enforce context-sensitive speed limits. AB 43 features the following five major components, focused on giving local jurisdictions more flexibility in setting speed limits, especially regarding vulnerable road users:

- Engineering & Traffic Survey (E&TS)
  An option to extend enforceable time period
- Post E&TS
  An agency can elect to retain current or immediately prior speed limit
- Speed Limit Reduction
  Reduction of additional 5 mph based on several factors, including designation of local "Safety Corridors"
- Prima Facie Speed Limits
  Options for 15 and 25 mph in certain areas depending on context
- Business Activity Districts
  Option for 20 or 25 mph

In particular, the designation of "Safety Corridors" could be applied to roadways where the highest number of serious injury and fatality crashes occur, identifying specific locations or corridor-level segments with high crash occurrences and stratified by mode. These designations must be approved by a professional engineer.

The most recent California Manual on Uniform Traffic Control Devices (MUTCD) is the document that provides guidance on how to re-evaluate posted speed limits in light of these AB 43 changes.

Lead Agency

Member agency Public Works Departments

Partners

- Member agency Police Departments
- Merced County Sheriff's Department
- California Highway Patrol (CHP)

Funding Sources

- California Office of Traffic Safety (OTS) grants
- Local funds

Context

Regional, focused on "safety corridors," business activity districts, and school zones

Effectiveness

Speed Limits

Source: NACTO

Automated Enforcement

Automated enforcement, such as red-light cameras or speed cameras, target the specific drivers who are behaving dangerously. Such enforcement is already allowed in California. Automated speed detection devices can identify speeding violations and provide citations. Such enforcement is currently allowed on a pilot bases in six cities in California and may be allowed to be implemented in all cities in the future.

A strictly data-driven approach to automated enforcement might place red-light or speed cameras in locations with the highest number of collisions. However, given that many low-income neighborhoods have historically received fewer infrastructure investments, which often results in a higher rate of collisions, a strictly data-driven approach could lead to a disproportionate burden of enforcement. Therefore, automated enforcement should be implemented evenly across a jurisdiction at problem locations. In addition, jurisdictions should pair automated enforcement with updated fine structures so that low-income communities don't bear a disproportionate burden.

Lead Agency

Member agency Public Works Departments

Partners

- Member agency Police Departments
- Merced County Sheriff's Department
- California Highway Patrol (CHP)
- Community-based organizations

Funding Sources

US Department of Transportation funding

Context

Regional, focused on areas with traffic signs and signal violations or unsafe speed collision trends

Effectiveness

Automated Enforcement

★★★★★

Safe Speeds Education Campaign

Continue existing safety education campaign targeting safe speeds. This could include yard signs, wall boards/posters along high-injury corridors and neighborhoods, ads on bus exteriors, radio ads, etc. Safe Speeds is also applicable to those who bike and scooter. On Class I shared-use paths, those who roll should manage speeds to ensure safety for all those using the facility.

Resources

The California Office of Traffic Safety (OTS) Go Safely California campaign has free resources for local agencies to use in implementing public awareness campaigns.

Lead Agency

MCAG

Partners

- Member agency Communications Departments
- Member agency Police Departments
- Merced County Sheriff's Department
- California Highway Patrol (CHP)
- Merced County Department of Public Health
- Local media outlets
- California Office of Traffic Safety (OTS) Go Safely California Campaign

Funding Sources

- MCAG funds
- California Office of Traffic Safety (OTS) grants

Context

Regional, focused on areas with unsafe speed collision trends

Effectiveness:

Communications and Outreach on Speeding

★★★☆☆

Emerging Technology

Recent advancements in transportation technology have not only introduced new transportation modes and travel patterns, but have also presented opportunities to better understand travel behavior and encourage safe behavior.

Intelligent Transportation Systems

Some existing and emerging on-board vehicle technologies require investments in public infrastructure in order to function properly. For example, lane departure warning technology common on newer vehicles requires regular maintenance of roadway striping and the use of highly retroreflective materials to maximize effectiveness. Emerging Vehicle-to-Infrastructure (V2I) technologies will likely require integration with existing infrastructure. MCAG's Capital Improvement Plan can facilitate the effectiveness of safe vehicle technology with traffic signal and detection upgrades and systematic resurfacing projects to ensure roadway striping is easily visible.

Near Miss Data

Near miss collisions have historically been difficult to study in practical safety applications due to an overall lack of reported information. In the absence of sufficient crash data, near miss data is an important indicator for guiding crash prevention. Video data and incident data from connected vehicles are emerging data sources that can provide key safety insights regarding near misses.

Autonomous Vehicle Readiness Planning

Having strategies prepared to meet and address the oncoming challenges posed by autonomous vehicle (AV) technology will be crucial in advancing road safety. Fully automated vehicles have the potential to transform travel behavior and safety outcomes given that AVs are ultimately designed to operate without any human intervention. Some strategies for preparation include educating the public on current and future safety features and limitations, developing signing and striping standards, and conducting reviews of equity implications. Without appropriate research and guidance, AVs could widen accessibility and safety gaps for vulnerable communities.

Lead Agency

MCAG

Partners

- Vehicle manufacturers
- Data vendors

Funding Sources

- MCAG
- California Office of Traffic Safety (OTS) grants
- Caltrans Highway Safety Improvement Program (HSIP)

Context

Regional

5

Taking Action for Roadway Safety

This chapter presents the **Safety Action Plan** for MCAG and its member agencies. MCAG is committed to providing regional leadership to improve roadway safety, and MCAG and its member agencies are committed to working to eliminate fatalities and severe injuries on the region's roadway network. The Action Plan is composed of strategies to facilitate successful implementation and evaluate and communicate progress. This chapter also identifies potential funding sources for safety improvements in the region.

Infrastructure projects are an important part of the solution towards meeting the region's safety goals, and are organized into two categories. Capital projects are large, long-term infrastructure projects that require advanced design, engagement, coordination, and permitting. These can include intersection redesigns, roadway reconfigurations, and other similar projects. Quickbuild projects typically have a shorter implementation time frame and lower cost than capital projects due to their semi-permanent nature. These projects may include spot improvements such as signal timing adjustments, installation of a Rectangular Rapid-Flashing Beacon (RRFB), and intersection enhancements. Projects will typically have a community engagement component and will be focused on spot locations. A list of safety projects are presented for each jurisdiction in their respective chapters within Volume Two of this LRSP.

In addition to infrastructure projects, the success of this LRSP is also dependent on changes to the policies and practices that institutionalize the Safe System Approach for MCAG and each of the local agencies in the region. The Action Plan covers these practices, policies and programs.

The Action Plan contains strategies that aim to use policy updates to create institutional improvements to design standards and create new standard practices that center safety in the day-to-day operations of MCAG and local agencies. For example, rolling safety projects into existing capital improvement projects by consolidating safety improvements with maintenance efforts such as roadway resurfacing can be cost efficient and expedite project implementation and delivery.

The Action Plan also establishes safety as the overriding priority for MCAG in decisions where trade-off between safety and other considerations, such as on-street parking or vehicle delay, arise as a result of limited funding or right-of-way. MCAG's commitment to this LRSP and its goals is also a commitment that safety considerations are prioritized in projects throughout the region over other competing priorities.

The Action Plan also provides for oversight and accountability towards the region's commitment to safety. MCAG will establish a standing **Regional Roadway Safety Working Group** that continues the work of the Stakeholder Group that was empaneled during the creation of this Plan. Having the leadership and oversight of this group will help maintain buy-in and support for the Plan from elected officials and the community. The Working Group's duties can include conducting briefings and presentations at board and agency meetings; collecting, and sharing information on a regular basis; and updating a public-facing web page on the MCAG website to inform progress towards safety goals, all of which are strategies within the Action Plan.

Finally, the Action Plan contains policies that promote community education to develop collective awareness around safety, target educational campaigns towards identified emphasis areas, and create a culture that supports both policy and infrastructure changes.

The Safety Action Plan

The following presents safety strategies organized into seven priorities. MCAG will periodically review the effectiveness of the strategies to identify those that would be helpful to expand vs. those that could be replaced. Each strategy includes an implementation timeline, performance metrics, and identifies the parties and partnerships needed to be successful. As the Action Plan is developed with alignment with the Safe System Approach in mind, each strategy is also identified with its related Safe System element and corresponding level on the Safe Systems Pyramid.

How to Read This Action Plan

Guiding goal for the following subset of Actions

Priority B

Systemically and proactively address common crash profiles

These strategies target key areas for improvement identified through collision analysis, including intersection control, lighting, and vulnerable users.

Strategy Number, along with corresponding **Safe System Element** and corresponding level of the **Safe Systems Pyramid**

7 — Built Environment — Safe Roads

Description of key steps in the action

Develop a strategy to update roadway, intersection, and pedestrian crossing lights with high quality light sources (i.e. LED) while minimizing impacts.

Estimated implementation timeline
- Near-term: 1-5 years
- Medium-term: 5-10 years
- Long-term 10+ years
- Ongoing: already in progress, and will continue

Timeline
Medium-term

Agencies leading implementation

Lead Agency
Member agency Public Works Departments

Agencies supporting implementation

Supporting Partners
MCAG

Method(s) for monitoring and communicating action **implementation progress**

Evaluation Framework
Create new standards for typical maintenance that reflect the LRSP goals.

Systemic resources needed to implement the action

Implementation Needs
- Staff Capacity
- Collaboration
- Funding

Parts of the **planning process** which inform action development

Evaluation Input
- Public Feedback
- Emphasis Areas/HIN

Priority A

Update design standards and policies for implementation of safety related projects

These strategies aim towards the implementation of safer roadway designs that infuse the Safe System Approach as part of routine practices and design decisions.

1

Built Environment

Safe Roads

Design projects to provide separation for vulnerable road users where prevailing speeds are greater than 25 MPH. Where separation is not feasible, implement geometric changes to slow vehicle speeds to 25 MPH or slower. Where posted speed is 25 MPH but prevailing speeds are greater, implement geometric changes to slow vehicle speeds to 25 MPH or slower.

Timeline

Ongoing

Lead Agency

- MCAG
- Member agency Public Works Departments

Evaluation Framework

Review all pipeline projects to include designs that separate vulnerable road users from vehicles where feasible. Implement a strategy for each agency to commit to a Safe System focused design review for each engineering project.

Implementation Needs

Staff Capacity | Collaboration

Evaluation Input

Policy Evaluation

2

Built Environment

Safe Roads

Implement quick build projects as temporary or low-cost improvements.

Timeline

Medium-term

Lead Agency

Member agency Public Works Department

Supporting Partners

MCAG

Evaluation Framework

Near-term: Review State Law and City codes to adopt policy around quick build projects.

Medium-term: Roll out of safety projects as quick builds to gather public and stakeholder feedback and make improvements and/or adjustments before a permanent project is put in place.

Implementation Needs

Staff Capacity | Collaboration

Funding | Legislation

Evaluation Input

Public Feedback

Emphasis Areas/HIN

3

Built Environment

Safe Roads

Bundle projects that are similar in scope to reduce costs and increase the efficiency of public outreach and engagement.

Timeline

Ongoing

Lead Agency

- Member agency Planning Departments
- Member agency Public Works Departments

Supporting Partners

MCAG

Evaluation Framework

Prioritize projects along the High-Injury Network (HIN) that are similar in nature.

Implementation Needs

Staff Capacity | Collaboration | Funding

Evaluation Input

Public Feedback

4

Built Environment

Safe Roads

Integrate safety projects into Public Works Department's regular maintenance.

Timeline

Ongoing

Lead Agency

Member agency Public Works Departments

Supporting Partners

MCAG

Evaluation Framework

Create new standards for typical maintenance that reflect the LRSP goals.

Implementation Needs

Staff Capacity

Evaluation Input

Policy Evaluation

Priority A

Update design standards and policies for implementation of safety related projects

These strategies aim towards the implementation of safer roadway designs that infuse the Safe System Approach as part of routine practices and design decisions.

5

Built Environment

Safe Roads

Update roadway design standards to create flexibility and push innovation with a Safe System lens in mind, making use of FHWA Safe System Design Hierarchy and FHWA Safe System Speed Management as guidelines.

Timeline

Ongoing

Lead Agency

Member agency Public Works Departments

Supporting Partners

MCAG

Evaluation Framework

- Near-term: Use quick build projects to test and receive feedback on design standards.
- Medium-term: Develop and adopt context sensitive design guidance

Implementation Needs

Staff Capacity | Collaboration

Evaluation Input

Public Feedback | Policy Evaluation | Emphasis Areas/HIN

6

Built Environment

Safe Roads

Create an internal training program for engineering and planning staff to stay up to date on best practices in Safety, Complete Streets, and Design Standards. Trainings may be hosted annually with Technical Advisory Committee Members and hosted by expert educators.

Timeline

Medium-term

Lead Agency

MCAG

Supporting Partners

Member agency Public Works Departments

Evaluation Framework

Establish consistent and recurring trainings with people from each member agency to keep up to date on best practices.

Implementation Needs

Staff Capacity

Evaluation Input

Policy Evaluation | Emphasis Areas/HIN

Priority B

Systemically and proactively address common crash profiles

These strategies target key areas for improvement identified through collision analysis, including intersection control, lighting, and vulnerable users.

7

Built Environment

Safe Roads

Develop a strategy to update roadway, intersection, and pedestrian crossing lights with high quality light sources (i.e. LED) while minimizing impacts.

Timeline

Medium-term

Lead Agency

Member agency Public Works Departments

Supporting Partners

MCAG

Evaluation Framework

Create new standards for typical maintenance that reflect the LRSP goals.

Implementation Needs

Staff Capacity

Collaboration

Funding

Evaluation Input

Public Feedback

Emphasis Areas/HIN

8

Built Environment

Safe Road Users

Establish guidance for existing pedestrian priority areas or activity centers to clearly designate and beautify pedestrian spaces with elements such as public art, benches, and shade.

Timeline

Medium-term

Lead Agency

Member agency Economic Development Groups

Supporting Partners

Merced County Public Health Department

Evaluation Framework

Partner with community-based organizations (CBOs) and Public Health Department to identify pedestrian activity areas using crash data and typology. Work with local artists to create murals or installations.

Implementation Needs

Staff Capacity

Collaboration

Funding

Evaluation Input

Public Feedback

9

Latent Safety Measures

Safe Roads

In areas with high concentration of pedestrians, bicyclists, children, or elderly, adjust signal timings to include Leading Pedestrian Intervals (LPIs) and longer signal cycle lengths. Prohibit right turn on red where feasible or adjust signal phasing to accommodate right turn movements with other phases.

Timeline
Medium-term

Lead Agency
Member agency Public Works Departments

Evaluation Framework
Prepare guidance and identify priority locations that would benefit from longer cycle lengths for vulnerable roadway users.

Implementation Needs
- Staff Capacity

Evaluation Input
- Public Feedback
- Policy Evaluation
- Emphasis Areas/HIN

10

Built Environment

Safe Roads

Develop a strategy to update intersection controls at intersections currently with permissive left and side-street stop controls, particularly those along high-traffic or high-speed corridors and the HIN. For intersections with permissive left operations, conversion to protected left operations is a possible treatment. For intersections with side-street stop operations, signalization, conversion to all-way stop operations, or the installation of PHBs or RRFBs are all possible treatments. Conversion to roundabouts or traffic circles is a possible treatment for all intersections.

Timeline
Medium-term

Lead Agency
Member agency Public Works Departments

Supporting Partners
MCAG

Evaluation Framework
Prepare guidance and identify priority intersections that would benefit from treatments

Implementation Needs
- Staff Capacity
- Collaboration
- Funding

Evaluation Input
- Public Feedback
- Emphasis Areas/HIN

Priority C

Reduce speeds through policy and design

These strategies aim towards achieving safer speeds and better speed management along the region's roadways.

11

Built Environment

Safe Speeds

As part of the Design Standards update in Strategy 5, include countermeasures and best practices for speed management.

Timeline

Medium-term

Lead Agency

- Member agency Planning Departments
- Member agency Public Works Department

Evaluation Framework

Develop context-sensitive design guidance and standards to include in an agency's Design Standards.

Implementation Needs

Staff Capacity

Evaluation Input

Public Feedback

Policy Evaluation

Emphasis Areas/HIN

12

Latent Safety Measures

Safe Speeds

Reevaluate speed limits across the roadway network to determine if any are candidates for speed limit reductions based on the California Manual on Uniform Traffic Control Devices (MUTCD).

Timeline

Near-term

Lead Agency

- Member agency Planning Departments
- Caltrans

Evaluation Framework

Each member agency completes an Engineering and Traffic Survey for arterial and colelctor roadways to determine if speed reduction is appropriate.

Implementation Needs

Staff Capacity

Collaboration

Evaluation Input

Public Feedback

Emphasis Areas/HIN

13

Built Environment

Safe Speeds

Roll out a regional engineering strategy that changes the roadway landscape to intentionally slow or manage vehicle speeds.

Timeline
Medium-term

Lead Agency
MCAG

Supporting Partners
Member agency Public Works Departments

Evaluation Framework
Develop a strategy with member agency support to identify where it's feasible to implement roundabouts, road diets, signal progression, etc. Strategy may have phases, where quick build occurs prior to full build out.

14

Latent Safety Measures

Safe Speeds

Support legislation to allow the use of speed safety cameras to allow for more equitable enforcement.

Timeline
Ongoing

Lead Agency
- MCAG
- Member agency Public Works Departments

Evaluation Framework
Monitor and participate in lobbying efforts in support of speed safety cameras in California.

Implementation Needs

Staff Capacity

Collaboration

Legislation

Evaluation Input

Policy Evaluation

Emphasis Areas/HIN

Priority D

Prioritize safety improvements on the HIN

These strategies aim to highlight the safety concerns along the high-injury network developed as part of the creation of this Plan, which represent locations with the highest numbers of past injury collisions.

15

Built Environment

Safe Roads

Prioritize and implement safety treatments along the HIN that respond to the identified Emphasis Areas. Roadways with a similar typology should be identified for proactive and systemic improvements.

Timeline

Near-term

Lead Agency

Member agency Public Works Department

Supporting Partners

- MCAG
- Caltrans

Evaluation Framework

- Near Term: Weave improvements into ongoing or planned projects
- Mid Term: Identify funding to implement safety treatments

16

Built Environment

Safe Roads

Reevaluate currently-funded general road projects and potentially reallocate funds to prioritize high priority locations identified in this Plan, adding safety improvements to project scopes.

Timeline

Ongoing

Lead Agency

- County Board of Supervisors
- Member agency Councils
- Member agency Public Works Departments

Supporting Partners

MCAG

Evaluation Framework

Review current capital improvements plans and strategically develop future plans to create opportunities for safety improvements with typical CIP projects.

Implementation Needs

Staff Capacity

Collaboration

Funding

Evaluation Input

Emphasis Areas/HIN


Parking
Permits

Priority E

Integrating the Safe System Approach in policy and practice

These strategies aim to institutionalize the Safe System Approach in MCAG's processes and establishes its leadership role in the region's roadway safety efforts.

17

Active Safety Measures

Safe Road Users

Establishing the Regional Roadway Safety Working Group to support projects through all phases of development and provide elected officials and stakeholders with periodic LRSP updates. The Working Group will likely be made up of elected officials and member agency staff.

Timeline

Ongoing

Lead Agency

MCAG

Supporting Partners

- Member agency Planning Departments
- Member agency Public Works Departments

Evaluation Framework

- Establish clear and on-going communication with community leaders through the Working Group.
- Identify when the Working Group meets (quarterly, bi-annually, etc.) where members get compensated for their time.

Implementation Needs

Staff Capacity

Collaboration

Evaluation Input

Public Feedback

18

Built Environment

Safe Roads

Prioritize safety criteria in local funding decision-making processes, consistent with federal, state, and regional funding requirements.

Timeline

Ongoing

Lead Agency

MCAG

Supporting Partners

- Member agency Planning Departments
- Member agency Public Works Departments
- Local Non-Profits

Evaluation Framework

- Near-term: Prepare Guidance on the decision-making process where projects located on the HIN or other safety enhancements can play a larger role in prioritization
- Medium-term: Increase transparency and provide public-facing updates

Implementation Needs

Staff Capacity

Evaluation Input

Policy Evaluation

Emphasis Areas/HIN

19

Built Environment

Safe Roads

Coordinate quarterly meetings with member agencies to coordinate on federal, state, regional, and local funding opportunities.

Timeline

Ongoing

Lead Agency

MCAG

Supporting Partners

- Member agency Planning Departments
- Member agency Public Works Departments

Evaluation Framework

Identify staff from Member Agencies to attend and execute quarterly meetings focused on safety funding opportunities.

Implementation Needs

Staff Capacity | Collaboration

Evaluation Input

Public Feedback | Policy Evaluation

Emphasis Areas/HIN

20

Latent Safety Measures

Post Crash Care

Conduct and prepare an annual crash analysis, and periodically update the HIN and Action Plan.

Timeline

Ongoing

Lead Agency

MCAG

Supporting Partners

- Member agency Planning Departments
- Member agency Public Works Departments
- Law Enforcement Officials

Evaluation Framework

Annual updates should include crash profiles and comparison of various time periods to better identify trends and progress toward safer streets. Analysis should layer available demographic and environmental justice data. Updates to the HIN should reflect progress being made to develop new strategies if current actions are not achieving the desired results.

Implementation Needs

Staff Capacity | Collaboration

Evaluation Input

Public Feedback

Emphasis Areas/HIN

Priority E

Integrating the Safe System Approach in policy and practice

These strategies aim to institutionalize the Safe System Approach in MCAG's processes and establishes its leadership role in the region's roadway safety efforts.

21 Built Environment | Safe Road Users

Utilize the MCAG website to provide the public with annual progress updates on LRSP safety implementation.

Timeline
Ongoing

Lead Agency
MCAG

Supporting Partners
- Member agency Planning Departments
- Member agency Public Works Departments

Evaluation Framework
Annual updates on Plan project implementation and crash data to provide transparency on progress.

Implementation Needs
Staff Capacity

Evaluation Input
Emphasis Areas/HIN

Priority F

Engage disadvantaged communities in transportation planning

These strategies serve to emphasize disadvantaged communities and other people who are historically disadvantaged or excluded from the planning process and who tend to have fewer mobility choices.

22 Socioeconomic Factors | Safe Road Users

Develop an equitable engagement strategy for transportation safety-related projects that include multilingual options, and consider cultural differences.

Timeline
Near-term

Lead Agency
MCAG

Supporting Partners
- Member agency Councils
- Member agency Public Works Departments
- Community-Based Organizations

Evaluation Framework
Create a plan that uses national examples of LRSP related equitable engagement strategies that includes types of outreach and thresholds for evaluation of effectiveness.

Implementation Needs
Staff Capacity | Collaboration

Evaluation Input
Public Feedback


MeasureV
RWA
YARTS
THE BUS

Priority G

Coordinate Travel Demand Management

These strategies can help reduce the number of high-risk vehicle trips on the roadway network, such as those that may involve DUIs, at night, or during major large events.

23

Active Safety Measures

Safe Road Users

Work with local businesses to offer overnight parking around restaurants, bars, and entertainment venues.

Timeline

Near-term

Lead Agency

Member agency Parking Enforcement

Supporting Partners

- Merced County Public Health Departments
- Local Businesses

Evaluation Framework

Partner with local businesses to identify locations to allow vehicles to park overnight, focusing on areas with high DUI-related crashes.

Implementation Needs

Staff Capacity | Collaboration

Evaluation Input

Public Feedback

Emphasis Areas/HIN

24

Active Safety Measures

Safe Road Users

Create programs for additional transit, microtransit, or shuttle service during holidays, festivals, and other large events that include promotional and proactive campaigns, schedules, and rates for fare purchases.

Timeline

Near-term

Lead Agency

MCAG (with Event Sponsorship)

Evaluation Framework

Identify events or times of year with highest rates of DUI-related collisions and offer free or subsidized transit fares, or partner with a private sponsor (e.g. microtransit service providers, event host, beverage company) to offer safe rides home.

Implementation Needs

Staff Capacity | Collaboration

Funding

Evaluation Input

Public Feedback

Emphasis Areas/HIN

Priority H

Educate all roadway users

These strategies represent a variety of educational and outreach programs and strategies that encourage behavior change in road users.

25

Education

Safe Road Users

Develop roadway safety educational campaigns.

Timeline
Near-term

Lead Agency
MCAG

Supporting Partners
- Member agency Planning Departments
- Member agency Public Works Departments
- Merced County Public Health Department

Evaluation Framework
Work to create an educational campaign with key stakeholders that target all audiences and educate all roadway users on the Safe System Approach, the goals and priorities of the LRSP, rules of the road, and changes to the roadway that involve new or unfamiliar features (for example, roundabouts). Campaigns can also focus on specific issues, such as impaired driving or promoting safe biking in partnership with organizations such as the Merced Bicycle Coalition.

Implementation Needs
Staff Capacity | Collaboration | Funding

Evaluation Input
Public Feedback | Policy Evaluation

26

Education

Safe Road Users

Develop a workshop for media outlets on how to best communicate traffic crashes and roadway safety to the public.

Timeline
Medium-term

Lead Agency
- Law Enforcement Officials
- Member agency Public Information Officers (PIOs)

Supporting Partners
MCAG

Evaluation Framework
Develop a workshop for media outlets to attend annually that focuses on language around crashes and roadway safety.

Implementation Needs
Staff Capacity | Collaboration | Funding

Evaluation Input
Public Feedback | Policy Evaluation

Funding Considerations

Many of these policy items from the Action Plan, as well as the infrastructure projects for each jurisdiction listed in Volume II of this Plan, can be funded through a wide range of sources at the federal, state, and regional levels. Project funding is often limited due to a variety of factors, including demand from the number of outstanding projects, finite resources, and trade-off decisions. The sources listed here may be used to fund a broad scope of projects targeting air quality and sustainability, affordable housing, and transportation. Successful projects often entail creative solutions that address challenges beyond safety alone.

Federal Sources

Congestion Mitigation and Air Quality (CMAQ) Improvement Program

The Bipartisan Infrastructure Law (BIL) continued the CMAQ program to provide a flexible funding source to State and local governments for transportation projects and programs to help meet the requirements of the Clean Air Act. Funding is available to reduce congestion and improve air quality for areas that do not meet the National Ambient Air Quality Standards for ozone, carbon monoxide, or particulate matter (nonattainment areas) and for former nonattainment areas that are now in compliance (maintenance areas).

Frequency Annual funding cycle

Rebuilding American Infrastructure with Sustainability and Equity (RAISE) Discretionary Grant Program

This program supports projects that are "road or bridge projects eligible under title 23, United States Code;" and "intermodal projects." Previously the BUILD grant, this program replaces the TIGER program.

Frequency Annual funding cycle

Community Development Block Grant (CDBG) Program

The Community Development Block Grant (CDBG) program is a flexible program that provides communities with resources to address a wide range of unique community development needs. Communities often use CDBG funds to construct and repair streets and sidewalks.

Frequency Annual funding cycle

Safe Streets for All (SS4A) Grant Program

The Safe Streets for All (SS4A) grant program is a Federal grant program established by the BIL centered around the Department of Transportation's National Roadway Safety Strategy and its goal of zero deaths and serious injuries on America's roadways. It will provide $5 billion in grant funding over its five-year duration to develop and implement safety plans and projects.

Frequency Annual funding cycle

Reconnecting Communities and Neighborhoods Program

The Reconnecting Communities and Neighborhoods program combines the Reconnecting Communities Pilot (RCP) and Neighborhood Access and Equity (NAE) discretionary grant programs into a single funding opportunity. The program funds projects that address the impact of transportation infrastructure, such as freeways and railroads, that form barriers for travel in communities. The program funds the removal, retrofit, mitigation, or replacement of the infrastructure in question.

Frequency Annual funding cycle

State Sources

Active Transportation Program (ATP)

ATP is a statewide competitive grant application process with the goal of encouraging increased use of active modes of transportation. The ATP consolidates existing federal and state transportation programs, including the Transportation Alternatives Program (TAP), Bicycle Transportation Account (BTA), and State Safe Routes to School (SRTS), into a single program with a focus to make California a national leader in active transportation. The ATP is administered by the Division of Local Assistance, Office of State Programs.

Frequency Biennial funding cycle

Clean California Grants

The Clean California Local Grant Program (CCLGP), operated by Caltrans, was created by AB 149 in 2021 to beautify and clean up local streets and roads, tribal lands, parks, pathways, transit centers, and other public spaces. The program will allocate $296 million in state funds, in grants not to exceed $5 million, to local and regional public agencies that install beautification measures and art in public spaces and remove litter and debris to enhance communities and improve spaces for walking and recreation. The goals of the CCLGP are to: reduce the amount of waste and debris within public rights-of-way, pathways, parks, transit centers, and other public spaces; enhance, rehabilitate, restore, or install measures to beautify and improve public spaces and mitigate the urban heat island effect; enhance public health, cultural connection, and community placemaking by improving public spaces for walking and recreation; and advance equity for underserved communities.

Frequency Three-year cycle

California Natural Resources Agency Urban Greening Program

This program supports projects that "use natural systems or systems that mimic natural systems to achieve multiple benefits." Eligible projects include "Non-motorized urban trails that provide safe routes for travel between residences, workplaces, commercial centers, and schools."

Frequency Annual funding cycle

California Strategic Growth Council (SGC) Transformative Climate Communities (TCC) Program

The Transformative Climate Communities (TCC) Program empowers the communities most impacted by pollution to choose their own goals, strategies, and projects to reduce greenhouse gas emissions and local air pollution.

Frequency Annual funding cycle

SGC Affordable Housing and Sustainable Communities (AHSC) Program

The Affordable Housing and Sustainable Communities (AHSC) Program makes it easier for Californians to drive less by making sure housing, jobs, and key destinations are accessible by walking, biking, and transit.

Frequency Quarterly funding cycle

California Office of Traffic Safety (OTS) Grant Program

OTS administers traffic safety grants in the following areas: Alcohol Impaired Driving, Distracted Driving, Drug-Impaired Driving, Emergency Medical Services, Motorcycle Safety, Occupant Protection, Pedestrian and Bicycle Safety, Police Traffic Services, Public Relations, Advertising, and Roadway Safety and Traffic Records. This funding is primarily geared to enforcement and outreach efforts.

Frequency Annual funding cycle

Highway Safety Improvement Program (HSIP)

California's Local HSIP focuses on infrastructure projects with nationally recognized crash reduction factors (CRFs). Local HSIP projects must be identified based on collision experience, collision potential, collision rate, or other data-supported means. There are opportunities to include systemic safety projects as well.

Frequency Biennial funding cycle

California Natural Resources Agency Environmental Enhancement and Mitigation (EEM) Program

This program supports projects that "contribute to mitigation of the environmental effects of transportation facilities." According to the program guidelines, projects that fall under the following category can apply: "Mitigation Projects Beyond the Scope of the Lead Agency responsible for assessing the environmental impact of the proposed transportation improvement."

Frequency Annual funding cycle

Caltrans Strategic Partnerships Grants

These grants, a subset of Caltrans' Sustainable Transportation Planning Grant Program, fund multi-modal planning studies, with a focus on transit, of regional, interregional, and statewide significance. Studies are conducted in partnership with Caltrans and must assist in achieving the Caltrans Mission and Grant Program Objectives.

Frequency Annual funding cycle

SB 1 Local Streets and Roads Program (LSRP)

SB 1 dedicated approximately $1.5 billion per year in new formula revenues apportioned by the State Controller to cities and counties for basic road maintenance, rehabilitation, and critical safety projects on the local streets and roads system.

Frequency Annual funding cycle

SB 1 Local Partnership Program (LPP)

The purpose of this program is to provide local and regional transportation agencies that have passed sales tax measures, developer fees, or other imposed transportation fees with a continuous appropriation of $200 million annually from the Road Maintenance and Rehabilitation Account to fund road maintenance and rehabilitation, sound walls, and active transportation projects. There is also a competitive grant portion of this project.

Frequency Biennial funding cycle

SB 1 Solutions for Congested Corridors Program (SCCP)

The Solutions for Congested Corridors Program funds projects designed to reduce congestion in highly traveled and highly congested corridors. This statewide, competitive program makes $250 million available annually for projects that implement specific transportation performance improvements and are part of a comprehensive corridor plan by providing more transportation choices while preserving the character of local communities and creating opportunities for neighborhood enhancement.

Frequency Annual funding cycle

SB 1 State Transportation Improvement Program (STIP)

The State Transportation Improvement Program (STIP) is the biennial five-year plan for future allocations of certain state transportation funds for state highway improvements, intercity rail, and regional highway and transit improvements.

Frequency Biennial funding cycle

Regional and Local Sources

Measure V Funding

Administered through MCAG, Measure V is a half-cent regional transportation sales tax measure that is designed to fund transportation maintenance and improvements in the Merced region. Local jurisdictions must spend at least 20 percent of their local Measure V funding on "alternative mode" projects, such as bicycle and pedestrian projects. As such, this Plan may be used as a resource to identify these projects.

Developer Fees

California law allows local governments to establish and charge a fee on residential and non-residential developments to fund public facilities and to service population growth. Public facility fees can be charged to new development based on density and traffic impacts, and can go towards a variety of public facilities, including local roadways.

Frequency Not applicable

Program for Arterial System Synchronization (PASS)

PASS delivers financial and technical assistance to cities and counties to enhance signal coordination across jurisdictions. This includes engineering help for local governments seeking to re-time signals, adjustments to existing traffic-responsive timing systems, "flush" plans for managing traffic incidents, and more.

Frequency Annual funding cycle

Transportation Development Act Article 3 (TDA3) Funding

TDA3 provides funding annually for bicycle and pedestrian projects. Each county coordinates a consolidated annual request for projects to be funded in the county. Some counties competitively select projects, while other counties distribute the funds to jurisdictions based on population.

Frequency Annual funding cycle

Local Funds

A variety of local fund sources are available for transportation improvements and non-infrastructure programs, including Transportation Development Act (TDA) funds, local membership fees and contributions, Caltrans funding for specific projects, and periodic one-time grants.

Volume II

Volume II

Jurisdiction-specific information including:

- Collision Data Analysis
- Collision Profiles
- Priority Locations and Project Concepts

City of Atwater

1

Collision Analysis

Chapter 2 of Caltrans' Local Roadway Safety Manual (LRSM) instructs safety practitioners to "consider a wide range of data sources to get an overall picture of the safety needs." To this end, this Local Roadway Safety Plan is data-driven and synthesizes findings from collison records alongside input from key stakeholders, a technical advisory group, and staff.

Collision records on roadways in Atwater from 2015 to 2022 were investigated to describe historic collision trends and identify high-risk locations. This information acts as a primary resource for this Plan, providing the underlying data to support key analyses.

The data-driven process for the creation of this Plan includes:

- **Examination of Collision Trends**
  Review of collision statistics to evaluate when, where, and why collisions occur and who is involved.
- **Development of a High-Injury Network**
  Identification of roadways where most injury collisions are concentrated for application of targeted intervention.
- **Development of Collision Profiles of Emphasis**
  Identification of the most prevalent collision types and contexts based on a combination of collision factors.
- **Creation of a Countermeasure Toolbox**
  Identification of effective, nationally proven countermeasures applicable to different collision profiles.
- **Identification of Priority Project Locations**
  Identification of locations suitable for project implementation based on collision density and community verification.

The following section presents findings from the first of these stages of data analysis, identifying collision patterns and trends.

A Note on the Data Source

This analysis utilizes data on injury collisions from 2015 through 2022 available through the Transportation Injury Mapping System (TIMS) as of August 2023. TIMS reports injury collisions from the Statewide Integrated Traffic Records System (SWITRS), but excludes collisions that cause property damage only (PDO) and no injuries.

Geographically, the data includes all collisions that occur within the City of Atwater. However, the data excludes collisions on State Route 99, as it is a controlled-access roadway (i.e. freeway).

While collision databases like TIMS remain the best source of collision data, they have been found to have certain reporting biases, including:

- Collisions involving people walking, on bicycles, or on motorcycles are less likely to be reported than collisions with people driving
- Property damage only collisions are less likely to be reported compared to more severe collisions
- Younger victims are less likely to report collisions
- Alcohol-involved collisions may be underreported

Race, income, immigration status, and English proficiency may also impact reporting, but there is limited research on these factors.

Figure 1.1
Injury Collisions by Year, 2015-2022

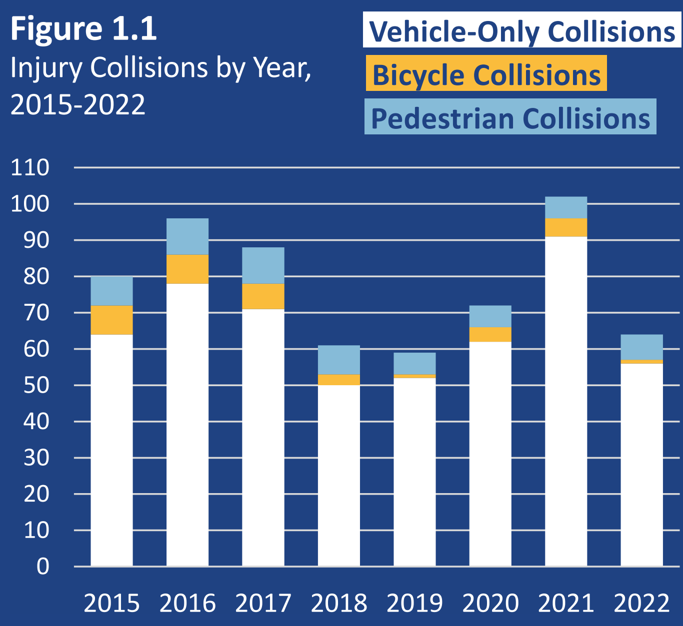


Figure 1.2
KSI Collisions by Year, 2015-2022

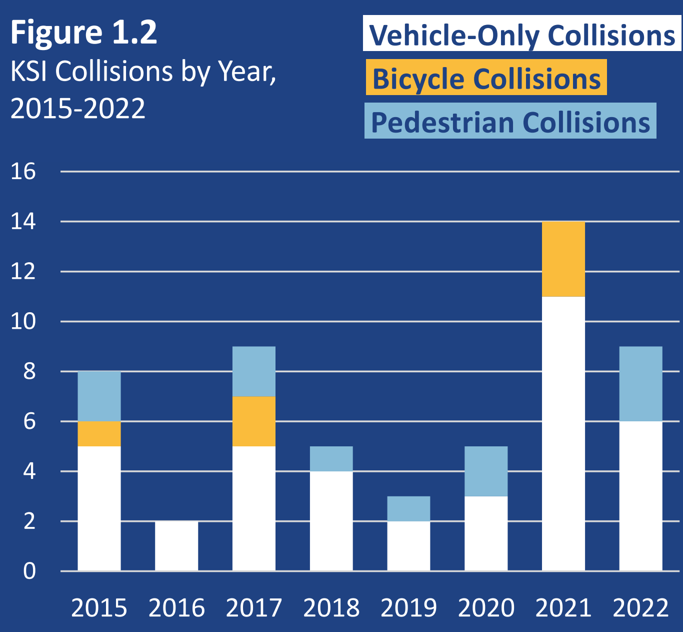
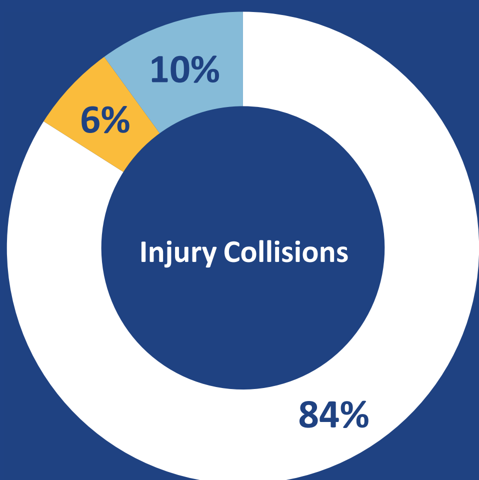
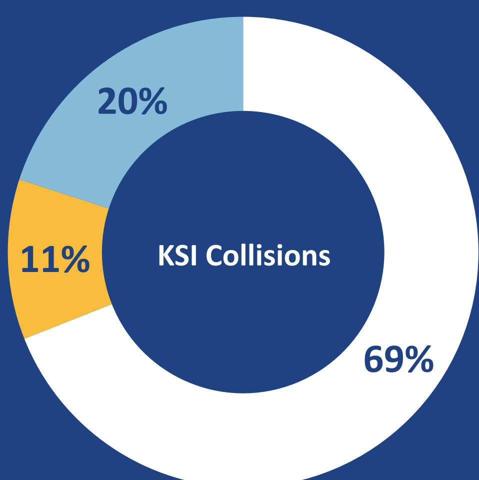


Figure 1.3
Collision Mode Share by Severity, 2015-2022

Vehicle-Only Collisions
Bicycle Collisions
Pedestrian Collisions





Collisions by Year and by Mode

The table below provides a summary of the number of collisions in Atwater by mode and severity within the dataset, which includes all collisions that resulted in injury or fatality. From 2015 to 2022, there were a total of 621 injury collisions, of which 55 were KSI collisions: collisions where someone was killed or severely injured.

Collision Summary	Total	KSI
Total	621	55
Bicycle	37	6
Pedestrian	61	11

Figures 1.1 and **1.2** show the temporal trends of collisions in Atwater. As shown, the annual number of injury collisions in Atwater has fluctuated through the study period, but peaks in 2021, as restrictions associated with the COVID-19 pandemic began to lift. The number of KSI collisions per year over the study period has also fluctuated, but also with the largest increase occurring in 2021. This is in line with national trends in 2020 and 2021, during and after the initial wave of the pandemic, where the number of collisions, especially KSI collisions, has increased despite travel restrictions and decreases in traffic volume.

People walking or biking are particularly vulnerable in the event of a collision, as they lack the protection afforded to them by being inside a motor vehicle. As a result, collisions involving people walking or biking are more likely to result in injury and fatality. As shown in **Figure 1.3**, people walking and biking are involved in 16% of all injury collisions, but 31% of KSI collisions.

Collisions by Collision Type

Figure 1.4 illustrates the share of collisions in the study period that fall into each collision type. As shown, the most common collision types across all injury collisions in Atwater are broadside collisions at 33%, rear-end collisions at 28%, and head-on collisions at 10%.

Taking a closer look at KSI collisions shows a different breakdown. Broadside collisions are also the most common type of KSI collisions, at 24%, followed by vehicle-pedestrian collisions at 20%, and head-on collisions at 16%.

This illustrates the disproportionate impact in severity that collision type can play. For example, while rear-ends account for a large share of overall collisions, they are generally less likely to result in fatalities and severe injuries. By contrast, broadsides and head-ons are more represented amongst KSI collisions, as these typically involve more kinetic energy and result in more serious collision outcomes.

This also further illustrates the significantly disproportionate impact people walking face in the event of a collision, as vehicle-pedestrian collisions are significantly overrepresented in the KSI collision record.

Collisions by Primary Collision Factor

Figure 1.5 illustrates the share of collisions in the study period that are classified under each Primary Collision Factor (PCF). PCFs are cited by the responding officer and are based on that person's judgment of what contributed to the collision. It is important to note that PCFs do not include contextual information about the design aspects of the collision location that could have been primary or secondary contributors to a collision.

In Atwater, the most common PCFs are Vehicle Right of Way Violation at 28% of collisions, Unsafe Speed at 25%, and Improper Turning at 10%.

Taking a closer look at KSI collisions shows a different PCF breakdown percentage. The most common PCFs for KSI collisions are Vehicle Right of Way Violation at 24%, Improper Turning at 18%, and Unsafe Speeds at 15%.

Figure 1.4

Share of Injury Collisions by Collision Type, 2015-2022

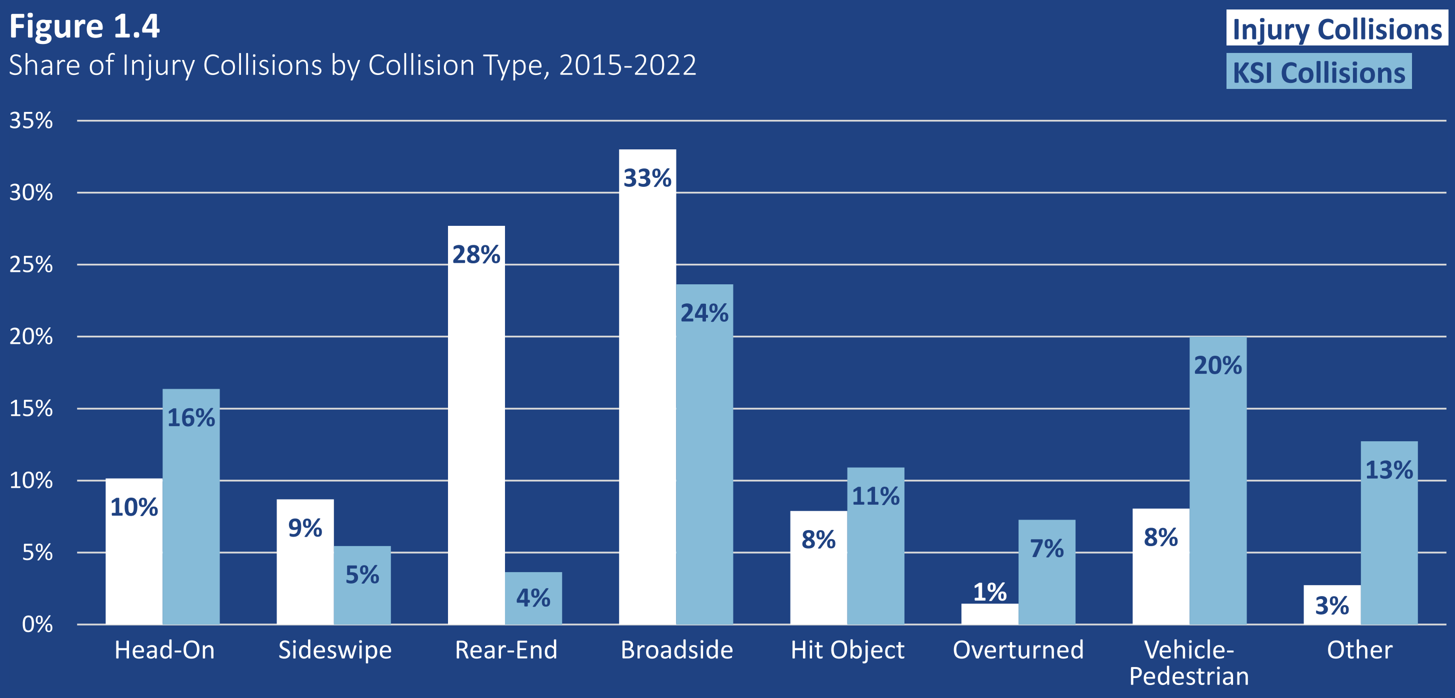
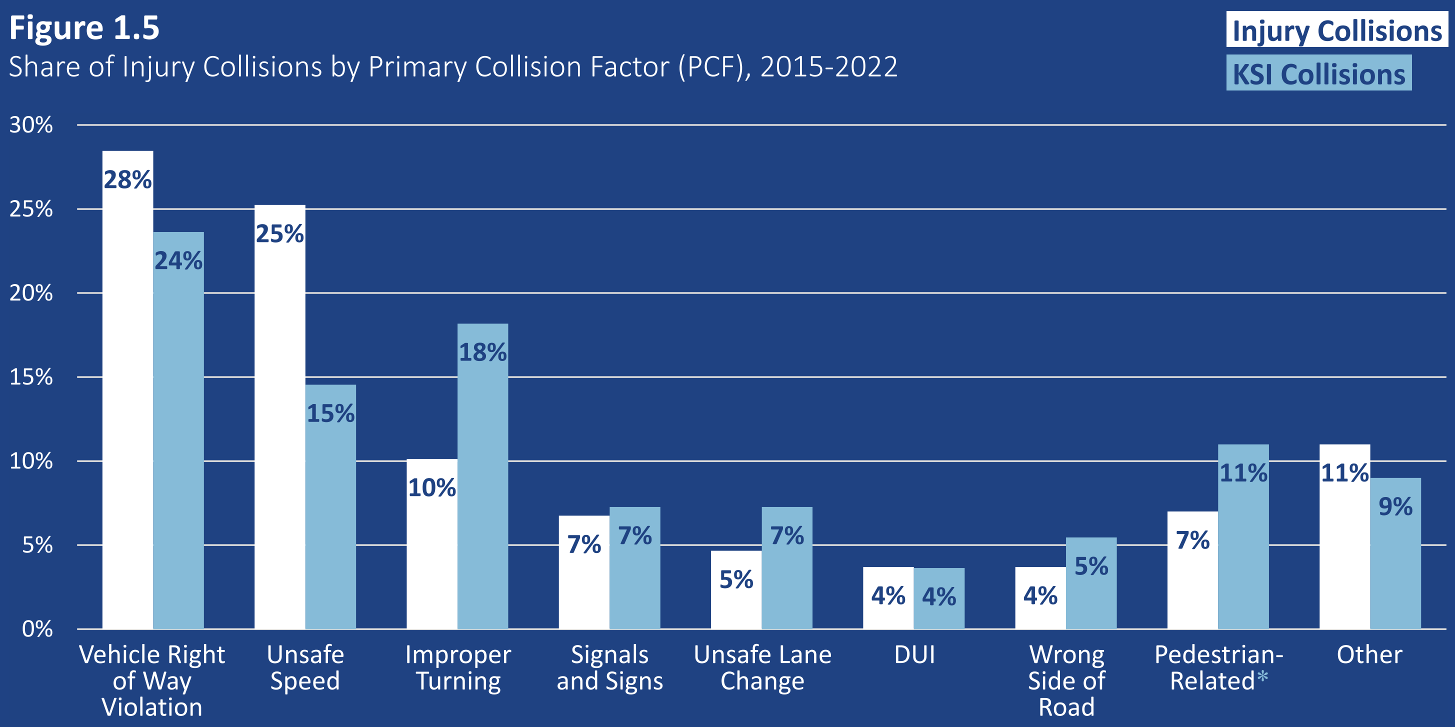


Figure 1.5

Share of Injury Collisions by Primary Collision Factor (PCF), 2015-2022



* **Note on Pedestrian PCF Categories**

The "Pedestrian-Related" category shown here combines two PCF categories: "Pedestrian Violation" and "Pedestrian Right of Way Violation." The former indicates that the pedestrian violated a rule of the road, such as crossing outside of a crosswalk, where the latter indicates the driver of a vehicle violated the pedestrian's right of way. The Pedestrian Violation category may be overrepresented due to a lack of clear information related to collision circumstances, and the increased likelihood that the pedestrian party may be unable to provide their side of the incident at the time of the collision. For this reason, we have elected to not show the distinction in these tallies, and instead show all pedestrian-related collisions in one single category.

Collisions by Lighting Conditions

Figure 1.6 illustrates the share of collisions in the study period that occur at night*. As shown, nighttime collisions are overrepresented among KSI collisions. While 27% of all injury collisions occurred at night where streetlights were present and a further 2% occurred where streetlights were not present or present but not functioning, those percentages jump to 32% and 13% for KSI collisions, respectively.

Collisions that occur during nighttime also disproportionately affect people walking, with almost two-thirds of all pedestrian KSI collisions occurring at night.

The concern around lighting is especially relevant given Atwater's small-town context and rural surroundings. There continue to be locations without functional street lighting in the City, and collisions at those locations are disproportionately represented in the KSI collision record. Furthermore, even where streetlights were present, the quality of the lighting can vary widely. Factors that may contribute to the quality of streetlights include lights being insufficiently bright, placed too widely apart, or poor quality of lighting for people walking on the sidewalk, as streetlights are often designed primarily for vehicles in travel lanes.

* Nighttime collisions are defined as those collisions whose lighting information is not reported as "daylight".

Driving Under the Influence (DUI)

Figure 1.7 illustrates the share of collisions of various types in the study period that involved at least one party driving under the influence (DUI). Drugs or alcohol increase the likelihood of increased crash severity. As shown, the number of DUI collisions are overrepresented amongst KSI collisions. While 9% of all injury collisions involve drugs or alcohol in Atwater, 23% of KSI collisions do.

These percentages reflect the portion of collisions involving one or more parties determined to be under the influence of drugs or alcohol. Driving under the influence may not always be listed as the primary collision factor even if a driver is found to be under the influence.

Figure 1.6
Nighttime Collisions, 2015-2022

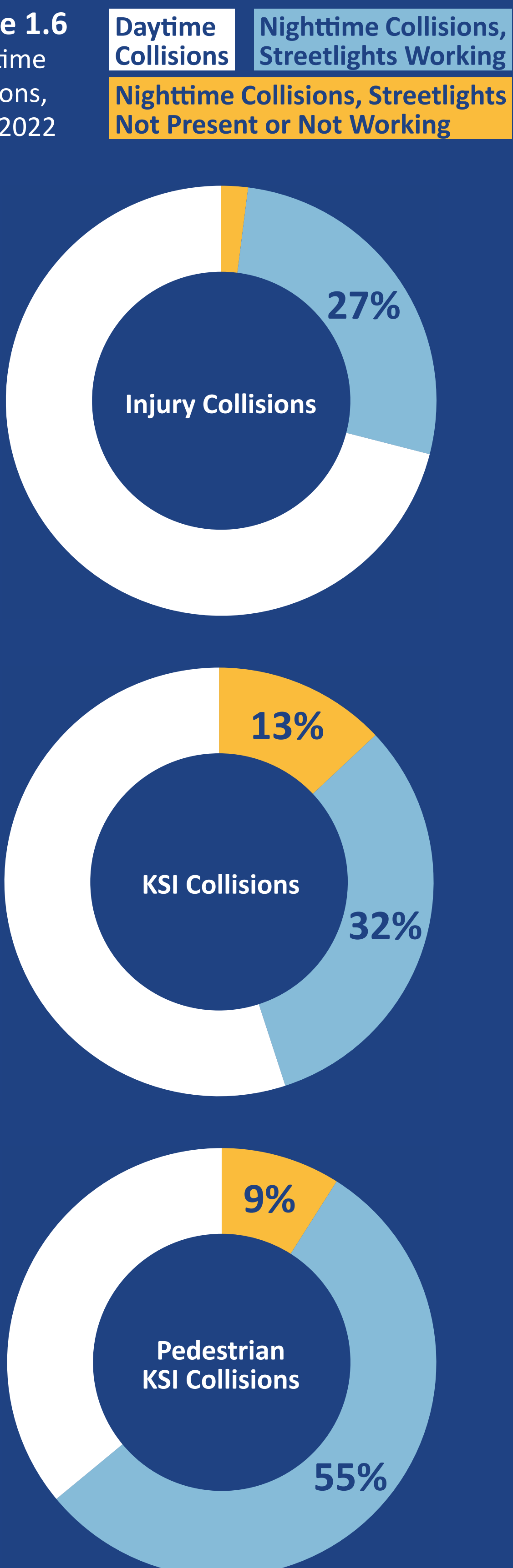
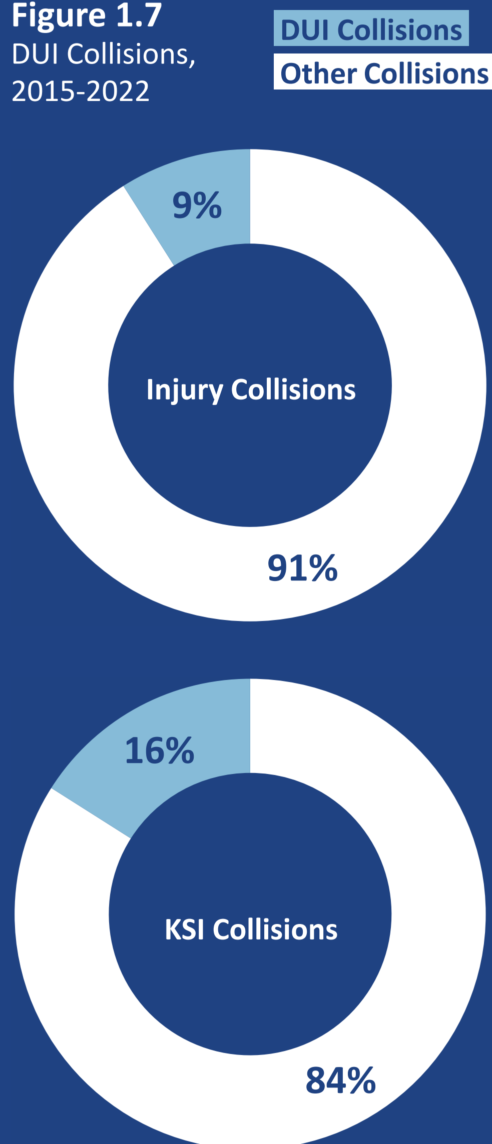


Figure 1.7
DUI Collisions, 2015-2022



Collisions by Pedestrian Location

Figure 1.8 illustrates for pedestrian-involved collisions the location of the pedestrian(s) at the time of collision. The most common location for pedestrians at the time of collisions is crossing the street, whether at a marked crosswalk (43%) or not (21%). This is followed by walking in or along the shoulder of the roadway, at 13%, and collisions with the pedestrian(s) not on the roadway at all, at 11%. For pedestrian KSI collisions, crossing at and not at a crosswalk were equally common at 27%, followed by walking in or along the shoulder of the roadway and not in road at 18% each.

This data illustrates the importance of both the presence and appropriate design of sidewalks, crosswalks and other similar pedestrian facilities that help reduce the risk of people being struck by separating them from moving vehicles.

Furthermore, the high number of collisions occurring with people walking in the roadway or shoulder or crossing not at crosswalks shows that there are pedestrian desire lines currently unserved by sidewalks and existing crosswalks. This points to the need for improving the coverage of pedestrian infrastructure and closing gaps.

Collisions by Day of Week

Figure 1.9 illustrates the share of collisions in the study period by day of week. As shown, while injury collisions are overall fairly evenly distributed across the seven days of the week, KSI collisions are heavily concentrated on the weekends, with 44% of KSIs occurring on Saturday and Sunday.

Figure 1.8
Share of Pedestrian-Involved Injury Collisions by Pedestrian Location at Time of Collision, 2015-2022

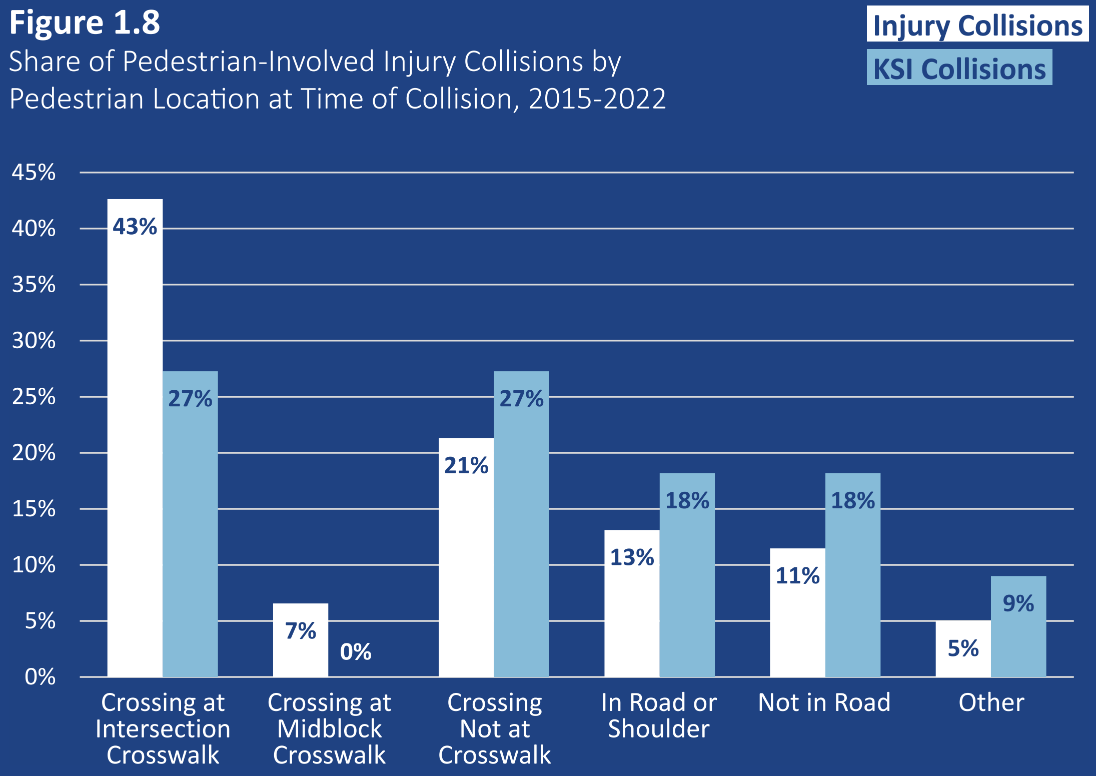
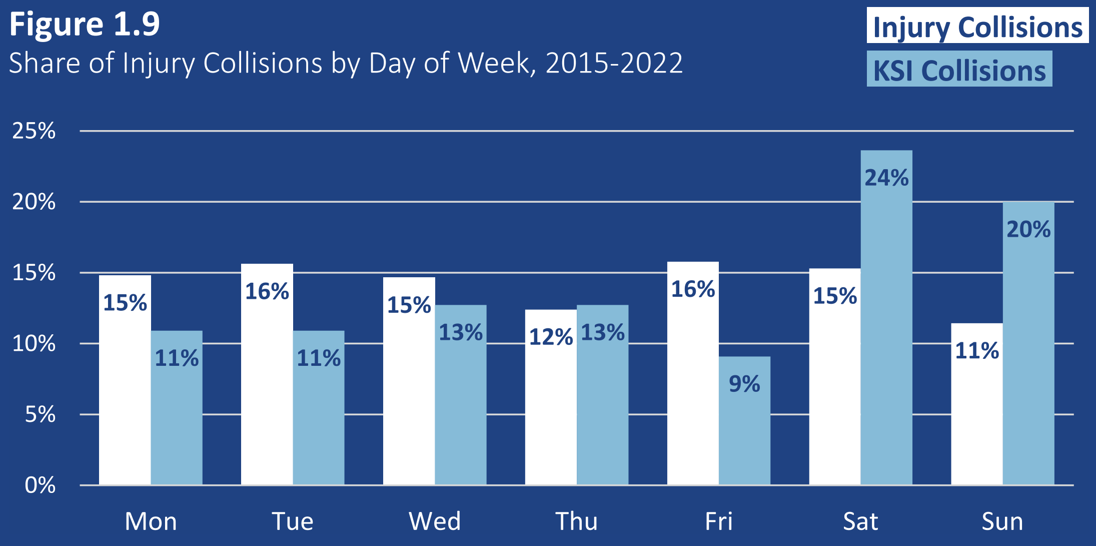


Figure 1.9
Share of Injury Collisions by Day of Week, 2015-2022

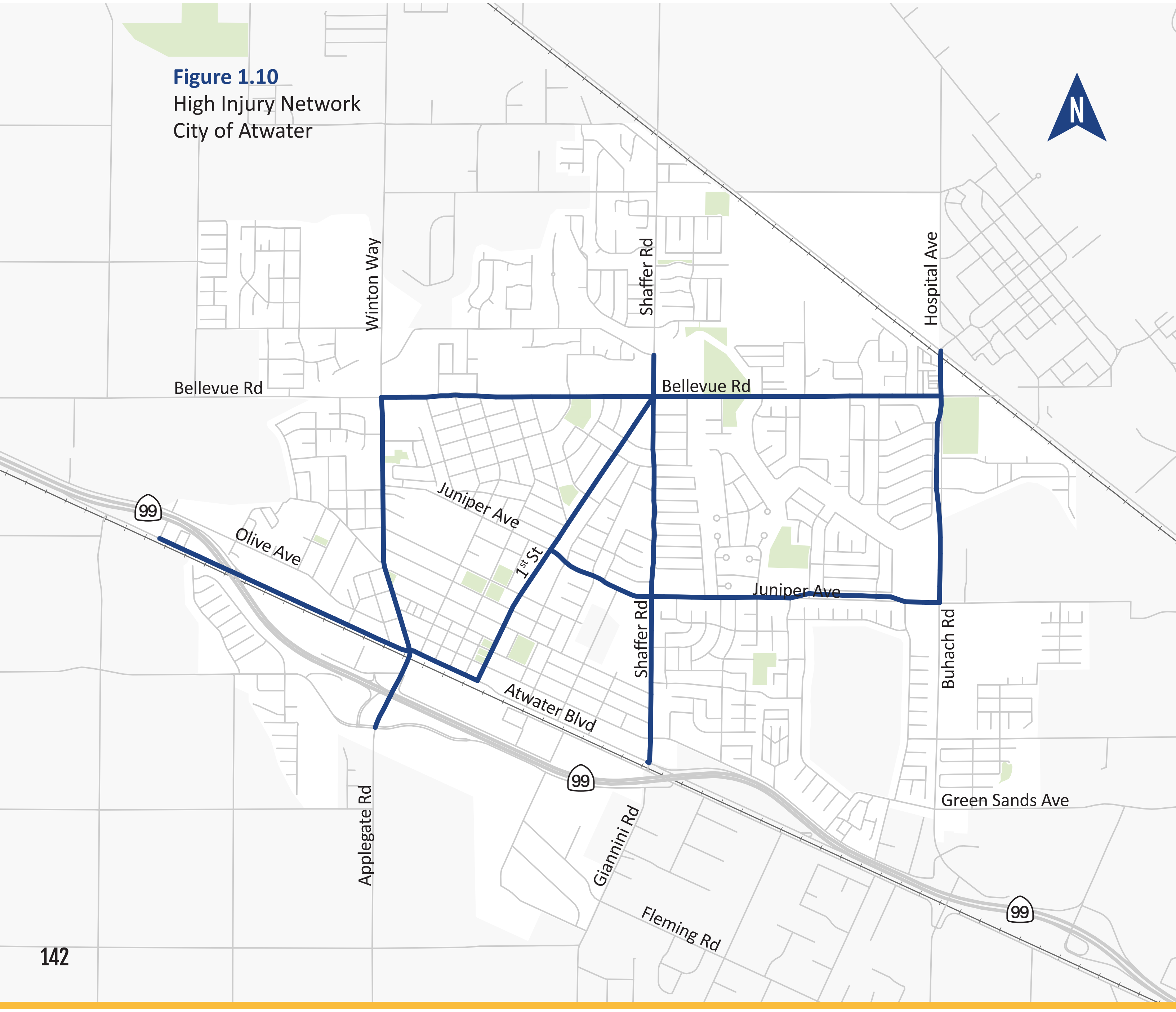


High Injury Network

From the collision data, a High Injury Network was developed to identify the roadways in Atwater with the highest levels of injury collisions, as shown on **Figure 1.10**.

The High Injury Network consists of just 9% of the roadway network in Atwater, but is the site of the majority of injury collisions. Of the 621 collisions that occurred during the study period, 409, or 66%, were located along the network. 55 of these study period collisions were KSIs, of which 34, or 62%, were located along the network.

Figure 1.10
High Injury Network
City of Atwater




ATWATER
FIRST ST
STOP

Equity Considerations

Both Merced County and the larger Central Valley region have historically been subject to underinvestment and marginalization. As a result, most of the region, including most areas within the six cities covered by this Plan, are identified as disadvantaged by the various criteria used by the state and federal governments.

The federal government has introduced a number of tools used to identify disadvantaged communities. In particular, two of these, the Climate and Economic Justice Screening Tool (CEJST) and the Equitable Transportation Communities (ETC) Explorer, are of particular note, as they see extensive use by the United States Department of Transportation (USDOT) in delineating disadvantaged areas, especially as part of grant funding opportunities.

Climate and Economic Justice Screening Tool (CEJST)

The Climate and Economic Justice Screening Tool (CEJST) is maintained by the Federal Council on Environmental Quality and used by many federal programs as a means of identifying disadvantaged communities. Census tracts are screened based on a variety of factors, including climate, energy, health, housing, transportation, legacy pollution, waste, and workforce development.

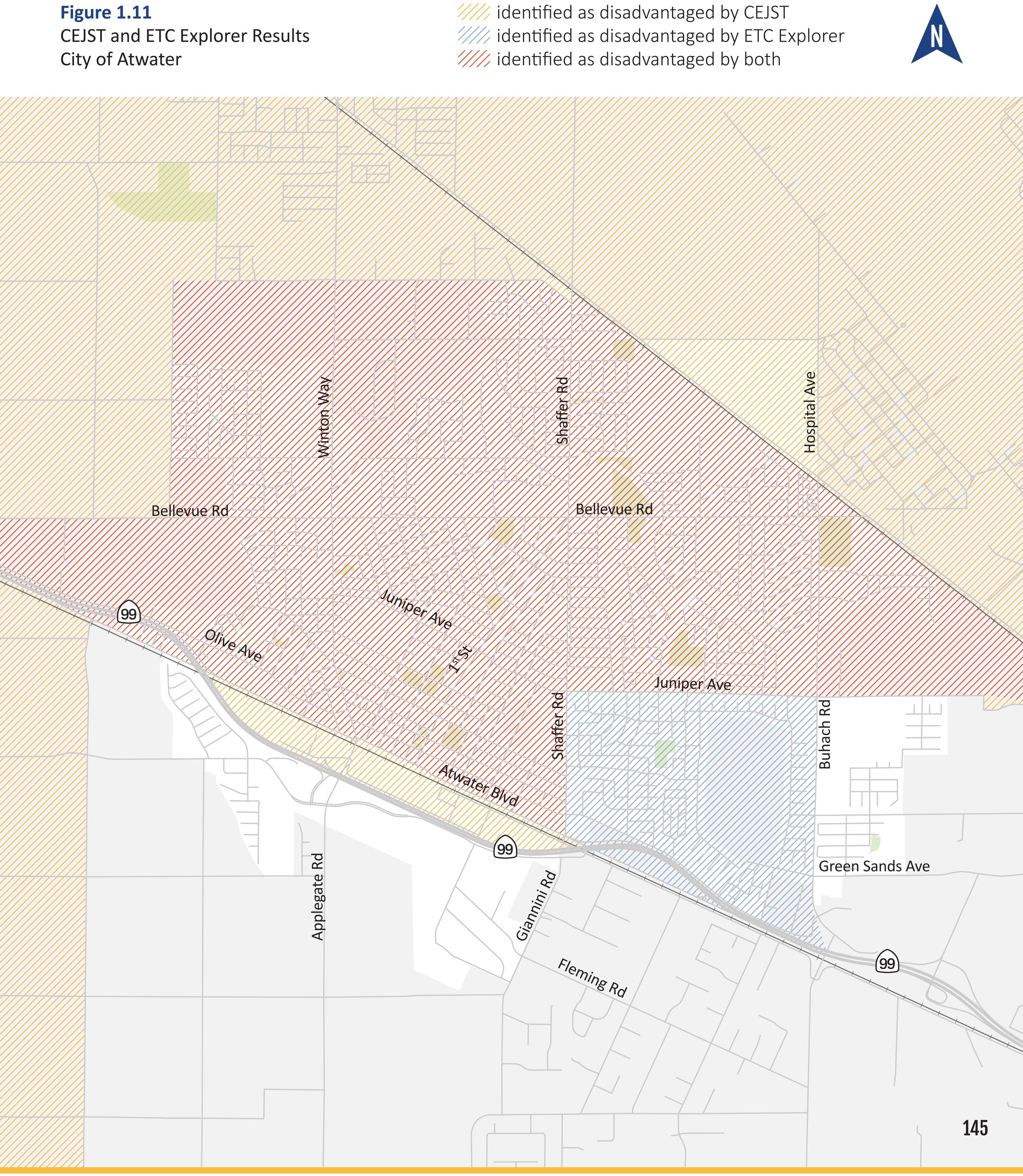
Equitable Transportation Communities (ETC) Explorer

USDOT created Equitable Transportation Communities (ETC) Explorer as part of its Justice40 initiative to complement the CEJST by providing additional insight into transportation factors specifically. The ETC Explorer is meant to capture the cumulative burden of underinvestment in transportation in a community.

Figure 1.11 shows areas in Atwater identified as disadvantaged under these two criteria. As shown, almost the entirety of Atwater, as well as all the unincorporated areas to the north of the city, are identified as disadvantaged by both metrics. The far southeastern corner of the city and the far southern fringes of the city south of SR 99 are the only areas not identified by either metric. With almost the entire city falls within these disadvantaged areas, the vast majority of collisions in Atwater occur within them as well, including 95% of all injury collisions and 93% of all KSI collisions.

Figure 1.11
CEJST and ETC Explorer Results
City of Atwater

identified as disadvantaged by CEJST
identified as disadvantaged by ETC Explorer
identified as disadvantaged by both



City of Atwater

2

Collision Profiles

Through a systemic analysis of collision records, collision profiles were identified to represent the most significant patterns behind injury collisions - and especially KSI collisions - in the region. Seven such profiles, identified with the letters "A" through "G" were identified across the region, with each one applicable to one, several, or all of the communities covered by this LRSP.

Atwater is covered by six of these profiles:

A. Driving Under The Influence

B. Dark Conditions

C. Side Street Stop-Controlled Intersections

D. Excessive Roadway and Lane Widths Leading To Speeding

E. Driveway Clusters on Arterials

F. Non-Standard Intersection Geometry

The following pages contain cutsheets that present each collision profile, along with the following information:

- Description and associated information about each profile
- Number of collisions associated, including number of KSI collisions among those (note that profiles are not mutually exclusive; collisions can fall under multiple profiles, and totals will exceed 100%)
- A map of collision locations

Engineering countermeasures that can potentially address these collisions are also presented with each profile. The full suite of engineering countermeasures can be found in **Chapter 3** of **Volume I**.

PROFILE A

Driving Under The Influence

Injury	KSIs		
89	17	4	9
(14%)	(31%)	(4%)	(10%)

Driving under the influence is a significant contributor to injury collisions, especially and disproportionately to collisions that cause someone to be killed or severely injured (KSI).

DUIs are clustered around the weekend and around nighttime. Across the region, 54% of all DUI collisions occurred on Friday, Saturday, and Sunday, and 65% occurred in the dark.

However, it is important to note that a substantial number of DUI collisions occurred outside these time periods as well.

Non-engineering interventions will need to be the primary means of addressing these challenges, but may be supplemented with the listed engineering countermeasures that aim to make roadway designs more forgiving in general.

Potential Supplemental Engineering Countermeasures

- Separated Bikeway
- Safety Edge
- Raised Median
- Red Light Cameras
- Add Sidewalk
- Guardrail
- Delineators, Reflectors, and/or Object Markers
- Speed Sensitive Rest in Red Signal
- Rumble Strips
- Roundabout
- Speed Limit Reduction
- Curve Advance Warning Sign
- Improved Pavement Friction
- Intersection Reconstruction and Tightening
- Remove Obstructions For Sightlines
- Chevron Signs on Horizontal Curves
- Speed Feedback Sign
- LED-Enhanced Sign
- Upgrade Striping
- Signal Coordination/ Green Wave

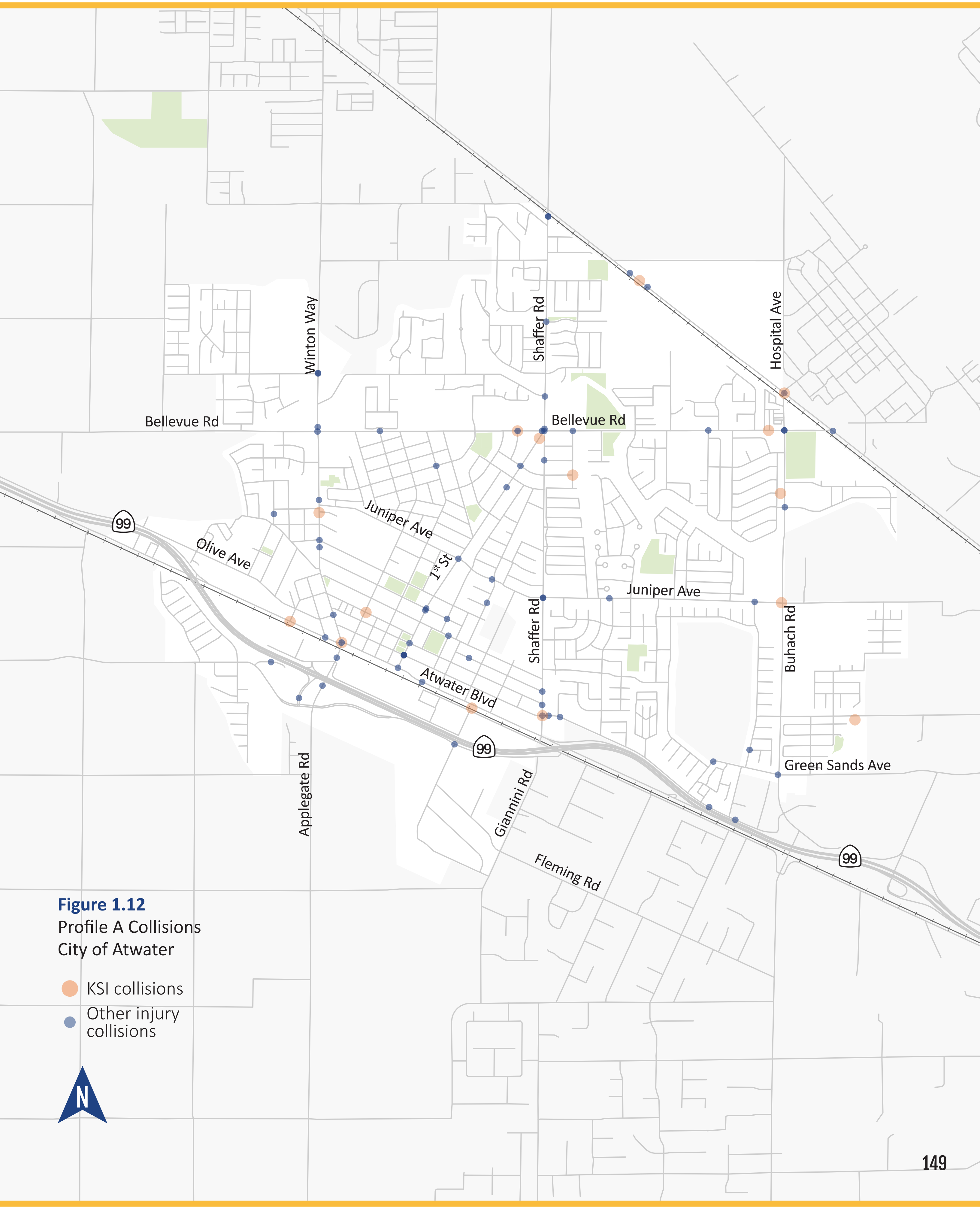


Figure 1.12
Profile A Collisions
City of Atwater

PROFILE B

Dark Conditions

Injury	KSIs		
179	25	6	21
(25%)	(45%)	(3%)	(12%)

A substantial number of collisions are occurring in the nighttime across the region. Based on the percentage of nighttime collisions, meaningful progress toward reducing collisions will require improvements that enhance nighttime visibility such as lighting, retroreflective signage, and sightline improvements.

Potential Engineering Countermeasures

- Separated Bikeway
- Rumble Strips
- Safety Edge
- Guardrail
- Intersection Reconstruction and Tightening
- Chevron Signs on Horizontal Curves
- Raised Crosswalk
- Raised Median
- Intersection Lighting
- Segment Lighting
- Delineators, Reflectors, and/or Object Markers
- Curve Advance Warning Sign
- Speed Limit Reduction
- Remove Obstructions For Sightlines
- Add Sidewalk
- High-Visibility Crosswalk
- Pedestrian Hybrid Beacon
- Upgrade Striping
- Leading Pedestrian Interval
- Rectangular Rapid Flashing Beacon
- Retroreflective Tape on Signals
- Advance Stop Bar
- Advance Yield Markings

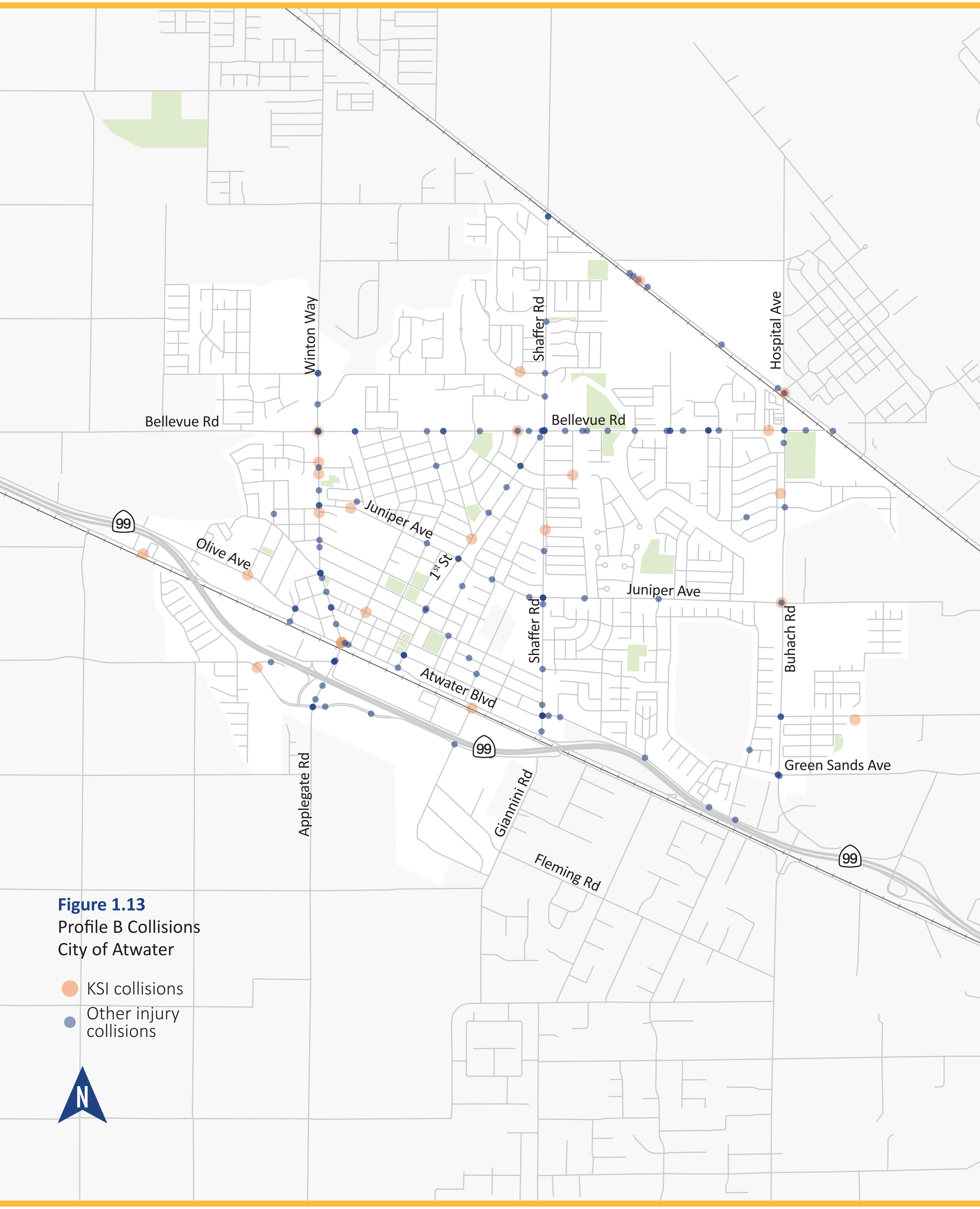


Figure 1.13
Profile B Collisions
City of Atwater

KSI collisions
Other injury collisions

PROFILE C

Side Street Stop-Controlled Intersections

Injury	KSIs	Bicycle	Pedestrian
203 (33%)	18 (33%)	13 (6%)	20 (10%)

Similar to permissive left-turn operations, the question of who has right-of-way can be confusing for drivers in side street stop-controlled intersections. Accurately judging and using a gap in traffic can also be challenging. Similar to permissive left-turn operations, high traffic volumes, high speeds, and limited visibility due to roadway width on the major crossing are factors that also contribute to risk at these locations.

Side street stop-controlled intersections often are accompanied by either an uncontrolled crossing of the major roadway or no crossing altogether. A long series of side street stop-controlled intersections will thus likely create long stretches of the major roadway without protected crossings for people walking, biking or otherwise needing to cross the major street.

Atwater saw a total of 203 collisions at side-street stop-controlled intersections, accounting for a quarter of all injury crashes within the city. Of the collisions, 18 were KSIs and 33 involved bicycles or pedestrians. The top primary collision factors (PCFs) were vehicle right-of-way violations, accounting for a third of all such collisions, followed by speeding at 30%.

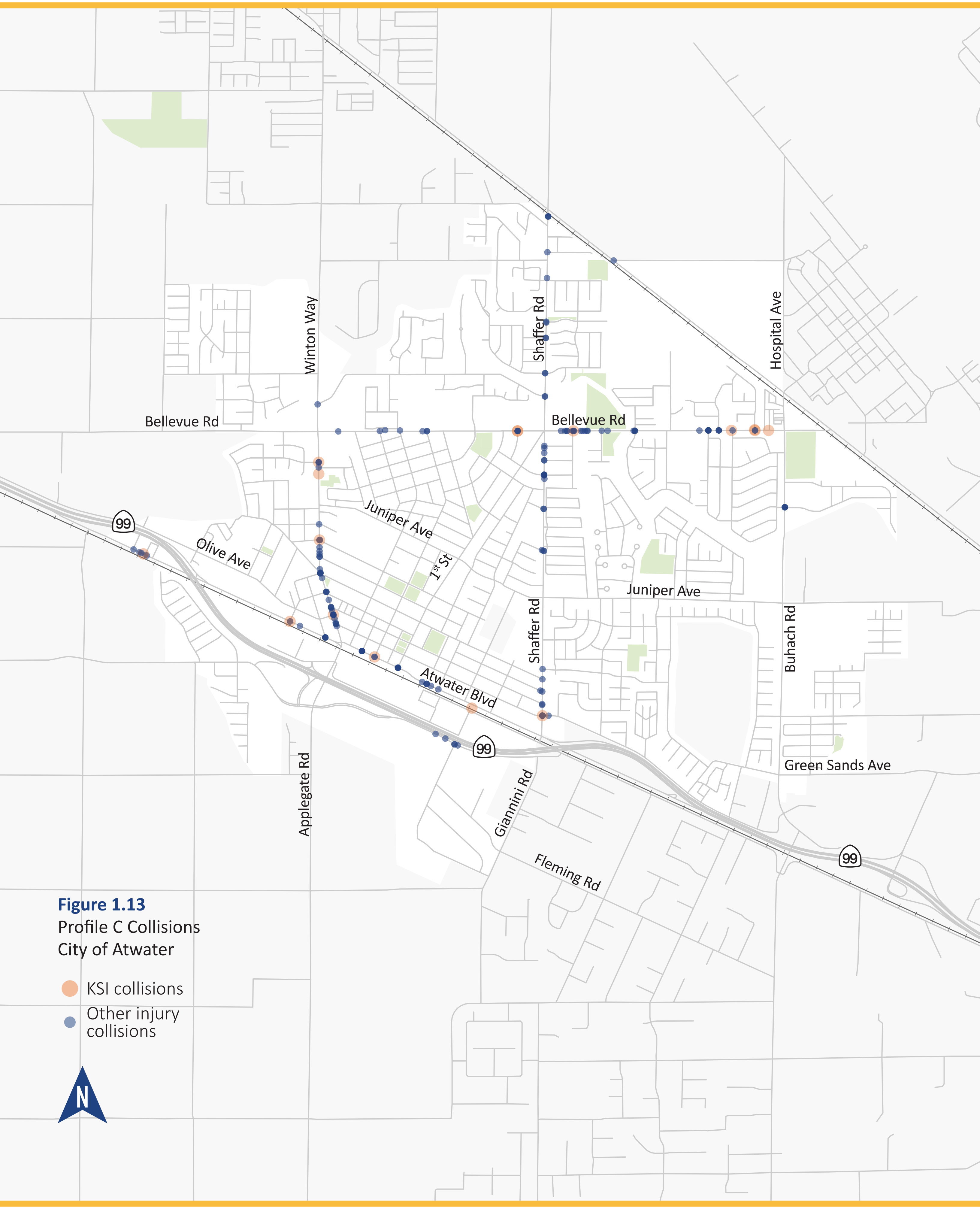


Figure 1.13
Profile C Collisions
City of Atwater

KSI collisions
Other injury collisions

PROFILE C

Side Street Stop-Controlled Intersections

Injury	KSIs		
203 (33%)	18 (33%)	13 (6%)	20 (10%)

Potential Engineering Countermeasures

Extend Bike Lane to Intersection	Prohibit Left Turn	Road Diet	Upgrade Uncontrolled Pedestrian Crossings	Widen Sidewalk
Green Conflict Striping	Lane Narrowing	Splitter Island	Curb Extensions	Rectangular Rapid Flashing Beacon
Separated Bikeway	Median Guardrail	Straighten Crosswalk	High-Visibility Crosswalk	Intersection Reconstruction and Tightening
All-Way Stop Control	Partial Closure/ Diverter	Intersection Lighting	Pedestrian Hybrid Beacon	Restrict Left Turns with Directional Median Openings
Centerline Hardening	Raised Crosswalk	Delineators, Reflectors, and/or Object Markers	Leading Pedestrian Interval	Advance Yield Markings
Advance Stop Bar	Raised Intersection	Speed Limit Reduction	Remove Crossing Prohibition	Speed Feedback Sign
Roundabout	Raised Median	Remove Obstructions For Sightlines	Restripe Crosswalk	Striping Through Intersection
Signal	Refuge Island	Add Sidewalk	Upgrade Curb Ramp	Time-Based Turn Restriction
Upgrade Striping	Flashing Beacon as Advance Warning	Yield To Pedestrians Sign	Signal Coordination/ Green Wave	Upgrade Intersection Pavement Markings
Bus Stop Relocation/ Enhancements				

PROFILE D

Excessive Roadway and Lane Widths Leading To Speeding

Injury	KSIs
25%	15%

The region's agricultural heritage has resulted in many roadways that are designed to be wide enough to accommodate larger vehicles, such as trucks and farm equipment. However, many of these design features are no longer necessary as many areas become more residential or retail-oriented in character.

Many roadways around the region feature more vehicle travel lanes than their demand necessitates, which can influence driver behavior towards higher speeds. Moreover, many of the region's roadways feature travel lanes that are wider (often significantly so) than the maximum of 11ft recommended by Caltrans, which is another major contributor to speeding behavior. High speeds on roadways not only pose risks for vehicles, but also make them less comfortable to walk or ride along and to cross for bicyclists and pedestrians.

Speeding is a major contributor to injury collisions in the region. It is cited as the primary collision factor for nearly a quarter of all injury collisions in the study area, as well as 14% of all KSI collisions. It is also important to note that speeding can also be a factor in other collisions where it is not cited as the primary collision factor, and that the number of speeding-related collisions in the region is likely higher.

Potential Engineering Countermeasures

- Bike Lane
- Raised Crosswalk
- Add Sidewalk
- Extend Pedestrian Crossing Time
- Speed Legends on Pavement at Neighborhood Entries
- Extend Bike Lane to Intersection
- Raised Intersection
- Curb Extensions
- Extend Yellow and All Red Time
- Neighborhood Traffic Circle
- Green Conflict Striping
- Refuge Island
- High-Visibility Crosswalk
- Shorten Cycle Length
- Remove Obstructions For Sightlines
- Separated Bikeway
- Road Diet
- Pedestrian Hybrid Beacon
- Advance Stop Bar
- Signal Coordination/ Green Wave
- Rectangular Rapid Flashing Beacon
- Improved Pavement Friction
- Remove Crossing Prohibition
- Advance Yield Markings
- Speed Hump or Speed Table
- Improved Pavement Friction
- Partial Closure/ Diverter
- Restripe Crosswalk
- Curve Advance Warning Sign
- Intersection Reconstruction and Tightening
- Safety Edge
- Speed Limit Reduction
- Widen Sidewalk
- Speed Feedback Sign
- Delineators, Reflectors, and/or Object Markers
- Lane Narrowing
- Back-In Angled Parking

PROFILE E

Driveway Clusters on Arterials

Injury	KSIs	Bike	Pedestrian
37 (6%)	3 (6%)	2 (5%)	6 (16%)

Atwater features many instances of the land use typology of suburban, parking-fronted shopping centers along high-speed, multi-lane arterials that feature frequent driveway ingresses and egresses. Frequent interactions between fast-moving arterial traffic with slow traffic turning from or to driveways is a significant risk factor, with left turns to or from such driveways being particularly conflict-prone. Higher densities of these driveways add additional complexity and risk. These contexts are particularly problematic for people walking and biking, who must also interact with frequent driveway crossings while traveling on sidewalks or bike facilities in such areas. These areas are also likely to feature higher volumes of walking and biking, as they are often significant destinations featuring essential retail and services.

In Atwater, this typology is found along Bellevue Road from Third Street and Elmer Wood Elementary School to Constitution Drive and Osborn Park. A total of 37 collisions occurred at driveway clusters along this short, three-quarter mile stretch, accounting for 6% of all citywide collisions. This included 8 collisions involving bikes and pedestrians, and 3 KSI collisions. The predominant PCFs were speeding, right-of-way violations, and improper turning, accounting for more than two-thirds of these collisions.

The engineering countermeasures below should be supplemented with land use improvements, such as enhancing pedestrian access through parking lots and changes to land use that feature more street-fronted development.

Potential Engineering Countermeasures

- Bike Lane
- Partial Closure/ Diverter
- Speed Limit Reduction
- Advance Yield Markings
- Co-Locate Bus Stops and Pedestrian Crossings
- Extend Bike Lane to Intersection
- Raised Median
- Remove Obstructions For Sightlines
- Striping Through Intersection
- Prohibit Left Turn
- Green Conflict Striping
- Refuge Island
- Add Sidewalk
- Upgrade Intersection Pavement Markings
- Raised Crosswalk
- Separated Bikeway
- Road Diet
- Curb Extensions
- Upgrade Striping
- Access Management/ Close Driveway
- Improved Pavement Friction
- Splitter Island
- Upgrade Curb Ramp
- Yield To Pedestrians Sign
- Restrict Left Turns with Directional Median Openings
- Lane Narrowing
- Access Management/ Close Driveway
- Widen Sidewalk
- Shared-Use Path
- Segment Lighting
- Median Guardrail

Figure 1.14
Profile E Collisions
City of Atwater

KSI collisions
Other injury collisions

PROFILE F

Non-Standard Intersection Geometry

Injury	KSIs	Bicycle	Pedestrian
85 (14%)	8 (15%)	6 (7%)	7 (8%)

Atwater features a number of intersections with more than four legs and/or roadways intersecting at non-right angles, which contributes to limited visibility, especially for turning traffic. Moreover, these intersections tend to be large by virtue of their geometry, which lengthens crossing distances and makes them especially difficult to navigate for people biking and walking. They also can feature slip lanes for certain turning movements that allow free flow turning traffic to proceed at higher speeds, which poses additional risk for people walking and biking as well conflicting traffic.

In Atwater, these include the five-way intersection of Bellevue Road, Shaffer Road, and First Street; the intersection of Shaffer Road and Atwater Boulevard; the intersection of First Street and Linden Street; and a series of intersections along Winton Way near Downtown. Despite being a small subset of the road network, these intersections combined saw 85 collisions – more than 13% of the citywide total, of which 8 were KSI collisions and 13 involved bicycles or pedestrians. Speeding and vehicle right-of-way violations were the top PCF categories, accounting for nearly two-thirds of collisions.

Figure 1.15
Profile F Collisions
City of Atwater

KSI collisions
Other injury collisions

PROFILE F

Non-Standard Intersection Geometry

Injury	KSIs	Bicyclist	Pedestrian
85 (14%)	8 (15%)	6 (7%)	7 (8%)

Potential Engineering Countermeasures

- Bicycle Crossing (Solid Green Paint)
- Bicycle Signal/ Exclusive Bike Phase
- Bike Box
- Bike Detection
- Bike Lane
- Extend Bike Lane to Intersection
- Floating Transit Island or Bus Boarding Island
- Green Conflict Striping
- Supplemental Signal Heads
- Advanced Dilemma Zone Detection
- Extend Pedestrian Crossing Time
- Extend Yellow and All Red Time
- Pedestrian Scramble
- Separated Bikeway
- Two-Stage Turn Queue Bike Box
- Extend Green Time For Bikes
- All-Way Stop Control
- Centerline Hardening
- Roundabout
- Signal
- Intersection Reconstruction and Tightening
- Prohibit Left Turn
- Prohibit Turns During Pedestrian Phase
- Protected Left Turns
- Prohibit Right-Turn-on-Red
- Separate Right-Turn Phasing
- Lane Narrowing
- Protected Intersection
- Raised Crosswalk
- Raised Intersection
- Refuge Island
- Road Diet
- Straighten Crosswalk
- Intersection Lighting
- Shorten Cycle Length
- Signal Coordination/ Green Wave
- Speed Sensitive Rest in Red Signal
- Upgrade Signal Head
- Delineators, Reflectors, and/or Object Markers
- Speed Limit Reduction
- Remove Obstructions For Sightlines
- Add Sidewalk
- Upgrade Uncontrolled Pedestrian Crossings
- Curb Extensions
- High-Visibility Crosswalk
- Pedestrian Countdown Timer
- Advance Yield Markings
- Striping Through Intersection
- Upgrade Intersection Pavement Markings
- Upgrade Striping
- Pedestrian Hybrid Beacon
- Leading Pedestrian Interval
- Remove Crossing Prohibition
- Restripe Crosswalk
- Upgrade Curb Ramp
- Widen Sidewalk
- Rectangular Rapid Flashing Beacon
- Retroreflective Tape on Signals
- Close or Reconfigure Approaches
- Yield To Pedestrians Sign
- Wayfinding
- Advance Stop Bar

City of Atwater

3

Priority Locations and Project Concepts

A set of locations to prioritize safety improvements were identified based on collision history as well as alignment with collision profiles, which are summarized in the previous chapters. These locations are presented in the following table. A project concept was developed for the locations along Winton Way to demonstrate how the principles outlined in this LRSP can be implemented to address identified safety risk factors. These locations are intended to be addressed in the medium- to long-term, within the next 5-15 years, subject to further study and the availability of funding.

Location	Injury Colli-sions	KSI Colli-sions		Matching Profiles and Associated Risk Factors	On Caltrans Facility?
Bellevue Rd/ Shaffer Rd/ 1st St	26	2	C	A number of intersections immediately adjacent to this one are side-street stop-controlled	No
			E	Multiple shopping plaza driveways in close proximity	
			F	Five-legged intersection with oblique turn angles	
			D	Intersecting roadways are wide (multiple lanes per direction) and high speed (speed limits 35 MPH+)	
Bellevue Rd/ Winton Way	15	1	E	Multiple shopping plaza driveways in close proximity	No
			D	Intersecting roadways are wide (multiple lanes per direction) and high speed (speed limits 35 MPH+)	
Winton Way/ Olive Ave and Winton Way/ Cedar Ave	15	1	C	Both intersections (as well as other adjacent ones along the corridor) are side-street stop-controlled	No
			F	Winton Way intersects these and other streets along the corridor at non-right angles	
Winton Way/ Fruitland Ave	14	0	F	The intersection contains a slip lane	No
			D	Winton Way is wide (multiple lanes per direction) and high speed (posted speed limit 40 MPH)	
Juniper Ave/ Shaffer Rd	14	0	D	Intersecting roadways are wide (multiple lanes per direction on Shaffer Rd and east leg of Juniper Ave) and high speed (speed limits 35 MPH along Shaffer Rd, 40 MPH along east leg of Juniper Ave)	No
			-	Missing crosswalk on the south side of the intersection	

WINTON WAY
from Atwater Boulevard to Bellevue Road

Collision Profiles
C D E F

On HIN?
Yes

Collision History
77 all collisions
9 bike collisions
10 pedestrian collisions
8 KSI collisions

This conceptual project covers two of the identified priority locations along Winton Way from Atwater's list. The existing posted speed limit is 35 MPH south of Juniper Avenue and increases to 40 MPH northwards. City of Atwater staff report routine observations of speeding. Throughout the half-mile stretch between Juniper Avenue and Olive Avenue, there is one signalized intersection and no stop controls for traffic along Winton Way, which can contribute to higher vehicular speeds.

The first priority location is along the portion of the corridor south of Grove Avenue. Through this stretch, Winton Way is an arterial with two lanes and a parking lane in each direction. Traffic volumes are relatively low – an average daily traffic (ADT) of approximately 15,000 vehicles – compared to vehicle capacity, which contributes to higher vehicular speeds. South of Mitchell Avenue, Winton Way also runs at an angle from the rest of the street grid of the city, and features several side street stop-controlled intersections with non-right angles (i.e., skewed intersections). The intersection skews increase the likelihood of collisions; the more skewed an intersection is (i.e., further from 90 degrees), the harder it is for motorists to see and accurately judge gaps in conflicting traffic. There is a rapid rectangular flashing beacon (RRFB) at the intersection with Grove Avenue, but vehicles have been observed not yielding to pedestrians when the beacon is activated. Limited visibility of pedestrians due to the intersection skew may contribute to lack of yielding by motorists.

North of the signalized intersection with Juniper Avenue, Winton Way remains two lanes in each direction, but with a center turn lane and no parking lanes. While the surrounding land use context are similar to what they are farther south along the corridor, the posted speed limit increases along this stretch leading up to the intersection with Bellevue Road, the second priority location. The Bellevue Road intersection features driveway ingresses and egresses in close proximity on each of its four legs; this increases the number of potential conflict points and corresponding likelihood of collisions at or near the intersection.

Due to the relatively low volumes along Winton Way for the number of lanes, it is a candidate for a road diet to three lanes (that is, one lane in each direction with a center turn lane). This is consistent with FHWA guidance and Proven Safety Countermeasures resources. A road diet would slow traffic speeds along the corridor and also allow for the creation of Class IIB buffered bike lanes, in line with the recommendations of the regional Active Transportation Plan (ATP). With a center turn lane in place for the entirety of the corridor, there would be space to add median pedestrian refuges to most of the crosswalks along the corridor, which improves the visibility of crosswalks and reduces overall crossing distances, and also has the effect of slowing vehicle speeds. An additional crosswalk at Elm Avenue can be considered to maintain the frequency of crosswalks along the corridor.

With these improvements, a lowering of the posted speed limit across this corridor could also be considered and would help further reduce the likelihood of severe collisions.

City of Dos Palos

1

Collision Analysis

Chapter 2 of Caltrans' Local Roadway Safety Manual (LRSM) instructs safety practitioners to "consider a wide range of data sources to get an overall picture of the safety needs." To this end, this Local Roadway Safety Plan is data-driven and synthesizes findings from collison records alongside input from key stakeholders, a technical advisory group, and staff.

Collision records on roadways in Dos Palos from 2015 to 2022 were investigated to describe historic collision trends and identify high-risk locations. This information acts as a primary resource for this Plan, providing the underlying data to support key analyses.

The data-driven process for the creation of this Plan includes:

- **Examination of Collision Trends**
  Review of collision statistics to evaluate when, where, and why collisions occur and who is involved.
- **Development of a High-Injury Network**
  Identification of roadways where most injury collisions are concentrated for targeted intervention.
- **Development of Collision Profiles of Emphasis**
  Identification of the most prevalent collision types and contexts based on a combination of collision factors.
- **Creation of a Countermeasure Toolbox**
  Identification of effective, nationally proven countermeasures applicable to different collision profiles.
- **Identification of Priority Project Locations**
  Identification of locations suitable for project implementation based on collision density and community verification.

The following section presents findings from the first of these stages of data analysis, identifying collision patterns and trends.

A Note on the Data Source

This analysis utilizes data on injury collisions from 2015 through 2022 available through the Transportation Injury Mapping System (TIMS) as of August 2023. TIMS reports injury collisions from the Statewide Integrated Traffic Records System (SWITRS), but excludes collisions that cause property damage only (PDO) and no injuries.

Geographically, the data includes all collisions that occur within the City of Dos Palos. The data includes collisions on all roadways, including State highways and other Caltrans-maintained roadways as well as privately-maintained roadways.

While collision databases like TIMS remain the best source of collision data, they have been found to have certain reporting biases, including:

- Collisions involving people walking, on bicycles, or on motorcycles are less likely to be reported than collisions with people driving
- Property damage only collisions are less likely to be reported compared to more severe collisions
- Younger victims are less likely to report collisions
- Alcohol-involved collisions may be underreported

Race, income, immigration status, and English proficiency may also impact reporting, but there is limited research on these factors.

Figure 2.1
Injury Collisions by Year, 2015-2022

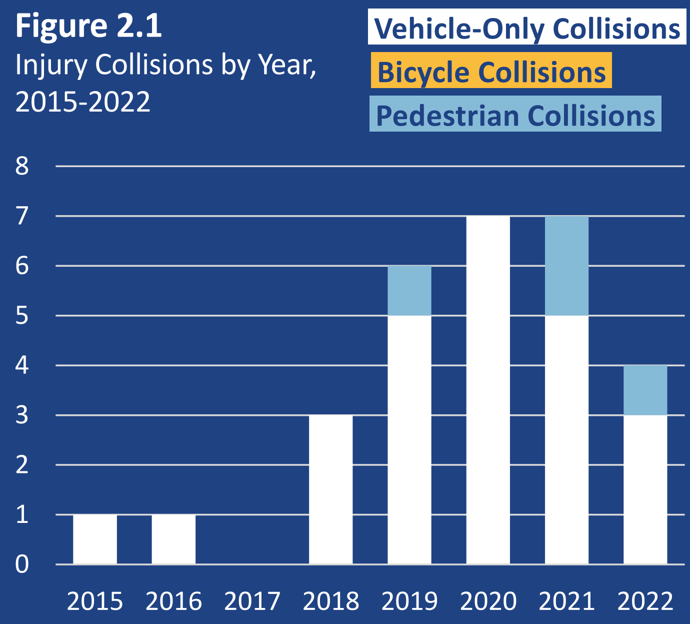


Figure 2.2
KSI Collisions by Year, 2015-2022

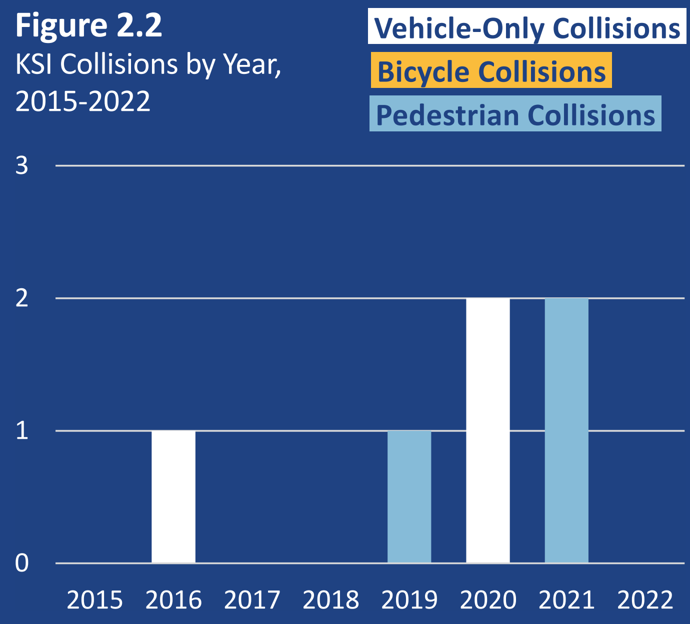
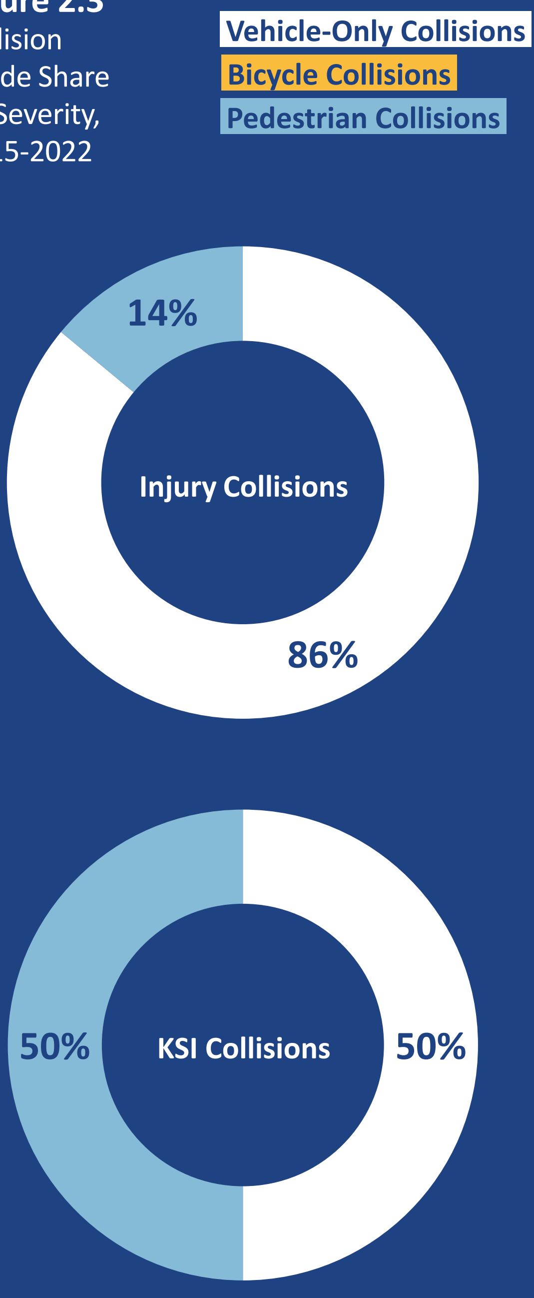


Figure 2.3
Collision Mode Share by Severity, 2015-2022



Collisions by Year and by Mode

The table below provides a summary of the number of collisions in Dos Palos by mode and severity within the dataset, which includes all collisions that resulted in injury or fatality. From 2015 to 2022, there were a total of 29 injury collisions, of which 6 were KSI collisions: collisions where someone was killed or severely injured.

Collision Summary	Total	KSI
Total	29	6
Bicycle	0	0
Pedestrian	4	3

Figures 2.1 and **2.2** show the temporal trends of collisions in Dos Palos. Owing to the small size of the City, the sample size of its collision records is small. However, the trend of an increase in the number of collisions in the City since 2018 is still apparent.

People walking or biking are particularly vulnerable in the event of a collision, as they lack the protection afforded to them by being inside a motor vehicle. As a result, collisions involving people walking or biking are more likely to result in injury and fatality. While there were no collisions involving people biking in Dos Palos during the study period, as shown in **Figure 2.3**, people walking are involved in just 14% of all injury collisions, but 50% of KSI collisions - a significant overrepresentation. Furthermore, three of the four collisions involving pedestrians that occured in Dos Palos during the study period were KSI collisions.

Collisions by Collision Type

Figure 2.4 illustrates the share of collisions in the study period that fall into each collision type. As shown, the most common collision types across all injury collisions in Dos Palos are broadside collisions at 45%, rear-end collisions at 21%, and head-on collisions at 14%.

Taking a closer look at KSI collisions shows a different breakdown. Six KSI collisions occurred in Dos Palos during the study period: three were broadside collisions, and three were vehicle-pedestrian collisions.

This illustrates the disproportionate impact in severity that collision type can play. For example, while rear-ends account for a large share of overall collisions, they are generally less likely to result in fatalities and severe injuries. By contrast, broadside collisions involve more kinetic energy and result in more serious outcomes.

This also further illustrates the significantly disproportionate impact people walking face in the event of a collision, as vehicle-pedestrian collisions are significantly overrepresented in the KSI collisions record.

Collisions by Primary Collision Factor

Figure 2.5 illustrates the share of collisions in the study period that are classified under each Primary Collision Factor (PCF). PCFs are cited by the responding officer and are based on that person's judgment of what contributed to the collision. It is important to note that PCFs do not include contextual information about the design aspects of the collision location that could have been primary or secondary contributors to a collision.

In Dos Palos, the most common PCFs are Vehicle Right of Way Violation at 27% of collisions, Driving or Bicycling Under the Influence (DUI) at 17%, Unsafe Speeds at 10%, and Pedestrian-Related at 10%.

The most common PCFs for KSI collisions is Pedestrian-Related at 33%, again demonstrating the overrepresentation of pedestrian collisions in the KSI collisions record.

Figure 2.4
Share of Injury Collisions by Collision Type, 2015-2022

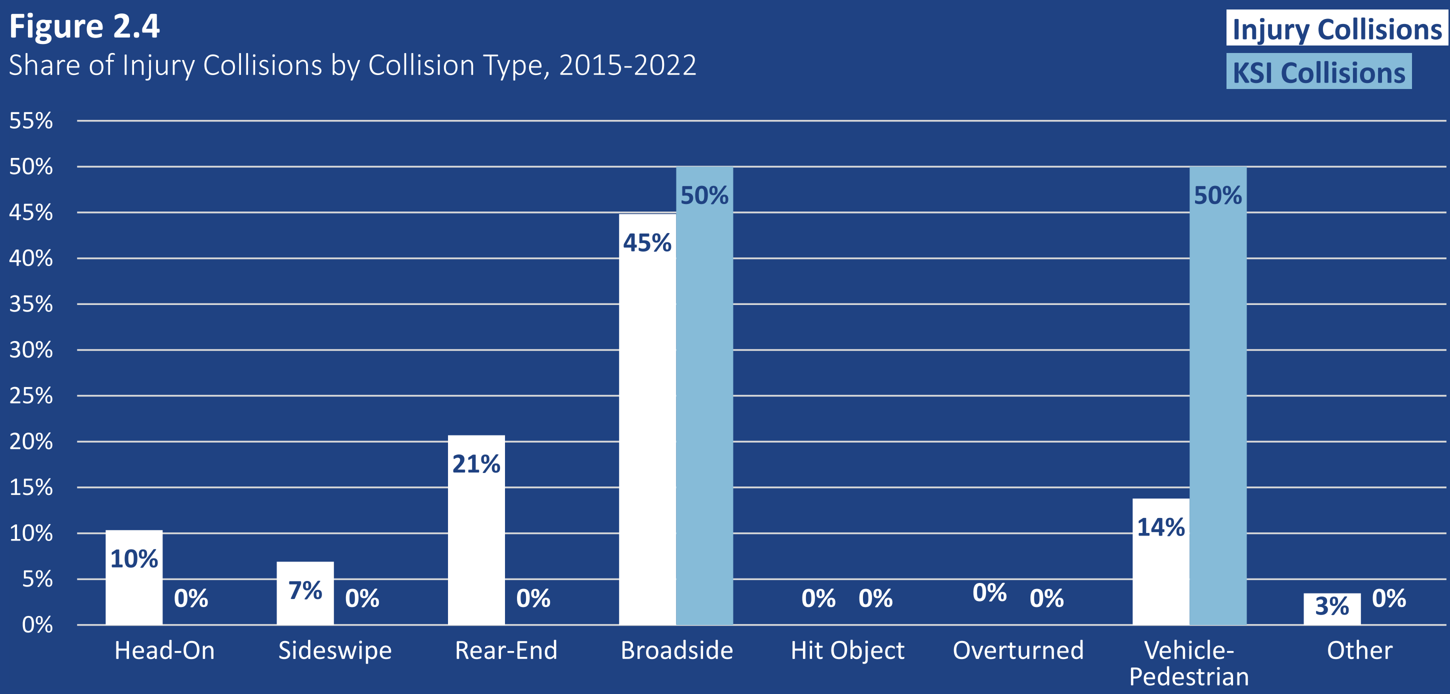
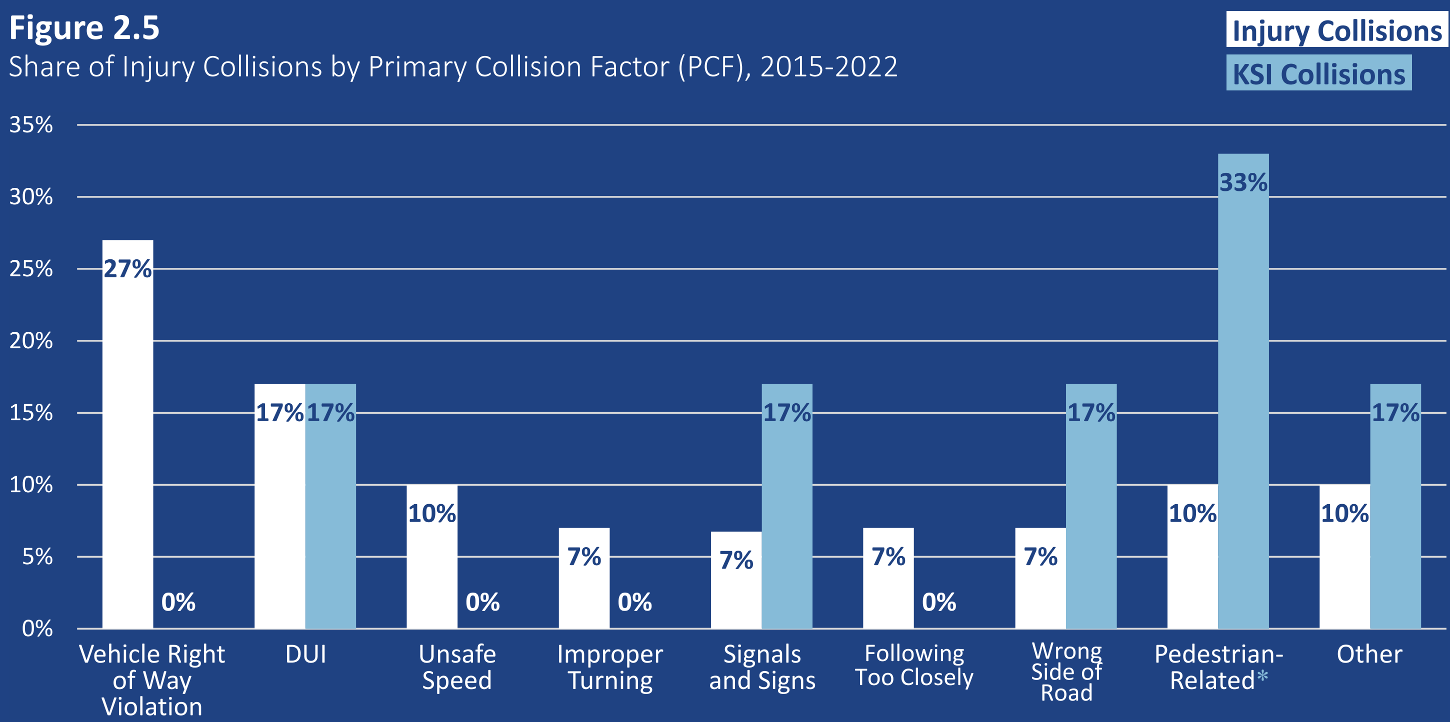


Figure 2.5
Share of Injury Collisions by Primary Collision Factor (PCF), 2015-2022



*** Note on Pedestrian PCF Categories**
The "Pedestrian-Related" category shown here combines two PCF categories: "Pedestrian Violation" and "Pedestrian Right of Way Violation." The former indicates that the pedestrian violated a rule of the road, such as crossing outside of a crosswalk, where the latter indicates the driver of a vehicle violated the pedestrian's right of way. The Pedestrian Violation category may be overrepresented due to a lack of clear information related to collision circumstances, and the increased likelihood that the pedestrian party may be unable to provide their side of the incident at the time of the collision. For this reason, we have elected to not show the distinction in these tallies, and instead show all pedestrian-related collisions in one single category.

Collisions by Lighting Conditions

Figure 2.6 illustrates the share of collisions in the study period that occur at night*****. Nighttime collisions and issues around lighting are top concerns for Dos Palos. As shown, nighttime collisions account for a large share of collisions overall, and are even more overrepresented among KSI collisions. 24% of all injury collisions occurred at night where streetlights were present and a further 21% occurred where streetlights were not present or present but not functioning - already nearly half of all collisions. Those percentages jump further to 50% and 33% for KSI collisions, respectively, amounting to almost 90% of all KSI collisions occurring in the dark.

Collisions that occur during nighttime also disproportionately affect people walking. All three pedestrian KSI collisions occurred at night.

The concern around lighting is especially relevant given Dos Palos' rural context. Nighttime collisions represent nearly half of the injury collision record, indicating a clear need for focused attention on the issue. There continues to be locations without functional street lighting in the City, and collisions at those locations are prominently represented in the collision record. Furthermore, even where streetlights were present, the quality of the lighting can vary widely. Factors that may contribute to the quality of streetlights include lights being insufficiently bright, placed too widely apart, or poor quality of lighting for people walking on the sidewalk, as streetlights are often designed primarily for vehicles in travel lanes.

***** Nighttime collisions are defined as those collisions whose lighting information is not reported as "daylight".

Driving Under the Influence (DUI)

Figure 2.7 illustrates the share of collisions of various types in the study period that involved at least one party driving under the influence (DUI). Drugs or alcohol increase the likelihood of increased crash severity. As shown, the number of DUI collisions are overrepresented amongst KSI collisions. While 20% of all injury collisions involve drugs or alcohol in Dos Palos, 33% of KSI collisions do.

These percentages reflect the portion of collisions involving one or more parties determined to be under the influence of drugs or alcohol. Driving under the influence may not always be listed as the primary collision factor even if a driver is found to be under the influence.

Figure 2.6
Nighttime Collisions, 2015-2022

Daytime Collisions
Nighttime Collisions, Streetlights Working
Nighttime Collisions, Streetlights Not Present or Not Working

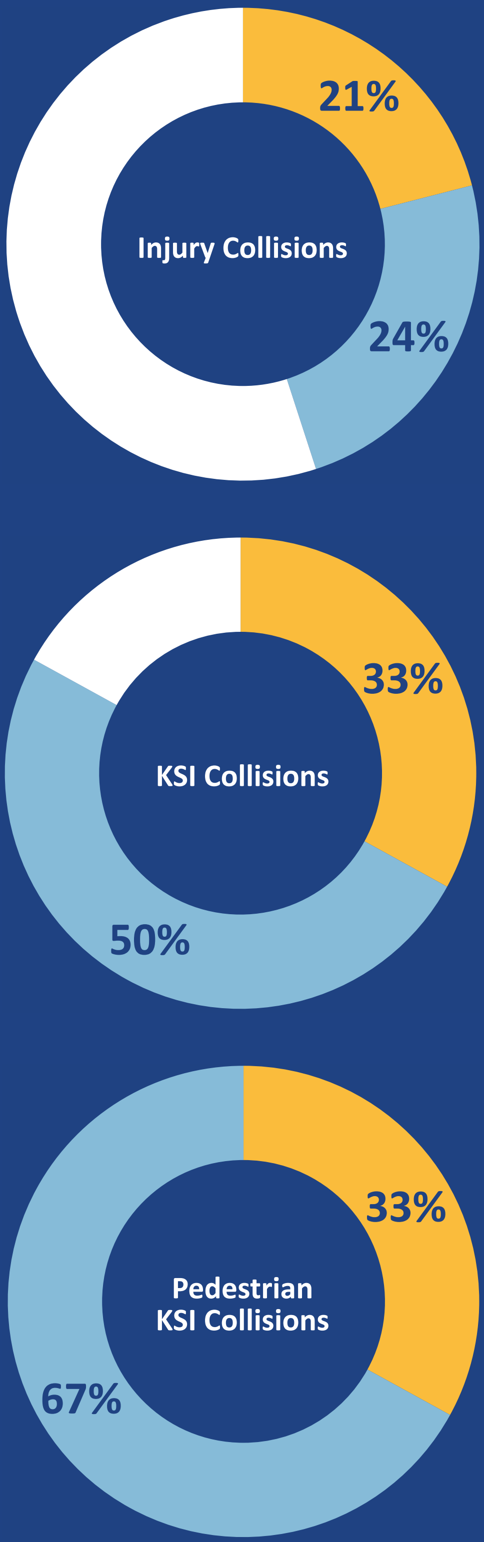
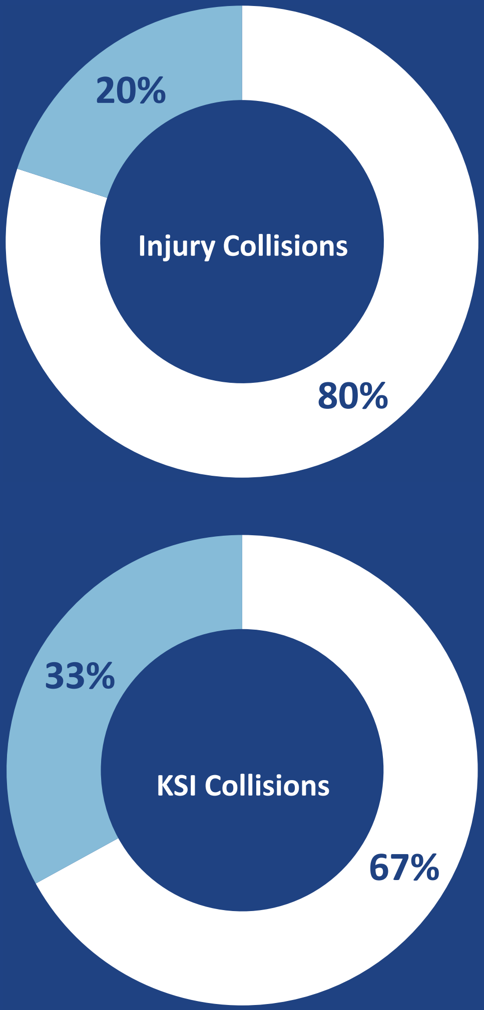


Figure 2.7
DUI Collisions, 2015-2022

DUI Collisions
Other Collisions

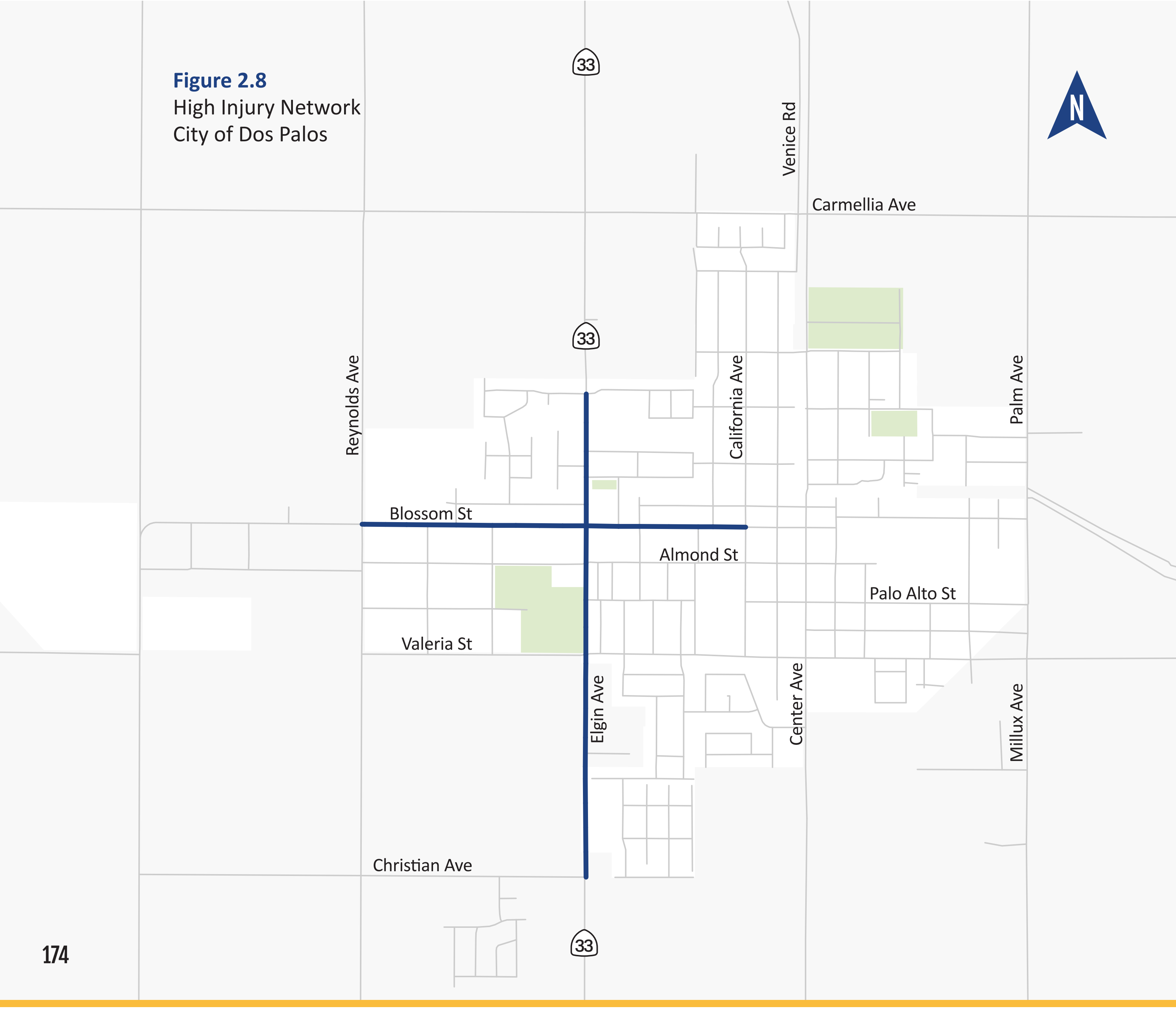


High Injury Network

From the collision data, a High Injury Network was developed to identify the roadways in Dos Palos with the highest levels of injury collisions, as shown on **Figure 2.8**. It is important to note, however, that the collision record in Dos Palos is limited due to the City's small size and, as a consequence, small sample size of collision records.

The High Injury Network consists of just 8% of the roadway network in Dos Palos, but is the site of the majority of injury collisions. Of the 29 collisions that occurred during the study period, 19, or 66%, were located along the network. six of these study period collisions were KSIs, of which five, or 83%, were located along the network.

Figure 2.8
High Injury Network
City of Dos Palos



Equity Considerations

Both Merced County and the larger Central Valley region have historically been subject to underinvestment and marginalization. As a result, most of the region, including most areas within the six cities covered by this Plan, are identified as disadvantaged by the various criteria used by the state and Federal governments.

The federal government has introduced a number of tools used to identify disadvantaged communities. In particular, two of these, the Climate and Economic Justice Screening Tool (CEJST) and the Equitable Transportation Communities (ETC) Explorer, are of particular note, as they see extensive use by the United States Department of Transportation (USDOT) in delineating disadvantaged areas, especially as part of grant funding opportunities.

Climate and Economic Justice Screening Tool (CEJST)

The Climate and Economic Justice Screening Tool (CEJST) is maintained by the Federal Council on Environmental Quality and used by many Federal programs as a means of identifying disadvantaged communities. Census tracts are screened based on a variety of factors, including climate, energy, health, housing, transportation, legacy pollution, waste, and workforce development.

Equitable Transportation Communities (ETC) Explorer

USDOT created Equitable Transportation Communities (ETC) Explorer as part of its Justice40 initiative to complement the CEJST by providing additional insight into transportation factors specifically. The ETC Explorer is meant to capture the cumulative burden of underinvestment in transportation in a community.

The entirety of the City of Dos Palos, as well as all of the surrounding unincorporated areas (including the community of South Dos Palos), are identified as disadvantaged by the CEJST. There are no areas identified as disadvantaged by the ETC Explorer in or near Dos Palos.

City of Dos Palos

2

Collision Profiles

Through a systemic analysis of collision records, collision profiles were identified to represent the most significant patterns behind injury collisions - and especially KSI collisions - in the region. Seven such profiles, identified with the letters “A” through “G” were identified across the region, with each one applicable to one, several, or all of the communities covered by this LRSP.

Dos Palos is covered by four of these profiles:

A. Driving Under The Influence

B. Dark Conditions

C. Side Street Stop-Controlled Intersections

D. Excessive Roadway and Lane Widths Leading To Speeding

The following pages contain cutsheets that present each collision profile, along with the following information:

- Description and associated information about each profile
- Number of collisions associated, including number of KSI collisions among those (note that profiles are not mutually exclusive; collisions can fall under multiple profiles, and totals will exceed 100%)
- A map of collision locations

Engineering countermeasures that can potentially address these collisions are also presented with each profile. The full suite of engineering countermeasures can be found in **Chapter 3** of **Volume I**.

PROFILE A

Driving Under The Influence

Injury	KSIs		
6	2	0	1
(21%)	(33%)	(0%)	(17%)

Driving under the influence is a significant contributor to injury collisions, especially and disproportionately to collisions that cause someone to be killed or severely injured (KSI).

DUIs are clustered around the weekend and around nighttime. Across the region, 54% of all DUI collisions occurred on Friday, Saturday, and Sunday, and 65% occurred in the dark.

However, it is important to note that a substantial number of DUI collisions occurred outside these time periods as well.

Non-engineering interventions will need to be the primary means of addressing these challenges, but may be supplemented with the listed engineering countermeasures that aim to make roadway designs more forgiving in general.

Potential Supplemental Engineering Countermeasures

- Separated Bikeway
- Safety Edge
- Raised Median
- Red Light Cameras
- Add Sidewalk
- Guardrail
- Delineators, Reflectors, and/or Object Markers
- Speed Sensitive Rest in Red Signal
- Rumble Strips
- Roundabout
- Speed Limit Reduction
- Curve Advance Warning Sign
- Improved Pavement Friction
- Intersection Reconstruction and Tightening
- Remove Obstructions For Sightlines
- Chevron Signs on Horizontal Curves
- Speed Feedback Sign
- LED-Enhanced Sign
- Upgrade Striping
- Signal Coordination/ Green Wave

Figure 2.9
Profile A Collisions
City of Dos Palos

PROFILE B

Dark Conditions

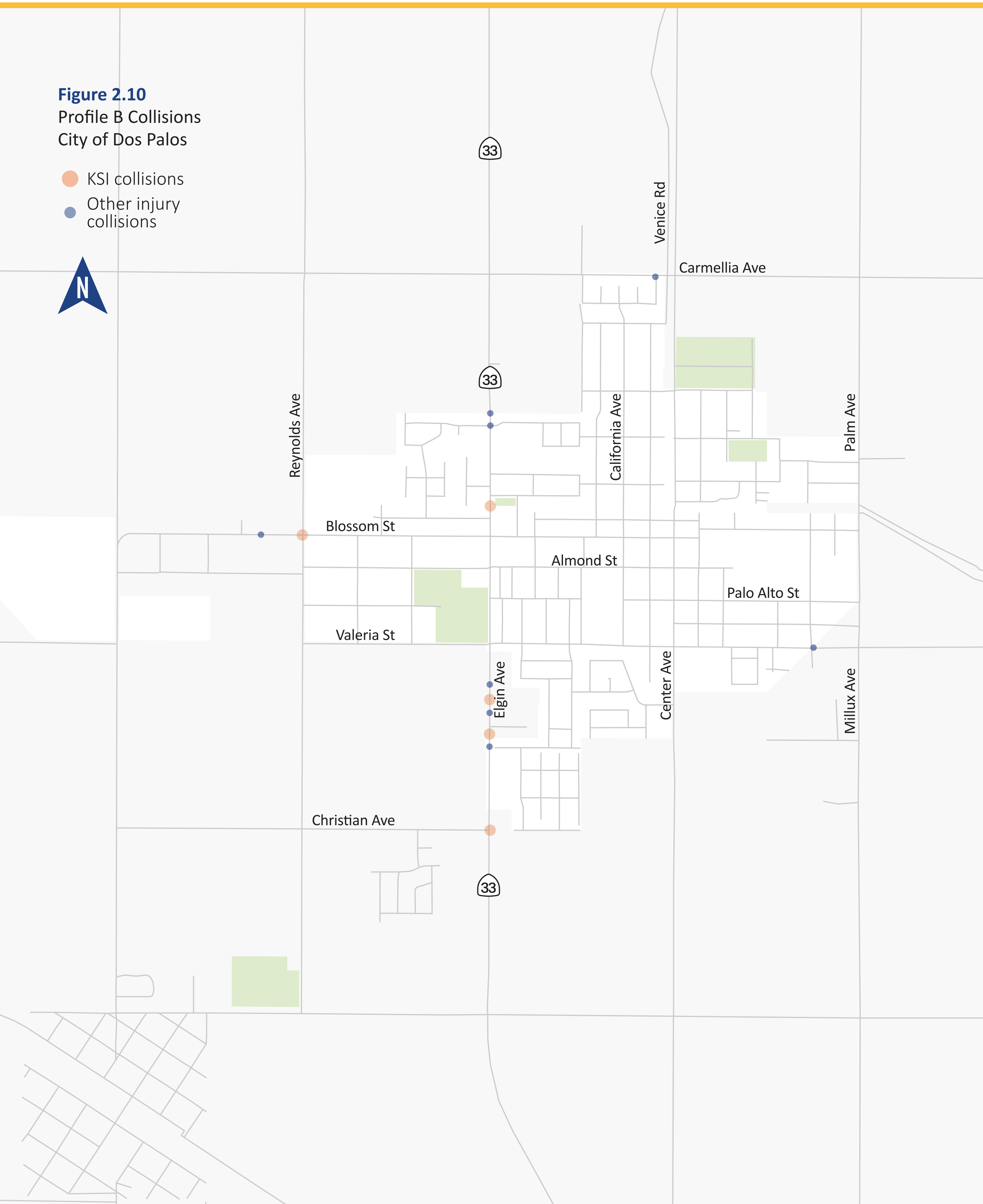
Injury	KSIs	Bicycle	Pedestrian
13 (45%)	5 (83%)	0 (0%)	3 (23%)

A substantial number of collisions are occurring in the nighttime across the region. Based on the percentage of nighttime collisions, meaningful progress toward reducing collisions will require improvements that enhance nighttime visibility such as lighting, retroreflective signage, and sightline improvements.

Potential Engineering Countermeasures

- Separated Bikeway
- Rumble Strips
- Safety Edge
- Guardrail
- Intersection Reconstruction and Tightening
- Chevron Signs on Horizontal Curves
- Raised Crosswalk
- Raised Median
- Intersection Lighting
- Segment Lighting
- Delineators, Reflectors, and/or Object Markers
- Curve Advance Warning Sign
- Speed Limit Reduction
- Remove Obstructions For Sightlines
- Add Sidewalk
- High-Visibility Crosswalk
- Pedestrian Hybrid Beacon
- Upgrade Striping
- Leading Pedestrian Interval
- Rectangular Rapid Flashing Beacon
- Retroreflective Tape on Signals
- Advance Stop Bar
- Advance Yield Markings

Figure 2.10
Profile B Collisions
City of Dos Palos



PROFILE C

Side Street Stop-Controlled Intersections

Injury	KSIs	🚲	🚶
18 (62%)	5 (83%)	0 (0%)	2 (11%)

Similar to permissive left-turn operations, the question of who has right-of-way can be confusing for drivers in side street stop-controlled intersections. Accurately judging and using a gap in traffic can also be challenging. Similar to permissive left-turn operations, high traffic volumes, high speeds, and limited visibility due to roadway width on the major crossing are factors that also contribute to risk at these locations.

Side street stop-controlled intersections often are accompanied by either an uncontrolled crossing of the major roadway or no crossing altogether. A long series of side street stop-controlled intersections will thus likely create long stretches of the major roadway without protected crossings for people walking, biking or otherwise needing to cross the major street.

The majority of Dos Palos' recorded collisions – 62% – occurred at side-street stop-controlled intersections. There were 18 such collisions in total, of which 14 occurred along Elgin Avenue. Of the collisions, 4 were KSIs, none involved bicycles, and 2 involved pedestrians. The top PCFs were vehicle right-of-way violations, accounting for 22% of all such collisions, followed by DUIs at 17%.

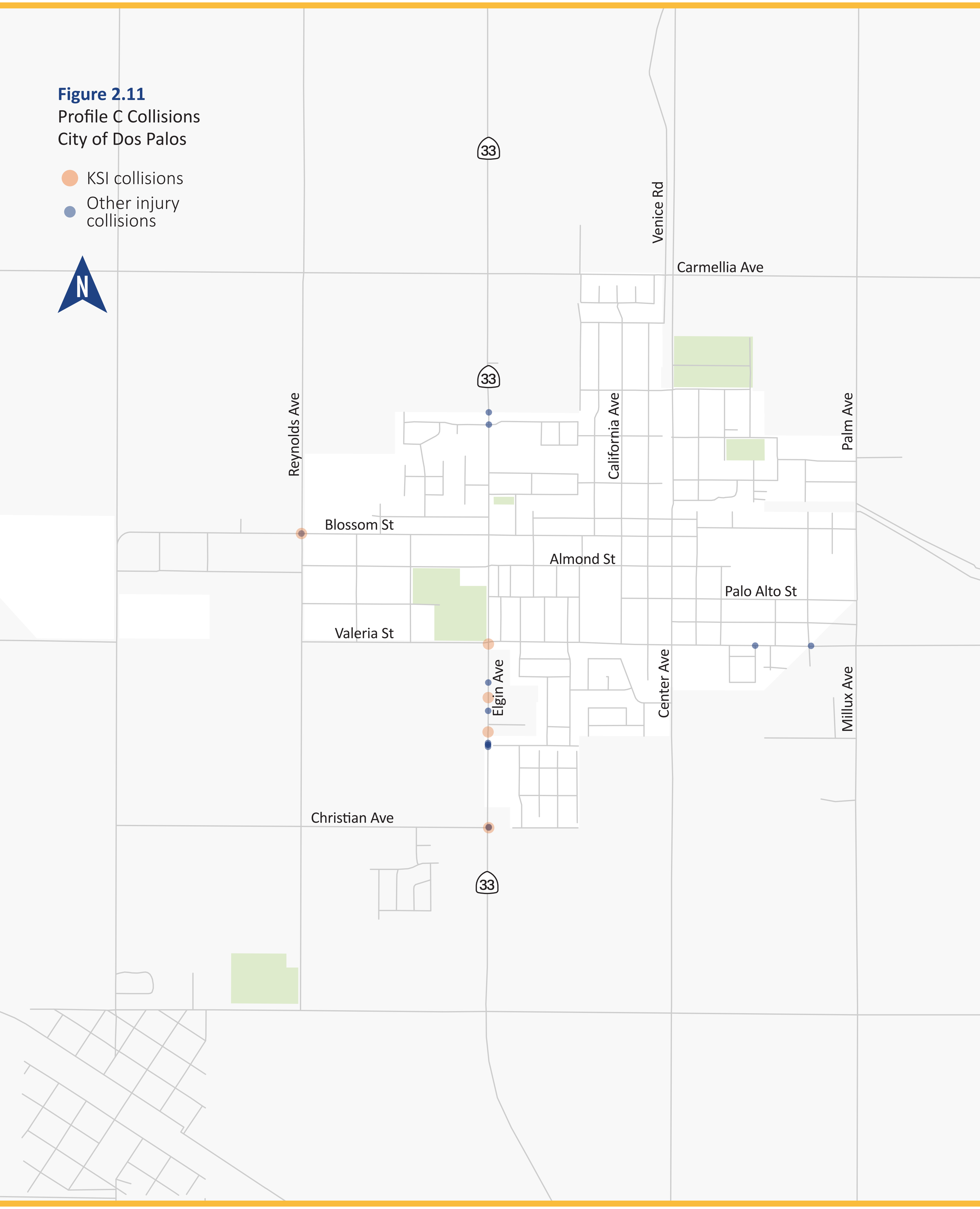


Figure 2.11
Profile C Collisions
City of Dos Palos
KSI collisions
Other injury collisions
N
33
Venice Rd
Carmellia Ave
Reynolds Ave
California Ave
Palm Ave
Blossom St
Almond St
Palo Alto St
Valeria St
Elgin Ave
Center Ave
Millux Ave
Christian Ave

PROFILE C

Side Street Stop-Controlled Intersections

Injury	KSIs	Bicyclists	Pedestrians
18 (62%)	5 (83%)	0 (0%)	2 (11%)

Potential Engineering Countermeasures

- Extend Bike Lane to Intersection
- Prohibit Left Turn
- Road Diet
- Upgrade Uncontrolled Pedestrian Crossings
- Widen Sidewalk
- Green Conflict Striping
- Lane Narrowing
- Splitter Island
- Curb Extensions
- Rectangular Rapid Flashing Beacon
- Separated Bikeway
- Median Guardrail
- Straighten Crosswalk
- High-Visibility Crosswalk
- Intersection Reconstruction and Tightening
- All-Way Stop Control
- Partial Closure/ Diverter
- Intersection Lighting
- Pedestrian Hybrid Beacon
- Restrict Left Turns with Directional Median Openings
- Centerline Hardening
- Raised Crosswalk
- Delineators, Reflectors, and/or Object Markers
- Leading Pedestrian Interval
- Advance Yield Markings
- Advance Stop Bar
- Raised Intersection
- Speed Limit Reduction
- Remove Crossing Prohibition
- Speed Feedback Sign
- Roundabout
- Raised Median
- Remove Obstructions For Sightlines
- Restripe Crosswalk
- Striping Through Intersection
- Signal
- Refuge Island
- Add Sidewalk
- Upgrade Curb Ramp
- Time-Based Turn Restriction
- Upgrade Striping
- Flashing Beacon as Advance Warning
- Yield To Pedestrians Sign
- Signal Coordination/ Green Wave
- Upgrade Intersection Pavement Markings
- Bus Stop Relocation/ Enhancements

PROFILE D

Excessive Roadway and Lane Widths Leading To Speeding

Injury	KSIs
10%	0%

The region's agricultural heritage has resulted in many roadways that are designed to be wide enough to accommodate larger vehicles, such as trucks and farm equipment. However, many of these design features are no longer necessary as many areas become more residential or retail-oriented in character.

Many roadways around the region feature more vehicle travel lanes than their demand necessitates, which can influence driver behavior towards higher speeds. Moreover, many of the region's roadways feature travel lanes that are wider (often significantly so) than the maximum of 11ft recommended by Caltrans, which is another major contributor to speeding behavior. High speeds on roadways not only pose risks for vehicles, but also make them less comfortable to walk or ride along and to cross for bicyclists and pedestrians.

Speeding is a major contributor to injury collisions in the region. It is cited as the primary collision factor for nearly a quarter of all injury collisions in the study area, as well as 14% of all KSI collisions. It is also important to note that speeding can also be a factor in other collisions where it is not cited as the primary collision factor, and that the number of speeding-related collisions in the region is likely higher.

Potential Engineering Countermeasures

- Bike Lane
- Raised Crosswalk
- Add Sidewalk
- Extend Pedestrian Crossing Time
- Speed Legends on Pavement at Neighborhood Entries
- Extend Bike Lane to Intersection
- Raised Intersection
- Curb Extensions
- Extend Yellow and All Red Time
- Neighborhood Traffic Circle
- Green Conflict Striping
- Refuge Island
- High-Visibility Crosswalk
- Shorten Cycle Length
- Remove Obstructions For Sightlines
- Separated Bikeway
- Road Diet
- Pedestrian Hybrid Beacon
- Advance Stop Bar
- Signal Coordination/ Green Wave
- Rectangular Rapid Flashing Beacon
- Improved Pavement Friction
- Remove Crossing Prohibition
- Advance Yield Markings
- Speed Hump or Speed Table
- Improved Pavement Friction
- Partial Closure/ Diverter
- Restripe Crosswalk
- Curve Advance Warning Sign
- Intersection Reconstruction and Tightening
- Safety Edge
- Speed Limit Reduction
- Widen Sidewalk
- Speed Feedback Sign
- Delineators, Reflectors, and/or Object Markers
- Lane Narrowing
- Back-In Angled Parking

City of Dos Palos

3

Priority Locations and Project Concepts

Due to the small sample size of Dos Palos' collision records, a full set of priority locations was not identified. The collision records that was extant in the City were largely centered around Elgin Avenue, which is a Caltrans facility that also carries SR 33. The contextual characteristics of the roadway aligns with Profiles 4 and 7. A proactive safety project concept is presented on the following pages for one intersection along the corridor, selected based on community feedback and walk audit findings. The timeframe for any implementation would be in the medium- to long- term, in the next 5-15 years, pending additional study, funding availability, and coordination with Caltrans.

Intersection of

SR 33/ELGIN AVENUE AND STEARMAN STREET

Collision Profiles

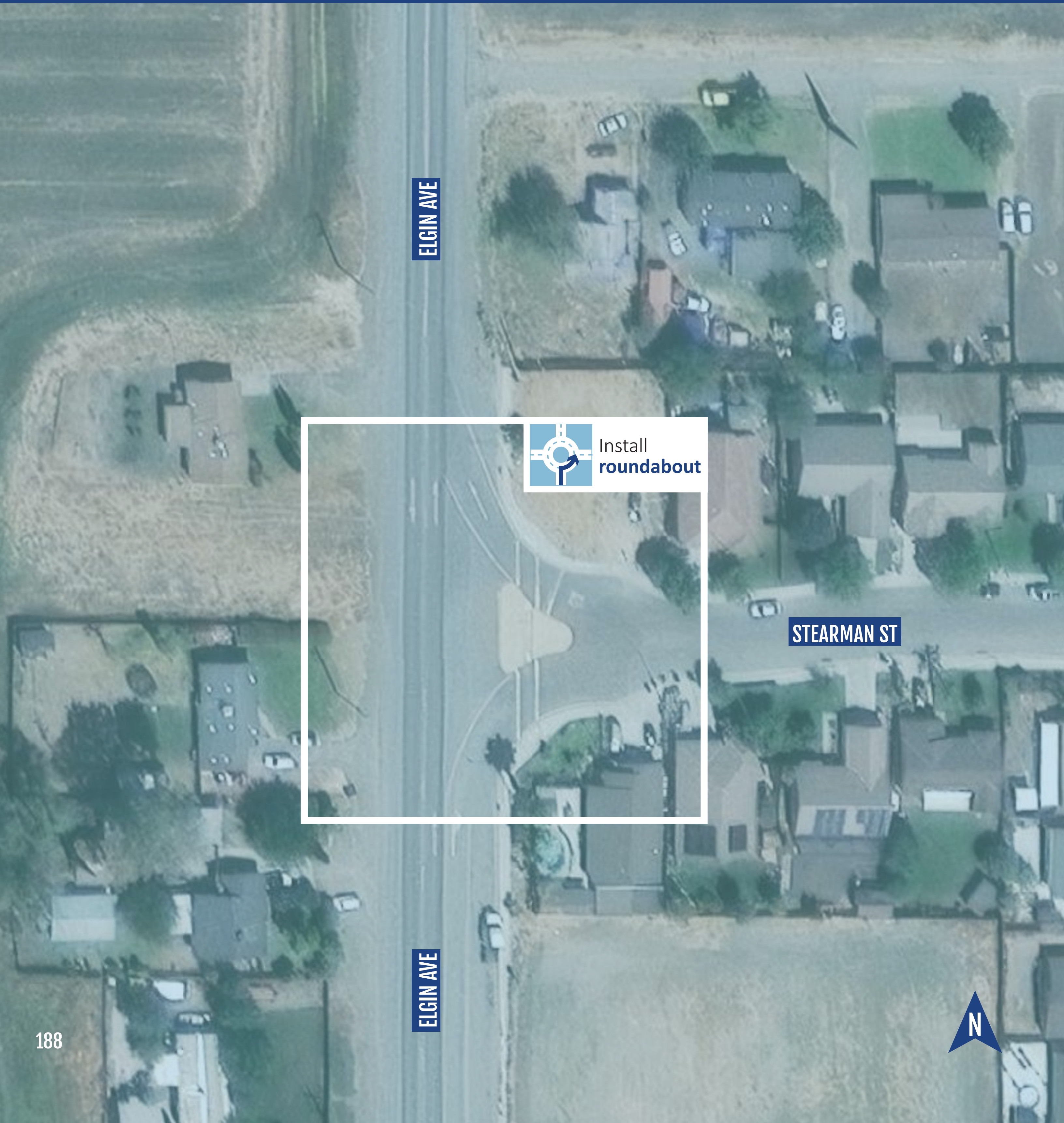
C D

On HIN?

Yes

Collision History

Due to the small sample size of Dos Palos' collision records, this project was identified systemically as a proactive safety improvement.



This intersection between Stearman Street and Elgin Avenue is designed for right-in right-out (RIRO) operations. At this intersection, Stearman Street is an unstriped residential collector, and Elgin Avenue is a two-lane rural roadway that also carries the SR 33 designation and, with it, regional through traffic along the highway. Elgin Avenue has a posted speed limit of 55 MPH, which drops to 45 MPH north of the intersection.

There is a traffic island at the intersection meant to direct westbound traffic from Stearman Street to turn right onto Elgin Avenue, while northbound traffic on Elgin Avenue accesses Stearman Street by turning right. However, City staff routinely observe motorists turning left from and onto Stearman Street by maneuvering around the traffic island. These left turns increase likelihood of collisions due to the angle at which they occur as well as the speed of approaching vehicles.

The footprint of the existing intersection provides an opportunity to convert it into a roundabout. A roundabout would reduce the number and severity of conflicts at the intersection as well as reduce the likelihood of severe collisions. It would also accommodate left-turn movements for which demand is observed. The location of the intersection at the edge of town also allows for the roundabout to serve as a gateway that slows down traffic along Elgin Avenue as it entering Dos Palos. North of the intersection, Elgin Avenue's posted speed limit drops, increases to two lanes in each direction, and is fronted by commercial and residential uses. The roundabout can create a clear delineation point between the rural highway south of the intersection and the Dos Palos context. With this improvement, a lowering of the speed limit in the section of Elgine Avenue through Dos Palos can also be considered.

City of Gustine

1

Collision Analysis

Chapter 2 of Caltrans' Local Roadway Safety Manual (LRSM) instructs safety practitioners to "consider a wide range of data sources to get an overall picture of the safety needs." To this end, this Local Roadway Safety Plan is data-driven and synthesizes findings from collison records alongside input from key stakeholders, a technical advisory group, and staff.

Collision records on roadways in Gustine from 2015 to 2022 were investigated to describe historic collision trends and identify high-risk locations. This information acts as a primary resource for this Plan, providing the underlying data to support key analyses.

The data-driven process for the creation of this Plan includes:

- **Examination of Collision Trends**
  Review of collision statistics to evaluate when, where, and why collisions occur and who is involved.
- **Development of a High-Injury Network**
  Identification of roadways where most injury collisions are concentrated for targeted intervention.
- **Development of Collision Profiles of Emphasis**
  Identification of the most prevalent collision types and contexts based on a combination of collision factors.
- **Creation of a Countermeasure Toolbox**
  Identification of effective, nationally proven countermeasures applicable to different collision profiles.
- **Identification of Priority Project Locations**
  Identification of locations suitable for project implementation based on collision density and community verification.

The following section presents findings from the first of these stages of data analysis, identifying collision patterns and trends.

A Note on the Data Source

This analysis utilizes data on injury collisions from 2015 through 2022 available through the Transportation Injury Mapping System (TIMS) as of August 2023. TIMS reports injury collisions from the Statewide Integrated Traffic Records System (SWITRS), but excludes collisions that cause property damage only (PDO) and no injuries.

Geographically, the data includes all collisions that occur within the City of Gustine. The data includes collisions on all roadways, including State highways and other Caltrans-maintained roadways as well as privately-maintained roadways.

While collision databases like TIMS remain the best source of collision data, they have been found to have certain reporting biases, including:

- Collisions involving people walking, on bicycles, or on motorcycles are less likely to be reported than collisions with people driving
- Property damage only collisions are less likely to be reported compared to more severe collisions
- Younger victims are less likely to report collisions
- Alcohol-involved collisions may be underreported

Race, income, immigration status, and English proficiency may also impact reporting, but there is limited research on these factors.

Figure 3.1
Injury Collisions by Year, 2015-2022

Vehicle-Only Collisions
Bicycle Collisions
Pedestrian Collisions

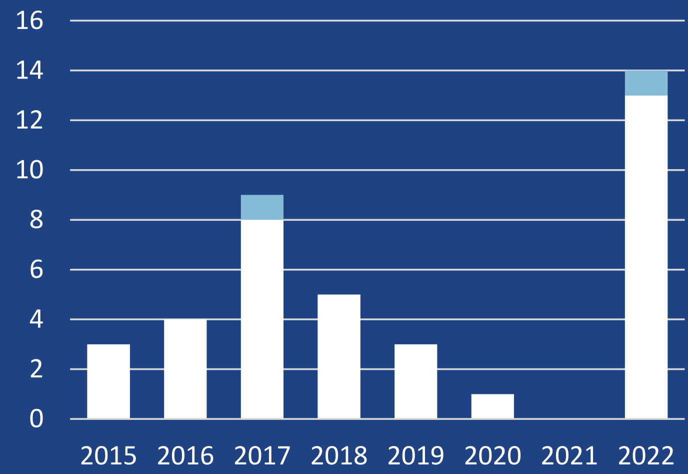


Figure 3.2
KSI Collisions by Year, 2015-2022

Vehicle-Only Collisions
Bicycle Collisions
Pedestrian Collisions

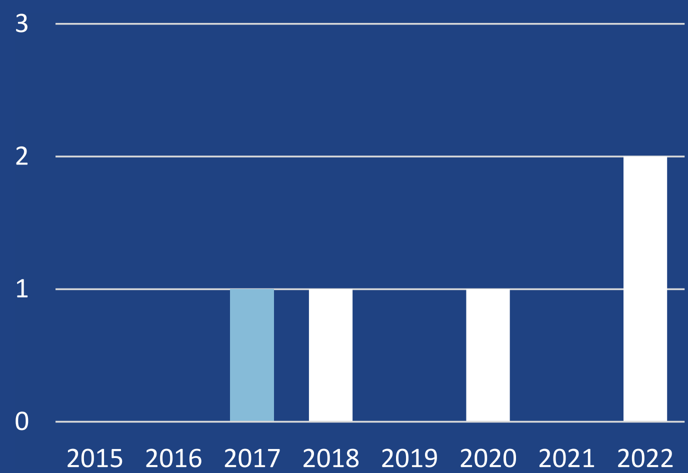
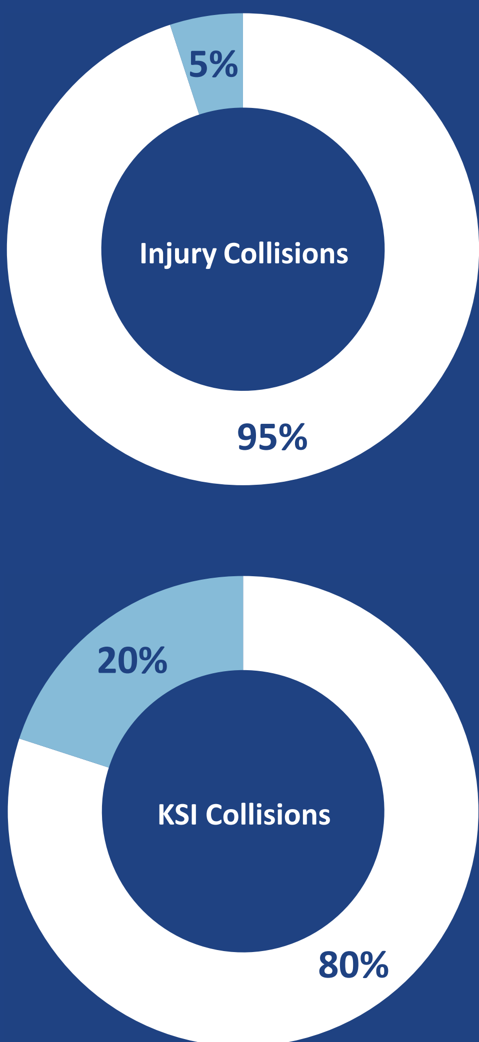


Figure 3.3
Collision Mode Share by Severity, 2015-2022



Collisions by Year and by Mode

The table below provides a summary of the number of collisions in Gustine by mode and severity within the dataset, which includes all collisions that resulted in injury or fatality. From 2015 to 2022, there were a total of 39 injury collisions, of which 5 were KSI collisions: collisions where someone was killed or severely injured.

Collision Summary	Total	KSI
Total	39	5
Bicycle	0	0
Pedestrian	2	1

Figures 3.1 and **3.2** show the temporal trends of collisions in Gustine. Owing to the small size of the City, the sample size of its collision records is small, and it is difficult to surmise a trend over time. However, 2022 saw the highest annual number of collisions in Gustine during the study period.

People walking or biking are particularly vulnerable in the event of a collision, as they lack the protection afforded to them by being inside a motor vehicle. As a result, collisions involving people walking or biking are more likely to result in injury and fatality. While there were no collisions involving people biking in Gustine during the study period, as shown in **Figure 3.3**, people walking are involved in just 5% of all injury collisions, but 20% of KSI collisions.

Collisions by Collision Type

Figure 3.4 illustrates the share of collisions in the study period that fall into each collision type. As shown, the most common collision types across all injury collisions in Gustine are rear-end collisions at 26%, broadside collisions at 23%, and head-on collisions at 18%.

Taking a closer look at KSI collisions shows a different breakdown. Five KSI collisions occurred in Gustine during the study period: two were broadside collisions, and there were one each of head-on and vehicle-pedestrian collisions, as well as one that was not classified.

This illustrates the disproportionate impact in severity that collision type can play. For example, while rear-ends account for a large share of overall collisions, none of them caused a fatality or severe injury, since they involve less kinetic energy and are thus generally less likely to do so. By contrast, broadside collisions involve more kinetic energy and result in more serious outcomes.

This also further illustrates the significantly disproportionate impact people walking face in the event of a collision, as vehicle-pedestrian collisions are significantly overrepresented in the KSI collisions record.

Collisions by Primary Collision Factor

Figure 3.5 illustrates the share of collisions in the study period that are classified under each Primary Collision Factor (PCF). PCFs are cited by the responding officer and are based on that person's judgment of what contributed to the collision. It is important to note that PCFs do not include contextual information about the design aspects of the collision location that could have been primary or secondary contributors to a collision.

In Gustine, the most common PCFs are Vehicle Right of Way Violation at 30% of collisions, Unsafe Speed at 25%, and Improper Turning at 18%. The five KSI collisions each fall into a different PCF category.

Figure 3.4
Share of Injury Collisions by Collision Type, 2015-2022

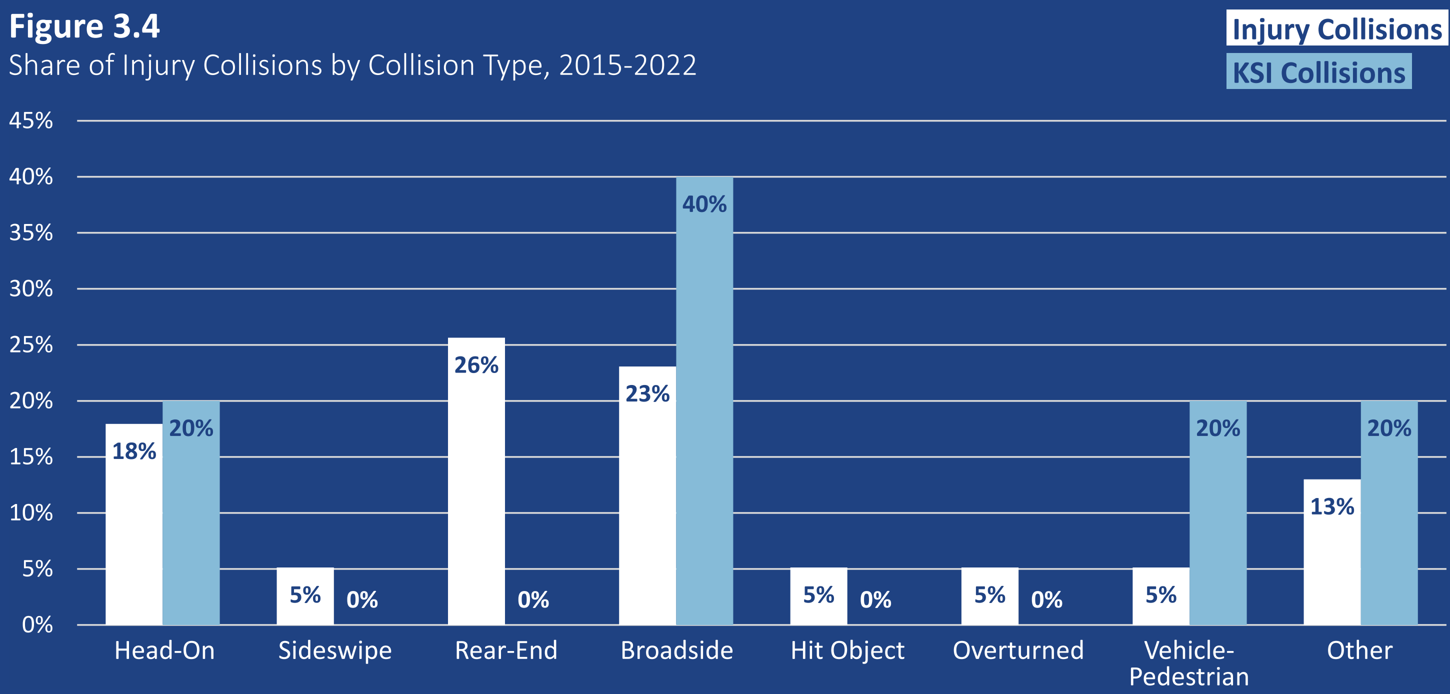
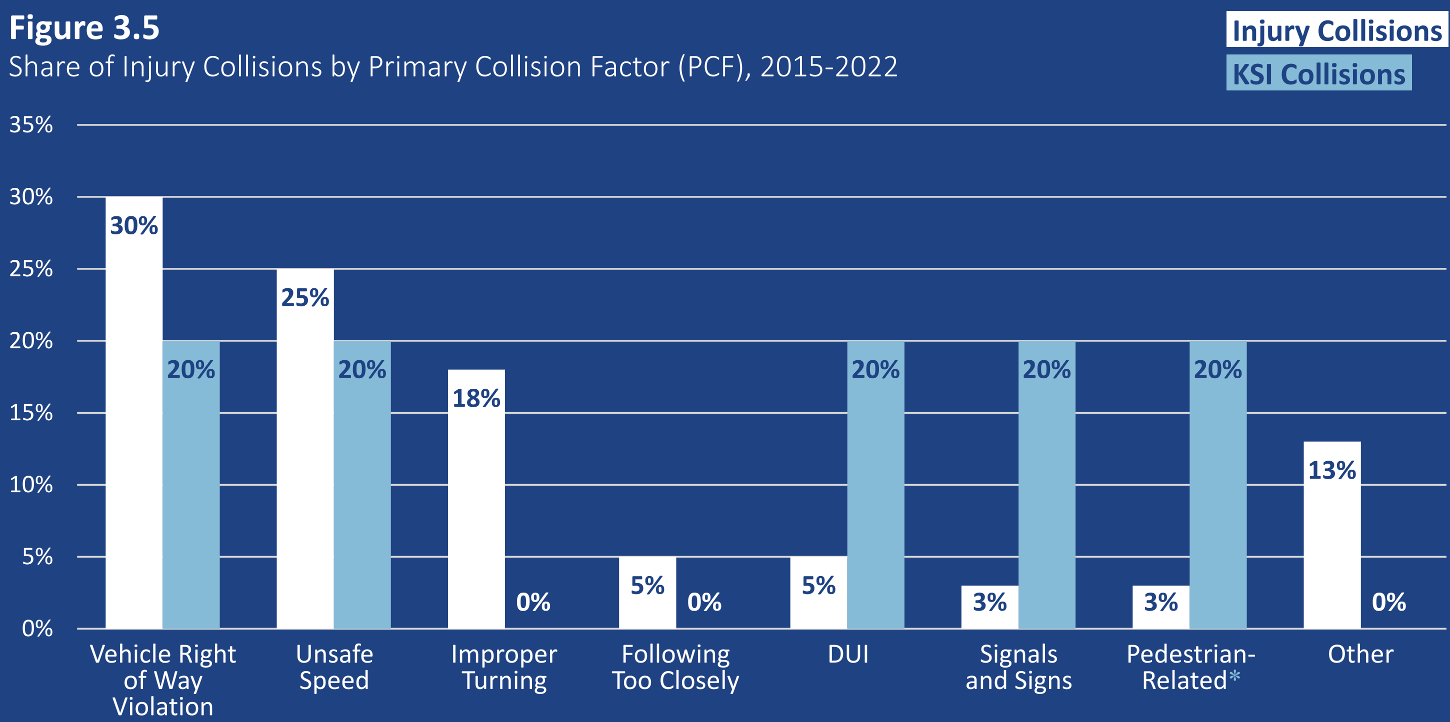


Figure 3.5
Share of Injury Collisions by Primary Collision Factor (PCF), 2015-2022



* **Note on Pedestrian PCF Categories**
The "Pedestrian-Related" category shown here combines two PCF categories: "Pedestrian Violation" and "Pedestrian Right of Way Violation." The former indicates that the pedestrian violated a rule of the road, such as crossing outside of a crosswalk, where the latter indicates the driver of a vehicle violated the pedestrian's right of way. The Pedestrian Violation category may be overrepresented due to a lack of clear information related to collision circumstances, and the increased likelihood that the pedestrian party may be unable to provide their side of the incident at the time of the collision. For this reason, we have elected to not show the distinction in these tallies, and instead show all pedestrian-related collisions in one single category.

Collisions by Lighting Conditions

Figure 3.6 illustrates the share of collisions in the study period that occur at night*****. Nighttime collisions are likely to be more severe due to a variety of additional risk factors, such as lack of visibility, and as shown, nighttime collisions are overrepresented among KSI collisions. While 13% of all injury collisions occurred at night where streetlights were present and a further 8% occurred where streetlights were not present or present but not functioning, accounting for a total of 21% of all injury collisions, 40% of KSI collisions occurred in the dark.

While most nighttime collisions occured where streetlights were present, the quality of the lighting can vary widely. Factors that may contribute to the quality of streetlights include lights being insufficiently bright, placed too widely apart, or poor quality of lighting for people walking on the sidewalk, as streetlights are often designed primarily for vehicles in travel lanes.

***** Nighttime collisions are defined as those collisions whose lighting information is not reported as "daylight".

Driving Under the Influence (DUI)

Figure 3.7 illustrates the share of collisions of various types in the study period that involved at least one party driving under the influence (DUI). Drugs or alcohol increase the likelihood of increased crash severity. As shown, the number of DUI collisions are overrepresented amongst KSI collisions. While 8% of all injury collisions involve drugs or alcohol in Gustine, 40% of KSI collisions do.

These percentages reflect the portion of collisions involving one or more parties determined to be under the influence of drugs or alcohol. Driving under the influence may not always be listed as the primary collision factor even if a driver is found to be under the

Figure 3.6
Nighttime Collisions, 2015-2022

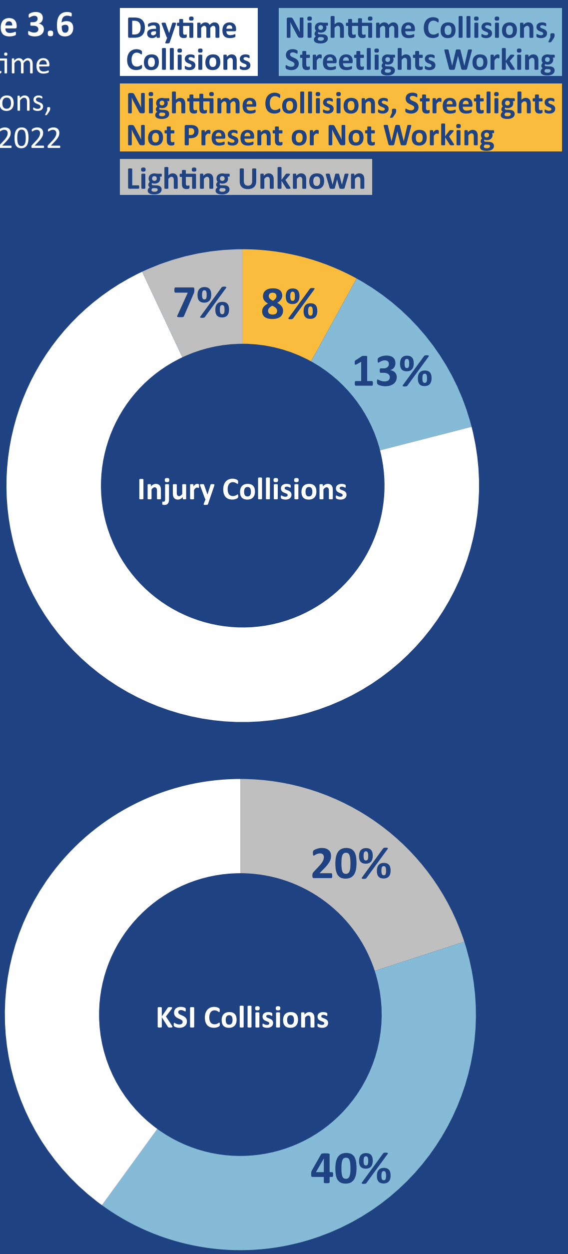
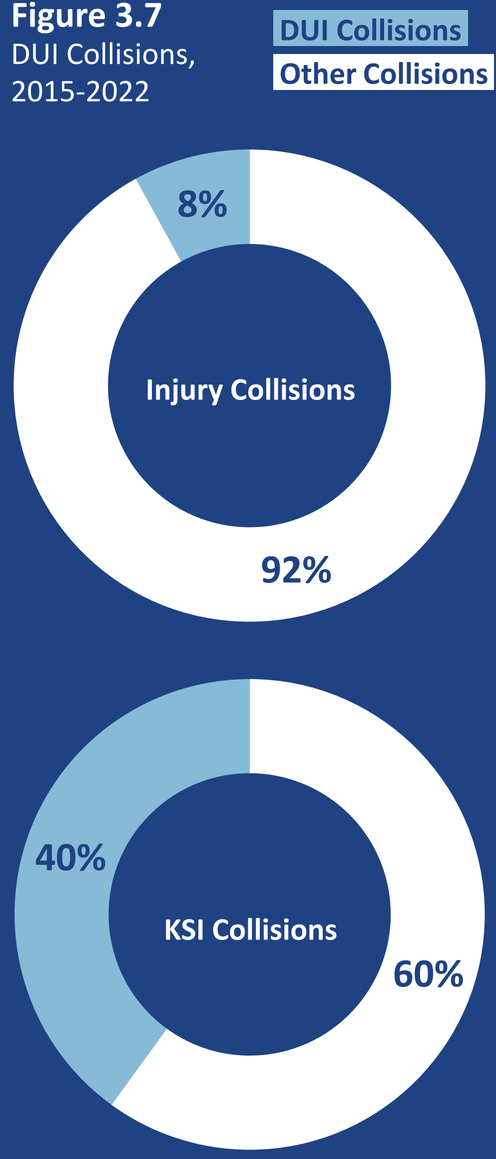


Figure 3.7
DUI Collisions, 2015-2022

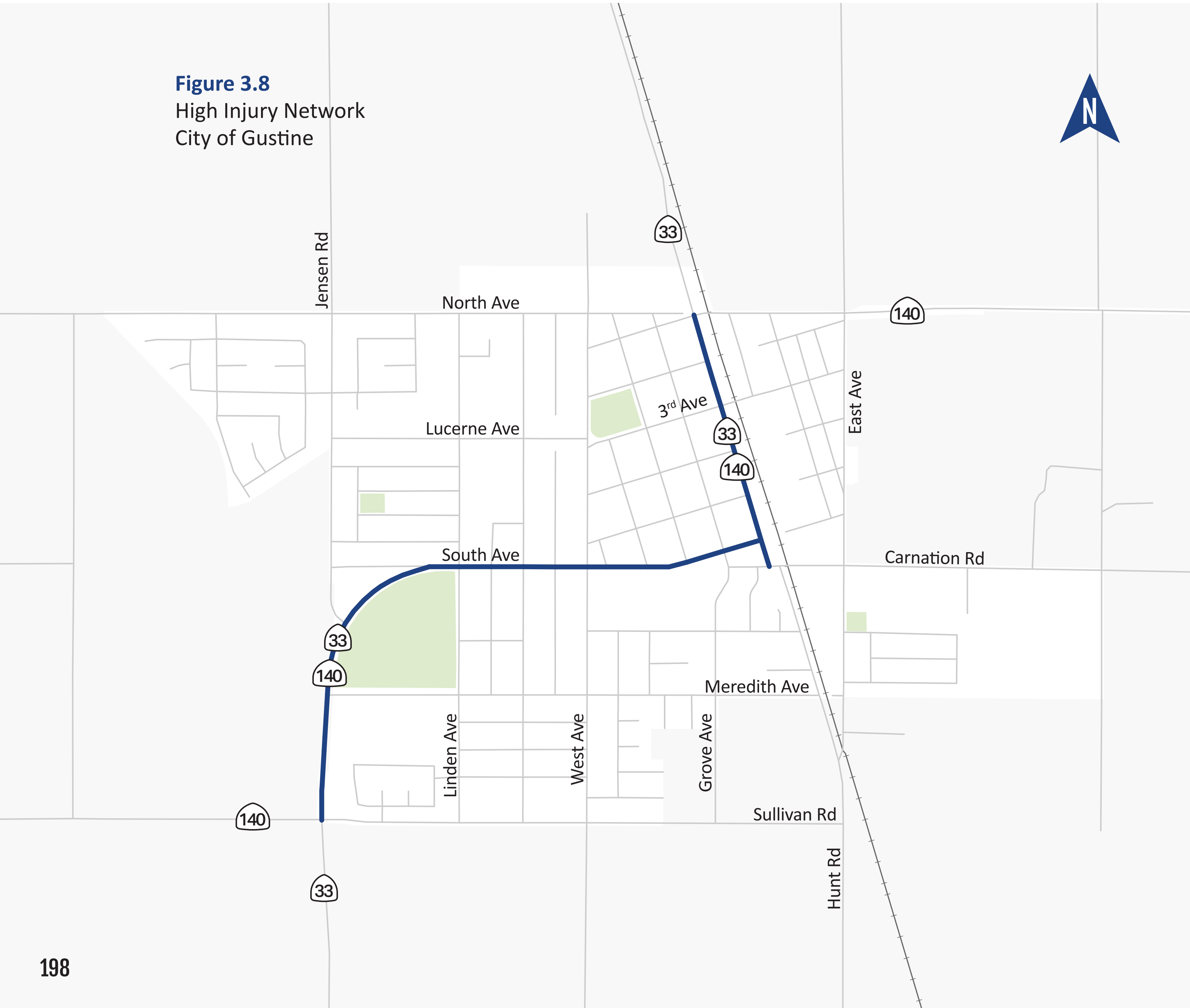


High Injury Network

From the collision data, a High Injury Network was developed to identify the roadways in Gustine with the highest levels of injury collisions, as shown on **Figure 3.8**. It is important to note, however, that the collision record in Gustine is limited due to the City's small size and, as a consequence, small sample size of collision records.

The High Injury Network consists of just 6% of the roadway network in Gustine. However, of the 39 collisions that occurred during the study period, 17, or 44%, were located along the network. Furthermore, all 5 of the study period collisions that were KSIs were located along the network.

Figure 3.8
High Injury Network
City of Gustine



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The federal government has introduced a number of tools used to identify disadvantaged communities. In particular, two of these, the Climate and Economic Justice Screening Tool (CEJST) and the Equitable Transportation Communities (ETC) Explorer, are of particular note, as they see extensive use by the United States Department of Transportation (USDOT) in delineating disadvantaged areas, especially as part of grant funding opportunities.

Climate and Economic Justice Screening Tool (CEJST)

The Climate and Economic Justice Screening Tool (CEJST) is maintained by the Federal Council on Environmental Quality and used by many Federal programs as a means of identifying disadvantaged communities. Census tracts are screened based on a variety of factors, including climate, energy, health, housing, transportation, legacy pollution, waste, and workforce development.

Equitable Transportation Communities (ETC) Explorer

USDOT created Equitable Transportation Communities (ETC) Explorer as part of its Justice40 initiative to complement the CEJST by providing additional insight into transportation factors specifically. The ETC Explorer is meant to capture the cumulative burden of underinvestment in transportation in a community.

The entirety of the City of Gustine, as well as all of the surrounding unincorporated areas, are identified as disadvantaged by the CEJST. There are no areas identified as disadvantaged by the ETC Explorer in or near Gustine.

City of Gustine

2

Collision Profiles

Through a systemic analysis of collision records, collision profiles were identified to represent the most significant patterns behind injury collisions - and especially KSI collisions - in the region. Seven such profiles, identified with the letters "A" through "G" were identified across the region, with each one applicable to one, several, or all of the communities covered by this LRSP.

Gustine is covered by four of these profiles:

A. Driving Under The Influence
B. Dark Conditions
C. Side Street Stop-Controlled Intersections
D. Excessive Roadway and Lane Widths Leading To Speeding

The following pages contain cutsheets that present each collision profile, along with the following information:

- Description and associated information about each profile
- Number of collisions associated, including number of KSI collisions among those (note that profiles are not mutually exclusive; collisions can fall under multiple profiles, and totals will exceed 100%)
- A map of collision locations

Engineering countermeasures that can potentially address these collisions are also presented with each profile. The full suite of engineering countermeasures can be found in **Chapter 3** of **Volume I**.

PROFILE A

Driving Under The Influence

Injury	KSIs	Bicycle	Pedestrian
8 (21%)	4 (80%)	0 (0%)	1 (13%)

Driving under the influence is a significant contributor to injury collisions, especially and disproportionately to collisions that cause someone to be killed or severely injured (KSI).

DUIs are clustered around the weekend and around nighttime. Across the region, 54% of all DUI collisions occurred on Friday, Saturday, and Sunday, and 65% occurred in the dark.

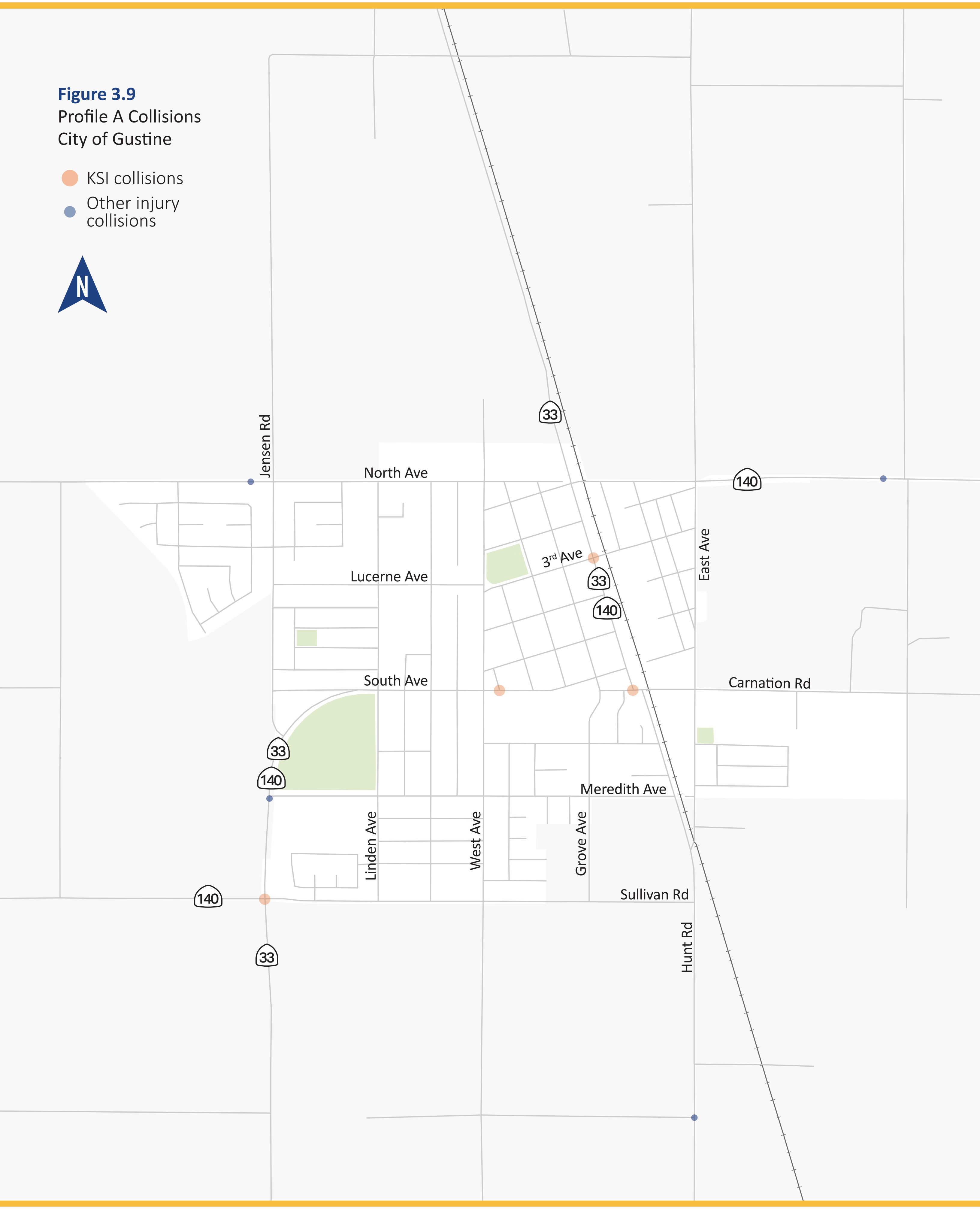
However, it is important to note that a substantial number of DUI collisions occurred outside these time periods as well.

Non-engineering interventions will need to be the primary means of addressing these challenges, but may be supplemented with the listed engineering countermeasures that aim to make roadway designs more forgiving in general.

Potential Supplemental Engineering Countermeasures

Separated Bikeway	Safety Edge	Raised Median	Red Light Cameras
Add Sidewalk	Guardrail	Delineators, Reflectors, and/or Object Markers	Speed Sensitive Rest in Red Signal
Rumble Strips	Roundabout	Speed Limit Reduction	Curve Advance Warning Sign
Improved Pavement Friction	Intersection Reconstruction and Tightening	Remove Obstructions For Sightlines	Chevron Signs on Horizontal Curves
Speed Feedback Sign	LED-Enhanced Sign	Upgrade Striping	Signal Coordination/ Green Wave

Figure 3.9
Profile A Collisions
City of Gustine



Dark Conditions

All	KSIs		
11	3	0	1
(28%)	(60%)	(0%)	(9%)

A substantial number of collisions are occurring in the nighttime across the region. Based on the percentage of nighttime collisions, meaningful progress toward reducing collisions will require improvements that enhance nighttime visibility such as lighting, retroreflective signage, and sightline improvements.

Potential Engineering Countermeasures

- Separated Bikeway
- Rumble Strips
- Safety Edge
- Guardrail
- Intersection Reconstruction and Tightening
- Chevron Signs on Horizontal Curves
- Raised Crosswalk
- Raised Median
- Intersection Lighting
- Segment Lighting
- Delineators, Reflectors, and/or Object Markers
- Curve Advance Warning Sign
- Speed Limit Reduction
- Remove Obstructions For Sightlines
- Add Sidewalk
- High-Visibility Crosswalk
- Pedestrian Hybrid Beacon
- Upgrade Striping
- Leading Pedestrian Interval
- Rectangular Rapid Flashing Beacon
- Retroreflective Tape on Signals
- Advance Stop Bar
- Advance Yield Markings

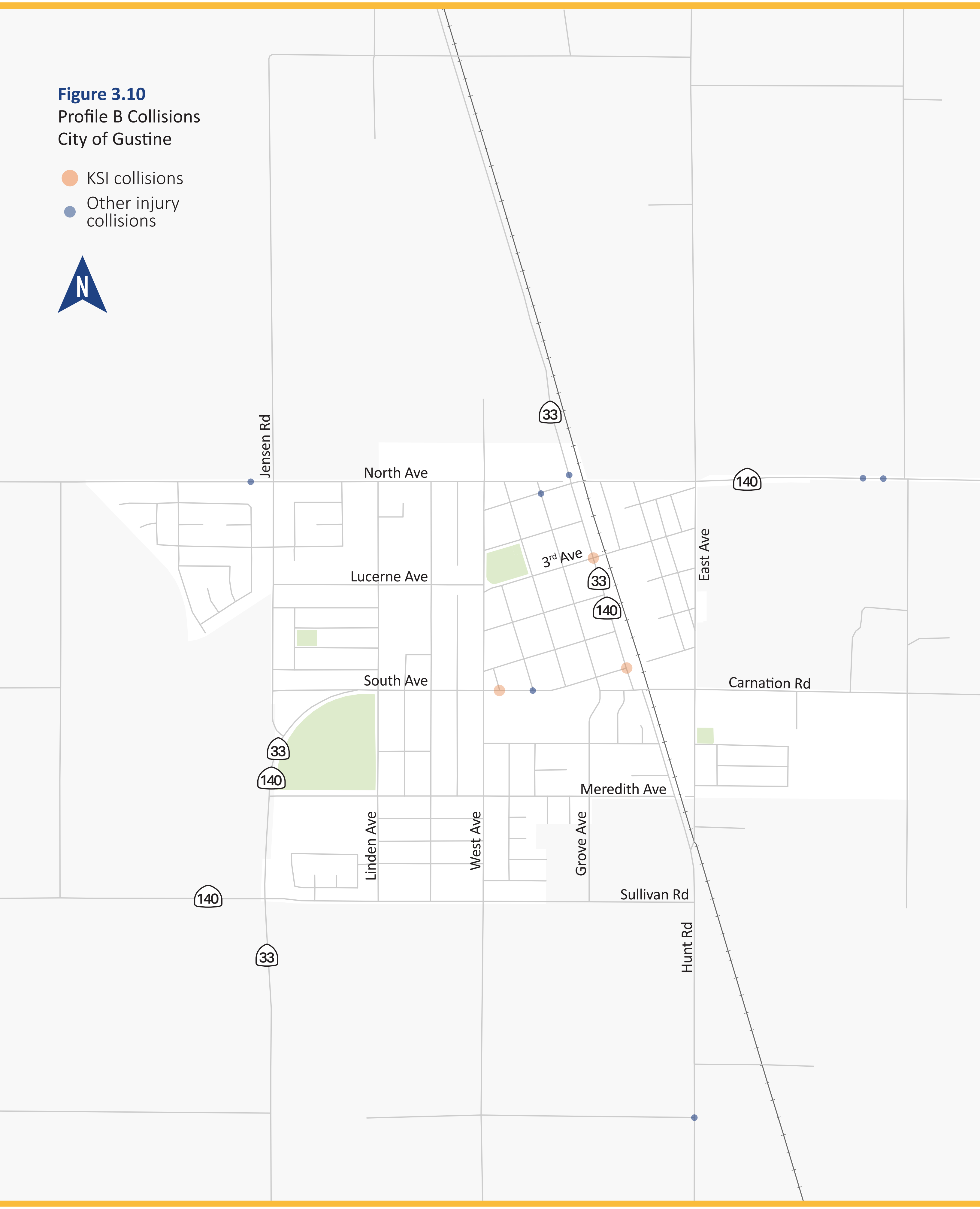


Figure 3.10
Profile B Collisions
City of Gustine

PROFILE C

Side Street Stop-Controlled Intersections

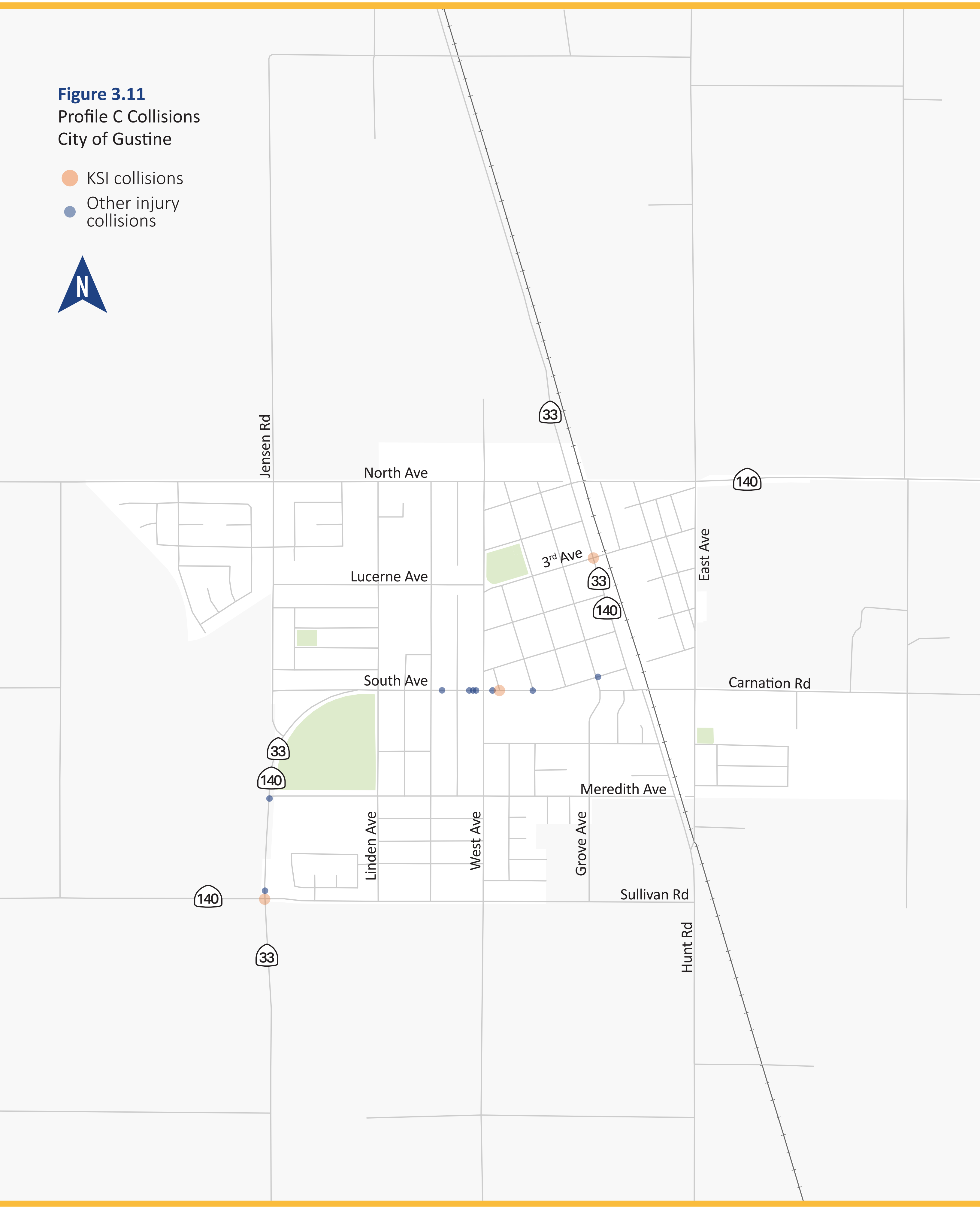
Injury	KSIs	Bicycle	Pedestrian
13	3	0	1
(33%)	(60%)	(0%)	(8%)

Similar to permissive left-turn operations, the question of who has right-of-way can be confusing for drivers in side street stop-controlled intersections. Accurately judging and using a gap in traffic can also be challenging. Similar to permissive left-turn operations, high traffic volumes, high speeds, and limited visibility due to roadway width on the major crossing are factors that also contribute to risk at these locations.

Side street stop-controlled intersections often are accompanied by either an uncontrolled crossing of the major roadway or no crossing altogether. A long series of side street stop-controlled intersections will thus likely create long stretches of the major roadway without protected crossings for people walking, biking or otherwise needing to cross the major street.

Gustine saw a total of 13 collisions at side-street stop-controlled intersections, accounting for one third of all injury crashes within the city. All 13 occurred on the shared alignment of State Routes 33 and 140 along South Avenue and Jensen Road between Sullivan Avenue and 4th Street, which features no control devices of any kind within that stretch. Of the collisions, 3 were KSIs and none involved bicycles or pedestrians. The top PCFs were speeding, accounting for 38% of all such collisions, followed by vehicle right-of-way violations at 31%.

Figure 3.11
Profile C Collisions
City of Gustine



PROFILE C

Side Street Stop-Controlled Intersections

All	KSIs	🚲	🚶
13 (33%)	3 (60%)	0 (0%)	1 (8%)

Potential Engineering Countermeasures

- Extend Bike Lane to Intersection
- Prohibit Left Turn
- Road Diet
- Upgrade Uncontrolled Pedestrian Crossings
- Widen Sidewalk
- Green Conflict Striping
- Lane Narrowing
- Splitter Island
- Curb Extensions
- Rectangular Rapid Flashing Beacon
- Separated Bikeway
- Median Guardrail
- Straighten Crosswalk
- High-Visibility Crosswalk
- Intersection Reconstruction and Tightening
- All-Way Stop Control
- Partial Closure/ Diverter
- Intersection Lighting
- Pedestrian Hybrid Beacon
- Restrict Left Turns with Directional Median Openings
- Centerline Hardening
- Raised Crosswalk
- Delineators, Reflectors, and/or Object Markers
- Leading Pedestrian Interval
- Advance Yield Markings
- Advance Stop Bar
- Raised Intersection
- Speed Limit Reduction
- Remove Crossing Prohibition
- Speed Feedback Sign
- Roundabout
- Raised Median
- Remove Obstructions For Sightlines
- Restripe Crosswalk
- Striping Through Intersection
- Signal
- Refuge Island
- Add Sidewalk
- Upgrade Curb Ramp
- Time-Based Turn Restriction
- Upgrade Striping
- Flashing Beacon as Advance Warning
- Yield To Pedestrians Sign
- Signal Coordination/ Green Wave
- Upgrade Intersection Pavement Markings
- Bus Stop Relocation/ Enhancements

PROFILE D

Excessive Roadway and Lane Widths Leading To Speeding

Injury	KSIs
25%	20%

The region's agricultural heritage has resulted in many roadways that are designed to be wide enough to accommodate larger vehicles, such as trucks and farm equipment. However, many of these design features are no longer necessary as many areas become more residential or retail-oriented in character.

Many roadways around the region feature more vehicle travel lanes than their demand necessitates, which can influence driver behavior towards higher speeds. Moreover, many of the region's roadways feature travel lanes that are wider (often significantly so) than the maximum of 11ft recommended by Caltrans, which is another major contributor to speeding behavior. High speeds on roadways not only pose risks for vehicles, but also make them less comfortable to walk or ride along and to cross for bicyclists and pedestrians.

Speeding is a major contributor to injury collisions in the region. It is cited as the primary collision factor for nearly a quarter of all injury collisions in the study area, as well as 14% of all KSI collisions. It is also important to note that speeding can also be a factor in other collisions where it is not cited as the primary collision factor, and that the number of speeding-related collisions in the region is likely higher.

Potential Engineering Countermeasures

Bike Lane	Raised Crosswalk	Add Sidewalk	Extend Pedestrian Crossing Time	Speed Legends on Pavement at Neighborhood Entries
Extend Bike Lane to Intersection	Raised Intersection	Curb Extensions	Extend Yellow and All Red Time	Neighborhood Traffic Circle
Green Conflict Striping	Refuge Island	High-Visibility Crosswalk	Shorten Cycle Length	Remove Obstructions For Sightlines
Separated Bikeway	Road Diet	Pedestrian Hybrid Beacon	Advance Stop Bar	Signal Coordination/ Green Wave
Rectangular Rapid Flashing Beacon	Improved Pavement Friction	Remove Crossing Prohibition	Advance Yield Markings	Speed Hump or Speed Table
Improved Pavement Friction	Partial Closure/ Diverter	Restripe Crosswalk	Curve Advance Warning Sign	Intersection Reconstruction and Tightening
Safety Edge	Speed Limit Reduction	Widen Sidewalk	Speed Feedback Sign	Delineators, Reflectors, and/or Object Markers
Lane Narrowing	Back-In Angled Parking			

City of Gustine

3

Priority Locations and Project Concepts

The locations in Gustine with the most collision records, which also aligns with risk factors identified by collision profiles, are presented in the following table. These locations are all located along alignments of SR 33 and SR 140 through the City. As such, these locations all fall on Caltrans facilities. Of these, the intersection of South Avenue and 4th Street is already receiving safety improvements in the form of an under-construction roundabout. These locations are intended to be addressed in the medium- to long-term, within the next 5-15 years, subject to additional study, the availability of funding, and coordination with Caltrans.

Due to the small sample size of Gustines' collision records, no non-Caltrans facilities could be flagged based on collision history. As the City continues to coordinate with Caltrans on safety improvements on Caltrans facilities in Gustine, this LRSP also seeks to provide the City with actionable project concepts for City-owned roadways that can proceed independent of that coordination. These concepts were developed with proactive safety improvements in mind, and targets two locations in the City near schools that were selected based on community feedback, walk audit findings, and alignment with collision profiles.

Location	Injury Colli-sions	KSI Colli-sions		Matching Profiles and Associated Risk Factors	On Caltrans Facility?
South Ave/ West Ave	5	1	C	This intersection is side-street stop-controlled, with the main road (South Ave) lacking any stop or signal control between the south end of town and 4th St	Yes
South Ave/ 4th St	3	1	C	This intersection is side-street stop-controlled, with only southbound traffic on 4th St being free-flow	Yes
SR 140/ East Ave	3	0	C	The intersection is stop-controlled	Yes
			F	2nd Ave intersects East Ave immediately south of the intersection at an oblique angle	
			D	SR 140 has high speeds (posted speed limit of 45 MPH)	

Intersection of

GROVE AVENUE AND MEREDITH AVENUE

Collision Profiles

D

On HIN?

No

Collision History

Due to the small sample size of Gustine's collision records, this project was identified systemically as a proactive safety improvement.

Both Meredith Avenue and Grove Avenue are residential streets with posted speed limits of 25 MPH, and respectively provide east-west and north-south crosstown connectivity. Their intersection is located adjacent to Gustine Elementary School, whose two primary points of access are located just south and east of the intersection, respectively.

The intersection is currently all-way stop-controlled. It does not have marked crosswalk on all four legs. A Class I shared-use path on the north side of Meredith Avenue terminates at the northwest corner of the intersection and does not connect to a marked crosswalk. Adding marked crosswalks will better serve the Class I path, as well as provide increased accessibility to the school. The City also plans to construct a new Class I path along Grove Avenue in the future, and additional marked crosswalks would serve that future connection as well. In addition, curb extensions at the intersection could be considered to boost the visibility of crosswalk users, reduce crossing distances, and reduce the visual width of the roadways.

In addition to the intersection itself, there is a mid-block crosswalk across Meredith Avenue a half-block east of the intersection, also serving the elementary school. Meredith Avenue features travel lanes wider than 12 feet, which can contribute to higher vehicular speeds and reduced visibility of pedestrians on the side of the road waiting to cross. A median pedestrian refuge island for the mid-block crosswalk would shorten the crossing distance, improve pedestrian visibility, and slow vehicle speeds. Raising the crosswalk to sidewalk level can be considered as a longer-term improvement.

Intersection of

1ST AVENUE AND 5TH STREET

Collision Profiles

C D

On HIN?

No

Collision History

Due to the small sample size of Gustine's collision records, this project was identified systemically as a proactive safety improvement.

The intersection serves as the northern gateway for downtown Gustine's main commercial corridor along 5th Street. The side-street stop-controlled intersection has a large footprint – while both intersecting roadways feature one lane in each direction, their cross-sections are each over 50 feet wide due to the presence of angled parking on both sides of the street. This can lead to visibility issues. The crosswalks at this intersection are also narrower than prescribed by current best practices, and substantially narrower than those present at the intersections north and south of it.

The intersection could be improved by converting the intersection into a roundabout. This would allow for the creation of full-width crosswalks, allow for more even traffic flow through the intersection, and reduce likelihood of collisions. The roundabout would also serve as a northern gateway to the downtown area.

City of Livingston

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Collision Analysis

Chapter 2 of Caltrans' Local Roadway Safety Manual (LRSM) instructs safety practitioners to "consider a wide range of data sources to get an overall picture of the safety needs." To this end, this Local Roadway Safety Plan is data-driven and synthesizes findings from collison records alongside input from key stakeholders, a technical advisory group, and staff.

Collision records on roadways in Livingston from 2015 to 2022 were investigated to describe historic collision trends and identify high-risk locations. This information acts as a primary resource for this Plan, providing the underlying data to support key analyses.

The data-driven process for the creation of this Plan includes:

- **Examination of Collision Trends**
  Review of collision statistics to evaluate when, where, and why collisions occur and who is involved.

- **Development of a High-Injury Network**
  Identification of roadways where most injury collisions are concentrated for targeted intervention.

- **Development of Collision Profiles of Emphasis**
  Identification of the most prevalent collision types and contexts based on a combination of collision factors.

- **Creation of a Countermeasure Toolbox**
  Identification of effective, nationally proven countermeasures applicable to different collision profiles.

- **Identification of Priority Project Locations**
  Identification of locations suitable for project implementation based on collision density and community verification.

The following section presents findings from the first of these stages of data analysis, identifying collision patterns and trends.

A Note on the Data Source

This analysis utilizes data on injury collisions from 2015 through 2022 available through the Transportation Injury Mapping System (TIMS) as of August 2023. TIMS reports injury collisions from the Statewide Integrated Traffic Records System (SWITRS), but excludes collisions that cause property damage only (PDO) and no injuries.

Geographically, the data includes all collisions that occur within the City of Livingston. The data excludes collisions on Route 99, as it is a controlled-access roadway (i.e. freeway), but includes collisions on all other roadways, including State highways and other Caltrans-maintained roadways as well as privately-maintained roadways.

While collision databases like TIMS remain the best source of collision data, they have been found to have certain reporting biases, including:

- Collisions involving people walking, on bicycles, or on motorcycles are less likely to be reported than collisions with people driving
- Property damage only collisions are less likely to be reported compared to more severe collisions
- Younger victims are less likely to report collisions
- Alcohol-involved collisions may be underreported

Race, income, immigration status, and English proficiency may also impact reporting, but there is limited research on these factors.

Figure 4.1
Injury Collisions by Year, 2015-2022

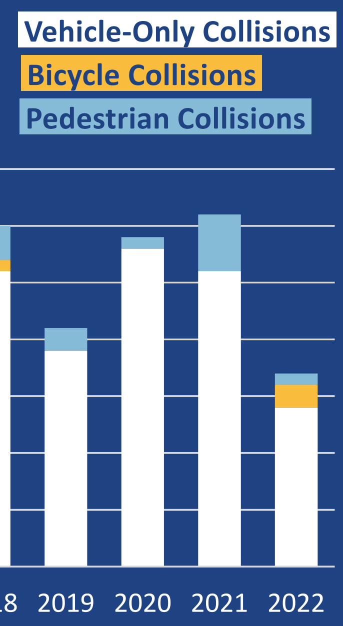


Figure 4.2
KSI Collisions by Year, 2015-2022

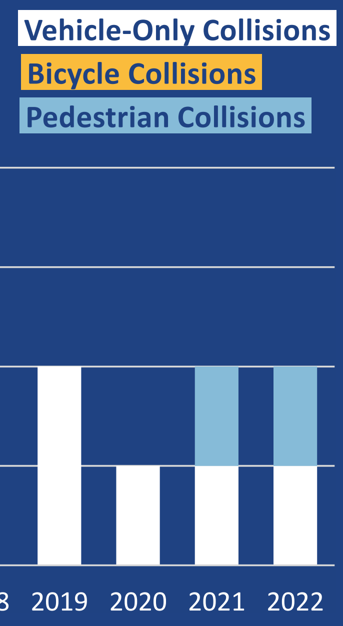
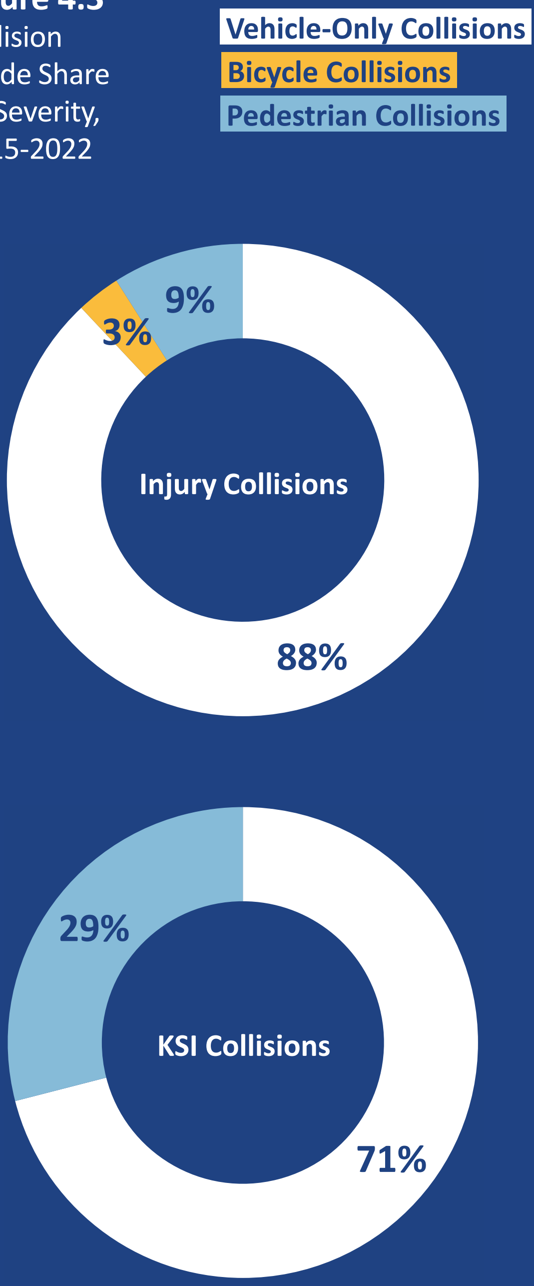


Figure 4.3
Collision Mode Share by Severity, 2015-2022



Collisions by Year and by Mode

The table below provides a summary of the number of collisions in Livingston by mode and severity within the dataset, which includes all collisions that resulted in injury or fatality. From 2015 to 2022, there were a total of 205 injury collisions, of which 14 were KSI collisions: collisions where someone was killed or severely injured.

Collision Summary	Total	KSI
Total	205	14
Bicycle	7	0
Pedestrian	18	4

Figures 4.1 and **4.2** show the temporal trends of collisions in Livingston. As shown, the annual number of injury collisions in Livingston has fluctuated through the study period, with a peak in 2020 and 2021 that coincide with the peak of the COVID-19 pandemic, and a drop in 2022. This is in line with national trends in 2020 and 2021, during and after the initial wave of the pandemic, where roadway safety outcomes worsened despite travel restrictions and decreases in traffic volume. The number of KSI collisions per year over the study period has also fluctuated, but hovers around two per year.

People walking or biking are particularly vulnerable in the event of a collision, as they lack the protection afforded to them by being inside a motor vehicle. As a result, collisions involving people walking or biking are more likely to result in injury and fatality. As shown in **Figure 4.3**, people walking and biking are involved in 12% of all injury collisions, but 29% of KSI collisions.

Collisions by Collision Type

Figure 4.4 illustrates the share of collisions in the study period that fall into each collision type. As shown, the most common collision types across all injury collisions in Livingston are broadside collisions at 28%, rear-end collisions at 23%, and sideswipe collisions at 14%.

Taking a closer look at KSI collisions shows a different breakdown. Broadside collisions are also the most common type of KSI collisions, at 36%, followed by vehicle-pedestrian collisions at 21%, and rear-end collisions at 14%.

This illustrates the disproportionate impact in severity that collision type can play. For example, while side-swipes account for a large share of overall collisions, they are generally less likely to result in fatalities and severe injuries. By contrast, broadsides are more represented amongst KSI collisions, as they typically involve more kinetic energy and result in more serious collision outcomes.

This also further illustrates the significantly disproportionate impact people walking face in the event of a collision, as vehicle-pedestrian collisions are significantly overrepresented in the KSI collision record.

Collisions by Primary Collision Factor

Figure 4.5 illustrates the share of collisions in the study period that are classified under each Primary Collision Factor (PCF). PCFs are cited by the responding officer and are based on that person's judgment of what contributed to the collision. It is important to note that PCFs do not include contextual information about the design aspects of the collision location that could have been primary or secondary contributors to a collision.

In Livingston, the most common PCFs are Vehicle Right of Way Violation at 28% of collisions, Unsafe Speed at 17%, and Driving/Biking Under the Influence (DUI) at 14%.

Taking a closer look at KSI collisions shows a different PCF breakdown percentage. The most common PCFs for KSI collisions are DUI at 29%, Vehicle Right of Way Violation at 21%, Pedestrian-Related at 14%, Unsafe Speed at 14%, and Improper Turning at 14%.

Figure 4.4
Share of Injury Collisions by Collision Type, 2015-2022

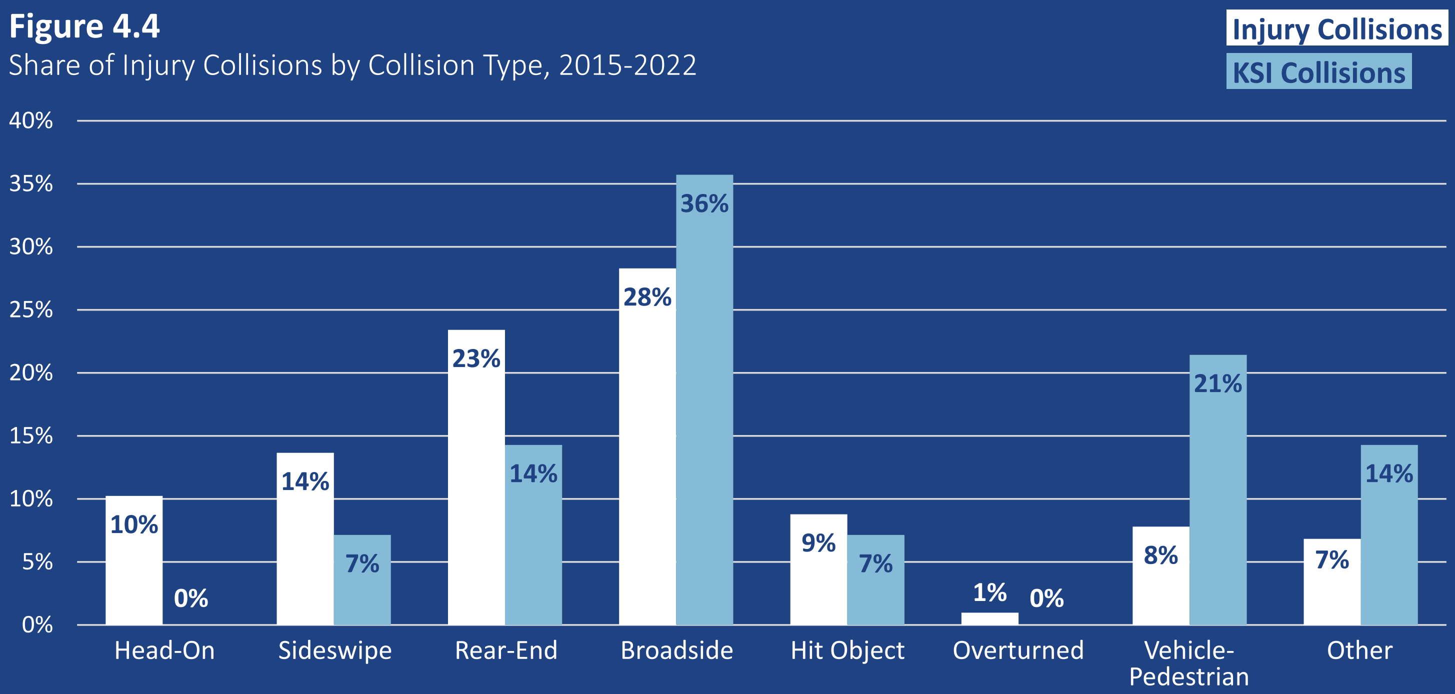
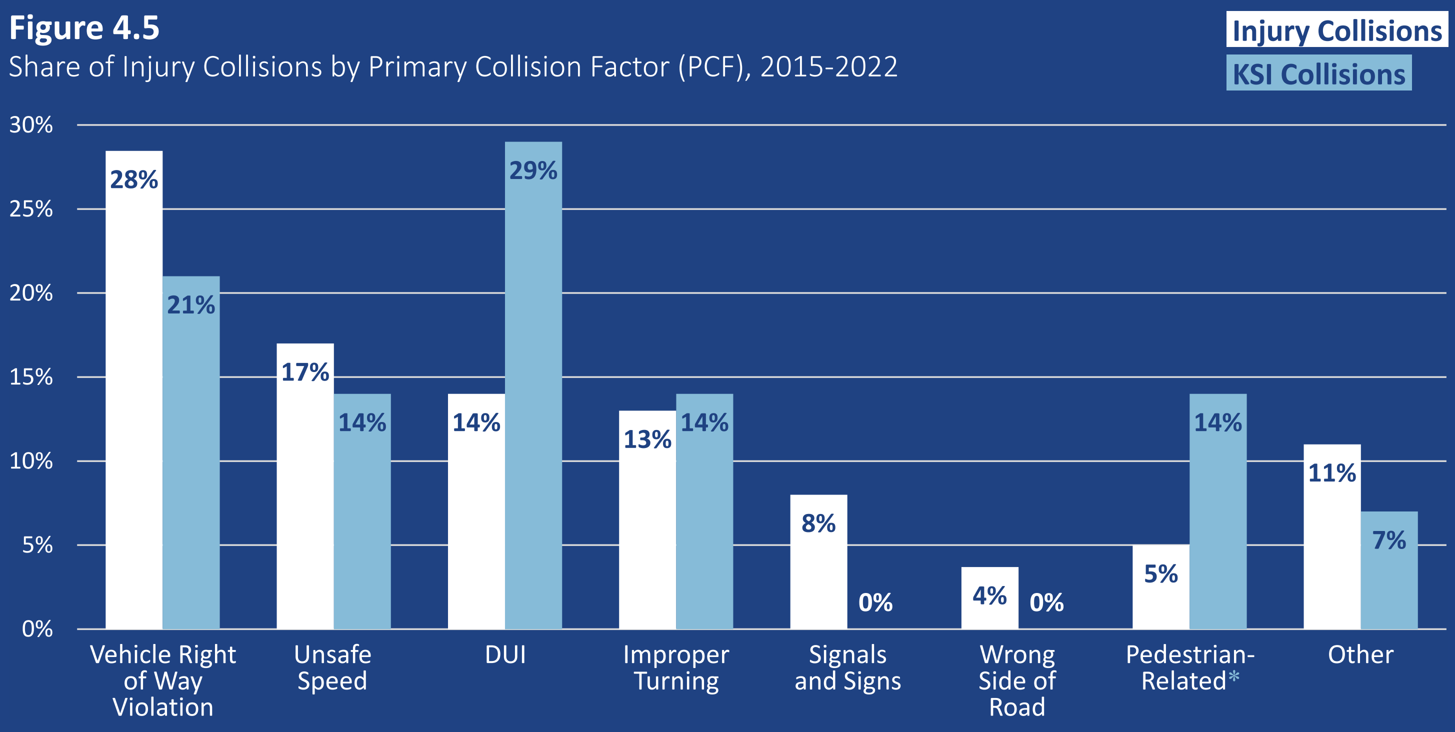


Figure 4.5
Share of Injury Collisions by Primary Collision Factor (PCF), 2015-2022



* **Note on Pedestrian PCF Categories**

The "Pedestrian-Related" category shown here combines two PCF categories: "Pedestrian Violation" and "Pedestrian Right of Way Violation." The former indicates that the pedestrian violated a rule of the road, such as crossing outside of a crosswalk, where the latter indicates the driver of a vehicle violated the pedestrian's right of way. The Pedestrian Violation category may be overrepresented due to a lack of clear information related to collision circumstances, and the increased likelihood that the pedestrian party may be unable to provide their side of the incident at the time of the collision. For this reason, we have elected to not show the distinction in these tallies, and instead show all pedestrian-related collisions in one single category.

Collisions by Lighting Conditions

Figure 4.6 illustrates the share of collisions in the study period that occur at night*****. Nighttime collisions and issues around lighting are top concerns for Livingston. As shown, nighttime collisions account for a large share of collisions overall, and are even more overrepresented among KSI collisions. 29% of all injury collisions occurred at night where streetlights were present and a further 4% occurred where streetlights were not present or present but not functioning, accounting for a third of all injury collisions. Those percentages jump further to 50% and 21% for KSI collisions, respectively, amounting to almost three-quarters of all KSI collisions occurring in the dark.

Collisions that occur during nighttime also disproportionately affect people walking. 39% of pedestrian-involved collisions occurred at night where streetlights were present and a further 17% occurred where streetlights were not present or present but not functioning, accounting for a majority of pedestrian-involved collisions.

The concern around lighting is especially relevant given Livingston's small-town context and rural surroundings. Nighttime collisions represent a third of the injury collision record and nearly three-quarters of the KSI collision record, indicating a clear need for focus on the issue. There continue to be locations without functional street lighting in the City, and collisions at those locations represent a significant share of the collision record. Furthermore, even where streetlights were present, the quality of the lighting can vary widely. Factors that may contribute to the quality of streetlights include lights being insufficiently bright, placed too widely apart, or poor quality of lighting for people walking on the sidewalk, as streetlights are often designed primarily for vehicles in travel lanes.

***** Nighttime collisions are defined as those collisions whose lighting information is not reported as "daylight".

Driving Under the Influence (DUI)

Figure 4.7 illustrates the share of collisions of various types in the study period that involved at least one party driving under the influence (DUI). Drugs or alcohol increase the likelihood of increased crash severity. As shown, the number of DUI collisions are overrepresented amongst KSI collisions. While 15% of all injury collisions involve drugs or alcohol in Livingston, 29% of KSI collisions do.

These percentages reflect the portion of collisions involving one or more parties determined to be under the influence of drugs or alcohol. Driving under the influence may not always be listed as the primary collision factor even if a driver is found to be under the influence.

Figure 4.6
Nighttime Collisions, 2015-2022

Daytime Collisions
Nighttime Collisions, Streetlights Working
Nighttime Collisions, Streetlights Not Present or Not Working

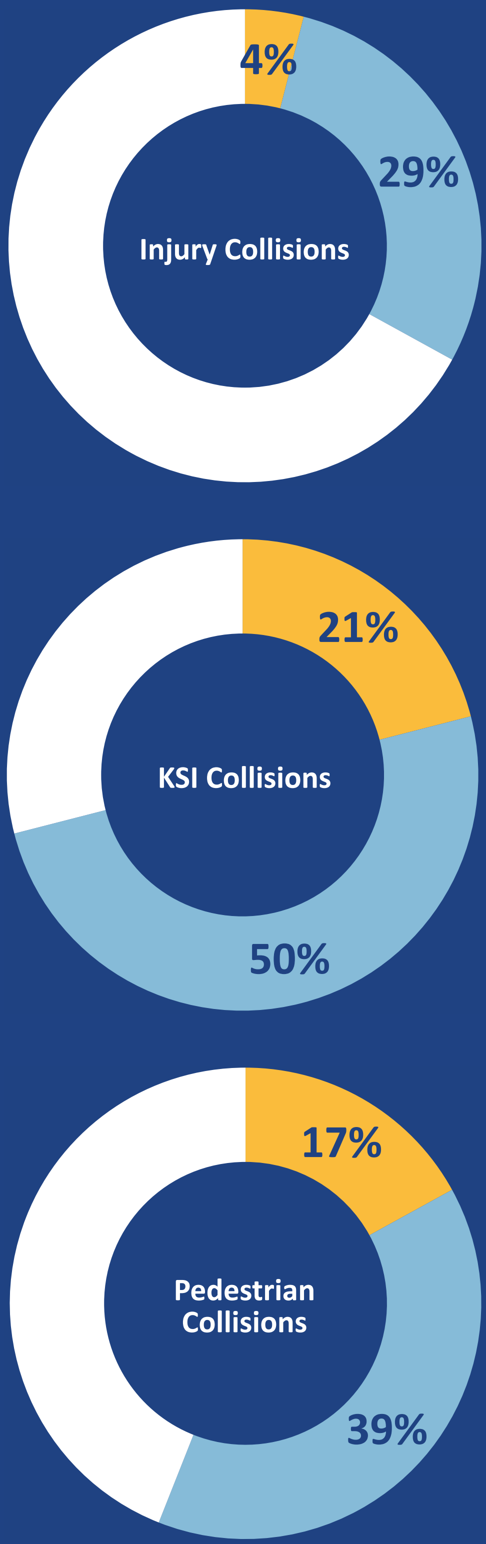
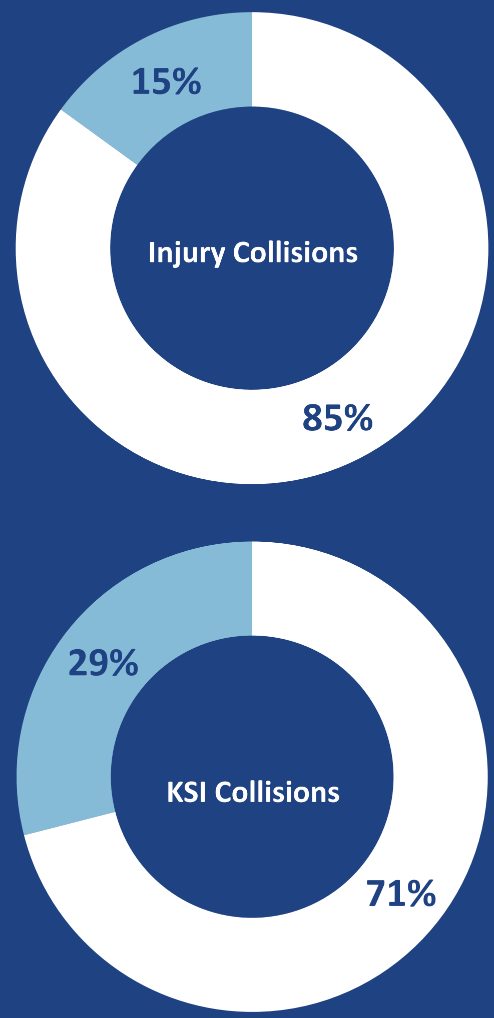


Figure 4.7
DUI Collisions, 2015-2022

DUI Collisions
Other Collisions

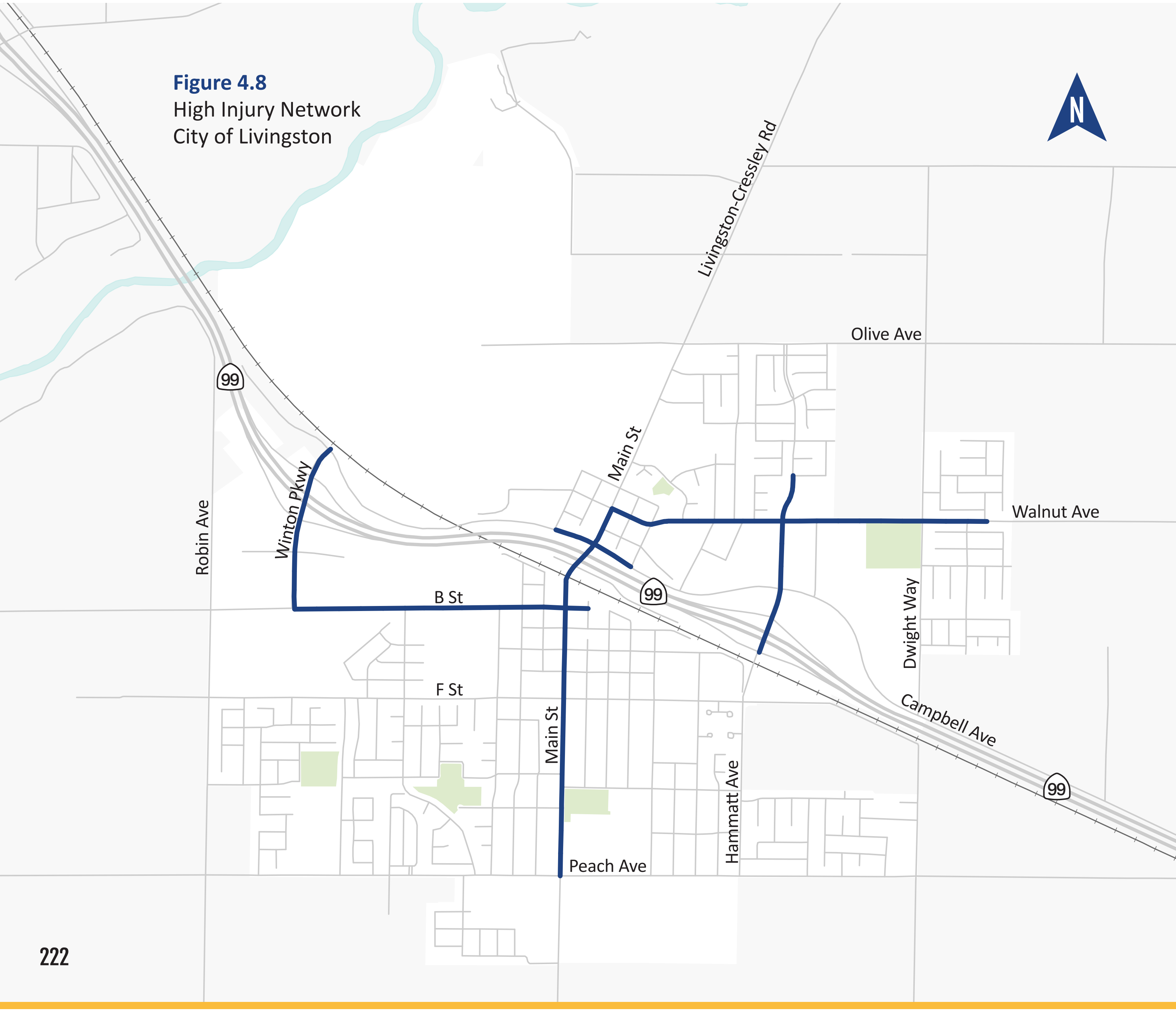


High Injury Network

From the collision data, a High Injury Network was developed to identify the roadways in Livingston with the highest levels of injury collisions, as shown on **Figure 4.8**.

The High Injury Network consists of just 10% of the roadway network in Livingston, but is the site of the majority of injury collisions. Of the 205 collisions that occurred during the study period, 114, or 56%, were located along the network. Fourteen of these study period collisions were KSIs, of which eleven, or 79%, were located along the network.

Figure 4.8
High Injury Network
City of Livingston



Equity Considerations

Both Merced County and the larger Central Valley region have historically been subject to underinvestment and marginalization. As a result, most of the region, including most areas within the six cities covered by this Plan, are identified as disadvantaged by the various criteria used by the state and Federal governments.

The federal government has introduced a number of tools used to identify disadvantaged communities. In particular, two of these, the Climate and Economic Justice Screening Tool (CEJST) and the Equitable Transportation Communities (ETC) Explorer, are of particular note, as they see extensive use by the United States Department of Transportation (USDOT) in delineating disadvantaged areas, especially as part of grant funding opportunities.

Climate and Economic Justice Screening Tool (CEJST)

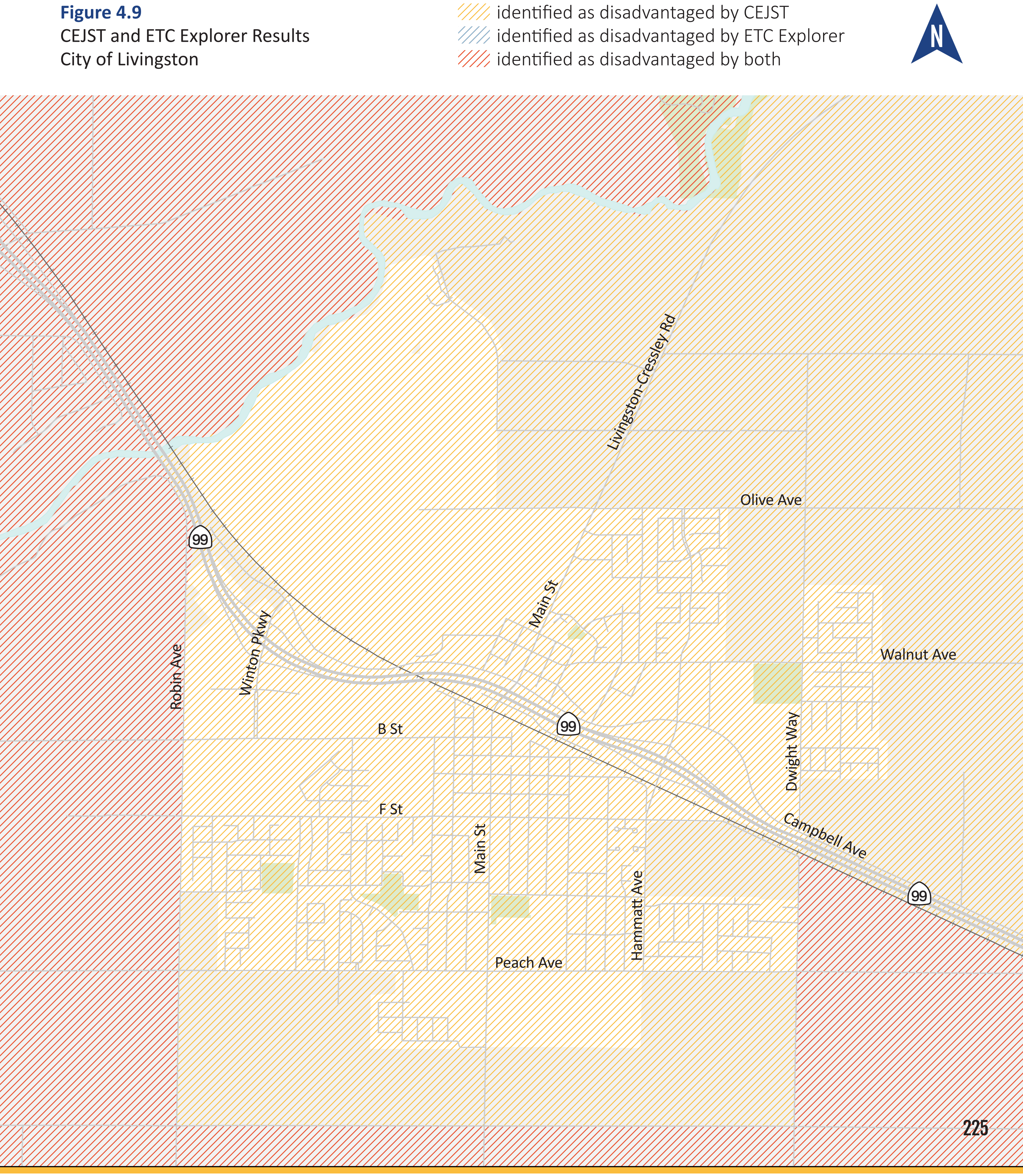
The Climate and Economic Justice Screening Tool (CEJST) is maintained by the Federal Council on Environmental Quality and used by many Federal programs as a means of identifying disadvantaged communities. Census tracts are screened based on a variety of factors, including climate, energy, health, housing, transportation, legacy pollution, waste, and workforce development.

Equitable Transportation Communities (ETC) Explorer

USDOT created Equitable Transportation Communities (ETC) Explorer as part of its Justice40 initiative to complement the CEJST by providing additional insight into transportation factors specifically. The ETC Explorer is meant to capture the cumulative burden of underinvestment in transportation in a community.

Figure 4.9 shows areas in Livingston identified as disadvantaged under these two criterion. As shown, the entirety of Livingston, and all unincorporated areas around it, are identified as disadvantaged by the CEJST. In addition, many of the unincorporated areas immediately adjacent to city limits are also identified as disadvantaged by the ETC Explorer.

Figure 4.9
CEJST and ETC Explorer Results
City of Livingston



City of Livingston

2

Collision Profiles

Through a systemic analysis of collision records, collision profiles were identified to represent the most significant patterns behind injury collisions - and especially KSI collisions - in the region. Seven such profiles, identified with the letters “A” through “G” were identified across the region, with each one applicable to one, several, or all of the communities covered by this LRSP.

Livingston is covered by four of these profiles:

A. Driving Under The Influence
B. Dark Conditions
C. Side Street Stop-Controlled Intersections
D. Excessive Roadway and Lane Widths Leading To Speeding

The following pages contain cutsheets that present each collision profile, along with the following information:

- Description and associated information about each profile
- Number of collisions associated, including number of KSI collisions among those (note that profiles are not mutually exclusive; collisions can fall under multiple profiles, and totals will exceed 100%)
- A map of collision locations

Engineering countermeasures that can potentially address these collisions are also presented with each profile. The full suite of engineering countermeasures can be found in **Chapter 3** of **Volume I**.

PROFILE A

Driving Under The Influence

Injury	KSIs		
35 (17%)	4 (29%)	0 (0%)	3 (9%)

Driving under the influence is a significant contributor to injury collisions, especially and disproportionately to collisions that cause someone to be killed or severely injured (KSI).

DUIs are clustered around the weekend and around nighttime. Across the region, 54% of all DUI collisions occurred on Friday, Saturday, and Sunday, and 65% occurred in the dark.

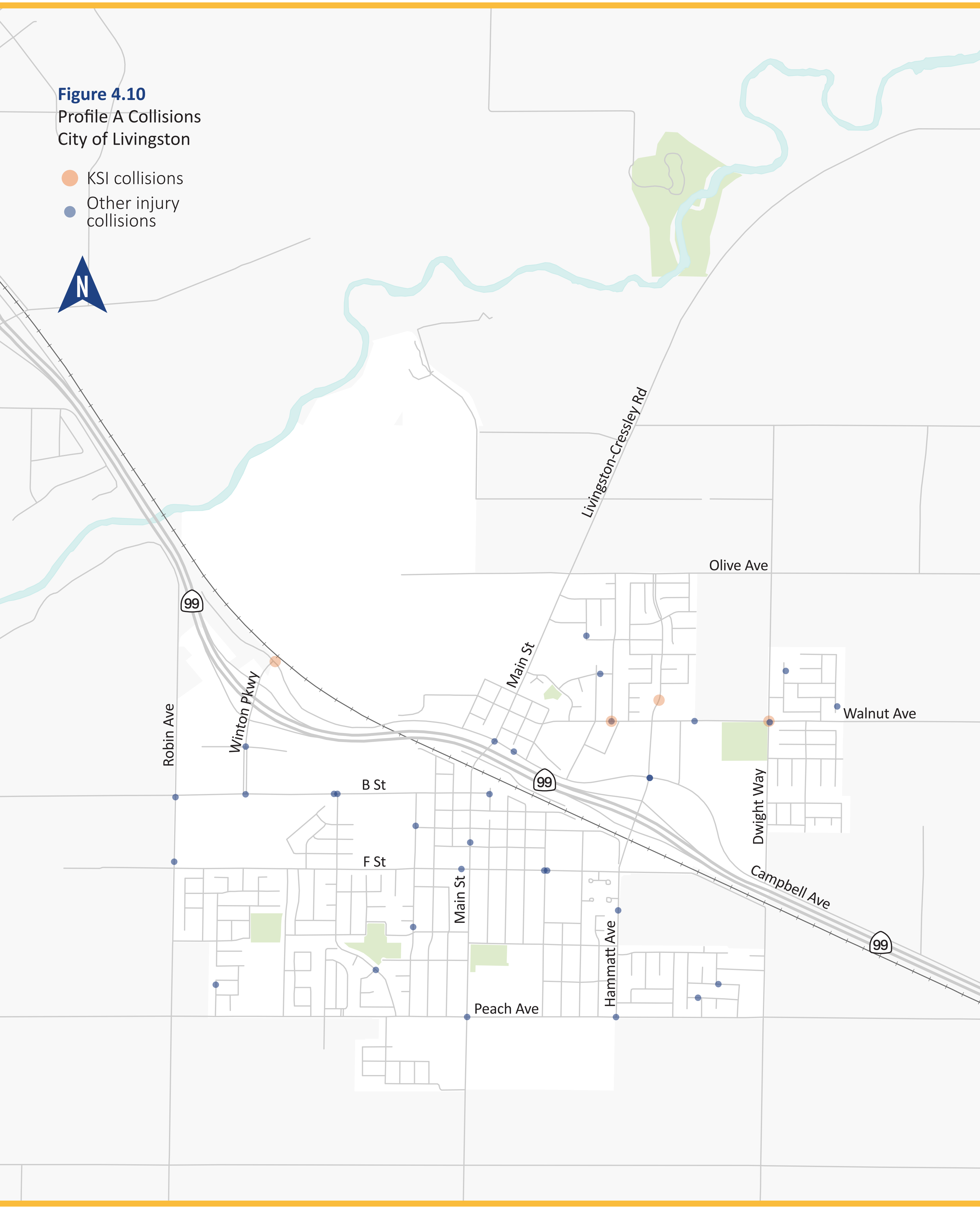
However, it is important to note that a substantial number of DUI collisions occurred outside these time periods as well.

Non-engineering interventions will need to be the primary means of addressing these challenges, but may be supplemented with the listed engineering countermeasures that aim to make roadway designs more forgiving in general.

Potential Supplemental Engineering Countermeasures

- Separated Bikeway
- Safety Edge
- Raised Median
- Red Light Cameras
- Add Sidewalk
- Guardrail
- Delineators, Reflectors, and/or Object Markers
- Speed Sensitive Rest in Red Signal
- Rumble Strips
- Roundabout
- Speed Limit Reduction
- Curve Advance Warning Sign
- Improved Pavement Friction
- Intersection Reconstruction and Tightening
- Remove Obstructions For Sightlines
- Chevron Signs on Horizontal Curves
- Speed Feedback Sign
- LED-Enhanced Sign
- Upgrade Striping
- Signal Coordination/ Green Wave

Figure 4.10
Profile A Collisions
City of Livingston



PROFILE B

Dark Conditions

Injury	KSIs		
68	10	1	10
(33%)	(71%)	(1%)	(15%)

A substantial number of collisions are occurring in the nighttime across the region. Based on the percentage of nighttime collisions, meaningful progress toward reducing collisions will require improvements that enhance nighttime visibility such as lighting, retroreflective signage, and sightline improvements.

Potential Engineering Countermeasures

- Separated Bikeway
- Rumble Strips
- Safety Edge
- Guardrail
- Intersection Reconstruction and Tightening
- Chevron Signs on Horizontal Curves
- Raised Crosswalk
- Raised Median
- Intersection Lighting
- Segment Lighting
- Delineators, Reflectors, and/or Object Markers
- Curve Advance Warning Sign
- Speed Limit Reduction
- Remove Obstructions For Sightlines
- Add Sidewalk
- High-Visibility Crosswalk
- Pedestrian Hybrid Beacon
- Upgrade Striping
- Leading Pedestrian Interval
- Rectangular Rapid Flashing Beacon
- Retroreflective Tape on Signals
- Advance Stop Bar
- Advance Yield Markings

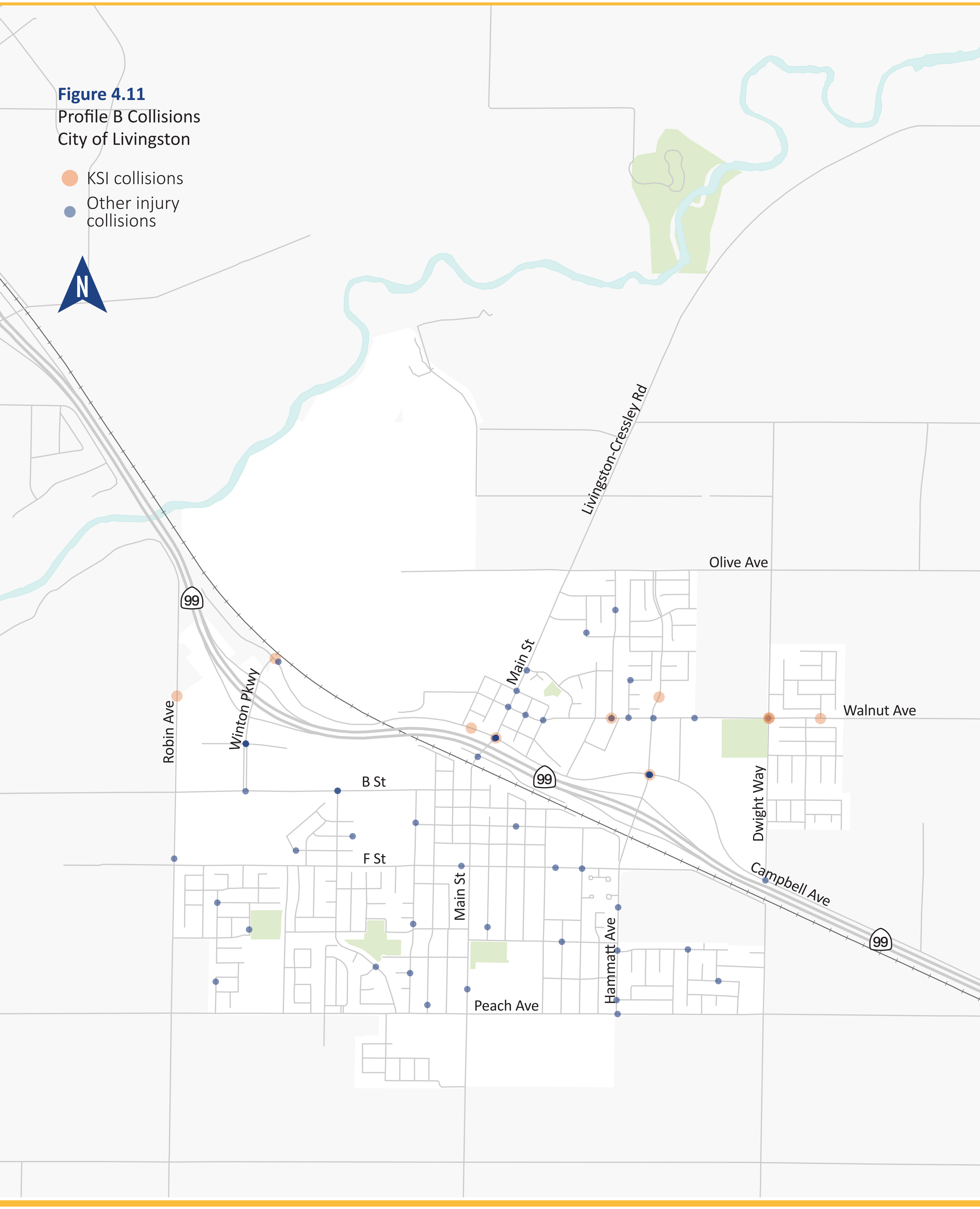


Figure 4.11
Profile B Collisions
City of Livingston
KSI collisions
Other injury collisions
N
Livingston-Cressley Rd
Olive Ave
Main St
Walnut Ave
Robin Ave
Winton Pkwy
99
B St
F St
Main St
Dwight Way
Campbell Ave
Hammatt Ave
Peach Ave

PROFILE C

Side Street Stop-Controlled Intersections

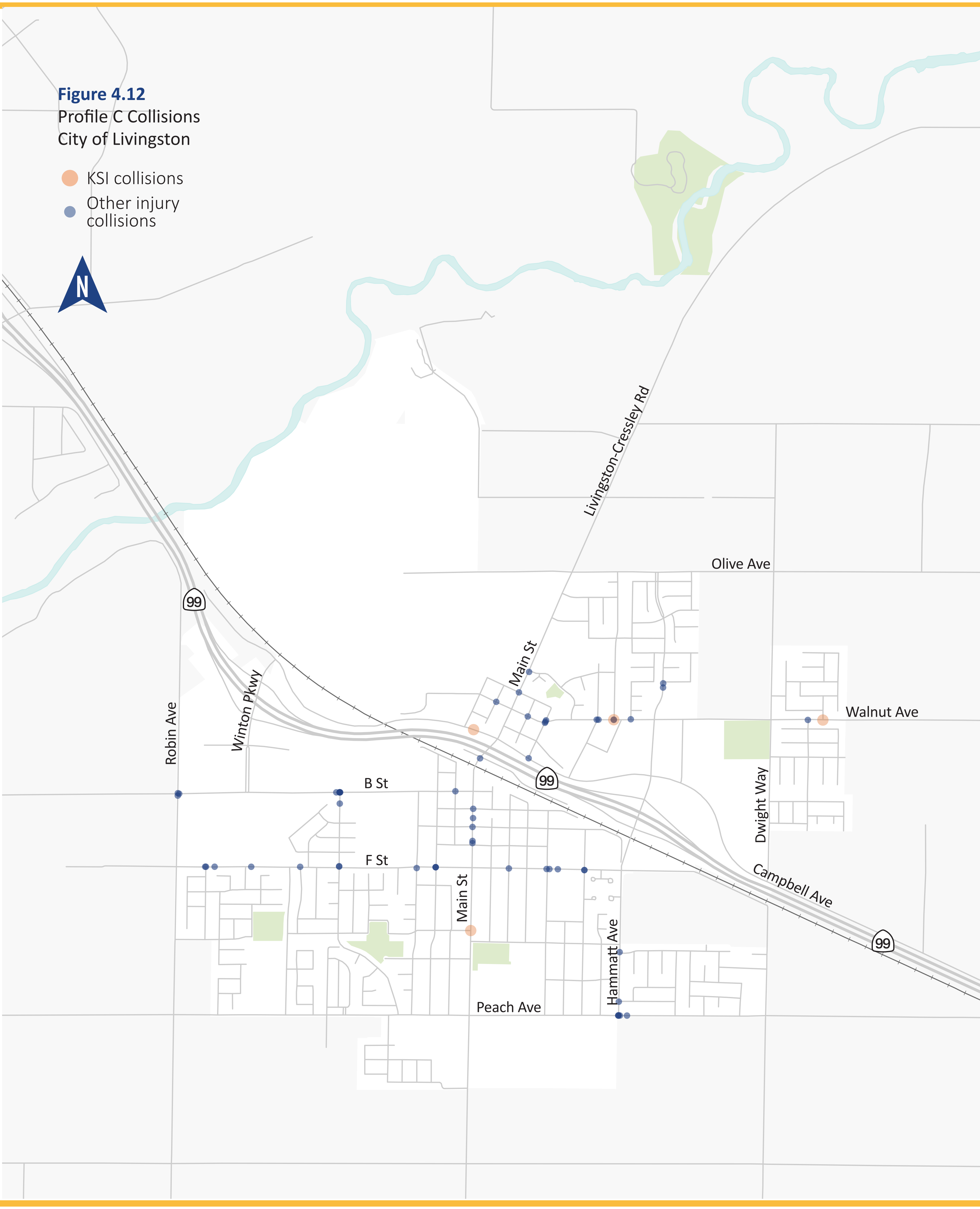
Injury	KSIs	Bicycles	Pedestrians
61 (30%)	4 (29%)	2 (3%)	9 (15%)

Similar to permissive left-turn operations, the question of who has right-of-way can be confusing for drivers in side street stop-controlled intersections. Accurately judging and using a gap in traffic can also be challenging. Similar to permissive left-turn operations, high traffic volumes, high speeds, and limited visibility due to roadway width on the major crossing are factors that also contribute to risk at these locations.

Side street stop-controlled intersections often are accompanied by either an uncontrolled crossing of the major roadway or no crossing altogether. A long series of side street stop-controlled intersections will thus likely create long stretches of the major roadway without protected crossings for people walking, biking or otherwise needing to cross the major street.

Livingston saw a total of 61 collisions at side-street stop-controlled intersections, accounting for nearly 30% of all injury crashes within the city. These incidents typically occur at the intersections of major thoroughfares like F Street and Walnut Avenue with residential streets. Of the collisions, 4 were KSIs and 11 involved bicycles or pedestrians. The top PCFs were speeding, accounting for 30% of all such collisions, followed by vehicle right-of-way violations at 20% and DUIs at 13%.

Figure 4.12
Profile C Collisions
City of Livingston



PROFILE C

Side Street Stop-Controlled Intersections

Injury	KSIs	Bike	Pedestrian
61 (30%)	4 (29%)	2 (3%)	9 (15%)

Potential Engineering Countermeasures

- Extend Bike Lane to Intersection
- Prohibit Left Turn
- Road Diet
- Upgrade Uncontrolled Pedestrian Crossings
- Widen Sidewalk
- Green Conflict Striping
- Lane Narrowing
- Splitter Island
- Curb Extensions
- Rectangular Rapid Flashing Beacon
- Separated Bikeway
- Median Guardrail
- Straighten Crosswalk
- High-Visibility Crosswalk
- Intersection Reconstruction and Tightening
- All-Way Stop Control
- Partial Closure/ Diverter
- Intersection Lighting
- Pedestrian Hybrid Beacon
- Restrict Left Turns with Directional Median Openings
- Centerline Hardening
- Raised Crosswalk
- Delineators, Reflectors, and/or Object Markers
- Leading Pedestrian Interval
- Advance Yield Markings
- Advance Stop Bar
- Raised Intersection
- Speed Limit Reduction
- Remove Crossing Prohibition
- Speed Feedback Sign
- Roundabout
- Raised Median
- Remove Obstructions For Sightlines
- Restripe Crosswalk
- Striping Through Intersection
- Signal
- Refuge Island
- Add Sidewalk
- Upgrade Curb Ramp
- Time-Based Turn Restriction
- Upgrade Striping
- Flashing Beacon as Advance Warning
- Yield To Pedestrians Sign
- Signal Coordination/ Green Wave
- Upgrade Intersection Pavement Markings
- Bus Stop Relocation/ Enhancements

PROFILE D

Excessive Roadway and Lane Widths Leading To Speeding

Injury	KSIs
17%	14%

The region's agricultural heritage has resulted in many roadways that are designed to be wide enough to accommodate larger vehicles, such as trucks and farm equipment. However, many of these design features are no longer necessary as many areas become more residential or retail-oriented in character.

Many roadways around the region feature more vehicle travel lanes than their demand necessitates, which can influence driver behavior towards higher speeds. Moreover, many of the region's roadways feature travel lanes that are wider (often significantly so) than the maximum of 11ft recommended by Caltrans, which is another major contributor to speeding behavior. High speeds on roadways not only pose risks for vehicles, but also make them less comfortable to walk or ride along and to cross for bicyclists and pedestrians.

Speeding is a major contributor to injury collisions in the region. It is cited as the primary collision factor for nearly a quarter of all injury collisions in the study area, as well as 14% of all KSI collisions. It is also important to note that speeding can also be a factor in other collisions where it is not cited as the primary collision factor, and that the number of speeding-related collisions in the region is likely higher.

Potential Engineering Countermeasures

Bike Lane	Raised Crosswalk	Add Sidewalk	Extend Pedestrian Crossing Time	Speed Legends on Pavement at Neighborhood Entries
Extend Bike Lane to Intersection	Raised Intersection	Curb Extensions	Extend Yellow and All Red Time	Neighborhood Traffic Circle
Green Conflict Striping	Refuge Island	High-Visibility Crosswalk	Shorten Cycle Length	Remove Obstructions For Sightlines
Separated Bikeway	Road Diet	Pedestrian Hybrid Beacon	Advance Stop Bar	Signal Coordination/ Green Wave
Rectangular Rapid Flashing Beacon	Improved Pavement Friction	Remove Crossing Prohibition	Advance Yield Markings	Speed Hump or Speed Table
Improved Pavement Friction	Partial Closure/ Diverter	Restripe Crosswalk	Curve Advance Warning Sign	Intersection Reconstruction and Tightening
Safety Edge	Speed Limit Reduction	Widen Sidewalk	Speed Feedback Sign	Delineators, Reflectors, and/or Object Markers
Lane Narrowing	Back-In Angled Parking			

City of Livingston

3

Priority Locations and Project Concepts

A set of locations to prioritize safety improvements were identified based on collision history as well as alignment with collision profiles, which are summarized in the previous chapters. These locations are presented in the following table, and are intended to be addressed in the medium- to long-term, within the next 5-15 years, subject to further study, the availability of funding, and coordination with Caltrans. A project concept was developed for the locations along Main Street, whose limits extend beyond these locations to proactively address additional safety risks at surrounding locations. This concept project is presented in the following pages to demonstrate how the principles outlined in this LRSP can be implemented to address identified safety risk factors.

Location	Injury Collisions	KSI Collisions		Matching Profiles and Associated Risk Factors	On Caltrans Facility?
Campbell Blvd/ Hammatt Ave	15	1	C	The intersection is stop-controlled	Yes
			D	Intersecting roadways are high speed (posted speed limits of 40-45 MPH). The wide turn radii and slip lanes at the intersection can enable higher turning speeds. The intersection is located close to a freeway interchange.	
Campbell Blvd/ Main St	11	1	D	Campbell Blvd is high-speed (posted speed limit of 45 MPH), while Main St has a wide cross-section (5 lanes) on the northern leg	No
Main St/ Davis St	9	0	D	Main St is wide (5 lanes), and high-speed (posted speed limit of 35 MPH) in context of the surrounding land uses	No

MAIN STREET

from Campbell Boulevard to Olive Avenue

Collision Profiles
C D

On HIN?
Yes

Collision History

- 17 all collisions
- 0 bike collisions
- 3 pedestrian collisions
- 1 KSI collisions

SWAN ST TO OLIVE AVE

Install **separated bike lane** or **multi-use path.** Install and/or widen **sidewalk.** At intersections, install **ADA compliant curbs**, **pedestrian refuge islands**, and **lighting**.

MAIN ST/CAMPBELL BLVD

Install **roundabout**

MAIN ST/SWAN ST

Install **high visibility crosswalks**, **advance stop bars**, and **roundabout**

CAMPBELL BLVD TO SWAN ST

Road diet to one lane in each direction with a center left turn lane **widen the sidewalk** throughout the segment. Improve **lighting** along the stretch.

This stretch of Main Street north of SR 99 serves as an extension of the downtown commercial area to the south of the freeway. However, unlike the stretch south of SR 99, it has not received the same pedestrian-friendly upgrades and reconfiguration, including sidewalk widenings, curb extensions at intersections, and lighting improvements. This stretch of Main Street carries two through lanes per direction and a center turn lane. It is a route for commuter traffic as well as heavy vehicles from the Foster Farms facility. The multi-lane roadway and wide turn radii along this stretch, intended to support freight traffic, has also created an environment conducive to high vehicle speeds and difficult to navigate for people walking and biking sharing the roadway.

In the short term, the corridor could be improved by targeted maintenance to address conditions that currently detracts from the pedestrian experience, including roadway rutting and overgrown plants invading sidewalk space. The existing marked crosswalk at Swan Street could be enhanced with high visibility markings and advance stop bars.

In the long term, the lighting and sidewalk improvements along the section of Main Street south of SR 99 can be used as a template and applied to this stretch as well. At the Campbell Boulevard intersection, a single lane roundabout would help manage reduce the likelihood of collisions and create a gateway, while serving traffic flow. The roundabout would be designed to be large enough to accommodate heavy freight vehicles. The increased throughput with the roundabout, especially for turning movements, can enable a simpler three-lane cross-section (one through each direction and center turn lane) from Campbell Boulevard to Swan Street. Any excess roadway width can be used to widen sidewalks, which will also reduce crossing distances across Main Street. The Swan Street intersection can also be converted to roundabout operations, similar to Campbell Boulevard.

As another long-term effort, Main Street from Swan Street to Olive Avenue can be targeted for improvement by widening the existing sidewalks or adding a separated bike lanes or multi-use path, extending the three-lane road diet through this stretch, and enhancing the existing marked crosswalks at Celia Drive and Nut Tree Road with ADA compliant curbs, pedestrian refuge islands, and additional lighting.

City of Los Banos

1

Collision Analysis

Chapter 2 of Caltrans' Local Roadway Safety Manual (LRSM) instructs safety practitioners to "consider a wide range of data sources to get an overall picture of the safety needs." To this end, this Local Roadway Safety Plan is data-driven and synthesizes findings from collison records alongside input from key stakeholders, a technical advisory group, and staff.

Collision records on roadways in Los Banos from 2015 to 2022 were investigated to describe historic collision trends and identify high-risk locations. This information acts as a primary resource for this Plan, providing the underlying data to support key analyses.

The data-driven process for the creation of this Plan includes:

- **Examination of Collision Trends**
  Review of collision statistics to evaluate when, where, and why collisions occur and who is involved.

- **Development of a High-Injury Network**
  Identification of roadways where most injury collisions are concentrated for targeted intervention.

- **Development of Collision Profiles of Emphasis**
  Identification of the most prevalent collision types and contexts based on a combination of collision factors.

- **Creation of a Countermeasure Toolbox**
  Identification of effective, nationally proven countermeasures applicable to different collision profiles.

- **Identification of Priority Project Locations**
  Identification of locations suitable for project implementation based on collision density and community verification.

The following section presents findings from the first of these stages of data analysis, identifying collision patterns and trends.

A Note on the Data Source

This analysis utilizes data on injury collisions from 2015 through 2022 available through the Transportation Injury Mapping System (TIMS) as of August 2023. TIMS reports injury collisions from the Statewide Integrated Traffic Records System (SWITRS), but excludes collisions that cause property damage only (PDO) and no injuries.

Geographically, the data includes all collisions that occur within the City of Los Banos. The data includes collisions on all roadways, including State highways and other Caltrans-maintained roadways as well as privately-maintained roadways.

While collision databases like TIMS remain the best source of collision data, they have been found to have certain reporting biases, including:

- Collisions involving people walking, on bicycles, or on motorcycles are less likely to be reported than collisions with people driving
- Property damage only collisions are less likely to be reported compared to more severe collisions
- Younger victims are less likely to report collisions
- Alcohol-involved collisions may be underreported

Race, income, immigration status, and English proficiency may also impact reporting, but there is limited research on these factors.

Figure 5.1
Injury Collisions by Year, 2015-2022

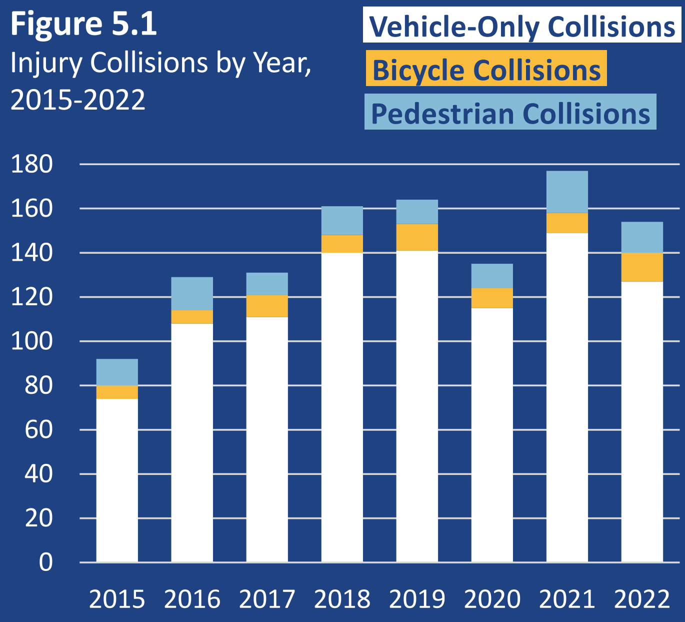


Figure 5.2
KSI Collisions by Year, 2015-2022

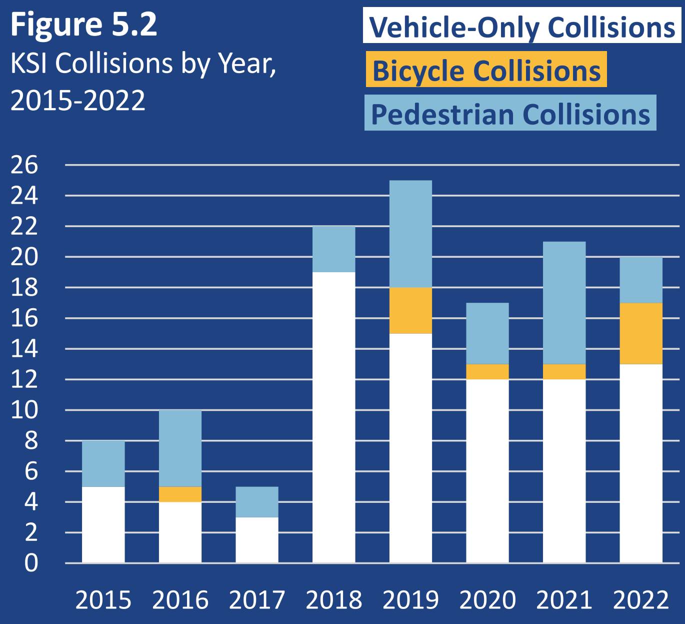
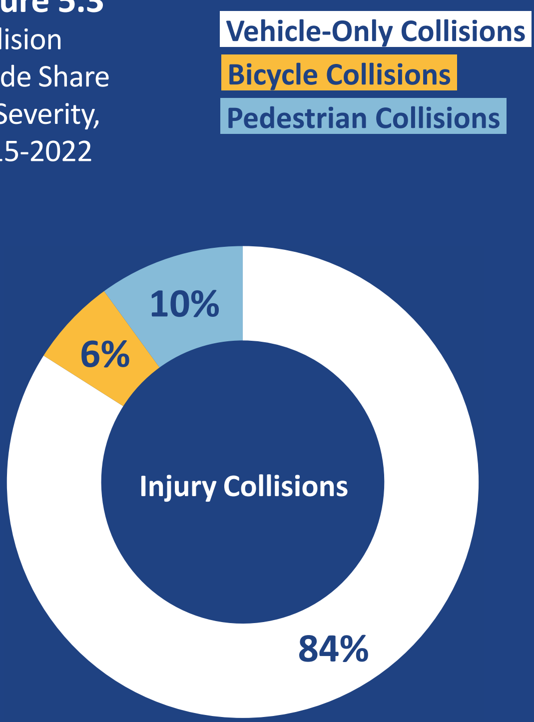
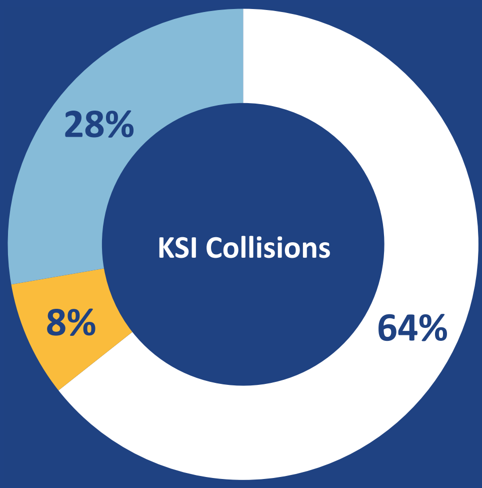


Figure 5.3
Collision Mode Share by Severity, 2015-2022





Collisions by Year and by Mode

The table below provides a summary of the number of collisions in Los Banos by mode and severity within the dataset, which includes all collisions that resulted in injury or fatality. From 2015 to 2022, there were a total of 1,143 injury collisions, of which 128 were KSI collisions: collisions where someone was killed or severely injured.

Collision Summary	Total	KSI
Total	1,143	128
Bicycle	73	10
Pedestrian	105	35

Figures 5.1 and **5.2** show the temporal trends of collisions in Los Banos. As shown, the annual number of injury collisions in Los Banos has been on a general upward trajectory through the study period. The number of KSI collisions per year over the study period saw a significant increase in 2018, and has plateaued in the years since.

People walking or biking are particularly vulnerable in the event of a collision, as they lack the protection afforded to them by being inside a motor vehicle. As a result, collisions involving people walking or biking are more likely to result in injury and fatality. As shown in **Figure 5.3**, people walking and biking are involved in 16% of all injury collisions, but 36% of KSI collisions.

Collisions by Collision Type

Figure 5.4 illustrates the share of collisions in the study period that fall into each collision type. As shown, the most common collision types across all injury collisions in Los Banos are broadside collisions and rear-end collisions at 32% each. However, KSI collisions show a different breakdown. Vehicle-pedestrian collisions are the most common, at 26%, followed by broadside collisions at 23%, and rear-end collisions at 14%.

This illustrates the disproportionate impact in severity that collision type can play. For example, while rear-ends account for a large share of overall collisions, they are generally less likely to result in fatalities and severe injuries. By contrast, broadsides are more represented amongst KSI collisions, as they typically involve more kinetic energy and result in more serious collision outcomes.

This also further illustrates the significantly disproportionate impact people walking face in the event of a collision, as vehicle-pedestrian collisions are significantly overrepresented in the KSI collision record.

Collisions by Primary Collision Factor

Figure 5.5 illustrates the share of collisions in the study period that are classified under each Primary Collision Factor (PCF). PCFs are cited by the responding officer and are based on that person's judgment of what contributed to the collision. It is important to note that PCFs do not include contextual information about the design aspects of the collision location that could have been primary or secondary contributors to a collision.

In Los Banos, the most common PCFs are Unsafe Speed at 28% of collisions, Vehicle Right of Way Violations at 25%, and Improper Turning at 15%.

The most common PCFs for KSI collisions are Pedestrian-Related at 24%, Improper Turning and Unsafe Speed at 16% each, and Vehicle

Figure 5.4

Share of Injury Collisions by Collision Type, 2015-2022

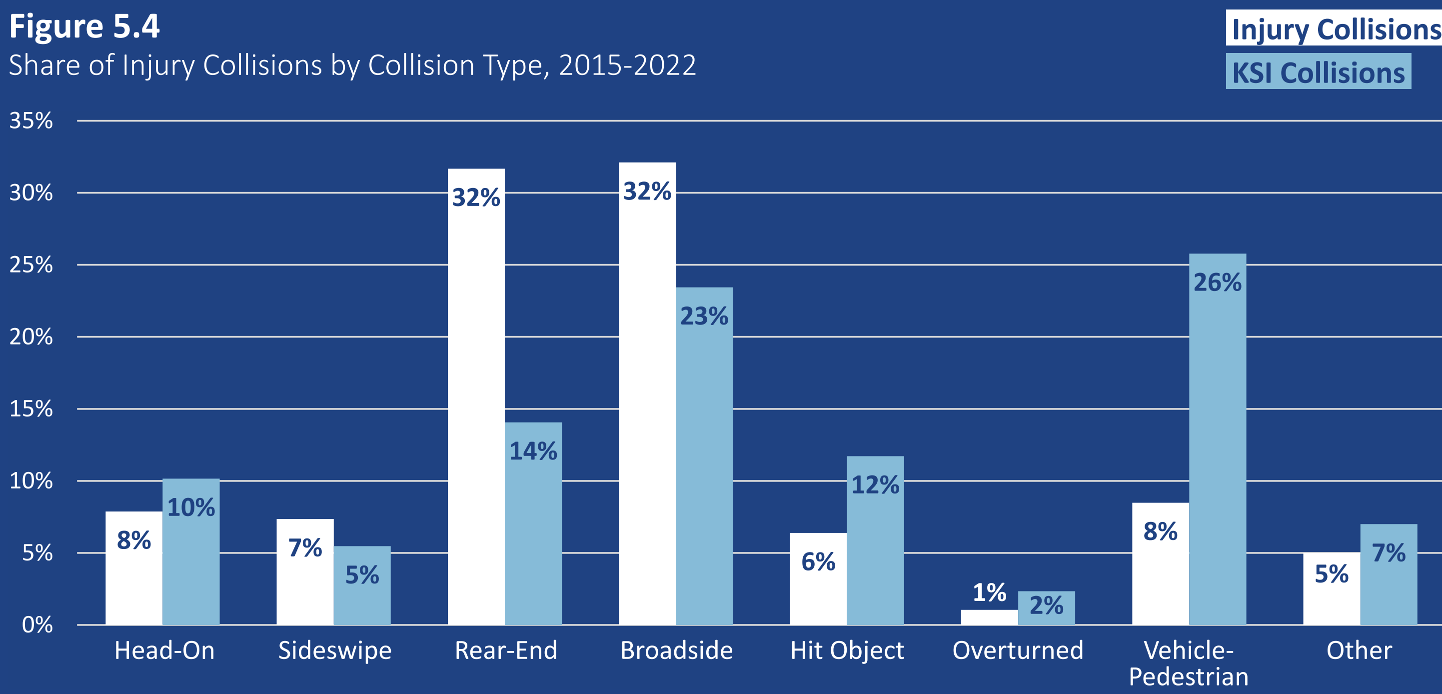
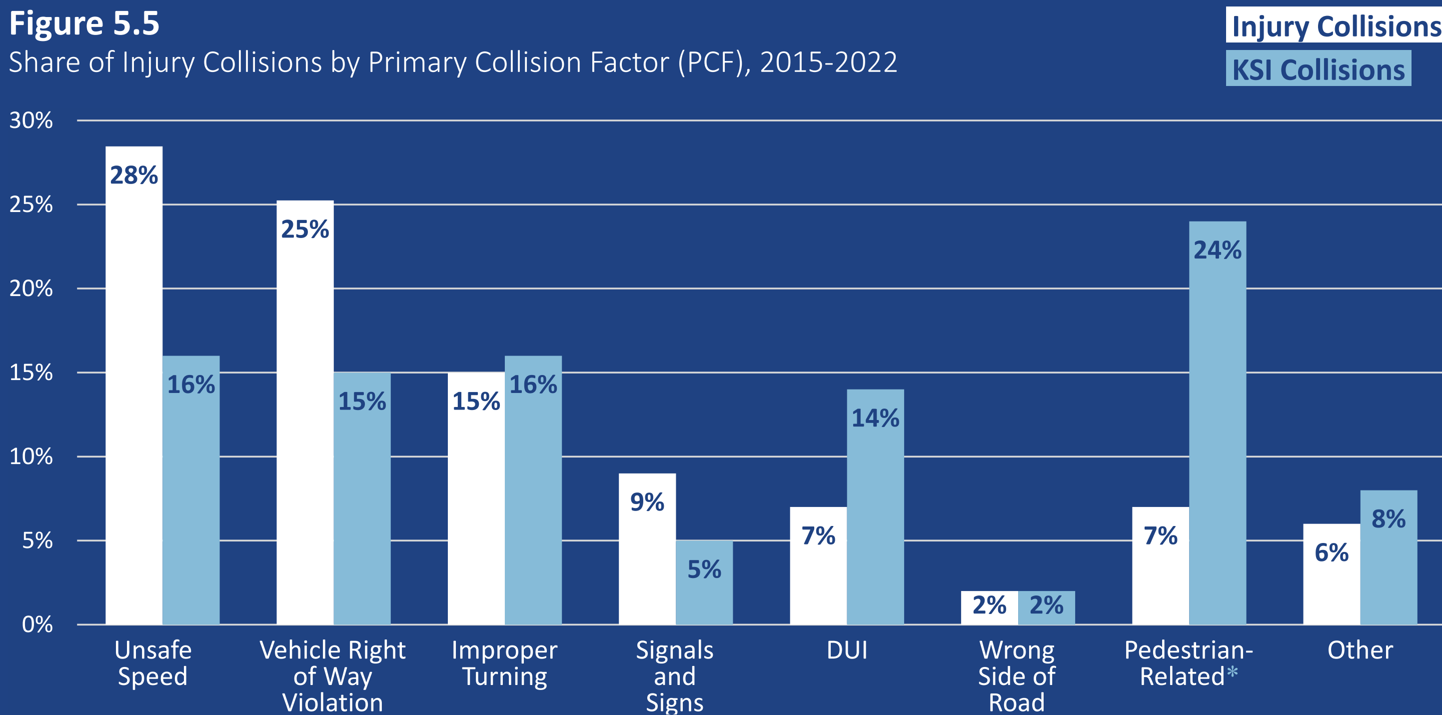


Figure 5.5

Share of Injury Collisions by Primary Collision Factor (PCF), 2015-2022



* **Note on Pedestrian PCF Categories**

The "Pedestrian-Related" category shown here combines two PCF categories: "Pedestrian Violation" and "Pedestrian Right of Way Violation." The former indicates that the pedestrian violated a rule of the road, such as crossing outside of a crosswalk, where the latter indicates the driver of a vehicle violated the pedestrian's right of way. The Pedestrian Violation category may be overrepresented due to a lack of clear information related to collision circumstances, and the increased likelihood that the pedestrian party may be unable to provide their side of the incident at the time of the collision. For this reason, we have elected to not show the distinction in these tallies, and instead show all pedestrian-related collisions in one single category.

Collisions by Lighting Conditions

Figure 5.6 illustrates the share of collisions in the study period that occur at night*****. As shown, nighttime collisions are overrepresented among KSI collisions. While 26% of all injury collisions occurred at night where streetlights were present and a further 4% occurred where streetlights were not present or present but not functioning, those percentages jump to 39% and 10% for KSI collisions, respectively.

Collisions that occur during nighttime also disproportionately affect people walking. 39% of pedestrian injury collisions occurred at night where streetlights were present and a further 10% occurred where streetlights were not present or present but not functioning, the same proportions as overall KSI collisions. The percentages for pedestrian KSI collisions are higher still, at 60% and 20%, respectively.

The concern around lighting is especially relevant given Los Banos' small-town context and rural surroundings. There continues to be locations without functional street lighting in the City, and collisions at those locations are well-represented in the KSI collision record. Even where streetlights were present, the quality of the lighting can vary widely. Factors that may contribute to the quality of streetlights include lights being insufficiently bright, placed too widely apart, or poor quality of lighting for people walking on the sidewalk, as streetlights are often designed primarily for vehicles in travel lanes.

***** Nighttime collisions are defined as those collisions whose lighting information is not reported as "daylight".

Driving Under the Influence (DUI)

Figure 5.7 illustrates the share of collisions of various types in the study period that involved at least one party driving under the influence (DUI). Drugs or alcohol increase the likelihood of increased crash severity. As shown, the number of DUI collisions are overrepresented amongst KSI collisions. While 8% of all injury collisions involve drugs or alcohol in Los Banos, 19% of KSI collisions do.

These percentages reflect the portion of collisions involving one or more parties determined to be under the influence of drugs or alcohol. Driving under the influence may not always be listed as the primary collision factor even if a driver is found to be under the influence.

Figure 5.6
Nighttime Collisions, 2015-2022

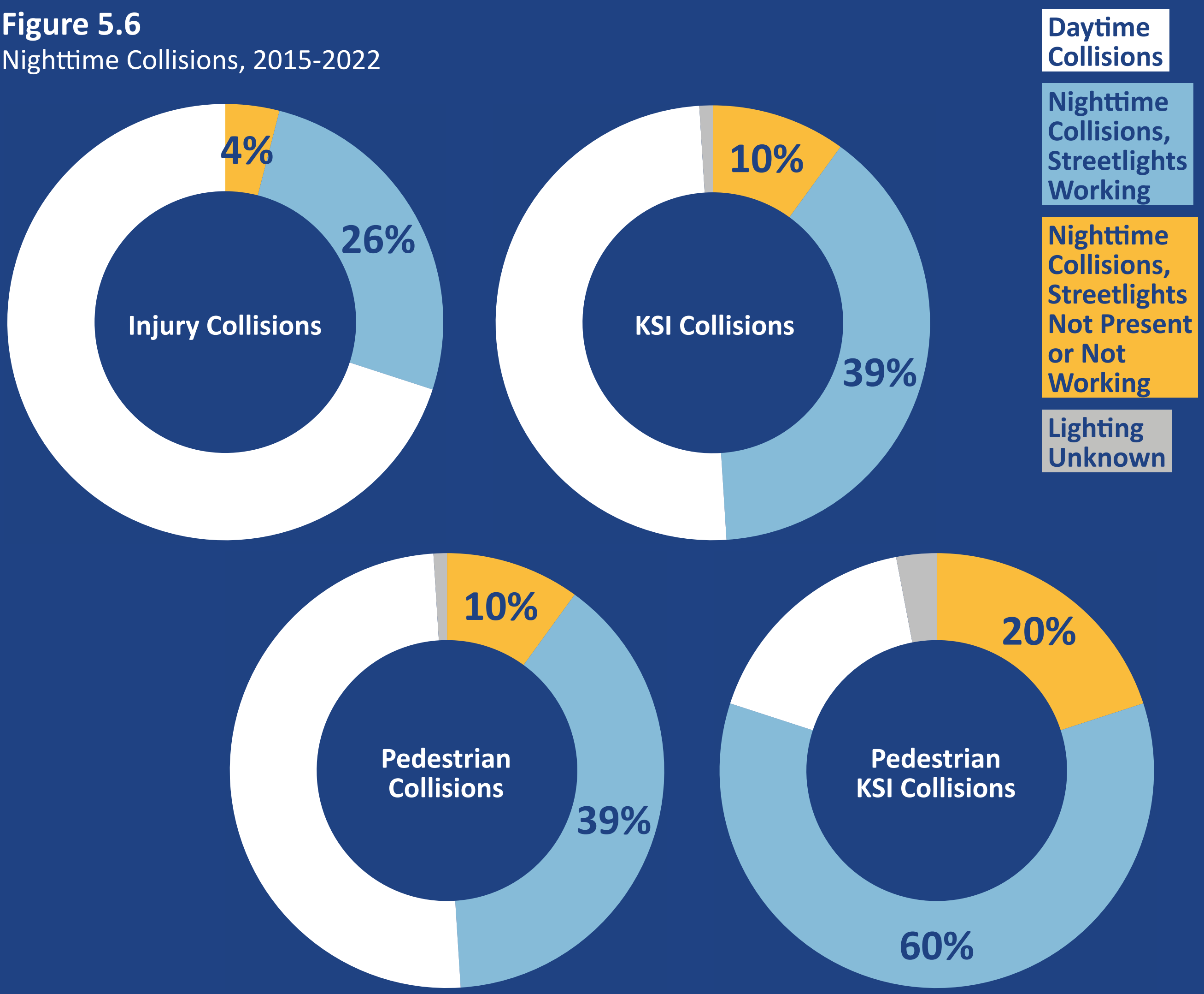
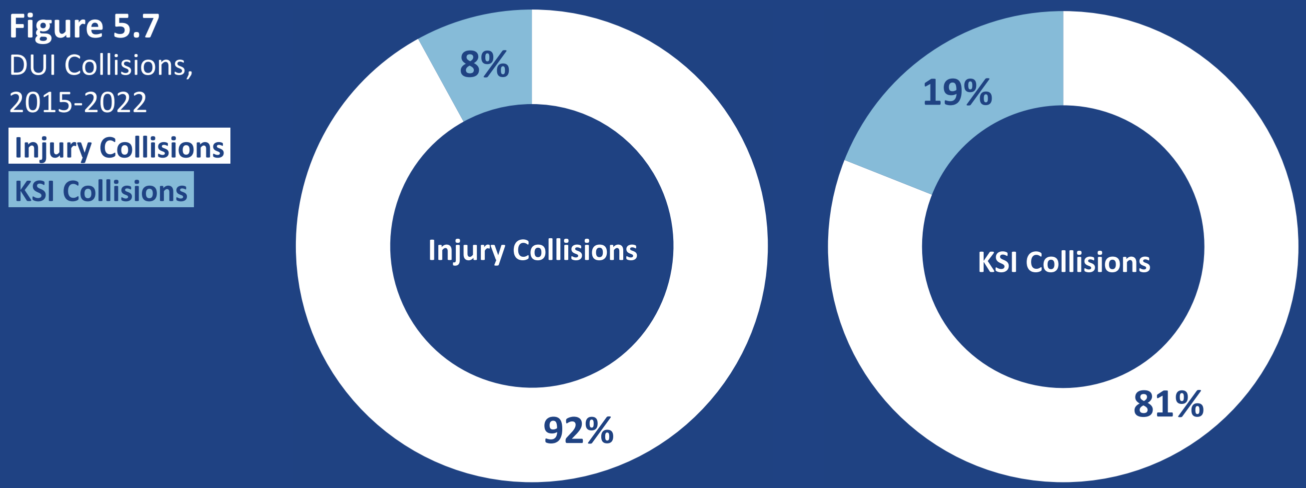


Figure 5.7
DUI Collisions, 2015-2022



Collisions by Pedestrian Location

Figure 5.8 illustrates for pedestrian-involved collisions the location of the pedestrian(s) at the time of collision. The most common location for pedestrians at the time of collision is crossing the street, whether at a marked crosswalk (41%) or not (30%). This is followed by walking in or along the shoulder of the roadway, at 18%. These percentages are mirrored for pedestrian KSI collisions, with crossing not at a crosswalk being the most common location at 43%, followed by walking in or along the shoulder of the roadway at 26%, and crossing at crosswalks at 23%. Furthermore, 8% of pedestrian-involved collisions and 6% of pedestrian-involved KSI collisions occurred with the pedestrian(s) not on the roadway at all.

This data points to the importance of ensuring that existing crosswalks are safe and properly protect users, and that pedestrian desire lines currently unserved by sidewalks and existing crosswalks are properly served.

High Injury Network

From the collision data, a High Injury Network was developed to identify the roadways in Los Banos with the highest levels of injury collisions, as shown on **Figure 5.9**.

The High Injury Network consists of just 8% of the roadway network in Los Banos, but is the site of the vast majority of injury collisions. 1,143 collisions occurred during the study period. Of these, 763, or 67%, were located along the network. 128 of these study period collisions were KSIs, of which 85, or 66%, were located along the network.

Figure 5.8
Share of Pedestrian-Involved Injury Collisions by Pedestrian Location at Time of Collision, 2015-2022

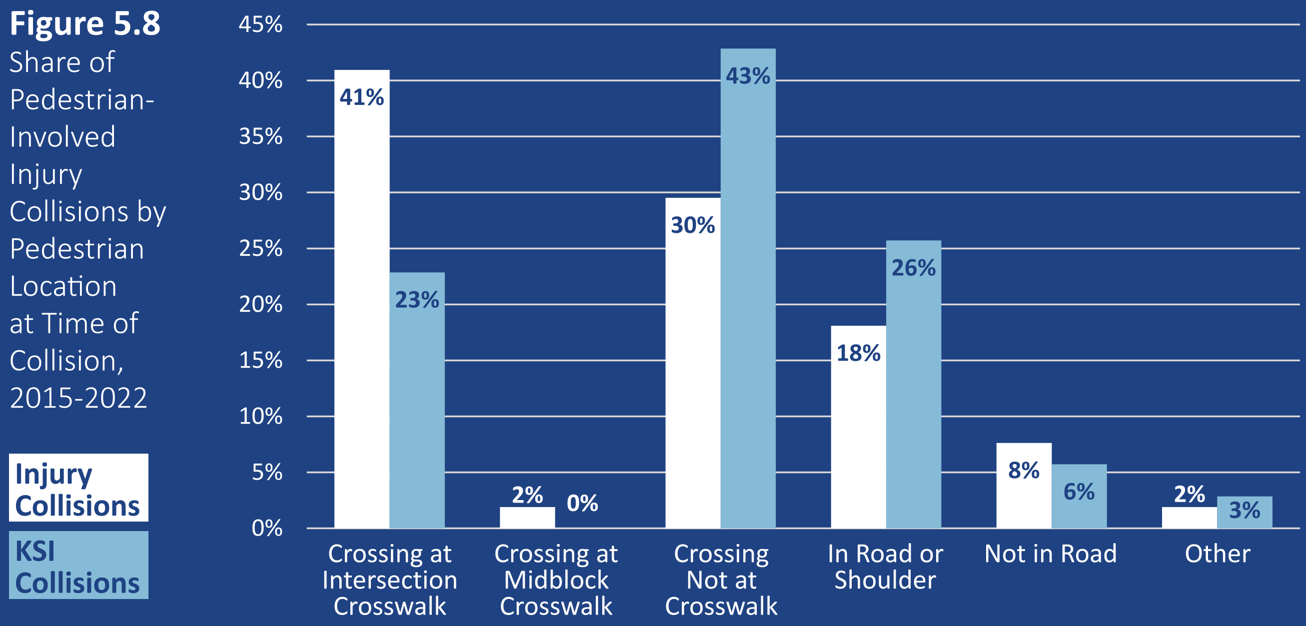
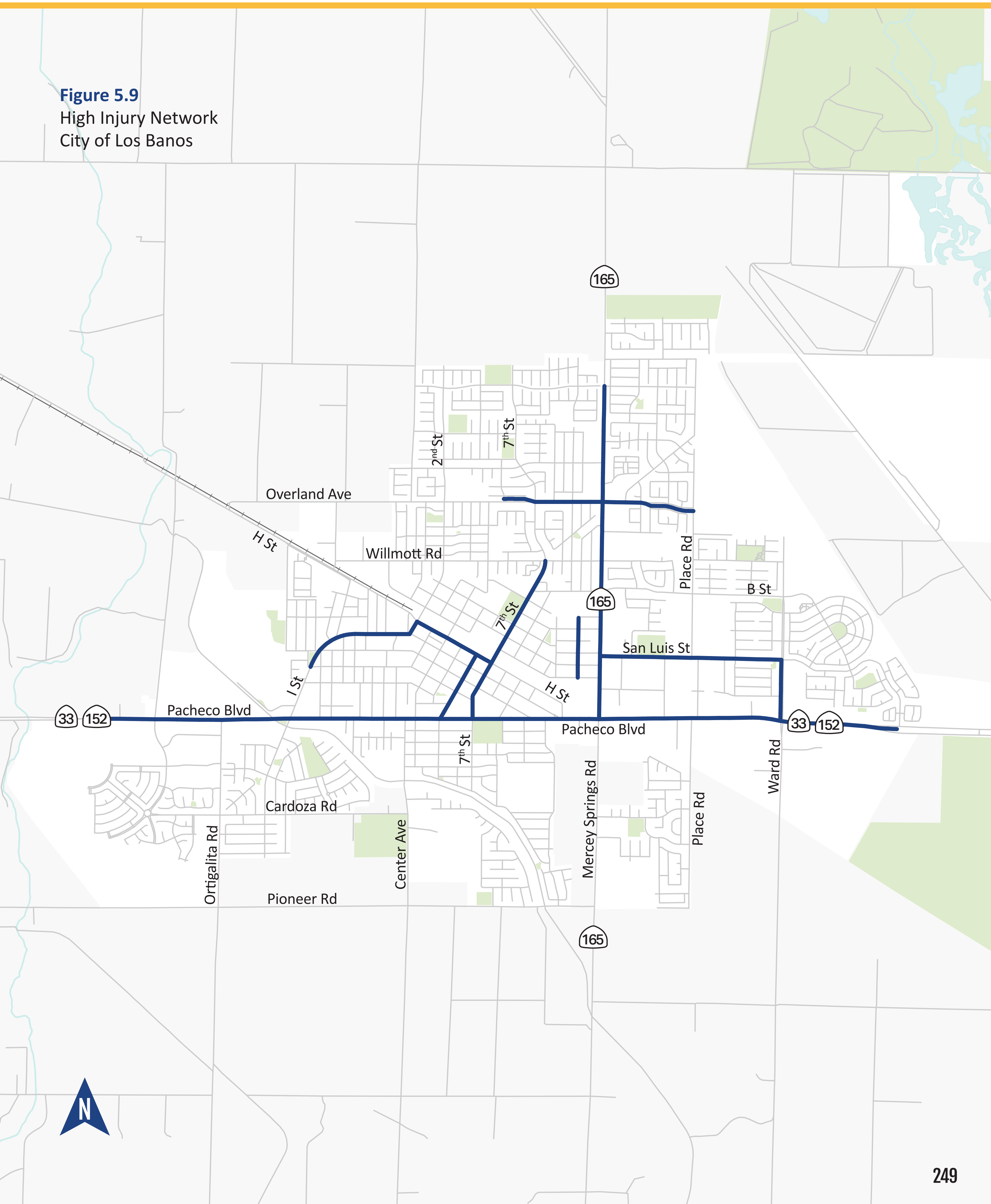


Figure 5.9
High Injury Network
City of Los Banos



Equity Considerations

Both Merced County and the larger Central Valley region have historically been subject to underinvestment and marginalization. As a result, most of the region, including most areas within the six cities covered by this Plan, are identified as disadvantaged by the various criteria used by the state and Federal governments.

The federal government has introduced a number of tools used to identify disadvantaged communities. In particular, two of these, the Climate and Economic Justice Screening Tool (CEJST) and the Equitable Transportation Communities (ETC) Explorer, are of particular note, as they see extensive use by the United States Department of Transportation (USDOT) in delineating disadvantaged areas, especially as part of grant funding opportunities.

Climate and Economic Justice Screening Tool (CEJST)

The Climate and Economic Justice Screening Tool (CEJST) is maintained by the Federal Council on Environmental Quality and used by many Federal programs as a means of identifying disadvantaged communities. Census tracts are screened based on a variety of factors, including climate, energy, health, housing, transportation, legacy pollution, waste, and workforce development.

Equitable Transportation Communities (ETC) Explorer

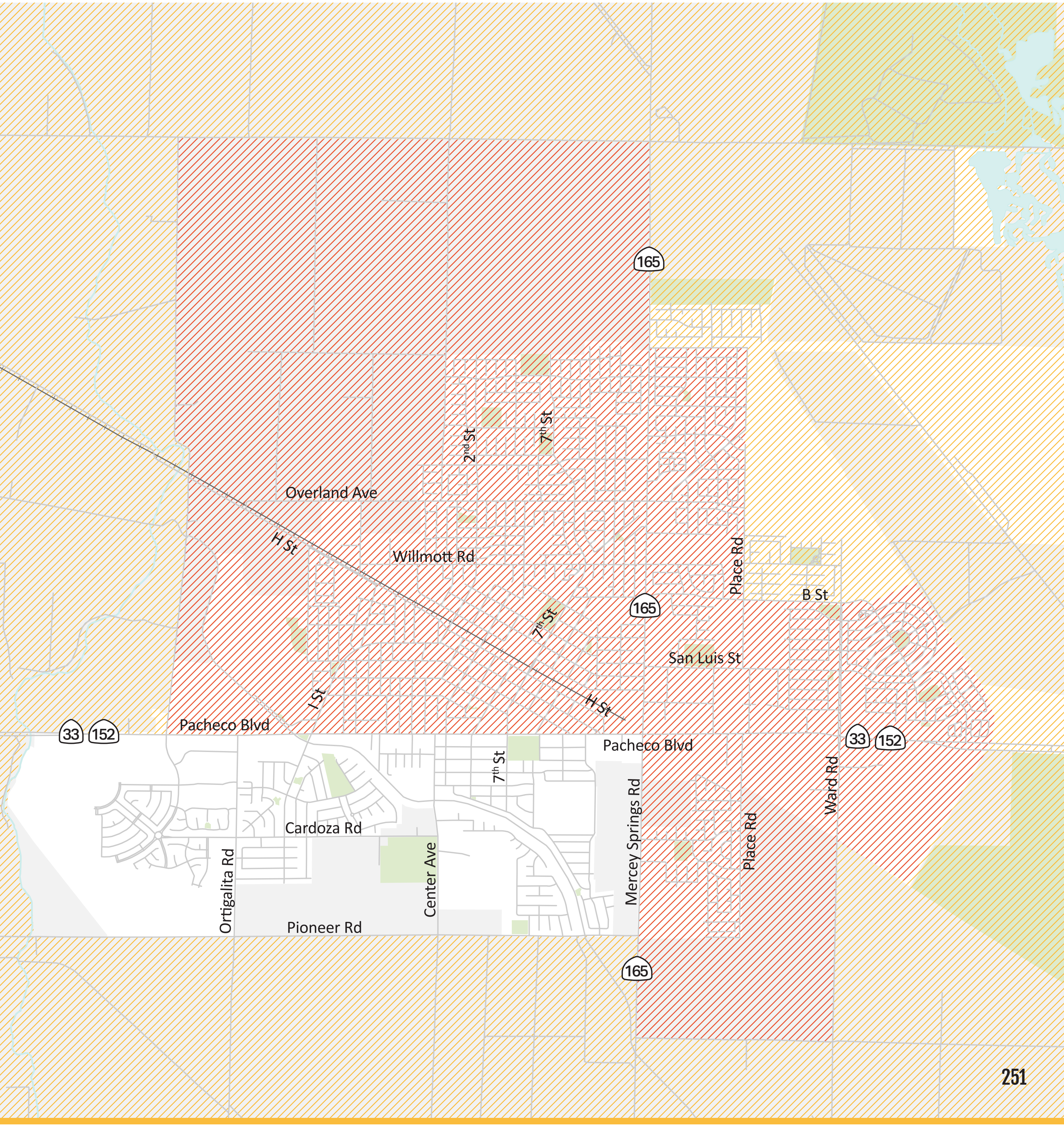
USDOT created Equitable Transportation Communities (ETC) Explorer as part of its Justice40 initiative to complement the CEJST by providing additional insight into transportation factors specifically. The ETC Explorer is meant to capture the cumulative burden of underinvestment in transportation in a community.

Figure 5.10 shows areas in Los Banos identified as disadvantaged under these two criterion. As shown, almost the entirety of Los Banos, as well as all surrounding unincorporated areas, is identified as disadvantaged by the CEJST, with the singular exception of an area in the southwest of the city, situated west of Mercey Springs Road, between Pacheco Boulevard and Pioneer Road. In addition, almost all of the built-up areas of Los Banos outside of the aforementioned area between Pacheco Boulevard and Pioneer Road are identified as disadvantaged by the ETC Explorer as well.

The vast majority of collisions in Los Banos occur within these disadvantaged areas, including 96% of all injury collisions and 98% of all KSI collisions.

Figure 5.10
CEJST and ETC Explorer Results
City of Los Banos

identified as disadvantaged by CEJST
identified as disadvantaged by ETC Explorer
identified as disadvantaged by both



City of Los Banos

2

Collision Profiles

Through a systemic analysis of collision records, collision profiles were identified to represent the most significant patterns behind injury collisions - and especially KSI collisions - in the region. Seven such profiles, identified with the letters "A" through "G" were identified across the region, with each one applicable to one, several, or all of the communities covered by this LRSP.

Los Banos is covered by six of these profiles:

A. Driving Under The Influence

B. Dark Conditions

C. Side Street Stop-Controlled Intersections

D. Excessive Roadway and Lane Widths Leading To Speeding

E. Driveway Clusters on Arterials

F. Non-Standard Intersection Geometry

The following pages contain cutsheets that present each collision profile, along with the following information:

- Description and associated information about each profile
- Number of collisions associated, including number of KSI collisions among those (note that profiles are not mutually exclusive; collisions can fall under multiple profiles, and totals will exceed 100%)
- A map of collision locations

Engineering countermeasures that can potentially address these collisions are also presented with each profile. The full suite of engineering countermeasures can be found in **Chapter 3** of **Volume I**.

PROFILE A

Driving Under The Influence

Injury	KSIs		
105 (9%)	26 (20%)	3 (3%)	15 (14%)

Driving under the influence is a significant contributor to injury collisions, especially and disproportionately to collisions that cause someone to be killed or severely injured (KSI).

DUIs are clustered around the weekend and around nighttime. Across the region, 54% of all DUI collisions occurred on Friday, Saturday, and Sunday, and 65% occurred in the dark.

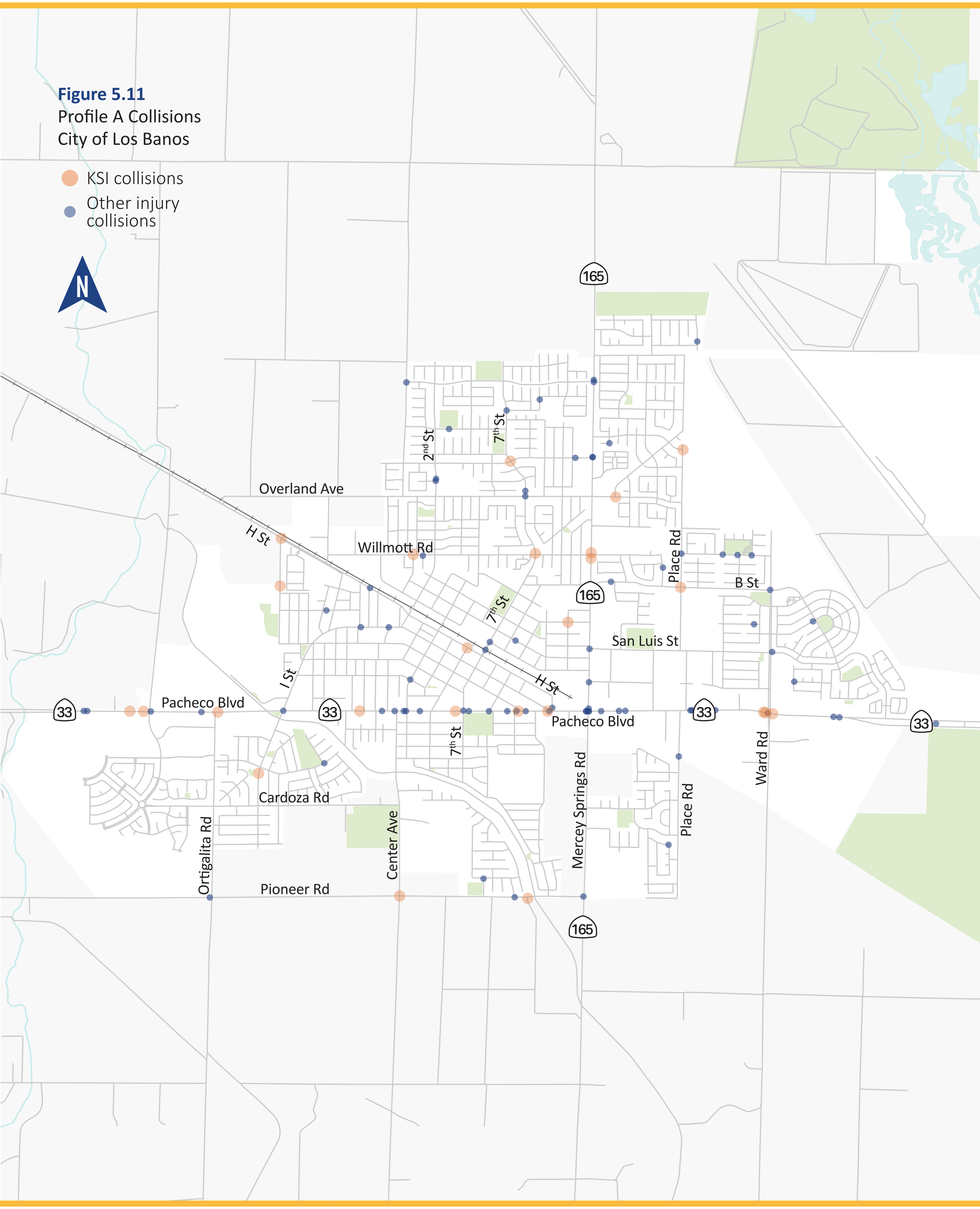
However, it is important to note that a substantial number of DUI collisions occurred outside these time periods as well.

Non-engineering interventions will need to be the primary means of addressing these challenges, but may be supplemented with the listed engineering countermeasures that aim to make roadway designs more forgiving in general.

Potential Supplemental Engineering Countermeasures

- Separated Bikeway
- Safety Edge
- Raised Median
- Red Light Cameras
- Add Sidewalk
- Guardrail
- Delineators, Reflectors, and/or Object Markers
- Speed Sensitive Rest in Red Signal
- Rumble Strips
- Roundabout
- Speed Limit Reduction
- Curve Advance Warning Sign
- Improved Pavement Friction
- Intersection Reconstruction and Tightening
- Remove Obstructions For Sightlines
- Chevron Signs on Horizontal Curves
- Speed Feedback Sign
- LED-Enhanced Sign
- Upgrade Striping
- Signal Coordination/ Green Wave

Figure 5.11
Profile A Collisions
City of Los Banos



PROFILE B

Dark Conditions

Injury	KSIs		
339 (30%)	64 (50%)	17 (5%)	53 (16%)

A substantial number of collisions are occurring in the nighttime across the region. Based on the percentage of nighttime collisions, meaningful progress toward reducing collisions will require improvements that enhance nighttime visibility such as lighting, retroreflective signage, and sightline improvements.

Potential Engineering Countermeasures

- Separated Bikeway
- Raised Crosswalk
- Speed Limit Reduction
- Leading Pedestrian Interval
- Rumble Strips
- Raised Median
- Remove Obstructions For Sightlines
- Rectangular Rapid Flashing Beacon
- Safety Edge
- Intersection Lighting
- Add Sidewalk
- Retroreflective Tape on Signals
- Guardrail
- Segment Lighting
- High-Visibility Crosswalk
- Advance Stop Bar
- Intersection Reconstruction and Tightening
- Delineators, Reflectors, and/or Object Markers
- Pedestrian Hybrid Beacon
- Advance Yield Markings
- Chevron Signs on Horizontal Curves
- Curve Advance Warning Sign
- Upgrade Striping

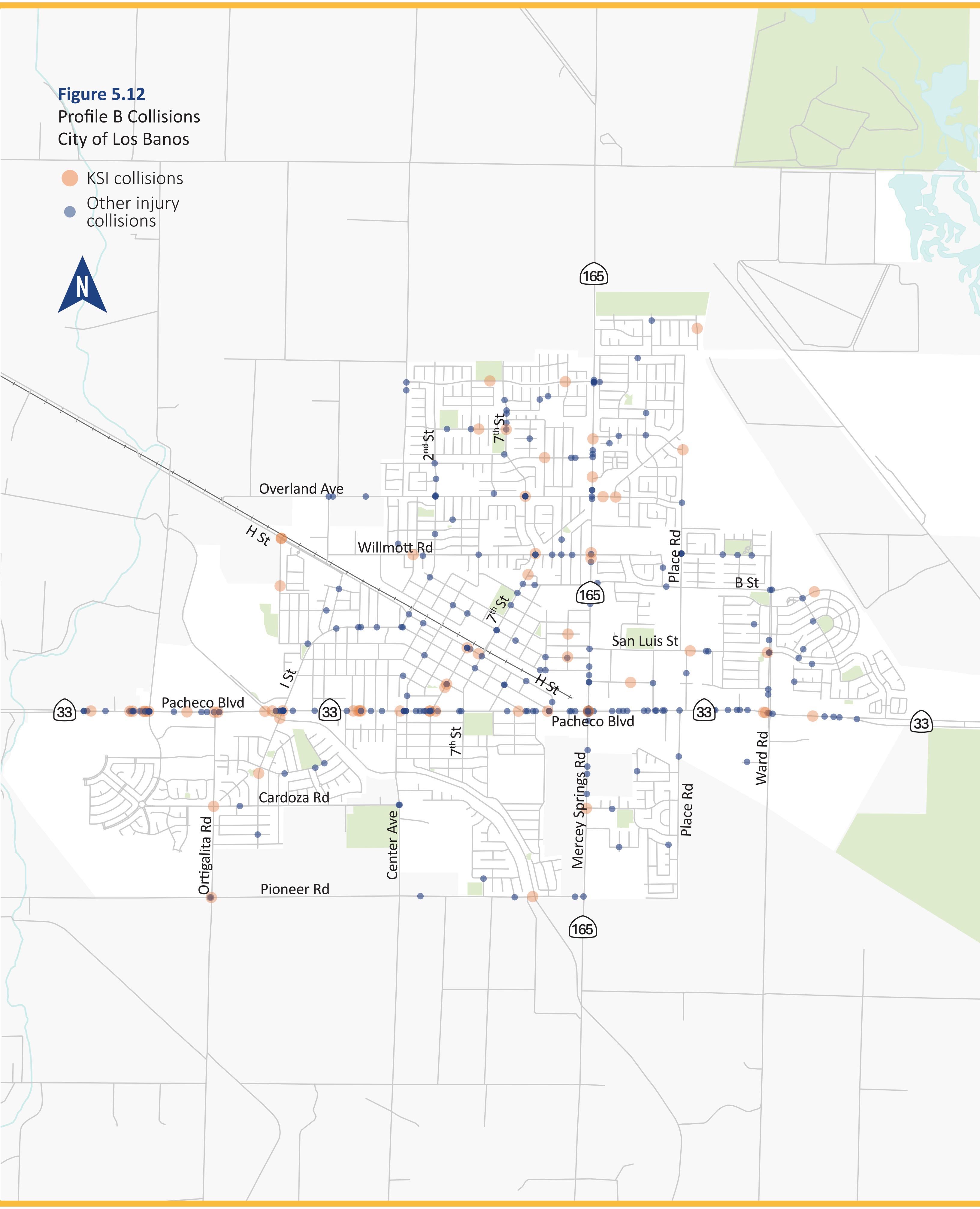


Figure 5.12
Profile B Collisions
City of Los Banos

PROFILE C

Side Street Stop-Controlled Intersections

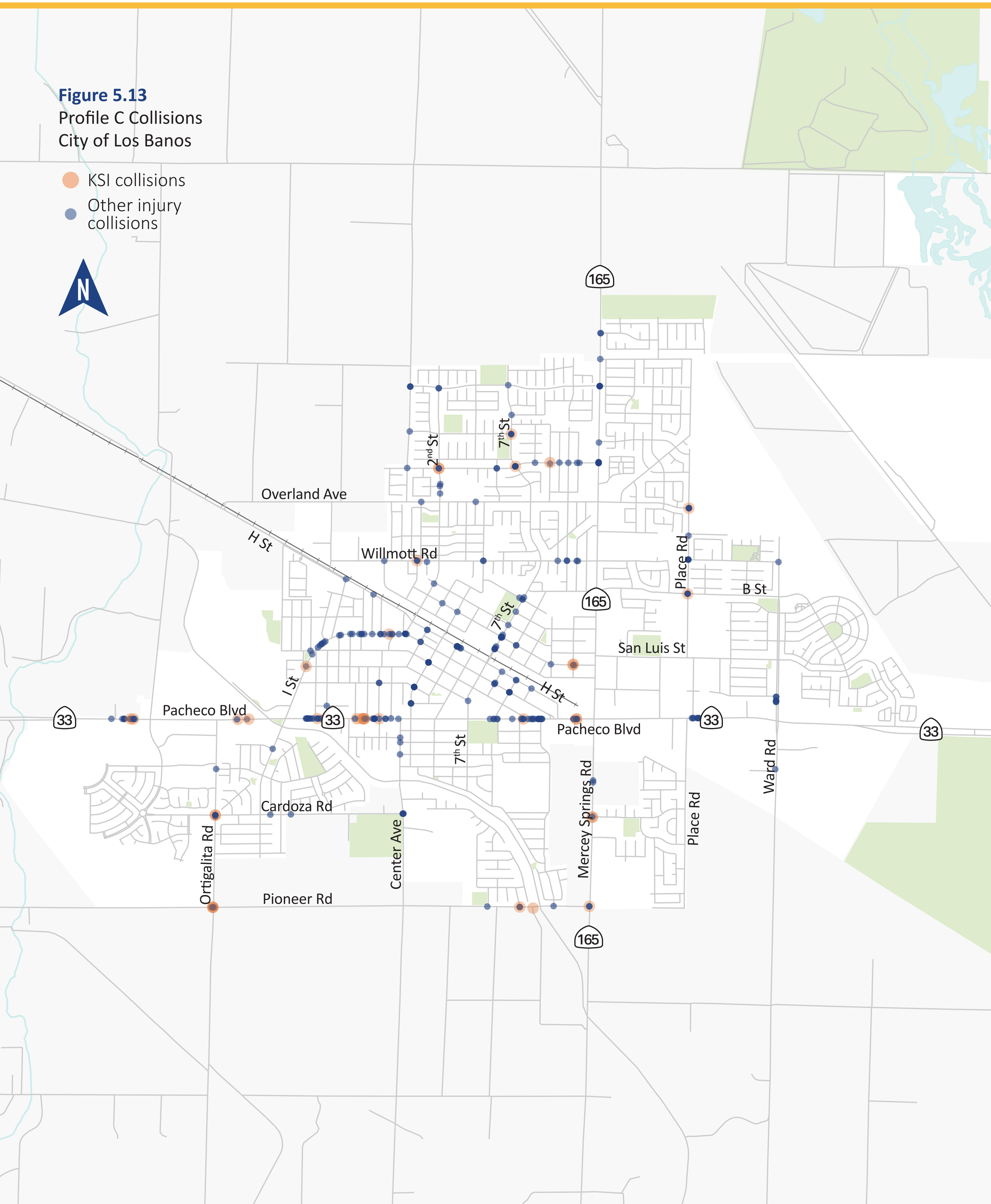
Injury	KSIs		
338 (30%)	37 (50%)	28 (8%)	30 (9%)

Similar to permissive left-turn operations, the question of who has right-of-way can be confusing for drivers in side street stop-controlled intersections. Accurately judging and using a gap in traffic can also be challenging. Similar to permissive left-turn operations, high traffic volumes, high speeds, and limited visibility due to roadway width on the major crossing are factors that also contribute to risk at these locations.

Side street stop-controlled intersections often are accompanied by either an uncontrolled crossing of the major roadway or no crossing altogether. A long series of side street stop-controlled intersections will thus likely create long stretches of the major roadway without protected crossings for people walking, biking or otherwise needing to cross the major street.

Los Banos saw a total of 338 collisions at side-street stop-controlled intersections, accounting for nearly 30% of all injury crashes within the city. Concentrations of such incidents were at major arteries such as I Street and Pacheco Boulevard, but also many of the smaller crosstown collector routes in the city. Of the collisions, 37 were KSIs and 58 involved bicycles or pedestrians. The top PCFs were vehicle right-of-way violations, accounting for 39% of all such collisions, followed by speeding at 21% and improper turning at 12%.

Figure 5.13
Profile C Collisions
City of Los Banos



PROFILE C

Side Street Stop-Controlled Intersections

Injury	KSIs	Bicyclists	Pedestrians
338 (30%)	37 (50%)	28 (8%)	30 (9%)

Potential Engineering Countermeasures

Extend Bike Lane to Intersection	Prohibit Left Turn	Road Diet	Upgrade Uncontrolled Pedestrian Crossings	Widen Sidewalk
Green Conflict Striping	Lane Narrowing	Splitter Island	Curb Extensions	Rectangular Rapid Flashing Beacon
Separated Bikeway	Median Guardrail	Straighten Crosswalk	High-Visibility Crosswalk	Intersection Reconstruction and Tightening
All-Way Stop Control	Partial Closure/ Diverter	Intersection Lighting	Pedestrian Hybrid Beacon	Restrict Left Turns with Directional Median Openings
Centerline Hardening	Raised Crosswalk	Delineators, Reflectors, and/or Object Markers	Leading Pedestrian Interval	Advance Yield Markings
Advance Stop Bar	Raised Intersection	Speed Limit Reduction	Remove Crossing Prohibition	Speed Feedback Sign
Roundabout	Raised Median	Remove Obstructions For Sightlines	Restripe Crosswalk	Striping Through Intersection
Signal	Refuge Island	Add Sidewalk	Upgrade Curb Ramp	Time-Based Turn Restriction
Upgrade Striping	Flashing Beacon as Advance Warning	Yield To Pedestrians Sign	Signal Coordination/ Green Wave	Upgrade Intersection Pavement Markings
Bus Stop Relocation/ Enhancements				

PROFILE D

Excessive Roadway and Lane Widths Leading To Speeding

Injury	KSIs
28%	16%

The region's agricultural heritage has resulted in many roadways that are designed to be wide enough to accommodate larger vehicles, such as trucks and farm equipment. However, many of these design features are no longer necessary as many areas become more residential or retail-oriented in character.

Many roadways around the region feature more vehicle travel lanes than their demand necessitates, which can influence driver behavior towards higher speeds. Moreover, many of the region's roadways feature travel lanes that are wider (often significantly so) than the maximum of 11ft recommended by Caltrans, which is another major contributor to speeding behavior. High speeds on roadways not only pose risks for vehicles, but also make them less comfortable to walk or ride along and to cross for bicyclists and pedestrians.

Speeding is a major contributor to injury collisions in the region. It is cited as the primary collision factor for nearly a quarter of all injury collisions in the study area, as well as 14% of all KSI collisions. It is also important to note that speeding can also be a factor in other collisions where it is not cited as the primary collision factor, and that the number of speeding-related collisions in the region is likely higher.

Potential Engineering Countermeasures

Bike Lane	Raised Crosswalk	Add Sidewalk	Extend Pedestrian Crossing Time	Speed Legends on Pavement at Neighborhood Entries
Extend Bike Lane to Intersection	Raised Intersection	Curb Extensions	Extend Yellow and All Red Time	Neighborhood Traffic Circle
Green Conflict Striping	Refuge Island	High-Visibility Crosswalk	Shorten Cycle Length	Remove Obstructions For Sightlines
Separated Bikeway	Road Diet	Pedestrian Hybrid Beacon	Advance Stop Bar	Signal Coordination/ Green Wave
Rectangular Rapid Flashing Beacon	Improved Pavement Friction	Remove Crossing Prohibition	Advance Yield Markings	Speed Hump or Speed Table
Improved Pavement Friction	Partial Closure/ Diverter	Restripe Crosswalk	Curve Advance Warning Sign	Intersection Reconstruction and Tightening
Safety Edge	Speed Limit Reduction	Widen Sidewalk	Speed Feedback Sign	Delineators, Reflectors, and/or Object Markers
Lane Narrowing	Back-In Angled Parking			

PROFILE E

Driveway Clusters on Arterials

Injury	KSIs		
172 (15%)	18 (14%)	2 (1%)	7 (4%)

Los Banos features many instances of the land use typology of suburban, parking-fronted shopping centers along high-speed, multi-lane arterials that feature frequent driveway ingresses and egresses. Frequent interactions between fast-moving arterial traffic with slow traffic turning from or to driveways is a significant risk factor, with left turns to or from such driveways being particularly conflict-prone. Higher densities of these driveways add additional complexity and risk.

These contexts are particularly problematic for people walking and biking, who must also interact with frequent driveway crossings while traveling on sidewalks or bike facilities in such areas. These areas are also likely to feature higher volumes of walking and biking, as they are often significant destinations featuring essential retail and services.

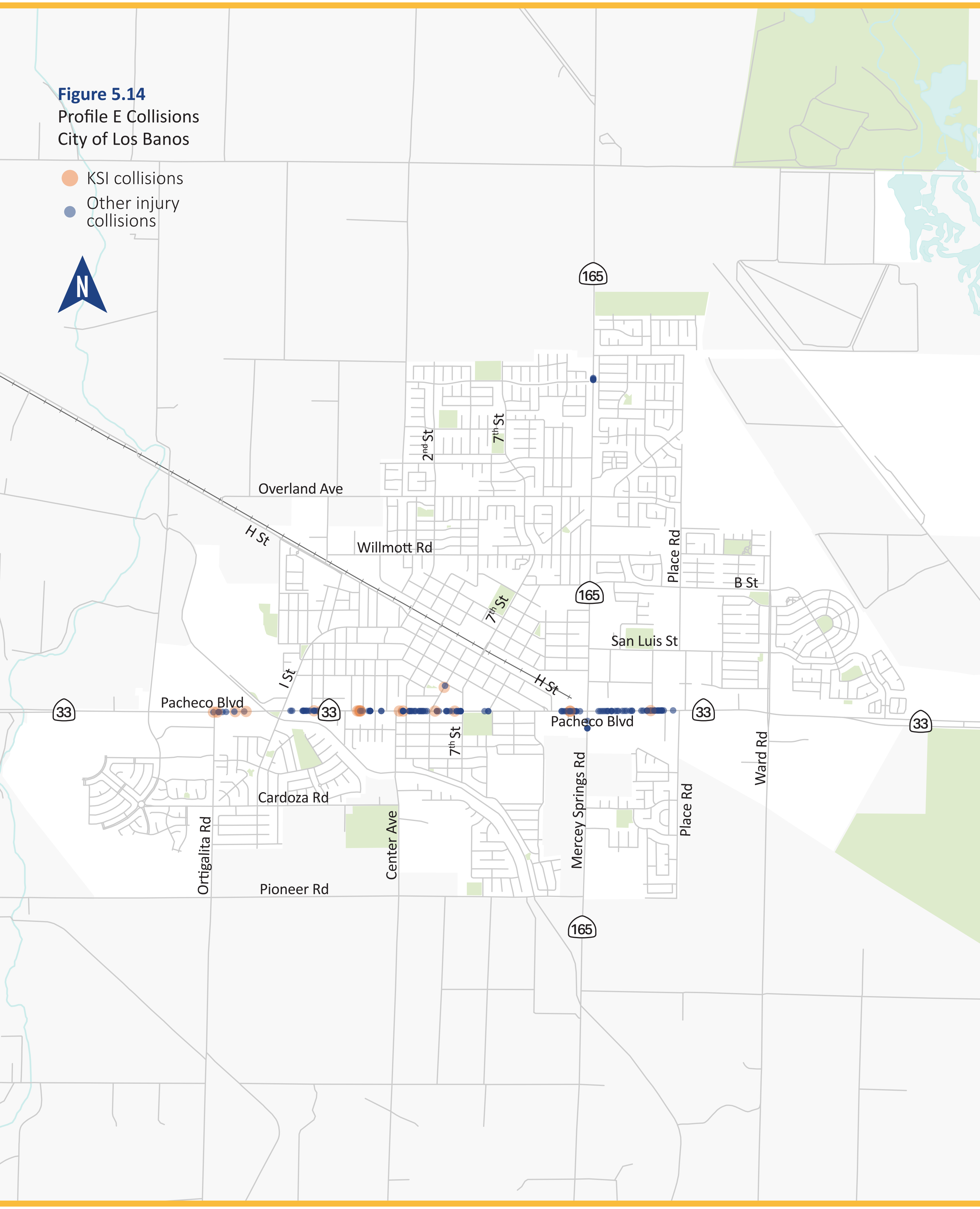
In Los Banos, this typology is found along Pacheco Boulevard through most of its length across town. A total of 172 collisions occurred at driveway clusters along Pacheco Boulevard, 9 of which involved bicycles or pedestrians; 18 of these collisions were KSIs. Nearly three-quarters of these collisions involved either speeding or violating another vehicle's right-of-way as the PCF.

The engineering countermeasures below should be supplemented with land use improvements, such as enhancing pedestrian access through parking lots and changes to land use that feature more street-fronted development.

Potential Engineering Countermeasures

- Bike Lane
- Partial Closure/ Diverter
- Speed Limit Reduction
- Advance Yield Markings
- Co-Locate Bus Stops and Pedestrian Crossings
- Extend Bike Lane to Intersection
- Raised Median
- Remove Obstructions For Sightlines
- Striping Through Intersection
- Prohibit Left Turn
- Green Conflict Striping
- Refuge Island
- Add Sidewalk
- Upgrade Intersection Pavement Markings
- Raised Crosswalk
- Separated Bikeway
- Road Diet
- Curb Extensions
- Upgrade Striping
- Access Management/ Close Driveway
- Improved Pavement Friction
- Splitter Island
- Upgrade Curb Ramp
- Yield To Pedestrians Sign
- Restrict Left Turns with Directional Median Openings
- Lane Narrowing
- Access Management/ Close Driveway
- Widen Sidewalk
- Shared-Use Path
- Segment Lighting
- Median Guardrail

Figure 5.14
Profile E Collisions
City of Los Banos



PROFILE F

Non-Standard Intersection Geometry

Injury	KSIs	🚲	🚶
48 (4%)	4 (3%)	3 (6%)	11 (23%)

Los Banos features a number of intersections with more than four legs and/or roadways intersecting at non-right angles, which contributes to limited visibility, especially for turning traffic. Moreover, these intersections tend to be large by virtue of their geometry, which lengthens crossing distances and makes them especially difficult to navigate for people biking and walking. They also can feature slip lanes for certain turning movements that allow free flow turning traffic to proceed at higher speeds, which poses additional risk for people walking and biking as well conflicting traffic.

In Los Banos, prominent examples of such intersections include, among others, that of 6th Street and Pacheco Boulevard; as well as intersections along I Street between Illinois Street and K Street, where it curves. There are a total of 48 collisions in Los Banos at intersections with non-standard geometries, of which 4 are KSI collisions and 14 involve bikes and pedestrians. Vehicle right-of-way violations are the top PCF, followed by speeding and improper turning.

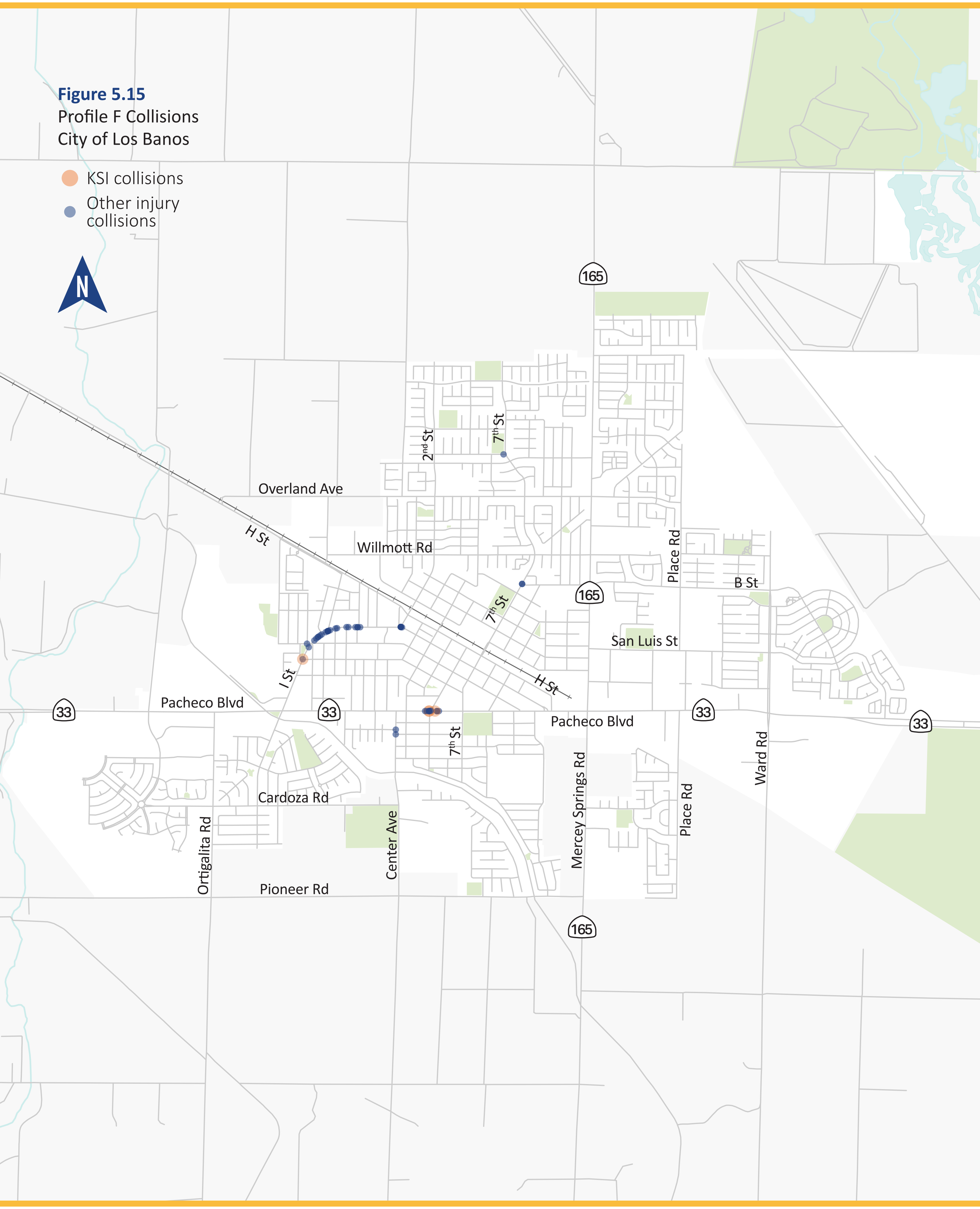


Figure 5.15
Profile F Collisions
City of Los Banos
KSI collisions
Other injury collisions
N
165
Overland Ave
2nd St
7th St
H St
Willmott Rd
Place Rd
B St
165
7th St
San Luis St
I St
H St
33
Pacheco Blvd
33
33
Pacheco Blvd
33
7th St
Ward Rd
Mercey Springs Rd
Place Rd
Cardoza Rd
Ortigalita Rd
Center Ave
Pioneer Rd
165

PROFILE F

Non-Standard Intersection Geometry

Injury	KSIs		
48	4	3	11
(4%)	(3%)	(6%)	(23%)

Potential Engineering Countermeasures

Bicycle Crossing (Solid Green Paint)	Separated Bikeway	Lane Narrowing	Delineators, Reflectors, and/or Object Markers	Pedestrian Hybrid Beacon
Bicycle Signal/ Exclusive Bike Phase	Two-Stage Turn Queue Bike Box	Protected Intersection	Speed Limit Reduction	Leading Pedestrian Interval
Bike Box	Extend Green Time For Bikes	Raised Crosswalk	Remove Obstructions For Sightlines	Remove Crossing Prohibition
Bike Detection	All-Way Stop Control	Raised Intersection	Add Sidewalk	Restripe Crosswalk
Bike Lane	Centerline Hardening	Refuge Island	Upgrade Uncontrolled Pedestrian Crossings	Upgrade Curb Ramp
Extend Bike Lane to Intersection	Roundabout	Road Diet	Curb Extensions	Widen Sidewalk
Floating Transit Island or Bus Boarding Island	Signal	Straighten Crosswalk	High-Visibility Crosswalk	Rectangular Rapid Flashing Beacon
Green Conflict Striping	Intersection Reconstruction and Tightening	Intersection Lighting	Pedestrian Countdown Timer	Retroreflective Tape on Signals
Supplemental Signal Heads	Prohibit Left Turn	Shorten Cycle Length	Advance Yield Markings	Close or Reconfigure Approaches
Advanced Dilemma Zone Detection	Prohibit Turns During Pedestrian Phase	Signal Coordination/ Green Wave	Striping Through Intersection	Yield To Pedestrians Sign
Extend Pedestrian Crossing Time	Protected Left Turns	Speed Sensitive Rest in Red Signal	Upgrade Intersection Pavement Markings	Wayfinding
Extend Yellow and All Red Time	Prohibit Right-Turn-on-Red	Upgrade Signal Head	Upgrade Striping	Advance Stop Bar
Pedestrian Scramble	Separate Right-Turn Phasing			


RAIL TRAIL
City of Los Banos

City of Los Banos

3

Priority Locations and Project Concepts

A set of locations to prioritize safety improvements were identified based on collision history and alignment with collision profiles. Of the locations meeting these criteria in Los Banos that saw the highest number of injury and KSI collisions, the lion's share are along Pacheco Boulevard, a Caltrans facility that carries SR 33 and SR 152. Nine of the top ten and sixteen of the top twenty locations were located along Pacheco Boulevard. Due to the length of the corridor, the magnitude of the collision numbers, complexities arising from the corridor's dual role as both one of Los Banos' main commercial corridors and a major state highway, and the necessity for extensive coordination with Caltrans to deliver safety improvements on a Caltrans facility, it is recommended that safety improvements along Pacheco Boulevard be implemented in the long-term, pending further corridor-specific study.

The table below lists additional locations around Los Banos not along Pacheco Boulevard that meet these criteria. One such location, the intersection of SR 165 with Dove Street, has safety improvements under design as of the writing of this LRSP. The remaining locations can be addressed in the medium- to long-term, within the next 5-15 years, subject to further study, the availability of funding, and coordination with Caltrans. The following pages present two project concepts that demonstrate how the principles outlined in this LRSP can be implemented to address identified safety risk factors: one for the intersection of K Street and 6th Street, and another for the intersection of Stonewood Drive and Overland Avenue. Both concepts extend beyond these intersections to proactively address additional safety risks at surrounding locations.

Location	Injury Collisions	KSI Collisions	Matching Profiles and Associated Risk Factors		On Caltrans Facility?
Willmot Ave/ SR 165	19	3	C	This intersection is side-street stop-controlled	Yes
			D	SR 165 has high speeds (posted speed limit of 45 MPH)	
Overland Ave/ Stonewood Dr	15	1	D	Intersection has a wide cross-section due to a large median and travel lanes wider than 12ft.	No
K St/6th St	14	2	E	Intersection is in a downtown context with adjacent driveways in close proximity	No
			D	Traffic from Pacheco Blvd sometimes do not slow sufficiently for the downtown context. Travel lanes are wider than 12ft, which can encourage speeding	
Dove/SR 165	13	0	C	This intersection is side-street stop-controlled	Yes
			D	SR 165 has high speeds (posted speed limit of 45 MPH)	

DOWNTOWN LOS BANOS

5th Street, 6th Street, and K Street

Collision Profiles
C D

On HIN?
Yes

Collision History
- 17 all collisions
- 0 bike collisions
- 3 pedestrian collisions
- 1 KSI collisions

5TH ST FROM M TO H ST & 6TH ST FROM PACHECHO BLVD TO H ST

Install **centerline** and **edgeline** pavement markings, **advanced stop bars**, **high-visibility crosswalks**, and **pedestrian refuge islands**.

K ST/6TH ST

Convert to **traffic circle** operations. If signal operations are retained, install **curb extensions**, fit the signals with **retroflective plates** and implement a **leading pedestrian interval** if feasible.

6TH ST/M ST & 6th ST/ALLEYWAY

Install **curb extension** and **raised crosswalk**.

K ST FROM 5TH TO 7TH ST

Install **centerline** and **edgeline** pavement markings, and **bike lanes** throughout the segment. At intersections, install **advanced stop bars**, **high-visibility crosswalks**, and **pedestrian refuge islands** to reduce crossing distances.

The intersection serves as the southern gateway for downtown Los Banos' main commercial corridor along 6th Street; the east leg of K Street also serves Westside Union Elementary School. The intersection has a large footprint – both of the intersecting roadways are over 50ft wide despite the two roadways only having one lane in each direction. 6th Street is wide enough to support angled parking on both sides of the street, and K Street, despite not having angled parking, is of similar width. These roadway cross-sections lead to impaired visibility of pedestrians on sidewalks and long crossing distances – these characteristics can increase the likelihood of collisions particularly for people walking and biking. The wide roadways are also conducive to high vehicle speeds – also a consideration for this particular location, as 6th Street is the main route traffic from Pacheco Boulevard, the arterial state highway that carries both local and long-distance traffic through the city, uses to reach downtown. This intersection lies less than a quarter-mile north of Pacheco Boulevard, where the posted speed limit is 35 MPH. Currently, 6th Street has few characteristics that would cue motorists to the need to slow their speeds to the posted speed of 25 MPH as they transition from a highway context to a downtown main street. Finally, there are numerous driveway ingresses and egresses within close proximity of this intersection, including one on the west leg of K Street just 20 feet from the intersection.

Curb extensions at the intersections that limits the cross-sections to two lanes on both roadways can improve visibility, reduce pedestrian crossing distances, and help slow traffic coming from Pacheco Boulevard by providing a visual cue of the transition to a downtown context. Implementing a mini roundabout or neighborhood traffic circle is an alternative option to curb extensions. Those would also help manage vehicle speeds and would eliminate severe turning conflicts. The driveway along the west leg of K Street closest to the intersection can be targeted for closure, as it is currently too close to the intersection, and there is another driveway further west providing the same access.

If the intersection is maintained as a signal control, the signal at the intersection could be mounted on a mast arm and be fitted with retroflective plates to improve visibility. Review of the pedestrian walk times to confirm they are consistent with CA MUTCD requirements and provide adequate crossing times. A leading pedestrian interval could be implemented to increase pedestrian visibility, especially to turning vehicles. Advanced stop bars and upgrading the crosswalk to a high-visibility or stamped design can further increase visibility.

Improvements can be made to roadways around the intersection and downtown more broadly as well. K Street from 5th Street to 7th Street can be improved by adding centerline and edgeline pavement markings throughout (as opposed to only at intersections) to delineate the travel lanes and visually narrow the roadway. Bike lanes could be added using the excess lane width as well. The section between 6th and 7th Streets can also be wide enough to be restriped to create an additional, separated eastbound lane to serve pick-up and drop-off traffic for Westside Union Elementary School, pending study and support from school officials. At intersections, crosswalks can be upgraded with high-visibility markings and advanced stop bars to improve visibility, as well as by adding pedestrian refuge islands that reduce crossing distances for pedestrians, and also slow vehicle speeds.

Similar treatments, including painted centerlines and edgelines, high-visibility crosswalks, advanced stop bars, and pedestrian refuge islands, can also be applied to 5th Street between M Street and H Street, and to 6th Street between Pacheco Boulevard and H Street. Additionally, upgrading the two crosswalks across 6th Street between Pacheco Boulevard and K Street (at M Street and an alleyway, respectively) to raised crosswalks and adding accompanying curb extensions that are as deep as the angled on-street parking can further slow vehicles on 6th Street as they approach downtown.

Intersection of

OVERLAND AVENUE AND STONEWOOD DRIVE

Collision Profiles

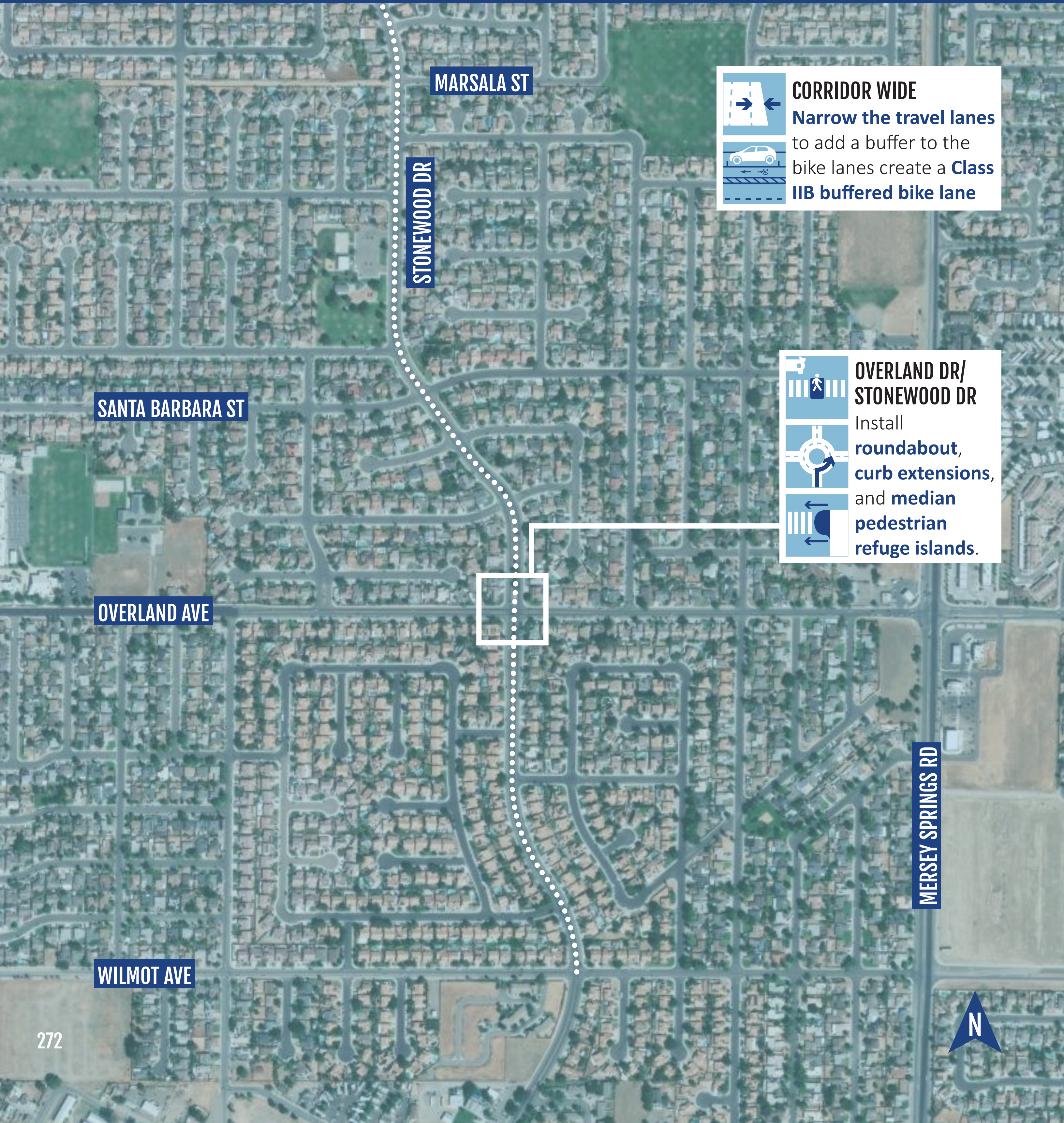
D

On HIN?

Yes

Collision History

13 all collisions
1 bike collisions
0 pedestrian collisions
1 KSI collisions



This intersection between Overland Avenue and Stonewood Drive serves two well-used crosstown routes. Both roadways carry one through lane, one parking lane, and a Class II bike lane in each direction; Overland Avenue also features left-turn pockets at the intersection, while Stonewood Drive features a planted center median. The intersection, which features all-way stop-control, has a large cross-section disproportionate with the number of lanes it serves, which reduces visibility for vehicles and lengthens crossing distances.

The intersection itself is sufficiently large to convert to roundabout operations, which will also be operationally more efficient than the current all-way stop-controlled operations. This will also create median pedestrian refuges at the entrances to the roundabout, which will reduce the crossing distance exposure.

While this intersection was chosen due to its high number of collision records, these recommendations can be applied systemically to the entire Stonewood Drive corridor, which features the same design issues surrounding lanes wider than the recommended 12 ft and intersections with long crossing distances. The corridor can be improved by restriping to widen the existing bike lanes, while also upgrade them to Class IIB buffered bike lanes by providing a painted buffer. These improvements can be made by simply narrowing the existing travel lane and without removing the parking lane. Doing so would create a brand-new Class IIB buffered bike lane corridor without changing parking or vehicular throughput. Narrowing the vehicular lanes can also reduce vehicular speeds through the corridor. Furthermore, for the segment of the corridor north of Overland Avenue where the median is present, crossing distances can be shortened for crosswalk legs across Stonewood Drive by creating median pedestrian refuges by extending the nose of the medians. In addition, curb extensions at the corners of the intersections that are as deep as the parking lane can also reduce crossing distances and improve visibility.

City of Merced

1

Collision Analysis

Chapter 2 of Caltrans' Local Roadway Safety Manual (LRSM) instructs safety practitioners to "consider a wide range of data sources to get an overall picture of the safety needs." To this end, this Local Roadway Safety Plan is data-driven and synthesizes findings from collison records alongside input from key stakeholders, a technical advisory group, and staff.

Collision records on roadways in Merced from 2015 to 2022 were investigated to describe historic collision trends and identify high-risk locations. This information acts as a primary resource for this Plan, providing the underlying data to support key analyses.

The data-driven process for the creation of this Plan includes:

- **Examination of Collision Trends**
  Review of collision statistics to evaluate when, where, and why collisions occur and who is involved.
- **Development of a High-Injury Network**
  Identification of roadways where most injury collisions are concentrated for targeted intervention.
- **Development of Collision Profiles of Emphasis**
  Identification of the most prevalent collision types and contexts based on a combination of collision factors.
- **Creation of a Countermeasure Toolbox**
  Identification of effective, nationally proven countermeasures applicable to different collision profiles.
- **Identification of Priority Project Locations**
  Identification of locations suitable for project implementation based on collision density and community verification.

The following section presents findings from the first of these stages of data analysis, identifying collision patterns and trends.

A Note on the Data Source

This analysis utilizes data on injury collisions from 2015 through 2022 available through the Transportation Injury Mapping System (TIMS) as of August 2023. TIMS reports injury collisions from the Statewide Integrated Traffic Records System (SWITRS), but excludes collisions that cause property damage only (PDO) and no injuries.

Geographically, the data includes all collisions that occur within the City of Merced, as well as along Bellevue Road and Lake Road between the city limits and the UC Merced campus, which are projected to be annexed into the City in the near future.

The data excludes collisions on Route 99, as it is a controlled-access roadway (i.e. freeway), but includes collisions on all other roadways, including State highways and other Caltrans-maintained roadways as well as privately-maintained roadways.

While collision databases like TIMS remain the best source of collision data, they have been found to have certain reporting biases, including:

- Collisions involving people walking, on bicycles, or on motorcycles are less likely to be reported than collisions with people driving
- Property damage only collisions are less likely to be reported compared to more severe collisions
- Younger victims are less likely to report collisions
- Alcohol-involved collisions may be underreported

Race, income, immigration status, and English proficiency may also impact reporting, but there is limited research on these factors.

Figure 6.1
Injury Collisions by Year, 2015-2022

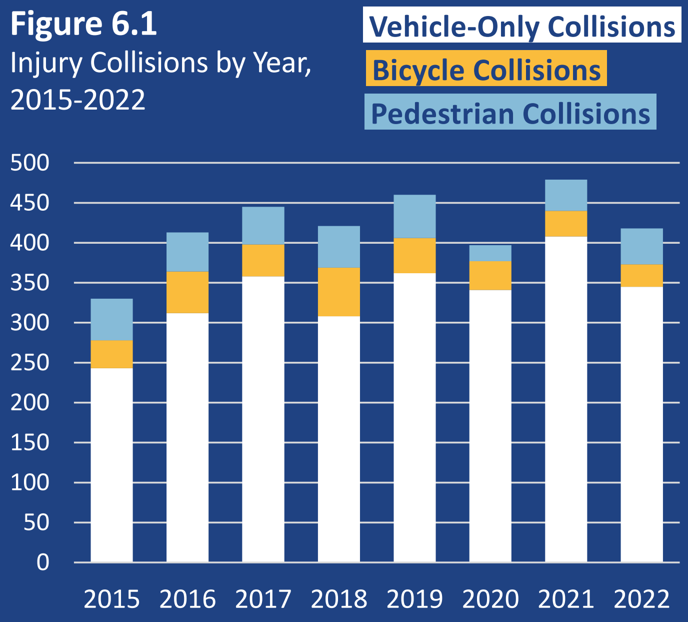


Figure 6.2
KSI Collisions by Year, 2015-2022

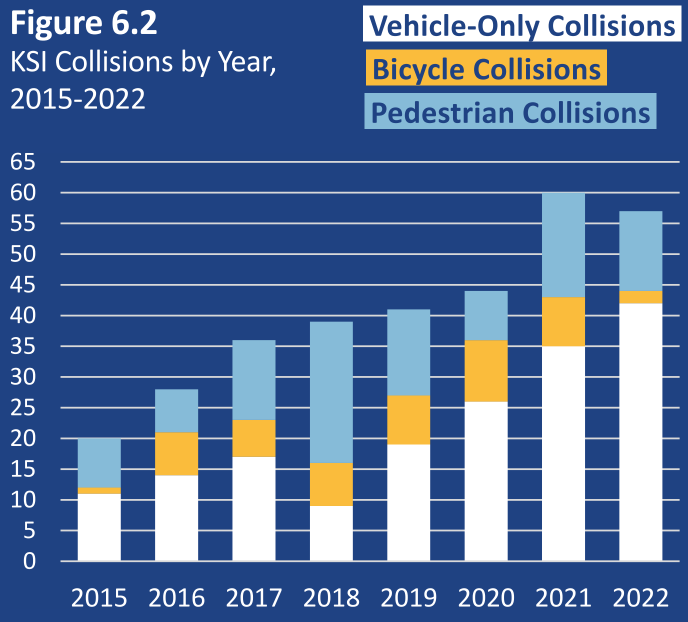
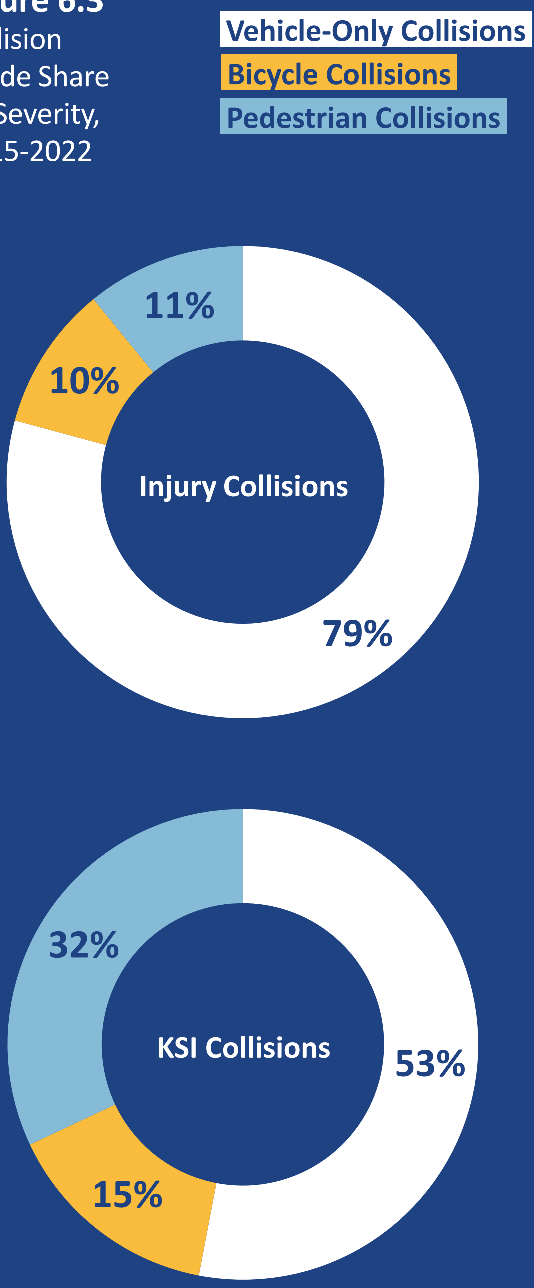


Figure 6.3
Collision Mode Share by Severity, 2015-2022



Collisions by Year and by Mode

The table below provides a summary of the number of collisions in Merced by mode and severity within the dataset, which includes all collisions that resulted in injury or fatality. From 2015 to 2022, there were a total of 3,363 injury collisions, of which 325 were KSI collisions: collisions where someone was killed or severely injured.

Collision Summary	Total	KSI
Total	3,363	325
Bicycle	328	49
Pedestrian	358	103

Figures 6.1 and **6.2** show the temporal trends of collisions in Merced. As shown, the annual number of injury collisions in Merced has fluctuated, but with a slight upward trajectory through the study period. The number of KSI collisions per year, on the other hand, has steadily and significantly increased during the study period, rising from 20 per year in 2015 to 50 to 60 per year in recent years. This upward trend has continued despite the COVID-19 pandemic. This is in line with national trends in 2020 and 2021, during and after the initial wave of the pandemic, where the number of collisions, especially KSI collisions, have increased despite travel restrictions and decreases in traffic volume.

People walking or biking are particularly vulnerable in the event of a collision, as they lack the protection afforded to them by being inside a motor vehicle. As a result, collisions involving people walking or biking are more likely to result in injury and fatality. As shown in **Figure 6.3**, people walking and biking are involved in 21% of all injury collisions, but 47% of KSI collisions.

Collisions by Collision Type

Figure 6.4 illustrates the share of collisions in the study period that fall into each collision type. As shown, the most common collision types across all injury collisions in Merced are broadside collisions at 40% and rear-end collisions at 24%. However, KSI collisions show a different breakdown. Vehicle-pedestrian collisions are the most common, at 30%, followed by broadside collisions at 27%.

This illustrates the disproportionate impact in severity that collision type can play. For example, while rear-ends account for a large share of overall collisions, they are generally less likely to result in fatalities and severe injuries. By contrast, broadsides are more represented amongst KSI collisions, as they typically involve more kinetic energy and result in more serious collision outcomes.

This also further illustrates the significantly disproportionate impact people walking face in the event of a collision, as vehicle-pedestrian collisions are the single most common collision type in the KSI collision record, despite it not being a leading collision type amongst all injury collisions.

Collisions by Primary Collision Factor

Figure 6.5 illustrates the share of collisions in the study period that are classified under each Primary Collision Factor (PCF). PCFs are cited by the responding officer and are based on that person's judgment of what contributed to the collision. It is important to note that PCFs do not include contextual information about the design aspects of the collision location that could have been primary or secondary contributors to a collision.

In Merced, the most common PCFs are Vehicle Right of Way Violations and Unsafe Speed, at 22% of collisions each. The most common PCF for KSI collisions is Pedestrian-Related, at 21%, once again showing the overrepresentation of pedestrian-involved collisions in the KSI collision record.

Figure 6.4
Share of Injury Collisions by Collision Type, 2015-2022

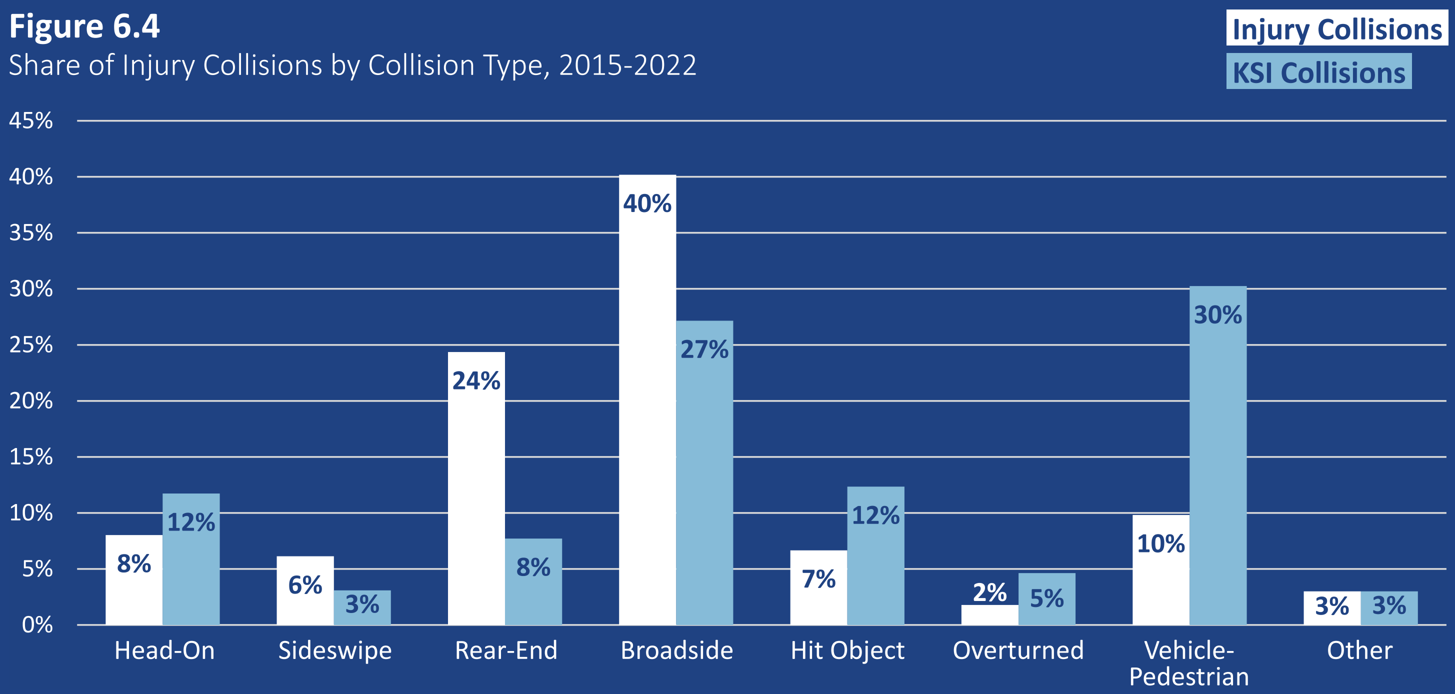
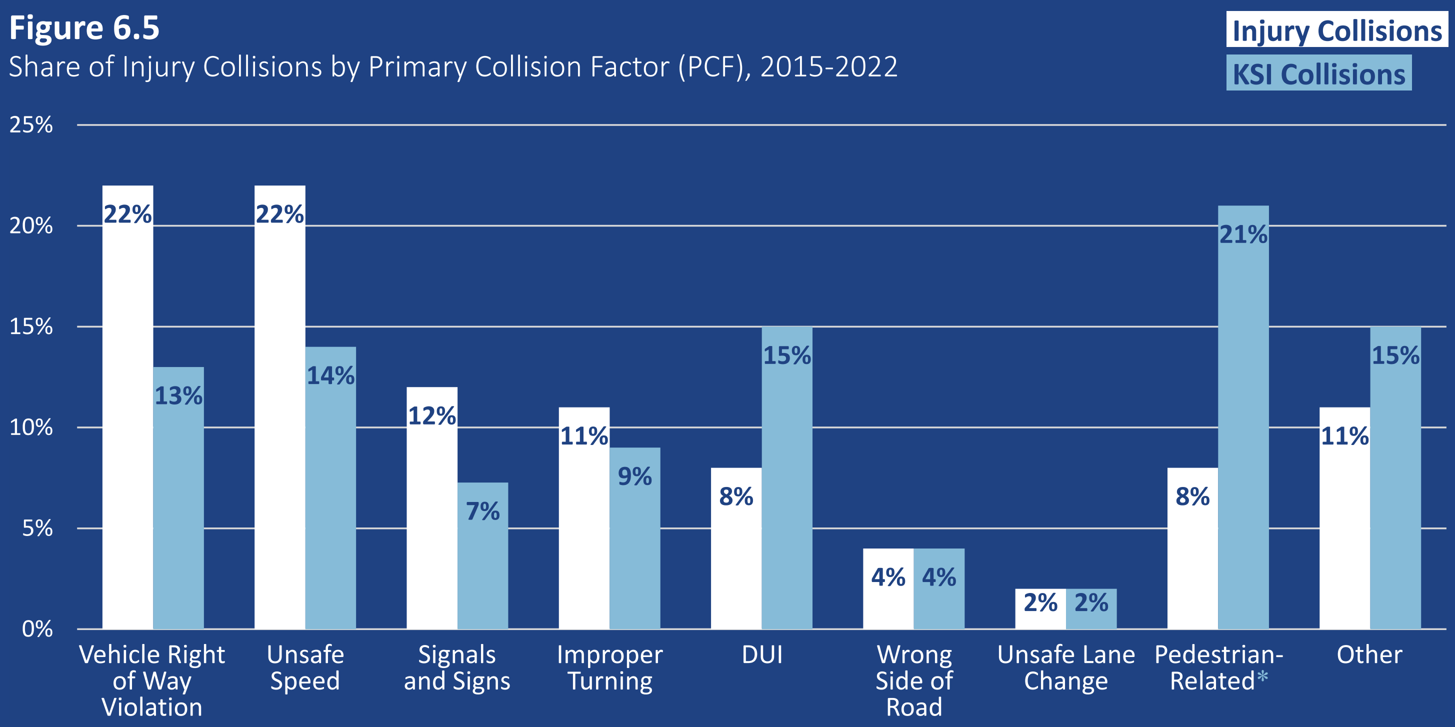


Figure 6.5
Share of Injury Collisions by Primary Collision Factor (PCF), 2015-2022



* **Note on Pedestrian PCF Categories**
The "Pedestrian-Related" category shown here combines two PCF categories: "Pedestrian Violation" and "Pedestrian Right of Way Violation." The former indicates that the pedestrian violated a rule of the road, such as crossing outside of a crosswalk, where the latter indicates the driver of a vehicle violated the pedestrian's right of way. The Pedestrian Violation category may be overrepresented due to a lack of clear information related to collision circumstances, and the increased likelihood that the pedestrian party may be unable to provide their side of the incident at the time of the collision. For this reason, we have elected to not show the distinction in these tallies, and instead show all pedestrian-related collisions in one single category.

Collisions by Lighting Conditions

Figure 6.6 illustrates the share of collisions in the study period that occur at night*****. As shown, nighttime collisions are overrepresented among KSI collisions. While 27% of all injury collisions occurred at night where streetlights were present and a further 4% occurred where streetlights were not present or present but not functioning, those percentages jump to 47% and 8% for KSI collisions, respectively.

Collisions that occur during nighttime also disproportionately affect people walking. 43% of pedestrian injury collisions occurred at night where streetlights were present and a further 8% occurred where streetlights were not present or present but not functioning, a similar proportion as overall KSI collisions. The percentages for pedestrian KSI collisions are higher still, at 58% and 11%, respectively.

The concern around lighting is especially relevant given Merced's geographic context, being home to many areas of suburban sprawl and of rural-urban interface. There continue to be locations without functional street lighting in the City, and collisions at those locations are well-represented in the KSI collision record. Even where streetlights were present, the quality of the lighting can vary widely. Factors that may contribute to the quality of streetlights include lights being insufficiently bright, placed too widely apart, or poor quality of lighting for people walking on the sidewalk, as streetlights are often designed primarily for vehicles in travel lanes.

***** Nighttime collisions are defined as those collisions whose lighting information is not reported as "daylight".

Driving Under the Influence (DUI)

Figure 6.7 illustrates the share of collisions of various types in the study period that involved at least one party driving under the influence (DUI). Drugs or alcohol increase the likelihood of increased crash severity. As shown, the number of DUI collisions are overrepresented amongst KSI collisions. While 9% of all injury collisions involve drugs or alcohol in Merced, 21% of KSI collisions do.

These percentages reflect the portion of collisions involving one or more parties determined to be under the influence of drugs or alcohol. Driving under the influence may not always be listed as the primary collision factor even if a driver is found to be under the influence.

Figure 6.6
Nighttime Collisions, 2015-2022

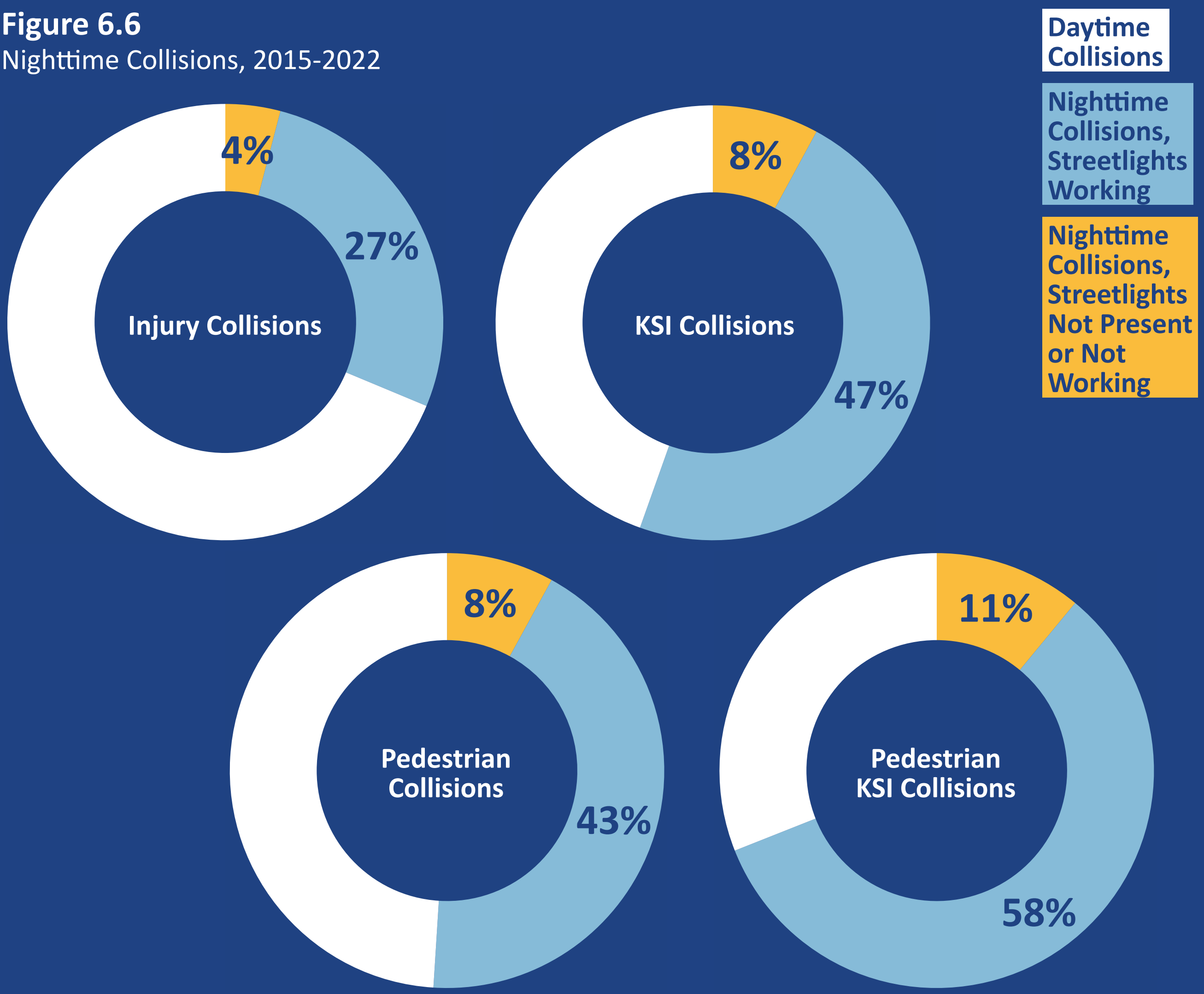
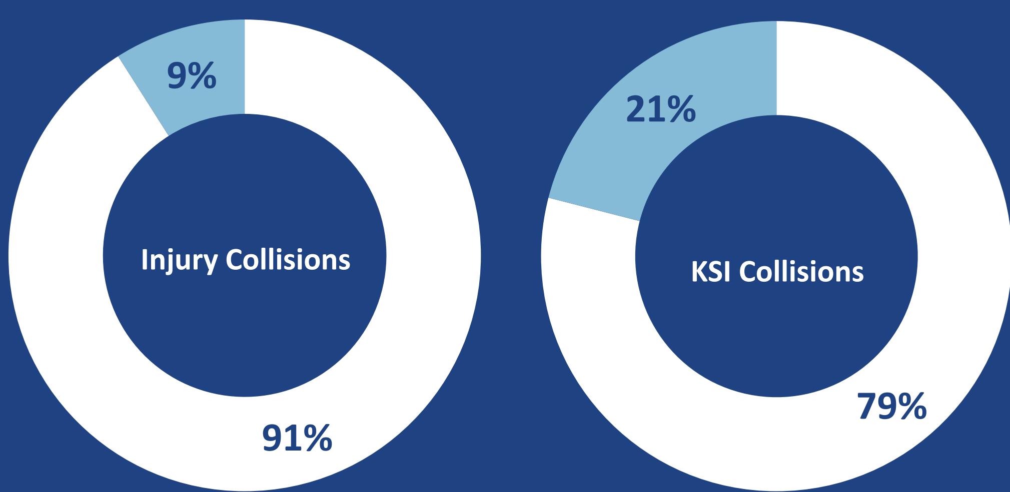


Figure 6.7
DUI Collisions, 2015-2022



Collisions by Pedestrian Location

Figure 6.8 illustrates for pedestrian-involved collisions the location of the pedestrian(s) at the time of collision. The most common location for pedestrians at the time of collision is crossing the street, whether at a marked crosswalk (39%) or not (38%). This is followed by walking in or along the shoulder of the roadway, at 16%. For pedestrian KSI collisions, crossing not at a crosswalk was the most common location at 42%, followed by walking in or along the shoulder of the roadway at 27%, and crossing at crosswalks at 24%.

This data points to the importance of ensuring that existing crosswalks are safe and properly protect users. It is also crucial to ensure pedestrian desire lines currently unserved by sidewalks and existing crosswalks are properly served- for example, ensuring that all legs of intersections feature crosswalks- to avoid having pedestrians resort to walking in road or crossing where no crossing facilities exist.

High Injury Network

From the collision data, a High Injury Network was developed to identify the roadways in the City of Merced with the highest levels of injury collisions, as shown on **Figure 6.9**.

The High Injury Network consists of just 10% of the roadway network in the City of Merced, but is the site of the vast majority of injury collisions. 3,363 collisions occurred during the study period. Of these, 2,307, or 69%, were located along the network. 325 of these study period collisions were KSIs, of which 214, or 66%, were located along the network.

Figure 6.8
Share of Pedestrian-Involved Injury Collisions by Pedestrian Location at Time of Collision, 2015-2022

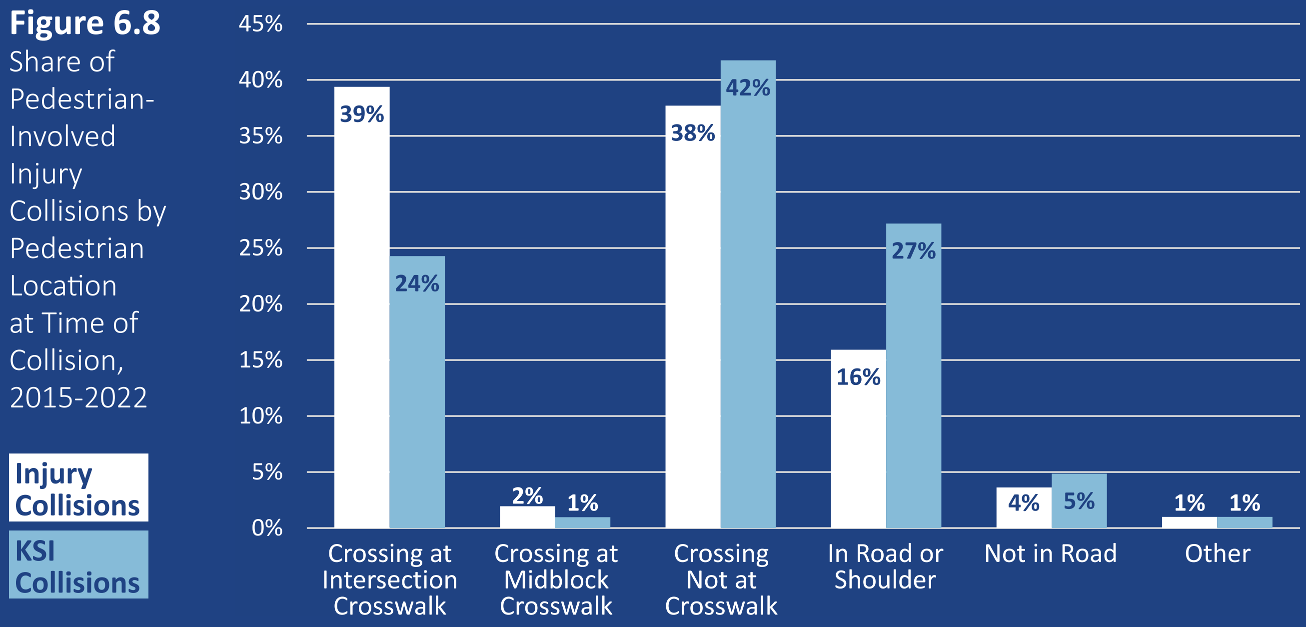
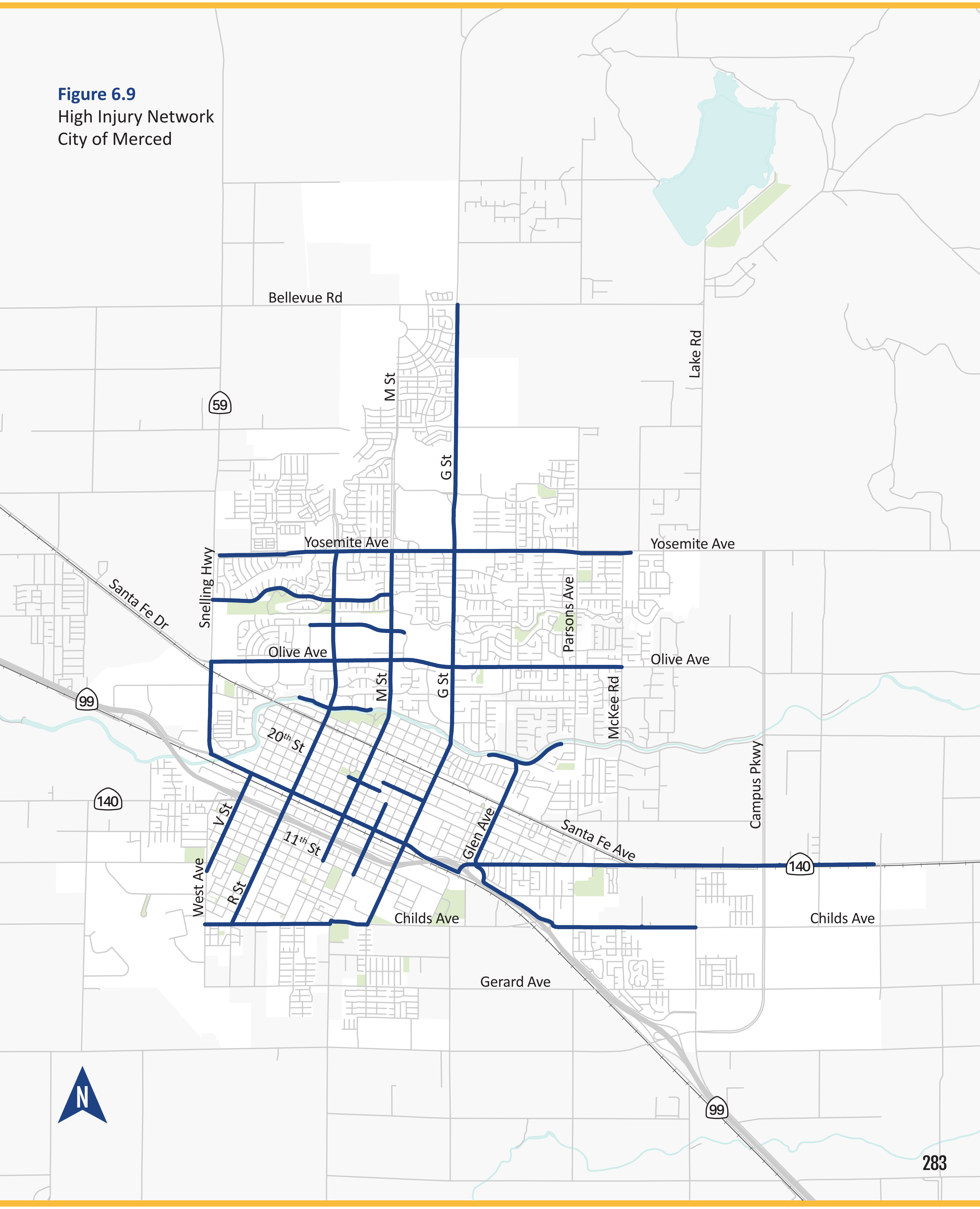


Figure 6.9
High Injury Network
City of Merced



Equity Considerations

Both Merced County and the larger Central Valley region have historically been subject to underinvestment and marginalization. As a result, most of the region, including most areas within the six cities covered by this Plan, are identified as disadvantaged by the various criteria used by the state and Federal governments.

The federal government has introduced a number of tools used to identify disadvantaged communities. In particular, two of these, the Climate and Economic Justice Screening Tool (CEJST) and the Equitable Transportation Communities (ETC) Explorer, are of particular note, as they see extensive use by the United States Department of Transportation (USDOT) in delineating disadvantaged areas, especially as part of grant funding opportunities.

Climate and Economic Justice Screening Tool (CEJST)

The Climate and Economic Justice Screening Tool (CEJST) is maintained by the Federal Council on Environmental Quality and used by many Federal programs as a means of identifying disadvantaged communities. Census tracts are screened based on a variety of factors, including climate, energy, health, housing, transportation, legacy pollution, waste, and workforce development.

Equitable Transportation Communities (ETC) Explorer

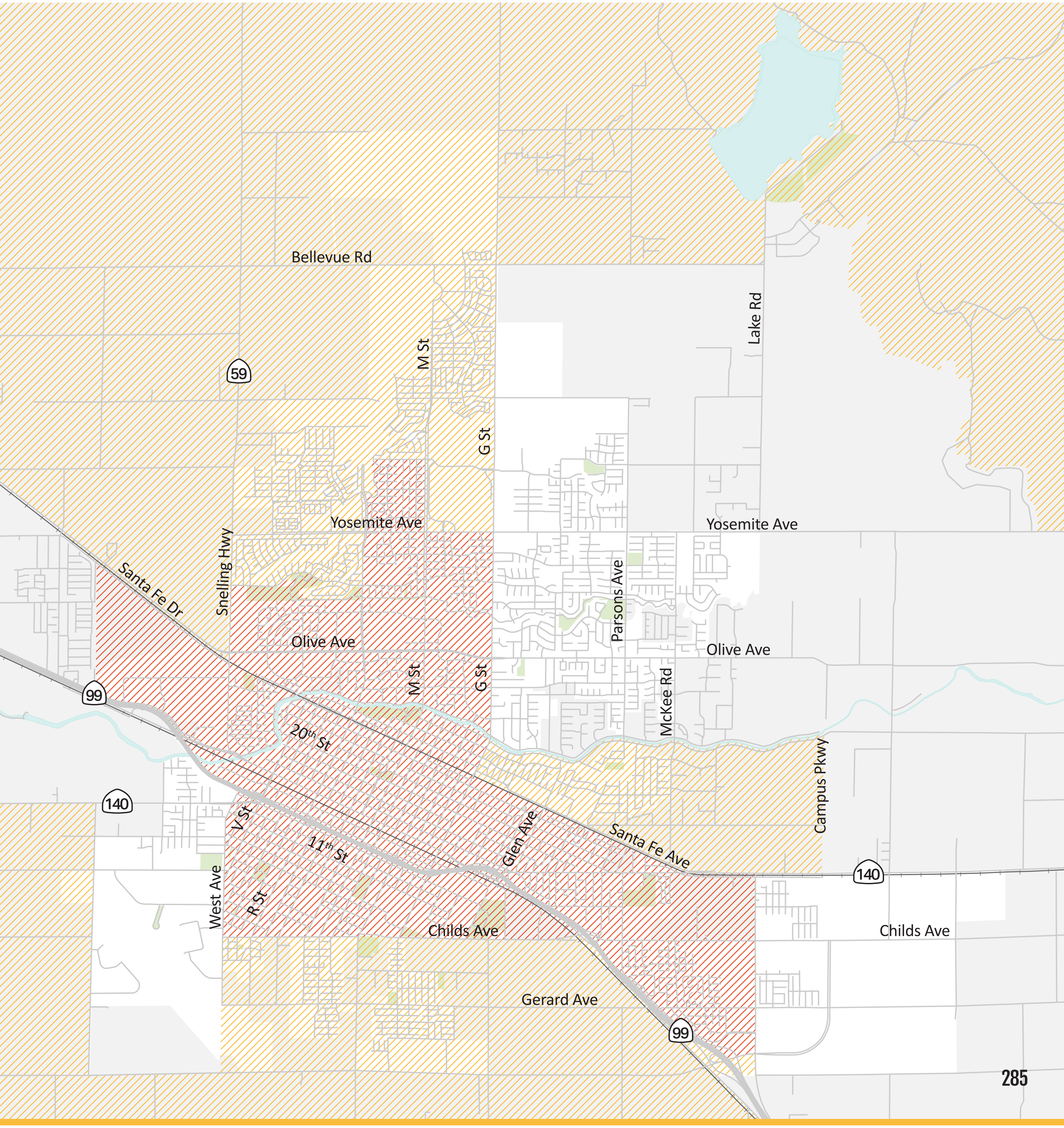
USDOT created Equitable Transportation Communities (ETC) Explorer as part of its Justice40 initiative to complement the CEJST by providing additional insight into transportation factors specifically. The ETC Explorer is meant to capture the cumulative burden of underinvestment in transportation in a community.

Figure 5.10 shows areas in the City of Merced identified as disadvantaged under these two criterion. As shown, most of the City, along with much of the surrounding unincorporated areas, is identified as disadvantaged by the CEJST. The exceptions are areas in the city's southeastern and southwestern corners, as well as the quadrant of the city north of Bear Creek and east of G Street. In addition, most of the built-up areas in the city identified as disadvantaged by the CEJST are also identified similarly by the ETC Explorer.

The vast majority of collisions in the City of Merced occur within these disadvantaged areas, including 93% of all injury collisions and 90% of all KSI collisions.

Figure 6.10
CEJST and ETC Explorer Results
City of Merced

identified as disadvantaged by CEJST
identified as disadvantaged by ETC Explorer
identified as disadvantaged by both



City of Merced

2

Collision Profiles

Through a systemic analysis of collision records, collision profiles were identified to represent the most significant patterns behind injury collisions - and especially KSI collisions - in the region. Seven such profiles, identified with the letters "A" through "G" were identified across the region, with each one applicable to one, several, or all of the communities covered by this LRSP.

The City of Merced is covered by all seven of these profiles:

A. Driving Under The Influence
B. Dark Conditions
C. Side Street Stop-Controlled Intersections
D. Excessive Roadway and Lane Widths Leading To Speeding
E. Driveway Clusters on Arterials
F. Non-Standard Intersection Geometry
G. Permissive Left Turns At Signalized Intersections

The following pages contain cutsheets that present each collision profile, along with the following information:

- Description and associated information about each profile
- Number of collisions associated, including number of KSI collisions among those (note that profiles are not mutually exclusive; collisions can fall under multiple profiles, and totals will exceed 100%)
- A map of collision locations

Engineering countermeasures that can potentially address these collisions are also presented with each profile. The full suite of engineering countermeasures can be found in **Chapter 3** of **Volume I**.

Driving Under The Influence

Injury	KSIs		
338 (12%)	86 (27%)	23 (6%)	50 (13%)

Driving under the influence is a significant contributor to injury collisions, especially and disproportionately to collisions that cause someone to be killed or severely injured (KSI).

DUIs are clustered around the weekend and around nighttime. Across the region, 54% of all DUI collisions occurred on Friday, Saturday, and Sunday, and 65% occurred in the dark. However, it is important to note that a substantial number of DUI collisions occurred outside these time periods as well.

Non-engineering interventions will need to be the primary means of addressing these challenges, but may be supplemented with the listed engineering countermeasures that aim to make roadway designs more forgiving in general.

Potential Supplemental Engineering Countermeasures

Separated Bikeway	Safety Edge	Raised Median	Red Light Cameras
Add Sidewalk	Guardrail	Delineators, Reflectors, and/or Object Markers	Speed Sensitive Rest in Red Signal
Rumble Strips	Roundabout	Speed Limit Reduction	Curve Advance Warning Sign
Improved Pavement Friction	Intersection Reconstruction and Tightening	Remove Obstructions For Sightlines	Chevron Signs on Horizontal Curves
Speed Feedback Sign	LED-Enhanced Sign	Upgrade Striping	Signal Coordination/ Green Wave

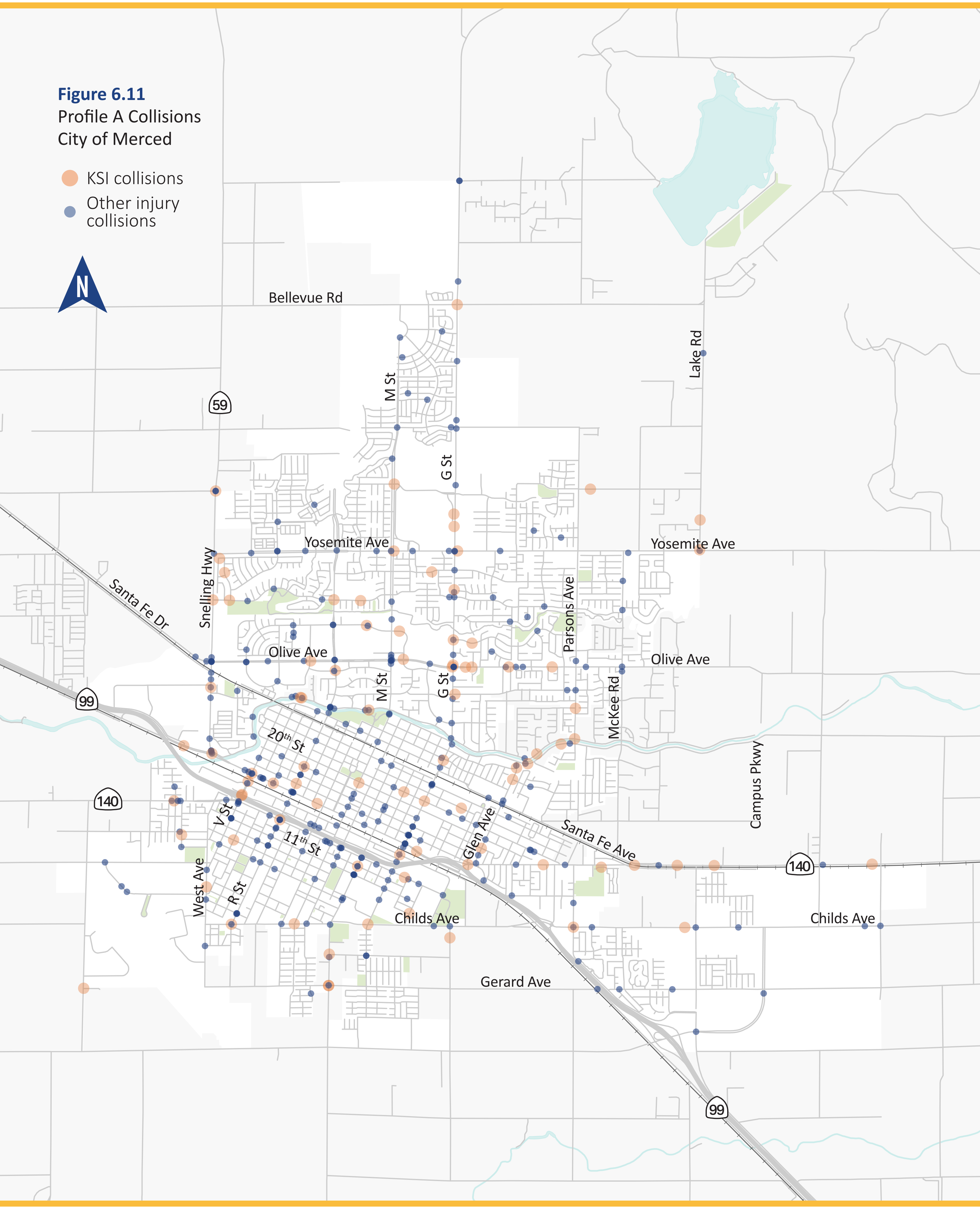


Figure 6.11
Profile A Collisions
City of Merced
KSI collisions
Other injury collisions
N
Bellevue Rd
M St
G St
Lake Rd
59
Yosemite Ave
Yosemite Ave
Snelling Hwy
Santa Fe Dr
Parsons Ave
Olive Ave
Olive Ave
M St
G St
McKee Rd
99
20th St
Campus Pkwy
140
V St
11th St
Glen Ave
Santa Fe Ave
140
West Ave
R St
Childs Ave
Childs Ave
Gerard Ave
99

PROFILE B

Dark Conditions

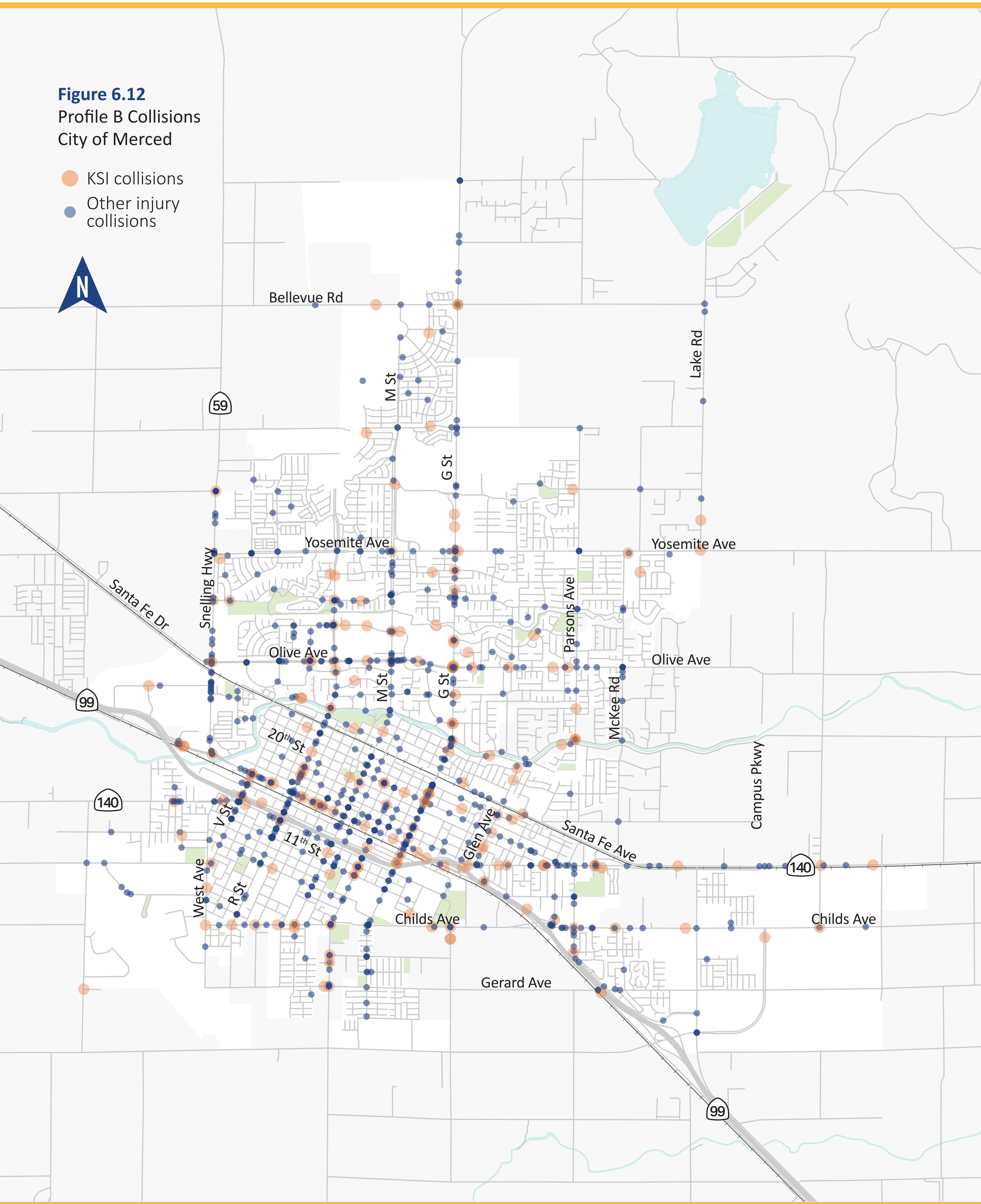
Injury	KSIs	Bicyclists	Pedestrians
1,069 (32%)	179 (55%)	103 (10%)	184 (17%)

A substantial number of collisions are occurring in the nighttime across the region. Based on the percentage of nighttime collisions, meaningful progress toward reducing collisions will require improvements that enhance nighttime visibility such as lighting, retroreflective signage, and sightline improvements.

Potential Engineering Countermeasures

- Separated Bikeway
- Rumble Strips
- Safety Edge
- Guardrail
- Intersection Reconstruction and Tightening
- Chevron Signs on Horizontal Curves
- Raised Crosswalk
- Raised Median
- Intersection Lighting
- Segment Lighting
- Delineators, Reflectors, and/or Object Markers
- Curve Advance Warning Sign
- Speed Limit Reduction
- Remove Obstructions For Sightlines
- Add Sidewalk
- High-Visibility Crosswalk
- Pedestrian Hybrid Beacon
- Upgrade Striping
- Leading Pedestrian Interval
- Rectangular Rapid Flashing Beacon
- Retroreflective Tape on Signals
- Advance Stop Bar
- Advance Yield Markings

Figure 6.12
Profile B Collisions
City of Merced



PROFILE C

Side Street Stop-Controlled Intersections

Injury	KSIs	Bicycle	Pedestrian
843 (25%)	87 (27%)	89 (11%)	100 (12%)

Similar to permissive left-turn operations, the question of who has right-of-way can be confusing for drivers in side street stop-controlled intersections. Accurately judging and using a gap in traffic can also be challenging. Similar to permissive left-turn operations, high traffic volumes, high speeds, and limited visibility due to roadway width on the major crossing are factors that also contribute to risk at these locations.

Side street stop-controlled intersections often are accompanied by either an uncontrolled crossing of the major roadway or no crossing altogether. A long series of side street stop-controlled intersections will thus likely create long stretches of the major roadway without protected crossings for people walking, biking or otherwise needing to cross the major street.

The City of Merced saw a total of 843 collisions at side-street stop-controlled intersections, representing a quarter of all injury crashes within the city and distributed across all major arterials through the city. Of these, 87 were KSIs and 189 involved bicycles or pedestrians. The top PCFs were vehicle right-of-way violations, accounting for a third of all such collisions, followed by speeding at 19% and improper turning at 10%.

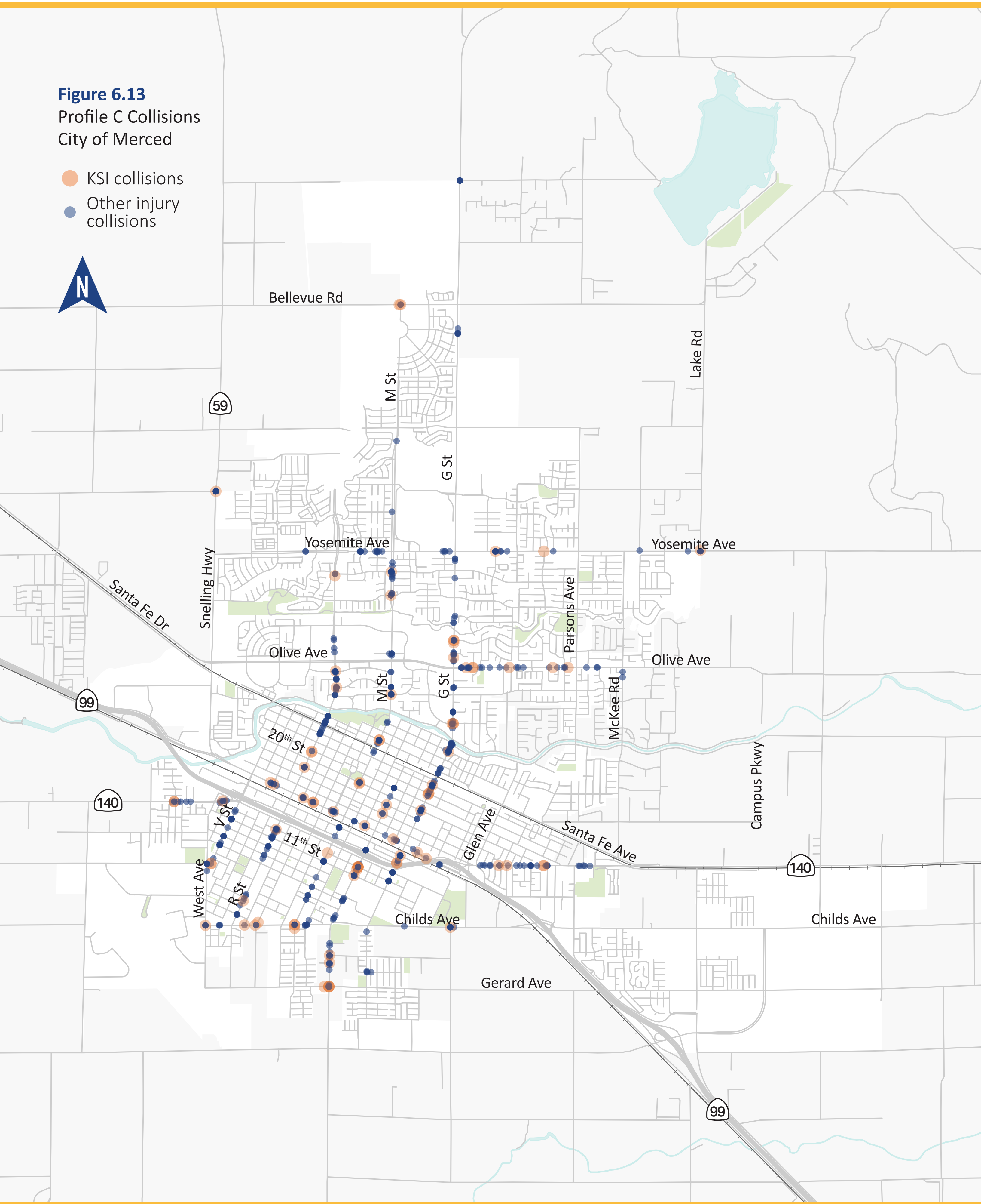


Figure 6.13
Profile C Collisions
City of Merced

PROFILE C

Side Street Stop-Controlled Intersections

Injury	KSIs	Bicycle	Pedestrian
843 (25%)	87 (27%)	89 (11%)	100 (12%)

Potential Engineering Countermeasures

- Extend Bike Lane to Intersection
- Prohibit Left Turn
- Road Diet
- Upgrade Uncontrolled Pedestrian Crossings
- Widen Sidewalk
- Green Conflict Striping
- Lane Narrowing
- Splitter Island
- Curb Extensions
- Rectangular Rapid Flashing Beacon
- Separated Bikeway
- Median Guardrail
- Straighten Crosswalk
- High-Visibility Crosswalk
- Intersection Reconstruction and Tightening
- All-Way Stop Control
- Partial Closure/ Diverter
- Intersection Lighting
- Pedestrian Hybrid Beacon
- Restrict Left Turns with Directional Median Openings
- Centerline Hardening
- Raised Crosswalk
- Delineators, Reflectors, and/or Object Markers
- Leading Pedestrian Interval
- Advance Yield Markings
- Advance Stop Bar
- Raised Intersection
- Speed Limit Reduction
- Remove Crossing Prohibition
- Speed Feedback Sign
- Roundabout
- Raised Median
- Remove Obstructions For Sightlines
- Restripe Crosswalk
- Striping Through Intersection
- Signal
- Refuge Island
- Add Sidewalk
- Upgrade Curb Ramp
- Time-Based Turn Restriction
- Upgrade Striping
- Flashing Beacon as Advance Warning
- Yield To Pedestrians Sign
- Signal Coordination/ Green Wave
- Upgrade Intersection Pavement Markings
- Bus Stop Relocation/ Enhancements

PROFILE D

Excessive Roadway and Lane Widths Leading To Speeding

Injury	KSIs
22%	14%

The region's agricultural heritage has resulted in many roadways that are designed to be wide enough to accommodate larger vehicles, such as trucks and farm equipment. However, many of these design features are no longer necessary as many areas become more residential or retail-oriented in character.

Many roadways around the region feature more vehicle travel lanes than their demand necessitates, which can influence driver behavior towards higher speeds. Moreover, many of the region's roadways feature travel lanes that are wider (often significantly so) than the maximum of 11ft recommended by Caltrans, which is another major contributor to speeding behavior. High speeds on roadways not only pose risks for vehicles, but also make them less comfortable to walk or ride along and to cross for bicyclists and pedestrians.

Speeding is a major contributor to injury collisions in the region. It is cited as the primary collision factor for nearly a quarter of all injury collisions in the study area, as well as 14% of all KSI collisions. It is also important to note that speeding can also be a factor in other collisions where it is not cited as the primary collision factor, and that the number of speeding-related collisions in the region is likely higher.

Potential Engineering Countermeasures

- Bike Lane
- Raised Crosswalk
- Add Sidewalk
- Extend Pedestrian Crossing Time
- Speed Legends on Pavement at Neighborhood Entries
- Extend Bike Lane to Intersection
- Raised Intersection
- Curb Extensions
- Extend Yellow and All Red Time
- Neighborhood Traffic Circle
- Green Conflict Striping
- Refuge Island
- High-Visibility Crosswalk
- Shorten Cycle Length
- Remove Obstructions For Sightlines
- Separated Bikeway
- Road Diet
- Pedestrian Hybrid Beacon
- Advance Stop Bar
- Signal Coordination/ Green Wave
- Rectangular Rapid Flashing Beacon
- Improved Pavement Friction
- Remove Crossing Prohibition
- Advance Yield Markings
- Speed Hump or Speed Table
- Improved Pavement Friction
- Partial Closure/ Diverter
- Restripe Crosswalk
- Curve Advance Warning Sign
- Intersection Reconstruction and Tightening
- Safety Edge
- Speed Limit Reduction
- Widen Sidewalk
- Speed Feedback Sign
- Delineators, Reflectors, and/or Object Markers
- Lane Narrowing
- Back-In Angled Parking

PROFILE E

Driveway Clusters on Arterials

Injury	KSIs	Bicyclists	Pedestrians
322 (10%)	37 (11%)	30 (9%)	48 (15%)

Merced features many instances of the land use typology of suburban, parking-fronted shopping centers along high-speed, multi-lane arterials that feature frequent driveway ingresses and egresses. Frequent interactions between fast-moving arterial traffic with slow traffic turning from or to driveways is a significant risk factor, with left turns to or from such driveways being particularly conflict-prone. Higher densities of these driveways add additional complexity and risk. These contexts are particularly problematic for people walking and biking, who must also interact with frequent driveway crossings while traveling on sidewalks or bike facilities in such areas. These areas are also likely to feature higher volumes of walking and biking, as they are often significant destinations featuring essential retail and services.

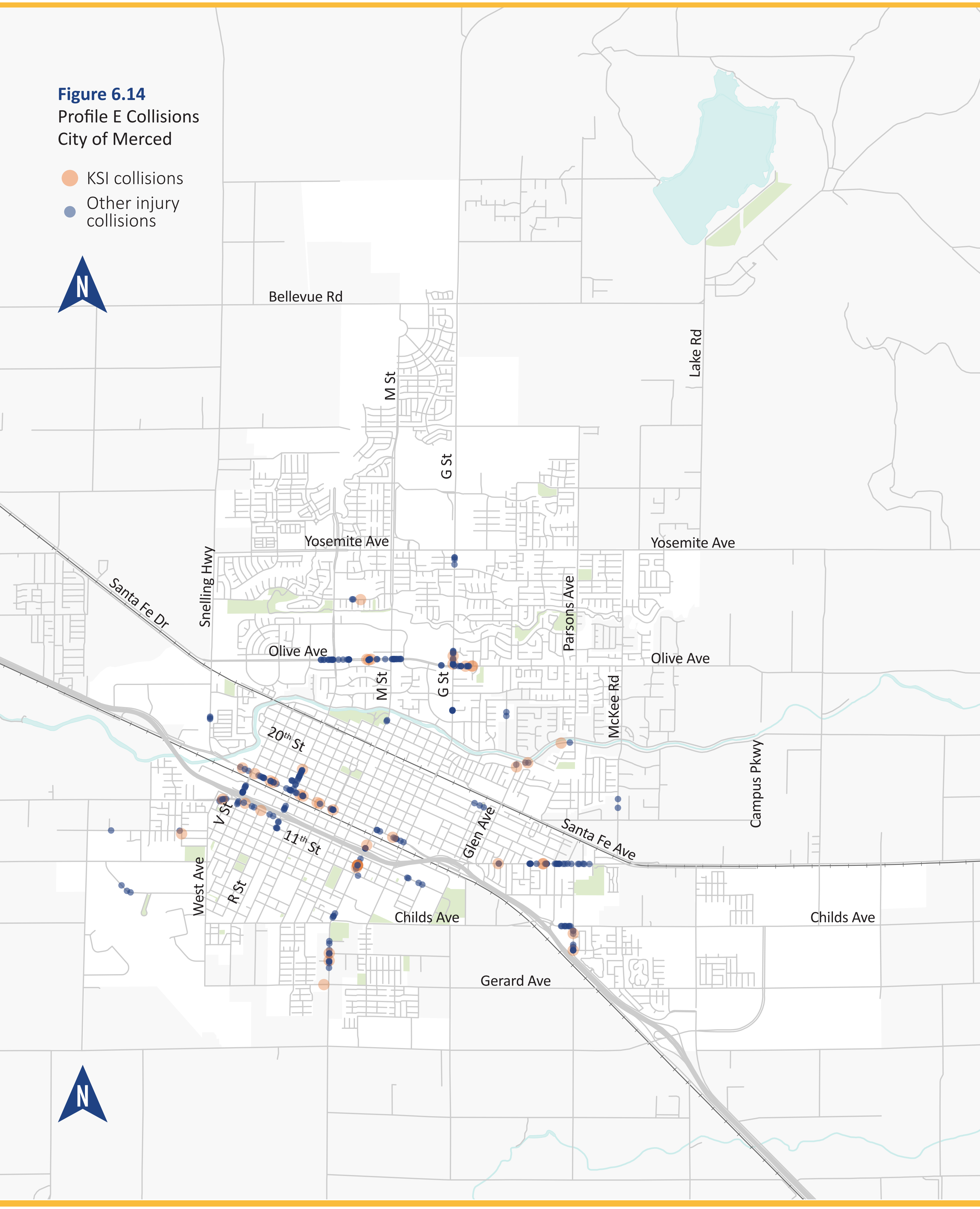
In Merced, this typology is found around the city. Significant clusters include 16th Street at either end of Downtown, Olive Avenue, SR 59 in the south side of town, and SR 140 on the east side of town, among others. A total of 322 collisions occurred at these driveway clusters, including 37 KSI collisions and 77 collisions involving pedestrians or bicyclists. The predominant PCFs were speeding, right-of-way violations, and improper turning, accounting for more than two-thirds of these collisions.

The engineering countermeasures below should be supplemented with land use improvements, such as enhancing pedestrian access through parking lots and changes to land use that feature more street-fronted development.

Potential Engineering Countermeasures

- Bike Lane
- Extend Bike Lane to Intersection
- Green Conflict Striping
- Separated Bikeway
- Improved Pavement Friction
- Lane Narrowing
- Median Guardrail
- Partial Closure/ Diverter
- Raised Median
- Refuge Island
- Road Diet
- Splitter Island
- Access Management/ Close Driveway
- Speed Limit Reduction
- Remove Obstructions For Sightlines
- Add Sidewalk
- Curb Extensions
- Upgrade Curb Ramp
- Widen Sidewalk
- Advance Yield Markings
- Striping Through Intersection
- Upgrade Intersection Pavement Markings
- Upgrade Striping
- Yield To Pedestrians Sign
- Shared-Use Path
- Co-Locate Bus Stops and Pedestrian Crossings
- Prohibit Left Turn
- Raised Crosswalk
- Access Management/ Close Driveway
- Restrict Left Turns with Directional Median Openings
- Segment Lighting

Figure 6.14
Profile E Collisions
City of Merced



PROFILE F

Non-Standard Intersection Geometry

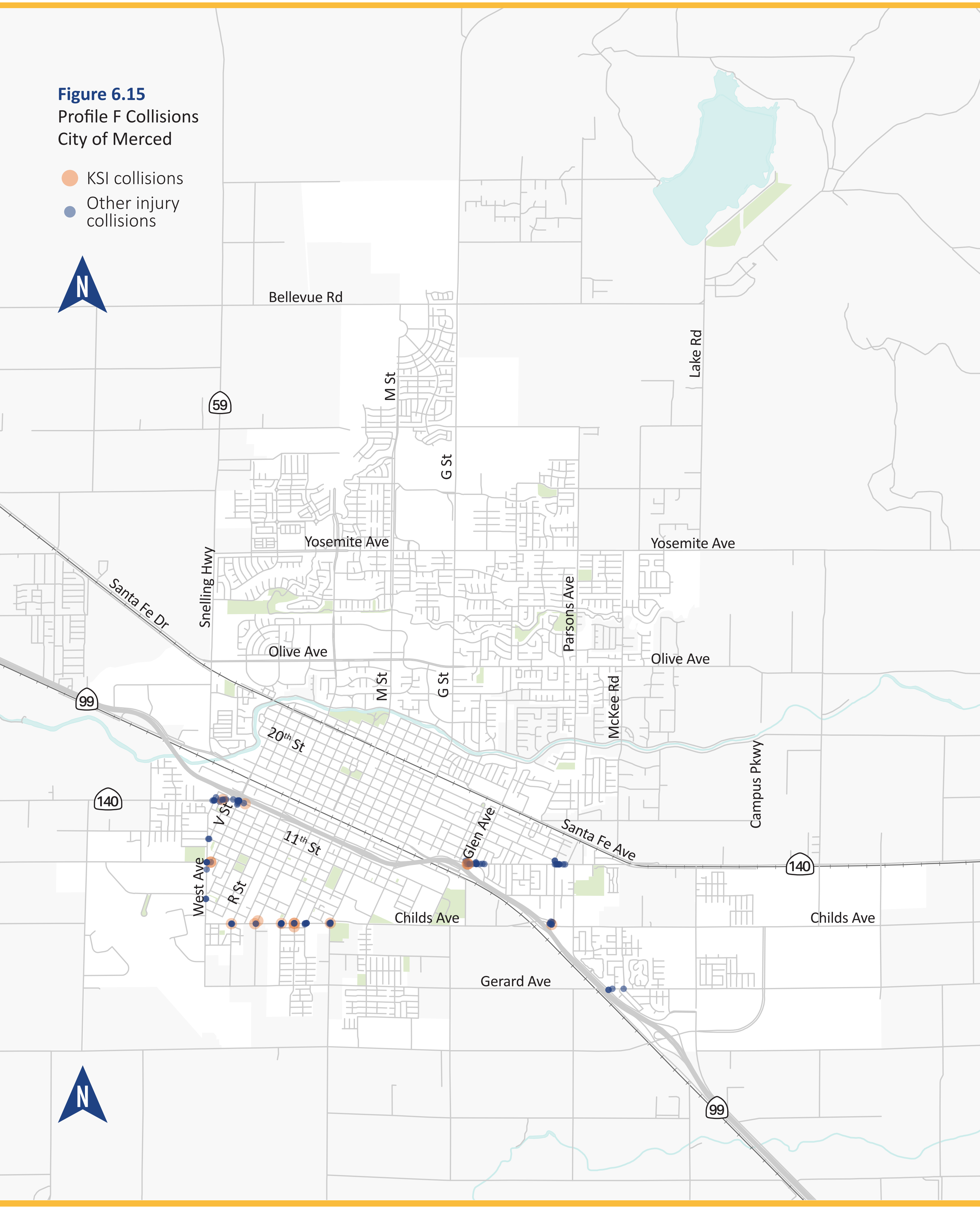
Injury	KSIs		
143 (4%)	16 (5%)	15 (10%)	16 (11%)

Merced features a number of intersections with more than four legs and/or roadways intersecting at non-right angles, which contributes to limited visibility, especially for turning traffic. Moreover, these intersections tend to be large by virtue of their geometry, which lengthens crossing distances and makes them especially difficult to navigate for people biking and walking. They also can feature slip lanes for certain turning movements that allow free flow turning traffic to proceed at higher speeds, which poses additional risk for people walking and biking as well conflicting traffic.

In Merced, many such intersections lie along SR 140, including both its interchanges with SR 99. Childs Avenue and West Avenue also has a number of these intersections. A total of 143 collisions in the city occurred at intersections with non-standard geometries. Of these, 16 were KSI collisions, and 31 involved bicycles and pedestrians. The top violation category was speeding at 27%, followed by vehicle right-of-way violations and signals and signs violations at 17% each.

Figure 6.15
Profile F Collisions
City of Merced

KSI collisions
Other injury collisions



PROFILE F

Non-Standard Intersection Geometry

Injury	KSIs	Bicyclists	Pedestrians
143 (4%)	16 (5%)	15 (10%)	16 (11%)

Potential Engineering Countermeasures

- Bicycle Crossing (Solid Green Paint)
- Separated Bikeway
- Lane Narrowing
- Delineators, Reflectors, and/or Object Markers
- Pedestrian Hybrid Beacon
- Bicycle Signal/ Exclusive Bike Phase
- Two-Stage Turn Queue Bike Box
- Protected Intersection
- Speed Limit Reduction
- Leading Pedestrian Interval
- Bike Box
- Extend Green Time For Bikes
- Raised Crosswalk
- Remove Obstructions For Sightlines
- Remove Crossing Prohibition
- Bike Detection
- All-Way Stop Control
- Raised Intersection
- Add Sidewalk
- Restripe Crosswalk
- Bike Lane
- Centerline Hardening
- Refuge Island
- Upgrade Uncontrolled Pedestrian Crossings
- Upgrade Curb Ramp
- Extend Bike Lane to Intersection
- Roundabout
- Road Diet
- Curb Extensions
- Widen Sidewalk
- Floating Transit Island or Bus Boarding Island
- Signal
- Straighten Crosswalk
- High-Visibility Crosswalk
- Rectangular Rapid Flashing Beacon
- Green Conflict Striping
- Intersection Reconstruction and Tightening
- Intersection Lighting
- Pedestrian Countdown Timer
- Retroreflective Tape on Signals
- Supplemental Signal Heads
- Prohibit Left Turn
- Shorten Cycle Length
- Advance Yield Markings
- Close or Reconfigure Approaches
- Advanced Dilemma Zone Detection
- Prohibit Turns During Pedestrian Phase
- Signal Coordination/ Green Wave
- Striping Through Intersection
- Yield To Pedestrians Sign
- Extend Pedestrian Crossing Time
- Protected Left Turns
- Speed Sensitive Rest in Red Signal
- Upgrade Intersection Pavement Markings
- Wayfinding
- Extend Yellow and All Red Time
- Prohibit Right-Turn-on-Red
- Upgrade Signal Head
- Upgrade Striping
- Advance Stop Bar
- Pedestrian Scramble
- Separate Right-Turn Phasing


MERCED
Martin Luther King, Jr. Way
LARGER THAN LIFE

PROFILE G

Permissive Left Turns At Signalized Intersections

Injury	KSIs		
536	38	52	76
(16%)	(12%)	(10%)	(14%)

The City of Merced is home to a number of signalized intersections with permissive rather than protected left turn signal phasing. These locations are located along busy arterial corridors and other high-traffic areas, and many are along multi-lane arterials.

The question of who has right-of-way can be confusing for drivers in a permissive left turn situation; it can also be challenging for motorists to accurately judge a gap in oncoming traffic. High traffic volumes, high vehicle speeds, and visibility issues stemming from wide, multi-lane roadways are contributing risk factors under this configuration. Additionally, permissive left turn configurations also pose risk factors for pedestrians, who do not have a fully-protected crossing phase and who rely on motorists to see them and then properly yield the right of way to them.

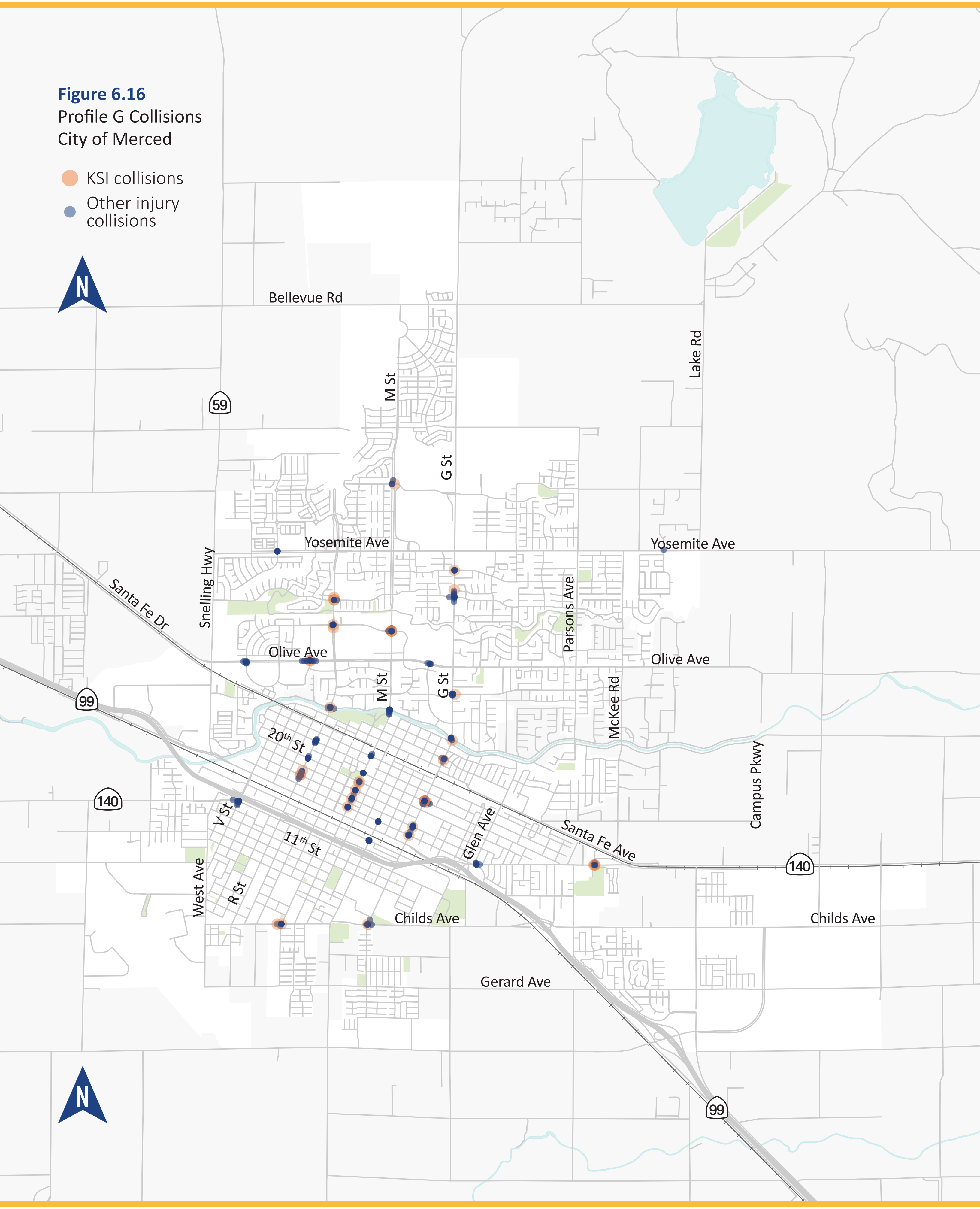
There is geographic disparity in the distribution of signal types – all of the fully-protected signalized intersections are located north of SR 99 or at one of its interchanges, meaning there are no fully-protected signalized intersections in the south side of the city. Moreover, while this profile is specific to the City of Merced, the issue of confusion over right-of-way and/or accurately judging a gap in traffic is very much a regional issue. Vehicle right-of-way violations are the leading PCF for collisions around the region, accounting for a quarter of total collisions.

Potential Engineering Countermeasures

- Retroreflective Tape on Signals
- Supplemental Signal Heads
- Advanced Dilemma Zone Detection
- Extend Pedestrian Crossing Time
- Extend Yellow and All Red Time
- Leading Pedestrian Interval
- Bicycle Signal/ Exclusive Bike Phase
- Pedestrian Scramble
- Prohibit Left Turn
- Prohibit Turns During Pedestrian Phase
- Protected Left Turns
- Prohibit Right-Turn-on-Red
- Separate Right-Turn Phasing
- Protected Intersection
- Shorten Cycle Length
- Signal Coordination/ Green Wave
- Speed Sensitive Rest in Red Signal
- Upgrade Signal Head
- Advance Stop Bar
- Advance Yield Markings
- Flashing Yellow Turn Phase
- Speed Feedback Sign
- Striping Through Intersection
- Time-Based Turn Restriction
- Upgrade Intersection Pavement Markings
- Upgrade Striping
- Yield To Pedestrians Sign

Figure 6.16
Profile G Collisions
City of Merced

KSI collisions
Other injury collisions



City of Merced

3

Priority Locations and Project Concepts

A set of locations to prioritize safety improvements were identified based on collision history as well as alignment with collision profiles, which are summarized in the previous chapters. These locations are presented in a table in the following pages. These locations are intended to be addressed in the medium- to long-term, in the next 5-15 years, within the next 5-15 years, subject to further study, the availability of funding, and coordination with Caltrans. Project concepts were developed for several corridors, each containing multiple such locations, but their limits sometimes extend beyond these locations to proactively address additional safety risks at surrounding locations. These concept projects, presented in the following pages, demonstrate how the principles outlined in this LRSP can be implemented to address identified safety risk factors.

Location	Injury Colli-sions	KSI Colli-sions		Matching Profiles and Associated Risk Factors	On Caltrans Facility?
G St/16st St	22	2	D	G St has high speeds (posted speed limit of 35MPH)	No
			G	This intersection has permissive left operations	
G St/Main St	32	2	D	G St has high speeds (posted speed limit of 35MPH)	No
			G	This intersection has permissive left operations	
G St/18st St	22	1	D	G St has high speeds (posted speed limit of 35MPH)	No
			G	This intersection has permissive left operations	
G St/21st St	46	5	D	G St has high speeds (posted speed limit of 35MPH)	No
			G	This intersection has permissive left operations	
G St/23rd St	31	1	C	This intersection is side-street stop-controlled, with visibility further impaired by being adjacent to a grade change from the railroad undercrossing	No
			D	G St has high speeds (posted speed limit of 35MPH)	
G St/S. Bear Creek Dr	29	1	C	This intersection is side-street stop-controlled	No
			D	G St has high speeds (posted speed limit of 35MPH)	
			F	G St intersects S. Bear Creek Dr at an oblique angle	
G St/ Alexander Ave	26	1	C	This intersection is side-street stop-controlled	No
			D	G St has high speeds (posted speed limit of 40MPH)	
			E	Multiple driveways in close proximity of intersection	
G St/ Yosemite Ave	24	2	D	Both roadways have high speeds (posted speed limits of 45 MPH for both roadways)	No
M St/ Olive Ave	39	1	D	M St and Olive Ave both have high speeds (posted speed limits of 40 and 45 MPH respectively)	No
			E	Multiple driveways in close proximity of intersection	
M St/Collins Dr/Lough-borough Dr	27	3	D	M St has high speeds (posted speed limit of 40MPH)	No
			G	This intersection has permissive left operations	
M St/Buena Vista Dr	32	1	C	This intersection is side-street stop-controlled, with a large, wooded median further obstructing visibility	No
			D	M St has high speeds (posted speed limit of 40MPH)	
MLK Way/12th	22	6	C	This intersection is side-street stop-controlled	Yes
			D	MLK Way is a state highway that carries high volumes of traffic, including truck traffic	
MLK Way/13th	30	0	C F	This intersection features freeway off-ramps that are side-street stop-controlled, and join the intersection at an oblique angle without first joining the frontage roads	Yes

Location	Injury Collisions	KSI Collisions		Matching Profiles and Associated Risk Factors	On Caltrans Facility?
SR 59/ Olive Ave	37	3	D	Both roadways have high speeds (posted speed limits of 45 MPH for both roadways)	Yes
G St/Olive Ave	33	7	D	G St and Olive Ave both have high speeds (posted speed limits of 40 and 45 MPH respectively)	No
			E	Multiple driveways in close proximity of intersection	
R St/Olive Ave	29	2	D	R St and Olive Ave both have high speeds (posted speed limits of 40 and 45 MPH respectively)	No
			E	Multiple driveways in close proximity of intersection	
R St/18th St	38	3	D	R St has high speeds (posted speed limit of 35MPH)	No
			E	Multiple driveways in close proximity of intersection	
			G	This intersection has permissive left operations	
R St/16th St	30	0	D	Both roadways have high speeds (posxted speed limits of 35 MPH for both roadways)	No
			E	Multiple driveways in close proximity of intersection	
R St/14th St	54	3	D	R St has high speeds (posted speed limit of 35MPH). The intersection also involves a freeway off-ramp that can channel in high-speed traffic	Yes
			F	The intersection consists of five legs, including a freeway off-ramp entering at an oblique angle	
V St/SR 140	41	2	E	This intersection, which involves arterials, frontage roads, and multiple freeway ramps, has non-standard geometry	Yes
			G	This intersection has permissive left operations	
Cooper Ave/ Willowbrook Dr/SR 59	31	1	D	SR 59 has high speeds (posted speed limit of 40MPH)	Yes

G STREET

from 16th Street
to Bear Creek

Collision Profiles

C D E G

On HIN?

Yes

Collision History

242 all collisions
38 bike collisions
41 pedestrian collisions
18 KSI collisions

This conceptual project covers the stretch of G Street between 16th Street and Bear Creek. The stretch contains several of Merced's top collision hotspots, including the intersections at 16th Street, Main Street, 18th Street, 21st Street, 23rd Street, and South Bear Creek Drive.

G St serves as one of Merced's major north-south thoroughfares, being one of the few north-south roadways that crosses Bear Creek to the northern parts of the city and the only north-south roadway in town with a grade-separated crossing of the BNSF rail tracks. It is fast-moving: the posted speed limit is 35 MPH for the entire stretch. Through this stretch, there are siganls at the intersections with 16th Street, Main Street, 18th Street, 21st Street, and 26th Street, but only the 16th Street and 26th Street intersections feature fully protected left turns from G Street. Outside of these intersections, this stretch of G Street has numerous driveway curb cuts, as it is fronted by many businesses and homes and also intersects a number of alleyways. These driveways add complexity and risk by introducing conflicting movements to and from G Street, and navigating frequent driveway crossings can make bike and pedestrian travel more cumbersome as well.

G Street carries five lanes throughout this stretch: two through lanes in each direction and a center turn lane. It also features an unprotected bike lane in each direction. The right-of-way is constrained, as these lanes are all at the minimum recommended widths prescribed by the latest best practices.

The primary component of this conceptual project is the conversion of the existing unbuffered bike lane into Class I shared-use paths on either side of the roadway. Given the current speeds and traffic volumes along G Street, the existing Class II bike lanes do not offer sufficient protection and comfort to users according to the latest federal and state guidelines, and a separated facility is required. The conceptual project envisions the sidewalk on both sides of the roadway to be widened into Class I shared-use paths by moving the curb line to consolidate the sidewalk with the existing bike lanes. In conjunction, driveways along G Street should be consolidated where possible to reduce instances of driveway crossings for users of the shared-use paths. As part of the conversion, signals along this stretch should be converted to protected left operations to provide a dedicated protected signal phase for users of the shared-use paths to cross.

M STREET

from Olive Avenue
to Yosemite Avenue

Collision Profiles

C D

On HIN?

Yes

Collision History

148 all collisions
17 bike collisions
12 pedestrian collisions
9 KSI collisions

This conceptual project covers the stretch of M Street between Olive Avenue in the south and Yosemite Avenue in the north. The stretch contains several of Merced's top collision hotspots, including the intersections at Olive Avenue and Buena Vista Avenue.

M St serves as one of Merced's major north-south thoroughfares, being one of the few north-south roadways that crosses Bear Creek to connect the northern parts of the city with points south, and one of the few roadways that cross the BNSF rail tracks. This stretch of M Street also serves a large number of activity centers including Merced College, commercial plazas, government agency offices, medical facilities, and multifamily housing. It is also proximate to the Merced High School campus.

M Street is fast-moving: the posted speed limit is 40 MPH for this stretch. It carries two lanes and a bike lane in each direction. In the south, there is a center turn lane that at times gives way to a raised median. North of Rascal Creek, the roadway widens further to also include a southbound parking lane, and the center turn lane gives way to a large, landscaped median approximately 60ft wide that hosts a Class I shared-use path. Between Olive and Yosemite Avenues, there is only one signalized intersection at Loughborough and Collins Drives. There are no stop controls for traffic along M Street for the over half-mile stretch between Loughborough Drive and Yosemite Street, which can contribute to higher vehicular speeds. Further, there are also no marked pedestrian or bicycle crossings along this stretch, including to provide access to and from the median shared-use path, limiting access for pedestrians and bicyclists due to a lack of safe, marked crossing facilities. The two intersections in this section, at Buena Vista Drive and at Donna Drive, feature side street stop-control operations, which carry numerous risk factors accentuated by M Street's high speeds and wide right-of-way (especially with the median path). As mentioned, Buena Vista Drive is one of Merced's top collision hotspots; while the intersection with Donna Drive has a lower number of collisions, it is contextually similar and features the same risk factors.

The largest component of this conceptual project is to narrow the vehicular lanes along this stretch of M Street to 11ft, and using the excess width to create a buffer that allows for upgrading the existing Class II bike lanes to Class IV separated bike lanes. This would be in line with the recommendations of the regional Active Transportation Plan (ATP), and can help create a bicycle connection to and from Rascal Creek trail and to Merced College. Additionally, this change can help manage speeds along the corridor, as narrowing travel lanes can have the effect of slowing vehicular speeds and reduce instances of speeding.

The intersections at Donna Drive and Buena Vista Drive should be improved for both pedestrians and bicyclists as well as for vehicles on those minor streets. Studies should be conducted to convert both intersections to roundabout operations, which offers safety improvements over the current side-street stop-controlled operations. Crosswalks that provide access to the median path should be included at both locations to improve bicyclist and pedestrian access. The roundabouts would also further manage speeds along M Street by breaking up the effectively more than a half-mile of free-flow traffic along this segment, a characteristic conducive to speeding.shared-use paths.

Finally, at Rascal Creek, a crossing that connects the median shared-use path (which currently dead-ends) with the Rascal Bike Path and the Class IV separated bike lanes should be studied.

OLIVE AVENUE

from SR 59 to G Street

Collision Profiles

C D

On HIN?

Yes

Collision History

251 all collisions
23 bike collisions
30 pedestrian collisions
21 KSI collisions

This conceptual project covers the stretch of Olive Avenue between SR 59 in the west and G Street in the east. The stretch contains several of Merced's top collision hotspots, including the intersections at SR 59, R Street, M Street, and G Street.

Olive Avenue is the primary east-west thoroughfare for northern Merced. It is also one of the city's primary commercial and retail destinations, serving numerous commercial plazas along this stretch, including the Merced Mall. Also served by the corridor are a number of offices, medical facilities, and the Merced High School campus.

Olive Avenue has one of the highest posted speed limits among city streets in Merced at 45 MPH. It is also the widest arterial in Merced. For most of its length, it carries three lanes in each direction, separated by a raised median, for most of this stretch. Between R Street and M Street, Olive Avenue widens to four lanes westbound; the eastbound right-of-way also widens by the same amount, but no fourth lane is striped. The roadway has a median through this entire stretch, which serves to restrict many minor street intersections by preventing traffic from proceeding straight across Olive Avenue at them. However, most still feature median openings that facilitate left turns across Olive Avenue.

The high speeds and wide right-of-way on Olive Avenue present potential risks for vehicle traffic at these side-street stop-controlled minor street intersections along this stretch, but also with pedestrians and bicyclists. Many of the destinations that Olive Avenue serves, such as Merced High School and retail destinations, are significant generators of bicycle and pedestrian traffic, but those users must share the roadway with fast-moving traffic and contend with long crossing distances across the wide arterial.

This conceptual project seeks to convert the sidewalks on either side of Olive Avenue to Class I shared-use paths to better serve pedestrian and bicyclist traffic. Given the current speeds and traffic volumes along Olive Avenue, only such a separated facility (a Class I or a Class IV facility) can provide the level of protection and comfort to users according to the latest federal and state guidelines. For most of the corridor the conceptual project envisions narrowing the lanes along Olive Avenue to a maximum of 11 feet, with the additional space used to widen the sidewalk on both sides of the into Class I shared-use paths by moving the curb line inwards. For the stretch between M and R Streets, where there is an extra fourth lane in the westbound direction and an unstriped fourth lane in the eastbound direction, the space can be added to the sidewalk as well.

In conjunction with these improvements, driveways along Olive Avenue should be consolidated where possible to reduce instances of driveway crossings for users of the shared-use paths.

R St
from 14th St
to 19th St

Collision Profiles
C D E G

On HIN?
Yes

Collision History
132 all collisions
12 bike collisions
13 pedestrian collisions
7 KSI collisions

This conceptual project covers the stretch of R Street between 14th Street and the interchange with SR 99 in the south, and 19th Street in the north. The stretch contains several of Merced's top collision hotspots, including the intersections at 14th Street, 16th Street, and 18th Street.

R St serves as one of Merced's major north-south thoroughfares, being one of the few north-south roadways that crosses Bear Creek into the northern parts of the city, and one of the few roadways that cross the BNSF rail tracks. This stretch of R Street also serves a number of key commercial destinations in Merced, including several strip malls, multiple grocery stores, as well as the Costco store and gas station.

R Street is fast-moving: the posted speed limit is 35 MPH for this stretch. It carries five lanes throughout this stretch: two through lanes in each direction and a center turn lane. It also features an unprotected bike lane in each direction, which end at 19th Street, north of which the street narrows. The right-of-way is constrained, as the current lanes are all at the minimum recommended widths prescribed by the latest state design guidance and cannot be narrowed further. Through this stretch, there are siganls at the intersections with 14th Street, 15th Street, 16th Street, Main Street, and 18th Street, of which all but the last features protected left turns. Outside of these intersections, this stretch of R Street has a number of driveway curb cuts with fronting businesses and intersecting alleyways. These driveways add complexity and risk by introducing conflicting movements to and from R Street, and navigating frequent driveway crossings can make bike and pedestrian travel more cumbersome as well.

The primary component of this conceptual project is the conversion of the existing unbuffered bike lane into Class I shared-use paths on either side of the roadway. Given the current speeds and traffic volumes along R Street, the existing Class II bike lanes do not offer sufficient protection and comfort to users according to the latest federal and state guidelines, and a separated facility is required. The conceptual project envisions the sidewalk on both sides of the roadway to be widened into Class I shared-use paths by moving the curb line to consolidate the sidewalk with the existing bike lanes. In conjunction, driveways along R Street should be consolidated where possible to reduce instances of driveway crossings for users of the shared-use paths. As part of the conversion, the signal at 18th Street should be converted to protected left operations to provide a dedicated protected signal phase for users of the shared-use paths to cross.

Appendices

Appendices

- Appendix A: Benchmarking Assessment Results
- Appendix B: Community Outreach Responses
- Appendix C: Cost and Benefits Documentation for Conceptual Projects
- Appendix D: Safe Streets and Roads for All (SS4A) Program Criteria Checklist

Appendix

A

Benchmarking Assessment Results

The development of this LRSP included a review of current and recent studies completed by MCAG and its jurisdictions to benchmark the region against Safe System best practices.

Making a commitment to zero traffic deaths means addressing all aspects of safety through the elements that together create the holistic approach with redundancy and layers of protection for roadway users. As such, the benchmark assessment identifies instances where MCAG is achieving Safe System best practices, where challenges may exist, and where MCAG can take action to meet the benchmark. Also identified are several areas where implementation is more suited to actions by individual member jurisdictions, but where MCAG may be able to provide technical assistance or funding support.

The matrix that documents the results of this benchmarking assessment follows.

Core Element	Category	Benchmark	Assessed Level of Commitment/Implementation			State of Current Practice for MCAG	Local Jurisdiction		MCAG	
			Not a Current Practice	Occasional/ Partial Practice	Institutionalized Practice		MCAG Assistance	MCAG Funding	ATP	LRSP
Safety Planning and Culture	Leadership and commitment	Leaders publicly commit to a "Zero" goal for traffic fatalities and serious injuries within a specific timeframe, and exhibit buy-in for the Safe System approach through media, public events, and support for related policies and programs.	x				x	x	x	x
		Develop a safety plan aligned with the Safe System approach that establishes a "Zero" goal for traffic fatalities and serious injuries and identifies concrete actions to help the MCAG achieve zero including designation of lead agency, timeline, and funding. Safety plan should include an assessment of the local challenges that have hindered safety interventions in the past and create a roadmap for addressing them.	x				x	x		x
		Establish key safety performance indicators and implement a monitoring process to evaluate progress and intervene if city is not on track.		x		The Gustine ATP recommends establishing: an annual report to council on city's progress towards the goals/metrics IDed in the plan, an advisory committee to meet monthly or quarterly, annual bike/ped counts, and a maintenance request form for active transportation concerns. ATP also lists goals with performance measures and targets fro meeting the goal. The City of Livingston BP has an evaluation/maintenance goal for measuring bicycle use. Policies to meet the goal include conducting annual surveys at big employers and schools, and bike counts. The City of Los Banos BPP follows the 5 Es of active transportation including Evaluation through "Monitoring and documenting outcomes, attitudes and trends through the collection of data before and after the intervention". The City of Merced BTP has the five Es of active transportation as policy goals. The evaluation goal focuses on developing the means to monitor/record bikeway facility and program successes through annual school/employer surveys, bike counts, including the Bike Advisory Commission in the BTP monitoring and updating, and improve or keep the same ranking on the League of American Bicyclist's list of "Bike Friendly Communities". The City of Merced AT/SR2S Plan recommends evaluating programs by reviewing bike/ped related crashes and near-misses on an annual basis; having communities prepare annual report cards to update elected officials on progress made to improve walking/biking; and yearly community surveys that evaluate the impact of projects/policies/programs - but it is unclear how the City actually collects the information or tracks it for evaluation. County of Merced BTP includes a table with action items and whose responsibility it is to complete. e.g. local bike plan updates due every 4 years. The MCAG RTP has both goals and performance metrics for mobility & accessibility including: vehicle trips, vmt, vmt growth, percentage of new households within walking distance of a transit stop, ped/bike daily mode share percentage, avg trip length for vehicle trips and commuter vehicle trips. But it isn't clear what the clear threshold is for these metrics to meet the goal. There is also a goal to "Achieve a significant reduction in traffic fatalities and serious injuries on all public roads." by coordinating with local	x	x	x	
		Identify a staff coordinator to manage the agency's safety program and convene an inter-agency working group that discusses safety projects and initiatives. The working group includes a representative from every agency or department that plays a critical role in advancing each Safe System element. Actively work to identify and overcome barriers to coordination across departments and agencies.		x		Gustine ATP: Has a policy for coordinating with other agencies and stakeholders to implement plan, but does not identify a staff member. Livingston BP: Mentions a regional bicycle coordinator to lead the regional bike program and implement area bike plans. City of Merced and Atwater BP: Mentions a regional bicycle coordinator to lead the regional bike program and implement area bike plans. City of Merced BTP: Mentions coordinating bike planning/implementation with local interest entities, but doesn't dedicate a staff member for this role. City of Merced AT/SR2S: Mentions a Bicycle Advisory Commission (which I am assuming has a staff lead) to discuss issues of concern for bicyclists. Also recommends a full-time staff person for acquiring bike/ped grant funding. The MCAG RTP mentions coordination with regional agencies and jurisdictions for safety work but does				x
		Provide training to MCAG staff, directors, elected officials, and community stakeholders on the Safe System approach.	x				x		x	x
		Establish an ongoing Safe Routes to Schools program and funding mechanism.		x		Merced County's Department of Public Health Department, County Planning Department, County Public Works Department, and school districts coordinate a countywide SR2S program. Funding mechanism unclear. Franklin-Beachwood SR2S Plan and Planada Pedestrian Improvement Plan were funded by the Caltrans Environmental Justice Trnasportation Planning Grant awarded to Merced County in FY 12-13. Both plan recommends using ATP funding to fund SR2S programs/projects. Other plans that also recommend this include Los Banos BPP, City of Merced AT/SR2S Plan, and MCAG RTP.	x	x	x	x
	Meaningful Engagement	Establish a website to inform the public about MCAG's safety program goals and progress and the effectiveness of implemented safety projects.	x			Right now only Merced County (jurisdiction) has a website for their current LRSP effort but can't find any safety related websites for any of the jurisdictions. The Los Banos BPP notes a public website with a GIS map to update projects, as well as make website announcements whenever complete, but can't find this website. MCAG has the social pinpoint site for the ATP but there aren't any links to it from the MCAG site.				
		Provide public materials in common languages spoken by the Merced Region residents whose first language is not English.		x		ATP effort has the ATP website/map in English/Spanish.	x		x	x
	Data and analysis	Apply a proactive and transparent approach to data-driven safety analysis, including the use of systemic profiles, emphasis areas based on roadway or contextual contributing factors, mode-specific conditions assessments (e.g., bicycle network stress or distance between marked crossings), and equity considerations.	x				x	x		x
		Establish a process for citizens to report safety hazards or request safety interventions and a data-driven approach for evaluating the reports/requests.		x		Most jurisdictions have a 311 website or phone number	x			
		Focus network screening and benefit/cost calculations on fatal and serious injuries, instead of all collisions, to identify the core safety issues for human vulnerability.	x				x	x		x
		Maintain a GIS inventory and actively work to improve accuracy of crash data and roadway data such as missing sidewalks, bikeways, intersection controls, etc.		x			x		x	x

		Use innovative data collection and analysis approaches, such as crowdsourcing or video detection data, to identify emphasis areas related to near misses or crashes previously unreported by vulnerable communities.	x				x			x
	Funding	Develop a project evaluation framework that prioritizes funding based on fatal and serious injury crash reduction opportunities, especially for equity populations. Audit MCAG's Overall Work Plan (OWP) for opportunities to enhance safety benefits and remove safety risks of funded projects.	x				x	x	x	x
		Apply for grant programs to fund safety projects.			x	Based on the SR2S note, most jurisdictions use ATP funding for bike/ped improvements and SR2S improvements.	x	x	x	x
		Institutionalize safety considerations in all project types to systematically fund projects through operations and maintenance efforts (such as repaving projects).	x				x		x	
	Development review	Conduct safety impact assessments of new developments to identify mitigation and cost sharing opportunities.	x				x			
	Equity first	Clearly define equity in the safety plan and include equity considerations throughout the emphasis areas and strategies.	x				x	x	x	x
		Incorporate equity considerations in implementation and assessment plans, such as goals related to safety improvements for populations that are traditionally underserved.	x				x	x	x	x
		Meaningfully engage populations that are traditionally underserved in shared decision-making for safety efforts.		x			x	x	x	x
Safe Users	Education	Perform outreach through educational programs, with a focus on the behaviors and target audiences most linked to death and serious injuries. Utilize partnerships with community-based organizations and advocacy groups.	x				x	x		x
		Use demonstration projects to raise awareness of new designs, encourage support among stakeholders for safety projects requiring capacity trade-offs, and solicit feedback from the public. Demonstration projects also provide opportunity to measure safety effects and encourage innovation and design flexibility.	x				x	x		x
	Enforcement	Investigate and document the impacts of traffic safety enforcement and traffic safety surveillance on minority communities. Take steps to mitigate disproportionate impact of enforcement on disadvantaged populations.	x				x	x		x
		Reallocate enforcement activities to target those behaviors and locations most linked to death and serious injury.	x				x			
	Research	Develop and implement strategies for robust demographic data collection in crash reporting.	x				x			x

Safe Roadways	Collision avoidance	Systemically install proven countermeasures to separate users in space, separate users in time, and increase attentiveness and awareness, such as: protected signal phases, clear zones, and vertical and horizontal separation for pedestrians and bicyclists.		x		City of Merced AT/SR2S Plan recommends safety countermeasures for bicyclists, pedestrians, and general traffic safety. Franklin-Beachwood and Planada plans mention crossing enhancements and sidewalk construction as countermeasures to ped-involved collisions.	x	x		
		Complete infrastructure connectivity for pedestrians and bicyclists and make progress toward providing separation where needed based on crash exposure, crash history, characteristics of the roadway, and adjacent land uses associated with higher levels of use.		x		Gustine ATP: Identifies projects that close gaps in their sidewalk and bicycle network. As a whole, this plan conducted a gap and barrier analysis. Franklin-Beachwood Plan recommends closing sidewalk gaps in the network. Los Banos BPP identified sidewalk gaps and recommended infill projects. City of Merced BTP has a project prioritization table listing bridging bikeway gaps as a criterion. It also has a policy listed to complete incomplete roadway networks. City of Merced AT/SR2S P recommends gap closures throughout the document. Planada Ped Improvement Plan recommends closing sidewalk gaps in the network. Merced County BTP has a goal on bicycle connectivity focused on establishing and integrating the bike network. Walkable Winton Town Center Plan recommends improving/closing sidewalk gaps.	x	x	x	x
	Kinetic energy reduction	Systemically install proven countermeasures to manage motor vehicle speed and collision angles, such as roadside appurtenances, roundabouts, refuge islands, hardened center lines, and road diets.		x		Gustine ATP: Describes an in progress installation of a roundabout. City of Merced AT/SR2S P lists roundabouts, median refuge islands, and road diets as appropriate countermeasures. MCAG RTP lists top projects including one county level roundabout (SR-140/Plainsburg). Walkable Winton Plan recommends a road diet for portions of Winton Way.	x	x		
		Evaluate intersection design and control decisions in the planning or scoping stage for opportunities to better prioritize reducing kinetic energy transfer, following new FHWA guidance.	x				x	x		x
	Policies and tradeoffs	Designate functional class and modal priority for roadways to pinpoint the most effective safety countermeasures and streamline tradeoff decisions - evaluated at a network scale for network-based priorities.		x		All jurisdictions have functional classifications for their roads - unsure they meet the criteria for modal priority and countermeasures on these classifications, or if they are just using standard Caltrans classifications.	x	x		
		Ensure safety for all users is prioritized, and accessibility maintained, during construction and road maintenance projects.	x				x	x		
	Innovation	Provide infrastructure for smarter roadways and intelligent transportation systems (ITS) in support of data collection and analysis, as well as proactive system management. Consider long-term network priorities and immediate pedestrian and bicyclist safety and mobility needs when citing EV charging stations.	x			MCAG RTP has a goal to develop ITS, but it is currently not in place.				
Safe Vehicles	Supportive infrastructure	Enable infrastructure-to-vehicle communication to provide warnings to drivers that support safer driving behavior.	x			Need to determine if this will be at MCAG level or by jurisdiction.				
		Provide supportive infrastructure for dynamic curbside management and autonomous vehicles to enable active safety technology.	x			MCAG RTP has a goal to address this, but it is currently not in place.				
	Fleet Management	Support safer operations of city and commercial vehicles through a transition plan of city's vehicle fleet to lower-mass and safety feature enhanced vehicles; heavy vehicle route restrictions to avoid high-pedestrian areas; and curbside management programs to limit user conflicts around stopped or loading vehicles.	x							
	Data	Collect data about the involvement of AVs in crashes for future data analysis, and to inform design and policies.	x			MCAG RTP has a goal to address AV technology, but it is currently not in place.				
Safe Speeds	Design and operations	Adopt roadway design standards that are focused on speed management, such as target speed-based design, for residential and arterial roadways. Adjust roadway geometries for context-appropriate speeds.	x				x		x	
	Enforcement	Deploy speed safety cameras, with a focus on equitable fee structures. Where not permitted, monitor changes in state legislation that may allow for this in the future.	x							
	Policy and training	Follow speed limit setting methodologies that determine appropriate or target speeds based on land use context, roadway context, and/or modal priority - accounting for the human body's ability to tolerate crash forces rather than the historic behavior of road users. Consider utilizing innovative data sources to systemically assess prevailing versus target speeds and develop a plan to lower speeds in areas with a large discrepancy.	x				x		x	
		Provide speed management training to staff focused on fatality and serious injury minimization.	x				x			
Post Crash Care	Crash investigation	Employ collision reporting practices that promote complete and accurate data collection and documentation of road user behavior and infrastructure.	x							?
		Establish a feedback loop such that key insights from crash investigations are shared with roadway designers and/or influence outreach and education. Consider the creation of an inter-agency rapid response team to immediately investigate the sites of collisions and make recommendations for near-term safety enhancements.	x				x			x
	Partnerships	Share data across agencies and organizations, including first responders and hospitals, to develop a holistic understanding of the safety landscape and improve accuracy.	x				x			
		Connect with victims' families and the advocacy community to offer support and resources, and encourage partnerships with outreach and education.	x				x			

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Appendix

B

Community Outreach Responses

A website was developed for the LRSP to collect public feedback, consisting of an interactive webmap and a community survey. With the webmap, users can identify specific locations within the region where they have roadway safety concerns, and tag them by mode of travel (i.e. walking, biking, driving, etc.), while the survey asks more general questions of respondents around their perceptions of and visions for roadway safety in the region. Both the webmap and the survey were open for public response from March to June of 2024, and both were made available in English and Spanish. The website was promoted through MCAG's existing public-facing channels, including newsletters and social media. Materials promoting the website were also handed out during in-person public outreach.

The webmap saw a total of 127 locations tagged. A map and log of all tags are included in this appendix. The community survey saw a total of 198 responses. The key takeaways from these responses are summarized in the following section. A full log of all responses is also included in this appendix.

LOG OF WEBMAP CONTRIBUTIONS

ID	Date Submitted	What's going wrong here? What can be improved?	Issue	Latitude	Longitude
18794	Jun 14, 2024, 04:36 PM	Rough/uneven road with some potholes between Vine Ave. and Cypress Ave. Also, this area might need some sidewalks.	Issues with driving	37.38937	-120.6243
18793	Jun 14, 2024, 04:32 PM	The road near this corner on Buena Vista is rough/uneven and has potholes. The intersection was repaved recently but didn't extend down the road in front of the school. This school has over 900 students, so there's a lot of traffic through this section of road.	Issues with driving	37.326355	-120.4863
18792	Jun 14, 2024, 04:29 PM	The section of Hatch Rd. between Dunn and Yosemite is rough and has multiple potholes. It gets a lot of traffic going to the lake and the UC.	Issues with driving	37.334753	-120.4419
18791	Jun 14, 2024, 04:25 PM	Rough road and lines need to be repainted.	Issues with driving	37.33471	-120.4692
18790	Jun 14, 2024, 04:24 PM	Too many vehicles are using this intersection to maintain safety. My father was hit by a vehicle pulling out of Ave 2 onto Santa Fe. His car was totaled and the driver said he didn't see him. It's difficult for cars pulling out of Ave 2 to see cars coming on Santa Fe with reasonable time. There should be a stoplight here to prevent future accidents.	Issues with driving	37.349609	-120.5554
18789	Jun 14, 2024, 04:19 PM	The section of Bert Crane Rd. between highway 99 and Bell Dr. is a rough drive. Many motorists use it to get to the Walmart and Target shopping center and it hasn't been repaved or "smoothed" out in years even though it gets used a lot. Also, the drop-off from the road to the shoulders is steep in some parts.	Issues with driving	37.34883	-120.6325
18788	Jun 14, 2024, 04:14 PM	Fox Road between Bellevue and Santa Fe has multiple potholes throughout. I'm worried to drive through that section because it might damage my vehicle and/or tires. It appears as though no repair or repavement has been done there in years!	Issues with driving	37.356089	-120.5495
18787	Jun 14, 2024, 04:11 PM	This section of Carmella (between Fox Rd. and Franklin Rd.) has multiple potholes and floods easily during rainy days. This section of the road is so bad, that I'm worried it may damage my vehicle and/or tires to drive through it.	Issues with driving	37.346181	-120.5435
18786	Jun 14, 2024, 04:08 PM	There's a large pothole on the road at this intersection. It's on Bellevue Road.	Other Issues	37.360769	-120.503
18762	Jun 12, 2024, 09:45 AM	Finish this section as a four-lane road over the railroad tracks to W Olive Ave	Issues with driving	37.317224	-120.5051
18761	Jun 12, 2024, 09:44 AM	Rebuild these bridges and make them much wider, perhaps enough for a four-lane highway that may be required for this section of 59 as Merced grows.	Issues with driving	37.3211	-120.5049
18760	Jun 12, 2024, 09:41 AM	A large roundabout would greatly decrease the gridlocked traffic on Snelling Hwy.	Issues with driving	37.308532	-120.5052
18759	Jun 12, 2024, 09:40 AM	Gridlock traffic. I emailed a redesign to Ms. Prince that is more applicable to the upcoming 2026 Regional Transportation Plan. Basically, the redesign reconfigures the Atwater-Merced Expressway that redirects through Hwy 59 traffic and industrial traffic in SW Merced into the new Expressway design.	Issues with driving	37.303057	-120.5006
18670	Jun 08, 2024, 09:28 PM	Speeding and zero enforcement, ever.	Issues with driving	37.442713	-120.5032
18644	Jun 07, 2024, 06:17 PM	Since the Buhach on ramp and offramp were removed, it’s almost impossible to get to the residence and businesses on Atwater Boulevard from Merced. If the offramp here had a left turn, you could go under the overpass and get to those businesses along the on ramp to South 99.	Issues with driving	37.340519	-120.5946

18643	Jun 07, 2024, 06:15 PM	There really needs to be a stoplight at this intersection. It’s dangerous for kids to cross to and from school and it’s almost impossible to turn left off of Grove onto Winton Way because it’s hard to see traffic coming around the curve near Elm.	Issues with driving	37.353391	-120.6137
18629	Jun 07, 2024, 12:33 PM	A stop light intersection or 4-way stop are desperately needed at this intersection due to speeds of cars coming from/to Hwy 99.	Issues with driving	37.309228	-120.509
18628	Jun 07, 2024, 12:30 PM	Can this on-ramp be extended? It's very difficult to get up to highway speed to merge successfully into traffic. Heavy traffic flow in this area with cars either unwilling or unable to move over to allow merging cars onto the highway make this a dangerous on-ramp. I was under the impression that at some point the on/off ramps here were going to be closed and traffic would be routed to use the Atwater-Merced Expressway on/off ramps. Is this ever going to happen?	Issues with driving	37.321357	-120.5412
18627	Jun 07, 2024, 12:26 PM	Suggestion: Add 3-way stop at intersection of Franklin and Dan Ward. Heavy traffic flowing very fast on Franklin lends itself to desperate individuals taking unnecessary risks to turn onto Franklin. This would also help slow traffic down where the speed limit changes.	Issues with driving	37.331676	-120.5408
18626	Jun 07, 2024, 12:17 PM	Suggestion: change the traffic signal at Santa Fe and Franklin. Allow traffic on one side of Santa Fe on Franklin to go (straight or turn) while the other side remains stopped. This would allow cars waiting to turn onto Santa Fe to go without waiting for cars to cross across the intersection. Traffic on the side of Franklin where W. Belcher Ave is located becomes VERY congested at peak drive times and I've seen many close calls of people who are running a red light because they've waited thru several cycles of the light to get thru the intersection.	Issues with driving	37.340285	-120.5404
18625	Jun 07, 2024, 12:11 PM	The corner of Franklin and Bellevue (right turn off Franklin onto Bellevue) is severely compromised. There is a large pothole that bandaid fixes are not fixing and the side of the roadway has caved away. This is a corner frequented by large vehicles such as garbage trucks and they are wearing away the roadway.	Issues with driving	37.360556	-120.5401
18624	Jun 07, 2024, 12:08 PM	The 4-way intersection at Ashby and Franklin needs repaving. The "bandaid" fixes of potholes are making the issue worse. Driving thru that intersection is terrible.	Issues with driving	37.32304	-120.541
18588	Jun 06, 2024, 04:19 AM	This area has way too many accidents due to high speed and poor visibility from all of the trees and multiple intersections.	Issues with driving	37.325397	-120.478
18540	Jun 05, 2024, 07:00 PM	In need of dire replacement. Drive down it and you will know. From g st. To 140 turn off eastbound.	Issues with driving	37.294913	-120.4705
18539	Jun 05, 2024, 06:55 PM	This street is soo pitted it isn't suitable for a covered wagon it's an embarrassing entrance to the amtrac station...seriously??	Issues with driving	37.30654	-120.4767
18507	Jun 03, 2024, 04:54 PM	Needs stop sign—In the 5 years I’ve lived on this street, I have seen countless kids, animals, and pedestrians almost hit and cars crashed into the house on the south east corner at least 3 times.	Issues with driving	37.308111	-120.4886
18469	Jun 02, 2024, 10:32 PM	The angle of this intersection makes it difficult to see oncoming traffic	Issues with driving	37.283702	-121.0083
18468	Jun 02, 2024, 10:30 PM	The traffic circle under construction is going to cause many accidents and prevent the flow of commerce when big rigs can’t make the turn.	Issues with driving	37.253785	-120.9974
18467	Jun 02, 2024, 10:28 PM	Tress blocking the view of the intersection	Issues with driving	37.173323	-121.0132
18466	Jun 02, 2024, 10:27 PM	Trees blocking the view of the intersection.	Issues with driving	37.172985	-121.0314
18465	Jun 02, 2024, 10:26 PM	Sidewalks so kids can walk to school	Issues with walking	37.245721	-121.002

18453	Jun 01, 2024, 12:15 PM	Please finish the four-lane portion of Yosemite Ave to 59. There's plenty of space to move the City of Merced refuge collection center a little north to accommodate the lanes and turnout.	Issues with driving	37.332116	-120.5031
18452	Jun 01, 2024, 12:10 PM	Please take away the double yellow line on Henry Miller Ave between 165 and Volta. We should be able to pass cares if conditions permit without breaking the law.	Issues with driving	37.100457	-120.8857
18404	May 28, 2024, 08:15 PM	Horrible drainage and potholes	Issues with driving	37.418054	-120.8473
18403	May 28, 2024, 08:15 PM	Potholes	Issues with driving	37.431136	-120.8378
18395	May 28, 2024, 11:05 AM	No sidewalk or bike lane	Issues with walking	37.341863	-120.6071
18394	May 28, 2024, 11:04 AM	No sidewalk or bike lane	Issues with walking	37.343799	-120.6173
18391	May 28, 2024, 06:43 AM	Giannini Rd and Commerce has be come so congested now due to increased homes and businesses in the area. There is no safe place for foot or bike traffic along these road which has also increased a lot.	Other Issues	37.32638	-120.5985
18320	May 26, 2024, 11:43 AM	Traffic on El Portal between McKee and Parsons is quite heavy. It's being used as a thoroughfare t get to G. This is a residential area with children, seniors, and pets. Many cars ignore the 25 mph sign and do 45.	Issues with driving	37.324825	-120.4487
18319	May 26, 2024, 11:40 AM	Nearly impossible to turn left o to McKee from El Portal. When the complex at McKee and Yosemite is complete, traffic will be far worse	Other Issues	37.324876	-120.4445
18318	May 26, 2024, 11:36 AM	There are no crosswalks even though there is an elementary school a few blocks away. Not safe for kids walking to/from school. Also, when school starts/ends is near impossible to cross (on foot or in a car) without taking your life in your own hands	Other Issues	37.325249	-120.4512
18313	May 26, 2024, 07:38 AM	Horrible road pot holes and torn up parts throughout Parsons to “G” Street.	Issues with driving	37.33212	-120.4642
18312	May 26, 2024, 07:36 AM	Horrible road! Fix it!	Issues with driving	37.321644	-120.4441
18309	May 26, 2024, 04:29 AM	paint ≠ infrastructure	Issues with biking	37.332023	-120.4425
18308	May 26, 2024, 04:27 AM	paint is not infrastructure, youd have to be suicidal to ride on the shoulder against 55mph heavy traffic, and yet countless do it everyday. its a miracle nobody's been killed. perfect candidate for a protected bikeway.	Issues with biking	37.360836	-120.4438

18288	May 25, 2024, 07:18 AM	I live on the corner of Massasso and Lopes. The City of Merced plans to extend Massasso Street from McSwain Road to Wardrobe Avenue. However, Massasso Street is a narrow residential street, about 10 feet narrower than Sydney Lane, the main road into the neighborhood. Many families on Massasso have young children who will loose the ability to safely play on the street. A better route is to connect Beachcraft Avenue with Wardrobe Avenue and McSwain Road. The heirs to the property at 2003 Lopes Avenue sold the 10 acre family farm. The new owners intend to subdivide the property into three parcels. Merced told them they must leave an easement for Massasso St. The owners could easily create an easement for Beachcraft at the western edge of the property where vacant land exists between the homes at 2056 and 2044 McSwain Road. There will be a short L-shaped route along Lopes Avenue, an L-shaped that will keep drivers from speeding through the neighborhood. The City of Merced will need to enforce the "no truck" parking on Beachcraft because many employees from Human Services and clients from the Central Valley Training Center walk along Beachcraft throughout the day during breaks.	Other Issues	37.299099	-120.5141
18287	May 25, 2024, 06:34 AM	Please resurface the section of Badger Flat Rd north of Ingomar Grade along with the railroad crossing. My wife and I frequently travel to the Bay Area from Merced. We drive through Turner Island and take Henry Miller Ave to bypass Los Baños. Recently, we tried Volta since Maps suggested the route. However it is much safer to enter and exit 152 at the stop light on Badger Flat.	Issues with driving	37.083276	-120.8777
18282	May 24, 2024, 11:15 PM	Roadway is almost non existent. Needs to be repaved.	Issues with driving	37.355775	-120.7782
18281	May 24, 2024, 11:12 PM	Dangerous intersection. Needs a stoplight.	Issues with driving	37.386316	-120.7121
18259	May 23, 2024, 09:32 PM	The road is terrible. Potholes, loose gravel, etc.	Issues with driving	37.331729	-120.4625
18249	May 23, 2024, 12:32 PM	Needs a sidewalk to the high school	Issues with walking	37.28779	-120.4337
18195	May 21, 2024, 10:03 AM	Sultana road is undrivable. Please redo the road and not just fill in the holes. That does not help.	Issues with driving	37.38046	-120.6868
18176	May 20, 2024, 02:44 PM	This road has so many potholes. It is very dangerous. A person passed away there last year from a car crash. It is a dangerous intersection as well with all of the semi trucks that drive through there. People usually cannot drive on the lane with the potholes and swerve onto the other side, but then risk getting hit by oncoming traffic.	Issues with driving	37.287788	-120.4148
18175	May 20, 2024, 02:42 PM	This road does not have a bike lane. Cross country bikers always come through here, but the road is full of potholes. There is no sidewalk either. It is EXTREMELY HAZARDOUS. It needs to be repaved. A bike lane and a sidewalk would also both be useful here. There is also no street lighting. This road is so bad and it is right next to two residential communities. It's the only road people are able to take to get into town.	Issues with biking	37.31051	-120.3246
18174	May 20, 2024, 02:40 PM	This road is EXTREMELY HAZARDOUS. It needs to be repaved. A sidewalk needs to be added. It is completely potholes and it is a road that is used very often.	Issues with walking	37.298853	-120.3247

18173	May 20, 2024, 02:39 PM	North Plainsburg Rd between HWY 140 and Bear Creek Rd is EXTREMELY HAZARDOUS. The road is completely potholes, there is no sidewalk, or bike lane, and people use this road daily and often, including people in wheelchairs. People have to dodge potholes, other cars, people walking on the road, and people in wheelchairs on the road. It needs to be repaved and at there needs to be a sidewalk.	Issues with driving	37.304158	-120.3248
17970	May 15, 2024, 08:27 PM	La banqueta esta mal echa en el drive way de. 166 Santa bárbara st los banos	Issues with driving	37.194461	-120.6773
17771	May 13, 2024, 12:32 PM	No crosswalk. A lot of people cross this road to get to the park. For saftey there should be a crosswalk with flashing lights, for example.	Issues with walking	37.252982	-121.008
17769	May 13, 2024, 12:25 PM	This road is full of potholes. Pavement can be improved.	Issues with driving	37.260038	-121.0215
17768	May 13, 2024, 12:23 PM	Due to the detour, more cars are crossing through here but they don't realize it's not a four way stop. I have seen cars almost crashing into each other because of this. This is concerning because during after school hours many students are walking through the area.	Other Issues	37.254747	-120.9991
17766	May 13, 2024, 12:16 PM	Students are walking by a busy street where there is no sidewalk. A sidewalk needs to be built for the safety of the students walking to and from school.	Issues with walking	37.245979	-120.9973
17455	May 04, 2024, 03:46 PM	motorists barrel through along W. 11th Streets despite pedestrians being in the crosswalk. Install a mini round about to change driver behaviors.	Issues with walking	37.301175	-120.5035
17432	May 02, 2024, 07:59 PM	No crosswalks or stoplights	Issues with walking	37.275404	-120.4335
17431	May 02, 2024, 07:57 PM	Pot holes	Issues with driving	37.272907	-120.4614
17425	May 02, 2024, 10:55 AM	The road is quite rough and has reoccurring potholes.	Issues with driving	37.332163	-120.4604
17417	May 01, 2024, 03:15 PM	Rough bumpy road once you exit off the 99	Other Issues	37.294355	-120.4687
17407	Apr 30, 2024, 09:34 AM	Sound wall needed on CA99 where it is at surface level with adjacent neighborhoods. Increasing traffic on CA99 has resulted in incessant noise for West Merced neighborhoods. Traffic noise is amplified by acres of asphalt surface at Home Depot.	Other Issues	37.304832	-120.5054
17381	Apr 29, 2024, 02:49 PM	Despite this being a nice looking building, the first impression for passengers is this is a risky (Yosemite transfer) station stop. Graffiti vandalism, boarded up buildings, retail with bars on openings, no landscaping... this does not offer a reassuring customer experience. It perpetuates Merced's current brand as "not being a safe place."	Other Issues	37.307189	-120.4762
17380	Apr 29, 2024, 02:39 PM	All bus service needs to directly interface with the Amtrak San Joaquins and YART at this train station-now. It is MCAG's responsibility to enable 'easy to use' access of local public transportation to access regional transportation. Expecting rail passengers to suffer through bus transfers to gain access to regional transit is NOT AN EXEMPLARY CUSTOMER EXPERIENCE .	Other Issues	37.307369	-120.4771
17379	Apr 29, 2024, 02:29 PM	City of Merced Administration needs to "wake up" and recognize 16th Street should be THE primary branding portal; extensively landscaped on both sides of street as well as a landscaped median incorporating a Yosemite architectural theme. THIS is the access to MITC, Intermodal Commuter Station, Downtown and other destination points in the community. Rename 16th Street to YOSEMITE PARK WAY.	Other Issues	37.297452	-120.4759

17378	Apr 29, 2024, 02:28 PM	City of Merced Administration needs to "wake up" and recognize 16th Street should be THE primary branding portal; extensively landscaped on both sides of street as well as a landscaped median incorporating a Yosemite architectural theme. THIS is the access to MITC, Intermodal Commuter Station, Downtown and other destination points in the community. Rename 16th Street to YOSEMITE PARK WAY.	Other Issues	37.311322	-120.5151
17377	Apr 29, 2024, 02:19 PM	Change Southbound 16th Street CA99 exit signage to Downtown Merced/Airport/Merced College/University of California. Current 16th Street signage is meaningless. City of Merced needs to get its branding strategy straight.	Issues with driving	37.314026	-120.5224
17376	Apr 29, 2024, 02:15 PM	Close the southbound V Street CA99 exit and return West 13th Street to two way East/West traffic flow. Designate Southbound CA99 16th Street as Downtown Merced/Airport/University of California Exit. This will improve traffic flow at 13th & V Streets.	Issues with driving	37.303255	-120.502
17375	Apr 29, 2024, 02:11 PM	City and County needs to undo this 'Caltrans lab experiment gone awry.' Having 5 Westbound lanes designated for a four block segment on a primary East/West arterial is improvident. Westbound traffic is thrown into residential streets resulting in excessive traffic, excessive speeding traffic, excessive traffic noise and increasing the risk of stressful living in R-1 neighborhoods.	Issues with driving	37.30169	-120.4982
17374	Apr 29, 2024, 02:03 PM	Persistent TOTAL GRIDLOCK directly attributed to unsynchronized traffic lights and poor street design. Backed up, idling traffic is not a solution for reducing green house gasses and reducing gasoline consumption.	Issues with driving	37.30312	-120.5006
17373	Apr 29, 2024, 01:59 PM	V Street between 16th and 13th Sts does not function effectively; too many curb cuts, too many unsynchronized traffic lights, no grade separation at Union Pacific crossing and overall poor street design at CA99 interface with V Street. This is where there is HIGH risk for delayed emergency response time.	Issues with driving	37.304163	-120.5
17369	Apr 28, 2024, 05:34 PM	There is a Caltrans proposal for a round about at this intersection. There needs to be a grade separated pedestrian/Class IV bike route over this intersection to connect the neighborhoods on Gerard Ave. The County needs to be a partner with this solution.	Issues with biking	37.280927	-120.4877
17368	Apr 28, 2024, 05:30 PM	N Street needs to be a North/South Class IV bike way from 13th St to south of Gerard Avenue to connect neighborhoods.	Issues with biking	37.288841	-120.4942
17367	Apr 28, 2024, 05:27 PM	O Street should be a North/South Class IV bikeway to connect all neighborhoods south of Bear Creek.	Issues with biking	37.295642	-120.4922
17366	Apr 28, 2024, 05:25 PM	a class IV bike way on 8th Street is needed to provide a safe route to school between Tenaya Middle School, Margaret Sheehy Elementary and Gracey Elementary schools; this route also connects McNamara Park, Stephen Leonard Park and the Youth Sports Complex	Issues with biking	37.295562	-120.498
17365	Apr 28, 2024, 05:19 PM	a traffic round about is needed to quiet traffic adjacent to Tenaya Middle School. Traffic speed limit needs to be reduced to 15 mph on 8th between P St and M Street; and reduce speed limit to 15 mph on N St between 9th St and 5th St.	Issues with driving	37.29327	-120.4917
17364	Apr 28, 2024, 05:15 PM	11th Street needs to be designated as a Class IV Bike way / Safe Route to School between Gracey Elementary on West Avenue and Stowell Elementary on East 11th Street; this route also links Little Angels Park, McNamara Park and Dennis Chavez Park.	Issues with biking	37.30098	-120.503
17363	Apr 28, 2024, 05:07 PM	pedestrian actuated signals needed on all four corners of V St. and West 8th Street, with flashing LED in 'Zebra' crosswalks	Issues with walking	37.297621	-120.5037
17362	Apr 28, 2024, 05:06 PM	pedestrian actuated signals needed on all four corners of V St and West 9th Street, with flashing LED in 'Zebra' crosswalks	Issues with walking	37.298651	-120.5031
17361	Apr 28, 2024, 05:04 PM	pedestrian actuated signals needed on all four corners of V Street and West 11th Street, with flashing LED in 'Zebra' crosswalks	Issues with walking	37.300569	-120.5021

17360	Apr 28, 2024, 05:03 PM	pedestrian actuated signals needed on all four corners of MLK and 8th Street, with flashing LED in 'Zebra' crosswalks	Issues with walking	37.291061	-120.4857
17359	Apr 28, 2024, 05:01 PM	pedestrian actuated signals needed on all four corners of MLK and 11th Street, with flashing LED in 'Zebra' crosswalks	Issues with walking	37.294009	-120.484
17358	Apr 28, 2024, 04:54 PM	a traffic round about is needed to quiet street adjacent to elementary school. Reduce speed to 15 mph on 11th Street between E Street and D Street, and D Street between 10th St and 13th St.	Issues with driving	37.290814	-120.475
17357	Apr 28, 2024, 04:51 PM	a traffic round about is needed to quiet street adjacent to park; speed limit needs to be reduce to 15 mph between MLK and Canal Street, 12th and 9th Street.	Issues with driving	37.294585	-120.4855
17356	Apr 28, 2024, 04:49 PM	a traffic roundabout is needed to quiet this route to school; street speed limit needs to be reduced to 15 mph between V Street and X Street; 10th Street and 12th Street.	Issues with driving	37.301061	-120.5035
17355	Apr 28, 2024, 04:46 PM	duplicite pedestrian signs and faded crosswalk markings do not make this a safer intersection for pedestrians. 'Zebra' pedestrian crossings needed on all four sides of the intersection; this is not a safe route to school for Gracey Elementary Students and parents.	Issues with walking	37.300677	-120.502
17354	Apr 28, 2024, 04:43 PM	there is no pedestrian crosswalk on West 12th & V Street. Need 'zebra' crosswalk marking to clearly delineate crossing.	Issues with driving	37.301639	-120.5015
17353	Apr 28, 2024, 04:40 PM	oversized commercial semi trucks with trailers are creating their own Truck Route on W Street and West 11th Street	Issues with driving	37.301021	-120.5036
17352	Apr 28, 2024, 04:38 PM	over 100 vehicles per hour are using West 11th St as a by pass to and from traffic lights at V and West 13th Street.	Issues with driving	37.301104	-120.5033
17351	Apr 28, 2024, 04:36 PM	motorists not yielding to elementary students in the crosswalks.	Issues with walking	37.301238	-120.5035
17350	Apr 28, 2024, 04:34 PM	motorist in a pick up truck running a red left turn light while pedestrians in the cross walk.	Issues with walking	37.302763	-120.5045
17347	Apr 28, 2024, 03:32 PM	People drive too fast through here, especially going to and from Hoover School.	Issues with driving	37.305962	-120.4681
17316	Apr 26, 2024, 04:49 PM	This intersection is very unsafe to walk across because there is no turn signals for drivers, and drivers that are turning right on red going down G street often can't see pedestrians. I've been hit and nearly been hit by a car at this intersection on two separate occasions already.	Issues with walking	37.332076	-120.4691
17243	Apr 24, 2024, 04:00 PM	new traffic pattern installed by County is a confusing conversion of high speed traffic, cross walks and bike lanes	Issues with biking	37.30937	-120.4443
17093	Apr 19, 2024, 11:30 PM	Need 4 way stop.also no semi trucks. Kids walk home from school. Very dangerous road. No sidewalks. Need 25 mile speed limit plus limit to no semi trucks, add speed bumps.	Issues with walking	37.245495	-121.0079
17092	Apr 19, 2024, 11:28 PM	Deadly area with car passing, head on collisions. People have died. Need barrier to prevent passing.	Issues with driving	37.157948	-121.0116
17091	Apr 19, 2024, 11:26 PM	Unsafe intersection. Many accidents and deaths. Need 4 way stop.	Issues with driving	37.245492	-121.013
16794	Apr 11, 2024, 05:46 PM	Bridge surface road over canal, especially heading south, is in really bad shape.	Issues with driving	37.247604	-121.0128
16787	Apr 11, 2024, 11:46 AM	In this area, some potholes need permanent repairs rather than every year. W. Yosemite Ave and Pacific Dr. on El Redondo Dr.	Issues with driving	37.33789	-120.4949
16700	Apr 09, 2024, 11:12 AM	Need safe transition for bikes/peds from road/sidewalk to middle bike path.	Issues with biking	37.325383	-120.4783
16699	Apr 09, 2024, 11:10 AM	Deteriorating asphalt. Makes for rough road.	Issues with driving	37.307514	-120.4966
16698	Apr 09, 2024, 11:08 AM	Too dark and no sidewalk/bike lane space. Have almost hit bicyclists and pedestrians walking this road to and from the UC.	Other Issues	37.361184	-120.4642
16695	Apr 09, 2024, 09:15 AM	Rough road	Issues with driving	37.318778	-120.4867
16694	Apr 09, 2024, 09:09 AM	rough road	Issues with driving	37.301674	-120.4915

16690	Apr 09, 2024, 08:43 AM	This is a dead end road that only has one sign posted approx. 20 yards from the entrance. Lots of traffic ignore the sign and go down sycamore thinking it goes all the way thru. A sign marker on the sycamore street sign that indicates dead end is requested.	Issues with driving	37.256235	-121.0046
16689	Apr 09, 2024, 08:40 AM	Railroad ave north and south is very uneven and littered with potholes.	Issues with driving	37.250867	-120.9958
16688	Apr 09, 2024, 08:39 AM	Railroad tracks are extremely bumpy to go over and uneven pavement.	Issues with driving	37.284165	-121.0083
16687	Apr 09, 2024, 08:37 AM	No crosswalk for students to cross to get to elementary or middle school.	Issues with walking	37.253012	-121.0046
16686	Apr 09, 2024, 08:37 AM	No crosswalk for students to cross to get to elementary or middle school.	Issues with biking	37.252931	-121.0046
16685	Apr 09, 2024, 08:36 AM	The bridge here was not repaired when Hwy 33 was repaved. It is full of potholes and uneven pavement.	Issues with driving	37.247644	-121.0128
16684	Apr 09, 2024, 08:35 AM	The whole road north and south Mils Rd is littered with pot holes and uneven pavement. Please resurface.	Issues with driving	37.243117	-121.0034
16683	Apr 09, 2024, 08:34 AM	No crosswalk at this busy intersection.	Issues with driving	37.253044	-121.0046
16682	Apr 09, 2024, 08:33 AM	No sidewalks for students to safely get to school.	Issues with walking	37.245812	-120.9984
16665	Apr 08, 2024, 07:56 PM	Sidewalk for children walking to and from school. Speeding motorists not respecting kids walking	Issues with walking	37.245866	-120.9979
16658	Apr 08, 2024, 06:33 PM	We need a sidewalk for students to walk to Gustine Middle School.	Issues with walking	37.245833	-120.9975
16657	Apr 08, 2024, 06:33 PM	We need a sidewalk for students to walk to Gustine Middle School.	Issues with walking	37.247745	-120.9947
16656	Apr 08, 2024, 06:33 PM	We need a sidewalk for students to walk to Gustine Middle School.	Issues with walking	37.246665	-120.9988
16651	Apr 08, 2024, 03:18 PM	no bike lanes	Issues with biking	37.31362	-120.4786

F&P Social Pinpoint

Report Type: Form Results Summary
Date Range: 20-03-2024 - 14-06-2024
Exported: 13-08-2024 17:03:49

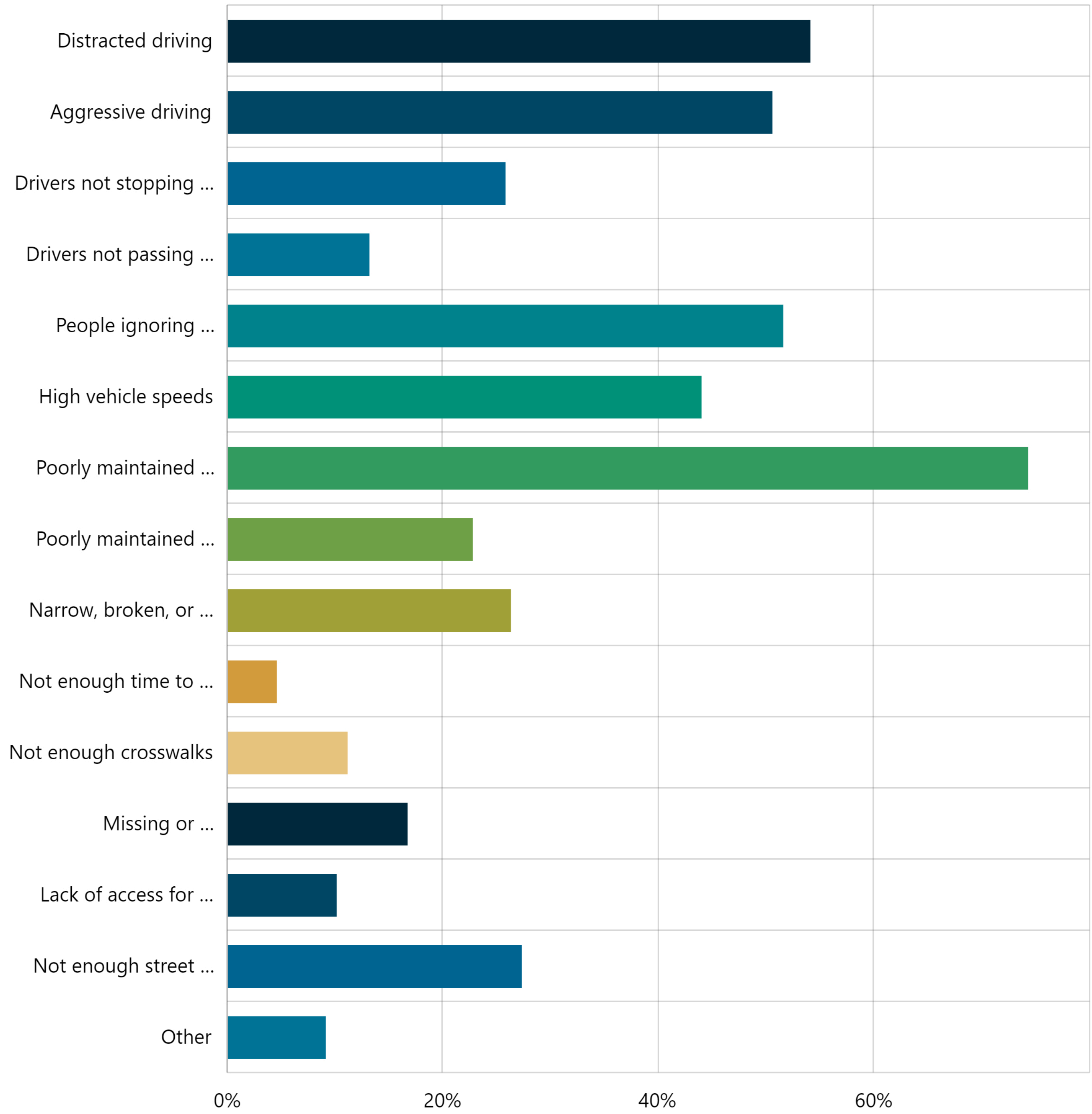
Open

LRSP Community Survey
MCAG LRSP

129	198
Contributors	Contributions

Contribution Summary

1. What are your top five (5) traffic safety concerns in your community? Required
Multi Choice | Skipped: 0 | Answered: 198 (100%)

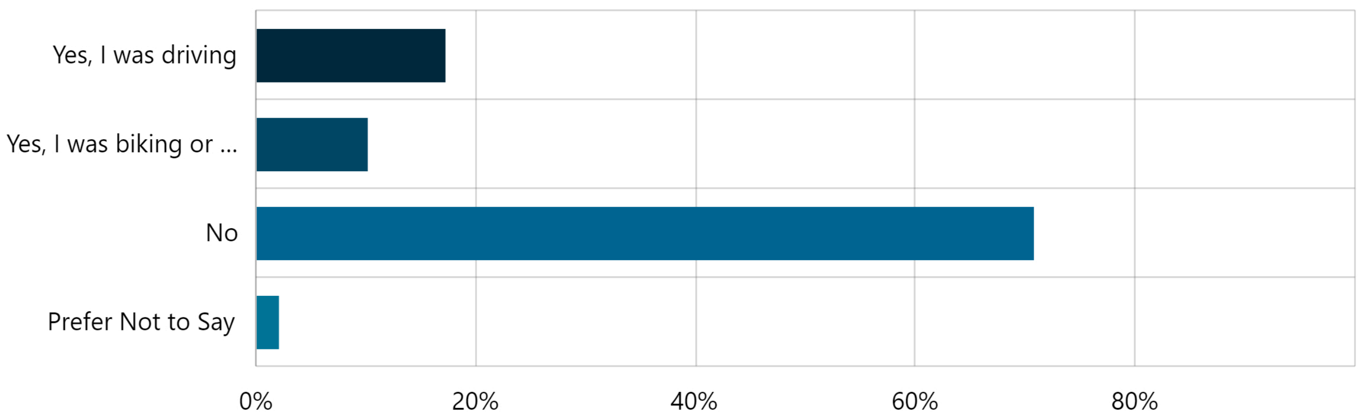


Answer choices	Percent	Count
Distracted driving	54.04%	107
Aggressive driving	50.51%	100
Drivers not stopping for pedestrians	25.76%	51
Drivers not passing bicyclists safely	13.13%	26
People ignoring traffic laws while driving	51.52%	102

High vehicle speeds	43.94%	87
Poorly maintained roads	74.24%	147
Poorly maintained bike lanes or paths (debris, potholes, etc.)	22.73%	45
Narrow, broken, or missing sidewalks	26.26%	52
Not enough time to cross the street (too many lanes of traffic, streets are too wide)	4.55%	9
Not enough crosswalks	11.11%	22
Missing or inadequate bike lanes or paths	16.67%	33
Lack of access for people with disabilities	10.10%	20
Not enough street lighting	27.27%	54
Other	9.09%	18

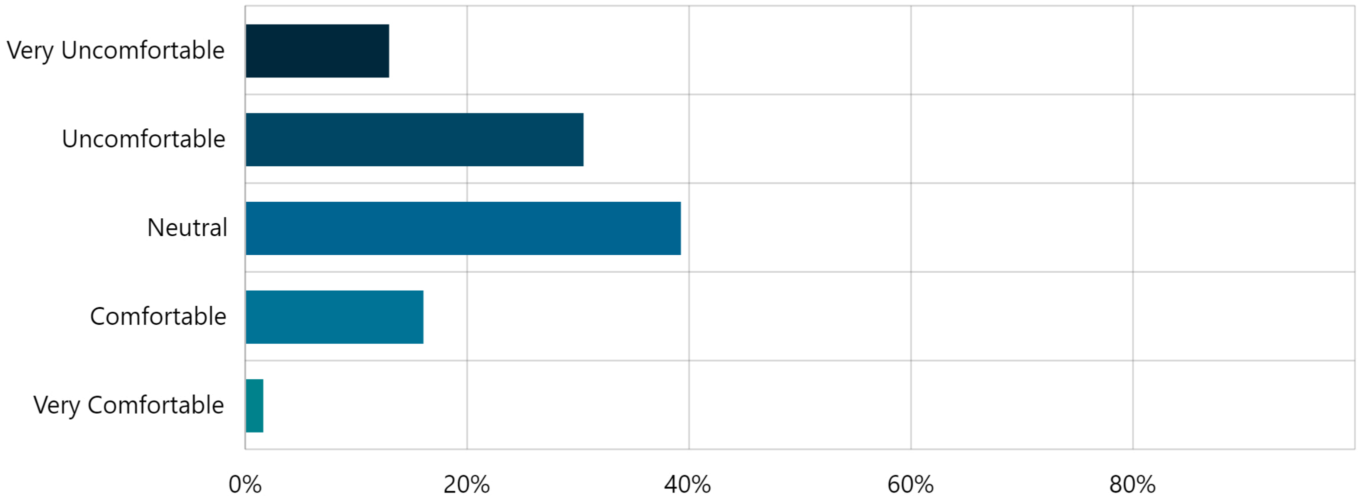
2. In the past ten years, have you seen or been involved in a vehicle-related crash or near miss that included someone walking or biking and was not reported to the police? Required

Select Box | Skipped: 0 | Answered: 198 (100%)



Answer choices	Percent	Count
Yes, I was driving	17.17%	34
Yes, I was biking or walking	10.10%	20
No	70.71%	140
Prefer Not to Say	2.02%	4
Total	**100.00%**	**198**

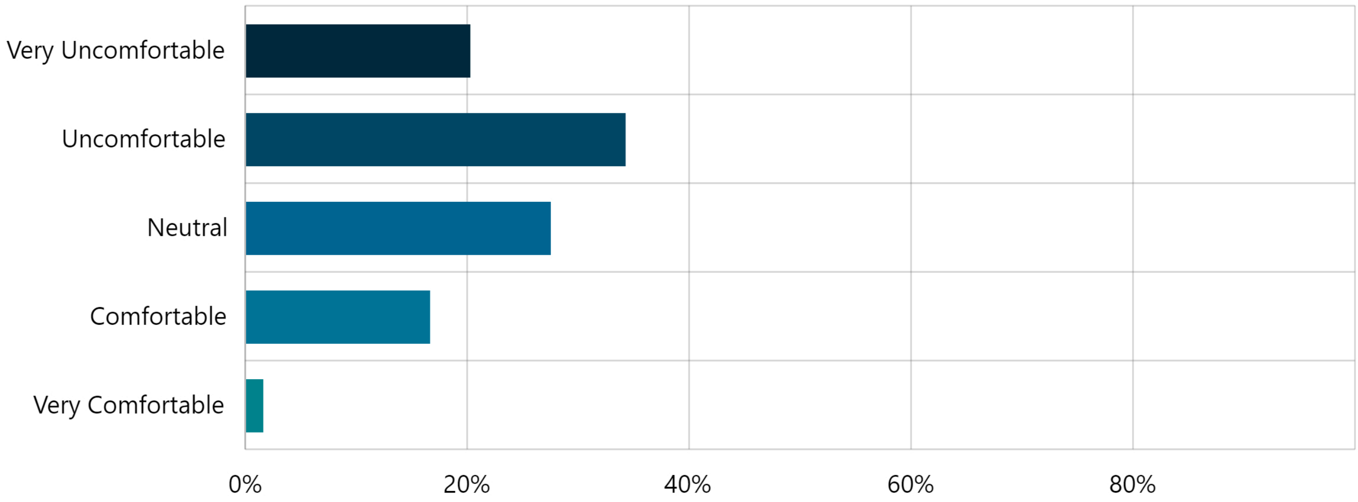
3. How comfortable do you feel walking and/or using a wheelchair in your community?
Select Box | Skipped: 4 | Answered: 194 (98%)



Answer choices	Percent	Count
Very Uncomfortable	12.89%	25
Uncomfortable	30.41%	59
Neutral	39.18%	76
Comfortable	15.98%	31
Very Comfortable	1.55%	3
Total	**100.00%**	**194**

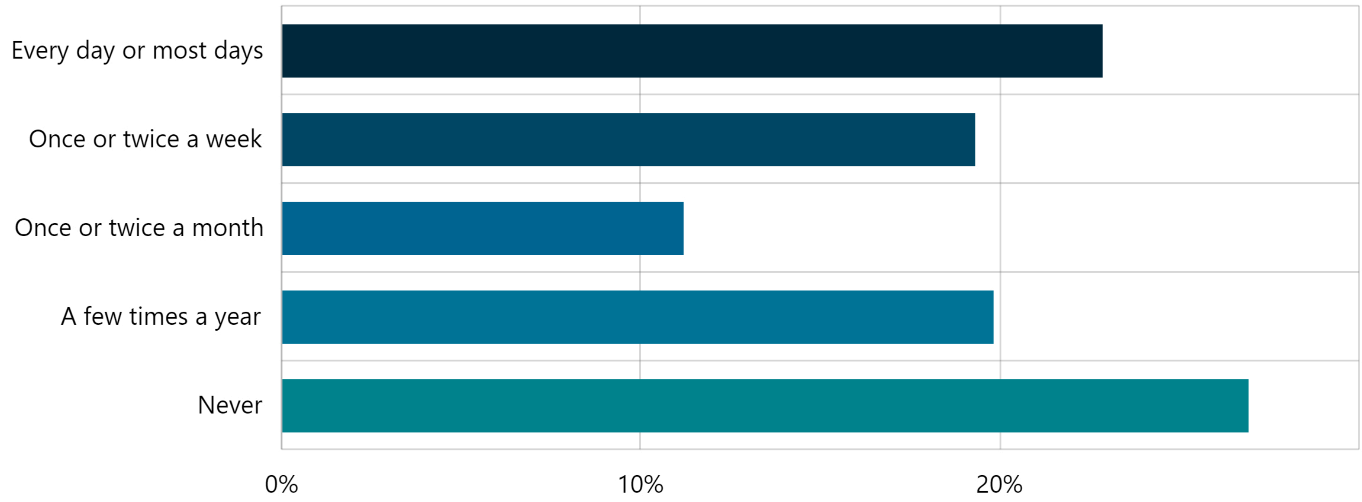
4. How comfortable do you feel riding a bike and/or some other device (i.e. a scooter) in your community?

Select Box | Skipped: 5 | Answered: 193 (97.5%)



Answer choices	Percent	Count
Very Uncomfortable	20.21%	39
Uncomfortable	34.20%	66
Neutral	27.46%	53
Comfortable	16.58%	32
Very Comfortable	1.55%	3
Total	**100.00%**	**193**

5. How often do you walk, bike, or take transit to get to work, school, shopping, or other activities? Required
Multi Choice | Skipped: 1 | Answered: 197 (99.5%)



Answer choices	Percent	Count
Every day or most days	22.84%	45
Once or twice a week	19.29%	38
Once or twice a month	11.17%	22
A few times a year	19.80%	39
Never	26.90%	53
Total	**100.00%**	**197**

6. What improvements would encourage you to walk, bike, or take transit more often?

Long Text | Skipped: 91 | Answered: 107 (54%)

Sentiment

No sentiment data

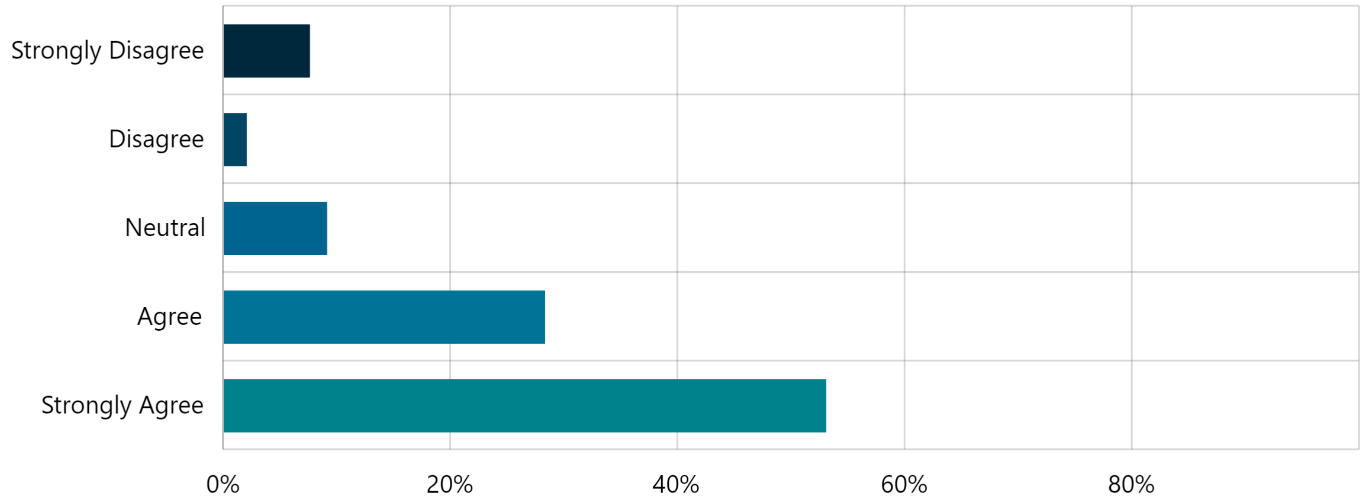
Tags

No tag data

Featured Contributions

No featured contributions

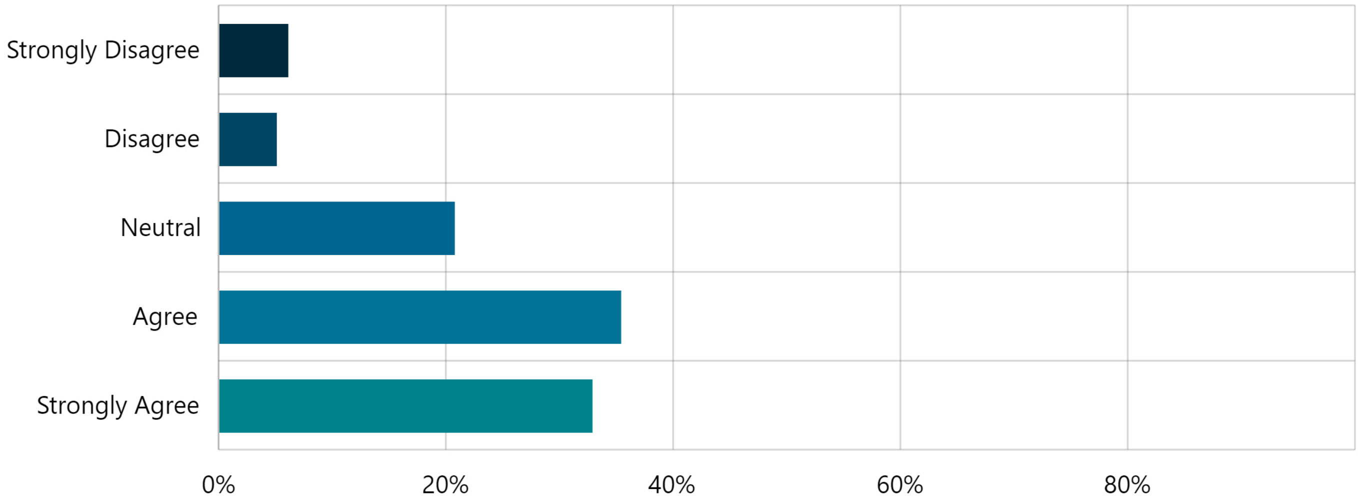
7. When making decisions about road or street design, people's safety should be the top priority. Required
Select Box | Skipped: 0 | Answered: 198 (100%)



Answer choices	Percent	Count
Strongly Disagree	7.58%	15
Disagree	2.02%	4
Neutral	9.09%	18
Agree	28.28%	56
Strongly Agree	53.03%	105
Total	**100.00%**	**198**

8. In areas where children or elderly may be present, the road or street should be designed for cars to drive 20 mph or slower. Required

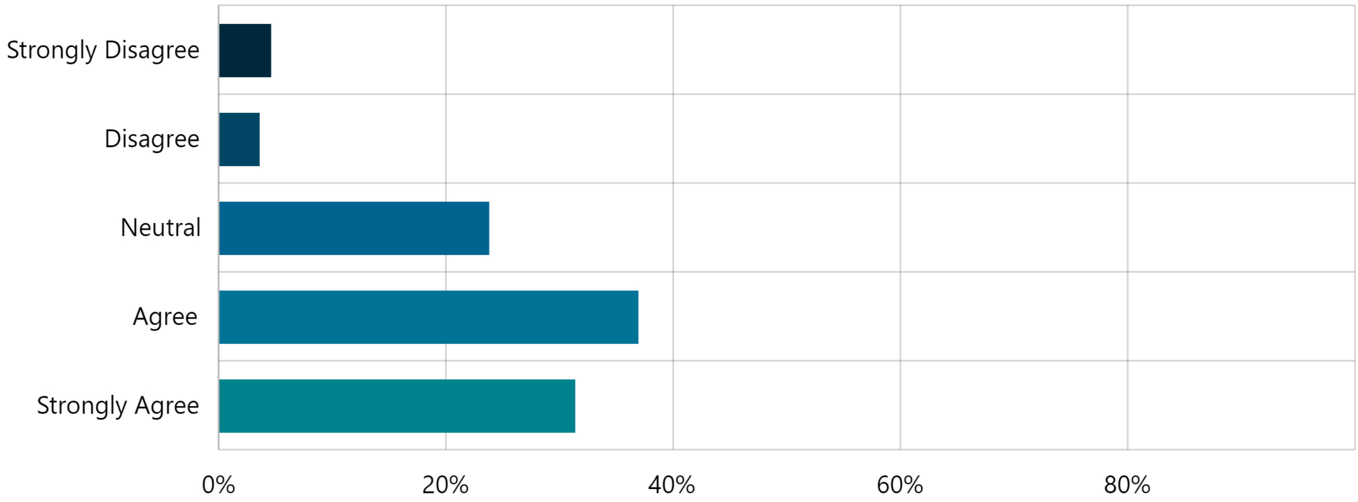
Select Box | Skipped: 0 | Answered: 198 (100%)



Answer choices	Percent	Count
Strongly Disagree	6.06%	12
Disagree	5.05%	10
Neutral	20.71%	41
Agree	35.35%	70
Strongly Agree	32.83%	65
Total	**100.00%**	**198**

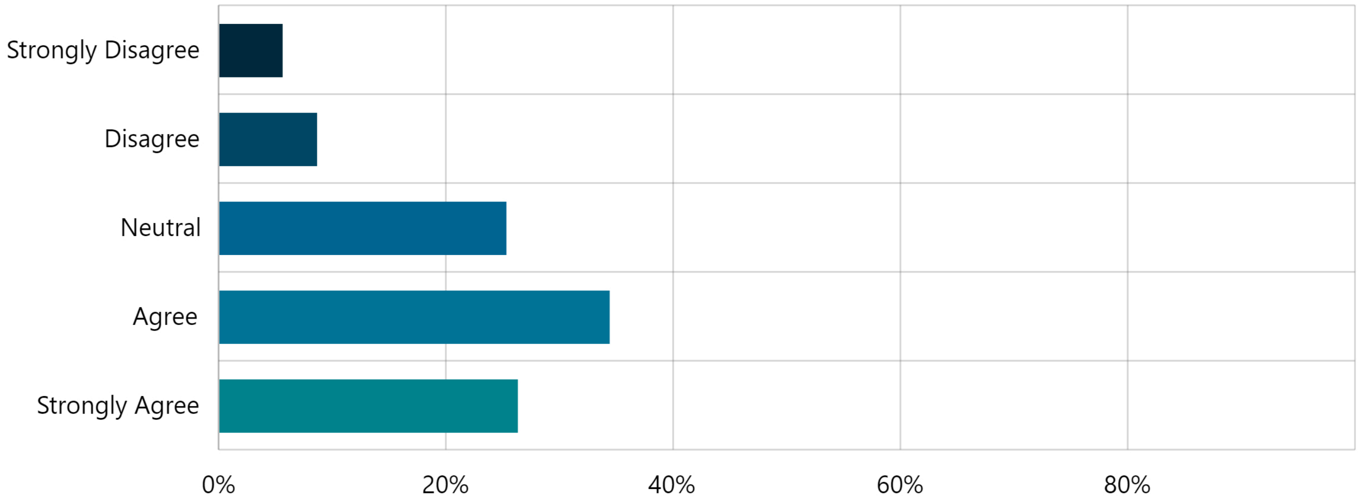
9. Intersection changes that reduce the possibility of cars crashing into one another or other users (e.g. pedestrians, bicyclists) should be prioritized over changes that reduce delay. Required

Select Box | Skipped: 0 | Answered: 198 (100%)



Answer choices	**Percent**	**Count**
Strongly Disagree	4.55%	9
Disagree	3.54%	7
Neutral	23.74%	47
Agree	36.87%	73
Strongly Agree	31.31%	62
Total	**100.00%**	**198**

10. In downtown areas or commercial corridors, space for people to walk, bike, and cross the street safely should be prioritized over on-street parking for cars. Required
Select Box | Skipped: 0 | Answered: 198 (100%)



Answer choices	**Percent**	**Count**
Strongly Disagree	5.56%	11
Disagree	8.59%	17
Neutral	25.25%	50
Agree	34.34%	68
Strongly Agree	26.26%	52
Total	**100.00%**	**198**

11. Are there any other safety improvements you would like to see on our roadways? (e.g., more speed enforcement or DUI checkpoints, safety educational campaigns for motorists or bicyclists, speed feedback signs)

Long Text | Skipped: 96 | Answered: 102 (51.5%)

Sentiment

No sentiment data

Tags

No tag data

Featured Contributions

No featured contributions

12. What is your ZIP code? Required
Short Text | Skipped: 19 | Answered: 179 (90.4%)

Sentiment

No sentiment data

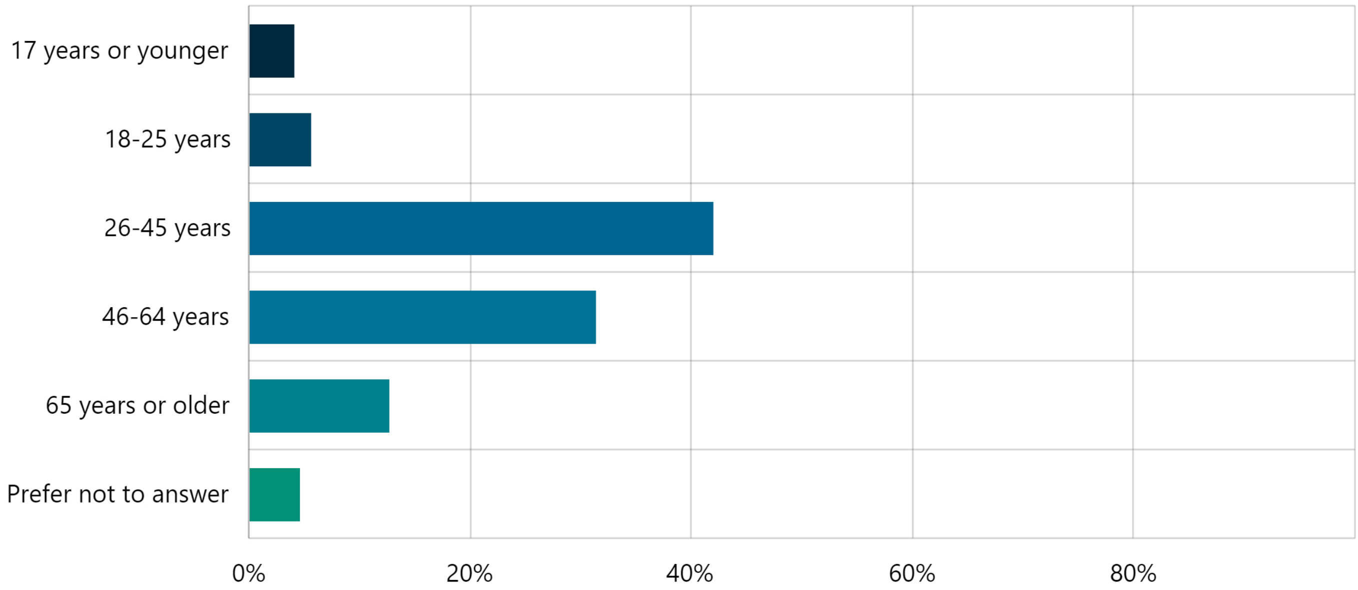
Tags

No tag data

Featured Contributions

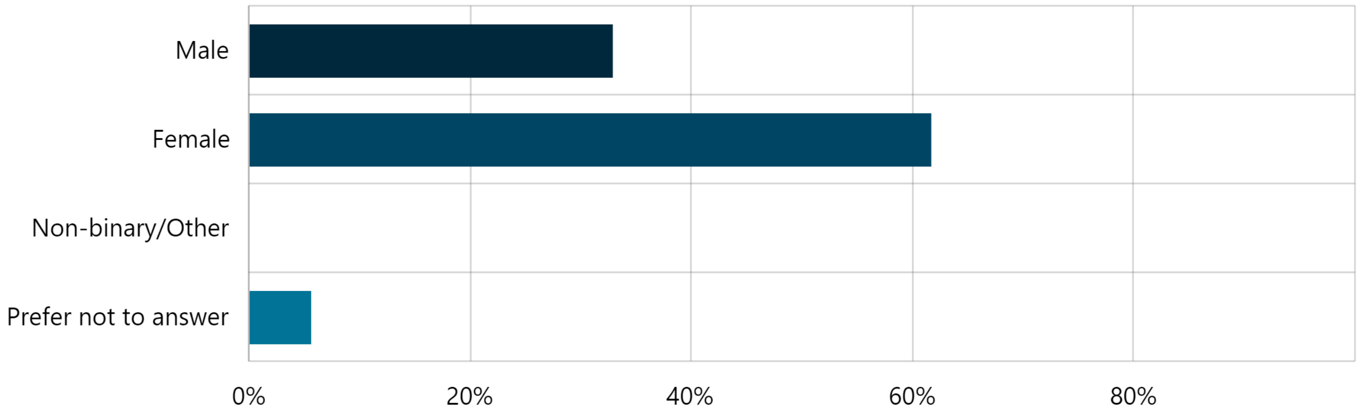
No featured contributions

13. What is your age? Required
Select Box | Skipped: 0 | Answered: 198 (100%)



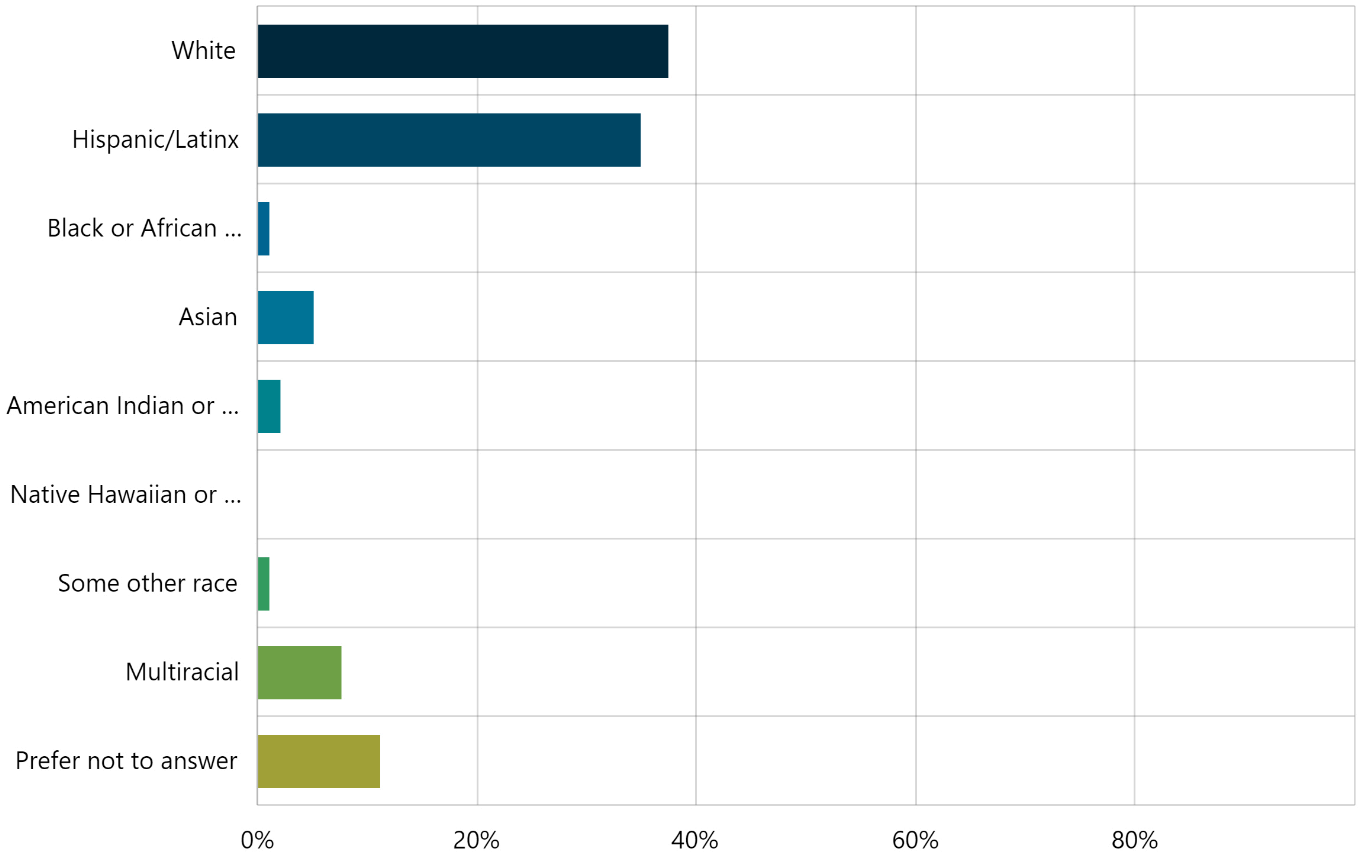
Answer choices	Percent	Count
17 years or younger	4.04%	8
18-25 years	5.56%	11
26-45 years	41.92%	83
46-64 years	31.31%	62
65 years or older	12.63%	25
Prefer not to answer	4.55%	9
Total	**100.00%**	**198**

14. What is your gender? Required
Select Box | Skipped: 0 | Answered: 198 (100%)



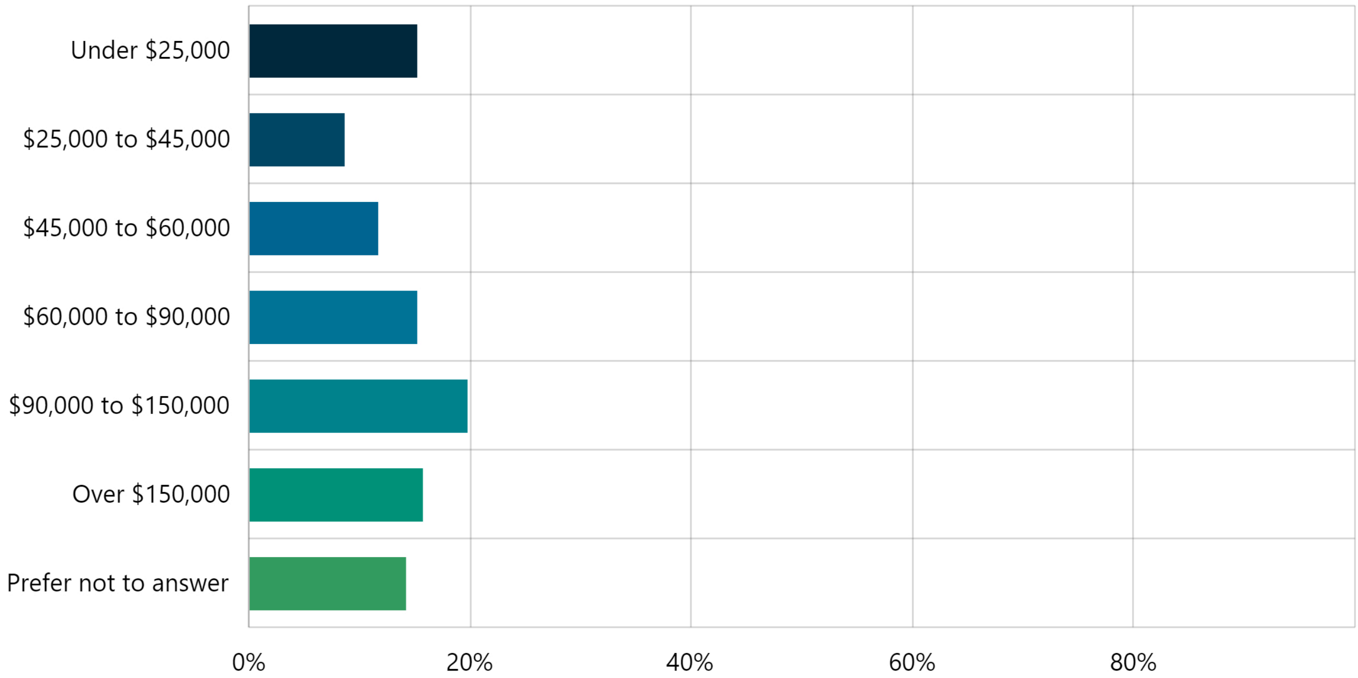
Answer choices	Percent	Count
Male	32.83%	65
Female	61.62%	122
Non-binary/Other	0%	0
Prefer not to answer	5.56%	11
Total	**100.00%**	**198**

15. What is your race? Required
Select Box | Skipped: 0 | Answered: 198 (100%)



Answer choices	Percent	Count
White	37.37%	74
Hispanic/Latinx	34.85%	69
Black or African American	1.01%	2
Asian	5.05%	10
American Indian or Alaska Native	2.02%	4
Native Hawaiian or Pacific Islander	0%	0
Some other race	1.01%	2
Multiracial	7.58%	15
Prefer not to answer	11.11%	22
Total	**100.00%**	**198**

16. What is your annual household income? Required
Select Box | Skipped: 0 | Answered: 198 (100%)



Answer choices	Percent	Count
Under $25,000	15.15%	30
$25,000 to $45,000	8.59%	17
$45,000 to $60,000	11.62%	23
$60,000 to $90,000	15.15%	30
$90,000 to $150,000	19.70%	39
Over $150,000	15.66%	31
Prefer not to answer	14.14%	28
Total	**100.00%**	**198**

Appendix

C

Cost and Benefits Documentation

The conceptual projects presented in this LRSP range in cost and effort and may be years-long efforts. Feasibility is also dependent upon the availability, reallocation, and/or acquisition of funding. Additionally, projects may be integrated into maintenance efforts and undertaken for a lower cost than if implemented separately.

Projects requiring land acquisition, utility relocation, or substantial drainage modifications may require extra time to implement. Detailed feasibility and design studies based on local conditions will also be necessary for the implementation of many projects. To give a general idea of the anticipated costs to implement and support funding procurement, cost estimates were developed at a planning level for each conceptual project.

Cost estimates for the conceptual projects are listed in this appendix, itemized by project component. The cost ranges are based on construction costs from recent bid documents throughout California, recognizing regional variations on construction costs throughout the state and fluctuations in material and labor costs over time.

The cost estimates are in 2024 dollars, and also assume a number of soft costs as listed, totalling 110% of construction costs.

All project cost estimates are high-level, and detailed study of individual projects will be required to refine them. Costs are not inclusive of engineering, draingage, contingency, and mobilization costs, as well as any land acquisition, road widening, and utility relocation costs that may be needed.

In addition to the costs, estimates of the benefits each project generates are listed. These benefits were calculated using the methodology developed by Caltrans for its Local Highway Safety Improvement Program (HSIP). These benefits are calculated by applying the crash modification or reduction factor (CMF/CRF) assigned by Caltrans to countermeasures applied, which is expressed as a percentage of the total number of crashes that can be “prevented” by the countermeasures. Multiplying that percentage by the total amount of cost associated with the crash history (in which crashes are assigned a monetary cost based on their severity) yields the benefit – the total amount of monetary costs of the crashes that the countermeasures are expected to prevent.

Atwater – Winton Way

Item	Assumptions	Unit	Quantity	Unit Cost	Total Costs
Road Diet	Striping only for 1mi corridor	mi	1	$80,000	$80,000
Slurry Seal	60ft ROW over 1mi	sf	316,800	$1	$316,800
Class II Bike Lane		mi	1	$260,000	$260,000
Median Refuge	Raised, concrete, 20ft*11ft each, with new curb ramps	each	2	$90,000	$180,000
Median Refuge	Raised, concrete, 20ft*11ft each, no new curb ramps	each	2	$70,000	$140,000
				Total Construction Costs	**$976,800**

Soft Costs	Traffic Control, SWPP, Mobilization (25%)	$244,200
	CM & Inspection Costs (20%)	$195,360
	Design Costs (15%)	$146,520
	Environmental Costs (10%)	$97,680
	City Staff Time (10%)	$97,680
	Construction Contingency (30%)	$293,040
	Total Soft Costs (110%)	**$1,074,480**

Total Costs	**$2,051,280**
Total Benefits	**$54,388,420**
BCR	**26.51**

Dos Palos – SR 33/Stearman St

Item	Assumptions	Unit	Quantity	Unit Cost	Total Costs
Roundabout	Full-sized 1-lane roundabout with no ROW acquisition	each	1	$2,000,000	$2,000,000
			Total Construction Costs		**$2,000,000**
Soft Costs	Traffic Control, SWPP, Mobilization (25%)				$500,000
	CM & Inspection Costs (20%)				$400,000
	Design Costs (15%)				$300,000
	Environmental Costs (10%)				$200,000
	City Staff Time (10%)				$200,000
	Construction Contingency (30%)				$600,000
			Total Soft Costs (110%)		**$2,200,000**

Total Costs	**$4,200,000**
Total Benefits	**$ 6,258,456**
BCR	**1.49**

Gustine – 1st Ave/5th St

Item	Assumptions	Unit	Quantity	Unit Cost	Total Costs
Mini Roundabout	Mini-roundabout with no ROW acquisition	each	1	$1,250,000	$1,250,000
				Total Construction Costs	**$1,250,000**
Soft Costs	Traffic Control, SWPP, Mobilization (25%)				$312,500
	CM & Inspection Costs (20%)				$250,000
	Design Costs (15%)				$187,500
	Environmental Costs (10%)				$125,000
	City Staff Time (10%)				$125,000
	Construction Contingency (30%)				$375,000
				Total Soft Costs (110%)	**$1,375,000**

Total Costs	**$2,625,000**
Total Benefits	**$2,922,704**
BCR	**1.11**

Gustine – Meredith Ave/Grove Ave

Item	Assumptions	Unit	Quantity	Unit Cost	Total Costs
Curb Extensions	Four corners at Meredith/Grove	each	4	$35,000	$140,000
Crosswalks	Two missing legs, two upgraded to high-vis	each	4	$1,000	$4,000
Raised Crosswalk	At midblock crossing location	each	1	$125,000	$125,000
Median Refuge	At midblock crossing location, no new curb ramps	each	1	$70,000	$70,000
				Total Construction Costs	**$339,000**
Soft Costs	Traffic Control, SWPP, Mobilization (25%)				$84,750
	CM & Inspection Costs (20%)				$67,800
	Design Costs (15%)				$50,850
	Environmental Costs (10%)				$33,900
	City Staff Time (10%)				$33,900
	Construction Contingency (30%)				$101,700
				Total Soft Costs (110%)	**$372,900**
				Total Costs	**$711,900**
				Total Benefits	**$413,712**
				BCR	**0.58**

Livingston – Main St from Campbell Dr to Swan St

Item	Assumptions	Unit	Quantity	Unit Cost	Total Costs
Round-about	Full-sized 1-lane roundabout with no ROW acquisition at Campbell and at Swan	each	2	$2,000,000	$4,000,000
Sidewalk Widening	Assuming 6' added to each side for a quarter-mile	LF	1320	$240	$316,800
Curb and Gutter	Relocated where sidewalk is widened	LF	1320	$240	$316,800
Roadway Repaving	Assuming roughly 45' ROW with sidewalk widening	LF	1320	$450	$594,000
Road Diet	Striping only	mi	0.25	$80,000	$20,000
Lighting	Assuming high-end, pedestrian-friendly lighting	LF	1320	$450	$594,000
Curb Ramps	8 each at Campbell and Davis, 6 at Cromwell	each	22	$15,000	$330,000
				Total Construction Costs	**$6,171,600**

Soft Costs	Traffic Control, SWPP, Mobilization (25%)	$1,542,900
	CM & Inspection Costs (20%)	$1,234,320
	Design Costs (15%)	$925,740
	Environmental Costs (10%)	$617,160
	City Staff Time (10%)	$617,160
	Construction Contingency (30%)	$1,851,480
	Total Soft Costs (110%)	**$6,788,760**

Total Costs	**$12,960,360**
Total Benefits	**$24,106,364**
BCR	**1.86**

Los Banos – Downtown

Item	Assumptions	Unit	Quantity	Unit Cost	Total Costs
Mini Round-about	Mini-roundabout with no ROW acquisition at 6th/K	each	1	$1,250,000	$1,250,000
Median Refuge	Roughly half the size of those in Atwater, no new curb ramps	each	26	$50,000	$1,300,000
Crosswalk	High-vis	each	39	$1,000	$39,000
Advance Stop Marks		each	38	$500	$19,000
Raised Crosswalk		each	2	$125,000	$250,000
Centerlines	5th from H to M, K from 5th to 7th	LF	2640	$5	$13,200
Edgelines	5th from H to L, 6th from Pacheco to H	LF	3696	$5	$18,480
Bike Lane	K from 5th to 7th	mi	0.2	$260,000	$52,000
				Total Construction Costs	**$2,941,680**
Soft Costs	Traffic Control, SWPP, Mobilization (25%)				$735,420
	CM & Inspection Costs (20%)				$588,336
	Design Costs (15%)				$441,252
	Environmental Costs (10%)				$294,168
	City Staff Time (10%)				$294,168
	Construction Contingency (30%)				$882,504
				Total Soft Costs (110%)	**$3,235,848**

Total Costs	**$6,177,528**
Total Benefits	**$37,360,873**
BCR	**6.05**

Los Banos – Stonewood Dr/Overland Ave

Item	Assumptions	Unit	Quantity	Unit Cost	Total Costs
Roundabout	Full-sized 1-lane roundabout with no ROW acquisition at Overland	each	1	$2,000,000	$2,000,000
Buffered Bike Lane	Adding painted buffer to existing bike lane for 0.8mi	LF	4224	$5	$21,120
				Total Construction Costs	**$2,021,120**
Soft Costs	Traffic Control, SWPP, Mobilization (25%)				$505,280
	CM & Inspection Costs (20%)				$404,224
	Design Costs (15%)				$303,168
	Environmental Costs (10%)				$202,112
	City Staff Time (10%)				$202,112
	Construction Contingency (30%)				$606,336
				Total Soft Costs (110%)	**$2,223,232**

Total Costs	**$4,244,352**
Total Benefits	**$14,788,334**
BCR	**3.48**

Merced – M St

Item	Assumptions	Unit	Quantity	Unit Cost	Total Costs
Roundabout	Full-sized 2-lane roundabouts with no ROW acquisition at Buena Vista and Donna	each	2	$2,000,000	$4,000,000
Class IV cycletrack		mi	1	$485,000	$485,000
				Total Construction Costs	**$4,485,000**
Soft Costs	Traffic Control, SWPP, Mobilization (25%)				$1,121,250
	CM & Inspection Costs (20%)				$897,000
	Design Costs (15%)				$672,750
	Environmental Costs (10%)				$448,500
	City Staff Time (10%)				$448,500
	Construction Contingency (30%)				$1,345,500
				Total Soft Costs (110%)	**$4,933,500**
				Total Costs	**$9,418,500**
				Total Benefits	**$57,259,142**
				BCR	**6.08**

Merced – G St

Item	Assumptions	Unit	Quantity	Unit Cost	Total Costs
Signal Modifi-cations	Minor modifications to Main St and 21st St intersections to protected left	each	2	$300,000	$600,000
Signal Modifi-cations	Major modification to 18th St intersection to protected left - need additional signal heads	each	1	$600,000	$600,000
Sidewalk Widening	Assuming 5' added to each side for 0.8mi - 18th to 23rd and Santa Fe to Bear Creek	LF	4224	$200	$844,800
Curb and Gutter	Relocated where sidewalk is widened	LF	4224	$240	$1,013,760
Curb Ramps	8 each at 9 four-way intersections, 6 each at 5 three-way intersections	each	102	$15,000	$1,530,000
Roadway Repaving	Assuming roughly 52' ROW with sidewalk widening	LF	4224	$520	$2,196,480
Striping	4 lanes	LF	4224	$20	$84,480
				Total Construction Costs	**$6,869,520**

Soft Costs	Traffic Control, SWPP, Mobilization (25%)	$1,717,380
	CM & Inspection Costs (20%)	$1,373,904
	Design Costs (15%)	$1,030,428
	Environmental Costs (10%)	$686,952
	City Staff Time (10%)	$686,952
	Construction Contingency (30%)	$2,060,856
	Total Soft Costs (110%)	**$7,556,472**

Total Costs	**$14,425,992**
Total Benefits	**$52,428,603**
BCR	**3.63**

Merced – R St

Item	Assumptions	Unit	Quantity	Unit Cost	Total Costs
Signal Modifi-cations	Major modification to 18th St intersection to protected left - need additional signal heads	each	1	$600,000	$600,000
Sidewalk Widening	Assuming 5' added to each side for 0.8mi - 18th to 23rd and Santa Fe to Bear Creek	LF	2112	$200	$422,400
Curb and Gutter	Relocated where sidewalk is widened	LF	2112	$240	$506,880
Curb Ramps	8 each at 4 four-way intersections, 4 each at 14th and 19th	each	40	$15,000	$600,000
Roadway Repaving	Assuming roughly 52' ROW with sidewalk widening	LF	2112	$520	$1,098,240
Striping	4 lanes	LF	2112	$20	$42,240
Railroad Crossing Improvements		each	1	$550,000	$550,000
				Total Construction Costs	**$3,819,760**

Soft Costs	Traffic Control, SWPP, Mobilization (25%)	$954,940
	CM & Inspection Costs (20%)	$763,952
	Design Costs (15%)	$572,964
	Environmental Costs (10%)	$381,976
	City Staff Time (10%)	$381,976
	Construction Contingency (30%)	$1,145,928
	Total Soft Costs (110%)	**$4,201,736**

Total Costs	**$8,021,496**
Total Benefits	**$35,805,601**
BCR	**4.46**

Merced – Olive Ave

Item	Assumptions	Unit	Quantity	Unit Cost	Total Costs
Sidewalk Widening	Assuming 4' added to each side for 1.5mi - SR-59 to R and M to G	LF	7920	$160	$1,267,200
Sidewalk Widening	Assuming 12' added to each side for 0.5mi - R to M	LF	2640	$480	$1,267,200
Curb and Gutter	Relocated where sidewalk is widened	LF	10560	$240	$2,534,400
Curb Ramps	8 each at 7 four-way intersections, 4 each at 4 intersections without crossings of Olive, 2 each at 46 driveways	each	164	$15,000	$2,460,000
Roadway Repaving	Assuming roughly 64' ROW each direction	LF	10560	$1,280	$13,516,800
Striping	6 lanes	LF	10560	$20	$211,200
				Total Construction Costs	**$21,256,800**

Soft Costs	Traffic Control, SWPP, Mobilization (25%)	$5,314,200
	CM & Inspection Costs (20%)	$4,251,360
	Design Costs (15%)	$3,188,520
	Environmental Costs (10%)	$2,125,680
	City Staff Time (10%)	$2,125,680
	Construction Contingency (30%)	$6,377,040
	Total Soft Costs (110%)	**$23,382,480**

Total Costs	**$44,639,280**
Total Benefits	**$57,584,647**
BCR	**1.29**

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Appendix

D

SS4A Program Criteria Checklist

The Safe Streets and Roads for All (SS4A) grant program was established by the Bipartisan Infrastructure Law in 2022, centered around USDOT's National Roadway Safety Strategy and its goal of zero deaths and serious injuries on America's roadways. It will provide $5 billion in grant funding over its five-year duration to develop and implement safety plans and projects.

The SS4A grant program provides funding for local agencies to create Comprehensive Safety Action Plans (CSAPs). It also provides funding to implement safety projects, but only to those agencies that have an adopted CSAP or an equivalent. In order to qualify as a CSAP (and allow an agency to be eligible for implementation planning grant funding), a plan must meet a nine-point criteria as set forth by the USDOT. They include an official commitment and goal to eliminate roadway fatalities and serious injuries; the creation of a standing task force or working group that will lead and monitor the implementation of the plan; data-driven safety analysis; public engagement and inter-governmental collaboration; consideration of equity in the planning process; assessment of current policies and guidelines to identify changes that will better prioritize safety; identification of a comprehensive set of projects and strategies that address safety issues; posting of the plan online along with description of how future progress will be measured; and that the plan will be updated every five years.

This Plan is designed to meet all of these criteria. The complete list of these criteria is included in this appendix.

Action Plan Components

For each question below, answer "YES" or "NO." If "YES," list the relevant plan(s) or supporting documentation that address the condition and the specific page number(s) in each document that corroborates your response. This form provides space to reference multiple plans, but please list only the most relevant document(s).

1. Leadership Commitment and Goal Setting

Are **BOTH** of the following true?

- A high-ranking official and/or governing body in the jurisdiction publicly committed to an eventual goal of zero roadway fatalities and serious injuries; and
- The commitment includes either setting a target date to reach zero OR setting one or more targets to achieve significant declines in roadway fatalities and serious injuries by a specific date.

☑ **YES**

☐ **NO**

Note: This may include a resolution, policy, ordinance, executive order, or other official announcement from a high-ranking official and the official adoption of a plan that includes the commitment by a legislative body.

If "YES," please list the relevant document(s) and page number(s) that corroborate your response.

Document Title	Page Number(s)
This LRSP	11

2. Planning Structure

To develop the Action Plan, was a committee, task force, implementation group, or similar body established and charged with the plan's development, implementation, and monitoring?

☑ **YES**

☐ **NO**

Note: This should include a description of the membership of the group and what role they play in the development, implementation, and monitoring of the Action Plan.

If "YES," please list the relevant document(s) and page number(s) that corroborate your response.

Document Title	Page Number(s)
This LRSP	25, 116

3. Safety Analysis

Does the Action Plan include **ALL** of the following?

- Analysis of existing conditions and historical trends to provide a baseline level of crashes involving fatalities and serious injuries across a jurisdiction, locality, Tribe, or region;
- Analysis of the location where there are crashes, the severity, as well as contributing factors and crash types;
- Analysis of systemic and specific safety needs, as needed (e.g., high-risk road features or specific safety needs of relevant road users); and,
- A geospatial identification (geographic or locational data using maps) of higher risk locations.

☑ **YES**

☐ **NO**

Note: Availability and level of detail of safety data may vary greatly by location. The Fatality and Injury Reporting System Tool (FIRST) provides county- and city-level data. When available, local data should be used to supplement nationally available data sets.

If "YES," please list the relevant document(s) and page number(s) that corroborate your response.

Document Title	Page Number(s)
This LRSP	128-313

4. Engagement and Collaboration

Did the Action Plan development include **ALL** of the following activities?

- Engagement with the public and relevant stakeholders, including the private sector and community groups;
- Incorporation of information received from the engagement and collaboration into the plan; and
- Coordination that included inter- and intra-governmental cooperation and collaboration, as appropriate.

☑ **YES**

☐ **NO**

Note: This should be a description of public meetings, participation in public and private events, and proactive meetings with stakeholders.

If "YES," please list the relevant document(s) and page number(s) that corroborate your response.

Document Title	Page Number(s)
This LRSP	25-29
This LRSP	Appendix B

5. Equity Considerations

Did the Action Plan development include **ALL** of the following?

- Considerations of equity using inclusive and representative processes;
- The identification of underserved communities through data; and
- Equity analysis developed in collaboration with appropriate partners, including population characteristics and initial equity impact assessments of proposed projects and strategies.

☑ YES

☐ NO

Note: This should include data that identifies underserved communities and/or reflects the impact of crashes on underserved communities, prioritization criteria that consider equity, or a description of meaningful engagement and collaboration with appropriate stakeholders.

If "YES," please list the relevant document(s) and page number(s) that corroborate your response.

Document Title	Page Number(s)
This LRSP	142-143, 222-223
This LRSP	173, 197
This LRSP	248-249, 282-283

6. Policy and Process Changes

Are **BOTH** of the following true?

- The plan development included an assessment of current policies, plans, guidelines, and/or standards to identify opportunities to improve how processes prioritize safety; and
- The plan discusses implementation through the adoption of revised or new policies, guidelines, and/or standards.

☑ YES

☐ NO

Note: This may include existing and/or recommended Complete Streets policy, guidelines for community engagement and collaboration, policy for prioritizing areas of greatest need, local laws (e.g., speed limit), design guidelines, and other policies and processes that prioritize safety.

If "YES," please list the relevant document(s) and page number(s) that corroborate your response.

Document Title	Page Number(s)
This LRSP	102-127
This LRSP	Appendix A

7. Strategy and Project Selections

Does the plan identify a comprehensive set of projects and strategies to address the safety problems in the Action Plan, with information about time ranges when projects and strategies will be deployed, and an explanation of project prioritization criteria?

☑ YES

☐ NO

Note: This should include one or more lists of community-wide multi-modal and multi-disciplinary projects that respond to safety problems and reflect community input and a description of how your community will prioritize projects in the future.

If "YES," please list the relevant document(s) and page number(s) that corroborate your response.

Document Title	Page Number(s)
This LRSP (projects)	160-163,184-187,208-211,234-237,266-271,302-313
This LRSP (strategies)	102-127

8. Progress and Transparency

Does the plan include **BOTH** of the following?

- A description of how progress will be measured over time that includes, at a minimum, outcome data.
- The plan is posted publicly online.

☑ YES

☐ NO

Note: This should include a progress reporting structure and list of proposed metrics.

If "YES," please list the relevant document(s) and page number(s) that corroborate your response.

Document Title	Page Number(s)
This LRSP	118

9. Action Plan Date

Was at least one of your plans finalized and/or last updated between 2019 and April 30, 2024?

☑ YES

☐ NO

Note: Updates may include major revisions, updates to the data used for analysis, status updates, or the addition of supplemental planning documents, including but not limited to an Equity Plan, one or more Road Safety Audits conducted in high-crash locations, or a Vulnerable Road User Plan.

If "YES," please list your most recent document(s), date of finalization, and page number(s) that corroborate your response.

Document Title	Date of Most Recent Update	Page Number(s)
This LRSP	10/31/2024	1-313

MERCED COUNTY ASSOCIATION OF GOVERNMENTS