Berkeley Safe Transportation Research and Education Center

City of Gridley Complete Streets Safety Assessment

Issues, Opportunities, and Suggested Strategies

Final Report
September 2024

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Acknowledgments

The CSSA team thanks the agency staff and community members from Gridley and Butte County who provided invaluable contributions to the benchmarking review and field audit to make the Complete Streets Safety Assessment in this community a success. Their knowledge and insight were instrumental to the completion of this project.

Disclosures

This report was developed with the best information available to the authors at that time.

This report summarizes crash data reported in the Statewide Integrated Traffic Records System (SWITRS) retrieved from the Transportation Injury Mapping System (TIMS). The current version of 2022 and 2023 SWITRS data is provisional and is subject to change when it is finalized.

The benchmarking analysis aims to provide the City of Gridley with information on current best practices and how the City of Gridley compares. The City of Gridley have differing physical, demographic, and institutional characteristics that may make certain goals or policies more appropriate in some jurisdictions than others. Ultimately, Gridley staff will need to determine where resources and efforts are best utilized to meet local development and infrastructure goals for people walking and biking.

The recommendations presented in this report are based on limited field observations and limited time spent in the City of Gridley by the CSSA technical evaluators. These recommendations are based on general knowledge of best practices in pedestrian and bicycle design and safety and are intended to guide local staff in making decisions for future safety improvement projects. The recommendations might not incorporate all factors that may be relevant to the pedestrian and bicyclist safety issues.

As this report is conceptual in nature, conditions may exist in the focus areas that were not observed and may not be compatible with recommendations in this report. Before finalizing and implementing any physical changes, staff may need to conduct more detailed studies or further analysis to refine or discard the recommendations in this report if they are found to be contextually inappropriate or appear not to improve pedestrian and bicyclist safety or accessibility due to conditions including, but not limited to, high vehicular traffic volume, high speeds, physical limitations on space or sight distance, or other potential safety concerns.

Executive Summary

The Butte County Public Health Department, on behalf of the City of Gridley, requested that the Safe Transportation Research and Education Center at the University of California, Berkeley, conduct a Complete Streets Safety Assessment (CSSA) study. The CSSA is organized into three core activities:

1. Reviewing historical crash data and trends with an emphasis on crashes involving people walking and biking;
2. Conducting a benchmarking assessment of policies, programs, standards, and guidelines; and
3. Conducting a complete streets walk audit of specific locations with suggestions to enhance conditions for people walking and biking.

The objectives of the CSSA are to improve safety and access for people walking and biking. The CSSA also creates an opportunity for the city of Gridley to integrate the Safe System Approach into policy, program, and design decisions related to active transportation. A walk audit was conducted on May 9th, 2024, to observe and document field conditions.

The report is organized into the following chapters:

1. Introduction
2. Safe System Approach
3. Background and Crash History
4. Benchmarking Analysis Results and Suggested Enhancements
5. Complete Streets Walk Audit Results and Recommendations

Background

Gridley is located in Butte County in the northern Sacramento Valley. The City has previously made efforts to plan for and design bicycle and pedestrian facilities, including the *City of Gridley's Local Road Safety Plan* (2023), *Bicycle Master Plan* (2021), and *State Route 99 Road Safety Assessment*.

The Safe System Approach

The U.S. Department of Transportation, California Department of Transportation, and California Office of Traffic Safety have all adopted the Safe System Approach. The Safe System Approach considers five elements of a safe transportation system — safe road users, safe vehicles, safe speeds, safe roads, and post-crash care — in an integrated and holistic manner. Creating a Safe System means shifting a major share of the responsibility from individual road users to those who design, operate, and maintain the transportation network. The Safe System Approach anticipates human mistakes by designing and managing road infrastructure to keep the risk of mistakes low, and if a mistake does lead to a crash, reducing the impact to the human body to limit the potential for fatality or serious injury.

The CSSA project team selected Sycamore Middle School, McKinley Primary School, Wilson Elementary School, and Gridley High School as locations to visit for the comprehensive walk audit. These locations were identified based on crash history and conversations with the applicant to understand local safety concerns. During the field assessment, the CSSA project team integrated the Safe System elements into a discussion with participants to prompt safety improvement ideas at the study locations. The CSSA focuses primarily on infrastructure-related countermeasures, with an emphasis on improving the safety of people walking and biking. Prioritizing safe target speeds and changing road geometry to manipulate crash angles can help reduce the risk of fatal and severe injuries.

Additionally, the CSSA reviewed benchmarking survey responses from local agency staff. Survey responses included information about local plans and policies already in place or underway. With the combination of walk audit and survey data, comprehensive recommendations framed by the Safe System Approach were developed. Through the benchmarking assessment, the CSSA team also provides non-infrastructure insight on safety countermeasures such as education, outreach, and post-crash care. All elements of the Safe System Approach can be applied to corridor and intersection studies moving forward to form an approach that creates layers of protection for all road users.

Benchmarking Analysis and Potential Improvements

To assess pedestrian and bicyclist safety conditions in the City of Gridley, the CSSA team conducted a benchmarking analysis to understand how the existing conditions compared to national best practices. Through an electronic benchmarking survey conducted with Butte County and the City of Gridley staff, the CSSA team identified their active transportation policies, programs, and practices and categorized these into three groups:

- Areas where the city is exceeding national best practices
- Areas where the city is meeting national best practices
- Areas where the city appears not to meet national best practices

While suggestions are provided for each category, local agencies have differing physical, demographic, and institutional characteristics that may make certain goals or policies more appropriate in some jurisdictions than others. Ultimately, county or local agency staff will determine where resources and efforts are best utilized for meeting local development and infrastructure goals for pedestrians and bicyclists.

Suggestions for potential improvement or further enhancement to City of Gridley’s existing programs and policies are presented in Chapter 4.

Complete Streets Audit and Potential Improvements

Sycamore Middle School, McKinley Primary School, Wilson Elementary School, and Gridley High School were studied to suggest policies and physical improvements to enhance accessibility and connectivity for pedestrians and bicyclists. Positive practices, pedestrian and

bicycle safety and accessibility issues were identified during the walk audit. Many of the strategies suggested in this report are appropriate for grant applications, including Office of Traffic Safety (OTS) or Active Transportation Program (ATP) funding. The strategies may also be incorporated into a bicycle or pedestrian master plan, documents that could set forth bicycle, pedestrian, and streetscape policies for the City of Gridley, identify, and prioritize capital improvement projects.

The suggestions presented in this report are based on limited field observations and time spent in the community by the CSSA team. Potential improvements recommended in this CSSA include all-way stop intersection control, high-visibility crosswalks, corner bulb outs, signage, lighting, no parking zones, etc. These suggestions are intended to guide staff in making decisions for future safety improvement projects in the City of Gridley, and they may not incorporate all factors relevant to walking and bicycling safety issues. Before finalizing and implementing any physical changes, City staff may choose to conduct additional studies or analyses to refine the suggestions in this report if they are found to be contextually inappropriate or appear not to improve active transportation safety or accessibility.

1. Introduction

The Complete Streets Safety Assessment (CSSA) is a statewide program of the University of California, Berkeley Safe Transportation Research and Education Center (SafeTREC). Through this program, the CSSA project team conducts crash data analysis, a benchmarking review of local policies, programs and practices, and a transportation safety assessment of select sites to identify safety improvements that align with the Safe System Approach. The objective of the CSSA is to improve safety and accessibility for all people walking and biking in their communities.

The Butte County Public Health Department, on behalf of the City of Gridley, requested a CSSA to study the transportation network surrounding Sycamore Middle School, McKinley Primary School, Wilson Elementary School, and Gridley High School.

The CSSA project team facilitated a kickoff telephone meeting with local staff on April 10th, 2024, to better understand the community's needs. The CSSA technical evaluators conducted a site visit with local staff on May 9th, 2024, to observe and document field conditions. Following the walk audit, the CSSA technical evaluators shared with the local agency staff their preliminary recommendations for site-specific improvements based on their observations and current best practices for designing transportation systems for people walking and biking.

This report provides an overview of the Safe System Approach and summarizes the findings of the crash data assessment, the benchmarking analysis, and the observations and recommendations from the walk audit. Additionally, this report includes four appendices covering pedestrian and bicyclist improvement options, a resource list, and street connectivity.

2. The Safe System Approach

Traffic crashes can irreversibly change the course of human lives, affecting victims, their families and loved ones, and society overall. The costs of traffic crashes include substantial economic and societal impacts, such as medical costs, lost productivity, and reduced quality of life. Cities, counties, and tribes need to work together to solve the complex problem of traffic safety in their communities to reduce the number of injuries and deaths. The Complete Streets Safety Assessment (CSSA) program provides an opportunity to integrate the Safe System Approach into programs, policies, and design decisions related to active transportation improvements to address the underlying road safety concerns in communities statewide. Moreover, the goal of a Complete Street is to ensure the safe and adequate accommodation of all road users.

The Safe System Approach to road safety started internationally as part of the Vision Zero proclamation that no one should be killed or seriously injured on the road system.[1, 2] It is founded on the principle that people make mistakes and that the road system should be adapted to anticipate and accommodate human mistakes and the physiological and psychological limitations of humans.[3] The Safe System Approach 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 and ensures that if crashes occur, they "do not result in serious human injury."[4]

Countries that have adopted the Safe System Approach have had significant success reducing highway fatalities, with reductions in fatalities between 50% and 70%.[5] The Safe System Approach is the foundation for the National Roadway Safety Strategy released by the United States Department of Transportation in 2022. Statewide, the California Office of Traffic Safety and Caltrans have both adopted the Safe System Approach and a Vision Zero goal for road safety planning. The principles and elements of the Safe System Approach can be seen in Figure 2.1.

[1] Johansson, R. (2009). Vision Zero - Implementing a policy for traffic safety. Safety Science, 47, 826-831.
[2] 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.
[3] 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.
[4] World Health Organization (2011). Retrieved on: June 3, 2024 Decade of Action for Road Safety 2011-2020 (PDF).
[5] World Resources Institute (2018). Sustainable and Safe: A Vision and Guidance for Zero Road Deaths. Retrieved on June 3, 2024 https://www.wri.org/publication/sustainable-and-safe-vision-and-guidance-zero-road-deaths
6 World Health Organization (2011). Decade of Action for Road Safety 2011-2020. Retrieved on: June 3, 2024 Decade of Action for Road Safety 2011-2020 (PDF).
7 World Health Organization (2011). Decade of Action for Road Safety 2011-2020. Retrieved on: June 3, 2024 Decade of Action for Road Safety 2011-2020 (PDF).

Figure 2.1 U.S. Department of Transportation Safe System Approach Graphic

Preliminary SWITRS crash data for 2022 suggests that traffic crashes caused nearly 4,500 preventable deaths and over 200,000 injuries in California. People walking, biking, and rolling are especially vulnerable to death or serious injuries when a crash occurs. Through collective action on the part of all roadway system stakeholders — from traffic engineers, planners, public health professionals, and vehicle manufacturers to law enforcement and everyday users — we can move to a Safe System Approach that anticipates human mistakes, with the goal of eliminating fatal and serious injuries for all road users.

2.1 Influence on Roadway Design and Operation

Kinetic energy has long been identified as the cause of injury, such that if a crash occurs, the peak forces at the point of contact determine the degree of injury.[6] [7] [8] Managing the forces of kinetic energy to a level that the human body can tolerate is critical to the Safe System Approach[9].

In the transportation system, kinetic energy risk is present based on three factors:

[6] Haddon, W. (1980). Advances in the epidemiology of injuries as a basis for public policy. Public Health Reports, 95(5), 411–421.
[7] De Haven, H. (1942). Mechanical analysis of survival in falls from heights of fifty to one hundred and fifty feet. Reproduced in Injury Prevention, 6(1), 62–68 (2000).
[8] Gangloff, A., 2013. Safety in accidents: Hugh DeHaven and the development of crash injury studies. Technol. Cult. 54 (1), 40–61.
[9] Tools like the Safe System Project-Based Alignment Framework developed by the Federal Highway Administration provide practitioners to assess and compare roadway locations and potential improvements through a SSA lens.

1. Exposure: the presence (or potential presence) of two or more users or a user and a fixed object
2. Likelihood: the chance that a conflict occurs between those users/objects based roadway design, intersection control, or other contextual conditions
3. Severity: the intensity of the energy should the conflict occur (driven by speed, mass, and angle), which is not mitigated by other factors (such as in-vehicle occupant protection)

Systemic assessments of roadway networks can identify and proactively address when these risk factors are high, meaning the consequence of a mistake could be severe.

The Institute of Transportation Engineers (ITE) and the Road to Zero Coalition articulate that to anticipate human mistakes, best practices for a Safe System seek to:

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

Recent guidance from the Federal Highway Administration (FHWA) characterizes engineering and infrastructure countermeasures and strategies along a hierarchy to help transportation practitioners prioritize efforts that will facilitate increased application of the Safe System Approach principles as seen in Figure 2.2. Specifically, the Safe System Roadway Design Hierarchy breaks down efforts into four tiers and seeks to: (1) eliminate severe conflicts through physical separation; (2) reducing vehicle speed; (3) manage conflicts in time; and (4) increase attentiveness and awareness.[10] The FHWA further clarifies a combination of strategies from multiple tiers would be the most effective, reinforcing the Safe System principle that redundancy is crucial.

[10] Hopwood, C., Little, K., and D. Gaines. (2024). Safe System Roadway Design Hierarchy: Engineering and Infrastructure-related Countermeasures to Effectively Reduce Roadway Fatalities and Serious Injuries (FHWA-SA-22-069). US Department of Transportation, Washington, D.C.

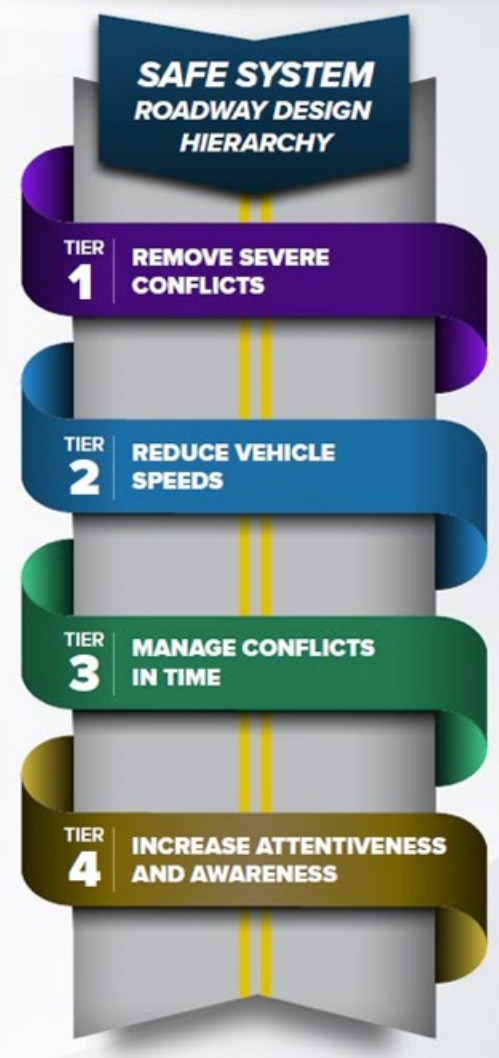


Figure 2.2: Safe System Roadway Design Hierarchy

Nearly one in three – 31.7% of the 4,428 – traffic fatalities in California in 2022 was associated with excessive speed or traveling at speeds deemed unsafe for the driving conditions.[11]

In 2021 through AB 43, California authorized local governments to reduce speed limits on certain roads, including state highways, in business and residential areas (as defined by the California Vehicle Code) and other roads identified as "safety corridors." SafeTREC's Safe Speeds Toolkit includes a flow chart for speed limit setting on locally controlled roads.[12] This new authority aligns with the Safe System approach and allows local jurisdictions to target speeds based on user context.

Caltrans also issued Design Information Bulletin (DIB) 94 in 2024 related to "complete streets" which provides local agencies with more flexibility to design context-sensitive facilities to better serve the needs of all travelers, including guidance for selecting treatment tools based on speed and volume context.

For vulnerable users, such as people walking, biking, or otherwise not in a vehicle, speed is a determining factor in survivability. Figure 2.3 depicts how a person's chance of surviving when being struck by a vehicle can increase from 20% at 40 miles per hour (mph) to 60% at 30 mph to 90% at 20 mph. Moreover, as drivers increase the speed of the vehicle, their peripheral vision narrows. This results in decreased depth perception and a reduced ability to notice others on the road, such as people walking and biking. Reducing speed in the presence of vulnerable users is a key Safe System strategy.

[11] National Highway Traffic Safety Administration (2023). Traffic Safety Facts: California 2018-2022.
[12] See the California Safe Speeds Toolkit for details on how to implement the speed setting flexibilities related to AB43 and AB1938: https://safetrec.berkeley.edu/tools/california-safe-speeds-toolkit/california-safe-speeds-toolkit-next-steps

Approaches include:

- Physical roadway designs (width, horizontal alignment) to limit speeds;
- Traffic calming treatments that induce slower speeds;
- Traffic signal timing that minimizes high-speed flow; and
- Traditional or automated enforcement[13] that discourages speeding

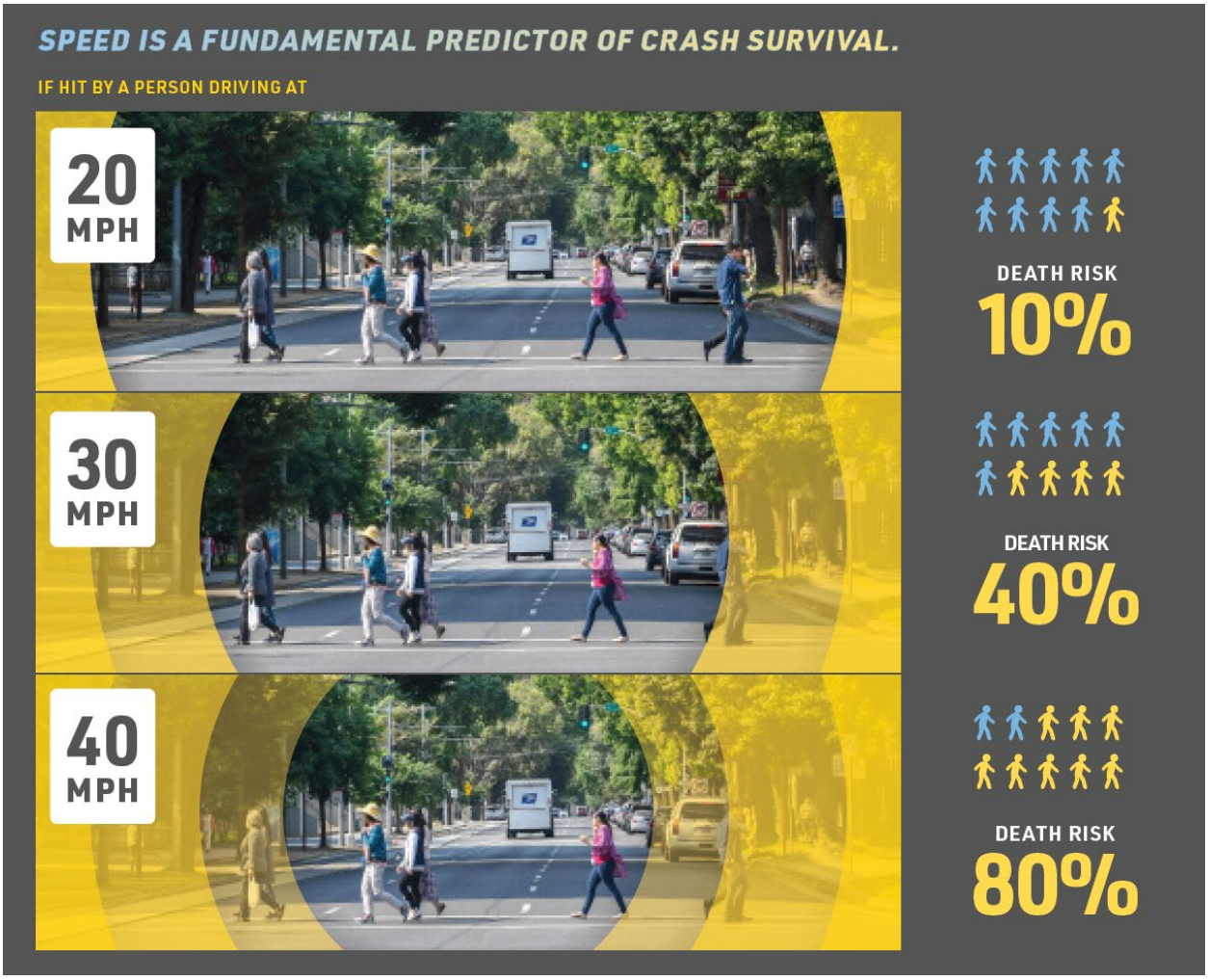


Figure 2.3: Increasing driver vehicle speed reduces vulnerable road user crash survivability and narrows the driver's field of vision

Many traffic safety efforts continue to lean on individuals to "do the right thing" to stay safe rather than apply lessons learned from the public health sector to invest in system-wide safety interventions. Ederer (2023) proposed the Safe Systems Pyramid[14], which acknowledges kinetic energy as the root cause of injury and introduces a public health-based intervention framework

[13] Assembly Bill (AB) 645 was signed into law in October 2023 authorizing six California cities (Glendale, Long Beach, Los Angeles, Oakland, San Francisco, and San Jose) to pilot automated speed cameras for five years.
[14] Ederer, D., Thompson Panik, R., Botchwey, N., & Watkins, K. (2023). Adaptation of the Health Impact Pyramid into the Safe System Pyramid. *Transportation Research Interdisciplinary Perspectives. Vol. 21*. https://doi.org/10.1016/j.trip.2023.100905.

to address this cause with strategies that require the least individual effort and have the broadest population impact. For example, interventions that require more individual effort (e.g., driver education programs, educational campaigns) have the least impact on improving system-wide safety, and those that change the context of transportation have the largest impacts on safety (e.g., affordable housing near transit, zoning reform). This framework provides guidance when transportation decision-makers cannot do it all, giving priority towards projects and interventions that will most impact safety outcomes.[15]

Figure 2.4: The Safe Systems Pyramid

Strategies at the base of this pyramid focus on reducing and limiting exposure upstream that affect where, when, and how people enter the transportation system and become exposed to risk. This includes Vehicle Miles Traveled (VMT) mitigation, in terms of both the duration of travel as well as the location and mode. Middle-of-the-pyramid strategies look for opportunities, on top of exposure mitigation, to limit conflicts through the separation of users in space and time, and limit severity through speed management and reduced angles of crashes. Less preferred strategies in this framework focus on educational interventions that are conditional on individual behavior change. In alignment with the Safe System Approach, education can be effective when they are combined with efforts from other tiers in the pyramid to strengthen redundancies.

Conventional safety practice is primarily reactive, largely based on data provided to engineers and planners in crash reports. However, the primary purpose of crash reports is to document the moment of the crash and the time immediately preceding it to determine “fault” across the involved parties (such as needed for insurance claims). As such, it shifts the responsibility for the crash to an individual, rather than assessing opportunities to intervene at the system level.

[15] Mitman, M. et al, (2024). Why and How to Focus on Kinetic Energy Risk, *ITE Journal: The Journey to Safer Communities.* 39-45. https://ite.ygsclicbook.com/pubs/itejournal/2024/march-2024/live/index.html#p=38

The Safe Systems Pyramid recommends focusing on root causes of the crash by considering the W's of safety:

- Who was involved; what is their personal story?
- Where were they traveling from and to? Why were they on this road?
- Why were they traveling on that day, at that time?
- Why did they use their selected travel mode?
- Why was the road they were traveling on designed the way it is?

Creating a Safe System means shifting a major share of the responsibility from individual road users to those who design the road transport system. "Individual road users have the responsibility to abide by laws and regulations" [16] and do so by exhibiting due care and proper behavior in the transportation system. While road users are responsible for their own behavior, a safe system requires a shared responsibility with those who design, operate, and maintain the transportation network: including the automotive industry, law enforcement, elected officials, and government bodies.[17] In a Safe System, roadway system designers and operators take on the highest level of ethical responsibility to look at crashes holistically and systemically, and recognize that crashes are not only caused by a driver's error.

2.2 Integrating the Safe System Approach into the CSSA

The Safe System Approach involves anticipating human mistakes by designing and managing road infrastructure to keep the risk of mistakes low, and if a mistake does lead to a crash, reducing the impact to the human body, so it does not lead to a fatality or serious injury. The first step in incorporating the Safe System Approach into the CSSA is a benchmarking analysis. The benchmarking analysis, based on the Safe System elements, is an evaluation of how the local agency's programs, policies, and other existing efforts compare to national best practices for the access and comfort for people walking and biking. Ideally, a local agency will fully institutionalize the Safe System Approach in their programs, practices, and policies (rather than on a case-by-case basis) and identify and remove barriers to its adoption.

The CSSA project team will identify some focus areas (i.e., intersections and corridors) to conduct a comprehensive walk audit based on crash history and conversations with the applicant to understand local safety concerns. During the walk audit, the CSSA project team integrated the Safe System elements into a discussion with participants to prompt safety improvements at the study locations.

The CSSA field assessment focuses primarily on infrastructure-related countermeasures, with an emphasis on improving safety for people walking and biking. Specifically, the CSSA seeks to

[16] World Health Organization (2011). Decade of Action for Road Safety 2011-2020. Retrieved on: June 3, 2024 Decade of Action for Road Safety 2011-2020 (PDF).
[17] World Health Organization (2011). Decade of Action for Road Safety 2011-2020. Retrieved on: June 3, 2024 Decade of Action for Road Safety 2011-2020 (PDF).

reduce speeds to a target speed for the road context, separate road users in space and time for that context, and change road geometry to manipulate crash angles as proactive strategies to address kinetic energy risk for fatal and serious injuries.

This CSSA report compiles a set of considerations for the local agency to both institutionalize a Safe System Approach into programs, practices, and policies, and to directly apply the Safe System Approach lens through field assessments and countermeasure selection.

3. Background and Crash History

Gridley is located in Butte County with a population of approximately 7,300. Of its residents, the majority, with 56%, identified as White alone (not Hispanic or Latino), and 38% identified as Hispanic or Latino.[1] The median household income in Gridley in 2022 was $56,428, lower than the statewide median household income of $91,905.[2] It had an estimated daily vehicle miles traveled on local roads of 34,553 in 2021.[3] The vicinity of Gridley is shown in Figure 3.1.

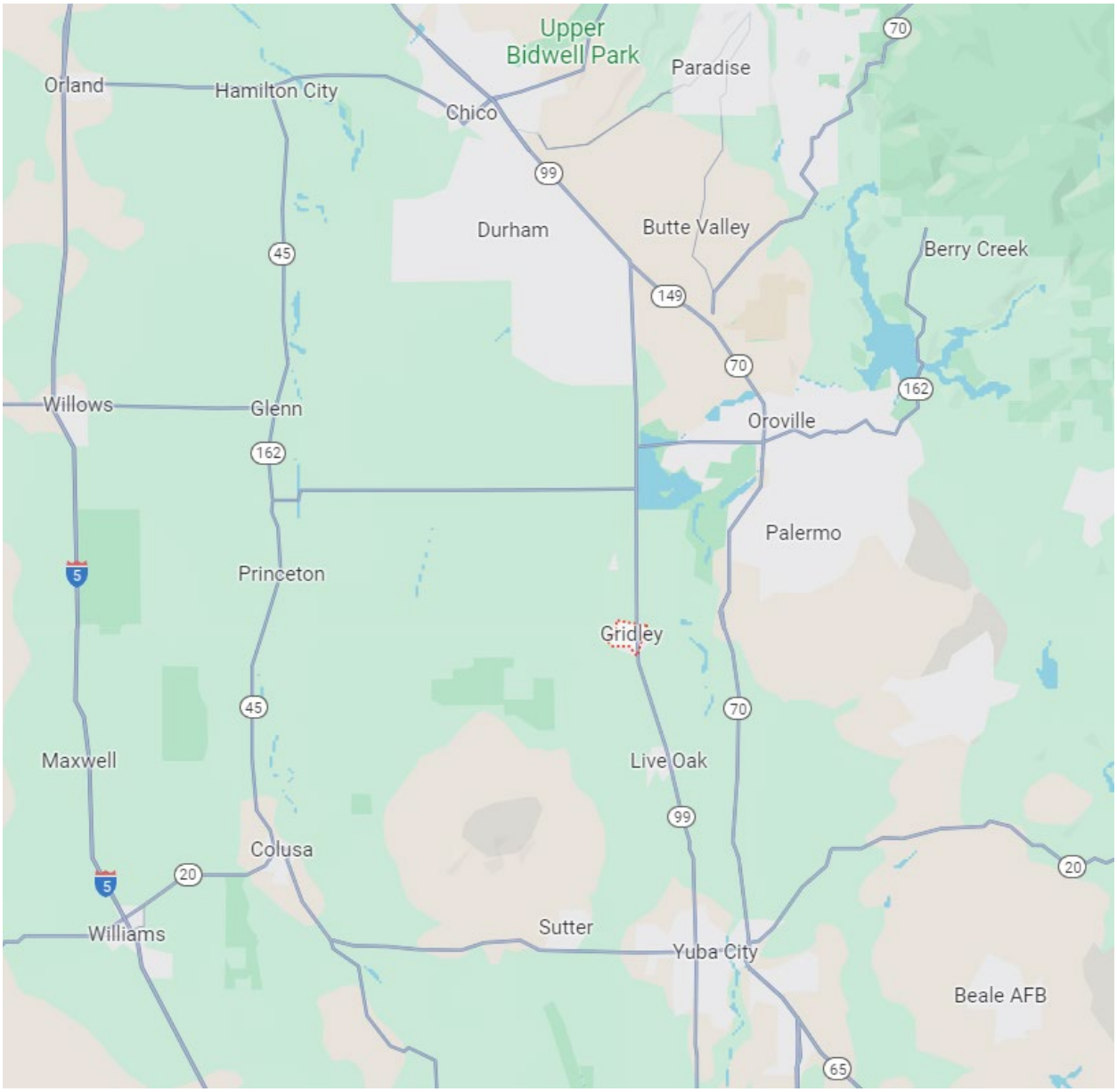


Figure 3.1: Gridley Vicinity Map

3.1 Overview of Pedestrian and Bicyclist Safety

One of the goals of the CSSA is to make walking and biking safer and more accessible for all residents and visitors in Gridley. In this section, we provide a summary of traffic crashes by statewide ranking, detailed analyses of crashes involving pedestrians and bicyclists to determine high-risk groups, high-priority locations and behaviors that need to be addressed, when crashes are occurring, as well as discuss the importance of underreported and near-miss crashes.

Office of Traffic Safety Ranking for Pedestrian and Bicycle Crashes

The California Office of Traffic Safety (OTS) maintains crash rankings to facilitate comparison between cities with similar sized populations to identify and address potential emerging or ongoing traffic safety issues. The rankings are based on the Empirical Bayesian (EB) Ranking Method that gives weights to many different factors, such as population, vehicle miles traveled, and crash counts. Rankings are available for incorporated cities and only includes local streets and state highways within the city limits. Counties are also assigned a statewide ranking. Data for the OTS rankings are taken from the Statewide Integrated Traffic Records System (SWITRS), the California Department of Transportation, and the California Department of Finance. The most current OTS statistics (2021) grouped Gridley within group F, as compared to 76 cities in California with a population between 2,501 and 10,000.

Per the OTS rankings, in 2021, Gridley was ranked 6 out of 76 cities of similar population size for people killed or injured in a traffic crash (with a ranking of “one” indicating the worst). For pedestrians and bicyclists killed or injured in a crash, Gridley ranked 24/76 and 29/76, respectively. For bicyclists under aged 15 killed or injured in a crash, Gridley ranked 7/76. Gridley ranked 11/76 for fatal and injury hit and run crashes, 3/76 for nighttime (9:00 p.m. – 2:59 a.m.) fatal and injury crashes, and 24/76 for speed related fatal and injury crashes.

3.2 Pedestrian and Bicycle Crash Data

Crash data is vital to compete for funding at the state and federal levels to implement safety improvements. SWITRS, maintained by the California Highway Patrol, is the state's official traffic records database. It captures reported crashes that resulted in injury or death. The 2022-2023 SWITRS data used is provisional as of June 2024 and subject to change before it is finalized. The CSSA team retrieved SWITRS crash data for Gridley from the Transportation Injury Mapping System (TIMS) database for 2019 through 2023. TIMS is a tool developed by SafeTREC to provide quick, easy, and free access to SWITRS which has been geo-coded by SafeTREC to make it easy to map crashes. The data presented below includes police-reported crashes that occurred within the city limits.

In this five-year period, 15 crashes involving pedestrians or bicyclists occurred in Gridley, including one fatal crash and six serious injury crashes. Of these 15 crashes, nine (60%) occurred on state roads.

Pedestrian Crashes

From 2019 to 2023, there were seven crashes involving pedestrians in Gridley. Among the seven victims of these pedestrian crashes, there was one person killed and two people seriously injured. The majority of pedestrian crashes resulted in minor injury[4] with four of the seven crashes. Three crash victims were youth under 20 years of age and four crash victims were adults between the ages of 20 to 44. The majority, 86%, of pedestrian crash victims were

male. The top Primary Collision Factor (PCF) violations were pedestrian right of way (four crashes).

Figure 3.2 shows the spatial distribution of pedestrian crashes by severity. Fatal and serious injury crashes are distributed primarily in the eastern portion of the city along California State Route 99 (SR 99). One fatal crash and two serious injury crashes occurred on SR 99; the fatal crash occurred at the intersection of Obermeyer Avenue and the serious injury crashes occurred at the intersections of Cherry Street and Hazel Street.

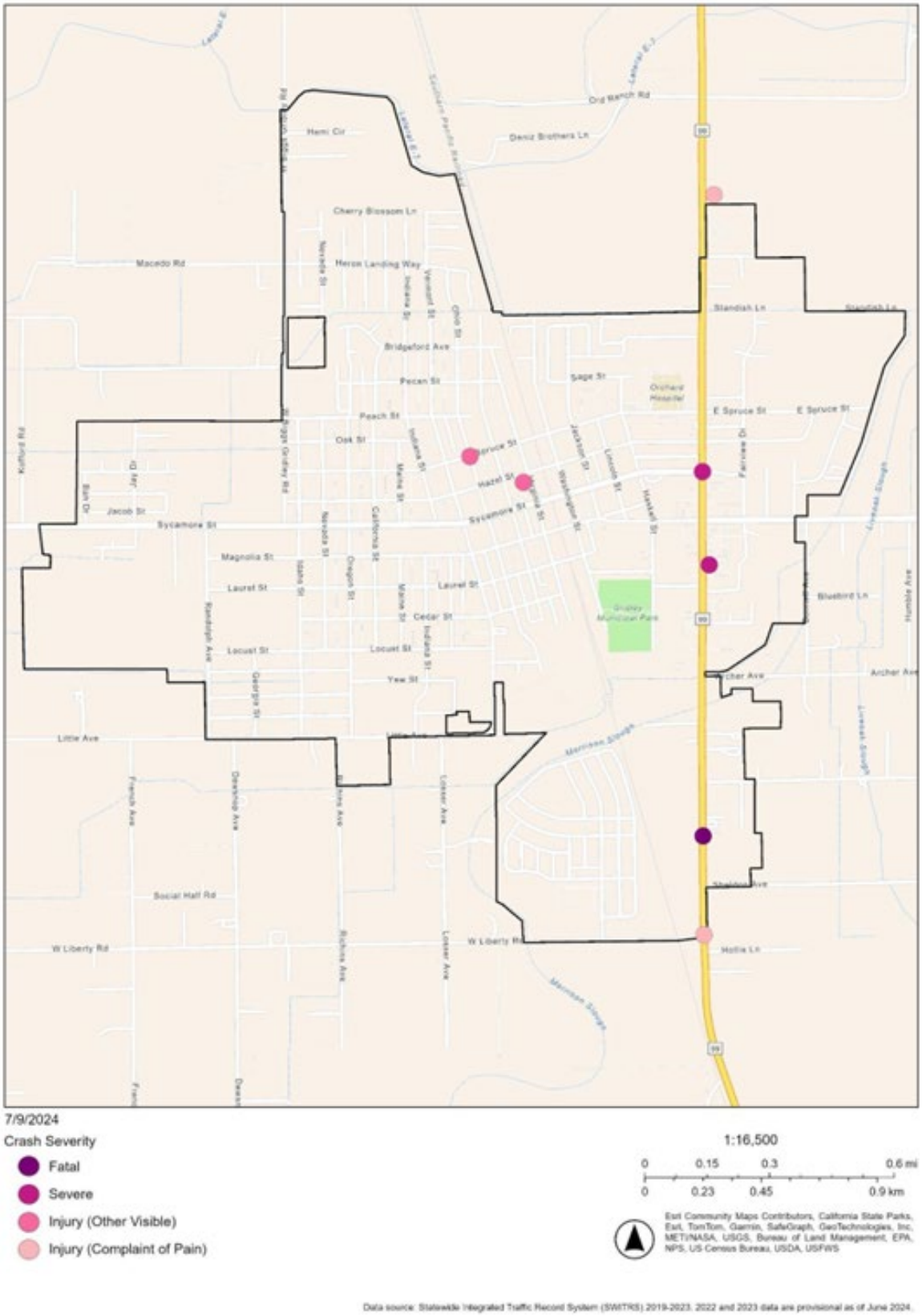


Figure 3.2: Map of Pedestrian Crashes in Gridley (2019-2023)

Figure 3.3 and Figure 3.4 show an analysis of pedestrian-related crashes in Gridley.

Figure 3.3 shows the distribution of when pedestrian crashes occurred. The seven pedestrian crashes were distributed on weekdays. There were no clear patterns for time of day of the crashes. Four pedestrian crashes occurred in daylight and another three pedestrian crashes occurred in the dark in areas with streetlights.

Figure 3.4 shows the distribution of where pedestrian crashes occurred. Six of seven pedestrian crashes occurred when crossing the street, the seventh crash occurred not in the road.

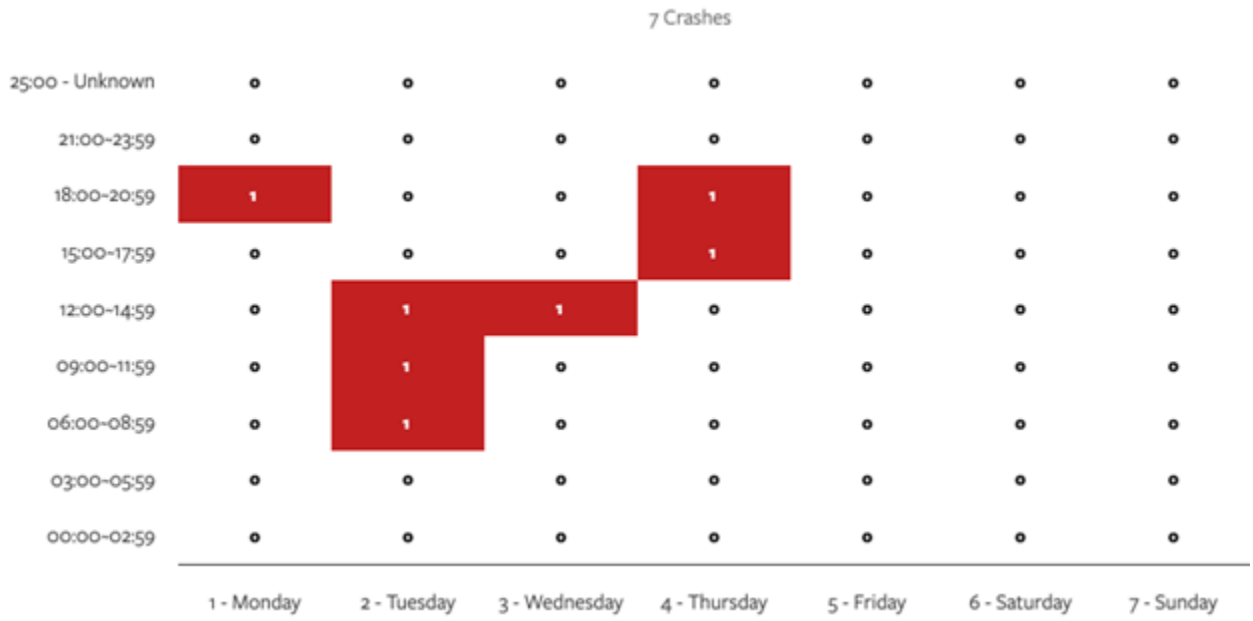


Figure 3.3: Pedestrian Crashes by Day of Week and Time of Day in Gridley (2019-2023)

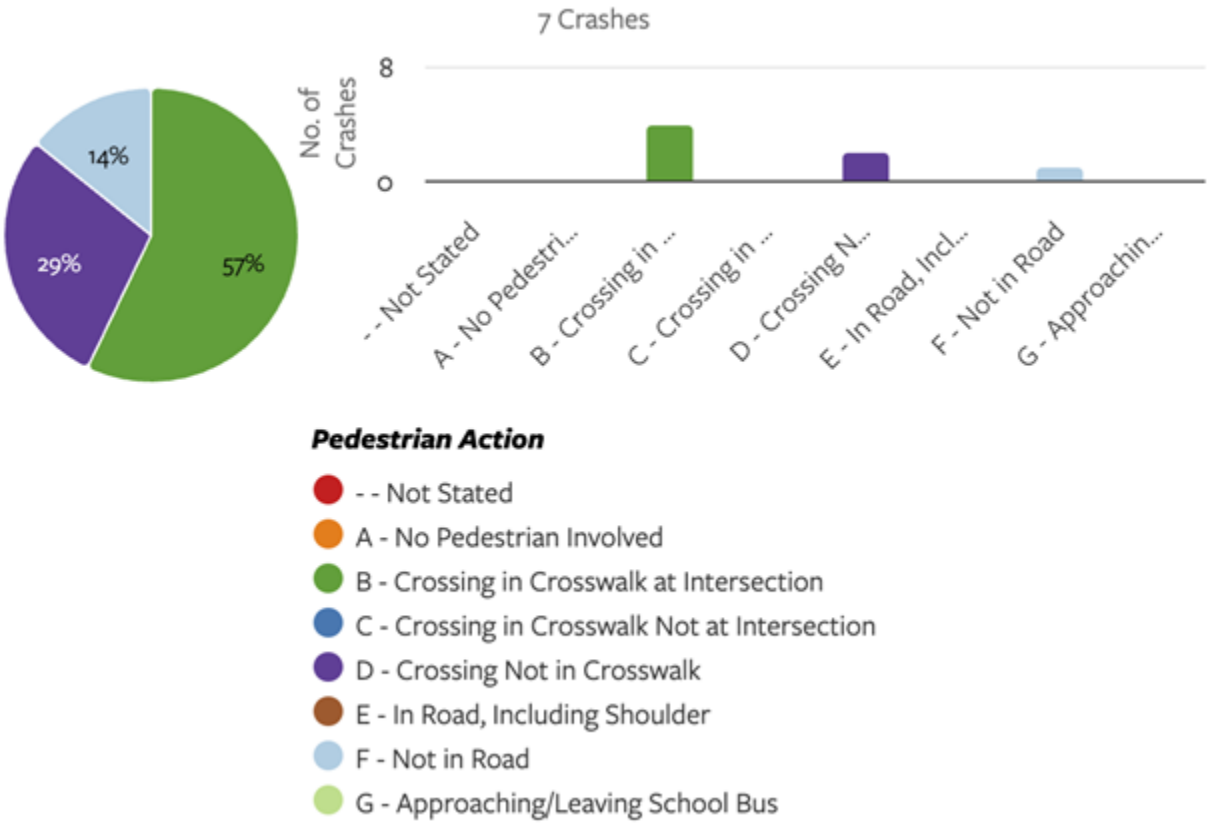


Figure 3.4: Pedestrian Crashes by Pedestrian Action in Gridley (2019-2023)

Bicycle Crashes

From 2019 to 2023, there were eight crashes involving bicycles in Gridley. Among the eight victims of these bicycle crashes, there were zero people killed and four people seriously injured. Half of the bicycle crashes resulted in minor injury[5] with four of the eight bicycle crashes. Two crash victims were youth under 20 years of age and five crash victims were adults between the ages of 21-64. Half of the bicycle crash victims were male and half were female. The top Primary Collision Factor (PCF) violations indicated for seven of the eight bicycle crashes were improper turning (three crashes), automobile right of way (two crashes), wrong side of road (one crash), and other hazardous violation (one crash).

Figure 3.5 shows the spatial distribution of bicycle crashes by severity. Serious injury crashes are distributed primarily in the eastern portion of the city along SR 99. Three serious injury crashes occurred on SR 99, at the intersections of Spruce Street, Archer Avenue, and Sheldon Avenue.

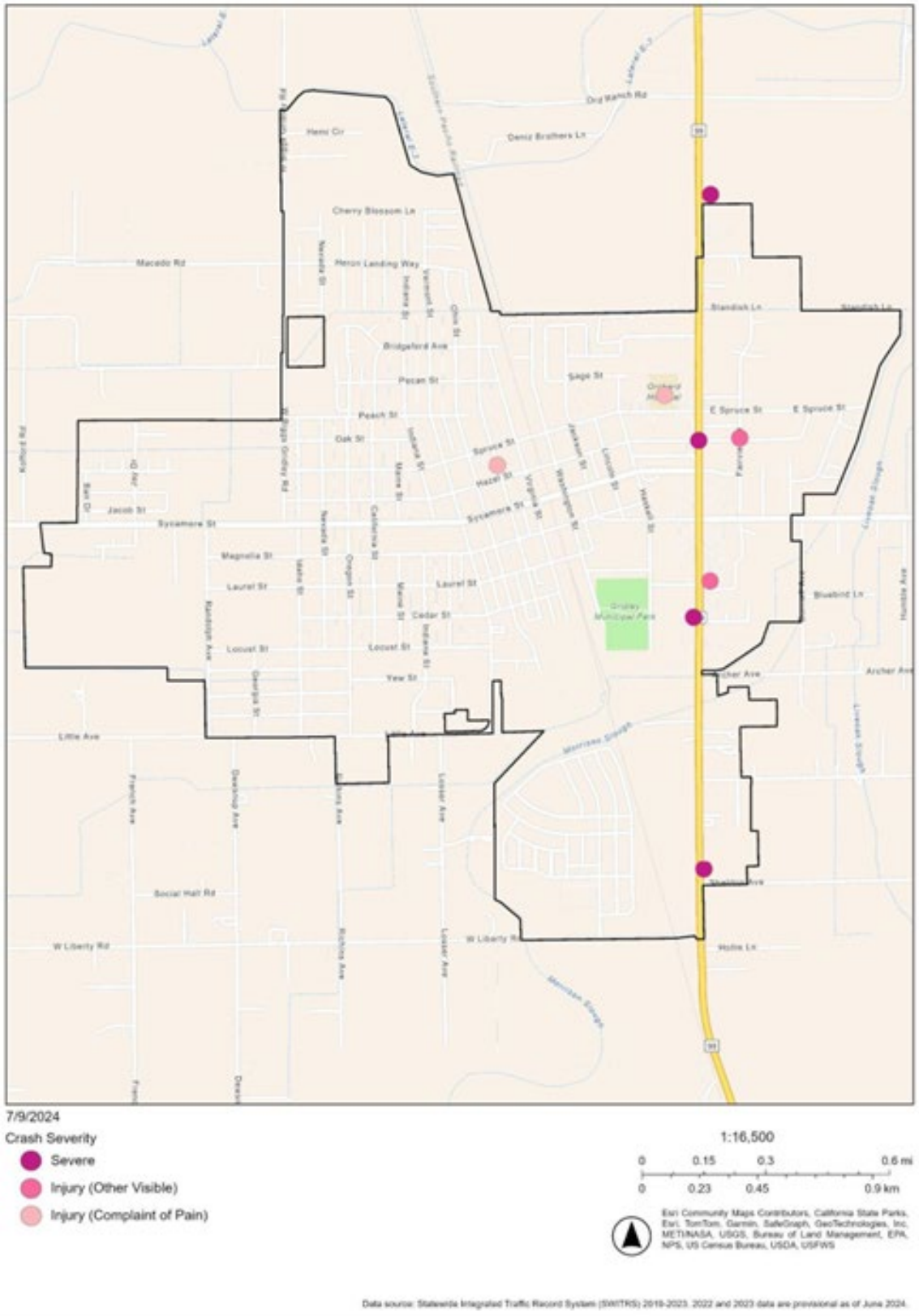


Figure 3.5: Map of Bicycle Crashes in Gridley (2019-2023)

Figure 3.6 and Figure 3.7 show an analysis of bicycle-related crashes in Gridley.

Figure 3.6 shows the distribution of when bicycle crashes occurred. The eight bicycle crashes were distributed across the week, with the majority of crashes on weekdays. Bicycle crashes were more likely to occur during the day. All bicycle crashes occurred in daylight.

Figure 3.7 shows the distribution of the types of bicycle crashes that occurred. Five of the eight bicycle crashes were categorized as other[6], two occurred as a result of a broadside, and one occurred as a result of a sideswipe.

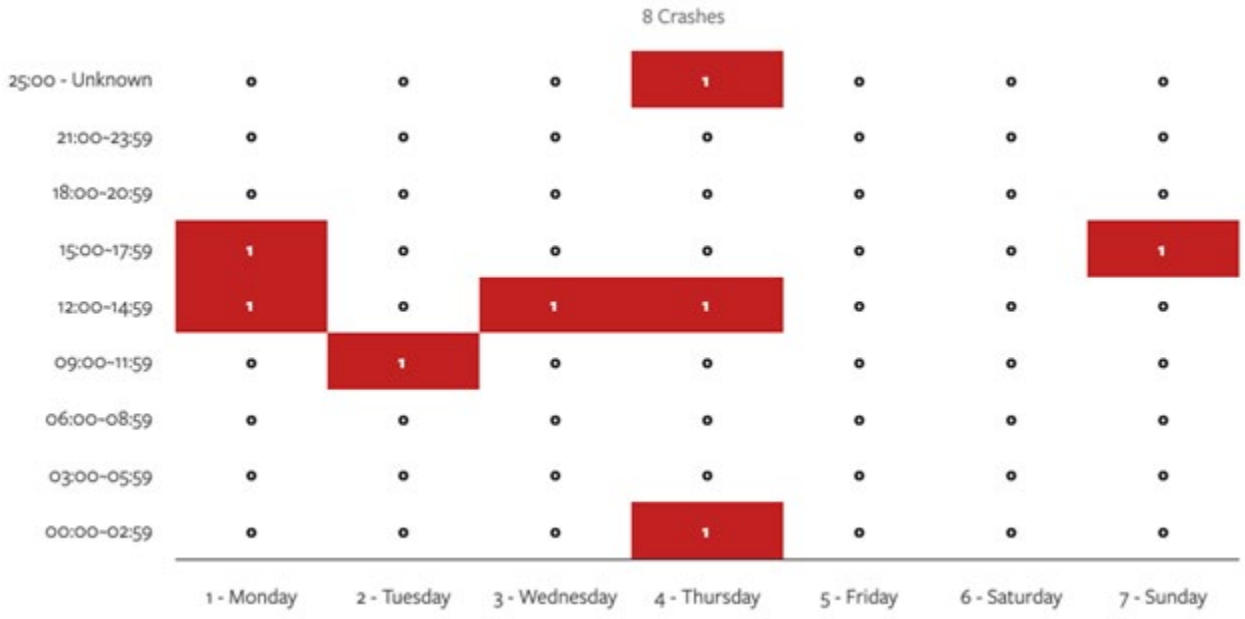


Figure 3.6: Number of Bicycle Crashes per Day of Week per Time in Gridley (2019-2023)

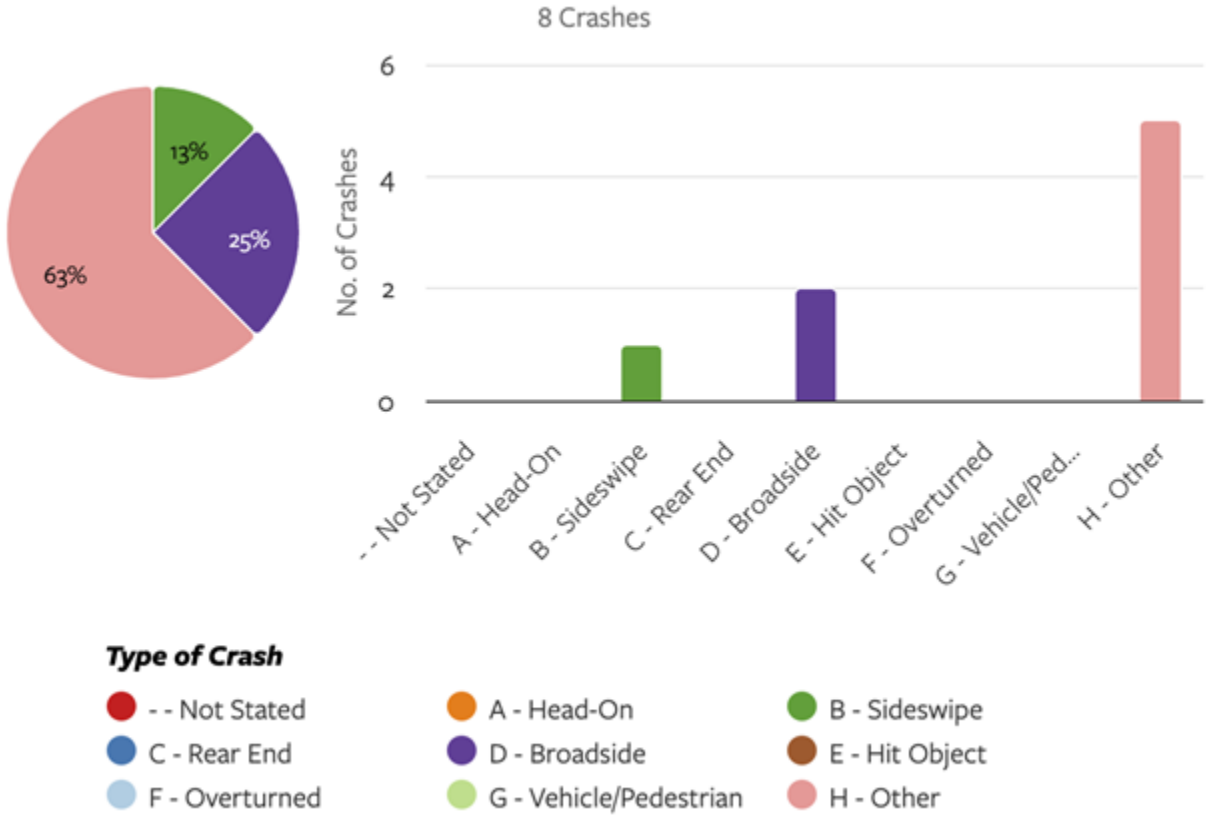


Figure 3.7: Number of Bicycle Crashes by Type of Crash in Gridley (2019-2023)

3.3 Areas of FocusAlthough it was the site of many pedestrian and bicycle crashes, SR 99 was not identified as a focus of the CSSA because improvement plans are already underway. Instead, city and county staff decided to prioritize travel adjacent to the Gridley's schools. The areas of focus for the Gridley CSSA study included the areas surrounding Sycamore Middle School/ McKinley Primary School, Wilson Elementary School, and Gridley High School, as well as Fairview Drive at East Gridley Road.

Pedestrian Crashes in Study Focus Areas

The following figure depicts the pedestrian crashes that happened in the focus areas of this study. There were no crashes on the intersections of focus between 2019 and 2023. Figure 3.8 shows the general area with two serious injury crashes and two minor injury pedestrian crashes between 2019 and 2023. There were also several injury pedestrian-vehicle crashes in the focus area between 2015 and 2019, including a severe injury crash at Magnolia Street & Ohio Street in 2016 and two fatal crashes: one at East Gridley Road & Fairview Drive in 2015 and one at Magnolia Street & Haskell Street in 2018.

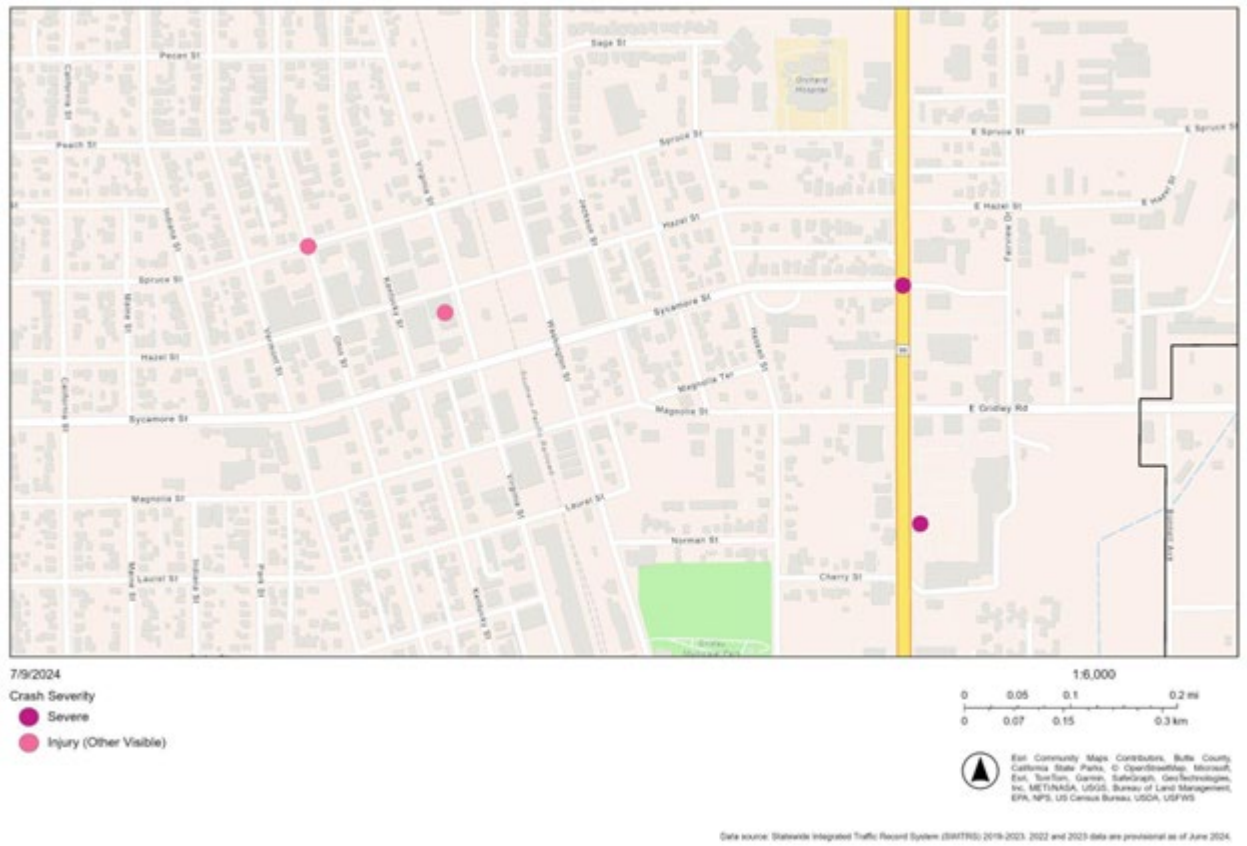


Figure 3.8: Pedestrian Crashes in and around Focus Areas (2019-2023)

Bicycle Crashes in Study Focus Areas

The following figure depicts the bicycle crashes that happened in the focus areas of this study. There were no crashes at the intersections of focus. The area saw one serious injury crash and four minor injury bicycle crashes between 2019 and 2023. There were also several injury bicycle-vehicle collisions in the focus area between 2015 and 2019, including one at East Gridley Road and SR 99 that resulted in severe injury in 2018, at Lincoln Street & Spruce Street, and at East Hazel Street & Fairview Drive in 2019.

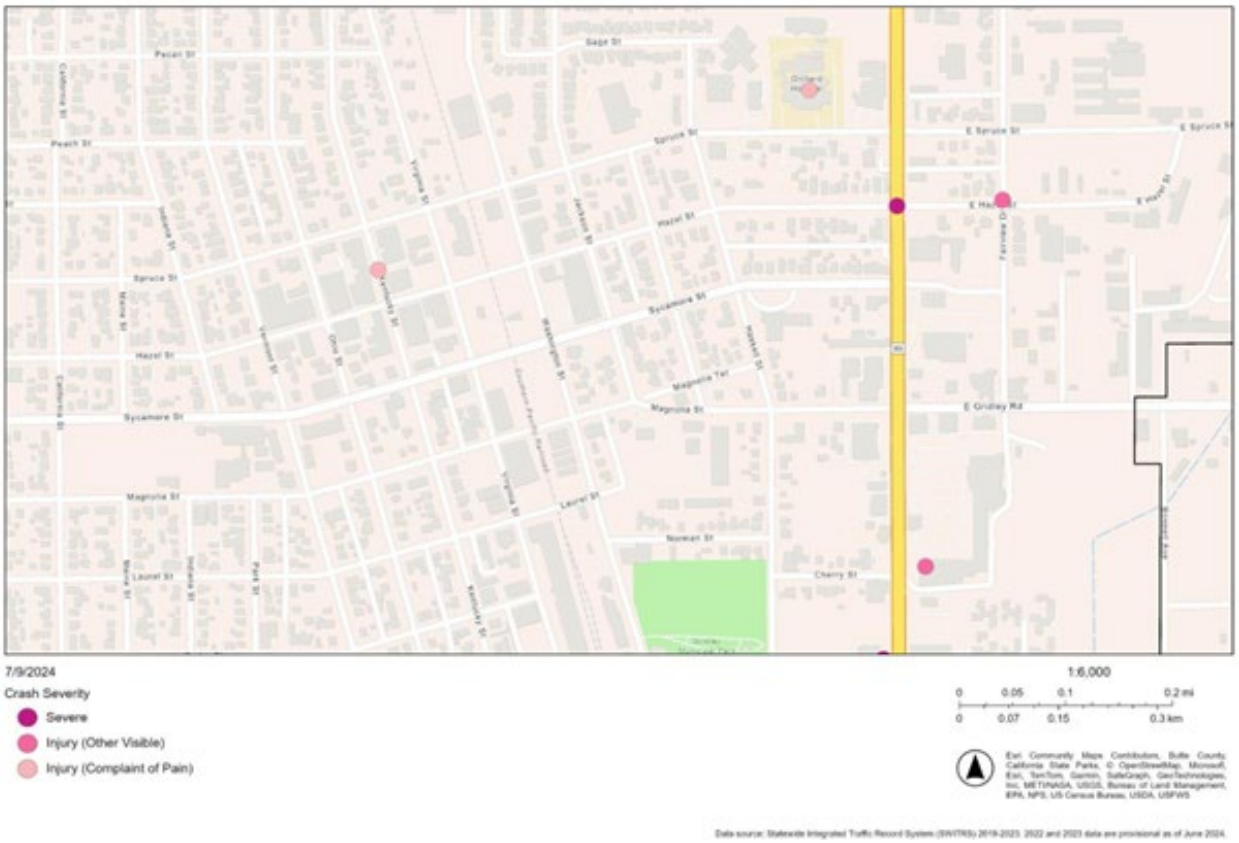


Figure 3.9: Bicycle Crashes in and around Focus Areas (2019-2023)

3.4 Street Story

Despite our best efforts, pedestrian and bicycle crash underreporting is common. Research suggests that a crash is less likely to be reported if there is no injury, little property damage, or only one party is involved.[7, 8, 9] Street Story (https://streetstory.berkeley.edu/) is a crowdsourced community engagement tool developed by UC Berkeley SafeTREC that allows residents, community groups, and agencies to collect information about traffic crashes, near-misses, general hazards, and safe locations to travel. Once a record has been entered, the information is added to a map and aggregate table of publicly accessible data.

Staff can use this free tool to collect information from residents for local needs assessments, transportation safety planning efforts, safety programs, and project proposals.

Jurisdictions can create custom boundaries through the Street Story tool to collect data for local needs assessments or to support local traffic safety planning efforts, safety programs, and project proposals. At the time of this report, no reports were input in Street Story for Gridley.

4. Benchmarking Analysis Results and Recommendations

To assess pedestrian and bicycle safety conditions in Gridley, the CSSA team conducted a benchmarking analysis to understand how the site's existing conditions compares to current national best practices, including consistency with the Safe System Approach.

An electronic questionnaire was sent to Gridley staff with an optional interview. Their responses are denoted by the yellow fill in the benchmarking matrix seen in Tables 4-1 through Table 4-5. The benchmarking questionnaire was separated into five categories:

- Enhancing Safety through Accessibility
- Policies and Programs
- Safety Data Collection and Assessment
- Pedestrian and Bicycle Network Planning and Design
- Pedestrian and Bicycle Support Programs

Each benchmarking category addresses one or more of the Safe System Approach elements (Safe Road Users, Safe Vehicles, Safe Speeds, Safe Roads, and Post-Crash Care) while also incorporating best practices related to access and comfort for people walking and biking. Suggestions for better aligning each topic with best practice benchmarks are also noted for Gridley's consideration.

The CSSA team compared staff's benchmarking questionnaire responses for each category against national best standards. The CSSA team also reviewed the county's website and relevant documents to identify the city's pedestrian and bicycle policies, programs, and practices. Based on these findings, the CSSA team assigned one of three ratings to each category, as indicated by the orange fill in the subsequent tables:

- Exceeds national best practices;
- Meets national best practices; or
- Does not meet national best practices.

Suggestions are provided for each category. However, Gridley has differing physical, demographic, and institutional characteristics that may make certain goals or policies more appropriate in some jurisdictions compared to others. Ultimately, Gridley and/or county staff may determine where resources and efforts are best placed for meeting local development and infrastructure goals for pedestrians and bicyclists.

4.1 Enhancing Safety through Accessibility

In order to improve traffic safety, it is important to consider the needs of all road users. This may include removing obstacles that prevent people with disabilities from traveling safely and comfortably by separating users in time and space, designing road networks to make road users more visible, or improving driver education and vehicle technologies. Key areas to consider in this category are safe road users and safe roads.

Table 4.1 Benchmarking Analysis for Enhancing Safety through Accessibility

Benchmarking Topic	Exceeds National Best Practices	Meets National Best Practices	Does Not Meet National Best Practices
1. Implementation of Americans with Disabilities Act (ADA) Improvements	Uses Public Right-of-Way Accessibility Guidelines (PROWAG) for ADA improvements with consistent installation practices	Has clear design guidelines but no regular practices for ADA compliance	Has minimal design guidelines and practices related to ADA requirements
2. ADA Transition Plan for Streets and Sidewalks	Has an ADA transition plan in place and an ADA coordinator	Partial or outdated ADA transition plan or an ADA coordinator	No transition plan or ADA coordinator

4.1.1 Implementation of Americans with Disabilities Act (ADA) Improvements

Implementation of ADA improvements is key to making walking accessible and safe for everyone, regardless of ability or age. See U.S. Access Board Public Right-of-Way Accessibility Guidelines for more information.

Suggestions for Potential Improvement

- Continue adding ADA ramps at intersections that currently lack them and upgrade non-compliant ramps.
- Develop an ADA improvement program for items such as dual curb ramps, truncated domes, and audible pedestrian signals that apply consistent treatments. The program may provide an inventory, prioritization plan, and funding source for such improvements.

4.1.2 ADA Transition Plan for Streets and Sidewalks

ADA Transition Plans identify gaps and issues in the city's current ADA infrastructure, prioritize projects for implementation, and set forth the process for bringing public facilities into compliance with ADA regulations. Transition Plans typically include a range of locations, such as public buildings, sidewalks, ramps, and other pedestrian facilities. Some cities also have

ADA Coordinators, who are responsible for administering the Plan and reviewing projects for accessibility considerations.

Suggestions for Potential Improvement

- Consider prioritizing sub-areas within the city that exhibit the greatest pedestrian activity.
- Expand the ADA Transition Plan to include the public right-of-way, particularly the downtown area, other priority development areas, bus stops, and schools.
- Consider having a part-time, trained ADA coordinator to review projects for accessibility and implement the ADA Transition Plan.
- Provide ADA standards and best practice training for public works staff at all levels.
- Ensure safety for all users is prioritized and accessibility is maintained during construction and road maintenance projects. It is vital to ensure that dedicated space is maintained for vulnerable users during construction and road maintenance projects.
- Create a policy that details how to maintain accessibility and provide designated space for pedestrians and bicyclists through a Construction Management Plan (CMP).

4.2 Policies and Programs, Safety Implementation Plans and Policies

Policies, programs, and plans play a critical role in keeping people safe on California roadways. Collectively, they signal a proactive approach to identifying risks and strategies to mitigate them. Key areas to consider in this category are safe road users, safe roads, and safe vehicles.

Table 4.2 Benchmarking Analysis for Policies and Programs, Safety Implementation Plans and Policies

Benchmarking Topic	Exceeds National Best Practices	Meets National Best Practices	Does Not Meet National Best Practices
1. Transportation Advisory Committee	Has a formal, active/ on-going Transportation Advisory Committee guided by a charter or mission that includes the safety of vulnerable road users and whose activities focus on improving pedestrian and bicycle safety.	Has an ad-hoc Transportation Advisory Committee or one not guided by a charter or mission that specifically includes safety of vulnerable road users. Note: City's Planning Commission may act as Transportation Advisory Committee	Does not have a Transportation Advisory Committee
2. Traffic Calming or Speed Management Program	Has a speed management program that is reviewed annually alongside the CIP project list. Major arterials and neighborhood corridors include proactive speed management strategies and countermeasures are implemented to reach safe target speeds.	Has a traffic calming program but funding and implementation of countermeasures are ad-hoc and reactive.	Explores traffic calming features other than speed humps. or Does not have a traffic calming or speed management program

Benchmarking Topic	Exceeds National Best Practices	Meets National Best Practices	Does Not Meet National Best Practices
3. Speed Limit Setting	Regularly surveys speed and identifies locations with high deviation from target speeds. The agency uses best practices for speed management in combination with allowances from AB 43 to lower speed limits. Lower speed limits are implemented using a consistent approach that prioritizes areas with historic underinvestment. https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=202120220AB43	Seeks to include 15 mph speed limits in school zones or commercial corridors.	Continues to use the 85th percentile to set speed limits.
4. Safe Routes to Schools	Has an ongoing Safe Routes to Schools program that is included as part of the agency's safety monitoring and is integrated with other policies and programs.	Has obtained funding for recent projects but has no communitywide Safe Routes to Schools program.	Does not have a Safe Routes to Schools program and has not obtained recent funding.
5. Systemic Signalized Intersection Enhancements	Has a systemic signalized intersection enhancement program that follows a Safe System-based framework and proactively implements FHWA's Proven Safety Countermeasures to manage speed and crash angles and to consider risk exposure.	Reactively implements Proven Safety Countermeasures at signalized intersections.	Does not routinely implement proven safety countermeasures (LPIs, protected left turns, roundabouts, medians, countdown signals, etc.) at signalized intersections.

Benchmarking Topic	Exceeds National Best Practices	Meets National Best Practices	Does Not Meet National Best Practices
6. Systemic Enhancements for Unsignalized and Uncontrolled Crossings	Has a crosswalk enhancement program that proactively implements a Safe Transportation for Every Pedestrian (STEP)-consistent countermeasure at uncontrolled crossings.	Has a crosswalk policy that is STEP-consistent but is only reactive to implementing Proven Safety Countermeasures.	Does not have a policy or set practices for addressing crosswalk installation or enhancements using Proven Safety Countermeasures.
7. Safe System Policy	Has a Safe System policy with redundancy built in for transportation projects with a checklist for the full set of incorporation of the Safe System elements. The policy includes all users and modes, affects new construction and maintenance, considers local context, and provides guidance for implementation.	Has a Safe System policy, but does not identify how redundancy can be incorporated through the Safe System elements.	Does not have a Safe System policy.

4.2.1 Transportation Advisory Committee

While they do not have their own transportation advisory committee, the City of Gridley participates in the Butte County Association of Governments (BCAG) Transporation Advisory Committee (TAC). Advisory committees serve as important sounding boards for new policies, programs, and practices. Responding to public concerns through public feedback mechanisms represents a more proactive and inclusive approach to bicycle and pedestrian safety compared with a conventional approach of reacting to crashes.

Suggestions for Potential Improvement

Consider establishing a Formal Advisory Committee with regularly scheduled meetings to bring all transportation projects to the general committee to provide opportunities for focused complete streets discussion.

4.2.2 Traffic Calming or Speed Management Program

The City of Gridley does not have a traffic calming program. Traffic calming programs and policies set forth a consensus threshold for neighborhood requests and approvals, as well as standard treatments and criteria.

Suggestions for Potential Improvement

- Increase the amount of dedicated funding available for traffic calming each year.
- Expand the city's traffic calming toolbox to include other tools, such as raised crosswalks, raised intersections, chicanes, and traffic diverters. The city should review their speed management program annually alongside the CIP project list to identify major arterials and neighborhood corridors for proactive speed management.
- Expand the city's practices to include proactive traffic calming measures instead of only responding to community requests. The city could consider allocating a portion of funding to proactive traffic calming, such as on bicycle boulevard streets or safe routes to schools, and then allocate the remaining funding to react to specific community requests.
- The following resources offer traffic calming best practices:
    - Traffic Calming to Slow Vehicle Speeds | US Department of Transportation
    - Traffic Calming Guidelines from the City of Danville (PDF)
    - Neighborhood Traffic Management Program from the City of Anaheim
    - ITE Technical Resources — Traffic Calming Measures:

4.2.3 Speed Limit Setting

Agencies should regularly survey speeds and identify locations with high deviations from target speeds. Local municipalities use best practices for speed management from AB 43 to lower speed limits. Implementing lower speed limits is accomplished by using a consistent approach that prioritizes areas with historic underinvestment.

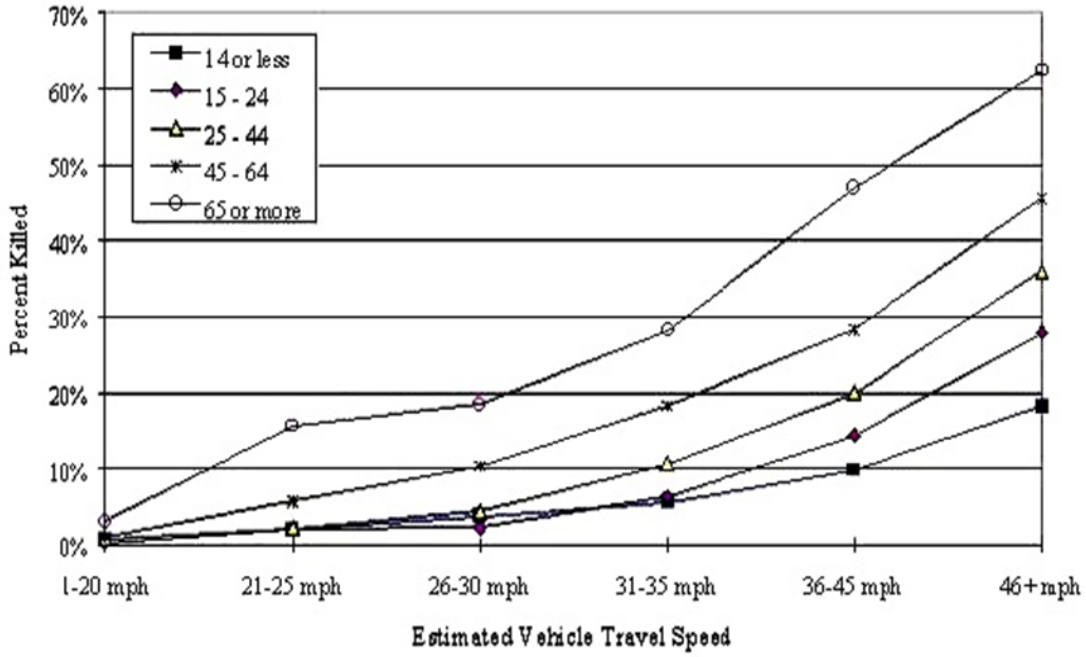


Figure 4.1 Relationship between Vehicle Speed, Victim Age, and Fatalities

Suggestions for Potential Improvement

- Install traffic calming measures, signal coordination, and similar tools to maintain slower speeds appropriate for an urban community, particularly on streets that will be reviewed in the next speed survey.
- After complete streets improvement and other safety measures are installed, conduct off-cycle speed surveys to review the speed limit and determine whether it needs to be reduced based on the improvements.
- Consider pedestrian volumes and known complete streets safety issues when setting speed limits and employ traffic calming strategies in locations where speed surveys suggest traffic speeds are too high for pedestrian and bicyclist safety.
- Ensure complete streets design standards have appropriate target design speeds for urban areas and do not contribute to a routine need for traffic calming.
- Consider the use of 15 MPH school zones.
- Additional information on AB 43:
- San Francisco's Speed Limit Setting in Business Districts: News Release: San Francisco Lowers Speed Limits in Targeted Business Districts Under New State Law

4.2.4 Safe Routes to Schools

Safe Routes to School (SRTS) programs encourage children to safely walk or bicycle to school. The Marin County Bicycle Coalition was an early champion of the concept, which has spread nationally (refer to best practices at https://www.saferoutesinfo.org). SRTS programs are important both for increasing physical activity (and reducing childhood obesity) and for reducing morning traffic associated with school drop-off (as much as 30% of morning peak hour traffic).

Suggestions for Potential Improvement

- Form an ongoing steering committee for the program (or each school) composed of city staff, school district staff, PTA leaders, and other stakeholders that meet regularly to monitor efforts and identify new opportunities.
- Consider a safe routes to school plan for all schools that are integrated with other policies and programs to conduct walk audits, identify recommended safety improvements, and secure funding for those improvements.

4.2.5 Systemic Signalized Intersection Enhancements

A systemic signalized intersection enhancement program follows a Safe System-based framework and proactively implements FHWA's proven safety countermeasures to manage speed and crash angles and to consider risk exposure. Proven safety countermeasures at signalized intersections include Leading Pedestrian Intervals (LPIs), protected left turns, roundabouts, medians, and countdown signals.

The only traffic signals in Gridley are on SR 99 and operated by Caltrans.

Suggestion for Potential Improvement

Consider working with Caltrans to establish a systemic signalized intersection enhancement program that follows a Safe System-based framework. FHWA resources include:

- Federal Highway Administration: Safe System-Based Framework and Analytical Methodology for Assessing Intersections
- Federal Highway Administration: Proven Safety Countermeasures (PDF)
- Federal Highway Administration: Safe Transportation for Every Pedestrian (STEP)
- National Cooperative Highway Research Program: Application of Pedestrian Crossing Treatments for Streets and Highways

4.2.6 Systemic Enhancements for Uncontrolled and Unsignalized Intersection Crossings

A systemic crosswalk enhancement program proactively implements a Safe Transportation for Every Pedestrian (STEP)-consistent countermeasure at uncontrolled crossings

Suggestions for Potential Improvement

- Develop a citywide crosswalk policy for the installation, removal, and enhancement of crosswalks at controlled and uncontrolled locations. Ensure that it is consistent with best practices and recent research. This includes removing crosswalks only as a last resort and providing midblock crossings where they serve pedestrian desire lines.
- Consider developing a treatment selection “tool” to assist staff with the identification of applicable treatments in a given context.
- When crosswalk enhancements are identified, add them to a prioritized list that will be upgraded over time as funding is available.
- FHWA resources include: Federal Highway Administration STEP Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations (PDF)

4.2.7 Safe System Policy

A Safe System policy with redundancy built in for transportation projects includes all users and modes, affects new construction and maintenance, considers local context, and provides guidance for implementation.

Suggestion for Potential Improvement

Consider adopting a Safe System Approach, based on the following resources:

- National Safety Council: Safe System Approach
- California Office of Traffic Safety: What is a Safe System Approach
- SafeTREC: Safe System Strategies for Bicyclists and Pedestrians Toolkit (PDF)
- SafeTREC: Conducting Community Engagement with a Safe System Lens (PDF)
- Vision Zero Network: Demystifying the Safe System Approach

- California Active Transportation Safety Information Pages (CATSIP): Safe System Approach to Road Safety
- U.S. Department of Transportation Federal Highway Administration: Zero Death and Safe System
- U.S. Department of Transportation: Safe Streets and Road Users for All (SS4A) Grant Program

4.3 Safety Data Collection and Assessment

Collecting and assessing data improves effectiveness, efficiency and overall system performance. Data can inform how to build safer roads for all modes of travel, including walking, biking, rolling, and driving. Key areas to consider in this category are safe road users.

Table 4.3 Benchmarking Analysis for Safety Data Collection and Assessment

Benchmarking Topic	Exceeds National Best Practices	Meets National Best Practices	Does Not Meet National Best Practices
1. Collection of Pedestrian and Bicyclist Volumes	Collects pedestrian and bicyclist volumes routinely with intersection counts and has a GIS database of counts. The database identifies key origin and destination locations that identifies patterns and needs in agencies policies and programs, especially in underserved communities	Collects pedestrian and bicyclist volumes on a project-by-project basis, but not routinely. Key origins and destinations are identified in a Bike, Pedestrian, or Active Transportation Plan but need to be updated	Does not collect pedestrian and bicycle volumes
2. Inventory of Bikeways, Parking, Informal Pathways, and Key Bicycle Opportunity Areas	Maintains and routinely updates an AI-based inventory of missing and existing bikeways in GIS and includes bikeway projects in the CIP	Has a partial, static inventory of missing facilities and opportunity areas through Bike, Pedestrian, or Active Transportation Plans	Does not have an inventory of missing/existing bikeways, parking, informal pathways, or key bicycle areas

Benchmarking Topic	Exceeds National Best Practices	Meets National Best Practices	Does Not Meet National Best Practices
3. Inventory of Sidewalks, Informal Pathways, and Key Pedestrian Opportunity Areas	Maintains and routinely updates an AI-based inventory of missing and existing sidewalks and crosswalks in GIS and includes sidewalk and crosswalk projects in the CIP	Maintains an inventory of missing sidewalks, crosswalks, informal pathways, or pedestrian opportunity areas	Does not have an inventory of missing sidewalks, crosswalks, informal pathways, or pedestrian opportunity areas
4. Inventory of Traffic Control Equipment (Signs, Markings, and Signals)	Maintains and updates an inventory of signs, markings, other countermeasures, and signals (including phasing) in GIS	Has some GIS-based inventories of signs, markings, other countermeasures, and signals	Does not have a GIS-based inventory of signs, markings, countermeasures, and signals
5. Crash History and Crash Reporting Practices	Employs a data-driven systemic safety or Vision Zero approach to regularly analyze crash data. Crash reporting is shared to key stakeholders in real-time and reporting details are consistent through the agency	Reviews data only following fatalities or other high-profile incidents	Does not have set practices for data review
6. Safety Action Plan	Has an LRSP that identifies routine data collection and assessment. Prioritized project list is updated based on crash data assessment	Completes crash data assessment on a project-by-project basis. Does not have an action plan that identifies regularity of assessment	Crash data assessment is ad-hoc and dependent on grant funded projects

4.3.1 Collection of Pedestrian and Bicyclist Volumes

Pedestrian and bicyclist volume data and a GIS database are important for understanding where people walk and bike. This establishes baseline data prior to project implementation and can help in prioritizing projects, developing crash rates, and determining appropriate bicycle and pedestrian infrastructure. The database helps to identify patterns and needs of underserved communities in local jurisdictions policies and programs.

Suggestions for Potential Improvement

- Routinely collect pedestrian and bicycle volumes by requiring them to be counted in conjunction with manual intersection turning movement counts.

- Metropolitan Transportation Commission: Traffic Data Collection in the San Francisco Bay Area (PDF)
- Geocode pedestrian volume data with GIS software along with other data such as pedestrian control devices and crashes to analyze data for trends or hotspots related to pedestrian safety.

4.3.2 Inventory of Bikeways, Parking, Informal Pathways, and Key Bicycle Opportunity Areas

A GIS-based inventory of bikeways, parking, informal pathways, and key bicycle opportunity areas enables project identification and prioritization, as well as project coordination with new development, roadway resurfacing, etc. This data set can be made available on a city's website for knowledge sharing with the public as well as agencies.

Suggestions for Potential Improvement

- Migrate the inventory of bikeways, bike parking, and future bike improvements into a GIS format for quick mapping and sharing.
- Identify a staff person responsible for maintaining the GIS data set.

4.3.3 Inventory of Sidewalks, Informal Pathways, and Key Pedestrian Opportunity Areas

A GIS-based sidewalk inventory enables project identification and prioritization, as well as project coordination with new development, roadway resurfacing, etc. This data set can be made available on a city's website for knowledge sharing with the public as well as agencies.

Suggestions for Potential Improvement

- Create a citywide inventory of existing and missing sidewalks, informal pathways and key pedestrian opportunity areas in GIS.
- Consider establishing a program to help property owners repair damaged sidewalks outside their property. This can be a condition for the sale of the property.

4.3.4 Inventory of Traffic Control Equipment (Signs, Markings, and Signals)

Cities have a wide variety of traffic control devices that regulate how bicyclists and pedestrians should use the street and interact safely with drivers. However, some cities do not have inventories of how, when, and where these are installed. Creating a database of this information allows city staff to know where infrastructure may be out of date or in need of updates. For example, countdown signals are an important pedestrian safety countermeasure. The 2012 California Manual of Uniform Traffic Control Devices (MUTCD) requires the installation of countdown pedestrian signals for all new signals. The CA MUTCD also requires the installation of bike detection at all actuated signals. Bike detection is a basic building block of the bike network that makes sure that bikes can trigger traffic signals. Inventorying bike detection and

countdown signals allows city staff to approach safety from a systems perspective and develop projects to close gaps in biking and walking infrastructure over time.

Suggestions for Potential Improvement

- Develop a city or countywide crosswalk inventory in GIS and maintain it over time. This would allow for a systemic safety approach to enhancing crosswalks and allow the city to prioritize all crosswalk enhancement projects citywide for implementation over time and as money is available.
- Ensure that locations with pedestrian desire lines have safe crosswalks. An updated crosswalk policy can help determine the appropriate crossing treatment at uncontrolled locations without marked crosswalks.
- Include maintenance records within the GIS inventory of signs, markings and signals.
- Develop a proactive monitoring program to ensure the quality and proper functioning of traffic control devices.

4.3.5 Crash History and Crash Reporting Practices

Safety is typically approached through both proactive and reactive measures. Identifying and responding to crash patterns on a regular basis and in real-time is an important reactive approach to bicycle and pedestrian safety, which may be combined with other proactive measures. This is the traditional way most cities have approached safety. However, many are now looking to proactive safety to address safety issues on a systemwide basis. This is often paired with a policy goal of getting to zero fatality or serious injury crashes (commonly referred to as “Vision Zero”).

Suggestions for Potential Improvement

- Adopt a data driven systemic safety approach, which would include a systems approach to identifying, prioritizing, and ultimately implementing safety countermeasure and/or a formal commitment to Vision Zero.
- Work with elected officials and department heads to adopt a Vision Zero policy formally stating the city’s commitment to reducing the number of traffic-related fatalities and severe injuries to zero.
- Additionally, with sufficient pedestrian volume data, the city could prioritize crash locations based on crash rates (i.e., crashes/daily pedestrian volume), a practice that results in a complete safety needs assessment. Treatments could then be identified for each location and programmatic funding allocated in the city’s Capital Improvements Program (CIP).

4.3.6 Safety Action Plan

A Local Road Safety Plan (LRSP) or Caltrans-approved safety report identifies and prioritizes improvements on local roads. A LRSP helps position communities to apply for dedicated, annual funding streams for bicycle and pedestrian projects. Bicycle and pedestrian projects can also be integrated into the other work that the city does, including repaving and other routine roadway network maintenance.

Dedicated annual funding streams may include general city funds, local and regional impact fees, county tax measure funds, and local tax measure funds. Some grant opportunities include

the Highway Safety Improvement Program (HSIP), Congestion Mitigation and Air Quality Improvement Program (CMAQ), Active Transportation Program (ATP), Safe Routes to School Grant (SRTS), TDA Article 3 (SB 821), and Safe Streets for All (SS4A).

Suggestions for Potential Improvement

- Partner with other agencies and continue applying for grant funding for both infrastructure and non-infrastructure projects.
- Integrate bicycle and pedestrian projects into the site plan review process for new development.
- Secure additional funding for repaving projects to allow for "quick build" projects and other bicycle and pedestrian safety improvements to be integrated into those projects.
- Establish a dedicated funding source for pedestrian and bicycle projects.

4.4 Pedestrian and Bicycle Network Planning and Design

Safe, comfortable, and connected pedestrian and bicycle networks allow people of all ages and abilities to navigate roads to get where they want to go. Key areas to consider in this category are safe road users and safe roads.

Table 4.4 Benchmarking Analysis for Pedestrian and Bicycle Network Planning and Design

Benchmarking Topic	Exceeds National Best Practices	Meets National Best Practices	Does Not Meet National Best Practices
1. Complete Streets Policy	Has a Complete Streets policy that includes all users and modes, affects new construction and maintenance, considers local context, and provides guidance for implementation	Has a Complete Streets policy that is narrow in scope or applies only to public works projects	Does not have a Complete Streets policy
2. Active Transportation Plan	Has a recently updated Active Transportation Plan (or similar) with a strategic prioritized list of projects that reflects current best practices (e.g., Level of Traffic Stress analysis, inclusion of Class IV protected bicycle facilities)	Has a Pedestrian or Bicycle Master Plan, but it may be outdated, and/or no recent projects from the Plan have been completed	Does not have a Pedestrian or Bicycle Master Plan

Benchmarking Topic	Exceeds National Best Practices	Meets National Best Practices	Does Not Meet National Best Practices
3. Existing bike network	Existing bike network includes best practice low stress facilities such as protected bikeways, bike boulevards, and protected intersections citywide or countywide	Bike network primarily includes Class I, II, and III facilities. There are gaps within the bike network and facilities do not accommodate all users	Bike network is not regularly maintained or routes are unclear to users
4. Existing pedestrian facilities	Existing pedestrian facilities includes low-stress facilities and frequent use of landscape strips, medians, frequent crosswalks, and roadways are primarily two-to-four lane roads	Narrow sidewalks or sidewalk gaps, crosswalks with few or no safety enhancements, crosswalks are minimal, and roadways are primarily arterials	Missing key marked crosswalks and sidewalks, with few ADA improvements and no safety enhancements, and no pedestrian countdown signals
5. Bike Network Implementation Practices	Age 8 to 80 bicyclist considerations are included in the agency's policies and level of traffic stress is considered. A Bike or Other Safety Plan identifies low-stress networks and funding mechanisms to implement a low-stress network city/countywide	Spot locations have been identified through safety plan(s) for a low-stress network. Plan also identifies additional proven countermeasures to be implemented as part of the project	Treatments are implemented where they fit within the right-of-way, and vehicle LOS is not affected
6. Pedestrian Network Implementation Practices	Pedestrian priority areas (PPA) are identified in a safety plan and the agency has policies prioritizing PPAs, crosswalk spacing, and design enhancements.	Spot PPA locations have been identified through safety plan(s). The plan also identifies additional proven countermeasures to be implemented as part of the project	Treatments are implemented on a project-by-project basis
7. Design guidelines and standards	Uses national best practices focused on bicycle and pedestrian safety for roadway and facility design guidelines and standards	Local standards reference national best practices, but are static or out of date, with minimal customized design policies for pedestrian and bicycle accommodations	Does not have comprehensive design guidelines or standards for pedestrian or bicyclist treatments

Benchmarking Topic	Exceeds National Best Practices	Meets National Best Practices	Does Not Meet National Best Practices
8. Attention to Bicycle Crossing Barriers	Separated bikeways and other innovative treatments, including geometric enhancements, are provided at intersections and interchanges	Higher-stress bike treatments are installed at some intersections and interchanges	Bike treatments are not installed at intersections or through interchanges
9. Attention to Pedestrian Crossing Barriers	Has a recently updated policy and comprehensive inventory of barriers. Has design guidelines and funding in place for addressing barriers	Has no policy, but has identified some barriers and taken steps to improve pedestrian access	Does not have a policy or practices for addressing barriers to walking
10. Intersection Control Evaluations	Uses intersection control evaluations to assess alternative traffic control (e.g., roundabout, signal, stop signs) performance (safety, ped/bike, etc.) and select appropriate control based on desired performance.	Uses relaxed warrants for traffic signals and/or all-way stops. If asked to by community or stakeholder may consider a roundabout or neighborhood traffic circle.	Uses MUTCD Warrants and/or does not have a practice of using Intersection Control Evaluations

4.4.1 Complete Streets Policy

Complete Streets Policies are formal statements showing a city's commitment to planning and designing for all modes of travel and travelers of all ages and abilities.

Suggestions for Potential Improvement

Consider adopting a Complete Streets Policy. The following jurisdictions have established practices for complete streets, including implementation of these policies through multimodal level of service thresholds, and may serve as models:

- Boston, Massachusetts: Boston's Complete Streets
- Philadelphia, Pennsylvania: Philly Free Streets (Facebook)

4.4.2 Active Transportation Plan

This type of plan includes a large menu of policy, program, and practice suggestions, as well as site-specific (and prototypical) engineering treatment suggestions. Bicycle and Pedestrian Master Plans document a jurisdiction's vision for improving walkability, bikeability, and bicycle

and pedestrian safety; establish policies, programs, and practices; and outline the prioritization and budgeting process for project implementation.

Suggestions for Potential Improvement

- Implement the low-hanging projects in the Bicycle and Pedestrian Master Plan and seek grant funding for major projects.
- Pursue additional funding opportunities for programs identified by the Plan.
- Provide regular updates to the Plan, including bicycle and pedestrian facilities and design guidelines that address the needs of bicyclists and pedestrians of all ages and abilities.
- Develop high injury networks for walking and biking to identify routes with the highest incidences of fatal and severe injuries for pedestrians and bicyclists. This will create a systematic safety analysis that can help in prioritizing limited resources.
- Consider identifying existing and missing bicycle and pedestrian infrastructure for safety improvement.

4.4.3 Existing bike network

Innovative features such as protected bikeways, bike boulevards, and protected intersections city- or county-wide can decrease the level of traffic stress experienced by bicyclists, make biking more comfortable, and appeal to a wide range of bicyclists. Level of traffic stress refers to the level of comfort or discomfort a bicyclist might experience. Research conducted by the Mineta Institute in San Jose establishes levels of traffic stress on a scale of 1 to 4 with LTS 1 at the level that most children can tolerate and LTS 4 at the level characterized by “strong and fearless” cyclists (see: http://transweb.sjsu.edu/project/1005.html). A bicycle network that is attractive to the majority of the population would have low stress and high connectivity.

Suggestions for Potential Improvement

- Continue to identify funding sources and implement the proposed projects identified in the Bicycle and Pedestrian Master Plan.
- Develop design standards for bike boulevards, trails, paths, and landscaping for bicycle networks.
- Create a GIS data for the existing bike network to identify gaps and opportunities for improvements.

4.4.4 Existing Pedestrian Facilities

Installation of pedestrian facilities that include low-stress facilities and frequent use of landscape strips, medians, and frequent crosswalks are best practices. A complete low-stress network of connected sidewalks and crosswalks with enhancements can remove some uncertainty, reduce crash risk, and provide a more comfortable experience for people walking to encourage more people to walk as a means of transportation.

Suggestions for Potential Improvement

- Continue to identify funding sources and implement the proposed projects identified in the Bicycle and Pedestrian Master Plan.
- Create a GIS database for existing pedestrian infrastructure to identify gaps, inventory assets, and create opportunities for systemic safety analysis of all crosswalks.

4.4.5 Bike Network Implementation Practices

Considering the safety and comfort of people biking leads to better projects that can encourage new biking trips and enhance safety for active transportation users today and in the future. Bicycle Level of Traffic Stress (LTS) was originally developed by researchers at the Mineta Transportation Institute. LTS assesses the comfort and connectivity of bicycle networks. A complete low-stress network of connected bikeways reduces crash risk and provides a more comfortable experience for people biking.

Suggestions for Potential Improvement

- Prioritize bicycle projects to align with roadway resurfacing and projects that are near school sites.
- Secure enough funding for repaving and other complete streets projects to allow for installation of protected bike and pedestrian facilities and intersection improvements.
- Prioritize Use Level of Traffic Stress (LTS) to strategically implement bikeways and traffic calming treatments that would improve LTS of existing bikeways.

4.4.6 Pedestrian Network Implementation Practices

Considering the safety and comfort of people walking leads to better projects that can encourage new walking trips and enhance safety for active transportation users today and in the future.

Suggestions for Potential Improvement

- Prioritize pedestrian projects to align with roadway resurfacing and projects that are near school sites.
- Identify pedestrian priority areas and have a policy in place for crosswalk spacing and design enhancements
- Secure enough funding for repaving and other complete streets projects to allow for installation of protected bike and pedestrian facilities and intersection improvements.

4.4.7 Design Guidelines and Standards

Design guidelines and development standards create a clear set of documents that guide how all transportation improvements should be installed citywide. As a result, they can create a consistent, high-quality biking and walking experience.

Suggestions for Potential Improvement

Consider adopting national bicycle and pedestrian safety best practices for roadway and facility design guidelines and standards:

- NACTO Urban Street Design Guide (PDF)
- CROW Design Manual for Bicycle Traffic
- FHWA Separated Bike Lane Planning and Design Guide (PDF)
- MassDOT Separated Bike Lane Planning & Design Guide
- ITE Recommended Practice for Accommodating Pedestrians and Bicyclists at Interchanges
- AASHTO Guide for the Development of Bicycle Facilities (PDF)
- AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities (PDF)

4.4.8 Attention to Bicycle Crossing Barriers

Crossing barriers — such as railroads, freeways, and major arterials — may discourage or even prohibit bicycle access and are often associated with vehicle-bicycle crashes. Large intersections and interchanges and uncontrolled crossings can often deter bicyclists due to high speeds, high number of conflict points with vehicles, and high level of exposure. Identifying and removing barriers and preventing new barriers is essential for improving bicyclist safety and access.

Suggestions for Potential Improvement

- Use green routinely to highlight conflict zones at large intersections and interchanges.
- To slow speeds at critical intersections, use smaller corner radii utilizing small design vehicles appropriate for urban areas and updated standard plans to reflect this.
- Review design of slip/trap-right lanes at intersections and implement improvements.
- Implement best practice guidance on bicycle accommodation through interchanges and expressways, as appropriate, using the ITE's Recommended Practice: Guidelines to Accommodate Bicyclist and Pedestrians at Interchanges plus consideration of protected bike lane design.
- Consider pedestrian barriers and needs when conducting bicycle barriers assessment.

4.4.9 Attention to Pedestrian Crossing Barriers

Similar to bicyclists crossing deterrence, crossing barriers may also discourage or even prohibit pedestrian access and can create safety challenges for pedestrians. These can be similar to the biking barriers or present additional challenges.

Suggestions for Potential Improvement

- To slow speeds at critical intersections, use smaller corner radii utilizing small design vehicles appropriate for urban areas and updated standard plans to reflect this.
- Review design of slip/trap-right lanes at intersections and implement improvements.
- Identify and create an inventory of pedestrian barriers with targeted recommendations for phased improvements.
- Consider pedestrian barriers and needs in conducting bicycle barriers assessment.

4.4.10 Intersection Control Evaluations

Providing alternative traffic controls such as roundabouts, signals, and stop signs may improve pedestrian and bicycle safety by reducing speeds and controlling vehicle conflicts. Installing bicycling signals and limiting stop signs on bicycle routes may enhance bicycle mobility and safety. The CA MUTCD defines warrants for installing signals and stop signs.

Suggestion for Potential Improvement

Develop specific signal and stop sign warrants that are pedestrian- and bicycle-friendly.

4.5 Pedestrian and Bicycle Support Program

Pedestrian and bicycle support programs are critical for improving safety for people walking and biking. Key areas to consider in this category are safe road users, safe speeds, and post-crash care.

Table 4.5 Benchmarking Analysis for Safety Data Collection and Assessment

Benchmarking Topic	Exceeds National Best Practices	Meets National Best Practices	Does Not Meet National Best Practices
1. Pedestrian and Bicycle Safety Education Program	Pedestrian and bicycle education programs are data-driven and focused on local safety context; education programs are customized for different groups. The program includes education for drivers/motorists.	Has some traffic safety education programs that address pedestrians and bicyclists	Does not have pedestrian and bicycle safety education programs
2. Enforcement	Police Department applies for annual OTS funding, and conducts sustained and data-driven enforcement efforts focused on education, behavior, and locations related to most severe bicycle and pedestrian crashes; enforcement is effective is KSI crashes decrease and there is lower racial disproportionality in traffic citations	Police Department conducts some data-driven enforcement activities related to bicyclist and pedestrian safety	Enforcement is not data-driven or Police Department does not have Traffic Safety Officer(s)

Benchmarking Topic	Exceeds National Best Practices	Meets National Best Practices	Does Not Meet National Best Practices
3. Pedestrian Walking Audit Program	Has significant and ongoing programs that include regular walking audits	Has no safety program, but has conducted walking audits sporadically	Does not have a pedestrian safety program and has not conducted a walking audit
4. Bicycling Safety Audit Program	Has significant and ongoing programs which include bicycling audits	Has some programs and may have conducted a bicycling audit	Does not have bicycling safety audit programs
5. Vehicle Miles Traveled (VMT) Mitigation Strategies	Has a VMT Mitigation Strategy that uses the most recent guidance from CAPCOA to measure potential impacts of pedestrian and bicycle facilities	Mitigation measures identified in CAPCOA are used independently on a project-by-project basis	Does not use CAPCOA mitigation strategies
6. Coordination with Emergency Response	Emergency response is involved in all aspects of bicycle/pedestrian facility planning and design (including pilot testing), and they balance response times with bicyclist/pedestrian safety. Agency also works with emergency response to implement policies providing information on traffic incident management	Emergency response is involved in some aspects of bicycle/pedestrian facility planning and design	Emergency response is not involved in bicycle/pedestrian facility planning and design

Benchmarking Topic	Exceeds National Best Practices	Meets National Best Practices	Does Not Meet National Best Practices
7. Coordination with Health Agencies	Coordinates regularly with health agencies in the planning of bicycle and pedestrian facilities and/or programs and collection of crash data	Health agencies have programs to promote healthy lifestyles through active transportation	Health agencies are not involved in bicycle/pedestrian safety or active transportation
8. Coordination with Transit Agencies	Bicycles are accommodated on all transit vehicles with overflow capacity available. The agency partners with transit providers to ensure safe and comfortable routes for biking and walking to transit stops and stations, including on roadways with both frequent bus service and bicycle facilities	Bicycles are accommodated on buses only, with accommodation limited to rack capacity. Some transit stops and stations safe and comfortable routes for biking and walking access	Bicycles are not accommodated on transit. There are few bicycle and pedestrian accommodations for accessing transit stops and stations

4.5.1 Pedestrian and Bicycle Safety Education Program

Engineering treatments are often not enough on their own to realize full safety benefits associated with the treatment. Safety education programs complement engineering treatments and increase compliance. Education campaigns target drivers and people of all ages, especially school-age children where safe walking and biking habits may be instilled as lifelong lessons.

Suggestion for Potential Improvement

- Conduct a formal education campaign about street safety targeting drivers, pedestrians, and bicyclists. This includes advertisements on buses and bus shelters, an in-school curriculum, community school courses, public service announcements, and a range of other strategies. Consider a focus on speed and safe driving.

4.5.2 Enforcement

Enforcement of pedestrian and bicycle right-of-way laws and speed limits is an important complement to engineering treatments and education programs.

Suggestions for Potential Improvement

- Implement sustained pedestrian safety enforcement efforts and involve the media. Use enforcement as an opportunity for education by distributing pedestrian safety pamphlets in lieu of, or in addition to, citations.
- Train officers in pedestrian safety enforcement principles.
- Establish a radar gun check-out program for trained community volunteers to record speeding vehicles' license plate numbers and send letters and/or document occurrences.

4.5.3 Pedestrian Walking Audit Program

Walking audits provide an interactive opportunity to solicit feedback from key stakeholders about the study area and to discuss the feasibility of potential solutions. The audits can be led by city staff, advocacy groups, neighborhood groups, or consultants.

Suggestion for Potential Improvement

- Include regular walking audits in citywide pedestrian safety programs, based on the suggestions of this CSSA. This effort may complement other "green" or health-oriented programs within the city.

4.5.4 Bicycling Safety Audit Program

Consensus is more readily reached on a vision and action plan for safety enhancements when city staff and key stakeholders ride along study corridors and experience key route and crossing challenges and best practices.

Suggestions for Potential Improvement

- Include regular bicycling audits in the citywide bicycle safety programs. Encourage interdepartmental participation.
- Routinely conduct bicycle safety audits of key corridors throughout the city, including those with recent improvements, those with heavy bicycle demand, and those with high crash rates.
- Collaborate with schools on projects beyond the school district boundaries.

4.5.5 Vehicle Miles Traveled (VMT) Mitigation Strategies

A VMT mitigation strategy should use the most recent guidance from California Air Pollution Control Officers Association (CAPCOA) to measure potential impacts of pedestrian and bicycle facilities.

Suggestion for Potential Improvement

- CAPCOA Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity (PDF)

4.5.6 Coordination with Emergency Response

Emergency response requires special roadway design considerations that sometimes conflict with bicycle and pedestrian treatments. One example is the design of turning radii at intersections. Bicyclists and pedestrians benefit from the reduced vehicle speeds of smaller radii, but larger vehicles, such as fire trucks, have more difficulty performing the turn within the smaller space. These conflicts require consensus building between the city and the respective departments. Consensus building could include pilot testing of alternative treatments, such as a model traffic circle in an open field.

Suggestions for Potential Improvement

- Include the Fire Department early in the process as a stakeholder.
- Balance the trade-off between traffic calming safety treatments such as roundabouts or partial street closures and longer emergency response times.
- Encourage emergency and transit responders to participate in test runs of roadway designs that are aimed to reduce speed and improve bicycling access.
- Implement policies providing information on tragic incident management.

4.5.7 Coordination with Health Agencies

Involving non-traditional partners such as public health agencies, physicians and others in the planning or design of pedestrian and bicycle facilities may create opportunities to be more proactive about pedestrian and bicycle safety, identify pedestrian and bicycle safety challenges and education venues, and secure funding. Additionally, underreporting of pedestrian-vehicle and bicycle-vehicle crashes could be a problem that may be partially mitigated by involving the medical community in pedestrian and bicycle safety planning.[18]

Suggestion for Potential Improvement

Consider coordinating with the health agencies in your community.

[18] Sciortino, S., Vassar, M., Radetsky, M. and M. Knudson, “San Francisco Pedestrian Injury Surveillance: Mapping, Underreporting, and Injury Severity in Police and Hospital Records,” *Accident Analysis and Prevention*, Volume 37, Issue 6, November 2005, Pages 1102-1113

4.5.8 Coordination with Transit Agencies

Providing safe and comfortable biking and walking routes to transit stops and stations, and the ability to take bicycles on-board transit vehicles increases the likelihood of multi-modal trips.

The City of Gridley currently works with BCAG and has a local on-call transit bus (Gridley Golden Feather Flyer) to facilitate safe access to transit. They have also worked with Caltrans to improve access and safety on SR 99.

Suggestion for Potential Improvement

Continue working with transit agencies, Caltrans, and other relevant partners to improve access and safety to stations and bus stops.

4.6 Additional Areas to Consider for Safety Improvements

The following topics were not included in the 2024 benchmarking survey. However, they remain important strategies to consider in improving safety for people walking and biking

4.6.1 Surrogate Safety Measures for Proactive Monitoring

Innovative data collection techniques such as hard braking, speed, and near miss data can provide additional insights into crashes. Community feedback tools such as Street Story can assist local jurisdictions to collect data. See: Street Story: A Platform for Community Engagement

4.6.2 Roadway Surfaces for Bicycle Facilities

The quality of a roadway surface along bikeways is an important consideration when choosing to bike. Rough surface in a bike lane creates an uncomfortable bicycling experience and may also pose safety hazards.

Suggestion for Potential Improvement

- Prioritize maintenance of roadways where bicycle facilities are present, particularly for closing gaps in the bikeway network or where improved pavement quality is needed on popular bicycle routes.
- Prioritize debris removal on roadways where bicycle facilities are present.
- Assess the need for new and enhanced crosswalks and curb ramps with each repaving project. Include consideration of lane reductions and quick build projects such as paint and plastic median refuges and bulb outs, high-visibility crosswalks, and advanced yield markings.

4.6.3 Sidewalk Furniture or Other Sidewalk Zone Policies

Street furniture encourages walking by accommodating pedestrians via benches to rest on along the route or wait for transit; trash receptacles to maintain a clean environment; street trees for shade, etc. Uniform street furniture requirements also enhance the design of the pedestrian realm and may improve economic vitality.

Suggestion for Potential Improvement

- Adopt a Street Furniture Ordinance to include locations and furniture amenities other than those associated with transit stops, as appropriate. Ensure that the ordinance is consistent with the ADA Transition Plan.

4.6.4 Street Tree Requirements

Street trees enhance the pedestrian environment by providing shade and a buffer from vehicles, which increase pedestrian safety. Street trees may also enhance property values, especially in residential neighborhoods. However, street trees, when improperly selected, planted, or maintained, may cause damage to adjacent public utilities.

Suggestion for Potential Improvement

- Develop a Street Tree Ordinance to provide guidance on permissible tree types and permitting requirements, also specifying a requirement for new tree plantings associated with development projects.

4.6.5 Bicycling Supportive Amenities and Wayfinding

In addition to designating roadway or paths in a bicycle network, supportive amenities (including parking, water fountains, and maintenance stations) can encourage bicycling. Wayfinding can both encourage bicycling and enhance safety by guiding cyclists to facilities that have been enhanced for bicyclist use or to local retail opportunities for economic growth.

Suggestions for Potential Improvement

- Create and deploy a bicycle wayfinding strategy city/countywide as recommended in the Bicycle and Pedestrian Master Plan.
- Develop a Biking Guide that includes a bike map and bicycle locker and rack locations.

4.6.6 Bicycle Parking Requirements

Safe and convenient bicycle parking is essential for encouraging bicycle travel (especially in lieu of vehicle travel). Bicycle parking can also facilitate last-mile connections between two modes, such as bicycle parking at a transit station. To be effective, bicycle parking needs to be visible and secure and have enough capacity to accommodate bicycle demand, both long-term and short-term. Long-term and short-term parking can be implemented through a bicycle parking ordinance.

Suggestions for Potential Improvement

- Implement short-term and long-term, secure bicycle parking at all new development, consistent with the APBP Bicycle Parking Guidelines, 2nd edition.
- Locate bicycle racks to be convenient for bicyclists, out of the way of pedestrians, and with good visibility for security, consistent with the APBP Bicycle Parking Guidelines, 2nd edition.
- Consider implementation of “branded” racks for the city (with a unique design or city’s symbol).

4.6.7 General Plan: Provision for Pedestrian and Bicycle Nodes

Planning principles contained in a city's General Plan can provide an important policy context for developing pedestrian-oriented, walkable areas. Transit-oriented development, higher densities, and mixed uses are important planning tools for pedestrian-oriented areas. The General Plan identifies pedestrian priority areas, which are zones in which high volumes of pedestrian traffic are encouraged and accommodated along the sidewalk.

Suggestions for Potential Enhancement

- Create an overlay district for pedestrian priority areas with special pedestrian-oriented guidelines, such as relaxing auto Level of Service standards and prioritizing pedestrian improvements. Prioritize sidewalk improvement and completion projects in these nodes.
- Utilize vehicle miles traveled (VMT) for future transportation impact analysis.

4.6.8 General Plan: Safety Element

SB 99 and AB 747 involve safety evacuation during natural disasters. Local jurisdictions should identify creative solutions on how to evacuate residents safely and efficiently while maintaining and implementing low-stress pedestrian and bicycle facilities.

On safety evacuation routes, agencies should identify creative solutions for evacuating residents safely and efficiently while maintaining and implementing low-stress pedestrian and bicycle facilities.

4.6.9 General Plan: Densities and Mixed-Use Zones

Planning principles contained in a city's General Plan can provide an important policy context for developing bicycle-oriented and walkable areas. Transit-oriented development, higher densities, and mixed uses are important planning tools for pedestrian-oriented areas.

Suggestion for Potential Improvement

- Utilize vehicle miles traveled (VMT) for future transportation impact analysis.
- Consider allowing moderate to high densities in the downtown and mixed-use zones as well as progressive parking policies, such as shared parking and demand-based pricing.
- Consider multi-modal trade-offs in the transportation impact analysis for new development, so that the safety and needs of people walking and biking are weighed heavily and vehicular delay is not the primary performance measure.
- Ensure that wide sidewalks, high quality, protected bike lanes, and intersection safety improvements are included in all new development projects, particularly where densities are higher.
- Strongly weigh walking and biking performance measures as well as safety metrics in determining appropriate intersection improvements and street design.

4.6.10 Specific Plans, Overlay Zones, and Other Area Plans

When specific plans, overlay zones, or any other area plans are being developed, the City or County can specifically request the bicyclist and pedestrian-oriented design, walkability, or placemaking be stressed in these plans.

Suggestion for Potential Improvement

- Emphasize bicyclist and pedestrian-oriented design, walkability, and/or placemaking in all new specific plans, overlay zones, and other area plans.

4.6.11 Historic Sites

Historic walking routes or bike trails, such as the famous Freedom Trail in Boston, encourage active transportation and enhance economic vitality.

Suggestions for Potential Improvement

- Continue to implement the goals, policies and programs that support walking trips included in the Historic Preservation and Community Design Element of the General Plan to showcase natural or local sites of interest, and link key features of the city. Maps of the tour route and historic documentation materials could be made available online or as a mobile app in addition to wayfinding signs, maps, and plaques throughout the city. Consider other areas of the city for walking tours and historic signs.
- Consider upgrading History Walk signs with larger text to improve legibility and wayfinding.

4.6.12 Economic Vitality

Improving bicycle and pedestrian safety and walkability can enhance economic vitality. Similarly, enhancing economic vitality through innovative funding options such as Business Improvement Districts (BIDs), parking management, and facade improvement programs can lead to more active areas and encourage walking and bicycling.

Suggestions for Potential Improvement

- Activate the built environment in business areas through BIDs and façade improvement programs.
- Use wayfinding, walking routes, and events to direct pedestrians to commercial areas throughout the area.
- Install bicycle parking in commercial areas and provide safe, comfortable bike facilities in commercial areas to make it convenient and fun to get to local businesses.

4.6.13 Post-Crash Care

An agency's adopted LRSP or CSAP should include resources for the agency to implement identified countermeasures for medical rehabilitation for people injured on the roadway, on-going advocacy group engagement, and resources for the adjudication process to ensure impaired driving offenders receive proper sentencing and treatment to reduce the risk of recidivism.

Suggestions for Potential Improvement

Consider reviewing your agency's LRSP or CSAP and add resources for implementing identified countermeasures for medical rehabilitation, on-going advocacy group engagement, and resources for the adjudication process to ensure offenders receive proper sentencing and treatment

4.6.14 Proactive Approach to Institutional Coordination

Institutional coordination associated with multiple agencies and advocacy groups is a critical part of the work of any municipality. Non-local control of right-of-way and differing policies regarding pedestrian and bicyclist accommodation can make the work complex.

Suggestions for Potential Improvement

- Work with local school districts to establish a policy on neighborhood-sized and oriented schools as part of a Safe Routes to School policy.
- Work with the school districts to establish suggested walking routes and address potential barriers to pedestrian or bicycle access.

5. Complete Streets Audit Results and Recommendations

5.1 Overview

This Chapter presents the observations and recommendations made during the walking audit conducted in Gridley with Butte County and City of Gridley staff on May 9, 2024. The suggestions are based on best practices and discussions regarding local needs and feasibility with the participant group. A glossary of the candidate treatment options is presented in Appendix A and B.

The walk audit is conducted to understand the needs, issues, and opportunities associated with walking and biking in the study area. During a walking audit, positive practices are observed, and issues and opportunity areas are noted. Observations are based on how people driving behave around pedestrians and bicyclists and how people walking and biking behave, especially at intersections. Anecdotal stories shared by participants related to road users' behavior issues are also noted.

The suggestions in this report are based on general knowledge of best practices in complete street design and safety. This report is conceptual in nature, and conditions may exist in the focus areas that were not observed and may not be compatible with suggestions presented below. City staff may conduct further analysis to refine or discard the suggestions in this report if they are contextually inappropriate or do not improve pedestrian safety or accessibility due to conditions including, but not limited to, high vehicular traffic volume or speeds, physical limitations on space or sight distance, or other unsafe conditions.

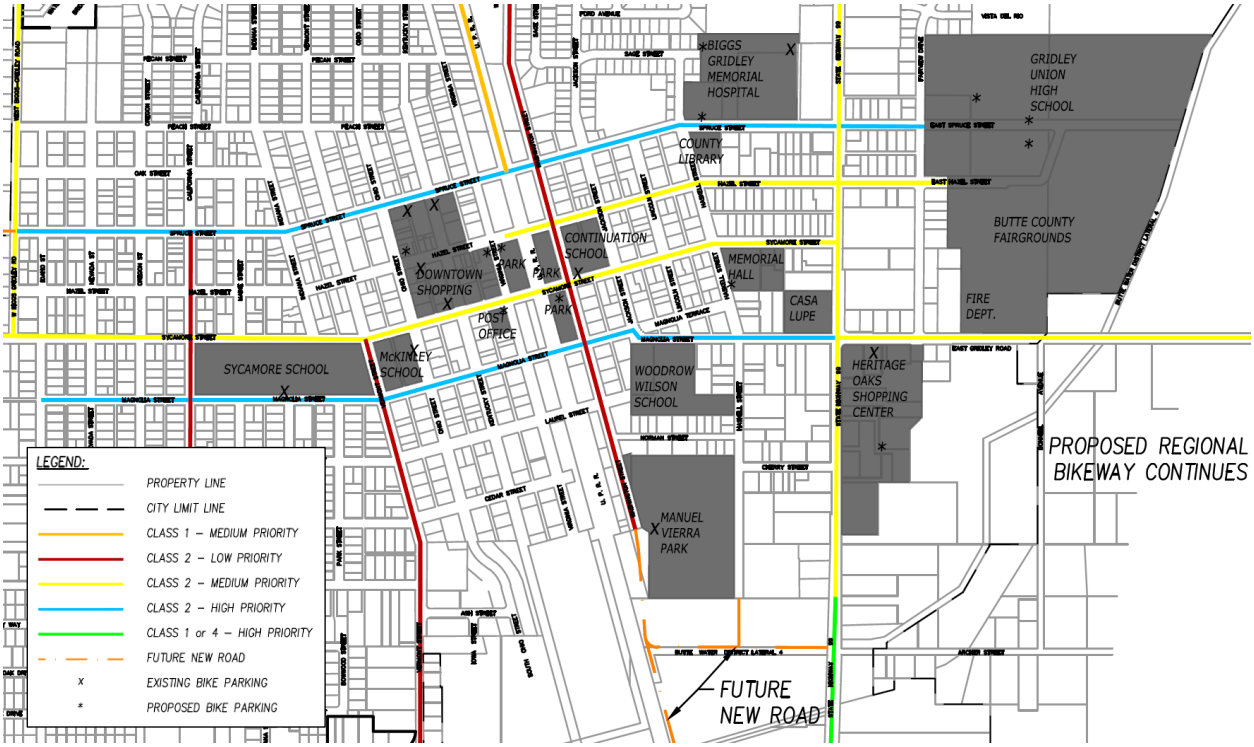
5.2 Relevant Plans

Two relevant local plans are referenced throughout this section to maintain consistency with past work: the *Gridley Bicycle Plan*[19] (last updated in 2021) and the 2023 *Gridley Local Road Safety Plan (LRSP)*.

The *Gridley Bicycle Plan* recommends and prioritizes bike facilities (both Class II bike lanes and Class I bike paths) for the City, as shown in the map below.

Ideally, this *Bicycle Plan* would be upgraded to an Active Transportation Plan (ATP) that includes pedestrian facility recommendations and that meets the Caltrans ATP requirements so that the city is illegible for funding through the state's Active Transportation Program.

[19] City of Gridley Bicycle Plan, 2021 update.



The *Gridley LRSP* creates a framework to systematically identify and address safety issues prevalent in the City of Gridley and makes the following recommendations in the areas close to Sycamore Middle School and McKinley Primary School, Wilson Elementary School, and Gridley High School:

- Add segment lighting on all streets.
- Convert intersections to all way stop control:
    - Sycamore Street & Vermont Street
    - Sycamore Street & Virginia Street (plus install other intersection warning/regulatory signs)
    - Ohio Street & Laurel Street
    - Magnolia Street & Haskell Street
- Improve intersection sight distance:
    - Spruce Street & California Street
    - Spruce Street & Indiana Street
    - Sycamore Street & Haskell Street
- Remove or relocate fixed objects outside of Clear Recovery Zone:
    - Ohio Street from Heron Landing Way to Ash Street
    - Vermont Street from Peach Street to Little Avenue
    - Virginia Street from Hazel Street to 350 ft. south of Cedar Street

- Install/upgrade pedestrian crossing with enhanced safety features:
    - Sycamore Street: Nevada Street to Jackson Street

  - Magnolia Street: Haskell Street to Jackson Street
  - Vermont Street: Peach Street to Little Avenue
  - Ohio Street: Heron Landing Way to Ash Street
- Install sidewalk/pathway:
  - E Gridley Road: Fairview Avenue and Bonnell Avenue
  - Fairview Drive: E Gridley Road and E Spruce Street

The suggestions made in this Complete Streets Safety Assessment are consistent with the recommendations made in the *Gridley Bicycle Plan* and *Gridley LRSP* and could help guide projects towards implementation. Additionally, Butte County is currently working on a *Comprehensive Safety Action Plan* that may make further recommendations in this study area.

5.3 General Citywide Suggestions

The following general improvements should be considered citywide:

- Construct planned and recommended improvements in the *Gridley Bicycle Plan* and *Gridley Local Road Safety Plan*, prioritizing locations near schools.
- Consider lowering speed limits using new allowances set forth by AB 43, which allows city governments to drop speed limits by five miles per hour, and to set limits of 15 to 25 mph in business or residential districts or school zones. See the California Safe Speeds Toolkit for details on how to implement the speed setting flexibilities related to AB 43.
- Paint curbs red for a length of 20 feet on all approaches to crosswalks, per the recently passed Senate Bill (SB) 413, which made it illegal in California to park within 20 feet of the approach of any marked or unmarked crosswalk.
- Install ADA-compliant curb ramps at all school marked crosswalks.
- Ensure all signage complies with the Manual on Uniform Traffic Control Devices (MUTCD), including speed limit signs and pedestrian crossing and warning signs.
- Upgrade all crosswalks adjacent to schools with high-visibility ladder designs. At uncontrolled locations, use the FHWA Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations[20].
- Improve street lighting to enhance visibility for all road users during nighttime hours.
- Install wayfinding signs to inform the traveling public of the locations of parks, schools, and downtown.
- Increase enforcement of traffic laws, particularly during school arrival and dismissal times, to ensure compliance with speed limits and other traffic regulations.
- Engage the local community in discussions about road safety and gather feedback on proposed changes to ensure that they meet the needs of all users.

[20] Federal Highway Administration Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations, July 2018. https://www.fhwa.dot.gov/innovation/everydaycounts/edc_5/docs/STEP-guide-improving-ped-safety.pdf

5.4 Focus Areas

Focus areas were chosen based on expressed interest in evaluation by City of Gridley and Butte County Public Health staff. Audit focus areas and their suggested improvements are shown in Figures 5-1 through 5-3. Three areas around schools in the city of Gridley were selected for analysis:

The three locations selected for analysis were:

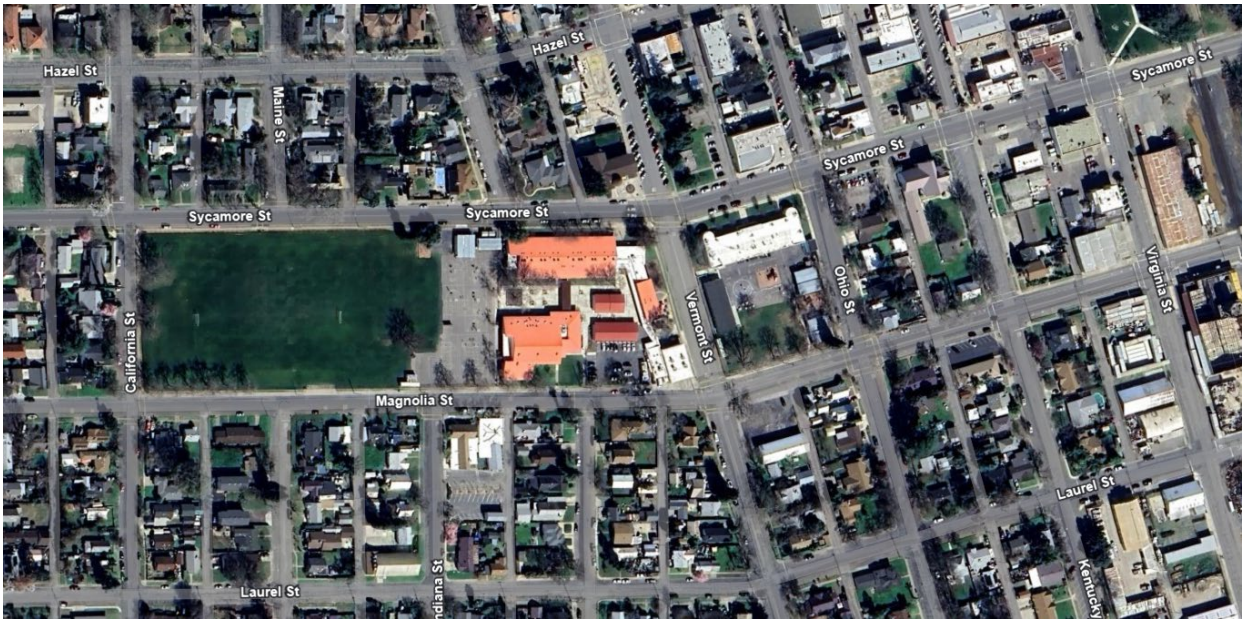
1. Sycamore Middle School and McKinley Primary School: This includes Sycamore Street and Magnolia Street from California Street to Ohio Street and all intersections and corridors in between.
2. Wilson Elementary School: This includes segments of Magnolia Street, Washington Street, Haskell Street, and other local roadways surrounding the elementary school.
3. Gridley High School: This includes segments of Fairview Drive, Spruce Street, and Hazel Street surrounding the high school.

The following sections present the key issues identified during the walking audits and suggested projects responding to the issues at each site.

5.4.1 Sycamore Middle School and McKinley Primary School

Existing Conditions

Sycamore Middle School and McKinley Primary School are just west of downtown Gridley, approximately a half mile west of SR 99. The two schools are bound by Sycamore Street on the northern frontage and Magnolia Street on the southern frontage. While to the east there are more commercial land uses, the north, west, and south side of the school's interface with residential properties.



Notably, the section of Vermont Street between Sycamore Street and Magnolia Street is closed during school hours to facilitate the shared use of facilities such as cafeterias and restrooms between the two schools. The speed limit within the school zone is 20 MPH.

Sidewalks are present along both Sycamore Street and Magnolia Street, and crosswalks are provided at all intersections within the school zone. There are faded bike lane markings on Magnolia Street east of Vermont Street, as shown in the picture below. There are no other dedicated bicycle facilities available in the immediate vicinity.

Faded bike lane on Magnolia Street

Section of Vermont Street closed during school hours

Parking is allowed along both corridors, except near crosswalks. Still, the presence of on-street parking close to crosswalks decreases visibility of pedestrians, especially smaller students.

Before and after school, students from Sycamore Middle School and McKinley Primary School frequently cross both Sycamore Street and Magnolia Street. A crossing guard is present at Sycamore Street & Vermont Street before school to supervise student crossings. During the walk audit, several drivers along Sycamore Street were observed to exceed the posted speed limit, with instances of vehicles traveling approximately over 35 MPH even in proximity to school crossings and during school hours. The visibility at the intersection of Sycamore Street & Vermont Street is limited, and the lack of stop signs on the east and west approaches allows east and westbound vehicles to continue through the intersection while maintaining speed.

Bike parking in front of Sycamore Middle School

Police presence before school at Vermont Street & Sycamore Street

Tire marks at the Sycamore Street & Vermont Street intersection

Sycamore Street

Magnolia Street & Vermont Street

Magnolia Street & Ohio Street

Suggestions for Improvements

Sycamore Street:

- After intersection treatments and/or speed limit lowering, if measured speeds along the corridor are at or below 25 MPH, paint shared lane markings or “sharrows” west of Vermont Street to indicate that cyclists can share the road. East of Vermont Street, stripe bike lanes consistent with the *Gridley Bicycle Plan*.
- Implement additional traffic calming measures such as speed humps and yield markings to reduce vehicle speeds and improve pedestrian safety.
- Upgrade all pedestrian crossings with ladder crosswalks to indicate school crossings, consistent with the *Gridley LRSP*.
- Add “SCHOOL XING” pavement markings.

Sycamore Street & Vermont Street Intersection:

- Convert intersection control to an All-Way Stop to slow down vehicles traveling east and west, consistent with the *Gridley LRSP*.
- Replace standard crosswalks with yellow ladder crosswalks to improve visibility and emphasize pedestrian connection to the schools.
- Add green paint to highlight vehicle-bike conflict zones in the intersection to increase driver awareness and improve cyclist safety.

Magnolia Street:

- After intersection treatments, if measured speeds along the corridor are at or below 25 MPH, paint shared lane markings or “sharrows” west of Vermont Street to indicate that cyclists can share the road. East of Vermont Street, restripe faded bike lanes.
- Implement additional traffic calming measures such as speed humps and yield markings to reduce vehicle speeds and improve pedestrian safety.
- Upgrade all pedestrian crossings with ladder crosswalks to indicate school crossings, consistent with the *Gridley LRSP*. Additionally, add “SCHOOL XING” pavement markings.

Magnolia Street & Vermont Street Intersection:

- Upgrade stop signs on all approaches with “all-way stop” signage.
- Replace standard crosswalks with high-visibility yellow ladder crosswalks to improve visibility and emphasize pedestrian connection to the schools.

Vermont Street:

- Given the inter-campus usage of the Sycamore Middle School and McKinley Primary School, make the road closure on Vermont Street permanent with pavement, planters, and other pedestrian-friendly elements.
- Add “SCHOOL XING” pavement markings.
- South of Magnolia Street, paint bike lanes on Vermont Street consistent with the *Gridley Bicycle Plan*.

Figure 5.1: Recommendations for Sycamore Middle School & Mckinley Primary School

5.4.2 Wilson Elementary School

Existing Conditions

Wilson Elementary School is located along Magnolia Street less than a ¼ mile west of SR 99 and less than a ¼ mile east of the railroad tracks. The posted speed limit along Magnolia Street within the school zone is 20 MPH. Commercial land uses are present closer to the railroad and SR 99, with parks and residential uses to the north and south.

Sidewalks are present along all surrounding local streets and marked crosswalks at every intersection near the school, which facilitate pedestrian movements. Parking is allowed on Magnolia Street, except near crosswalks. Despite these pedestrian facilities, there is a lack of dedicated bicycle infrastructure.

The student pick-up/drop-off area along Magnolia Street contributes to congestion on the frontage of the school before and after school hours. During peak times, the influx of vehicles can create bottlenecks, leading to increased wait times for both parents and students. This condition, with multiple stopped/parked vehicles and children weaving between vehicles or crossing the road, can contribute to dangerous outcomes.

A crossing guard is typically present after school at the Magnolia Street & Lincoln Street intersection to supervise student crossings. During the walk audit, heavy trucks were observed using this segment of Magnolia Street; the usage of this road as a truck route is consistent with the *Gridley General Plan*[21].

[21] City of Gridley 2030 General Plan Circulation Element, http://gridley.ca.us/public/uploads/pdfs/General_Plan-_Circulation_Element.pdf

Roadway curvature on Magnolia Street

School crossing at Magnolia Street & Haskell Street

Suggestions for Improvements

Magnolia Street:

- Restripe bike lanes on Magnolia Street west of Jackson Street, consistent with the *Gridley Bicycle Plan*. East of Jackson Street, consider prohibiting street parking on the north side of Magnolia Street in order to fit bike lanes.
- Install speed feedback signs to alert drivers of their speed and encourage adherence to the 20 MPH school zone limit.
- Install/upgrade pedestrian crossings with enhanced safety features on Magnolia Street from Jackson Street to Haskell Street consistent with the *Gridley LRSP*.
- Implement additional traffic calming measures such as yield markings to reduce vehicle speeds and improve pedestrian safety. If an appropriate alternative exists, consider prioritizing another route for trucks given the presence of schools along the corridor.
- Paint curbs red for a length of 20 feet on all approaches to crosswalks, per the recently passed Senate Bill (SB) 413, which made it illegal in California to park within 20 feet of the approach of any marked or unmarked crosswalk.
- Add “SCHOOL XING” pavement markings.

Magnolia Street & Washington Street Intersection:

- Enhance existing crosswalks with high-visibility yellow ladder markings and add advanced stop bars to ensure vehicles stop before the crossing area.

Magnolia Street & Jackson Street Intersection:

- Consider converting intersection control to an All-Way Stop to slow down vehicles traveling east and west. Alternatively, consider a small traffic circle to control movements at the large intersection.
- Rebuild intersection with narrower approaches to slow down vehicle traffic. In the near-term, consider adding striping and/or bollards to visually narrow the approach.

Magnolia Street & Lincoln Street Intersection:

- Add curb extensions to the southwest and southeast corners of the intersection on the Wilson Elementary School frontage to enhance visibility of pedestrians and create a shorter crossing distance. In the short-term, consider utilizing paint and bollards to delineate pedestrian space.
- Paint curbs red for a length of 20 feet and prohibit parking on all approaches to crosswalks.

Magnolia Street & Haskell Street Intersection:

- Convert intersection control to an All-Way Stop to slow down vehicles traveling east and west on Magnolia Street, consistent with the *Gridley LRSP*.

Laurel Street & Washington Street Intersection:

- Consider converting the gravel parking lot area on the east leg into a loading zone/drop-off/pick-up area if the existing Magnolia Street loading becomes too congested during peak times.

Figure 5.2: Suggestions for Wilson Elementary School

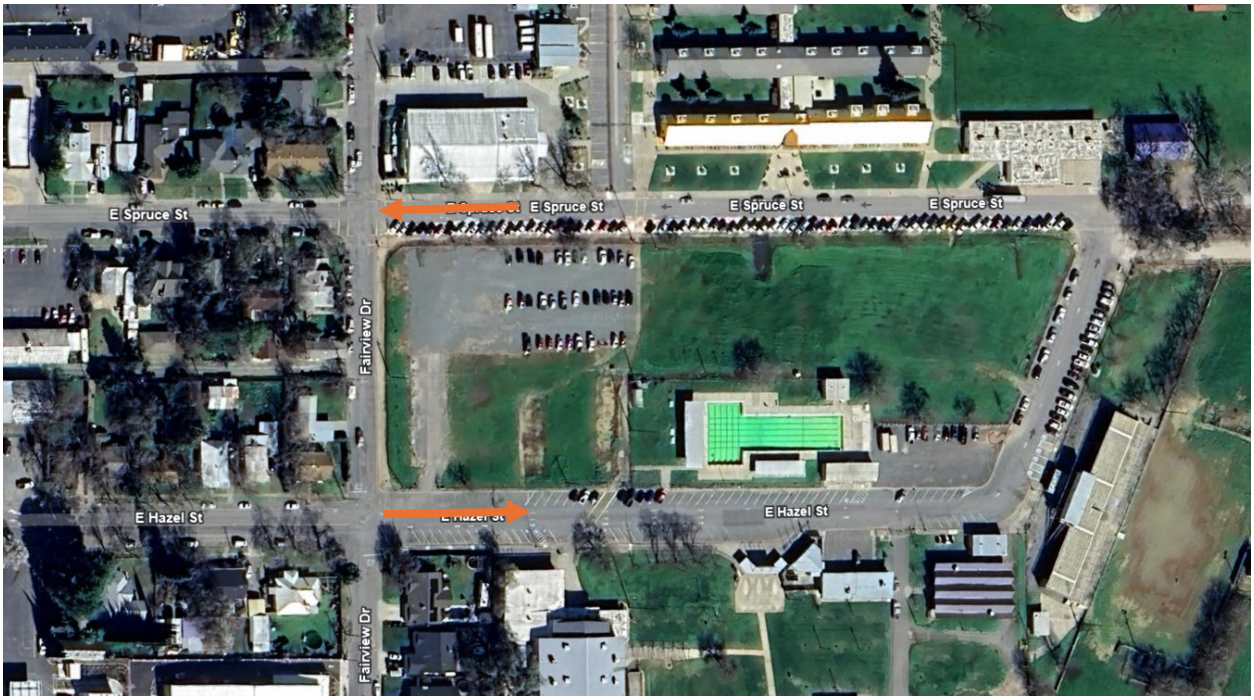
Conceptual – Not for Construction. Additional Detailed Analysis and Engineering Design Required.

5.4.3 Gridley High School

Existing Conditions

Gridley High School is located at the easterly city limits on Spruce Street approximately a ¼ mile east of SR 99. The High School is just north of the Butte County Fairgrounds. Otherwise, land uses near the High School are primarily residential, with highway commercial establishments along SR 99.

Hazel Street and Spruce Street are residential streets that provide access to and from the High School and have a posted speed limit of 25 MPH. Vehicles enter the Gridley High School student parking area via E. Hazel Street at Fairview Drive and exit via E. Spruce Street. This part of Hazel Street and Spruce Street allows travel in only in one direction, as shown in the aerial below.



On Fairview Drive, perceived speeds along the corridor are higher than the posted speed limit, with some vehicles reaching over 40 MPH. There was also a heavier than average percentage of heavy trucks using the corridor, given the commercial and industrial uses nearby.

As Hazel Street intersects Fairview Drive, sight distance issues arise due to obstructions like overgrown vegetation, parked vehicles, and nearby buildings. These impediments block visibility at the intersection, reducing reaction times for both drivers and pedestrians and increasing the likelihood of collisions.

Marked crosswalk and student parking at the main Gridley High School entrance

Fairview Drive at Hazel Street facing north

During lunch hours, high school students are permitted to have off-campus lunch. Many students walk or drive south on Fairview Drive to get lunch. The project team observed long vehicle queues exiting the school parking lot on Spruce Street and on southbound Fairview Drive at Hazel Street. A few student drivers were observed to have erratic driving behavior near walking students.

Gridley High School students walking south on Fairview Drive during the lunch period

Fairview Drive facing south towards E. Gridley Road

In the past decade, there have been three collisions at the Fairview Drive & East Gridley Road intersection. In 2015, a 14-year-old Gridley High School student was hit and killed by a driver going east at this intersection. The City installed some improvements since that crash, including a ladder crosswalk and Rectangular Rapid Flashing Beacon, but markings have since degraded and the crossing distance is still high.

Crossing and Rectangular Rapid Flashing Beacon at Fairview Drive & East Gridley Road

Suggestions for Improvements

Fairview Drive:

- Fill in sidewalk gaps: Construct sidewalks on the east side of the road between E. Spruce Street and E. Hazel Street, and on the west side of the road between Hazel Street and the existing sidewalk.
- Install additional street lighting along to enhance nighttime visibility.

Fairview Drive & Spruce Street Intersection:

- Upgrade the existing crosswalks with high-visibility ladder-style markings and add advanced stop bars to encourage vehicles to stop before the crossing. Upgrade stop signs on all approaches with “all-way stop” signage.
- Stripe new bike lanes on East Spruce Street west of Fairview Drive consistent with the *Gridley Bicycle Plan*.

Fairview Drive & Hazel Street Intersection:

- Convert intersection control to an All-Way Stop to slow down vehicles traveling east on Hazel Street, consistent with the *Gridley LRSP*.
- Stripe new marked crosswalks on all legs of the intersection.
- Add bulb-outs to the east leg of the intersection, narrowing the approach of East Hazel Street to slow vehicles and dissuade wrong-way movements.
- Add markings and signage to provide clear directions to drivers on the flow of traffic and to notify drivers of crossings.
- Improve pedestrian pathways from the parking area to the school entrance with clear signage and markings and adequate lighting.
- Stripe new bike lanes on East Hazel Street west of Fairview Drive consistent with the *Gridley Bicycle Plan*.

East Gridley Road:

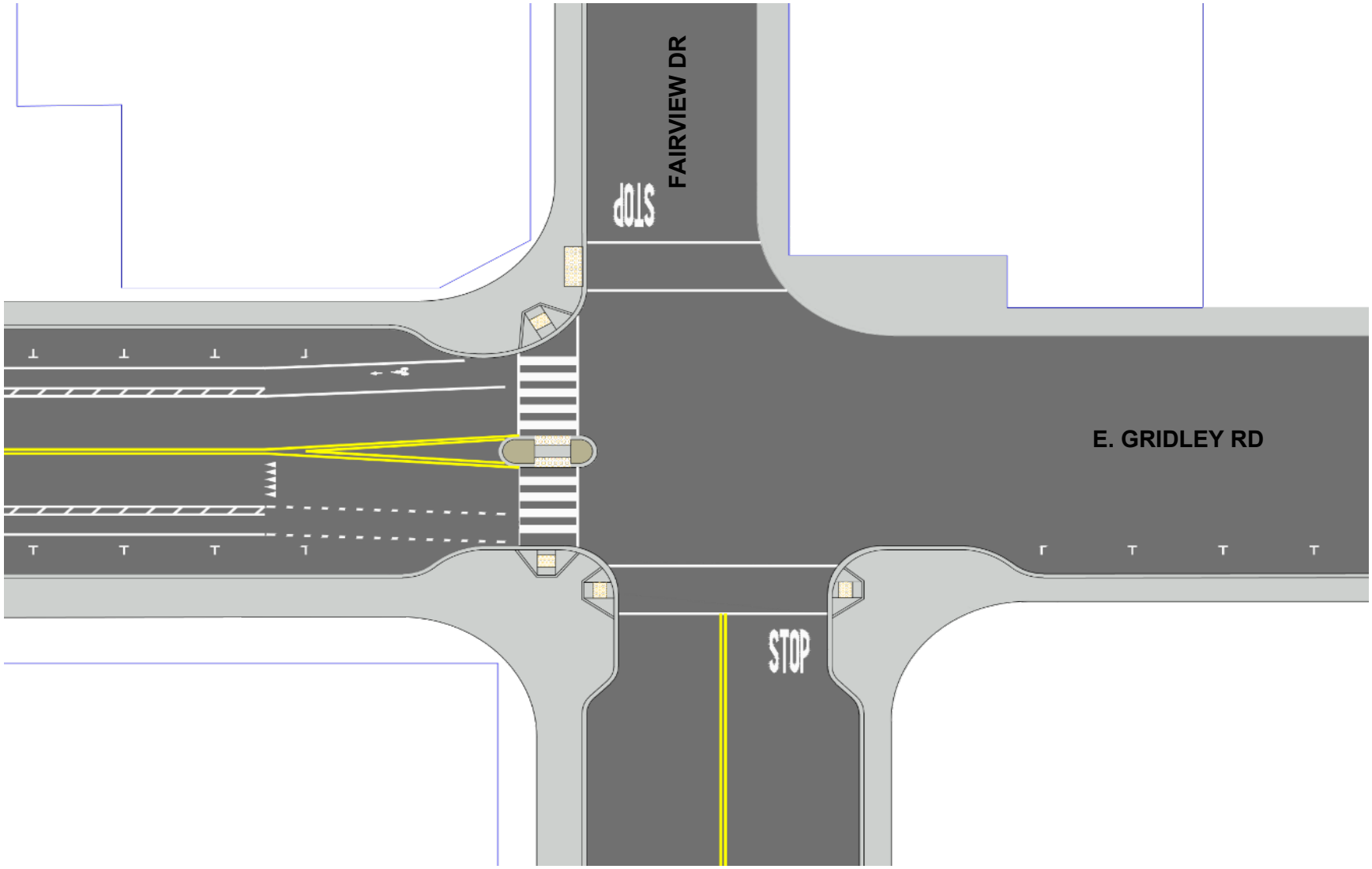
- Stripe buffered bike lanes and parking to delineate space for bicyclists and decrease the width of the vehicular travel lane. Narrower travel lanes can lower vehicle speeds. Bike lanes are recommended on East Gridley Road in the *Gridley Bicycle Plan.*
- Construct sidewalk between Fairview Avenue and Bonnell Avenue, consistent with *Gridley LRSP.*

Fairview Drive & East Gridley Road Intersection:

- Restripe the existing west leg crosswalk with high-visibility zebra markings.
- Install a pedestrian refuge island on the west leg of the intersection to provide a safe stopping point between directions of travel for those crossing.
- Construct bulb-outs (curb extensions) on the northwest, southwest, and southeast corners of the intersection to shorten crossing distances for pedestrians.
- Improve the brightness of the flashing lights in the existing Rectangular Rapid Flashing Beacon (RRFB) to better alert drivers when pedestrians are crossing. If bulb-outs are constructed, move the location of RRFB nearer to the crossing.

Figure 5.3: Suggestions for Gridley High School

Figure 5.4: Suggestions for E. Gridley Road & Fairview Drive



Conceptual – Not for Construction. Additional Detailed Analysis and Engineering Design Required.

Berkeley SafeTREC

About the Program

The Complete Streets Safety Assessment (CSSA) conducts comprehensive transportation safety assessments that focus on pedestrian and bicycle safety. The aim of the CSSA is to help communities identify and implement traffic safety solutions that lead to improved safety and accessibility for all users, especially people walking and biking, on California's roadways.

The Safe Transportation Research and Education Center (SafeTREC) is a University of California, Berkeley research center affiliated with the Institute of Transportation Studies and the School of Public Health. Our mission is to inform decision-making and empower communities to improve roadway safety for all. We envision a world with zero roadway fatalities or serious injuries and a culture that prioritizes safe mobility.

For more information, visit: https://safetrec.berkeley.edu or email us at safetrec@berkeley.edu.

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Appendix A: Glossary of Pedestrian Improvement Measures

PEDESTRIAN IMPROVEMENT MEASURES

Measure	Description	Benefits	Application
Traffic Control Countermeasures			
Traffic Signal or All-Way Stop	Conventional traffic control devices with warrants for use based on the Manual on Uniform Control Devices (MUTCD).	Reduces pedestrian-vehicle conflicts and slows traffic speeds.	Must meet warrants based on traffic and pedestrian volumes; however, exceptions are possible based on demonstrated pedestrian safety concerns (Crash history).
Pedestrian Hybrid Beacon	PHBs (Pedestrian Hybrid Beacons) are pedestrian-actuated signals that are a combination of a beacon flasher and a traffic control signal. When actuated, PHBs display a yellow (warning) indication followed by a solid red light. During pedestrian clearance, the driver sees a flashing red "wig-wag" pattern until the clearance interval has ended and the signal goes dark.	Reduces pedestrian-vehicle conflicts and slows traffic speeds.	Useful in areas where it is difficult for pedestrians to find gaps in automobile traffic to cross safely, but where normal signal warrants are not satisfied. Appropriate for multi-lane roadways.
Overhead Flashing Beacons	Flashing amber lights are installed on overhead signs, in advance of the crosswalk or at the entrance to the crosswalk.	The blinking lights during pedestrian crossing times increase the number of drivers yielding for pedestrians and reduce pedestrian-vehicle conflicts. This measure can also improve conditions on multi-lane roadways.	Best used in places where motorists cannot see a traditional sign due to topography or other barriers.

PEDESTRIAN IMPROVEMENT MEASURES

Measure	Description	Benefits	Application
Rectangular Rapid Flashing Beacon	A Rectangular Rapid Flashing Beacon (RRFB) is a pedestrian-actuated enhancement that improves safety at uncontrolled, marked crossings.	FHWA states that research indicates RRFBs can result in motorist yielding rates as high as 98 percent at marked crosswalks. Solar panels reduce energy costs associated with maintenance of the device.	Appropriate for multi-lane roadways.
In-Roadway Warning Lights	Both sides of a crosswalk are lined with pavement markers, often containing an amber LED strobe light. The lights may be push-button activated or activated with pedestrian detection.	This measure provides a dynamic visual cue and is increasingly effective in bad weather.	Best in locations with low bicycle ridership, as the raised markers present a hazard to bicyclists. May not be appropriate in areas with heavy winter weather due to high maintenance costs. May not be appropriate for locations with bright sunlight. The lights may cause confusion when pedestrians fail to activate them and/or when they falsely activate.
High-Visibility Signs and Markings	High-visibility markings include a family of crosswalk striping styles including the “ladder” and the “triple four.” One style, the zebra-style crosswalk pavement markings, were once popular in Europe, but have been phased out because the signal-controlled puffin is more effective (see notes). High-visibility fluorescent yellow green signs are made of the approved fluorescent yellow-green color and posted at crossings to increase the visibility of a pedestrian crossing ahead.	FHWA recently ended its approval process for the experimental use of fluorescent yellow crosswalk markings and found that they had no discernible benefit over white markings.	Beneficial in areas with high pedestrian activity, as near schools, and in areas where travel speeds are high and/or motorist visibility is low.

PEDESTRIAN IMPROVEMENT MEASURES

Measure	Description	Benefits	Application
In-Street Pedestrian Crossing Signs	This measure involves posting regulatory pedestrian signage on lane edge lines and road centerlines. The In-Street Pedestrian Crossing sign may be used to remind road users of laws regarding right of way at an unsignalized pedestrian crossing. The legend STATE LAW may be shown at the top of the sign if applicable. The legends STOP FOR or YIELD TO may be used in conjunction with the appropriate symbol.	This measure is highly visible to motorists and has a positive impact on pedestrian safety at crosswalks.	Mid-block crosswalks, unsignalized intersections, low-speed areas, and two-lane roadways are ideal for this pedestrian treatment. The STOP FOR legend shall only be used in states where the state law specifically requires that a driver must stop for a pedestrian in a crosswalk.
Pedestrian Crossing Flags	Square flags of various colors, which are mounted on a stick and stored in sign-mounted holders on both side of the street at crossing locations; they are carried by pedestrians while crossing a roadway.	This measure makes pedestrians more visible to motorists.	Appropriate for mid-block and uncontrolled crosswalks with low visibility or poor sight distance.
Advanced Yield Lines	Standard white stop or yield limit lines are placed in advance of marked, uncontrolled crosswalks.	This measure increases the pedestrian's visibility to motorists, reduces the number of vehicles encroaching on the crosswalk, and improves general pedestrian conditions on multi-lane roadways. It is also an affordable option.	Useful in areas where pedestrian visibility is low and in areas with aggressive drivers, as advance limit lines will help prevent drivers from encroaching on the crosswalk. Addresses the multiple-threat Crash on multi-lane roads.
Geometric Treatments			
Pedestrian Overpass/ Underpass	This measure consists of a pedestrian-only overpass or underpass over a roadway. It provides complete separation of pedestrians from motor vehicle traffic, normally where no other pedestrian facility is available, and connects off-road trails and paths across major barriers.	Pedestrian overpasses and underpasses allow for the uninterrupted flow of pedestrian movement separate from the vehicle traffic.	Grade separation via this measure is most feasible and appropriate in extreme cases where pedestrians must cross roadways such as freeways and high-speed, high-volume arterials. This measure should be considered a last resort, as it is expensive and visually intrusive.

PEDESTRIAN IMPROVEMENT MEASURES

Measure	Description	Benefits	Application
Road Diet (aka Lane Reduction)	The number of lanes of travel is reduced by widening sidewalks, adding bicycle and parking lanes, and converting parallel parking to angled or perpendicular parking.	This is a good traffic calming and pedestrian safety tool, particularly in areas that would benefit from curb extensions but have infrastructure in the way. This measure also improves pedestrian conditions on multi-lane roadways.	Roadways with surplus roadway capacity (typically multi-lane roadways with less than 15,000 to 17,000 ADT) and high bicycle volumes, and roadways that would benefit from traffic calming measures.
Median Refuge Island	Raised islands are placed in the center of a roadway, separating opposing lanes of traffic with cutouts for accessibility along the pedestrian path.	This measure allows pedestrians to focus on each direction of traffic separately, and the refuge provides pedestrians with a better view of oncoming traffic as well as allowing drivers to see pedestrians more easily. It can also split up a multi-lane road and act as a supplement to additional pedestrian tools.	Suggested for multi-lane roads wide enough to accommodate an ADA-accessible median.
Staggered Median Refuge Island	This measure is similar to traditional median refuge islands; the only difference is that the crosswalks in the roadway are staggered such that a pedestrian crosses half the street and then must walk towards traffic to reach the second half of the crosswalk. This measure must be designed for accessibility by including rails and truncated domes to direct sight-impaired pedestrians along the path of travel.	Benefits of this tool include an increase in the concentration of pedestrians at a crossing and the provision of better traffic views for pedestrians. Additionally, motorists are better able to see pedestrians as they walk through the staggered refuge.	Best used on multi-lane roads with obstructed pedestrian visibility or with off-set intersections.

PEDESTRIAN IMPROVEMENT MEASURES

Measure	Description	Benefits	Application
Curb Extension	Also known as a pedestrian bulb-out, this traffic-calming measure is meant to slow traffic and increase driver awareness. It consists of an extension of the curb into the street, making the pedestrian space (sidewalk) wider.	Curb extensions narrow the distance that a pedestrian has to cross and increases the sidewalk space on the corners. They also improve emergency vehicle access and make it difficult for drivers to turn illegally.	Due to the high cost of installation, this tool would only be suitable on streets with high pedestrian activity, on-street parking, and infrequent (or no) curb-edge transit service. It is often used in combination with crosswalks or other markings.
Reduced Curb Radii	The radius of a curb can be reduced to require motorists to make a tighter turn.	Shorter radii narrow the distance that pedestrians have to cross; they also reduce traffic speeds and increase driver awareness (like curb extensions), but are less difficult and expensive to implement.	This measure would be beneficial on streets with high pedestrian activity, on-street parking, and no curb-edge transit service. It is more suitable for wider roadways and roadways with low volumes of heavy truck traffic.
Curb Ramps	Curb ramps are sloped ramps that are constructed at the edge of a curb (normally at intersections) and are bi-directional (if applicable), as a transition between the sidewalk and a crosswalk.	Curb ramps provide easy access between the sidewalk and roadway for people using wheelchairs, strollers, walkers, crutches, handcarts, bicycles, and also for pedestrians with mobility impairments who have trouble stepping up and down high curbs.	Curb ramps must be installed at all intersections and mid-block locations where pedestrian crossings exist, as mandated by federal legislation (1973 Rehabilitation Act and 1990 Americans with Disabilities Act). Where feasible, separate curb ramps for each crosswalk at an intersection should be provided rather than having a single ramp at a corner for both crosswalks.

PEDESTRIAN IMPROVEMENT MEASURES

Measure	Description	Benefits	Application
Raised Crosswalk	A crosswalk whose surface is elevated above the travel lanes.	Attracts drivers' attention; encourages lower travel speeds by providing visual and tactile feedback when approaching the crosswalk.	Appropriate for multi-lane roadways, roadways with lower speed limits that are not emergency routes, and roadways with high levels of pedestrian activity, such as near schools, shopping malls, etc.
Chicanes	A chicane is a sequence of tight serpentine curves (usually an S-shape curve) in a roadway, used on city streets to slow cars.	This is a traffic-calming measure that can improve the pedestrian environment and pedestrian safety.	Chicanes can be created on streets with higher volumes, given that the number of through lanes is maintained; they can also be created on higher-volume residential streets to slow traffic. Chicanes may be constructed by alternating parallel or angled parking in combination with curb extensions.
Pedestrian Access and Amenities			
Marked Crosswalk	Marked crosswalks should be installed to provide designated pedestrian crossings at major pedestrian generators, crossings with significant pedestrian volumes (at least 15 per hour), crossings with high vehicle-pedestrian Crashes, and other areas based on engineering judgment.	Marked crosswalks provide a designated crossing, which may improve walkability and reduce jaywalking.	Marked crosswalks alone should not be installed on multi-lane roads with more than about 10,000 vehicles/ day. Enhanced crosswalk treatments (as presented in this table) should supplement the marked crosswalk.

PEDESTRIAN IMPROVEMENT MEASURES

Measure	Description	Benefits	Application
Textured Pavers	Textured pavers come in a variety of materials (for example, concrete, brick, and stone) and can be constructed to create a textured pedestrian surface such as a crosswalk or sidewalk. Crosswalks are constructed with the pavers, or can be made of stamped concrete or asphalt.	Highly visible to motorists, this measure provides a visual and tactile cue to motorists and delineates a separate space for pedestrians, as it provides a different texture to the street for pedestrians and motorists. It also aesthetically enhances the streetscape.	Appropriate for areas with high volumes of pedestrian traffic and roadways with low visibility and/or narrow travel ways, as in the downtown area of towns and small cities.
Anti-Skid Surfacing	Surface treatment is applied to streets to improve skid resistance during wet weather. This is a supplementary tool that can be used to reduce skidding in wet conditions.	Improves driver and pedestrian safety.	Appropriate for multi-lane roadways and roadways with higher posted speed limit and/or high vehicle volumes or Crash rates.
Accessibility Upgrades	Treatments such as audible pedestrian signals, accessible push buttons, and truncated domes should be installed at crossings to accommodate disabled pedestrians.	Improves accessibility of pedestrian facilities for all users.	Accessibility upgrades should be provided for all pedestrian facilities following a citywide ADA Transition Plan.
Pedestrian Countdown Signal	Displays a “countdown” of the number of seconds remaining for the pedestrian crossing interval. In some jurisdictions the countdown includes the walk phase. In other jurisdictions, the countdown is only displayed during the flashing don’t walk phase.	Increases pedestrian awareness and allows them the flexibility to know when to speed up if the pedestrian phase is about to expire.	All pedestrian signals should incorporate countdown signals. The signals should be prioritized for areas with pedestrian activity, roadways with high volumes of vehicular traffic, multi-lane roadways, and areas with elderly or disabled persons (who may walk slower than others may).
Transit			

PEDESTRIAN IMPROVEMENT MEASURES

Measure	Description	Benefits	Application
High-Visibility Bus Stop Locations	This measure should include siting bus stops on the far side of intersections, with paved connections to sidewalks where landscape buffers exist.	Provides safe, convenient, and inviting access for transit users; can improve roadway efficiency and driver sight distance.	Appropriate for all bus stops subject to sight distance and right-of-way constraints.
Transit Bulb	Transit bulbs or bus bulbs, also known as nubs, curb extensions, or bus bulges are a section of sidewalk that extends from the curb of a parking lane to the edge of the through lane.	Creates additional space at a bus stop for shelters, benches, and other passenger amenities.	Appropriate at sites with high patron volumes, crowded city sidewalks, and curbside parking.
Enhanced Bus Stop Amenities	Adequate bus stop signing, lighting, a bus shelter with seating, trash receptacles, and bicycle parking are desirable features at bus stops.	Increase pedestrian visibility at bus stops and encourage transit ridership.	Appropriate at sites with high patron volumes.

Appendix B: Glossary of Bicycling Improvement Measures

BICYCLING IMPROVEMENT MEASURES

Measure	Description	Benefits	Application
LINKS /ROADWAY SEGMENTS			
A. Road Design and Operations to Slow Traffic			
Traffic Calming	There are a variety of measures too numerous to list here. See ITE Institute of Transportation Engineers, "Traffic Calming: State of the Practice".	Reduces motor vehicle speeds, which improves safety for all modes and increases bicyclist's comfort.	Urban and suburban settings; suggested for urban major streets with prevailing speeds of 35 mph and higher and for suburban major streets with prevailing speeds 45 mph or higher; and for all local streets with speeds of 30+ mph.
Bicycle Boulevard	A minor street on which traffic control devices are designed and placed to encourage cycling; these include: unwarranted stop signs along bike route are removed; crossing assistance at major arterials is provided (see examples in Nodes-Section E below).	Allows cyclists to maintain their travel speeds, significantly reducing their travel time; provides cyclists with a low volume, low speed street where motorists are aware that it is a bicycle-priority street.	On minor streets with less than 3000 vehicles per day especially useful when Bike Blvd is parallel to and within ¼ mile of a major arterial with many desirable destinations.
Signal Coordination at 15 -25 mph	The signal timing along a corridor is set so that traffic which receives a green light at the first intersection will subsequently receive a green light at all downstream intersections if they travel at the design speed; aka a "green wave."	Encourages motorists to travel at slower speeds, provides a more comfortable experience for cyclists and increases overall traffic safety; also allows cyclists to hit the green lights, so that they can maintain their travel speeds, significantly reducing their travel time.	Urban settings, typically downtown and other areas with relatively short blocks and with traffic signals at every intersection.
Woonerf/Shared Space	A shared space concept where the entire public right of way is available for all modes, often with no sidewalks, and with no lane striping, and little if any signage.	Access for motor vehicles is maintained, unlike a pedestrian zone, but motor vehicle speeds are constrained to 5 mph by design and the presence of other modes. Safety for all modes is improved.	Low volume residential streets where families can gather, and children are encouraged to play; also commercial areas with high pedestrian volumes, bicyclists and transit.
B. Road Design to Provide Bicycle Infrastructure			

BICYCLING IMPROVEMENT MEASURES

Measure	Description	Benefits	Application
Bike Lanes	A painted lane for the exclusive use of bicyclists; it is one-way and is 5 feet minimum in width. They can be retrofitted onto an existing street by either a) narrowing existing wide travel lanes; b) removing a parking lane; c) removing a travel lane, or d) widening the roadway. A common method to retrofit bike lanes is described below.	Provides cyclists with their own travel lane so that they can safely pass and be passed by motor vehicles.	Roadways with over 4000 vehicles per day (if less than 4000 vehicles per day see Bicycle Boulevards above).
Road Diet (aka Lane Reduction)	One to two travel lanes are replaced with a bike lane in each direction, and in most cases by also adding left-turn lanes at intersections or a center two-way left-turn lane; variations include widening sidewalks, and replacing parallel parking with angled or perpendicular parking.	Improves traffic safety for all modes by: a) eliminating the double-threat to pedestrians posed by the two or more travel lanes in each direction; b) providing bike lanes for cyclists; c) providing a left-turn pocket for motorists, reducing rear-end Crashes and improving visibility to oncoming traffic.	Classic application is a four-lane undivided roadway with less than 15,000 to 17,000 ADT though conversions of four-lane streets may work up to 23,000 ADT. Also applies to three-lane roadways and to 5 or 6-lane undivided roadways
Buffer adjacent to bike lanes	A three to five-foot buffer area is provided on one or both sides of the bike lane.	Right-side buffer (between bike lane and on-street parking): Removes cyclists from the door zone; Left-side (between bike lane and adjacent travel lane): provides greater separation from passing motor vehicle traffic.	This measure is particularly beneficial in the following conditions: Right-side: on streets with parallel on-street parking particularly in cities with a Crash history of dooring; Left-side: on streets with traffic with prevailing speeds of 40 mph and higher.
Cycle Tracks	A bikeway within the roadway right of way that is separated from both traffic lanes and the sidewalks by either a parking lane, street furniture, curbs or other physical means.	Reduces sidewalk riding, provides greater separation between motorists and cyclists.	Urban settings with parallel sidewalks and heavy traffic.
Left-Turn Staging Box	This roadway treatment provides bicyclists with a means of safely making a left turn at a multi-lane signalized intersections from a bike lane or cycle track on the far-right side of the roadway.	Bicyclists are protected from the flow of traffic while waiting to turn.	Appropriate for multilane roadways. Can also be mirrored for right-turns from a one-way street with a left-side bikeway.

BICYCLING IMPROVEMENT MEASURES

Measure	Description	Benefits	Application
C Other Traffic Control Devices			
Except Bicycles placard	A Regulatory sign placard for use with other regulatory signs.	Increases or maintains the access and circulation capabilities of bicyclists.	Used at locations where the restriction in question does not apply to bicyclists, such as No Left Turn or Do Not Enter.
Sharrows	A pavement legend that indicates the location within the travel lane where bicyclists are expected to occupy.	The sharrow encourages cyclists to ride outside of the door zone and studies have shown that sharrows reduce the incidence of cyclists riding on the sidewalk and wrong-way riding.	Two or more lane city streets where the right-most lane is too narrow for a motor vehicle to safely pass a cyclist within the travel lane.
Bike Lanes May Use Full Lane sign (MUTCD R4-11)	Regulatory Sign	Informs motorists and cyclists that cyclists may be travelling in the center of a narrow lane.	Two or more lane city streets where the right-most lane is too narrow for a motor vehicle to safely pass a cyclist within the travel lane.
Share the Road sign (MUTCD W-11/ W16-1p)	Warning sign and placard	Informs motorists to expect cyclists on the roadway.	Two-lane roads particularly in rural areas where shoulders are less than four feet.
Bike Directional Signs (MUTCD D1 series or similar)	Informational signs indicating place names and arrows, with distances as a suggested option (D1-2C)	Informs bicyclists of the most common destination served by the bike route in question.	Particularly useful to direct cyclists to a facility such as a bike bridge or to use a street to access a major destination that might not otherwise be readily apparent.
D. New infrastructure to improve bicycle connectivity			
Bike Path	A paved pathway for the exclusive use of non-motorized traffic within its own right of way;	Provides additional connectivity and route options that otherwise would not be available to bicyclists.	Wherever a continuous right of way exists, typically found along active or abandoned railroad ROW, shorelines, creeks, and river levees.
Pathway connections	Short pathway segments for non-motorized traffic, for example, that join the ends of two cul-de-sacs or provide other connectivity not provided by road network.	Provides short-cuts for bicyclists that reduce their travel distance and travel time.	Varies by community; suggested at the end of every newly constructed cul-de-sac.

BICYCLING IMPROVEMENT MEASURES

Measure	Description	Benefits	Application
Bicycle Overpass/ Underpass	A bicycle overpass or underpass is a bridge or tunnel built for the exclusive use of non-motorized traffic and is typically built where at-grade crossings cannot be provided such as to cross freeways, rivers, creeks and railroad tracks. They can also be built to cross major arterials where, for example, a bike path must cross a major roadway.	A bike bridge / tunnel complements a local roadway system that is discontinuous due to man-made or natural barriers. They reduce the distance traveled by cyclists, and provide a safer conflict-free crossing, particularly if it is an alternative to a freeway interchange.	Grade separation via this measure is most feasible and appropriate when it would provide direct access to major bicyclist destinations such as a school or college, employment site, major transit station or would reduce the travel distance by one mile or more.
NODES / INTERSECTIONS			
E. Intersection Design for Motor Vehicles			
Reduced Curb Radii	The radius of a curb is reduced to require motorists to make the turn at slower speeds and to make a tighter turn.	Shorter curb radii reduce the speed of turning traffic thereby enabling a more comfortable weave between through cyclists and right-turning motorists.	This measure is suitable for downtown settings, at all cross streets with minor streets, all residential streets and all roadways that are not designated truck routes.
Remove/Control Free Right-Turn Lanes	Where a separate right-turn lane continues as its own lane after the turn, it may be redesigned to eliminate the free turn. A short-term solution is to control the turning movement with a stop sign or signal control and to redesign the island as discussed below.	Improves bicyclist safety since this design forces through cyclists on the cross street to end up in between two lanes of through motor vehicle traffic.	All locations where there are free right-turn lanes except those leading onto freeway on-ramps.
Remove/Redesign Right-Turn Slip-Lane Design	Right-turn slip lanes (aka channelized right-turn lanes) are separated from the rest of the travel lanes by a pork chop-shaped raised island which typically is designed to facilitate fast right turns, and right-turning vehicles are often not subject to the traffic signal or stop sign.	Improves bicyclist safety by slowing right-turning motorists and facilitates the weave between through bicyclists and right-turning motorists.	All locations with a channelized right-turn.
Remove Optional Right-Turn Lane in Combination with a Right-Turn Only Lane	At locations where there is an optional right-turn lane in combination with a right-turn only lane, convert the optional right-turn lane to a through-only lane.	Improves bicyclist safety since cyclists have no way of knowing how to correctly position themselves in the optional (through /right turn) lane.	All locations where there is an optional right-turn lane in combination with a right-turn only lane per HDM 403.6(1) (except on freeways).

BICYCLING IMPROVEMENT MEASURES

Measure	Description	Benefits	Application
Redesign Ramp Termini	Redesign high speed free flow freeway ramps to intersection local streets as standard intersections with signal control.	Improves bicyclist and pedestrian safety on intersections of local streets with freeway ramps.	All freeway interchanges with high speed ramps
F. Intersection Design Treatments - Bicycle-Specific			
Bicycle Signal Detection and Pavement Marking	Provide signal detectors that also detect bicyclists in the rightmost through lane and in left-turn lanes with left-turn phasing. Provide pavement marking to indicate to cyclists where to position themselves in order to activate the detector.	Enables cyclists to be detected when motor vehicles are not present to trigger the needed signal phase. Improves bicyclists' safety.	Per CA MUTCD 4D.105 and CVC 21450.5, all new and modified traffic detection installations must detect bicyclists; All other traffic-actuated signals may be retrofitted to detect bicyclists as soon as feasible.
Bicycle Signal Timing	Provides signal timing to account for the speed of cyclists to cross an intersection.	Improves bicyclists' safety by reducing the probability of a bicyclist being in an intersection when the phase terminates and being hit by traffic that receives the next green phase.	Signal timing that accounts for cyclists is particularly important for cyclists on a minor street approach to a major arterial which crosses a greater distance due to the width of the arterial, hence requiring a longer time interval.
Bicycle Signal Heads	A traffic signal indication in the shape of a bicycle, with full red, yellow green capability.	Improves bicyclist safety by providing a bicycle - only phase, where appropriate, given the geometry and phasing of the particular intersection.	Where intersection geometry is such that a bicycle-only phase is provided and/or bicycle signal heads would improve safety at the intersection. See also CA MUTCD for warrants for bicycle signal heads.
Widen Bike Lane at Intersection Approach	Within the last 200 feet of an intersection, widen the bike lane and narrow the travel; for example from 5 foot bike lane and 12 feet travel lane would become a 7 foot bike lane and 10 foot travel lane.	Improves cyclist safety by encouraging right-turning motorists to enter the bike lane to turn right, (as required by the CVC), which reduces the chance of a right-turn hook Crash in which a through cyclist remains to the right of a right-turning motorist.	On roads with bike lanes approaching an intersection without a right-turn only lane and there is noncompliance with right-turning vehicles merging into the bike lane as required by the CVC and UVC.

BICYCLING IMPROVEMENT MEASURES

Measure	Description	Benefits	Application
Bike Lane inside Right-Turn Only Lane ("Combined Bicycle/Right-Turn Lane")	Provide a bike lane line inside and on the left side of a right-turn only lane.	Encourages cyclists to ride on the left side of the right-turn only lane thus reducing the chance of a right hook Crash, where a cyclist remains to the right of a right-turning motorist.	On roads with bike lanes approaching an intersection with a right-turn only lane and there is not enough roadway width to provide a bike lane to the left of the right-turn lane.
Bike Boxes	Area between an Advance Stop Line and a marked crosswalk which is designates as the queue space for cyclists to wait for a green light ahead of queued motor vehicle traffic; sometimes painted green.	Primary benefits are to reduce conflicts between bicyclists and right-turning traffic at the onset of the green signal phase, and to reduce vehicle and bicyclist encroachment in a crosswalk during a red signal phase.	Locations where there are at least three cyclists at the beginning of the green phase and moderate to high pedestrian volumes.
Marked Crosswalk with Distinct Marked Area for Bicyclists separate from Pedestrians	A marked crosswalk that has two distinct areas, one for pedestrians and one for bicyclists.	Reduces conflicts between bicyclists and pedestrians by indicating the part of the crosswalk intended for the two different modes.	At a typical intersection, cyclists would not be riding within the crosswalk, so this measure is intended for those few locations where the intersection design is such that bicyclists are tracked into a crosswalk such as at a midblock bike path crossing or possibly a cycle track.
Pedestrian Countdown Signal	Displays a "countdown" of the number of seconds remaining for the pedestrian crossing interval. In some jurisdictions the countdown includes the walk phase. In other jurisdictions, the countdown is only displayed during the flashing don't walk phase.	While designed for pedestrians, this measure also assists bicyclists in knowing how much time they have to left to cross the intersection.	The 2012 MUTCD requires all pedestrian signals to incorporated countdown signals within ten years
G. Geometric Countermeasures to Assist crossing a Major Street			
Median Refuge Island	A raised island placed in the center of a roadway, separating opposing lanes of traffic, with ramps for cyclists and ADA accessibility	This measure allows bicyclists to cross one direction of traffic at a time; it allows drivers to see bicyclists crossing from the center more easily.	Suggested for multilane roads at uncontrolled crossings where an 8-foot (min.) wide by 15-foot (min.) long median can be provided.

BICYCLING IMPROVEMENT MEASURES

Measure	Description	Benefits	Application
Staggered Refuge Pedestrian Island	This measure is similar to traditional median refuge islands; the only difference is that the crosswalk is staggered such that a pedestrian crosses one direction of traffic street and then must turn to their right facing oncoming to reach the second part of the crosswalk. This measure must be designed for accessibility by including rails and truncated domes to direct sight-impaired pedestrians along the path of travel.	Benefits of this measure include forcing the bicyclists and pedestrians to face the oncoming motorists, increasing their awareness of the impending conflict. Additionally, can improve motorists' visibility to those persons in the crosswalk.	Best used on multilane roads with obstructed pedestrian visibility or with off-set intersections
Raised Crosswalk/Speed Table	A crosswalk whose surface is elevated above the travel lanes at the same level as the approaching sidewalk. For bicyclists, a typical location would be at a bike path crossing, where the bike path elevation would remain constant while roadway cross traffic would experience a speed-hump type effect.	Attracts drivers' attention to the fact there will be non-motorized users crossing the roadway and slows traffic by providing a speed-hump effect for motorists approaching the crosswalk.	Appropriate for multi-lane roadways, roadways with lower speed limits that are not emergency routes, and roadways with high levels of pedestrian activity, such as near schools, shopping malls, etc.
H. Traffic Control Countermeasures to Assist Crossing a Major Street			
Traffic Signal or All-Way Stop Sign	Conventional traffic control devices with warrants for use based on the Manual on Uniform Control Devices (MUTCD)	Provides the gap needed in traffic flow so that cyclists can cross the street, reducing bicycle-vehicle conflicts and risk-taking by cyclists to	Must meet warrants based on traffic/ pedestrian / bicycle volumes, Crash history, and/ or other factors.
Modern Roundabout	A traffic circle combined with splitter island on all approaches and entering traffic must YIELD to traffic within the roundabout; typically designed for traffic speed within the roundabout of between 15 and 23 mph.	Slows traffic on cross street so that cyclists can more easily cross.	Roundabouts are a better alternative than an All-Way Stop signs when the side street volume is approximately 30 % of the total intersection traffic volume and total peak hour volume is less than 2300 vehicles per day.

BICYCLING IMPROVEMENT MEASURES

Measure	Description	Benefits	Application
Pedestrian Hybrid Beacon	PHBs (Pedestrian Hybrid Beacon) are pedestrian-actuated signals that are a combination of a beacon flasher and a traffic control signal. When actuated, PHBs display a yellow (warning) indication followed by a solid red light. During pedestrian clearance, the driver sees a flashing red "wig-wag" pattern until the clearance interval has ended and the signal goes dark.	Reduces pedestrian-vehicle conflicts and slows traffic speeds.	Useful in areas where it is difficult for pedestrians to find gaps in automobile traffic to cross safely, but where normal signal warrants are not satisfied. Appropriate for multi-lane roadways.
Rectangular Rapid Flashing Beacon	A Rectangular Rapid Flashing Beacon (RRFB) is a pedestrian-actuated enhancement that improves safety at uncontrolled, marked crossings.	FHWA states that research indicates RRFBs can result in motorist yielding rates as high as 98 percent at marking crosswalks. Solar panels reduce energy costs associated with maintenance of the device.	Appropriate for multi-lane roadways.
In-Roadway Warning Lights	Both sides of a crosswalk are lined with pavement markers, often containing an amber LED strobe light. The lights may be push-button activated or activated with pedestrian detection.	This measure provides a dynamic visual cue of the uncontrolled crosswalk and is especially effective at night and in bad weather.	Locations not controlled by any measures listed above. Best in locations with low bicycle ridership on the cross street, as the raised markers may present difficulty to bicyclists. May not be appropriate in areas with heavy winter weather due to high maintenance costs. May not be appropriate for locations with bright sunlight.
Bicycle Crossing Sign (MUTCD W11-1) or Trail Crossing sign (MUTCD W11-15/W11-15p)	Warning Sign and placard.	Alerts motorists to a location where bicyclists or bicyclists and pedestrians will be crossing the roadway at an uncontrolled location.	Typical application is at bike path crossing of a roadway. (At a typical pedestrian crosswalk at an intersection, use the Pedestrian warning sign W11-2)

BICYCLING IMPROVEMENT MEASURES

Measure	Description	Benefits	Application
In-Street Pedestrian Crossing Signs (MUTCD R1-6)	This measure involves posting this regulatory sign on road centerlines that read, "YIELD for Pedestrians in crosswalk". (Depending on state law, the word STOP may replace the word YIELD).	This measure improves the visibility of the crossing to motorists and has a positive impact on pedestrian safety at crosswalks.	Mid-block crosswalks, unsignalized intersections, low-speed areas, and two-lane roadways.
Advanced Yield Lines	Standard white stop or yield limit lines are placed 20-50 feet in advance of marked, uncontrolled crosswalks.	This measure increases the pedestrian's visibility to motorists, reduces the number of vehicles encroaching on the crosswalk, and improves general pedestrian conditions on multi-lane roadways. It is also an affordable option.	Useful in areas where pedestrian visibility is low and in areas with aggressive drivers, as advance limit lines will help prevent drivers from encroaching on the crosswalk. Addresses the multiple-threat Crash on multi-lane roads.
Transit			
Bike Racks on Buses	A rack on the front of the bus that typically holds two or three bicycles.	Increases the trip length distance that a person can make.	Appropriate for all buses; most urban transit agencies have already implemented this measure.
Bikes allowed inside buses when bike rack is full	A policy adopted by a transit agency that allows passengers to bring bicycles inside the bus when the bike rack is full and there is room inside.	Prevents cyclists from needless being left behind to wait for the next bus if the bike rack is full yet there is room inside the bus.	Appropriate for all buses; most urban transit agencies have already implemented this measure.
Folding bikes allowed inside buses	A policy adopted by a transit agency that treats a folding bicycle as luggage, thereby allowing it inside the bus at all times.	Removes cyclists' uncertainty as to whether they will be able to fit their bike either on the bike rack or inside the bus; thus, they can reliably plan on being able to catch their intended bus.	Appropriate for all buses; most urban transit agencies have already implemented this measure.

Appendix C: Resource List and References

RESOURCE LIST
A Guide for Reducing Collisions Involving Pedestrians (NCHRP Report 500) http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_500v10.pdf
Pedestrian and Bicycle Information Center http://www.walkinginfo.org/
National Center for Safe Routes to School http://www.saferoutesinfo.org/
Safety Effects of Marked Versus Unmarked Crosswalks at Uncontrolled Locations (HRT-04-100) http://www.thrc.gov/safety/pubs/04100/index.htm
How to Develop a Pedestrian Safety Action Plan (FHWA-SA-05-12) http://www.walkinginfo.org/pp/howtoguide2006.pdf
Improving Pedestrian Safety at Unsignalized Crossings (NCHRP Report 562) http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_562.pdf
Road Safety Audits: Case Studies (FHWA-SA-06-17) http://safety.fhwa.dot.gov/rsa/rsa_cstudies.htm
Pedestrian Road Safety Audit Guidelines and Prompt Lists http://drusilla.hsrc.unc.edu/cms/downloads/PedRSA.reduced.pdf
PEDSAFE: The Pedestrian Safety Guide and Countermeasure Selection System (FHWA-SA-04-003) http://www.walkinginfo.org/pedsafe/
Pedestrian and Bicycle Crash Analysis Tool (PBCAT) http://www.bicyclinginfo.org/bc/pbcat.cfm
FHWA, A Resident's Guide for Creating Safe and Walkable Communities http://safety.fhwa.dot.gov/ped_bicycle/ped/ped_walkguide/index.htm
FHWA, Pedestrian Safety Guide for Transit Agencies (FHWA-SA-07-017) http://safety.fhwa.dot.gov/ped_bicycle/ped/ped_transguide/
FHWA Pedestrian Safety Training Courses:
Developing a pedestrian safety action plan (two-day course) *next California course:* http://www.google.com/calendar/embed?src=lssandt@email.unc.edu
Designing for pedestrian safety (two-day course) *next California course:* http://www.google.com/calendar/embed?src=lssandt@email.unc.edu
Planning and designing for pedestrian safety (three-day course) *next California course:* http://www.google.com/calendar/embed?src=lssandt@email.unc.edu
Adapted from FHWA Pedestrian Road Safety Audit Guidelines and Prompt Lists

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California Local Government Commission, Center for Livable Communities. “Economic Benefits of Walkable Communities.” http://www.lgc.org/freepub/PDF/Land_Use/focus/walk_to_money.pdf

Dill, Jennifer. “Measuring Connectivity for Bicycling and Walking." Presented at Pro Walk/ Pro Bike, September 9, 2004. Accessed online at http://web.pdx.edu/~jdill/PWPB_Connectivity_slides.pdf

Pedestrian and Bicycle Information Center. “El Cajon’s Road Diet Case Study.” http://www.walkinginfo.org/library/details.cfm?id=3967

Zegeer, Charles V., et al. Safety Effects of Marked Versus Unmarked Crosswalks at Uncontrolled Locations. Report HRT-04-100. http://www.thrc.gov/safety/pubs/04100/index.htm

CROW, Design Manual for Bicycle Traffic, The Netherlands
http://www.crow.nl/nl/Publicaties/publicatiedetail?code=REC25
From the CROW English website, http://www.crow.nl/English
CROW is The Netherlands technology platform for transport, infrastructure and public space. It is a not-for-profit organization in which the government and businesses work together in pursuit of their common interests through the design, construction and management of roads and other traffic and transport facilities. Active in research and in issuing regulations, CROW focuses on distributing knowledge products to all target groups.

Transport for London, London Cycling Design Standards, UK
http://www.tfl.gov.uk/businessandpartners/publications/2766.aspx

Thompson, Laura and Julie Bondurant, Trail Planning in California, Solano Press, 2009

Fundamentals of Traffic Engineering, 16th Edition, Chapter 21: Bicycle Facilities; UC Berkeley Institute of Transportation Studies, 2007

DeRobertis, Michelle and Rhonda Rae, Buses and Bicycles: Design Options for Sharing The Road, ITE Journal, May 2001

Thomas, Beth and Michelle DeRobertis, *Cycle Track Literature Review*, Accident Analysis and Prevention, Volume 52, pp 219-227, March 28, 2013

Hillsman, Edward L. et al, A Summary of Design, Policies and Operational Characteristics for Shared Bicycle/Bus Lanes, Project No. BDK85 977-32, University of South Florida, July 2012

Mekuria, Maaza C., Peter G. Furth, and Hilary Nixon, Low-Stress Bicycling And Network Connectivity, Mineta Transportation Institute, May 2012

Thompson S.R. et al, Bicycle-Specific Traffic Signals: Results from a State-of-the-Practice Review, Transportation Research Board, January 2013, Paper # 13-0536

Appendix D: Street Connectivity

Importance of Street Connectivity

Providing direct paths for bicyclists and pedestrians via well-connected street networks is important for encouraging bicycling and walking by helping people overcome real and perceived senses of distance.

Street connectivity is also associated with public health benefits. The SMARTRAQ Project analysis in Atlanta, Georgia, found that doubling the current regional average intersection density, from 8.3 to 16.6 intersections per square kilometer was associated with a reduction in average per capita vehicle mileage of about 1.6 percent. Furthermore, the Frank et al. (2006) study of King County, Washington, found that per-household VMT declines with increased street connectivity, all else held constant.

Policies for Street Connectivity

A network of safe, direct, and comfortable routes and facilities: A 2004 PAS report suggests that pedestrian (and bicycle) path connections to be every 300 to 500 feet; for motor vehicles, they suggest 500 to 1,000 feet.[1] [2] For new development, such standards can be implemented through ordinances, like those of the regional government of Portland Oregon, Metro, which requires street connectivity in its Regional Transportation Plan and in the development codes and design standards of its constituent local governments.[3]

Measuring Connectivity

The following discussion of measuring street connectivity is provided as a resource and not officially a part of regular BSA processes. However, individuals are certainly encouraged to make such calculations. Jennifer Dill (2004) presents the following measures of street connectivity:

- Intersection density
- Street density
- Average block length
- Link/node ratio
- Connected node ratio = intersections/ (intersections + cul-de-sacs)
- Alpha index = number of actual circuits/ maximum number of circuits
- Gamma index = number of links in the network/ maximum possible number of links between nodes
- Effective walking area = number of parcels within a one-quarter mile walking distance of a point/ total number of parcels within a one-quarter mile radius of that point
- Route directness = route distance/ straight-line distance for two selected points

Dill suggests that route directness (RD) is perhaps the best connectivity measure to reflect minimizing trip distances, but may be difficult to use in research and policy. However, it may be applied in practice by randomly selecting origin-destination pairs and calculating a sample for the subject area.

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[1] Susan Handy, Robert G. Paterson, and Kent Butler, 2004, *Planning for Street Connectivity: Getting from Here to There,* PAS Report #515 (Chicago: APA Planners Press).

[2] American Association of State Highway and Transportation Officials (AASHTO), *Guide for the Design of Pedestrian Facilities* (Washington, D.C., AASHTO, 2004); *AASHTO Guide for the Development of Bicycle Facilities* (Washington, D.C., AASHTO, 1999; updated 2009); Institute of Traffic Engineers (ITE), Traffic Calming Guidelines and ITE *Context-Sensitive Solutions in Designing Major Urban Thoroughfares for Walkable Communities* (Washington, D.C.: ITE, 2006).

[3] The regional government of Portland Oregon, Metro, requires street connectivity in its Regional Transportation Plan and in the development codes and design standards of its constituent local governments as follows: local and arterial streets be spaced no more than 530 feet apart (except where barriers exist), bicycle and pedestrian connections must be made (via pathways or on road right of ways) every 330 feet, Cul de sacs (or dead-end streets) are discouraged and can be no longer than 200 feet, and have no more than 25 dwelling units.