

Berkeley SafeTREC

SAFE TRANSPORTATION RESEARCH AND EDUCATION CENTER

PS21022

City of Fort Bragg Complete Streets Safety Assessment

**Final Report:
Issues, Opportunities, and Suggested Strategies**

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Executive Summary

The City of Fort Bragg requested that the Safe Transportation Research and Education Center at University of California, Berkeley conduct a Complete Streets Safety Assessment (CSSA) study. A team of three complete streets safety experts conducted an on-site visit for the CSSA for Fort Bragg on May 31, 2022 and prepared this report. The objectives of the CSSA are to improve pedestrian and bicycle safety and to enhance walkability and accessibility for all pedestrians and bicyclists in Fort Bragg.

Based on the Office of Traffic Safety (OTS) 2019 statistics, Fort Bragg ranked 13 out of 74 California cities of comparable size in total fatal and injury collisions (with a ranking of “1” being the worst and “74” the best). It ranked 8 for pedestrian collisions and 24 for bicyclist collisions. This ranking is based on a number of weighted factors including population, daily vehicle miles traveled, collision records, and collision trends. For more information on OTS rankings, please refer to <https://www.ots.ca.gov/media-and-research/crash-rankings-results/>. Chapter 2 provides an overview of collision data for the county.

Benchmarking Analysis of Policies, Programs, and Practices

To assess pedestrian and bicyclist safety conditions in Fort Bragg, the consultant team conducted a benchmarking analysis to understand how the county’s existing conditions compared to current best practices. Through a pedestrian and bicycle safety assessment interview conducted with City staff, the team identified the City’s pedestrian policies, programs, and practices and categorized these into three groups:

- Key strengths (areas where the City is exceeding national best practices)
- Enhancement areas (areas where the City is meeting best practices)
- Opportunity areas (areas where the City appears not to meet best practices)

A discussion of the City’s current pedestrian safety policies, programs, and practices, and ideas for enhancement is presented in Chapter. While suggestions and ideas for enhancement are provided for each category, cities and counties have differing physical, demographic, and institutional characteristics that may make certain goals or policies more appropriate in some jurisdictions than others. Ultimately, County staff may determine where resources and efforts are best placed for meeting local development and infrastructure goals for bicyclists and pedestrians.

Walking Audit Suggestions for Potential Improvement

A walk audit was conducted at three locations, determined in coordination with City staff. Positive practices, as well as pedestrian safety and accessibility issues, were identified. The three focus areas were:

1. Harold Street from Fir Street in the north to Oak Street in the south, covering the proximity of Fort Bragg Middle School
2. Main Street / State Route (SR) 1 from Fir Street in the north to Oak Street in the south, covering the downtown area
3. Dana Street from Oak Street in the north to Chestnut Street in the south, covering the proximity of Fort Bragg High School and Dana Gray Elementary School

Observations made during the walking audit were used to suggest policies and physical improvements intended to enhance accessibility and connectivity for pedestrians and bicyclists. Key observations from the Fort Bragg walking audit include the following:

- Citywide, there is a high proportion of taller vehicles, such as large pickup trucks and SUVs, among vehicles observed. These vehicles have blind spots that pose significant risks for individuals of shorter stature (e.g., children) crossing in front of such vehicles.
- Citywide, the widths of the typical two-lane residential streets are excessive, resulting in design contexts conducive to speeding. While some residential streets have improvements such as striped bike lanes, and some intersections feature curb extensions, the presence of such improvements remain sporadic.
- School pick-ups and drop-offs often feature dangerous maneuvers from vehicles that pose safety risks for pedestrians, such as unpredictable lane merges and reverse maneuvers where children are present and/or crossing.
- Crosswalk facilities, while relatively widespread, can contain design flaws or inadequacies that make them less useful for pedestrians.

A narrative description of audit observations and potential improvements is provided in Chapter 4. Detailed suggestions for potential improvements are also summarized graphically, corresponding to each walking audit location, and depicted in Figures 4-1 through 4-4.

Many of the strategies suggested in this report are appropriate for grant applications, including Office of Traffic Safety (OTS), Safe-Routes-to-School, Active Transportation Program (ATP), and Highway Safety Improvement Program (HSIP) 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 and that could identify and prioritize capital improvement projects.

The suggestions presented in this report are based on field observations by the CSSA evaluators. These suggestions, which are based on general knowledge of best practices in bicyclist and pedestrian design and safety, are intended to guide City staff in making decisions for future safety improvement projects in the city, and they may not incorporate all factors which may be relevant to the pedestrian and bicyclist safety issues in the city.

1. Introduction

1.1 Objective

The City of Fort Bragg has requested that the Safe Transportation Research and Education Center at University of California, Berkeley conduct a Complete Streets Safety Assessment (CSSA) study. The objectives of the CSSA are to improve safety and accessibility for all people walking and biking in Fort Bragg.

1.2 Evaluation Approach

Prior to visiting the city, the CSSA team conducted a pre-visit telephone interview with City staff on March 28, 2022. The results from this interview provided input for the benchmarking analysis and aided in the selection of study sites. The team visited the county on May 31, 2022 to observe and document field conditions. Following this, a list of suggestions for potential site-specific improvements was drafted based on the results of the complete streets audit and best practices in designing for pedestrians and bicyclists.

1.3 Organization of this Report

Chapter 2 presents background information on bicyclist and pedestrian safety in the county, including safety rankings, locations of the highest number of bicyclist- and pedestrian-involved injuries, and locations where bicyclist and pedestrian fatalities occurred (from 2017 to 2021). Chapter 3 presents the findings and suggestions for potential improvement from the benchmarking analysis. Chapter 4 presents the findings and suggestions for potential improvements from the audit.

The report has four appendices: Appendix A and Appendix B present a glossary of pedestrian and bicyclist improvement options, respectively, Appendix C is a resource list, and Appendix D is a countywide connectivity resource.

1.4 Acknowledgements

Staff members from the City of Fort Bragg, Fort Bragg Unified School District, and Mendocino County contributed to the wide range of topics addressed in this report, including providing local important context that informed the site selection and recommendations. Participating staff included:

- Chantell O’Neal, Public Works Assistant Director of Engineering
- John Smith, Public Works Director
- Captain Thomas O’Neal, Fort Bragg Police Department
- Officer Refugio Zavala, Fort Bragg Police Department
- Donna Schuler, Mendocino County Department of Public Health

1.5 Disclosures

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

The suggestions presented in this report are based on limited field observations and limited time spent in the city of Fort Bragg by the CSSA evaluators. These suggestions, which are based on general knowledge of best practices in pedestrian and bicycle design and safety, are intended to guide City staff in making decisions for future safety improvement projects in the city, and they may not incorporate all factors which may be relevant to the pedestrian and bicycle safety issues in the city.

As this report is conceptual in nature, conditions may exist in the focus areas that were not observed and may not be compatible with suggestions in this report. Before finalizing and implementing any physical changes, City staff may conduct more detailed studies or further analysis to refine or discard the suggestions 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 or speeds, physical limitations on space or sight distance, or other potential safety concerns.

2. Background and Crash History

The City of Fort Bragg is located in Mendocino County. Per Office of Traffic Safety, as of 2019, with a population of approximately 7,451, it is categorized as one of the 74 cities in Group F, population of 2,501-10,000, as shown in **Table 2-1**.

TABLE 2-1: CITY OF FORT BRAGG SUMMARY STATISTICS

Year	County	Population	Population Group	Daily Vehicle Miles Traveled (DVMT)
2019	Mendocino	7,451	F	43,370

Source: California Office of Traffic Safety, <https://www.ots.ca.gov/media-and-research/collision-rankings/>

2.1 Pedestrian And Bicyclist Crash Data

The crash data for City of Fort Bragg from January 2017 to the end of 2021 was taken from the SafeTREC Transportation Injury Mapping System (TIMS) database. During this five-year period, 101 crashes occurred in Fort Bragg, in which 3 people were killed. There were 18 crashes involving pedestrians and 9 involving bicyclists.

Pedestrian Crashes

Within the 5-year period analyzed from TIMS data, 18 crashes involved pedestrians, 2 of which were fatal. The following chart depicts this data.

Number of Crashes by Crash Severity

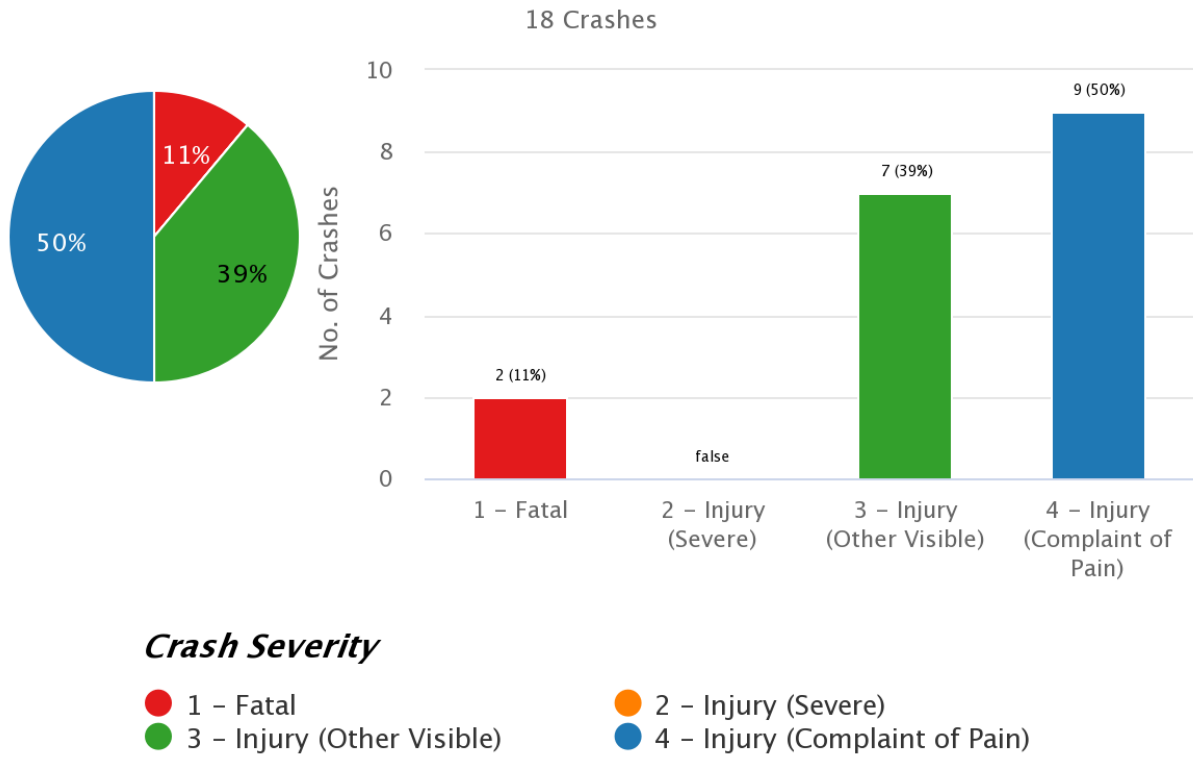


Figure 2-1: City of Fort Bragg, January 2017 to December 2021, Number of Pedestrian Crashes by Crash Severity

The following chart depicts that most pedestrian involved crashes happened on Fridays.

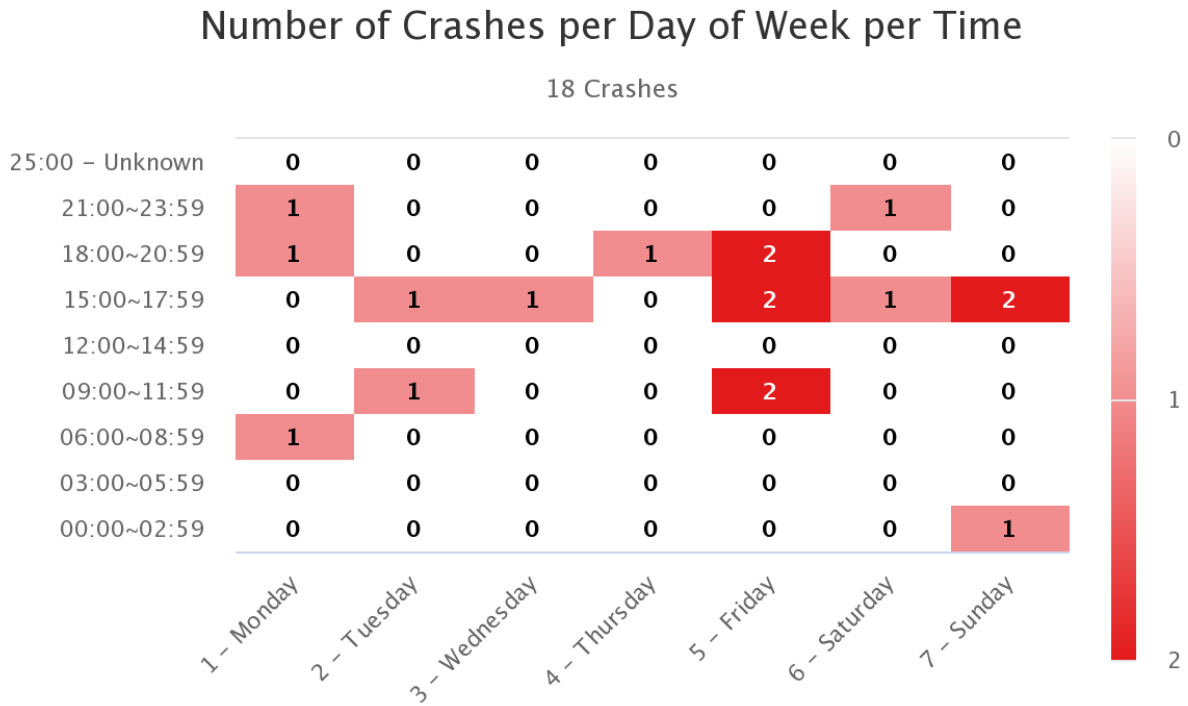
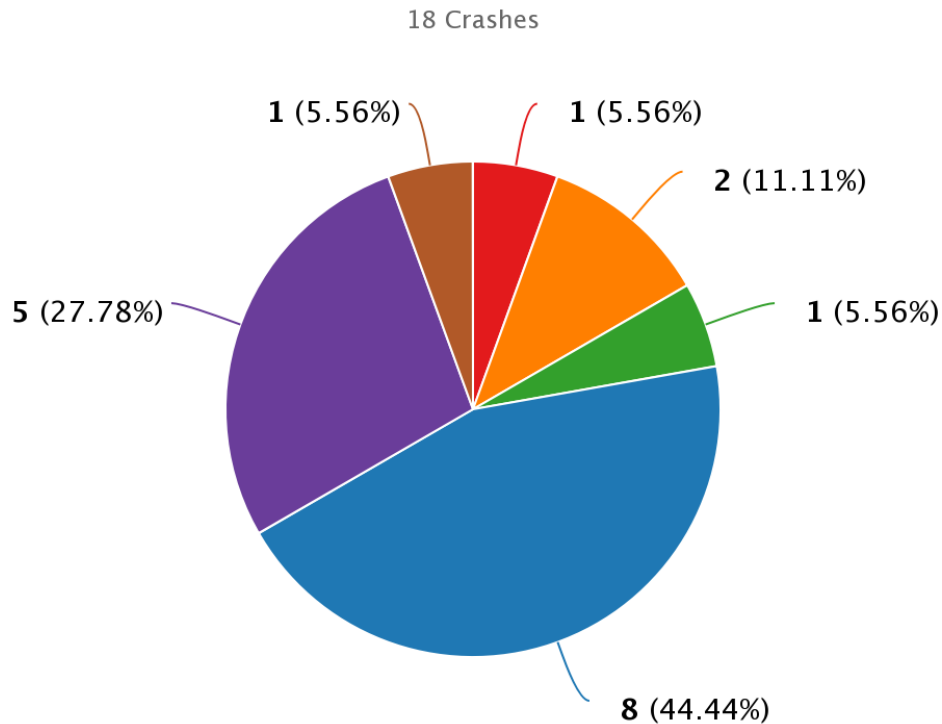


Figure 2-2: City of Fort Bragg, January 2017 to December 2021, Number of Pedestrian Crashes per Day of Week, per Time

The following chart and table depict all the Primary Collision Factors (PCF).

Number of Crashes by PCF Violation



PCF Violation

- 00 - Unknown
 - 08 - Improper Turning
 - 11 - Pedestrian Violation
- 03 - Unsafe Speed
 - 10 - Pedestrian Right of Way
 - 12 - Traffic Signals and Signs

PCF Violation	Count	%
00 - Unknown	1	5.56%
03 - Unsafe Speed	2	11.11%
08 - Improper Turning	1	5.56%
10 - Pedestrian Right of Way	8	44.44%
11 - Pedestrian Violation	5	27.78%
12 - Traffic Signals and Signs	1	5.56%

Figure 2-3: City of Fort Bragg, January 2017 to December 2021, Number of Pedestrian Crashes by PCF Violation

Bicycle Crashes

Within the 5-year period analyzed from TIMS data, from January 2017 to the end of 2021, 9 crashes involved bicyclists, with no fatalities. The following chart depicts this data.

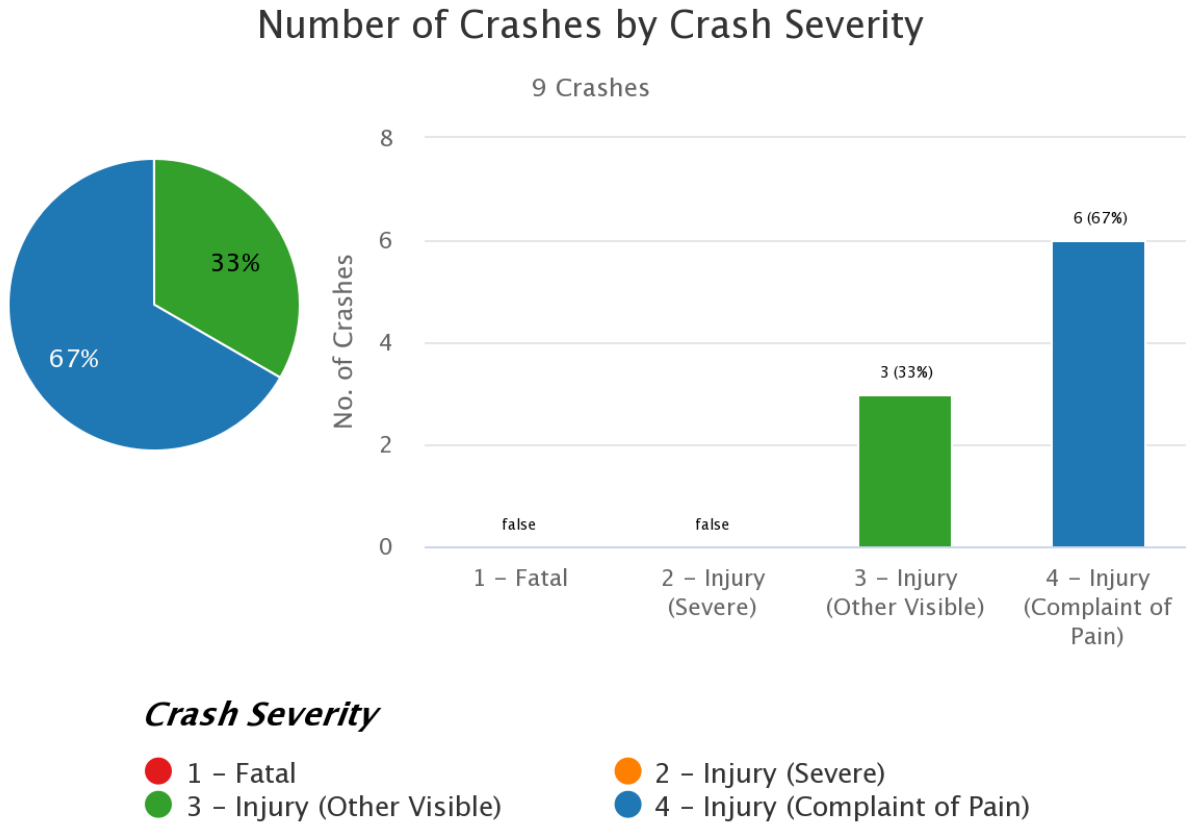


Figure 2-4: City of Fort Bragg, January 2017 to December 2021, Number of Bicycle Crashes by Crash Severity

According to the following chart, most of bicycle crashes happened on Mondays.

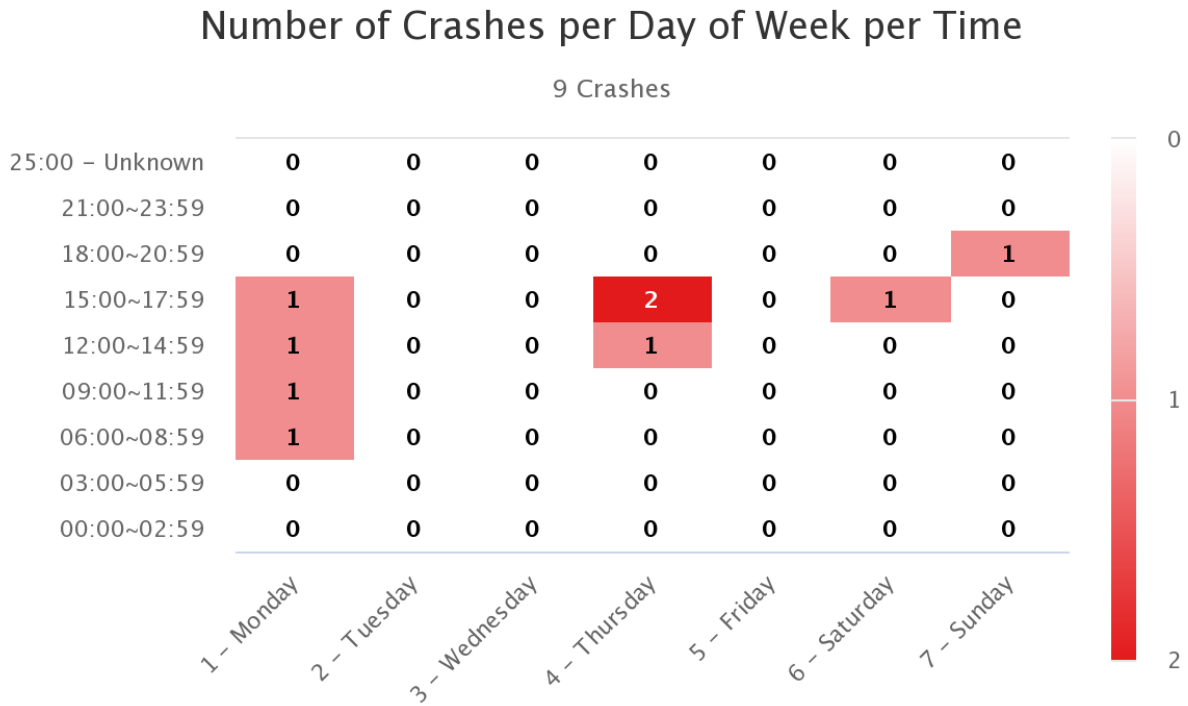
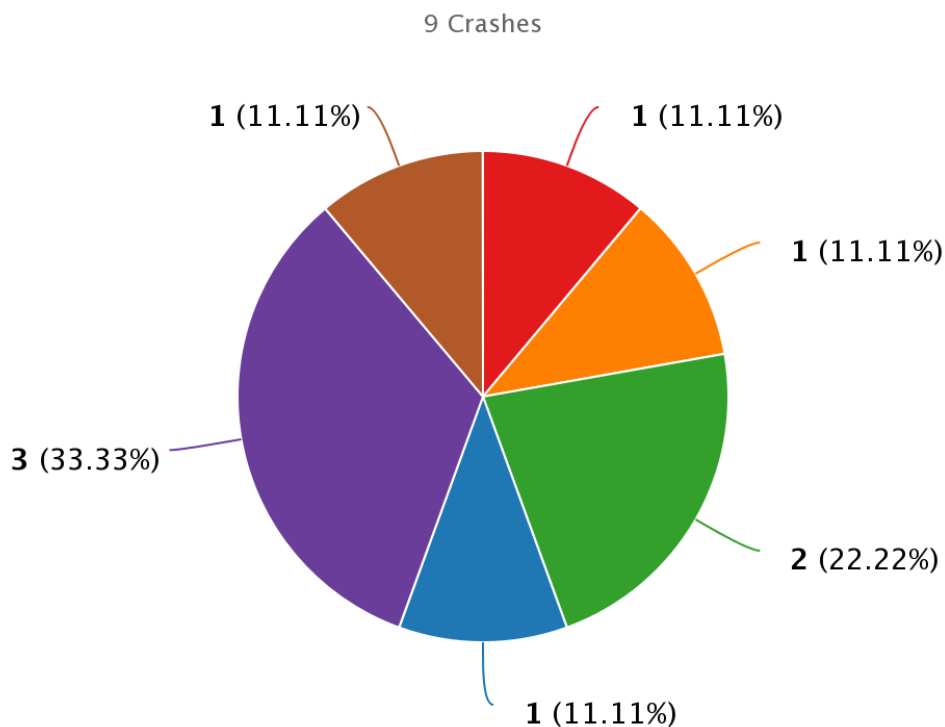


Figure 2-5: City of Fort Bragg, January 2017 to December 2021, Number of Bicycle Crashes per Day of Week, per Time

One crash occurred due to unsafe speed and two were due to bicycling on the wrong side of the street. Three crashes were due to violation of motorist right of way. The following chart and table depict all the Primary Collision Factors (PCF).

Number of Crashes by PCF Violation



PCF Violation

- 00 - Unknown
- 05 - Wrong Side of Road
- 09 - Automobile Right of Way
- 03 - Unsafe Speed
- 08 - Improper Turning
- 12 - Traffic Signals and Signs

PCF Violation	Count	%
00 - Unknown	1	11.11%
03 - Unsafe Speed	1	11.11%
05 - Wrong Side of Road	2	22.22%
08 - Improper Turning	1	11.11%
09 - Automobile Right of Way	3	33.33%
12 - Traffic Signals and Signs	1	11.11%

Figure 2-6: City of Fort Bragg, January 2017 to December 2021, Number of Bicycle Crashes by PCF Violation

The type of information provided above was obtained from SafeTREC's TIMS (<https://tims.berkeley.edu/>) can help the enforcement department in decision-making regarding their enforcement efforts.

2.2 Street Story

The Street Story program (<https://streetstory.berkeley.edu/>) is a relatively new tool developed by UC Berkeley's Safe Transportation Research and Education Center (SafeTREC) with OTS support. Street Story is a community engagement tool that allows residents, community groups and agencies to collect information about transportation crashes, near-misses, general hazards, and safe locations to travel. To promote access to the tool, SafeTREC conducts technical assistance sessions with communities and organizations on using Street Story. Street Story is free to use and publicly accessible.

Street Story features a survey where people can record travel experiences. Once a record has been entered, the information is publicly accessible on the website with maps and tables that can be downloaded.

It is suggested that City staff use this free tool to collect information from their residents for local needs assessments, transportation safety planning efforts, safety programs and project proposals.

3. Benchmarking Analysis Results and Suggestions

3.1 Benchmarking Analysis of Policies, Programs, and Practices

To assess pedestrian and bicycle safety conditions in the City of Fort Bragg, the CSSA team conducted a benchmarking survey to understand how the City’s existing conditions compared to current national best practices including consistency with the Safe System approach as shown in here. Through a holistic view of first anticipating human mistakes and keeping impact energy levels on the human body at tolerable levels, the Safe System approach aims to eliminate fatal and serious injuries for all road users.¹ The City staff responses to the survey questions were analyzed with a benchmarking matrix, as shown in Table 3-1, which lists the benchmarking topics that fall under the following categories:



The Safe System Approach
Source: Fehr & Peers for FHWA

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

The CSSA team also reviewed the local agency’s website and relevant documents. The CSSA team identified the local agency’s pedestrian and bicycle policies, programs, and practices and categorized these into three groups:

- Key strengths (areas where the City is exceeding national best practices)
- Enhancement areas (areas where the City is meeting national best practices)
- Opportunity areas (areas where the City appears not to meet national best practices)

¹ https://safety.fhwa.dot.gov/zerodeaths/docs/FHWA_SafeSystem_Brochure_V9_508_200717.pdf

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

Based on the City staff's responses to the questionnaire, each topic receives one of those three ratings. This analysis shares information on current national best practices and how the City compares.

The items in Table 3-1 are further elaborated in the following sections, which provide a description for each benchmarking topic. The topics incorporate the Safe System 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 with best practice benchmarks are also noted; the Local Agency could consider implementing as they determine is appropriate.

**TABLE 3-1: SUMMARY OF PROGRAMS, POLICIES, AND PRACTICES
 BENCHMARKING ANALYSIS FOR THE CITY OF FORT BRAGG**

Benchmark Topic	Key Strength	Enhancement	Opportunity
Enhancing Safety through Accessibility			
Safe Road Users, Safe Roads			
Implementation of Americans with Disabilities Act (ADA) Improvements	Uses state-of-the- practice (PROWAG) 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
ADA Transition Plan for Streets and Sidewalks	Has 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
Ensure Safety for All Users is Prioritized, and Accessibility Maintained, During Construction and Road Maintenance Projects	Has a policy in place that details how to maintain accessibility and provide designated space for people biking and walking through a Construction Management Plan (CMP)	Occasionally requires a CMP or has outdated CMP guidelines	No CMP guidelines
Policies and Programs			
Safe Road Users, Safe Roads, Safe Vehicles			
Roadway Safety Coordinator	Has a Roadway Safety Coordinator on staff who manages the agency's pedestrian and bicycle programs (e.g. Complete Streets Program and/or Vision Zero Program) and helps with capacity building of staff	Occasionally uses a part-time contract coordinator	Does not have a Roadway Safety Coordinator
Formal 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: Local Agency's Planning Commission may act as Transportation Advisory Committee	Does not have a Transportation Advisory Committee

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 BENCHMARKING ANALYSIS FOR THE CITY OF FORT BRAGG**

Benchmark Topic	Key Strength	Enhancement	Opportunity
Equitable Community Engagement Strategy that Includes Community Based Organization (CBO) Involvement	Has an equity-focused public engagement strategy and, along with a local CBO, creates opportunities for public engagement on walking and biking topics through a variety of community-specific formats (e.g. venues, times of day, languages). Community engagement is an ongoing process and does not only happen during the duration of the project, but also leading up to and after the project is completed (e.g. 311 app).	Has an equitable public outreach strategy, but formal community engagement events happen on a project-by project basis and/or without CBO partnerships.	Does not have a formal public involvement or feedback process for bicycle/pedestrian planning or safety
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	Does not have a traffic calming program funding and implementation of countermeasures are ad-hoc and reactive
Speed Limit Setting	Regularly surveys speed and identifies locations with high deviation from target speeds. Agency uses best practices for speed management in combination with allowances from AB 43 to lower speed limits. Implementing lower speed limits is done using a consistent approach that prioritizes areas with historic under investment. https://leginfo.ca.gov/faces/billNavClient.xhtml?bill_id=202120220AB43	Seeks to include 15 mph speed limits in school zones or commercial corridors.	Prima facie speed limit for all City maintained roads
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 community-wide Safe Routes to Schools program	Does not have a Safe Routes to Schools program and has not obtained recent funding. Funding last received in 2015
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 consider risk exposure.	Reactively implements Proven Safety Countermeasures at signalized intersections	Does not routinely implement proven safety countermeasures (LPs, protected left turns, roundabouts, medians, countdown signals, etc.) at signalized intersections. City maintains no signalized intersections, All on Caltrans ROW.

**TABLE 3-1: SUMMARY OF PROGRAMS, POLICIES, AND PRACTICES
 BENCHMARKING ANALYSIS FOR THE CITY OF FORT BRAGG**

Benchmark Topic	Key Strength	Enhancement	Opportunity
Systemic Enhancements for 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 reactively to implementing Proven Safety Countermeasures City's Traffic Committee reviews and considers installation of crosswalks on a case-by case base in accordance with the Traffic Committee Handbook.	Does not have a policy or set practices for addressing crosswalk installation or enhancements using Proven Safety Countermeasures
Safety-focused Curbside Management	Has curbside management policy in place that prioritizes pedestrian and bicyclist safety, and provides driver education programs for fleet drivers	Has a curbside management program in place, but without a focus on safety	No curbside management program or policies in place
Policies Supporting Micromobility	Has micromobility policy in place that prioritizes low stress facilities in areas with micromobility use (e.g. downtown areas) and speed regulators in geofenced locations. Micromobility is built into network planning and design for all projects with retail or in urban space	Requirements for micromobility are noted on a project-by-project basis	No micromobility policies are in place
Connected and Automated Vehicle (CAV) Readiness	Has policy that strategizes preparation to meet and address oncoming challenges posed by CAV technology. As CAV technology is deployed, it is imperative to have strategies in place that discuss the interface between technology and human road users, the role of smart infrastructure, and the need for physical separation of AVs and vulnerable road users	Has EV charging policy and curbside management guidance, but not a full CAV readiness plan	No policy around CAV readiness
Heavy Vehicle Fleets and Truck Routing	Has policy that identifies various future fleet incorporation and funding (e.g. research on what type of fleet (Hydrogen Fuel Cell vs. Electric) best fits the agency) as well as identification of routes within City boundaries dedicated to buses, trucks, and other heavy vehicles. Identifying specific truck routes allows for parallel routes that can be identified as pedestrian and bicycle corridors	Has future fleet incorporation identified, but does not have a robust Heavy Vehicle and Truck Routing plan	No policy around future fleets and truck routing

**TABLE 3-1: SUMMARY OF PROGRAMS, POLICIES, AND PRACTICES
 BENCHMARKING ANALYSIS FOR THE CITY OF FORT BRAGG**

Benchmark Topic	Key Strength	Enhancement	Opportunity
Public Advertisements Supporting Safety Culture	Regularly runs culturally relevant and accessible education campaigns and outreach through various communication tools (e.g. bus and bus shelter ads, radio, social media)	Culturally relevant and accessible education campaigns occur on a project-by-project basis	Does not implement culturally relevant and accessible education campaigns
Safety Implementation Plans and Policies			
Safe Road Users, Safe Roads, Safe Vehicles			
Adopted Safety Plan	Has an approved Local Road Safety Plan (LRSP) or other Caltrans-approved safety report that identifies funding sources and prioritization of projects within underserved communities. Safety upgrades are noted on the agency's High-Injury Network (HIN) and tied into repaving projects, CIP updates, etc.	Has received funding for a Safety Plan, which is underway and not yet adopted. Receives grant funding and/or developer fees, but projects are not tied to the High Injury Network or underserved communities	Does not have an LRSP or other Caltrans-approved Safety Plan. Moderately successful in obtaining grant funding or has trouble spending funds when given grants. Or unable to secure grants
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
Safety Data Collection and Assessment			
Safe Road Users			
Collection of Pedestrian and Bicyclist Volumes	Collects pedestrian and bicyclist volumes routinely with intersection counts and has a GIS database of counts. 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
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

**TABLE 3-1: SUMMARY OF PROGRAMS, POLICIES, AND PRACTICES
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Benchmark Topic	Key Strength	Enhancement	Opportunity
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
Traffic Control Audit (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
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
Surrogate Safety Measures for Proactive Monitoring	To inform safety projects, agency uses community feedback tools such as Street Story and innovative data collection techniques such as hard breaking, speed, and near miss data	Uses surrogate safety measures on a project-by-project basis	Does not use surrogate safety measures as part of data collection and assessment process
Updated 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
Pedestrian and Bicycle Network Planning and Design			
Safe Road Users, Safe Roads			
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
Active Transportation Plans	Has a recently-updated Active Transportation Plan (or similar) with 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
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

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 BENCHMARKING ANALYSIS FOR THE CITY OF FORT BRAGG**

Benchmark Topic	Key Strength	Enhancement	Opportunity
Existing pedestrian facilities	Existing pedestrian facilities includes low stress facilities, 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
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
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). Plan also identifies additional proven countermeasures to be implemented as part of the project	Treatments are implemented on a project-by-project basis
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
Roadway Surfaces for Bicycle Facilities	Roadway resurfacing projects and debris removal are prioritized for bicycle routes.	Roadway surface is acceptable on bicycle routes and routine maintenance, including debris removal, occurs.	Roadway surface conditions are poor on some bicycle facilities and maintenance is not prioritized for bicycle facilities
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
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
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

**TABLE 3-1: SUMMARY OF PROGRAMS, POLICIES, AND PRACTICES
 BENCHMARKING ANALYSIS FOR THE CITY OF FORT BRAGG**

Benchmark Topic	Key Strength	Enhancement	Opportunity
Sidewalk furniture or other sidewalk zone policies	Design standards require implementation of the sidewalk zone system. Does not allow apron parking or attached (unbuffered) sidewalks anywhere.	Design standards require implementation of the sidewalk zone system in some districts (e.g., CBD, neighborhood commercial, etc.).	There are no design standards requiring implementation of the sidewalk zone system.
Pedestrian and Bicycle Support Program			
Safe Road Users, Safe Speeds, Safe Roads, Post-Crash Care			
Street Tree Requirements	Has a street tree ordinance that improves pedestrian safety and access. The ordinance includes details on debris maintenance and actions to take when sidewalk buckling occurs	Has a street tree ordinance, but it does not improve pedestrian safety or access	Does not have a street tree ordinance
Bicycling Supportive Amenities and Wayfinding	Bicycle supportive amenities (parking, routing/wayfinding, water fountains, repair stations) are found community-wide	Some bicycle supportive amenities are found in key areas	Bicyclist supportive amenities are not provided in the community
Bicycle Parking Requirements	A bicycle parking ordinance is enforced for all development and a program is in place to install and maintain public bike parking in existing development	A bicycle ordinance for off-street parking is in place but no requirement exists to install parking for existing development	No bike parking ordinance or program in place
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 diverse 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
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)
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
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

**TABLE 3-1: SUMMARY OF PROGRAMS, POLICIES, AND PRACTICES
 BENCHMARKING ANALYSIS FOR THE CITY OF FORT BRAGG**

Benchmark Topic	Key Strength	Enhancement	Opportunity
General Plan: Provision for Pedestrian and Bicycle Nodes	Pedestrian and bicycle nodes are identified and pedestrian-oriented policies are in place for these nodes	Pedestrian and bicycle nodes are identified, but pedestrian and bicycle accommodations are not	Pedestrian and bicycle nodes are not identified
General Plan: Safety Element	On safety evacuation routes, agencies should identify creative solutions on how to evacuate residents safely and efficiently while maintaining and implementing low stress pedestrian and bicycle facilities	Safety Element does not identify the need to maintain low stress facilities and produce creative solutions that does not prohibit the implementation of low-stress facilities on evacuation routes	Safety Element does not mention pedestrian and bicycle facilities on evacuation routes
Bike Ordinances (Sidewalk Riding)	Local ordinances allow for context-specific flexibility in sidewalk riding policies and enforcement (e.g. is there an adjacent bike facility?)	Local ordinance does not include section on sidewalk riding	Ordinances mandate that bikes are not allowed on sidewalks under any circumstances
Vehicle Miles Traveled (VMT) Mitigation Strategies	Not Formally adopted, but written with MCOG-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
General Plan: Densities and Mixed-Use Zones	Has moderate to high densities in the CBD and mixed-use zones and progressive parking policies, and transportation impact analysis for new development prioritizes safety	Has moderate densities with separate uses; transportation impact analysis considers safety	Has low densities with separate uses; transportation impact analysis relies on LOS
Specific Plans, Overlay Zones, and Other Area Plans	Bicyclist and pedestrian-oriented design, walkability, or placemaking is stressed in the plans	Plans require bicycle and pedestrian accommodations, and placemaking	Plans do not address bicyclist or pedestrian needs or do not exist
Historic Sites	Cultural and historic preservation plans include a wayfinding, bicycle, and walkability focus	Historic areas have been identified, and pedestrian and bicycle access are addressed	No plan is in place, and little consideration is given for pedestrian and bicycle access in historic areas
Economic Vitality	Has several business improvement districts, an established façade improvement program, and progressive downtown parking policies	Has a business improvement district, façade improvement program, or downtown parking policies	Does not have business improvement districts, a façade improvement program, or downtown parking policies

**TABLE 3-1: SUMMARY OF PROGRAMS, POLICIES, AND PRACTICES
 BENCHMARKING ANALYSIS FOR THE CITY OF FORT BRAGG**

Benchmark Topic	Key Strength	Enhancement	Opportunity
Post-Crash Care	Agency has an adopted LRSP or Caltrans-approved Safety Plan that identifies the importance of post-crash care and how the agency will implement identified countermeasures; this includes resources for medical rehabilitation, on-going advocacy group engagement (i.e. Mothers Against Drunk Driving, Families for Safe Streets), and resources for the adjudication process to ensure offenders receive proper sentencing and treatment	The adopted LRSP or Caltrans-approved Safety Plan is vague or does not include an Action Plan that identifies countermeasure implementation	The adopted LRSP or Caltrans-approved Safety Plan does not include action items and implementation strategies surrounding post-crash care
Proactive Approach to Institutional Coordination	Has identified obstacles and proactive coordination with advocacy groups and public health services where multiple facility owners (such as Caltrans or school districts) are involved, and has implemented efforts to overcome barriers	Has reactive coordination with advocacy groups and public health services with facility owners	Projects requiring cross-jurisdictional coordination are rarely coordinated and implemented
Coordination with Emergency Response	Emergency response engages 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 engages in some aspects of bicycle/pedestrian facility planning and design	Emergency response is not involved in bicycle/pedestrian facility planning and design
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
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

Implementation of Americans with Disabilities Act (ADA) Improvements (Enhancement)

Implementation of ADA improvements is key to making walking accessible and safe for everyone, regardless of ability or age.

The City of Fort Bragg has clear design guidelines but no regular practices for ADA compliance.

Suggestions for Potential Improvement

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

ADA Transition Plan for Streets and Sidewalks (Enhancement)

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 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.

The City has a partial or outdated ADA transition plan or an ADA coordinator.

Suggestions for Potential Improvement

- Consider prioritizing sub-areas within the City that exhibit 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 engineering staff at all levels.

Ensure Safety for All Users is Prioritized, and Accessibility Maintained, During Construction and Road Maintenance Projects (Key Strength)

It is vital to ensure that dedicated space is maintained for vulnerable users during construction and road maintenance projects.

The City has a policy in place that details how to maintain accessibility and provide designated space for people biking and walking through a Construction Management Plan (CMP) and has practices related to the installation of ADA improvements such as directional curb ramps and high-contrast truncated domes.

Suggestions for Potential Improvement

- Create a policy that details how to maintain accessibility and provide designated space for pedestrians and bicyclists through a Construction Management Plan (CMP)
- Cities that have created a CMP include:
 - <http://www2.oaklandnet.com/oakca1/groups/pwa/documents/memorandum/oakO62315.pdf>

Roadway Safety Coordinator (Opportunity)

A roadway safety coordinator provides guidance for pedestrian/bicycle planning efforts and oversees implementation of programs and helps with capacity building of staff. In a sampling of pedestrian-oriented California cities, a common denominator among cities (with a population over 100,000) is a full-time pedestrian/bicycle coordinator.

The City does not have a Roadway Safety Coordinator.

Suggestion for Potential Improvement

- Include dedicated time for the pedestrian and bicycle staff person to write grants for both capital projects and ongoing funding for walking and biking related programs and optics as well as to liaison with local non-profit, advocacy groups, and schools.

Formal Advisory Committee (Key Strength)

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 to a conventional approach of reacting to crashes.

The City 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. The City also has staff TAC member of the Mendocino Council of Governments (MCOG) who focuses mainly on transportation planning throughout the County and other committees may be formed as needed.

Equitable Community Engagement Strategy that Includes Community Based Organization (CBO) Involvement (Enhancement)

Having multiple touch points with the community creates transparency and open lines of communication between the Local Agency staff, residents, and businesses. Various kinds of formats and venues for public involvement and feedback allows for broader participation from the community. Consideration of local demographics (e.g. languages spoken) and the easiest formats for people to participate (e.g. online, in person but in the course of their daily activities, or at Local Agency-organized meetings) are important for meaningful and productive community dialogue.

Community engagement is an on-going process and does not only happen during the duration of the project, but also leading up to and after the project is completed.

The City has an equitable public outreach strategy, but formal community engagement events happen on a project-by project basis and/or without CBO partnerships.

Suggestion for Potential Improvement

- Add “safety” or bicycle and pedestrian specific issues as the “work type” when people place a pin in 311 for easy coding and understanding of issues.
- Provide quarterly or annual updates to the community on the “state of walking and biking,” including recently completed projects, anticipated timeline for upcoming projects, and what the Local Agency plans to fund.
- Provide notices and interpretation in the most commonly spoken languages.
- Agencies that have an equitable community engagement strategy:
 - LA DOT Livable Streets: <https://ladotlivablestreets.org/content-detail/Dignity-Infused-Community-Engagement-Strategy#:~:text=The%20Vision%20Zero%20Dignity%2DInfused,into%2othe%2otechnical%2oplanning%2oprocess>

Traffic Calming or Speed Management Program (Opportunity)

Traffic calming programs and policies set forth a consensus threshold on neighborhood requests and approvals, as well as standard treatments and criteria.

The City does not have a traffic calming program funding and implementation of countermeasures are ad-hoc and reactive.

Suggestion for Potential Improvement

- Increase the amount of dedicated funding available for traffic calming each year.
- Expand the Local Agency’s traffic calming toolbox to include other tools, such as raised crosswalks, raised intersections, chicanes, and traffic diverters. The Local Agency should review their speed management program annually alongside the CIP project list to identify major arterials and neighborhood corridors to include proactive speed management.
- Expand the Local Agency’s practices to include proactive traffic calming measures instead of only responding to community requests. The Local Agency 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.
- Refer to the following resources for traffic calming best practices:
 - www.trafficcalming.org
 - Traffic Calming Guidelines from the City of Danville (<https://www.danville.ca.gov/DocumentCenter/View/139/NTMP-Guidelines-Booklet-PDF>)
 - Neighborhood Traffic Management Program from the City of Anaheim (<https://www.anaheim.net/2841/NTMP3>)
 - ITE Technical Resources – Traffic Calming Measures: (<https://www.ite.org/technical-resources/traffic-calming/traffic-calming-measures/>)

Speed Limit Settings (Opportunity)

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

The City uses prima facie speed limit for all City maintained roads.

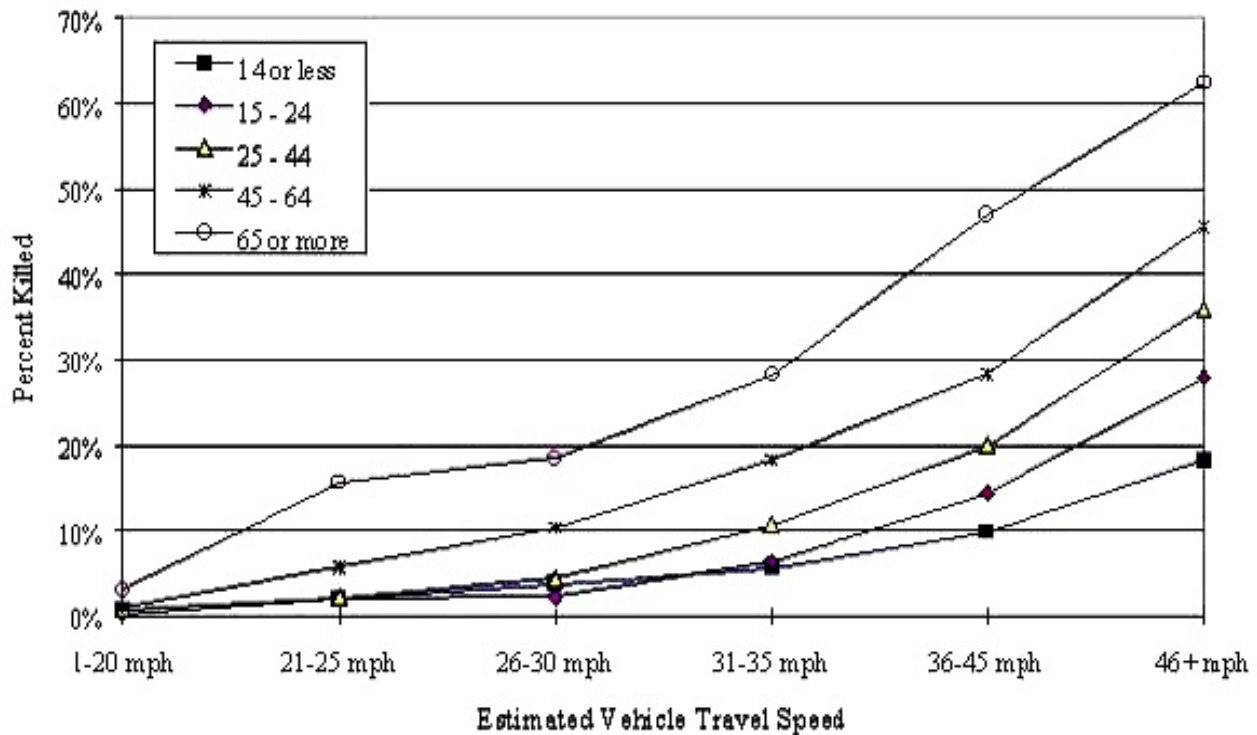


Figure 3-1: Relationship between Vehicle Speed, Victim Age, and Fatalities

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 improvements are installed, conduct off-cycle speed surveys to review the speed limit and see if 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 can be found here:
 - https://leginfo.ca.gov/faces/billNavClient.xhtml?bill_id=202120220AB43
 - San Francisco's Speed Limit Setting in Business Districts: <https://sfmayor.org/article/san-francisco-lowers-speed-limits-targeted-business-districts-under-new-state-law>

Safe Routes to Schools (Opportunity)

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 www.saferoutestoschools.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).

The City does not have a Safe Routes to Schools program and has not obtained recent funding. Funding was last received in 2015.

Suggestion for Potential Improvement

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

Systemic Signalized and Unsignalized Intersection Enhancements (Opportunity)

Has a formal policy for systemic signalized intersection enhancements that follows a Safe System-based framework and proactively implements FHWA's Proven Safety Countermeasures to manage speed and crash angles and considers risk exposure.

The City maintains no signalized intersections, all are on Caltrans ROW. The City's Traffic Committee reviews and considers installation of crosswalks on a case-by-case base in accordance with the Traffic Committee Handbook.

Suggestion for Potential Improvement

- Develop a City or County-wide crosswalk policy for the installation, removal, and enhancement of crosswalks at controlled and uncontrolled location. 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 Safe System-Based Framework and Analytical Methodology for Assessing Intersections:
<https://safety.fhwa.dot.gov/intersection/ssi/fhwas21008.pdf>
- Federal Highway Administration Proven Safety Countermeasures
<https://safety.fhwa.dot.gov/provencountermeasures/>
- Federal Highway Administration STEP Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations:
https://safety.fhwa.dot.gov/ped_bike/step/docs/STEP_Guide_for_Improving_Ped_Safety_at_Unsig_Loc_3-2018_07_17-508compliant.pdf
- National Cooperative Highway Research Program Application of Pedestrian Crossing Treatments for Streets and Highways: <http://www.trb.org/Publications/Blurbs/175419.aspx>

Safety-focused Curbside Management Opportunity)

Shared mobility services are transportation services – typically offered by private companies – that offer ride-hail services (e.g. Lyft or Uber) for both solo and pooled trips, bike share, and scooter share. Policies for shared mobility services can allow agencies to encourage, prohibit, or direct how they want shared mobility to work in their agency. They can allow for curb space management, clear organization of sidewalk space, and encourage (or discourage) private vendors to come to the City/County. Curb space management is a practice that requires curb access to be planned, designed, operated, and maintained to enable curb utilization with safe, convenient, and multimodal access for all transportation users and provides driver education programs for fleet drivers.

The City has no curbside management program or policies in place.

Suggestion for Potential Improvement

- Adopt a curb management plan to designate how the Local Agency will prioritize and proactive plan for curb uses (e.g. parking, passenger loading, commercial loading, ADA loading and parking, bicycle parking, bus-only lanes) and to make sure that the curb has the highest and best use of space.
- Consider micro-mobility policies (e.g. permitting, enforcement) in place to prioritize pedestrian and bicyclist safety and keep the sidewalk organized and usable for people of all abilities.
- Curbside management policy and education resources:
 - NYC Vision Zero Education:
<https://www1.nyc.gov/content/visionzero/pages/education>
 - NYC Vision Zero Outreach:
<https://www1.nyc.gov/site/tlc/about/tlc-vision-zero-outreach.page>
 - NYC Vision Zero Safety Toolkit for Trucks:
<https://www1.nyc.gov/content/visionzero/pages/trucks>

Policies Supporting Micromobility (Opportunity)

Micromobility should prioritize low-stress facilities in areas with high micromobility use and built into network planning and design for all projects with retail or in urban space.

The City has no shared micromobility policies in place.

Suggestions for Potential Improvement

- Create a micromobility policy and implement speed regulators in geofenced locations
- NACTO Resources include: https://nacto.org/wp-content/uploads/2019/09/NACTO_Shared_Micromobility_Guidelines_Web.pdf

Connected and Automated Vehicle (CAV) Readiness (Opportunity)

As CAV technology is deployed, strategies and readiness to discuss the interface between technology and human road users, the role of smart infrastructure, and the need for physical separation of AVs and vulnerable road users.

The City has no policy around C/AV readiness.

Suggestions for Potential Improvement

- Create a policy that strategizes the oncoming challenges posed by CAV technology
- FHWA Resources include: <https://www.fhwa.dot.gov/policy/otps/policyanalysis.cfm>

Heavy Vehicle Fleets and Truck Routing (Opportunity)

As the conversation around heavy vehicle fleets and truck routings are changing, local jurisdictions must be prepared to identify incorporation of these fleets along with funding. Identifying dedicated routes or boundaries within City/County boundaries allows for parallel routes of pedestrian and bicycle corridors.

The City has no policy around future fleets and truck routing.

Suggestions for Potential Improvement

- Create a policy that identifies future fleet incorporating, funding, and dedicated routes for daily use

Public Advertisements Supporting Safety Culture (Enhancement)

Culturally relevant and accessible education campaigns and outreach should occur regularly and on various platforms.

In Fort Bragg, culturally relevant and accessible education campaigns occur on a project-by-project basis.

Additional resources on successful safety culture campaigns can be found below:

- Stick to the Limits San Francisco: <https://www.sticktothelimitsf.org/>

Adopted Safety Plan (Key Strength)

A Local Road Safety Plan (LRSP) or Caltrans-approved safety report identifies dedicated, annual funding stream for bicycle and pedestrian projects within underserved communities. Bicycle and pedestrian projects can also be integrated in the other work that the Local Agency does, including repaving and other routine maintenance of the roadway network.

The City has an approved LRSP or other Caltrans-approved safety report that identifies funding sources and prioritization of projects within underserved communities. Safety upgrades are noted on the agency's High-Injury Network (HIN) and tied into repaving projects, CIP updates, etc.

Dedicated Annual Funding Stream:

- General City Funds
- Local and regional impact fees
- Local tax measure funds

Apply for Grants:

- Surface Transportation Program Funding
- Highway Safety Improvement Program (HSIP)
- Active Transportation Program (ATP)
- Safe Routes to School Grant (SRTS)

Suggestion 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.

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.

The City does not have a safe system policy.

Collection of Pedestrian and Bicyclist Volumes (Enhancement)

Pedestrian and bicyclist volume data, along with a GIS database, is important for understand where people walk and bike. This establishes baseline data prior to project implementation and can help prioritize projects, develop crash rates, and determine appropriate bicycle and pedestrian

infrastructure. The database helps to identify patterns and needs of underserved communities in local jurisdictions policies and programs.

The City 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.

Suggestions for Potential Improvement

- Routinely collect pedestrian and bicycle volumes by requiring them to be counted in conjunction with manual intersection turning movement counts.
https://mtc.ca.gov/sites/default/files/4_AOC_Tech_Transfer_Seminar_Banner_06032013.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.

Inventory of Bikeways, Parking, Informal Pathways, and Key Bicycle Opportunity Areas (Enhancement)

The City has a partial, static inventory of missing facilities and opportunity areas through Bike, Pedestrian, or Active Transportation Plans.

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.

Inventory of Sidewalks, Informal Pathways, and Key Pedestrian Opportunity Areas (Opportunity)

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

The City does not have an inventory of missing sidewalks, crosswalks, informal pathways, or pedestrian opportunity areas.

Suggestion for Potential Improvement

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

Traffic Control Audit (Signs, Markings, and Signals) (Enhancement)

Cities have a wide variety of traffic control devices that regulate how bicyclist and pedestrians should use the street and interact safely with drivers. However, some cities do not have inventories how, when, and where this is installed. Creating a database of this information allows the City's staff to know where infrastructure may be out of date or in needed of updates. For example, countdown signals are 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. Likewise, the CA MUTCD also requires installation of bike detection at all actuated signals. Bike detection is a basic building block of the bike network to make sure that bikes can trigger the traffic signal. Inventorying bike detection and countdown signals allows the Local Agency's staff to approach safety from a systems perspective and develop projects to close gaps in biking and walking infrastructure over time.

The City has some GIS-based inventories of signs, markings, other countermeasures, and signals.

Suggestion for Potential Improvement

- Develop a City wide crosswalk inventory in GIS and maintain it over time. This would allow for a systemic safety approach to enhancing crosswalks, and allow the Local Agency to prioritize all crosswalk enhancement projects City or County wide 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 database inventory of signs, markings, and signals.
- Develop a proactive monitoring program for ensuring the quality and proper functioning of traffic control devices.

Crash History and Crash Reporting Practices (Opportunity)

Safety is typically approach 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 system wide basis. This is often paired with a policy goal of getting to zero fatality or severe injury crash (commonly referred to as "Vision Zero").

The City does not have set practices for data review.

The City also has an LRSP that identifies routine data collection and assessment. Prioritized project list is updated based on crash data assessment.

The City uses crossroads crash data, local data from Police Services or similar (not TIMS/SWITRS), and require crash data be included in Transportation Impact Assessments.

Suggestion 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 Local Agency's commitment to reducing the number of traffic-related fatalities and severe injuries to zero.
- Additionally, with sufficient pedestrian volume data, the Local Agency could prioritize crash locations based on crash rates (i.e., crashes/daily pedestrian volume), a practice that results in a more complete safety needs assessment. Treatments could then be identified for each location and programmatic funding allocated in the Local Agency's Capital Improvements Program (CIP).
 - The City of Sacramento's Pedestrian Master Plan includes a section on how to prioritize locations based on crash rates:
<http://www.cityofsacramento.org/transportation/engineering/publications.html>

Surrogate Safety Measures for Proactive Monitoring (Opportunity)

Innovative data collection techniques such as hard breaking, 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.

The City does not use surrogate safety measures as part of data collection and assessment process.

- <https://safetrec.berkeley.edu/tools/street-story-platform-community-engagement>

Complete Streets Policy (Opportunity)

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

The City does not have a Complete Streets policy.

Suggestion for Potential Improvement

- 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:
<http://bostoncompletestreets.org/about/>
 - Philadelphia, Pennsylvania, Philly Free Streets:
<http://www.phillyfreestreets.com/>
 - Baltimore, Maryland, Complete Streets Ordinance:
<https://transportation.baltimorecity.gov/completestreets>
 - South Bend, Indiana, Complete Streets Policy:
<https://www.smartgrowthamerica.org/app/legacy/documents/cs/policy/cs-in-south-bend-resolution.pdf>

- Town of Ashland, Massachusetts, Complete Streets Policy:
<https://www.smartgrowthamerica.org/app/legacy/documents/cs/policy/cs-ma-ashland-policy.pdf>

Active Transportation Plan (Opportunity)

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 Plan(s) documents 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.

The City has a Pedestrian and/or Bicycle Master Plan but it may be outdated and/or no recent projects from the Plan have been completed.

Suggestion 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 improvement.

Existing Bike Network (Enhancement)

Innovative features such as protected bikeways, bike boulevards, and protected intersections citywide or countywide can decrease the level of traffic stress experienced by bicyclists, make biking more comfortable, and – in so doing - 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 for 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.

The City's existing bike network primarily includes Class I, II, and III facilities. There are gaps within the bike network and facilities do not accommodate all users.

Suggestion 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 network.
- Create a GIS data for existing bike network to identify gaps and opportunities for improvements.

Existing Pedestrian Facilities (Enhancement)

The City's existing pedestrian facilities includes low stress facilities and frequent crosswalks, and roadways are primarily two-to-four lane roads. The City has the following pedestrian components: reduced corner radii, corner bulbs, directional curb ramps with truncated dome, raised crosswalks, speed tables, pedestrian refuge islands, advanced yield lines, advanced stop bar, and restricted parking at corners to increase visibility of crossing.

Suggestion 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.

Bike and Pedestrian Network Implementation Practices (Enhancement)

Considering the safety and comfort of people walking and biking leads to better projects that can encourage new walking and 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.

In Fort Bragg, spot locations have been identified through a safety plan for a low stress network for bicycles. The plan identifies additional proven countermeasures to be implemented as part of the projects. For pedestrian network implementation practices, treatments are implemented on a project-by-project basis.

Suggestion for Potential Improvement:

- Prioritize bicycle projects to align with roadway resurfacing and projects that are near school sites.
- Identify pedestrian priority areas and have a policy in place around 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.
- Prioritize use of LTS to strategically implement bikeways and traffic calming treatments that would improve LTS of existing bikeways.

Design Guidelines and Standards (Opportunity)

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

The City's local standards reference national best practices, but are static or out of date, with minimal customized design policies for pedestrian and bicycle accommodations. The City uses NACTO Urban

Bikeway Design Guide, NACTO Urban Street Design Guide, FHWA Separated Bike Lane Planning and Design Guide, Caltrans DIB 89 Class IV Bikeway Guidance and CA MUTCD and the Highway Design Manual when making design decisions.

Suggestion for Potential Improvement

- Continue adopting national bicycle and pedestrian safety best practices for roadway and facility design guidelines and standards:
 - NACTO Urban Street Design Guide:
<http://www.nyc.gov/html/dot/downloads/pdf/2012-nacto-urban-street-design-guide.pdf>
 - CROW Design Manual for Bicycle Traffic
 - FHWA Separated Bike Lane Planning and Design Guide
https://nacto.org/wp-content/uploads/2016/05/2-4_FHWA-Separated-Bike-Lane-Guide-ch-5_2014.pdf
 - MassDOT Separated Bike Lane Planning & Design Guide
<https://www.mass.gov/lists/separated-bike-lane-planning-design-guide>
 - ITE Recommended Practice for Accommodating Pedestrians and Bicyclists at Interchanges
 - AASHTO Guide for the Development of Bicycle Facilities
https://nacto.org/wp-content/uploads/2015/04/AASHTO_Bicycle-Facilities-Guide_2012-toc.pdf
 - AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities:
https://transops.s3.amazonaws.com/uploaded_files/Update%20of%20the%20AASHTO%20Guide%20for%20the%20Planning%20Design%20and%20Operation%20of%20Pedestrian%20Facilities.pdf

Roadway Surfaces for Bicycle Facilities (Enhancement)

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.

The City's roadways' surface is acceptable on bicycle routes and routine maintenance, including debris removal, occurs.

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 needs 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.

Attention to Bicycle and Pedestrian Crossing Barriers (Opportunity)

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 elevated level of exposure. Identifying and removing barriers and preventing new barriers is essential for improving bicyclist safety and access. Crossing barriers 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.

The bike treatments are not installed at intersections or through interchanges. The City has no policy, but has identified some barriers and taken steps to improve pedestrian access.

The City uses the following crossing treatments at uncontrolled crossings: high visibility crosswalk striping and restricting parking at crosswalk to increase visibility of crossing.

Suggestion for Potential Improvement:

- Use green routinely to highlight conflict zones at large intersection and interchanges. See Oakland's bicycle lane striping guidance for more information: <http://www2.oaklandnet.com/government/o/PWA/o/EC/s/BicycleandPedestrianProgram/OAKO24653>
- To slow speeds at critical intersections, use smaller corner radii using 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.
- Identify and create an inventory of pedestrian barriers with targeted recommendations for phased improvements.
- Consider pedestrian barriers and needs in doing bicycle barriers assessment.

Intersection Control Evaluation (Opportunity)

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.

The City uses MUTCD Warrants and/or does not have a practice of using Intersection Control Evaluations. All signalized intersections are within Caltrans ROW, and are not maintained by City.

Suggestion for Potential Improvement

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

Sidewalk Furniture or Other Sidewalk Zone Policies (Opportunity)

Street furniture encourages walking by accommodating pedestrians with benches to rest along the route or wait for transit; trash receptacles to maintain a clean environment; street trees for shade, and

so on. Uniform street furniture requirements also enhance the design of the pedestrian realm and may improve economic vitality.

In the City, there are no design standards requiring implementation of the sidewalk zone system.

Suggestion for Potential Improvement

- Adopt a Street Furniture Ordinance to include locations and furniture amenities other than those associated with transit stops, as appropriate.

Street Tree Requirements (Opportunity)

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.

Currently, the City does not have a street tree ordinance, but by request of the Council, one is in progress.

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 trees plantings associated with development projects.

Bicycling Supportive Amenities and Wayfinding (Key Strength)

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 navigating cyclists to facilities that have been enhanced for bicyclist use or to local retail opportunities for economic growth.

Bicycle supportive amenities (parking, routing/wayfinding, water fountains, repair stations) are found community-wide.

Suggestion for Potential Improvement:

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

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 as in the City of Oakland (see details at <http://www2.oaklandnet.com/Government/o/PWA/o/EC/s/BicycleandPedestrianProgram/OAKo24596>).

In the City, a bicycle parking ordinance is enforced for all development and a program is in place to install and maintain public bike parking in existing development.

Suggestion for Potential Improvement:

- Implement short-term and long-term, secured bicycle parking at all new development, consistent with the Bicycle and Pedestrian Master Plan and the APBP Bicycle Parking Guidelines, 2nd edition.
- Site 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/County (with a unique design or City/County’s symbol).

Pedestrian and Bicycle Safety Education Program (Opportunity)

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.

The City does not have pedestrian and bicycle safety education programs.

Suggestion for Potential Improvement

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

Enforcement (Enhancement)

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

The Police Department conducts some data-driven enforcement activities related to bicyclist and pedestrian safety.

Suggestion 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. The Miami-Dade Pedestrian Safety Demonstration Project provides a model for the role of media in the sustained effectiveness of

The 3-E’s of Pedestrian Safety:

Engineering

Education

Enforcement

enforcement. Information is available at:

http://www.miamidade.gov/MPO/docs/MPO_ped_safety_demo_eval_report_200806.pdf.

- Train officers in pedestrian safety enforcement principles. The Madison, Wisconsin Department of Transportation has developed a DVD in collaboration with the Madison Police Department to train traffic officers in pedestrian and bicycle issues (for more information see <http://www.walkinginfo.org/library/details.cfm?id=2865>). The Bicycle Transportation Alliance in Portland, Oregon offers Pedestrian Safety Enforcement Training (for more information on this five-hour course see: http://www.bta4bikes.org/at_work/pedestriangrants.php).
- 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. Radar gun check-out programs are available in Albany, Pleasanton, and Thousand Oaks, California, among other cities.

Pedestrian Walking Audit Program (Opportunity)

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

The City has no safety program, but has conducted walking audits sporadically.

Suggestion for Potential Improvement

- Include regular walking audits in City/County wide pedestrian safety program, based on the suggestions of this CSSA. This effort may complement other “green” or health-oriented programs within the Local Agency.

Bicycling Safety Audit Program (Opportunity)

When Local Agency staff and key stakeholders ride along study corridors and experience key route and crossing challenges and best practices, consensus is more readily reached on a vision and action plan for safety enhancements.

The City does not have bicycling safety audit programs.

Suggestion for Potential Improvement

- Include regular bicycling audits in the City/County wide bicycle safety programs. Encourage interdepartmental participation.
- Routinely conduct bicycle safety audits of key corridors throughout the City/County, 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.

General Plan: Provision for Pedestrian and Bicycle Nodes (Key Strength)

Planning principles contained in a local agency'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.

In the City, pedestrian and bicycle nodes are identified and pedestrian-oriented policies are in place for these nodes.

Suggestion 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.

General Plan: Safety Element (Opportunity)

SB 99 and AB 747 are legislation around 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.

The City's Safety Element of the General plan does not mention pedestrian and bicycle facilities on evacuation routes.

Bike Ordinances (Sidewalk Riding) (Opportunity)

The City's ordinances mandate that bikes are not allowed on sidewalks in certain districts and/or when signage exists indicating such.

Suggestion for Potential Improvement:

- Consider an optional helmet ordinance for adults.
- Consider allowing for context-specific flexibility in sidewalk riding policies and enforcement

Vehicle Miles Traveled (VMT) Mitigation Strategies (Opportunity)

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.

Not Formally adopted, but written with MCOG, the City has a VMT Mitigation Strategy that uses 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:
https://www.caleemod.com/documents/handbook/full_handbook.pdf

General Plan: Densities and Mixed-Use Zones

Planning principles contained in a local agency'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.

The City has low densities with separate uses; transportation impact analysis relies on LOS

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 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 is 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 with 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.

Specific Plans, Overlay Zones, and Other Area Plans (Key Strength)

Bicyclist and pedestrian-oriented design, walkability, or placemaking is stressed in the City's 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.

Historic Sites (Enhancement)

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

In the City, historic areas have been identified, and pedestrian and bicycle access are addressed.

Suggestion 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 Local Agency. 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 could also be provided throughout the Local Agency. Consider other areas of the City/County for walking tours and historic signs.
- Consider upgrading History Walk signs with larger text to improve legibility and wayfinding.

Economic Vitality (Enhancement and Opportunity)

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.

The City does not have business improvement districts, a facade improvement program, or downtown parking policies. Recent work to create one was completed last year and code enforcement actively engaged to work on facade improvement program. City has applied for grant funds for parking policy updates this year.



Sample store facades

Suggestion for Potential Improvement

- Activate the built environment in business areas through BIDs and facade 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.

Post-Crash Care (Opportunity)

An agency's adopted LRSP or Caltrans-approved Safety Plan should include resources for the agency to implement identified countermeasure for medical rehabilitation, on-going advocacy group engagement, and resources for the adjudication process to ensure offenders receive proper sentencing and treatment.

The City has an adopted LRSP or Caltrans-approved Safety Plan, but does not include action items and implementation strategies surrounding post-crash care.

Proactive Approach to Institutional Coordination (Enhancement and Opportunity)

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.

The City has reactive coordination with advocacy groups and public health services with facility owners. Projects requiring cross-jurisdictional coordination are rarely coordinated and implemented.

Suggestion for Potential Improvement

- Work with the 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.

Coordination with Emergency Response (Enhancement)

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 Local Agency and the respective departments. Consensus building could include pilot testing of alternative treatments, such as a model traffic circle in an open field.

In the City, emergency response engages in some aspects of bicycle/pedestrian facility planning and design.

Suggestion for Potential Improvement:

- Include the Fire Department early in the process as a stakeholder in the Williams Street and Bancroft Street separated bikeway projects to ensure access needs are accommodated.
- 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

Coordination with Health Agencies (Opportunity)

Involving non-traditional partners such as public health agencies, pediatricians, etc., in the planning or design of pedestrian and bicycle facilities may create opportunities to be more proactive with pedestrian and bicycle safety, identify pedestrian and bicycle safety challenges and education venues, and secure funding. Additionally, under-reporting 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.²

The health agencies in Fort Bragg are not involved in bicycle/pedestrian safety or active transportation.

² 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

Coordination with Transit Agencies (Enhancement)

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.

In the City, 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.

Suggestion for Potential Improvement:

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

4. Complete Streets Audit Results and Suggestions

Overview

This chapter presents the observations and recommendations from the City of Fort Bragg staff, the Fort Bragg Police Department, school officials, and staff from the County of Mendocino made during the walking audit on May 31, 2022. The recommendations are based on best practices and discussions with the participant group regarding local needs and feasibility. A glossary of the candidate treatment options is presented in **Appendices A and B**.

Walking audits are typically 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 motorists are behaving around pedestrians and bicyclists and how pedestrians and bicyclists are behaving, especially at intersections (e.g., if pedestrians are crossing at unmarked locations to avoid certain intersections, why might they feel the need to do so?).

The suggestions in this report are based on limited field observations and general knowledge of best practices in complete streets design and safety. As this report is conceptual in nature, the City may conduct more detailed studies before finalizing and implementing any physical changes. Conditions may exist in the focus areas that were not observed and are not compatible with recommendations in this report. City staff may conduct further analysis to refine or discard the recommendations 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.

4.1 Selection of Focus Areas

Three broad focus areas were chosen based on collision data and City interest in evaluation. Locations were selected that are not part of City projects currently underway or planned for in the forthcoming year. Two of the chosen locations were near schools the third is centered around downtown and the SR 1 corridor, home to the city's largest collision hotspots.

The three focus areas selected for the audit are:

1. Harold Street from Fir Street in the north to Oak Street in the south, generally consisting of the major route to and from Fort Bragg Middle School
2. Main Street / SR 1 from Fir Street in the north to Oak Street in the south, spanning the west edge of the downtown area

3. Dana Street from Oak Street in the north to Chestnut Street in the south, covering the main roadways between Fort Bragg High School and Dana Gray Elementary School

The audit, conducted on May 31, 2022, occurred on a Tuesday following the Memorial Day long weekend. While school officials and City staff noted that conditions and phenomena observed were typical, it should be noted that school attendance on that day was lower than usual.

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

4.2 Location #1: Harold Street

Harold Street is a north-south roadway in the central part of Fort Bragg. For most of its length, it is a two-lane street with a speed limit of 25 miles per hour. It has unprotected Class II bike facilities (“bike lanes”) and on-street parking in both directions. It is wide, at approximately 50 feet from curb to curb—wide enough to accommodate two lanes of travel in each direction. It has continuous sidewalks on both sides of the street throughout. Crosswalks are striped at most legs of intersections, and some crosswalk legs across Harold Street are equipped with splitter islands (although without accompanying median refuges). With the exception of the all-way stop controlled intersections with Oak and Madrone Streets, the intersections along Harold Street are side-street stop-controlled with Harold Street being the major street. The surrounding land use is mostly single-family residential, but there is a cluster of neighborhood-serving commercial uses at the intersection with Oak Street. It also serves Fort Bragg Middle School at its northern end, for which it acts as the primary access route.

In some ways, Harold Street can be viewed as a prototypical street in Fort Bragg, as its typology and context are prevalent across much of the city: two-lane roadway with a 25 mile per hour speed limit, but with a width much more typical of a larger, faster-moving roadway.

The walk audit proceeded north from the intersection of Harold Street and Oak Street to the main entrance of Fort Bragg Middle School at the intersection of Harold Street and Fir Street. The walk audit began at 7:45 AM at Oak Street to coincide with the morning commute to Fort Bragg Middle School, whose first bell is at 8:25 AM.

Observations

The following observations were noted during the site visit:

- There was a steady stream of traffic towards the Middle School that began around the time our audit began and continued until the first bell time, consisting of vehicles, a high number of pedestrians (schoolchildren walking alone or with a guardian), and a moderate number of bicyclists.
- There was a high proportion of taller vehicles, such as large pickup trucks and SUVs, among vehicles observed, which have blind spots that pose significant risks for middle-school age children crossing in front of such vehicles.

- Sunlight comes in at a relatively low angle, even during the summer when the audit took place, and it is understood that the sun is even lower during the winter months, which substantially impacts visibility.
- The streets, which are comparatively wide given their context, lead to long crossing distances and times for pedestrians, and encourage speeding.
- There were numerous observed instances of vehicles failing to yield to pedestrians and bicyclists, who must wait longer at intersections for an opportunity to cross.
- The splitter islands feature visual evidence of frequent impacts by vehicles.
- At the intersection with Oak Street, the westbound approach of Oak Street has a right-turn lane that is well-used but creates a situation that periodically blocks the line of sight between crossing pedestrians and motorists in the other two lanes of traffic on that approach. However, while only this particular approach is striped this way, many intersection approaches throughout this corridor and the city have identical widths, and vehicles were observed illegally using the bike lane or parking lane as a turning lane in many instances, with similar negative effects for visibility for pedestrians and bicyclists crossing.
- At Fort Bragg Middle School, the mid-block crosswalk at 545 North Harold Street was well-used, while the one further south and the one at Fir Street were not well-used. The former saw several occasions of vehicles failing to yield to crossing pedestrians.
- Vehicles dropping off students used the right lane of Harold Street but did not attempt to form a single line or pull forward to the main entrance of the school; instead, they merged into and out of the lane at random points, including at crosswalks, causing points of conflict with other vehicles and pedestrians. Many vehicles then used the intersection with Fir Street to make U-turns (a notably unsafe maneuver).

Suggested Improvements

To improve pedestrian, bicycle, and motor vehicle access and circulation at this location, the following improvements are suggested:

HAROLD STREET

Suggested improvements to the Harold Street corridor are documented in Figure 4-1.

- At the intersection of Oak and Harold Streets, eliminate the right-turn lane on the westbound approach of Oak Street. Implement curb extensions to reduce crossing distances.
 - While the most high-trafficked of the intersections along the corridor, the contextual and design attributes of the intersection of Harold and Oak Streets is not significantly different from that of other intersections along the corridor.
 - Consider implementing curb extensions at other intersections along the corridor. If not feasible, daylighting (i.e., designating a section of curb immediately adjacent to the intersection as no-parking red zones) can be implemented as a low-cost intermediate step that will also offer improved visibility.
- At locations along the corridor already equipped with splitter islands at intersections (Alder Street, Laurel Street, and Redwood Avenue), convert those islands to full median refuges. The FHWA recommends a minimum width of 4 feet for the pedestrian space portion of the island.

FORT BRAGG MIDDLE SCHOOL

The following improvements to the transportation infrastructure of the two schools are also recommended, to be undertaken in partnership with Fort Bragg Unified School District:

- Two options are presented for modifying the pick-up / drop-off situation at Fort Bragg Middle School:
 - Option 1 involves formalizing the right lane of northbound Harold Street into a pick-up / drop-off lane. The lane would begin with the end of the bulb-out for the crosswalk at 525 North Harold Street and merge back into the through lane just south of the accessible parking spaces. All vehicles making a pick-up or drop-off at the front of the school would need to merge into the lane when it begins and be instructed to pull forward as far as possible, and then continue in the lane and not merge back into the through lane until the lane ends. A surface mounted channelizing system (“delineators”) can be deployed to physically separate the lane from the through lane to enforce this traffic pattern. Delineators should also be deployed on the centerline of Harold Street throughout its westward turn as it approaches the intersection with Fir Street, to prevent vehicles from making the U-turn at the intersection. There are many potential options for delineators that can be used for such a purpose, such as the FG 300 Interstate Grade Curb System. Option 1 is documented in Figure 4-2.
 - Option 2 would involve dead-ending both Fir Street and Harold Street at Fort Bragg Middle School. Two cul-de-sacs would be created, one at each terminus, to be used as drop-off / pick-up zones. School bus drop-off and pick-up would occur curbside along the east side of Harold Street between the two crosswalks. The space between the two cul-de-sacs will serve as an extension of the plaza in front of the auditorium and can be used for community events. There will be a one-lane-wide section of pavement preserved as a passage between the two cul-de-sacs for use by bicycles, school buses, and emergency vehicles. Option 2 is documented in Figure 4-3.
- Regardless of which option is selected, the crosswalk near 545 North Harold Street should be upgraded to a raised crosswalk.
- Regardless of which option is selected, the stretch of Harold Street between Pine and Fir Streets should have a speed limit of no more than 15 miles per hour on school days.
- Regardless of which option is selected, there should be additional communication with family and community members about pick-up and drop-off procedures to clarify the operations of whichever alternative is selected and traffic rules surrounding the school in general. This can happen, ideally, through a combination of in-person contact opportunities such as parent-teacher conferences and back-to-school events, flyers sent home, and proactive outreach by school staff and volunteers during pick-up and drop-off.

FIGURE 4-1 Harold Street Improvements

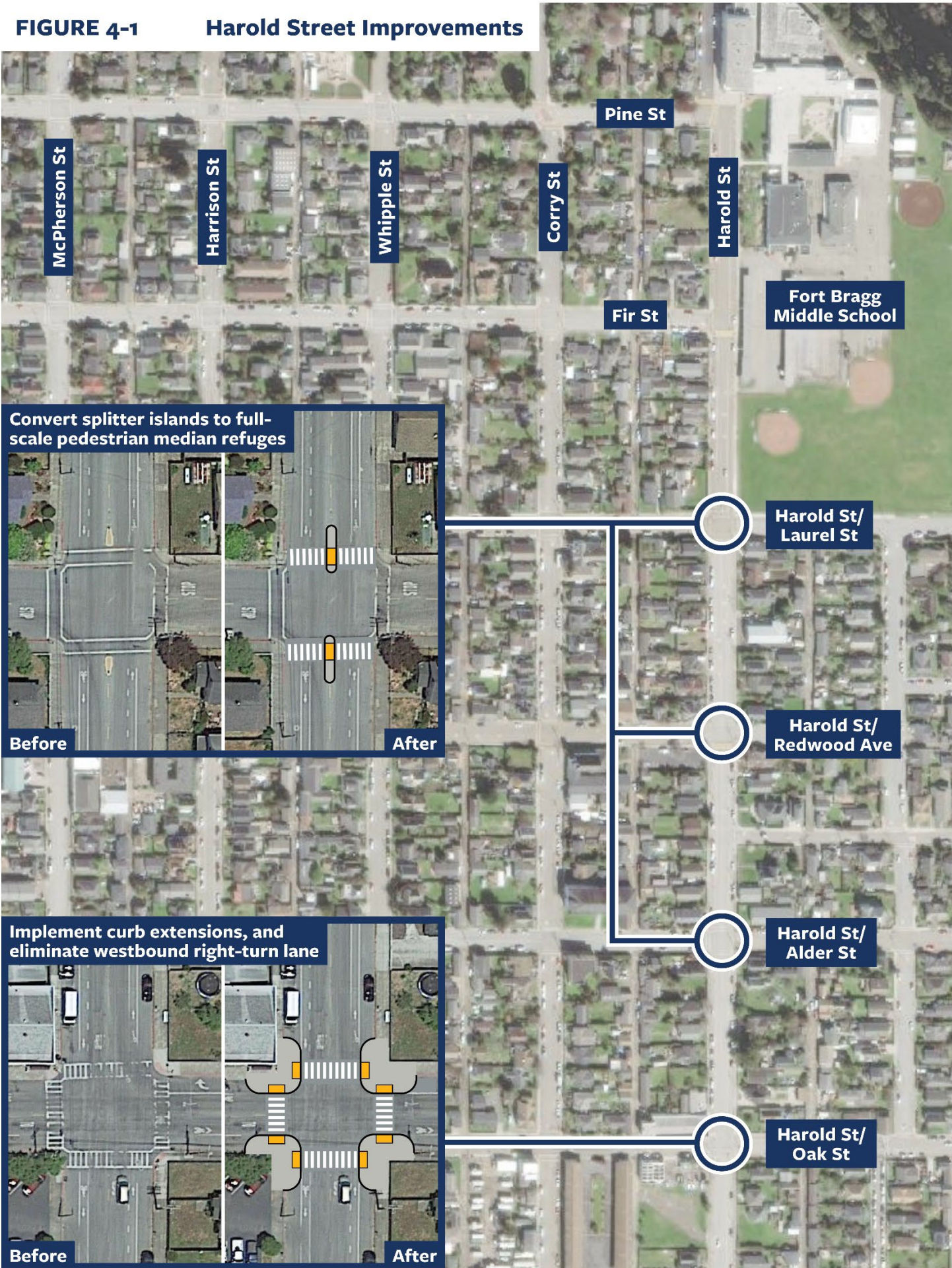


FIGURE 4-2 Fort Bragg MS - Option 1

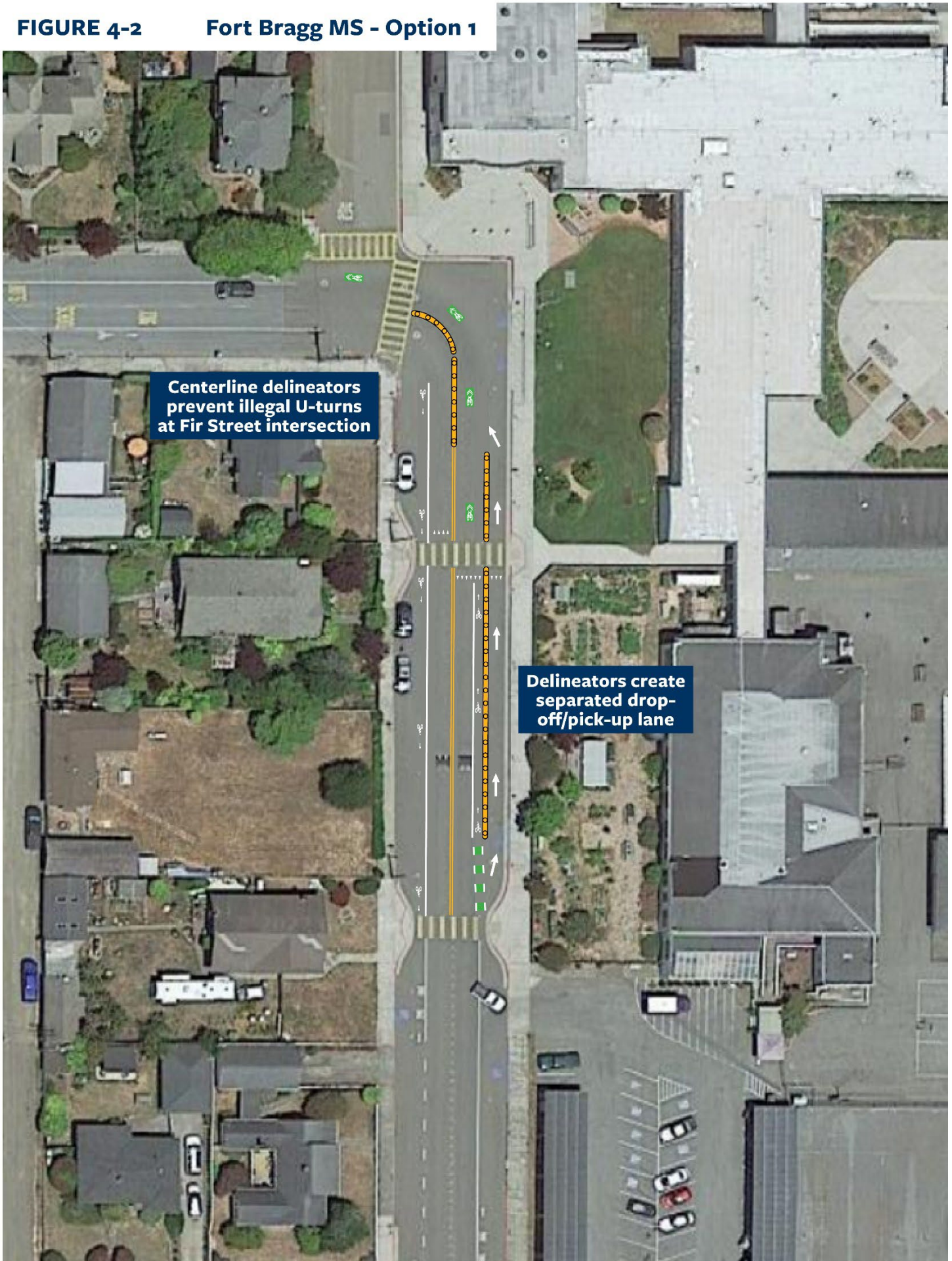
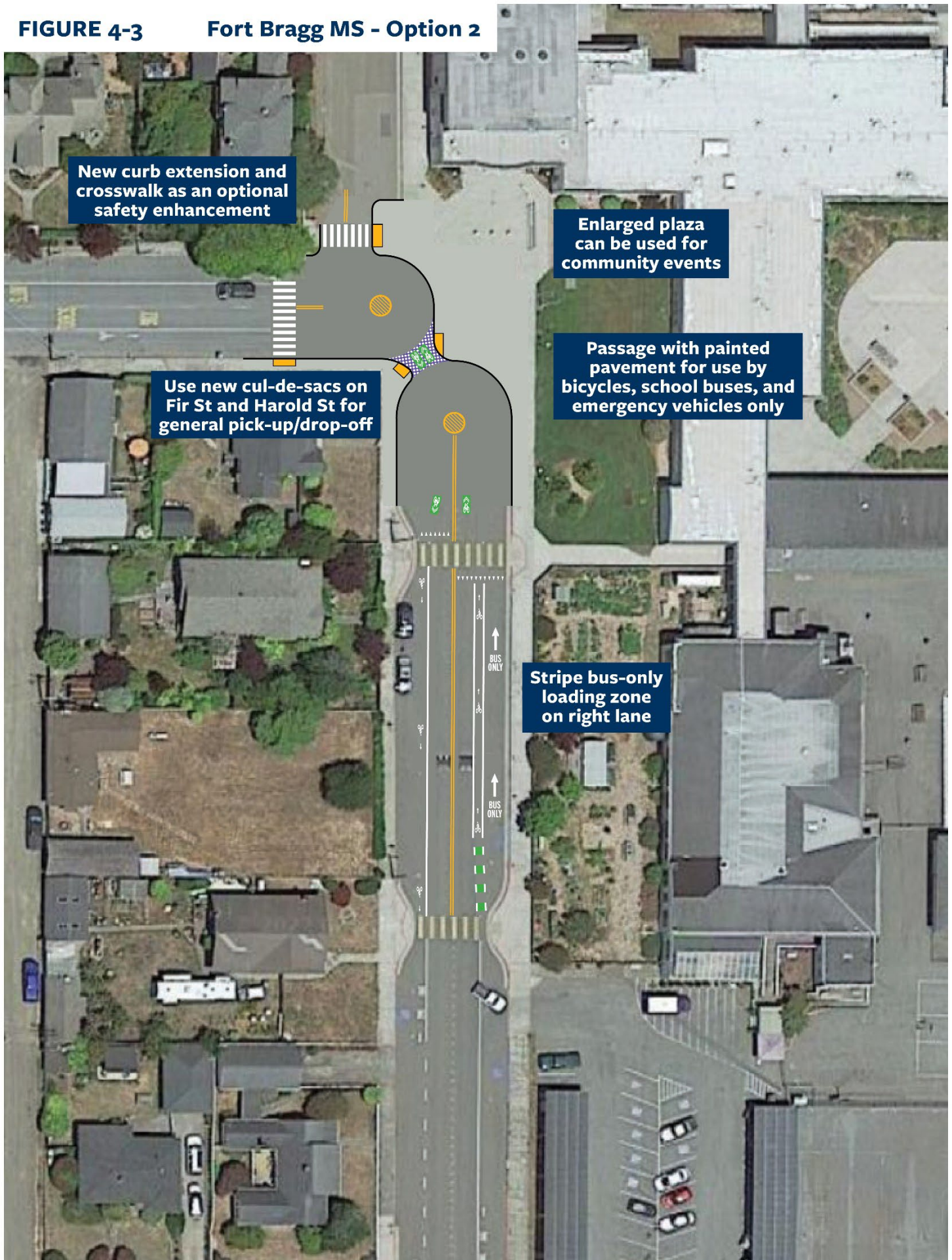


FIGURE 4-3 Fort Bragg MS - Option 2



New curb extension and crosswalk as an optional safety enhancement

Enlarged plaza can be used for community events

Passage with painted pavement for use by bicycles, school buses, and emergency vehicles only

Use new cul-de-sacs on Fir St and Harold St for general pick-up/drop-off

Stripe bus-only loading zone on right lane



The intersection of Harold Street and Oak Street, looking east



The intersection of Harold Street and Alder Street, looking north



Morning drop-off traffic at Fort Bragg Middle School, along Harold Street looking south

4.3 Location #2: Main Street (State Route 1)

Main Street, which also carries the designation of SR 1, is the principal north-south arterial in the city and its main external road connection. Being a state highway, it is owned and maintained by Caltrans, and serves the dual role of being both the city's principle commercial corridor as well as a key highway corridor with large volumes of through traffic. The corridor is mostly commercial in its surrounding land use, ranging from dense, pedestrian-oriented commercial development in downtown to strip malls in the southern end of the city. Main Street varies in size and width through the city, ranging from a five-lane roadway (two through lanes in each direction with a center left-turn lane) in the south to two lanes (one through lane in each direction without a center turn lane) in parts of downtown; generally, it has two travel lanes in each direction south of Redwood Avenue, and narrows to one travel lane in each direction north of it. It has a speed limit of 35 miles per hour, except in the crosstown section between Redwood Avenue and Elm Street, where the speed limit is 25 miles per hour. Crosswalks are marked at most legs of intersections, although they vary in legibility and width. There are signalized intersections at Elm Street, Laurel Street, Redwood Avenue, Oak Street, Chestnut Street, Cypress Street, Boatyard Drive, and the State Route 20 junction, with all remaining intersections being side-street stop-controlled. Main Street has, by far, the highest concentration of collisions in Fort Bragg.

The walk audit proceeded north from the intersection of Main and Oak Streets to the intersection of Main and Fir Streets. Chief Celeri Drive from Oak Street to Redwood Avenue was also audited. The walk audit occurred following morning peak hours, at approximately 10 AM.

Observations

The following observations were noted during the site visit:

- Many intersections feature single diagonal curb ramps (as opposed to directional curb ramps for each crosswalk leg) and many are in deteriorated condition.
- The crosswalk legs across Main Street at Alder Street are unusually narrow.
- The placement of traffic signal and wooden utility poles directly at the edge of the intersection is common across much of the city, including at the intersections with Alder and Fir Streets. Such placement affects pedestrian visibility at crossings, as they may be obscured by the poles. They also pose physical obstacles for the implementation of certain countermeasures.
- Even with non-peak period traffic, traffic speed and volumes were high enough to create an uncomfortable condition for pedestrians crossing Main Street. Vehicles often did not yield for pedestrians.
- Conflicts at signalized intersections between pedestrians crossing Main Street and vehicles turning left from side streets onto Main Street (i.e., side street permissive left-turn maneuvers conflicting with pedestrians crossing) were observed.
- Streetlights were observed to be of a design and spacing that would provide insufficient continuous light for pedestrians during the nighttime period.

Suggested Improvements

Since the corridor is owned and maintained by Caltrans, the City lacks the ability to implement design changes to the Main Street corridor without additional review and approval from Caltrans. However, based on observations during the site visit, the following improvements to pedestrian, bicycle, and motor vehicle activity are suggested for the City to propose to and consider in partnership with Caltrans. These improvements are also illustrated in Figure 4-3.

- At the intersection with Alder Street, close the more northern of the pair of the narrow uncontrolled crosswalk legs across Main Street, widen the southern crosswalk, and install a pedestrian hybrid beacon (PHB) system for improved pedestrian crossing.
- Signalize the intersection with Pine Street.
- Implement protected left-turn phasing on side streets at all signalized intersections. This may require the installation of new poles and mast arms.
- Install curb extensions, and either install directional curb ramps or other ramp improvements consistent with ADA requirements and best practices for pedestrian access and circulation at all intersections, corridor wide, that do not have ADA accessible, directional curb ramps. Locations with strong pedestrian demand, such as those with coast/beach access, should be prioritized if prioritization is necessary.
- At all intersections where right-of-way is available, add median islands for pedestrian refuge. Space for median refuge islands can be created by shifting the through traffic lane rightward into a portion of the parking lane and the left-turn lane rightward onto the original location of the through traffic lane at intersection approaches, as illustrated in Figure 4-4.
- Improve lighting, including introduction of pedestrian-scale lighting in the core downtown area.



The intersection of Main Street and Laurel Street, looking east



The intersection of Main Street and Alder Street, showing the narrow crosswalk on the south side of the intersection

4.4 Location #3: Dana Street

Dana Street is a short roadway stretching for just over one block in the eastern part of Fort Bragg, beginning at a T-intersection with Chestnut Street in the south and dead-ending in a driveway and trail just north of Oak Street. It is two lanes with a parking lane on either side throughout its length and has a posted speed limit of 25 miles per hour. The roadway primarily serves two schools – Dana Gray Elementary School and Fort Bragg High School, which front the roadway for most of its length, although there is some single-family residential land use at the northern end of the roadway. The roadway has three intersections: an all-way stop-controlled intersection with Oak Street at the north; a minor side-street stop-controlled intersection with dead-end Taubold Court; and its terminus at Chestnut Street, where there is a unique stop-control pattern where eastbound Chestnut Street is free-flow, but southbound Dana Street and westbound Chestnut Street are stop-controlled.

The walk audit proceeded south from the intersection of Dana and Oak Streets to the intersection of Dana and Chestnut Streets, with subsequent audits of the two campuses. The walk audit began at 2:45 PM at Oak Street to coincide with school dismissal at 3:15 PM for the elementary school and 3:20 PM for the high school.

Observations

The following observations were noted during the site visit:

- School buses, which must pick up at both the elementary school and the high school, made a series of complicated and tight turns, but appeared to have managed with little difficulty or delay.
- Because school buses were parked in the pick-up / drop-off loop at Dana Gray Elementary School, the loop could not accommodate any other vehicles. Almost all pick-up / drop-off occurred in the parking lot along Chestnut Street in front of the school, where schoolchildren crossing the parking lot had to dodge vehicles pulling in and out of parking spaces, often by reversing, creating many risky points of conflict.
- On-street parking along Dana Street was almost completely occupied, and most vehicles appear to belong to Fort Bragg High School students who do not park in one of the school lots.
- There was a substantial amount of queuing on southbound Dana Street at the intersection with Chestnut Street due to drivers waiting for pedestrians in the crosswalk.
- There was a substantial amount of traffic heading westbound on Chestnut Street after each of the two dismissal times. While the peak of traffic flow was in the three to five minutes immediately following the dismissal time, there was still an overlap between elementary and high school traffic.

Suggested Improvements

To improve pedestrian, bicycle, and motor vehicle activity at this location, the following improvements are suggested:

- Closing the midblock crosswalk across Chestnut Street that lies between the one at the east side of the Woodland Drive intersection and the one at the east side of the Dana Street intersection, and paving a path along the most direct desire line between the curb ramp leading to that crosswalk to the curb ramp leading to the crosswalk across Dana Street at the intersection of Dana and Chestnut Streets. This improvement is shown in Figure 4-4.

The following improvements to the transportation infrastructure of the two schools are also recommended, to be undertaken in partnership with Fort Bragg Unified School District:

- Dana Gray Elementary School should consider parking lot reconfiguration that allows for improved pick-up and drop-off operations while prioritizing pedestrian safety and school bus access and circulation. One potential reconfiguration could include the use of at least part of the parking area in the front of the school adjoining Chestnut Street to create a one-way pick-up/drop-off loop for use by non-school bus vehicles. The concrete island on the south side of the existing pick-up loop could be repurposed, for example, by converting the parking spaces to its south into a pick-up/drop-off lane.
- School traffic peaked and then dissipated rather rapidly (within a matter of minutes), as is typical of school traffic patterns. School traffic, therefore, can be further alleviated by staggering the dismissal times at the two schools even more – to ten minutes apart as opposed to five currently – to avoid overlapping traffic peaks.

FIGURE 4-4 Dana St / Chestnut St





The intersection of Chestnut Street and Dana Street, looking east



Fort Bragg High School

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 (collision history).
HAWK Beacon Signal	HAWK (High Intensity Activated Crosswalks) are pedestrian-actuated signals that are a combination of a beacon flasher and a traffic control signal. When actuated, HAWK displays 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.
Stutter Flash	The Overhead Flashing Beacon is enhanced by replacing the traditional slow flashing incandescent lamps with rapid flashing LED lamps. The beacons may be push-button activated or activated with pedestrian detection.	Initial studies suggest the stutter flash is very effective as measured by increased driver yielding behavior. Solar panels reduce energy costs associated with 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 severe 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.

PEDESTRIAN IMPROVEMENT MEASURES

Measure	Description	Benefits	Application
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.
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 assorted 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 collision 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.	Recommended 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.
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.

PEDESTRIAN IMPROVEMENT MEASURES

Measure	Description	Benefits	Application
Curb Ramps	Curb ramps are sloped ramps that are constructed at the edge of a curb (normally at intersections) 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, handcars, 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.
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.
Improved 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 striped area. This measure separates right-turning traffic and streamlines right-turning movements. Improved right-turn slip lanes would provide pedestrian crossing islands within the intersection and be designed to optimize the right-turning motorist's view of the pedestrian and of vehicles to his or her left.	This measure reduces the pedestrian's crossing distance and turning vehicle speeds.	Appropriate for intersections with high volumes of right-turning vehicles.
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

PEDESTRIAN IMPROVEMENT MEASURES

Measure	Description	Benefits	Application
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 collisions, 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.
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 collision 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.	The forthcoming 2009 MUTCD is expected to require all pedestrian signals to incorporate countdown signals within ten years. 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			
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).

BICYCLING IMPROVEMENT MEASURES

Measure	Description	Benefits	Application
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 collisions 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 collision 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.
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 recommended 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.

BICYCLING IMPROVEMENT MEASURES

Measure	Description	Benefits	Application
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, which 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.
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.

BICYCLING IMPROVEMENT MEASURES

Measure	Description	Benefits	Application
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).
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 collision 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.
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 collision, 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.

BICYCLING IMPROVEMENT MEASURES

Measure	Description	Benefits	Application
Bike Boxes	Area between an Advance Stop Line and a marked crosswalk which is designated 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 incorporate 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.
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

BICYCLING IMPROVEMENT MEASURES

Measure	Description	Benefits	Application
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, collision 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.
Hawk Beacon Signal	HAWK (High Intensity Activated Crosswalks) are pedestrian-bicyclist actuated signals that are a combination of a beacon flasher and a traffic control signal. When actuated, HAWK displays a yellow (warning) indication followed by a solid red light. During the cross-street phase, the driver sees a flashing red "wig-wag" pattern until the clearance interval has ended and the signal goes dark.	Provides the need gaps in traffic so bicyclists can safely cross the street, can be timed separately for bicycles and pedestrians. Reduces pedestrian-vehicle conflicts and slows traffic speeds	Useful in areas where it is difficult for bicyclists /pedestrians to find gaps in automobile traffic to cross safely, but where normal signal warrants are not satisfied. Appropriate for multilane roadways.
Rectangular Rapid Flashing Beacon (RRFB/Stutter Flash)	A warning sign that also contains rapid flashing LED lamps. The beacon may be push-button activated or activated with pedestrian detection.	Initial studies suggest the stutter flash is very effective as measured by increased driver yielding behavior. Solar panels reduce energy costs associated with the device.	Locations not controlled by any measures listed above. 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 severe 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.

BICYCLING IMPROVEMENT MEASURES

Measure	Description	Benefits	Application
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)
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 collision 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/howtguide2006.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.hsrrc.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) <i>next California course:</i> http://www.google.com/calendar/embed?src=Issandt@email.unc.edu
Designing for pedestrian safety (two-day course) <i>next California course:</i> http://www.google.com/calendar/embed?src=Issandt@email.unc.edu
Planning and designing for pedestrian safety (three-day course) <i>next California course:</i> http://www.google.com/calendar/embed?src=Issandt@email.unc.edu
<i>Adapted from FHWA Pedestrian Road Safety Audit Guidelines and Prompt Lists</i>

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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

<p>Pedestrian and Bicycle Information Center. "El Cajon's Road Diet Case Study." http://www.walkinginfo.org/library/details.cfm?id=3967</p>
<p>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</p>
<p>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.</p>
<p>Transport for London, London Cycling Design Standards, UK http://www.tfl.gov.uk/businessandpartners/publications/2766.aspx</p>
<p>Thompson, Laura and Julie Bondurant, Trail Planning in California, Solano Press, 2009</p>
<p>Fundamentals of Traffic Engineering, 16th Edition, Chapter 21: Bicycle Facilities; UC Berkeley Institute of Transportation Studies, 2007</p>
<p>DeRobertis, Michelle and Rhonda Rae, Buses and Bicycles: Design Options for Sharing The Road, ITE Journal, May 2001</p>
<p>Thomas, Beth and Michelle DeRobertis, <i>Cycle Track Literature Review</i>, <u>Accident Analysis and Prevention</u>, Volume 52, pp 219-227, March 28, 2013</p>
<p>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</p>
<p>Mekuria, Maaza C., Peter G. Furth, and Hilary Nixon, Low-Stress Bicycling And Network Connectivity, Mineta Transportation Institute, May 2012</p>
<p>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</p>

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 recommends that pedestrian (and bicycle) path connections to be every 300 to 500 feet; for motor vehicles, they recommend 500 to 1,000 feet.^{3 4} 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.⁵

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
 - Where a circuit is a finite, closed path starting and ending at a single node
- 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.

³ 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).

⁴ For more information on this topic, see American Association of State Highway and Transportation Officials (AASHTO), *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), <http://www.ite.org/bookstore/RP036.pdf> (accessed September 3, 2008).

⁵ 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.

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).

For more information on this topic, see American Association of State Highway and Transportation Officials (AASHTO), *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), <http://www.ite.org/bookstore/RP036.pdf> (accessed September 3, 2008).

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About SafeTREC

SafeTREC's mission is the reduction of transportation-related injuries and fatalities through research, education, outreach, and community service. Motor vehicle crashes are the number one cause of death for people aged 1 to 34 in the U.S.—and a major cause of minor and debilitating injuries for all age groups.