# City of Isleton

City Council
Staff Report

DATE: February 22, 2022

ITEM#: 4.A

CATEGORY: Communications

## CITY COUNCIL COMMUNICATIONS

### SUMMARY

City has received the following communications:

A. County of Sacramento, Order of Health Officer, Rescission of face coverings, February 16, 2022.
B. County of Sacramento, Order of Health Officer, Rescission of public meetings, February 16, 2022.
C. Isleton Lions Club "reinstating" the annual Easter Egg Hunt.
D. Quong Wo Sing building, Certified Historic Structure - 23 Main Street.
E. Grand Jury Report - Sacramento County Board of Supervisors abandoned responsibility for COVID-19 Cares Act Spending.

### FISCAL IMPACT

None

### RECOMMENDATION

Information only.

### ATTACHMENT

- County of Sacramento, Order of Health Officer (2)
- Isleton Lions Club email
- Quong Wo Sing building email
- Grand Jury Report - Sac. County

Prepared and Submitted by: Yvonne Zepeda, Deputy City Clerk
Reviewed by: Charles Bergson, City Manager

**RESCISSION OF ORDER OF THE HEALTH OFFICER OF THE COUNTY OF SACRAMENTO DIRECTING ALL INDIVIDUALS IN THE COUNTY TO WEAR FACE COVERINGS INDOORS IN WORKPLACES AND PUBLIC SETTINGS**

**DATE OF RESCISSION: February 16, 2022**

Effective immediately, the Order of the Health Officer issued July 29, 2021 directing all individuals in Sacramento County to wear face coverings indoors in workplaces and public settings is rescinded. Individuals should continue to follow all California Department of Public Health (CDPH) guidance and requirements and are reminded that CDPH continues to require face coverings in specific settings throughout California, including public transit, indoors in K-12 schools and childcare, emergency shelters and cooling/heating centers, healthcare settings, State and local correctional facilities and detention centers, homeless shelters, and long term care setting and adult and senior care facilities (https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/COVID-19/guidance-for-face-coverings.aspx).

Under the CDPH Order, masks remain required for unvaccinated individuals in indoor public settings and businesses, such as retail, restaurants, theaters, family entertainment centers, meetings, and State and local government offices serving the public. Fully vaccinated individuals are recommended to continue indoor masking when the risk may be high. Surgical masks or high-level respirators (e.g. N95, KN95, KF94) with a good fit are highly recommended.

The Health Officer will continue to assess COVID-19's evolving impact on our community and may re-issue a face covering order as changing circumstances dictate.

**IT IS SO ORDERED:**

Olivia Kasirye MD

Olivia Kasirye, MD, MS
Health Officer of the County of Sacramento

Dated: February 16, 2022

**RESCISSION OF ORDER OF THE HEALTH OFFICER OF THE COUNTY OF SACRAMENTO DIRECTING ALL PUBLIC MEETINGS IN THE COUNTY TO OCCUR VIRTUALLY AND ENCOURAGING WORKPLACES TO CONDUCT MEETINGS REMOTELY AS BUSINESS NEEDS PERMIT**

**DATE OF RESCISSION: February 16, 2022**

Effective immediately, the Order of the Health Officer issued January 6, 2022 directing all public meetings in Sacramento County to occur virtually and encouraging workplaces to conduct meetings remotely is rescinded. Individuals should continue to follow all California Department of Public Health guidance and requirements.

In workplaces, employers are subject to the Cal/OSHA COVID-19 Emergency Temporary Standard (ETS) or for some workplaces the Cal/OSHA Aerosol Transmissible Diseases (ATD) Standard and should consult those regulations for additional applicable requirements.

The Health Officer will continue to assess COVID-19's evolving impact on our community and may re-issue a public meeting or workplace order as changing circumstances dictate.

**IT IS SO ORDERED:**

Olivia Kasirye MD

Olivia Kasirye, MD, MS
Health Officer of the County of Sacramento

Dated: February 16, 2022

## Yvonne Zepeda

**From:**
**Sent:** Thursday, February 10, 2022 9:25 AM
**To:** Yvonne Zepeda
**Subject:** Community Easter Egg Hunt

Our Isleton Lions Club is considering "reinstating" the annual Easter Egg Hunt, but we need to know if the county health department is approving such an activity. We would appreciate using the Fred Wilson Ball Park. I am uncertain as to the date at this writing. Thank you for your input. In Lionism, Cheryle Apple

**Yvonne Zepeda**

**From:**
**Sent:** Tuesday, February 15, 2022 8:45 AM
**To:** Yvonne Zepeda; Charles Bergson
**Subject:** Fw: Quong Wo Sing Building, Part 3 decision

This was the best news I received on valentine's day. This project took 5 years and now it is finally approved. Please share this with the Historic Review Committee. I was told by Mark Huck from the Historic Preservation Office they will use this project in their annual report. He is also encouraging the National Park Service to include it in their annual report. Jean

----- Forwarded Message -----
**From:** Aguilar, Antonio <antonio_aguilar@nps.gov>
**To:** >
**Cc:** Huck, Mark@Parks <mark.huck@parks.ca.gov>
**Sent:** Monday, February 14, 2022, 02:40:32 PM PST
**Subject:** Quong Wo Sing Building, Part 3 decision

February 14, 2022

PROPERTY: **Quong Wo Sing Building, 23 Main Street, Isleton, CA**
PROJECT NUMBER: **34236**
APPLICATION: **Part 3**
DECISION: **Approve**

Dear Ms. Yokotobi:

The National Park Service (NPS) has completed the review of your Historic Preservation Certification Application - Part 3- Request for Certification of Completed Work, for the property cited above. This office has determined that the completed rehabilitation work meets the Secretary of the Interior's Standards for Rehabilitation and is consistent with the historic character of the property and the district in which it is located. Effective the date of this decision, the rehabilitation of the "certified historic structure" is hereby designated a "certified rehabilitation."

**Due to the ongoing public health emergency, NPS Technical Preservation Services staff are currently teleworking from home. This notice of decision is a copy solely for notice to the applicant. An officially signed application decision will be mailed to you as soon as possible, but please anticipate that there may be up to a 1-to-2-week delay.**

**Antonio Aguilar**
Historical Architect
Technical Preservation Services
National Park Service
1849 C Street NW, Mail Stop 7243
Washington, DC 20240
202-354-2032

antonio_aguilar@nps.gov email

Deanna Hanson
Foreperson

Tina Bonilla

Francis Bremson

Christina Budwine

Jeannine English

Stephen Holland

Rachel Kaldor

Gregg Magaziner

Barbara Marquez

Douglas Scott McDonald

Brian McElroy

Patricia Murray-Turner

James Parvis

Marc Remis

Jill Sherrill

Ken Smith

Olivia Washington

Norval Wellsfry

Gregory Williams

# SUPERIOR COURT OF CALIFORNIA
## COUNTY OF SACRAMENTO
### Grand Jury

February 14, 2022

Charles Bergson, City Manager
City of Isleton
P.O. Box 716
Isleton, CA 95641

Re: Grand Jury Report – **Sacramento County Board of Supervisors Abandons Responsibility for Covid-19 Cares Act Spending**

On behalf of the 2021-2022 Sacramento County Grand Jury, I am providing to members of the Isleton City Council, the enclosed report. This report will be released to the public on February 16, 2022 and is being provided to you in advance of its general release pursuant to Penal Code section 933.05, subdivision (1), which provides:

*A grand jury shall provide to the affected agency a copy of the grand jury report relating to that person or entity two working days prior to its public release and after the approval of the presiding judge.* ***No officer, agency, department, or governing body of a public agency shall disclose any contents of the report prior to the public release of the final report.*** It is very important that you comply with this confidentiality requirement.

The Penal Code also prescribes the obligations of a governing board or elected county official with regard to responding to the grand jury's findings and recommendations. Specifically, if the report contains one or more recommendations directed to you as an elected county official, or to the governing board of which you are a member, you must respond to those recommendations and to the supporting findings, as directed in the report.

The time within which to respond is prescribed by subdivision (c) of Penal Code section 933, which states in relevant part:

*No later than 90 days after the grand jury submits a final report on the operations of any public agency, the governing body of the public agency, shall comment to the presiding judge of the superior court on the findings*

*and recommendations pertaining to matters under the control of the governing body, and every elected county officer or agency head for which the grand jury has responsibility pursuant to Section 914.1 shall comment within 60 days to the presiding judge of the superior court, with an information copy sent to the board of supervisors, on the findings and recommendations pertaining to matters under the control of that county officer or agency head and any agency or agencies which that officer or agency head supervises or controls. In any city and county, the mayor shall also comment on the findings and recommendations.* ***All such comments and reports shall forthwith be submitted to the presiding judge of the superior court who impaneled the grand jury.***

The Penal Code also prescribes the content of your responses. Subdivisions (a) through (c) of the Penal Code 93305 state:

(a) For purposes of subdivision (b) of Section 933, as to **each grand jury finding**, the responding person or entity shall indicate one of the following:

(1) The respondent agrees with the finding.

**(2)** The respondent disagrees wholly or partially with the finding, in which case the response shall specify the portion of the finding that is disputed **and shall include an explanation of the reasons therefor.**

(b) For purposes of subdivision (b) of Section 933, **as to each grand jury recommendation**, the responding person or entity shall report on of the following:

**(1)** The recommendation has been implemented, **with a summary regarding the implemented action.**

(2) The recommendation has not yet been implemented, but will be implemented in the future, **with a time frame for implementation**.

(3) The recommendation requires further analysis, with an explanation and the scope and parameters of an analysis or study, **and a time frame for the matter to be prepared for discussion** by the officer or head of the agency or department being investigated or reviewed, including the governing body of the public agency when applicable. This time frame shall not exceed six months from the date of publication of the grand jury report.

(4) The recommendation will not be implemented because it is not warranted or is not reasonable, **with an explanation therefor**.

(c) However, if a finding or recommendation of the grand jury addresses budgetary or personnel matters of a county agency or department headed by an elected officer, both the department head and the board of supervisors shall respond if requested by the grand jury, but the response to the board of supervisors shall address only those budgetary or personnel matters over which it has some decision-making authority. The response of the elected agency or department head shall address all aspects of the findings or recommendations affecting his or her agency or department.

Please be aware that your responses will be a matter of public record and widely read by both community members and local media. Therefore, it is important that your responses be as clear and specific as possible. A response that is vague, does not provide a clear explanation of any action that has or will be taken, or that does not include a specific time frame for implementation, is either helpful nor legally sufficient. Furthermore, if a response does not comply with the applicable provisions of the California Penal Code, you mat be directed by the presiding judge to provide an amended response.

**Please send your response addressed to Honorable Michael Bowman, Presiding Judge, Sacramento County Superior Court, 720 9th Street, Sacramento, CA 95814, with a copy to Ms. Erendira Tapia-Bouthillier, Grand jury within the time period provided in subdivision (c) of Penal Code section 933 (see above).**

This Grand Jury report and the responses will be posted on the Grand Jury's website *(Grand Jury Reports: Sacramento Superior Court (ca.gov)*. We would appreciate receiving an electronic copy, as well as a signed hard copy, of your response. You may email a copy to TapiaE@saccourt.ca.gov.

Thank you for your cooperation in providing a meaningful and timely response.

Sincerely,

Deanna Hanson- Foreperson
2021-2022 Sacramento County Grand Jury

# SACRAMENTO COUNTY BOARD OF SUPERVISORS ABANDONS RESPONSIBILITY FOR COVID-19 CARES ACT SPENDING


## SUMMARY

The Sacramento County Grand Jury conducted an extensive examination of the use and distribution of more than $270 million in federal Coronavirus Aid, Relief and Economic Security (CARES) Act funding received by both the County and City of Sacramento. The Grand Jury uncovered that the County and City took very different approaches to their use of CARES Act dollars. More importantly, and in the midst of a countywide emergency, the County of Sacramento made questionable and opaque maneuvers that skirted the intent of the CARES Act, to the benefit of County coffers and with scant regard for the needs of its citizens.

The CARES Act was enacted in March 2020. It was directed to cover extraordinary and necessary pandemic related expenditures incurred by state and local government agencies. Receipt of CARES Act funding was determined by population, which meant that while Sacramento County was eligible to receive $181 million in CARES Act dollars, the City of Sacramento was the only other local governmental entity located in Sacramento County with a large enough population to qualify for its own CARES Act funding. The City received $89.6 million from the CARES Act.

A fundamental CARES Act requirement was that funding utilized by government agencies had to be allocated for pandemic specific activities, and could not be applied toward already budgeted items. The Grand Jury found that the City of Sacramento distributed nearly its entire $89.6 million CARES Act allocation to community agencies and businesses to help alleviate Coronavirus Disease 2019 (COVID-19) impacts.

In stark contrast, the Grand Jury investigation revealed that the County of Sacramento conducted no outreach, and made no CARES Act funding plan to support countywide COVID-19 relief activities. Instead, the County Chief Executive directed, and the Board of Supervisors approved, allocation of $104 million of its $181 million in CARES Act funding directly to the Sheriff's Office, transferring the same amount of Sheriff's Office funding back into the County's General Fund. While the CARES Act permitted its funding to support public safety, the County's maneuver was inconsistent with the widely publicized intent that CARES Act funds be directed to meet the community's challenges triggered by the COVID-19 pandemic.

The Grand Jury's comprehensive review of the County's budgeting process uncovered a failure to operate with transparency. The result of this failure undermined public confidence in government during a countywide emergency. The County Board of Supervisors failed to engage in governance and oversight at a critical moment.

The County Chief Executive had argued that the fund transfer to the Sheriff was entirely legal and made in anticipation of a pandemic-induced county revenue shortfall. However, neither the County Executive nor the Board presented any statutory or regulatory language, or a legal opinion, that would verify this assertion. At a minimum, the County Board of Supervisors, as elected representatives, had an obligation to timely notify its constituents of the fund allocation and transfer.

The Sacramento Grand Jury recommends that the Board of Supervisors appoint an independent panel to conduct an audit of the allocation and use of CARES Act funds and determine whether County actions were, in fact, in compliance with federal CARES Act requirements.

## BACKGROUND

Sacramento County received $181 million in CARES Act funds. These funds were directed by Congress to cover extraordinary and necessary expenditures related to local, state/US Territory, or tribal government COVID-19 response activities. CARES Act funds were not allowed to be used to replace already budgeted activities. Further, these COVID-19 related expenditures were required to be incurred between March 1 and December 30, 2020.

Due to the pandemic crisis, the County estimated in April 2020 that it would receive approximately $170 million less in revenue than expected for fiscal year[1] (FY) 2019-2020 and FY 2020-2021. On April 21, 2020, the Board of Supervisors authorized the County Executive, or his designee, to apply for, accept, and draw down all available loans, grants and other funding that might be available to the County to respond to the COVID-19 public health emergency.

The Board of Supervisors did not request, nor did it receive reports on the receipt, allocation or use of CARES Act funds until over three months later. On August 11, 2020, the County Executive reported to the Board that putting $104 million of the $181 million in CARES Act funds into the Sheriff's Office budget for existing County public safety employee salaries and benefits, as well as other existing service costs, was allowed by the Act. He provided further justification by explaining that moving already allocated General Fund dollars out of the

[1] The Sacramento County's Fiscal Year runs from July 1 through June 30 of the following calendar year

Sheriff's budget back into the County General Fund would 1) help offset the anticipated $170 million County revenue shortfall brought about by the COVID-19 pandemic, and 2) preserve those General Fund dollars that had no expiration date by putting CARES Act monies into use by the Sheriff, to be spent by the December 30, 2020 CARES Act deadline.

A citizen complaint about the County's conduct in its disposition of its CARES Act funds was submitted to the 2019-2020 Sacramento County Grand Jury. Due to the limited time remaining in the Jury's term, the complaint was forwarded to the 2021-2022 Grand Jury, which approved an investigation on March 18, 2021.

## METHODOLOGY

During its investigation, the grand jury conducted interviews and reviewed numerous documents, websites, and recordings including, but not limited to:

- Sacramento County Public Health Orders
- Sacramento City and County Public Health website
- Planning documents related to the COVID-19 and the CARES Act from the City and County
- Reports from City and County agencies related to COVID-19 status and responses
- Directives from the Sacramento County Board of Supervisors
- Directives from the Sacramento City Council
- Sacramento County Board of Supervisors meeting agenda packets, action summaries, and videos
- Sacramento City Council Agendas and Minutes
- Communications related to COVID-19 funding from both the County and City
- Announcements, agendas, and information from community workshops
- City and County Budget documents
- City and County documents related to reporting on COVID-19 response
- Citizen Complaint#19.20.48
- Federal CARES Act of 2020
- Department of the Treasury - Coronavirus Relief Fund for States, Tribal Governments, and Certain Eligible Local Governments
- Department of the Treasury - 31 CFR Part 35 RIN 1505–AC77, Coronavirus State and Local Fiscal Recovery Funds
- Budgetary and other documentation from the Sacramento County Sheriff's Department
- Interviews of several County officials
- California Health and Safety Code Sections 101040, 101085, 120175, and 120220

## DISCUSSION

To stem the economic fallout from the COVID-19 pandemic, Congress passed and the president signed the CARES Act of 2020 in March 2020. The CARES Act provided a total of $150 billion in relief funding to states, local government and US Territories and tribal governments. These funds were directed to be used for COVID-19 related expenditures incurred between March 1

and December 30, 2020. CARES Act funds were prohibited from use for already budgeted expenditures. Sacramento County received $181 million in CARES Act funding.

On April 21, 2020, in preparation for receipt of CARES Act funds, the Board of Supervisors passed a resolution which authorized:

> *The County Executive, or his designee, to apply for, accept, and draw down loans, advances, grants or other funding that may be available to the County to respond to the COVID-19 public health emergency and that the County Executive determines it is in the best interests of the county to accept; and*
>
> *That the Board grants the County Executive, or his designee, retroactive authority to apply for and accept funds due to the nature of the emergency and the changing guidance from the federal and state government regarding application criteria and timelines.*

Despite the ongoing public health emergency and a 2020 summer surge, the Board showed little interest in the allocation and utilization of the CARES Act funds received by the County. In fact, the Board waited more than three months to receive a CARES Act revenue and expenditure report from the County Executive. It was August 11, 2020, when the County Executive finally provided an outline identifying "key goals" explaining how CARES Act eligible expenditures were approved by him:

1. Address critical public health needs to contain the spread of COVID-19;
2. Avoid potentially massive budget cuts to critical County programs, including public health, mental health, alcohol and drug, public safety, child protective services, homeless services, parks and other programs; and
3. Fully comply with federal law and guidance on the use of CARES Act funds, such as the prohibition on backfilling revenue losses, the requirement that the use of funds be subject to the Single Audit Act, the prohibition on using CARES Act funds to match other federal funds and the general requirement that the funds be used to cover COVID-19 related expenses.

The County Executive reported structuring use of the $181 million of CARES Act funding over a two-year period, $147.97 million for FY 2019-2020, and $33.1 million in FY 2020-21.

Table 1 on the following page shows County expenditures for FY 2019-2020 listed in the reporting categories as required by the federal government:

**Table 1: Sacramento County Spending**

| Category of Spending for FY2019-2020 | Amount |
|---|---|
| Transferred to other governments | $0.00 |
| Payroll for public health and safety employees | $132,857,301.43 |
| Budgeted personnel and services diverted to a substantially different use | $4,465,562.87 |
| Improvements to telework capabilities of public employees | $67,701.36 |
| Medical expenses | $4,056,586.22 |
| Public health expenses | $217,623.57 |
| Distance learning | $0.00 |
| Economic support | $7,127.00 |
| Expenses associated with the issuance of tax anticipation notes | $0.00 |
| All items not listed above | $6,296,050.20 |
| Total | $147,967,952.65 |

*Source: August 11, 2020 County Executive Report to Sacramento County Board of Supervisors; "Status of Coronavirus Relief Fund Revenue Received by Sacramento County"*

The Sacramento County Grand Jury, during its investigation, took specific note of the actual reported spending of $132.86 million for "payroll for public health and safety employees." The Sheriff's Department received $104.2 million (78%) of that $132.86 million. On its face, this CARES Act allocation to the Sheriff to fund "public safety" payroll was permitted under federal guidelines. But the Grand Jury found that these CARES Act funded "public safety" employees simply continued performing the same duties as they had prior to the start of the COVID-19 pandemic. The CARES Act prohibited use of its funds for already budgeted staffing activities.

Further, the Grand Jury found a notable disconnect between the Sheriff's receipt of a majority of the County's CARES Act funds for public safety purposes, and the Sheriff's flat refusal to publicly enforce the Governor and County's Public Health stay-at-home and masking orders issued to prevent the community spread of COVID-19.

During this August 11th Board meeting, the County Executive and Chief Financial Officer (CFO) explained the Sheriff's disproportionate allocation by stating that while other County departments could have used the CARES Act money, the County Executive and CFO were concerned that spending the entire CARES Act allocation could not be accomplished by the initial federal deadline of December 30, 2020. Unspent funds would then revert back to the federal government.

The County Executive and CEO asserted that since there was no deadline on use of County General Fund dollars, switching the Sheriff's County General Fund allocation with CARES Act funds would guarantee that the entire $181 million of CARES Act funding ($147.97 million FY 2019-2020/$33.1 million FY 2020-2021) would be retained by the County.

Switching County General Fund dollars with CARES Act funds may have provided the County with flexibility to maximize all the available federal and state funds that carry spending deadlines. However, the Grand Jury found that this maneuver had adverse consequences to the local community at a critical time in County history.

Most important to County residents, the lack of governance and oversight by the Board of Supervisors allowed the County Executive to violate the first goal of the County's stated criteria for use of CARES Act funds: to "address critical public health needs to contain the spread of COVID-19." While the entire County was immersed in the largest public emergency in memory, the Board of Supervisors failed to oversee the activities of the County Executive, and to provide regular, comprehensive public discussion of County emergency activities and use of CARES Act funding.

As shown in Figures 1 and 2, the City of Sacramento and the City Council, acted in marked contrast with the County. The City made its first CARES Act funding decision using a Request for Proposal (RFP) process to allocate $1 million in discretionary General Fund money mostly to the city's smaller businesses, including restaurants. The City Council also made an early decision to distribute a significant amount of its $89.6 million in CARES Act funding to the city community, retaining a small amount for internal City operations. The City's allocation of CARES Act funding is presented in Figure 3.

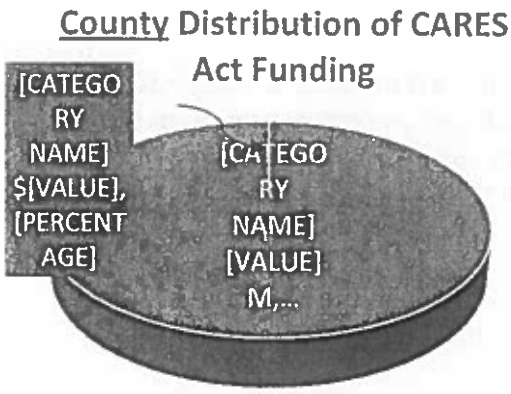


Figure 1

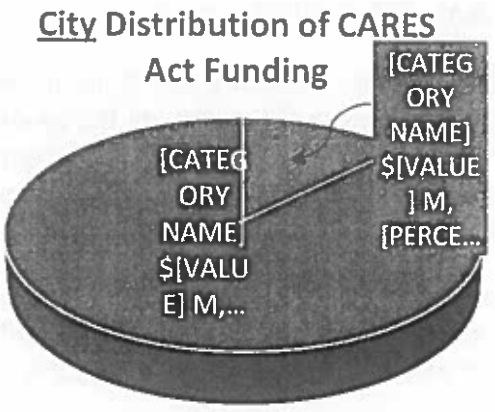


Figure 2

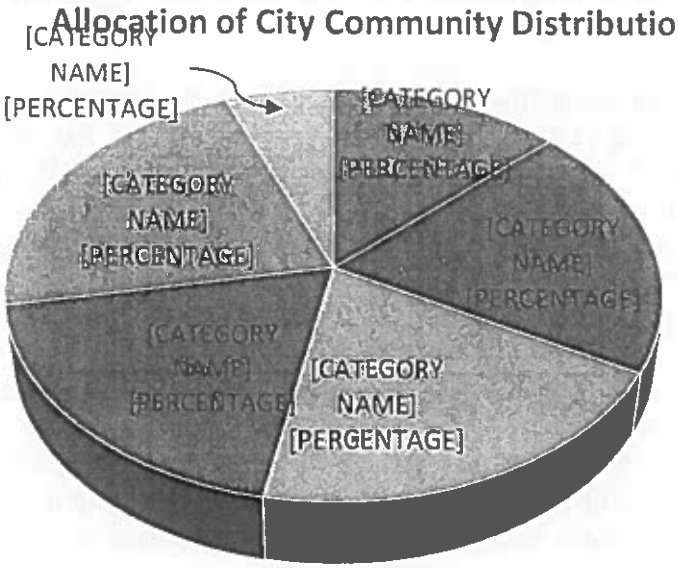


Figure 3

For its part, the County Executive did name an advisory committee of County agency heads to receive CARES Act funding requests from County departments and recommend allocation proposals to the County Executive for final action. However, scant information was provided regarding the request and approval process. No reports of funding requests or approvals were made to the Board between April 21, 2020 and August 11, 2020. As further evidence of its fractured response to the pandemic, the County Executive provided little guidance within County government regarding COVID-19 response and mitigation, resulting in an ad hoc set of County department COVID-19 related actions. The County Executive was placed on administrative leave and subsequently resigned his position effective February 2021.

## FINDINGS

**F1.** The Sacramento County Board of Supervisors abdicated its responsibility to determine community needs and to provide oversight in the development and implementation of the County COVID-19 response.

**F2.** The Sacramento County Board of Supervisors used the vast majority of the CARES Act funding it received to augment the county budget and support county operations while providing minimal support to the Sacramento County Health Department or other County agencies to address community needs resulting from the COVID-19 pandemic, neglecting its public support responsibility.

**F3.** The vast majority of the Sacramento County CARES Act dollars were used to fund County operations. No funds were distributed to the cities within the County to assist their effort to directly address the COVID-19 pandemic.

**F4.** Each department within the Sacramento County Administration had to create its own action plan to address the COVID-19 pandemic because there was no overarching County Plan nor was specific direction provided from the County Executive regarding these action plans.

**F5.** The Sheriff's Department final FY 2019-2020 budget was not increased due to the use of CARES Act funding of $104.2 million. At year-end closing, Sacramento County provided the Sheriff's Department with $104.2 million of CARES Act funds, and removed an equivalent amount of General Funds from the Sheriff's Department. The Sheriff used these CARES Act funds for standard non-COVID-19 operations. The Grand Jury was unable to determine if the switching of funds was in compliance with federal CARES Act requirements.

**F6.** Sacramento County's allocation of the majority of CARES Act funds to the Sheriff's Department achieved several benefits. It ensured there was no loss of CARES Act funds, provided the County with greater financial flexibility in funding services, and addressed the COVID-19 emergency. The Grand Jury was unable to determine if the switching of funds was in compliance with federal CARES Act requirements.

**F7.** The County Executive's decision to allocate 70% of Sacramento County's FY2019/2020 CARES Act expenditures to the Sheriff's Department ignored many of the critical public health needs to contain the spread of COVID-19. The Grand Jury was unable to determine if this action was in compliance with federal CARES Act requirements.

**F8.** While the Sheriff's Department conducted COVID-19 mitigation efforts within detention facilities, it expressly chose not to enforce the Governor's active emergency orders related to minimizing the spread of COVID-19 among the general public. The Grand Jury was unable to determine if the lack of enforcement of the Governor's emergency orders while using CARES Act funding was in compliance with federal CARES Act requirements.

**F9.** The CARES Act prohibited use of its funds for already budgeted staffing activities. But these CARES Act funded "public safety" employees simply continued to perform their same duties as they had prior to the start of the COVID-19 pandemic. The Grand Jury was unable to determine if this action was in compliance with federal CARES Act requirements.

**F10.** The Board of Supervisors, the County Executive, and the Sheriff's Department were not transparent in the use of the CARES Act funds. There was no written notice provided in the Board meeting agenda nor explanation within the Board Packet meeting materials regarding the replacement of allocated Sheriff's Department General Funds with CARES Act funds.

**F11.** The lack of governance and oversight by the Board of Supervisors allowed the County Executive to violate the first goal of the County's stated criteria for use of CARES Act funds.

**F12.** The City of Sacramento used a significant majority of its federal CARES Act funding to mitigate the impact of the COVID-19 pandemic on the local community.

**F13.** The City of Sacramento actively solicited community input on the allocation of CARES Act funding from local community.

**F14.** The Sacramento City Council actively engaged in the planning and oversight of CARES Act funding and determined five categories of funding included in the City's "COVID-19 Response: CARES Act Investments."

## RECOMMENDATIONS

**R1.** The Board of Supervisors should appoint an independent panel by June 2022 to conduct an audit to determine whether County actions were, in fact, in compliance with federal CARES Act requirements.

**R2.** The Sacramento Board of Supervisors, the County Executive, and the Sheriff's Department should each adopt a transparent and properly noticed budget allocation and approval process to be used upon receipt by the County for all funding sources, including surplus dollars. This process should include adequate notice, extensive engagement with county residents, and utilize detailed public notices, media briefings, stakeholder

workshops and appropriate social media outreach. This recommendation should be in place by December 2022.

**R3.** The County Board of Supervisors should engage in an active process to identify and address community needs and develop a plan to deliver appropriate funding and services to the community outside of County operations. A policy should be developed and approved to ensure community input in the use of supplemental emergency funding by December 2022.

**R4.** A policy should be developed by the County Board of Supervisors directing the County Executive to provide clear and specific direction and oversight to county operations to ensure that the Board's plans and strategic directions in response to community emergencies are properly carried out. This policy should be developed and approved by December 2022.

**R5.** A policy should be developed by County Board of Supervisors to require that the County Executive provide monthly updates on the use of special funding. This policy should be developed and approved by December 2022.

## REQUIRED RESPONSES

Pursuant to Penal Code sections 933 and 933.05, the grand jury requests responses as follows:

From the following elected county officials within 60 days:

- Don Nottoli, Chair
  Sacramento County Board of Supervisors
  700 H Street, Suite 2450
  Sacramento, CA 95814

- Scott Jones, County Sheriff
  Sacramento County Sheriff's Department
  4500 Orange Grove Avenue
  Sacramento, CA 95841

Mail or deliver a hard copy response to:

- Hon. Michael Bowman
  Presiding Judge
  Sacramento County Superior Court
  720 9th St.
  Sacramento. CA 95814

Please email a copy of this response to:

- Ginger Durham
  Jury Commissioner

DurhamG@saccourt.ca.gov

Erendira Tapia-Bouthillier
Grand Jury
TapiaE@saccourt.ca.gov

## INVITED RESPONSES

- Rich Desmond, Vice Chair
  Sacramento County Board of Supervisors
  700 H Street, Suite 2450
  Sacramento, CA 95814

- Phil Serna, Supervisor
  Sacramento County Board of Supervisors
  700 H Street, Suite 2450
  Sacramento, CA 95814

- Patrick Kennedy, Supervisor
  Sacramento County Board of Supervisors
  700 H Street, Suite 2450
  Sacramento, CA 95814

- Sue Frost, Supervisor
  Sacramento County Board of Supervisors
  700 H Street, Suite 2450
  Sacramento, CA 95814

- Ann Edwards, County Executive
  Sacramento County
  700 H Street, Room 7650
  Sacramento, CA 95814

- Darrell Steinberg, Mayor
  City of Sacramento
  915 I St., 5th Floor
  Sacramento, CA 95814

- Howard Chan, City Manager
  City of Sacramento
  915 I Street
  Sacramento, CA 95814

- Porsche Middleton, Mayor

City of Citrus Heights
6237 Fountain Square Dr.
Citrus Heights, CA 95621

- Christopher W. Boyd, City Manager
  City of Citrus Heights
  6360 Fountain Square Drive
  Citrus Heights, CA 95621

- Bobbie Singh-Allen, Mayor
  City of Elk Grove
  8401 Laguna Palms Way
  Elk Grove, CA 95758

- Jason Behrmann, City Manager
  City of Elk Grove
  8401 Laguna Palms Way
  Elk Grove, CA 95758

- Kerri Howell, Mayor
  City of Folsom
  50 Natoma St.
  Folsom, CA 95630

- Elaine Andersen, City Manager
  City of Folsom
  50 Natoma St.
  Folsom, CA 95630

- Shawn Farmer, Mayor
  City of Galt
  380 Civic Drive
  Galt, CA 95632

- Lorenzo Hines Jr., City Manager
  City of Galt
  380 Civic Drive
  Galt, CA 95632

- Eric Pene, Mayor
  City of Isleton
  P.O. Box 716
  Isleton, CA 95641

- Charles Bergson, City Manager
  City of Isleton

P.O. Box 716
Isleton, CA 95641

- Garrett Gatewood, Mayor
  City of Rancho Cordova
  2729 Prospect Park Drive
  Rancho Cordova CA 95670

- Cyrus Abhar, City Manager
  City of Rancho Cordova
  2729 Prospect Park Drive
  Rancho Cordova CA 95670

Mail or deliver a hard copy response to:

Hon. Michael Bowman Presiding Judge
Sacramento County Superior Court
720 9th St.
Sacramento. CA 95814

Please email a copy of this response to:

- Ginger Durham
  Jury Commissioner
  DurhamG@saccourt.ca.gov

- Erendira Tapia-Bouthillier
  Grand Jury
  TapiaE@saccourt.ca.gov

*Reports issued by the Grand Jury do not identify individuals interviewed Penal Code section 929 requires that reports of the Grand Jury not contain the name of any person or facts leading to the identity of any person who provides information to the Grand Jury*

Department of Alcoholic Beverage Control

State of California

# APPLICATION FOR ALCOHOLIC BEVERAGE LICENSE(S)

ABC 211 (6/99)

**TO:** Department of Alcoholic Beverage Control
2400 DEL PASO ROAD
SUITE 155
SACRAMENTO, CA 95834
(916) 419-1319

File Number:
Receipt Number: **2705592**
Geographical Code: **3403**
Copies Mailed Date: **February 14, 2022**
Issued Date:

02/17/2

DISTRICT SERVING LOCATION: **SACRAMENTO**

First Owner: **DELTA QUEEN LLC**

Name of Business: **DELTA QUEEN LODGE**

Location of Business: **34 MAIN ST**
**ISLETON, CA 95641**

County: **SACRAMENTO**

Is Premises inside city limits? **Yes** Census Tract: **0098.00**

Mailing Address:(If different from premises address) **6162 MULBERRY AVE**
**ATWATER, CA 95301**

Type of license(s): **47** Dropping Partner: Yes___ No ✓

Transferor's license/name: **179627 / ROGELIOS INC**

| License Type | Transaction Type | Master | Secondary LT And Count |
|---|---|---|---|
| 47 - On-Sale General Eating Place | PER | Y | |

| License Type | Transaction Description | Fee Code | Dup | Date | Fee |
|---|---|---|---|---|---|
| Application Fee | STATE FINGERPRINTS | NA | 2 | 02/14/22 | $78.00 |
| Application Fee | PERSON TO PERSON TRF | NA | 0 | 02/14/22 | $1,305.00 |
| Application Fee | FEDERAL FINGERPRINTS | NA | 2 | 02/14/22 | $48.00 |
| 47 - On-Sale General Eating Place | ANNUAL FEE | P0 | 0 | 02/14/22 | $825.00 |
| | | | | Total | $2,256.00 |

Have you ever been convicted of a felony? **No**
Have you ever violated any provisions of the Alcoholic Beverage Control Act, or regulations of the Department pertaining to the Act? **No**

STATE OF CALIFORNIA County of SACRAMENTO Date: February 14, 2022

Applicant Name(s)

DELTA QUEEN LLC

# City of Isleton

City Council
Staff Report

DATE: February 22, 2022

ITEM#: 5.A

CATEGORY: Consent Calendar

**MINUTES OF THE REGULAR CITY COUNCIL MEETINGS OF JANUARY 11, 2022 AND SPECIAL CITY COUNCIL MEETING OF JANUARY 27, 2022**

## SUMMARY

A. Review of the Regular City Council Meetings of January 11, 2022.
B. Review of the Special City Council Meeting of January 27, 2022.

## FISCAL IMPACT

There is no fiscal impact associated with this action.

## RECOMMENDATION

A. City Council review and approve the draft minutes of the Regular City Council Meeting on January 11, 2022 and Special City Council Meeting of January 27, 2022.

## ATTACHMENTS

- Minutes of January 11, 2022.
- Minutes of January 27, 2022

Reviewed by: Charles Bergson, City Manager

Submitted and prepared by: Yvonne Zepeda, Deputy City Clerk

**CITY OF ISLETON**

**Regular City Council Meeting Minutes**

Tuesday, January 11th, 2022 at 6:30pm
208 Jackson Boulevard
Isleton, California 95641
You can call in to join our public meeting
**TELECONFERENCE MEETING**
**ORDER OF THE HEALTH OFFICER OF THE COUNTY OF SACRAMENTO JANUARY 6, 2022 DIRECTING ALL INDIVIDUALS IN THE COUNTY TO WEAR FACE COVERINGS INDOORS IN WORKPLACES AND PUBLIC SETTINGS**
**ALL PUBLIC MEETINGS TO BE CONDUCTED REMOTELY**

1. **OPENING CEREMONIES**

   **A.** Welcome & Call to Order – Vice Mayor Pamela Bulahan called to order at 6:30pm.
   **B.** Pledge of Allegiance
   **C.** Roll Call
   PRESENT: Councilmember's Paul Steele, Iva Walton, Vice Mayor Pamela Bulahan, City Manager and Deputy City Clerk Yvonne Zepeda via teleconference.

2. **AGENDA CHANGES OR DELETIONS**
   ACTION: None.

3. **PUBLIC COMMENT**

   This is an opportunity for the public to speak to the Council on any item other than those listed for public hearing on this Agenda. Speakers are requested to use the podium in front of the Council and to begin by stating their name, whether they reside in Isleton and the name of the organization they represent if any. The Mayor may impose a time limit on any speaker depending on the number of people wanting to speak and the time available for the rest of the Agenda. In the event comments are related to an item scheduled on the Agenda, speakers will be asked to wait to make their comments until that item is being considered.
   ACTION: Alieda Suarez and Ruby Fowler-Regarding Crime in Isleton and on Main St. and Thank you for professionalism and adherence. Jory and Crew working hard. Delta Boyz thanks for the holiday provided meals to those in need. Chris Jones-regarding crime in Isleton and the need for Law Enforcement and transients down town.

4. **COMMUNICATION**

   **A.** County of Sacramento, Order of Health Officer.
   **B.** Letter of Complaint.
   **C.** CWSRF Planning Grant Draft Project Status Report
   ACTION: Information only.

5. **CONSENT CALENDAR**

   **A. SUBJECT:** Approval of Minutes of the Regular City Council Meeting of November 23, 2021.

**AMERICANS WITH DISABILITIES ACT NOTICE:** In compliance with the Americans with Disabilities Act, persons needing a disability-related modification or accommodation, including auxiliary aids or services, to participate in this meeting, may contact Deputy City Clerk Yvonne Zepeda, at (916) 777-7770, by fax at (916) 777-7775 or by email to Yvonne.zepeda@cityofisleton.com at least 48 hours prior to the meeting.

**GOV. CODE § 54957.5 NOTICE:** Public records related to an agenda item that are distributed less than 72 hours before this meeting are available for public inspection during normal business hours at Isleton City Hall located at 101 Second Street, Isleton, California 95641.

**RECOMMENDATION:** City Council review and approve draft minutes of the Regular City Council meeting of November 23, 2021.
ACTION: Councilmember Paul Steele motion to approve draft minutes of the Regular City Council meeting of November 23, 2021. Vice Mayor Pamela Bulahan second the motion. AYES: Councilmember's Paul Steele, Iva Walton, Vice Mayor Pamela Bulahan. NOES: None. ABSTAIN: None. ABSENT: Mayor Eric Pene. PASSED 3-0.

## 6. OLD BUSINESS

**A. SUBJECT:** 204 A Street, Development Plan.

**RECOMMENDATION:** It is recommended City Council review and provide direction on developing the property at 204 A Street.

ACTION: 204 A Street closes tomorrow. City Councilmember Paul Steele – Peter has tried to buy it and there is 3 lots, it's about half the size. Build City Hall and Parking Lot. No public comments.

**B. SUBJECT:** Sacramento Area Council of Governments (SACOG) Transportation Development ACT (TDA) revised claim packet for Fiscal Year 2020-2021.

**RECOMMENDATION:** Staff recommends City Council to approve revisions to the 2020-2021 Transportation Development Act claim packet.

ACTION: City Manager read staff report of funds and allocations-STA-4500. Resolution accepting funds and report. Public Comments: Michelle Burke – Lighting-Pedestrian Lights on Main St. and business. Comments Closed. Councilmember Paul Steele motion to approve revisions to the 2020-2021 Transportation Development Act claim packet. Councilmember Iva Walton second the motion. AYES: Councilmember's Paul Steele, Iva Walton, Vice Mayor Pamela Bulahan. NOES: None. ABSTAIN: None. ABSENT: Mayor Eric Pene. PASSED 3-0.

## 7. NEW BUSINESS

**A. SUBJECT:** City Council Sub-Committee Assignments and review Appointment Boards and Commission Policy.

**RECOMMENDATION:** Staff recommends that City Council review and modify as necessary the sub-committee assignments.

ACTION: Tabled.

**B. SUBJECT:** Resolution 01-22, a Resolution of the City Council of the City of Isleton approving Fiscal Year 2021-2022 Transportation Development ACT (TDA) claim, and

authorizing submissions and amendments by the City Manager, or his/her designee, to the Sacramento Area Council of Governments (SACOG) for Local Transportation Funds (LTF) and State Transit Assistance Funds (STA).

**RECOMMENDATION:** Staff recommends City Council to approve Resolution 01-22 pertaining to SACOG Transportation Development Act Claim Packet for Fiscal Year 2021-2022.

ACTION: No Public comments. Councilmember Paul Steele motion to approve Resolution 01—22 pertaining to SACOG Transportation Development Act Claim Packet for Fiscal Year 2021-2022. Councilmember Iva Walton second the motion. AYES: Councilmember's Paul Steele, Iva Walton, Vice Mayor Pamela Bulahan. NOES: None. ABSTAIN: None. ABSENT: Mayor Eric Pene. PASSED 3-0.

C. **SUBJECT:** 4th and A Street, 4-Way Stop Sign, Traffic Warrant; Purchase Order.

**RECOMMENDATION:** Staff recommends City Council review and approve purchase order with TJKM for traffic warrant for 4th and A Streets.

ACTION: No Public comments. Councilmember Iva Walton motion to approve purchase order with TJKM for traffic warrant for 4th and A Streets. Councilmember Paul Steele second the motion. AYES: Councilmember's Paul Steele, Iva Walton, Vice Mayor Pamela Bulahan. NOES: None. ABSTAIN: None. ABSENT: Mayor Eric Pene. PASSED 3-0.

D. **SUBJECT:** Resolution No. 02-22, Resolution of the City Council authorizing submittal of application(s) for all CalRecycle Grants for which City of Isleton is eligible.

**RECOMMENDATION:** Staff recommends that the City Council adopt Resolution No. 02-22, application for a recycle grant.

ACTION: No Public comments. Vice Mayor Pamela Bulahan motion to adopt Resolution No. 02-22, application for recycle grant. Councilmember Paul Steele second the motion. AYES: Councilmember's Paul Steele, Iva Walton, Vice Mayor Pamela Bulahan. NOES: None. ABSTAIN: None. ABSENT: Mayor Eric Pene. PASSED 3-0.

## 8. COUNCIL REPORTS AND COMMITTEE UPDATES

A. Councilmember Vacant
B. Councilmember Paul Steele – Delta Protection Committee. Spam Festival-Raffle-February 5, 2022.
C. Councilmember Iva Walton – Interview with Comstock Magazine, McBoodery is in it.
D. Vice Mayor Pamela Bulahan – SACOG Meeting coming up.
E. Mayor Eric Pene – Absent.

## 9. STAFF GENERAL REPORTS AND DISCUSSION

A. City Manager Report – None.
B. Fire Chief Report – Absent.

**AMERICANS WITH DISABILITIES ACT NOTICE:** In compliance with the Americans with Disabilities Act, persons needing a disability-related modification or accommodation, including auxiliary aids or services, to participate in this meeting, may contact Deputy City Clerk Yvonne Zepeda, at (916) 777-7770, by fax at (916) 777-7775 or by email to Yvonne.zepeda@cityofisleton.com at least 48 hours prior to the meeting.

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**10. CLOSED SESSION**

A. None.

**11. ADJOURNMENT**

AYES:
NOES:
ABSTAIN:
ABSENT:

_____
MAYOR, Eric Pene

ATTEST:

_____
DEPUTY CITY CLERK, Yvonne Zepeda

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**CITY OF ISLETON**

**Special City Council Meeting Minutes**

Thursday, January 27th, 2022 at 3:00pm
208 Jackson Boulevard
Isleton, California 95641
You can call in to join our public meeting
**TELECONFERENCE MEETING**
**ORDER OF THE HEALTH OFFICER OF THE COUNTY OF SACRAMENTO JANUARY 6, 2022 DIRECTING ALL INDIVIDUALS IN THE COUNTY TO WEAR FACE COVERINGS INDOORS IN WORKPLACES AND PUBLIC SETTINGS ALL PUBLIC MEETINGS TO BE CONDUCTED REMOTELY**

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1. **OPENING CEREMONIES**

   **A.** Welcome & Call to Order – Mayor Eric Pene called to order.
   **B.** Pledge of Allegiance
   **C.** Roll Call
   Present: Councilmember's Paul Steele, Iva Walton, Vice Mayor Pamela Bulahan, Mayor Eric Pene, City Manager Charles Bergson, City Attorney Andreas Booher and Deputy City Clerk Yvonne Zepeda.

2. **AGENDA CHANGES OR DELETIONS**
   ACTION: None.

3. **PUBLIC COMMENT**

   This is an opportunity for the public to speak to the Council on any item other than those listed for public hearing on this Agenda. Speakers are requested to use the podium in front of the Council and to begin by stating their name, whether they reside in Isleton and the name of the organization they represent if any. The Mayor may impose a time limit on any speaker depending on the number of people wanting to speak and the time available for the rest of the Agenda. In the event comments are related to an item scheduled on the Agenda, speakers will be asked to wait to make their comments until that item is being considered.
   ACTION: Jessica, Dean , Marissa, Phil Treat, Shauna, IPhone, Mary Costello, Kristen Ordon, Bill Chism, Chris Jones, O'Leary and Andreas: All regarding crime in Isleton, Shooting near Hotel Del Rio and obtaining our own police department. Code Enforcement, make Isleton safe. What are the options, sub-contract with us? Del Rio out of control. Who do we call? Call Isleton City Hall and Sheriff's. Send all activity to City Hall.

4. **COMMUNICATION**
   **A.** County of Sacramento, Order of Health Officer.

**AMERICANS WITH DISABILITIES ACT NOTICE:** In compliance with the Americans with Disabilities Act, persons needing a disability-related modification or accommodation, including auxiliary aids or services, to participate in this meeting, may contact Deputy City Clerk Yvonne Zepeda, at (916) 777-7770, by fax at (916) 777-7775 or by email to Yvonne.zepeda@cityofisleton.com at least 48 hours prior to the meeting.

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**B.** Isleton Fire Department Donation.
Action: Information only.

**5. CONSENT CALENDAR**

**A. SUBJECT:** Approval of Minutes of the Regular City Council Meeting of December 14, 2021.

**RECOMMENDATION:** City Council review and approve draft minutes of the Regular City Council meeting of December 14, 2021.
ACTION: Councilmember Paul Steele motion to approve draft minutes of the Regular City Council meeting of December 14, 2021. Councilmember Iva Walton second the motion. AYES: Councilmember Paul Steele, Iva Walton, Vice Mayor Pamela Bulahan, Mayor Eric Pene. NOES: None. ABSTAIN: None. ABSENT: None. PASSED 4-0.

**6. OLD BUSINESS**

**A. SUBJECT:** City Council accept the Isleton West Side Rehabilitation Project #20-21 as complete; authorizing City Clerk to file the Notice of Completion with the Sacramento County Recorder.

**RECOMMENDATION**: Staff request City Council accept the Isleton West Side Rehabilitation #20-21 as complete.

ACTION: Councilmember Paul Steele motion to accept the Isleton West Side Rehabilitation #20-21 as complete. Vice Mayor Pamela Bulahan second the motion. AYES: Councilmember Paul Steele, Iva Walton, Vice Mayor Pamela Bulahan, Mayor Eric Pene. NOES: None. ABSTAIN: None. ABSENT: None. PASSED 4-0.

**7. NEW BUSINESS**

**A. SUBJECT:** City Council Sub-Committee Assignments and review Appointment Boards and Commission Policy.

**RECOMMENDATION**: Staff recommends that City Council review and modify as necessary the sub-committee assignments.
ACTION: City Council amended sub-committee assignments

**B. SUBJECT:** Resolution No. 03-22, a Resolution of the City Council of the City of Isleton authorizing the submission of an application to the California Infrastructure and Economic Development Bank (IBANK) for Financing a Capital Improvement

Project, Authorizing the incurring of an obligation payable to IBank for the financing of a Capital Improvement Project if IBank approves said application, Declaration of Official Intent to Reimburse certain expenditures from the proceeds of an obligation, and approving certain other matters in connection therewith.

**RECOMMENDATION:** Staff recommends City Council to Adopt Resolution 03-22 Authorizing the Submission of an Application to the California Infrastructure and Economic Development Bank (IBank) for Financing a Capital Improvement Project, Authorizing the Incurring of an Obligation Payable to IBank for the Financing of a Capital Improvement Project if IBank Approves Said Application, Declaration of Official Intent to Reimburse Certain Expenditures from the Proceeds of an Obligation, and Approving Certain Other Matters in Connection Therewith.

ACTION: Vice Mayor Pamela Bulahan motion to adopt Resolution No. 03-22 Authorizing the Submission of an Application to the California Infrastructure and Economic Development Bank (IBank) for Financing a Capital Improvement Project, Authorizing the Incurring of an Obligation Payable to IBank for the Financing of a Capital Improvement Project if IBank Approves Said Application, Declaration of Official Intent to Reimburse Certain Expenditures from the Proceeds of an Obligation, and Approving Certain Other Matters in Connection Therewith. Councilmember Paul Steele second the motion. AYES: Councilmember Paul Steele, Iva Walton, Vice Mayor Pamela Bulahan, Mayor Eric Pene. NOES: None. ABSTAIN: None. ABSENT: None. PASSED 4-0.

C. **SUBJECT:** Staff recommends that City Council adopt Resolution No. 04-22, approving Memorandum of Understanding (MOU) by and Between the Sacramento Area Council of Governments ("SACOG:) and the City of Isleton for the City's Rental Inspection Program.

**RECOMMENDATION:** Staff is requesting City Council approve Resolution No. 04-22, approving Memorandum of Understanding (MOU) between the City of Isleton and SACOG to establish the City's Rental Inspection Program.
ACTION: Councilmember Iva Walton motion to approve Resolution No. 04-22, approving Memorandum of Understanding (MOU) between the City of Isleton and SACOG to establish the City's Rental Inspection Program. Councilmember Paul Steele second the motion. AYES: Councilmember's Paul Steele, Iva Walton, Vice Mayor Pamela Bulahan and Mayor Eric Pene. NOES: None. ABSTAIN: None. ABSENT: None. PASSED 4-0.

**AMERICANS WITH DISABILITIES ACT NOTICE:** In compliance with the Americans with Disabilities Act, persons needing a disability-related modification or accommodation, including auxiliary aids or services, to participate in this meeting, may contact Deputy City Clerk Yvonne Zepeda, at (916) 777-7770, by fax at (916) 777-7775 or by email to Yvonne.zepeda@cityofisleton.com at least 48 hours prior to the meeting.

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D. **SUBJECT:** Resolution No. 05-22, a Resolution by the City Council of the City of Isleton authorizing a proposal for funding form the California Department of Water Resources and Designating a representative to execute the agreement and any amendments thereto, for the Multi-Benefits City of Isleton Perimeter Flood Barrier Road and Berm.

**RECOMMENDATION:** Staff is requesting City Council pass Resolution No. 05-22 authorizing a proposal for funding from the California Department of Water Resources and designating representative to execute the agreement for the Isleton Perimeter Flood Barrier Road and Berm project.
ACTION: Councilmember's Paul Steele motion to pass Resolution No. 05-22, authorizing a proposal for funding from the California Department of Water Resources and designating representative to execute the agreement for the Isleton Perimeter Flood Barrier Road and Berm project. Councilmember Iva Walton second the motion. AYES: Councilmember Paul Steele, Iva Walton, Vice Mayor Pamela Bulahan, Mayor Eric Pene. NOES: None. ABSTAIN: None. ABSENT: None. PASSED 4-0.

**8. COUNCIL REPORTS AND COMMITTEE UPDATES**

A. Councilmember Vacant
B. Councilmember Paul Steele – Isleton Spam Festival Feb. 5 at Peter's Steak House.
C. Councilmember Iva Walton – None.
D. Vice Mayor Pamela Bulahan – None.
E. Mayor Eric Pene – Police for Isleton.

**9. STAFF GENERAL REPORTS AND DISCUSSION**

A. City Manager Report – Police in Isleton working on it.
B. Fire Chief Report – None.

**10. CLOSED SESSION**

**A.** None.

**11. ADJOURNMENT**

AYES:
NOES:
ABSTAIN:
ABSENT:

_____
MAYOR, Eric Pene

**AMERICANS WITH DISABILITIES ACT NOTICE:** In compliance with the Americans with Disabilities Act, persons needing a disability-related modification or accommodation, including auxiliary aids or services, to participate in this meeting, may contact Deputy City Clerk Yvonne Zepeda, at (916) 777-7770, by fax at (916) 777-7775 or by email to Yvonne.zepeda@cityofisleton.com at least 48 hours prior to the meeting.

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ATTEST: DEPUTY CITY CLERK, Yvonne Zepeda

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# City of Isleton

DATE: February 22, 2022

City Council
Staff Report

ITEM#: 6.A

CATEGORY: Old Business

**TJKM PRESENTATION, LOCAL ROAD SAFETY PLAN (LRSP); DRAFT FINAL REPORT PRESENTATION ADOPTION**

## SUMMARY

The City of Isleton's Local Road Safety Plan (LRSP) is a comprehensive plan that creates a framework to systematically identify and analyze traffic safety related issues and recommend projects and countermeasures. The LRSP aims to reduce fatal and severe injury collisions through a prioritized list of improvements that can enhance safety on local roadways.

The LRSP utilizes a comprehensive approach to safety incorporating the "4 E's of traffic safety": Engineering, Enforcement, Education and Emergency Medical Services (EMS). This approach recognizes that not all locations can be addressed solely by infrastructure improvements. Incorporating the 4 E's of traffic safety is often required to ensure successful implementation of significant safety improvements and reduce the severity and frequency of collisions throughout a jurisdiction.

The LRSP takes a proactive approach to addressing safety needs. It is viewed as a guidance document that can be a source of information and ideas. It can also be a living document, one that is routinely reviewed and updated by City staff and their safety partners to reflect evolving collision trends and community needs and priorities. With the LRSP as a guide, the City will be able to ready to apply for grant funds, such as the federal Highway Safety Improvement Program (HSIP). Starting with the next call for projects (Cycle 11), a LRSP will be required to apply for funds.

## DISCUSSION

The City received a $72,000 grant from Caltrans to prepare the LRSP, along with an $8,000 match from the City. After conducting an RFP process in spring 2021, the City selected TJKM Transportation Consultants to prepare the LRSP.

The City of Isleton's LRSP is a comprehensive plan that takes a proactive approach to addressing safety needs. The plan collected and evaluated collision data within the City from 2015 to 2019, conducted a community/stakeholder outreach campaign, and prepared a set of recommended improvements to address safety concerns at specific roadways and intersections throughout the community. The plan first established a set of five goals, which are as follows:

1. Identify and analyze safety problems and recommend improvements.
2. Improve the safety of pedestrians and bicyclists.

3. Coordinate implementation with key stakeholders.
4. Seek consistent funding until the vision is fulfilled.
5. Ensure safety improvements are made in an equitable manner.

Stakeholder and community outreach is an integral part of the LRSP process, to ensure that it is responsive and shaped by the community's needs and values. To meet this need, a stakeholder group was formed and met twice, once on October 19th, 2021 and the other on December 13th, 2021 to discuss traffic safety issues and give feedback on the LRSP process. This was supplemented by a project website (www.isletonsafestreets.com) with an interactive map tool platform that allowed community members to submit traffic safety concerns directly to the project on an interactive map. The tool remained open for approximately two months and garnered 51 responses.

An analysis of Isleton's collisions showed that 10 collisions occurred during the study period, of which two were fatalities. Four identified prominent collision trends included improper turning violations, unsafe speeding violations, nighttime collisions, and pedestrian collisions. The team then utilized the Equivalent Property Damage Only (EPDO) analysis methodology from the Caltrans HSIP program to determine the most high-risk intersections and roadway segments in Isleton. The identified locations were:

- Intersection of H St/Main St
- Intersection of SR-160/2nd St/A St
- Intersection of SR-160/H St
- Intersection of Union St/D St
- SR-160 between Tyler Island Bridge Rd and 1st St
- H St between SR-160 and 6th St
- Main St/2nd St between SR-160 and H St
- 4th Ave between Delta Ave and Georgiana Dr.

Four additional corridors that had experienced few or no collisions were analyzed based on City staff input and supported by community input. These locations are:

- A St, 4th St, and Jackson St from City Limit to SR-160
- B St between SR-160 and 5th St
- Union St between C St and H St
- 6th St between Jackson St and H St

Based on the identified collision trends, the project team selected emphasis areas for the LRSP. Emphasis areas are focus areas for the LRSP that are identified through the comprehensive collision analysis of the identified high injury locations within the City of Isleton. Emphasis areas help in identifying appropriate safety strategies and countermeasures with the greatest potential to reduce collisions occurring at these high injury locations. They can include (but not be limited to): specific collision types, human behaviors, facility types, and specific locations or corridors. The following are the identified emphasis areas:

1. Reduce Intersection Collisions (collisions within 250 feet of intersections)

2. Improve Pedestrian Safety
3. Reduce Collisions from Improper Turning Violations
4. Address SR-160 Collisions
5. Reduce Unsafe Speed Violations and Rear End Collisions
6. Reduce Nighttime Collisions

Following the selection of emphasis areas, countermeasures were selected for each of the identified high-risk intersections, roadway segments and staff identified corridors based on extensive review of existing conditions at the site and characteristics of identified collisions in Isleton. The project team conducted a thorough review of the high-risk locations (intersections and roadway segments) using aerial photography, Google Maps Street View software, and in-person site visits. Crash characteristics of all collisions were considered. This resulted in the development of a countermeasure toolbox that includes HSIP approved countermeasures for each location and emphasis area, as well as non HSIP approved countermeasures and non-engineering related countermeasures (Education, Enforcement, and EMS). A summary of the recommendations is included in the draft LRSP Report.

The engineering countermeasures were then grouped into safety projects for high-risk intersections and roadway segments. A total of six safety projects were developed along with cost estimates and a Benefit/Cost Ratio (BCR), in accordance with Caltrans HSIP guidelines. The six safety projects are:

- Project 1: Systemic Improvements at Unsignalized Intersections (Advance Flashing Beacons and Splitter Islands)
- Project #2: Systemic Improvements at Unsignalized Intersections (Upgrade/Install Warning Signs, Upgrade Intersection Pavement Markings, and Improve Sight Distance)
- Project #3: Pedestrian Improvements at Unsignalized Intersections (Upgrade Pedestrian Crossings and Install Rectangular Rapid Flashing Beacon (RRFB) and Median Refuge Island)
- Project #4: Roadway Segment Improvements on SR-160 (Install Segment Lighting and Edge-line Rumble Strips)
- Project #5: Systemic Improvements on Roadway Segments (Install/Upgrade Signs with Fluorescent Sheeting, and Install Delineators, Reflectors, and Object Markers)
- Project #6: Systemic Improvements on Roadway Segments (Install Edge-lines and Centerlines)

The LRSP is a living document that is continuously monitored and evaluated to ensure the recommended countermeasures are effective, typically every 2-5 years. Since the most recent presentation to City Council on December 14th, 2021, a Draft LRSP report has been developed incorporating all sections described in this staff report.

The next step is to apply for HSIP grant funding to implement safety improvements in Isleton. The next call for projects (Cycle 11) is expected to open in April 2022. TJKM has scoped to assist the City with preparing and submitting two HSIP applications, and will work with the City to which projects and locations will be most competitive for funding.

## FISCAL IMPACT

Caltrans Local Road Safety Plant Grant $80,000 awarded $72,000
TJKM Transportation Consultants $74,476.13
City match is $7,476 and will be funded through transportation funds.

## RECOMMENDATION

Staff recommends City Council adopt the Draft Final City of Isleton Isleton LRSP Report Feb 2022.

## ATTACHMENTS

1. City of Isleton Local Road Safety Plan (LRSP) Draft

Prepared by: Diana O'Brien, Administrative Assistant
Reviewed by: Charles Bergson, City Manager
Submitted by: Yvonne Zepeda, Deputy City Clerk

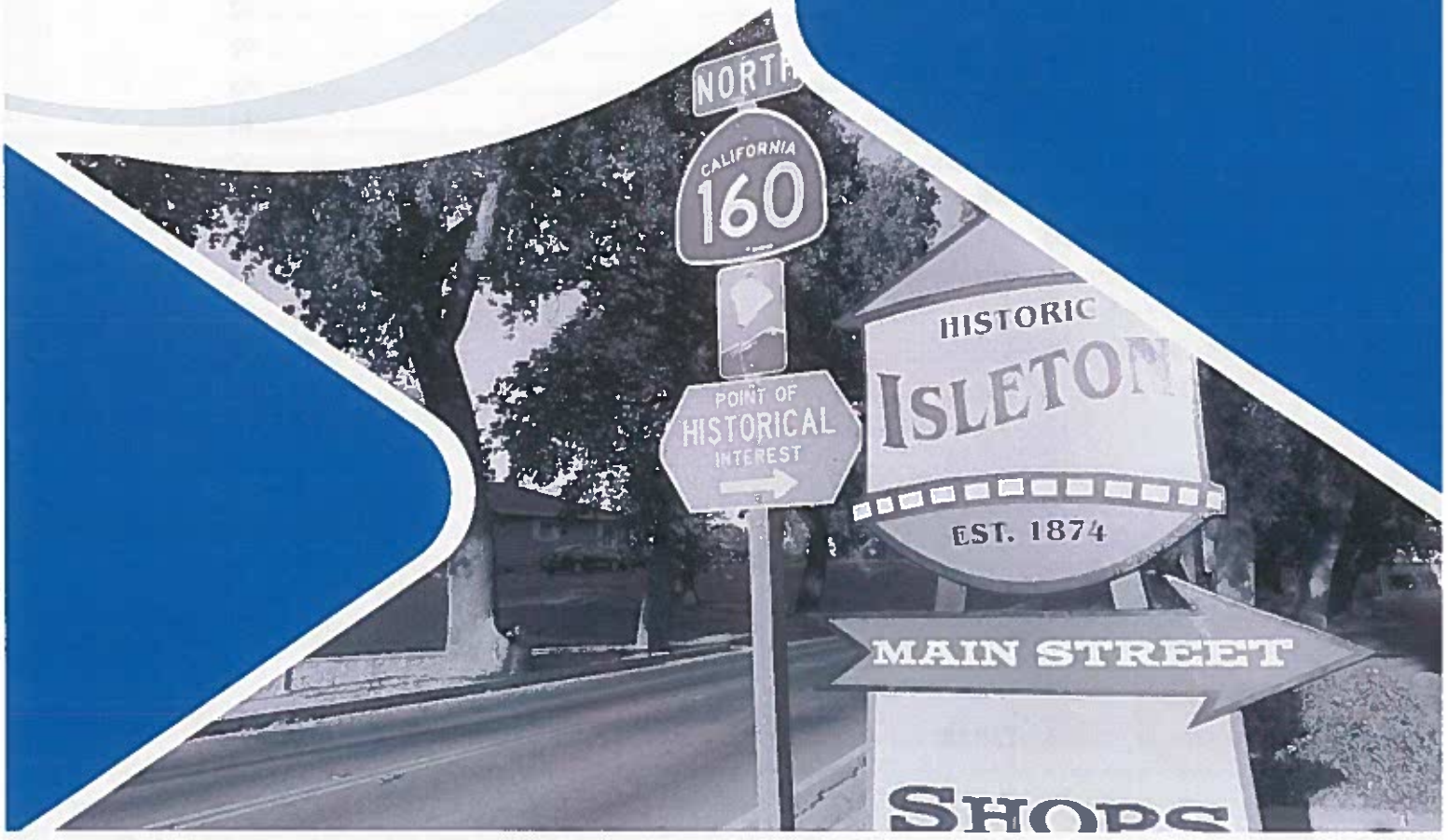
# Isleton

## Local Road Safety Plan

## Draft Report

February 2022

TJKM



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## Appendices

# Executive Summary

The City of Isleton's Local Road Safety Plan (LRSP) is a comprehensive plan that creates a framework to systematically identify and analyze traffic safety related issues and recommend projects and countermeasures. The LRSP aims to reduce fatal and severe injury collisions through a prioritized list of improvements that can enhance safety on local roadways.

The LRSP takes a proactive approach to addressing safety needs. It is viewed as a guidance document that can be a source of information and ideas. It can also be a living document, one that is routinely reviewed and updated by City staff and their safety partners to reflect evolving collision trends and community needs and priorities. With the LRSP as a guide, the City will be able to ready to apply for grant funds, such as the federal Highway Safety Improvement Program (HSIP). This document summarizes the collision analysis, identifies high-risk locations and recommends countermeasures at each of these high-risk locations. This is conducted as a part of the LRSP for the City of Isleton. This document is organized into seven sections as follows:

## Chapter 1 – Introduction

The Introduction presents the project, describes how this report is organized, summaries the vision and goals, the study area for the LRSP, details how the report is organized and introduces the safety partners.

## Chapter 2 – Literature Review

This chapter summarizes the City's and regional planning documents and projects that are relevant to the LRSP. It ensures that the recommendations of the LRSP are in line with existing goals, objectives, policies, or projects.

## Chapter 3 – Collision Data Collection and Analysis

This chapter summarizes data analysis approach and presents preliminary as well as detailed collision analysis and findings in the study area. This analysis of fatal and severe injury collisions is performed by facility type (intersection and roadway segment). Collision data was obtained and analyzed for a five-year period from 2015 to 2019 from the California Highway Patrol's Statewide Integrated Traffic Records System (SWITRS) and the University of California at Berkeley SafeTREC's Transportation Injury Mapping Service (TIMS).

## Chapter 4 - Emphasis Areas

Emphasis areas are a focus of the LRSP that are identified through the various collision types and factors resulting in fatal and severe injury collisions within the City of Isleton. The six emphasis areas for Isleton are:

1. Reduce Intersection Collisions
2. Improve Pedestrian Safety
3. Reduce Collisions from Improper Turning Violations
4. Address SR-160 Collisions
5. Reduce Unsafe Speed Violations and Rear End Collisions
6. Reduce Nighttime Collisions

## Chapter 5 – Countermeasure Identification

Engineering countermeasures were selected for each of the high-risk locations and for the emphasis areas. These were based off of approved countermeasures from the Caltrans Local Roadway Safety Manual (LRSM) used in HSIP grant calls for projects. The intention is to give the City potential countermeasures for each location that can be implemented either in future HSIP calls for projects, or using other funding sources, such as the City's Capital Improvement Program. Non-engineering countermeasures were also selected using the 4 E's strategies, and are included with the emphasis areas.

## Chapter 6 – Safety Projects

A set of six safety projects were created for high-risk intersections and roadway segments, using HSIP approved countermeasures. These safety projects are:

Project #1: Systemic Improvements at Unsignalized Intersections
Project #2: Systemic Improvements at Unsignalized Intersections
Project #3: Pedestrian Improvements at Unsignalized Intersections
Project #4: Roadway Segment Improvements on SR-160
Project #5: Systemic Improvements on Roadway Segments
Project #6: Systemic Improvements on Roadway Segments

## Chapter 7 – Evaluation and Implementation

The LRSP is a guidance document that is recommended to be updated every two to five years in coordination with the safety partners. The LRSP document provides engineering, education, enforcement, and emergency medical service-related countermeasures that can be implemented throughout the City to reduce fatal and severe injury collisions. After implementing countermeasures, the performance measures for each emphasis area should

be evaluated annually. The most important measure of success of the LRSP should be reducing fatal and severe injury collisions throughout the City. If the number of fatal and severe injury collisions does not decrease over time, then the emphasis areas and countermeasures should be re-evaluated.

# 1. Introduction

## What is a LRSP?

The Local Road Safety Plan (LRSP) is a localized data-driven traffic safety plan that provides opportunities to address unique highway safety needs and reduce the number of fatal and severe injury collisions. The LRSP creates a framework to systematically identify and analyze traffic safety-related issues, and recommend safety projects and countermeasures. The LRSP facilitates the development of local agency partnerships and collaboration, resulting in the development of a prioritized list of improvements that can qualify for Highway Safety Improvement Program (HSIP) funding. The LRSP is a proactive approach to addressing safety needs and is viewed as a living document that can be constantly reviewed and revised to reflect evolving trends, and community needs and priorities.

## Process

The systemic approach in preparing the LRSP involves the following steps:

- Develop plan goals and objectives
- Analyze collision data
- Meet with stakeholders/safety partners
- Determine focus areas and identify crash reduction strategies
- Prioritize countermeasures/projects
- Prepare the LRSP

## Goals and Objectives of the Isleton LRSP

### Goal #1: Systematically identify and analyze roadway safety problems and recommend improvements

**Objective 1:** Use the Systemic Safety Analysis data-driven process to identify traffic collisions in Isleton, (with an emphasis on fatal and severe injury collisions); where, when, and how they are occurring, and implement appropriate and proven countermeasures.

**Objective 2:** Improve roadway planning, design, operations, and connectivity to enhance safety and mobility for users of all ages and abilities

**Objective 3:** Implement traffic calming strategies to discourage speeding and other unsafe driving behaviors on residential streets

**Objective 4:** Ensure that all recommended improvements are consistent with City of Isleton goals, as well as State and Federal plans and goals (such as, but not limited to: California Strategic Highway Safety Plan, and the FHWA Local and Rural Road Safety Program).

### Goal 2: Improve the safety of pedestrians and bicyclists by using proven effective countermeasures

**Objective 1:** Identify safety issues and locations/hot spots where bicycle and pedestrian collisions occur in Isleton, and treat with appropriate and effective engineering countermeasures

**Objective 2:** Provide educational programs for bicyclists, pedestrians, and motorists to inform on how to be safe in the public right-of-way; either through after-school programs, law enforcement programs, or other public/private sponsored programs

**Objective 3:** Improve sidewalks, walkways, and crossings to be free of hazards and to minimize conflicts with vehicular traffic

**Objective 4:** Prioritize improvements that promote Safe Routes to School efforts or are located near schools

### Goal 3: Ensure coordination of key stakeholders to implement roadway safety improvements & response within Isleton

**Objective 1:** Coordinate between City Departments, Sheriff's Office, Fire Department, and EMS agencies to ensure a coordinated response to traffic safety, including:

- Implementation of safety improvements
- Public education on safely traveling in the public right-of-way, regardless of mode
- Enforcement of traffic safety laws in the public right-of-way
- Minimizing impacts to emergency response times.

**Objective 2:** Coordinate with local, regional, and state partners (such as SACOG or Caltrans), to identify and address traffic safety issues and ensure a coordinated response.

### Goal 4: Continually seek funding for safety improvements

**Objective 1:** Ensure the LRSP meets Highway Safety Improvement Program (HSIP) guidelines in order to apply for funding for identified countermeasures

**Objective 2:** Provide a list of prioritized improvements that guide City investments and grant funding applications

**Objective 3:** Continually seek funding sources to implement engineering, education, enforcement, and emergency response solutions to roadway safety issues in Isleton

### Goal 5: Ensure that safety improvements are made in a manner that is fair and equitable for all Isleton residents

**Objective 1:** Provide a forum for residents to submit traffic safety related complaints; and for City staff and officials to respond to such complaints

**Objective 2:** Ensure the consideration of equity when selecting where to make traffic safety improvements

**Objective 3:** Where feasible, implement community outreach to inform the public about upcoming safety improvements and seek their input

## Study Area

The City of Isleton is located in Sacramento County, California covering a total area of just under 314 acres, located on Andrus Island in the San Joaquin-Sacramento River Delta. The City's estimated population is 794 (US Census 2020). Jackson Blvd and River Road (SR 160) are the primary roadways that connect the City of Isleton to the Rio Vista Bridge and other nearby cities. The nearest cities include Rio Vista and Antioch to the south and west, Lodi to the east, and unincorporated Walnut Grove to the north. The study area is mapped in **Figure 1** below.

## Demographic and Jurisdiction Information

Demographic data has been collected from the Census for the City of Isleton, Sacramento County, and California. A summary of the City's population and commute to work characteristics are presented below.

### Population

The City of Isleton is located on the Sacramento River in the heart of the scenic Sacramento-San Joaquin Delta region. According to www.data.census.gov, the population of Isleton in 2020 was 794, which is about 0.05% of the county population. Sacramento County's population is 1,585,055.

### Commute to Work

According to the Census American Community Survey (ACS) 2019 5-Year Estimates, 87.6% of Isleton commuters get to work by driving alone. The second most common method of commuting to work is walking at nearly 5%, higher than both the Sacramento County and State rate of walking commuters. The different modes of transportation used by Isleton residents to commute to work are shown in **Table 1** below.

Figure 1: Study Area

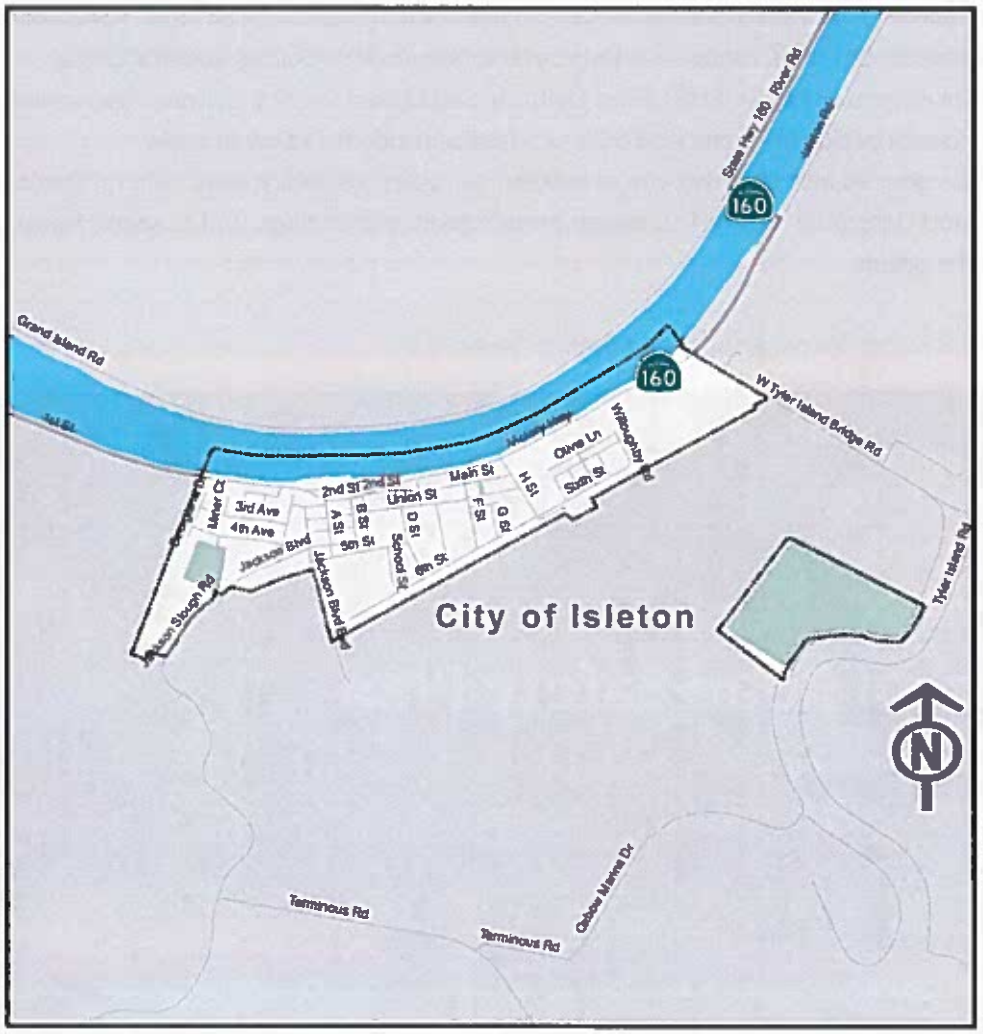



Table 1: Isleton Commute to Work Census Data

| Commute to Work | Isleton | Sacramento County | California |
|---|---|---|---|
| Drive Alone | 87.6% | 77.1% | 73.7% |
| Carpool | 3.0% | 10.1% | 10.1% |
| Public Transportation | 2.6% | 2.5% | 5.1% |
| Walked | 4.9% | 1.8% | 2.6% |
| Bicycle | 0.0% | 0.9% | 1.0% |
| Work from Home | 1.9% | 6.3% | 5.9% |
| Other | 0.0% | 1.3% | 1.6% |

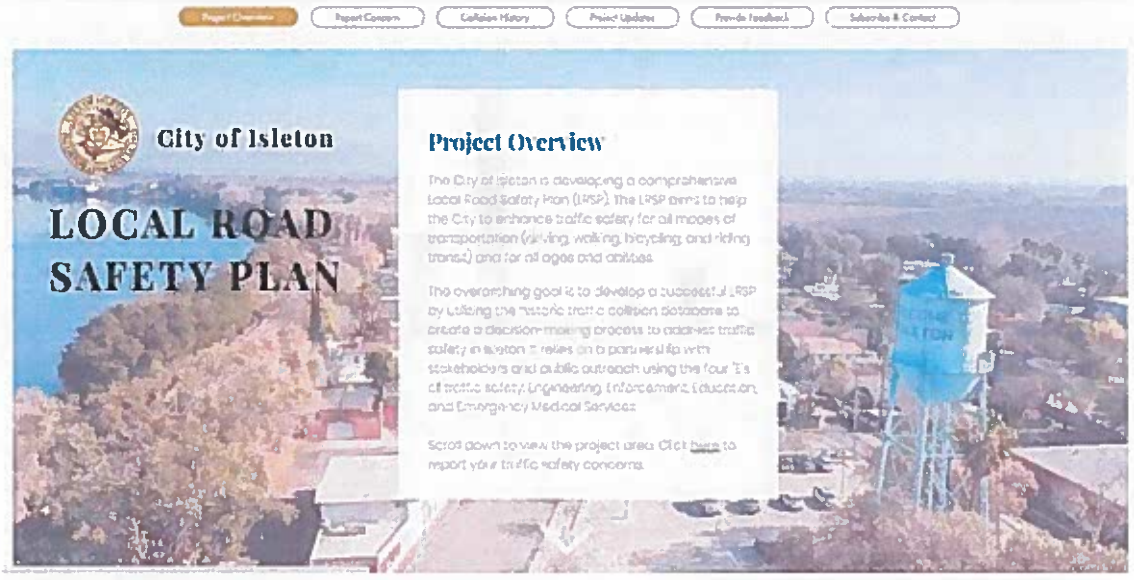
## Safety Partners

Safety partners are vital to the development and implementation of an LRSP. For Isleton, these include City staff, Isleton Fire Department, Sacramento County Sheriff's Office, California Highway Patrol (CHP), River Delta Unified School District, Caltrans, Sacramento Area Council of Governments (SACOG), and Isleton residents. Many of these groups/agencies attended two virtual stakeholder meetings, which were held on October 19, 2021, and December 13, 2021 to review project goals and findings, and to solicit feedback from the group.

Figure 2: Zoom Meeting from Stakeholder Meeting #1


This stakeholder outreach was supplemented by a project website (www.isletonsafestreets.com), with an interactive map tool platform. The interactive map was used to solicit input from Isleton residents outside the confines of traditional meetings.

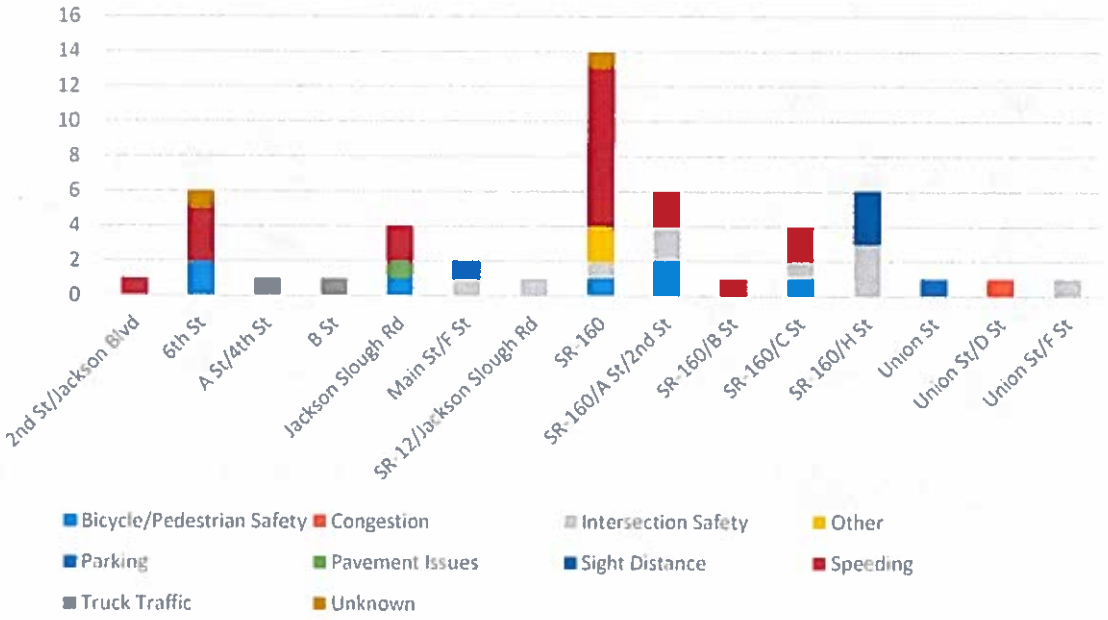
Figure 3: Isleton LRSP Project Website




In total, 51 comments were received on this map. The most comments were received about SR-160, and the most common concern was speeding. The results of the interactive map are shown below in **Figure 4**, and summarized in **Figure 5**.

Figure 4: Interactive Map Comment Responses

Figure 5: Public Comments on Traffic Safety by Location



# 2. Existing Planning Efforts

This section summarizes the planning documents, projects underway, and studies reviewed for Isleton Local Road Safety Plan (LRSP). The purpose is to ensure the LRSP vision, goals, and E's strategies are aligned with prior planning efforts, planned transportation projects and non-infrastructure programs. The documents reviewed are listed below:

1. City of Isleton Comprehensive General Plan and Environmental Impact Report, 2000
2. City of Isleton Opportunities, Constraints, and Vision Report, 2017
3. Safety Element (Existing Conditions) of Isleton General Plan Memo, 2021
4. Land Use Background Report of Isleton General Plan, 2020
5. City of Isleton Parking Analysis and Development Program, 1989
6. Isleton 10-Year Capital Improvement Program (CIP), 2017
7. SACOG Regional Bicycle, Pedestrian, and Trails Master Plan, 2015
8. SACOG Metropolitan Transportation Plan/ Sustainable Communities Strategy, 2016

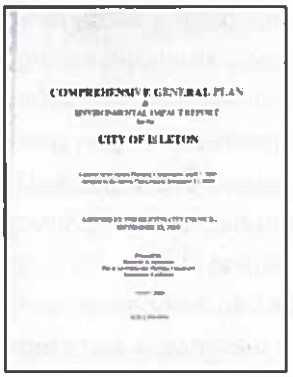
The following sections include brief descriptions of these documents and how they inform the development of the LRSP. A brief document summary is listed in **Table 2**. A more detailed list of upcoming projects and relevant policies is listed in **Appendix A**.

Table 2: Document Review Summary

| Document | Highlights |
|---|---|
| City of Isleton Comprehensive General Plan and Environmental Impact Report, 2000 | Enables the City Council to agree on development policies, provide clear guidance in judging whether projects comply with policies of the General Plan, and provide the basis for making intelligent amendments to the Plan as time and changing circumstances may dictate while being true to its purposes. |
| City of Isleton Opportunities, Constraints, and Vision Report, 2017 | Documents community vision for Isleton and informs LRSP safety constraints along SR 160 and Main Street within the city limits. |
| Safety Element (Existing Conditions) of Isleton General Plan Memo, 2021 | Reduces potential for short and long-term risks due to various hazards; identifies safety issues on SR 160 recommends specific mitigation actions. |
| Land Use Background Report of Isleton General Plan, 2020 | Presents existing conditions and trends specific to land use and serves as a resource for the Land Use Element of the General Plan and the associated Environmental Impact Report. |
| City of Isleton Parking Analysis and Development Program, 1989 | Parking study intended to alleviate parking issues within downtown Isleton. Assessed current and projected demand for off-street parking, identified possible sites for new parking development, and developed a financing program and implementation schedule. |
| Isleton 10-Year Capital Improvement Program (CIP), 2017 | Outlines all city project investments and cost estimates from 2017-2026 including streets, parks and recreation, City services, waste water, and planning/design projects. |
| SACOG Regional Bicycle, Pedestrian, and Trails Master Plan, 2015 | Provides a guiding document for all active transportation related investments in the six county Sacramento region, including two projects within Isleton. |
| SACOG Metropolitan Transportation Plan/ Sustainable Communities Strategy, 2016 | Federally required guiding document for all transportation related investments across the six-county Sacramento region. The MTP/SCS lists all planned investments in roadways, bicycle and pedestrian infrastructure, transit, etc., including land use and growth forecasts, to ensure the transportation system meets the needs of the Sacramento region. |

## Relevant City and County Planning Documents & Projects

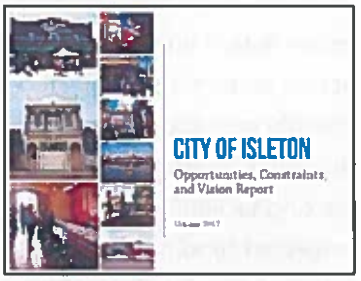
***Isleton Comprehensive General Plan and Environmental Impact Report (2000)***




Adopted in 2000, the Isleton Comprehensive General Plan and Environmental Impact Report is a planning document that compiled the City's long-term vision and outlined policies, standards, and programs to guide decisions concerning the City's development. The three primary functions of the General Plan are to enable the City Council to agree on development policies, provide clear guidance in judging whether projects comply with policies of the General Plan, and provide the basis for making intelligent amendments to the Plan as time and changing circumstances may dictate while being true to its purposes.

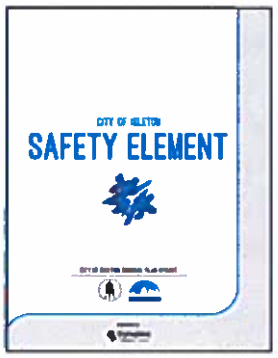
The General Plan aims to guide the City on land use, circulation, housing, public utilities, resource, and hazard management. The Circulation Element identifies transportation routes and design standards for streets and neighborhoods. It also suggests four alternatives for the realignment of State Route 160 within the Isleton and advises its expansion in future years. The General Plan documents typical roadway cross-section diagrams and circulation policies of different street systems. The General Plan informs the LRSP of the goals and policies guiding transportation development. It helps ensure the proposed countermeasures are well aligned with the City's vision. The General Plan is currently undergoing an update, and aspects of the new update (Safety Element, Land Use Background Report), are presented in this memo.

***City of Isleton Opportunities, Constraints, and Vision Report (2017)***




This report documents the community's vision for Isleton and lays the groundwork for achieving a successful, safe, and vibrant community in future years. It contains a community profile that describes existing conditions in Isleton, a section on Assets, Constraints, and Opportunities, and a draft Vision statement for the future. In addition, based on community feedback, this report informs the LRSP about the safety constraints along State Route 160 and insufficient parking along Main Street within the city limits. These constraints present the opportunity to capitalize on mobility, implement traffic calming and possible wayfinding measures.

***Safety Element of Isleton General Plan & Existing Conditions Memo (2021)***




The objective of the Safety Element of the General Plan is to reduce any potential for short and long-term risk of injury, loss of life, property damage, and socioeconomic impacts from fires, floods, droughts, earthquakes, landslides, climate change, and other hazards. The Safety Element directly relates to the land use, conservation, open space, housing, and environmental justice sections of the General Plan; flooding is one clear linkage, emphasized in the Safety Element and threaded throughout the General Plan. In the Existing Conditions memo, the Public Safety section emphasizes safety issues on State Route 160 and recommends to eliminate hazards to pedestrians and motorists resulting from pedestrians crossing the highway to reach the river.

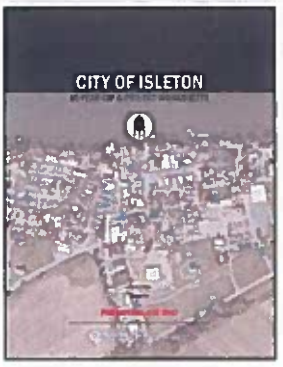
***Land Use Background Report of Isleton General Plan (2020)***


The purpose of the Background Report is to support the City of Isleton's update to the Land Use Element of the General Plan. It presents existing conditions and trends specific to land use in the City of Isleton and serves as a resource for the Land Use Element of the General Plan and the associated Environmental Impact Report (EIR) that will be prepared pursuant to the requirements of the California Environmental Quality Act (CEQA).

***City of Isleton Parking Analysis and Development Program (1989)***

Recognizing increased tourist traffic by automobile, the City conducted a parking study of the entire city help alleviate parking issues within downtown Isleton. The purpose of the study was to assess current and projected demand for off-street parking, identify possible sites for new parking development, develop a financing program with adequate resources to construct new parking facilities, provide an implementation schedule based on projected funding availability, and to review current zoning ordinance and make recommendations as appropriate. Recommendations included striping all on-street parking spaces and exploring future parking lots along State Highway 160, First Street, A Street, and across from City Hall.

***Isleton 10-Year Capital Improvement Program (CIP) (2017)***

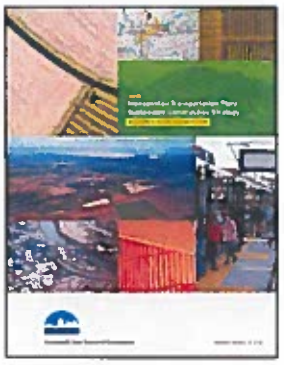



The City's 10-Year CIP outlines all capital and planning project investments from 2017-2026. This includes streets, parks and recreation, City services, waste water, and planning/design projects. Some of the transportation investments the City plans to make includes ADA ramp upgrades, road repaving, curb/gutter improvements, widening sidewalks, new signage/landscaping, and traffic calming improvements on Highway 160. The plan outlines cost estimates for each projects as well as identified City funds and identified or planned grant funds.

***SACOG Regional Bicycle, Pedestrian, and Trails Master Plan (2015)***


The Regional Bicycle, Pedestrian, and Trails Master Plan serves as the guiding document for active transportation investments in the six county Sacramento region. In order for a project to be eligible for funding from SACOG, it must be contained within this plan. As it pertains to Isleton, two projects are proposed: a Class I multi-use path along the Sacramento River waterfront and Highway 160, and a Bicycle/Pedestrian Master Plan & Feasibility Study. Additional Class II bike lanes are proposed just outside City limits on Tyler Island Bridge Road and Oxbow Road

***SACOG Metropolitan Transportation Plan/ Sustainable Communities Strategy (2020)***



This document serves as the guiding document for all transportation related investments across the six-county Sacramento region. The MTP/SCS is a federally required document that not only lists all planned investments in roadways, bicycle and pedestrian infrastructure, transit, etc., but also includes land use and growth forecasts. The intention is to provide a link between land use and transportation and ensure that the transportation system is meeting the needs of the Sacramento region. Projects that are included in the plan are eligible to receive federal funding. The Plan is guided by the following four priority policy areas:

- Build vibrant places for today's and tomorrow's residents
- Foster the next generation of mobility solutions
- Modernize the way we pay for transportation infrastructure
- Build and maintain a safe, reliable, and multimodal transportation system

# 3. Collision Data Collection and Analysis

This chapter summarizes the results of a citywide collision analysis for the time period between January 2015 and December 2019, as part of the Local Road Safety Plan (LRSP). This chapter includes the following sections:

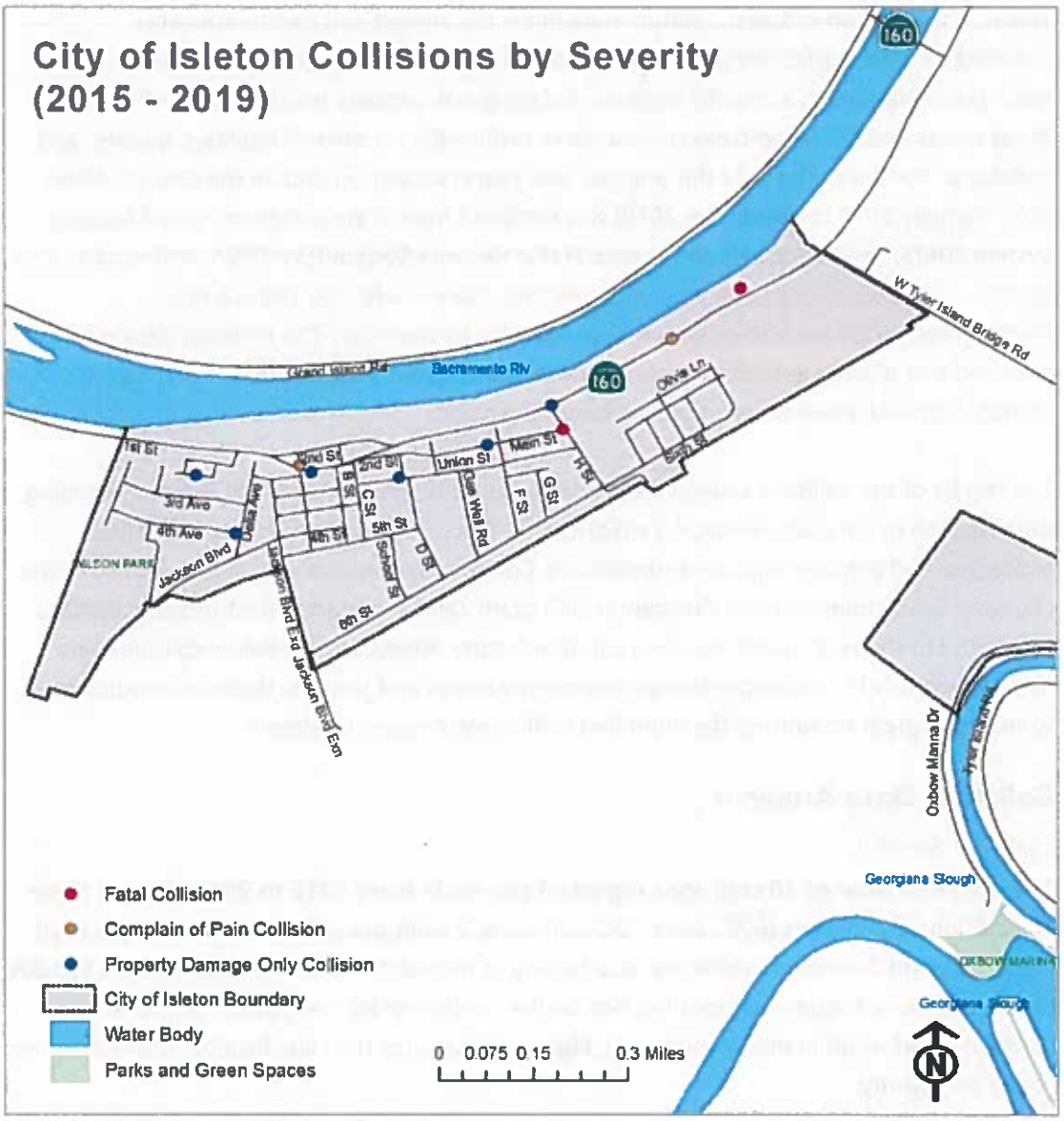
- Collision Data Analysis
- Geographic Collision Analysis
- High Injury Network
- Summary and Next Steps

The LRSP focuses on systemically identifying and analyzing traffic safety issues and recommends appropriate safety improvements. This chapter starts with an analysis of the collisions of all severity for the City of Isleton, including Property Damage Only (PDO) collisions. Collisions on State Route 160 (SR-160) were also included. A more detailed analysis for fatal and severe injury (F+SI) collisions that have occurred on Isleton roadways is included alongside the analysis of collisions of all severity.

After this data was separated between intersection collisions and roadway segment collisions, a comprehensive evaluation was conducted based on factors such as: collision severity, type of collision, primary collision factor, lighting, weather, and time of the day. A list of high-injury intersections and roadway segments were then identified and ranked based on the calculation of the equivalent property damage only (EPDO) scoring system.

**Figure 6** illustrates all the injury collisions that have occurred in Isleton from 1/1/2015 to 12/31/2019.

Figure 6: All Injury Collisions on City Roadways (2015-2019)



## Data Collection

This is a data-driven process. Collision data helps the analyst and decision-makers understand different factors that might be influencing collision patterns and various factors leading to collisions in a specific location. A data-driven process leads to more efficient use of resources and evidence-based measures to reduce the number of fatalities, injuries, and collisions. For the purpose of this analysis, five years of collision data in the City of Isleton (from January 2015 to December 2019) was retrieved from Transportation Injury Mapping System (TIMS)[1] and Statewide Integrated Traffic Records System (SWITRS)[2]. Although a LRSP typically focuses on roads maintained by the City, State Route (SR) 160 is a major thoroughfare in Isleton and as such was included in this analysis. The collision data was analyzed and plotted in the Geographic Information Systems (GIS) software ArcMap to identify high-risk intersections and roadways segments.

The results of the collision analysis below will be used to inform future LRSP tasks, including the selection of Emphasis Areas, 4 E's (Education, Enforcement, Engineering, and EMS) strategies, and engineering countermeasures. Collision data is also critical as it is used in the Highway Safety Improvement Program (HSIP) grant call for projects. Most projects that are submitted to the HSIP grant require a collision history. Analyzing the below collision data helps to identify the most appropriate countermeasures and projects that can be submitted to the HSIP grant to address the identified traffic safety issues in Isleton.

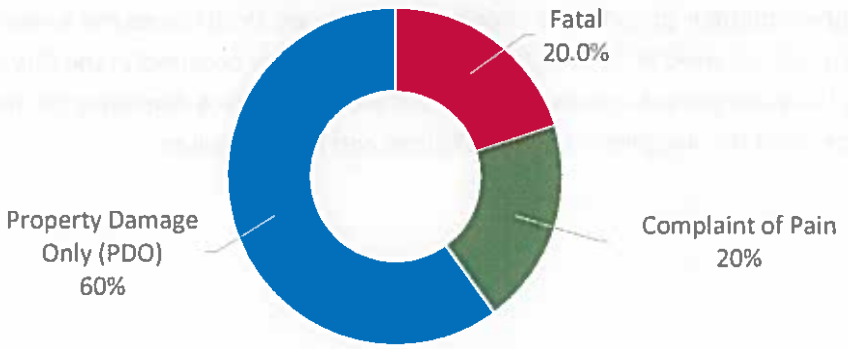
## Collision Data Analysis

### Collision Severity

**There were a total of 10 collisions reported city-wide from 2015 to 2019**. Among these 10 collisions, 6 collisions (60%) were PDO collisions, 2 collisions (20%) led to a complaint of pain injury and 2 collisions (20%) led to a fatality. It should be noted that this analysis focuses on the number of injury collisions but not on the number of injured parties (e.g., one collision could result in multiple injuries). **Figure 7** illustrates the classification of all collisions based on severity.

[1] UC Berkeley Safe TREC. (2021). Transportation Injury Mapping System https://tims.berkeley.edu/
[2] California Highway Patrol. (2021). Statewide Integrated Traffic Records System. https://www.chp.ca.gov/programs-services/services-information/switrs-internet-statewide-integrated-traffic-records-system

Figure 7: Collisions by Severity (2015-2019)




The analysis first includes a comparative evaluation between all collisions and F+SI collisions, based on various factors, including: collision trend over time, primary collision factor/violation category, collision type, facility type, motor vehicle involved with, weather, lighting, time of the day, and demographics of parties at-fault. Collision factors were then combined into pairs to dive deeper into the data and see what prominent trends are causing collisions in Isleton.

The collision data was separated below by facility type, i.e. based on collisions occurring on intersections and roadway segments. In accordance with HSIP guidelines, a collision was said to have occurred at an intersection if it occurred within 250 feet of it. The reported collisions categorized by facility type and collision severity are presented in **Table 3**.

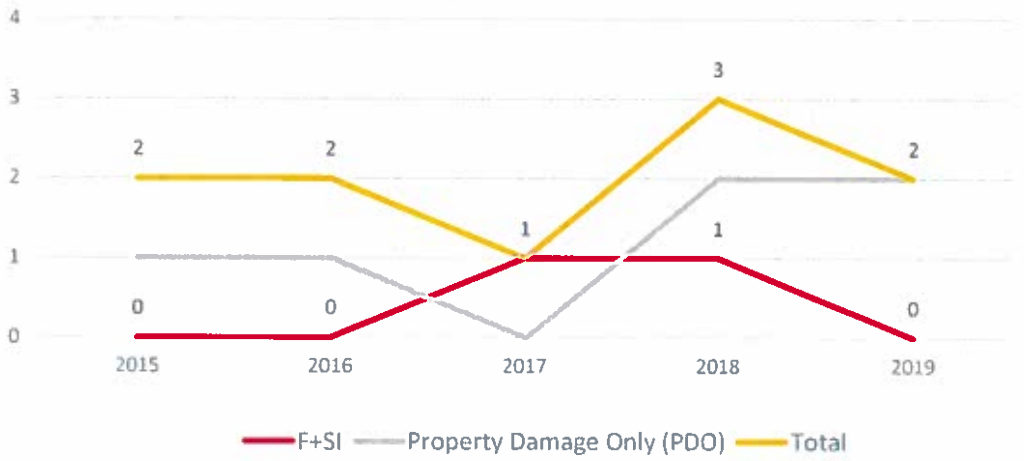
Table 3: Collisions by Severity and Facility Type

| Collision Severity | Roadway Segment | Intersection | Total |
|---|---|---|---|
| Fatal | 1 | 1 | 2 |
| Severe Injury | 0 | 0 | 0 |
| Visible Injury | 0 | 0 | 0 |
| Complaint of Pain | 1 | 1 | 2 |
| Property Damage Only (PDO) | 0 | 6 | 6 |
| **Total** | **2** | **8** | **10** |

## Collision Severity by Year

For all collisions, the number overall increased from 2015 to 2018 before decreasing in 2019. The highest number of collisions (3 collisions) occurred in 2018 and the lowest number of collisions (1) occurred in 2017. A total of 2 F+SI collisions occurred in the City of Isleton during the study period, one in 2017 and 2018 each. **Figure 8** illustrates the five-year collision trend for all collisions, F+SI collisions and PDO collisions.

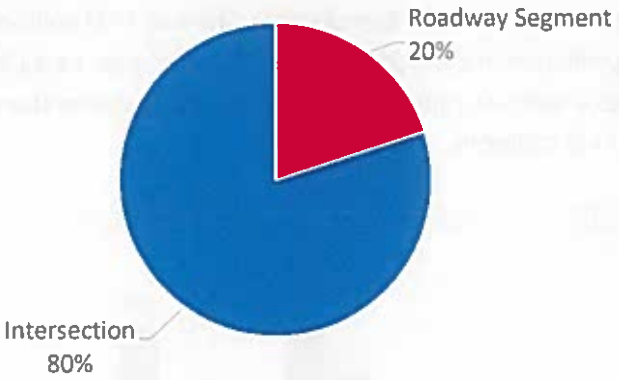
Figure 8: Five Year Collision Trend




## Intersection vs. Roadway Collisions

For the purposes of the analysis, a collision was said to have occurred at an intersection if it occurred within 250 feet of it. When evaluating collision location data for Isleton, the vast majority of collisions occurred at intersections. In the City of Isleton, 80% of all collisions (8 collisions) occurred at intersections whereas 20% (2 collisions) occurred on roadway segments. For the two F+SI collisions, one occurred at an intersection and one occurred on a roadway segment. This classification by location can be observed in **Figure 9**.

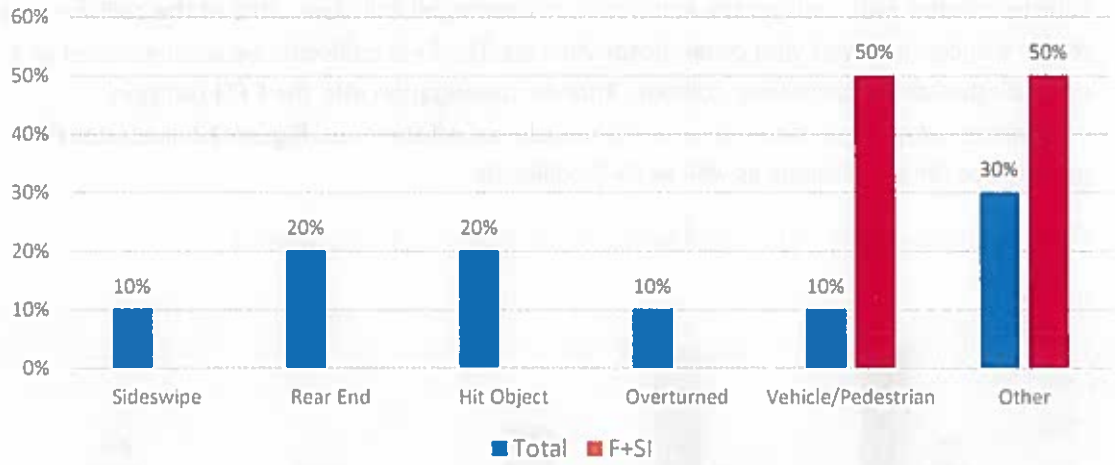
Figure 9: Intersection vs. Roadway Collisions – All Collisions




## Collision Type

Considering all collisions, the most commonly occurring collision types (besides Other, where a specific type is not coded in the collision report) were rear end (20%) and hit object collisions (20%). The high percentage of intersection collisions overall likely contributes to higher percentages of rear-end collisions (this type of collision more commonly occurs at intersections). The two F+SI collisions includes a vehicle-pedestrian and other type collision. **Figure 10** illustrates the collision type for all collisions as well as F+SI collisions.

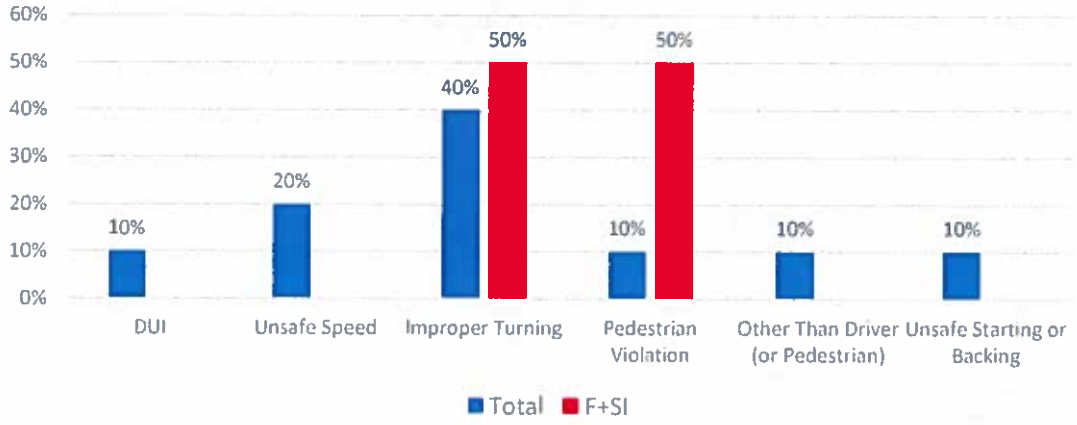
Figure 10: Collision Type – All Collisions vs. F+SI Collisions



## Violation Category

Considering all collisions, the most common violation category was observed to be the improper turning (40%) and unsafe speed (20%). The two F+SI collisions includes an improper turning violation and a pedestrian violation (in most cases, this is when the pedestrian violates a vehicle's right-of-way). **Figure 11** illustrates the violation category for all collisions and F+SI collisions.

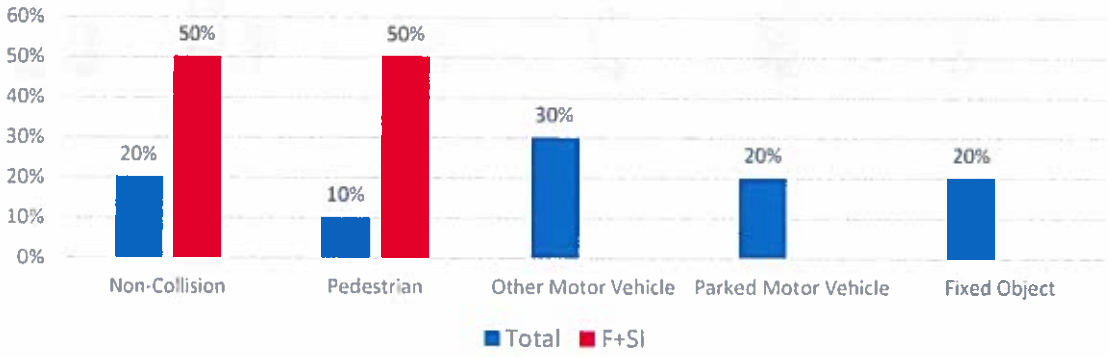
Figure 11: Violation Category: All Collisions vs. F+SI Collisions




## Motor Vehicle Involved With

Motor Vehicle Involved With (MVIW) is the term used in SWITRS to indicate what the motor vehicle collided with, causing the collision. Considering all collisions, 30% of the collisions are motor vehicles involved with other motor vehicles. The F+SI collisions were categorized as a non-collision and a pedestrian collision. Further investigation into the F+SI collision categorized as non-collision indicates the vehicle ran off the road. **Figure 12** illustrates the percentage for all collisions as well as F+SI collisions.

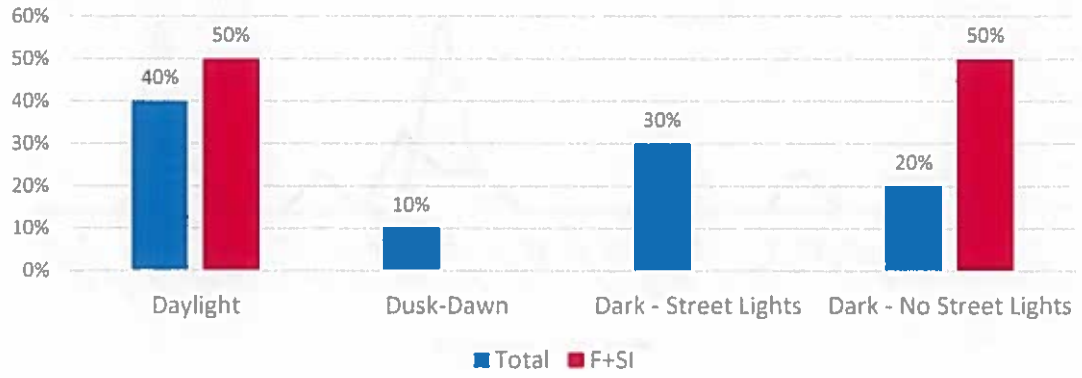
Figure 12: Motor Vehicle Involved With: All Collisions vs. F+SI Collisions



## Lighting

For collisions of all severity, 50% of collisions have occurred in low light conditions (either at night or dawn/dusk), including 20% that occurred on streets with no street lights. 1 F+SI collision occurred in the dark with no street lights, while the other occurred in daylight. The significant percentage of collisions that occurred in low light conditions indicates that lighting may be a factor. **Figure 13** illustrates the lighting condition for all collisions and F+SI collisions.

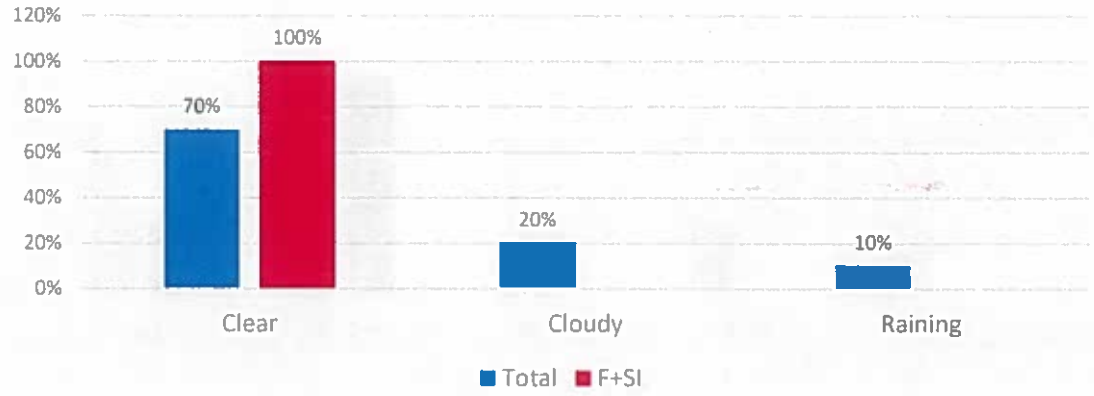
Figure 13: Lighting Conditions: All Collisions vs. F+SI Collisions




## Weather

A large majority of all collisions (70%) occurred during clear weather conditions, while 20% of collisions occurred during cloudy weather conditions and 10% occurred during rainy conditions. Both F+SI collision occurred during clear weather conditions. **Figure 14** illustrates the percentage distribution of weather conditions during occurrence of collisions of all severity as well as F+SI collisions.

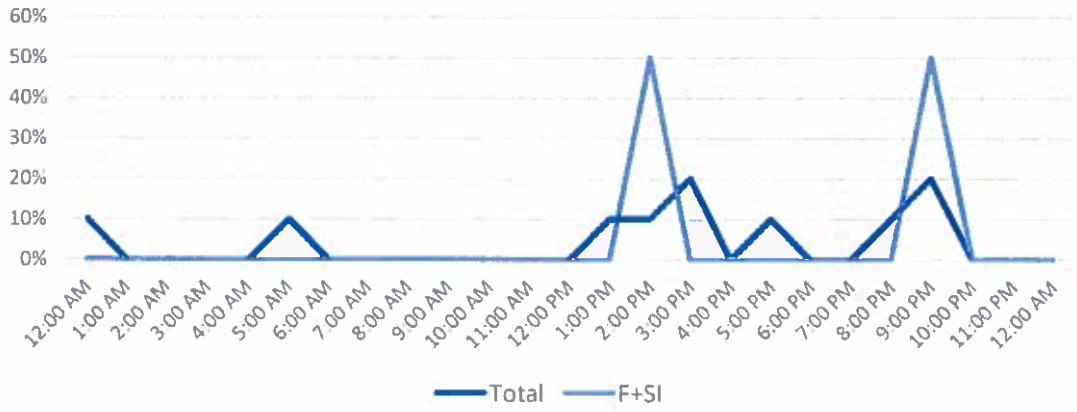
Figure 14: Weather Conditions: All Collisions vs. F+SI Collisions



### Time of the Day

For collisions of all severity, the highest frequency occurred between 3:00 PM to 4:00 PM (20 percent) and 9:00 PM to 10:00 PM (20 percent). The two F+SI collisions occurred between 2:00 PM and 3:00 PM and 9:00 PM to 10:00 PM. **Figure 15** illustrates the percentage of collisions occurring during the day for all collisions as well as F+SI collisions.

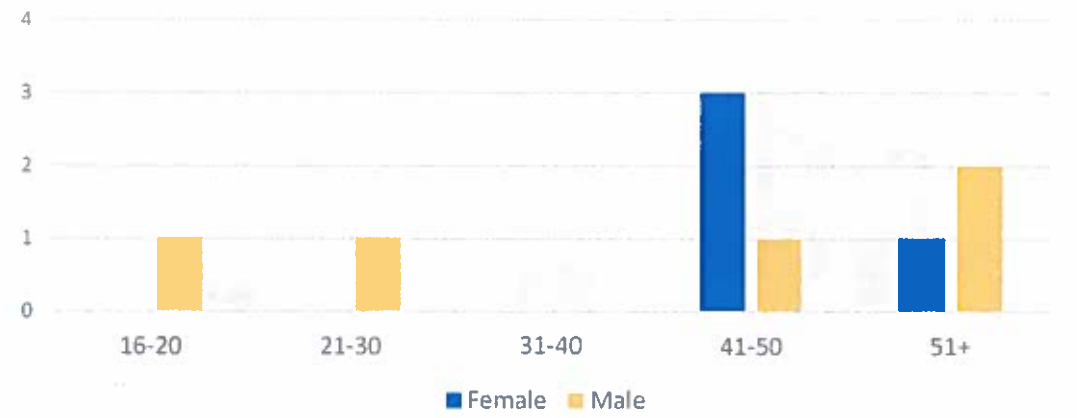
Figure 15: Time of the Day: All Collisions vs. F+SI Collisions




### Age and Gender of At-Fault Parties

For all collisions, the gender of the party at fault is slightly more likely to be male than female (56%). The party at fault is also much more likely to be age 40 or above (78%). The two F+SI collisions show similar trends in age, with both at fault parties over the age of 40 (though both were female). **Figure 16** illustrates the gender and ages of at-fault parties in all collisions.

Figure 16: Age and Gender of At-Fault Parties



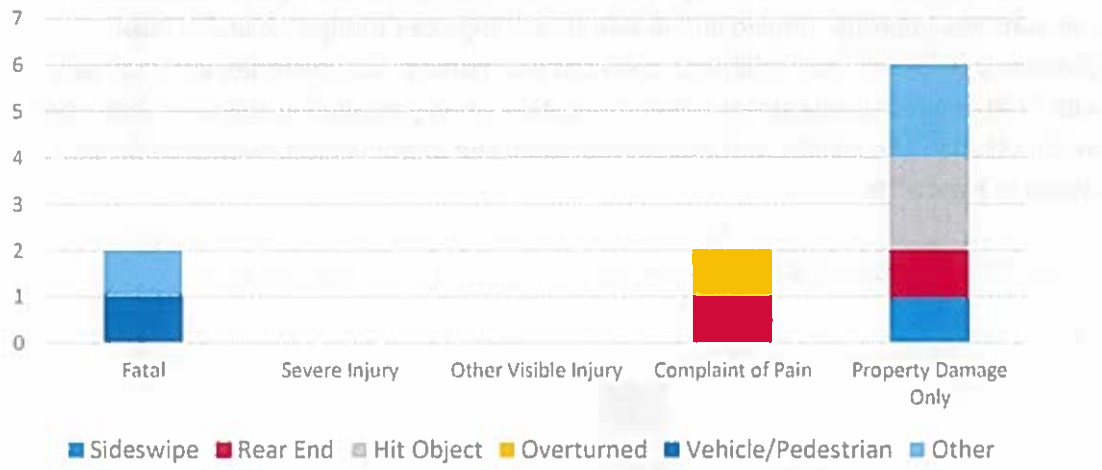
## Combining Collision Factors

Combining collision factors allows the project team to dive deeper into the data and understand what factors may be contributing to collisions on Isleton's roadways. Understanding what collision factors are occurring most commonly together will inform which countermeasures or 4 E's strategies are most appropriate to address them. Below presents five combinations of collision factors to better understand the most prevalent traffic safety issues in Isleton: collision type and severity, collision type and violation category, motor vehicle involved with and violation category, collision type and lighting conditions, and collision type and time of day.

### Collision Type and Severity

For all collisions, the most common collision types and severity combinations were Property Damage Only/Other, and Property Damage Only/Hit Object. **Figure 17** shows the severity of collisions as well as the collision types.

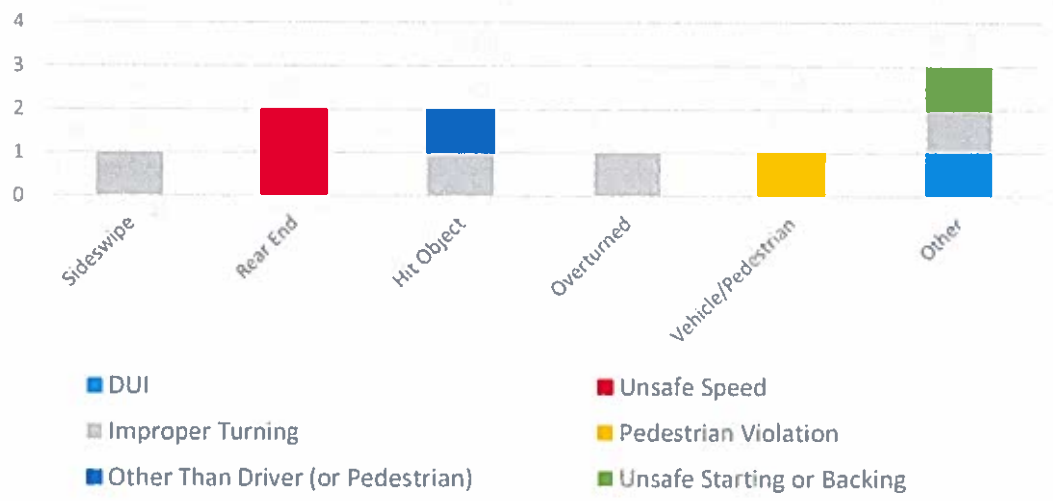
Figure 17: All Collisions: Collision Type vs Severity (2015-2019)




### Collision Type and Violation Category

For all collisions, the most common collision types (other than Other collisions, which indicates a specific collision type was not coded in the collision report) were rear end and hit object collisions. Rear end collisions were caused by unsafe speed, while hit object collisions resulted from improper turning and factors other than the driver or pedestrian. Collisions labeled as Other were caused by DUI, improper turning, and unsafe starting or backing. **Figure 18** illustrates the type of collision as well as the violation category for all collision severities.

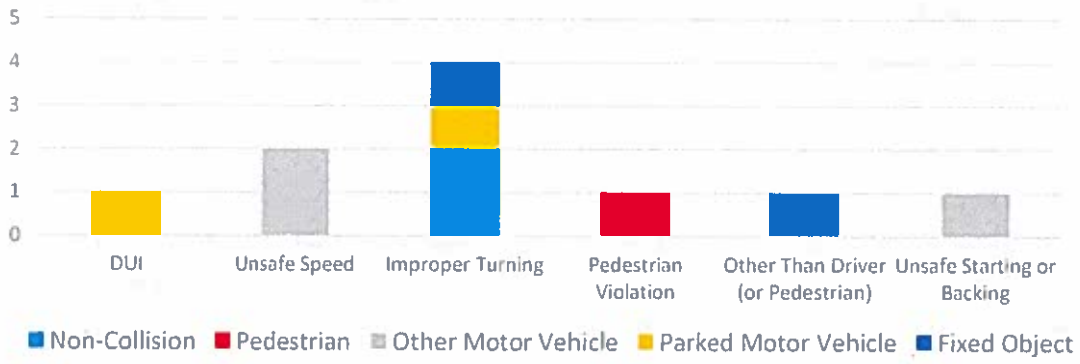
Figure 18: All Collisions: Collision Type vs Violation Category (2015-2019)




## Motor Vehicle Involved with and Violation Category

For all collisions, the violation category of collisions that led to the highest amount of collisions was improper turning and unsafe speed. Improper turning violations most commonly resulted in non-collisions, collisions with parked motor vehicles, and collisions with fixed objects. Unsafe speed collisions most commonly resulted in collisions with other motor vehicles. The results, with violation category and motor vehicle involved with, are shown in **Figure 19.**

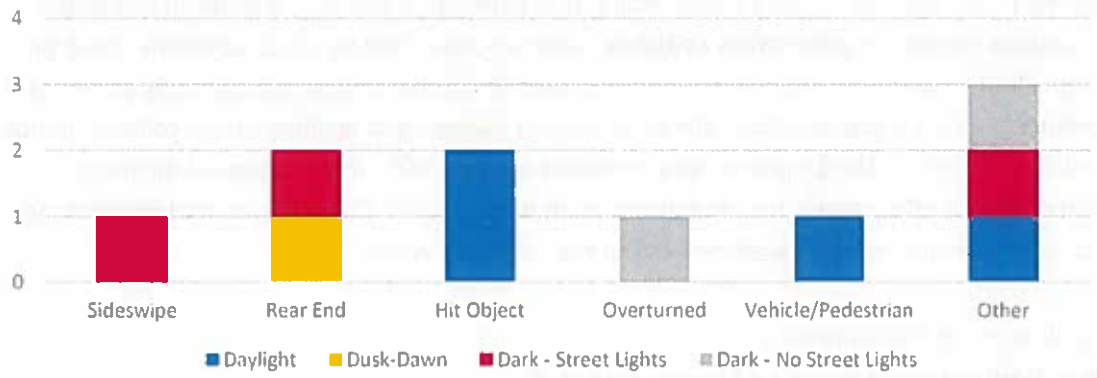
Figure 19: All Collisions: Motor Vehicle Involved with vs Violation Category



## Collision Type and Lighting Conditions

Based on this chart, collisions occurring in low or no light collisions resulted in sideswipe, rear end, and overturned collisions. Daylight collisions included hit object and vehicle/pedestrian collisions. Collisions labeled as Other occurred in both daylight and nighttime conditions. **Figure 20** illustrates the lighting condition and the collision type as observed for all collisions.

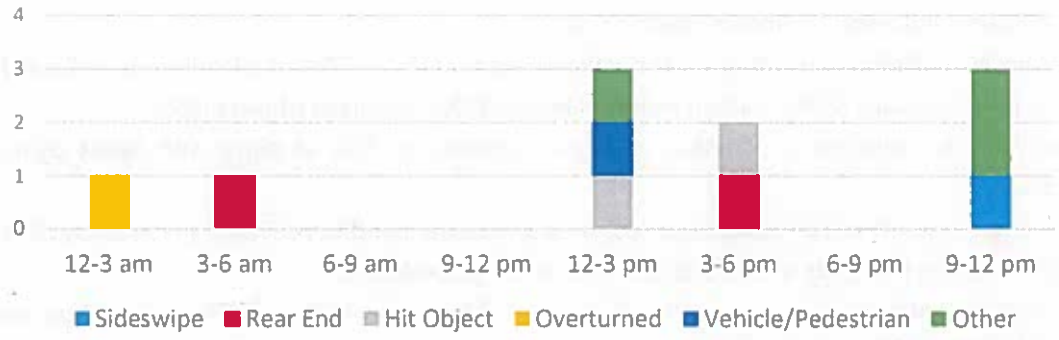
Figure 20: All Collisions: Collision Type vs Lighting Conditions




## Collision Type and Time of the Day

For all collisions types, the most common collision type was hit object and rear end. Hit object collisions have been observed to occur primarily between 12pm and 6pm, while rear end collisions occurred between 3am-6am and 3pm-6pm. **Figure 21** illustrates the collision type by the time of the day for all collisions.

Figure 21: All Collisions: Collisions Type vs Time of the Day



## Collision Locations and Trends

The collisions analysis above was used to identify three prominent collision factors that highlight the top trends among collisions in Isleton. These three identified collision factors were: **improper turning**, **unsafe speed**, and **nighttime collisions**. Improper turning was the most common violation type among all collisions (40%), and also was the cause of one of the F+SI collisions. Unsafe speed caused 20% of all injury collisions and was a factor in one of the four injury collisions. Lastly, nighttime collisions made up half of all collisions when dawn/dusk collisions are included. It was a factor in two of the injury collisions, including one of the F+SI collisions. It's also worth noting that although it was only a factor in one of the collisions citywide, a **pedestrian collision** made up one of the two F+SI collisions. It will be important to examine potential countermeasures to combat pedestrian collisions as well and ensure Isleton's transportation network is safe for all ages and abilities. These collision trends will help to inform the Emphasis Areas selected for the LRSP, which represent the most critical traffic safety issues needing attention in Isleton. The 4 E's strategies and engineering countermeasures will be developed out of the Emphasis Areas.

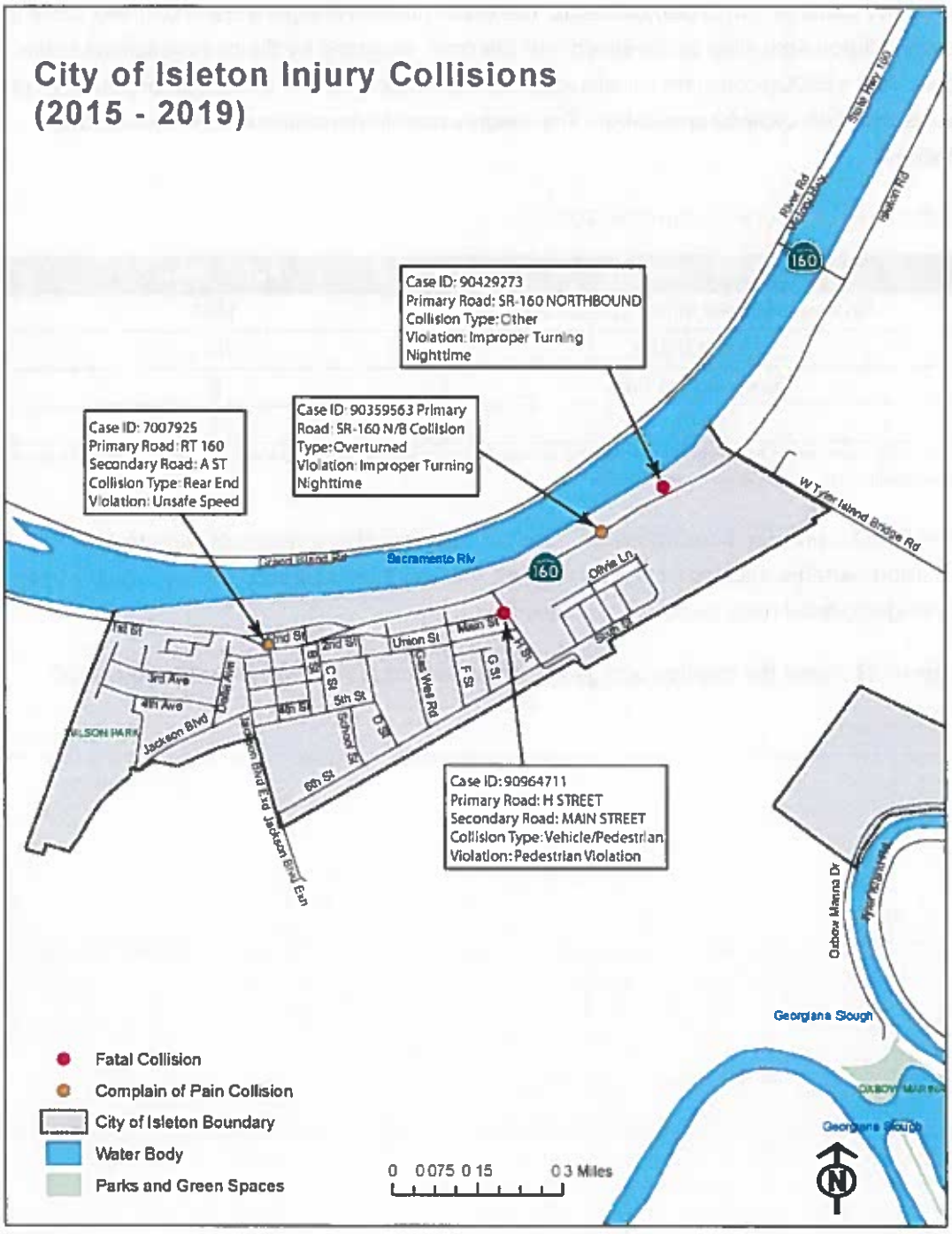
### Collisions by the Numbers

**Key findings on patterns and trends included:**

- 10 collisions occurred in Isleton between 2015 and 2019.
- Of these, six were Property Damage Only (PDO) collisions, two collisions led to a complaint of pain injury, and two led to a fatality.
- 2018 had the most collisions with three, while 2017 had the fewest (one).
- 80% of all collisions occurred at intersections, while 20% occurred on roadway segments.
- Rear-end collisions (20%) and hit object collisions (20%) were the most common collision types among all collisions.
- Improper turning violations were observed to be the most common with 40% of all collisions, followed by unsafe speed (20%).
- Vehicles colliding with other motor vehicles accounted for 30% of all collisions, followed by non-collisions (20%), parked motor vehicles (20%), and fixed objects (20%).
- 40% of all collisions occurred in daylight, followed by 30% at night with street lights present.
- A large majority of collisions occurred in clear weather conditions (70%), followed by 20% of collisions in cloudy conditions and 10% in rainy conditions.
- The hour with the most observed collisions was 3:00 pm to 4:00 pm (20%) and 9:00 pm to 10:00 pm (20%).

**Figure 22** shows the location, collision type, violation type and severity for injury collisions in Isleton.

Figure 22: Injury Collisions by Type and Violation Category



## Collision Severity Index

A collision severity weight was used to identify the high severity collision network, using the Equivalent Property Damage Only (EPDO) method. The EPDO method accounts for both the severity and frequency of collisions by converting each collision to an equivalent number of property damage only (PDO) collisions. The EPDO method assigns a crash cost and score to each collision according to the severity of the crash weighted by the comprehensive crash cost. These EPDO scores are calculated using a simplified version of the comprehensive crash costs per HSIP Cycle 10 application. The weights used in the analysis are shown below in **Table 4**.

Table 4: EPDO Score used in HSIP Cycle 10

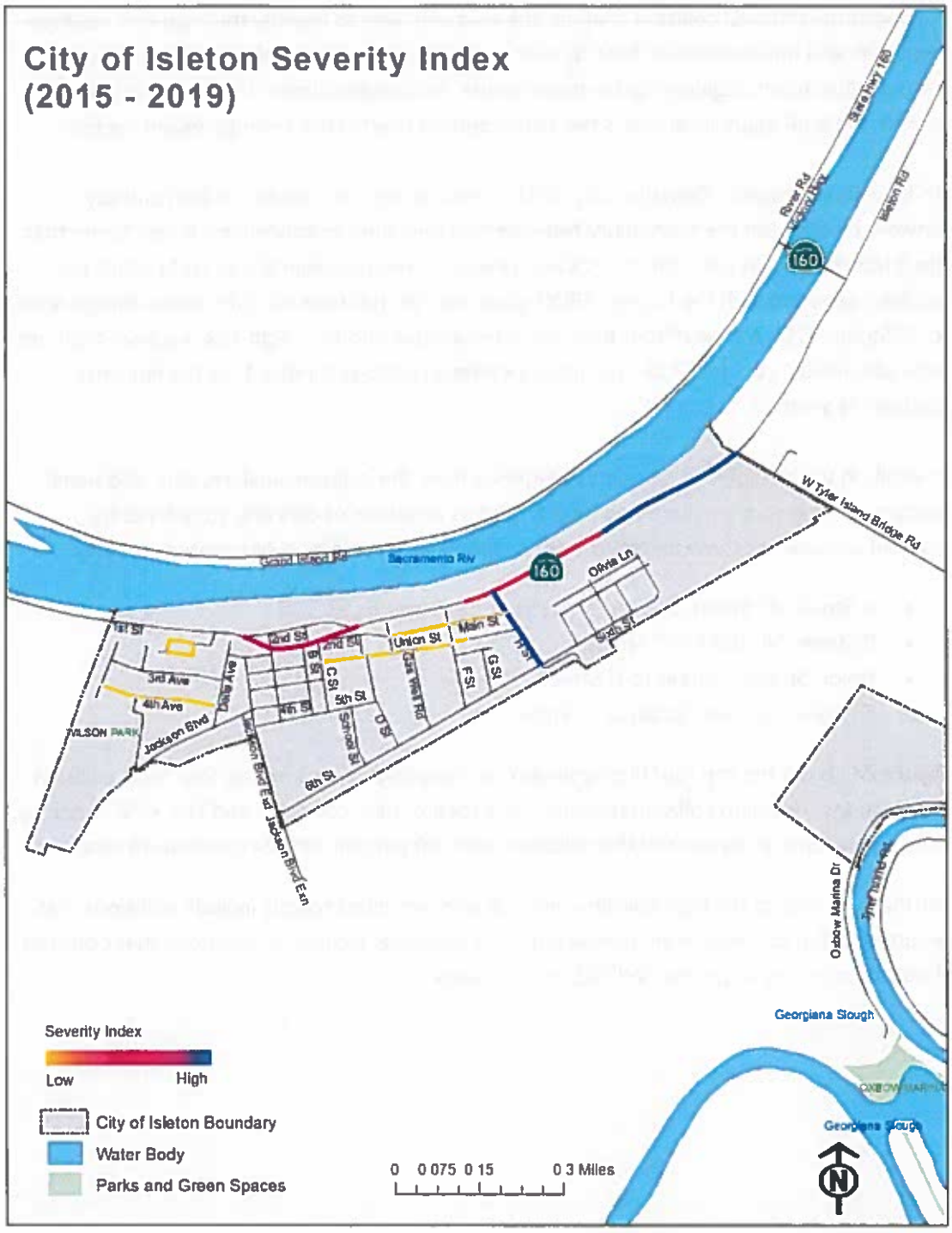
| Collision Severity | EPDO Score |
|---|---|
| Fatal and Severe Injury Combined | 165* |
| Visible Injury | 11 |
| Complaint of Pain | 6 |
| PDO | 1 |

*This is the score used in HSIP Cycle 10 for collisions on roadways segments, to simplify the analysis this study uses the same score for all F+SI collisions regardless of location

The EPDO scores for all collisions can then be aggregated in a variety of ways to identify collision patterns, such as location hot-spots. The weighted collisions for the City of Isleton were geolocated onto Isleton's road network.

**Figure 23** shows the location and geographic concentration of collisions by their EPDO score.

Figure 23: Isleton Severity Index



## High-Injury Network

Following the detailed collision analysis, the next step was to identify the high-risk roadway segments and intersections in the City of Isleton. The high-risk locations will form the basis for the subsequent engineering countermeasure recommendations. The methodology for scoring the high injury locations is the same method used in the severity weight section.

An Equivalent Property Damage Only (EPDO) analysis was performed for the roadway network to establish the High Injury Network and rank high-risk locations. It was found that the intersection with the highest EPDO score was H Street at Main Street (165), while the roadway segment with the highest EPDO score was SR-160 from W. Tyler Island Bridge Road to 1st Street (179). A total of four high-risk intersections and four high-risk roadway segments were identified (see Table 3 for the high-risk intersections and Table 4 for the high-risk roadway segments).

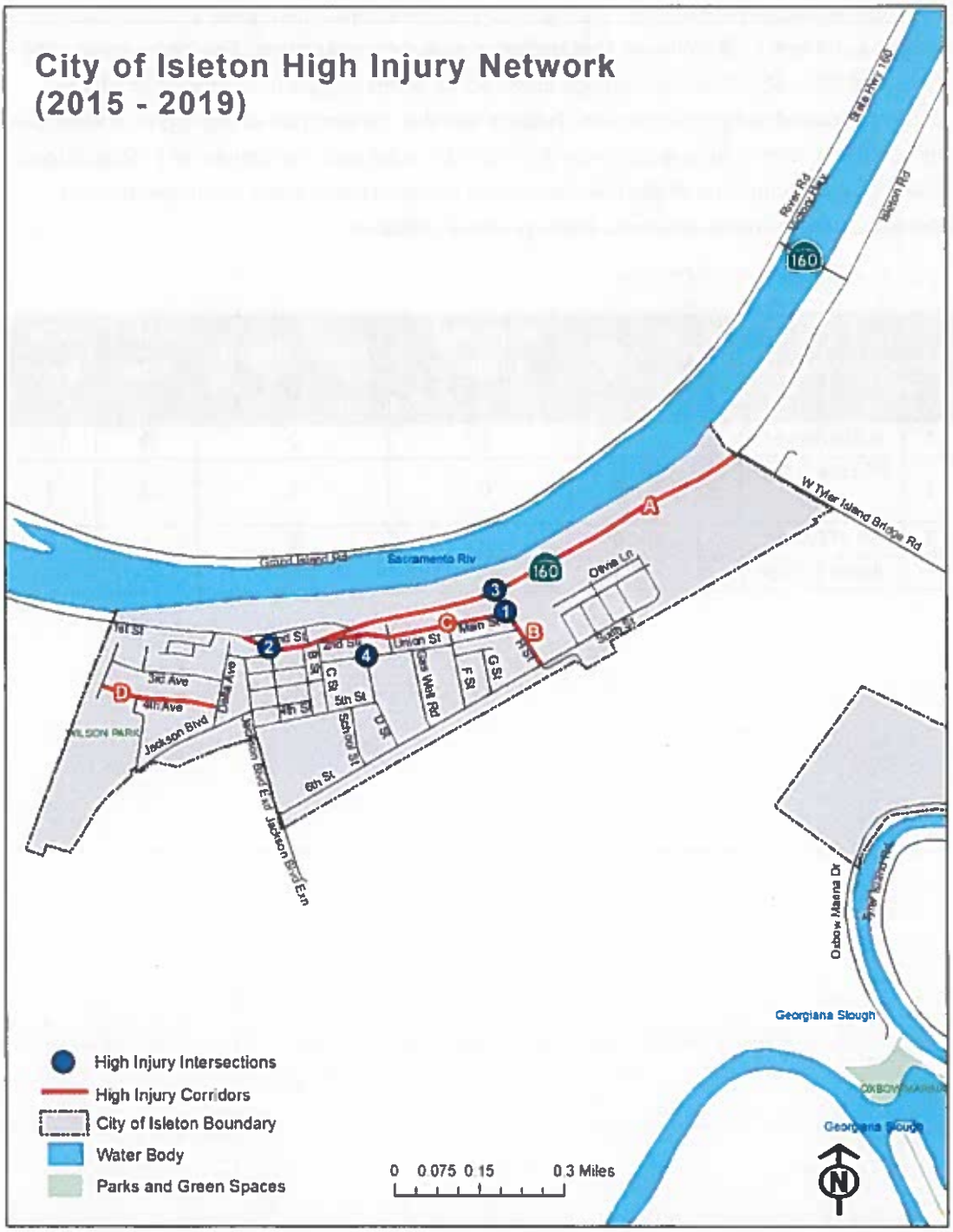
In addition to the high-risk segments identified from the collision analysis, four additional roadway segments were identified by City staff as locations of concern, supported by resident comments. These locations were included in the selection of countermeasures:

- A Street, 4th Street, and Jackson Street: City Limit to SR-160
- B Street: SR-160 to 5th Street
- Union Street: C Street to H Street
- 6th Street: Jackson Street to H Street

**Figure 24** shows the top four high-collision roadway segments, and top four high-collision intersections. This high collision network has a total of nine collisions and two F+SI collisions, which represents 90 percent of the collisions and 100 percent of F+SI collisions in Isleton.

For the purposes of the high collision network analysis, intersections include collisions that occurred within 250 feet of an intersection, and roadways include all collisions that occurred along the roadway as per the SWITRS collision data.

Figure 24: City of Isleton High Injury Network



## High Injury Intersections

Four intersections were identified as high injury intersections. There were a total of five collisions and one F+SI collisions that occurred at these intersections. The intersection of H Street and Main Street has the highest EPDO score, primarily due to the fact that a fatal collision occurred at this intersection. **Table 5** lists the collision rate of the top four identified high-collision intersections along with their collision total and the number of F+SI collisions. Collisions falling into one of the three identified trends are also listed (improper turning violations, unsafe speed violations, and nighttime collisions)

Table 5: High Injury Intersections

| ID | Intersection | Total | F+SI | Improper Turning | Unsafe Speed | Night-time | EPDO Score |
|---|---|---|---|---|---|---|---|
| | | Collisions | | | | | |
| 1 | H St/Main St | 1 | 1 | 0 | 0 | 0 | 165 |
| 2 | 2nd St/A St/SR-160 | 2 | 0 | 0 | 1 | 0 | 7 |
| 3 | SR-160/H St | 1 | 0 | 0 | 1 | 1 | 1 |
| 4 | Union St/D St | 1 | 0 | 1 | 0 | 1 | 1 |

## High Injury Corridors

Four corridors were identified as high injury corridors. There was a total two F+SI collisions and eight total collisions on these corridors. The corridor with the highest EPDO score is River Road/SR-160. **Table 6** lists the collision rate of the top four identified high-collision corridors along with the number of F+SI collisions and total collisions. Collisions falling into one of the three identified trends are also listed (improper turning violations, unsafe speed violations, and nighttime collisions)

Table 6: High Injury Corridors

| ID | Corridors | Total | F+SI | Improper Turning | Unsafe Speed | Night-time | Length (miles) | EPDO Score |
|---|---|---|---|---|---|---|---|---|
| | | Collisions | | | | | | |
| A | River Rd/SR-160: W Tyler Island Bridge Rd to 1st St | 5 | 1 | 2 | 2 | 3 | 1.0 | 179 |
| B | H St: River Rd/SR-160 to 6th St | 1 | 1 | 0 | 0 | 0 | 0.15 | 165 |
| C | Main St/2nd St: SR-160 to H St | 1 | 0 | 1 | 0 | 0 | 0.30 | 1 |
| D | 4th Ave: Delta Ave to Georgiana Dr | 1 | 0 | 0 | 0 | 1 | 0.21 | 1 |

## Annual Average Daily Traffic (AADT) on SR-160

One of the biggest concerns of Isleton residents, when asked in stakeholder meetings and on the interactive map, is increasing traffic on SR-160. To understand if changes in traffic volumes had occurred over the recent seven years, TJKM pulled Annual Average Daily Traffic (AADT) data from Caltrans' Traffic Census program for Highway 160 at the Isleton Bridge (the closest available location to Isleton). It was found that from 2013-2020, AADT increased in the NB direction by 98%, and by 44% in the SB direction. This shows a trend to increasing northbound volumes passing through the city, although some of this increase can possibly be attributed to an improving economy following the recession.

## Summary

Between 2015 and 2019, a total of 10 collisions occurred within the City of Isleton, four of which resulted in an injury. Two of these injury collisions were fatal, representing 20% of all collisions in Isleton. These two fatal collisions were a vehicle/pedestrian collision and a non-collision (further analysis revealed the vehicle ran off the road), and were caused by a pedestrian violation and improper turning respectively. Among all collisions, the most prominent collision type were hit object and rear end collisions, while improper turning and unsafe speed were the most common violation types. Three of the four injury collisions occurred along SR-160.

**Three prominent collision factors that emerged were:**

- **Improper turning**
- **Unsafe speed**
- **Nighttime collisions**
- **Pedestrian collisions**

Improper turning was the most common violation type among all collisions (40%), and also was the cause of one of the F+SI collisions along SR-160. Of all collisions, two improper turning collisions occurred on SR-160, one occurred on Main St, and one occurred on Union St. Improper turning collisions can potentially be mitigated by improving the visibility of an intersection or roadway through upgraded pavement markings, upgraded signage, installing/upgrading lighting, or improving sight distance. Driver education or enforcement can also be beneficial in addressing improper turning movements.

Unsafe speed caused 20% of all injury collisions and was a factor in one of the four injury collisions. Both observed unsafe speed caused collisions occurred on SR-160. Speeding can be mitigated through the introduction of traffic calming, which can be a combination of street narrowing, medians, bulb outs at intersections, or Complete Streets elements like high visibility crosswalks, bike lanes, and wider sidewalks. Driver education and speed enforcement, either through radar trailers or officer patrols, can also help to mitigate instances of unsafe speed violations.

For all collisions, 50% of collisions occurred during the nighttime or low light conditions, including one of the two fatal or severe injury collisions. Nighttime injury collisions were observed primarily on SR-160 east of H St. This may indicate that lighting at these locations should be evaluated to insure lumen levels are adequate. Many different factors can contribute to nighttime collisions, such as low lighting levels that can be targeted with countermeasure, but extraneous factors can also contribute to nighttime injury such as

alcohol use, sleep and fatigue. Improvements such as installing new lighting, upgrading existing lighting to a higher lumen, installing and upgrade signs with new fluorescent sheeting and installing pedestrian improvements with lighting elements such as RRFBs (rectangular rapid flashing beacons) and HAWKs can help make these locations safer for all road users.

Although it made up only one of the 10 collisions citywide, it's worth noting that a **fatal pedestrian collision** was one of the two F+SI collisions that occurred in the study period. Addressing these types of collisions helps to make Isleton's transportation network safe for all modes of travel. Countermeasures such as traffic calming, high visibility crosswalks, Rectangular Rapid Flashing Beacons (RRFBs), sidewalk bulb outs, advanced flashing warning signs, can all help to address pedestrian collisions.

# 4. Emphasis Areas

Emphasis areas are focus areas for the LRSP that are identified through the comprehensive collision analysis of the identified high injury locations within the City of Isleton. Emphasis areas help in identifying appropriate safety strategies and countermeasures with the greatest potential to reduce collisions occurring at these high injury locations. They can include (but not be limited to): specific collision types, human behaviors, facility types, and specific locations or corridors.

This technical memorandum summarizes the top six (6) emphasis areas identified for the City of Isleton. These emphasis areas were derived from the consolidated high injury collision database (**Appendix B**) where top injury factors were identified by combining the data manually. Along with findings from the data analysis, stakeholder input was also considered while identifying emphasis areas specific to the City of Isleton.

## The Four E's of Traffic Safety

The LRSP utilizes a comprehensive approach to safety incorporating the "4 E's of traffic safety": Engineering, Enforcement, Education and Emergency Medical Services (EMS). This approach recognizes that not all locations can be addressed solely by infrastructure improvements. Incorporating the 4 E's of traffic safety is often required to ensure successful implementation of significant safety improvements and reduce the severity and frequency of collisions throughout a jurisdiction.

Some of the common violation types that may require a comprehensive approach are speeding, failure-to-yield to pedestrians, red light running, aggressive driving, failure to wear safety belts, distracted driving, and driving while impaired. When locations are identified as having these types of violations, coordination with the appropriate law enforcement agencies is needed to arrange visible targeted enforcement to reduce the potential for future driving violations and related crashes and injuries.

To improve safety, education efforts can be used to supplement enforcement and improve the efficiency of each strategy. Education can also be employed in the short-term to address high crash locations until the recommended infrastructure project can be implemented. Similarly, Emergency Medical Services entails strategies around supporting organizations that provide rapid response and care when responding to collisions causing injury, by stabilizing victims and transporting them to medical facilities.

## Existing Traffic Safety Efforts in the City of Isleton

The City of Isleton and Sacramento County have already planned or implemented safety strategies corresponding to the 4 E's of traffic safety. The strategies detailed in this memorandum can supplement these existing programs and concentrate them on high injury collision locations and crash types. These initiatives are summarized in the following table:

Table 7: Existing Traffic Safety Efforts in Isleton

| Document/ Program | Description | E's Addressed |
|---|---|---|
| **City of Isleton Opportunities, Constraints, and Vision Report (2017)** | This report focus on safety issue along the SR-160, and insufficient parking along Main Street within the city limits. These constraints present the opportunity to capitalize on mobility, implement traffic calming and possible wayfinding measures. | Engineering |
| **Safety Element of Isleton General Plan & Existing Conditions Memo (2021)** | In the Existing Conditions memo, the Public Safety section emphasizes safety issues on SR-160 and recommends to eliminate hazards to pedestrians and motorists resulting from pedestrians crossing the highway to reach the river. | Engineering |
| **City of Isleton Parking Analysis and Development Program (1989)** | Recognizing increased tourist traffic by automobile and to ensure safety, this study recommends striping all on-street parking spaces and exploring future parking lots along SR-160, First Street, A Street, and across from City Hall. | Engineering |
| **Isleton 10-Year Capital Improvement Program (CIP) (2017)** | As per the 2017 CIP, City plans to invest in transportation safety projects including ADA ramp upgrades, road repaving, curb/gutter improvements, widening sidewalks, new signage/landscaping, and traffic calming improvements on SR-160. | Engineering |

| Document/ Program | Description | E's Addressed |
|---|---|---|
| **SACOG Metropolitan Transportation Plan/ Sustainable Communities Strategy (2020)** | This plan/strategy sets policies related to transportation safety such as prioritizing cost effective safety improvements, investing in bicycle and pedestrian infrastructure, and reduce greenhouse gas emissions and vehicle miles traveled. | Engineering |
| **Sacramento Area Bicycle Advocates** | This non-profit organization encourages safe bike trips within the Sacramento area by promoting improvements to the bicycling infrastructure by local governments, partnering with community and decision-makers, and providing skill training under a safe route to school program. | Education |
| **California Highway Patrol (CHP) Problem Oriented Policing (POP)** | CHP's Valley Division has implemented a POP team for the South Sacramento region that also serves the Delta. Citizens can contact the team to inform them of a recurring traffic safety issue and respond to the issue. | Enforcement |
| **Sacramento County Sheriff's Office (SCSO)** | SCSO serves as the police department in the City of Isleton and enforces traffic laws on the City's roadways. | Enforcement, EMS |

## Factors Considered in the Determination of Emphasis Areas

This section presents collision data analysis for each emphasis area. Emphasis areas were determined by factors that led to the highest amount of collisions, with a specific emphasis on fatal and severe (F+SI) injury collisions. In addition to the collision data, emphasis areas were also identified from the feedback received from community and stakeholders. This section also presents comprehensive programs, policies and countermeasures from the 4 E's of traffic safety to reduce collisions in specific emphasis areas, identifies performance metrics, and potential implementing partners.

The City of Isleton experienced nine collisions on its high injury network, which consists of all identified high-risk intersections and roadway segments. Of these, two were fatal or severe

injury collisions (F+SI). All statistics presented below are based on these nine high injury network collisions. The identified emphasis areas are as follows:

- Emphasis Area 1 – Reduce Intersection Collisions
- Emphasis Area 2 – Improve Pedestrian Safety
- Emphasis Area 3 – Reduce Collisions from Improper Turning Violations
- Emphasis Area 4 – Address SR-160 Collisions
- Emphasis Area 5 – Reduce Unsafe Speed Violations and Rear-End Collisions
- Emphasis Area 6 – Reduce Nighttime Collisions

## Emphasis Area 1 – Reduce Intersection Collisions

Seven of the nine high-injury network collisions (78%) occurred at intersections. Intersection collisions are in many cities the most common locations for collisions due to increased conflict points between vehicles, pedestrians, and bicycles. Of the intersection collisions in Isleton, two occurred due to unsafe speed, two occurred due to improper turning, and four occurred at night. The following table details 4 E's strategies selected to address intersection collisions in Isleton.

| 2 | 2 | 4 |
|---|---|---|
| **Unsafe Speed** | **Improper Turning** | **Nighttime** |

Table 8: Emphasis Area 1 Strategies

| Objective: Reduce the number of fatal and severe injury collisions at intersections. | | | |
|---|---|---|---|
| | **Strategy** | **Performance Measure** | **Agencies/ Organizations** |
| **Education** | Conduct public information and education campaign for intersection safety laws regarding stop signs, and safe driving habits, such as proper turning. | Number of education campaigns or residents reached. | City/Sheriff's Office |
| **Enforcement** | Targeted enforcement at high-risk intersections to monitor traffic law violations right-of-way violations, speed limit laws and other violations that occur at intersections. | Number of tickets issued. | Sheriff's Office/CHP |
| **Engineering** | • NS06, Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs<br>• NS07, Upgrade intersection pavement markings<br>• NS08, Install Flashing Beacons at Stop-Controlled Intersections<br>• NS09, Install flashing beacons as advance warning (NS.I.)<br>• NS10, Install transverse rumble strips on approaches<br>• NS11, Improve sight distance to intersection (Clear Sight Triangles)<br>• NS13, Install splitter-islands on the minor road approaches<br>• R01, Add Segment Lighting<br>• R22, Install/Upgrade signs with new fluorescent sheeting (regulatory or warning)<br>• R27, Install delineators, reflectors and/or object markers | Number of intersections improved. | City |
| **EMS** | Improve resource deployment and clear routes for emergency responses to collision sites. | EMS vehicle response time. | Sacramento County Emergency Medical Services Agency (SCEMSA) |

## Emphasis Area 2 – Improve Pedestrian Safety

While Isleton experienced only one pedestrian collision (11% of all high injury network collisions) it resulted in a fatality. Pedestrians, along with bicyclists, are among the most vulnerable road users and will benefit from pedestrian safety improvements on Isleton streets. The fatal collision that occurred was the result of a pedestrian violation and crossing not in a crosswalk.

| 1 | 1 | 1 |
|---|---|---|
| **Involved a pedestrian crossing not on a crosswalk** | **Pedestrian Violation** | **Fatal Collision** |

Table 9: Emphasis Area 2 Strategies

| Objective: Reduce the number of fatal and severe injury pedestrian collisions. | | | |
|---|---|---|---|
| | **Strategy** | **Performance Measure** | **Agencies/ Organizations** |
| **Education** | Conduct pedestrian safety campaigns and outreach to raise their awareness of pedestrian safety needs through media outlets, social media and Sacramento County Walk & Bike.<br><br>Consider partnering with Safe Routes to School to conduct bicycle and pedestrian safety programs at Isleton Elementary School. | Number of education campaigns or residents reached | City/School District/Sheriff's Office |
| **Enforcement** | Targeted enforcement at high-risk locations especially near schools and downtown Isleton where pedestrians are more present.<br><br>Increase enforcement during time periods of high bicycle/pedestrian activity. | Number of tickets issued. | Sheriff's Office/CHP |
| **Engineering** | • NS07, Upgrade intersection pavement markings (NS1)<br>• NS19PB, Install raised medians (refuge islands)<br>• NS21PB/R35PB, Install/upgrade pedestrian crossing (with enhanced safety features)<br>• R36PB, Install raised pedestrian crossing<br>• R37PB, Install Rectangular Rapid Flashing Beacons (RRFB)<br>• High-visibility ladder crosswalks<br>• Mid-block curb extension or intersection bulb-outs<br>• In-road yield sign for pedestrian crossing at crosswalk<br>• The City should apply for HSIP pedestrian set aside funds every two years | Number of locations improved. | City |
| **EMS** | Improve resource deployment and clear routes for emergency responses to collision sites. | EMS vehicle response time | Sacramento County Emergency Medical Services Agency (SCEMSA) |

## Emphasis Area 3 – Reduce Collisions from Improper Turning Violations

Four (44%) of the collisions on the high injury network were improper turning collisions, including 1 fatal or severe injury (F+SI) collision. Of these improper turning collisions, two resulted in a non-collision (one of these was an overturned vehicle), two occurred on SR-160, and three occurred at night.

| 2 | 2 | 3 |
|---|---|---|
| **Collisions due to Non-Collision Factor** | **Collisions on SR-160** | **Nighttime Collisions** |

Table 10: Emphasis Area 3 Strategies

| Objective: | | | |
|---|---|---|---|
| **Reduce the number of fatal and severe injury collisions at intersections that are a result of improper turning.** | | | |
| | **Strategy** | **Performance Measure** | **Agencies/ Organizations** |
| **Education** | Conduct public information and education campaign for intersection safety laws regarding traffic lights, stop signs, and turning left or right. | Number of education campaigns or residents reached | City/Sheriff's Office |
| **Enforcement** | Targeted enforcement at high-risk intersections to monitor improper turning violations. | Number of tickets issued. | Sheriff's Office/CHP |
| **Engineering** | • NS06, Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs<br>• NS07, Upgrade intersection pavement markings (NS.I.)<br>• NS11, Improve sight distance to intersection (Clear Sight Triangles)<br>• NS13, Install splitter-islands on the minor road approaches<br>• NS14, Install raised median on approaches (NS.I.)<br>• NS18, Install left-turn lane (where no left-turn lane exists)<br>• R01, Add Segment Lighting<br>• R22, Install/Upgrade signs with new fluorescent sheeting (regulatory or warning)<br>• R27, Install delineators, reflectors and/or object markers<br>• R28, Install edge-lines and centerlines<br>• R31, Install edge-line rumble strips/stripes | Number of intersections improved. | City |
| **EMS** | Improve resource deployment and clear routes for emergency responses to collision sites. | EMS vehicle response time. | Sacramento County Emergency Medical Services Agency (SCEMSA) |

## Emphasis Area 4 – Address SR-160 Collisions

Five of the nine collisions on the high injury network (56%) were collisions that occurred on SR-160, including 1 fatal or severe injury (F+SI) collision. Two of these collisions occurred due to unsafe speed, two of them resulted in a rear end collision, and four of them occurred at night. As SR-160 is an important arterial and the roadway with the highest amount of traffic in Isleton, this corridor is a high priority to the City. Feedback from Isleton residents through the project website interactive map tool also shows that residents are concerned about safety on SR-160.

**2** **Unsafe Speed Collisions**

**2** **Rear End Collisions**

**4** **Nighttime Collisions**

Table 11: Emphasis Area 4 Strategies

| Objective: Reduce the number of fatal and severe injury collisions that occur on SR-160. | | | |
|---|---|---|---|
| | **Strategy** | **Performance Measure** | **Agencies/ Organizations** |
| **Education** | Conduct public information and education campaign for safe driving habits, including the dangers of speeding and obeying traffic laws to specifically address unsafe speed and illegal passing violations on SR-160 (based on stakeholder comments). | Number of education campaigns or residents reached | City/Sheriff's Office |
| **Enforcement** | Targeted enforcement at high-risk intersections and corridors to monitor safety along SR-160, particularly monitoring unsafe speed violations. | Number of tickets issued | Sheriff's Office/CHP |
| **Engineering** | • NS09, Install flashing beacons as advance warning (NS.I.)<br>• NS10, Install transverse rumble strips on approaches<br>• NS11, Improve sight distance to intersection (Clear Sight Triangles)<br>• NS12, Improve pavement friction (High Friction Surface Treatments)<br>• NS07, Upgrade intersection pavement markings (NS.I.)<br>• NS19PB, Install raised medians (refuge islands)<br>• NS21PB/R35PB, Install/upgrade pedestrian crossing (with enhanced safety features)<br>• R04, Install Guardrail<br>• R27, Install delineators, reflectors and/or object markers<br>• R31, Install edge line rumble strips/stripes<br>• Traffic calming on SR-160 through downtown Isleton (e.g. pedestrian crossing enhancements, bulb outs, raised medians) | Number of locations improved. | Caltrans/City |
| **EMS** | Improve resource deployment and clear routes along SR-160 for emergency responses to collision sites. | EMS vehicle response time. | Sacramento County Emergency Medical Services Agency (SCEMSA) |

## Emphasis Area 5 – Reduce Unsafe Speed Violations and Rear-End Collisions

Two (22%) of the high injury network collisions were collisions that occurred due to unsafe speed and led to a rear end collision. This violation and collision type commonly occur together as speeding often does not leave a vehicle enough time to stop quickly if needed. Of these unsafe speed/rear end collisions, both collisions occurred with another motor vehicle, on SR-160, and at night.

| 2 | 2 | 2 |
|---|---|---|
| **Collisions Involving Other Motor Vehicle** | **SR-160 Intersection Collisions** | **Nighttime Collisions** |

Table 12: Emphasis Area 5 Strategies

| Objective: Reduce the number of fatal and severe injury collisions that are a result of unsafe speed violations and rear end collisions. | | | |
|---|---|---|---|
| | **Strategy** | **Performance Measure** | **Agencies/ Organizations** |
| **Education** | Conduct public information and education campaign on the dangers of speeding and causes of rear end collisions. | Number of education campaigns | City/Sheriff's Office |
| **Enforcement** | Targeted enforcement along SR-160 to monitor speeding.<br><br>Portable radar trailers to provide drivers with a visual speed feedback. | Number of tickets issued. | Sheriff's Office/CHP |
| **Engineering** | • NS01, Add intersection lighting (NS.I.)<br>• NS06, Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs<br>• NS07, Upgrade intersection pavement markings (NS.I.)<br>• NS09, Install flashing beacons as advance warning (NS.I.)<br>• NS10, Install transverse rumble strips on approaches<br>• NS12, Improve pavement friction (High Friction Surface Treatments)<br>• R21, Improve pavement friction (High Friction Surface Treatments)<br>• R26, Install dynamic/variable speed warning signs<br>• Install traffic calming features to slow traffic (e.g. pedestrian crossing enhancements, bulb outs/curb extensions, raised medians) | Number of locations improved. | City |
| **EMS** | Improve resource deployment and clear routes for emergency responses to collision sites. | EMS vehicle response time. | Sacramento County Emergency Medical Services Agency (SCEMSA) |

## Emphasis Area 6 – Reduce Nighttime Collisions

Of the nine collisions on the high injury network, six (67%) of these collisions were nighttime collisions. Of these, three were improper turning collisions, two involved alcohol, and two occurred at locations without street lights.

**3**
**Improper Turning Collisions**

**2**
**Collisions Involved Alcohol**

**2**
**Nighttime Collisions without Street Lights**

Table 13: Emphasis Area 6 Strategies

| Objective: Reduce the number of fatal and severe injury collisions at night. | | | |
|---|---|---|---|
| | **Strategy** | **Performance Measure** | **Agencies/ Organizations** |
| **Education** | Develop awareness program to inform residents of safe nighttime driving habits, as well as high-risk collision locations and the most common violations/collision types occurring at night.<br><br>Develop education programs warning of the dangers of drunk driving. | Number of education campaigns or residents reached. | City/Sheriff's Office |
| **Enforcement** | Increase patrolling at locations where nighttime collisions are higher.<br><br>Implement DUI check points at night to enforce drunk driving laws. | Number of tickets issued. | Sheriff's Office/CHP |
| **Engineering** | • NS01, Add intersection lighting (NS.I.)<br>• NS06, Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs<br>• NS07, Upgrade intersection pavement markings (NS.I.)<br>• NS08, Install Flashing Beacons at Stop-Controlled Intersections<br>• NS09, Install flashing beacons as advance warning (NS.I.)<br>• NS11, Improve sight distance to intersection (Clear Sight Triangles)<br>• R01, Add Segment Lighting<br>• R22, Install/Upgrade signs with new fluorescent sheeting (regulatory or warning)<br>• R27, Install delineators, reflectors and/or object markers | Number of locations improved. | City/Caltrans |
| **EMS** | Improve resource deployment and clear routes for emergency responses to collision sites. | EMS vehicle response time. | Sacramento County Emergency Medical Services Agency (SCEMSA) |

# 5. Countermeasure Identification

Upon the identification of high-risk locations and Emphasis Areas, the next step was to identify appropriate safety countermeasures. The Caltrans Local Roadway Safety Manual (LRSM) provides 84 countermeasures, of which 22 are eligible in the current HSIP call for signalized intersections, 24 for un-signalized intersections, and 38 for roadway segments. The LRSM provides guidance on where to apply the countermeasures including the crash types each countermeasure would address, and a Crash Reduction Factor (CRF) for each countermeasure. The Federal Highway Administration (FHWA) CMF Clearinghouse and published research papers were reviewed by the project team to gain additional insight on CRFs and effectiveness of specific countermeasures.

The project team conducted a thorough review of the high-risk locations (intersections and roadway segments) using aerial photography, Google Maps Street View software, and in-person site visits. Crash characteristics of all collisions occurring on the High Injury Network were considered. After combining the physical and collision characteristics, the project team developed a table of preliminary countermeasures that address each of the six identified Emphasis Areas. The table was refined by selecting up to four countermeasures for each high-risk location that were most commonly recommended among all Emphasis Areas. By doing this, the project team was able to identify countermeasures with the greatest opportunity for systemic implementation.

## Countermeasure Toolbox

Engineering countermeasures were selected for each of the high-risk locations and for the emphasis areas. These were based off of approved countermeasures from the Caltrans Local Roadway Safety Manual (LRSM) used in HSIP grant calls for projects. The intention is to give the City potential countermeasures for each location that can be implemented either in future HSIP calls for projects, or using other funding sources, such as the City's Capital Improvement Program. Non-engineering countermeasures were also selected using the 4 E's strategies, and are included with the emphasis areas. The countermeasure toolbox in **Appendix C** details the draft countermeasures for each high-risk location and Emphasis Area, separated by intersections and roadway segments. While not all of these countermeasures will be included in the resulting safety projects, they are included to give the City a toolbox for implementing future safety improvements through other means, such as the City's Capital Improvement Program.

**Table 14** details the list of locations that were included in the countermeasure toolbox, along with HSIP eligible recommended improvements that can help address traffic safety at each location.

Table 14: List of Countermeasure Toolbox Improvements by Location

| ID | Location | HSIP Eligible Recommended Countermeasures |
|---|---|---|
| I-1 | H St/Main St | • Upgrade intersection pavement markings<br>• Upgrade/install pedestrian crossing (with enhanced safety features)<br>• Install flashing beacons at stop-controlled intersection<br>• Convert to all-way stop control (if warrant is met)<br>• Install raised medians as pedestrian refuge island<br>• Improve sight distance to intersection (Clear Sight Triangles)<br>• Add intersection lighting |
| I-2 | 2nd St/A St/SR-160 | • Install flashing beacons as advance warning<br>• Install or upgrade stop or other intersection regulatory/warning signs<br>• Install splitter islands on minor road approaches<br>• Install raised medians on approaches<br>• Install transverse rumble strips on approaches<br>• Upgrade/install pedestrian crossing (with enhanced safety features)<br>• Install Rectangular Rapid Flashing Beacon<br>• Install raised medians as pedestrian refuge island<br>• Upgrade intersection pavement markings<br>• Improve pavement friction<br>• Install or add intersection lighting |
| I-3 | SR-160/H St | • Improve sight distance to intersection<br>• Install flashing beacons at stop controlled intersection<br>• Install flashing beacons as advance warning<br>• Install or add intersection lighting<br>• Install or upgrade stop or other intersection regulatory/warning signs<br>• Install splitter islands on minor road approaches<br>• Install raised medians on approaches<br>• Install transverse rumble strips on approaches<br>• Improve pavement friction |
| I-4 | Union St/D St | • Install or add intersection lighting<br>• Upgrade intersection pavement markings<br>• Improve sight distance to intersection<br>• Upgrade/install pedestrian crossing (with enhanced safety features)<br>• Install or upgrade stop or other intersection regulatory/warning signs<br>• Install splitter islands on minor road approaches |
| A | SR-160: Tyler Island Bridge Rd to 1st St | • Install guard rail<br>• Install edge-line rumble strips/stripes<br>• Upgrade/install pedestrian crossing (with enhanced safety features)<br>• Add segment lighting<br>• Install or upgrade signs with new fluorescent sheeting<br>• Remove or relocate fixed objects outside Clear Recovery Zone<br>• Install raised median<br>• Install Rectangular Rapid Flashing Beacon<br>• Install dynamic/variable speed warning signs<br>• Improve pavement friction<br>• Install delineators, reflectors, and/or object markers |

| ID | Location | HSIP Eligible Recommended Countermeasures |
|---|---|---|
| B | **H St: SR-160 to 6th St** | • Add segment lighting<br>• Upgrade/install pedestrian crossing (with enhanced safety features)<br>• Install or upgrade signs with new fluorescent sheeting<br>• Install edge-lines and centerlines<br>• Install delineators, reflectors, and/or object markers<br>• Install sidewalk<br>• Remove or relocate fixed objects outside Clear Recovery Zone |
| C | **Main St/2nd St: SR-160 to H St** | • Add segment lighting<br>• Install or upgrade signs with new fluorescent sheeting<br>• Upgrade/install pedestrian crossing (with enhanced safety features)<br>• Install edge-lines and centerlines |
| D | **4th Ave: Delta Ave to Georgiana Dr** | • Add segment lighting<br>• Install or upgrade signs with new fluorescent sheeting<br>• Install edge-lines and centerlines<br>• Upgrade/install pedestrian crossing (with enhanced safety features) |
| E | **A St/4th St/Jackson St: City Limit to SR-160** | • Install sidewalk<br>• Upgrade/install pedestrian crossing (with enhanced safety features)<br>• Add segment lighting<br>• Install or upgrade signs with new fluorescent sheeting<br>• Install delineators, reflectors, and/or object markers |
| F | **B St: SR-160 to 5th St** | • Add segment lighting<br>• Upgrade/install pedestrian crossing (with enhanced safety features)<br>• Install edge-lines and centerlines<br>• Install delineators, reflectors, and/or object markers<br>• Install sidewalk<br>• Remove or relocate fixed objects outside Clear Recovery Zone<br>• Install or upgrade signs with new fluorescent sheeting |
| G | **Union St: C St to H St** | • Remove or relocate fixed objects outside Clear Recovery Zone<br>• Install sidewalk<br>• Upgrade/install pedestrian crossing (with enhanced safety features)<br>• Install edge-lines and centerlines<br>• Add segment lighting<br>• Install or upgrade signs with new fluorescent sheeting<br>• Install delineators, reflectors, and/or object markers |
| H | **6th St: Jackson St to H St** | • Add segment lighting<br>• Install curve advance warning signs<br>• Install chevron signs on horizontal curves<br>• Improve pavement friction<br>• Install sidewalk<br>• Upgrade/install pedestrian crossing (with enhanced safety features)<br>• Install bike lanes<br>• Install edge-lines and centerlines<br>• Install raised median<br>• Install or upgrade signs with new fluorescent sheeting<br>• Install delineators, reflectors, and/or object markers |

**Tables 15 and 16** provides a description of each countermeasure along with the crash reduction factor (CRF), federal funding eligibility, and opportunity for systemic implementation. An excerpt of the LRSM, detailing each available HSIP countermeasure referenced in the recommendations tables, is included as **Appendix D**. (Note: CRF = Crash Reduction Factor).

Table 15: Non-Signalized Intersection Countermeasures

| Code | Countermeasure Name | Countermeasure Description | CRF | Federal Funding | Systemic Approach Opportunity |
|---|---|---|---|---|---|
| NS01 | Add intersection lighting (NS.I.) | Provision of lighting at the intersection and all its approaches | 40% | 100% | Medium |
| NS02 | Convert to all-way STOP control (from 2-way or Yield control) | Conversion of 2-way stop intersection to 4-way stop | 50% | 100% | High |
| NS06 | Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs | Additional regulatory and warning signs at or prior to intersections will help enhance the ability of approaching drivers to perceive them | 15% | 100% | Very High |
| NS07 | Upgrade intersection pavement markings | Increase the visibility of an intersection by upgrading pavement markings where none exist or are faded/cracked | 25% | 100% | Very High |
| NS08 | Install Flashing Beacons at Stop-Controlled Intersections | Reinforce driver awareness of an intersection | 15% | 100% | High |
| NS09 | Install flashing beacons as advance warning (NS.I.) | Installation of an advance flashing beacons can be used to supplement and call driver attention to intersection control signs | 30% | 100% | High |
| NS10 | Install transverse rumble strips on approaches | Provide an auditory and tactile sensation for a motorist approaching an intersection | 20% | 90% | High |

| Code | Countermeasure Name | Countermeasure Description | CRF | Federal Funding | Systemic Approach Opportunity |
|---|---|---|---|---|---|
| NS11 | Improve sight distance to intersection (Clear Sight Triangles) | Clearing roadside obstructions to improve sight distance at the intersection | 20% | 90% | High |
| NS12 | Improve pavement friction (High Friction Surface Treatments) | Improves the friction of the pavement and improves skid resistance | 55% | 100% | Medium |
| NS13 | Install splitter-islands on the minor road approaches | Splitter islands can provide a positive separation between turning vehicles on a through road and vehicles stopped on the minor road approach. Also allows for an extra stop sign at an intersection. | 40% | 90% | Medium |
| NS14 | Install raised medians on approaches | Channels traffic approaching an intersection | 25% | 90% | Medium |
| NS19PB | Install raised medians (refuge islands) | Decreases the level of exposure of pedestrians to traffic and allows pedestrians to only cross one direction of traffic at a time | 45% | 90% | Medium |
| NS21PB | Install/upgrade pedestrian crossing at uncontrolled locations (with enhanced safety features) | Enhances pedestrian crossings with high visibility patterns, yield lines, pedestrian signage, etc. to warn drivers of the presence of pedestrians | 35% | 100% | Medium |
| NS22PB | Install Rectangular Rapid Flashing Beacon (RRFB) | Rectangular Rapid Flashing Beacon (RRFB) includes pedestrian-activated flashing lights and additional signage that enhance the visibility of marked crosswalks and alert motorists to pedestrian crossings | 35% | 100% | Medium |

Table 16: Roadway Segment Countermeasures

| Code | Countermeasure Name | Countermeasure Description | CRF | Federal Funding | Systemic Approach Opportunity |
|---|---|---|---|---|---|
| R01 | Add Segment Lighting | Provision of lighting along roadways. | 35% | 100% | Medium |
| R02 | Remove or relocate fixed objects outside of Clear Recovery Zone | Provisions of a clear zone. A clear zone is an unobstructed, traversable roadside area that allows a driver to stop safely or regain control of a vehicle that has left the roadway. Removing or moving fixed objects, flattening slopes, or providing recovery areas reduces the likelihood of a crash. | 35% | 90% | Medium |
| R04 | Install guardrail | Reduces the severity of lane departure crashes | 25% | 100% | Medium |
| R08 | Install raised median | Provides a rigid barrier between opposing traffic | 25% | 90% | Medium |
| R21 | Improve pavement friction (High Friction Surface Treatments) | Improves the friction of the pavement and improves skid resistance | 55% | 100% | High |
| R22 | Install/Upgrade signs with new fluorescent sheeting (regulatory or warning) | Additional or new signage can address crashes caused by lack of driver awareness or compliance of roadway signing. | 15% | 100% | Very High |
| R23 | Install chevron signs on horizontal curves | Warns driver of an approaching curve and provides guidance to drivers | 40% | 100% | Very High |
| R24 | Install curve advance warning signs | Serves as an advance warning of an unexpected or sharp curve | 25% | 100% | Very High |
| R26 | Install dynamic/variable speed warning signs | Includes the addition of dynamic regulatory signs to warn drivers of speed | 30% | 100% | High |

| Code | Countermeasure Name | Countermeasure Description | CRF | Federal Funding | Systemic Approach Opportunity |
|---|---|---|---|---|---|
| R27 | Install delineators, reflectors and/or object markers | Installation of delineators, reflectors and/or object markers are intended to warn drivers of an approaching curve or fixed object that cannot easily be removed. | 15% | 100% | Very High |
| R28 | Install edgelines and centerlines | Provisions of centerlines and edge-lines where none exist or make significant upgrades to existing lines | 25% | 100% | Very High |
| R31 | Install edgeline rumble strips/stripes | Provision of edgeline rumble strips that create an auditory sound when driven over to mitigate lane departures | 15% | 100% | High |
| R32PB | Install bike lanes | Delineates available road space that is exclusive or preferential for use by bicycles | 35% | 90% | High |
| R34PB | Install sidewalk/pathway (to avoid walking along roadway) | Sidewalks and walkways provide people with space to travel within the public right-of-way that is separated from roadway vehicles. | 80% | 90% | Medium |
| R35PB | Install/upgrade pedestrian crossing (with enhanced safety features) | The enhanced safety elements, which may include curb extensions, medians and pedestrian crossing islands, beacons, and lighting, combined with pavement markings delineating a portion of the roadway that is designated for pedestrian crossing. | 35% | 90% | Medium |

# 6. Safety Projects

This chapter summarizes the process of selecting safety projects as part of the analysis for the City of Isleton's Local Road Safety Plan (LRSP). The next step after the identification of high-risk locations, emphasis areas and applicable countermeasures was to identify location specific safety improvements for all high-risk roadway segments and intersections.

Specific countermeasures and improvements were selected from the 2020 Local Roadway Safety Manual (LRSM) from Caltrans, where:

- S refers to improvements at signalized locations,
- NS refers to improvements at non-signalized locations, and
- R refers to improvements at roadway segments.

The corresponding number refers to the countermeasure number in the LRSM (2020). The countermeasures were grouped into safety projects for high-risk intersections and roadway segments. A total of six safety projects were developed. All countermeasures were identified based on the technical teams' assessment of viability that consisted of extensive analysis, observations, City staff input, and stakeholder/community input. The most applicable and appropriate countermeasures as identified have been grouped together to form projects that can help make high-risk locations safer.

A set of six safety projects were created for high-risk intersections and roadway segments, using HSIP approved countermeasures:

- Project #1: Systemic Improvements at Unsignalized Intersections – Install Flashing Beacons as Advance Warning, and Install Splitter Islands on Minor Road Approaches
- Project #2: Systemic Improvements at Unsignalized Intersections – Install/Upgrade Larger or Additional Stop Signs or Other Intersection Regulatory/Warning Signs, Upgrade Intersection Pavement Markings, and Improve Sight Distance to Intersection
- Project #3: Pedestrian Improvements at Unsignalized Intersections (Pedestrian Set-Aside Application) – Install/Upgrade Pedestrian Crossing with Enhanced Safety Features, Install Rectangular Rapid Flashing Beacon (RRFB), and Install Raised Medians (Refuge Islands)
- Project #4 – Roadway Segment Improvements on SR-160 – Add Segment Lighting and Install edgeline rumble strips/stripes
- Project #5 – Systemic Improvements on Roadway Segments – Install/Upgrade Signs with New Fluorescent Sheeting, and Install Delineators, Reflectors, and/or Object Markers

- Project #6 – Systemic Improvements on Roadway Segments (Edgeline Set-Aside Application) – Install Edgelines and Centerlines

These safety projects were chosen based on the previously completed collisions analysis, which was used to identify main collision attributes that were found to be leading factors of fatal and severe collisions in Isleton. These collision factors were identified to be:

- **Improper turning collisions**
- **Unsafe speed collisions**
- **Nighttime collisions**
- **Pedestrian collisions**

For collisions of all severity, including PDO collisions, **40% occurred as a result of an improper turning violation**, and the cause of one the F+SI collisions along SR-160. To address these collisions, viable safety projects at intersections include: installing or upgrade to larger or adding additional stop signs or other intersection warning/regulatory signs, upgrade signs with new fluorescent sheeting, upgrade intersection pavement markings, improving sight distance, installing edgeline rumble strips/stripes, and improving lighting along SR-160 east of H Street.

**Unsafe speed caused 20% of all injury collisions** and was a factor in one of the four injury collisions. Both observed unsafe speed collisions occurred on SR-160. To address these collisions, viable safety projects include installing/upgrading pedestrian crossing at uncontrolled locations (with enhanced safety features), installing a pedestrian median refuge island, installing a Rectangular Rapid Flashing Beacon (RRFB), installing splitter islands on minor road approaches, and installing flashing beacons as advance warning.

**50% of all collisions occurred at night or during low light conditions** (dawn/dusk), including one of two fatal or severe injury collisions. To address these collisions, viable safety projects include installing segment lighting on SR-160 east of H Street, installing or upgrade to larger or adding additional stop signs or other intersection warning/regulatory signs, upgrade intersection pavement markings, and upgrade signs with new fluorescent sheeting for better visibility. Pedestrian improvements that can help nighttime visibility include installing/upgrading pedestrian crossing at uncontrolled locations (with enhanced safety features), and installing a Rectangular Rapid Flashing Beacon (RRFB).

Although it made up only one of the 10 collisions citywide, it's worth noting that a fatal pedestrian collision was one of the two F+SI collisions that occurred in the study area. To

address these collisions, viable safety projects include installing/upgrading pedestrian crossing at uncontrolled locations (with enhanced safety features), installing a median refuge island, and installing a Rectangular Rapid Flashing Beacon (RRFB)

The next step in the process will be to prepare grant ready materials for HSIP Cycle 11 applications. TJKM has scoped to provide the City with materials for up to two applications. However, it should be noted that while the LRSP projects were based on high-risk locations, HSIP applications can be expanded to include many locations across the city. TJKM will work with the City to identify additional locations that may be beneficial to add to the HSIP application and calculate the BCR.

**Table 17** lists the safety projects for high-risk intersections and roadway segments, along with total base planning level cost (2021 dollar amounts) estimates and the resultant preliminary Benefit-Cost (B/C) Ratio. The "Total Benefit" estimates were calculated for the proposed improvements being evaluated in the proactive safety analysis. This "Total Benefit" is divided by the "Total Cost per Location" estimates for the proposed improvements, giving the resultant B/C Ratio. The B/C Ratio Calculation follows the methodology as mentioned in the LRSM (2020). The title of each countermeasure is located in **Table 18**.

**Appendix E** lists the detailed methodology to calculate B/C Ratio, as well as the complete cost, benefit and B/C Ratio calculation spreadsheet.

Table 17: List of Viable Safety Projects

| Location | CM1 | CM2 | CM3 | Cost per Location | B/C Ratio |
|---|---|---|---|---|---|
| **Project 1 – Install Flashing Beacons as Advance Warning, and Install Splitter Islands on Minor Road Approaches** | | | | | |
| 2nd St/A St/SR-160 | NS09 | NS13 | | $69,664 | 29.85 |
| H St/Main St | NS09 | NS13 | | $35,518 | |
| SR-160/H St | NS09 | NS13 | | $64,120 | |
| **Project 2: Install/Upgrade STOP or Intersection Warning/Regulatory Signs, Upgrade Intersection Pavement Markings, and Improve Sight Distance to Intersection** | | | | | |
| H St/Main St | NS06 | NS07 | NS11 | $2,128 | 30.12 |
| 2nd St/A St/SR-160 | NS06 | NS07 | NS11 | $13,244 | |
| SR-160/H St | NS06 | NS07 | NS11 | $76,944 | |
| Union St/D St | NS06 | NS07 | NS11 | $13,300 | |

| Location | CM1 | CM2 | CM3 | Cost per Location | B/C Ratio |
|---|---|---|---|---|---|
| **Project 3: Pedestrian Improvements (Crossings, Refuge Island, and Rectangular Rapid Flashing Beacon) at Unsignalized Intersections (Set-Aside Application)** | | | | | |
| H St/Main St | NS21PB | | | $32,305 | N/A* |
| 2nd St/A St/SR-160 | NS21PB | | | $63,385 | |
| Union St/D St | NS21PB | | | $63,805 | |
| SR-160/C St | NS21PB | NS19PB | NS22PB | $87,514 | |
| **Project 4: Roadway Segment Improvements on SR-160 (Add Segment Lighting and Edge-Line Rumble Strips)** | | | | | |
| SR-160: H St to Tyler Island Bridge Rd | R01 | R31 | | $374,080 | 6.38 |
| **Project 5: Install/Upgrade Signs with New Florescent Sheeting, and Install Delineators, Reflectors, and/or Object Markers** | | | | | |
| SR-160: W. Tyler Island Bridge Rd to 1st St | R22 | R27 | | $15,120 | 16.68 |
| H St: SR-160 to 6th St | R22 | R27 | | $6,650 | |
| Main St/2nd St: SR-160 to H St | R22 | R27 | | $6,160 | |
| A St, 4th St, Jackson St: City Limit to SR-160 | R22 | R27 | | $27,860 | |
| B St: SR-160 to 5th St | R22 | R27 | | $5,110 | |
| Union St: C St to H St | R22 | R27 | | $14,120 | |
| 6th St: Jackson St to H St | R22 | R27 | | $8,260 | |
| 4th Ave: Delta Ave to Georgiana Dr | R22 | R27 | | $3,640 | |
| **Project 6: Install Edge-Lines and Centerlines (Edgeline Set-Aside Application)** | | | | | |
| Various locations citywide** | R28 | | | $214,663 | N/A* |

Notes: CM – countermeasure. B/C ratio is the dollar amount of benefits divided by the cost of the countermeasure.

*HSIP Set-Aside Applications do not require a collision history or BCR

**Cost is based on 40% of the City's centerline miles.

Table 18: List of Countermeasure Names

| Countermeasure Name |
|---|
| NS06 – Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs |
| NS07 – Upgrade intersection pavement markings |
| NS09 – Install flashing beacons as advance warning (Non-signalized Intersection) |
| NS11- Improve sight distance to intersection (Clear Sight Triangles) |
| NS13 – Install splitter-islands on the minor road approaches |
| NS19PB – Install raised medians (refuge islands) |
| NS21PB – Install/upgrade pedestrian crossing at uncontrolled locations (with enhanced safety features) |
| NS22PB – Install Rectangular Rapid Flashing Beacon (RRFB) |
| R01 – Add Segment Lighting |
| R22 – Install/Upgrade signs with new fluorescent sheeting (regulatory or warning) |
| R27 – Install delineators, reflectors and/or object markers |
| R28 – Install edge-lines and centerlines |
| R31 – Install edgeline rumble strips/stripes |

# 7. Evaluation and Implementation

This chapter describes the steps the City may take to evaluate the success of this plan and steps needed to update the plan in the future. The LRSP is a guidance document and requires periodic updates to assess its efficacy and re-evaluate potential solutions. It is recommended to update the plan every two to five years in coordination with the identified safety partners. This document was developed based on community needs, stakeholder input, and collision analysis conducted to identify priority emphasis areas throughout the City. The implementation of strategies under each emphasis area would aim to reduce fatal and severe injury collisions in the coming years.

## Implementation

The LRSP is a guidance document that is recommended to be updated every two to five years in coordination with the safety partners. The LRSP document provides engineering, education, enforcement, and emergency medical service-related countermeasures that can be implemented throughout the City to reduce fatal and severe injury collisions. It is recommended that the City of Isleton implement the selected projects in high-collision locations in coordination with other projects proposed for the City's infrastructure development in their future Capital Improvement Plans. After implementing countermeasures, the performance measures for each emphasis area should be evaluated annually. The most important measure of success of the LRSP should be reducing fatal and severe injury collisions throughout the City. If the number of fatal and severe injury collisions does not decrease over time, then the emphasis areas and countermeasures should be re-evaluated.

Funding is a critical component of implementing any safety project. While the HSIP program is a common source of funding for safety projects, there are numerous other funding sources that could be pursued for such projects. (See **Table 19** below).

Table 19: List of Potential Funding Sources

| Funding Source | Funding Agency | Amount Available | Next Estimated Call for Projects | Applicable E's | Notes |
|---|---|---|---|---|---|
| Active Transportation Program | Caltrans, California Transportation Commission, SACOG | ~$450 million per cycle (every two years) | 2022 | Engineering, Education | Can use used for most active transportation related safety projects as well as education programs. Funding available through Caltrans or SACOG |
| Highway Safety Improvement Program | Caltrans | | April 2022 | Engineering | Most common grant source for safety projects |
| Regional Program | SACOG (Combines various federal and state funds) | $163.4 million in FY 2020/21 | TBD, last call in 2021 | Engineering | Implement cost effective projects that support MTP/SCS performance outcomes, including Fix-it-First and system modernization |
| Community Design | SACOG (Combines various federal and state funds) | $18.2 million in FY 2020/21 | TBD, last call in 2021 | Engineering | Focuses on placemaking projects |
| Disadvantaged Community Pipeline Projects | SACOG (Combines various federal and state funds) | $3 million | Mid-2022 | Engineering, Others TBD | Identify and advance community-led projects that benefit disadvantaged communities |
| Innovative Mobility Program | SACOG (Combines various federal and state funds) | $6 million | 2022 TBD | Engineering | Plan and pilot mobility projects and programs to reduce VMT and GHG emissions |
| Office of Traffic Safety Grants | California Office of Traffic Safety | Varies by grant | Closes January 31st annually | Education, Enforcement, Emergency Response | 10 grants available to address various components of traffic safety |
| Affordable Housing and Sustainable Communities Program | Strategic Growth Council and Dept. of Housing and Community Development | ~$405 million | 2022 | Engineering, Education | Must be connected to affordable housing projects; typically focuses on bike/pedestrian infrastructure/programs |
| Urban Greening | California Natural Resources Agency | $28.5 million | 2022 | Engineering | Focused on bike/pedestrian infrastructure and greening public spaces |
| Local Streets and Road Maintenance and Rehabilitation | CTC (distributed to local agencies) | $1.5 billion statewide | N/A; distributed by formula | Engineering | Typically pays for road maintenance type projects |
| RAISE Grant | USDOT | ~$1 billion | 2022 | Engineering | Typically used for larger infrastructure projects |
| Sustainable Transportation Equity Project | California Air Resources Board | ~$19.5 million | TBD; most recent call in 2020 | Engineering, Education | Targets projects that will increase transportation equity in disadvantaged communities |
| Transformative Climate Communities | Strategic Growth Council | ~$90 million | TBD; most recent call in 2020 | Engineering | Funds community-led projects that achieve major reductions in greenhouse gas emissions in disadvantaged communities. |

## Monitoring and Evaluation

For the success of the LRSP, it is crucial to monitor and evaluate the four E-strategies continuously. Monitoring and evaluation help provide accountability, ensures the effectiveness of the countermeasures for each emphasis area, and help making decisions on the need for new strategies. The process would help the City make informed decisions regarding the implementation plan's progress and accordingly, update the goals and objectives of the plan.

After implementing countermeasures, the strategies should be evaluated annually as per their performance measures. The evaluation should be recorded in a before-after study to validate the effectiveness of each countermeasure as per the following observations:

- Number of fatal and severe injury collisions
- Number of police citations
- Number of public comments and concerns

Evaluation should be conducted during similar time periods and durations each year. The most important measure of success of the LRSP should be reduction in fatal and severe injury collisions throughout the City. If the number of F+SI collisions doesn't decrease initially, then the countermeasures should be evaluated as per the other observations, as mentioned above. The effectiveness of the countermeasures should be compared to the goals for each emphasis area.

## LRSP Update

The LRSP is a guidance document and is recommended to be updated every two to five years after adoption. After monitoring performance measures focused on the status and progress of the E's strategies in each emphasis area, the next LRSP update can be tailored to resolve any continuing safety problems. An annual stakeholder meeting with the safety partners is also recommended to discuss the progress for each emphasis area and oversee the implementation plan. The document should then be updated as per the latest collision data, emerging trends, and the E's strategies' progress and implementation.

# Appendix A: Matrix of Planning Goals, Policies, and Projects

**Appendix A: Table of Policies and Projects from the Literature Review:**

| Document | Relevant Goals, Policies, and Projects |
|---|---|
| **Isleton Comprehensive General Plan and Environmental Impact Report (2000)** | **Goals:**<br>• Balancing the Costs and Benefits of Urbanization through Economic Development<br>• Equality of Opportunity<br>• Community Identity<br>• Quality in the Form, Design and Functions of the Urban Area<br>• Enhancing the Quality of Life<br>• Protections from Flood Hazards<br>• Assigning the Costs of Constructing and Maintaining New Development<br>• Assigning the Benefits of Redevelopment<br>• Accessing the Sacramento River Frontage<br>• Historic Preservation<br>**Policies:**<br>• In-fill Development within the Existing City Limits<br>• Expanding the Urban Pattern Beyond the Existing City Limits<br>• Annexation to the Urban Limit Line through Phased Development<br>• Limitations Upon the Timing of Development<br>• Maintaining Reasonable Balance in Housing Type<br>• Achieving Visual and Functional Quality in New Development<br>• Redevelopment and Revitalization<br>• Population and Economic Policies<br><br>**Circulation Element**<br>Objective: The development of an integrated system of internal circulation and to provide access to other parts of the County and the region to serve all citizens of the Isleton area, including the young, the elderly, and the physically disabled, by seeking the following:<br>• Increased safety for citizens.<br>• The efficient movement of people and goods. |

Appendix A

| Document | Relevant Goals, Policies, and Projects |
|---|---|
| | • Lower vehicle operating costs.<br>• Lower vehicle miles traveled and therefore lower quantities and impacts of vehicle emissions.<br>• Economy in street construction and maintenance.<br>• A circulation system which is correlated and consistent with the needs of land use patterns fostered by the Land Use Element.<br>• Minimizing and (where possible) avoiding the disruption of residential areas caused by through traffic.<br>• Protection of future rights-of-way needed for Arterial and Collector Street widening within developed areas. |
| **City of Isleton Opportunities, Constraints, and Vision Report (2017)** | **Circulation Constraints:**<br>• **State Highway 160** (River Road) runs east/west through the northern end of Isleton. The majority of Highway 160 is on the levee adjacent to the Sacramento River, although part of the highway descends from the levee, primarily in the portion north of Delta Avenue to E Street. The speed limit drops from 50 mph to 40 mph as travelers reach the city limits, and then drops to 30 mph near 1st Street as Highway 160 dips down into downtown.<br>• **Safety**: Highway 160 creates safety issues as it passes through Isleton, particularly at the intersection with A Street and 2nd Street. The intersection configuration can create confusion, and many drivers are traveling above the posted 30 mph speed limit as they enter downtown. While there are crosswalks at three of the five intersections, they are not well-marked and there are no other signs warning travelers to watch for pedestrians.<br>• **Segmented Downtown**: The major segment of Downtown is along 2nd Street from A Street to C Street, where Highway 160 dips down into the community, bringing higher-speed through traffic. Travelers along Highway 160 could easily pass through a portion of the downtown without realizing that the Historic District along Main Street even exists. This circulation pattern and lack of wayfinding |

| Document | Relevant Goals, Policies, and Projects |
|---|---|
| | signage detracts from downtown's sense of place and potential economic activity.<br><br>Circulation Opportunities:<br>• **Thoroughfare**: The City has an opportunity to capitalize on the amount of traffic that passes through Isleton along Highway 160.<br>• **Traffic Slowing Measures**: Drivers tend to slow down when they perceive that bikes and pedestrians are likely to be present and when the design of the street conveys that it is more than just a travel conduit. The community has an opportunity to transform the portion of Highway 160 that is in downtown into a shared and valued community space. Improvements to Highway 160 such as aesthetic paving for pedestrian crossings, bike lanes, street trees, landscaping, decorative lighting, and street furniture can improve the pedestrian experience and also serve to slow traffic, improving safety at the intersection of Highway 160 and A Street.<br>• **City Gateway** features that elevate Isleton's sense of place could help attract drivers who are passing through the city to stop and explore Isleton. Such features could include large wayfinding and historical information signage and banners on light posts. The Delta Protection Commission and Sacramento-San Joaquin Delta Conservancy will be working with the City of Isleton and organizations such as the Isleton Chamber of Commerce on a range of signage efforts, including developing a Delta wide signage plan, creating interpretive signs for heritage sites, and placing signs near and within the city. The signage plan, which is led by the Delta Conservancy, will identify and prioritize the locations for three types of signs (welcome, directional, and interpretive), create sign design templates, and discuss implementation requirements. |

Appendix A

| Document | Relevant Goals, Policies, and Projects |
|---|---|
| **Safety Element (Existing Conditions) of Isleton General Plan Memo, 2021** | • The City will continue to give priority to the support of police protection, and to fire suppression and prevention functions of the Isleton Fire Department.<br>• The City will maintain a street system which is capable of providing access to any fires that may develop within the urban area, and which is capable of providing for the adequate evacuation of residents in the event of an emergency condition of magnitude.<br>• In the event that any part of the levee system protecting Isleton was to fail, the most expedient evacuation routes would be east and north along the Sacramento River levee roads toward Walnut Grove, and then east toward Interstate 5.<br>**Goals, Policies, and Implementation Actions**<br>• GOAL SAF-2: Create and maintain a safe environment in Isleton<br>• POLICY-SAF-2.2: Provide adequate policing and fire protection services to serve the existing and projected population of Isleton<br>• POLICY-SAF-2.3: Engage Isleton residents in public safety initiatives<br>• POLICY-SAF-4.2: Ensure that City-owned properties, facilities, trails, and parks meet the needs of the community while maximizing public safety for all users<br>• POLICY-SAF-4.3: Require new development to fully accommodate emergency access<br>• POLICY-SAF-4.4: Design the right-of-way and maintain a street system to facilitate emergency access and evacuation to all residents<br>• Action-SAF-4.3.2: Require new development to incorporate existing evacuation routes in their design and define new evacuation routes, if needed.<br>• Action-SAF-4.4.1: Include the Fire Department and Sacramento County Sheriff's Department in all capital improvement projects to ensure that emergency access is prioritized as a design consideration. |

Appendix A

| Document | Relevant Goals, Policies, and Projects |
|---|---|
| **Land Use Background Report of Isleton General Plan (2020)** | **Recommendations**<br>• Consideration should be given to how land use decisions can mitigate anticipated traffic increases on Highway 160<br>• The General Plan should consider whether land acquisitions by the City will be necessary to accommodate future public facilities, i.e. a new City Hall, and if so where such public facilities should be located.<br>• Land use decisions and future growth in the City of Isleton should consider and be balanced with the public safety capabilities of the City including policing, fire and emergency response.<br>• A new traffic study must be done to account for previously unanalyzed build out capacities. Specifically, the traffic study should account for impacts as a result of the Commercial, Industrial, and Mixed Use designations moving forward. (For "mixed use" designations residential units are now considered in the 2040 build out analysis and can be accounted for in future traffic studies). |
| **City of Isleton Parking Analysis & Development Report (1989)** | Recommendations<br>• Investigate the feasibility of acquisition and development of the triangular shaped parcel bounded by Highway 160, First Street, and A Street. Feasibility and timing will be dependent on funding availability and negotiated acquisition.<br>• When the City is no longer in need of the Fire Department building across from City Hall, convert and develop the property as a surface parking lot.<br>• Restripe and physically improve (Curbs and Planter) the center parking area on Second Street between A and D Streets and A Street between 1st and 2nd Streets.<br>• Stripe all on-street parking spaces.<br>• If a volunteer effort to reduce employer and employee parking is unsuccessful, limit parking in the downtown area to 2 hours between 8am and 6pm. |
| **City of Isleton 10-Year Capital** | Upcoming Road Projects (Project Cost) |

Appendix A

| Document | Relevant Goals, Policies, and Projects |
|---|---|
| **Improvement Program (2017)** | • 3rd Street from Jackson to C: Repave and upgrade ADA ramps ($130,900)<br>• 4th Street from A St to B St: Upgrade ADA ramps and gutter rehab ($62,832)<br>• B Street from 2nd to 5th St: Widen sidewalk, upgrade ADA ramps, and upgrade drainage ($81,496)<br>• C Street from 3rd St to 5th St: Make sidewalks ADA accessible ($46,569)<br>• G Street from 6th St to E. 3rd St: Repave ($77,677)<br>• H Street from Union to 6th St: Repave ($75,583)<br>• Union St from C St to D St: Make sidewalks ADA accessible, water service repairs ($243,946)<br>• B St from Hwy 160 to 1st St: Repave and ADA ramps ($31,185)<br>• 1st St to Hwy 160: Repave ($18,595)<br>• Entry Improvement #1: Install new signage and landscaping ($70,000)<br>• Entry Improvement #2: Install new signage and landscaping ($70,000)<br>• Traffic Calming & Safety Improvements on Hwy 160: Install pedestrian crossings, bike lanes, street trees, landscaping, decorative lighting, street furniture, and intersection improvements at Hwy 160/A St intersection ($1,400,000) |
| **SACOG Regional Bicycle, Pedestrian, and Trails Master Plan (2015** | **Goals**<br>**Goal 1**: Increase and Improve bicycle and pedestrian access and mobility for residents and visitors for all ages and abilities<br>**Goal 2**: Improve and maintain the quality and operation of bikeway and walkway networks<br>**Goal 3**: Improve bicycle and pedestrian safety<br>**Goal 6**: Increase education, encouragement, and awareness programs about bicycle and pedestrian travel<br>**Goal 8**: Increase collaboration among stakeholders throughout the region to seek funding and implement bicycle and pedestrian projects, programs, and related efforts.<br><br>City of Isleton Projects |

Appendix A

| Document | Relevant Goals, Policies, and Projects |
|---|---|
| | • Multi-Use Class I Path along the Sacramento River waterfront and Highway 160 (Delta Trail)<br>• Bicycle & Pedestrian Master Plan and Feasibility Study |
| **SACOG Metropolitan Transportation Plan/ Sustainable Communities Strategy (2020)** | **Policy 2:** Pursue funding opportunities that support the infrastructure improvements needed to support new housing and employment opportunities in existing urban, suburban, and rural communities.<br><br>**Policy 10**: Find solutions and reliable funding sources to meet the maintenance needs of roads that support rural economies, natural resource-based industries, agriculture, farm-to-market routes, and freight corridors.<br><br>**Policy 20**: Prioritize cost effective safety improvements that will help the region eliminate fatal transportation related accidents.<br><br>**Policy 22**: Invest in bicycle and pedestrian infrastructure to encourage healthy, active transportation trips and provide recreational opportunities for residents and visitors.<br><br>**Policy 24**: Invest in transportation improvements that improve access to major economic assets and job centers.<br><br>**Policy 25**: Prioritize investments in transportation improvements that reduce greenhouse gas emissions and vehicle miles traveled. |

# Appendix B: Consolidated Collision Database

Appendix B

| CASE_ID | ACCIDENT_ | PROC_DAT | JURIS | COLLISION | COLLISION | OFFICER_II | REPORTIN( | DAY_OF_W | CHP_SHIFT | POPULATI( | CNTY_CITY | SPECIAL_C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8362239 | 2016 | 20170517 | 3403 | 20160626 | 1500 | 20CSO | RC | 7 | 5 | 1 | 3403 | 0 |
| 90359563 | 2016 | 20170103 | 9252 | 20161224 | 15 | 19787 | | 6 | 3 | 1 | 3403 | 0 |
| 90429273 | 2017 | 20170406 | 9252 | 20170115 | 2114 | 20145 | | 7 | 2 | 1 | 3403 | 0 |
| 90651496 | 2018 | 20180130 | 9252 | 20180118 | 1725 | 18598 | | 4 | 2 | 1 | 3403 | 0 |
| 90692338 | 2018 | 20180329 | 9252 | 20180314 | 2050 | 19053 | | 3 | 2 | 1 | 3403 | 0 |
| 90964711 | 2018 | 20190410 | 9252 | 20181211 | 1348 | 20369 | | 2 | 1 | 1 | 3403 | 0 |
| 91044216 | 2019 | 20190802 | 9252 | 20190730 | 1520 | 19787 | | 2 | 2 | 1 | 3403 | 0 |
| 7007925 | 2015 | 20170113 | 9252 | 20150714 | 550 | 17258 | | 2 | 3 | 1 | 3403 | 0 |
| 90082427 | 2015 | 20151228 | 9252 | 20151211 | 1955 | 19202 | | 5 | 2 | 1 | 3403 | 0 |

Appendix B

| CASE_ID | BEAT_TYPE | CHP_BEAT | CITY_DIVIS | CHP_BEAT | BEAT_NUM | PRIMARY_ | SECONDAR | DISTANCE | DIRECTION | INTERSECT | WEATHER_ | WEATHER_ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8362239 | 0 | 0 | | 0 | 5 | MAIN ST | F ST | 106 | W | N | A | - |
| 90359563 | 3 | 5 | | 2 | 90 | SR-160 N/I | W. TYLER I | 1500 | S | N | A | - |
| 90429273 | 1 | 3 | | 2 | 162 | SR-160 NO | W. TYLER I | 655 | S | N | A | - |
| 90651496 | 1 | 3 | | 2 | 162 | SR-160 | H STREET | 5 | N | N | C | - |
| 90692338 | 3 | 5 | | 2 | 90 | 4TH AVE | DELTA AVE | 45 | W | N | B | - |
| 90964711 | 3 | 5 | | 2 | 90 | H STREET | MAIN STRE | 0 | | Y | A | - |
| 91044216 | 1 | 3 | | 2 | 162 | SR-160 N/I | A ST | 50 | N | N | A | - |
| 7007925 | 1 | 3 | | 2 | 162 | RT 160 | A ST | 30 | N | N | A | - |
| 90082427 | 3 | 5 | | 2 | 90 | UNION ST | D ST. | 18 | E | N | B | - |

Appendix B

| CASE_ID | STATE_HW | CALTRANS | CALTRANS | STATE_RO | ROUTE_SU | POSTMILE | POSTMILE | LOCATION | RAMP_INT | SIDE_OF_I | TOW_AWA | COLLISION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8362239 | N | | | | | | | | | | N | 0 |
| 90359563 | Y | | | | | | | | | | Y | 4 |
| 90429273 | Y | | | | | | | | | | Y | 1 |
| 90651496 | Y | | | | | | | | | | N | 0 |
| 90692338 | N | | | | | | | | | | N | 0 |
| 90964711 | N | | | | | | | | | | N | 1 |
| 91044216 | Y | | | | | | | | | | Y | 0 |
| 7007925 | Y | SAC | 3 | 160 | - | - | 4.59 | H | - | S | N | 4 |
| 90082427 | N | | | | | | | | | | Y | 0 |

Appendix B

| CASE_ID | NUMBER_I | NUMBER_I | PARTY_CO | PRIMARY_ | PCF_CODE | PCF_VIOL_ | PCF_VIOLA | PCF_VIOL_ | HIT_AND_I | TYPE_OF_C | MVIW | PED_ACTIC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8362239 | 0 | 0 | 1 | A | - | 8 | 22107 | M | E | I | A | |
| 90359563 | 0 | 1 | 1 | A | - | 8 | 22107 | N | F | A | A | |
| 90429273 | 1 | 0 | 1 | A | - | 8 | 22107 | N | H | A | A | |
| 90651496 | 0 | 0 | 2 | A | - | 3 | 22350 | N | C | C | A | |
| 90692338 | 0 | 0 | 2 | A | - | 1 | 23152 | A | N | H | E | A |
| 90964711 | 1 | 0 | 2 | A | - | 11 | 21954 | A | N | G | B | D |
| 91044216 | 0 | 0 | 2 | C | - | 18 | | | N | E | I | A |
| 7007925 | 0 | 1 | 3 | A | - | 3 | 22350 | N | C | C | A | |
| 90082427 | 0 | 0 | 2 | A | - | 8 | 22107 | M | B | E | A | |

Appendix B

| CASE_ID | ROAD_SUF | ROAD_COI | ROAD_COI | LIGHTING | CONTROL_ | CHP_ROAI | PEDESTRIA | BICYCLE_A | MOTORCY | TRUCK_AC | NOT_PRIV/ | ALCOHOL_ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8362239 | A | H | - | A | D | 0 | | | | | Y | |
| 90359563 | A | H | - | D | D | 0 | | | | | Y | |
| 90429273 | A | H | - | D | D | 0 | | | | | Y | |
| 90651496 | B | H | - | C | D | 0 | | | | | Y | |
| 90692338 | B | H | - | C | D | 0 | | | | | Y | Y |
| 90964711 | A | H | - | A | D | 0 | Y | | | | Y | |
| 91044216 | A | H | - | A | D | 0 | | | | | Y | |
| 7007925 | A | H | - | B | A | 0 | | | | | Y | |
| 90082427 | A | H | - | C | D | 0 | | | | | Y | Y |

Appendix B

| CASE_ID | STWD_VEH | CHP_VEHT | COUNT_SE | COUNT_VI | COUNT_CC | COUNT_PE | COUNT_PE | COUNT_BI | COUNT_BI | COUNT_M | COUNT_M | PRIMARY_ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8362239 | A | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| 90359563 | A | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| 90429273 | A | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| 90651496 | H | 66 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| 90692338 | D | 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| 90964711 | N | 60 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | - |
| 91044216 | - | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| 7007925 | D | 22 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | - |
| 90082427 | A | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - |

Appendix B

| CASE_ID | SECONDAF | LATITUDE | LONGITUDE |
|---|---|---|---|
| 8362239 | - | 38.16255 | -121.606 |
| 90359563 | - | 38.24209 | -121.51 |
| 90429273 | - | 38.16613 | -121.599 |
| 90651496 | - | 38.16345 | -121.604 |
| 90692338 | - | 38.59627 | -121.505 |
| 90964711 | - | 38.1629 | -121.604 |
| 91044216 | - | 38.16193 | -121.611 |
| 7007925 | - | 38.16209 | -121.612 |
| 90082427 | - | 38.16179 | -121.609 |

# Appendix C: Countermeasure Toolbox

## Appendix C

**Table 1: Countermeasures for High-Risk Intersections**

| ID | Intersection | Control | Consolidated CMs (HSIP Eligible - Refer to LRSAP 2022) | | | | Additional CM (HSIP and non-HSIP) | EA - 1 Intersection Safety | | | EA - 2 Pedestrian Safety | | | EA - 3 Improper Turning Collisions | | | EA - 4 at 180 Collisions | | | EA - 5 Unsafe Speed and Rear End Collisions | | | EA - 6 Fixed/Non-Collisions | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | CM1 | CM2 | CM3 | CM4 | | CM1 | CM2 | CM3 | CM1 | CM2 | CM3 | CM1 | CM2 | CM3 | CM1 | CM2 | CM3 | CM1 | CM2 | CM3 | CM1 | CM2 | CM3 |
| I-1 | H St/Adam St | One-way stop controlled | R107 | R12PB | R108 | R102 | Add flashers, Add two-direction arrow sign (T-intersection), Remove on-street parking near STOP sign, Advance ped warning sign | R102 | R107 | R108 | R12PB | R11PB | | R111 | R108 | R107 | | | | | | | R101 | R107 | R108 |
| I-2 | 2nd St/E St/SR 160 | Two-way stop controlled | R109 | R105 | R113 | R114 | Advance ped warning sign, R109 warning SR-160, speed feedback sign, consider removing RT yield (pro-rate 160, don't block the intersection markings, consider extending existing island and removing yield, perform signal warrant analysis | R109 | R110 | R113 | R12PB | R12PB | R11PB | R113 | R106 | R107 | R11PB | R112 | R109 | R109 | R110 | R108 | R101 | R109 | R106 |
| I-3 | SR-160/A St | One-way stop controlled | R111 | R106 | R109 | R101 | Advance intersection warning sign, speed feedback sign, pursue removal of billboard at SW corner of intersection | R106 | R109 | R111 | | | | R111 | R113 | R114 | R109 | R112 | R110 | R109 | R112 | R114 | R101 | R108 | R109 |
| I-4 | Union St/D St | All-way stop controlled | R101 | R107 | R113 | R12PB | Install Speed Limit sign, Red Curb north of Union St, Improve Curb Radii, Relocate or rot corner, ADA ramps | R111 | R107 | R106 | R11PB | R12PB | | R106 | R111 | R118 | | | | | | | R101 | R112 | R106 |

EA = Emphasis Area

| Code | Countermeasure Name |
|---|---|
| R101 | Add intersection lighting |
| R102 | Convert to all-way STOP control (from 1-way or Yield control) |
| R106 | Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs |
| R107 | Upgrade intersection pavement markings |
| R108 | Install Flashing Beacons at Stop-Controlled Intersections |
| R109 | Install flashing beacons as advance warning (R1...) |
| R110 | Install transverse rumble strips on approaches |
| R111 | Improve sight distance to the intersection (Clear Sight Triangles) |
| R112 | Improve pavement friction (High Friction Surface Treatments) |
| R113 | Install splitter islands on the minor road approaches |
| R114 | Install raised medians on approaches |
| R11PB | Install raised medians (refuge islands) |
| R12PB | Install/upgrade pedestrian crossing at uncontrolled locations (with enhanced safety features) |
| R13PB | Install Rectangular Rapid Flashing Beacon (RRFB) |

Appendix C

**Table 2: Countermeasures for High-Risk Roadway Segments**

| ID | Roadway Segment | Consolidated CMs (HSMP Highlights - Refer to LRSMP 2020) | | | | Additional CMs (HSMP and non-HSMP) | EA - 1 Intersection Safety | | | EA - 2 Pedestrian Safety | | | EA - 3 Improper Turning Collisions | | | EA - 4 SR 160 Collisions | | | EA - 5 Unsafe Speed and Rear End Collisions | | | EA - 6 Nighttime Collisions | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CM1 | CM2 | CM3 | CM4 | | CM1 | CM2 | CM3 | CM1 | CM2 | CM3 | CM1 | CM2 | CM3 | CM1 | CM2 | CM3 | CM1 | CM2 | CM3 | CM1 | CM2 | CM3 |
| A | River Rd/SR-180: W Tyler Island Bridge Rd to 1st St | R04 | R31 | R35PB | R01 | Traffic calming measures in Downtown Curb extensions, speed feedback signs | R33 | R02 | R09 | R35PB | R37PB | | R04 | R08 | R31 | R04 | R31 | R22 | R26 | R21 | R33 | R01 | R27 | R22 |
| B | H St: River Rd/SR 160 to 6th St | R0 | R35PB | R22 | R26 | Curb-cuts/curb extensions | R01 | R22 | R27 | R35PB | R36PB | | R28 | R22 | | | | | R22 | | | R01 | R22 | R02 |
| C | Main St/2nd St: SR-180 to H St | R01 | R36PB | R28 | | Curb-cuts, Restrict parking near intersections to increase sight distance (red curbs) | R01 | R22 | | R35PB | | | R28 | R22 | | | | | R22 | | | R01 | R22 | |
| D | 4th Ave: Delta Ave to Georgiana Dr | R01 | R33 | R28 | R35PB | ADA Ramps, Resurface Pavement, Add missing STOP sign on 4th | R01 | R22 | | R35PB | | | R28 | R22 | | | | | R22 | | | R01 | R22 | |
| | **Identified from City Staff Input** | | | | | | | | | | | | | | | | | | | | | | | |
| E | A Street, 4th Street, Jackson St: City Limit to SR-180 | R34PB | R35PB | R01 | | Remove truck route, All-way STOP at 4th/A St, High Visibility Crosswalk, Install Sidewalk on Jackson | R01 | R22 | R27 | R34PB | R35PB | | | | | | | | R22 | | | R01 | R22 | R27 |
| F | B Street, SR-180 to 5th Street | R01 | R36PB | R28 | | Sign audit - Improve visibility, replace/add signs, resurface pavement | R01 | R22 | R27 | R34PB | R35PB | | R28 | | | | | | R22 | | | R01 | R22 | R27 |
| G | Union Street: C Street to H Street | R02 | R34PB | R36PB | R28 | Resurface Pavement, Sign audit - Improve visibility, replace/add signs | R01 | R22 | R27 | R34PB | R35PB | | R28 | R02 | | | | | R02 | R28 | R22 | R01 | R22 | R27 |
| H | 6th Street from Jackson Street to H Street | R01 | R34 | R23 | R21 | Traffic calming, Speed cushions or tables to reduce speeding, Curve warning sign near school | R34 | R21 | R23 | R34PB | R35PB | R37PB | R28 | R34 | R06 | | | | R21 | R28 | R22 | R01 | R22 | R27 |

EA = Emphasis Area

| Code | Countermeasure Name |
|---|---|
| R01 | Add Segment Lighting |
| R02 | Remove or relocate fixed objects outside of Clear Recovery Zone |
| R04 | Install guardrail |
| R06 | Install raised median |
| R21 | Improve pavement friction (High friction surface treatments) |
| R22 | Install/Upgrade signs with new fluorescent sheeting (regulatory or warning) |
| R23 | Install chevron signs on horizontal curves |
| R26 | Install curve advance warning signs |
| R28 | Install dynamic/variable speed warning signs |
| R27 | Install delineators, reflectors and/or object markers |
| R28 | Install edge lines and centerlines |
| R31 | Install supplemental turning signs/lighting |
| R32PB | Install bike lanes |
| R34PB | Install sidewalk/pathway (to avoid walking along roadway) |
| R35PB | Install/upgrade pedestrian crossing (with enhanced safety features) |
| R37PB | Install Rectangular Rapid Flashing Beacon (RRFB) |

Appendix C

**Table 3: Non-Engineering Countermeasures**

| | Strategy | Performance Measure | Organizations to be involved |
|---|---|---|---|
| **Education** | Conduct public information and education campaign for intersection safety laws, unsafe speeds, distracted driving, improper turning and driving under the influence | Number of education campaigns | City, Sheriff's Office, CHP |
| | Conduct pedestrian safety campaigns and outreach to raise their awareness of pedestrian safety needs through media outlets, social media. Create a pamphlet for pedestrian safety in Isleton | Number of education campaigns | City, School District, Sheriff's Office, CHP |
| | Conduct bicycle safety campaigns and outreach to raise their awareness of bicycle safety needs through media outlets, social media and Sacramento area bicycle advocates. Create a pamphlet for bicycle safety in Isleton | Number of education campaigns | City, School District, Sheriff's Office, CHP |
| | Participate in Safe Routes to School educational programs at Isleton Elementary School | Number of education campaigns | City, School District, WALK Sacramento |
| **Enforcement** | Targeted enforcement at high-risk locations. | Number of tickets issued. | Sheriff's Office and CHP |
| | Increase the number of personnel who have completed Advanced Roadside Impaired Driving Enforcement (ARIDE) training | Number of personnel who have completed Advanced Roadside Impaired Driving Enforcement (ARIDE) training | Sheriff's Office and CHP |
| **Emergency Medical Services (EMS)** | Improve resource deployment and clear routes for emergency responses to collision sites | EMS vehicle response time. | Sacramento County Emergency Medical Services Agency (SCEMSA) |
| | Increase the number of EMS/fire control personnel taking Traffic Incident Management Training | Number of EMS/fire control personnel taking Traffic Incident Management Training | Sacramento County Emergency Medical Services Agency (SCEMSA) |

Appendix C

**Table 4: Countermeasure Descriptions for Intersections**

| Code | Countermeasure Name | CM Description | CRF | Federal Funding | Systemic Approach Opportunity |
|---|---|---|---|---|---|
| NS01 | Add intersection lighting (NS.1.) | Provision of lighting at the intersection and all it's approaches | 40% | 100% | Medium |
| NS02 | Convert to all-way STOP control (from 2-way or Yield control) | Conversion of 2-way stop intersection to 4-way stop | 50% | 100% | High |
| NS06 | Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs | Additional regulatory and warning signs at or prior to intersections will help enhance the ability of approaching drivers to perceive them | 15% | 100% | Very High |
| NS07 | Upgrade intersection pavement markings | Increase the visibility of an intersection by upgrading pavement markings where none exist or are faded/cracked | 25% | 100% | Very High |
| NS08 | Install Flashing Beacons at Stop-Controlled Intersections | Reinforce driver awareness of an intersection | 15% | 100% | High |
| NS09 | Install flashing beacons as advance warning (NS.1.) | Installation of an advance flashing beacons can be used to supplement and call driver attention to intersection control signs | 50% | 100% | High |
| NS10 | Install transverse rumble strips on approaches | Provide an auditory and tactile sensation for a motorist approaching an intersection | 20% | 90% | High |
| NS11 | Improve sight distance to intersection (Clear Sight Triangles) | Clearing roadside obstructions to improve sight distance at the intersection | 20% | 90% | High |
| NS12 | Improve pavement friction (High Friction Surface Treatments) | Improves the friction of the pavement and improves skid resistance | 55% | 100% | Medium |
| NS13 | Install splitter-islands on the minor road approaches | Splitter islands can provide a positive separation between turning vehicles on a through road and vehicles stopped on the minor road approach. Also allows for an extra stop sign at an intersection. | 40% | 90% | Medium |
| NS14 | Install raised medians on approaches | Channels traffic approaching an intersection | 25% | 90% | Medium |
| NS19PB | Install raised medians (refuge islands) | Decreases the level of exposure of pedestrians to traffic and allows pedestrians to only cross one direction of traffic at a time | 45% | 90% | Medium |
| NS21PB | Install/upgrade pedestrian crossing at uncontrolled locations (with enhanced safetyfeatures) | Enhances pedestrian crossings with high visibility patterns, yield lines, pedestrian signage, etc to warn drivers of the presence of pedestrians | 35% | 100% | Medium |
| NS22PB | Install Rectangular Rapid Flashing Beacon (RRFB) | Rectangular Rapid Flashing Beacon (RRFB) includes pedestrian-activated flashing lights and additional signage that enhance the visibility of marked crosswalks and alert motorists to pedestrian crossings | 35% | 100% | Medium |

**Table 5: Countermeasure Descriptions for Roadway Segments**

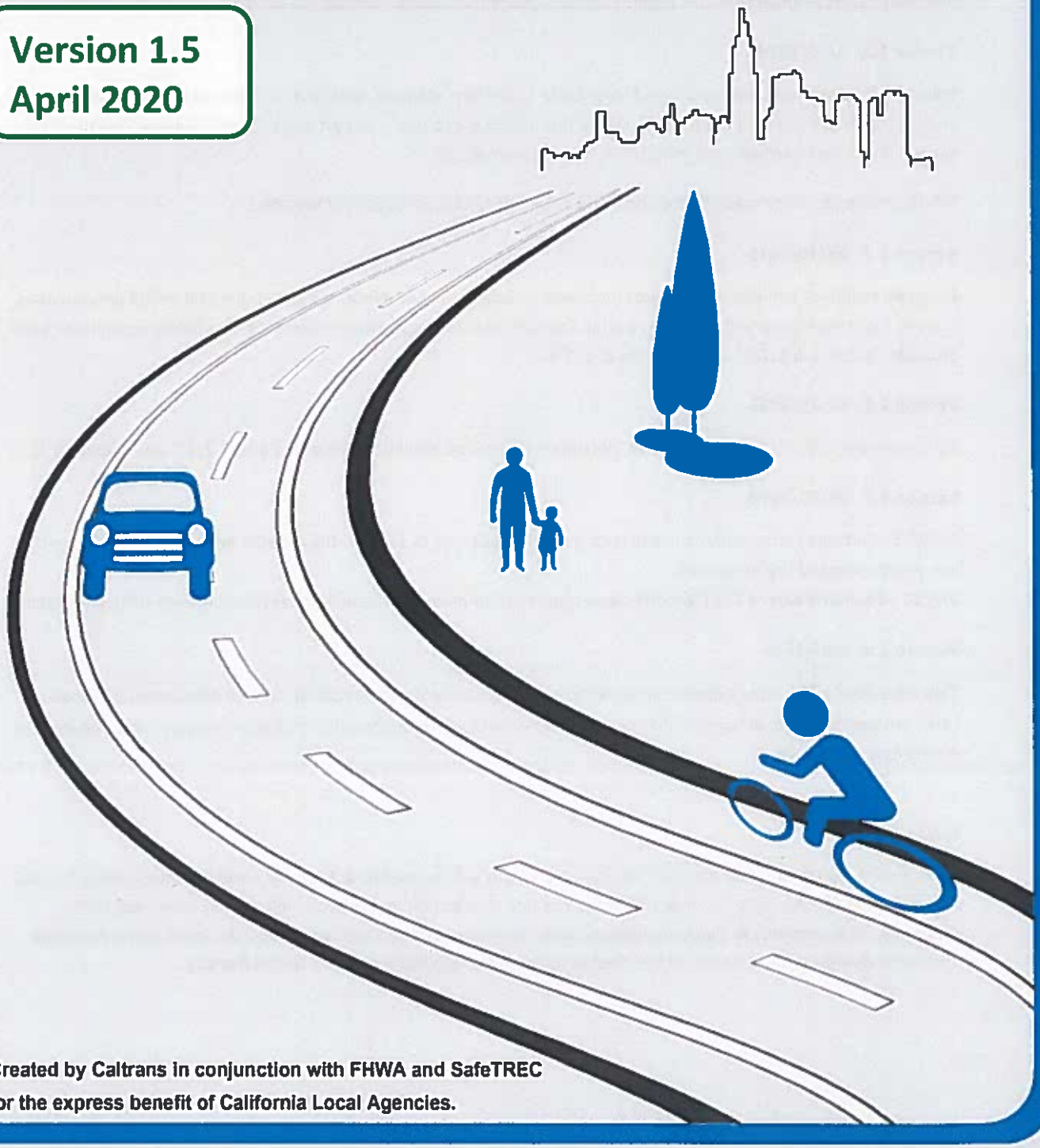
| Code | Countermeasure Name | CM Description | CRF | Federal Funding | Systemic Approach Opportunity |
|---|---|---|---|---|---|
| RO1 | Add Segment Lighting | Provision of lighting along roadways. | 35% | 100% | Medium |
| RO2 | Remove or relocate fixed objects outside of Clear Recovery Zone | Provisions of a clear zone. A clear zone is an unobstructed, traversable roadside area that allows a driver to stop safely or regain control of a vehicle that has left the roadway. Removing or moving fixed objects, flattening slopes, or providing recovery areas reduces the likelihood of a crash. | 35% | 90% | Medium |
| RO4 | Install guardrail | Reduces the severity of lane departure crashes | 25% | 100% | Medium |
| RO8 | Install raised median | Provides a rigid barrier between opposing traffic | 25% | 90% | Medium |
| R21 | Improve pavement friction (High Friction Surface Treatments) | Improves the friction of the pavement and improves skid resistance | 55% | 100% | High |
| R22 | Install/Upgrade signs with new fluorescent sheeting (regulatory or warning) | Additional or new signage can address crashes caused by lack of driver awareness or compliance of roadway signing. | 15% | 100% | Very High |
| R23 | Install chevron signs on horizontal curves | Warns driver of an approaching curve and provides guidance to drivers | 40% | 100% | Very High |
| R24 | Install curve advance warning signs | Serves as an advance warning of an unexpected or sharp curve | 25% | 100% | Very High |
| R26 | Install dynamic/variable speed warning signs | Includes the addition of dynamic regulatory signs to warn drivers of speed | 30% | 100% | High |
| R27 | Install delineators, reflectors and/or object markers | Installation of delineators, reflectors and/or object markers are intended to warn drivers of an approaching curve or fixed object that cannot easily be removed. | 15% | 100% | Very High |
| R28 | Install edge-lines and centerlines | Provisions of centerlines and edge-lines where none exist or make significant upgrades to existing lines | 25% | 100% | Very High |
| R31 | Install edgeline rumble strips/stripes | Provision of edgline rumble strips that create an audtory sound when driven over to mitigate lane departures | 15% | 100% | High |
| R32PB | Install bike lanes | Delineates available road space that is exclusive or preferential for use by bicycles | 35% | 90% | High |
| R34PB | Install sidewalk/pathway (to avoid walking along roadway) | Sidewalks and walkways provide people with space to travel within the public right-of-way that is separated from roadway vehicles. | 80% | 90% | Medium |
| R35PB | Install/upgrade pedestrian crossing (with enhanced safety features) | The enhanced safety elements, which may include curb extensions, medians and pedestrian crossing islands, beacons, and lighting, combined with pavement markings delineating a portion of the roadway that is designated for pedestrian crossing. | 35% | 90% | Medium |
| R37PB | Install Rectangular Rapid Flashing Beacon (RRFB) | Rectangular Rapid Flashing Beacon (RRFB) includes pedestrian-activated flashing lights and additional signage that enhance the visibility of marked crosswalks and alert motorists to pedestrian crossings | 35% | 100% | Medium |

# Appendix D: HSIP Eligible Countermeasures

# Local Roadway Safety

## A Manual for California's Local Road Owners

Version 1.5
April 2020



Created by Caltrans in conjunction with FHWA and SafeTREC
for the express benefit of California Local Agencies.

Caltrans

U. S. Department of Transportation
Federal Highway Administration

Safe Transportation
Research & Education Center
SafeTREC

## Document History

**Version 1.0: 4/20/2012**

The California Department of Transportation - Division of Local Assistance developed the first version of the Local Roadway Safety Manual (Version 1.0) in 2012 to support the Cycle 5 HSIP call-for-projects.

**Version 1.1: 4/26/2013**

Based on feedback and lessons learned from Cycle 5, Caltrans updated Appendix B: "Table of Countermeasures and Crash Reduction Factors" to better clarify text in "Where to use", "Why it works", and "General Qualities" for several of the countermeasures included in the original manual.

No other changes were made to the Local Roadway Safety Manual as part of Version 1.1

**Version 1.2: 03/10/2015**

Based on feedback and lessons learned from Cycle 6, Caltrans made minor updates to the text of the document as needed for achieving consistency with overall Caltrans local HSIP guidance documents. The following sections were updated: 1.2, 4.2, 5.1, 6.2, and Appendix B, E, F & G.

**Version 1.3: 04/29/2016**

Caltrans made updates to the text of the document as needed in the following sections: 4.2, 5.1 and Appendix B.

**Version 1.4: 06/08/2018**

3/30/18 - Caltrans made updates to the crash costs in Appendix D, some of the website links in Appendix G, and some other texts of the document.
6/8/18 - Countermeasure S22 ("Modify signal phasing to implement a Leading Pedestrian Interval (LPI)") is added.

**Version 1.5: April 2020**

Caltrans added a few more countermeasures (e.g. Pedestrian Scramble, Install Separated Bike Lanes, Reduced Left-Turn Conflict Intersections, and Curve Shoulder widening), renumbered the countermeasures and updated the crash costs in Appendix D.

***Future Updates:***

*In the future, Caltrans anticipates that additional changes will be needed to keep the Local Roadway Safety Manual consistent with future Calls-for-Projects' Guidelines and Application Instructions. In addition, new local HSIP programs, improvements to California data on local roadways, data analysis tools, and the latest safety research and methodologies may give rise to the need to make more significant changes to this manual.*

# Table of Contents

# Appendix B: Table of Countermeasures and Crash Reduction Factors

The intent of the information contained in this appendix is to provide local agency safety practitioners with a list of effective countermeasures that are appropriate remedies to many common safety issues. The tables in Section 4.2 present a quick summary of the specific values that the Caltrans Division of Local Assistance uses to assess and select projects for its calls- for-projects. In addition to the same information as in Section 4.2, this appendix also includes notes for Caltrans HSIP calls-for-projects and "General information" regarding where the countermeasure should be used, why it works, the general qualities that can be used to suggest the potential complexity of installation, and information from FHWA CMF Clearinghouse on the type of crashes where the countermeasure is best used and a range of their expected overall effectiveness.

The countermeasures have been sorted into 3 categories: Signalized Intersection, Non-Signalized Intersection, and Roadway Segment. Pedestrian and bicycle related countermeasures have been included in each of these categories.

Caltrans gives careful consideration to the fair application of its calls-for-projects process. Starting in 2012, the award of safety funding has been solely based on a determined benefit-to-cost ratio for each project. The fixed set of countermeasures and CRFs included in these tables are intended to allow for all projects to be evaluated consistently and fairly throughout the project selection process. However, at this time, there are no CRFs/CMFs available for several safety improvements, such as: "dynamic/variable speed regulatory signs", "non-motorized signs and markings (regulatory and warning)", "Square-up (reduce curve radius) turn lanes" and non-infrastructure elements. These safety improvement items can be included in project applications, but they will not be included into the B/C ratio calculations, unless the safety improvements meet the intent of other separate countermeasures included in the attached lists. Caltrans is interested in adding these countermeasures (and many others) to these tables once CRFs/CMFs have been established. Caltrans will continue to periodically update this list of allowable countermeasures and CRFs as new safety research data becomes available. With this in mind, Caltrans is interested in feedback and suggestions from local agency safety practitioners on the overall countermeasure list as well as specific details of individual countermeasures, including locally developed safety effectiveness information.

Caltrans used the following references to assist its team in developing the information shown in the following tables. Safety Practitioners are encouraged to utilize these references for a more expansive list of countermeasures and CRFs / CMFs.

The Crash Modification Factors Clearinghouse
http://www.cmfclearinghouse.org/

NCHRP Report 500 Series: Volumes 4, 5, 6, 7, 10, 12, 13, and others
http://www.trb.org/Main/Blurbs/152868.aspx

Highway Safety Manual (HSM)

http://www.highwaysafetymanual.org

Pedestrian and Bicycle - Tools to Diagnose and Solve the Problem
https://safety.fhwa.dot.gov/ped_bike/tools_solve/

FHWA Local and Rural Road / Training, Tools, Guidance and Countermeasures for Locals
http://safety.fhwa.dot.gov/local_rural/training/

FHWA Desktop Reference for Crash Reduction Factors
https://safety.fhwa.dot.gov/tools/crf/resources/fhwasa08011/

## For each countermeasure (CM):

### (Title) CM No., CM Name

- CM No. is
  - S01 through S21PB for Intersection Countermeasures – Signalized,
  - NS01 through NS23PB for Intersection Countermeasures – Unsignalized, or
  - R01 through R38 for Roadway Countermeasures.

### For HSIP Calls-for-projects:

- **Funding Eligibility** - 100%, 90% or 50%.
- **Crash Types Addressed** - "All", "Pedestrian and Bicycle", "Night", "Emergency Vehicle", or "Animal".
- **CRF** - Crash Reduction Factor used for HSIP calls-for-projects.
- **Expected Life** - 10 years or 20 years.
- **Notes** - Specific requirements are provided for utilizing the countermeasure on applications for Caltrans statewide calls-for-projects.
-

### General Information:

- **Where to use** – Roadway segments and intersections with specific common characteristics can be addressed with similar countermeasures that are most effective.
- **Why it works** – A discussion of the benefit of a countermeasure is important to determine its appropriateness in addressing certain roadway crash types at areas with specific issues as determined by the data and roadway features.
- **General Qualities (Time, Cost and Effectiveness)** – This category is more subjective and can vary substantially. 'Time' refers to the approximate relative time it can take to implement the countermeasure. Costs can vary considerably due to local conditions, so 'cost' represents the relative cost of applying a countermeasure. A relative overall 'effectiveness' is also provided for some countermeasures. All of this subjective information may not be applicable to the unique circumstances for the agency and should not be utilized without verification by the safety practitioner.
- **FHWA CMF Clearinghouse**
  - **Crash Types Addressed** – In order to effectively reduce the number and severity of roadway crashes, it is necessary to match countermeasures to the crash types they are intended to address. Depending on the type of problem, one or more of a range of countermeasures could be the most effective way to reduce the number and severity of future crashes.

- **Crash Reduction Factor** – The crash reduction factor (CRF) is an indication of the effectiveness of a particular treatment, measured by the percentage of crashes it is expected to reduce. Note: As mentioned earlier in this section, the effectiveness of a countermeasure can also be expressed as a Crash Modification Factor (CMF), which is defined mathematically as 1 – CRF. However, this document uses CRFs as they can be more insightful when analyzing roadways for potential "reductions" in crashes. There is a range of CRF values that exist for each of the countermeasures (or similar countermeasures). The range of CRFs is provided to give local safety practitioners a clear understanding that they may need to go to the FHWA CMF Clearinghouse to find the most appropriate countermeasure and CRF for their specific projects and local prioritization.

## B.1 Intersection Countermeasures – Signalized

### S01, Add intersection lighting (Signalized Intersection => S.I.)

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 100% | "night" crashes | 40% | 20 years |
| Notes: | This CM only applies to "night" crashes (all types) occurring within limits of the proposed roadway lighting 'engineered' area. | | |

| General information |
|---|
| **Where to use:** |
| Signalized intersections that have a disproportionate number of night-time crashes and do not currently provide lighting at the intersection or at its approaches. Crash data should be studied to ensure that safety at the intersection could be improved by providing lighting (this strategy would be supported by a significant number of crashes that occur at night). |
| **Why it works:** |
| Providing lighting at the intersection itself, or both at the intersection and on its approaches, improves the safety of an intersection during nighttime conditions by (1) making drivers more aware of the surroundings at an intersection, which improves drivers' perception-reaction times, (2) enhancing drivers' available sight distances, and (3) improving the visibility of non-motorists. Intersection lighting is of particular benefit to non-motorized users. Lighting not only helps them navigate the intersection, but also helps drivers see them better. |
| **General Qualities (Time, Cost and Effectiveness):** |
| A lighting project can usually be completed relatively quickly, but generally requires at least 1 year to implement because the lighting system must be designed and the provision of electrical power must be arranged. The provision of lighting involves both a fixed cost for lighting installation and an ongoing maintenance and power cost which results in a moderate to high cost. Some locations can result in high B/C ratios, but due to higher costs, these projects often result in medium to low B/C ratios. |

| FHWA CMF Clearinghouse: | Crash Types Addressed: | Night, All | CRF: | 20-74% |
|---|---|---|---|---|

### S02, Improve signal hardware: lenses, back-plates with retroreflective borders, mounting, size, and number

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 100% | All | 15% | 10 years |
| Notes: | This CM only applies to crashes occurring on the approaches / influence area of the upgraded signals. This CM does not apply to improvements like "battery backup systems", which do not provide better intersection/signal visibility or help drivers negotiate the intersection (unless applying past crashes that occurred when the signal lost power). If new signal mast arms are part of the proposed project, CM "S2" should not be used and the signal improvements would be included under CM "S7". | | |

| General information |
|---|
| **Where to use:** |
| Signalized intersections with a high frequency of right-angle and rear-end crashes occurring because drivers are unable to see traffic signals sufficiently in advance to safely negotiate the intersection being approached. Signal intersection improvements include new LED lighting, signal back plates, retro-reflective tape outlining the back plates, or visors to increase signal visibility, larger signal heads, relocation of the signal heads, or additional signal heads. |
| **Why it works:** |
| Providing better visibility of intersection signals aids the drivers' advance perception of the upcoming intersection. Visibility and clarity of the signal should be improved without creating additional confusion for drivers. |
| **General Qualities (Time, Cost and Effectiveness):** |
| Installation costs and time should be minimal as these type strategies are classified as low cost and implementation does not typically require the approval process normally associated with more complex projects. When considered at a single location, these low cost improvements are usually funded through local funding by local maintenance crews. However, This CM can be effectively and efficiently implemented using a systematic approach with numerous locations, resulting in low to moderate cost projects that are more appropriate to seek state or federal funding. |

| FHWA CMF Clearinghouse: | Crash Types Addressed: | Rear-End, Angle | CRF: | 0-46% |
|---|---|---|---|---|

## S03, Improve signal timing (coordination, phases, red, yellow, or operation)

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 50% | All | 15% | 10 years |

| Notes: | This CM only applies to crashes occurring on the approaches / influence area of the new signal timing. For projects coordination signals along a corridor, the crashes related to side-street movements should not be applied. This CM does not apply to projects that only 'study' the signal network and do not make physical timing changes, including corridor operational studies and improvements to Traffic Operation Centers (TOCs).<br>In Caltrans calls for projects, this CM has a HSIP reimbursement ratio of 50%, considering that it will improve the signal operation rather than merely the safety. |
|---|---|

| General information |
|---|
| **Where to use:** |
| Locations that have a crash history at multiple signalized intersections. Signalization improvements may include adding phases, lengthening clearance intervals, eliminating or restricting higher-risk movements, and coordinating signals at multiple locations. Understanding the corridor or roadway's crash history can provide insight into the most appropriate strategy for improving safety. |
| **Why it works:** |
| Certain timing, phasing, and control strategies can produce multiple safety benefits. Sometimes capacity improvements come along with the safety improvements and other times adverse effects on delay or capacity occur. Corridor improvements often have the highest benefit but may take longer to implement. Projects focused on capacity improvements (without a separate focus on signal timing safety needs) may not result in a reduction in future crashes. |
| **General Qualities (Time, Cost and Effectiveness):** |
| In general, these low-cost improvements to multiple signalized intersections can be implemented in a short time. Typically these low cost improvements are funded through local funding by local maintenance crews. However, some projects requiring new interconnect infrastructure can have moderate to high costs making them more appropriate to seek state or federal funding. The expected effectiveness of this CM must be assessed for each individual project. |

| FHWA CMF Clearinghouse: | Crash Types Addressed: | All | CRF: | 0 - 41% |
|---|---|---|---|---|

## S04, Provide Advanced Dilemma-Zone Detection for high speed approaches

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 100% | All | 40% | 10 years |

| Notes: | This CM only applies to crashes occurring on the approaches / influence area of the new detection and signal timing. |
|---|---|

| General information |
|---|
| **Where to use:** |
| More rural/remote areas that have a high frequency of right-angle and rear-end crashes. The Advanced Dilemma-Zone Detection system enhances safety at signalized intersections by modifying traffic control signal timing to reduce the number of drivers that may have difficulty deciding whether to stop or proceed during a yellow phase. This may reduce rear-end crashes associated with unsafe stopping and angle crashes due to illegally continuing into the intersection during the red phase. |
| **Why it works:** |
| Clearance times provide safe, orderly transitions in ROW assignment between conflicting streams of traffic. An Advanced Dilemma-Zone Detection system has several benefits relative to traditional multiple detector systems, which have upstream detection for vehicles in the dilemma zone but do not take the speed or size of individual vehicles into account. These benefits include: Reducing the frequency of red-light violations; Reducing the frequency of crashes associated with the traffic signal phase change (for example, rear-end and angle crashes); Reducing delay and stop frequency on the major road and a reduction in overall intersection delay. |
| **General Qualities (Time, Cost and Effectiveness):** |
| Installation costs should be low and the time to implement short. Additional modifications to the traffic signal controller may also necessary. In general, This CM can be very effective and can be considered on a systematic approach. Video detection equipment is now available for this purpose, making installation and maintenance more efficient. |

| FHWA CMF Clearinghouse: | Crash Types Addressed: | All | CRF: | 39% |
|---|---|---|---|---|

## S05, Install emergency vehicle pre-emption systems

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 100% | Emergency Vehicle - only | 70% | 10 years |
| Notes: | This CM only applies to "E.V." crashes occurring on the approaches / influence area of the new pre-emption system. | | |

| General information |
|---|
| **Where to use:** |
| Corridors that have a history of crashes involving emergency response vehicles. The target of this strategy is signalized intersections where normal traffic operations impede emergency vehicles and where traffic conditions create a potential for conflicts between emergency and nonemergency vehicles. These conflicts could lead to almost any type of crash, due to the potential for erratic maneuvers of vehicles moving out of the paths of emergency vehicles |
| **Why it works:** |
| Providing emergency vehicle preemption capability at a signal or along a corridor can be a highly effective strategy in two ways; any type of crash could occur as emergency vehicles try to navigate through intersections and as other vehicles try to maneuver out of the path of the emergency vehicles. In addition, a signal preemption system can decrease emergency vehicle response times therefore decreasing the time in receiving emergency medical attention, which is critical in the outcome of any crash. When data is not available for past crashes with emergency vehicles, an agency may consider combining the E.V. pre-emption improvements into a comprehensive project that also makes significant signal hardware and/or signal timing improvements. |
| **General Qualities (Time, Cost and Effectiveness):** |
| Costs for installation of a signal preemption system will vary from medium to high, based upon the number of signalized intersections at which preemption will be installed and the number of emergency vehicles to be outfitted with the technology. The number of detectors, a requirement for new signal controllers, and the intricacy of the preemption system could increase costs. This CM is considered systemic as it is usually implemented on a corridor-basis. |

| FHWA CMF Clearinghouse: | Crash Types Addressed: | Emergency Vehicle - only | CRF: | 70% |
|---|---|---|---|---|

## S06, Install left-turn lane and add turn phase (signal has no left-turn lane or phase before)

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 90% | All | 55% | 20 years |
| Notes: | This CM only applies to crashes occurring on the approaches / influence area of the new left turn lanes. This CM does NOT apply to converting a single-left into double-left turn. | | |

| General information |
|---|
| **Where to use:** |
| Intersections that do not currently have a left turn lane or a related left-turn phase that are experiencing a large number of crashes. Many intersection safety problems can be traced to difficulties in accommodating left-turning vehicles, in particular where there is currently no accommodation for left turning traffic. A key strategy for minimizing collisions related to left-turning vehicles (angle, rear-end, sideswipe) is to provide exclusive left-turn lanes and the appropriate signal phasing, particularly on high-volume and high-speed major-road approaches. Agencies need to document their consideration of the MUTCD, Section 4D.19 guidelines; the section on implementing protected left-turn phases. |
| **Why it works:** |
| Left-turn lanes allow separation of left-turn and through-traffic streams, thus reducing the potential for rear-end collisions. Left-turn phasing also provides a safer opportunity for drivers to make a left-turn. The combination of left-turn storage and a left turn signal has the potential to reduce many collisions between left-turning vehicles and through vehicles and/or non-motorized road users. |
| **General Qualities (Time, Cost and Effectiveness):** |
| Implementation time may vary from months to years. At some locations, left-turn lanes can be quickly installed simply by restriping the roadway. At other locations, widening of the roadway, acquisition of additional right-of-way, and extensive environmental processes may be needed. Such projects require a substantial time for development and construction. Costs are highly variable and range from very low to high. Installing a protected left turn lane and phase where none exists results in a high Crash Reduction Factor and is often highly effective. |

| FHWA CMF Clearinghouse: | Crash Types Addressed: | All | CRF: | 17 - 58 % |
|---|---|---|---|---|

## S07, Provide protected left turn phase (left turn lane already exists)

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 100% | All | 30% | 20 years |
| Notes: | This CM only applies to crashes occurring on the approaches / influence area of the new left turn phases. This CM does NOT apply to converting a single-left into double-left turn (unless the single left is unprotected and the proposed double left will be protected). | | |

| General information |
|---|
| **Where to use:** |
| Signalized intersections (with existing left turns pockets) that currently have a permissive left-turn or no left-turn protection that have a high frequency of angle crashes involving left turning, opposing through vehicles, and non-motorized road users. A properly timed protected left-turn phase can also help reduce rear-end and sideswipe crashes between left-turning vehicles and the through vehicles as well as vehicles behind them. Protected left-turn phases are warranted based on such factors as turning volumes, delay, visibility, opposing vehicle speed, distance to travel through the intersection, presence of non-motorized road users, and safety experience of the intersections. Agencies need to document their consideration of the MUTCD, Section 4D.19 guidelines; the section on implementing protected left-turn phases. |
| **Why it works:** |
| Left turns are widely recognized as the highest-risk movements at signalized intersections. Providing Protected left-turn phases (i.e., the provision for a specific phase for a turning movement) for signalized intersections with existing left turn pockets significantly improve the safety for left-turn maneuvers by removing the need for the drivers to navigate through gaps in oncoming/opposing through vehicles. Where left turn pockets are not protected, the pedestrian and bicyclist crossing phase often conflicts with these left turn maneuvers. Drivers focused on navigating the gaps of oncoming cars may not anticipate and/or perceive the non-motorized road users. |
| **General Qualities (Time, Cost and Effectiveness):** |
| If the existing traffic signal only requires a minor modification to allow for a protected left-turn phase, then the cost would also be low. The time to implement this countermeasure is short because there is no actual construction that has to take place. In-house signal maintainers can perform this operation once the proper signal phasing is determined so the cost is low. In addition, the countermeasure is tried and proven to be effective. Has the potential of being applied on a systemic/systematic approach. |

| FHWA CMF Clearinghouse: | Crash Types Addressed: | Rear-End, Sideswipe, Broadside | CRF: | 16 - 99% |
|---|---|---|---|---|

## S08, Convert signal to mast arm (from pedestal-mounted)

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 100% | All | 30% | 20 years |
| Notes: | This CM only applies to crashes occurring on the approaches / influence area of the converted signal heads that are relocated from median and/or outside shoulder pedestals to signal heads on master arms over the travel-lanes. Projects using CM "S7" should not also apply "S2" in the B/C calc. | | |

| General information |
|---|
| **Where to use:** |
| Intersections currently controlled by pedestal mounted traffic signals (in medians and/or on outside shoulder) that have a high frequency of right-angle and rear-end crashes occurring because drivers are unable to see traffic signals in advance to safely negotiate the intersection. Intersections that have pedestal-mounted signals may have poor visibility and can result in vehicles not being able to stop in time for a signal change. Care should be taken to place the new signal heads (with back plates) as close to directly over the center of the travel lanes as possible. |
| **Why it works:** |
| Providing better visibility of intersection signs and signals aids the drivers' advance perception of the upcoming intersection. Visibility and clarity of the signal should be improved without creating additional confusion or distraction for drivers. |
| **General Qualities (Time, Cost and Effectiveness):** |
| Dependent on the scope of the project. Costs are generally moderate for this type of project. There is usually no right-of-way costs, minimal roadway reconstruction costs, and a shorter project development timeline. At the same time, new mast arms can be expensive. Some locations can result in high B/C ratios, but due to moderate costs, some locations may result in medium to low B/C ratios. |

| FHWA CMF Clearinghouse: | Crash Types Addressed: | Rear-End, Angle | CRF: | 12 - 74% |
|---|---|---|---|---|

## S09, Install raised pavement markers and striping (Through Intersection)

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| **Funding Eligibility** | **Crash Types Addressed** | **CRF** | **Expected Life** |
| 100% | All | 10% | 10 years |
| **Notes:** | This CM only applies to crashes occurring in the intersection and influence areas of the new pavement markers and/or markings. | | |

| General information | | | | |
|---|---|---|---|---|
| **Where to use:** | | | | |
| Intersections where the lane designations are not clearly visible to approaching motorists and/or intersections noted as being complex and experiencing crashes that could be attributed to a driver's unsuccessful attempt to navigate the intersection. Driver confusion can exist in regard to choosing the proper turn path or where through-lanes do not line up. This is especially relevant at intersections where the overall pavement area of the intersection is large, and multiple turning lanes are involved or other unfamiliar elements are presented to the driver. | | | | |
| **Why it works:** | | | | |
| Adding clear pavement markings can guide motorists through complex intersections. When drivers approach and traverse through complex intersections, drivers may be required to perform unusual or unexpected maneuvers. Providing more effective guidance through an intersection will minimize the likelihood of a vehicle leaving its appropriate lane and encroaching upon an adjacent lane. | | | | |
| **General Qualities (Time, Cost and Effectiveness):** | | | | |
| Costs of implementing this strategy will vary based on the scope and number of applications. Applying raised pavement markers is relatively low cost but can be variable and determined largely by the material used for pavement markings (paint, thermoplastic, epoxy, RPMs etc.). When using this type delineators, an issue of concern is the cost-to-service-life of the material. (Note: When HSIP safety funding is used for these installations in high-wear-locations, the local agency is expected to maintain the improvement for a minimum of 10 years.) When considered at a single location, these low cost improvements are usually funded through local funding by local maintenance crews. However, This CM can be effectively and efficiently implemented using a systematic approach with numerous locations, resulting in moderate cost projects that are more appropriate to seek state or federal funding. | | | | |
| **FHWA CMF Clearinghouse:** | Crash Types Addressed: | Wet, Night, All | CRF: | 10 - 33% |

## S10, Install flashing beacons as advance warning (S.I.)

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| **Funding Eligibility** | **Crash Types Addressed** | **CRF** | **Expected Life** |
| 100% | All | 30% | 10 years |
| **Notes:** | This CM only applies to crashes occurring on the approaches / influence area of the new flashing beacons. | | |

| General information | | | | |
|---|---|---|---|---|
| **Where to use:** | | | | |
| At signalized intersections with crashes that are a result of drivers being unaware of the intersection or are unable to see the traffic control device in time to comply. | | | | |
| **Why it works:** | | | | |
| Increased driver awareness of an approaching signalized intersection and an increase in the driver's time to react. Driver awareness of both downstream intersections and traffic control devices is critical to intersection safety. Crashes often occur when the driver is unable to perceive an intersection, signal head or the back of a stopped queue in time to react. Advance flashing beacons can be used to supplement and call driver attention to intersection control signs. Most advance warning flashing beacons can be powered by solar, thus reducing the issues relating to power source. | | | | |
| **General Qualities (Time, Cost and Effectiveness):** | | | | |
| Before choosing this CM, the agency needs to confirm the ability to provide power to the site (solar may be an option). Flashing beacons can be constructed with minimal design, environmental and right-of-way issues and have relatively low costs. This combined with a relatively high CRF, can result in high B/Cs for locations with a history of crashes and lead to a high effectiveness. | | | | |
| **FHWA CMF Clearinghouse:** | Crash Types Addressed: | Rear End, Angle | CRF: | 36 - 62% |

## S11, Improve pavement friction (High Friction Surface Treatments)

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| **Funding Eligibility** | **Crash Types Addressed** | **CRF** | **Expected Life** |
| 100% | All | 55% | 10 years |
| **Notes:** | This CM only applies to crashes occurring within the limits of the improved friction overlay. This CM is not intended to apply to standard chip-seal or open-graded maintenance projects for long segments of corridors or structure repaving projects intended to fix failed pavement. | | |

| General information | | | | |
|---|---|---|---|---|
| **Where to use:** | | | | |
| Nationally, this countermeasure is referred to as "High Friction Surface Treatments" or HFST. Signalized Intersections noted as having crashes on wet pavements or under dry conditions when the pavement friction available is significantly less than needed for the actual roadway approach speeds. This treatment is intended to target locations where skidding and failure to stop is determined to be a problem in wet or dry conditions and the target vehicle is unable to stop due to insufficient skid resistance. | | | | |
| **Why it works:** | | | | |
| Improving the skid resistance at locations with high frequencies of wet-road crashes and/or failure to stop crashes can result in reductions of 50 percent for wet-road crashes and 20 percent for total crashes. Applying HFST can double friction numbers, e.g. low 40s to high 80s. This CM represents a special focus area for both FHWA and Caltrans, which means there are extra resources available for agencies interested in more details on High Friction Surface Treatment projects. | | | | |
| **General Qualities (Time, Cost and Effectiveness):** | | | | |
| This strategy can be relatively inexpensive and implemented in a short timeframe. The installation would be done by either agency personnel or contractors and can be done by hand or machine. In general, This CM can be very effective and can be considered on a systematic approach. | | | | |
| **FHWA CMF Clearinghouse:** | Crash Types Addressed: | Wet, Night, ALL | CRF: | 10 - 62 % |

## S12, Install raised median on approaches (S.I.)

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| **Funding Eligibility** | **Crash Types Addressed** | **CRF** | **Expected Life** |
| 90% | All | 25% | 20 years |
| **Notes:** | This CM only applies to crashes occurring on the approaches / influence area of the new raised median. All new raised medians funded with HSIP funding must not include the removal of the existing roadway structural section and must be doweled into the existing roadway surface. This new requirement is being implemented to maximize the safety-effectiveness of the limited HSIP funding and to minimize project impacts. | | |

| General information | | | | |
|---|---|---|---|---|
| **Where to use:** | | | | |
| Intersections noted as having turning movement crashes near the intersection as a result of insufficient access control. Application of this CM should be based on current crash data and a clearly defined need to restrict or accommodate the movement. | | | | |
| **Why it works:** | | | | |
| Raised medians next to left-turn lanes at intersections offer a cost-effective means for reducing crashes and improving operations at higher volume intersections. The raised medians prohibit left turns into and out of driveways that may be located too close to the functional area of the intersection. | | | | |
| **General Qualities (Time, Cost and Effectiveness):** | | | | |
| Raised medians at intersections may be most effective in retrofit situations where high volumes of turning vehicles have degraded operations and safety, and where more extensive CMs would be too expensive because of limited right-of-way and the constraints of the built environment. The result is This CM can be very effective and can be considered on a systematic approach. Raised medians can often be installed directly over the existing pavement. When agencies opt to install landscaping in conjunction with new raised medians, the portion of the cost for landscaping and other non-safety related items that exceeds 10% of the project total cost is not federally participated and must be funded by the applicant. | | | | |
| **FHWA CMF Clearinghouse:** | Crash Types Addressed: | Angle | CRF: | 21 -55 % |

## S13PB, Install pedestrian median fencing on approaches

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 90% | Pedestrian and Bicycle | 35% | 20 years |
| Notes: | This CM only applies to "Ped & Bike" crashes occurring on the approaches/influence area of the new pedestrian median fencing. | | |

| General information |
|---|
| **Where to use:** |
| Signalized Intersections with high pedestrian-generators nearby (e.g. transit stops) may experience a high volumes of pedestrians J-walking across the travel lanes at mid-block locations instead of walking to the intersection and waiting to cross during the walk-phase. When this safety issue cannot be mitigated with signal timing and shoulder/sidewalk treatments, then installing a continuous pedestrian barrier in the median may be a viable solution. |
| **Why it works:** |
| Adding pedestrian median fencing has the opportunity to enhance pedestrian safety at locations noted as being problematic involving pedestrians running/darting across the roadway outside the intersection crossings. Pedestrian median fencing can significantly reduce this safety issue by creating a positive barrier, forcing pedestrians to the designated pedestrian crossing. |
| **General Qualities (Time, Cost and Effectiveness):** |
| Costs associated with this strategy will vary widely depending on the type and placement of the median fencing. Impacts to transit and other land uses may need to be considered and controversy can delay the implementation. In general, this CM can be effective as a spot-location approach. |

| FHWA CMF Clearinghouse: | Crash Types Addressed: | Pedestrian, Bicycle | CRF: | 25- 40% |
|---|---|---|---|---|

## S14, Create directional median openings to allow (and restrict) left-turns and U-turns (S.I.)

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 90% | All | 50% | 20 years |
| Notes: | This CM only applies to crashes occurring in the intersection / influence area of the new directional openings. | | |

| General information |
|---|
| **Where to use:** |
| Crashes related to turning maneuvers include angle, rear-end, pedestrian, and sideswipe (involving opposing left turns) type crashes. If any of these crash types are an issue at an intersection, restriction or elimination of the turning maneuver may be the best way to improve the safety of the intersection. |
| **Why it works:** |
| Restricting turning movement into and out of an intersection can help reduce conflicts between through and turning traffic. The number of access points, coupled with the speed differential between vehicles traveling along the roadway, contributes to crashes. Affecting turning movements by either allowing them or restricting them, based on the application, can ensure safe movement of traffic. |
| **General Qualities (Time, Cost and Effectiveness):** |
| Turn prohibitions that are implemented by closing a median opening can be implemented quickly. The cost of this strategy will depend on the treatment. Impacts to businesses and other land uses must be considered and controversy can delay the implementation. In general, This CM can be very effective and can be considered on a systematic approach. |

| FHWA CMF Clearinghouse: | Crash Types Addressed: | All | CRF: | 51% |
|---|---|---|---|---|

## S15, Reduced Left-Turn Conflict Intersections (S.I.)

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| **Funding Eligibility** | **Crash Types Addressed** | **CRF** | **Expected Life** |
| 90% | All | 50% | 20 years |
| **Notes:** | This CM only applies to crashes occurring in the intersection / influence area of the new Reduced Left-Turn Conflict. | | |

**General information**

**Where to use and Why it works:**

Reduced left-turn conflict intersections are geometric designs that alter how left-turn movements occur in order to simplify decisions and minimize the potential for related crashes. Two highly effective designs that rely on U-turns to complete certain left-turn movements are known as the restricted crossing U-turn (RCUT) and the median U-turn (MUT).

**Restricted Crossing U-turn (RCUT):**

The RCUT intersection modifies the direct left-turn and through movements from cross-street approaches. Minor road traffic makes a right turn followed by a U-turn at a designated location (either signalized or unsignalized) to continue in the desired direction.

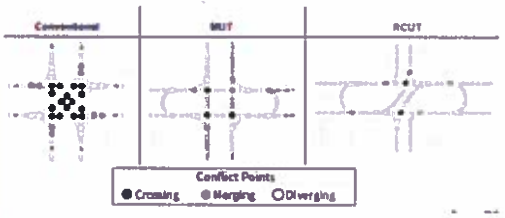
The RCUT is suitable for a variety of circumstances, including along rural, high-speed, four-lane, divided highways or signalized routes. It also can be used as an alternative to signalization or constructing an interchange. RCUTs work well when consistently used along a corridor, but also can be used effectively at individual intersections.

**Median U-turn (MUT)**

The MUT intersection modifies direct left turns from the major approaches. Vehicles proceed through the main intersection, make a U-turn a short distance downstream, followed by a right turn at the main intersection. The U-turns can also be used for modifying the cross-street left turns.

The MUT is an excellent choice for heavily traveled intersections with moderate left-turn volumes. When implemented at multiple intersections along a corridor, the efficient two-phase signal operation of the MUT can reduce delay, improve travel times, and create more crossing opportunities for pedestrians and bicyclists.

*MUT and RCUT Can Reduce Conflict Points by 50%*




**General Qualities (Time, Cost and Effectiveness):**

Implementing this strategy may take from months to years, depending on whether additional R/W is required. Such projects require a substantial time for development and construction. Costs are highly variable and range from very low to high. The expected effectiveness of this CM must be assessed for each individual location.

| | | | | |
|---|---|---|---|---|
| **FHWA CMF Clearinghouse:** | Crash Types Addressed: | Angle/Left-turn/Rear-End/All | CRF: | 34.8-100% |

## S16, Convert intersection to roundabout (from signal)

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 100% | All | Varies | 20 years |
| Notes: | This CM only applies to crashes occurring in influence area of the new roundabout. This CM is not intended for mini-roundabouts.<br>The benefit of this CM is calculated using Caltrans procedure. The CRF is dependent on the ADT, project location (Rural/Urban) and the roundabout type (1 lane or 2 lanes). The benefit comes from both the reduction in the number and the severity of the crashes. | | |

| General information |
|---|
| **Where to use:** |
| Signalized intersections that have a significant crash problem and the only alternative is to change the nature of the intersection itself. Roundabouts can also be very effective at intersections with complex geometry and intersections with frequent left-turn movements. |
| **Why it works:** |
| The types of conflicts that occur at roundabouts are different from those occurring at conventional intersections; namely, conflicts from crossing and left-turn movements are not present in a roundabout. The geometry of a roundabout forces drivers to reduce speeds as they proceed through the intersection. This helps keep the range of vehicle speed narrow, which helps reduce the severity of crashes when they do occur. Pedestrians only have to cross one direction of traffic at a time at roundabouts, thus reducing their potential for conflicts. |
| **General Qualities (Time, Cost and Effectiveness):** |
| Provision of a roundabout requires substantial project development. The need to acquire right-of-way is likely and will vary from site to site and depends upon the geometric design. These activities may require up to 4 years or longer to implement. Mini-roundabouts may be able to be built more expediently with signs and markings, but do not have the same CRFs as those shown in this CM. Costs are variable, but construction of a roundabout to replace an existing signalized intersection are relatively high. The result is this CM may have reduced relative-effectiveness compared to other CMs. |

| FHWA CMF Clearinghouse: | Crash Types Addressed: | All | CRF: | 35 - 67% |
|---|---|---|---|---|

## S17PB, Install pedestrian countdown signal heads

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 100% | Pedestrian and Bicycle | 25% | 20 years |
| Notes: | This CM only applies to "Ped & Bike" crashes occurring in the intersection/crossing with the new countdown heads. | | |

| General information |
|---|
| **Where to use:** |
| Signals that have signalized pedestrian crossing with walk/don't walk indicators and where there have been pedestrian vs. vehicle crashes. |
| **Why it works:** |
| A pedestrian countdown signal contains a timer display and counts down the number of seconds left to finish crossing the street. Countdown signals can reassure pedestrians who are in the crosswalk when the flashing "DON'T WALK" interval appears that they still have time to finish crossing. Countdown signals begin counting down either when the "WALK" or when the flashing "DON'T WALK" interval appears and stop at the beginning of the steady "DON'T WALK" interval. These signals also have been shown to encourage more pedestrians to use the pushbutton rather than jaywalk. |
| **General Qualities (Time, Cost and Effectiveness):** |
| Costs and time of installation will vary based on the number of intersections included in this strategy and if it requires new signal controllers capable of accommodating the enhancement. When considered at a single location, these low cost improvements are usually funded through local funding by local crews. However, This CM can be effectively and efficiently implemented using a systematic approach with numerous locations, resulting in moderate cost projects that are more appropriate to seek state or federal funding. |

| FHWA CMF Clearinghouse: | Crash Types Addressed: | Pedestrian, Bicycle | CRF: | 25% |
|---|---|---|---|---|

## S18PB, Install pedestrian crossing (S.I.)

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 100% | Pedestrian and Bicycle | 25% | 20 years |
| Notes: | This CM only applies to "Ped & Bike" crashes occurring in the intersection/crossing with the new crossing. This CM is not intended to be used for high-cost aesthetic enhancements to intersection crosswalks (i.e. stamped concrete or stamped asphalt). | | |

| General information |
|---|
| **Where to use:** |
| Signalized intersections with no marked crossing and pedestrian signal heads, where pedestrians are known to be crossing intersections that involve significant turning movements. They are especially important at intersections with (1) multiphase traffic signals, such as left-turn arrows and split phases, (2) school crossings, and (3) double-right or double-left turns. At signalized intersections, pedestrian crossings are often safer when the left turns have protected phases that do not overlap the pedestrian walk phase. |
| **Why it works:** |
| Adding pedestrian crossings has the opportunity to enhance pedestrian safety at locations noted as being problematic. Nearly one-third of all pedestrian-related crashes occur at or within 50 feet of an intersection. Of these, 30 percent may involve a turning vehicle. Another 22 percent of pedestrian crashes involve a pedestrian either running across the intersection or darting out in front of a vehicle whose view was blocked just prior to the impact. Finally, 16 percent of these intersection-related crashes occur because of a driver violation (e.g., failure to yield right-of-way). When agencies opt to install aesthetic enhancement to intersection crosswalks like stamped concrete/asphalt, the project design and construction costs can significantly increase. For HSIP applications, these costs must be accounted for in the B/C calculation, but these costs (over standard crosswalk markings) must be tracked separately and are not federally reimbursable and will increase the agency's local-funding share for the project costs. |
| **General Qualities (Time, Cost and Effectiveness):** |
| Costs associated with this strategy will vary widely, depending if curb ramps and sidewalk modifications are required with the crossing. When considered at a single location, these low cost improvements may be funded through local funding by local crews. However, This CM can be effectively and efficiently implemented using a systematic approach with numerous locations, resulting in moderate to high cost projects that are appropriate to seek state or federal funding. |

| FHWA CMF Clearinghouse: | Crash Types Addressed: | Pedestrian, Bicycle | CRF: | 25% |
|---|---|---|---|---|

## S19PB, Pedestrian Scramble

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 100% | Pedestrian and Bicycle | 40% | 20 years |
| Notes: | This CM only applies to "Ped & Bike" crashes occurring in the intersection with the new pedestrian crossing. | | |

| General information |
|---|
| **Where to use:** |
| Pedestrian Scramble is a form of pedestrian "WALK" phase at a signalized intersection in which all vehicular traffic is required to stop, allowing pedestrians/bicyclists to safely cross through the intersection in any direction, including diagonally. Pedestrian Scramble may be considered at signalized intersections with very high pedestrian/bicycle volumes, e.g. in an urban business district. |
| **Why it works:** |
| Pedestrian Scramble has been shown to reduce injury risk and increase bicycle ridership due to its perceived safety and comfort. |
| **General Qualities (Time, Cost and Effectiveness):** |
| Not involving any additional R/W, Pedestrian Scramble should not require a long development process and should be implemented reasonably soon. A systemic approach may be used in implementing this CM, resulting in cost efficiency with low to moderate cost. |

| FHWA CMF Clearinghouse: | Crash Types Addressed: | Pedestrian, Bicycle | CRF: | -10% to 51% |
|---|---|---|---|---|

## S20PB, Install advance stop bar before crosswalk (Bicycle Box)

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 100% | Pedestrian and Bicycle | 15% | 10 years |
| Notes: | This CM only applies to "Ped & Bike" crashes occurring in the intersection-crossing with the new advanced stop bars. | | |

| General information |
|---|
| **Where to use:** |
| Signalized Intersections with a marked crossing, where significant bicycle and/or pedestrians volumes are known to occur. |
| **Why it works:** |
| Adding advance stop bar before the striped crosswalk has the opportunity to enhance both pedestrian and bicycle safety. Stopping cars well before the crosswalk provides a buffer between the vehicles and the crossing pedestrians. It also allows for a dedicated space for cyclists, making them more visible to drivers (This dedicated space is often referred to as a bike-box.) |
| **General Qualities (Time, Cost and Effectiveness):** |
| Costs and time of installation will vary based on the number of intersections included in this strategy and if it requires new signal controllers capable of accommodating the enhancement. When considered at a single location, these low cost improvements are usually funded through local funding by local crews. However, This CM can be effectively and efficiently implemented using a systematic approach with numerous locations, resulting in moderate cost projects that are more appropriate to seek state or federal funding. |

| FHWA CMF Clearinghouse: | Crash Types Addressed: | Pedestrian, Bicycle | CRF: | 35% |
|---|---|---|---|---|

## S21PB, Modify signal phasing to implement a Leading Pedestrian Interval (LPI)

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 100% | Pedestrian and Bicycle | 60% | 10 years |
| Notes: | This CM only applies to "Ped & Bike" crashes occurring in the intersections with signalized pedestrian crossing with the newly implemented Leading Pedestrian Interval (LPI). | | |

| General information |
|---|
| **Where to use:** |
| Intersections with signalized pedestrian crossing that have high turning vehicles volumes and have had pedestrian vs. vehicle crashes. |
| **Why it works:** |
| A leading pedestrian interval (LPI) gives pedestrians the opportunity to enter an intersection 3-7 seconds before vehicles are given a green indication. With this head start, pedestrians can better establish their presence in the crosswalk before vehicles have priority to turn left. LPIs provide (1) increased visibility of crossing pedestrians; (2) reduced conflicts between pedestrians and vehicles; (3) Increased likelihood of motorists yielding to pedestrians; and (4) enhanced safety for pedestrians who may be slower to start into the intersection. |
| **General Qualities (Time, Cost and Effectiveness):** |
| Costs for implementing LPIs are very low, since only minor signal timing alteration is required. This makes it an easy and inexpensive countermeasure that can be incorporated into pedestrian safety action plans or policies and can become routine agency practice. When considered at a single location, the LPI is usually local-funded. However, This CM can be effectively and efficiently implemented using a systematic approach with numerous locations, resulting in moderate cost projects that are more appropriate to seek state or federal funding. |

| FHWA CMF Clearinghouse: | Crash Types Addressed: | Pedestrian, Bicycle | CRF: | 59% |
|---|---|---|---|---|

## B.2 Intersection Countermeasures – Non-signalized

### NS01, Add intersection lighting (NS.I.)

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 100% | Night | 40% | 20 years |
| Notes: | This CM only applies to "night" crashes (all types) occurring within limits of the proposed roadway lighting 'engineered' area. | | |

| General information |
|---|
| **Where to use:** |
| Non-signalized intersections that have a disproportionate number of night-time crashes and do not currently provide lighting at the intersection or at its approaches. Crash data should be studied to ensure that safety at the intersection could be improved by providing lighting (this strategy would be supported by a significant number of crashes that occur at night). |
| **Why it works:** |
| Providing lighting at the intersection itself, or both at the intersection and on its approaches, improves the safety of an intersection during nighttime conditions by (1) making drivers more aware of the surroundings at an intersection, which improves drivers' perception-reaction times, (2) enhancing drivers' available sight distances, and (3) improving the visibility of non-motorists. Intersection lighting is of particular benefit to non-motorized users as lighting not only helps them navigate the intersection, but also helps drivers see them better. |
| **General Qualities (Time, Cost and Effectiveness):** |
| A lighting project can usually be completed relatively quickly, but generally requires at least 1 year to implement because the lighting system must be designed and the provision of electrical power must be arranged. The provision of lighting involves both a fixed cost for lighting installation and an ongoing maintenance and power cost. For rural intersections, studies have shown the installation of streetlights reduced nighttime crashes at unlit intersections and can be more effective in reducing nighttime crashes than either rumble strips or overhead flashing beacons. Some locations can result in high B/C ratios, but due to higher costs, these projects often result in medium to low B/C ratios. |

| FHWA CMF Clearinghouse: | Crash Types Addressed: | Night, All | CRF: | 25- 50% |
|---|---|---|---|---|

### NS02, Convert to all-way STOP control (from 2-way or Yield control)

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 100% | All | 50% | 10 years |
| Notes: | This CM only applies to crashes occurring in the intersection and/or influence area of the new control. CA-MUTCD warrant must be met. | | |

| General information |
|---|
| **Where to use:** |
| Unsignalized intersection locations that have a crash history and have no controls on the major roadway approaches. However, all-way stop control is suitable only at intersections with moderate and relatively balanced volume levels on the intersection approaches. Under other conditions, the use of all-way stop control may create unnecessary delays and aggressive driver behavior. MUTCD warrants should always be followed. |
| **Why it works:** |
| All-way stop control can reduce right-angle and turning collisions at unsignalized intersections by providing more orderly movement at an intersection, reducing through and turning speeds, and minimizing the safety effect of any sight distance restrictions that may be present. Advance public notification of the change is critical in assuring compliance and reducing crashes. |
| **General Qualities (Time, Cost and Effectiveness):** |
| The costs involved in converting to all-way stop control are relatively low. All-way stop control can normally be implemented at multiple intersections with just a change in signing on intersection approaches, and typically are very quick to implement. When considered at a single location, these low cost improvements are usually funded through local funding by local maintenance crews. However, This CM can be effectively and efficiently implemented using a systematic approach with numerous locations, resulting in moderate cost projects that are more appropriate to seek state or federal funding. |

| FHWA CMF Clearinghouse: | Crash Types Addressed: | Left-turn, Angle | CRF: | 6 - 80% |
|---|---|---|---|---|

## NS03, Install signals

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| **Funding Eligibility** | **Crash Types Addressed** | **CRF** | **Expected Life** |
| 100% | All | 30% | 20 years |
| **Notes:** | This CM only applies to crashes occurring in the intersection and/or influence area of the new signals. **All new signals must meet MUTCD "safety" warrants: 4, 5 or 7.** Given the over-arching operational changes that occur when an intersection is signalized, no other intersection CMs can be applied to the intersection crashes in conjunction with this CM. | | |

| General information | | | | |
|---|---|---|---|---|
| **Where to use:** | | | | |
| Traffic signals can be used to prevent the most severe type crashes (right-angle, left-turn). Consideration to signalize an unsignalized intersection should only be given after (1) less restrictive forms of traffic control have been utilized as the installation of a traffic signal often leads to an increased frequency of crashes (rear-end) on major roadways and introduces congestion and (2) signal warrants have been met. Refer to the CA MUTCD, Section 4C.01, Studies and Factors for Justifying Traffic Control Signals. | | | | |
| **Why it works:** | | | | |
| Traffic signals have the potential to reduce the most severe type crashes but will likely cause an increase in rear-end collisions. A reduction in overall injury severity is likely the largest benefit of traffic signal installation. | | | | |
| **General Qualities (Time, Cost and Effectiveness):** | | | | |
| Typical traffic signal costs fall in the medium to high category and are affected by application, type of signal and right-of-away considerations. Projects of this magnitude should only be considered after alternate and lesser means of correction have been evaluated. Some locations can result in high B/C ratios, but due to higher costs, these projects often result in medium to low B/C ratios. | | | | |
| **FHWA CMF Clearinghouse:** | Crash Types Addressed: | All | CRF: | 0 - 74% |

## NS04, Convert intersection to roundabout (from all way stop)

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| **Funding Eligibility** | **Crash Types Addressed** | **CRF** | **Expected Life** |
| 100% | All | Varies | 20 years |
| **Notes:** | This CM only applies to crashes occurring in the intersection and/or influence area of the new control.<br>The benefit of this CM is calculated using Caltrans procedure. The CRF is dependent on the ADT, project location (Rural/Urban) and the roundabout type (1 lane or 2 lanes). The benefit comes from both the reduction in the number and the severity of the crashes. | | |

| General information | | | | |
|---|---|---|---|---|
| **Where to use:** | | | | |
| Intersections that have a high frequency of right-angle and left-turn type crashes. Whether such intersections have existing crash patterns or not, a roundabout provides an alternative to signalization. The primary target locations for roundabouts should be moderate-volume unsignalized intersections. Roundabouts may not be a viable alternative in many suburban and urban settings where right-of-way is limited. | | | | |
| **Why it works:** | | | | |
| Roundabouts provide an important alternative to signalized and all-way stop-controlled intersections. Modern roundabouts differ from traditional traffic circles in that they operate in such a manner that traffic entering the roundabout must yield the right-of-way to traffic already in it. Roundabouts can serve moderate traffic volumes with less delay than all-way stop-controlled intersections and provide fewer conflict points. Crashes at roundabouts tend to be less severe because of the speed constraints and elimination of left-turn and right-angle movements. | | | | |
| **General Qualities (Time, Cost and Effectiveness):** | | | | |
| Construction of roundabouts are usually relatively costly and major projects, requiring the environmental process, right-of-way acquisition, and implementation under an agency's long-term capital improvement program. (For this reason, roundabouts may not be appropriate for California's Federal Safety Programs that have relatively short delivery requirements.) Even with roundabouts higher costs, they still can have a relatively high effectiveness. | | | | |
| **FHWA CMF Clearinghouse:** | Crash Types Addressed: | Left-turn, Angle | CRF: | 12 - 78 % |

## NS05, Convert intersection to roundabout (from 2-way stop or Yield control)

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| **Funding Eligibility** | **Crash Types Addressed** | **CRF** | **Expected Life** |
| 100% | All | Varies | 20 years |
| **Notes:** | This CM only applies to crashes occurring in the intersection and/or influence area of the new control.<br>The benefit of this CM is calculated using Caltrans procedure. The CRF is dependent on the ADT, project location (Rural/Urban) and the roundabout type (1 lane or 2 lanes). The benefit comes from both the reduction in the number and the severity of the crashes. | | |

| General information | | | | |
|---|---|---|---|---|
| **Where to use:** | | | | |
| Intersections that have a high frequency of right-angle and left-turn type crashes. Whether such intersections have existing crash patterns or not, a roundabout provides an alternative to signalization. The primary target locations for roundabouts should be moderate-volume unsignalized intersections. Roundabouts may not be a viable alternative in many suburban and urban settings where right-of-way is limited. | | | | |
| **Why it works:** | | | | |
| Roundabouts provide an important alternative to signalized and all-way stop-controlled intersections. Modern roundabouts differ from traditional traffic circles in that they operate in such a manner that traffic entering the roundabout must yield the right-of-way to traffic already in it. Roundabouts can serve moderate traffic volumes with less delay than all-way stop-controlled intersections and provide fewer conflict points. Crashes at roundabouts tend to be less severe because of the speed constraints and elimination of left-turn and right-angle movements. | | | | |
| **General Qualities (Time, Cost and Effectiveness):** | | | | |
| Construction of roundabouts are usually relatively costly and major projects, requiring the environmental process, right-of-way acquisition, and implementation under an agency's long-term capital improvement program. (For this reason, roundabouts may not be appropriate for California's Federal Safety Programs that have relatively short delivery requirements.) Even with roundabouts higher costs, they still can have a relatively high effectiveness. | | | | |
| **FHWA CMF Clearinghouse:** | Crash Types Addressed: | Left-turn, Angle | CRF: | 12 - 78 % |

## NS06, Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| **Funding Eligibility** | **Crash Types Addressed** | **CRF** | **Expected Life** |
| 100% | All | 15% | 10 years |
| **Notes:** | This CM only applies to crashes occurring in the influence area of the new signs. The influence area must be determined on a location by location basis. | | |

| General information | | | | |
|---|---|---|---|---|
| **Where to use:** | | | | |
| The target for this strategy should be approaches to unsignalized intersections with patterns of rear-end, right-angle, or turning collisions related to lack of driver awareness of the presence of the intersection. | | | | |
| **Why it works:** | | | | |
| The visibility of intersections and, thus, the ability of approaching drivers to perceive them can be enhanced by installing larger regulatory and warning signs at or prior to intersections. A key to success in applying this strategy is to select a combination of regulatory and warning sign techniques appropriate for the conditions on a particular unsignalized intersection approach. | | | | |
| **General Qualities (Time, Cost and Effectiveness):** | | | | |
| Signing improvements do not require a long development process and can typically be implemented quickly. Costs for implementing this strategy are nominal and depend on the number of signs. When considered at a single location, these low cost improvements are usually funded through local funding by local maintenance crews. However, This CM can be effectively and efficiently implemented using a systematic approach with numerous locations, resulting in moderate cost projects that are more appropriate to seek state or federal funding. | | | | |
| **FHWA CMF Clearinghouse:** | Crash Types Addressed: | All | CRF: | 11 - 55% |

## NS07, Upgrade intersection pavement markings (NS.I.)

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| **Funding Eligibility** | **Crash Types Addressed** | **CRF** | **Expected Life** |
| 100% | All | 25% | 10 years |
| **Notes:** | This CM only applies to crashes occurring on the approaches / influence area of the new pavement markings. This CM is not intended to be used for general maintenance activities (i.e. the replacement of existing pavement markings in-kind) and must include upgraded safety features over the existing pavement markings and striping. | | |

| General information |
|---|
| **Where to use:** |
| Unsignalized intersections that are not clearly visible to approaching motorists, particularly approaching motorists on the major road. The strategy is particularly appropriate for intersections with patterns of rear-end, right-angle, or turning crashes related to lack of driver awareness of the presence of the intersection. Also at minor road approaches where conditions allow the stop bar to be seen by an approaching driver at a significant distance from the intersection. Typical improvements include "Stop Ahead" markings and the addition of Centerlines and Stop Bars. |
| **Why it works:** |
| The visibility of intersections and, thus, the ability of approaching drivers to perceive them can be enhanced by installing appropriate pavement delineation in advance of and at intersections will provide approaching motorists with additional information at these locations. Providing visible stop bars on minor road approaches to unsignalized intersections can help direct the attention of drivers to the presence of the intersection. Drivers should be more aware that the intersection is coming up, and therefore make safer decisions as they approach the intersection. |
| **General Qualities (Time, Cost and Effectiveness):** |
| Pavement marking improvements do not require a long development process and can typically be implemented quickly. Costs for implementing this strategy are nominal and depend on the number of markings. When considered at a single location, these low cost improvements are usually funded through local funding by local maintenance crews. However, This CM can be effectively and efficiently implemented using a systematic approach with numerous locations, resulting in moderate cost projects that are more appropriate to seek state or federal funding. Note: When federal safety funding is used for these installations in high-wear-locations, the local agency is expected to maintain the improvement for a minimum of 10 years. |

| **FHWA CMF Clearinghouse:** | Crash Types Addressed: | All | CRF: | 13 - 60% |
|---|---|---|---|---|

## NS08, Install Flashing Beacons at Stop-Controlled Intersections

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| **Funding Eligibility** | **Crash Types Addressed** | **CRF** | **Expected Life** |
| 100% | All | 15% | 10 years |
| **Notes:** | This CM only applies to crashes occurring on the stop-controlled approaches / influence area of the new beacons. | | |

| General information |
|---|
| **Where to use:** |
| Flashing beacons can reinforce driver awareness of the Non-Signalized intersection control and can help mitigate patterns of right-angle crashes related to stop sign violations. Post-mounted advanced flashing beacons or overhead flashing beacons can be used at stop-controlled intersections to supplement and call driver attention to stop signs. |
| **Why it works:** |
| Flashing beacons provide a visible signal to the presence of an intersection and can be very effective in rural areas where there may be long stretches between intersections as well as locations where night-time visibility of intersections is an issue. |
| **General Qualities (Time, Cost and Effectiveness):** |
| Flashing beacons can be constructed with minimal design, environmental and right-of-way issues and have relatively low costs. Before choosing this CM, the agency needs to confirm the ability to provide power to the site (solar may be an option). In general, This CM can be very effective and can be considered on a systematic approach. |

| **FHWA CMF Clearinghouse:** | Crash Types Addressed: | Angle, Rear-End | CRF: | 5-34% |
|---|---|---|---|---|

## NS09, Install flashing beacons as advance warning (NS.I.)

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 100% | All | 30% | 10 years |
| Notes: | This CM only applies to crashes occurring on the approaches / influence area of the new beacons placed in advance of the intersection. | | |

| General information | | | | |
|---|---|---|---|---|
| **Where to use:** | | | | |
| Non-Signalized Intersections with patterns of crashes that could be related to lack of a driver's awareness of approaching intersection or controls at a downstream intersection. | | | | |
| **Why it works:** | | | | |
| Advance flashing beacons can be used to supplement and call driver attention to intersection control signs. Flashing beacons are intended to reinforce driver awareness of the stop or yield signs and to help mitigate patterns of crashes related to intersection regulatory sign violations. Most advance warning flashing beacons can be powered by solar, thus reducing the issues relating to power source. | | | | |
| **General Qualities (Time, Cost and Effectiveness):** | | | | |
| Use of flashing beacons requires minimal development process, allowing flashing beacons to be installed within a short time period. Before choosing this CM, the agency needs to confirm the ability to provide power to the site (solar may be an option). In general, This CM can be very effective and can be considered on a systematic approach. | | | | |
| **FHWA CMF Clearinghouse:** | Crash Types Addressed: | Angle, Rear-End | CRF: | 36 - 62% |

## NS10, Install transverse rumble strips on approaches

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 90% | All | 20% | 10 years |
| Notes: | This CM only applies to crashes occurring on the approaches / influence area of the new rumble strips. | | |

| General information | | | | |
|---|---|---|---|---|
| **Where to use:** | | | | |
| Transverse rumble strips are installed in the travel lane for the purposes of providing an auditory and tactile sensation for each motorist approaching the intersection. They can be used at any stop or yield approach intersection, often in combination with advance signing to warn of the intersection ahead. Due to the noise generated by vehicles driving over the rumble strips, care must be taken to minimize disruption to nearby residences and businesses. | | | | |
| **Why it works:** | | | | |
| When motorists are traveling along the roadway, they are sometimes unaware they are approaching an intersection. This is especially true on rural roads, as there may be fewer clues indicating an intersection ahead. Transverse rumble strips warn motorists that something unexpected is ahead that they need to pay attention to. | | | | |
| **General Qualities (Time, Cost and Effectiveness):** | | | | |
| Use of transverse rumble strips requires minimal development process, allowing transverse rumble strips to be installed within a short time period. In general, This CM can be very effective and can be considered on a systematic approach, although care should be taken to not over-use this CM. Note: When federal safety funding is used for these installations in high-wear-locations, the local agency is expected to maintain the improvement for a minimum of 10 years. | | | | |
| **FHWA CMF Clearinghouse:** | Crash Types Addressed: | All | CRF: | 0 - 35% |

## NS11, Improve sight distance to intersection (Clear Sight Triangles)

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| **Funding Eligibility** | **Crash Types Addressed** | **CRF** | **Expected Life** |
| 90% | All | 20% | 10 years |
| **Notes:** | This CM only applies to crashes occurring on the approaches / influence area of the significantly improved new sight distance. Minor/incidental improvements to sight distance would not likely result in the CRF shown below. | | |

| General information |
|---|
| **Where to use:** |
| Unsignalized intersections with restricted sight distance and patterns of crashes related to lack of sight distance where sight distance can be improved by clearing roadside obstructions without major reconstruction of the roadway. |
| **Why it works:** |
| Adequate sight distance for drivers at stop or yield-controlled approaches to intersections has long been recognized as among the most important factors contributing to overall safety at unsignalized intersections. By removing sight distance restrictions (e.g., vegetation, parked vehicles, signs, buildings) from the sight triangles at stop or yield-controlled intersection approaches, drivers will be able see approaching vehicles on the main line, without obstruction and therefore make better decisions about entering the intersection safely. |
| **General Qualities (Time, Cost and Effectiveness):** |
| Projects involving clearing sight obstructions on the highway right-of-way can typically be accomplished quickly, assuming the objects are readily moveable. Clearing sight obstructions on private property requires more time for discussions with the property owner. Costs will generally be low, assuming that in most cases the objects to be removed are within the right-of-way. In general, this CMs can be very effective and can be implemented by agencies' maintenance staff and/or implemented on a systematic approach. Usually only high-cost removals would be good candidates for Caltrans Federal Safety Funding. Note: When federal safety funding is used to remove vegetation that has the potential to grow back, the local agency is expected to maintain the improvement for a minimum of 10 years. |

| **FHWA CMF Clearinghouse:** | Crash Types Addressed: | All | CRF: | 11 - 56% |
|---|---|---|---|---|

## NS12, Improve pavement friction (High Friction Surface Treatments)

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| **Funding Eligibility** | **Crash Types Addressed** | **CRF** | **Expected Life** |
| 100% | All | 55% | 10 years |
| **Notes:** | This CM only applies to crashes occurring within the limits of the improved friction overlay. This CM is not intended to apply to standard chip-seal or open-graded maintenance projects for long segments of corridors or structure repaving projects intended to fix failed pavement. | | |

| General information |
|---|
| **Where to use:** |
| Nationally, this countermeasure is referred to as "High Friction Surface Treatments" or HFST. Non-signalized Intersections noted as having crashes on wet pavements or under dry conditions when the pavement friction available is significantly less than needed for the actual roadway approach speeds. This treatment is intended to target locations where skidding and failure to stop is determined to be a problem in wet or dry conditions and the target vehicle is unable to stop due to insufficient skid resistance. |
| **Why it works:** |
| Improving the skid resistance at locations with high frequencies of wet-road crashes and/or failure to stop crashes can result in reductions of 50 percent for wet-road crashes and 20 percent for total crashes. Applying HFST can double friction numbers, e.g. low 40s to high 80s. This CM represents a special focus area for both FHWA and Caltrans, which means there are extra resources available for agencies interested in more details on High Friction Surface Treatment projects. |
| **General Qualities (Time, Cost and Effectiveness):** |
| This strategy can be relatively inexpensive and implemented in a short timeframe. The installation would be done by either agency personnel or contractors and can be done by hand or machine. In general, This CM can be very effective and can be considered on a systematic approach. |

| **FHWA CMF Clearinghouse:** | Crash Types Addressed: | Wet, Night, ALL | CRF: | 10 - 62 % |
|---|---|---|---|---|

## NS13, Install splitter-islands on the minor road approaches

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 90% | All | 40% | 20 years |
| Notes: | This CM only applies to crashes occurring on the approaches / influence area of **the new splitter island on the minor road approaches.** | | |

| General information |
|---|
| **Where to use:** |
| Minor road approaches to unsignalized intersections where the presence of the intersection or the stop sign is not readily visible to approaching motorists. The strategy is particularly appropriate for intersections where the speeds on the minor road are high. In creation of a splitter island allows for an additional stop sign to be placed in the median for the minor approach. |
| **Why it works:** |
| The installation of splitter islands allows for the addition of a stop sign in the median to make the intersection more conspicuous. Additionally, the splitter island on the minor-road provides for a positive separation between turning vehicles on the through road and vehicles stopped on the minor road approach. |
| **General Qualities (Time, Cost and Effectiveness):** |
| Splitter islands at non-signalized intersections can usually be installed with minimal roadway reconstruction and relatively quickly. In general, This CM can be very effective and can be considered on a systematic approach. |

| FHWA CMF Clearinghouse: | Crash Types Addressed: | Angle, Rear-End | CRF: | 35 - 100 % |
|---|---|---|---|---|

## NS14, Install raised median on approaches (NS.I.)

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 90% | All | 25% | 20 years |
| Notes: | This CM only applies to crashes occurring on the approaches / influence area of the new raised median. All new raised medians funded with federal HSIP funding must not include the removal of the existing roadway structural section and must be doweled into the existing roadway surface. This new requirement is being implemented to maximize the safety-effectiveness of the limited HSIP funding and to minimize project impacts. | | |

| General information |
|---|
| **Where to use:** |
| Where related or nearby turning movements affect the safety and operation of an intersection. Effective access management is key to improving safety at, and adjacent to, intersections. The number of intersection access points coupled with the speed differential between vehicles traveling along the roadway often contributes to crashes. Any access points within 250 feet upstream and downstream of an intersection are generally undesirable. |
| **Why it works:** |
| Raised medians with left-turn lanes at intersections offer a cost-effective means for reducing crashes and improving operations at higher volume intersections. The raised medians also prohibit left turns into and out of driveways that may be located too close to the functional area of the intersection. |
| **General Qualities (Time, Cost and Effectiveness):** |
| Raised medians at intersections may be most effective in retrofit situations where high volumes of turning vehicles have degraded operations and safety, and where more extensive approaches would be too expensive because of limited right-of-way and the constraints of the built environment. Because raised medians limit property access to right turns only, the need for providing alternative access ways should be considered. In general, This CM can be very effective and can be considered on a systematic approach. When agencies opt to install landscaping in conjunction with new raised medians, the portion of the cost for landscaping and other non-safety related items that exceeds 10% of the project total cost is not federally participated and must be funded by the applicant. |

| FHWA CMF Clearinghouse: | Crash Types Addressed: | All | CRF: | 20 - 39 % |
|---|---|---|---|---|

## NS15, Create directional median openings to allow (and restrict) left-turns and u-turns (NS.I.)

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 90% | All | 50% | 20 years |
| Notes: | This CM only applies to crashes occurring in the intersection / influence area of the new directional openings. | | |

| General information |
|---|
| **Where to use:** |
| Crashes related to turning maneuvers include angle, rear-end, pedestrian, and sideswipe (involving opposing left turns) type crashes. If any of these crash types are an issue at an intersection, restriction or elimination of the turning maneuver may be the best way to improve the safety of the intersection. Because raised medians limit property access to right turns only, they should be used in conjunction with efforts to provide alternative access ways and promote driveway spacing objectives. |
| **Why it works:** |
| Agencies are increasingly using access management techniques on urban and suburban arterials to manage the number of conflicts experienced at an intersection. A key element of access management is to restrict certain movements, create directional median openings, or close median openings that are deemed too close to an intersection. |
| **General Qualities (Time, Cost and Effectiveness):** |
| Turn prohibitions that are implemented by closing a median opening can usually be implemented quickly. Costs are highly variable but in many cases could be considered low. In some cases this strategy may involve acquiring access or constructing replacement access; those actions will significantly increase the cost of the project. Impacts to businesses and other land uses must be considered and controversy can delay the implementation. In general, This CM can be very effective and can be considered on a systematic approach. |

| FHWA CMF Clearinghouse: | Crash Types Addressed: | All | CRF: | 51% |
|---|---|---|---|---|

## NS16, Reduced Left-Turn Conflict Intersections (NS.I.)

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| **Funding Eligibility** | **Crash Types Addressed** | **CRF** | **Expected Life** |
| 90% | All | 50% | 20 years |
| **Notes:** | This CM only applies to crashes occurring in the intersection / influence area of the new Reduced Left-Turn Conflict. | | |

**General information**

**Where to use and Why it works:**

Reduced left-turn conflict intersections are geometric designs that alter how left-turn movements occur in order to simplify decisions and minimize the potential for related crashes. Two highly effective designs that rely on U-turns to complete certain left-turn movements are known as the restricted crossing U-turn (RCUT) and the median U-turn (MUT).

**Restricted Crossing U-turn (RCUT):**

The RCUT intersection modifies the direct left-turn and through movements from cross-street approaches. Minor road traffic makes a right turn followed by a U-turn at a designated location (either signalized or unsignalized) to continue in the desired direction.

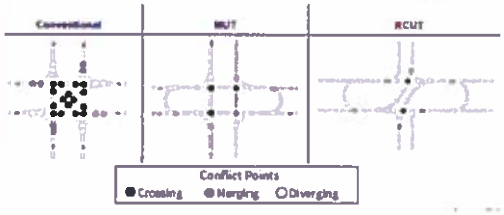
The RCUT is suitable for a variety of circumstances, including along rural, high-speed, four-lane, divided highways or signalized routes. It also can be used as an alternative to signalization or constructing an interchange. RCUTs work well when consistently used along a corridor, but also can be used effectively at individual intersections.

**Median U-turn (MUT)**

The MUT intersection modifies direct left turns from the major approaches. Vehicles proceed through the main intersection, make a U-turn a short distance downstream, followed by a right turn at the main intersection. The U-turns can also be used for modifying the cross-street left turns.

The MUT is an excellent choice for heavily traveled intersections with moderate left-turn volumes. When implemented at multiple intersections along a corridor, the efficient two-phase signal operation of the MUT can reduce delay, improve travel times, and create more crossing opportunities for pedestrians and bicyclists.

*MUT and RCUT Can Reduce Conflict Points by 50%*




**General Qualities (Time, Cost and Effectiveness):**

Implementing this strategy may take from months to years, depending on whether additional R/W is required. Such projects require a substantial time for development and construction. Costs are highly variable and range from very low to high. The expected effectiveness of this CM must be assessed for each individual location.

| **FHWA CMF Clearinghouse:** | Crash Types Addressed: | Angle/Left-turn/Rear-End/All | CRF: | 34.8-100% |
|---|---|---|---|---|

## NS17, Install right-turn lane (NS.I.)

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 90% | All | 20% | 20 years |
| Notes: | This CM only applies to crashes occurring on the approaches / influence area of the new right-turn lanes. This CM is not eligible for use at existing all-way stop intersections. | | |

| General information | | | | |
|---|---|---|---|---|
| **Where to use:** | | | | |
| Many collisions at unsignalized intersections are related to right-turn maneuvers. A key strategy for minimizing such collisions is to provide exclusive right-turn lanes, particularly on high-volume and high-speed major-road approaches. When considering new right-turn lanes, potential impacts to non-motorized users should be considered and mitigated as appropriate. When considering new right-turn lanes, potential impacts to non-motorized users should be considered and mitigated as appropriate. | | | | |
| **Why it works:** | | | | |
| The strategy is targeted to reduce the frequency of rear-end collisions resulting from conflicts between vehicles turning right and following vehicles and vehicles turning right and through vehicles coming from the left on the cross street. Right-turn lanes also remove slow vehicles that are decelerating to turn right from the through-traffic stream, thus reducing the potential for rear-end collisions. Right-turn lanes can increase the length of the intersection crossing and create an additional potential conflict point for non-motorized users. | | | | |
| **General Qualities (Time, Cost and Effectiveness):** | | | | |
| Implementing this strategy may take from months to years. At some locations, right-turn lanes can be quickly and simply installed by restriping the roadway. At other locations, widening of the roadway, acquisition of additional right-of-way, and extensive environmental processes may be needed. Such projects require a substantial time for development and construction. Costs are highly variable and range from very low to high. The expected effectiveness of this CM must be assessed for each individual location. | | | | |
| **FHWA CMF Clearinghouse:** | Crash Types Addressed: | All | CRF: | 14 - 26 % |

## NS18, Install left-turn lane (where no left-turn lane exists)

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 90% | All | 35% | 20 years |
| Notes: | This CM only applies to crashes occurring on the approaches / influence area of the new left-turn lanes. This CM does NOT apply to converting a single-left into double-left turn. This CM is not eligible for use at existing all-way stop intersections. | | |

| General information | | | | |
|---|---|---|---|---|
| **Where to use:** | | | | |
| Many collisions at unsignalized intersections are related to left-turn maneuvers. A key strategy for minimizing such collisions is to provide exclusive left-turn lanes, particularly on high-volume and high-speed major-road approaches. When considering new left-turn lanes, potential impacts to non-motorized users should be considered and mitigated as appropriate. | | | | |
| **Why it works:** | | | | |
| Adding left-turn lanes remove vehicles waiting to turn left from the through-traffic stream, thus reducing the potential for rear-end collisions. Because they provide a sheltered location for drivers to wait for a gap in opposing traffic, left-turn lanes may encourage drivers to be more selective in choosing a gap to complete the left-turn maneuver. This strategy may reduce the potential for collisions between left-turn and opposing through vehicles. | | | | |
| **General Qualities (Time, Cost and Effectiveness):** | | | | |
| Implementing this strategy may take from months to years. At some locations, left-turn lanes can be quickly and simply installed by restriping the roadway. At other locations, widening of the roadway, acquisition of additional right-of-way, and extensive environmental processes may be needed. Such projects require a substantial time for development and construction. Costs are highly variable and range from very low to high. The expected effectiveness of this CM must be assessed for each individual location. | | | | |
| **FHWA CMF Clearinghouse:** | Crash Types Addressed: | All | CRF: | 9 -55 % |

## NS19PB, Install raised medians (refuge islands)

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 90% | Pedestrian and Bicycle | 45% | 20 years |
| Notes: | This CM only applies to "Ped & Bike" crashes occurring in the crossing with the new islands. All new raised medians funded with federal HSIP funding must not include the removal of the existing roadway structural section and must be doweled into the existing roadway surface. This new requirement is being implemented to maximize the safety-effectiveness of the limited HSIP funding and to minimize project impacts. | | |

| General information | | | | |
|---|---|---|---|---|
| **Where to use:** | | | | |
| Intersections that have a long pedestrian crossing distance, a higher number of pedestrians, or a crash history. Raised medians decrease the level of exposure for pedestrians and allow pedestrians to concentrate on (or cross) only one direction of traffic at a time. | | | | |
| **Why it works:** | | | | |
| Raised pedestrian refuge islands, or medians at crossing locations along roadways, are another strategy to reduce exposure between pedestrians and motor vehicles. Refuge islands and medians that are raised (i.e., not just painted) provide pedestrians more secure places of refuge during the street crossing. They can stop partway across the street and wait for an adequate gap in traffic before completing their crossing. | | | | |
| **General Qualities (Time, Cost and Effectiveness):** | | | | |
| Median and pedestrian refuge areas are a low-cost countermeasure to implement. This cost can be applied to retrofit improvements or if it is a new construction project, implementing this countermeasure is even more cost-effective. In general, This CM can be very effective and can be considered on a systematic approach. When agencies opt to install landscaping in conjunction with new raised medians, the portion of the cost for landscaping and other non-safety related items that exceeds 10% of the project total cost is not federally participated and must be funded by the applicant. | | | | |
| **FHWA CMF Clearinghouse:** | Crash Types Addressed: | Pedestrian and Bicycle | CRF: | 30 - 56 % |

## NS20PB, Install pedestrian crossing at uncontrolled locations (signs and markings only)

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 100% | Pedestrian and Bicycle | 25% | 10 years |
| Notes: | This CM only applies to "Ped & Bike" crashes occurring in the intersection/crossing with the new crossing. This CM is not intended to be used for high-cost aesthetic enhancements to intersection crosswalks (i.e. stamped concrete or stamped asphalt). | | |

| General information | | | | |
|---|---|---|---|---|
| **Where to use:** | | | | |
| Non-signalized intersections without a marked crossing, where pedestrians are known to be crossing intersections that involve significant vehicular traffic. They are especially important at school crossings and intersections with right and/or left turns pockets. See Zegeer study (Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations) for additional guidance regarding when to install a marked crosswalk. | | | | |
| **Why it works:** | | | | |
| Adding pedestrian crossings has the opportunity to enhance pedestrian safety at locations noted as being problematic. Pavement markings delineate a portion of the roadway that is designated for pedestrian crossing. These markings will often be different for controlled verses uncontrolled locations. The use of "ladder", "zebra" or other enhanced markings at uncontrolled crossings can increase both pedestrian and driver awareness to the increased exposure at the crossing. Incorporating advanced "stop" or "yield" markings provides an extra safety buffer and can be effective in reducing the 'multiple-threat' danger to pedestrians. Nearly one-third of all pedestrian-related crashes occur at or within 50 feet of an intersection. Of these, 30 percent may involve a turning vehicle. There are several types of pedestrian crosswalks, including: continental, ladder, zebra, and standard. When agencies opt to install aesthetic enhancement to intersection crosswalks like stamped concrete/asphalt, the project design and construction costs can significantly increase. For HSIP applications, these costs must be accounted for in the B/C calculation, but these costs (over standard crosswalk markings) must be tracked separately and are not federally reimbursable and will increase the agency's local-funding share for the project costs. | | | | |
| **General Qualities (Time, Cost and Effectiveness):** | | | | |
| Costs associated with this strategy will vary widely, depending upon if curb ramps and sidewalk modifications are required with the crossing. When considered at a single location, these low cost improvements are usually funded through local funding by local crews. However, This CM can be effectively and efficiently implemented using a systematic approach with numerous locations, resulting in moderate cost projects that are more appropriate to seek state or federal funding. | | | | |
| **FHWA CMF Clearinghouse:** | Crash Types Addressed: | Pedestrian and Bicycle | CRF: | 25 % |

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

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 100% | Pedestrian and Bicycle | 35% | 20 years |
| Notes: | This CM only applies to "Ped & Bike" crashes occurring in the new crossing (influence area) with enhanced safety features. This CM is not intended to be used for high-cost aesthetic enhancements to intersection crosswalks (i.e. stamped concrete or stamped asphalt). | | |

| General information |
|---|
| **Where to use:** |
| Non-signalized intersections where pedestrians are known to be crossing intersections that involve significant vehicular traffic. They are especially important at school crossings and intersections with turn pockets. Based on the Zegeer study (Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations) at many locations, a marked crosswalk alone may not be sufficient to adequately protect non-motorized users. In these cases, **flashing beacons, curb extensions, advanced "stop" or "yield" markings, and other safety features** should be added to complement the standard crossing elements. |
| **Why it works:** |
| Adding pedestrian crossings that include enhances safety features has the opportunity to enhance pedestrian safety at locations noted as being especially problematic. The enhanced safety elements help delineate a portion of the roadway that is designated for pedestrian crossing. Incorporating advanced "yield" markings provide an extra safety buffer and can be effective in reducing the 'multiple-threat' danger to pedestrians. Nearly one-third of all pedestrian-related crashes occur at or within 50 feet of an intersection. When agencies opt to install aesthetic enhancement to intersection crosswalks like stamped concrete/asphalt, the project design and construction costs can significantly increase. For HSIP applications, these costs must be accounted for in the B/C calculation, but these costs (over standard crosswalk markings) must be tracked separately and are not federally reimbursable and will increase the agency's local-funding share for the project costs. |
| **General Qualities (Time, Cost and Effectiveness):** |
| Costs associated with this strategy will vary widely, depending upon the types of enhanced features that will be combined with the standard crossing improvements. The need for new curb ramps and sidewalk modifications will also be a factor. This CM may be effectively and efficiently implemented using a systematic approach with more than one location and can have relatively high B/C ratios based on past non-motorized crash history. |

| FHWA CMF Clearinghouse: | Crash Types Addressed: | Pedestrian and Bicycle | CRF: | 37% |
|---|---|---|---|---|

## NS22PB, Install Rectangular Rapid Flashing Beacon (RRFB)

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 100% | Pedestrian and Bicycle | 35% | 20 years |
| Notes: | This CM only applies to "Ped & Bike" crashes occurring in the influence area (expected to be a maximum of within 250') of the crossing which includes the RRFB. | | |

| General information |
|---|
| **Where to use:** |
| Rectangular Rapid Flashing Beacon (RRFB) includes pedestrian-activated flashing lights and additional signage that enhance the visibility of marked crosswalks and alert motorists to pedestrian crossings. It uses an irregular flash pattern that is similar to emergency flashers on police vehicles. RRFBs are installed at unsignalized intersections and mid-block pedestrian crossings. |
| **Why it works:** |
| RRFBs can enhance safety by increasing driver awareness of potential pedestrian conflicts and reducing crashes between vehicles and pedestrians at unsignalized intersections and mid-block pedestrian crossings. The addition of RRFB may also increase the safety effectiveness of other treatments, such as crossing warning signs and markings. |
| **General Qualities (Time, Cost and Effectiveness):** |
| RRFBs are a lower cost alternative to traffic signals and hybrid signals. This CM can often be effectively and efficiently implemented using a systematic approach with numerous locations. |

| FHWA CMF Clearinghouse: | Crash Types Addressed: | Pedestrian, Bicycle | CRF: | 7 – 47.4% |
|---|---|---|---|---|

## NS23PB, Install Pedestrian Signal (including Pedestrian Hybrid Beacon (HAWK))

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| **Funding Eligibility** | **Crash Types Addressed** | **CRF** | **Expected Life** |
| 100% | Pedestrian and Bicycle | 55% | 20 years |
| **Notes:** | This CM only applies to "Ped & Bike" crashes occurring in the intersection/crossing with the new signal. | | |

| General information |
|---|
| **Where to use:** |
| Intersections noted as having a history of pedestrian vs. vehicle crashes and in areas where the likelihood of the pedestrian presence is high. Corridors should also be assessed to determine if there are adequate safe opportunities for non-motorists to cross and if a pedestrian signal, or a Pedestrian Hybrid Beacon (PHB) (also called High-Intensity Activated crossWalK beacon (HAWK)) are needed to provide an active warning to motorists when a pedestrian is in the crosswalk. |
| **Why it works:** |
| Adding a pedestrian signal has the opportunity to greatly enhance pedestrian safety at locations noted as being problematic. Nearly one-third of all pedestrian-related crashes occur at or within 50 feet of an intersection. In combination with this CM, better guidance signs and markings for non-motorized and motorized roadway users should be considered, including: sign and markings directing pedestrians and cyclists on appropriate/legal travel paths and signs and markings warning motorists of non-motorized uses of the roadway that should be expected. |
| **General Qualities (Time, Cost and Effectiveness):** |
| The cost of improvements are generally high, but can vary dependent on the type of signal and overall scope of the project. In most cases the project duration can be short. The expected effectiveness of this CM must be assessed for each individual location. |

| **FHWA CMF Clearinghouse:** | Crash Types Addressed: | Pedestrian and Bicycle | CRF: | 15 - 69% |
|---|---|---|---|---|

## B.3 Roadway Countermeasures

### R01, Add Segment Lighting

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 100% | Night | 35% | 20 years |
| Notes: | This CM only applies to "night" crashes (all types) occurring within limits of the proposed roadway lighting 'engineered' area. | | |

| General information |
|---|
| **Where to use:** |
| Where to use: Noted substantial patterns of nighttime crashes. In particular, patterns of rear-end, right-angle, turning or roadway departure collisions on the roadways may indicate that night-time drivers can be unaware of the roadway characteristics. |
| **Why it works:** |
| Providing roadway lighting improves the safety during nighttime conditions by (1) making drivers more aware of the surroundings, which improves drivers' perception-reaction times, (2) enhancing drivers' available sight distances to perceive roadway characteristic in advance of the change, and (3) improving non-motorist's visibility and navigation. |
| **General Qualities (Time, Cost and Effectiveness):** |
| It expected that projects of this type may be constructed in a year or two and are relatively costly. There are several types of costs associated with providing lighting, including the cost of providing a permanent source of power to the location, the cost for the luminaire supports (i.e., poles), and the cost for routinely replacing the bulbs and maintenance of the luminaire supports. Some locations can result in high B/C ratios, but due to higher costs, these projects often result in medium to low B/C ratios. |

| FHWA CMF Clearinghouse: | Crash Types Addressed: | Night, All | CRF: | 18 - 69 % |
|---|---|---|---|---|

### R02, Remove or relocate fixed objects outside of Clear Recovery Zone

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 90% | All | 35% | 20 years |
| Notes: | This CM only applies to crashes occurring within the limits of the new clear recovery zone (per Caltrans' HDM). | | |

| General information |
|---|
| **Where to use:** |
| Known locations or roadway segments prone to collisions with fixed objects such as utility poles, drainage structures, trees, and other fixed objects, such as the outside of a curve, end of lane drops, and in traffic islands. A clear recovery zone should be developed on every roadway, as space is available. In situations where public right-of-way is limited, steps should be taken to request assistance from property owners, as appropriate. |
| **Why it works:** |
| While this strategy does not prevent the vehicle leaving the roadway, it does provide a mechanism to reduce the severity of a resulting crash. A clear zone is an unobstructed, traversable roadside area that allows a driver to stop safely or regain control of a vehicle that has left the roadway. Removing or moving fixed objects, flattening slopes, or providing recovery areas reduces the likelihood of a crash. |
| **General Qualities (Time, Cost and Effectiveness):** |
| Projects involving removing fixed objects from highway right-of-way can typically be accomplished quickly, assuming the objects are readily moveable. Clearing objects on private property requires more time for discussions with the property owner. Costs will generally be low, assuming that in most cases the objects to be removed are within the right-of-way. This CMs can be very effective and can be implemented by agencies' maintenance staff and/or implemented on a systematic approach. High-cost removals or removals implemented using a systematic approach would be good candidates for Caltrans Federal Safety Funding. |

| FHWA CMF Clearinghouse: | Crash Types Addressed: | Fixed Object | CRF: | 17 - 100 % |
|---|---|---|---|---|

## R03, Install Median Barrier

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| **Funding Eligibility** | **Crash Types Addressed** | **CRF** | **Expected Life** |
| 100% | All | 25% | 20 years |
| **Notes:** | Note: For Caltrans' statewide Calls-for-Projects, this CM only applies to crashes occurring within the limits of the new barrier. | | |

| General information |
|---|
| **Where to use:** |
| Areas where crash history indicates drivers are unintentionally crossing the median and the cross-overs are resulting in high severity crashes. The installation of median barriers can increase the number of PDO and non-severe injuries. The net result in safety from this countermeasure is connected more to reducing the severity of crashes not the number of crashes. It is recommended to review the warrants as outlined in Chapter 7 of the Caltrans Traffic Manual when considering whether to install median barriers. |
| **Why it works:** |
| This strategy is designed to prevent head-on collisions by providing a barrier between opposing lanes of traffic. The variety of median barriers available makes it easier to choose a site-specific solution. The main advantage is the reduction of the severity of the crashes. The key to success would be in selecting an appropriate barrier based on the site, previous crash history, maintenance needs, and median width. |
| **General Qualities (Time, Cost and Effectiveness):** |
| This strategy would in many cases be possible to implement within a short period after site selection. Costs will vary depending on the type of median barrier selected and whether the strategy is implemented as a stand-alone project or incorporated as part of a reconstruction or resurfacing effort. Maintenance costs and worker exposure will also vary depending on the type of barrier selected. The expected effectiveness of this CM must be assessed for each individual location. |

| **FHWA CMF Clearinghouse:** | Crash Types Addressed: | Head-on | CRF: | 0 - 94 % |
|---|---|---|---|---|

## R04, Install Guardrail

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| **Funding Eligibility** | **Crash Types Addressed** | **CRF** | **Expected Life** |
| 100% | All | 25% | 20 years |
| **Notes:** | This CM only applies to crashes occurring within the limits of the new guardrail. This CM is not intended to be used for general maintenance activities (i.e. the replacement of existing damaged rail). For projects proposing to upgrade existing guardrail to current standards, this CM and corresponding CRF should only be applied to locations where past crash data or engineering judgment applied to the existing rail conditions suggests the upgraded guardrail may result in fewer or less severe crashes (justifying the use of the 25% CRF for this CM). | | |

| General information |
|---|
| **Where to use:** |
| Guardrail is installed to reduce the severity of lane departure crashes. However, guardrail can reduce crash severity only for those conditions where striking the guardrail is less severe than going down an embankment or striking a fixed object. Guardrail should only be installed where it is clear that crash severity will be reduced, or there is a history of run-off-the-road crashes at a given location that have resulted in severe crashes. New and upgraded guardrail and end-treatments must meet current safety standards; see Method for Assessing Safety Hardware (MASH) for more information. Caltrans (or other national accepted guidance) slope/height criteria need to be considered and documented. |
| **Why it works:** |
| Guardrail redirects a vehicle away from embankment slopes or fixed objects and dissipates the energy of an errant vehicle. |
| **General Qualities (Time, Cost and Effectiveness):** |
| Strategies range from relatively inexpensive too costly. Costly projects may include those that upgrade existing guardrail applications to more semi-rigid and rigid barrier systems over extended distances. In general, this CMs can be effective and can be implemented by agencies' maintenance staff and/or implemented on a systematic approach. |

| **FHWA CMF Clearinghouse:** | Crash Types Addressed: | Fixed Object, Run-off Road | CRF: | 11 - 78 % |
|---|---|---|---|---|

## R05, Install impact attenuators

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 100% | All | 25% | 10 years |
| Notes: | This CM only applies to crashes occurring within the limits of the new attenuators. This CM is not intended to be used for general maintenance activities (i.e. the replacement of existing damaged attenuators). For projects proposing to upgrade existing attenuators to current standards, this CM and corresponding CRF should only be applied to locations where past crash data or engineering judgment applied to the existing attenuator conditions suggests the upgraded attenuators may result in fewer or less severe crashes (justifying the use of the 25% CRF for this CM). | | |

| General information | | | | |
|---|---|---|---|---|
| **Where to use:** | | | | |
| Impact attenuators are typically used to shield rigid roadside objects such as concrete barrier ends, steel guardrail ends and bridge pillars from oncoming automobiles. Attenuators should only be installed where it is impractical for the objects to be removed. New and upgraded barrier end-treatments must meet current safety standards; see MASH for more information. | | | | |
| **Why it works:** | | | | |
| Attenuators bring an errant vehicle to a more-controlled stop or redirect the vehicle away from a rigid object. Attenuators are effective at absorbing impact energy and increasing occupant safety. They also tend to draw attention to the fixed object, which helps drivers steer clear of the fixed objects. | | | | |
| **General Qualities (Time, Cost and Effectiveness):** | | | | |
| Costs depending on the scope of the project, type(s) used, and associated ongoing maintenance costs. Time to install is fairly quick once site is identified. | | | | |
| **FHWA CMF Clearinghouse:** | Crash Types Addressed: | Fixed Object, Run-off Road | CRF: | 5 - 50 % |

## R06, Flatten side slopes

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 90% | All | 30% | 20 years |
| Notes: | This CM only applies to crashes occurring within the limits of the new side slopes. Minor/incidental flattening of side slopes would not likely result in the CRF shown below and may not be appropriate for use in Caltrans B/C calculations. | | |

| General information | | | | |
|---|---|---|---|---|
| **Where to use:** | | | | |
| Roadways experiencing frequent lane departure crashes that result in roll-over type crashes as a result of the roadway slope being so severe as to not accommodate a reasonable degree of driver correction. When there is a need to reduce the severity of lane departure crashes without installing a barrier system that could result in increased numbers of crashes. | | | | |
| **Why it works:** | | | | |
| Flattened slopes provide a greater area for a driver to regain control of a vehicle. Steep slopes, ditches or unprotected hazardous drops-offs adjacent to a travel lane offer little opportunities to correct an inappropriate action by a driver and can result in sever crashes. | | | | |
| **General Qualities (Time, Cost and Effectiveness):** | | | | |
| Roadside modifications range from relatively inexpensive to very costly. Strategies that include creating safer side slopes where none exists can be moderately expensive based on the scope of the project and the associated clearing, grading, etc. The potential for high environmental and right-of-way impacts is high which can take several years to clear. In other cases This CM can be effective and can be implemented by agencies' maintenance staff and/or implemented on a systematic approach. | | | | |
| **FHWA CMF Clearinghouse:** | Crash Types Addressed: | Fixed Object, Run-off Road | CRF: | 5 - 62 % |

## R07, Flatten side slopes and remove guardrail

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| **Funding Eligibility** | **Crash Types Addressed** | **CRF** | **Expected Life** |
| 90% | All | 40% | 20 years |
| **Notes:** | This CM only applies to crashes occurring within the limits of both the removed guardrail and the new side slopes. | | |

| General information | | | | |
|---|---|---|---|---|
| **Where to use:** | | | | |
| Locations where high number of crashes originate as a lane departure and result in collision with guardrail or a fixed object located on the side slope shielded by guardrail. The guardrail may or may not meet current standards. Even though guardrails are generally installed to reduce the severity of departure crashes, they still can result in severe crashes in some locations. | | | | |
| **Why it works:** | | | | |
| Flattened side slopes and an unobstructed clear zone provide a greater area for a driver to regain control of a vehicle. The existing guardrail may help protect the steep slopes, fixed objects, or unprotected hazardous drops-offs adjacent to a travel lane, but removing all of these obstacles generally improves safety. | | | | |
| **General Qualities (Time, Cost and Effectiveness):** | | | | |
| Roadside modifications range from relatively inexpensive to very costly. Strategies that include creating safer side slopes where none exists can be moderately expensive based on the scope of the project and the associated clearing, grading, etc. The potential for high environmental and right-of-way impacts is high which can take several years to clear. | | | | |
| **FHWA CMF Clearinghouse:** | Crash Types Addressed: | Roll Over, Fixed Object | CRF: | 42% |

## R08, Install raised median

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| **Funding Eligibility** | **Crash Types Addressed** | **CRF** | **Expected Life** |
| 90% | All | 25% | 20 years |
| **Notes:** | This CM only applies to crashes occurring within the limits of the new raised median. All new raised medians funded with federal HSIP funding must not include the removal of the existing roadway structural section and must be doweled into the existing roadway surface. This new requirement is being implemented to maximize the safety-effectiveness of the limited HSIP funding and to minimize project impacts. | | |

| General information | | | | |
|---|---|---|---|---|
| **Where to use:** | | | | |
| Areas experiencing head-on collisions that may be affected by both the number of vehicles that cross the centerline and by the speed of oncoming vehicles. Installing a raised median is a more restrictive approach in that it represents a more rigid barrier between opposing traffic. Application of raised medians on roadways with higher speeds is not advised - instead a median barrier should be considered. Including landscaping in new raised medians can be counterproductive to the HSIP safety goals and should only be done in ways that do not increase drivers' exposure to fixed objects and that will maintain driver's sight distance needs throughout the life of the proposed landscaping. **Agencies need to consider and document impacts of additional turning movements at nearby intersections.** | | | | |
| **Why it works:** | | | | |
| Adding raised medians is a particularly effective strategy as it adds to or reallocates the existing cross section to incorporate a buffer between the opposing travel lanes and reinforces the limits of the travel lane. Raised median may also be used to limit unsafe turning movements along a roadway. | | | | |
| **General Qualities (Time, Cost and Effectiveness):** | | | | |
| In some cases this strategy may be a retrofit into the existing roadway by utilizing a portion of the existing paved shoulder. These raised medians can be installed directly over the existing pavement. Cost and time to implement could significantly increase if the paved area is not sufficient to include a median. The surface treatment of the raised median also significantly affects their cost-effectiveness: standard concrete or other hardscape surfaces are usually more cost effective than landscaped medians. When agencies opt to install landscaping in conjunction with new raised medians, the project design and construction costs can significantly increase due to excavation, backfill/top-soil, water-connection, irrigation, planting, maintenance needed for the landscaping. When agencies opt to install landscaping in conjunction with new raised medians, the portion of the cost for landscaping and other non-safety related items that exceeds 10% of the project total cost is not federally participated and must be funded by the applicant. | | | | |
| **FHWA CMF Clearinghouse:** | Crash Types Addressed: | Head-on | CRF: | 20 - 75 % |

## R09, Install median (flush)

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 90% | All | 15% | 20 years |
| Notes: | This CM only applies to crashes occurring within the limits of the new flush median. The new median must be a minimum of 4 feet wide (or "wider" if a narrow median exists before the proposed project). | | |

| General information | | | | |
|---|---|---|---|---|
| **Where to use:** | | | | |
| Areas experiencing head-on collisions that may be affected by both the number of vehicles that cross the centerline and by the speed of oncoming vehicles. Roadways with oversized lanes offer an opportunity to restripe the roadway to reduce the lanes to standard widths and use the extra width for the median. | | | | |
| **Why it works:** | | | | |
| Adding medians is a particularly effective strategy as it adds to or reallocates the existing cross section to incorporate a narrow buffer median between opposing flows, thereby providing a greater opportunity to correct an errant maneuver and further reinforce the limits of the travel lane. Application widths can vary based on the available cross section and intended application. Additional safety can be provided by combining this CM with rumble strips. | | | | |
| **General Qualities (Time, Cost and Effectiveness):** | | | | |
| In some cases this strategy may be retrofitted into the existing roadway by utilizing a portion of the existing paved shoulder and can ultimately be as simple as restriping the roadway. Costs and time to implement could significantly increase if the paved area is not sufficient to include a median. | | | | |
| **FHWA CMF Clearinghouse:** | Crash Types Addressed: | All | CRF: | 15 - 78 % |

## R10PB, Install pedestrian median fencing

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 90% | Pedestrian and Bicycle | 35% | 20 years |
| Notes: | This CM only applies to "Ped & Bike" crashes occurring on the approaches/influence area of the new pedestrian median fencing. | | |

| General information | | | | |
|---|---|---|---|---|
| **Where to use:** | | | | |
| Roadway segments with high pedestrian-generators and pedestrian-destinations nearby (e.g. transit stops) may experience a high volume of pedestrians J-walking across the travel lanes at mid-block locations instead of walking to the nearest intersection or designated mid-block crossing. When this safety issue cannot be mitigated with shoulder, sidewalk and/or crossing treatments, then installing a continuous pedestrian barrier in the median may be a viable solution. | | | | |
| **Why it works:** | | | | |
| Adding pedestrian median fencing has the opportunity to enhance pedestrian safety at locations noted as being problematic involving pedestrians running/darting across the roadway outside designated pedestrian crossings. Pedestrian median fencing can significantly reduce this safety issue by creating a positive barrier, forcing pedestrians to the designated pedestrian crossing. | | | | |
| **General Qualities (Time, Cost and Effectiveness):** | | | | |
| Costs associated with this strategy will vary widely depending on the type and placement of the median fencing. Impacts to transit and other land uses may need to be considered and controversy can delay the implementation. In general, this CM can be effective as a spot-location approach. | | | | |
| **FHWA CMF Clearinghouse:** | Crash Types Addressed: | Pedestrian, Bicycle | CRF: | 25 - 40% |

## R11, Install acceleration/ deceleration lanes

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 90% | All | 25% | 20 years |
| Notes: | This CM only applies to crashes occurring within the limits of the new accel/decel lanes on high speed roadways. Significant improvements to the merge length for lane-drop locations is also an acceptable use of this CM. | | |

| General information |
|---|
| **Where to use:** |
| Areas proven to have crashes that are the result of drivers not being able to turn onto a high speed roadway to accelerate until the desired roadway speed is reached and areas that do not provide the opportunity to safety decelerate to negotiate a turning movement. This CM can also be used to improve the safety of merging vehicles at a lane-drop location. |
| **Why it works:** |
| A lane that does not provide enough deceleration length and storage space for turning traffic may cause the turn queue to back up into the adjacent through lane. This can contribute to rear-end and sideswipe crashes. An acceleration lane is an auxiliary or speed-change lane that allows vehicles to accelerate to highway speeds (high speed roadways) before entering the through-traffic lanes of a highway. Additionally, if acceleration by entering traffic takes place directly on the traveled way, it may disrupt the flow of through-traffic and cause rear-end and sideswipe collisions. |
| **General Qualities (Time, Cost and Effectiveness):** |
| Costs are highly variable. Where sufficient median or shoulder space exists it may be possible to provide acceleration/deceleration lanes at a moderate cost. Where the roadway must be widened and additional right-of-way must be acquired, higher costs and a lengthy time-to-construct are likely. The expected effectiveness of this CM must be assessed for each individual location. |

| FHWA CMF Clearinghouse: | Crash Types Addressed: | Sideswipe, Rear-End | CRF: | 10 - 75 % |
|---|---|---|---|---|

## R12, Widen lane (initially less than 10 ft)

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 90% | All | 25% | 20 years |
| Notes: | Note: For Caltrans' statewide Calls-for-Projects, this CM only applies to crashes occurring within the limits of the widened lanes. Widening must a minimum of 1 foot. | | |

| General information |
|---|
| **Where to use:** |
| Horizontal curves or tangents and low speed or high speed roadways identified as having lane departure crashes, sideswipe or head-on crashes that can be attributed to an existing pavement width less than 10 feet. |
| **Why it works:** |
| Increasing pavement width can affect almost all crash types. A common practice is to widen the traveled way on horizontal curves to make operating conditions on curves comparable to those on tangents. Speed is a primary consideration when evaluating potential adverse impacts of lane width on safety. On high-speed, rural two-lane highways, an increased risk of cross-centerline head-on or cross-centerline sideswipe crashes is a concern because drivers may have more difficulty staying within the travel lane. |
| **General Qualities (Time, Cost and Effectiveness):** |
| Costs will depend on the amount of reconstruction necessary and on whether additional right-of-way is required. In general, this is one of the higher-cost strategies recommended, but it can also be very beneficial. Since this is a relatively expensive treatment, one of the keys to creating a cost effective project with at least a medium B/C ratio is targeting higher-hazard roadways. |

| FHWA CMF Clearinghouse: | Crash Types Addressed: | All | CRF: | 5 - 70 % |
|---|---|---|---|---|

## R13, Add two-way left-turn lane (without reducing travel lanes)

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 90% | All | 30% | 20 years |
| Notes: | This CM only applies to crashes occurring within the limits of the new lane, where an existing median did not already exist. | | |

| General information |
|---|
| **Where to use:** |
| Roadways having a high frequency of drivers being rear-ended while attempting to make a left turn across oncoming traffic. Also can be effective for drivers crossing the centerline of an undivided multilane roadway inadvertently. |
| **Why it works:** |
| Two-way left-turn lanes provide a buffer between opposing directions of travel and separate left turning traffic from through traffic. They can also help to allow vehicles to begin to accelerate before entering the through-traffic lanes. They reduce the disruption of flow of through-traffic and reducing rear-end and sideswipe collisions. For some roadways the option of converting a four-lane undivided arterials to three-lane roadways with a center left-turn lane and bike lanes should be considered (see "Road Diet" CM.) |
| **General Qualities (Time, Cost and Effectiveness):** |
| In some cases this strategy may be retrofitted into the existing roadway by utilizing a portion of the existing paved shoulder and can ultimately be as simple as restriping the roadway. Costs and time to implement could significantly increase if the paved area is not sufficient to include a median, requiring new right-of-way, and having significant environmental impacts. The expected effectiveness of this CM must be assessed for each individual location as the B/C ratios will vary from low to high. |

| FHWA CMF Clearinghouse: | Crash Types Addressed: | All | CRF: | 8 - 50 % |
|---|---|---|---|---|

## R14, Road Diet (Reduce travel lanes from 4 to 3 and add a two way left-turn and bike lanes)

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 90% | All | 30% | 20 years |
| Notes: | This CM only applies to crashes occurring within the limits of the new lane striping. "Intersection" crashes can only be applied when they resulted from turning movements that had no designated turn lanes/phases in the existing condition and the Road Diet will provide turn lanes/phases for these movements. This CM does not apply to roadway sections that already included left turn lanes or two way left turn lanes before the lane reductions. New bike lanes are also expected to be part of these projects. Pre-approval from the HSIP program manager is needed for: 1) the use of this CM without removing a travel lane in each direction and/or without adding new bike lanes; and/or 2) if any pavement is planned to be removed for the purpose of adding landscaping, planter-boxes, or other non-roadway user features. | | |

| General information |
|---|
| **Where to use:** |
| Areas noted as having a higher frequency of head-on, left-turn, and rear-end crashes with traffic volumes that can be handled by only 2 free flowing lanes. Using this strategy in locations with traffic volumes that are too high could result in diversion of traffic to routes less safe than the original four-lane design. It may also result in congestion levels that contribute to other crashes. |
| **Why it works:** |
| The application of this strategy usually reduces the roadway segment speeds and serious head-on crashes. In many cases the extra pavement width can be used for the installation of bike lanes. In addition to increasing bicycle safety, these bike lanes can improve the safety of on-street parking. |
| **General Qualities (Time, Cost and Effectiveness):** |
| Implementation would require more time than in other low-cost treatments to complete environmental analyses, traffic studies and public input. Projects that only require new lane markings and minor signalization modifications will have relatively low cost and can be very effective and can be considered on a systematic approach. These striping and signal modification costs should be considered part of this CM and not an additional CM. (If additional signal hardware improvements are being made, over what is needed for the road diet, then the Improve Signal Hardware CM may also be used.) Often road diet projects need a seal-coat placed on the roadway to fully remove the old striping. These seal coats are considered part of the proper installation of this CM. In contrast, structural-overlays should not be considered part of this CM and are not considered eligible for funding in the California Local HSIP. |

| FHWA CMF Clearinghouse: | Crash Types Addressed: | All | CRF: | 26 - 43 % |
|---|---|---|---|---|

## R15, Widen shoulder

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 90% | All | 30% | 20 years |

| Notes: | This CM only applies to crashes occurring within the limits of the new paved shoulder. A minimum of 2 feet width must be added and the new/resulting shoulders must be a minimum of 4 feet wide. This CM is not eligible unless it is done as the last step of an "incremental approach", for which the agency documents that: 1) they have already pursued and installed lower cost and lower impact CMs (i.e. signing/striping upgrades to MUTCD standards/recommendations, rumble strips, etc.), 2) they have already monitored the crash occurrences after these improvements were installed, and 3) the 'after' crash rate is still unacceptably high. This 'incremental approach' (or a special exception from the HSIP program manager) must be documented in the Narrative Questions in the application and a summary of the 'before' and 'after' crash analysis must be attached to the application. |
|---|---|

| General information |
|---|
| **Where to use:** |
| Roadways that have a frequent incidence of vehicles leaving the travel lane resulting in an unsuccessful attempt to reenter the roadway. The probability of a safe recovery is increased if an errant vehicle is provided with an increased paved area in which to initiate such a recovery. |
| **Why it works:** |
| Based on the best available research, adding shoulder or widening an existing shoulder provides a greater area to regain control of a vehicle, as well as lateral clearance to roadside objects such as guardrail, signs and poles. They may also provide space for disabled vehicles to stop or drive slowly, provide increased sight distance for through vehicles and for vehicles entering the roadway, and in some cases reduce passing conflicts between motor vehicles and bicyclists and pedestrians. The likely safety benefits for adding or widening an existing shoulder generally increase as the widening width increases - practitioners should refer to NCHRP Report 500 Series, the CMF Clearinghouse or other references for more details. |
| **General Qualities (Time, Cost and Effectiveness):** |
| Shoulder widening costs would depend on whether new right-of-way is required and whether extensive roadside modification is needed. Since shoulder widening can be a relatively expensive treatment, one of the keys to creating a cost effective project with at least a medium B/C ratio is targeting higher-hazard roadways. |

| FHWA CMF Clearinghouse: | Crash Types Addressed: | Fixed Object, Run-off Road, Sideswipe | CRF: | 15 - 75 % |
|---|---|---|---|---|

## R16, Curve Shoulder widening (Outside Only)

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 90% | All | 45% | 20 years |

| Notes: | This CM only applies to crashes occurring within the limits (or influence area) of the new shoulder widening at curves. A minimum of 2-4 feet width must be added to the outside of horizontal curves and the new traversable shoulder must be a minimum of 4 feet wide. |
|---|---|

| General information |
|---|
| **Where to use:** |
| Roadway curves noted as having frequent lane departure crashes due to inadequate or no shoulders, resulting in an unsuccessful attempt to reenter the roadway. |
| **Why it works:** |
| Adding shoulders (outside only) creates a recovery area in which a driver can regain control of a vehicle, as well as lateral clearance to roadside objects. |
| **General Qualities (Time, Cost and Effectiveness):** |
| To minimize the R/W needs and the cost, only outside shoulder at curves is to be widened. This CM can be implemented in a relatively short timeframe. |

| FHWA CMF Clearinghouse: | NA |
|---|---|

## R17, Improve horizontal alignment (flatten curves)

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 90% | All | 50% | 20 years |

| | |
|---|---|
| Notes: | This CM only applies to crashes occurring within the limits (or influence area) of the improved alignment. **This CM is not eligible unless** it is done as the last step of an "incremental approach", including: the agency documents that: 1) they have already pursued and installed lower cost and lower impact CMs (i.e. signing/striping upgrades to MUTCD standards/recommendations, rumble strips, etc.), 2) they have already monitored the crash occurrences after these improvements were installed, and 3) the 'after' crash rate is still unacceptably high. This 'incremental approach' (or a special exception from the HSIP program manager) must be documented in the Narrative Questions in the application and a summary of the agency's 'before' and 'after' crash analysis must be attached to the application. |

| General information |
|---|
| **Where to use:** |
| Roadways with horizontal curves that have experienced lane departure crashes as a result of a roadway segment having compound curves or a severe radius. This strategy should generally be considered only when less expensive strategies involving clearing of specific sight obstructions or modifying traffic control devices have been tried and have failed to ameliorate the crash patterns. |
| **Why it works:** |
| Increasing the radius of a horizontal curve can be very effective in improving the safety performance of the curve. Curve modification reduces the likelihood of a vehicle leaving its lane, crossing the roadway centerline, or leaving the roadway at a horizontal curve; and minimizes the adverse consequences of leaving the roadway. Horizontal alignment improvement projects are expected to include standard/improved superelevation elements, which should be considered part of this CM and not an additional CM. |
| **General Qualities (Time, Cost and Effectiveness):** |
| This strategy is a long-term, higher-cost alternative for improving the safety of a horizontal curve because it usually involves total reconstruction of the roadway. It may also require acquisition of additional right-of-way and an environmental review. This strategy, albeit costly, has shown that increasing the radius of curvature can significantly reduce total curve-related crashes by up to 80 percent. The expected effectiveness of this CM must be assessed for each individual location. |

| | | | | |
|---|---|---|---|---|
| **FHWA CMF Clearinghouse:** | Crash Types Addressed: | All | CRF: | 24 - 90% |

## R18, Flatten crest vertical curve

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 90% | All | 25% | 20 years |
| Notes: | This CM only applies to crashes occurring within the limits (or influence area) of the improved alignment. This CM is not eligible unless it is done as the last step of an "incremental approach", including: the agency documents that: 1) they have already pursued and installed lower cost and lower impact CMs (i.e. signing/striping upgrades to MUTCD standards/recommendations, rumble strips, etc.), 2) they have already monitored the crash occurrences after these improvements were installed, and 3) the 'after' crash rate is still unacceptably high. This 'incremental approach' (or a special exception from the HSIP program manager) must be documented in the Narrative Questions in the application and a summary of the agency's 'before' and 'after' crash analysis must be attached to the application. | | |

| General information | | | | |
|---|---|---|---|---|
| **Where to use:** | | | | |
| The target for this strategy is usually unsignalized intersections with restricted sight distance due to vertical geometry and with patterns of crashes related to that lack of sight distance that cannot be ameliorated by less expensive methods. This strategy should generally be considered only when less expensive strategies involving clearing of specific sight obstructions or modifying traffic control devices have been tried and have failed to ameliorate the crash patterns. | | | | |
| **Why it works:** | | | | |
| Adequate sight distance for drivers at stopped approaches to intersections has long been recognized as among the most important factors contributing to overall intersection safety. Vertical alignment improvement projects are expected to include standard/improved superelevation elements, which should be considered part of this CM and not an additional CM. | | | | |
| **General Qualities (Time, Cost and Effectiveness):** | | | | |
| Projects involving changing the horizontal and/or vertical alignment to provide more sight distance are quite extensive and usually take several years to accomplish. If additional right-of-way is required or environmental impacts are expected, these projects will require a substantial period of time. Since this is usually an expensive treatment, one of the keys to creating a cost effective project with at least a medium B/C ratio is targeting higher-hazard locations. | | | | |
| **FHWA CMF Clearinghouse:** | Crash Types Addressed: | All | CRF: | 20 - 51 % |

## R19, Improve curve superelevation

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 90% | All | 45% | 20 years |
| Notes: | This CM only applies to crashes occurring within the limits (or influence area) of the improved superelevation. This CM does not apply to sections of roadways where the horizontal or vertical alignments are changing via another CM. | | |

| General information | | | | |
|---|---|---|---|---|
| **Where to use:** | | | | |
| Roadways noted as having frequent lane departure crashes and inadequate or no superelevation. Safety can be enhanced when the superelevation is improved or restored along curves where the actual superelevation is less than the optimal. | | | | |
| **Why it works:** | | | | |
| Superelevation works with friction between the tires and pavement to counteract the forces on the vehicle associated with cornering. Many curves may have inadequate superelevation because of vehicles traveling at higher speeds than were originally designed for, because of loss of effective superelevation after resurfacing, or because of changes in design policy after the curve was originally constructed. | | | | |
| **General Qualities (Time, Cost and Effectiveness):** | | | | |
| This strategy can be a higher-cost alternative for improving the safety of a curve because it involves reconstruction to some degree. Other projects may be able to be constructed by simple overlays and minimal reconstruction of roadways features. When simple overlay fixes are pursued, a systematic installation approach may be appropriate. The expected effectiveness of this CM must be assessed for each individual location. | | | | |
| **FHWA CMF Clearinghouse:** | Crash Types Addressed: | Run-off Road, All | CRF: | 40 - 50 % |

## R20, Convert from two-way to one-way traffic

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 90% | All | 35% | 20 years |
| Notes: | This CM only applies to crashes occurring within the limits of the new one-way sections. | | |

| General information |
|---|
| **Where to use:** |
| One-way streets can offer improved signal timing and accommodate odd-spaced signals. One-way streets can simplify crossings for pedestrians, who must look for traffic in only one direction. While studies have shown that conversion of two-way streets to one-way generally reduces pedestrian crashes and the number of conflict points, one-way streets tend to have higher speeds which creates new problems. Care must be taken not to create conditions that cause driver confusion and erratic maneuvers. |
| **Why it works:** |
| Studies have shown a 10 to 50-percent reduction in total crashes after conversion of a two-way street to one-way operation. While studies have shown that con-version of two-way streets to one-way generally reduces pedestrian crashes, one-way streets tend to have higher speeds which creates new problems. At the same time, this strategy (1) increases capacity significantly and (2) can have safety-related drawbacks including pedestrian confusion and minor sideswipe crashes. |
| **General Qualities (Time, Cost and Effectiveness):** |
| The costs will vary depending on length of treatment and if the conversion requires modification to signals. Conversion costs can be high to build "crossovers" where the one-way streets convert back to two-way streets and to rebuild traffic signals. It's also likely that these types of modifications will require public involvement and could significantly add to the time it takes to complete the project. The expected effectiveness of this CM must be assessed for each individual location. |

| FHWA CMF Clearinghouse: | Crash Types Addressed: | All | CRF: | 26 - 43 % |
|---|---|---|---|---|

## R21, Improve pavement friction (High Friction Surface Treatments)

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 100% | All | 55% | 10 years |
| Notes: | This CM only applies to crashes occurring within the limits of the improved friction overlay. This CM is not intended to apply to standard chip-seal or open-graded **maintenance** projects for long segments of corridors or structure repaving projects intended to fix failed pavement. | | |

| General information |
|---|
| **Where to use:** |
| Nationally, this countermeasure is referred to as "High Friction Surface Treatments" or HFST. Areas as noted having crashes on wet pavements or under dry conditions when the pavement friction available is significantly less than actual roadway speeds; including but not limited to curves, loop ramps, intersections, and areas with short stopping or weaving distances. This treatment is intended to target locations where skidding is determined to be a problem, in wet or dry conditions and the target vehicle is one that runs (skids) off the road or is unable to stop due to insufficient skid resistance. |
| **Why it works:** |
| Improving the skid resistance at locations with high frequencies of wet-road crashes and/or failure to stop crashes can result in a reduction of 50 percent for wet-road crashes and 20 percent for total crashes. Applying HFST can double friction numbers, e.g. low 40s to high 80s. This CM represents a special focus area for both FHWA and Caltrans, which means there are extra resources available for agencies interested in more details on High Friction Surface Treatment projects. |
| **General Qualities (Time, Cost and Effectiveness):** |
| This strategy can be relatively inexpensive and implemented in a short timeframe. The installation would be done by either agency personnel or contractors and can be done by hand or machine. In general, This CM can be very effective and can be considered on a systematic approach. |

| FHWA CMF Clearinghouse: | Crash Types Addressed: | Wet, Rear-End, All | CRF: | 17 - 68 % |
|---|---|---|---|---|

## R22, Install/Upgrade signs with new fluorescent sheeting (regulatory or warning)

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| **Funding Eligibility** | **Crash Types Addressed** | **CRF** | **Expected Life** |
| 100% | All | 15% | 10 years |

| | |
|---|---|
| **Notes:** | This CM only applies to crashes occurring within the influence area of the new/upgraded signs. This CM is not intended for maintenance upgrades of street-name, parking, guide, or any other signs without a primary focus on roadway safety. **This CM is not eligible unless** it is done as part of a larger sign audit project, including the study of: 1) the existing signs' locations, sizes and information per MUTCD standards, 2) missing signs per MUTCD standards, and 3) sign retroreflectivity. The overall sign audit scope (or a special exception from the HSIP program manager) must be documented in the Narrative Questions in the application. Based on the scope of the project/audit, it may be appropriate to combine other CMs in the B/C calculation. |

**General information**

**Where to use:**

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

**Why it works:**

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

**General Qualities (Time, Cost and Effectiveness):**

Signing improvements do not require a long development process and can typically be implemented quickly. Costs for implementing this strategy are nominal and depend on the number of signs. When considered at a single location, these low cost improvements are usually funded through local funding by local maintenance crews. However, This CM can be effectively and efficiently implemented using a systematic approach with numerous locations, resulting in moderate cost projects that are more appropriate to seek state or federal funding. When considering any type of federally funded sign upgrade project, California local agencies are encouraged to consider "Roadway Safety Signing Audit (RSSA) and Upgrade Projects". Including RSSAs in the development phase of sign projects are expected to identify non-standard (per MUTCD) sign features and missing signs that may otherwise go unnoticed. More information on RSSA is available on the Local Assistance HSIP webpage.

| | | | | |
|---|---|---|---|---|
| **FHWA CMF Clearinghouse:** | Crash Types Addressed: | Head on, Run-off road, Sideswipe, Night | CRF: | 18 - 35% |

## R23, Install chevron signs on horizontal curves

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 100% | All | 40% | 10 years |
| Notes: | This CM only applies to crashes occurring within the influence area of the new signs. (i.e. only through the curve). | | |

| General information |
|---|
| **Where to use:** |
| Roadways that have an unacceptable level of crashes on relatively sharp curves during periods of light and darkness. Ideally this type of safety CM would be combined with other sign evaluations and upgrades (install warning signs, delineators, markers, beacons, and relocation of existing signs per MUTCD standards.) |
| **Why it works:** |
| Post-mounted chevrons are intended to warn drivers of an approaching curve and provide tracking information and guidance to the drivers. While they are intended to act as a warning, it should also be remembered that the posts, placed along the roadside, represent a possible object with which an errant vehicle can crash into. Design of posts to minimize damage and injury is an important part of the considerations to be made when selecting these treatments. |
| **General Qualities (Time, Cost and Effectiveness):** |
| Signing improvements do not require a long development process and can typically be implemented quickly. Costs for implementing this strategy are nominal and depend on the number of signs. When considered at a single location, these low cost improvements are usually funded through local funding by local maintenance crews. However, This CM can be effectively and efficiently implemented using a systematic approach with numerous locations, resulting in moderate cost projects that are more appropriate to seek state or federal funding. When considering any type of federally funded sign upgrade project, California local agencies are encouraged to consider "Roadway Safety Signing Audit (RSSA) and Upgrade Projects". Including RSSAs in the development phase of sign projects are expected to identify non-standard (per MUTCD) sign features and missing signs that may otherwise go unnoticed. More information on RSSA is available on the Local Assistance HSIP webpage. |

| FHWA CMF Clearinghouse: | Crash Types Addressed: | Run-off Road, All | CRF: | 6 - 64 % |
|---|---|---|---|---|

## R24, Install curve advance warning signs

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 100% | All | 25% | 10 years |
| Notes: | This CM only applies to crashes occurring within the influence area of the new signs. (i.e. only through the curve) | | |

| General information |
|---|
| **Where to use:** |
| Roadways that have an unacceptable level of crashes on relatively sharp curves during periods of light and darkness. This countermeasure may also include horizontal alignment and/or advisory speed warning signs. Ideally this type of safety CM would be combined with other sign evaluations and upgrades (install warning signs, chevrons, delineators, markers, beacons, and relocation of existing signs per MUTCD standards.) |
| **Why it works:** |
| This strategy primarily addresses problem curves, and serves as an advance warning of an unexpected or sharp curve. It provides advance information and gives drivers a visual warning that their added attention is needed. |
| **General Qualities (Time, Cost and Effectiveness):** |
| Signing improvements do not require a long development process and can typically be implemented quickly. Costs for implementing this strategy are nominal and depend on the number of signs. When considered at a single location, these low cost improvements are usually funded through local funding by local maintenance crews. However, This CM can be effectively and efficiently implemented using a systematic approach with numerous locations, resulting in moderate cost projects that are more appropriate to seek state or federal funding. When considering any type of federally funded sign upgrade project, California local agencies are encouraged to consider "Roadway Safety Signing Audit (RSSA) and Upgrade Projects". Including RSSAs in the development phase of sign projects are expected to identify non-standard (per MUTCD) sign features and missing signs that may otherwise go unnoticed. More information on RSSA is available on the Local Assistance HSIP webpage. |

| FHWA CMF Clearinghouse: | Crash Types Addressed: | Run-off Road, All | CRF: | 20 - 30 % |
|---|---|---|---|---|

## R25, Install curve advance warning signs (flashing beacon)

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 100% | All | 30% | 10 years |
| Notes: | This CM only applies to crashes occurring within the influence area of the new signs. (i.e. only through the curve) | | |

| General information | | | | |
|---|---|---|---|---|
| **Where to use:** | | | | |
| Roadways that have an unacceptable level of crashes on relatively sharp curves. Flashing beacons in conjunction with warning signs should only be used on horizontal curves that have an established severe crash history to help maintain their effectiveness. | | | | |
| **Why it works:** | | | | |
| This strategy primarily addresses problem curves, and serves as an enhanced advance warning of an unexpected or sharp curve. It provides advance information and gives drivers a visual warning that their added attention is needed. Flashing beacons are an added indication that a curve may be particularly challenging. | | | | |
| **General Qualities (Time, Cost and Effectiveness):** | | | | |
| Use of flashing beacons requires minimal development process, allowing flashing beacons to be installed within a short time period. Before choosing this CM, the agency needs to confirm the ability to provide power to the site (solar may be an option). In general, This CM can be very effective and can be considered on a systematic approach. | | | | |
| **FHWA CMF Clearinghouse:** | Crash Types Addressed: | All | CRF: | 30 % |

## R26, Install dynamic/variable speed warning signs

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 100% | All | 30% | 10 years |
| Notes: | This CM only applies to crashes occurring within the influence area of the new signs. (i.e. through the curve) {**<u>This CM does not apply to dynamic regulatory speed warning signs.</u>** There are currently no nationally accepted CRFs for dynamic regulatory signs (also known as Radar Speed Feedback Signs). CRFs are being developed and Caltrans hopes to include these CMs and CRFs in future calls for projects.} | | |

| General information | | | | |
|---|---|---|---|---|
| **Where to use:** | | | | |
| Curvilinear roadways that have an unacceptable level of crashes due to excessive speeds on relatively sharp curves. | | | | |
| **Why it works:** | | | | |
| This strategy primarily addresses crashes caused by motorists traveling too fast around sharp curves. It is intended to get the drivers attention and give them a visual warning that they may be traveling over the recommended speed for the approaching curve. Care should be taken to limit the placement of these signs to help maintain their effectiveness. | | | | |
| **General Qualities (Time, Cost and Effectiveness):** | | | | |
| Use of dynamic speed warning signs requires minimal development process, allowing them to be installed within a short time period. Before choosing this CM, the agency needs to confirm the ability to provide power to the site (solar may be an option). In general, This CM can be very effective and can be considered on a systematic approach. | | | | |
| **FHWA CMF Clearinghouse:** | Crash Types Addressed: | All | CRF: | 0 - 41 % |

## R27, Install delineators, reflectors and/or object markers

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 100% | All | 15% | 10 years |
| Notes: | This CM only applies to crashes occurring within the limits / influence area of the new features. (**This is not a striping-related CM**) | | |

| General information |
|---|
| **Where to use:** |
| Roadways that have an unacceptable level of crashes on curves (relatively flat to sharp) during periods of light and darkness. Any road with a history of fixed object crashes is a candidate for this treatment, as are roadways with similar fixed objects along the roadside that have yet to experience crashes. If a fixed object cannot be relocated or made break-away, placing an object marker can provide additional information to motorists. Ideally this type of safety CM would be combined with other sign evaluations and upgrades (install warning signs, chevrons, beacons, and relocation of existing signs per MUTCD standards.) |
| **Why it works:** |
| Delineators, reflectors and/or object markers are intended to warn drivers of an approaching curve or fixed object that cannot easily be removed. They are intended to provide tracking information and guidance to the drivers. They are generally less costly than Chevron Signs as they don't require posts to place along the roadside, avoiding an additional object with which an errant vehicle can crash into. |
| **General Qualities (Time, Cost and Effectiveness):** |
| These improvements do not require a long development process and can typically be implemented quickly. Costs for implementing this strategy are nominal and depend on the number of locations. When considered at a single location, these low cost improvements are usually funded through local funding by local maintenance crews. However, This CM can be effectively and efficiently implemented using a systematic approach with numerous locations, resulting in low to moderate cost projects that are more appropriate to seek state or federal funding. When considering any type of federally funded sign upgrade project, California local agencies are encouraged to consider "Roadway Safety Signing Audit (RSSA) and Upgrade Projects". Including RSSAs in the development phase of sign projects are expected to identify non-standard (per MUTCD) sign features and missing signs that may otherwise go unnoticed. More information on RSSA is available on the Local Assistance HSIP webpage. |

| FHWA CMF Clearinghouse: | Crash Types Addressed: | All | CRF: | 0 - 30 % |
|---|---|---|---|---|

## R28, Install edge-lines and centerlines

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 100% | All | 25% | 10 years |
| Notes: | This CM only applies to crashes occurring within the limits of the new centerlines and/or edge-lines. This CM is not intended to be used for general maintenance activities (i.e. the replacement of existing striping and RPMs in-kind) and must include upgraded safety features over the existing striping. For two lane roadways allowing passing, a striping audit must be done to ensure the passing limits meeting the MUTCD standards. Both the centerline and edge-lines are expected to be upgraded, unless prior approval is granted by Caltrans staff in writing and attached to application. | | |

| General information |
|---|
| **Where to use:** |
| Any road with a history of run-off-road right, head-on, opposite-direction-sideswipe, or run-off-road-left crashes is a candidate for this treatment - install where the existing lane delineation is not sufficient to assist the motorist in understanding the existing limits of the roadway. Depending on the width of the roadway, various combinations of edge line and/or center line pavement markings may be the most appropriate. Incorporating raised/reflective pavement markers (RPMs) into centerlines (and edge-lines) should be considered as it has been shown to improve safety. |
| **Why it works:** |
| Installing edge-lines and centerlines where none exists or making significant upgrades to existing lines (paint to thermoplastic, adding audible disks/bumps in the thermoplastic stripes, or adding RPMs) are intended/designed to help drivers who might leave the roadway because of their inability to see the edge of the roadway along the horizontal edge of the pavement or cross-over the centerline of the roadway into oncoming traffic. New pavement marking products tend to be more durable, are all-weather, more visible, and have a higher retroreflectivity than traditional pavement markings. |
| **General Qualities (Time, Cost and Effectiveness):** |
| These improvements do not require a long development process and can typically be implemented quickly. Costs for implementing this strategy are nominal and depend on the number and length of locations. This CM can be effectively and efficiently implemented using a systematic approach with numerous and long locations, resulting in low to moderate cost projects that are more appropriate to seek state or federal funding. When considering any type of federally funded striping upgrade project, California local agencies are encouraged to consider "Roadway Safety Striping Audit and Upgrade Projects". Including wide-scale striping audits in the development phase of striping projects are expected to identify non-standard (per MUTCD) striping/marking features, no-passing zone limits needing adjustment, and missing striping/markings that may otherwise go unnoticed. More information on this concepts is available on the Local Assistance HSIP webpage under an RSSA example document. Note: When federal safety funding is used for these installations in high-wear-locations, the local agency is expected to maintain the improvement for a minimum of 10 years. |

| FHWA CMF Clearinghouse: | Crash Types Addressed: | Head-on, Run-off Road, All | CRF: | 0 - 44 % |
|---|---|---|---|---|

## R29, Install no-passing line

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 100% | All | 45% | 10 years |
| Notes: | This CM only applies to crashes occurring within the limits of the new or extended no-passing zones. | | |

| General information |
|---|
| **Where to use:** |
| Roadways that have a high percentage of head-on crashes suggesting that many head-on crashes may relate to failed passing maneuvers. No-passing lines should be installed where drivers "passing sight distance" is not available due to horizontal or vertical obstructions. General restriping projects can be good opportunities to reevaluate and incorporate new no-passing zones limits. The incorporation 'No Passing Zone' pennants should also be considered when reevaluating the limits of no-passing zones. Installing no-passing limits in areas that are not warranted may reduce the overall safety of the corridor as drivers may become frustrated and attempt passing maneuvers at other locations without the necessary sight distance. |
| **Why it works:** |
| When the centerline markings do not differentiate between passing and no-passing areas, drivers may have difficulty determining where passing maneuvers can be completed safely. Providing clear and engineered passing and no-passing areas can encourage drivers to wait patiently for safe passing areas and avoid aggressively looking for passing opportunities. |
| **General Qualities (Time, Cost and Effectiveness):** |
| These improvements do not require a long development process and can typically be implemented quickly. Costs for implementing this strategy are nominal and depend on the number and length of locations. When considered at a single location, these low cost improvements are usually funded through local funding by local maintenance crews. However, This CM can be effectively and efficiently implemented using a systematic approach with numerous and long locations, resulting in low to moderate cost projects that are more appropriate to seek state or federal funding. |

| FHWA CMF Clearinghouse: | Crash Types Addressed: | Head-on, Side-swipe | CRF: | 40 - 53% |
|---|---|---|---|---|

## R30, Install centerline rumble strips/stripes

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 100% | All | 20% | 10 years |
| Notes: | This CM only applies to crashes occurring within the limits of the new rumble strips/stripes. | | |

| General information |
|---|
| **Where to use:** |
| Center Line rumble strips/stripes can be used on virtually any roadway – especially those with a history of head-on crashes. It is recommended that rumble strips/stripes be applied systematically along an entire route instead of only at spot locations. For all rumble strips/stripes, pavement condition should be sufficient to accept milled rumble strips. Care should be taken when considering installing rumble strips in locations with residential land uses or in areas with high bicycle volumes. |
| **Why it works:** |
| Rumble strips provide an auditory indication and tactile rumble when driven on, alerting drivers that they are drifting out of their travel lane, giving them time to recover before they depart the roadway or cross the center line. Additionally, rumble stripes (pavement marking in the rumble itself) provide an enhanced marking, especially in wet dark conditions. |
| **General Qualities (Time, Cost and Effectiveness):** |
| These improvements do not require a long development process and can typically be implemented quickly. Costs for implementing this strategy are nominal and depend on the number and length of locations. This CM can be effectively and efficiently implemented using a systematic approach with numerous and long locations, resulting in moderate cost projects that are more appropriate to seek state or federal funding. |

| FHWA CMF Clearinghouse: | Crash Types Addressed: | Head-on, Side-swipe, All | CRF: | 15 - 68% |
|---|---|---|---|---|

## R31, Install edgeline rumble strips/stripes

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 100% | All | 15% | 10 years |
| Notes: | This CM only applies to crashes occurring within the limits of the new rumble strips/stripes. | | |

| General information | | | | |
|---|---|---|---|---|
| **Where to use:** | | | | |
| Shoulder and edge line milled rumble strips/stripes should be used on roads with a history of roadway departure crashes. It is recommended that rumble strips/stripes be applied systematically along an entire route instead of only at spot locations. For all rumble strips/stripes, pavement condition should be sufficient to accept milled rumble strips. Special requirements may apply and care should be taken when considering installing rumble strips in locations with residential land uses or in areas with high bicycle volumes. | | | | |
| **Why it works:** | | | | |
| Rumble strips provide an auditory indication and tactile rumble when driven on, alerting drivers that they are drifting out of their travel lane, giving them time to recover before they depart the roadway or cross the center line. Additionally, rumble stripes (pavement marking in the rumble itself) provide an enhanced marking, especially in wet dark conditions. | | | | |
| **General Qualities (Time, Cost and Effectiveness):** | | | | |
| These improvements do not require a long development process and can typically be implemented quickly. Costs for implementing this strategy are nominal and depend on the number and length of locations. This CM can be effectively and efficiently implemented using a systematic approach with numerous and long locations, resulting in moderate cost projects that are more appropriate to seek state or federal funding. | | | | |
| **FHWA CMF Clearinghouse:** | Crash Types Addressed: | Run-off Road | CRF: | 10 - 41% |

## R32PB, Install bike lanes

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 90% | Pedestrian and Bicycle | 35% | 20 years |
| Notes: | This CM only applies to "Ped & Bike" crashes occurring within the limits of the Class II (not Class III) bike lanes. When an off-street bike-path is proposed that is not adjacent to the roadway, the applicant must document the engineering judgment used to determine which "Ped & Bike" crashes to apply. | | |

| General information | | | | |
|---|---|---|---|---|
| **Where to use:** | | | | |
| Roadway segments noted as having crashes between bicycles and vehicles or crashes that may be preventable with a buffer/shoulder. Most studies suggest that bicycle lanes may provide protection against bicycle/motor vehicle collisions. Striped bike lanes can be incorporated into a roadway when is desirable to delineate which available road space is for exclusive or preferential use by bicyclists. | | | | |
| **Why it works:** | | | | |
| Most studies present evidence that bicycle lanes provide protection against bicycle/motor vehicle collisions. Bicycle lanes provide marked areas for bicyclist to travel along the roadway and provide for more predictable movements for both bicyclist and motorist. Evidence also shows that riding with the flow of vehicular traffic reduces bicyclists' chances of collision with a motor vehicle. Locations with bicycle lanes have lower rates of wrong-way riding. In combination with this CM, better guidance signs and markings for non-motorized and motorized roadway users should be considered, including: sign and markings directing cyclists on appropriate/legal travel paths and signs and markings warning motorists of non-motorized uses of the roadway that should be expected. | | | | |
| **General Qualities (Time, Cost and Effectiveness):** | | | | |
| Adding striped bicycle lanes can range from the simply restriping the roadway and minor signing to projects that require roadway widening, right-of-way, and environmental impacts. It is most cost efficient to create bike lanes during street reconstruction, street resurfacing, or at the time of original construction. The expected effectiveness of this CM must be assessed for each individual location. For simple installation scenarios, This CM can be very effective and can be considered on a systematic approach. | | | | |
| **FHWA CMF Clearinghouse:** | Crash Types Addressed: | Pedestrian, Bicycle | CRF: | 0 - 53 % |

## R33PB, Install Separated Bike Lanes

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 90% | Pedestrian and Bicycle | 45% | 20 years |
| Notes: | This CM only applies to "Ped & Bike" crashes occurring within the limits of the separated bike lanes. When an off-street bike-path is proposed that is not adjacent to the roadway, the applicant must document the engineering judgment used to determine which "Ped & Bike" crashes to apply. | | |

**General information**

**Where to use:**

Separated bikeways are most appropriate on streets with high volumes of bike traffic and/or high bike-vehicle collisions, presumably in an urban or suburban area. Separation types range from simple, painted buffers and flexible delineators, to more substantial separation measures including raised curbs, grade separation, bollards, planters, and parking lanes. These options range in feasibility due to roadway characteristics, available space, and cost. In some cases, it may be possible to provide additional space in areas where pedestrian and bicyclists may interact, such as the parking buffer, or loading zones, or extra bike lane width for cyclists to pass one another.

**Why it works:**

Separated bike lanes provide increased safety and comfort for bicyclists beyond conventional bicycle lanes. By separating bicyclists from motor traffic, "protected" or physically separated bike lanes can offer a higher level of comfort and are attractive to a wider spectrum of the public. Intersections and approaches must be carefully designed to promote safety and facilitate left-turns for bicyclists from the primary corridor to cross street.

In combination with this CM, better guidance signs and markings for non-motorized and motorized roadway users should be considered, including: sign and markings directing cyclists on appropriate/legal travel paths and signs and markings warning motorists of non-motorized uses of the roadway that should be expected.

**General Qualities (Time, Cost and Effectiveness):**

The cost of installing separated bike lanes can be low to medium or high, depending on whether roadway widening, right-of-way and environmental impacts are involved. It is most cost efficient to create bike lanes during street reconstruction, street resurfacing, or at the time of original construction. The expected effectiveness of this CM must be assessed for each individual location.

| FHWA CMF Clearinghouse: | Crash Types Addressed: | Pedestrian, Bicycle | CRF: | 3.7 - 100 % |
|---|---|---|---|---|

## R34PB, Install sidewalk/pathway (to avoid walking along roadway)

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 90% | Pedestrian and Bicycle | 80% | 20 years |
| Notes: | This CM only applies to "Ped & Bike" crashes occurring within the limits of the new walkway. This CM is not intended to be used where an existing sidewalk is being replaced with a wider one, unless prior Caltrans approval is included in the application. When an off-street multi-use path is proposed that is not adjacent to the roadway, the applicant must document the engineering judgment used to determine which "Ped & Bike" crashes to apply. | | |

**General information**

**Where to use:**

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

**Why it works:**

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

**General Qualities (Time, Cost and Effectiveness):**

Costs for sidewalks will vary, depending upon factors such as width, materials, and existing of curb, gutter and drainage. Asphalt curbs and walkways are less expensive, but require more maintenance. The expected effectiveness of this CM must be assessed for each individual location. These projects can be very effective in areas of high-pedestrian volumes with a past history of crashes involving pedestrians.

| FHWA CMF Clearinghouse: | Crash Types Addressed: | Pedestrian, Bicycle | CRF: | 65 - 89 % |
|---|---|---|---|---|

## R35PB, Install/upgrade pedestrian crossing (with enhanced safety features)

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| **Funding Eligibility** | **Crash Types Addressed** | **CRF** | **Expected Life** |
| 90% | Pedestrian and Bicycle | 35% | 20 years |
| **Notes:** | This CM only applies to "Ped & Bike" crashes occurring in the influence area (expected to be a maximum of within 250') of the new crossing which includes new enhanced safety features. Note: This CM is not intended to be combined with the "Install raised pedestrian crossing" when calculating the improvement's B/C ratio. This CM is not intended to be used for high-cost aesthetic enhancements (i.e. stamped concrete or stamped asphalt). | | |

| General information |
|---|
| **Where to use:** |
| Roadway segments with no controlled crossing for a significant distance in high-use midblock crossing areas and/or multilane roads locations. Based on the Zegeer study (Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations) at many locations, a marked crosswalk alone may not be sufficient to adequately protect non-motorized users. In these cases, flashing beacons, curb extensions, medians and pedestrian crossing islands and/or other safety features should be added to complement the standard crossing elements. For multi-lane roadways, advance "yield" markings can be effective in reducing the 'multiple-threat' danger to pedestrians. |
| **Why it works:** |
| Adding pedestrian crossings has the opportunity to greatly enhance pedestrian safety at locations noted as being problematic. The enhanced safety elements, which may include curb extensions, medians and pedestrian crossing islands, beacons, and lighting, combined with pavement markings delineating a portion of the roadway that is designated for pedestrian crossing. Care must be taken to warn drivers of the potential for pedestrians crossing the roadway and enhanced improvements added to the crossing increase the likelihood of pedestrians crossing in a safe manner. In combination with this CM, better guidance signs and markings for non-motorized and motorized roadway users should be considered, including: sign and markings directing pedestrians and cyclists on appropriate/legal travel paths and signs. When agencies opt to install aesthetic enhancement to crossing like stamped concrete/asphalt, the project design and construction costs can significantly increase. For HSIP applications, these costs must be accounted for in the B/C calculation, but these costs (over standard crosswalk markings) must be tracked separately and are not federally reimbursable and will increase the agency's local-funding share for the project costs. |
| **General Qualities (Time, Cost and Effectiveness):** |
| Costs associated with this strategy will vary widely, depending on the extent of the curb extensions, raised medians, flashing beacons, and other pedestrian safety elements that are needed with the crossing. When considered at a single location, these improvements can sometimes be low cost and funded through local funding by local crews. This CM can often be effectively and efficiently implemented using a systematic approach with numerous locations, resulting in moderate to high cost projects that are appropriate to seek state or federal funding. |

| **FHWA CMF Clearinghouse:** | Crash Types Addressed: | Pedestrian, Bicycle | CRF: | 8 - 56% |
|---|---|---|---|---|

## R36PB, Install raised pedestrian crossing

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 90% | Pedestrian and Bicycle | 35% | 20 years |
| Notes: | This CM only applies to "Ped & Bike" crashes occurring in the area with the new raised crossing. Note: This CM is not intended to be combined with the "Install pedestrian crossing (with enhanced safety features)" when calculating the improvement's B/C ratio. | | |

| General information |
|---|
| **Where to use:** |
| On lower-speed roadways, where pedestrians are known to be crossing roadways that involve significant vehicular traffic. Based on the Zegeer study (Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations) at many locations, a marked crosswalk alone, may not be sufficient to adequately protect non-motorized users. In these cases, raised crossings can be added to complement the standard crossing elements. Special requirements may apply and extra care should be taken when considering installing raised crossings to ensure unintended safety issues are not created, such as: emergency vehicle access or truck route issues. |
| **Why it works:** |
| Adding a raised pedestrian crossing has the opportunity to enhance pedestrian safety at locations noted as being especially problematic. The raised crossing encourages motorists to reduce their speed and provides improved delineation for the portion of the roadway that is designated for pedestrian crossing. In combination with this CM, better guidance signs and markings for non-motorized and motorized roadway users should be considered, including: sign and markings directing pedestrians and cyclists on appropriate/legal travel paths. |
| **General Qualities (Time, Cost and Effectiveness):** |
| Costs associated with this strategy will vary widely, depending upon the elements of the raised crossing and the need for new curb ramps and sidewalk modifications. This CM may be effectively and efficiently implemented using a systematic approach with more than one location and can have medium to high B/C ratios based on past non-motorized crash history. |

| FHWA CMF Clearinghouse: | Crash Types Addressed: | Pedestrian, Bicycle | CRF: | 30 - 46% |
|---|---|---|---|---|

## R37PB, Install Rectangular Rapid Flashing Beacon (RRFB)

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 100% | Pedestrian and Bicycle | 35% | 20 years |
| Notes: | This CM only applies to "Ped & Bike" crashes occurring in the influence area (expected to be a maximum of within 250') of the crossing which includes the RRFB. | | |

| General information |
|---|
| **Where to use:** |
| Rectangular Rapid Flashing Beacon (RRFB) includes pedestrian-activated flashing lights and additional signage that enhance the visibility of marked crosswalks and alert motorists to pedestrian crossings. It uses an irregular flash pattern that is similar to emergency flashers on police vehicles. RRFBs are installed at unsignalized intersections and mid-block pedestrian crossings. |
| **Why it works:** |
| RRFBs can enhance safety by increasing driver awareness of potential pedestrian conflicts and reducing crashes between vehicles and pedestrians at unsignalized intersections and mid-block pedestrian crossings. The addition of RRFB may also increase the safety effectiveness of other treatments, such as crossing warning signs and markings. |
| **General Qualities (Time, Cost and Effectiveness):** |
| RRFBs are a lower cost alternative to traffic signals and hybrid signals. This CM can often be effectively and efficiently implemented using a systematic approach with numerous locations. |

| FHWA CMF Clearinghouse: | Crash Types Addressed: | Pedestrian, Bicycle | CRF: | 7 – 47.4% |
|---|---|---|---|---|

## R38, Install Animal Fencing

| For HSIP Calls-for-projects | | | |
|---|---|---|---|
| Funding Eligibility | Crash Types Addressed | CRF | Expected Life |
| 90% | Animal | 80% | 20 years |
| Notes: | This CM only applies to "animal" crashes occurring within the limits of the new fencing. | | |

| General information |
|---|
| **Where to use:** |
| At locations with high percent of vehicular/animal crashes (reactive) or where there is a known high percent of animals crossing due to migratory patterns (proactive). |
| **Why it works:** |
| Animal fencing helps to channelize the identified animals to a natural or man-made crossing, eliminating the conflict between vehicles and animals on the same place. Animal fencing is typically installed at a bridge location with its "run of need" dependent on the surrounding terrain. |
| **General Qualities (Time, Cost and Effectiveness):** |
| Time to install fencing can be moderate to lengthy depending on the environmental commitments and agreed upon solution to mitigating project impacts. Costs will be fairly low and depend on the "run of need" length. There will be minimal reoccurring maintenance costs on keeping the fence intact. The expected effectiveness of this CM must be assessed for each individual location. |

| FHWA CMF Clearinghouse: | Crash Types Addressed: | Animal | CRF: | 70 - 90 % |
|---|---|---|---|---|

# Appendix E: B/C Ratio Calculation – LRSM (2020)

# Benefit/Cost Ratio Calculations

This appendix includes the Benefit/Cost methodology used in the Caltrans calls-for-projects in the HSIP programs. The HSM, Part B - Chapter 7, includes more details on conducting Economic Appraisal for roadway safety projects. Local agencies will be required to utilize the HSIP Analyzer to calculate the B/C ratio as part of their application for HSIP funding. Starting in Cycle 7 call for projects, the fatality and severe injury costs have been combined for calculating the benefit. Because fatality figures are small and are a matter of randomness, this change is being made to reduce the possibility of selecting an improvement project on the basis of randomness.

1) $Benefit\ (Annual) = \sum_{s=0}^{3} \frac{CRF \times N \times CC_{ave}}{Y}$

- $CRF$ : Crash reduction factor in each countermeasure.
- $S$ : Severity (0: PDO, 1: Minor Injury, 2: Injury, 3: Severe Injury/Fatal). See the below table.
- $N$ : Number of Crashes, in severity levels, related to selected countermeasure.
- $Y$ : Crash data time period (Year).
- $CC_{ave}$ : Crash costs in severity levels.

| Severity (S) | Crash Severity * | Location Type | Crash Cost *** |
|---|---|---|---|
| 3 | **Fatality and Severe Injury Combined (KA) | Signalized Intersection | $1,590,000 |
| 3 | | Non Signalized Intersection | $2,530,000 |
| 3 | | Roadway | $2,190,000 |
| 2 | Evident Injury – Other Visible (B) | | $142,300 |
| 1 | Possible Injury–Complaint of Pain (C) | | $80,900 |
| 0 | Property Damage Only (O) | | $13,300 |

* The letters in parenthesis (K, A, B, C and O) refer to the KABCO scale; it is commonly used by law enforcement agencies in their crash reporting efforts and is further documented in the HSM.

** Figures were calculated based on an average Fatality (K) / Severe Injury (A) ratio for each area type, a crash cost for a Fatality (K) of $7,219,800, and a crash cost of a Severe/Disabling Injury (A) of $389,000. These costs are used in the HSIP Analyzer.

*** Based on Table 7-1, Highway Safety Manual (HSM), First Edition, 2010. Adjusted to 2020 Dollars.

2) *Benefit (Life) = Benefit (annual) x Years of service life*

3) Benefit/Cost Ratio (each countermeasure): $Benefit\ \ Cost\ Ratio_{(CM)} = \frac{Benefit\ (Life)_{(CM)}}{Total\ \text{Project}\ Cost_{(CM)}}$

4) Benefit/Cost Ratio (project): $Benefit/Cost\ Ratio\ (\text{Project}) = \frac{\sum_{CM=1}^{3} Benefit\ (Life)_{(CM)}}{Total\ \text{Project}\ Cost}$

Years of Collision Data 5

## Cost, Benefit and B/C Ratio Calculation Table

| FID | Location | CM 1 | CM 2 | CM 3 | CM1_CRF | CM2_CRF | CM3_CRF | CM1_Life (Year) | CM2_Life (Year) | CM3_Life (Year) | Unused & Desired CM | Cost CM 1 | Cost CM 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Project 1** | | | | | | | | | | | | |
| | 2nd St/A St/SR-160 | NS09 | NS13 | | 0.3 | 0.4 | | 10 | 20 | | | $ 39,500.00 | $ 10,260.00 |
| | H St/Main St | NS09 | NS13 | | 0.3 | 0.4 | | 10 | 20 | | | $ 19,750.00 | $ 5,820.00 |
| | SR-160/H St | NS09 | NS13 | | 0.3 | 0.4 | | 10 | 20 | | | $ 39,000.00 | $ 6,800.00 |
| | **Project 2** | | | | | | | | | | | | |
| | H St/Main St | NS06 | NS07 | NS11 | 0.15 | 0.25 | 0.2 | 10 | 10 | 10 | | $ 400.00 | $ 720.00 |
| | 2nd St/A St/SR-160 | NS06 | NS07 | NS11 | 0.15 | 0.25 | 0.2 | 10 | 10 | 10 | | $ 1,600.00 | $ 4,260.00 |
| | SR-160/H St | NS06 | NS07 | NS11 | 0.15 | 0.25 | 0.2 | 10 | 10 | 10 | | $ 2,000.00 | $ 960.00 |
| | Union St/D St | NS06 | NS07 | NS11 | 0.15 | 0.25 | 0.2 | 10 | 10 | 10 | | $ 5,200.00 | $ 500.00 |
| | **Project 3 PSA** | | | | | | | | | | | | |
| | H St/Main St | NS21PB | | | | | | | | | | $ 23,075.00 | |
| | 2nd St/A St/SR-160 | NS21PB | | | | | | | | | | $ 45,275.00 | |
| | Union St/D St | NS21PB | | | | | | | | | | $ 45,575.00 | |
| | SR-160/C St | NS21PB | NS19PB | NS22PB | | | | | | | | $ 23,160.00 | $ 7,000.00 |
| | **Project 4** | | | | | | | | | | | | |
| | SR 160: H St to Tyler Island Bridge Rd | R01 | R31 | | 0.25 | 0.15 | | 20 | 10 | | | $ 241,200.00 | $ 26,000.00 |
| | **Project 5** | | | | | | | | | | | | |
| | River Rd/SR-160: W Tyler Island Bridge Rd to 1st St | R22 | R27 | | 0.15 | 0.15 | | 10 | 10 | | | $ 4,800.00 | $ 6,000.00 |
| | H St: River Rd/SR-160 to 6th St | R22 | R27 | | 0.15 | 0.15 | | 10 | 10 | | | $ 2,000.00 | $ 2,750.00 |
| | Main St/2nd St: SR-160 to H St | R22 | R27 | | 0.15 | 0.15 | | 10 | 10 | | | $ 2,400.00 | $ 2,000.00 |
| | A Street, 4th Street, Jackson St: City Limit to SR-160 | R22 | R27 | | 0.15 | 0.15 | | 10 | 10 | | | $ 8,900.00 | $ 11,000.00 |
| | B Street: SR-160 to 5th Street | R22 | R27 | | 0.15 | 0.15 | | 10 | 10 | | | $ 2,400.00 | $ 1,250.00 |
| | Union Street: C Street to H Street | R22 | R27 | | 0.15 | 0.15 | | 10 | 10 | | | $ 4,900.00 | $ 5,250.00 |
| | 6th Street from Jackson Street to H Street | R22 | R27 | | 0.15 | 0.15 | | 10 | 10 | | | $ 400.00 | $ 5,500.00 |
| | 4th Ave: Delta Ave to Georgiana Dr | R22 | R27 | | 0.15 | 0.15 | | 10 | 10 | | | $ 1,600.00 | $ 1,000.00 |
| | **Project 6 (ELSA)** | | | | | | | | | | | | |
| | Citywide | R28 | | | | | | | | | | $ 153,331.00 | |

| Countermeasure Name |
|---|
| NS06 - Install/upgrade larger or additional stop signs or other intersection warning/regulatorysigns |
| NS07 - Upgrade intersection pavement markings |
| NS09 - Install flashing beacons as advance warning (NS.L) |
| NS11 - Improve sight distance to intersection (Clear Sight Triangles) |
| NS13 - Install splitter-islands on the minor road approaches |
| NS19PB - Install raised medians (refuge islands) |
| NS21PB - Install/upgrade pedestrian crossing at uncontrolled locations (with enhanced safety features) |
| NS22PB - Install Rectangular Rapid Flashing Beacon (RRFB) |
| R01 - Add Segment Lighting |
| R22 - Install/Upgrade signs with new fluorescent sheeting (regulatory or warning) |
| R27 - Install delineators, reflectors and/or object markers |
| R28 - Install edge-lines and centerlines |
| R31 - Install edgeline rumble strips/stripes |

CM R22 use 25%
25%

| | 10% | 5% | 10% | 0% | 0% | 15% | | | | Collisions (2015-2019) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cost CM 3 | Contingency Cost | Environmental Cost | PS&E Cost | Right of Way Engineering Cost | Appraisals, Acquisitions & Utilities Cost | Construction Engineering (CE) Cost | Cost Per Location | All Locations (Cost 2021) | 20% More | Total #Collisions | Fatal | Severe Injury | Other Visible Injury | Complaint of Pain |
| | $ 4,976 | $ 2,488 | $ 4,976 | | | $ 7,464 | $ 69,664 | | | 2 | | | | 1 |
| | $ 2,537 | $ 1,269 | $ 2,537 | | | $ 3,806 | $ 35,518 | $ 169,302 | $ 203,162 | 1 | 1 | | | |
| | $ 4,580 | $ 2,290 | $ 4,580 | | | $ 6,870 | $ 64,120 | | | 1 | | | | |
| $ 400.00 | $ 152 | $ 76 | $ 152 | | | $ 228 | $ 2,128 | | | 1 | 1 | | | |
| $ 3,600.00 | $ 946 | $ 473 | $ 946 | | | $ 1,419 | $ 13,244 | $ 105,515 | $ 126,739 | 2 | | | | 1 |
| $ 52,000.00 | $ 5,496 | $ 2,748 | $ 5,496 | | | $ 8,244 | $ 76,944 | | | 1 | | | | |
| $ 3,800.00 | $ 950 | $ 475 | $ 950 | | | $ 1,425 | $ 13,300 | | | 1 | | | | |
| | $ 2,308 | $ 1,154 | $ 2,308 | | | $ 3,461 | $ 32,305 | | | | | | | |
| | $ 4,528 | $ 2,264 | $ 4,528 | | | $ 6,791 | $ 63,385 | $ 247,009 | $ 296,411 | | | | | |
| | $ 4,558 | $ 2,279 | $ 4,558 | | | $ 6,836 | $ 63,805 | | | | | | | |
| $ 32,350.00 | $ 6,251 | $ 3,126 | $ 6,251 | | | $ 9,377 | $ 87,514 | | | | | | | |
| | $ 26,720 | $ 13,360 | $ 26,720 | | | $ 40,080 | $ 374,080 | $ 374,080 | $ 448,896.00 | 3 | 1 | | | 1 |
| | $ 1,080 | $ 540 | $ 1,080 | | | $ 1,620 | $ 15,120 | | | 5 | 1 | | | 2 |
| | $ 475 | $ 238 | $ 475 | | | $ 713 | $ 6,650 | | | | | | | |
| | $ 440 | $ 220 | $ 440 | | | $ 660 | $ 6,160 | | | 1 | | | | |
| | $ 1,990 | $ 995 | $ 1,990 | | | $ 2,985 | $ 27,860 | $ 87,010 | $ 104,412 | | | | | |
| | $ 365 | $ 183 | $ 365 | | | $ 548 | $ 5,110 | | | | | | | |
| | $ 1,015 | $ 508 | $ 1,015 | | | $ 1,523 | $ 14,210 | | | 1 | | | | |
| | $ 590 | $ 295 | $ 590 | | | $ 885 | $ 8,260 | | | | | | | |
| | $ 260 | $ 130 | $ 260 | | | $ 390 | $ 3,640 | | | 1 | | | | |
| | $ 15,333 | $ 7,667 | $ 15,333 | | | $ 23,000 | $ 214,663 | $ 214,663 | $ 257,596.08 | | | | | |

| | Crash Costs | | | | | | | CM Annual Benefit | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Property Damage Only | Fatal | Severe Injury | Other Visible Injury | Complaint of Pain | PDO | Crash Costs | Total Crash Cost | CM1_Benefit (Annual) | CM2_Benefit (Annual) | CM3_Benefit (Annual) | CM1_Benefit (Life) |
| 1 | $ - | $ - | $ - | $ 80,900.00 | $ 13,300.00 | $ 94,200.00 | | $ 5,652.00 | $ 7,536.00 | $ - | $ 56,520.00 |
| | $ 2,190,000.00 | $ - | $ - | $ - | $ - | $ 2,190,000.00 | $ 2,297,500 | $ 131,400.00 | $ 175,200.00 | $ - | $ 1,314,000.00 |
| 1 | $ - | $ - | $ - | $ - | $ 13,300.00 | $ 13,300.00 | | $ 798.00 | $ 1,064.00 | $ - | $ 7,980.00 |
| | $ 2,530,000.00 | $ - | $ - | $ - | $ - | $ 2,530,000.00 | | $ 75,900.00 | $ 126,500.00 | $ 101,200.00 | $ 759,000.00 |
| 1 | $ - | $ - | $ - | $ 80,900.00 | $ 13,300.00 | $ 94,200.00 | $ 2,650,800 | $ 2,826.00 | $ 4,710.00 | $ 3,768.00 | $ 28,260.00 |
| 1 | $ - | $ - | $ - | $ - | $ 13,300.00 | $ 13,300.00 | | $ 399.00 | $ 665.00 | $ 532.00 | $ 3,990.00 |
| 1 | $ - | $ - | $ - | $ - | $ 13,300.00 | $ 13,300.00 | | $ 399.00 | $ 665.00 | $ 532.00 | $ 3,990.00 |
| | $ - | $ - | $ - | $ - | $ - | $ - | | $ - | $ - | $ - | $ - |
| | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| | $ - | $ - | $ - | $ - | $ - | $ - | | $ - | $ - | $ - | $ - |
| | $ - | $ - | $ - | $ - | $ - | $ - | | $ - | $ - | $ - | $ - |
| 1 | $ 1,590,000.00 | $ - | $ - | $ 80,900.00 | $ 13,300.00 | $ 1,684,200.00 | $ 1,684,200 | $ 117,894.00 | $ 50,526.00 | $ - | $ 2,357,880.00 |
| 2 | $ 2,190,000.00 | $ - | $ - | $ 161,800.00 | $ 26,600.00 | $ 2,378,400.00 | | $ 71,352.00 | $ 71,352.00 | $ - | $ 713,520.00 |
| | $ - | $ - | $ - | $ - | $ - | $ - | | $ - | $ - | $ - | $ - |
| 1 | $ - | $ - | $ - | $ - | $ 13,300.00 | $ 13,300.00 | | $ 399.00 | $ 399.00 | $ - | $ 3,990.00 |
| | $ - | $ - | $ - | $ - | $ - | $ - | $ 2,418,300 | $ - | $ - | $ - | $ - |
| | $ - | $ - | $ - | $ - | $ - | $ - | | $ - | $ - | $ - | $ - |
| 1 | $ - | $ - | $ - | $ - | $ 13,300.00 | $ 13,300.00 | | $ 399.00 | $ 399.00 | $ - | $ 3,990.00 |
| | $ - | $ - | $ - | $ - | $ - | $ - | | $ - | $ - | $ - | $ - |
| 1 | $ - | $ - | $ - | $ - | $ 13,300.00 | $ 13,300.00 | | $ 399.00 | $ 399.00 | $ - | $ 3,990.00 |
| | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ - |

| CM Life Benefit | | Benefit | Total Benefit | B/C |
|---|---|---|---|---|
| CM2_Benefit (Life) | CM3_Benefit (Life) | Benefit per Location (Life) | Total_Benefit (Life) | B/C |
| | | | | |
| $ 150,720.00 | $ - | $ 207,240.00 | | |
| $ 3,504,000.00 | $ - | $ 4,818,000.00 | $ 5,054,500.00 | 29.85 |
| $ 21,280.00 | $ - | $ 29,260.00 | | |
| | | | | |
| $ 1,265,000.00 | $ 1,012,000.00 | $ 3,036,000.00 | | |
| $ 47,100.00 | $ 37,680.00 | $ 113,040.00 | $ 3,180,960.00 | 30.12 |
| $ 6,650.00 | $ 5,320.00 | $ 15,960.00 | | |
| $ 6,650.00 | $ 5,320.00 | $ 15,960.00 | | |
| | | | | |
| $ - | $ - | $ - | | |
| $ - | $ - | $ - | $ - | N/A |
| $ - | $ - | $ - | | |
| $ - | $ - | $ - | | |
| | | | | |
| $ 505,260.00 | $ - | $ 2,863,140.00 | $ 2,863,140.00 | 6.38 |
| | | | | |
| $ 713,520.00 | $ - | $ 1,427,040.00 | | |
| $ - | $ - | $ - | | |
| $ 3,990.00 | $ - | $ 7,980.00 | | |
| $ - | $ - | $ - | $ 1,450,980.00 | 16.86 |
| $ - | $ - | $ - | | |
| $ 3,990.00 | $ - | $ 7,980.00 | | |
| $ - | $ - | $ - | | |
| $ 3,990.00 | $ - | $ 7,980.00 | | |
| | | | | |
| $ - | $ - | $ - | $ - | N/A |