



MULTIJURISDICTIONAL LOCAL ROAD SAFETY PLAN

January 2022





APPENDICES

APPENDIX B. REGIONAL COUNTERMEASURES TOOLBOX

Regional Safety Plan

Countermeasures and Safety Strategies

Fresno Council of Governments
California

July 2021

Regional Safety Plan

Countermeasures and Safety Strategies

Fresno Council of Governments
California

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INTRODUCTION

Kittelson & Associates, Inc. (Kittelson) is supporting the Fresno Council of Governments (COG) to identify countermeasures and strategies to improve roadway safety performance in the region as part of a broader effort to develop the Regional Safety Plan. Safety performance is defined as reducing collision frequency and severity. This report is organized into two parts:

- **Countermeasures Toolbox:** Summarizes the systemic or location-specific countermeasures (i.e., engineering countermeasures) that could be implemented in the region to reduce the severity of collisions as well as the risk of collisions occurring.
- **Non-Engineering Safety Strategies:** Summarizes the education, enforcement, and emergency services strategies that could complement engineering projects to reduce severe collisions and collision risk.

The countermeasures toolbox in this report will ultimately be incorporated into the COG's final Regional Safety Plan and serve as a resource for local agencies within the region. The countermeasures toolbox is organized to help local agencies identify countermeasures that have been found to be effective at reducing collision risk and are likely to be eligible for grant funding through Caltrans' Highway Safety Improvement Program (HSIP).

The non-engineering safety strategies are complementary to the engineering countermeasures. These strategies tend to be more effectively coordinated and implemented at a regional level. The implementation of the strategies provides benefits at a local and regional level. Typically funding and coordinating the education, enforcement, and emergency services strategies requires collaboration across jurisdictional boundaries, which is often better suited to the role of a regional agency able to bring those different agency stakeholders together. These strategies will be integrated into the final Regional Safety Plan along with recommendations for steps towards implementation.

COUNTERMEASURES TOOLBOX

The following presents the engineering-related countermeasures identified for Fresno County. These countermeasures were selected based on the collision patterns and trends identified in the existing conditions report and professional resources. Professional resources used to identify these countermeasures include: the Caltrans' *Local Road Safety Manual*, American Association of State Highway and Transportation Officials' (AASHTO) *Highway Safety Manual*; Federal Highway Administration's (FHWA) CMF Clearinghouse and resources on systemic safety; and National Association of City Transportation Officials (NACTO) guidance documents related to pedestrian and bicycle facilities.

The section describes each countermeasure, the types of locations it is intended to be used at, and why it was selected for the incorporated and unincorporated areas of the Fresno County. The collision reduction factor (CRF) and if the countermeasure is eligible for federal funding is also noted for each of the countermeasures in this report. The information regarding the estimated collision reduction and eligibility for federal funding is obtained from the Local Roadway Safety Manual for California's Local Road Owners (LRSM, 2020), unless otherwise noted.

ROADWAY SEGMENT COUNTERMEASURES

Street Lighting (R1)

Planning-Level Cost Estimate: \$7,000 - \$10,000 per light

Eligible for Federal Funding: Yes (100%)

Potential Effectiveness at Reducing Collision Frequency and/or Severity: CRF = 35%. Collision reduction only applies to nighttime collisions occurring within the limits of the roadway.

Brief Description: This countermeasure involves installing or modifying lighting on roadway segments. This is done to improve the visibility of non-motorized users to drivers and reduce potential conflicts and collisions. Providing roadway lighting improves the safety by improving the drivers' perception-reaction times, enhancing drivers' available sight distances to perceive roadway characteristics in advance of the change, and non-motorized users' visibility and navigation. An example of the countermeasure is shown in Figure 1.

Figure 1: Example Lighting on the Roadway



Source: FHWA

Why was this selected for Fresno County?



This countermeasure was selected for Fresno County because darkness was a factor in 32% of reported total collisions and 44% of reported fatal and severe injury collisions. Out of the 318 reported fatal collisions that occurred in the dark, 168 occurred where there were either no streetlights or streetlights were reported not to be functioning.

Increased visibility would contribute to pedestrian, bicycle, and motorist safety, allowing drivers to more easily see non-motorized users. Consideration should be taken before implementation to account for maintenance and electrical costs that occur after implementation.

Remove or Relocate Fixed Objects Outside of Clear Recovery Zone (R2)

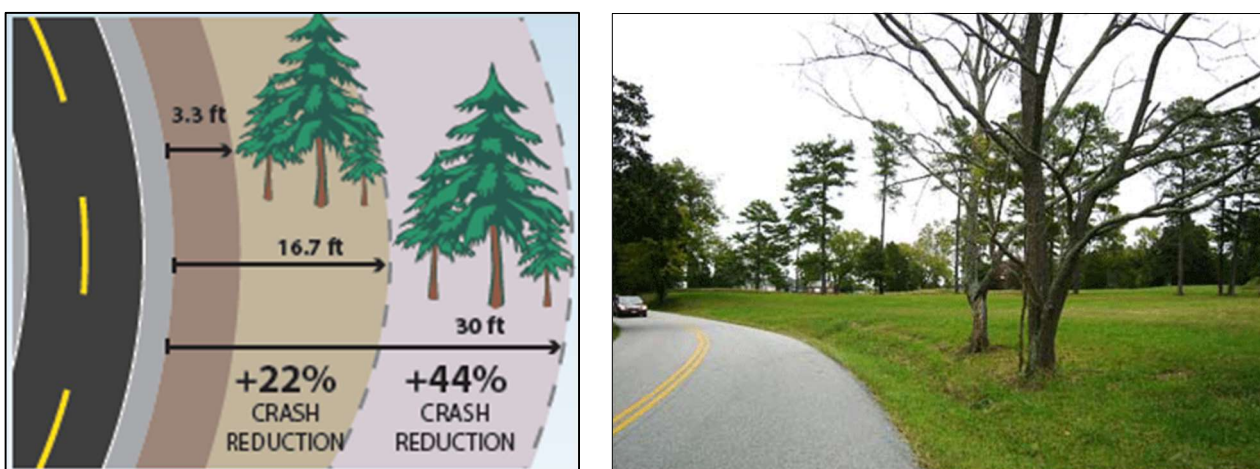
Planning-Level Cost Estimate: \$200-\$10,000 per object

Eligible for Federal Funding: Yes (90%)

Potential Effectiveness at Reducing Collision Frequency and/or Severity: CRF = 35%.

Brief Description: Removing or relocating roadside fixed objects such as utility poles, drainage, trees, or other fixed objects provides a clear recovery zone that allows drivers to correct their path of travel when they leave the roadway. This countermeasure is particularly effective outside of curves, along lane drops and in traffic islands where fixed object collisions are more common. A clear recovery zone should be developed in more rural context roadways, as space is available. The jurisdictions are only able to address sight obstructions within jurisdiction's right of way. Where public right of way is limited, steps should be taken to request assistance from property owners. An example of this countermeasure is shown in Figure 2.

Figure 2: Example of Removing or Relocating Fixed Object



Source: FHWA

Why was this selected for Fresno County?



Hit object collisions are among the top three collision types (21%) resulting in a fatality or severe injury. The most common primary contributing collision factor (23%) among fatal and severe injury collisions was *unsafe speed*¹. Removing or relocating fixed objects outside of a clear recovery zone would provide an opportunity for drivers to correct their path of travel and can proactively address a history of hit object collisions.

¹ Driving at a speed greater than is reasonable or prudent for given conditions.

Install Guardrail (R4)

Planning-Level Cost Estimate: Varies - \$9.50 - \$39 per linear foot of guardrail, depending on the posts and end flares used (Maryland, St. Mary's County, 2021).

Eligible for Federal Funding: Yes (100%)

Potential Effectiveness at Reducing Collision Frequency and/or Severity: CRF = 25%.

Brief Description: This countermeasure involves installing guardrails, to reduce the frequency and severity of lane departure collisions. These countermeasures are used to prevent vehicles from leaving the roadside and are particularly recommended at slopes steeper than 4:1 (AASHTO Green Book, 2011). This countermeasure is applicable at locations where striking the guardrail is less severe than going down an embankment or striking a fixed object. The guardrail can operate to deflect a vehicle back to the roadway, slow the vehicle down to a complete stop, or in certain circumstances, slow the vehicle down and then let it proceed past the guardrail. An example of this countermeasure is shown in Figure 3.

Figure 3: Example of a Guardrail



Source: FHWA

Why was this selected for Fresno County?



Hit object collisions are among the top three collision types (21%) resulting in a fatality or severe injury. The most common primary contributing collision factor (23%) among fatal and severe injury collisions was *unsafe speed*. Installing guardrail at appropriate locations would reduce the severity of hit-object collisions and provide an opportunity for the drivers to deflect vehicles back onto the roadway. Potential locations for installing this countermeasure should consider available right of way and costs of acquiring any additional right of way.

Install Raised Median (R8)

Planning-Level Cost Estimate: \$15,000 - \$30,000 per 100 feet of the roadway, depending on design, site conditions, and whether the median can be added as part of a utility improvement or capital improvement.

Eligible for Federal Funding: Yes (90%)

Potential Effectiveness at Reducing Collision Frequency and/or Severity: CRF = 25%.

Brief Description: This countermeasure involves adding new raised medians on roadways to control and restrict left-turn and U-turn movements on the roadways except at few designated locations. Adding raised medians can help reduce conflicts by restricting access-related movements to the roadway. The raised medians prohibit left turns into and out of driveways that may be located along the roadway and within the influence area of an intersection. In addition to preventing left-turns at minor driveways, the raised median reduces friction in the traffic stream by separating opposing traffic. An example of the countermeasure is shown in Figure 4.

Figure 4: Example of a Raised Median



Source: FHWA

Why was this selected for Fresno County?



This countermeasure was selected to Fresno County because *improper turning*² is among top three primary contributing collision factors for reported total (21%) and fatal and severe injury (23%) collisions. The safety benefits of restricting movements should be balanced with restrictions to business access and its associated impacts on commercial and retail areas.

² Turning from a direct course without reasonable safety or not signaling appropriately.

Road Diet (R14)**Planning-Level Cost Estimate:** \$6-\$10 per linear foot (changes to pavement markings only)**Eligible for Federal Funding:** Yes (90%)**Potential Effectiveness at Reducing Collision Frequency and/or Severity:** CRF = 30

Brief Description: Reduce the number of vehicle lanes on a roadway to manage vehicle speeds and reduce risk of crashes for all road users. A common road diet is to convert a four-lane undivided roadway to a three-lane cross-section, with one lane in each direction and a two-way center left turn lane. This enables space for bicycle lanes and sidewalks. An example three-lane cross-section, i.e. road diet is shown in. An example of a road diet is shown in Figure 5.

Figure 5: Example of Road Diet

Source: FHWA

Why was this selected for Fresno County?

This countermeasure was selected to Fresno County because head-on and hit object collisions are among the top five reported collision types. The most common primary contributing collision factor (23%) among fatal and severe injury collisions was *unsafe speed*. Performing a road diet would reduce motorists speeds, provide additional space for bicyclists and/or pedestrians, and help provide vehicular access for turning into and out of various driveways.

Widen Shoulder (R15)

Planning-Level Cost Estimate: \$10 per ft of added width per ft lane

Eligible for Federal Funding: Yes (90%)

Potential Effectiveness at Reducing Collision Frequency and/or Severity: CRF = 30%.

Brief Description: Widening the shoulder gives a driver who is in the travel way more time and space to correct and move back into the travel lane. It provides a buffer space from objects such as guardrails, trees, and signs, reducing the likelihood of hit object and run-off-road collisions. A paved shoulder, where available, provides a consistent road surface for recovery. If widening a shoulder by paving is not an option due to a restricted right of way or adjacent objects/trees, a shoulder could also be added or widened by striping edge lines and reducing the vehicular lane width. An example countermeasure is shown in Figure 6.

Figure 6: Example of the Countermeasure



Source: Google Maps

Why was this selected for Fresno County?



Hit object collisions are among the top three collision types (21%) resulting in a fatality or severe injury. The most common primary contributing collision factor (23%) among fatal and severe injury collisions was *unsafe speed*. Providing additional paved shoulder width can address areas with a history of hit object collisions and provide drivers with time to react and road surface to recover. Potential locations for installing this countermeasure should consider available right of way and costs of acquiring any additional right of way.

Improve Pavement Friction (High Friction Surface Treatment) (R21)

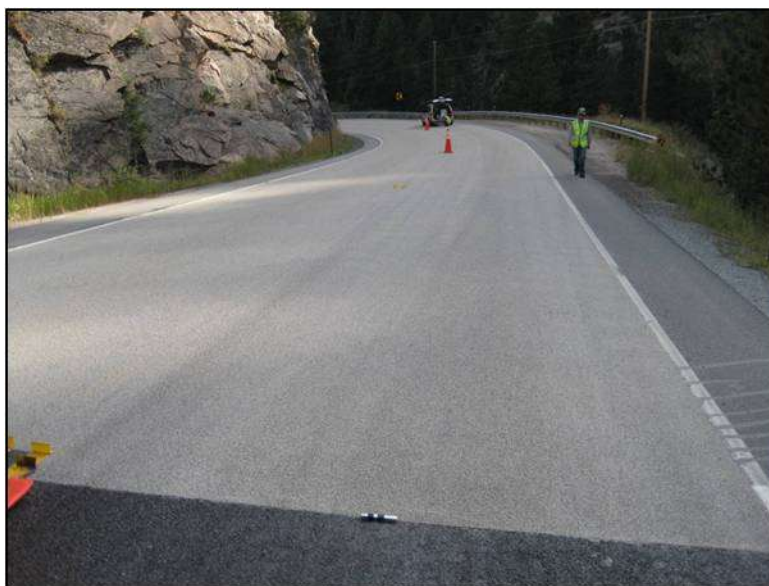
Planning-Level Cost Estimate: \$35 per square yard

Eligible for Federal Funding: Yes (100%)

Potential Effectiveness at Reducing Collision Frequency and/or Severity: CRF = 55%.

Brief Description: This countermeasure involves the application of very high-quality aggregate to the pavement using a polymer binder to restore and/or maintain pavement friction. Improving pavement friction or skid resistance gives a driver who is skidding more control and time to react. It is particularly effective in areas where pavement conditions contribute to collisions, such as wet pavement or inadequate pavement for posted roadway speeds; areas also include curves, loop ramps, and areas with short stopping distances. An example countermeasure application is shown in Figure 7.

Figure 7: Example High Friction Surface Treatment Application



Source: Utah Department of Transportation

Why was this selected for Fresno County?



These countermeasures may be considered when high frequencies of run-off road collisions related to a horizontal curve are identified or frequent hard-braking related collisions occur on intersection approaches. This countermeasure was selected to Fresno County because hit object collisions are among the top three collision types (21%) resulting in a fatality or severe injury. The most common primary contributing collision factor (23%) among fatal and severe injury collisions was *unsafe speed*. Improving pavement friction or introducing other high friction surface countermeasures would provide added resistance and improve recovery for drivers who depart the roadway.

Install/Upgrade Signs with New Fluorescent Sheeting (R22)**Planning-Level Cost Estimate:** \$500 per sign.**Eligible for Federal Funding:** Yes (100%)**Potential Effectiveness at Reducing Collision Frequency and/or Severity:** CRF = 15%.

Brief Description: This countermeasure involves installing and/or upgrading signs with fluorescent sheeting, which provides drivers with a visual warning of the presence of a specific roadway feature or regulatory requirement they may have missed with existing signs. This countermeasure is appropriate on roadway segments with a history of head-on, nighttime, non-intersection, run-off-road, and sideswipe collisions. This countermeasure should be installed in combination with additional countermeasures, such as installing or adding chevrons, warning signs, delineators, markers and beacons, and relocating existing signs. An example countermeasure is shown in Figure 8.

Figure 8: Example Countermeasure Application

Source: FHWA

Why was this selected for Fresno County?

This countermeasure was selected to Fresno County because hit object collisions are among the top three collision types (21%) resulting in a fatality or severe injury. The most common primary contributing collision factor (23%) among fatal and severe injury collisions was *unsafe speed*. Furthermore, collisions that occurred during dark conditions accounted for 32% of the total reported collisions and 44% of the reported fatal and severe injury collisions. Installing and/or upgrading signs with new fluorescent sheeting would provide drivers with increased awareness of changing roadway elements.

Install Dynamic/Variable Speed Warning Signs (R26)

Planning-Level Cost Estimate: \$2,000 - \$11,000 per sign, depending on whether it is solar powered or AC (Hallmark & Hawkins, 2014).

Eligible for Federal Funding: Yes (100%)

Potential Effectiveness at Reducing Collision Frequency and/or Severity: CRF = 30%

Brief Description: These countermeasures to address motorists traveling too fast around sharp curves. They provide a message to drivers exceeding a certain speed threshold (or posted speed limit). The intent of these countermeasures is to get drivers attention and provide them with a visual warning that they may be traveling over the recommended speed for the approaching curve. An example of this countermeasure is shown in Figure 9.

Figure 9: Example of Dynamic Speed Warning Sign



Source: Center for Transportation Research and Education, Iowa State University

Why was this selected for Fresno County?



This countermeasure was selected to Fresno County because hit object collisions are among the top three collision types (21%) resulting in a fatality or severe injury. The most common primary contributing collision factor (23%) among fatal and severe injury collisions was *unsafe speed*. Providing appropriate signing can address curve-related collisions which often result in hit object or run-off-road collisions.

Install Edgelines and Centerlines (R28)

Planning-Level Cost Estimate: \$4 per linear foot.

Eligible for Federal Funding: Yes (100%)

Potential Effectiveness at Reducing Collision Frequency and/or Severity: CRF = 25%.

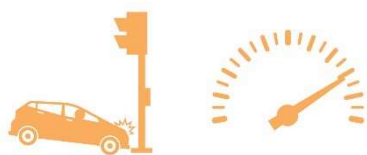
Brief Description: This countermeasure consists of installing or modifying edgelines and centerlines, which helps clarify and increase visibility of the road and lane boundaries. These countermeasures help drivers who may depart the roadway or travel lane. Additional enhancements can improve visibility, including thermoplastic application with audible disks or bumps, or raised/reflective pavement markers. An example countermeasure is shown in Figure 10.

Figure 10: Example of Road with Edge-lines and Centerlines



Source: FHWA

Why was this selected for Fresno County?



These countermeasures may be considered when high frequencies of run-off-road collisions related to a horizontal curve are identified and the roadway is not defined through edge-lines or centerlines (or may benefit from adjustments to the existing striping). This countermeasure was selected to Fresno County because hit object collisions are among the top three collision types (21%) resulting in a fatality or severe injury. The most common primary contributing collision factor (23%) among fatal and severe injury collisions was *unsafe speed*. Installing edgelines and centerlines would provide positive guidance for drivers to stay within the travel lane and roadway.

Install Centerline Rumble Strips/Stripes (R30)

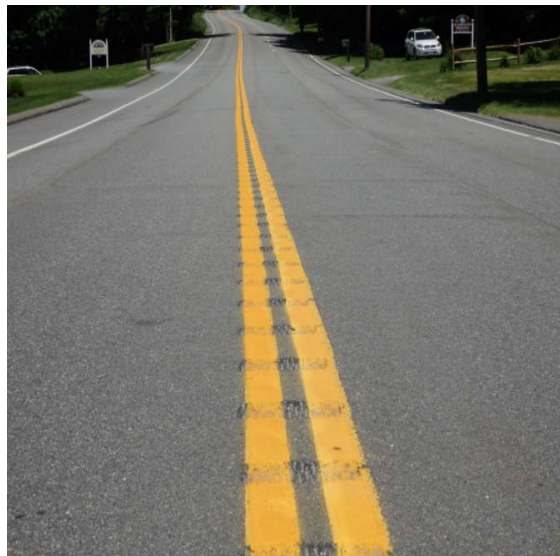
Planning-Level Cost Estimate: \$0.30 per centerline foot (NYDOT, 2021)

Eligible for Federal Funding: Yes (100%)

Potential Effectiveness at Reducing Collision Frequency and/or Severity: CRF = 20%.

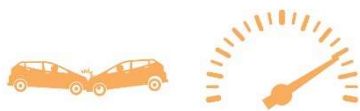
Brief Description: This countermeasure involves installing centerline rumble strips to alert drivers who are drifting out of their travel lane before they cross the centerline, giving them time to correct and stay in their lane. Centerline rumble strips are grooves within the double yellow centerline that provide driver with both an audible warning (rumbling sound) and a physical vibration when a vehicle meets them. They are relatively easy to install and have an additional benefit of helping drivers navigate during poor weather conditions such as fog and rain. An example of the countermeasure is shown in Figure 11.

Figure 11: An Example Countermeasure Application



Source: Connecticut Department of Transportation

Why was this selected for Fresno County?



within the travel lane.

This countermeasure was selected to Fresno County because head-on and sideswipe collisions are among the top five reported collision types. The most common primary contributing collision factor (23%) among fatal and severe injury collisions was *unsafe speed*. Installing centerline rumble strips/stripes would provide positive guidance for drivers to stay

Install Edgeline Rumble Strips/Stripes (R31)

Planning-Level Cost Estimate: \$10 per linear foot

Eligible for Federal Funding: Yes (100%)

Potential Effectiveness at Reducing Collision Frequency and/or Severity: CRF= 15%.

Brief Description: Edgeline rumble strips alert drivers who are drifting out of their travel lane before they depart the roadway, giving them time to correct and stay in their lane. The Caltrans Local Roadway Safety Manual recommends installing rumble strips along an entire corridor, instead of in intermittent spots. Rumble *stripes*—so called when the pavement marking is in the rumble strip—provide enhanced marking in wet or dark conditions. An example of this countermeasure is shown in Figure 12.

Figure 12: An Example Edgeline Rumble Strip Application



Source: FHWA

Why was this selected for Fresno County?



This countermeasure was selected to Fresno County because hit object collisions are among the top three collision types (21%) resulting in a fatality or severe injury. The most common primary contributing collision factor (23%) among fatal and severe injury collisions was *unsafe speed*. Installing edgeline rumble strips/stripes would provide positive guidance for drivers to stay within the travel lane and roadway.

However, despite the vehicular safety benefit of edgeline rumble strips, they create additional challenges for people bicycling. Strategic placement of rumble strips is important in order to balance the safety affects for motorists and bicyclists. Agencies shall consider adjusting rumble strip dimensions, location, and offset to better accommodate bicyclists.

Convert Intersection to Roundabout (from signal) (S16)

Planning-Level Cost Estimate: \$4,000,000 - \$8,000,000 per intersection

Eligible for Federal Funding: Yes (100%)

Potential Effectiveness at Reducing Collision Frequency and/or Severity: CRF = 35-67%

Brief Description: Roundabouts are a form of intersection control that have fewer conflict points in comparison to conventional intersections. Moreover, the types of conflicts that occur at roundabouts are different from those occurring at conventional intersections. The layout of a roundabout forces drivers to reduce speeds as they proceed through the intersection. Reducing vehicular speeds helps reduce the severity of crashes when they occur. Additionally, roundabouts reduce the potential for pedestrian conflicts as people walking only need to cross one direction of traffic.

Figure 13: Example of Single Lane Roundabout



Source: FHWA

Why was this selected for Fresno County?



This countermeasure was selected for Fresno County because broadside collisions are among the top three collision types (26% of the reported collisions) resulting in a fatality or severe injury. The most common primary contributing collision factor (23%) among fatal and severe injury collisions was *unsafe speed*. Controlling movements and reducing the number of conflicting turning movements would reduce the overall quantity and severity of crashes.

Install Dynamic Regulatory Speed Warning Signs

Planning-Level Cost Estimate: \$2,000 - \$11,000 per sign, depending on whether it is solar powered or AC (Hallmark & Hawkins, 2014).

Eligible for Federal Funding: No

Potential Effectiveness at Reducing Collision Frequency and/or Severity: N/A

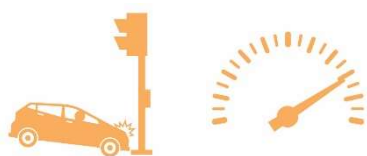
Brief Description: These countermeasures are used to reduce motorist speeds in urban and suburban areas. They provide a message to drivers exceeding a certain speed threshold (or posted speed limit) in urban areas. The intent of these countermeasures is to get drivers attention and provide them with a visual warning that they may be traveling over the recommended speed on the roadway. An example of this countermeasure is shown in Figure 14.

Figure 14: Example of Dynamic Regulatory Warning Sign



Source: City of Bellevue Transportation Department

Why was this selected for Fresno County?



This countermeasure was selected to Fresno County because hit object collisions are among the top three collision types (21%) resulting in a fatality or severe injury. The most common primary contributing collision factor (23%) among fatal and severe injury collisions was *unsafe speed*. Providing appropriate signing can address speed-related collisions in the urban areas.

Install Variable Message Signs

Planning-Level Cost Estimate: \$8,000 - \$30,000 per sign, depending on the technology, data, and sensors used.

Eligible for Federal Funding: No

Potential Effectiveness at Reducing Collision Frequency and/or Severity: CRF = 17% (USDOT ITS, 2018)

Brief Description: Variable message signs (VMS) are electronic roadside signs used to post traveler information messages to inform drivers of collisions, travel times, detours, special events, weather conditions, road construction, and other useful road conditions or travel information. They are especially useful to display in advance of locations where travelers must take action or make route choice decisions. An example of this countermeasure is shown in Figure 15.

Figure 15: Example of Variable Message Sign



Source: Mobile VMS

Why was this selected for Fresno County?

These countermeasures can be installed at locations where travelers routinely need information or before locations where travelers must make a routing decision. They can be particularly useful during roadway construction, weather conditions such as fog or rain, and special events to provide information about temporary conditions to travelers. This countermeasure was selected for Fresno County because collisions cited to have occurred under or during fog conditions show an increase in the winter months (November through February) in the existing conditions report.

INTERSECTION COUNTERMEASURES

Add Intersection Lighting at Intersections (S1/NS1)

Planning-Level Cost Estimate: \$7,000 - \$10,000 per light

Eligible for Federal Funding: Yes (100%)

Potential Effectiveness at Reducing Collision Frequency and/or Severity: CRF = 40%. Collision reduction only applies to nighttime collisions occurring within the influence area of the intersection.

Brief Description: This countermeasure involves installing or modifying lighting at signalized or unsignalized intersections. This is done to improve the visibility of non-motorized users to drivers and reduce potential conflicts and collisions. Illuminating crosswalks helps make pedestrians visible for approaching drivers and assists pedestrians in navigating the crossing. An example of the countermeasure is shown in Figure 16.

Figure 16: Example of Lighting at Intersection



Source: Kittelson & Associates, Inc.

Why was this selected for Fresno County?



This countermeasure was selected for Fresno County because darkness was a factor in 32% of reported total collisions and 44% of reported fatal and severe injury collisions. Out of the 318 reported fatal collisions that occurred in the dark, 168 occurred where there were either no streetlights or streetlights were reported not to be functioning.

Increased visibility would contribute to pedestrian, bicycle, and motorist safety, allowing drivers to more easily see non-motorized users.

Improve Signal Hardware - Lenses, Backplates with Retroreflective Border, Mounting Size, Number (S2)

Planning-Level Cost Estimate: \$6,000 - \$12,000 per intersection (VDOT, 2018).

Eligible for Federal Funding: Yes (100%)

Potential Effectiveness at Reducing Collision Frequency and/or Severity: CRF = 15%. Collision reduction only applies to collisions occurring on approaches and within the influence area of the intersections (usually within the 250 feet of the intersection) where this countermeasure has been applied.

Brief Description: This countermeasure improves the visibility of the illuminated face of the traffic signal by introducing a controlled-contrast background. Signal heads with backplates equipped with retroreflective borders or larger signal heads are more visible in daytime and nighttime conditions, and help drivers become aware of the upcoming signalized intersections. This countermeasure is more effective when it is adopted as a standard countermeasure for signalized intersections across the town or jurisdiction (FHWA, 2018). An example of the countermeasure is shown in Figure 17.

Figure 17: Example of Signal Backplate Framed with a Retroreflective Border



Source: FHWA, 2018

Why was this selected for Fresno County?



This countermeasure was selected for Fresno County because broadside collisions are among the top three collision types (26% of the reported collisions) resulting in a fatality or severe injury. Making intersections more visible, particularly for drivers traversing larger signalized intersections would help promote driver compliance at intersections.

Provide Advanced Dilemma-Zone Detection (S4)

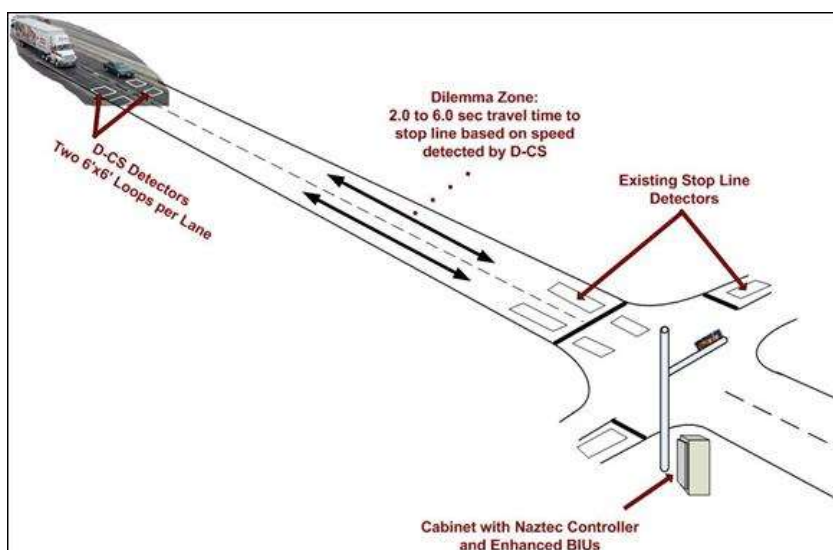
Planning-Level Cost Estimate: \$5,000 - \$25,000 per approach depending on whether hardware modifications are necessary beyond the detection system.

Eligible for Federal Funding: Yes (100%)

Potential Effectiveness at Reducing Collision Frequency and/or Severity: CRF = 40%.

Brief Description: This countermeasure consists of adding new advance detection and signal hardware to detect vehicles that may approach the intersection in the “dilemma zone” of deciding whether to stop or proceed during a yellow phase. The detection system modifies the signal timing to reduce the numbers of drivers needing to make this decision and the potential for conflicts due to phase changes. It is most effective on high-speed approaches. Figure 18 shows an example layout of advanced dilemma zone detection at an intersection.

Figure 18: Example Layout of Dilemma Zone Detection



Source: FHWA

Why was this selected for Fresno County?

This countermeasure was selected for Fresno County because rear-end collisions account for 27% of the total reported collisions in the County. This countermeasure can help reduce conflicts due to late-entering vehicles proceeding through the intersection or conflicts arising from hard-stopping vehicles due to dilemma of whether to proceed or stop during the yellow phase of a signal. These countermeasures may be considered when high frequencies of collisions involve hard-stopping vehicles resulting in rear-end collisions, or there is a pattern of collisions related to late-entering vehicles or vehicles running red lights.

Install Flashing Beacons as Advance Warning (S10/NS9)

Planning-Level Cost Estimate: \$5,000 - \$25,000 depending on the site conditions and type of device.

Eligible for Federal Funding: Yes (100%)

Potential Effectiveness at Reducing Collision Frequency and/or Severity: CRF = 30%

Brief Description: This countermeasure consists of installing flashing beacons as advance warnings on intersection approaches, that will increase driver's awareness of the upcoming traffic control in order to comply timely. These signs are equipped with one or more yellow flashing beacons or LED lights and they increase the awareness of the traffic signal or stop sign presence at the intersection and will reduce the drivers' non-compliance with traffic control at any intersection. It is most effective on high-speed approaches. An example of the countermeasure is shown in Figure 19.

Figure 19: Example of Flashing Beacons or LED Lights as Advance Warning to Intersection



Source: Sonoma County, OKSolar

Why was this selected for Fresno County?

This countermeasure was selected for Fresno County *because unsafe speed* is one of the three top primary collision contributing factors (23% of the reported collisions) resulting in a fatality or severe injury. Additionally, rear-end collisions accounted for 27% of the total reported collisions in the County and broadside collisions are among the top three collision types (26%) resulting in a fatality or severe injury. This countermeasure can help reduce collisions that have occurred due to drivers' not being able to perceive the intersection, signal head, stop sign presence, or the back of a stopped queue in time to react.

No Right-Turn on Red

Planning-Level Cost Estimate: \$500 - \$5,000 (per approach)

Eligible for Federal Funding: No

Potential Effectiveness at Reducing Collision Frequency and/or Severity: 7% (CMF Clearing House, 2009).

Brief Description: This countermeasure prohibits vehicles from turning right when pedestrians have the right-of-way to cross the adjacent street. In combination with thoughtful signal phasing, this can reduce or eliminate the conflict of turning-vehicles and pedestrians crossing the street. The no right-turn on red may be a dynamic restriction that occurs only when the pedestrian push button is activated. An example of an intersection with right-turn-on-red prohibited is shown in Figure 20.

Figure 20: Example of No Right-Turn on Red



Source: Flickr, 2018

Why was this selected for Fresno County?



This countermeasure was selected to encourage motorists to stop at the red light. This was recommended in areas where the drivers have been observed and reported as not yielding to pedestrians and/or bicyclists crossing the intersection approach to the motorists' right, resulting in collisions and/or near-misses with people attempting to cross the street.

Install/Upgrade Stop Signs or Intersection Warning/Regulatory Signs (NS6)

Planning-Level Cost Estimate: \$450 - \$1,020 per sign, assuming a 7' signpost (VDOT, 2018).

Eligible for Federal Funding: Yes (100%)

Potential Effectiveness at Reducing Collision Frequency and/or Severity: CRF = 15%.

Brief Description: This countermeasure involves installing larger stop, warning or regulatory signs at or in advance of an intersection, which improves the sign visibility and increases drivers' awareness at intersections and/or intersection approaches. An example of a large stop sign is shown in Figure 21. The effectiveness of this strategy is greatest when implementation involves a combination of regulatory and warning signs appropriate for the conditions at an unsignalized intersection approach.

Figure 21: Example of a Stop Sign



Source: South Carolina DOT

Why was this selected for Fresno County?

Broadside collisions are among the top three collision types (26%) resulting in a fatality or severe injury and have occurred primarily at unsignalized intersections. Making intersections more visible would help promote driver compliance at intersections.

Upgrade Intersection Pavement Markings (NS7)

Planning-Level Cost Estimate: \$500 - \$5,000 per approach

Eligible for Federal Funding: Yes (100%)

Potential Effectiveness at Reducing Collision Frequency and/or Severity: CRF = 25%.

Brief Description: This countermeasure consists of adding or upgrading pavement markings at and on the approach to an unsignalized intersection. Upgrades to intersection pavement markings include "stop ahead" markings and the addition of centerlines and stop bars for stop-controlled approaches. Providing visible stop bars and clearer lane delineation on minor road approaches to unsignalized intersections can help increase the visibility of the intersection for approaching drivers as well as reducing potential conflicts by clarifying the footprint of the intersection. An example of the countermeasure is shown in Figure 22.

Figure 22: Example Pavement Markings at an Intersection



Source: Kittelson & Associates, Inc.

Why was this selected for Fresno County?



Broadside collisions are among the top three collision types (26%) resulting in a fatality or severe injury and have occurred primarily at unsignalized intersections. Making intersections more visible would help promote driver compliance at intersections.

Install Splitter Islands for Minor Street Approaches (NS 13)

Planning-Level Cost Estimate: \$10,000 per approach.

Eligible for Federal Funding: Yes (90%)

Potential Effectiveness at Reducing Collision Frequency and/or Severity: CRF = 40%.

Brief Description: This countermeasure consists of adding a raised median island at minor street intersection approaches. These islands create a physical separation between vehicles turning onto the stop-controlled approach and vehicles stopped on that same approach. The splitter island also increases the visibility of the intersection, clarifies movements at the intersection, and provides a space for a secondary stop sign on the approach, if needed. Splitter islands should be designed to accommodate appropriate design vehicles while still being large enough to be visible to drivers and provide a refuge area for crossing pedestrians. The example splitter island is shown in Figure 23.

Figure 23: Example of Splitter Island



Source: Mid-Ohio Regional Planning Commission

Why was this selected for Fresno County?



Broadside collisions are among the top three collision types (26%) resulting in a fatality or severe injury and have occurred primarily at unsignalized intersections. These countermeasures may be considered when high frequencies of collisions are related to conflicting movements resulting from movements onto or off minor street approaches. Making intersections more visible would help promote driver compliance at intersections.

PEDESTRIAN AND BICYCLE COUNTERMEASURES

Install Bike Lanes (R32 PB)

Planning-Level Cost Estimate: \$10 per ft

Eligible for Federal Funding: Yes (90%)

Potential Effectiveness at Reducing Collision Frequency and/or Severity: CRF = 35%. Collision reduction only applies to pedestrian and bicycle collisions occurring within the influence area of the intersection.

Brief Description: This countermeasure designates a portion of roadway for the preferential or exclusive use of bicyclists through striping, signage, and pavement markings. Bike lanes typically run in the same direction of traffic, though they may be configured in the contra-flow direction on low-traffic corridors for the connectivity of a particular bicycle route. Buffered bike lanes provide greater separation from an adjacent traffic lane or on-street parking by using painted chevrons or diagonal markings. Buffered bike lanes may be desirable on streets with higher vehicle speeds or volumes. An example of the countermeasure is shown in Figure 24.

Figure 24: Example of Buffered Bike Lane



Source: Kittelson & Associates, Inc.

Why was this selected for Fresno County?



This countermeasure was selected for Fresno County because bicycle fatal and severe injury collisions (6%) are overrepresented for signalized and unsignalized intersections. There is presence of wrong-way riding³ behavior by bicyclists in this region, which is another factor to consider this type of countermeasure. The use of bike lanes helps bicyclists to ride at their preferred speed without interference from prevailing traffic conditions and facilitates predictable behavior and movements between motorists and bicyclists.

³ This may indicate wrong-way or sidewalk riding by bicyclists where bike facilities are not present.

Install Sidewalk/Pathway (R34 PB)**Planning-Level Cost Estimate:** \$25 per ft**Eligible for Federal Funding:** Yes (90%)**Potential Effectiveness at Reducing Collision Frequency and/or Severity:** CRF = 80%. Collision reduction only applies to pedestrian and bicycle collisions occurring within the influence area of the intersection.**Brief Description:** This countermeasure provides a separate, protected space for pedestrians to walk along the roadway. It helps to increase comfort, increase visibility of pedestrians to motorists, and can help prevent vehicles from departing the roadway and striking pedestrians. Additionally, installing sidewalks—particularly when providing access to public transit—can increase the transportation options for individuals who may not be able to drive a car. The presence of sidewalks on both sides of the street has been found to reduce the collision risks associated with pedestrians walking along the roadways as compared to locations where no sidewalks or walkways exist. An example of the countermeasure is shown in Figure 25.**Figure 25: Example of Sidewalk**

Source: FHWA

Why was this selected for Fresno County?

Pedestrians walking in road⁴ is one of the top contributing factors (21% of the reported total collisions) associated with pedestrian collisions. Installing sidewalks would provide pedestrians with a dedicated space for travel separated from vehicle travel lanes. Additionally, by moving pedestrians off the travel lanes, motorist operations are improved and capacity increased.

⁴ This may indicate a pedestrian walking on a roadway on the right-hand or left-hand edge of the roadway.

Install/Upgrade Pedestrian Crossing with Enhanced Features (R35 PB)**Planning-Level Cost Estimate:** \$60,000 - \$160,000 per crossing**Eligible for Federal Funding:** Yes (90%)**Potential Effectiveness at Reducing Collision Frequency and/or Severity:** CRF = 35%.

Brief Description: This countermeasure involves installing pedestrian crossings with enhanced safety features such as high-visibility crosswalk markings, curb extensions, raised medians, beacons, and lighting to delineate the portion of the roadway to be used by crossing pedestrians. The features help indicate preferred locations for pedestrians to cross and increase the visibility of a crossing location. These countermeasures increase both pedestrian and driver awareness and help reinforce drivers' requirement to yield the right-of-way to crossing pedestrians.

The enhanced improvements added to the crossing also increase the likelihood that pedestrians will cross at a location visible to and predictable for motorists. They are useful in aligning pedestrian behavior with driver expectations at mid-block crossings. Guidance signs and markings should be used in combination with the enhanced pedestrian crossing to guide pedestrians and bicyclists along appropriate travel paths. An example of the countermeasure is shown in Figure 26.

Figure 26: Example of Curb Extensions and Enhanced Pedestrian Crossing

Source: Google Maps, Toole Design Group

Why was this selected for Fresno County?

This countermeasure was selected for Fresno County because vehicle-pedestrian collisions accounted for 3% of the total reported collisions. Pedestrians crossing out of crosswalk⁵ is the top contributing factor (40% of the reported fatal and severe injury collisions) associated with pedestrian collisions. Installing enhanced mid-block pedestrian crossings would warn drivers to expect pedestrian and bicycle crossings and clarify that drivers must yield right of way to pedestrians and bicyclists in marked and unmarked crossings.

⁵ This indicates a pedestrian crossing a roadway outside of a marked or unmarked crosswalk at an intersection.

Install Pedestrian Countdown Signal Heads (S17 PB)

Planning-Level Cost Estimate: \$1,800 per signal head

Eligible for Federal Funding: Yes (100%)

Potential Effectiveness at Reducing Collision Frequency and/or Severity: CRF = 25%. Collision reduction only applies to pedestrian and bicycle collisions occurring within the influence area of the intersection.

Brief Description: This countermeasure involves installing pedestrian countdown signal heads that contain a timer display and counts down the remaining number of seconds 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 push button rather than cross illegally. An example of the countermeasure is shown in Figure 27.

Figure 27: Example of Pedestrian Countdown Signal Head at an Intersection



Source: Toole Design Group

Why was this selected for Fresno County?



Pedestrians crossing out of crosswalk is the top contributing factor (40% of the reported fatal and severe injury collisions) associated with pedestrian collisions. Installing pedestrian countdown signals would inform pedestrians of the remaining time allocated for them to cross the street during their phase of the traffic signal.

Install Pedestrian Crossing (S18 PB/NS 20 PB)**Planning-Level Cost Estimate:** \$2,500 - \$8,000 per crossing**Eligible for Federal Funding:** Yes (100%)**Potential Effectiveness at Reducing Collision Frequency and/or Severity:** CRF = 25%. Collision reduction only applies to pedestrian and bicycle collisions occurring within the influence area of the intersection.**Brief Description:** This countermeasure involves installing pedestrian crossings at intersections to improve pedestrian and bicycle safety by designating a portion of the roadway for pedestrian and bicycle crossing. This helps reduce pedestrian-related collisions within 50 feet of an intersection. High-visibility crosswalk markings, pedestrian countdown signals, and appropriate signs will alert drivers and enhance pedestrian and bicycle safety at pedestrian crossings. Incorporating advance yield lines provides an extra safety buffer and can be effective in reducing multiple-threat danger to pedestrians. An example of the countermeasure is shown in Figure 28.**Figure 28: Example of Pedestrian Crossing at an Intersection**

Source: Toole Design Group

Why was this selected for Fresno County?

This countermeasure was selected for Fresno County because vehicle-pedestrian fatal and severe injury collisions (17%) are overrepresented for signalized and unsignalized intersections. Signalized intersections tend to be the intersections with the greatest concentration of road user activity (higher vehicle volumes to warrant a signal, where people tend to go to cross the street) so the presence of conflicts between modes is greater at signalized intersections. Reducing and managing those conflicts through signal phasing adjustments and designating separate space for each mode helps to reduce collision risk. Pedestrian crossing signs and markings at uncontrolled intersections warn drivers to expect pedestrian and bicycle crossings and clarify that drivers must yield right of way to crossing pedestrians and bicyclists.

Modify Signal Phasing to Implement a Leading Pedestrian Interval (S21 PB)

Planning-Level Cost Estimate: \$550 - \$6,000 including countdown timer, controller, signal head, and software upgrade.

Eligible for Federal Funding: Yes (100%)

Potential Effectiveness at Reducing Collision Frequency and/or Severity: CRF = 60%. Collision reduction only applies to pedestrian and bicycle collisions occurring within the influence area of the intersection.

Brief Description: This countermeasure involves implementing leading pedestrian interval (LPI) which improves drivers' awareness of pedestrians at intersections. LPIs provide pedestrians a head start when crossing at a signalized intersection. LPIs can be easily programmed into existing signals to give pedestrians the "Walk" signal a minimum of 3 to 7 seconds before motorists are given a green indication. With this head start, pedestrians can better establish their presence in the crosswalk before motorists have priority to turn left at the intersection. LPIs can be provided automatically with each phase or provided only when actuated (actively or passively). An example of the countermeasure is shown in Figure 29.

Figure 29: Example of a Leading Pedestrian Interval



Source: PedBikeInfo

Why was this selected for Fresno County?



This countermeasure was selected for Fresno County because vehicle-pedestrian fatal and severe injury collisions (17%) are overrepresented for signalized and unsignalized intersections. These countermeasures may be considered at signalized intersections, specifically at intersections with medium to high motor vehicle turning volumes and pedestrian volumes.

Install Pedestrian Refuge Islands (NS19 PB)**Planning-Level Cost Estimate:** \$120 per ft.**Eligible for Federal Funding:** Yes (90%)**Potential Effectiveness at Reducing Collision Frequency and/or Severity:** CRF = 45%. Collision reduction only applies to pedestrian and bicycle collisions occurring within the influence area of the intersection.**Brief Description:** This countermeasure involves adding new raised median on the approaches to intersections to control and restrict movements from access points on the approach to an intersection. Raised medians with pedestrian refuge islands are roadway countermeasures designed to provide dedicated areas for pedestrians and bicyclists between vehicle travel lanes at intersections and mid-block locations. They must have a minimum width of 6 feet to meet pedestrian accessibility requirements. To provide bicyclists refuge and to accommodate larger groups of pedestrians, the minimum should be increased to 8 feet.

This countermeasure improves the safety for pedestrians and bicyclists by reducing crossing distances and creating a place of refuge to allow multiple-stage crossings. They are particularly beneficial at uncontrolled crossings, large signalized crossings, or complex intersections where people may have difficulty completing crossings. An example of the countermeasure is shown in Figure 30.

Figure 30: Example of a Raised Median

Source: FHWA

Why was this selected for Fresno County?

This countermeasure was selected for Fresno County because vehicle-pedestrian fatal and severe injury collisions (17%) are overrepresented for signalized and unsignalized intersections. The primary collision factor is often listed as pedestrian violation, which can indicate the need for improved pedestrian crossings. These countermeasures would provide a space for pedestrians to wait during multiple-stage crossings.

Install/Upgrade Pedestrian Crossing at Uncontrolled Locations (with Enhanced Safety Features) (NS21 PB)

Planning-Level Cost Estimate: \$60,000 - \$160,000 each.

Eligible for Federal Funding: Yes (100%)

Potential Effectiveness at Reducing Collision Frequency and/or Severity: CRF = 35%. Collision reduction only applies to pedestrian and bicycle collisions occurring within the influence area of the intersection.

Brief Description: Enhanced pedestrian crossing countermeasures are for uncontrolled, marked crosswalks that cross multilane arterials or collectors. The enhanced crossing alerts the drivers of crossing pedestrian by way of high visibility markings, warning signs, flashing beacons, and by providing pedestrian refuge islands.

In particular, rectangular rapid flashing beacons (RRFB) have been shown to significantly increase driver yielding behavior at uncontrolled crosswalks, with driver yield rates ranging from 34% to over 90%. Studies have also associated RRFBs with reduced pedestrian-vehicle conflicts, increased stopping distance, and reductions in the number of pedestrians trapped in roadway (Thomas et al. 2016). These safety benefits likely extend to bicyclists crossing at RRFB locations. RRFBs are generally more appropriate at two-lane locations, whereas pedestrian hybrid beacons (PHB) are best suited to higher-speed or multi-lane contexts or locations with limited sight distance. An example of the countermeasure is shown in Figure 31.

Figure 31: Example of Enhanced Pedestrian Crossing



Source: Washington County, NACTO

Why was this selected for Fresno County?



This countermeasure was selected for Fresno County because vehicle-pedestrian fatal and severe injury collisions (17%) are overrepresented for signalized and unsignalized intersections. Installing enhanced pedestrian crossings at uncontrolled intersections can help increase drivers' yielding behavior and reduce the risk of pedestrian and bicycle collisions.

Bike Lane Extension Through Intersections

Planning-Level Cost Estimate: Varies - \$200 - \$5,000 per intersection depending on the surface area of markings, materials used, and the color of markings.

Eligible for Federal Funding: No

Potential Effectiveness at Reducing Collision Frequency and/or Severity: CRF = 39% (ODOT, 2021).

Brief Description: Bicycle pavement markings through intersections indicate the intended path of bicyclists through an intersection. They guide bicyclists on a safe and direct path through the intersection and provide clear boundary between paths of bicyclists and motorists. This countermeasure reinforces that the through bicyclists have priority over turning motor vehicles. An example of the countermeasure is shown in Figure 32.

Figure 32: Example of Bike Lane Extension Through Intersection



Source: Kittelson & Associates, Inc.

Why was this selected for Fresno County?



This countermeasure was selected for Fresno County because bicycle fatal and severe injury collisions (6%) are overrepresented for signalized and unsignalized intersections. High visibility bike lane markings are intended to provide notice to drivers and bicyclists of areas where the two may come into conflict. Since the effectiveness of markings depends entirely on their visibility, maintaining markings should be a priority where this countermeasure is considered.

Bike Boxes

Planning-Level Cost Estimate: \$5,000 per box, including green thermoplastic, pavement markings and signage.

Eligible for Federal Funding: No

Potential Effectiveness at Reducing Collision Frequency and/or Severity: CRF = 35% (ODOT, 2021).

Brief Description: This countermeasure involves installing a bike box, which is a designated area at the head of the traffic lane at a signalized intersection. This is to provide bicyclists with a safe and visible way to get ahead of the motor vehicle queuing traffic during the red signal phase. Bike boxes increase the visibility of bicyclists at an intersection and helps prevent right-hook or left-hook conflicts with turning motor vehicles at the start of the green indication. An example of the countermeasure is shown in Figure 33.

Figure 33: Example of Bike Box



Source: NACTO

Why was this selected for Fresno County?



This countermeasure was selected for Fresno County because bicycle fatal and severe injury collisions (6%) are overrepresented for signalized and unsignalized intersections. Bike boxes are intended to provide notice to drivers and bicyclists of areas where the two may come into conflict at intersections. Additionally, bike boxes allow for a better accommodation of right and left turning bicycle traffic.

NON-ENGINEERING STRATEGIES

In addition to the engineering countermeasures outlined above, Kittelson identified the following education, enforcement, and emergency services strategies to further support efforts to reduce collisions across the County.

EDUCATIONAL STRATEGIES

Toole Design Group is actively working on creating a comprehensive transportation safety education program for the region as part of the work under Task 5. The final safety education program will be incorporated into the Regional Safety Plan.

ENFORCEMENT STRATEGIES

Even when engineering countermeasures are implemented, road users failing to adhere to traffic laws can result in collisions of varying severity. Police enforcement can increase driver awareness and consequently reduce traffic collisions. Potential enforcement strategies to address collision patterns and trends in Fresno County are presented below.

For enforcement strategies to be effective at improving overall safety within a community, it is important that enforcement of traffic laws be done equitably and with sensitivity toward communities where there may be limited rapport with law enforcement. Enforcement strategies should be undertaken with due caution to avoid inequitable enforcement activities and evaluated to determine the strategy's impact. The following considerations can help lead to more successful outcomes for roadway safety enforcement strategies:

- Appropriately train police officers and periodically refresh police officers' training related to enforcement activities.
- Incorporate social equity considerations in camera placement for automated enforcement such as red-light running cameras.
- Dedicate some portion of enforcement revenue towards funding for outreach and engagement with community groups around roadway safety.
- Tailor enforcement campaigns to suit the needs of different neighborhoods and demographics and incorporate education as part of those campaigns.
- Conduct enforcement with the help of staff support and awareness of the courts.
- Use warnings and flyers before moving on to issuing citations.

Collision data can help identify priority intersections and/or road segments and the times of the day when certain behaviors may be more prevalent. This information can inform and guide the type of enforcement strategy to be selected at the most appropriate locations and time periods. The COG or local agency staff can also help monitor the impact of the enforcement strategy by coordinating with the respective agency's Police Department to obtain and analyze enforcement records to help evaluate effectiveness and equity considerations.

Progressive Ticketing

Progressive ticketing is a method for introducing ticketing through a three-staged process. Issuing tickets is the strongest strategy of an enforcement program and it is usually reserved for changing unsafe

behaviors that other strategies failed to change or that pose a real threat to the safety of road users. There are three main steps of an effective progressive ticketing program:

1. **Educating** - Establish community awareness of the problem. The public needs to understand that drivers are speeding and the consequences of this speeding for road safety. Raising awareness about the problem will change some behaviors and create public support for the enforcement efforts to follow.
2. **Warning** - Announce what action will be taken and why. Give the public time to change behaviors before ticketing starts. Fliers, signs, newspaper stories and official warnings from officers can all serve as reminders.
3. **Ticketing** – After the “warning” period, hold a press conference announcing when and where the police operations will occur. If offenders continue their unsafe behaviors, officers issue tickets.

Speed Trailers

Portable speed trailers visually display a driver’s real-time speed compared to the speed limit and may be effective at reducing speeds and increasing awareness of local speed limits. Portable speed trailers are most effective when the trailer flashes “SLOW DOWN” or flashes a bright white light that mimics a photo speed camera or a blue and red light that mimics a police car when drivers are moving too fast. In some cases, back-up speed enforcement by officers may be needed when radar speed trailers are used.

Speed Enforcement in School Zones

Strict enforcement of speed laws in school zones is one law enforcement tool that can improve the safety for children walking and bicycling to school as well as drivers. A ‘zero tolerance’ policy for speeders in school zones and even an increase in fines for drivers who violate the posted school zone speed limit are potential approaches.

High Visibility Saturation Patrols

A saturation patrol (also called a blanket patrol or dedicated DWI patrol) consists of many law enforcement officers patrolling a specific area to look for drivers who may be impaired. These patrols usually take place at times and locations where impaired driving collisions commonly occur. Like publicized sobriety checkpoint programs, the primary purpose of publicized saturation patrol programs is to deter driving after drinking by increasing the perceived risk of arrest.

EMERGENCY MEDICAL SERVICES

The emergency medical services (EMS) or strategies focus on strategies and partnerships that could help regionwide response times and sharing of real-time information to improve overall coordination, particularly for more rural or remote areas of the region. The effectiveness of EMS is tied closely to the time it takes for a person injured in a collision to receive prompt medical care. Research indicates that there is a “golden hour,” total pre-hospital time under 60 minutes is associated with a decrease in patient mortality. The following considerations can help lead to more successful outcomes for EMS strategies:

Partner with Local Hospitals or Outreach Groups

Partnership between local hospitals or outreach groups needs to be established to help provide bystander training courses to the public (i.e., train members of the public to respond to emergencies

since they are sometimes the first on the scene at a collision and may be the only ones for some time in rural areas). Opportunities for this include:

- Partner with hospitals such as Community Regional Medical Center and trauma centers in the region to provide injury prevention programs.
- Promote the Community Emergency Response Team (CERT) program, which trains community members in first responder skills.
- Work with local groups, such as fire departments, to be trainers themselves and then offer training more frequently in their local community.

Coordinate with all Stakeholders Involved with Emergency Medical Services

Work with the Central California Emergency Medical Services Agency (CCEMSA) and other stakeholders to maximize efficiency with urban and rural response times through evidence-based techniques. Opportunities for this include:

- Build advanced education EMS personnel capacity in rural areas.
- Identify reasons for delay in transport for both ground EMS and helicopter EMS (using registry data and EMS records).
- Consider process improvement initiatives to increase EMS documentation and data collection.
- Work with stakeholders to identify equipment upgrades, training, or enhancements that would improve patient outcomes.

Work with the County 911 Team

Work with the County 911 team and involve them in appropriate project planning and design activities to identify opportunities to improve EMS access and location identification. Additional opportunities include, involving the 911 team in enforcement and EMS grant opportunities, and developing or modifying a system that allows the County 911 dispatchers to quickly input reported road issues and send the information to the appropriate agency (i.e., the City, County, or the appropriate jurisdiction).

NEXT STEPS

As part of the Regional Safety Plan's development, Fresno COG and the Regional Safety Steering Committee (RSSC) members will review the countermeasures toolbox and safety strategies. Based on the COG's and RSSC's input and comments, the Regional Safety Plan itself will include the final countermeasures toolbox and safety strategies. Also, as part of the Regional Safety Plan, the countermeasure toolbox will be applied to twenty locations within the County. The application of the countermeasure toolbox will result in twenty safety concept designs that local agencies can reference as a template for their future use of the countermeasure toolbox.

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