Federal Highway Administration

Proven Safety Countermeasures in **Rural Communities**

U.S. Department of Transportation
Federal Highway Administration

ZERO IS OUR GOAL
A SAFE SYSTEM IS HOW WE GET THERE

FHWA-SA-24-005

Introduction

From 2017 to 2021, over 83,000 people died on rural roadways; this accounts for 43 percent of all roadway deaths despite only 20 percent of the U.S. population residing in these areas and only 31 percent of vehicle miles traveled occurring in rural areas.[1,2] Furthermore, 43 percent of speed- related fatalities, 56 percent of roadway departure fatalities (i.e., a crash that occurs after a vehicle crosses an edge line or center line or otherwise leaves the traveled way), and 26 percent of all intersection fatalities occurred in rural areas. Across the same time period, over 6,400 pedestrians and bicyclists were killed on rural roadways.[3]

The Federal Highway Administration (FHWA) has identified 28 Proven Safety Countermeasures (PSCs) to reduce fatal and serious injury crashes on roads nationwide (see figure 1). These PSCs are applicable for a range of contexts, road types, and governing agencies across the country. The PSCs can offer significant and measurable impacts across an agency's rural road network as part of their approach to improving safety.

The PSCs can support agencies with implementation of the Safe System Approach, which seeks to build and reinforce multiple layers of protection to both prevent crashes from happening and minimize the harm caused to those involved when crashes do occur. Implementing a Safe System Approach requires collaborative engagement among a diverse group of stakeholders to increase safety for all road users. Accordingly, agencies should consider how the PSCs and National Highway Traffic Safety Administration's (NHTSA) Countermeasures that Work[4] can create a system with redundancies in place to protect all road users.

1 https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/813336
2 https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/813488
3 2017-2021 FARS query
4 https://www.nhtsa.gov/book/countermeasures/countermeasures-work

OFFICE OF SAFETY

Proven Safety Countermeasures

SPEED MANAGEMENT

- Speed Safety Cameras
- Variable Speed Limits
- Appropriate Speed Limits for All Road Users

ROADWAY DEPARTURE

- Wider Edge Lines
- Enhanced Delineation for Horizontal Curves
- Longitudinal Rumble Strips and Stripes on Two-Lane Roads
- SafetyEdge^{SM}
- Roadside Design Improvements at Curves
- Median Barriers

INTERSECTIONS

- Backplates with Retroreflective Borders
- Corridor Access Management
- Dedicated Left- and Right-Turn Lanes at Intersections
- Reduced Left-Turn Conflict Intersections
- Roundabouts
- Systemic Application of Multiple Low-Cost Countermeasures at Stop-Controlled Intersections
- Yellow Change Intervals

PEDESTRIANS/BICYCLES

- Crosswalk Visibility Enhancements
- Bicycle Lanes
- Rectangular Rapid Flashing Beacons (RRFB)
- Leading Pedestrian Interval
- Medians and Pedestrian Refuge Islands in Urban and Suburban Areas
- Pedestrian Hybrid Beacons
- Road Diets (Roadway Reconfiguration)
- Walkways

Crosscutting

- Pavement Friction Management
- Lighting
- Local Road Safety Plans
- Road Safety Audit

Figure 1. FHWA's 28 Proven Safety Countermeasures. Source: FHWA.

Guide Contents

Rural agencies and communities should consider implementing PSCs that address at least one of four focus areas:

- **Roadway Departure**
- **Intersections**
- **Pedestrian/Bicyclist**
- **Speed Management**

The following pages highlight a subset of the PSCs with direct application in rural areas. The highlights describe the PSC, include considerations, crash reduction effectiveness, and case studies and resources. This guide is organized by these focus areas and includes a crosscutting section for PSCs that apply to more than one area.

Within this guide, crash reduction effectiveness is presented for each PSC. This effectiveness data draws from the Crash Modification Factors (CMF) Clearinghouse,[5] which provides a searchable database of CMFs along with guidance and resources on using CMFs in road safety practice. The CMF Clearinghouse ID number is listed for each effectiveness citation. Where available, the guide provides data on crash reductions on rural roads. However, in several cases there was not research or studies available regarding the effectiveness on rural roads. This does not suggest that the PSCs are not effective on rural roads, but rather more studies are necessary to better quantify their effectiveness.

Through implementation of the PSCs, agencies can reduce rural road fatalities and serious injuries for all users. Agencies should consult the PSC webpage[6] for additional information on each PSC, including a search and filter function.[7] Users answer questions regarding area type, functional classification, traffic volumes, safety problem(s) to be addressed, targeted crash types, and other information to receive a list of PSCs meeting the criteria. The search function allows users to obtain a tailored list of potential PSCs and assists practitioners with identifying the most appropriate PSC(s) for their location of interest.

This guide also features a Desktop Reference table of PSCs that may be considered in rural communities and compares Safe System design hierarchy alignment, relative cost, unpaved road applicability, relative crash reduction, and typical service life.

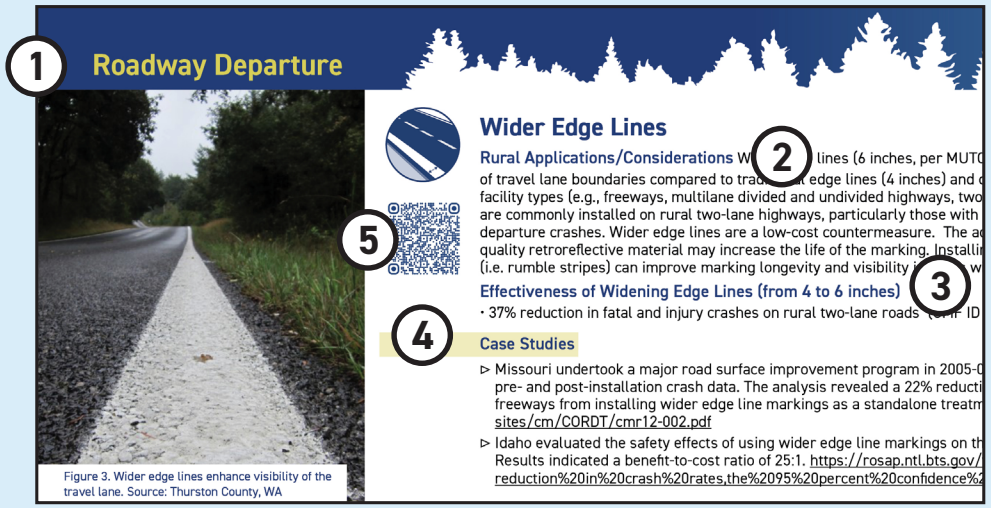


Figure 2. Example image of a PSC page within this guide.

Reference Areas

1 Focus Area

2 Rural Applications/Considerations

3 Crash Reduction Effectiveness

4 Case Studies

5 QR Code to PSC Webpage

5 https://www.cmfclearinghouse.org/
6 https://highways.dot.gov/safety/proven-safety-countermeasures
7 https://highways.dot.gov/safety/proven-safety-countermeasures/search

Figure 3. Wider edge lines enhance visibility of the travel lane. Source: Thurston County, WA

Wider Edge Lines

Rural Applications/Considerations Wider edge lines (6 inches, per MUTCD Section 3A) improve visibility of travel lane boundaries compared to traditional edge lines (4 inches) and can provide safety benefits to all facility types (e.g., freeways, multilane divided and undivided highways, two-lane highways). Wider edge lines are commonly installed on rural two-lane highways, particularly those with a history of single-vehicle roadway departure crashes. Wider edge lines are a low-cost countermeasure. Installing wider edge lines over rumble strips (i.e., rumble stripes) can improve marking longevity and visibility in areas with snowplow operations.

Effectiveness of Widening Edge Lines (from 4 to 6 inches)

- 37% reduction in fatal and injury crashes on rural two-lane roads (CMF ID 4737).

Case Studies

- ▷ Missouri undertook a major road surface improvement program in 2005-06 and analyzed three years of both pre- and post-installation crash data. The analysis revealed a 22% reduction in fatal and injury crashes on rural freeways from installing wider edge line markings as a standalone treatment. https://spexternal.modot.mo.gov/sites/cm/CORDT/cmr12-002.pdf
- ▷ Idaho evaluated the safety effects of using wider edge line markings on their rural two-lane highway system. Results indicated a benefit-to-cost ratio of 25:1. https://rosap.ntl.bts.gov/view/dot/63580#:~:text=The%20reduction%20in%20crash%20rates,the%2095%20percent%20confidence%20level

Figure 4. Shoulder rumble strips. Source: FHWA

Rumble Strips and Stripes

Rural Applications/Considerations Center line and shoulder rumble strips and stripes (where the pavement marking is placed over the rumble strip) are milled or rolled-in corrugations in the pavement to alert inattentive drivers that they are leaving their lane. Center line rumble strips/stripes can be used in both passing and no passing zones wherever an agency has identified risk factors (such as lane width, shoulder width, median type, horizontal curvature, or crash history), that indicate a higher probability of head-on crashes. Consider shoulder or edge line rumble strips/stripes wherever risk factors indicate a higher probability of run-off-road crashes.

Effectiveness

- Center line rumble strips on two-lane roads have resulted in a 44% to 64% reduction in head-on and opposite direction sideswipe fatal and injury crashes (CMF IDs 3358, 3356).
- Shoulder rumble strips on rural freeways have resulted in a 13% to 51% reduction in run-off-road fatal and injury crashes (CMF IDs 3425, 3648).

Case Study and Resources

- ▷ To reduce roadway departure crashes on rural roads, Mercer County, NJ implemented 6 miles of center line rumble stripes across 18 different roads after seeing favorable results from pilot projects. Community backlash subsided after public outreach regarding safety benefits. https://safety.fhwa.dot.gov/FoRRRwD/Countermeasure4-pager.pdf
- ▷ FHWA developed the Sweet Sound of Safety informational video to highlight the safety benefits of centerline and shoulder rumble strips for community outreach purposes. https://youtu.be/2V5-M4-070E

Figure 5. Curve delineation enhancements may include in-lane curve warning pavement markings and chevron signs with retroreflective strips on sign posts. Source: FHWA

Enhanced Delineation for Horizontal Curves

Rural Applications/Considerations Horizontal curves are common crash locations, particularly at night or during inclement weather. Improving curve delineation through signage and/or pavement markings can promote proper vehicle alignment through the curve. There are a wide range of options available for improving horizontal curve delineation in advance of or within curves, either in combination or individually; common treatments include pavement markings, in-lane curve warning pavement markings, retroreflective strips on signposts, delineators (post-mounted or guardrail-mounted), chevrons, improving sign conspicuity (larger, fluorescent, and/or retroreflective signs), and dynamic warning signs or chevrons.

Effectiveness

- Installing chevrons on horizontal curves on rural two-lane roads has resulted in a 16% reduction in fatal and injury crashes overall and a 25% reduction in nighttime crashes. (CMF IDs 2438, 2439).
- Installing in-lane curve warning pavement markings on rural two-lane roads has resulted in 35% reduction in total crashes. (CMF ID 10312).

Case Study and Resources

- ▷ Bonner County, ID improved visibility at higher-risk rural horizontal curves by installing edge lines and delineators. The public has responded positively and requested the countermeasures at more locations. https://safety.fhwa.dot.gov/FoRRRwD/Countermeasure4-pager.pdf
- ▷ FHWA developed an instructional video for proper chevron sign spacing on horizontal curves. https://www.youtube.com/watch?v=LeI9_rffS34

Figure 6. Inside shoulder widening at a horizontal curve. Source: FHWA

Roadside Design Improvements at Curves

Rural Applications/Considerations Horizontal curves are associated with about 27 percent of all fatal crashes, and around 80 percent of those are roadway departure crashes. Improving the roadside environment can give vehicles space to recover safely and reduce the severity of crashes that occur. Typical roadside design improvements include vegetation management, delineation/relocation/removal of roadside objects, clear zone widening, flattening of side slopes, adding or widening shoulders, and installing roadside barrier.

Effectiveness

Widening the clear zone through tree removal on rural two-lane highways:

Increase distance to treeline by

- 5 to 8 ft: 35-49% reduction in total crashes.
- 10 to 13 ft: 57-66% reduction in total crashes.

(Source: NCHRP Report 440 https://onlinepubs.trb.org/Onlinepubs/nchrp/nchrp_rpt_440.pdf)

Case Study and Resources

- ▷ Lapeer County, MI, developed a proactive tree removal and trimming program by targeting locations for treatment using identified risk factors to reduce fixed object crashes on rural roads. https://safety.fhwa.dot.gov/FoRRRwD/Countermeasure4-pager.pdf
- ▷ Refer to the *Rural Roadway Departure Countermeasure Pocket Guide* for more information on this PSC. https://safety.fhwa.dot.gov/FoRRRwD/RwDPocketGuide.pdf

Figure 7. Single lane roundabout in a rural area. Source: Caltrans

Roundabouts

Rural Applications/Considerations Roughly one-third of intersection fatalities occur on rural two-lane highways, with posted speed limits over 40 mph. Unlike traditional intersections, roundabouts require yield control on entry and splitter islands on the approaches to reduce speeds both on approach and within the intersection. Single lane roundabouts at 4-legged intersections have 8 conflict points compared to 32 conflict points for a stop-controlled intersection. Roundabouts can reduce severe crashes (i.e., angle crashes) at intersections and travel delays at both isolated intersections and within rural town centers.

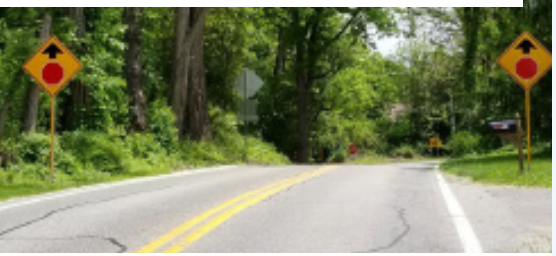
Effectiveness of Converting High-Speed Rural Intersection (4-leg) to Roundabout

- 68% reduction in total crashes (CMF ID 4697).
- 88% reduction in injury crashes (CMF ID 4698).

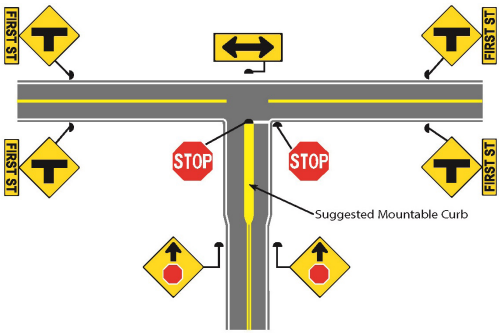
Case Studies

- ▷ Kansas DOT collaborated with freight stakeholders to design a roundabout that would reduce speeds and crashes without sacrificing mobility for truck drivers. In the 6 years following installation, there were zero injury crashes recorded at the intersection. https://highways.dot.gov/sites/fhwa.dot.gov/files/2022-06/fhwasa14013_0.pdf
- ▷ A successful community outreach program on roundabouts educating skeptical residents in Brown County, WI resulted in the implementation of two successive roundabouts within a busy school zone and the reverse of a policy prohibiting students from biking and walking to school. https://highways.dot.gov/sites/fhwa.dot.gov/files/2022-06/fhwasa11031.pdf

Figure 8. Doubled up "Stop Ahead" warning signs with retro-reflective strips on sign posts. Source: PennDOT



Basic plan showing low-cost countermeasures at a stop-controlled T-intersection. Source: FHWA



Systemic Application of Multiple Low-Cost Countermeasures at Stop-Controlled Intersections

Rural Applications/Considerations Systemically deploying multiple low-cost treatments to many stop-controlled intersections throughout a jurisdiction can maximize resources and reduce crashes. Examples of common treatments include enhanced pavement markings, retroreflective signpost sheeting, advance warning signs, doubled-up signs, flashing beacons, oversized signs, and sight distance improvements.

Effectiveness

- 15% reduction in nighttime crashes at all intersection locations/types/areas (CMF ID 8870).
- 27% reduction in fatal and injury crashes at rural intersections (CMF ID 8874).

Case Studies

- ▷ Louisiana DOT installed low-cost safety treatments at 89 stop-controlled intersections and found a 56% reduction at three-legged intersections and 64% reduction at four-legged intersections of fatal and injury crashes. https://highways.dot.gov/sites/fhwa.dot.gov/files/2022-06/fhwasa18047.pdf
- ▷ South Carolina DOT implements a variety of low-cost countermeasures at stop-controlled intersections throughout the State as part of their proactive approach to intersection safety. According to a follow-up study, this approach led to a 27% reduction in fatal/injury crashes and a 25% reduction in total crashes at rural intersections. https://highways.dot.gov/sites/fhwa.dot.gov/files/2022-06/fhwasa12021.pdf

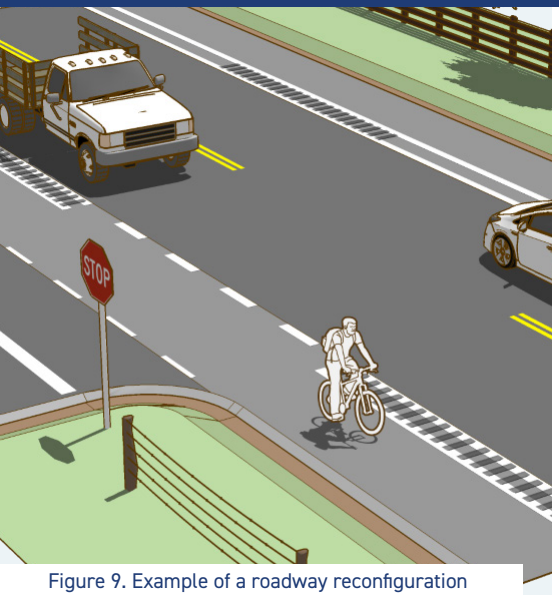


Figure 9. Example of a roadway reconfiguration using available roadway width to include bicycle lanes. Source: Rural Design Guide

Road Diets/Reconfiguration

Rural Applications/Considerations A road diet is a conversion of an existing road to reduce the number of through lanes and reallocate roadway space to other uses (e.g., bicycle lanes, sidewalks, and parking). Often this will consist of reducing four-lane roads to three lanes, with the middle lane serving as a two-way left-turn lane or combination of median and left-turn lanes; this can reduce travel speeds, ease pedestrian crossing difficulties, and reduce crashes. In rural areas without sidewalks, increasing the paved shoulder width by removing a travel lane can accommodate non-motorized users. A road diet can be a low-cost safety solution when planned in conjunction with a simple pavement overlay.

Effectiveness

- Convert 4-lane undivided road to 2-lanes plus turning lane: 37% reduction in injury crashes (CMF ID 11231).

Case Studies

- Battle Lake, MN revitalized their downtown streets with a successful road diet implementation alongside pedestrian and bicycle improvements. MnDOT noted that crashes have been reduced in the four years following the road diet. https://www.dot.state.mn.us/trafficeng/safety/road-diet-battle-lake.html
- Residents of Colorado have been advocating for bicycle infrastructure since the 1940s to connect western townships and improve non-vehicular mobility throughout the region. The Eagle Valley Trail, set to be completed in 2024, consists of over 60 miles of paved pathways throughout the region. https://www.eaglevalleytrail.org/

Figure 10. Crosswalk visibility enhancements include advance yield markings, high visibility crosswalk markings, lighting, and a rectangular rapid flashing beacon. Source: FHWA

Crosswalk Visibility Enhancements

Rural Applications/Considerations High-visibility crosswalk markings, lighting, and supplemental signing and pavement markings can improve driver awareness of crosswalks and non-motorized road users (e.g., pedestrians, bicyclists, wheelchair and other mobility device users, public transit users) at rural locations. These devices also help channelize crossing movements to locations where drivers expect them to occur. Crosswalk visibility enhancements can be installed as standalone devices if desired, but multiple treatments are encouraged to maximize safety benefits.

Effectiveness

- Install intersection lighting: 42% reduction in nighttime vehicle-pedestrian injury crashes and 78% reduction in fatal vehicle-pedestrian crashes (CMF IDs 436, 435).
- Install rural highway lighting: 28% reduction in nighttime injury crashes (CMF ID 192).
- Install high-visibility crosswalks at urban intersections (i.e., town centers): 40% reduction in pedestrian injury crashes (CMF ID 4123).

Case Study and Resources

- In Kansas, the Flint Hills Metropolitan Planning Organization has modified crosswalks with a multitude of quick-build (i.e., common projects include curb extensions and pedestrian islands) techniques and public demonstrations. Common projects include curb extensions and pedestrian islands. https://www.flinthillsmpo.org/demoprojects
- The *Pedestrian Lighting Primer* provides information on lighting design considerations for locations with pedestrian activity. https://highways.dot.gov/sites/fhwa.dot.gov/files/2022-09/Pedestrian_Lighting_Primer_Final.pdf
- FHWA is promoting traffic control devices and properly designed lighting to improve safety for all users as part of the Every Day Counts Nighttime Visibility for Safety initiative. https://www.fhwa.dot.gov/innovation/everydaycounts/edc_7/nighttime_visibility.cfm

Speed Management

Figure 11. Flashing beacons alerting drivers to decrease speeds in a school zone. Source: FHWA

Appropriate Speed Limits for All Road Users

Rural Applications/Considerations Setting speed limits that are consistent and reasonable for local conditions is critical for effectively managing travel speeds and reducing crash severity. When setting speed limits, agencies should consider non-vehicular activities, types of road users present, crash history, land use context, traffic volumes, and observed speeds, among other factors. An effective speed management program uses multiple strategies concurrently with setting speed limits, such as traffic calming features, design features, high-visibility enforcement, and speed safety cameras, that encourage compliance with the posted speed limit.

Effectiveness

- Research shows setting a lower speed limit, in conjunction with other speed management strategies, on rural roads can reduce fatal and injury crashes up to 40% and lead to drivers complying more closely with the posted speed limit (CMF ID 10249).
- Installing a speed feedback sign in advance of horizontal curves on high-speed rural roads can reduce all crashes by 7% (CMF ID 6886).

Case Studies

▷ Iowa DOT used a variety of speed management techniques to address transitions zones from 55 mph to 25 mph in rural communities, resulting in a 53% to 100% decline in excessive speeding (i.e., >15 mph over speed limit) and 2.3 to 7.6 mph decline in average speeds across the range of treatments. https://safety.fhwa.dot.gov/speedmgt/ref_mats/fhwasa16079/

▷ Jefferson County, MO evaluated speed limits at 19 school zone locations on County-maintained roads and found that 11 locations had 85th percentile speeds higher than posted speed limits when school was in session. https://www.jeffcomo.org/DocumentCenter/View/12886/JCPW-Traffic-Safety-Improvement-Program-Summary-PDF

Crosscutting

Figure 12. HFST applied at a horizontal curve. Source: Maricopa County, AZ

Pavement Friction

Rural Applications/Considerations Pavement friction is a critical component of roadway performance, particularly in rural areas with higher speeds and sharp curves or intersections. Measuring, monitoring, and maintaining pavement friction at locations where vehicles frequently turn, slow, or stop can improve performance and reduce roadway departure, intersection-related, wet-road, and pedestrian crashes. Where increased friction is desired, agencies can install a High Friction Surface Treatment (HFST) on the pavement to enhance friction and skid resistance. HFSTs are applied directly on stable, existing pavement and costs can be reduced by bundling installations at multiple locations.

Effectiveness of Installing HFSTs on two-lane rural roads

- 48% reduction in injury crashes (CMF ID 10333).
- 72% reduction in run-off-road crashes (CMF ID 10334).

Case Study

▷ Maricopa County, AZ applied HFST to multiple horizontal curves identified based on crash history. Before HFST installation, one location had 35 crashes (7 of which resulted in severe injuries) over a 5-year period. Only 1 crash occurred on the curve in the 13 months following installation. https://safety.fhwa.dot.gov/forrrwd/hfst4localsstoryboard/page09.html

Figure 13. RSA participants conducting a site visit. Source: FHWA

Road Safety Audit (RSA)

Rural Applications/Considerations An RSA is a formal evaluation of the safety performance of an existing or future road segment or intersection that is performed by an independent, multidisciplinary team. RSAs can be performed at any point in the project development process, including during planning and construction periods, and on any sized existing roadways. RSAs conclude with a formal report that accounts for human factors, the built environment, and all modes of transportation. RSAs are an objective review of project locations and can result in a wide variety of safety-related recommendations, including other PSCs, that are more comprehensive than a traditional safety review performed by a project design team. RSAs are a great way to engage community representatives that have a vested interest in project outcomes.

Effectiveness

- Performing an RSA and implementing recommendations: 10% to 60% reduction in total crashes. (Source: https://safety.fhwa.dot.gov/rsa/case_studies/fhwasa12037/ and https://safety.fhwa.dot.gov/rsa/guidelines/documents/FHWA_SA_06_06.pdf).

Case Study and Resources

- Twelve RSAs were completed in South Dakota for a variety of facility types, including county roads, gravel roads, intersections, and railroad crossings. https://rosap.ntl.bts.gov/view/dot/64141
- The *Road Safety Audit Toolkit for Federal Land Management Agencies and Tribal Governments* provides the framework for developing and implementing a successful RSA program. https://safety.fhwa.dot.gov/rsa/resources/toolkitflh/toolkitflh.pdf

Figure 14. Example of roadway improvements that may be included in an LRSP. Source: FHWA

Local Road Safety Plan (LRSP)

Rural Applications/Considerations An LRSP provides a framework for identifying, analyzing, and prioritizing roadway safety improvements on all local and Tribal roads within a jurisdiction. The successful development of an LRSP engages multiple stakeholders, uses a data-driven approach, and results in a list of issues, risks, actions, and improvements that are tailored and prioritized based on local needs to aid agencies in reducing fatalities and serious injuries on their road network.

Effectiveness of Implementing LRSPs

- 25% reduction in county road fatalities in Minnesota.
- 17% reduction in fatal and serious injury crashes on county-owned roads in Washington.
- 35% reduction in severe curve crashes in Thurston County, WA.

Case Studies and Resources

- LRSPs in California: https://youtu.be/PJ0Iid8izvI
- Local agency insights: https://youtu.be/V_apdVeEbQ4
- Short informational video on LRSPs: https://youtu.be/Wzdm798MoI8
- Visit the LRSP Do-It-Yourself website developed by FHWA for more information and guidance for developing an LRSP: https://highways.dot.gov/safety/local-rural/local-road-safety-plans

Desktop Reference

The Rural PSC Desktop Reference only includes PSCs most applicable to a local and rural road context. For more information on the complete list of PSCs, refer to FHWA's PSC webpage.[8] The Desktop Reference includes information in four key categories: how the countermeasure addresses the Safe System design hierarchy, representative cost ranges for installation, common crash reduction ranges, and typical service life for the countermeasure.

1 – Safe System Roadway Design Hierarchy Alignment

- Remove Severe Conflicts - Eliminating specific high-risk conditions, such as separating road users moving at different speeds or different directions in space to minimize conflicts.
- Reduce Vehicle Speeds - Implementing design features and speed management strategies to reduce vehicle speeds; effectively reduces the kinetic energy involved in a crash should it occur.
- Manage Conflicts in Time - Separating the users in time using traffic control devices, such as traffic signals or hybrid beacons, to minimize vehicle conflicts with vulnerable road users.
- Increase Attentiveness and Awareness - Alerting roadway users to certain types of conflicts so that appropriate action can be taken.
- Find more information on the Safe System Approach at https://highways.dot.gov/safety/zero-deaths.

2 – Cost Ranges

- Low-cost (L) – up to $5,000 per mile or per curve/location.
- Medium-cost (M) – $5,000 to $50,000 per mile or per curve/location
- High-cost (H) – More than $50,000 per mile or per curve/location.
- Note that costs can vary considerably due to local conditions.

3 – Crash Reduction[9]

- Low (L) = greater than 0% and less than 25% reduction.
- Medium (M) = greater than 25% and less than 50% reduction.
- High (H) = greater than 50% reduction.

4 – Typical Service Life

- The Highway Safety Manual (HSM) defines countermeasure service life as "the number of years in which the countermeasure is expected to have a noticeable and quantifiable effect on the crash occurrence at the site."
- See the FHWA Countermeasure Service Life Guide for more information on Countermeasures Service Life at https://safety.fhwa.dot.gov/hsip/docs/FHWA-SA-21-021_Countermeasure_Serv_Life_Guide.pdf.

Table 1. The Rural PSC Desktop Reference

		①				②		③	④
Focus Area	Proven Safety Countermeasure	Safe System Design Hierarchy Alignment				Cost L-M-H	Option on Unpaved Roads	Crash Reduction L-M-H	Typical Service Life (in years)
		Remove Severe Conflicts	Reduce Vehicle Speeds	Manage Conflicts in Time	Increase Attentiveness and Awareness				
Speed Management	Appropriate Speed Limits for All Road Users	-	Yes	-	-	L	Yes	L-M	15
	Speed Safety Cameras	-	Yes	-	-	M-H	-	M-H	10
	Variable Speed Limits	-	Yes	-	Yes	L-H	-	M-H	10

Figure 15. Excerpt of the Rural PSC Desktop Reference table columns.

8 https://highways.dot.gov/safety/proven-safety-countermeasures

9 All cited crash reductions are consistent with the PSC fact sheets and materials. For purposes of this resource, there was a focus on crash reductions on rural roads. However, in several cases there was not research or studies available regarding the effectiveness on rural roads. This does not suggest that the PSCs are not effective on rural roads, but rather more implementation or evaluation is necessary to better quantify their effectiveness.

Table 1. The Rural PSC Desktop Reference

Focus Area	Proven Safety Countermeasure	Safe System Design Hierarchy Alignment				Cost L-M-H	Option on Unpaved Roads	Crash Reduction L-M-H	Typical Service Life (in years)
		Remove Severe Conflicts	Reduce Vehicle Speeds	Manage Conflicts in Time	Increase Attentiveness and Awareness				
Speed Management	Appropriate Speed Limits for All Road Users	-	Yes	-	-	L	Yes	L-M	15
	Speed Safety Cameras	-	Yes	-	-	M-H	-	M-H	10
	Variable Speed Limits	-	Yes	-	Yes	L-H	-	M-H	10
Pedestrian / Bicyclist	Bicycle Lanes	Yes	-	-	-	L-M	-	M	20
	Crosswalk Visibility Enhancements	-	-	-	Yes	L-M	-	M	5
	Medians and Pedestrian Refuge Islands	Yes	Yes	-	-	M	-	M-H	20
	Road Diets (Roadway Reconfiguration)	Yes	Yes	-	-	L-H	-	M	20
	Walkways	Yes	-	-	-	L-H	Yes	H	20
	Rectangular Rapid Flashing Beacon (RRFB)	-	-	-	Yes	L	-	M	10
Roadway Departure	Enhanced Delineation for Horizontal Curves	-	-	-	Yes	L	Yes	L-H	10-15
	Longitudinal Rumble Strips and Stripes	-	-	-	Yes	L	-	M-H	10
	Median Barriers	Yes	-	-	-	M-H	-	H	25
	Roadside Design Improvements at Curves	Yes	-	-	-	L-H	Yes	L-M	10-20
	SafetyEdge^{SM}	Yes	-	-	-	L	-	L	10
	Wider Edge Lines	-	-	-	Yes	L	-	M	5
Intersection	Roundabouts	Yes	Yes	-	-	M-H	-	H	20
	Systemic Application of Multiple Low-Cost Countermeasures at Stop-Controlled Intersections	-	-	-	Yes	L	Yes	L	15
	Dedicated Left and Right Turn Lanes at Intersections	Yes	-	-	-	M	-	M	20
	Corridor Access Management	Yes	-	-	-	L-M	-	M	20
Crosscutting	Lighting	-	-	-	Yes	M-H	Yes	M	15
	Local Road Safety Plans	Yes	Yes	Yes	Yes	L-H	Yes	M	-
	Pavement Friction Management	Yes	Yes	-	-	M	-	M-H	10
	Road Safety Audits	Yes	Yes	Yes	Yes	L-H	Yes	L-H	-

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