



LG TRRIP

Local Government Transport & Roads
Research & Innovation Program



Low-cost road safety improvements for rural Local Government roads in WA

Housekeeping

► Moderator

Max Bushell

Policy Officer Road Safety
and Infrastructure

WALGA

► Duration

Introduction – 5 minutes

Presentation – 35 minutes

Questions – 20 minutes



Microphones on mute



Type questions in the chat



This session will be recorded

Acknowledgement of Country

We acknowledge the Traditional Owners and Custodians of this land and waterways.

We pay respect to their ancestors and Elders both past and present.



Welcome

About LG TRRIP and WARRIP



LG TRRIP

The Local Government Transport and Roads Research and Innovation Program is a joint initiative between WALGA and Main Roads Western Australia.

The program seeks to provide collaborative research that positively contributes to the design, construction and maintenance of safe, sustainable transport infrastructure for local government in Western Australia.

Presenters and Agenda

Topic	Presenter
Overview of this project	Malcolm
New Guideline	Elliott
Overview of each treatment	Elliott and Malcolm
Summary	Malcolm
Q&A	All

► **Malcolm Mak**

Senior Technology Leader
Safer Smarter Infrastructure
ARRB

► **Elliott Tang**

Senior Professional
Safer Smarter Infrastructure
ARRB



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Overview of this Project

Background

Local Governments bear the responsibility of ensuring the safety of their local road networks and could benefit from guidance on selecting and implementing low-cost road safety improvements.

Local Government Challenges:

- ▶ Large regional/rural LG road network
- ▶ Lower traffic volumes
- ▶ Limited budgets
- ▶ Crash patterns can be random
- ▶ Existing guidance is targeted to State arterial roads

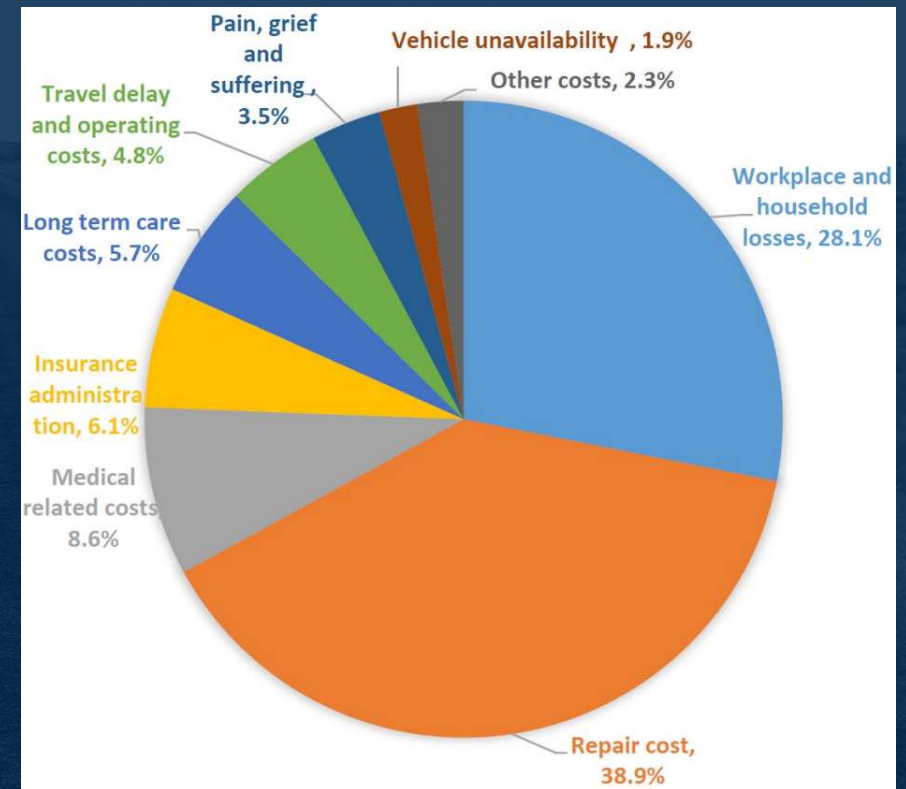
Local Government Roles and Responsibilities

Children and families	Health and wellbeing	Your home	Sport and leisure	Roads and safety	Community
 Childcare	 Disability services	 Planning permits	 Sportsgrounds	 Roads and footpaths	 Libraries
 Kindergartens	 Home maintenance	 Building permits	 Swimming pools	 Car parks	 Volunteering
 Maternal and child health	 Home and community care	 Pet registrations	 Leisure centres	 Street lighting	 Theatre and the arts
 Playgroups	 Meals on wheels	 Rubbish and recycling	 Parks and gardens	 School crossing supervision	 Grants
 Immunisation	 Food safety	 Graffiti removal	 Festivals and events	 Emergency management	 Community centres

Crash Costs

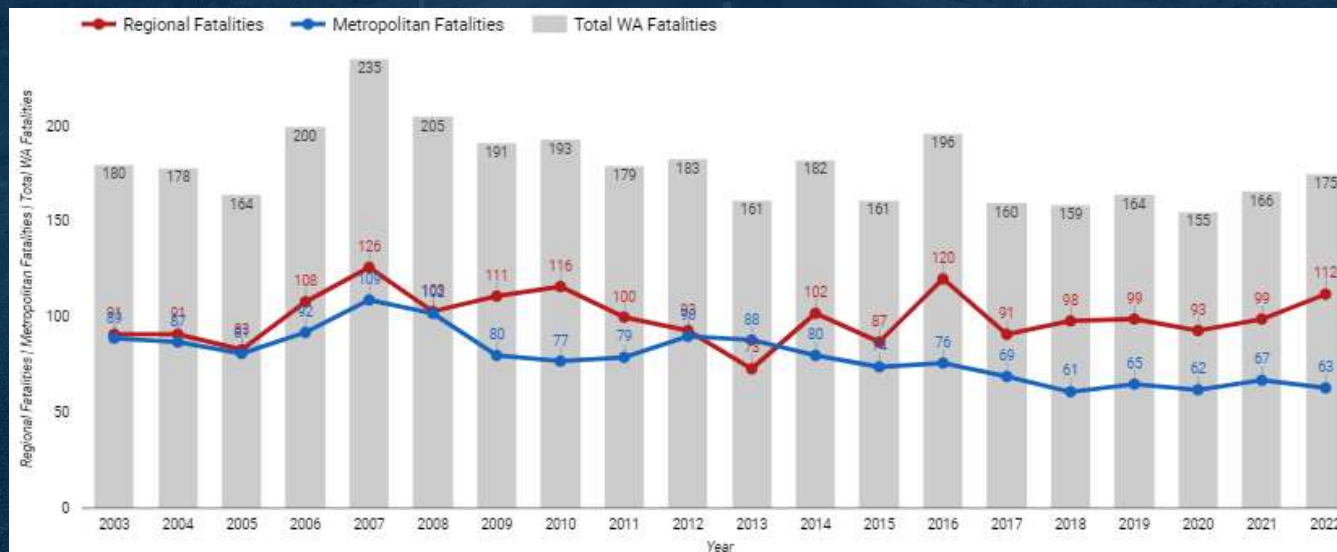
Crash Costs provide an estimate of the overall cost to society incurred when crashes occur on the road network.

They are used in road safety treatment applications and evaluating road safety outcomes.



Fatalities on WA Roads

During 5-year period 2018 to 2022 there were 501 fatalities on regional roads and 318 on metropolitan roads



Economic Cost of Crashes in WA

For the 5-year period between 2017-2021:

Region Group	Fatal	Hospital	Medical	PDO
Metro	\$ 7,888,051	\$ 325,705	\$ 78,977	\$ 13,266
Rural	\$ 9,182,339	\$ 508,912	\$ 106,463	\$ 13,266
State	\$ 8,680,493	\$ 384,039	\$ 82,167	\$ 13,266

Fatalities on WA roads cost approximately \$7.1 billion during 2017-2021.

- ▶ Metropolitan: \$2.5 billion
- ▶ Rural: \$4.6 billion

Background

Generic guidance on the design of low-cost road safety improvements is available in the Austroads Guide to Road Design and the MRWA Supplement as well as other guidance documents.

Little context-specific guidance exists to support the implementation of low-cost road safety improvements on rural Local Government roads in Western Australia.

A practitioner's guide has been developed to support selection and delivery of low-cost safety treatments and also discuss delivery considerations.



Source: Main Roads Western Australia website.

Team

Malcolm Mak

Project Lead (ARRB)

Max Bushell

Project Manager (WALGA)

Elliott Tang

Team Member (ARRB)

Keith Mwathi

Team Member (ARRB)

Acknowledgement to Brendon Wiseman

Initial Project Lead (ARRB)

Acknowledgement to all Local Governments who participated in our engagement and consultation

Methodology



Local Government Consultation

WALGA Leadership

Literature Review

Literature	
1	Austrroads 2016a, Safe System Assessment Framework
2	Austrroads Safe System Roads for Local Government (2016)
3	Austrroads Guide to Road Safety Part 5: Road Safety for Regional and Remote Areas (2019) Superseded Document
4	Austrroads Guide to Road Safety Part 2: Safe Roads (2021a)
5	Austrroads Guide to Road Safety Part 3: Safe Speed (2021b)
6	Austrroads Guide to Road Safety Part 6: Road Safety Audit (2022)
7	R99: Identification of Safety Risk and Development of Mitigating Treatments for Narrow (4 m) Sealed Roads: 2020/21
8	iRAP 2022, Road Safety Toolkit
9	Main Roads Western Australia: Treatment Resource Guide (2021)
10	Main Roads Western Australia, Speed Zoning: Policy and Application Guidelines (2022)
11	R85: Review of Engineering Treatments for Urban Fringe Environments: 2018/19
12	Australian Standard 1742.2 Manual of Uniform Traffic Control Devices Part 2: Traffic Control Devices for General Use (2022)
13	Australian Standard 1742.4 Manual of Uniform Traffic Control Devices Part 4: Speed Controls (2020)
14	Austrroads Guide to Traffic Management Part 10: Transport Control - Types of Devices (2020)
15	U.S. Department of Transportation Federal Highway Administration

Literature Review

- ▶ What
- ▶ Why
- ▶ Where
- ▶ When
- ▶ How
- ▶ Who



Source: WALGA.

Local Government Engagement

Responses from the following Local Governments

- ▶ Albany
- ▶ Augusta Margaret River
- ▶ Bruce Rock
- ▶ Cranbrook
- ▶ Cunderdin
- ▶ Dardanup
- ▶ Dumbleyung
- ▶ Esperance
- ▶ Gingin
- ▶ Goomalling
- ▶ Greater Geraldton
- ▶ Harvey
- ▶ Kalamunda
- ▶ Koorda
- ▶ Kulin
- ▶ Moora
- ▶ Plantagenet
- ▶ Waroona
- ▶ West Arthur
- ▶ Wyndham – East Kimberley

Do you use any of these treatments?

If so, was it easy to install? Were there administrative issues?

Please provide an example location

How was the treatment selected, was it installed as part of a larger project? (e.g. larger maintenance or improvement project)

Were there any warrants or guidelines applied to select the treatment?

What is the cost per unit for the material and installation budget?

Is there any other information you would like us to consider in the preparation of this Guideline?



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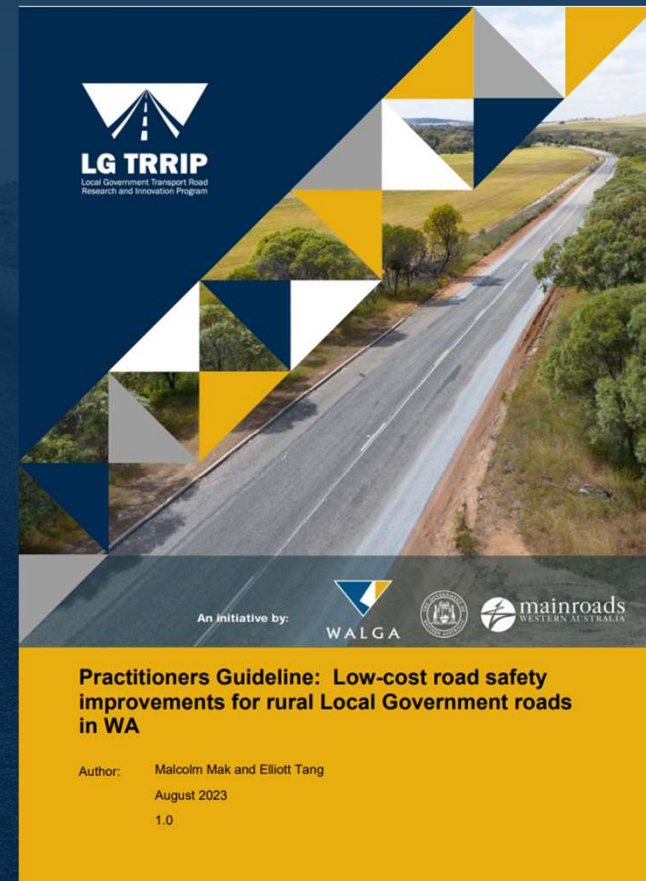
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New Practitioners Guideline

New Guideline

A Local Government practitioner's guide to the selection and delivery considerations for low-cost safety treatments on rural roads



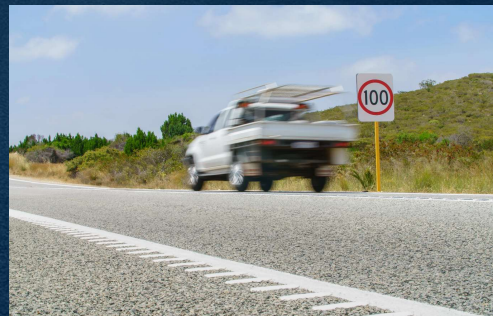
Low-Cost Road Safety Treatments

- ▶ Longitudinal Line Marking
- ▶ Audio-tactile Line Marking
- ▶ Guide Posts
- ▶ RRPMs
- ▶ Speed Limit Review and Zoning
- ▶ Advisory Speed Signs
- ▶ Intersection Warning Signs
- ▶ Curve Warning Signs
- ▶ Guide Signs – i.e. CAMs
- ▶ Vehicle Activated Signs
- ▶ Shoulder Sealing
- ▶ Lane Widening
- ▶ Surface Corrections
- ▶ Skid Resistance
- ▶ Road Safety Barriers
- ▶ Flag Lighting



Audio-tactile linemarking

Source: Main Roads Western Australia website.



Speed limit review and zoning

Source: WALGA.



Guideposts Source: WALGA.



Shoulder sealing

Source: Main Roads Western Australia website.



Warning signs Source: ARRB Group.

Treatment Selection Matrix

		Longitudinal linemarking	RRPMs	Guide posts	Curve warning signs	Intersection warning signs	Advisory speed signs	Guide signs (i.e. CAMs)	Audio-tactile linemarking	Speed limit review and zoning	Skid resistance	Flag lighting	Shoulder sealing	Surface corrections	Road safety barriers	Vehicle activated signs	Lane widening
Cost		Low	Low	Low	Low	Low	Low	Low	Low	Low to medium	Low to medium	Low to medium	Medium	Medium	Medium	Medium to high	Medium to high
Road	Sealed	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Unsealed	✗	✗	✓	✓	✓	✗	✓	✗	✗	✗	✓	✗	✗	✓	✓	✗
Location	Mid-block	✓	✓	✓	✓	✗	✓	✓	✓	✓	✗	✗	✓	✓	✓	✓	✓
	Intersection	✓	✓	✓	✗	✓	✗	✗	✗	✗	✓	✓	✗	✓	✗	✓	✗
Hierarchy	Change road user behaviour	✗	✓	✓	✓	✓	✓	✓	✓	✓	✗	✓	✗	✗	✗	✓	✗
	Reduce the risk	✓	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗	✓	✓	✓	✗	✓
Crash type	Head on																
	Hit animal																
	Hit object																
	Hit pedestrian																
	Non-collision																
	Off carriageway hit object																
	Off carriageway non-collision																
	Other																
	Rear end																
	Right angle																
	Right turn thru																
Sideswipe																	

Legend:

Yes - ✓; No - ✗


Reduction in crash type:

- Likely to be effective: **Green**;
- Somewhat effective: **Yellow**;
- Unlikely to be effective: **Red**

Case Studies

3.1 Audio-tactile Linemarking

Local Government (LG): City of Albany

Road	Lower Denmark Road	
Treatment type	Audio-tactile linemarking	
Start Straight Line Kilometres (SLK) and End SLK	0-36.7	
Road classification	Regional Distributor	
Traffic volume	2,000 vehicles per day	
Speed limit	60–90 km/h	
Installation year	2022	
What was the driver behind the installation of the treatment?	Regional Road Safety Program funding	
What were the safety benefits after the treatment was installed? Has it reduced crashes? Any anecdotal safety outcomes?	Too soon to say	
Were there any challenges during the implementation of this treatment?	Preparing shoulders and widening to get best safety results	
Other comments	Nil	

Treatment Factsheets

2.2.2 Curve Warning Signs

Curve Warning Signs

W1-5: Left or Right W1-1: Left or Right W1-5: Left or Right

W1-7: Left or Right W1-4: Left or Right W1-2: Left or Right

Source: AS 1742.2:2022.

Description

Curve warning signs are used to inform drivers of an upcoming curve in the road. These signs are particularly useful for substandard curves where additional signage may be necessary to convey the severity and nature of the curve to motorists, giving drivers time to react and adjust their driving behaviour accordingly.

Warning signs are an effective measure to reduce crashes for a relatively small cost where more expensive interventions cannot be achieved.

Crash reduction factors

10% to 30% (Main Roads Western Australia 2021)

Potential locations

- Sealed road: Yes
- Unsealed road: Yes
- Areas where the alignment of the road changes, such as when the road transitions from a straight to a curved section.

Considerations

- Consider whether the horizontal and vertical alignments of the road are suitable for the 85th percentile traffic speed. If not, consider installing warning signs and advisory speed signs, and ensure that the posted advisory speed for each curve is appropriately assessed.
- The type and size of the warning sign.
- Ensure signage is consistently applied on other roads with similar road geometry.

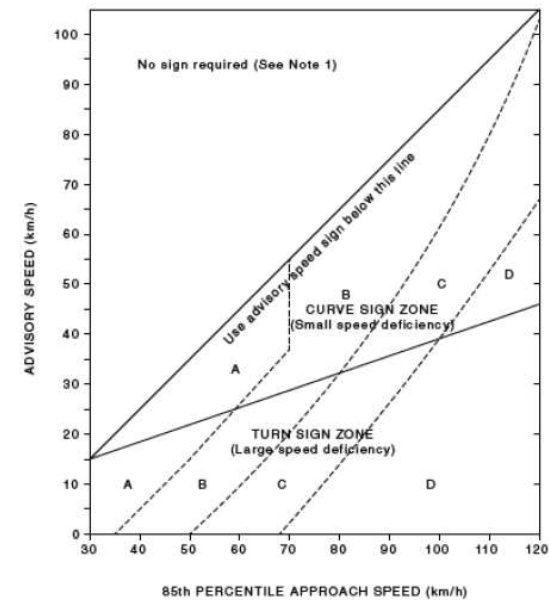
Warrants

Curve warning signs shall be used in advance of a substandard curve.

The use of supplementary Advisory Speed signs (W8-2) in conjunction with Curve Warning signs is determined by the following chart.

AS 1742.2:2022

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NOTE 1 No sign is required in this zone unless otherwise indicated by [Clause 4.3.2](#).

NOTE 2 A, B, C and D indicate the size of the sign. B size is the minimum size recommended for arterial roads. Increase one size where either the sign is cantilevered over the roadway, there are two or more lanes in one direction or the sign is more than 6 m from edge of the travel lane.

Figure 4.1 — Guide to the signposting of substandard horizontal curves

Source: AS 1742.2:2022.

Treatment Factsheets

Hierarchy

- Road safety audit risk control method: Change road user behaviour.
- Safe System assessment framework: Supporting treatment.

Other supporting treatments

- Edge lines to help delineate the edge of the road and provide guidance to drivers.
- Guide posts and RRPMs can provide additional guidance to drivers, particularly in areas where visibility may be limited.
- Flattening of batters to provide a more stable road surface and reduce the risk of run-off-road crashes.
- Advisory speed signs can ensure drivers are aware of the appropriate speed for travelling.
- Superelevation changes of the road for horizontal curves.

Pros

- Change road user behaviour by providing appropriate warning and advice, reducing the likelihood of crashes caused by driver error.
- Improved curve delineation, reducing the likelihood of run-off-road crashes on curves.
- Cost-effective at improving road safety.
- Able to alert drivers to hazardous or potentially hazardous conditions that may not appear apparent due to road geometry or environmental conditions.

Cons

- Regular maintenance is required to ensure signs remain visible and effective, which can be costly and time consuming.
- Warning signs do not eliminate the hazard itself, and poorly maintained or installed signs can add to the risk of crashes.
- Overuse of warning signs can be confusing for drivers and can reduce their effectiveness due to inconsistency.
- Warning signs are prone to vandalism.

Types (material)

Typically made of reflective sheeting and aluminium substrate that is shaped into the appropriate curve warning sign configuration. It provides a durable and long-lasting material for the sign that can withstand adverse weathering conditions.

Installation methods

Typically involves mounting the sign on a post or pole, which is buried in a hole that is dug into the ground. For additional stability, the hole is then backfilled with concrete which helps to prevent the post from leaning or falling over. Once the post or pole is anchored into the ground, the sign is then attached to post or pole using bolts or other fasteners, which are tightened securely.

The installation process must adhere to AS 1742 to ensure the sign is properly positioned and visible to drivers approaching the curve.

Installation considerations

When installing the warning signs, it is important to position them effectively without restricting lateral clearance or sight distance. Typically, a curve warning sign will be erected on the left side of the carriageway, but a duplicate sign may be installed on the right side if necessary to effectively convey the message to motorists.

Cost

Low (approximately \$350 per sign, including installation)

Life expectancy

5 years



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Overview of Each Treatment

Longitudinal Linemarking (Centre, Edge)

- ▶ **Description:** Essential road safety guidance with centrelines and edge lines
- ▶ **Crash Reduction Factors:** 10% to 25%
- ▶ **Locations:** Sealed roads only
- ▶ **Considerations:** Consistency, road geometry, visibility, and weather
- ▶ **Warrants:** Dividing lines for roads >5.5m wide, specific conditions in AS 1742.2
- ▶ **Hierarchy:** Reduce risk (road safety audit), support Safe System framework
- ▶ **Supporting Treatments:** Audio-tactile linemarking, retroreflective markers, guide posts
- ▶ **Pros:** Delineation, control speed, discourage shoulder travel, reduce crashes and costs
- ▶ **Cons:** Confusion, increased risk with poor design/installation, frequent maintenance
- ▶ **Materials:** AS 4049-compliant materials for durability and reflectiveness
- ▶ **Installation:** Paint, preformed tape, thermoplastic, per Main Roads WA Specification 6.4
- ▶ **Considerations:** Thickness compliance, dry surface, proper curing
- ▶ **Cost:** Low
- ▶ **Life Expectancy:** Typically 1 to 5 years



Source: WALGA

Audio-tactile Linemarking

- ▶ **Description:** Stimulates drivers when crossing lane boundaries, reducing crashes
- ▶ **Crash Reduction Factors:** 20% (ATLM edge line), 15% (ATLM centreline)
- ▶ **Locations:** Rural areas with high traffic, run-off-road history, poor visibility, wet weather, or night-time crashes
- ▶ **Considerations:** Sealing shoulders, sound perception, noise impact, continuous installation, rib colors, length requirements
- ▶ **Warrants:** Sealed road, cross-section width, sealed shoulder width, road factors, blackspot projects
- ▶ **Supporting Treatments:** Shoulder sealing, raised retroreflective pavement markers (RRPMs)
- ▶ **Pros:** Reduces crashes, improves wet weather visibility, lowers maintenance costs
- ▶ **Cons:** Hazards for cyclists, less noticeable for heavy vehicles, noise disturbance, time-consuming maintenance, specialised installation
- ▶ **Materials:** Thermoplastic
- ▶ **Installation:** Surface prep, preheating, application, cooling, excess material removal
- ▶ **Considerations:** Minimum road width, offset, linemarking integration, road surface integrity, resurfacing timeframe
- ▶ **Cost:** Low
- ▶ **Life Expectancy:** 5 years



Source: Main Roads Western Australia website.

Guide Posts

- ▶ **Description:** Improve road delineation, 1m height with reflectors
- ▶ **Crash Reduction Factors:** 10% to 25%
- ▶ **Locations:** Sealed/Unsealed roads
- ▶ **Considerations:** Spacing, reflective colors, flexible posts
- ▶ **Warrants:** Based on road width
- ▶ **Supporting Treatments:** Linemarking, warning signs, shoulder seal, barriers
- ▶ **Pros:** Maintain safe position, highlight road changes, enhance visibility
- ▶ **Cons:** Maintenance, design impact crash risk
- ▶ **Materials:** Wood, metal, plastic
- ▶ **Installation:** Varies based on shoulder materials
- ▶ **Cost:** Low, approx. \$80 per post (including installation)
- ▶ **Life Expectancy:** 5 years



Source: WALGA

Raised Retroreflective Pavement Markers

- ▶ **Description:** RRPMS enhance visibility for motorists in low light or adverse weather conditions. RRPMS mark lanes, changes in alignment, and delineate areas such as medians and traffic islands.
- ▶ **Crash Reduction Factors:** 15%
- ▶ **Locations:** Sealed roads
- ▶ **Considerations:** Consistent treatment, proper positioning
- ▶ **Warrants:** Use requirements specified in AS 1742.2:2022
- ▶ **Supporting Treatments:** Augment Linemarking
- ▶ **Pros:** Improved visibility of linemarking, audible and tactile warnings for lane departure crash prevention
- ▶ **Cons:** Noise for nearby residents, regular maintenance/replacement may be needed
- ▶ **Materials:** Durable materials like ceramic or plastic
- ▶ **Installation:** Adhesive attachment to the pavement surface
- ▶ **Cost:** Low, approx. \$12 per RRPM (including installation)
- ▶ **Life Expectancy:** 5 years



Source: ARRB Group

Speed Limit Review and Zoning

- ▶ **Description:** Review speed limits and consider factors for effective management
- ▶ **Crash Reduction Factors:** 10 km/h reduction decreases crashes by 20%
- ▶ **Locations:** Apply speed limits to all roads
- ▶ **Considerations:** Road function, activity, history, and observed speeds
- ▶ **Warrants:** Main Roads WA guidelines for speed limit setting
- ▶ **Supporting Treatments:** Design, calm traffic, enforce rules
- ▶ **Pros:** Fewer crashes, emissions, better flow, safety
- ▶ **Cons:** Slight travel time increase, compliance challenges
- ▶ **Material:** Signs, markings, message signs
- ▶ **Installation:** Compliant, visible, consult stakeholders
- ▶ **Cost:** low to medium, approx. \$350 per sign (including installation)
- ▶ **Life Expectancy:** Around 10 years



Source: WALGA

Advisory Speed Signs

- ▶ **Description:** Used with curve warning signs to indicate safe speed for navigating curves
- ▶ **Crash Reduction Factors:** 30%
- ▶ **Locations:** Sealed roads only, not on unsealed roads
- ▶ **Considerations:** Sign size, visibility, and appropriate speed based on road design and hazards
- ▶ **Warrants:** AS 1742.2:2022 provides guidelines for use
- ▶ **Supporting Treatments:** Used in conjunction with curve warning signs
- ▶ **Pros:** Alerts drivers, reduces crashes from excessive speed, enhances safety and comfort
- ▶ **Cons:** Requires regular maintenance, poorly maintained signs increase crash risk, overuse can be confusing
- ▶ **Materials:** Reflective sheeting and durable aluminium substrate
- ▶ **Installation:** Mounted beneath a curve warning sign on a post or pole
- ▶ **Installation Considerations:** Position signs effectively without hindering clearance or sight distance
- ▶ **Cost:** Low, approx. \$120 to \$1,000 per sign (including installation)
- ▶ **Life Expectancy:** Around 5 years



Source: WALGA

Intersection Warning Signs

- ▶ **Description:** Alerts drivers of upcoming intersections
- ▶ **Crash Reduction Factors:** 10% to 30%
- ▶ **Locations:** Sealed/unsealed roads, curves, grade changes
- ▶ **Considerations:** Size, visibility, engineering changes first, no interference with regulatory signs
- ▶ **Warrants:** Limited sight distance, unusual layouts, safety audits, adherence to standards
- ▶ **Supporting Treatments:** Flattening batters, improving sight distance
- ▶ **Pros:** Inform drivers, cost-effective, highlight hidden hazards
- ▶ **Cons:** Regular maintenance, no hazard elimination, confusion risk, vandalism
- ▶ **Materials:** Reflective sheeting on aluminium substrate
- ▶ **Installation:** Post/pole with concrete backfill
- ▶ **Considerations:** Left side placement, visibility, duplication if needed
- ▶ **Cost:** Low, approx. \$350 per sign (including installation)
- ▶ **Life Expectancy:** 5 years



Source: ARRB Group

Curve Warning Signs

- ▶ **Description:** Inform drivers of upcoming curves
- ▶ **Crash Reduction Factors:** 10% to 30%
- ▶ **Locations:** Sealed/Unsealed roads, transition areas
- ▶ **Considerations:** Road alignment, sign type/size, consistency
- ▶ **Warrants:** Used for substandard curves
- ▶ **Supporting Treatments:** Edge lines, guide posts, advisory signs
- ▶ **Pros:** Change driver behavior, improve curve delineation, cost-effective
- ▶ **Cons:** Maintenance, signs don't eliminate hazards, overuse confusion
- ▶ **Material:** Reflective sheeting, aluminum
- ▶ **Installation:** Mount on post/pole, anchored with concrete
- ▶ **Cost:** Low, approx. \$350 per sign (including installation)
- ▶ **Life Expectancy:** 5 years



Source: AS 1742.2:2022

Guide Signs (Chevron Alignment Markers)

- ▶ **Description:** CAMs improve road safety by alerting drivers to curves.
- ▶ **Crash Reduction Factors:** 10% to 25%
- ▶ **Locations:** Sealed/Unsealed roads, substandard curves (200m-500m radius)
- ▶ **Considerations:** Consistent treatment, proper positioning
- ▶ **Warrants:** Use requirements specified in AS 1742.2:2022
- ▶ **Supporting Treatments:** Guide posts, advisory speed signs
- ▶ **Pros:** Improve positioning, control speed, provide warning
- ▶ **Cons:** Do not eliminate hazard, require maintenance, proximity hazard
- ▶ **Materials:** Reflective sheeting, aluminum
- ▶ **Installation:** Mount on post/pole anchored with concrete
- ▶ **Cost:** Low, approx. \$315 per sign (including installation)
- ▶ **Life Expectancy:** 5 years



Source: WALGA

Vehicle Activated Signs

- ▶ **Description:** Signs triggered by vehicle speed to alert drivers of hazards
- ▶ **Crash Reduction Factors:** Curves - 40%, Intersections - 70%
- ▶ **Locations:** Sealed/unsealed roads, curves, ineffective sign areas, intersections
- ▶ **Considerations:** Prioritize high-risk corridors, develop safety plans
- ▶ **Warrants:** Corridor analysis, crash data
- ▶ **Supporting Treatments:** Duplication with static sign
- ▶ **Pros:** Control speeds, warn of hazards, potential data collection
- ▶ **Cons:** Vandalism risk, power supply challenges
- ▶ **Materials:** Aluminium frame, LED lights, solar panels, batteries, reflective materials
- ▶ **Installation:** Ground/portable on trailers/mobile platforms
- ▶ **Considerations:** Visibility, height, power source, wiring
- ▶ **Cost:** Medium to high, approx. \$8,000-\$8,500 per sign (including installation)
- ▶ **Life Expectancy:** 10 years



*Source: Main Roads
Western Australia website*

Lane Widening

- ▶ **Description:** Increases lane width for improved safety and reduced head-on collision risk
- ▶ **Crash Reduction Factors:** 25% to 40%
- ▶ **Locations:** Curves, crests, high-risk areas on sealed roads
- ▶ **Considerations:** Lane width standards, passing locations, visibility, shoulders, infrastructure
- ▶ **Warrants:** Lane widths based on traffic volumes
- ▶ **Supporting Treatments:** Increase curve radius, markings, signs, barriers, shoulder sealing
- ▶ **Pros:** Enhances traffic flow, reduces crashes, improves sight distance, benefits heavy vehicles
- ▶ **Cons:** Costly, potential for misuse, environmental impact
- ▶ **Materials:** Spray seal, asphalt, concrete, gravel
- ▶ **Installation:** Full-depth or partial depth widening, meet service requirements
- ▶ **Cost:** Medium to high (\$100k-\$500k per km)
- ▶ **Life Expectancy:** 10 to 20 years



Source: WALGA

Shoulder Sealing

- ▶ **Description:** Sealing road shoulders improves moisture conditions, reduces maintenance costs, and enhances safety
- ▶ **Crash Reduction Factors:** 25% at 110 km/h
- ▶ **Locations:** Target horizontal curves and high-risk areas on sealed roads
- ▶ **Considerations:** Shoulder width based on traffic, hazards, and superelevation evaluation
- ▶ **Warrants:** Shoulder widths based on traffic volumes
- ▶ **Supporting Treatments:** Audio-tactile edge lines, centerline marking, guide posts, safety barriers, removal of hazards
- ▶ **Pros:** Reduces crashes, allows emergency stopping, provides structural support, minimises "edge drop," accommodates cyclists and pedestrians
- ▶ **Cons:** Potential for unsafe driver behaviour, maintenance requirements, environmental impact
- ▶ **Materials:** Asphalt emulsion, chip seal, concrete, gravel
- ▶ **Installation:** Surface preparation, drainage, traffic management, material selection, quality control, environmental measures
- ▶ **Cost:** Medium, varies by region and shoulder width
- ▶ **Life Expectancy:** 5 to 10 years



Source: Main Roads Western Australia website

Surface Corrections (rutting, cracking, pot holes)

- ▶ **Description:** Fixing pavement defects for safe road use. Surface Defects: Cracking, potholes, roughness, etc.
- ▶ **Crash Reduction Factors:** 25% to 40%
- ▶ **Locations:** Sealed/Unsealed roads
- ▶ **Considerations:** Design, drainage, skid resistance
- ▶ **Warrants:** Surveys, Integrated into projects, Compliance
- ▶ **Supporting Treatments:** Road safety audit, Safe System assessment, Warning signs
- ▶ **Pros:** Enhanced safety, Strengthened pavement, Improved skid resistance, Address issues
- ▶ **Cons:** Varying cost effectiveness, Temporary inconvenience, Disruption
- ▶ **Materials:** Wearing Course, Basecourse, Subbase, Subgrade
- ▶ **Installation Considerations:** Weather, Traffic management, Quality control, Environmental measures
- ▶ **Cost:** Medium



Source: WALGA

Improving Skid Resistance

- ▶ **Description:** Treatments to enhance pavement friction and reduce skidding risks
- ▶ **Crash Reduction Factors:** 25% to 40% in wet conditions
- ▶ **Locations:** Sealed roads, curves, grades, intersections, crash-prone areas
- ▶ **Considerations:** Assess pavement condition, treatment suitability, durability, weather impact
- ▶ **Warrants:** High-speed condition survey
- ▶ **Supporting Treatments:** 'Slippery' warning signs
- ▶ **Pros:** Reduce skidding risk, prevent crashes, extend pavement life
- ▶ **Cons:** Regular monitoring needed, time-consuming, specialised equipment
- ▶ **Materials:** Durable aggregate with resin binder
- ▶ **Installation:** Re-texturing or resurfacing
- ▶ **Considerations:** Surface prep, debris-free, dry weather, curing time
- ▶ **Cost:** Low to medium
- ▶ **Life Expectancy:** 10 years



Source: WALGA

Road Safety Barriers

- ▶ **Description:** Installations to protect motorists and prevent crashes
- ▶ **Crash Reduction Factors:** 40% to 60%
- ▶ **Locations:** Sealed/unsealed roads with high risk
- ▶ **Considerations:** Vehicle types, continuous installation, barrier types, length requirements
- ▶ **Warrants:** Austroads Guide, Main Roads Western Australia guidelines
- ▶ **Supporting Treatments:** Infrastructure improvement, speed limit reduction, proper linemarking
- ▶ **Pros:** Contain/redirect vehicles, reduce crash severity, prevent run-off-road collisions
- ▶ **Cons:** Risk to motorcyclists, sign obstruction, limited recovery area, redirecting vehicles, maintenance
- ▶ **Materials:** Steel, concrete
- ▶ **Installation:** Follow specifications, consider space and ground conditions
- ▶ **Considerations:** Space, ground conditions, environmental suitability, visibility of safety measures
- ▶ **Cost:** Medium
- ▶ **Life Expectancy:** 10 years



Source: WALGA

Flag Lighting

- ▶ **Description:** Illuminate remote intersections with streetlights for improved visibility
- ▶ **Crash Reduction Factors:** 10%
- ▶ **Locations:** Isolated rural intersections on sealed/unsealed roads
- ▶ **Considerations:** Developer funded, crash history, road alignment, pedestrian activity
- ▶ **Supporting Treatments:** Warning signs, vehicle activated signs, pavement markings, vegetation maintenance
- ▶ **Pros:** Enhance visibility at night, safer for pedestrians and cyclists
- ▶ **Cons:** Reduced effectiveness in adverse weather, maintenance required
- ▶ **Materials:** Solar-powered, wired, battery-powered flag lighting
- ▶ **Installation:** Solar panels and batteries for solar-powered, wiring for wired, batteries for temporary use
- ▶ **Considerations:** Height, location, regulations, lighting effect
- ▶ **Cost:** Low to medium, average \$12,000 per light (including installation)
- ▶ **Life Expectancy:** 20 years



Source: WALGA



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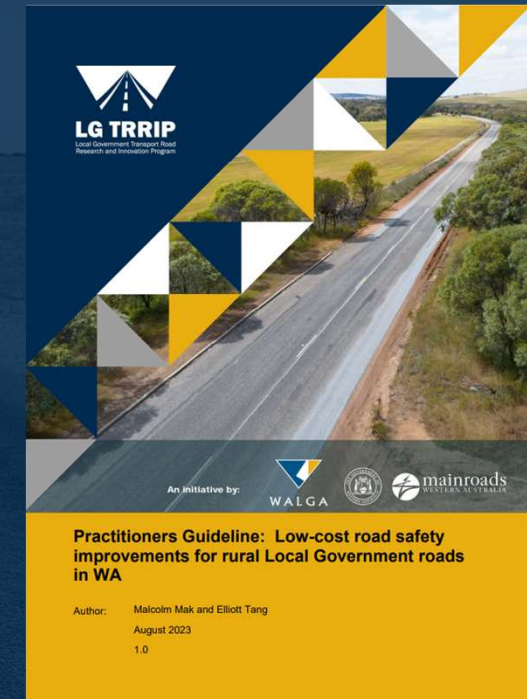
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Summary

Summary

Local Government Challenges

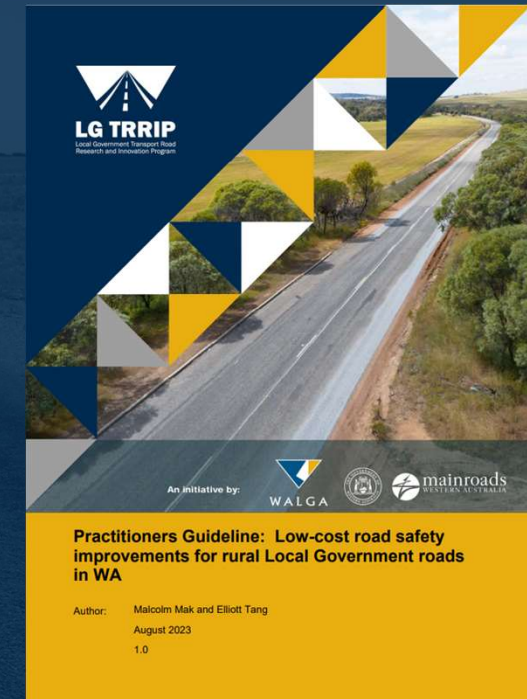
- ▶ Large regional/rural LG road network
- ▶ Lower traffic volumes
- ▶ Limited budgets
- ▶ Crash patterns can be random
- ▶ Existing treatment guidance can be targeted to State arterial roads



Summary

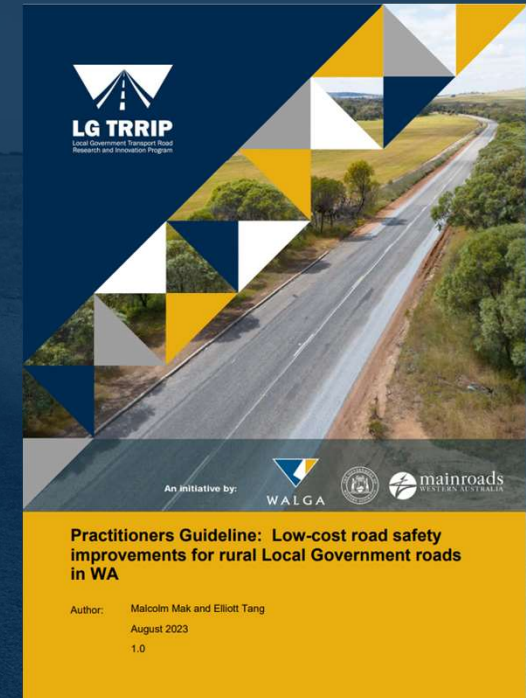
The Practitioners Guideline will provide Local Government practitioners with:

- ▶ treatment selection and hierarchy,
- ▶ design and construction guidance,
- ▶ case studies,
- ▶ examples of what to consider in the implementation



Summary

- ▶ **Increased safety** outcomes on Local Government roads over time
- ▶ **Time savings** for Local Government staff during treatment selection and design process
- ▶ **Consistency** between Local Governments and regions for the implementation of safety treatments
- ▶ Improved understanding of expected **benefits and costs**
- ▶ Promotion of **best practices**





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**Thank you for listening.
Any questions?**