Speed management

Austroads

Why is it important to manage traffic speeds as part of Safe System implementation?

Low risk

High risk

Speed management in the Safe System

- *Safe System should not result in death or serious injury as a consequence of road user error.*
- *Prevent conflicts, or if unavoidable, reduce their energy to safe levels.*
- *Safe mobility: maximise mobility without compromising safety.*

What does it all mean?

- **Match traffic speeds to road infrastructure, road use and function.**

OR

- **Equip the road to provide safe mobility for all intended road users.**

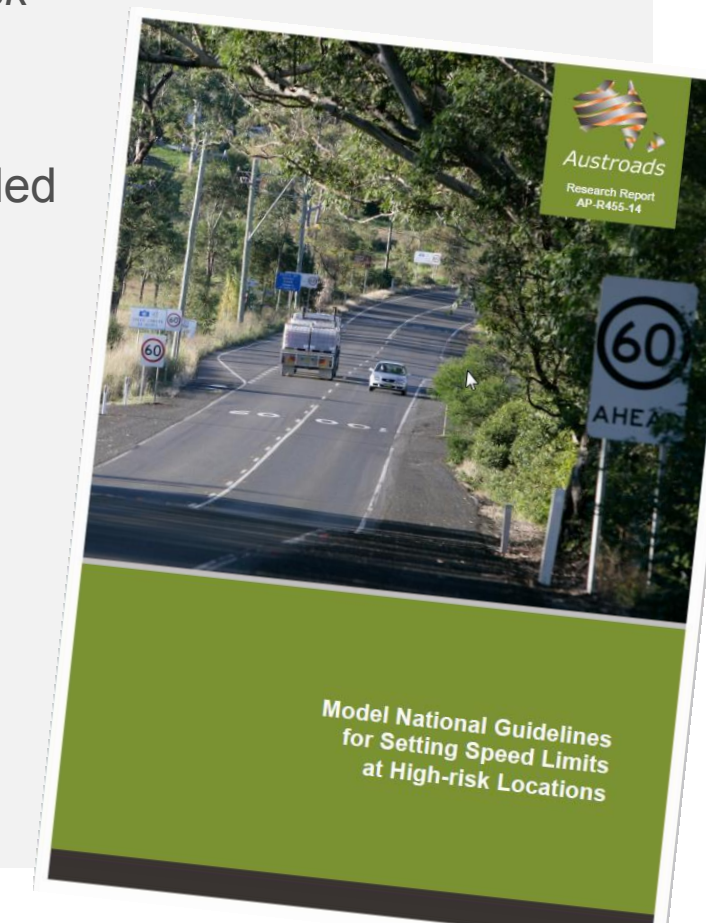
Contents: speed management tools

Austroads

- Speed limit guidelines / methods (next generation)
- Enforcement and education effects
- Changing the road environment: arterial traffic calming
- A speed limit setting game!

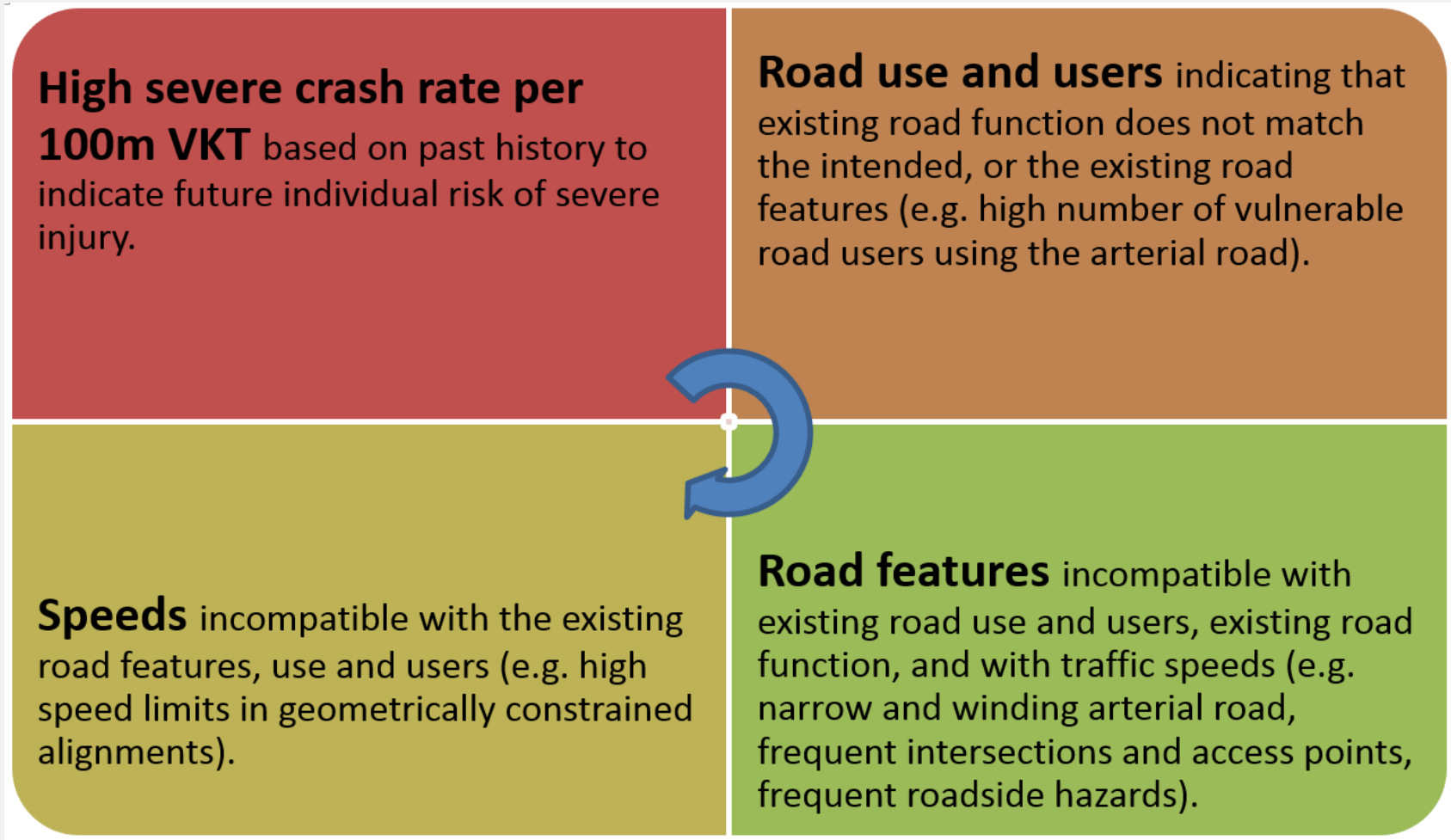
Setting speed limits using a risk-based approach

- A step towards Safe System, supporting the vision
- Austroads report *Model National Guidelines for Setting Speed Limits at High-risk Locations* (AP-R455-14)
- Reduce speed limits when road cannot be equipped to safely provide it's intended function and actual use.
- Starts with recognition of roads functional hierarchy and form, e.g.
  - Urban local access and collector roads
  - Urban arterial roads – undivided
  - Rural roads – undivided
  - Rural freeways / motorways



Setting speed limits using a risk-based approach

Types of risk factors which prompt reduction from the typical 'functional' speed limits:



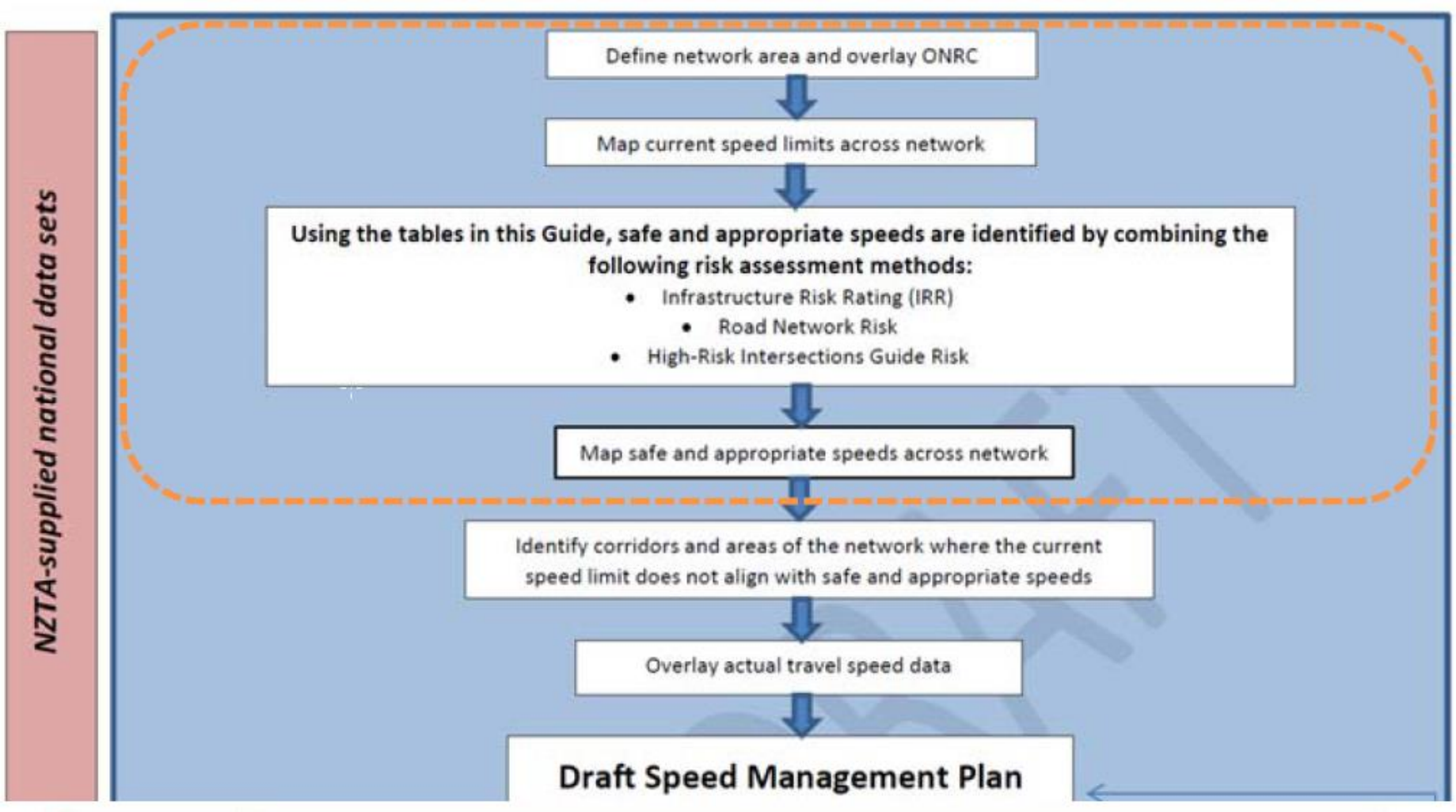
Source: Austroads report *Model National Guidelines for Setting Speed Limits at High-risk Locations* (AP-R455-14)

Setting speed limits using a risk-based approach

Road category/function and proposed speed limit (km/h)		Consider a reduced speed limit when any one of these severe crash risks is present[1]			
		Severe crash rate/100 million VKT	Road use and users	Road features	Speeds[7]
Urban arterials – divided (fully and partially built-up areas)	80	–	–	–	–
	70[10]	–	–	▪ 2–4 standard access points per 100 m (includes intersections)[6] ▪ Consistent and frequent presence of unprotected roadside hazards within 1.5 m of the traffic (e.g. trees/poles spaced closer than every 10 m, or continuous[11]) ▪ No protection for left or right-turning vehicles ▪ Generally curving or winding road alignment (e.g. > 4 higher-risk curves per km [5][12])	▪ Mean speed is well below the existing speed limit[8] due to congestion[3] and competing road uses[3][4] leading to high speed variation
	60	▪ Severe crash rate is high[2]	▪ Pedestrians or cyclists are present in high numbers[2], especially in commercial areas and business districts ▪ On-road parking is permitted and occurs frequently along the route ▪ High one-way AADT, e.g. over approximately 56 000 vpd per carriageway[9]	▪ > 4 standard access points per 100 m (includes intersections)[6]. More than two of the road feature risk factors for 70 km/h	▪ Mean speed is well below the existing speed limit[8] due to congestion[3] and competing road uses[3][4] leading to high speed variation
	40	–	▪ School frontage[3]	–	–

Source: Austroads (2014)

The NZ Speed Management Framework



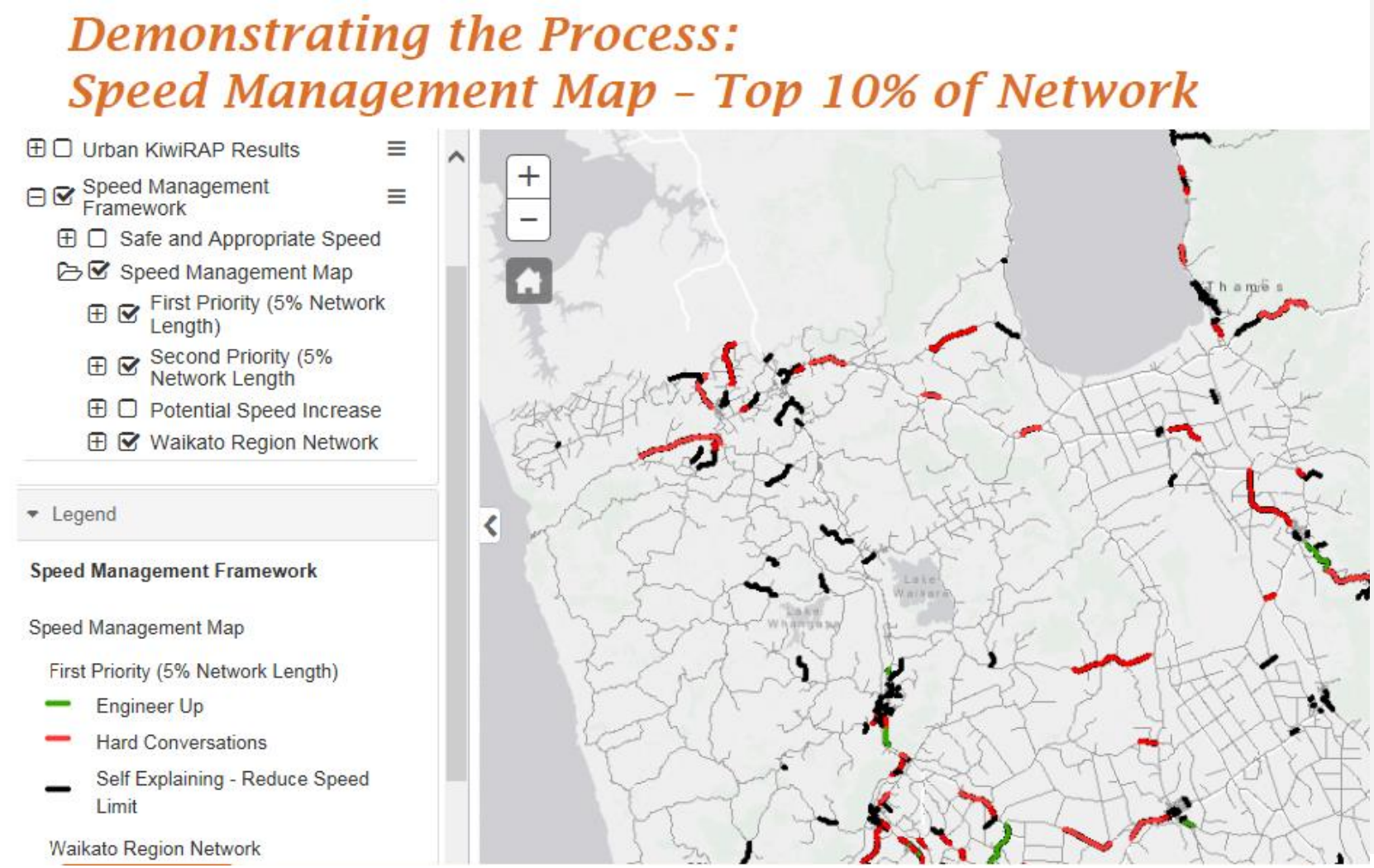
New Zealand – Infrastructure Risk Rating (IRR)

Austroads

IRR Score	IRR Rating Interpretation (Compatibility with Speed Management Framework & Urgency of Speed Management Review)	
	Rural	**Urban**
0 to <0.8	Low IRR Rating Safe speed No review required	Low IRR Rating Safe speed No review required
0.8 to <1.2	Low-Medium IRR Rating Compatible speed No review required	Low IRR Rating Safe speed No review required
1.2 to <1.6	Medium IRR Rating Appropriate speed Low urgency for review	Low IRR Rating Safe speed No review required
1.6 to <2.0	Medium-High IRR Rating Incompatible speed Moderate urgency for review	Low-Medium IRR Rating Compatible speed No review required
2.0 to <2.4	High IRR Rating Unsafe speed High urgency for review	Medium IRR Rating Appropriate speed Low urgency for review
2.4 to <2.8	High IRR Rating Unsafe speed High urgency for review	Medium-High IRR Rating Incompatible speed Moderate urgency for review
2.8+	High IRR Rating Unsafe speed High urgency for review	High IRR Rating Unsafe speed High urgency for review

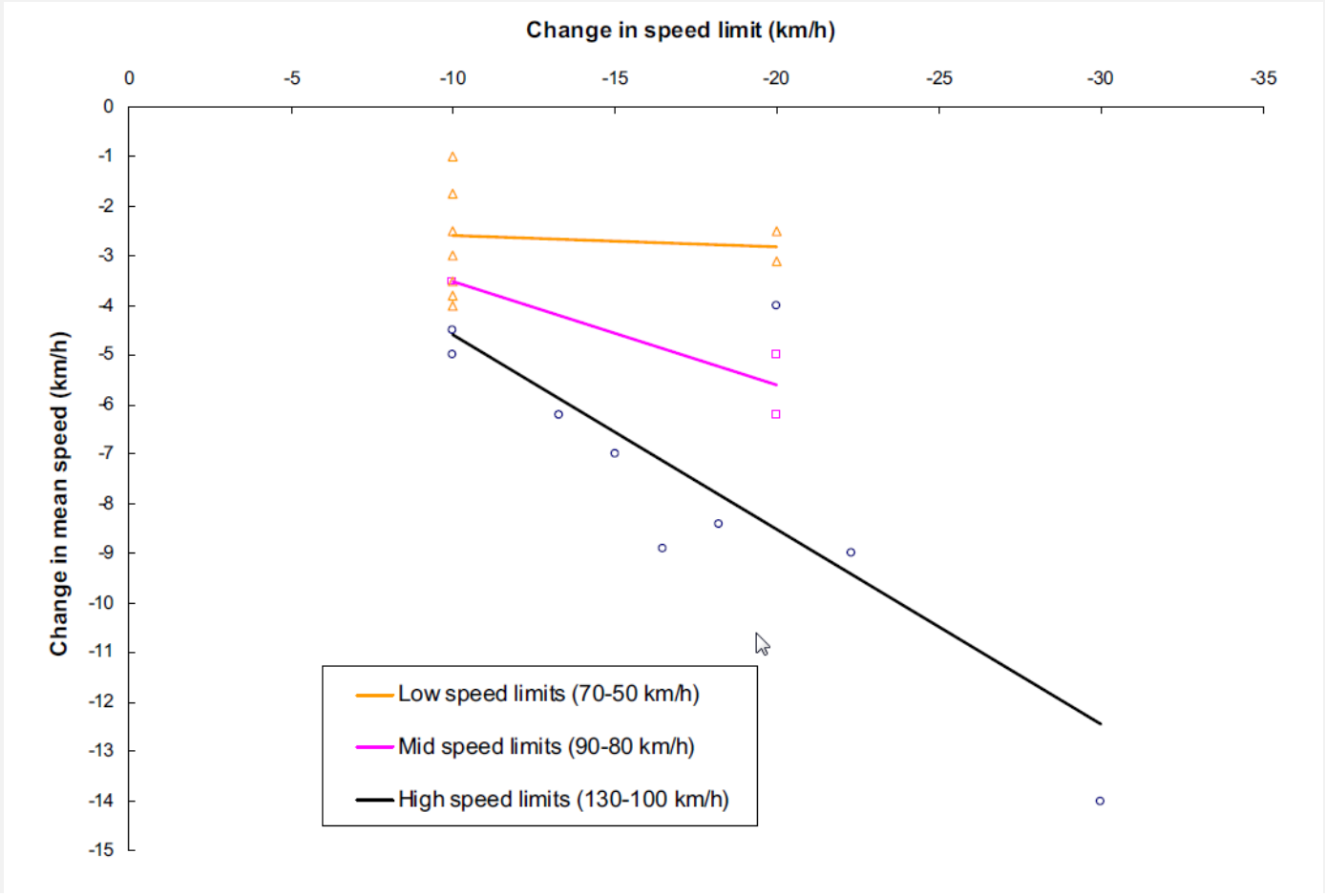
High
Medium – High
Medium
Low-Medium
Low

New Zealand – IRR



Enforcement and education effects

Short-term…



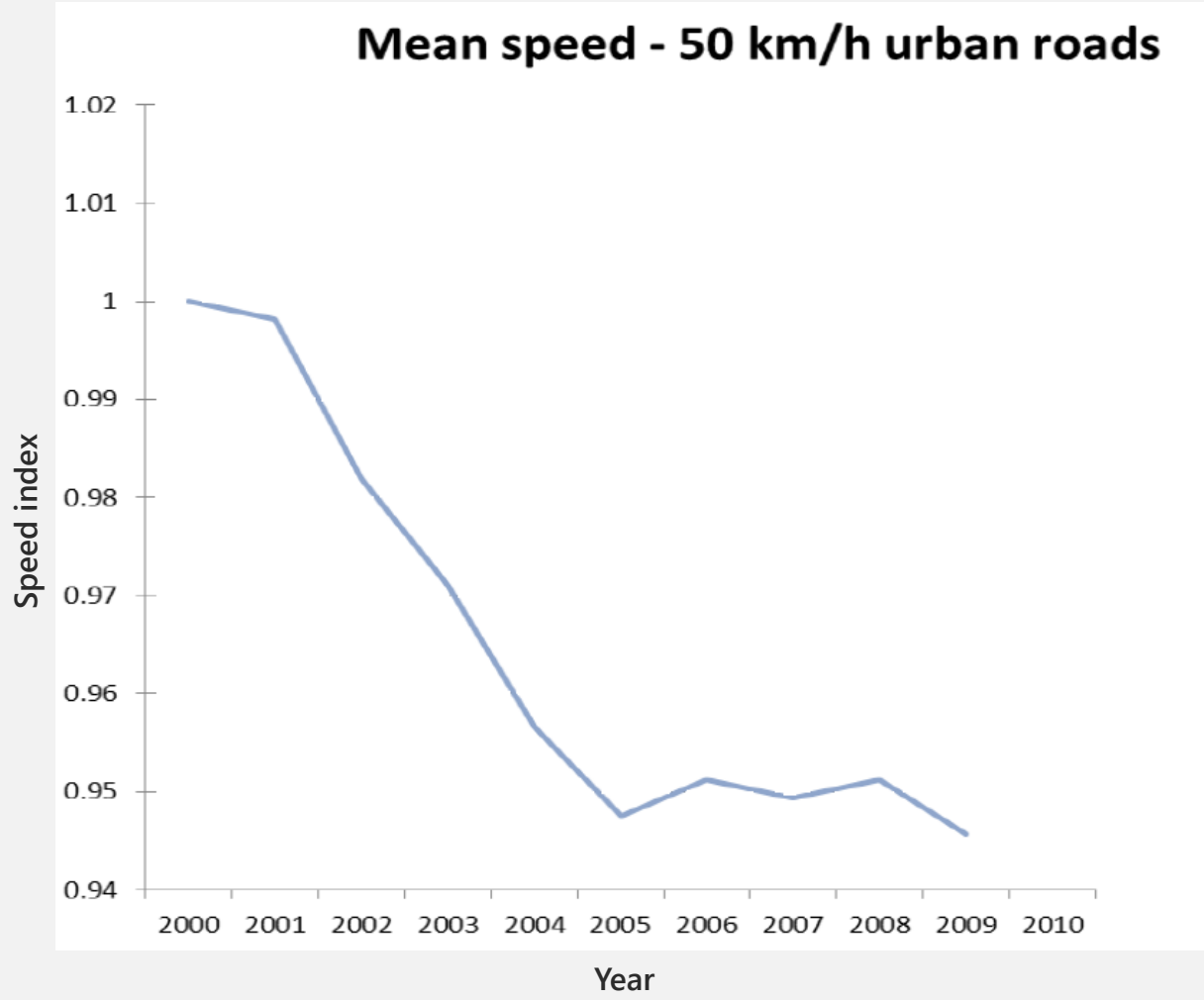
Source: Austroads (2009c).

- 5 km/h mean speed reduction from 100 km/h ➔ 12% reduction in serious injury crashes (Elvik 2009)
- Achieved in typical study period of < 1 year

Enforcement and education effects

Long-term…

- General deterrent (enforcement) and education campaigns work together to produce steady reduction in speeding, and hence, in mean speeds
- Further reductions towards the -10 km/h change

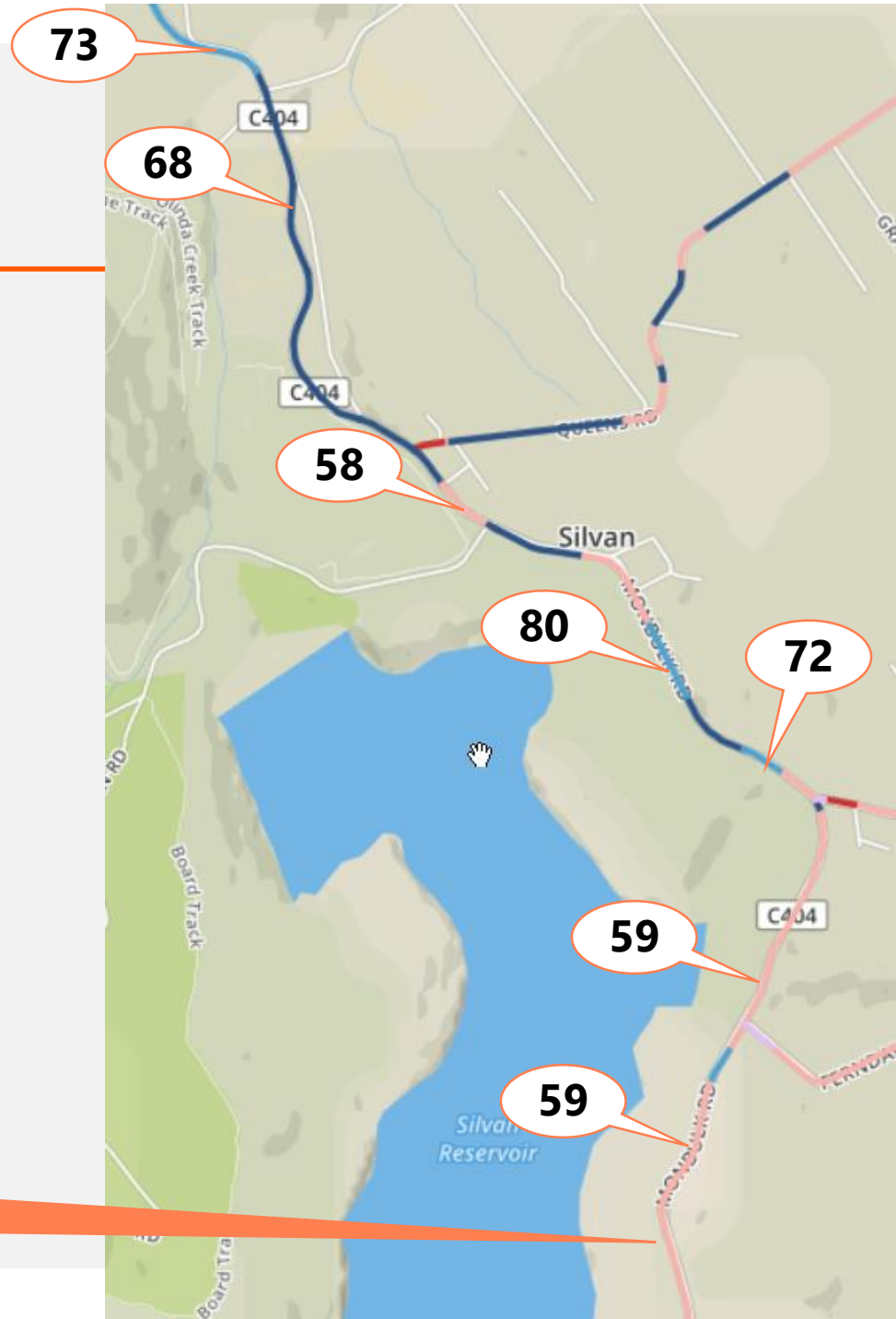


Source: Austroads (2012) IR-204-12

Speeds… explore, understand

Mean speeds along an outer metro road signed at 80 km/h

Would 70 km/h be credible?



Changing the road environment: arterial traffic calming

- **Use of engineering features to reduce traffic speeds to safer and consistent levels**
  - Approaches to curves
  - Intersection approaches
  - Rail crossings
  - Approaches to towns, shopping centres
- **Makes roads more self-explaining**
- **Rural and urban Austroads guides**

Achieving Safe System Speeds on Urban Arterial Roads: Compendium of Good Practice

Methods for Reducing Speeds on Rural Roads

Compendium of Good Practice

Changing the road environment: arterial traffic calming

Summary: speed limits supporting Safe System

- **A step towards Safe System**
- **Match traffic speeds with road infrastructure, road use and function**
- **Reduce speed limit if there are high risk factors present**
- **Manage speed discrepancies with traffic calming**

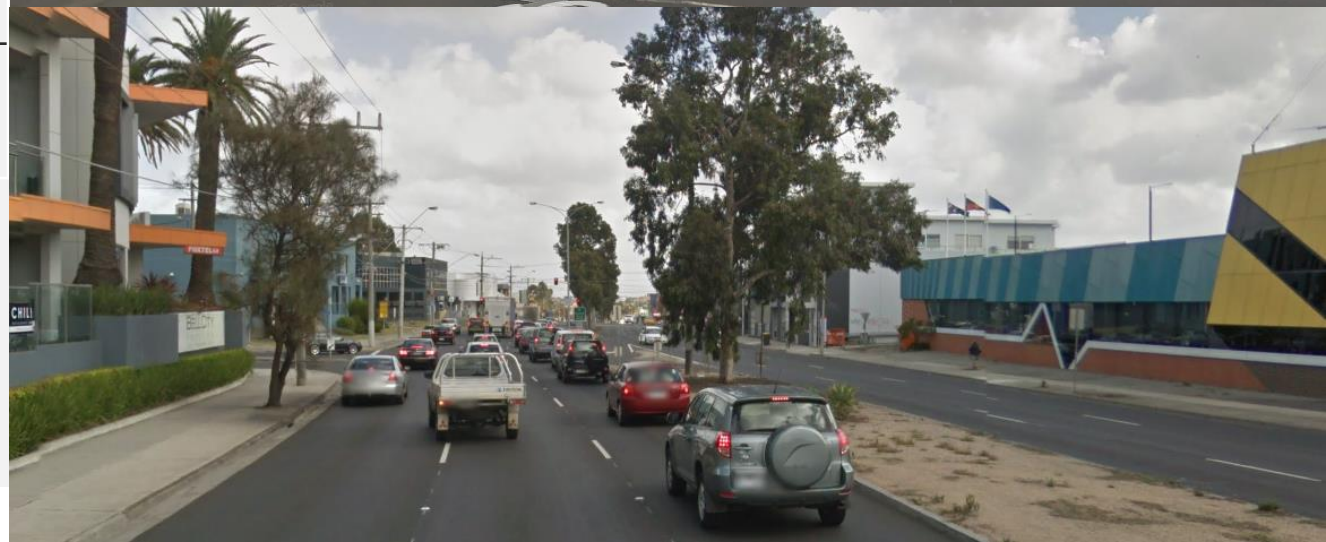
Guess the speed limit (supporting Safe System)

Considerations	Risk factors present
Functional speed limit:	Rural default (100 km/h)
Severe crash rate:	2.2 cr/km/5 years (high) ✓
Road use and user factors	AADT is high 12,000 vpd, some accesses, rural industries ✓
Road feature risk factors	Good cross-section, BUT strong curvature, roadside hazards ✓
Speed factors	V_{50}=67 km/h, V_{85}=72 km/h i.e. low due to traffic & curves ✓

Reference: Model National Guidelines for Setting Speed Limits at High-risk Locations (AP-R455-14)

Guess the speed limit (supporting Safe System)

Considerations	Risk factors present	
Functional speed limit:	80 km/h divided arterial	
Severe crash rate:	1.3 cr/km/5 years (low)	X
Road use and user factors	Peds, cyclists, parking, intersections & access.	✓
Road feature risk factors	Frequent intersections, roadside hazards, narrow lanes	✓
Speed factors	V_{50}=78 km/h, V_{85}=83 km/h i.e. as expected	X

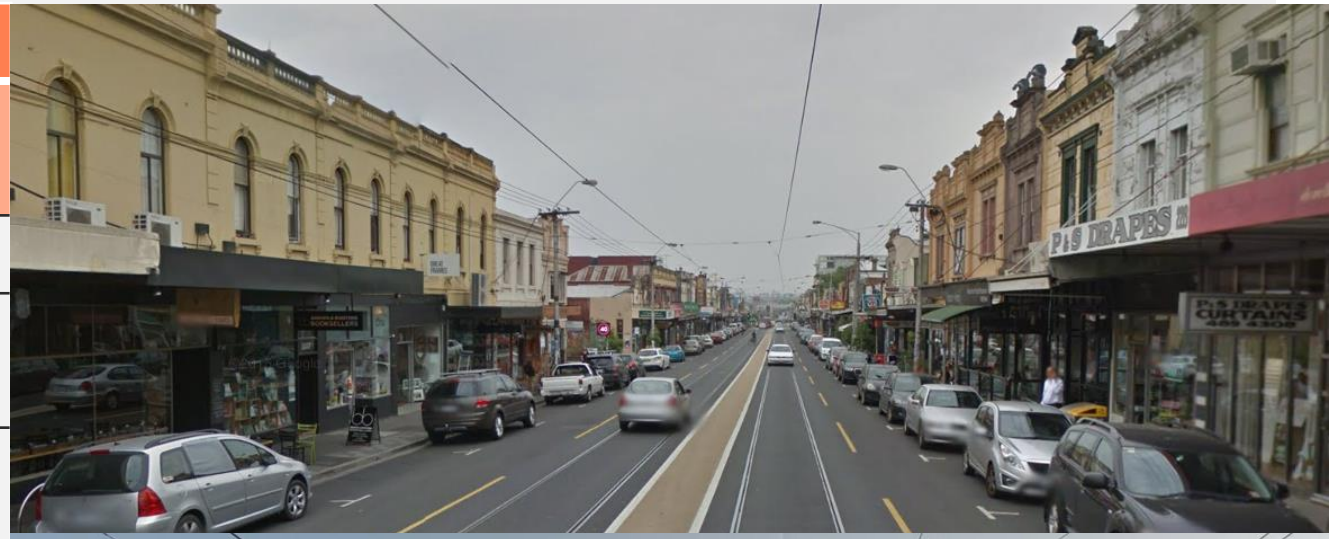


Reference: Model National Guidelines for Setting Speed Limits at High-risk Locations (AP-R455-14)

Guess the speed limit (supporting Safe System)

Considerations	Risk factors present	
Functional speed limit:	60 km/h undivided arterial	
Severe crash rate:	3 cr/km/5 years (high)	✓
Road use and user factors	Peds, cyclists, parking - a shopping strip, mixed use	✓
Road feature risk factors	Frequent intersections, roadside hazards, narrow lanes	✓
Speed factors	V_{50}=30 km/h, V_{85}=39 km/h v. low due to traffic friction	✓

Reference: Model National Guidelines for Setting Speed Limits at High-risk Locations (AP-R455-14)



Thank you

Additional slides for the notes showing arterial traffic calming solutions

A.1.4 Vehicle-activated Signs – Curves

Source: Warwickshire County Council.

Description

The electronic signs are only activated by the presence of a vehicle, and in some cases only if the vehicle is travelling above a threshold speed limit. Once triggered, the sign displays the hazard, and may include a message to slow down. This alerts the driver to the presence of the curve with the aim being that they reduce their speed to negotiate the curve safely.

Benefits

Speed reduction: 2–6 km/h.

Crash reduction: 35% in injury crashes.

A.1.6 Transverse Rumble Strips – Curves

Source: ARRB Group.

Description

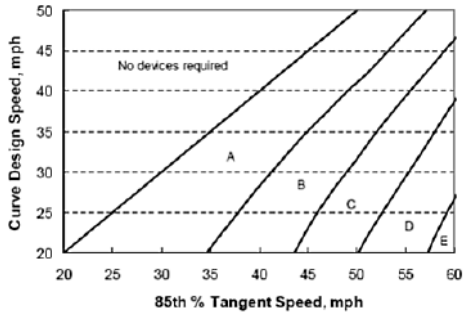
Rumble strips are lines or sections of profiled road markings placed across the carriageway so as to cause noise and vibration in the vehicle to alert the driver to the presence of a hazard. They have been used to a limited extent in advance of rural curves.

Benefits

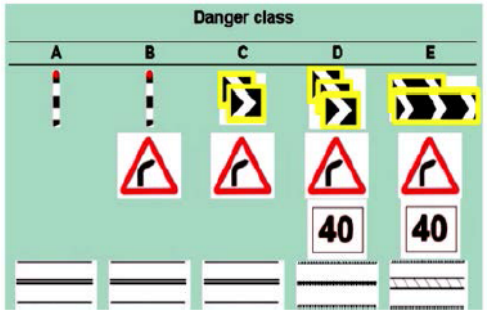
Speed reduction: 5 km/h.

Crash reduction: Unknown.

A.1.8 Route-based Curve Treatments – Curves



Source: Bonneson, Pratt, Miles and Carlson (2007).



Source: TRL and Department for International Development (2001).

Description

Route-based treatments are a method of ensuring consistency of signing of curves along a section of road. Each curve is classified based on risk factors, such as design speed, tangent speed, sight distances etc. Once the risk of the curve has been identified, signs and markings for that curve are installed according to this risk category. The higher the risk category the more treatments are installed. These include advance curve warning signs, guide posts, chevron markers and profiled road markings.

Benefits

Speed reduction: Unknown.

Crash reduction: Unknown.

A.2.4 Perceptual Countermeasures – Intersections

Source: Macaulay et al. (2004).

Source: DETR (2001).

Description

The treatments are used to alter a driver's perception of the environment. Can be used to make drivers think they are going faster than they are, or that the road narrows. Both of these cause the driver to slow on approach to the intersection. In addition, the treatments are likely to raise awareness of the presence of the intersection. This type of treatment is quite common in the UK, particularly on the approach to roundabouts.

Benefits

Speed reduction:

- 4 km/h from perceptual narrowing
- up to 8 km/h from markings that give the appearance of travelling faster on the approach to an intersection.

Crash reduction: 60% on approach to roundabouts.

Other: Increased awareness of intersection.

A.2.8 Variable Speed Limits – Intersections

Source: Swedish Road Administration (2006).

Description

Use of variable message signs to signal changes in the speed limit, when traffic volumes or environmental conditions make it necessary. These can be mandatory or advisory speed limits. Some systems respond when vehicles approach the intersection from a side road.

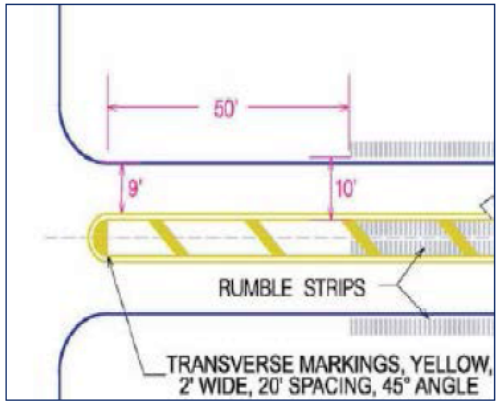
Benefits

Speed reduction: Dependent on limits; 17 km/h when reduced from 90 km/h to 70 km/h.

Crash reduction: Unknown.

Other: Improved traffic flow.

A.2.9 Lane Narrowing – Intersections



Source: Gross et al. (2009).

Description

Use of solid or painted median, possibly incorporating profiled edge lines, to create narrower lanes on the approach to an intersection. This encourages motorists to slow down to safely navigate through the narrower section. Also see Appendix A.2.4 on perceptual countermeasures, which may also act to produce a perceived narrowing of lanes on approach to intersections.

Benefits

Speed reduction: 5 km/h.

Crash reduction:

- 30% all crashes
- 20% fatal and injury crashes.

A.4.4 Rural Thresholds – Transition Zones

Source: ARRB Group.

Source: Land Transport Safety Authority (2002).

Description

Using a combination or treatments to slow traffic down and to create a visual difference on entering a village or other built-up area. There is usually a combination of signs (either static or active), road markings and road narrowing. Threshold treatments work significantly better when a pinch point (some form of perceived or actual road narrowing) is used.

Benefits

Speed reduction: Up to 25 km/h.

Crash reduction:

- 25% overall reduction (fatal and injury)
- 35% overall if pinch point used
- 40% reduction in fatal and serious injury when a pinch point is used.

Other: Raised awareness of a change in road environment.

A.1.2 Roundabouts

Source: ARRB Group.

Source: ARRB Group.

Description

Roundabouts are circular central islands, around which (in Australia and NZ) traffic circulates in a clockwise direction, which are used where T or X intersections may not be appropriate. Entry to the roundabout is controlled by way of signs and markings, with all entering traffic required to give way to the right and to traffic on the circulating roadway. However, in certain circumstances roundabouts are signalised, either partly or wholly and either at peak times only or all the time. Other roundabout types include turbo and mini roundabouts. Mini roundabouts are not typically applied on high volume roads therefore are not addressed in this report.

Effectiveness

Speed reduction:

- 10 km/h reduction in 85th percentile speed.

Crash reduction:

- 75% reduction (CMF 0.25).

A.1.5 Raised Intersections

Source: ARRB Group.

Source: VicRoads.

Description

Raised intersections (also known as platform intersections, raised junctions or plateaus) are a speed management device, typically with the aim of reducing the speed of vehicles to 50 km/h or less. The entire intersection can be raised, with the pavement surface sometimes flush with the adjoining footpath. Alternatively, raised sections can be placed in advance of the intersection (sometimes referred to as raised stop bars) in order to achieve a similar effect. Raised intersections can be painted or paved in a manner such that they serve to further increase driver awareness of the intersection.

Effectiveness

Speed reduction*:

- 3 km/h reduction in mean speed.
- 8 km/h reduction in 85th percentile speed.

Crash reduction*:

- 40% reduction in casualty crashes (CMF 0.60).

A.1.6 Horizontal Deflection

Source: Austroads (2011).

Description

Horizontal deflection treatments often involve the installation of kerb extensions, medians and/or pedestrian refuge islands at intersection approaches. This combination of treatments can be used to slow vehicles to a Safe System compliant intersection speed, as well as to facilitate shorter and safer pedestrian crossings.

Additionally, a similar approach involves installing splitter islands at intersections, generally on the approach to give-way or stop-controlled intersections. The splitter island slows and directs traffic, and also separates opposing traffic streams. Splitter islands can also serve as pedestrian refuge islands if required. This treatment is often applied at roundabouts, but it is also used on minor intersection approaches.

Effectiveness

Speed reduction:

- Up to 5 km/h.

Crash reduction:

- 30% reduction in pedestrian crashes (CMF 0.70).
- 35% reduction in crashes for splitter islands (CMF 0.65).
- 15% reduction in crashes for a mountable median (CMF 0.85).
- 25% reduction in crashes for a non-mountable median (CMF 0.75).

Road environment safe for pedestrians and cyclists

- Most vulnerable of all road users
- Severe injury 10% risk at ~20 km/h impact, death almost certain at 50 km/h impact
- Young and old even more vulnerable
- Manage speeds to ~20 km/h if possible where pedestrian volumes are significant
- Otherwise seek to separate from vehicles