Improving Safe System Intersection Performance

Fabian Marsh - Lead Advisor Safety

WAKA KOTAHI
NZ TRANSPORT AGENCY

New Zealand Government

Systemic design failures

People are placed in circumstances where failure can be expected

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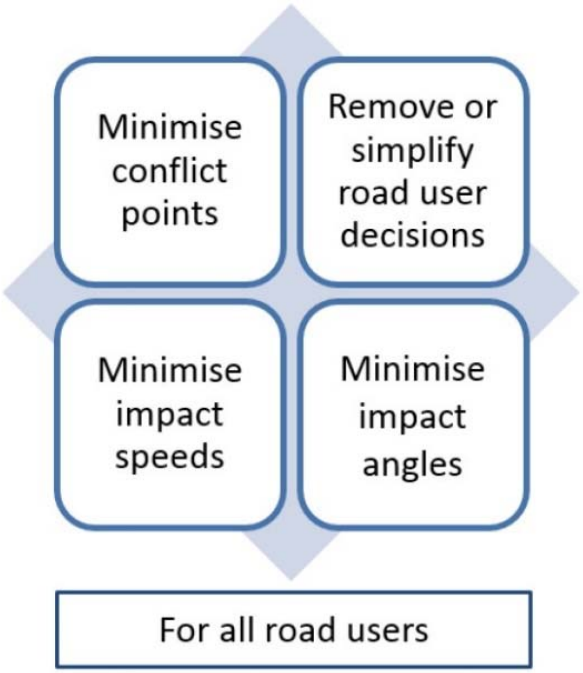
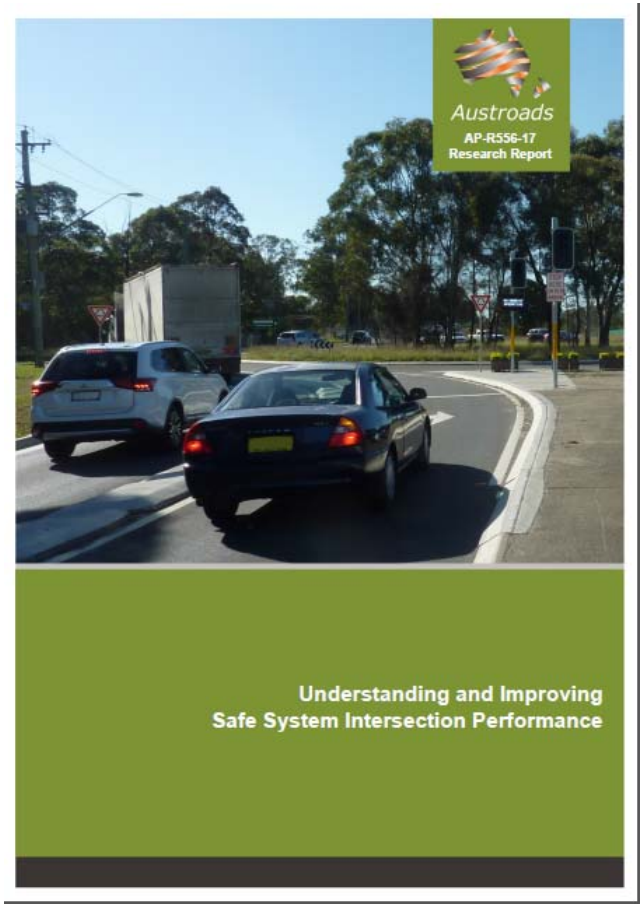
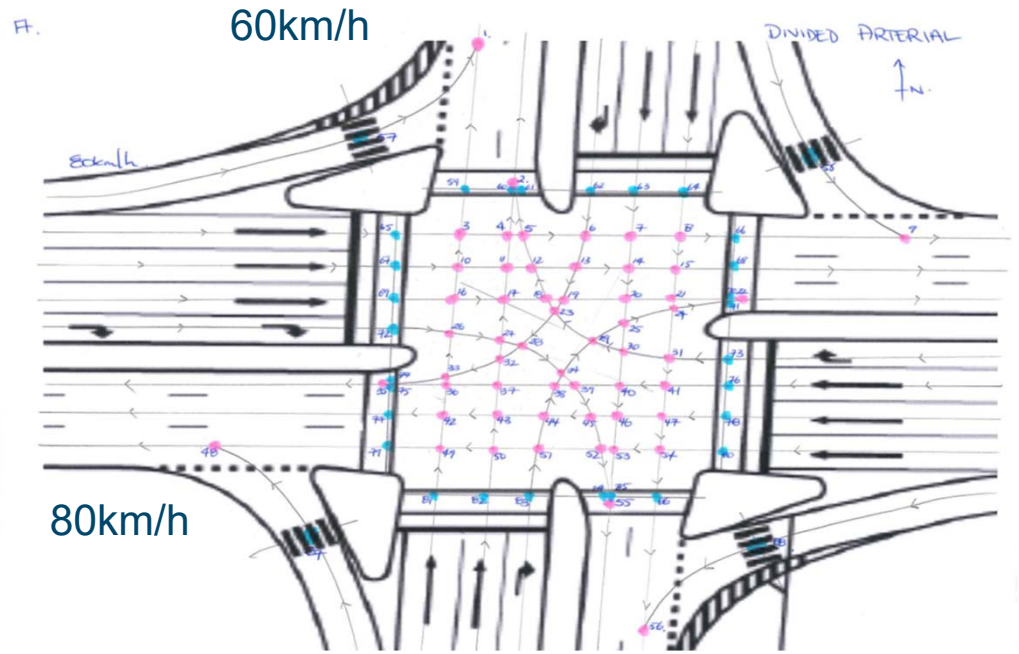
Safe System intersections

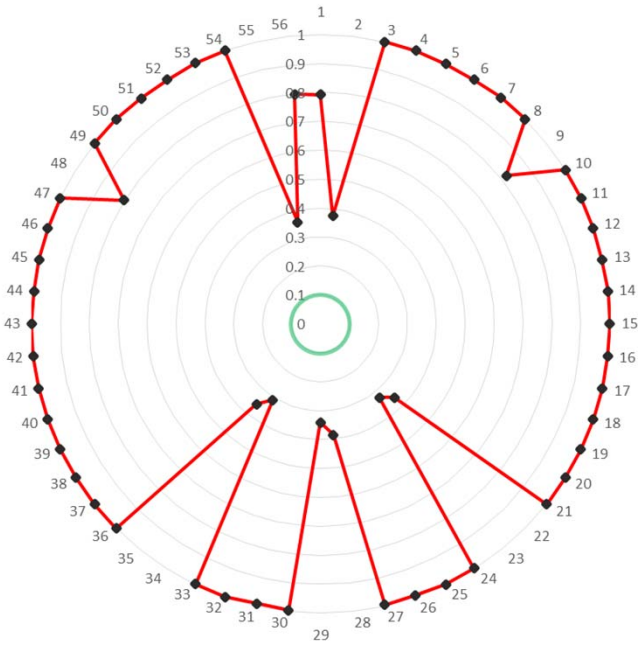




X-KEMM-X application examples

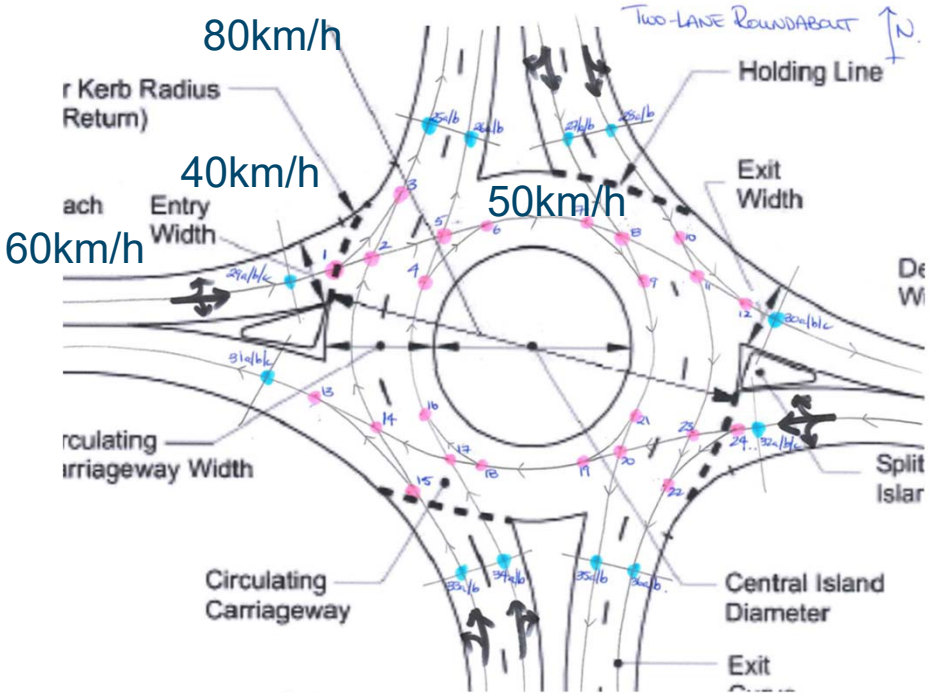


Probability of FSI injury at each conflict point

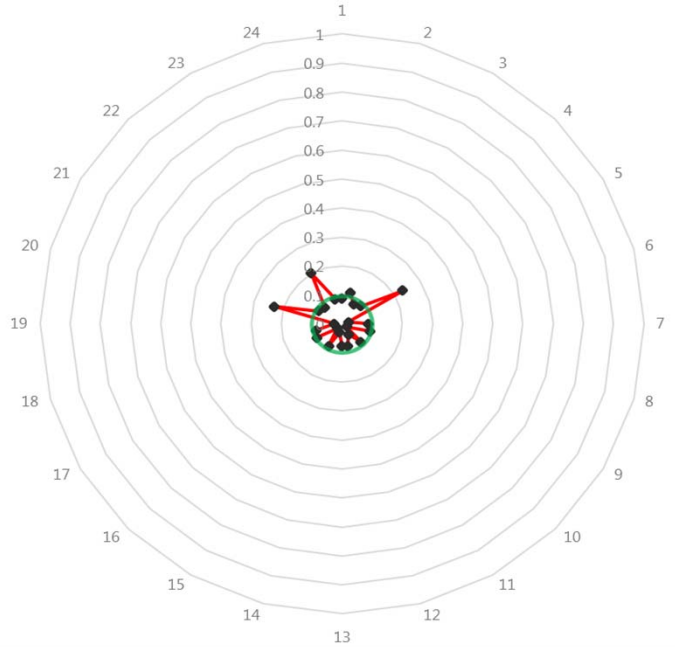


Assumes a crash will occur at full speed

Roundabout (multi-lane)

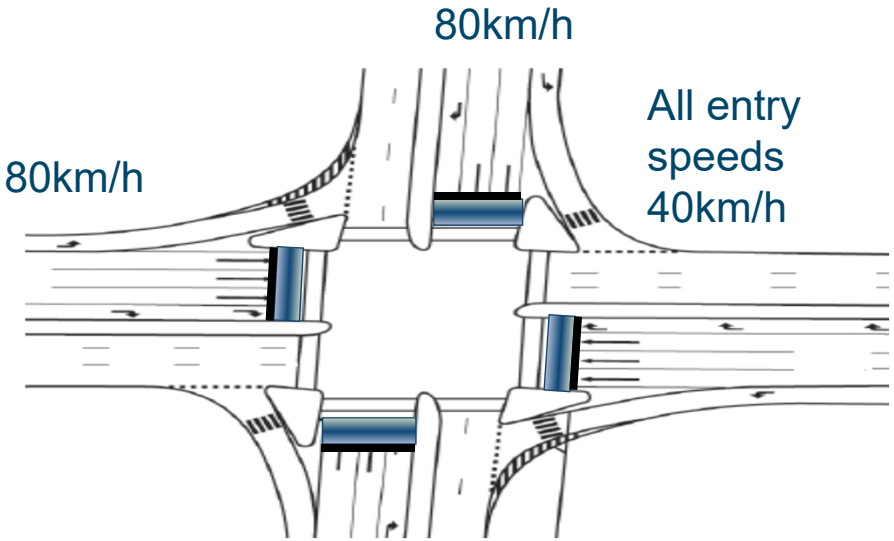


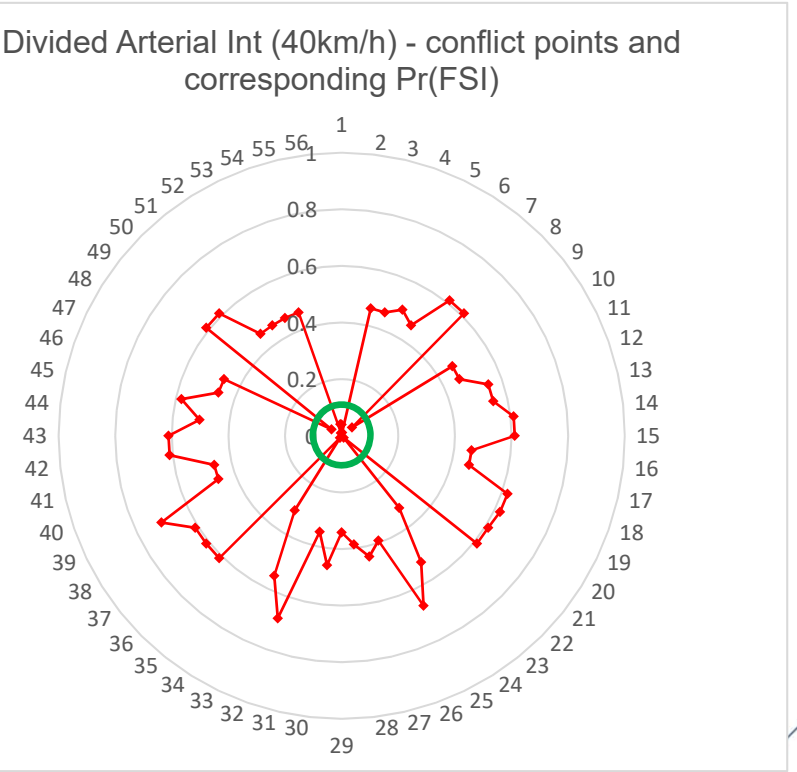
Probability of FSI injury at each conflict point



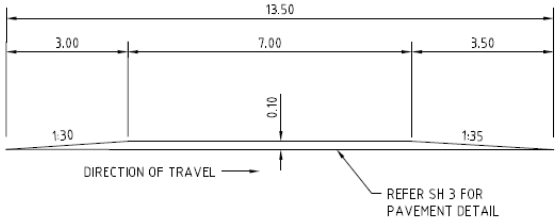
Assumes a crash will occur at full speed

Urban signalised with vertical approach deflections





Signalised intersections with raised safety platforms



TYPICAL SECTION – RAISED PLATFORM

Raised safety platforms

Effectiveness

40-50% reduction in injury crashes

Sourced from: Corben, B. F. (2014). Criteria for the use of elevated stop lines at traffic signals. Contract report for VicRoads prepared by Corben Consulting, August 2014.

Table 1. Safety effects of speed reducing facilities at signalised intersections

	'Intersection years'	Injury crashes per intersection year	Total number of crashes per intersection year
Before (3 years)	120	1.23	7.01
After (4 years)	90	0.74	4.50
Effect in %		-39.6	-35.8
χ^2-test		12.0	54.4
Significance level		0.05	0.00

Notes:

1. **Intersection year: sum of all (before or after) periods of the 40 intersections involved**
2. **Injury crashes: all types of injuries including minor injuries.**

When two highly-congested intersections were removed from the sample of 40 intersections being evaluated, the reduction in casualties increased from 40% to 50%.

Raised safety platforms

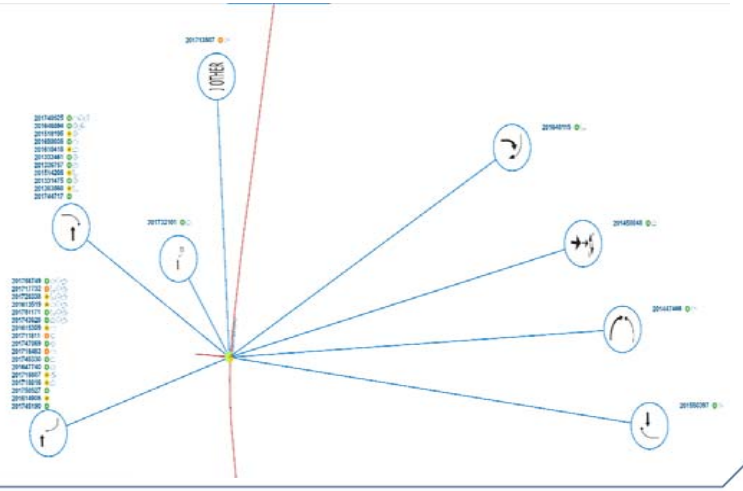
Thomas / Gordonton

- Upgraded with new signals
- Previously priority controlled intersection with 80km/h speed limit
- Lowered to 60km/h on approaches
- Stop line in advance of platforms
- Signal post locations designed according to new layout
- 50km/h design ramps (1:25 approach and 1:35 departure)

Thomas Gordonton (before)

Crash history

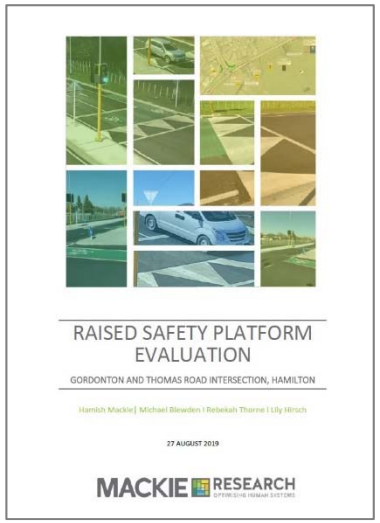
- 34 Crashes in 5 years before
  - 4 serious
  - 10 minor
- 12 (35%) JA : Right turn right side
- 17 (50%) LB : Right turn colliding with through traffic
- 30 involved northbound vehicle on Gordonton Road

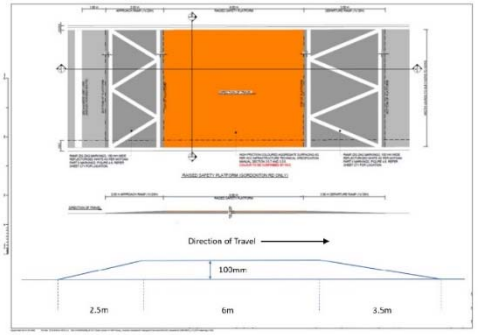


Thomas Gordonton RSP evaluation

Evaluation measures

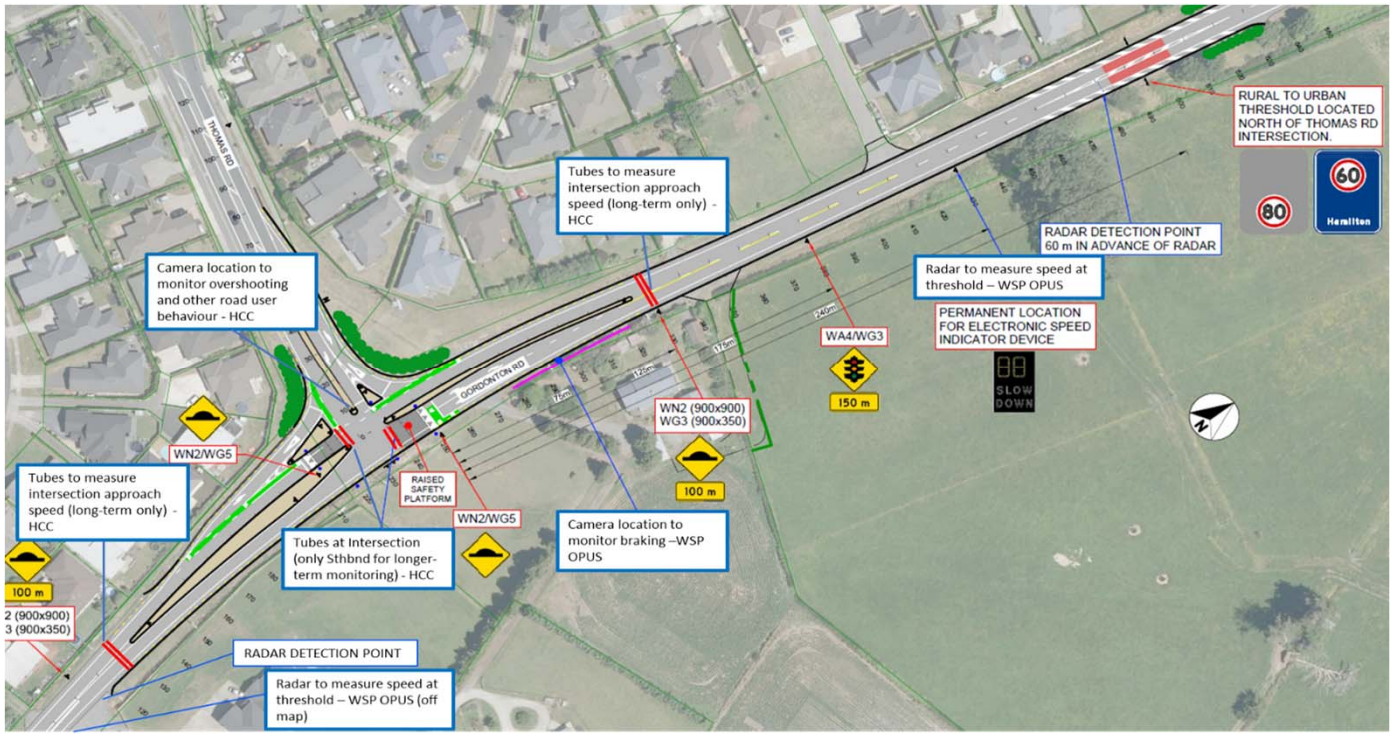
- Vehicle speed - tubes, radar
- Road user behaviour - video, braking, RLR, compliance
- Perceived Safety - HCC customer feedback, informal observations
- Impact on Traffic flow - expert feedback from HCC Engineer
- Vertical acceleration - phone, accelerometer
- Development and delivery issues - from HCC ‘Lessons Learned’
- Council and community buy-in - customer service channels





Thomas Gordonton RSP evaluation

Vehicle speed



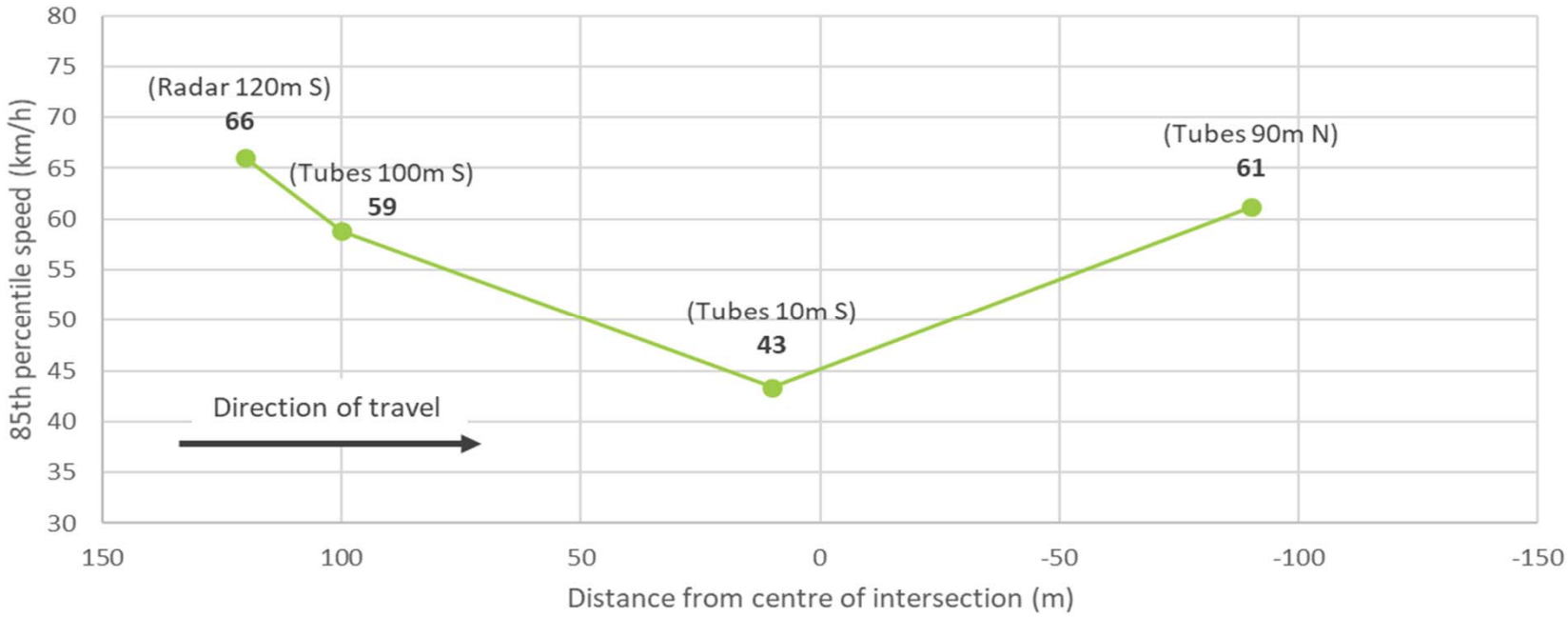
Thomas Gordonton RSP evaluation

Vehicle speed - results

	Northbound		Southbound	
	All data	*<3 second head way removed*	*All data*	*<3 second head way removed*
Total vehicle count	18423	12083	25623	15639
85th percentile speed (km/h)	41	**43**	44	**46**
95th percentile speed (km/h)	49	52	52	54
Vehicles over speed limit	0.7%	**1.0%**	1.1%	**1.6%**

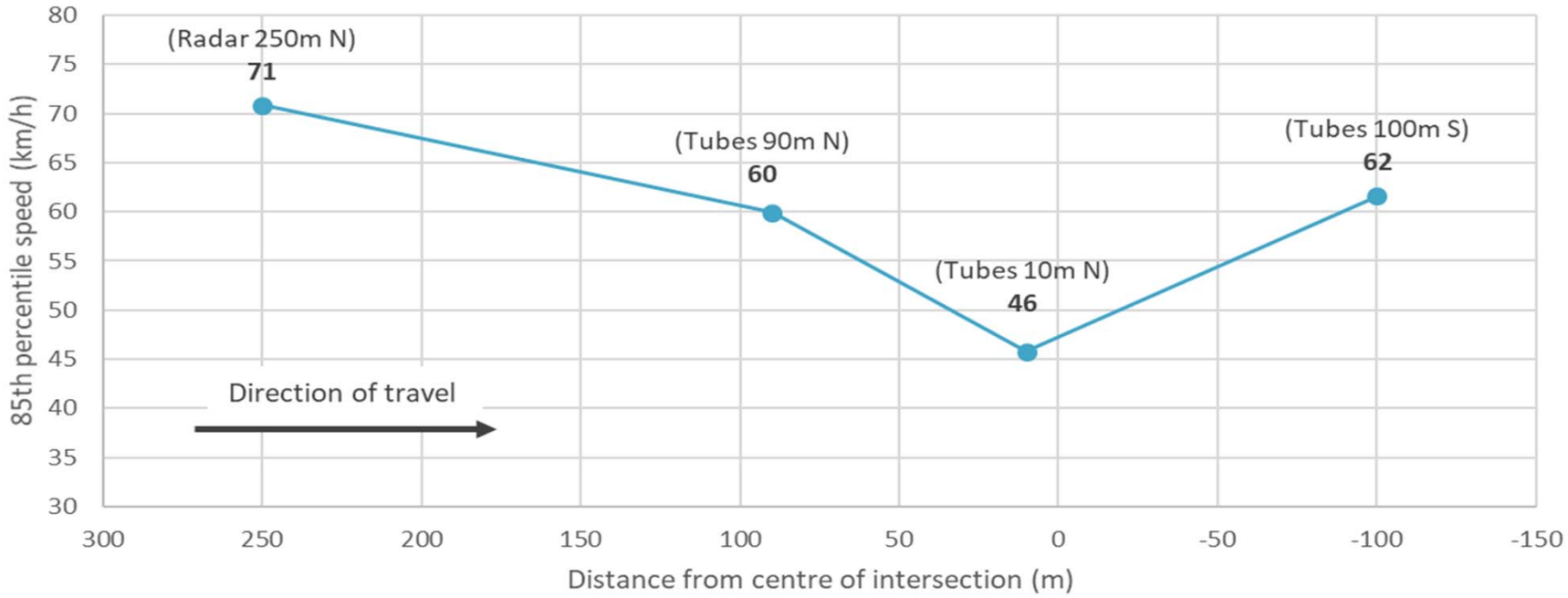
Thomas Gordonton RSP evaluation

Vehicle speed - northbound profile



Thomas Gordonton RSP evaluation

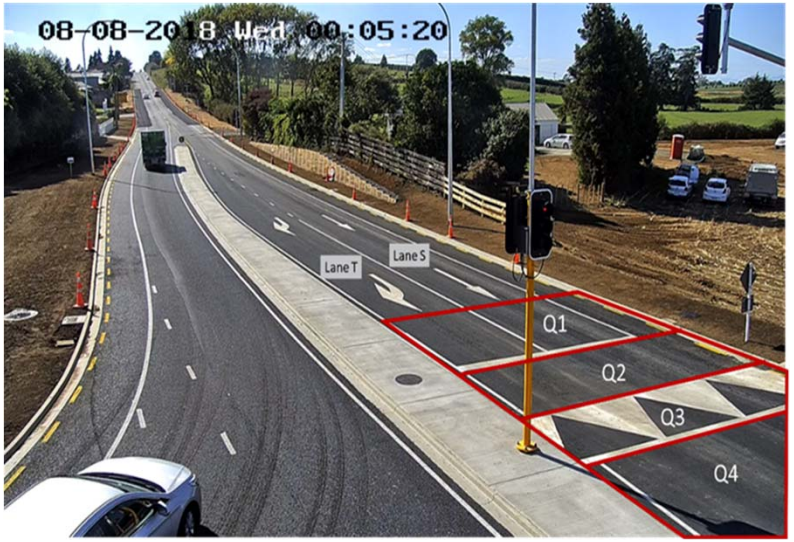
Vehicle speed - southbound profile



Thomas Gordonton RSP evaluation

Braking and road user behaviour

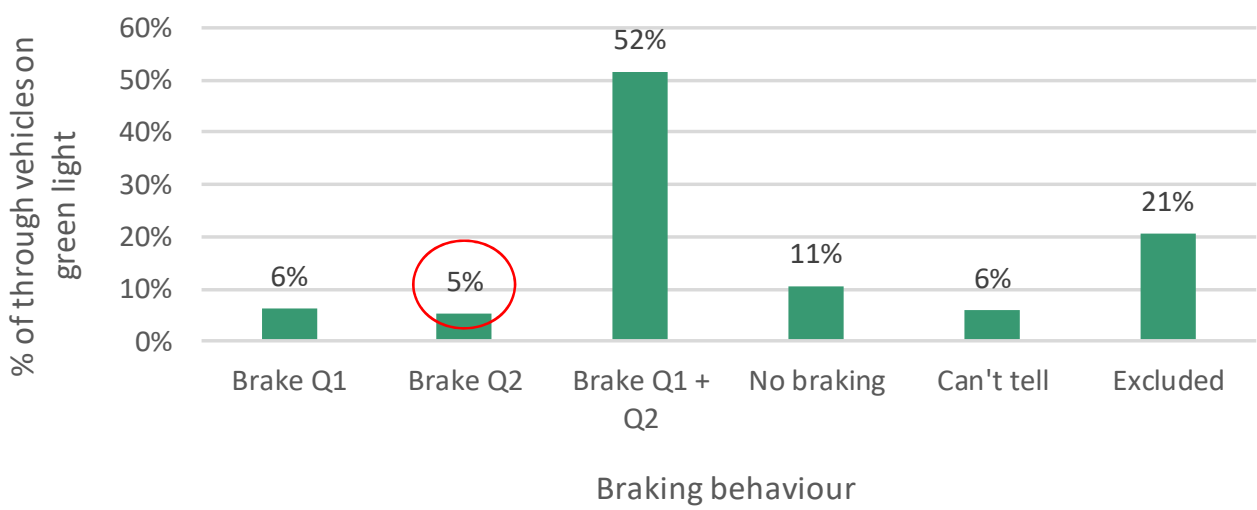
- Braking on approach
- Red light running
- Cyclists and pedestrians



- Stopping at limit line
- Cyclists and pedestrians

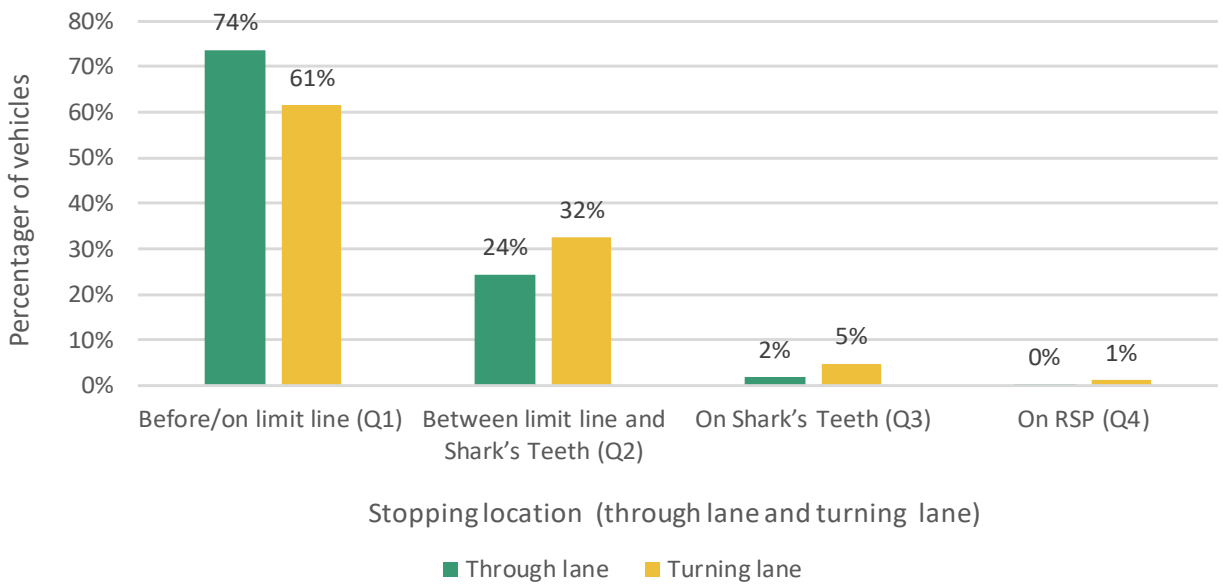
Thomas Gordonton RSP evaluation

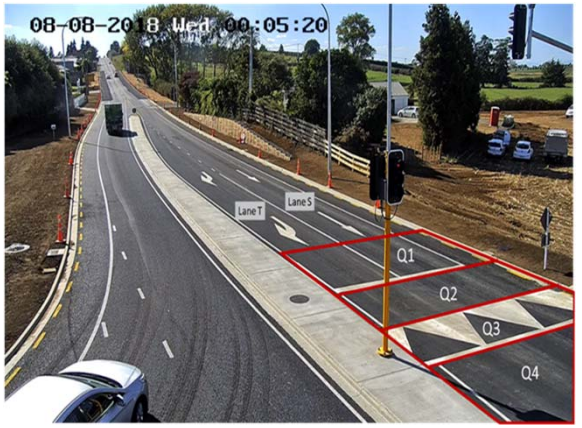
Braking behaviour



Thomas Gordonton RSP evaluation

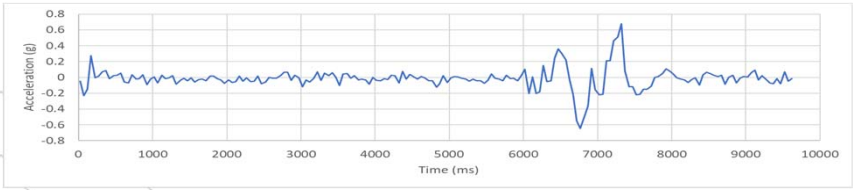
Stopping behaviour

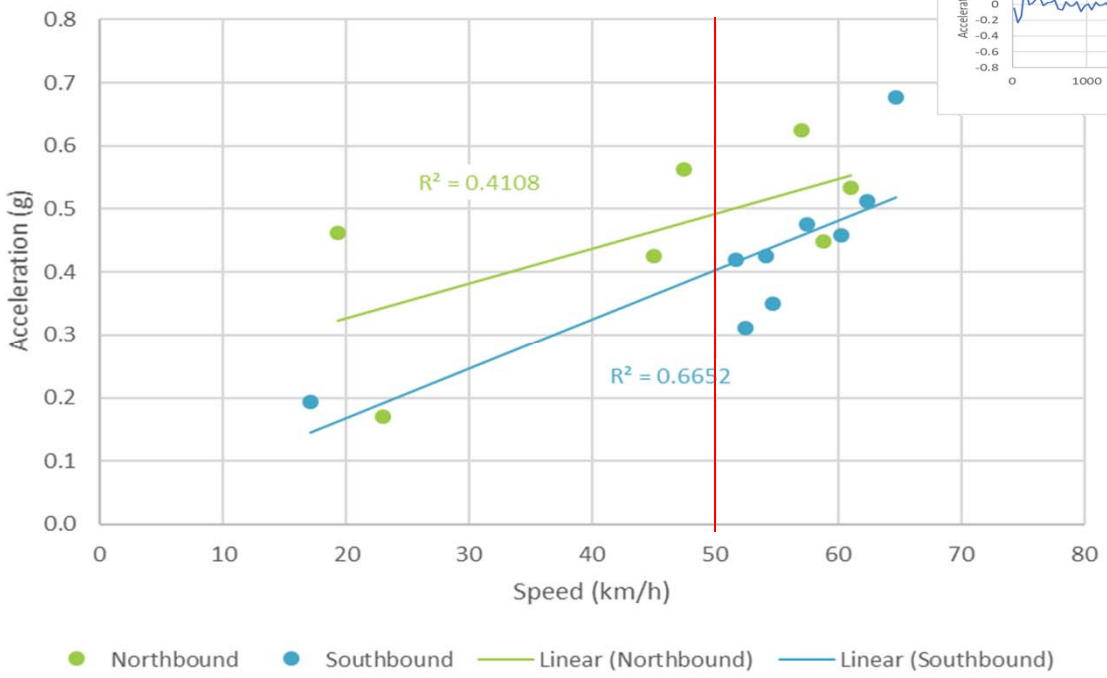




Thomas Gordonton RSP evaluation

Vertical acceleration





Comfort rating (TRL research):

0-1 = Comfortable

2-3 = Slightly uncomfortable

4-5 = Uncomfortable

6 = Very uncomfortable

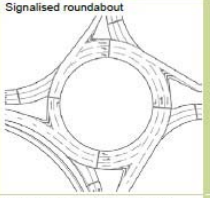
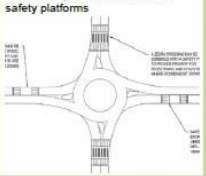
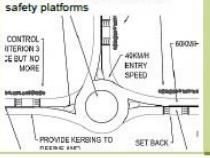
Thomas Gordonton RSP evaluation

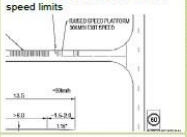
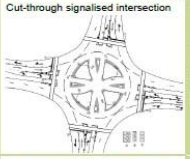
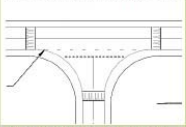
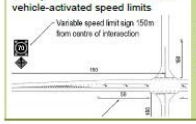
Results

	Dimension	Satisfactory Performance?
Safety improvement	DSis	Too early
	Intersection Speed	✓
Associated safety	Braking on approach	✓
	Stopping at limit line	✓
	Red light running	✓
	Vertical acceleration	✓
	Perceived safety	✓
	Impact on VRUs	Not enough data
Delivery and operation	Traffic flow	✓
	Community buy-in	✓
	Delivery/operational issues	✓

Safe System design concepts

Innovation

Concept name	Applicability	Safe System alignment [a]		Crash reduction factor	Cost (retrofit/ new)
		Vehicle-vehicle	Vehicle-pedestrian		
Signalised intersection with safety platforms 	Urban Retrofit, greenfield Emerging solution, under trial	Poor to moderate	Poor to moderate	30% estimated casualty, retrofit to signals 50–60% casualty, replace priority-controlled (estimate)	Low to moderate
Signalised roundabout 	Urban, outer-urban Retrofit (large sites), greenfield Established traffic solution	Moderate to high	Poor	11% all-crashes, retrofit to roundabout 65% casualty, replace priority-controlled (estimate)	Moderate to high
Urban compact roundabout with safety platforms 	Urban, outer-urban Retrofit, greenfield Emerging solution already in use	High	Moderate	55% casualty, replace priority-controlled (estimate)	Low to moderate
Rural compact roundabout with safety platforms 	Rural Retrofit, greenfield Conceptual solution, not yet trialled	High	n.a.	70% casualty, replace priority-controlled (estimate)	Low to moderate

Concept name	Applicability	Safe System alignment [a]		Crash reduction factor	Cost (retrofit/ new)
		Vehicle-vehicle	Vehicle-pedestrian		
Signalised intersection retrofit combination treatment 	Urban, outer-urban Retrofit, greenfield Already in use	Poor	Poor	50% casualty and FSI, retrofit to signals (estimate)	Moderate
Priority-controlled rural intersection with safety platforms and reduced speed limits 	Rural Retrofit Conceptual solution, not yet trialled	Moderate to high	n.a.	Not available	Low
Cut-through signalised intersection 	Urban, outer-urban Greenfield Conceptual solution, not yet trialled	Moderate to high	Poor	Not available	High
Priority-controlled raised intersection 	Urban Retrofit, greenfield Emerging solution already in use	High	Poor to moderate	55% casualty, retrofit to priority-controlled	Moderate
Priority-controlled intersection with vehicle-activated speed limits 	Rural Retrofit Emerging solution already in use	Poor to moderate	n.a.	51% all crashes, 79% FSI crashes, retrofit to priority-controlled	Low to moderate

Urban compact roundabouts

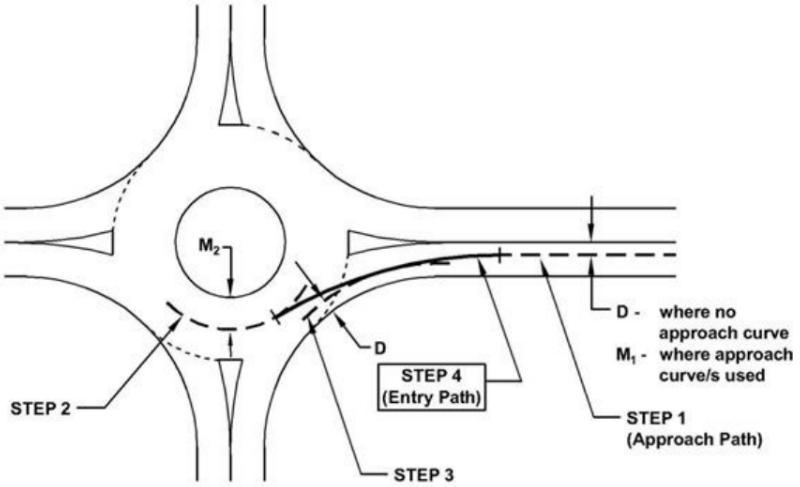
Victoria

- Pedestrians and cyclists on raised safety platforms

Urban compact roundabouts

Low cost treatment

Figure 4.5: Construction of the entry path of a single-lane entry



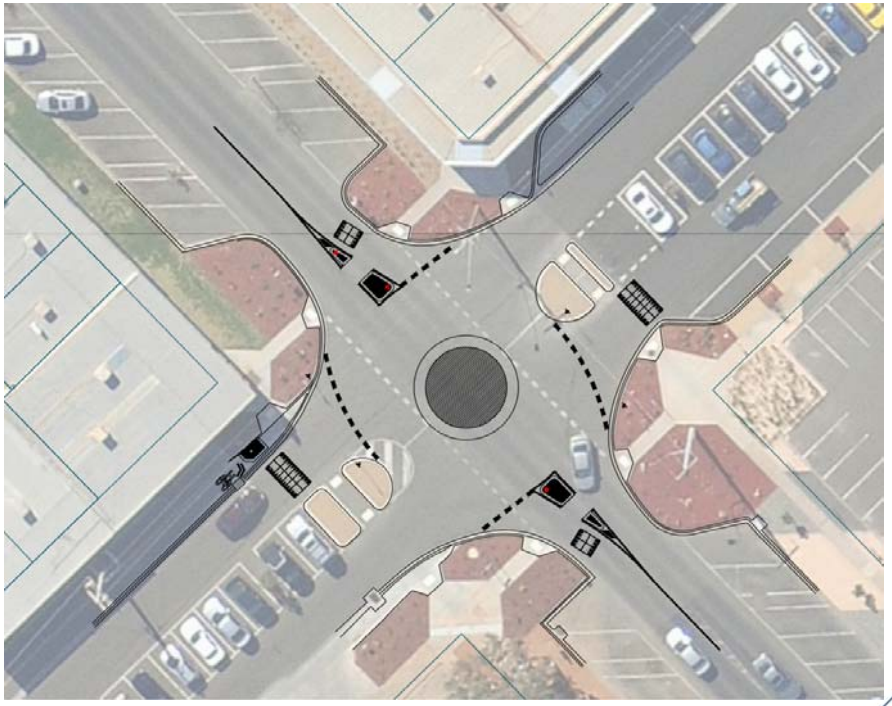
Mildura Rural City Council

Christopher Davis
Road Safety Officer
Mildura Rural City Council
Ph. 0408 101 663

Courtesy of Chris Davis, Mildura Rural City Council

Urban compact roundabouts

Low cost treatment



Urban compact roundabouts

Day 1

Day 2

Urban compact roundabouts

Day 3

Day 4

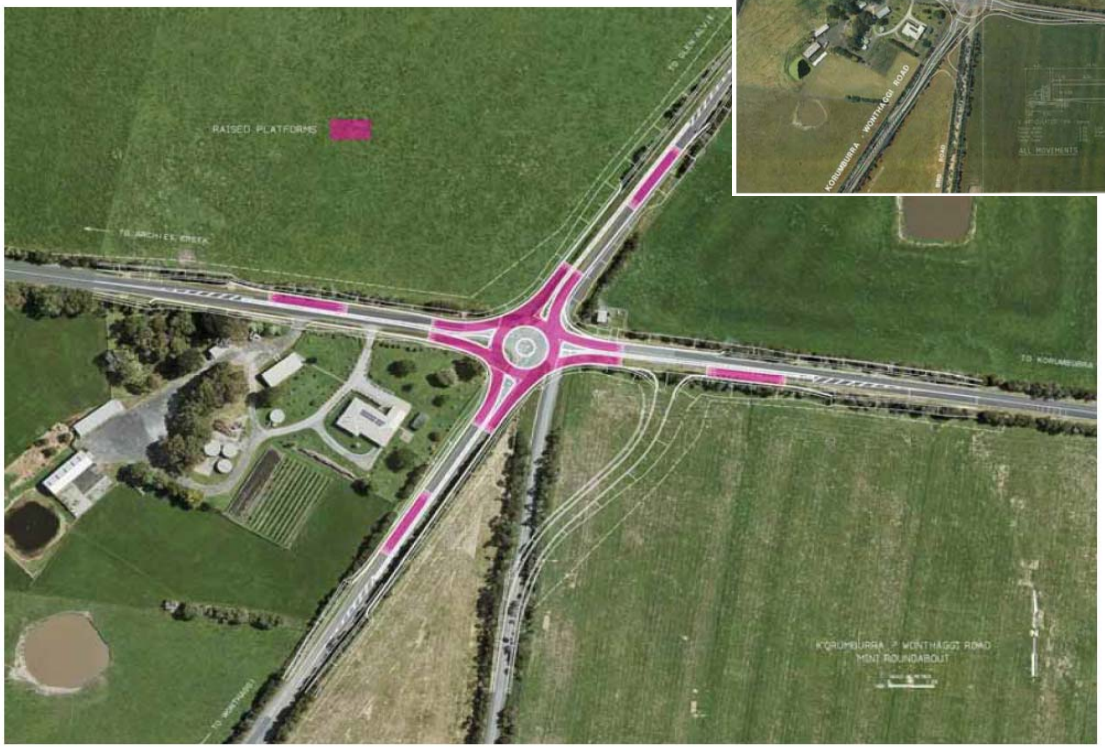
Urban compact roundabouts

Day 5

Complete Layout

Rural compact roundabouts

Victoria



Courtesy of Wayne Moon, VicRoads

Rural compact roundabouts

Victoria

Rural compact roundabouts

Victoria

Rural compact roundabouts

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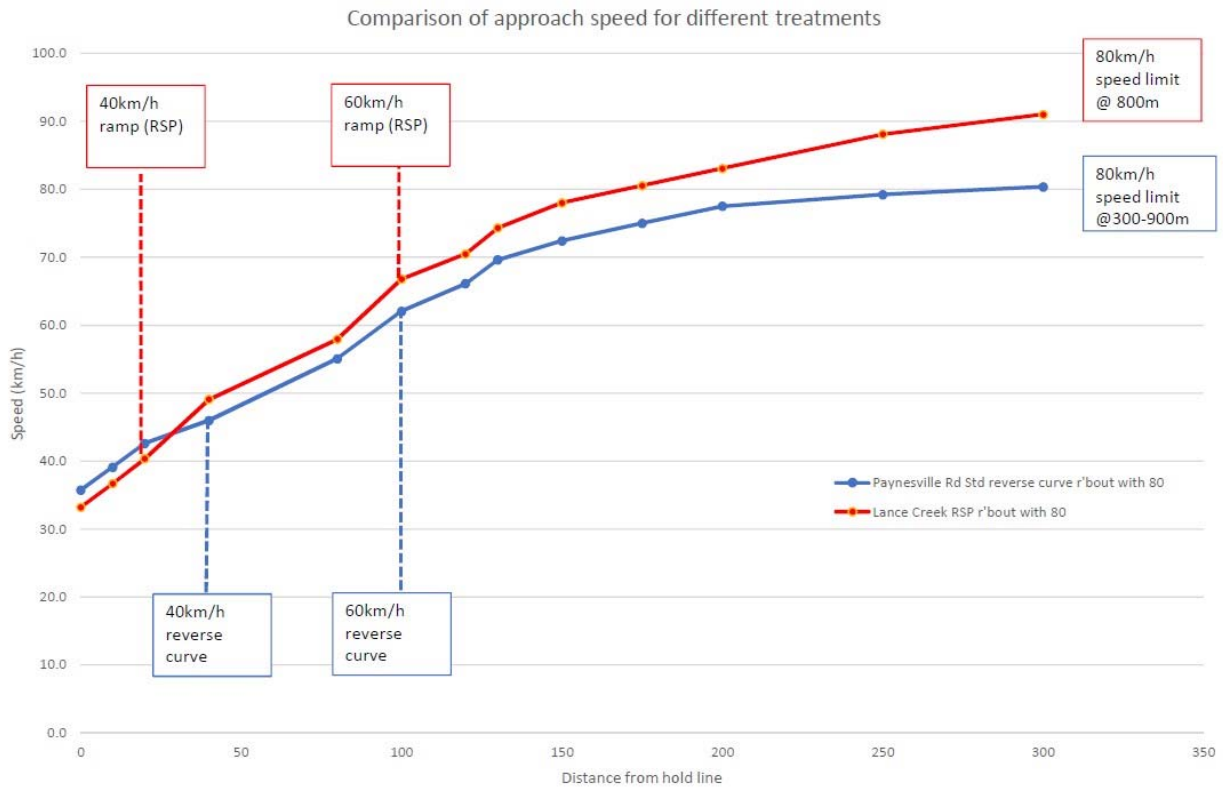
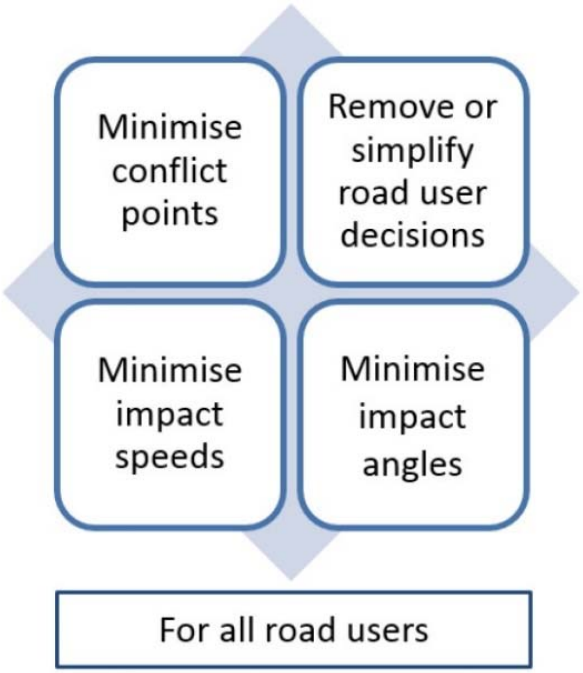
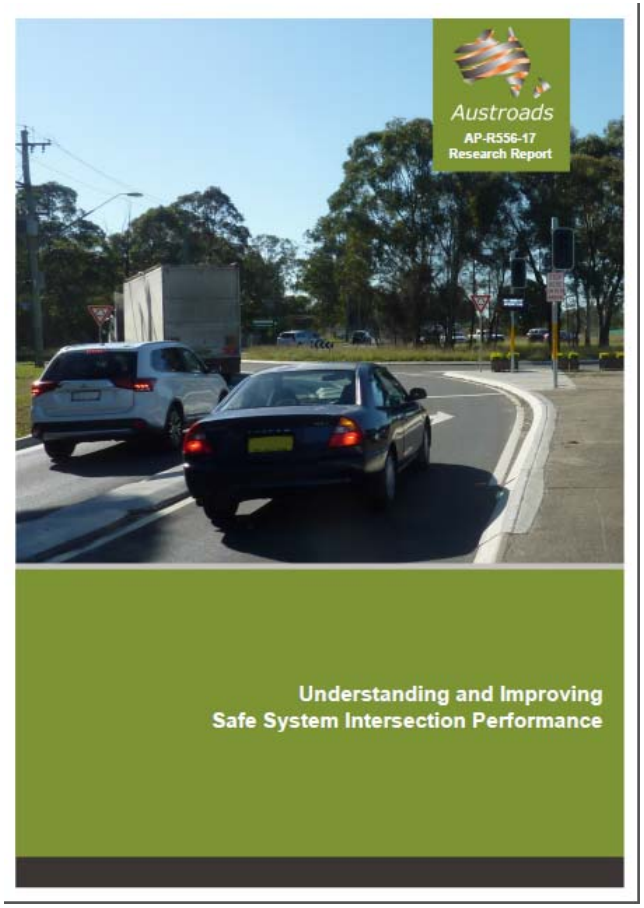


Safe System intersections





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