Road Safety

Evidence of what works

Speed and infrastructure

NZ Case studies

Dr Iain McAuley

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Road Safety

- Introduction – not all interventions are equal
  - Median barriers
  - Intersection speed zones
  - Speed limit reductions
  - Roundabouts
  - Raised safety platforms
  - Right-turn filters
  - Emerging technologies
  - France case study

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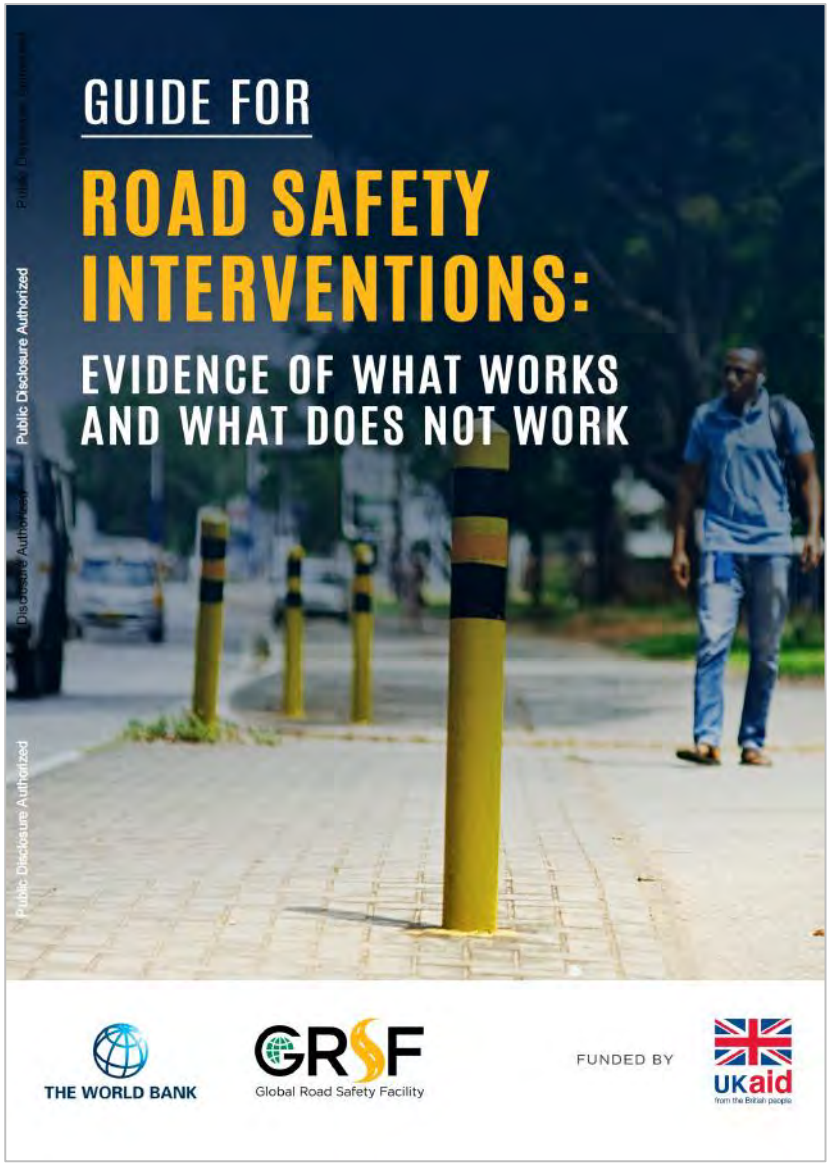
Road Safety Interventions

Evidence of what works and what does not work

"Interventions that reduce crash severity outcomes are the most beneficial, producing up to 80 percent reductions in fatal and serious injury.

These include roadside and central barrier systems on higher speed roads, infrastructure that supports lower speed environments … and roundabouts at intersections."

Infrastructure interventions are effective immediately and their benefits sustainable. Once installed, they will deliver consistent benefits over time.



https://www.worldbank.org/en/news/press-release/2021/03/15/what-works-and-what-does-not-work-in-road-safety

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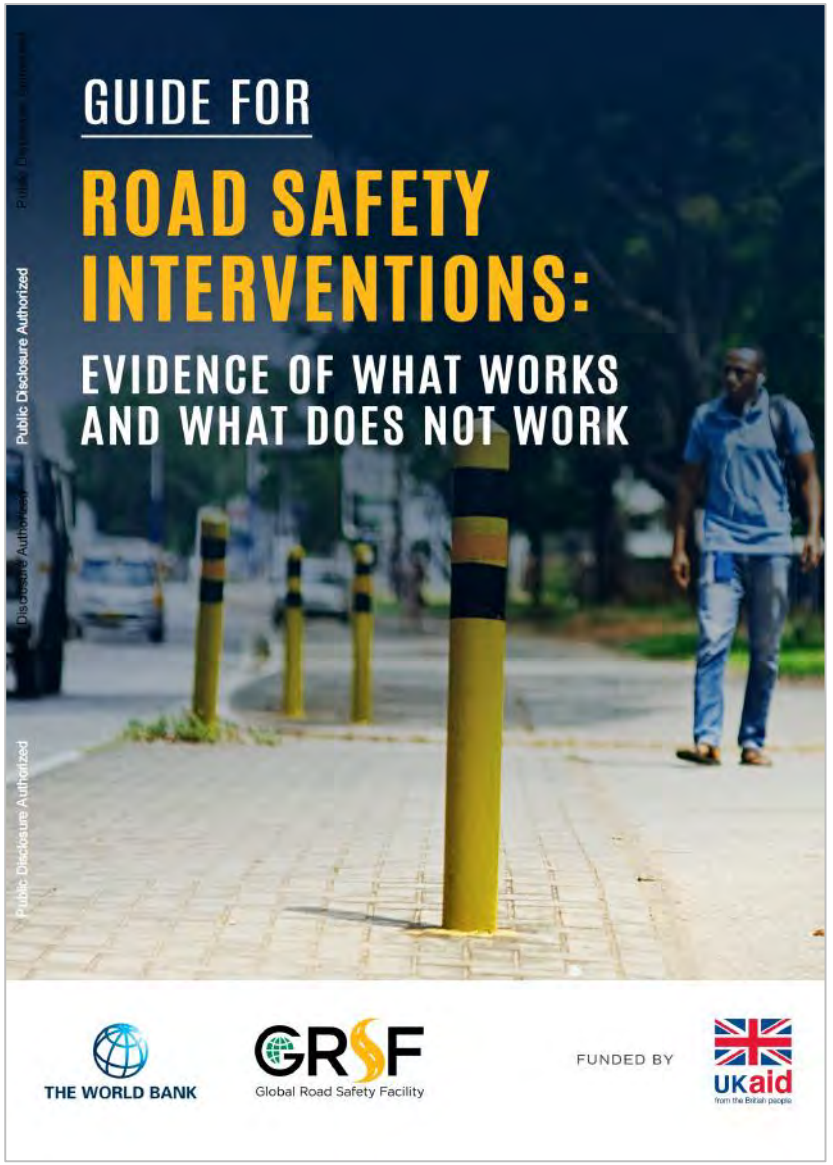
Road Safety Interventions

Evidence of what works and what does not work

"Interventions can also reduce the likelihood of a crash occurring in the first place. This class of intervention has more varied results.

Examples include signs and line-marking (lower safety benefits), traffic signals (moderate benefits), and infrastructure that supports speed reduction (high benefits …)"



https://www.worldbank.org/en/news/press-release/2021/03/15/what-works-and-what-does-not-work-in-road-safety

Road Safety Interventions

DSI effectiveness based on research and evidence used to forecast predicted benefits for Speed and Infrastructure Programme

Standard safety intervention	SSI Toolkit assumed DSI reduction
Median barrier	65%
Intersection speed zone	65%
Speed management (speed limit changes)	15-30%
Roundabouts	75%
Raised intersection platforms	40%

https://www.nzta.govt.nz/assets/resources/standard-safety-intervention-toolkit/standard-safety-intervention-toolkit.pdf

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Median Barriers

Median barriers

How do they work?

Median Barriers

SH1 Rangiriri

Effectiveness

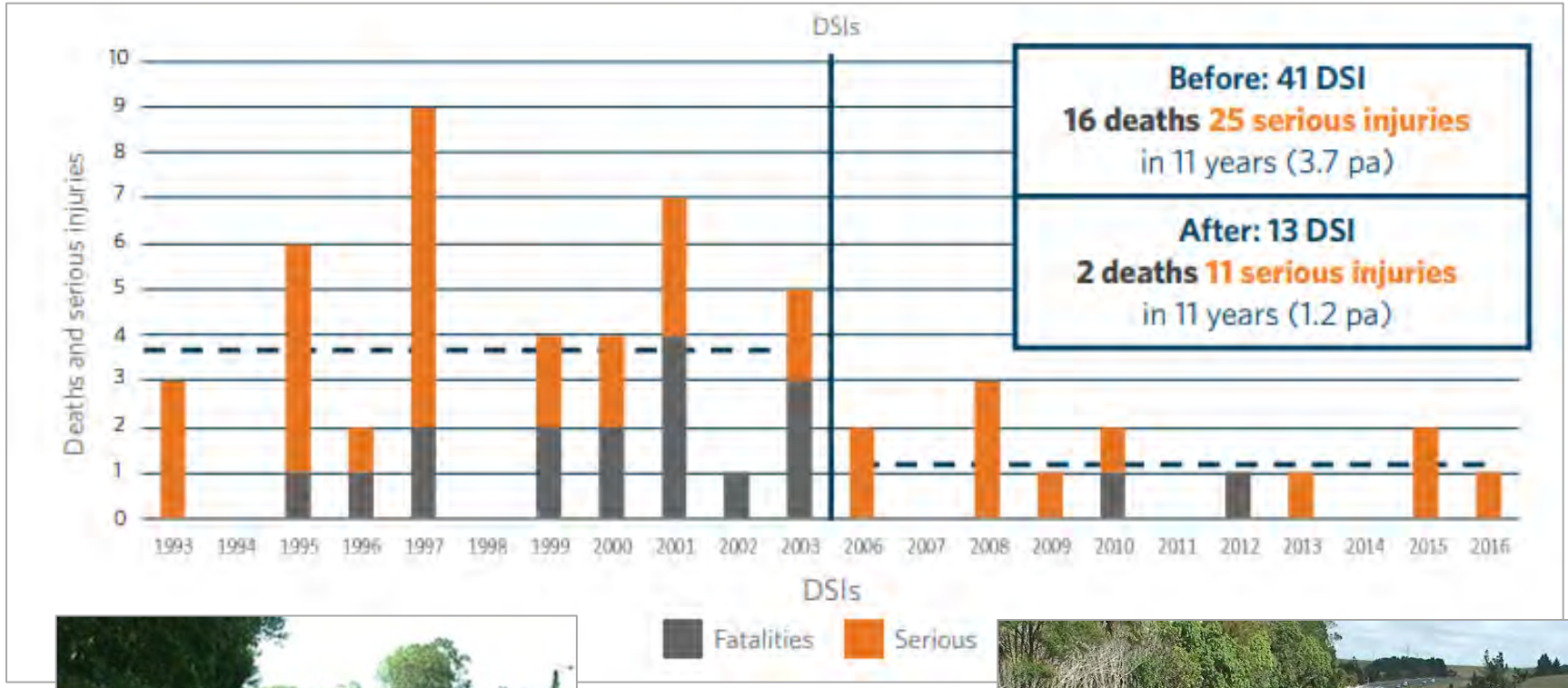
- 68% reduction in all deaths and serious injuries
- 100% reduction in head-on deaths and serious injuries

Additional information

Treatment length = 9km

18 months to deliver from design to construction at a cost of $6 million (approx. $667,000 per km)

Primary treatment



Case study document link - https://www.nzta.govt.nz/assets/Safety/docs/road-to-zero/safe-system-case-study-sh1-longswamp-to-rangiriri-median-barrier.pdf

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Median Barriers

SH1 Centennial Highway

Effectiveness

- 94% reduction in all deaths and serious injuries
- 100% reduction in head-on deaths and serious injuries

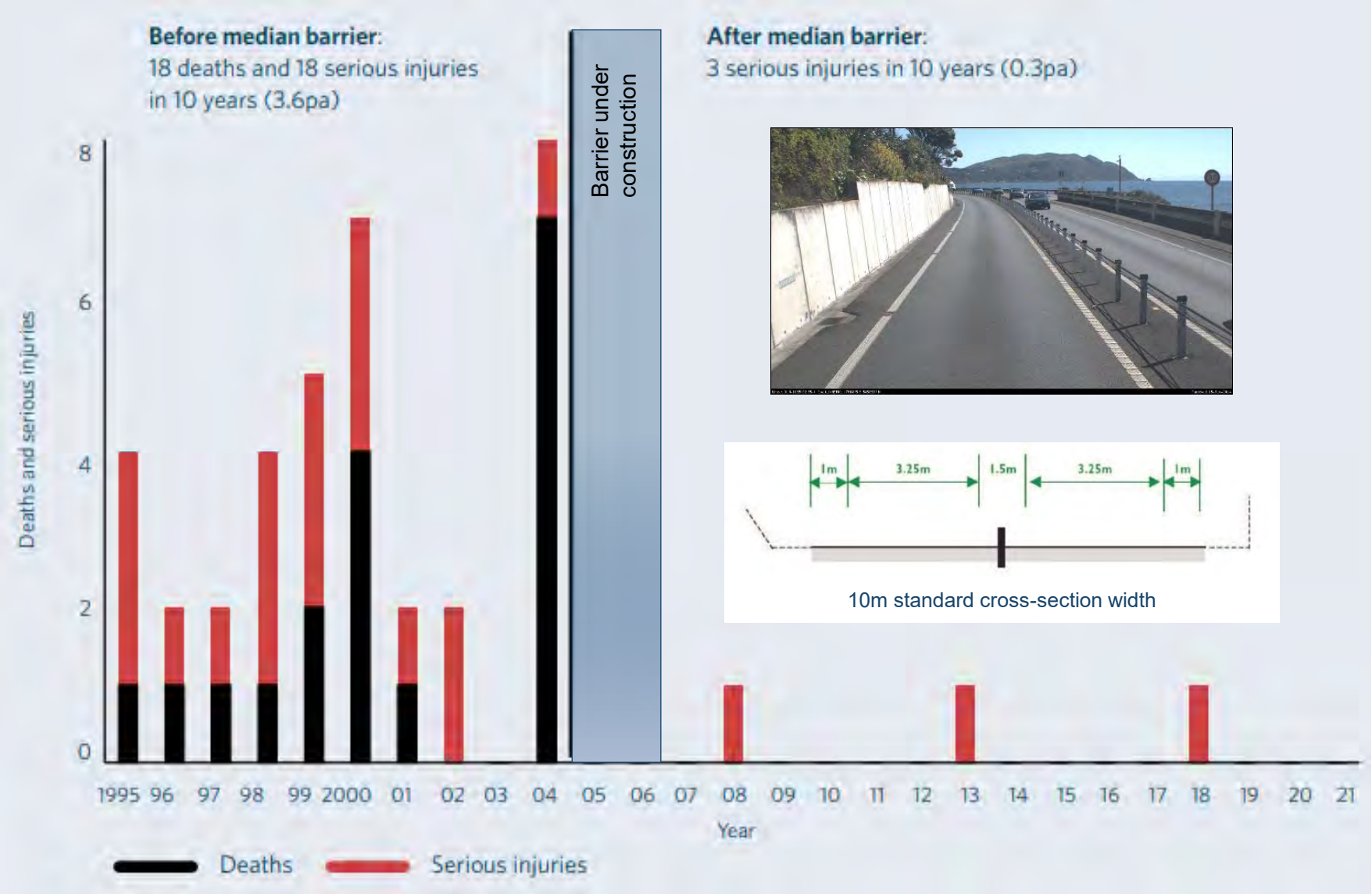
Social cost of crashes (2008)

- Pre - $5.8M / year
- Post - $65k / year

Additional information

Treatment length = 3.5km

Primary treatment



Case study document link - https://www.nzta.govt.nz/assets/Safety/docs/road-to-zero/safe-system-case-study-sh1-centennial-highway-median-barrier-project.pdf

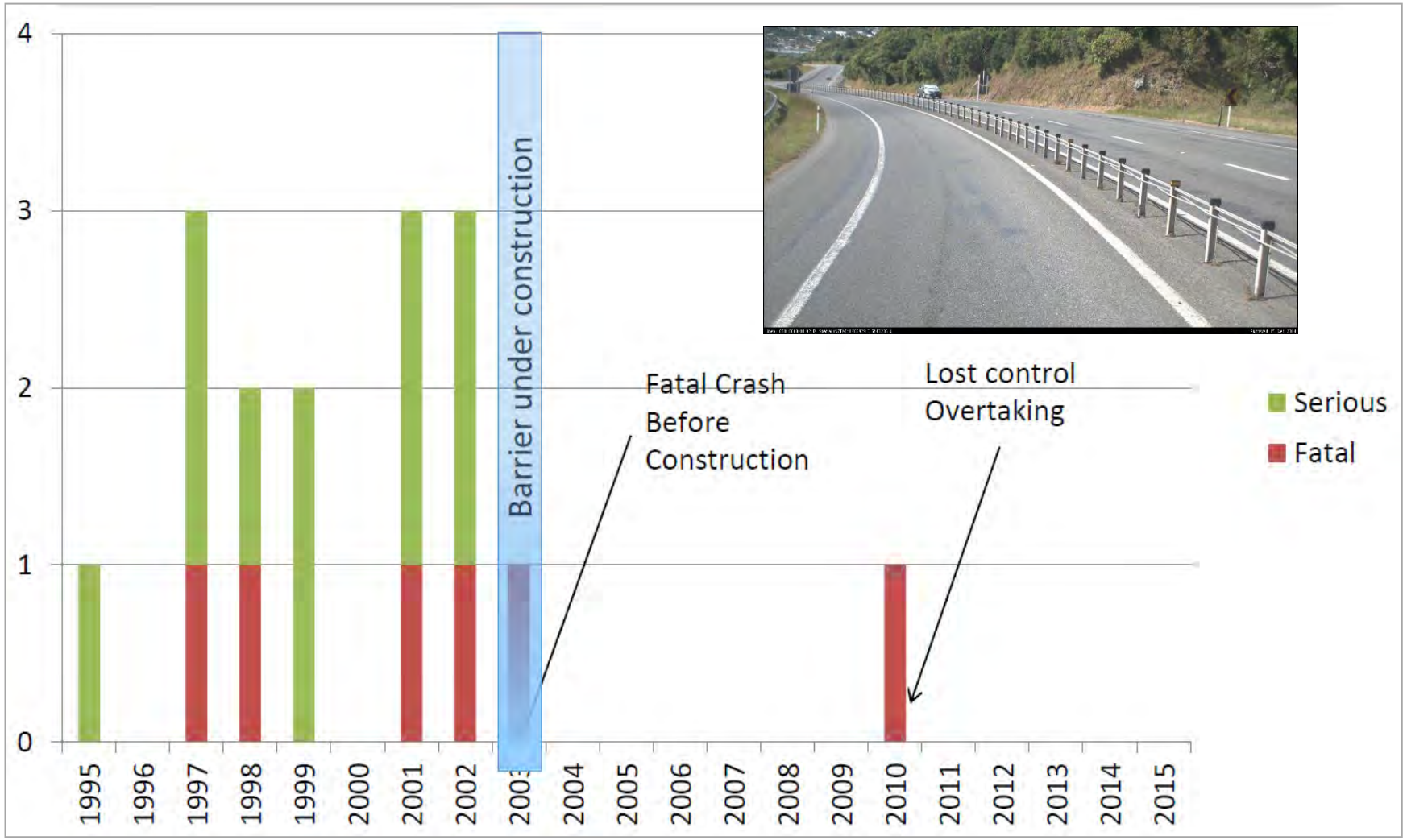
Median Barriers

SH58 Haywards

Effectiveness

- 95% reduction in all deaths and serious injuries
- 100% reduction in head-on deaths and serious injuries

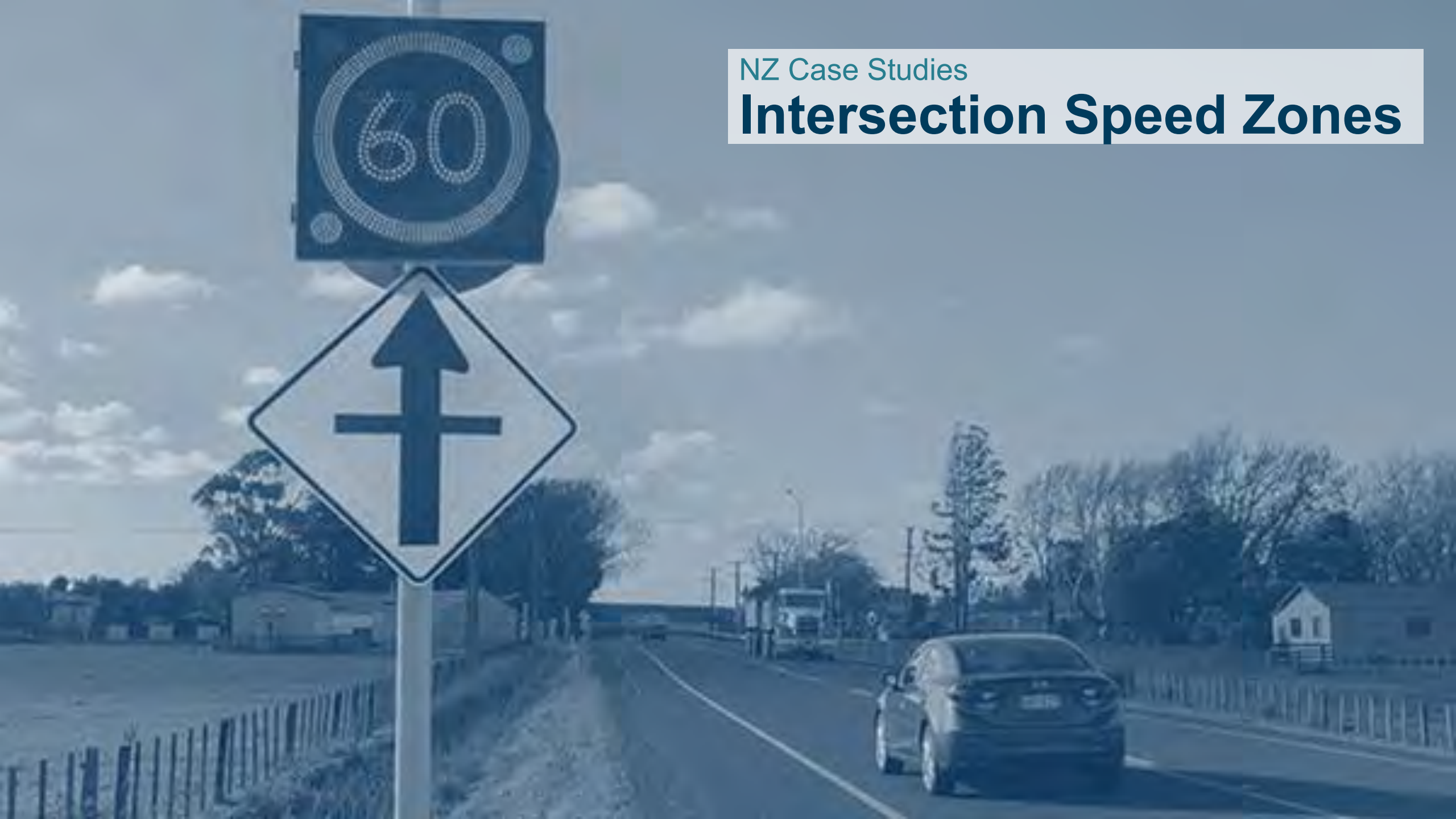
Primary treatment



Presentation on median barrier performance - https://www.nzta.govt.nz/assets/Safety/docs/road-to-zero/median-barrier-presentation.pdf

Median barriers

How we maintain them



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Intersection Speed Zones

Intersection Speed Zones

Evaluation of ten (10) rural intersection speed zone sites

Effectiveness

- 69% reduction in fatal and serious crashes
- 28% reduction in all crashes

Additional information

- Mean speed reduction of 4-19km/h comparing sites from before installation to when signs are turned on
- As well as reducing harm through lower speeds, ISZs also seem to increase the awareness of people travelling along main road

Supporting treatment

Table 1: Aggregated crash reductions across all ten sites compared to control sites

	Average fatal and serious crashes per month			Average total crashes per month		
	Pre	Post	% change	Pre	Post	% change
Original sites	0.035	0.011	-69%	0.228	0.164	-28%
Control sites	0.005	0.012	+140%	0.078	0.147	+88%

Figure: Northbound VSL sign at Brynderwyn Intersection Speed Zone

Table 2: List of ten (10) sites assessed

Case study document link - https://www.nzta.govt.nz/assets/Safety/docs/road-to-zero/safe-system-case-study-intersection-speed-zones.pdf

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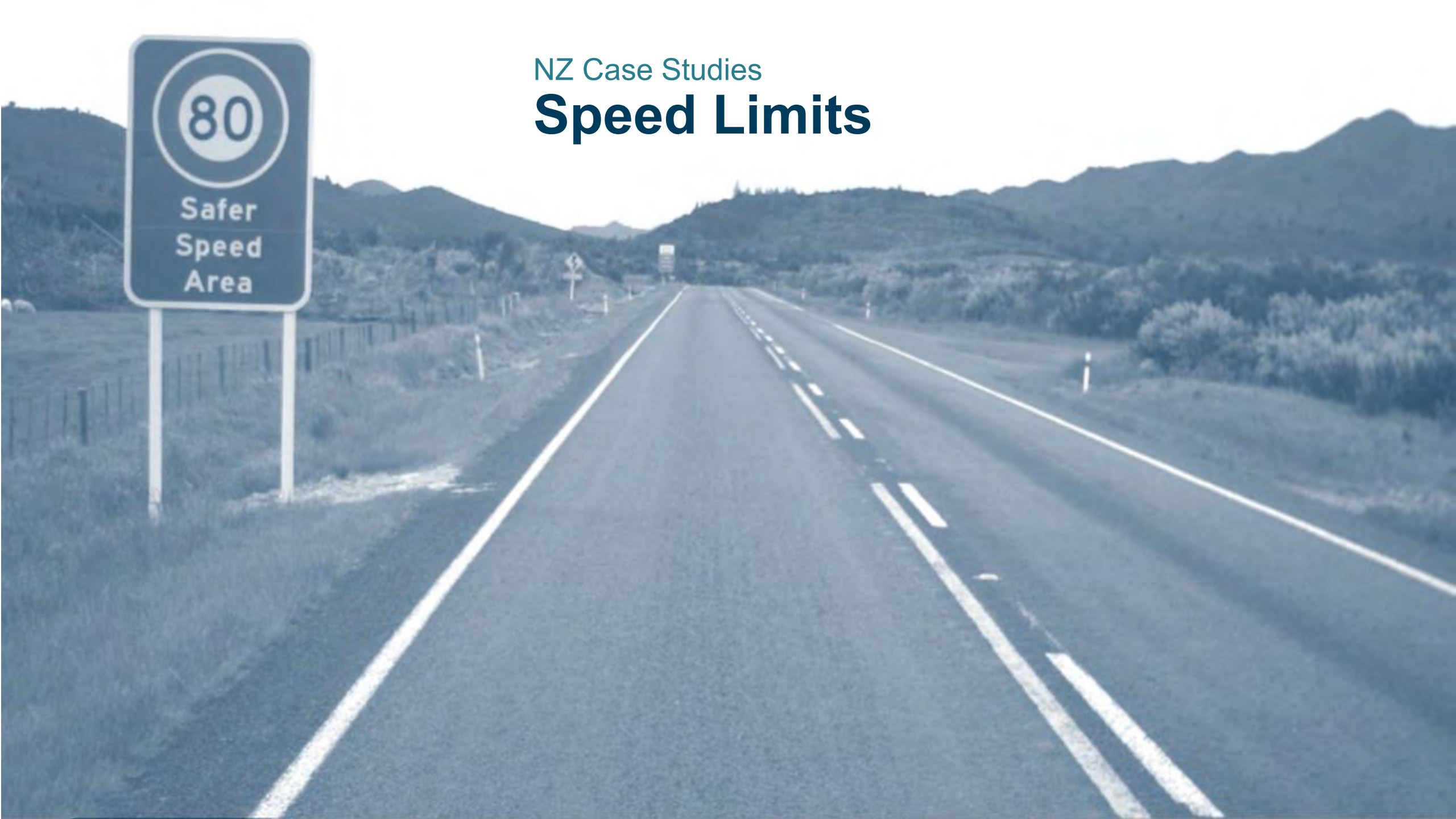
Speed Limits



Speed Limits

SH6 Blenheim to Nelson

Effectiveness

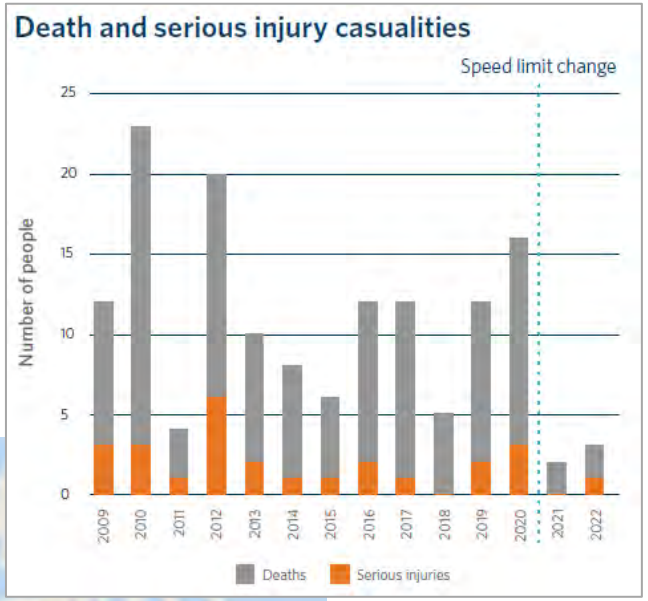
- ~80% reduction in deaths and serious injuries, noting only two (2) years post-implementation
- average journey time has increased by appropriately 4 minutes over the 110 km length, i.e. 2 seconds per kilometre.

Supporting treatment

Case study document link - being finalised

Changes in mean speed

	Before	After	Change	% Change
Whole corridor	82.1 km/h	77.6 km/h	-4.5 km/h	-5.5%
100 km/h to 90 km/h	89.4 km/h	84.7 km/h	-4.7 km/h	-5.3%
100 km/h to 80 km/h	80.0 km/h	75.4 km/h	-4.6 km/h	-5.7%
100 km/h to 60 km/h	54.9 km/h	53.2 km/h	-1.7 km/h	-3.1%



International research suggests a 3 to 5 km/h reduction in mean speed for each 10 km/h reduction in speed limit.

International research suggests for every 1% reduction in mean speed we could expect approx. a 4% reduction in fatal crashes, a 3% reduction in FSI crashes and a 2% reduction in injury crashes.

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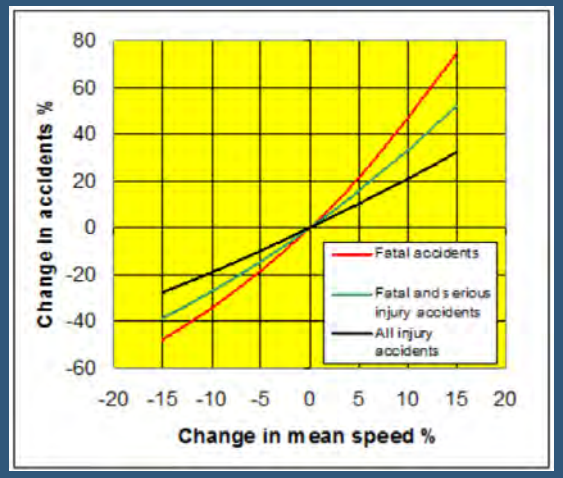
Speed Limits

Summary for three sites

Effectiveness

The net reductions in injury crashes and death and serious injury numbers are generally around or in excess of what international literature would predict.

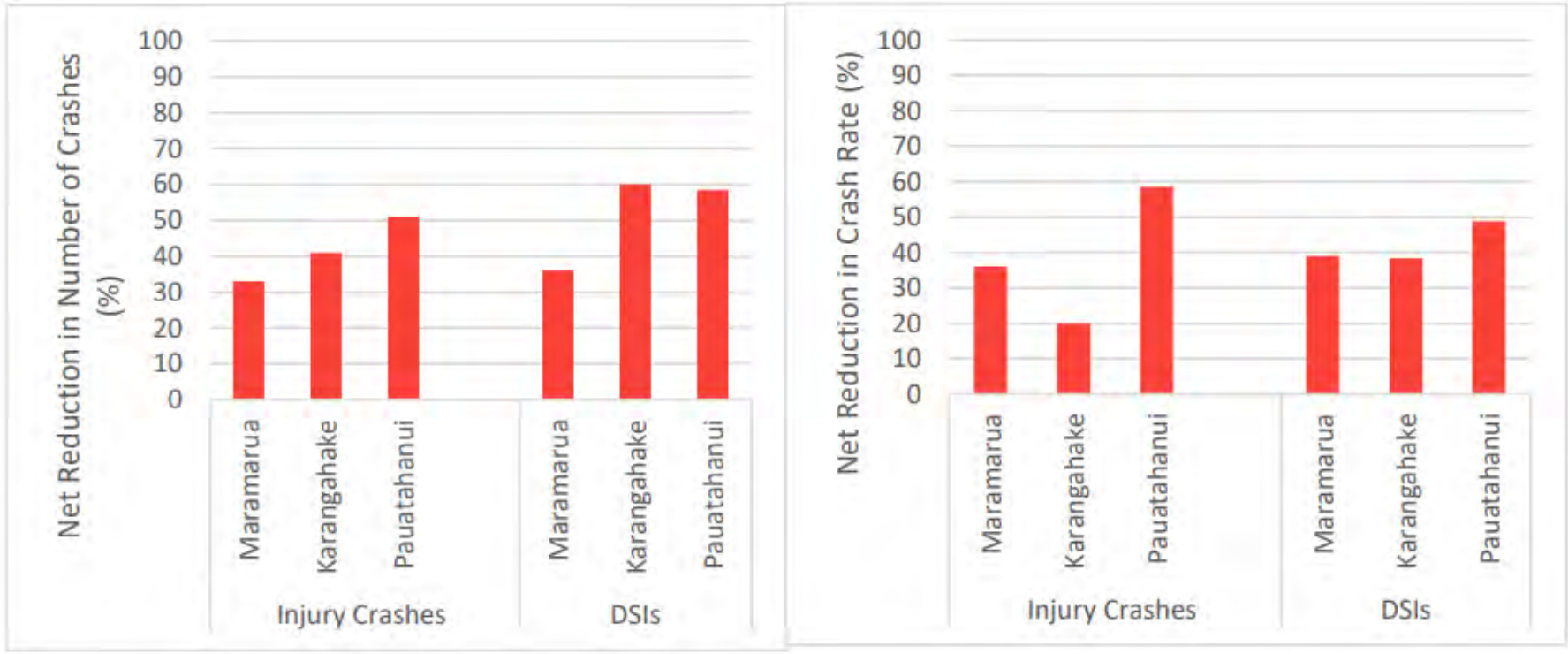


Supporting treatment

Location	Speed limit reduction	Date
SH2 Maramarua	100km/h to 90 km/h	December 2011
SH2 Karangahake Gorge	100km/h to 80 km/h	November 2005
SH58 around Pāuatahanui Harbour	100km/h to 80 km/h	April 2006

Research suggests a 3 to 5 km/h reduction in mean speed for each 10 km/h reduction in speed limit

Figure: Net reductions at treated sites - Numbers (left) and rate per 100 million vkt (right)



Evaluation report link - https://www.nzta.govt.nz/assets/resources/speed-management-guide-road-to-zero-edition/wsp-the-impact-of-change-in-speed-limit-of-three-sites-report.pdf

What of the future?

Average speed cameras

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Roundabouts

Roundabouts

Evaluation of nine (9) rural roundabout installations

Effectiveness

- 75% reduction in fatal and serious crashes

Review of crashes

- Loss of control was the most common type, followed by changing lanes.
- There were two motorcycle injury crashes, compared to 16 motorcycle injury crashes before installation.
- There have been no reported cyclist or pedestrian crashes, however, numbers of pedestrians and cyclists would be extremely low at rural sites.

Primary treatment

Total crashes per month - pre- and post-construction

Site name	Fatal and serious (pre)	Fatal and serious (post)	Installed	Cost
SH1/5 Tirau	0.02	0.03	2014-15	$4.7m
SH27/Paeroa and Tahuna Road	0.02	0.01	2009-10	$2.5m
SH3/37 Waitomo Road	0.07	0	2015-16	$3.3m
SH26/Ruakura Road	0.03	0	2016-18	$6.8m*
SH3/21 Airport Road	0.05	0	2016-19	$3.9m
SH2/25 Mangatarata	0.05	0	2014-17	$3.2m
SH26/27 Tatuanui	0.02	0.01	2011-13	$3.5m
Glenbrook/Kingseat intersection	0.08	0	2013	
Whitford Park Rd/Sandstone Road	0	0	2014-15	
Total	**0.04**	**0.01**		

The fatal and serious crashes, and deaths and serious injuries equivalents (the estimated number of deaths and injuries), have **reduced by 75%**. From an average of 0.04 per month (0.5 per year) to 0.01 per month.

Glenbrook/Kingseat intersection

Case study document link - https://www.nzta.govt.nz/assets/Safety/docs/road-to-zero/safe-system-case-study-rural-roundabouts.pdf

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Roundabouts and active road users

Roundabout design should consider the safety of all modes, e.g. grade separation

Design for entry speeds 25-30km/h

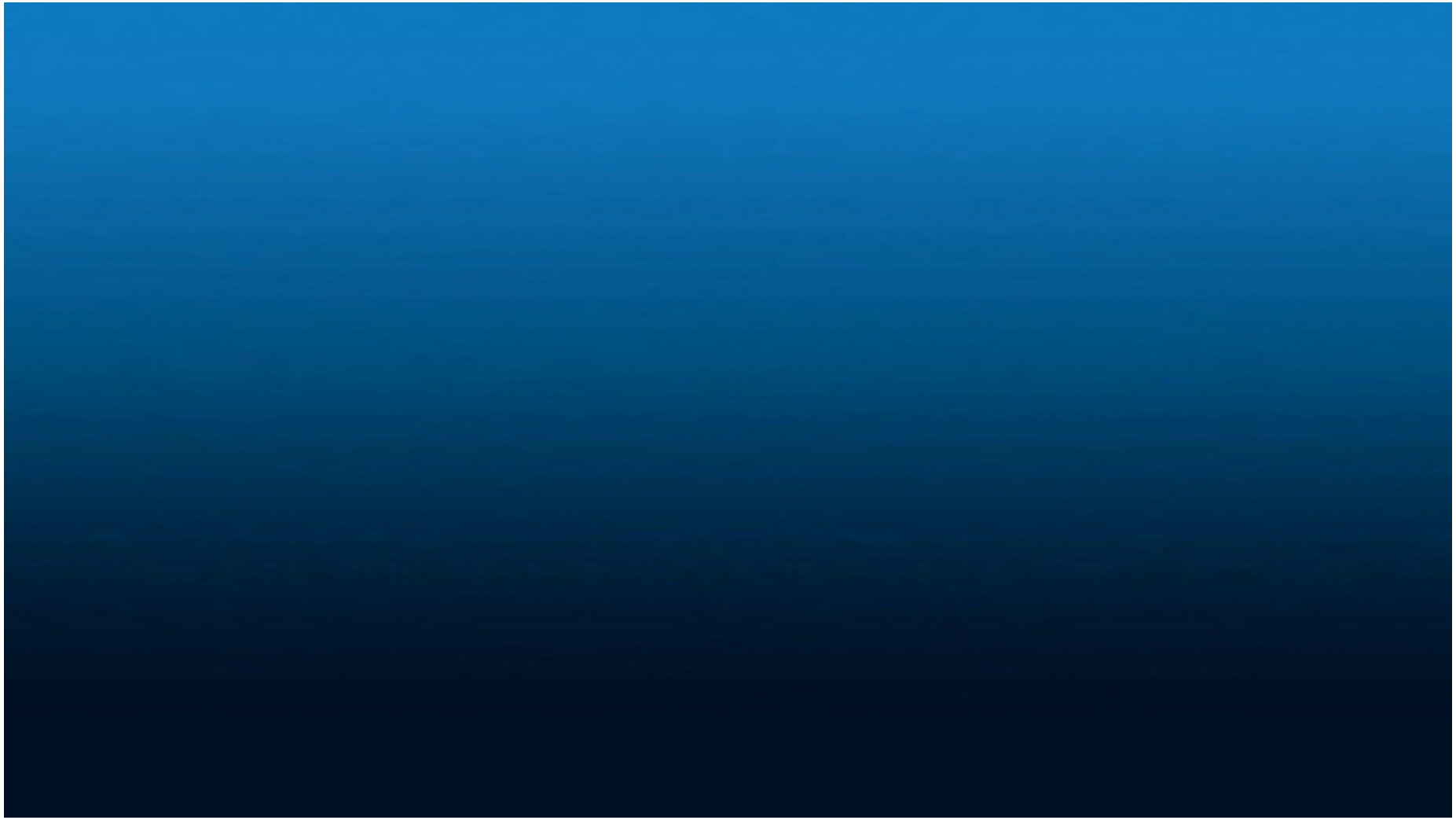
Roundabouts and active road users

Roundabout design should consider the safety of all modes, e.g. grade separation

Sharrow markings to indicate that cyclists share the lane, Elstree Ave/Taniwha St, Auckland (Glen Koorey)

What of the future?

Intelligent speed assistance



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Raised Safety Platforms

Raised Safety Platforms

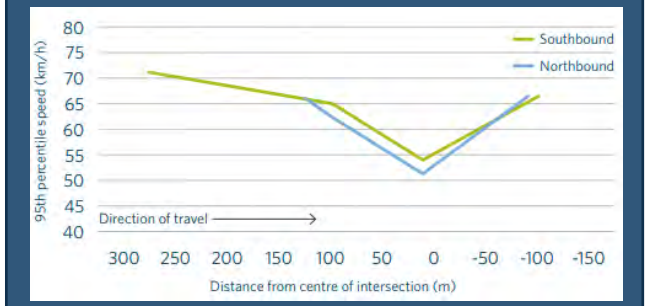
Thomas / Gordonton

Effectiveness

- 100% reduction in DSI crashes
- 98% reduction in all crashes

Speed profile

High speed environment (70-80km/h approaches) with 50km/h design platforms



Primary treatment

Case study document link - https://www.nzta.govt.nz/assets/Safety/docs/road-to-zero/safe-system-case-study-raised-safety-platforms.pdf

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Right-turn Filters

Right-turn Filters

Removal of filter right turn phasing at signalised intersections

Effectiveness

- 83% reduction in right turn crashes
- 72% reduction in DSIs

Additional information

- A FRT is where drivers are permitted to turn right on a full green signal display without a right turn arrow displayed, allowing drivers to seek gaps in the traffic flow.

Supporting treatment

Results from an **Auckland Transport** evaluation following the removal of filter right turn (FRT) phasing at 29 signalised intersections on the Auckland network

Indicator	FRT removal sites			Control Group
	Before	After	% Change	
Annual average number of LB-type crashes per intersection	1.73	0.30	**-83%**	**0.87**
Annual average equivalent death and serious injury crashes per intersection	0.13	0.02	**-76%**	**0.07**
Annual average actual number of death and serious injury crashes per intersection	0.07	0.02	**-72%**	**0.04**

Christchurch in particular still has many traffic signals that allow filtering of right turns

Reviewed literature indicates that up to 90% of opposing-turning casualty crashes can be prevented by retrofitting this solution (Austroads 2012).

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What of the future?

Alcohol interlocks

Speed management in France

Rural speed limit reduction study

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Deaths and serious injuries

France at a glance

- Population = 66 million
- Area = 600,000km
- 80% live in urban areas
- 63% deaths happen outside urban areas
- 606 billion vehicle km travelled each year
- 2019 = 3,500 people died in France

Targeting speed to reduce deaths

Background for reducing speed limits

2012-2017

- Target set to reduce deaths by 50% by 2020
- National road safety council advises:
  - reducing speed on rural roads from 90 – 80km/h could save 300-400 lives each year (on single carriageway outside urban areas)

2018

- 1 July 2018 speed limit reduced to 80km/h

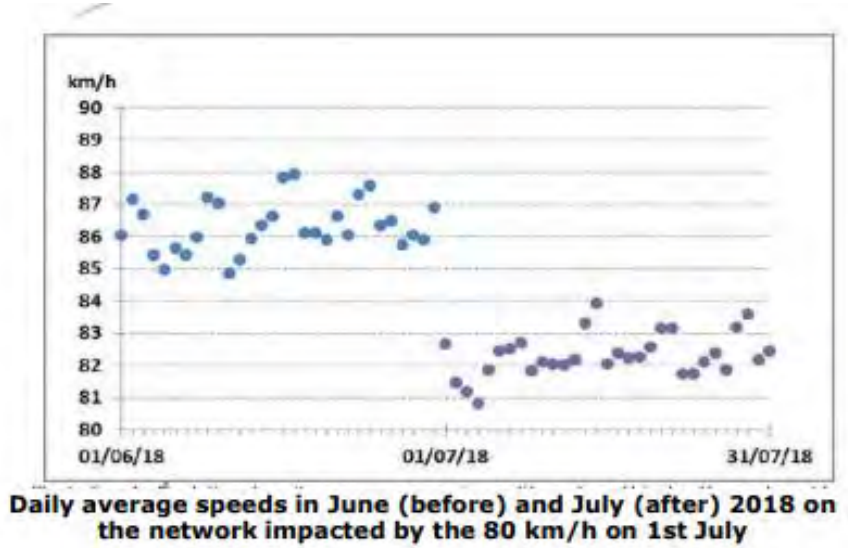
Average speed changes

Before and after speed reduction

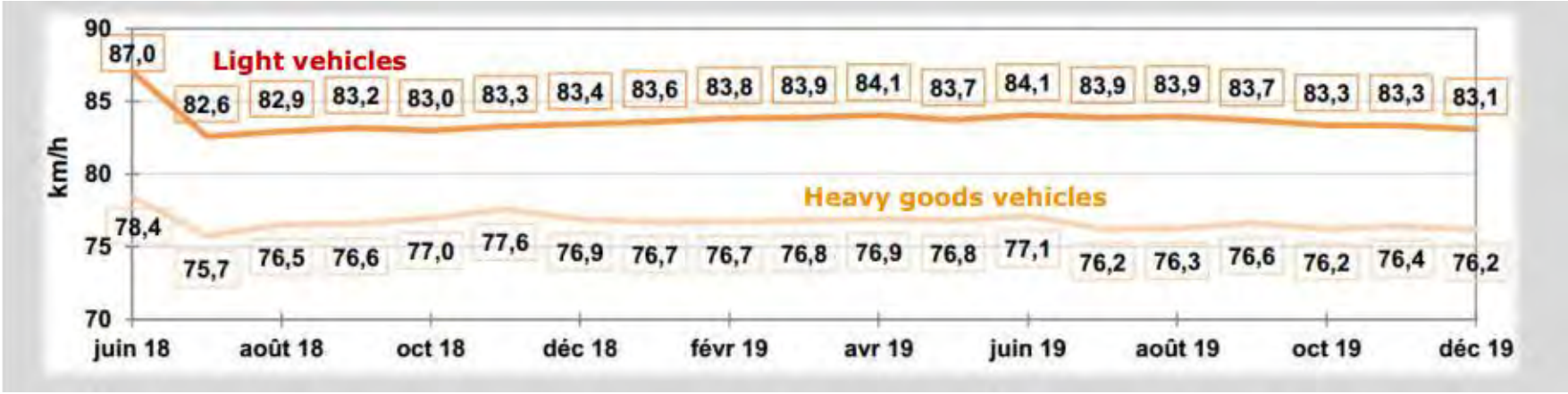
In the first 6 months after the speed change from 90 to 80km/h the average travel speed decreased from:

- Cars = 87 km/h to 83.1 km/h (-3.9 km/h)
- Heavy vehicles = 78.4 km/h to 76.2 km/h (2.2 km/h)

This table shows average speeds for light and heavy vehicles from June 2018 to December 2019:



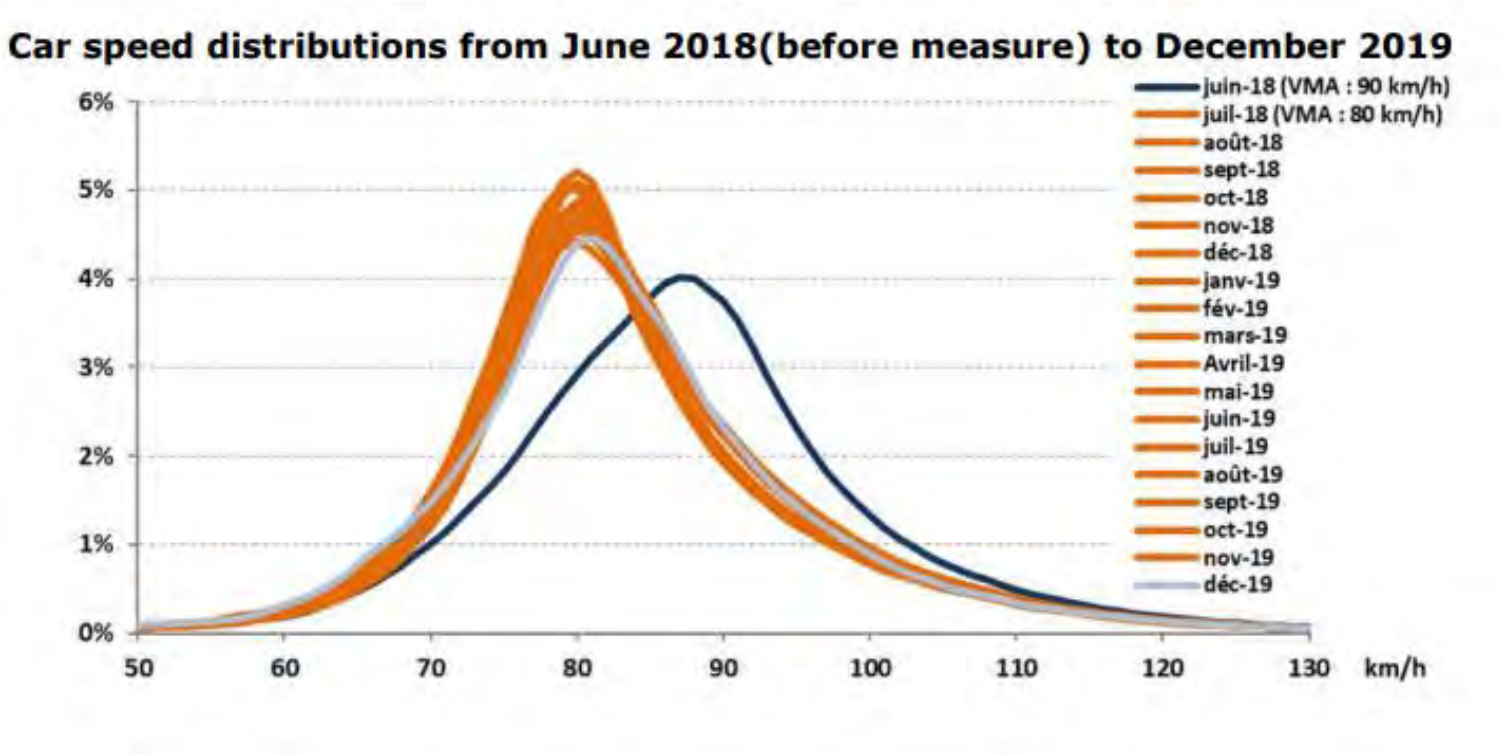
Daily average speeds in June (before) and July (after) 2018 on the network impacted by the 80 km/h on 1st July



Light vehicle driving speed changes

June 2018 (before) to December 2019

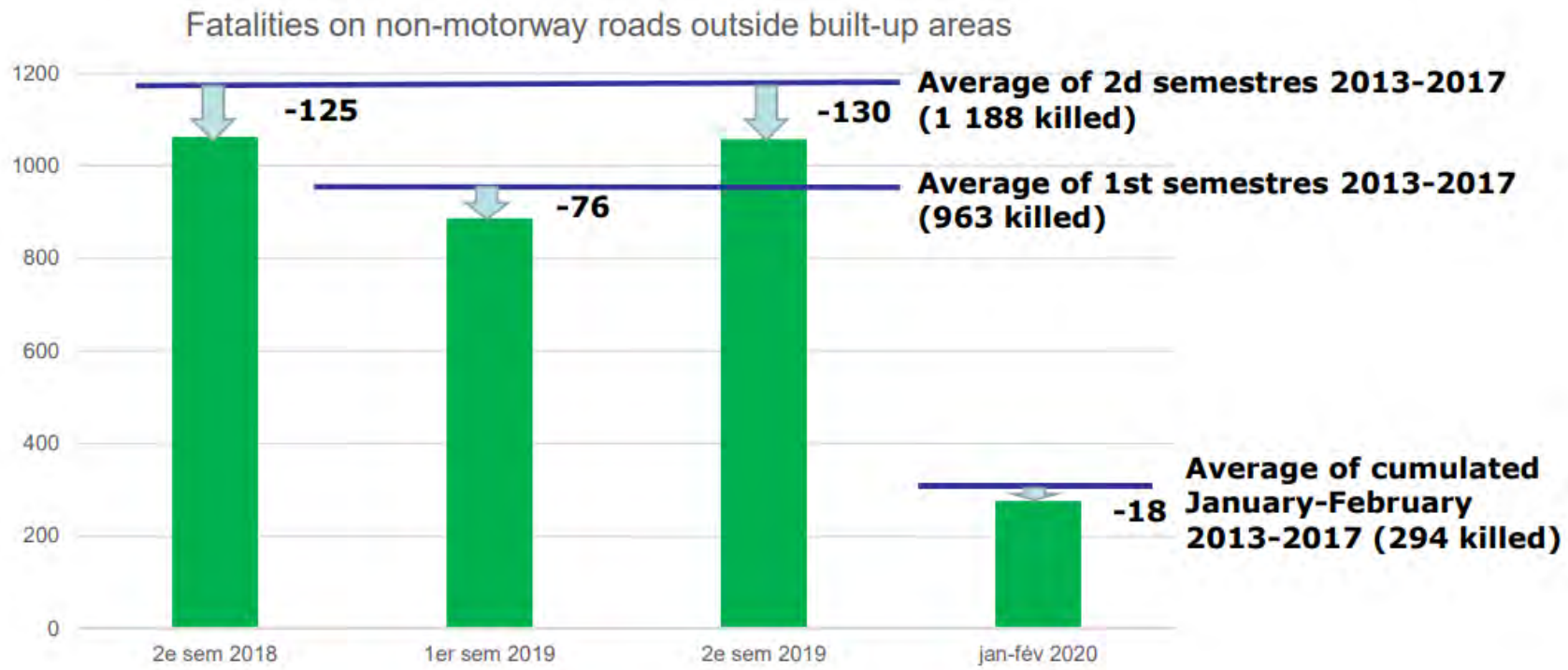
- Blue curve = actual measured vehicle speeds (90km/h speed limit)
- Orange curve = actual vehicle speeds (80 km/h speed limit)
- The whole driving speed distribution has moved to the left and narrowed – which means a more consistent driving speeds



Lives saved on rural roads

Compared to 5 year average (2013-2017)

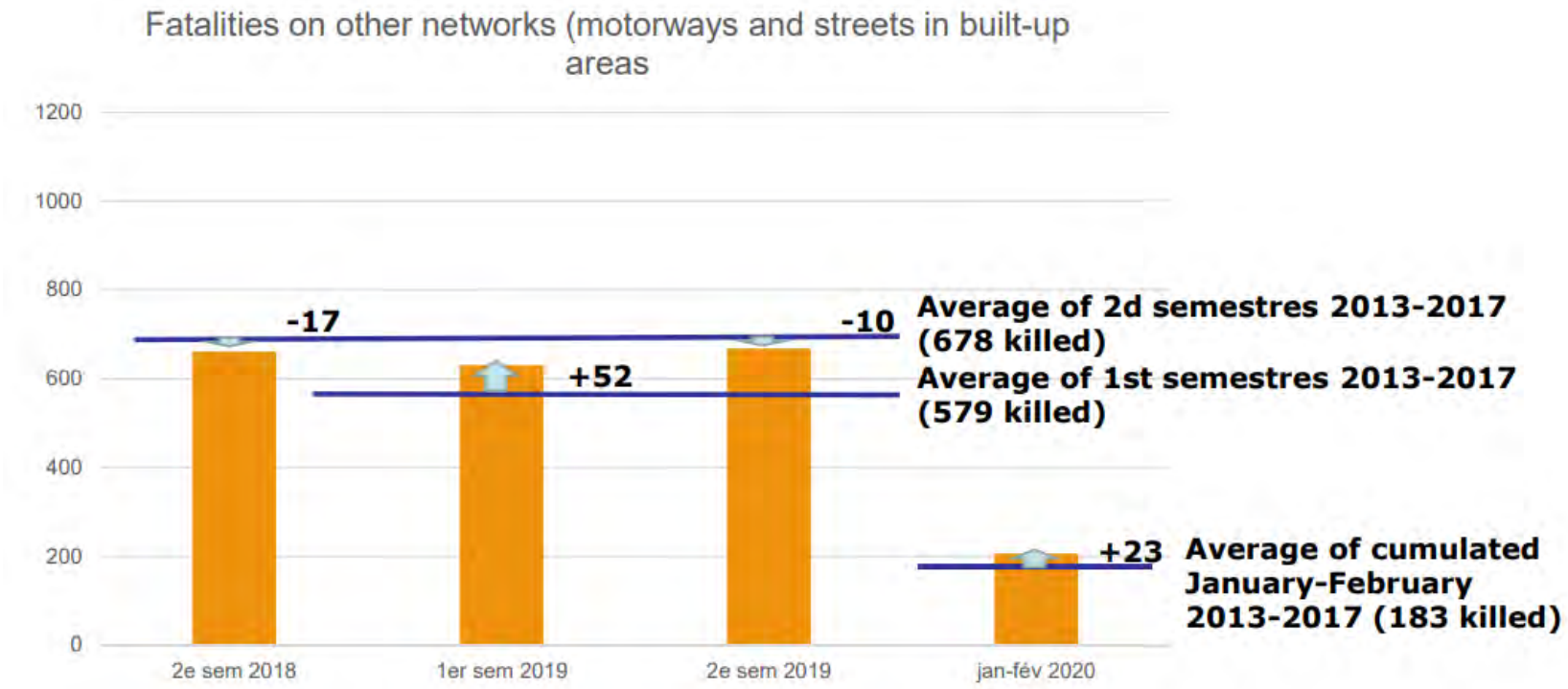
349 lives were saved over 20 months from 1 July 2018 when speed was reduced from 90 to 80 km/h



Deaths on urban roads

Compared to 5 year average (2013-1017)

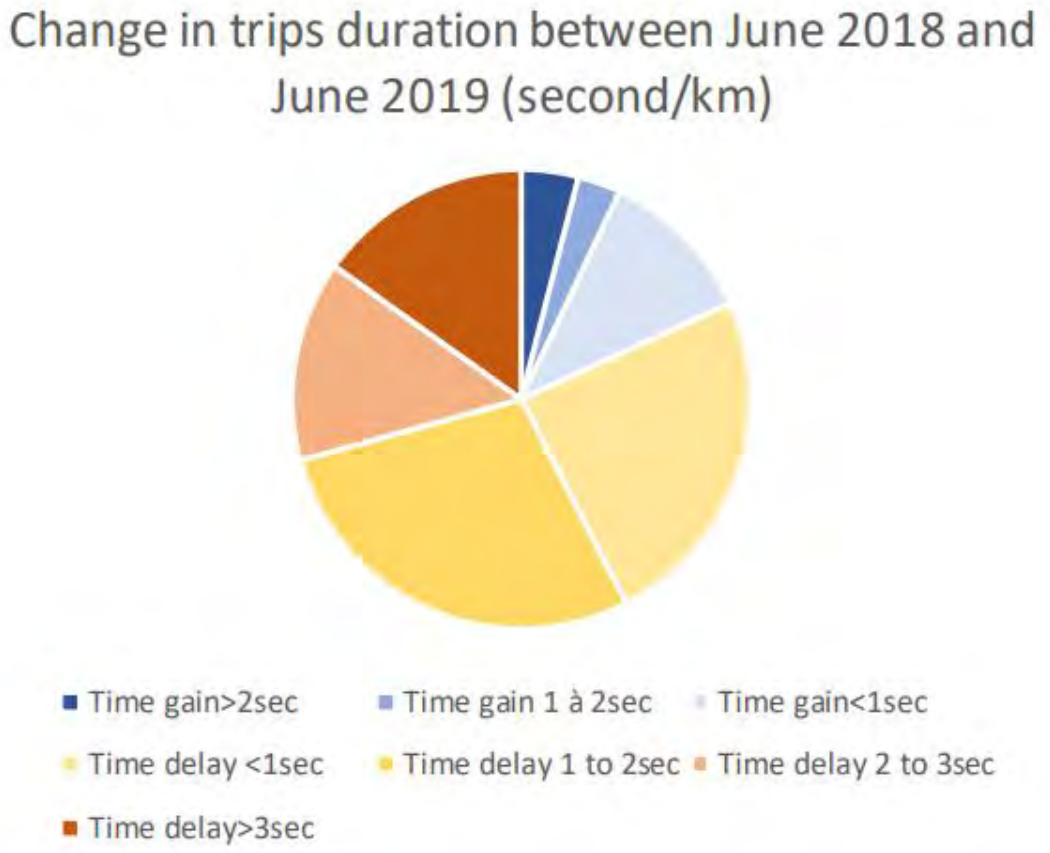
48 more deaths happened on urban roads in 20 months from 1 July 2018 (no speed change)



Journey time on rural roads

Before and after speed reduction

- 1 second / km = average increase in trip time
- 19% had shorter trip time
- 52% had delay under 2 seconds / km
- 85% had delay less than 3 seconds / km



Road user survey

Before and after speed change

Before speed change

- 5,310 respondents
- 30% in favour
- 40% totally opposed

After speed change

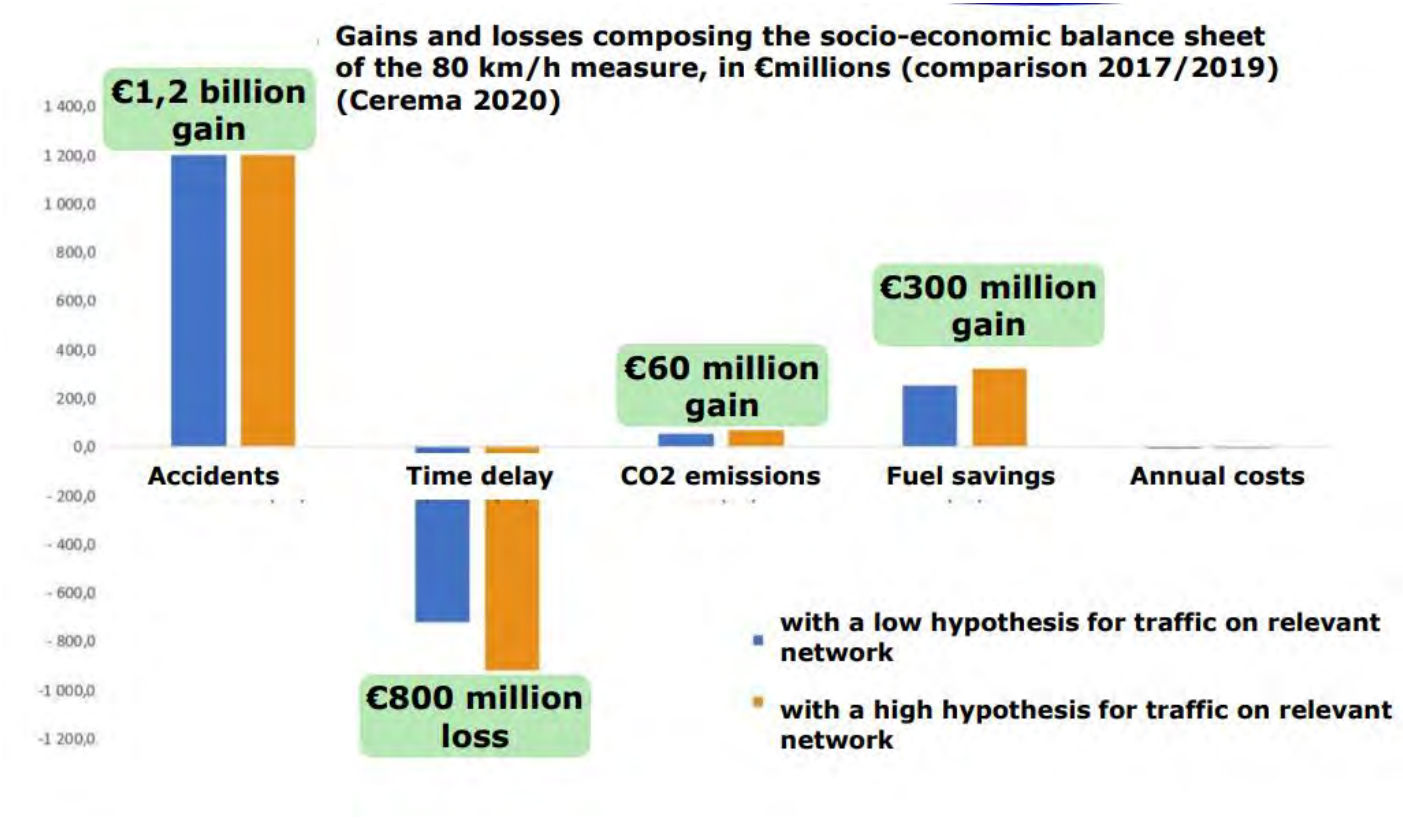
- 3,800 respondents
- 48% in favour
- 20% totally opposed
- Additional travel time estimated between 2 and 5 minutes (at worst)

Socio-economic impacts

Gains and losses –

Reducing the speed from 90 to 80 km/h on rural roads has achieved a positive overall socio-economic impact of about €700 million/year:

- Crashes = + €1.2 billion gain
- CO2 emissions = €60 million gain
- Fuel savings = €300 million gain
- Time delay = €800 million loss



In summary…

- We know what works
- We have an ever-increasing evidence base
- We need to maintain and even increase the pace of delivery
- Emerging technologies will complement proven interventions

Achknowledgements…

The following colleagues provided slides for this presentation:

- Fabian Marsh
- Jessica Rattray
- Adam Beattie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