IR-01-22-38431

17 February 2022

Adam Irish
fyi-request-21382-6aacbb12@requests.fyi.org.nz

Dear Adam

Request for information

Thank you for your Official Information Act 1982 (OIA) request of 10 December 2022, in which you requested information about speed enforcement.

I have answered each part of your request below.

1. *The dates for when speeding camera speed tolerances were reduced. Does this apply to highway patrol officers as enforcement as well.*

Police removed the 'Speed tolerance threshold' section from the *Speed Enforcement* chapter of the Police Manual in May 2021. At the same time, Police added guidance around when/how to use discretion in relation to speeding offences. This guidance applies to all police officers, whether they are in a dedicated road policing role or otherwise.

The posted speed limit is the maximum legal driving speed on a given public road. Pursuant to section 5.1(1) of the Land Transport (Road User) Rule 2004, a driver must not drive a vehicle exceeding the applicable speed limit. Therefore, any driver travelling any speed over the posted speed limit is speeding and Police may take enforcement action.

2. *If the Minister of Police was consulted and when this occurred. What other special interest groups/lobby groups were consulted.*

No consultation was undertaken with the Minister nor any other third party in respect of removing the 10km/h 'tolerance'. Under the Policing Act 2008, Police is not responsible to and must act independently of any Minister of the Crown regarding the enforcement of the law. Police removed the applicable section at its own discretion.

3. *What the rational was for the reduction/elimination of tolerances. (Other than the oversimplification of less spending means less accidents, presumably this could be applied to a 5km speed limit, clearly economic efficiency in terms of wasted time and transportation costs needs to be balanced, all so the principles of fairness and natural justice by which people drive).*

Speeding increases the risks of death and injury on the roads. While the risks posed by high end speeding are well known and understood, typically, drivers who exceed speed limits by a few km/h incorrectly perceive there to be no increased risk to themselves and others. However, if all drivers have this mindset and travel at a few km/h over the posted speed limit, the collective risk to other road users on the network increases significantly. This is supported by international studies.

Australian research and New Zealand analysis also indicates that most illegal speeding is in the 1-10km/h band above the limit, and collectively, with current limits, this is the band associated with the most casualties, followed closely by speeding in the 11-20km/h band.

Enforcement of low-level speeding slows drivers down as most drivers won't exceed the 'implied' limit which is where they believe they may receive a speed infringement notice. Research shows that this changes overall speeding population behaviours by reducing mean speeds and reducing crash severity and frequency across the entire spectrum.

This is why Police continues to focus on speed enforcement.

4. *What is the actual research on fatalities vs marginal speed limit increases, ig for every 5km increase in the speeding limit there is a 0.00002% per million increase in fatalities up to 130km. Or does such correlations not exist.*

Police has summarised large amounts of national and international research and evidence on the relationship between speed and crash risk. Please find included with my response a copy of the Evidence Review – Speed, conducted by the National Road Policing Centre in 2020.

5. *How was the 100km speed limit established to begin with on our highways, for example Germany has drive to your ability limits.*

As advised on 10 January 2023, this part of you request was transferred to the Te Manatū Waka Ministry of Transport as it is more closely connected with their functions.

6. *The police's rationale for having a speed limit and not allowing any tolerance around that target. That is, does NZ Police now assume and have a realistic expectation that people can drive to a target speed 100% of the time and never marginally exceed this.*

I refer you to my answer to part 4 of your request.

7. *Where do the proceeds for speeding tickets go. Are they held by NZ police, the Ministry of Justice or do they get returned to core crown accounts managed by the Treasury.*

Section 141 of the Land Transport Act 1998 sets out the requirement for Police to pay all money received in respect of infringement fees into a Crown Bank Account. Police does not retain any portion of any fees paid.

Regardless, the effectiveness of prevention and enforcement activities is not judged by amount of money received, but by the number of lives saved. We would be delighted if there was never another dollar collected from speeding infringements, because that would mean everyone was driving within the legally established speed limits.

If that happened, the number of road deaths would drop significantly; there would be fewer children missing a parent, thousands of hospital beds taken up by people injured in road crashes would be freed up, waiting lists for other surgeries would be slashed, and the country would be a much healthier, safer, and happier place. We therefore make no apology for targeting excess speed and the other factors that we know contribute to fatal crashes and injuries and will continue to use all the tools and tactics at our disposal to save lives.

8. *The targets that officers or local police stations have in terms of issuing tickets.*

The Road Safety Partnership Programme is the statutory agreement between New Zealand Police, Waka Kotahi NZ Transport Agency, and Te Manatū Waka Ministry of Transport. It outlines the road safety prevention and enforcement activities expected of Police with a number of these activities measured through "desired activity levels".

These desired activity levels are agreed at the national level. Police has apportioned these national levels across the 12 Police districts based on the number of dedicated road policing positions in each district. There are no individual officer or station level targets.

A copy of the Road Safety Partnership Programme is publicly available from the Waka Kotahi website here: https://www.nzta.govt.nz/resources/road-safety-partnership-programme

9. *The total number of spending tickets issued monthly for the last 2 years across the country.*

Police regularly publishes road policing speed offence data on our website. This information is updated quarterly. Therefore, this part of your request is refused under section 18(d) of the OIA as the information requested is or will soon be publicly available.

You can view a copy of the latest available data here: https://www.police.govt.nz/about-us/publication/road-policing-driver-offence-data-january-2009-september-2022

Future updates can be found by selecting "Publications and statistics" from the "About Us" menu on the Police website, then searching for "Road policing driver offence data."

10. *Any internal or ministeral briefings that outline or sign off the decision to reduce the tolerances.*

In respect of Ministerial briefings, I refer you to my answer to part 2 of your request.

The decision to remove the 10km/h 'tolerance' was made following consultations with members of the National Road Policing Centre (including the Calibrations and the Police Infringement Bureau) and all District Road Policing Managers. I have attached a copy of the audit trail completed at the time the policy was updated.

Please note that as part of its commitment to openness and transparency, Police proactively releases some information and documents that may be of interest to the public. An anonymised version of this response may be publicly released on the New Zealand Police website.

If you are not satisfied with the way I have responded to your request, you have the right under section 28(3) of the OIA to ask the Ombudsman to review my decisions. Information on how to do this is available online at www.ombudsman.parliament.nz

Yours sincerely

Inspector Peter McKennie
Acting Director: National Road Policing Centre
Police National Headquarters

NEW ZEALAND POLICE
Ngā Pirihimana o Aotearoa

National Road Policing Centre

AUDIT TRAIL

URGENT ☒ **SEMI-URGENT** ☐ **ROUTINE** ☐

Document Type	Title / Subject		
POLICE INSTRUCTIONS	SPEED ENFORCEMENT		
File Reference	**Date Received**	**Date Required**	**Date Dispatched**

RESPONSIBILITIES **CHECKED AND APPROVED BY:**

Section	Comment
Operational Support	Upon endorsement, return to BRITTANY YOUNG for publication

Person Responsible	Manager: Road Policing Policy	Manager: Operational Support
BRITTANY YOUNG		Jason Eady
Date Ext.	Date Ext.	Date Ext. 44318

CONSULTATION

Police Executive
- ☐ Assistant Commissioner: Road Policing & Prevention

National Road Policing Centre Tier 2
- ☐ Manager: Portfolio and Programmes
- ☐ Manager: Insights & Learning
- ☐ Manager: Strategy & Relationships
- ☐ Manager: Commercial Vehicle Safety Team
- ☑ Co-Director: Road Safety Partnership

National Road Policing Centre Tier 3
- ☐ Manager: Relationships
- ☑ Manager: Operational Support
- ☑ Manager: Strategy and Implementation
- ☐ Principle Advisor: Operational Learning
- ☐ Manager: Insights and Intelligence
- ☐ Manager: Evidence
- ☐ Team Leader: Portfolio Delivery
- ☐ Portfolio & Insights: Financial Analyst

Road Policing Manager (or delegation)
- ☐ Northland
- ☐ Counties Manukau
- ☐ Waitematä
- ☐ Auckland City
- ☐ Waikato
- ☐ Bay of Plenty
- ☐ Eastern
- ☐ Central
- ☐ Wellington
- ☐ Tasman
- ☐ Canterbury
- ☐ Southern
- ☐ CVST Area 1
- ☐ CVST Area 2
- ☐ CVST Area 3
- ☐ CVST Area 4
- ☐ CVST Deployment Manager
- ☐ CVST Training & Standards

National Manager (or delegation)
- ☐ Business Planning Group
- ☐ Community Policing
- ☐ Communications Centres / SNEN
- ☐ Criminal Investigations Group
- ☐ Finance Group
- ☐ Fleet
- ☐ Human Resources
- ☐ Information Communication Technology
- ☐ International Services Group
- ☐ Legal Service Centre
- ☐ Maori Pacific Ethnic Services
- ☐ National Intelligence Unit
- ☐ OFCANZ
- ☐ Operational Services
- ☐ Organisational Assurance Group
- ☐ Policy Group
- ☐ Professional Standards
- ☐ Prosecutions
- ☐ Public Affairs
- ☐ Record Keeping
- ☐ RNZPC (Training Service Centre)
- ☐ Road Policing Support
- ☐ Youth Services

Policy & Partnerships
- ☐ Director: Policy and Partnerships
- ☐ Manager: Road Policing Policy

Other
- ☐ District staff (specify)
- ☐ External (specify)
- ☐ Other (specify)

Other (specify below)
- ☑ POLICE CALIBRATIONS
- ☑ POLICE INFRINGEMENT BUREAU

Sign Off **COMMENTS**

Sign Off	COMMENTS
Superintendent Steve Greally **National Manager:** **Road Policing** Date: 27/5/21	Nil

Police Manual
Approval / Cancellation

To	Police Instructions (police.instructions@police.govt.nz)
From	[Brittany Young, [Senior Road Policing Advisor] [National Road Policing Centre]
Topic	**Speed Enforcement Policy**

Action Required
Amendment of Police Manual chapter.

Brief Rationale (Detail purpose, what changed and why, any other matters)
The Speed Enforcement Chapter of the Police Instruction has been updated to ensure it remains fit for purpose, aligns with current practice, and the removal of the speed thresholds and tolerances.

The main changes include; a new 'Speed Enforcement Levels' section that replaces the previous 'Speed tolerance thresholds' section, a new 'Speed Limit Changes' section outlining the role of Police in supporting the implementation of safe speed limits, and the approach that Police should use as guidance where speed limits are changed.

The removal of the 'Speed tolerance thresholds' section reflects the assertion that there is no acceptable tolerance of a threshold to speed, rather that there is a tolerance at Police discretion.

The new speed limit changes section provides comprehensive guidance on the role of Police and our approach in setting changes to the speed limits. This will be particularly useful in assisting Police if other District Councils choose to lower their speed limits, which has been seen in Auckland and Tasman.

The chapter also has minor amendments to ensure that it reflects changes to titles and the roles and responsibilities of certain groups. This chapter also provides minor amendments and additional guidance on the use of radar and laser equipment and mobile and static speed cameras.

This chapter has been consulted widely with members of the National Road Policing Centre (including Calibrations and the Police Infringement Bureau) and all District Road Policing Managers and their staff. It has not been necessary to consult with the Police Association or Police Managers Guild.

Does the chapter contain reporting requirements (See note 6 next page):	☐ Yes ☒ No
Is the chapter new or significantly updated (See note 1 next page):	☒ Yes ☐ No
If to SLB, detail: Sub-Committee: Paper ref: Date:	

Impact assessment	**Recommended security classification**
☒ Impact assessment form attached (see note 2 next page)	☐ UNCLASSIFIED ☐ SENSITIVE / RESTRICTED (See note 3 next page)

Communications planning (see note 4 next page)
These communications are planned as a result of publishing this document:
A panui bulletin board message and an email out to Prevention and Road Policing Managers will be sent out.

Consultation (tick to indicate who was consulted)	
☒ Police Instructions **mandatory**	☐ Police Association **mandatory, or** ☒ Not required (see note 5 next page)
☐ Police Leaders Guild **mandatory, or** ☒ Not required (see note 5 next page)	☐ Safer People (if there could be possible health & safety issues), or ☒ Not required
☒ National Road Policing Centre	☐
☒ Legal	☐
☐	☐
☐ Other (state)	☐ Other (state)

Approval

The National Manager/Director or equivalent, detailed below, has approved the required action.

Approving Manager details: [Superintendent Steve Greally, Director], National Road Policing Centre]

Note: When emailing the completed form to Police Instructions, you must cc the Approving Manager listed above.

EVIDENCE REVIEW

Speed 2020

NRPC Edition 2

NATIONAL ROAD POLICING CENTRE

*"Excessive and inappropriate **speed** is the **number one** road safety problem in many countries, often contributing to as much as **one third** of fatal accidents and **an aggravating factor in all.**"*

– OECD report on speed management

CONTENTS

SPEED

Evidence Review **Edition 2**
July 2020 **National Road Policing Centre**

Purpose and content

The purpose of the current document is to provide a systematic review of the evidence on the efficacy of enforcement in raising compliance with speed limits, influencing safe driving speeds, and reducing speed-related road trauma. The review examines speed in the wider context of road safety, why it matters, and why it is a salient and persisting problem. The review examines the underpinnings of speeding (including speed limit exceedance and inappropriate speed), its countermeasures and the role of enforcement. Finally, the evidence for tactical considerations that may facilitate the effectiveness of enforcement is reviewed, and opportunities for new interventions are identified.

Summary of findings

- Speed is at the very centre of road safety. The risk of fatal and severe traffic crashes is now well demonstrated to rise exponentially as driving speeds increase.
- The safety of driving speeds and optimal speed limits depend on the level of protective elements built into the road and roadside.
- New Zealand has a large mismatch between speed limits and driving speeds on one hand, and (what are objectively determined to be) 'safe speeds' on the other.
- People do largely not understand or recognise the risks of speed, an issue which continues to fuel resistance to measures designed to restrict driving speeds such as speed limit reductions, and speed enforcement.
- There is good evidence that speed enforcement is effective in raising speed limit compliance, and the research has found a dose-response relationship between enforcement intensity and the incidence of severe crashes.
- This evidence extends to local, specific effects (time and distance halo of an enforcement unit), to general area effects where enforcement is shown to reduce speeds even when no enforcement unit is present.
- Enforcement should ideally be the last intervention as part of an integrated speed management approach, which does not describe the current New Zealand situation.
- There are several deployment tactics that can be utilised to enhance the effect of manual speed enforcement.
- Use of covert methods of enforcement is effective and could be undertaken more widely to leverage its effects on perceptions of unpredictability.
- Publicity can effectively raise perceptions of speed enforcement and improve compliance.

WHY SPEED MATTERS

Background

In the last five years, 3,165 people have died or were seriously injured in crashes where speed was identified as a contributing factor. This is about 22% of all fatal and serious crash injuries. This proportion may sound relatively minor given the prominence given to the role of speed in road trauma by road safety authorities, such as the World Health Organization; "Speed is at the core of the road traffic injury problem" (WHO, 2017, p. 5). However, aside from this statistic likely underestimating the role of speed as a factor contributing to the crash occurring, speed is a trauma aggravating factor in almost all single and multiple vehicle crashes resulting in serious injury or death [1].

The most recent speed survey taken from sites across the country showed that 23% of vehicles were travelling above the speed limit in rural locations, and 46% were speeding in urban locations [2]. Speeding is a well-studied aspect of road safety; large scale international reviews have concluded it to be the primary source of traffic-related mortality [3, 4]. Speeding encompasses driving at excessive speed and driving at inappropriate speeds [1]. This section will unpack why it is wrong to assume speed is not a factor in 78% of New Zealand road trauma.

The physics of speed

A small change in speed has a relatively large change in stopping distance, which has a much larger change in impact speed, a still larger change in impact energy and a very large change in probability of death and serious injury [5]. To illustrate this, a driver reacting to an object 70 metres away will be able to stop in time if travelling at 80 km/h; a driver travelling at 100 km/h who immediately commences braking will hit the object at 67 km/h (see Figure 3) [6]. If that object is an oncoming vehicle or solid stationary object, the probability of sustaining severe injuries or death for light vehicle occupants is estimated to be greater than 90% at that impact speed [7]. Had the initial speed been just 20 km/h lower, the crash could be avoided entirely.

The severity of crash forces can be described generally as the change in velocity, known as Delta-v, this is when the kinetic energy of the vehicle travelling at speed transfers onto the vehicle, its occupants, and object or road user struck [8]. Kinetic energy quadruples for every doubling in speed, which in part explains the non-linear relationship between speed and the risk of fatal crash involvement (see also Figure 4) [4].

Two cars of the same mass travelling at the same speed colliding head on at 100 km/h is sometimes viewed as comparable to an impact speed of 200 km/h, however as per Newton's third law of motion, this is rather the same colliding force with a solid wall or roadside object such as a tree at 100 km/h. When mass is unequal, however, the lighter vehicle and its occupant(s) is subjected to relatively greater crash forces at the same speed. For this reason, head-on collisions involving trucks have high fatality rates for the occupants of passenger cars.

What is the relationship between speed and crash risk?

There is a strong, well demonstrated, relationship between mean speed and the risk of fatal crashes; risk curves estimating this relationship were developed in Nilsson's power model [9, 10], and Kloeden's relative risk model [11–13]. The earlier iterations of the power model provided a simple conversion of a 1% change in mean speed being associated with a 3% change in serious injury crashes and a 4% change in fatal crashes. Kloeden's model showed that casualty crash risk doubles for each 5 km/h increase in speed above the mean. The original power model becomes less accurate in higher and lower speed environments which was addressed in subsequent revisions [14].

Later work showed that this relationship varies by road type, with changes to speed in urban environments to have a lower effect on severe crashes than in rural environments [15]. Later models have also shown that the change in fatal crash risk is greater for higher initial speeds, meaning reducing speeding on rural roads by a relatively smaller proportion would yield a greater safety benefit [16]. Based on these latest models proposing an exponential relationship, a reduction in mean speed from 110 to 100 km/h would reduce the incidence of fatal crashes by about 50% (see Figure 4) [16]. This relationship has later been found to also be applicable for attributing risk to individual driving speeds [17–19].

The relationship between speed and crash risk can be most succinctly be summarised as a 28% reduction in the incidence of fatal crashes for every 5 km/h reduction in speed compared to the crash rate at the initial speed, or 6% per km/h [4]. This model is accepted by the World Health Organization and OECD/ITF [4, 20].

What are safe speeds?

While vehicle protection systems and infrastructure measures can reduce vehicle occupants' exposure to crash forces, these are relatively applied; the same risk curve applies as speeds increase. I.e. the same car on the same road has an equal exponential relationship between a change in driving speed and the risk of a fatal crash (refer Figure 4). Survivability probabilities based on travel speed, however, vary given the possible crash angle (e.g. side on), and the mode of travel (e.g. pedestrian). These are reflected in what are known as 'safe system speeds'.

Safe system speed limits were introduced in Sweden's Vision Zero based on the premise that there are critical speed cut-offs (10% fatality risk) above which the probability of death increases rapidly [21, 22]. Despite being frequently cited in road safety literature, there have been few attempts to validate these limits with experimental data, and these limits may be seen as aspirational in nature [23]. Although there have been some more recent models that provide support for these limits, and that these critical limits are even lower if set for serious injury (Figure 5) [7, 23, 24].

Table 1. "Safe system speed limits" (Tingvall & Haworth, 1999).

Type of infrastructure and traffic	**Possible travel speed (km/h)**
Locations with possible conflicts between pedestrians and cars	30
Intersections with possible side impacts between cars	50
Roads with possible frontal impacts between cars	70
Roads with no possibility of a side impact or frontal impact (only impact with the infrastructure)	100+

Safe speed limits can also be set by keeping in mind the role of braking prior to collision, which would bring the critical speed limits in line with or slightly above the proposed 'safe system speed limits' [25, 26] . Maximum speed limits may for various other reasons not be a good indicator of collision speeds and their risk, including the fact that traffic won't be all be travelling at the maximum allowable speed and that vehicle occupant protection levels vary widely among passenger cars [27] . Basing safe speed limits on the probability of a crash resulting a fatality in given a crash scenario produces a different set of critical speed limits (Table 2) [27] .

Optimal speed limits are in most cases going to be higher than limits based primarily on safety and possible conflict angles but require investment into infrastructure to safely operate. The safer a road becomes due to various measures, the higher the optimal speed limit. A contemporary assessment of Vision Zero speed limits based on the biomechanical tolerance of the human body to crash forces mostly aligns with the original "safe system speed limits", where the goal is to eliminate road deaths. This would mean 30-40 in pedestrianised zones, 50 in other urban zones, 70-80 in rural zones without barrier protection, and 90-110 km/h in rural zones and motorways with barrier protection [28] .

Table 2. Safe speed limits for a given threshold fatal crash rate

Crash type	1 in 100 safe speed limit (km/h)	1 in 1,000 safe speed limit (km/h)
Hit pedestrian	40	<40
Head-on	50	<50
Hit fixed object	60	<50
Right angle	80	50
Right turn	80	50
Left road/rollover	80	<60
Rear-end	110 or >110	80

What is the role of speed variation?

In addition to mean speeds and the rate of speeding, there is also a relationship between the variation in driving speeds and the rate of crashes. Homogenous speeds being safer than large differences in vehicle speeds. Although the relationship between speed the variation in speeds and crash rates is more difficult to summarise or quantify [4] , it appears to largely affects property damage only and minor injury crash rates [29, 30] . On motorways, higher between lane speed variation also combines with traffic volumes and speed to influence injury crash rates [31] .

Some have taken this to mean that given the relationship with speed variation and crashes it to be more unsafe to drive below the speed limit or at lower speeds than surrounding traffic [30, 32] . This also appears to be a false belief held by some drivers [33] . Absolute speed (individual or mean) remains the key risk factor, and it is not safer to speed or drive at higher speeds if this is closer to the mean speed [30, 32] . There is no such a power or exponential relationship between variation in speed and severe crash risk [4] .

Why does low-level speeding matter?

The issue of low level speeding is a perpetuating and common issue in road safety, characterised by public perceptions that low level speeding (defined as less than 10-15 km/h over the limit) is not much of an issue and police should focus their efforts on high-end speeding [34] . Having established the exponential relationship between speed and fatal crash risk, it is clear that, not only do relatively small increments in speed have a large effect on fatal crash risk, the prevalence of low-level speeding comes into play (which describes Kloeden's earlier mentioned approach to estimating risk).

Total speed attributable risk should be seen in the context not only of the risk associated with the higher-end speeds, but take into account the proportion of vehicles travelling at those speeds (i.e. relative risk of driving at +x km/h over the speed limit * percentage traffic driving at that speed) [35] . This makes the issue of 'low-level' speeding particularly problematic; while high-end speeding is very risky, it is relatively rare. Low-level speeding increases risk less severely, but is much more common [36] .

Compounding this problem are public perceptions of acceptability and permissibility of lower-end speeding, particularly in the <11 km/h excess range. This effectively raises already excessively high speed limits to a de facto limit of 110 km/h on rural roads and 60 km/h on urban roads. Police's position on speed camera activation settings and officer discretion (including the practice of 'speed discounting' or setting even higher thresholds) has inadvertently reinforced this perception [37–39] .

Due to the prevalence and implicit acceptance of low-level speeding as 'normal' the majority of collective casualty crash risk associated with speeding is attributable to speeding below 16 km/h excess (at the population level) [35, 40, 41] .

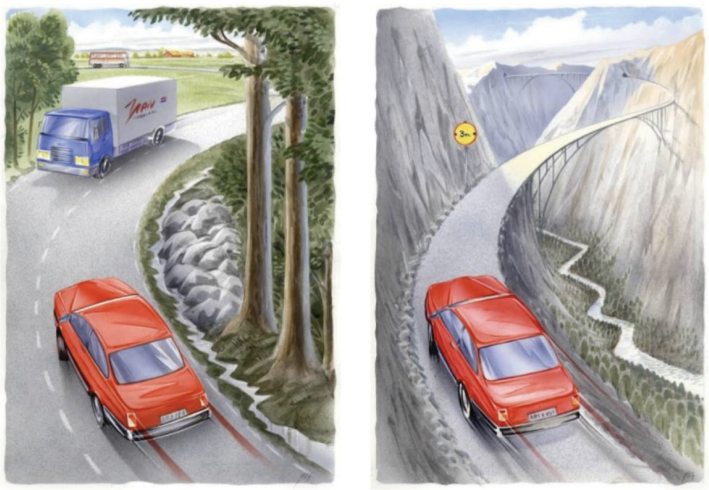
Why do drivers speed?

There are a number of reasons why drivers speed and factors that relate to speeding behaviour, such as age, sex, attitudes and other behaviours like drink driving [42, 43] . There are also road factors, vehicle factors, enforcement levels, sanction severity, education, and publicity [44] . However, three fundamental reasons underpin the persistence of speeding behaviour, resistance to speed limits and their enforcement [43] . This includes the reluctance to adopt safety-appropriate driving speeds and support speed limit reductions that would align with this [45] .

Recognition of risk

People don't readily appreciate the stark relationship between speed and the risk of severe injury and death. Humans are not exposed to speed in the same way we learn to fear height, for example; despite this, the exposure to potential energy transfer from speed is identical to falling from a height [5] . The physics are essentially the same. The potential kinetic energy transfer for a vehicle travelling at 100 km/h can be expressed as similar to the same car falling from a 40-metre height [5] . While the risk of harm in the latter case is readily accepted and understood, the same risk presented by the former is not [46] .

Figure 1. Perceived and actual risk of exposure to kinetic energy transfer (Tingvall, as cited in Woolley et al. (2018)).



When it comes to heights and unforgiving environments, there is a great tendency to mitigate the potentially injurious results of human error; balconies and stairs have railings, ravines have barriers. It is likely unacceptable to rely on education or signage to produce careful balcony users in order to prevent people from falling off elevated balconies. However, driving environments that carry the same potential for exposure to transfer of kinetic energy because of human error, but are viewed and treated differently. Speed carries several economic and time saving benefits but the necessity to make those speeds safe is not typically appreciated in the same way [46].

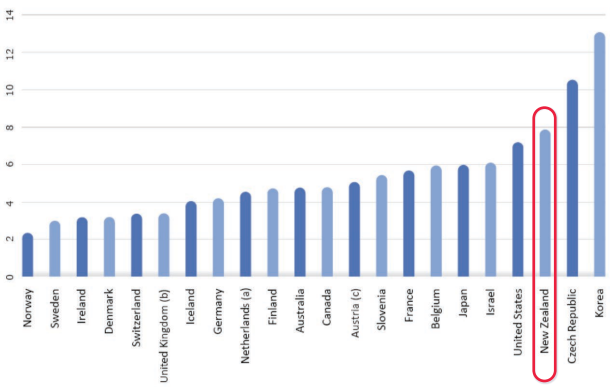
Having safely used a railing-less balcony for years and it being uneconomical or otherwise undesirable to put one in is irrelevant; it is an uncontroversial matter of public safety. Speed limit setting and its enforcement can be described in remarkably similar terms and yet has attracted significant controversy and contention [47]. The risk is not recognised.

This failure to recognise the risk of speed is reinforced by a feedback loop of having experienced a growing driving history filled with high speed driving but most likely a lack of involvement in severe crashes [33]. It is also true that the odds of being involved in a high-speed crash are low for the individual driver because they are relatively rare events. Driving at 100 km/h rather than 80 km/h carries more than twice the fatal crash risk, however, at the individual level this is making an exceptionally rare event no more appreciably likely.

Say the odds of a New Zealand driver being involved in a crash killing a driver or passenger each year is about 1 in 13,000; doubling that risk to say 1 in 6,500 by driving faster still makes it highly improbable for an individual driver to be involved in a fatal crash that kills a driver or passenger.

However, multiplying that doubling in risk at the population level, all things being equal (infrastructure is for example not put in place to safely accommodate higher speeds), means accepting twice the number of road deaths; some 3,000 additional preventable deaths over a decade.

Figure 2. Road deaths per billion KM travelled (OECD/ITF, 2019).



Paradoxically, drivers have been shown to happily accept and prefer this risk if it means getting somewhere more quickly but simultaneously want the government to provide safe roads [48]. In 2016, 80% of New Zealand drivers surveyed believed our roads were safe [49]. In contrast to New Zealand drivers' belief regarding the safety of our roads, New Zealand had the third highest rate of road deaths per distance travelled in the OECD (Figure 2), and experienced the largest rise in the rate of road deaths recorded across the OECD over 2013-2017 (Figure 6) [50]. Speed has a large part to play in shaping our road safety record [51].

Illustration 1: *Speed and field of vision (Ministry of Infastructure, 2015)*

Normalised behaviour

The majority of drivers speed because it is widespread and because other drivers speed (normative behaviour) [43, 52]. The majority of drivers who speed tend to do so in response to other drivers around them, and in response to social influences [53, 54]. This finding has been replicated in a number of local and international studies [39, 43, 52, 55–57]. There is also a minority of high-risk drivers who drive at substantially high speeds (e.g. thrill-seeking behaviour) and at considerable risk that fall outside this, but most drivers speed because surrounding traffic speeds.

False belief speed preference is rational

There are a number of biases and false perceptions that perpetuate the preference to drive faster, and drivers tend to ignore impacts of speed they don't immediately notice [58]. Drivers tend to overestimate the time savings impact from higher maximum driving speeds [59]. Drivers tend to fail to appreciate the increased fuel consumption, reduced efficiency and increased emissions of higher driving speeds [58, 60].

Drivers tend to underestimate the role of impact speed on their own safety, perceiving the relationship between speed and severe crash risk to be linear, when it is in fact exponential [58]. Drivers tend to underestimate braking distances at various speeds [61]. Perceived risk is actually an important predictor of drivers' speed preference [62, 63]. However drivers tend to read risk through various cues that have no relation to actual risk and fail to identify real risks in the driving environment that are beyond their control [64, 65].

Speed management

Speed management describes measures intended to reduce driving at excess speed and/or driving at inappropriate speed [1, 20, 44].

Speed limits

Speed limits and speed limit reductions are in themselves effective in bringing driving speeds down and reducing severe crashes. On average, a 20 km/h speed limit reduction will reduce the mean speed by about 8 km/h [6]. NZTA's assessment of the road network shows that 87% of the road network has speed limits that are above what are considered to be safe driving speeds, for some roads the safe and appropriate driving speed is 40 km/h lower than the posted speed limit. This restricts the ability of enforcement to bring about safe driving speeds.

Speed limit enforcement

Automated (camera) and manual enforcement (officer) describe various methods of enforcement. Fixed speed cameras have a very localised effect (250-500 metres) and reduce all crashes by about 20%, the fatal crash reduction rate is uncertain [66]. This localised (kangaroo) effect seems to increase with higher conspicuity and may encourage speeding outside camera areas if camera numbers are small but highly visible [67, 68].

Covertly and unsigned overtly operated mobile speed cameras have a less pronounced local effect but project wider deterrence and speed reductions across the network [69]; increases in camera numbers and operating hours is strongly related to reductions in severe crash rates [70]. There is a strong network-level dose-response relationship between the amount of mobile camera enforcement and fatal crashes that seems to improve with random scheduling [71, 72]. A covert mobile speed camera programme with sufficient intensity has a general network effect on casualty crash reductions ranging 21-30% [73].

Section control cameras are used to calculate a driver's average speed between two or more distances using ANPR and are very effective in reducing speeding and severe crash risk on enforced sections of road. Section control reduces fatal and serious injuries by 56% [66].

Manual enforcement using lasers and radars is less efficient at offence detection compared to automated methods but has several advantages over automated technology. Manual enforcement can be targeted to entire road network with agility to foster general deterrence and prefer deployment to routes with high operating speed and low infrastructure protection. This makes manual enforcement more effective when crashes and risk is more widely dispersed across a route or the network [74]. Apprehension and resulting feedback is also immediate and can be connected to a specific instance of speeding behaviour. Officer-based speed enforcement also produces much greater speed reduction halo effects compared to fixed cameras (distance over which speed reductions are achieved), up to 10 km [75]. Public support for manual speed enforcement is high at 73%, and higher than that for the use of speed cameras (63% support) [49].

Credibility of speed limits

Credible speed limits describe speed limits that align with the function and design cues of the road; drivers are more likely to comply with the limit if it is perceived as credible [76]. Various types of visual and physical treatments, such as markings, use of traffic islands, cycle lanes, provisions

for pedestrians, and roundabouts can substantially reduce vehicle speeds by making the correct speed on roads intuitive [77–79].

Dynamic and variable speed limits

Dynamic speed limits can be varied according to road and weather conditions, and have been found to significantly reduce crashes by 18% [80]. Temporary speed limit reductions in school zones are also an example of a variable speed limit. Another application is the rural intersection active warning system which temporarily reduces the speed limit on main roads when a car is approaching from an intersecting road, significantly reducing speed by 6-28 km/h [81].

Road narrowing

Road narrowing including physical and perceptual narrowings encourage earlier deceleration and probably reduce mean speeds, for example in anticipation of an intersection or pedestrian crossing [82]. Gateways and transition zones can also make use of narrowings to physically signal to drivers that they are entering a different speed zone on a continuous road [1].

Speed activated warnings

Speed activated warnings flash either a warning message or the approaching vehicle's speed. Generic warnings do not tend to significantly reduce speeds, but displaying the trigger speed can reduce mean speeds by between 5 km/h (day) and 8 km/h (night) [83].

Speed humps

Speed humps are a category of vertical speed deflection devices usually installed in urban locations to physically restrict driving speeds. Speed humps reduce crashes by about 17% [84].

Incentives and rewards

Various incentive programmes to reward speed limit compliance have been tested and found to be effective in motivating compliance up to 80%. However, reward schemes are difficult to target to the right drivers (drivers who would most benefit from the reward scheme being least likely to take part), and cost prohibitive to implement to good effect [85].

In-vehicle technology

There is good evidence that various forms of intelligent speed adaptation (ISA) are effective in reducing speeding and can provide a substantial safety benefit [86]. ISA provide feedback to the driver when the speed limit gets exceeded. ISA generally covers three levels of control:

- Informative – where the speed limit is displayed, and the driver is warned when the limit is exceeded (-7.5% DSI risk). These systems are most effective for drivers who oppose voluntary ISA.
- Over-ridable – where informative is combined with a counterforce that gets applied to the gas pedal when the speed limit is exceeded (-9.3% DSI risk).
- Mandatory – where the driver is prevented from accelerating further when the speed limit gets exceeded (-16.2% DSI risk).

ISA is currently not utilised as part of the criminal justice process, but like mandatory alcohol interlocks could be effective sentencing or relicensing options for repeat and high-end speeding offenders, and cases involving speed as part of a dangerous driving conviction [87].

Education

Given the reasons drivers speed and resist appropriate speed management, getting drivers to understand their speeding matters, and that the speed limit setting policy should reflect the risk of exposure to life threatening collisions, is a tough sell. However, as there is an association between attitudes and speeding behaviour [88, 89], and also a lack of understanding around the risks of speed [5], it would appear to make sense to pursue educative measures. Many road safety campaigns and education programmes do assume that a certain proportion of road users do not behave legally or safely because they lack knowledge of traffic rules, risk of speeding, or have negative attitudes. These measures further presume that exposure to information can provide increased knowledge, which in turn leads to a positive change in attitude, thereby improving driving behaviour and consequently reducing crash risk [84].

The research regarding education and information measures for speeding is characterised by poor evaluations and lack of evidence for behaviour changes or reductions in crash risk, some reporting no change or even negative results [84, 90, 91].

A notable exception may be in the UK's National Speed Awareness Course, where drivers apprehended for speeding by a police officer or speed camera are given the option to have the fee and demerits waived if they complete the 4-hour course. Reoffending reduced by 14% for those who participated in the course compared to those who refused; crash involvement was also 7% lower in the three years following participation [92]. There is good incentive for repeat offenders, who tend to be more resistant to participating, to complete the course if it provides an avenue to avoid licence suspension for excess demerit point accumulation.

Education and information initiatives do have a role to play in speed management and may be more effective when tied to enforcement efforts such as the intensive awareness course operated in the UK (which may be seen as a rehabilitation measure).

Integrated speed management

Speed enforcement and other speed management measures all have an individual impact on speed. The concept of integrated speed management brings measures together to bring about enduring reductions in speed and associated trauma [1]. Setting speed limits to align with human tolerance to crash forces in mind without enforcement are not going to achieve the maximum effect. Effective speed enforcement is ideally the final aspect of an integrated speed management approach that first seeks to encourage appropriate speed [93]. This involves setting appropriate speed limits (based on the function and forgivingness of the road), providing information about speed limits (such as signs and in-vehicle systems), putting in place road engineering measures (including protection features and design cues) followed by enforcement aimed at intentional violations [74].

What enforcement does

Traffic enforcement should above all else seek to prevent those behaviours most closely related to the incidence of fatal crashes and severity of serious injury crashes [74]. Speeding is chief among these.

Police enforcement has consistently been found to have a strong dose-response type of relationship to the incidence of speeding, mean speeds, and risk of severe crashes [6, 72, 94–97]. The overall summary effect of speed enforcement has been estimated at a 29% reduction in fatal crashes, however, speed enforcement can be delivered to varying degrees of intensity and there is variation in effect size estimates in the literature. The dose-response model, called the crash modification factor, summarises these effects (Figure 7) [98]. A comparison of patrol activities found speed enforcement to produce the greatest reduction in fatal crashes, while 'general patrolling' did not have a significant effect on casualty crashes [84].

Speed enforcement is primarily effective in bringing about safety and compliance via general deterrence and general effects by raising perceptions that the risk of being apprehended is high but be difficult to anticipate [70, 99]. Secondary to this, speed enforcement has specific effects in the locations it is being undertaken and has specific deterrent effects for those drivers who are apprehended for speeding [100]. While manual enforcement is less efficient than automated methods, it is better suited to produce wider general effects across the network [101], and therefore more suited to New Zealand's relatively large rural road network. New Zealand has the highest proportion of fatal crashes on rural roads across the OECD (Figure 8).

Enforcement has a unique effect on speed in comparison to many other speed management measures in that it specifically targets and affects the high-end of the speed distribution i.e. a relative minority of the riskiest speeds [17]. The downside of this is that it cannot affect inappropriate speeds below the speed limit and is hampered in conducing safety when speed limits permit driving above speeds that would be safe in a given driving environment. This currently describes the majority of New Zealand's road network. Notwithstanding this, the mere presence of a stationary police car on the side of the road has been shown to reduce vehicle speeds substantially and to slow speeds below the posted speed limit [102].

So even though, given the high rural speed limits, a relatively small proportion of traffic will be travelling above the speed limit and can be targeted by enforcement, enforcement still positively affects the driving speeds of most drivers through exposure to enforcement (witnessing it taking place) [75].

HOW ACTIVITIES AND TACTICS ARE BEST UNDERTAKEN

Background

On a whole, considerations given to how, where, and when speed enforcement activities are undertaken are of lesser concern to the intensity or amount of speed enforcement undertaken [103]. However, a risk targeted approach is more efficient than a general one [99, 100]. Using techniques to heighten general deterrence and produce general effects are more efficient than techniques aimed at specific deterrence and producing specific effects. At a high level, this means prioritising high speed environments with lower levels of protective infrastructure.

NZ Police currently delivers to an enforcement level of around 256 speeding offences per 1,000 population (2019). This compares relatively favourable to EU member states with only two reporting a higher level of offence detection (where data is available, 2017) [104].

Stationary versus moving patrols?

Stationary speed enforcement using radar or laser have been shown to be approximately twice as effective in reducing crash rates, and the local speed reduction effect for stationary patrol vehicles is larger [75, 105]. The mere presence of an unmanned police car at the side of the road is able to slow traffic down [106, 107].

Nevertheless, mobile patrols undertaking speed enforcement are effective in reducing speeding, and may reduce speeds over greater distances [108], but may not be as efficient in offence detection, and are visible to fewer drivers [75, 109]. Having two stationary patrol cars per road segment is most effective at bringing speeds down (or one stationary and one circling) [110]. Overall stationary speed enforcement that moves around sites is preferred over mobile patrols, but both methods are effective.

High visibility versus covert?

Mobile unmarked patrol vehicles have no local speed reduction effect (presumably unless lights are activated), while there is some evidence of a local effect on speeds involving stationary unmarked patrol vehicles [75, 111]. This finding may be a combination of greater awareness that a stationary patrol vehicle on the side of the road is undertaking speed enforcement, and the fact that a stationary vehicle is seen by traffic travelling in both directions.

Covert speed enforcement is more effective in detecting speeding and overt enforcement is more effective in reducing local speeds [110], however marked cars can be used to the same effect if stationary speed checks are being undertaken in locations where their presence cannot easily be anticipated from a significant distance [112]. High visibility speed enforcement is also effective in producing local reductions in speeding, and have in a number of studies been shown to produce a similar or greater local reduction in speed [111, 113]. Covert, or difficult to anticipate overt (unpredictable) speed enforcement is, however, better at producing a general effect on speeding and crash risk across a wider area [69, 84, 101, 114].

A study comparing enforcement undertaken overt versus covert with immediate or delayed feedback found that covert enforcement combined with immediate feedback (apprehension) was most effective in reducing speeding [115]. Overall, a manual speed enforcement programme is most effective when it employs a combination of high visibility and inconspicuous patrol vehicles/methods [84, 116].

There is high public awareness (93%) that covert traffic enforcement is undertaken in New Zealand using unmarked patrol cars and 85% of people surveyed believed this to be fair [49]. This is a good starting position to build on and encourage greater use of inconspicuous and unpredictable speed enforcement activities.

Risk based deployment and randomisation

Local effects can be achieved through such a simple mechanism as parking police cars near stations on the side of the road to elicit speed reductions, so long as the risk of apprehension for speeding is kept high overall, and offence detection is most closely connected with deterring traffic offending [117, 118].

It is better to slow drivers down across the network because speed enforcement is difficult to anticipate, but perceived as a credible risk in a given environment (perceived as likely), than a strategy aimed at slowing drivers down in particular areas because it carries more risk than others [1, 70, 99]. However, pursuing one does not preclude the other. Speed enforcement can be efficiently targeted more strongly to routes that carry high speeds but lack median barriers, and roads where the rate of speeding is high while still maintaining a focus on network-level general deterrence.

There is some evidence of a longer-term lag effect of speed enforcement of up to one year [119]. This means that there are immediate effects associated with enforcement with a speed reduction halo of a few kilometres, an intermediate effect with a time halo up spanning from two weeks [110] to eight weeks [120] (likely depending on the intensity of the local operation), and a long-term effect [119] of speed enforcement on driving speeds and risk of severe crashes.

One study found that conducting about 22 hours of speed enforcement in 2-hour blocks over a week was associated with a 5-day local speed reduction halo in the next week [121]. These effects go both ways, i.e. for introducing and maintaining speed enforcement compliance will go up, and for removing and discontinuing speed enforcement compliance will go down. This also highlights the preventative role of speed enforcement, and the need for enforcement even when compliance is high, in that its removal will likely see speeding revert back to previous levels [122].

In terms of time, speed enforcement has a greater effect on driving speeds on weekend days than weekdays. Enforcement appears to be least effective in the afternoon, but more effective during early mornings [110].

Covert, random and difficult to anticipate speed enforcement principles should be kept in mind when considering 'risk targeting' to avoid 'site learning' adaptation and supports the 'any time, anywhere' approach [1, 123].

Targeting low-level speeding

Previous local [124–126] and international research has shown that immediate and dramatic reductions in speeding are attainable with a publicised reduction or removal of the 'tolerance' or well-known discretional/detection threshold for speeding [71, 127–129]. Local reduced speed enforcement operations that involved increased officer enforcement for lower excess speeding, a reduced speed enforcement threshold for speed cameras, accompanied by publicity was associated with various benefits. This included an immediate and sustained reduction in speeding <11 km/h excess of 22%, and a reduction in speeding >10 km/h of 25% [124].

An increased focus on enforcing lower-end speed offending also reduced speeding above the enforcement threshold, and it shifted the entire excess speed distribution to the left. Best estimates for crash reductions indicated a 22% reduction in fatal crashes, an 8% reduction in serious injury crashes, and a 16% reduction in minor injury crashes [37].

Australian research has indicated that drivers are quick to respond to reductions in the activation settings of speed cameras, with rapid reductions in detected offending as it becomes well-known that lower-level speeding is no longer 'tolerated' [130].

Despite various controversial media reports, New Zealand drivers largely support enforcement of the speed limit for speeding below 11 km/h so long as there is fairness, transparency, and consistency in messaging and its application [39, 55]. Surveys conducted in relation to Police and ACC's Safer Summer operations indicated that 74% of respondents believed enforcement action should be taken for speeding by <11 km/h in excess in rural locations and 80% supported enforcement action for low level speeding in urban locations. Fifty-eight percent of those surveyed indicated the increased focus on lower-end speeding made a positive impact on their driving. A separate Austroads survey indicated support for lower rather than higher detection thresholds. Preferences were 4.5 km/h in rural locations, 1.5 km/h in school zones, and 3.2 km/h in urban locations.

For an enforcement policy that focusses on targeting lower-end speeding to either temporarily or permanently be effectively introduced as part of a local or national operation, there needs to be adequate publicity and awareness that enforcement action can be expected for lower excess speeds. It would be realistic to expect a large reduction in fatal crashes under such a programme. Temporary reductions in the discretionary speed enforcement threshold could be perceived as arbitrary [55].

N.B. a focus on lower-end speed enforcement by officers should not be taken to mean higher end speeds is lower priority. It's more about shifting public perceptions of what is acceptable and taking enforcement action for speeding offences that may otherwise be ignored. Stopping more drivers for lower excess speeds also presents the opportunity to subject drivers to a breath screening test, make intel notings, and other risky driving offences can still be detected while undertaking speed enforcement.

Public messaging and publicity

Information or publicity campaigns on speeding in isolation may have a modest effect on behaviour and associated risk [131]. Publicity campaigns that aim to elicit fear through presenting confronting or shocking consequences of risky driving like speeding have mixed results, and overall do not appear to be effective [132]. Publicity with fear appeals relating to speed, however, may even be counterproductive [133]; the audience may deny, ridicule, personally disconnect or minimise the messaging and defiantly increase their speeding behaviour [134]. The message of fear-based appeals may, however, be accepted if it elicits an emotional connection in the intended audience [135].

Publicity is effective at enhancing the effects of speed enforcement, but may not be as efficient if the publicity is not connected to actual enforcement operations [136, 137]. Publicity and advertising for speed enforcement is effective and associated with a greater risk reduction if it also accompanies greater enforcement intensity [96, 138].

Earned advertising through providing commentary, interviews and messaging in news media for speed enforcement can be positive, particularly if it highlights why speeding is a problem and what Police is going to be doing locally or nationally [139]. There are, however, many examples of articles being run on a few extremely high speeds being detected where staff are being quoted calling for such behaviour to cease and that those drivers will be held to account.

While it may be headline grabbing, the emphasis of highlighting extreme and high-end speeding in public messaging may be more harmful than it seems. Firstly this line of messaging reinforces the idea in a larger subset of drivers who routinely drive over the speed limit by a small to moderate amount that it's 'the other drivers' that are the problem [34]. Secondly, those few drivers who do at times choose to drive at very high speeds are least likely to respond to such messaging [43]. There are various examples of studies on media campaigns conducted by Police, NZTA and ACC where 'average' drivers use such terms as 'over-speeding', 'safe speeding' and 'sticking to their speeding allowance' pointing to this habitual low-level speeding and belief that only extreme speeds are the problem [39, 55].

Instead most drivers tend to shift the problem with speed onto those driving at extreme speeds and hold on to their average speed norms of 5-11 km/h excess [33]. These are unhelpful and harmful attitudes. To shift perceptions of what is, and is not acceptable when it comes to speeding, the focus in the messaging ideally needs to relate to most drivers.

Given the majority of speed related risk above the limit is attributable to lower end speeding <15 km/h excess, due to this being a normalised behaviour. Highlighting high-end speeds reinforces the view that there is not much risk of being apprehended for lower-end speeding [34].

Alternative measures to legal penalties

Wider use of rehabilitation and education measures could be better and more consistently integrated as part of enforcement and sanctioning. Use of warnings and an escalating penalty system for repeat offending could fit within this.

Avenues for new interventions

There is substantial scope to expand mobile speed camera operations and introducing section control speed enforcement.

In-vehicle systems may have a greater role to play in addressing repeat and high-end speeding offenders and high-risk drivers. ISA is a promising technology that offers a substantial safety benefit.

In the Netherlands, France, and Switzerland (possibly more) it is illegal to own or operate a radar detector. In France and Switzerland, it is additionally illegal for GPS systems to indicate the presence of speed camera sites or installations. Such prohibitions seek to diminish drivers' belief that speed controls (being manual or automatic) can be anticipated and apprehension can be avoided when speeding. These measures could be easily adopted in New Zealand.

Evidence base for activity

Strong: Meta-analyses and systematic reviews containing level 4/5 studies.

There is strong evidence that the speed of traffic has a strong relationship with the incidence of severe crashes. Managing speed is the number one road safety priority. Speeding, including low-level speeding and driving at inappropriate speeds continues to present a substantial road safety problem and is rated as harmful.

There is strong evidence that police enforcement of speed limits is effective at raising compliance locally and, depending on the intensity and mode of operation, more generally across the network. There is promising evidence of a dose-response type of relationship between manual speed enforcement and the incidence of fatal crashes.

The various tactics described in the current review should be viewed as complimentary to one another that may be employed to target a particular set of risks or to inform an ongoing strategy.

Table 3. Ratings guide

Strong	Robust evidence from meta-analysis; level 4/5 studies with consistent results
Promising	Robust and consistent evidence from lower quality study designs
Inconclusive	Conflicting evidence or lack of good quality evidence
Fair	Some evidence
Poor	Robust evidence that shows no effect
Harmful	Robust evidence that shows a negative effect

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APPENDIX

Figure 3. Speed and stopping distance (Elvik 2011).

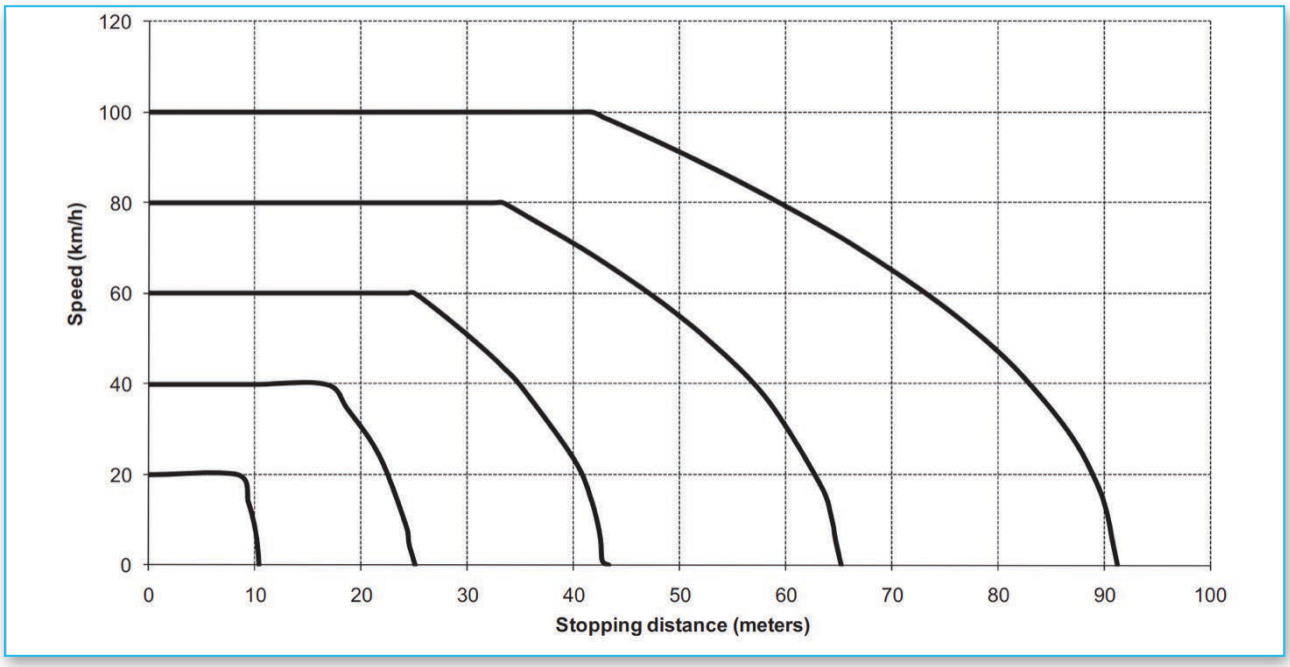


Figure 4. Relationship between speed and incidence of fatal crashes - solid line has best fit (Elvik 2013).

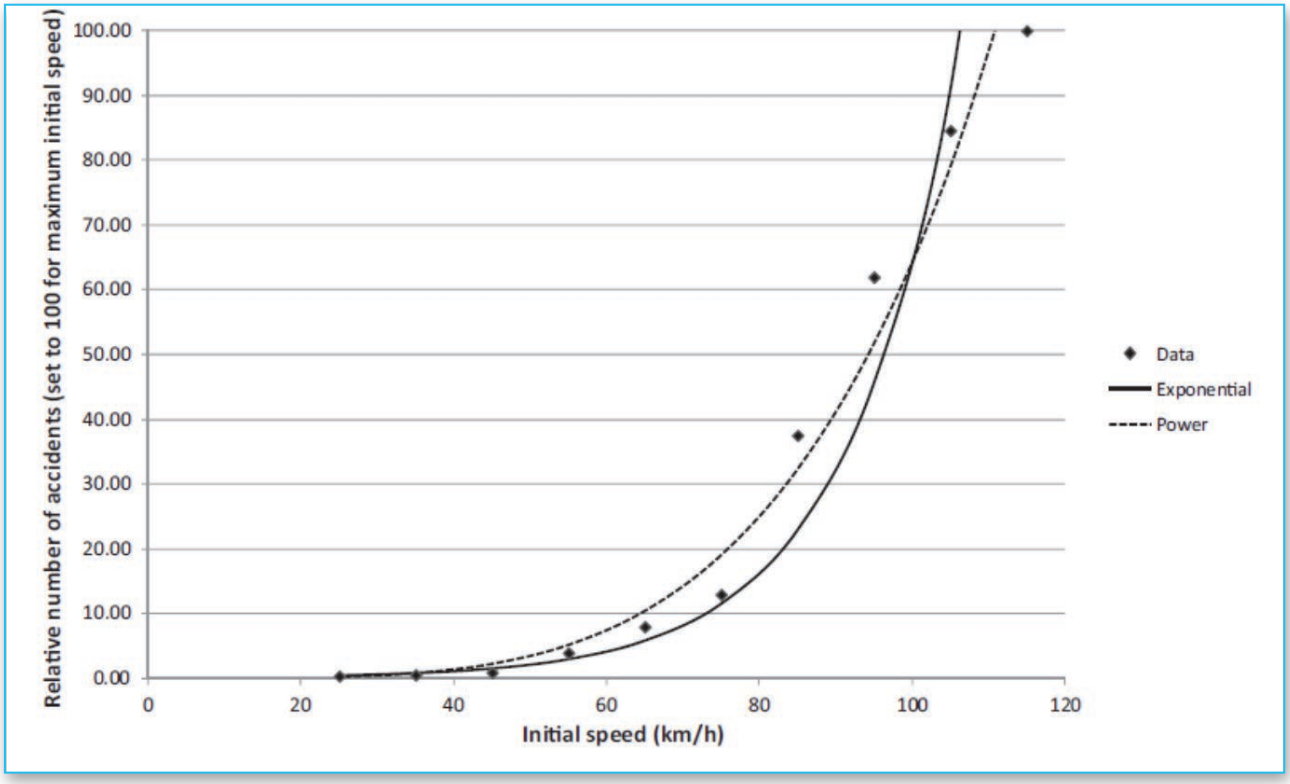


Figure 5. Severe injury probability vs. bullet vehicle impact speeds in different crash types (Jurewicz et al., 2015).

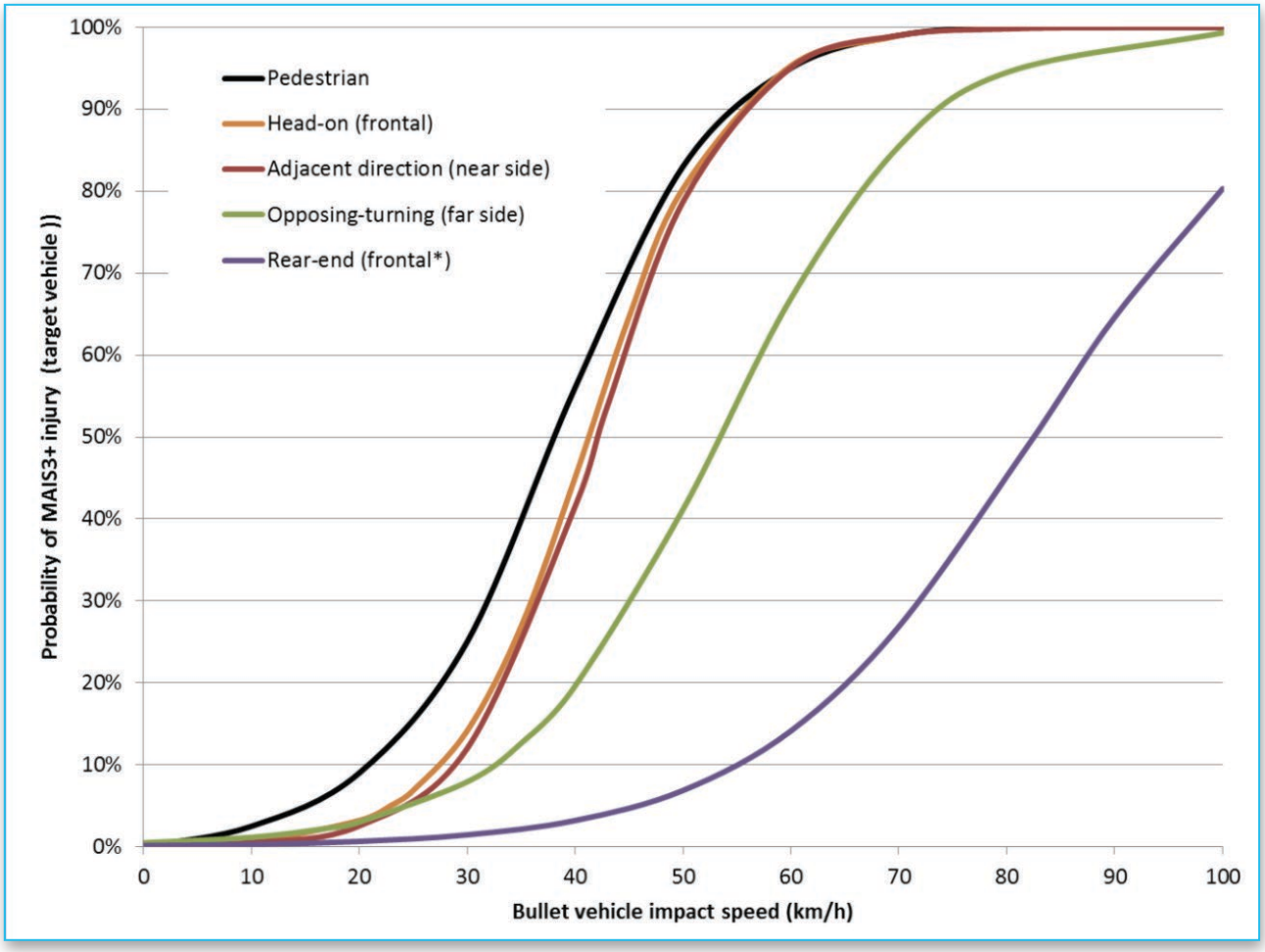


Figure 6. Change in number of road deaths, 2000-13 vs. 2013-17 (ITF, 2019).

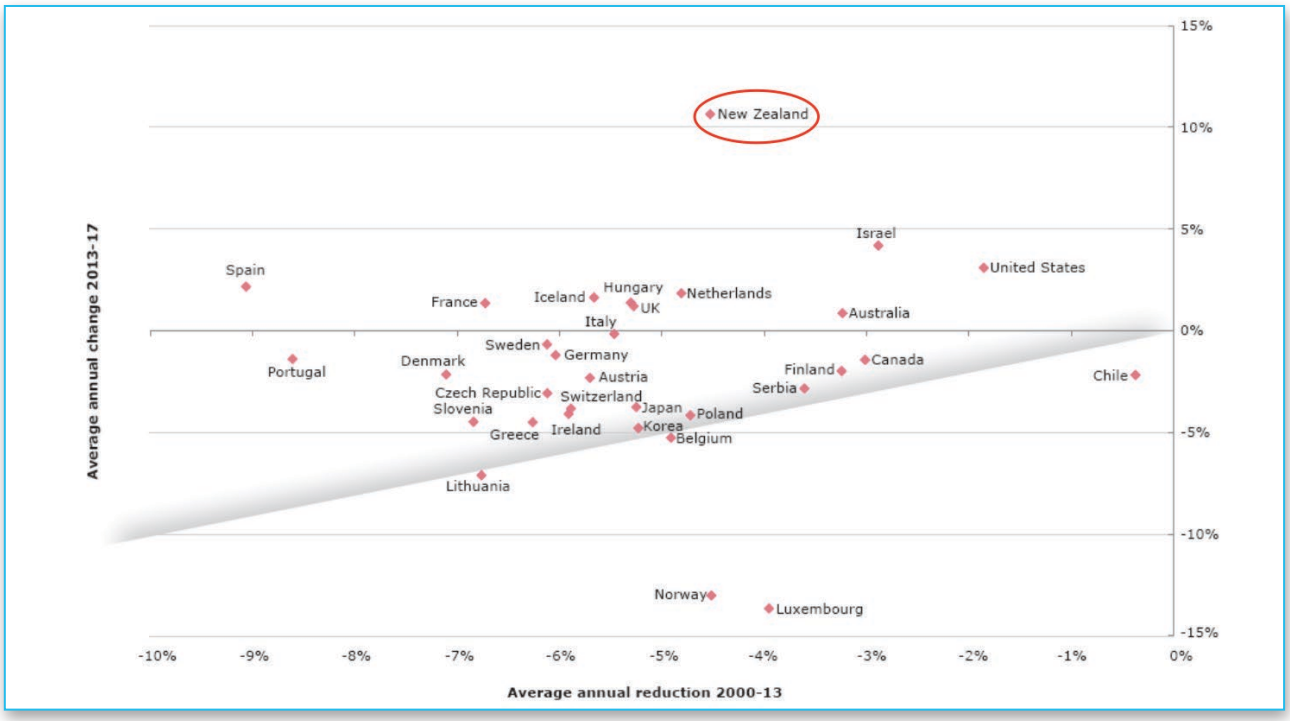


Figure 7. Dose-response relationship between speed enforcement and rate of fatal crashes (Elvik, 2012).

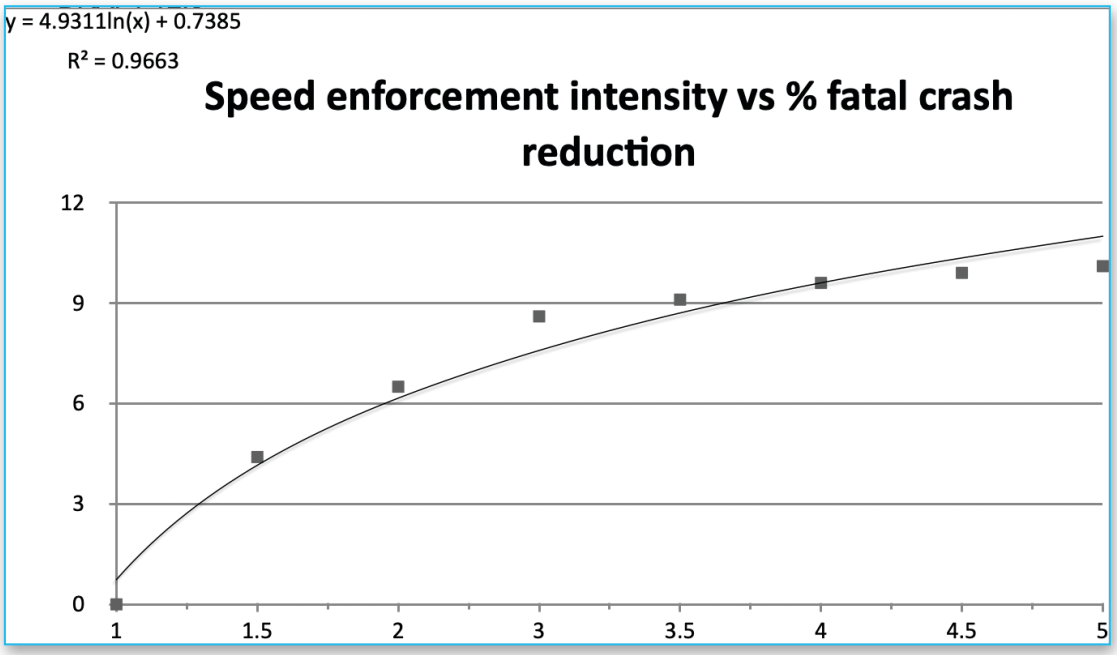
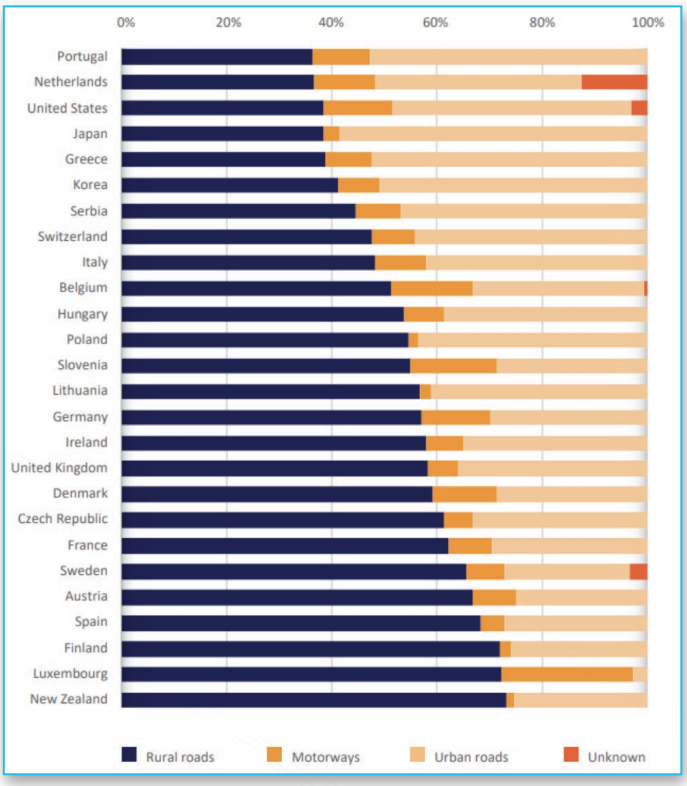


Figure 8. Proportion of fatal crashes by road type (OECD/ITF, 2020).



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