Trends in and insight into road crashes resulting in death or serious injury to cyclists in New Zealand

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Abstract

Following a record low of five cyclists fatally injured in 2016, there were 18 cyclists that died on our roads last year (2017), the highest since 19 died in 2000. Despite the increase in cyclist fatalities in 2017, reported injury rates to cyclists from traffic crashes did not change significantly.

Around 90 percent of crashes where a cyclist was seriously injured occurred on roads with a speed limit of 70km/hr or less (urban roads) and slightly more than half those fatally injured (2013-17, 56 percent) occurred on urban roads. This research looks in-depth at on-road cyclist deaths and injuries, particularly with respect to urban road crash trends.

The research looks at risk factors for cyclists including stability and agility, vulnerability due to their low level of protection, visibility to other road users and behaviours that contribute to crashes. These factors, combined with the condition of the road environment, give cyclists a high level of personal risk, based upon time travelled.

The research looks into what is happening overseas, examining international casualty data, and compares New Zealand cyclist injury to that in other developed jurisdictions. The research discusses interventions, infrastructure and future implications of electric powered cycles.

Introduction

Cycling is a popular and efficient mode of transport and a healthy recreation activity. The benefits of cycling are promoted in New Zealand by strong community based associations and by policies and programs developed at all government levels, locally and nationally. Infrastructure designed to meet the needs of cycling is being progressively built across New Zealand.

In New Zealand, cyclist casualties are a low percentage of road trauma (6 percent annually). In recent years, the number of cyclist road deaths has been in single digits, including a record low of five in 2016. That changed last year when 18 were fatally injured.

Cyclists have a number of risk factors unique to them. The main risk factors are decreased stability and a much lower level of protection than is afforded to car occupants. In addition, a cycle is less visible to other road users than a car or a truck. These factors, combined with the nature of road environments, give cyclists a high level of personal risk, the risk relative to time unit travelled.

Cyclist road deaths in 2017 were some two and a half times higher than in 2016, 18 compared to five and one and a half times higher compared to the average 7 deaths per annum over the preceding five year period 2012-16. Total road deaths in 2017 were up but not on the scale seen by cyclists. Nationally, all road deaths in 2017 were up, they were 16 percent higher than those in 2016, while the 378 roads deaths in 2017 were 27 percent higher the annual average of 300 road deaths over the preceding five year period 2012-16.

Cyclists accounted for five percent of all road deaths in 2017, by way of comparison motorcyclists accounted for 12 percent and pedestrians 11 percent.

The paper will briefly consider international casualty data, the effect of various interventions and whether infrastructure initiatives for cyclists are working.

Method

This paper comprises mainly of a review of Police reported traffic crashes in New Zealand, through original police reports, encoded traffic crash data, reports from detailed crash investigations, coronial reports and international findings. We include a brief overview of infrastructure, funding and risk. Cycling abroad is also examined using international data and research, also looking at data captured in New Zealand via observational surveys, self-reported surveys and travel logs.

Data sources are listed under the primary direct sources used and secondary in-direct sources on pp10-11.

International data

As a proportion of all road traffic crash casualties, cyclist casualties are increasing for most OECD countries, but the proportion varies significantly across countries. For example, it varies between 3 percent for countries like New Zealand and Australia, and 26 percent for the Netherlands. For the period covering 2013 to 2015, New Zealand had one of the lowest levels of cyclist road deaths for counties who report to the IRTAD of the OECD *(Source, IRTAD, OECD)***.**

Table 1: Proportion of cyclist deaths in selected countries 2013 to 2015

Country	Total road deaths	Cyclist deaths	% of road deaths
Netherlands	1483	387	26%
Denmark	551	89	16%
Japan	14888	2321	16%
Hungary	1861	249	13%
Switzerland	765	94	12%
Slovenia	353	43	12%
Germany	10175	1133	11%
Czech Republic	2079	227	11%
Belgium	2183	232	11%
Finland	757	78	10%
Austria	1364	135	10%
Poland	9497	892	9%
Sweden	789	64	8%
Lithuania	767	59	8%
Italy	10210	775	8%
Chile	6369	466	7%
United Kingdom	5428	329	6%
Norway	451	27	6%
Korea	14475	825	6%
Ireland	543	27	5%
Portugal	1868	89	5%
France	10113	455	4%
Israel	878	37	4%
Spain	5057	202	4%
Australia	3542	124	4%
Iceland	35	1	3%
New Zealand	865	24	3%
Canada	5667	152	3%
United States	101122	2307	2%
Greece	2467	45	2%
Luxembourg	116	0	0%

It is difficult to compare cycling participation rates across countries using international data: surveys differ on size, date and other parameters. Pucher et al (2008) provides some data and analysis which shows that the Netherlands, Germany and Austria have much higher rates of cycling than Australia, New Zealand or the United Kingdom. Similarly in The European Commission's (2012) urban mobility survey, rates of recent cycle

use are reported to be approximately double that of New Zealand and Australia. Data for Japan was not available.

Data collection in New Zealand about cycling use

Cycle use in New Zealand is not well recorded. But we do have some data information about cycling use in New Zealand. Surveys in Auckland and Christchurch carried out suggest increases in cycling activity (and thereby suggesting new cycling infrastructure is being utilised). The 2013 census indicated 3% ride a bike to work and that commuting by bike is increasing in many cities including Auckland, Wellington and Christchurch.

The latest New Zealand Household Travel Survey (HHTS), data for 2015-2017, suggests cycling activity as a form of transportation is declining across main and secondary urban areas. The HHTS also indicates over half of all household travel time is spent driving. Driver and passenger travel together account for 82 percent of all time spent travelling. Ten percent of time is spent walking, nearly 5 percent on local public transport and 3 percent by other modes of transport (for example, cycle, plane, motorcycle or boat).

Data collection & quality

The Police attend all fatal crashes and most injury crashes. Police complete and send a Traffic Crash Report (TCR) to the NZ Transport Agency. The Agency encodes the information from the TCR reports as data into the Crash Analysis System (CAS). This comprises of coded and text input describing vehicle types, description of the crash scene, road users, movement types and contributing factors, as well as digitising the original reports, all of which is available for analysis in CAS.

Historically CAS recorded only crashes involving a motor vehicle, however from 2014 onward include on-road cyclist crashes, a change that recognises the importance of cycling as a mode of transport. To date very few such crashes are reported to the police and recorded in the Crash Analysis System.

For fatal crashes, the Serious Crash Unit (SCU) of the Police write large intensive reports that provide more in-depth detail for analysis in understanding why the crash happened. Quite often, these reports are presented at Coronial hearings and form the basis of the findings and recommendations of the Coroner.

The quality of data pertaining to serious crashes is generally of a good quality. In addition there are other sources of information with respect to crashes.

The Ministry of Health collects hospitalisation data for those who were injured in a motor vehicle crash. This is a good barometer to report against reported serious injury crashes from the Police (via the TCR).

Accident claims are made by members of the public and lodged with ACC. Data from these claims give a good indication of involvement in crashes, detailing injury and recuperation but not the crash itself.

Crash analysis

Table 2 shows the number of cyclists fatally and seriously injured from Police TCRs. Not all cyclist injuries are reported to police, and hospitalisation data from the Ministry of Health can provide a more complete picture of the number of cyclists injured in traffic crashes. The table shows that as well as cyclist fatalities rising to the highest level since 2000, the number of reported serious injuries and hospitalisations over 1 day has also increased slightly versus 2016.

Table 2: cyclist deaths, reported serious injuries and hospitalisations 2000 to 2017 *(Sources: CAS, NZ Transport Agency; Ministry of Health)*

Year	Deaths	Seriously injured	Police report Total DSI	Hospitalised for over one day (all stays)
2000	19	100	119	125
2001	10	146	156	130
2002	14	140	154	110
2003	6	148	154	103
2004	7	162	169	136
2005	12	132	144	132
2006	9	162	171	141
2007	12	198	210	141
2008	10	198	208	138
2009	8	156	164	114
2010	10	161	171	113
2011	9	178	187	128
2012	8	175	183	113
2013	8	186	194	130
2014	10	158	168	118
2015	6	146	152	100
2016	5	169	174	104
2017*	18	194	212	121

** Note: CAS data is as at 5/5/18 2017 serious injury data is provisional*

Using CAS data we observe some common trends for cyclists in crashes, for example:

- around one in five cyclists that died or were injured in traffic crashes were aged 10 to19 years old
- nearly three-quarters of cyclists involved were male
- week day morning (8–10 am) and the early evening (4–6 pm) were the most common times for cyclist crashes
- cyclists had primary responsibility for about one fifth of all cycle-vehicle crashes in which they were injured or died.

Crash scenarios

Table 3 shows a summary of crash movement types assigned to cyclist fatal and serious injury crashes 2013-2017, the latest five year data. The tables show the conflict between cyclists and vehicles crossing paths feature largely looking at crash movement types in urban speed zones, whereas in rural speed zones the predominant conflict is with passing vehicles.

Table 3: cyclist crash movement classifications for fatal & serious injury cycle crashes (2013-2017)

Mvmt code	Movement	Rural	Urban
L	Right turn against	9	151
H	Crossing no turns	5	118
J	Crossing vehicle turning	7	77
E	Collision with obstruction	6	71
A	Overtaking or lane change	31	46
G	Turning versus same direction	5	67
K	Vehicles merging	7	57
M	Vehicle manoeuvring	6	58
F	Rear end	24	23
B	Head on	16	30
C	Lost control on straight	6	35
D	Lost control while cornering	14	11
N	Pedestrian crossing road	0	17
P	Pedestrian other	0	7
Q	Miscellaneous	1	3
TOTAL fatal and serious crashes		137	771

Note: CAS data is as at 5/5/18

The top 3 crash movement types for cyclist injury crashes 2012-2016 are shown in figure 1 below *(Source: cyclists' crash fact sheet, Ministry of Transport)*:

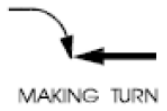
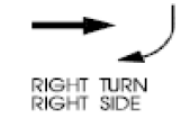
	Crossing (No Turns)	14.2%	This crash type involves a collision at a right angle, typically when both parties involved are moving straight through an intersection.
	Right Turn Against	15.3%	Approximately 87 percent of this crash type involves another vehicle turning in front of the cyclist.
	Crossing (Vehicle Turning)	9.9%	Approximately 82 percent of this crash type involves another vehicle turning in front of the cyclist while crossing an intersection.

Figure 1: Top three crash movement types for cyclist crashes (2012-2016)

Identification of contributing crash factors

The table below, Table 4, shows that the crash factor poor observation is by far the leading contributing factor in fatal and serious cycle crashes 2013-2017. Following this are contributing factors by all road users in the crash. Interestingly, leading contributing factors for all crashes such as alcohol and too fast for conditions appear to be much lower for cyclist crashes.

Table 4: Crash factors in fatal and serious injury crashes involving a cyclist (2013-2017)

Crash factors (*)	Rural	% Rural	Urban	% Urban
Poor Observation	73	53%	464	60%
Failed Give way/Stop	27	20%	386	50%
Incorrect Lane/position	40	29%	129	17%
Poor judgement	20	15%	67	9%
Poor handling	24	18%	63	8%
Other	18	13%	58	8%
Road factors	21	15%	55	7%
Too fast	15	11%	50	6%
Weather	17	12%	38	5%
Alcohol	8	6%	29	4%
Failed Keep Left	11	8%	20	3%
Overtaking	7	5%	19	2%
Vehicle factors	1	1%	17	2%
Pedestrian factors	0	-	14	2%
Disabled/old/ill	0	-	11	1%
Fatigue	4	3%	10	1%
TOTAL CRASHES	137		771	

Note: more than one factor can be assigned to a crash. CAS data is as at 5/5/18

Motor vehicles in cycle crashes

In 2017 ten of the 18 crashes where a cyclist died involved a truck, 56 percent. Of the 189 serious injury cycle crashes in 2017, eight of these involved a truck, four percent.

There were two main types of cycle-truck crashes leading to death and serious injury for cyclists in 2017; truck overtaking cyclist on a narrow open road and an unsighted cyclist inside of a left turning truck in the urban environment. The severity of a cycle-truck crash is highlight by the fact that out of the 61 serious cycle-truck crashes 2013-2017, 31 percent ended in death as shown in Table 5 below.

Table 5: Motor vehicles involved in cyclist fatal and serious injury crashes (2013-2017)

Vehicle type	Fatal crashes		Serious crashes	
	No. of vehicles	% Injury crashes	No. of vehicles	% Injury crashes
Truck	19	40%	42	5%
Car/Station Wagon	15	27%	544	64%
Van Or Utility	5	10%	106	12%
SUV	5	10%	86	10%
Bus	0	-	9	1%
Motorcycle	0	-	6	1%
Taxi	0	-	2	0%

Urban crashes

Most fatal and serious cycle crashes occurred in urban environments. Urban roads are defined as roads with a speed limit of 70km/hr or less. Open roads are defined as roads with a speed limit of 80km/hr or more.

- over 90 percent of cyclist crashes occurred on urban roads
- more than half of all cyclist casualties occurred on major urban roads (typically busy arterials), rather than on the minor urban roads that usually provide access to adjacent properties.
- most cyclist injuries occurred on urban roads, just over 1 in 3 (35 percent) cyclist deaths occurred on the open road, due to the higher impact speeds associated with crashes on these roads.

Just over half of all cyclist involved fatal and serious injury crashes were at intersections in 2013-2017, 56 percent and mostly on urban roads.

Table 6: Road Environment Statistics fatal and serious cycle crashes (2013-2017)

Road environment	Open road	Urban road	Injury crashes	% Injury crashes
Intersection	12	425	437	56%
Non-intersections	50	298	348	44%
TOTAL	62	723	785	100%

Note: CAS data is as at 5/5/18

The majority, over 80 percent of cyclist crashes occurred in light or overcast conditions and mostly on dry roads when cycling activity is highest.

Infrastructure

New Zealand has moved in recent years to increase infrastructure for the purposes of walking and cycling.

In August 2014, the government announced the $100 million Urban Cycleways Fund (UCF). This led to the $333 million Urban Cycleways Programme (UCP) being implemented from late 2014 to June 2018. The programme provided increased investment to accelerate the delivery of cycling networks in our main urban centres, and incentivised our partners to increase their investment in cycling and walking projects. At the end of 2016/17, two-thirds the Urban Cycleways Programme projects were complete (16 projects) or under construction (20 projects), and the remaining 18 were all either in the investigation stage or design stage.

There is as yet limited information how much use has been made of new infrastructure nor whether cycling generally has increased.

Risk

Cyclists have a number of risk factors that do not affect car drivers. The main risk factors are decreased stability and a much lower level of protection than those afforded to car occupants. In addition, a cyclist is less visible to other road users than a car or truck. These factors combined give cyclists a high level of personal, risk per time unit travelled. The fact that recreational cycling time is poorly collected, as is cycle time by children and young people, makes it difficult to accurate state personal risk to cyclists. The most recent travel survey data available is for June 2014 so all risk information in this publication is for the five years ended June 2014.

If the number of hours spent riding by different age groups (based on the New Zealand Household Travel Survey) is taken into account, cyclists in the 13–17 and 18–44 year old age groups appear to be more at risk of being in a collision with a motor vehicle than younger or older cyclists. These cyclists tend to ride further in a given time than younger cyclists, and may also ride in more dangerous traffic conditions, for example, on busy commuting routes which have no provision for cyclists and on narrow open roads. Cyclist training plays an important part in the cyclist's route choice, judgement and road behaviour.

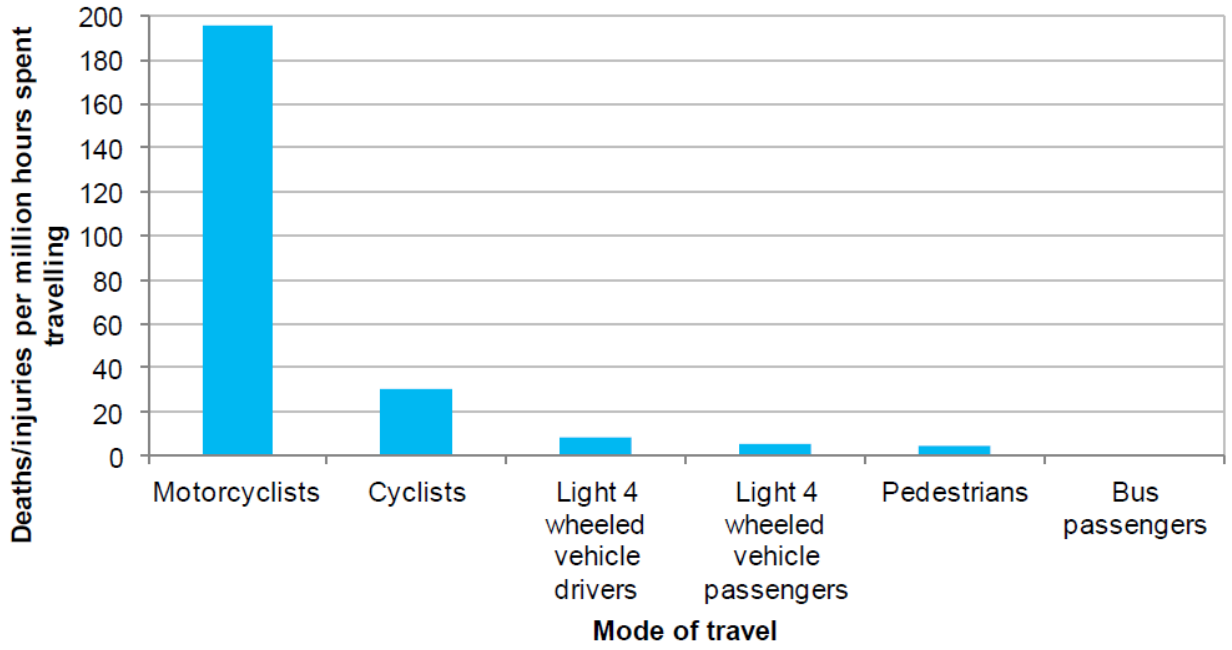


Figure 2: Deaths and injuries in motor vehicle crashes per million hours spent travelling, July 2010 – June 2014 *(Source: Crash Analysis System, NZ Transport Agency and Household Travel Survey, Ministry of Transport)*

New Zealand research (Turner, et al 2006) suggests that if the number of individuals in New Zealand who cycle increases, the risk profile of cyclists may improve due to a safety in number' effect. It is also likely that, if cycling numbers increase, this will increase demand for cycle-friendly road infrastructure. The health benefits of cycling have been proven, so the gain to society of increasing safe cycling extends far beyond reducing DSIs.

Discussion

Common traits across active road user crashes could be a useful approach in developing an understanding of these events and in seeking solutions.

It was noted in the introduction that cyclist road deaths in 2017 were 36 percent higher than in 2016, 18 compared to five and twice as high as the latest five year average of nine deaths per annum, 2013-17. As way of comparison pedestrian road deaths in 2017 were 40 percent higher than those in 2016, 41 compared to 29 and up 18 percent on the latest five year average of 35 deaths per annum, 2013-17.

There could be merit in looking further at pedestrian crashes in addressing urban cycle crashes. There are nearly twice as many pedestrian fatal and serious crashes annually than cycle fatal and serious crashes. In these pedestrian crashes there are many crash contributing factors or behaviours to learn from.

Identifying issues that cyclists share with pedestrians and those unique to each could benefit addressing the needs of both groups and increase the number of people cycling. A submission to the House (Clendon, 2016) suggested a strong case for allowing younger cyclists to share the footpath and thus increase cycling in this younger age group. A Wellington City Council fact sheet suggests cycling would increase if infrastructure, such as protected bike lanes, were improved.

The current policy environment offers the opportunity to make a difference. We are in a period of renewal with the draft Government Policy Statement (GPS) out for public comment as we write this report. Also the government has signalled that priorities have changed, which means that key policies that support funding and strategy around road safety will likely change in some way.

This period of change is a great opportunity to make the bold moves that are needed in order to significantly reduce road trauma with respect to cyclists. What needs to be done has already been identified; we now need to act on these.

There are also changes in technology disrupting how we travel presently. We need to consider the future impact of electric powered cycles, the e-bike is a new vehicle entering the New Zealand transport system recently and one that is already featuring in road deaths overseas as people use these e-bikes to travel longer distances and at greater speeds.

Conclusions

Five main points to be taken from researching recent cyclist crashes in New Zealand are:

- Cyclist crashes mainly occurred on urban roads (roads with a speed limit of 70 km/hr or less). This is where the majority of intervention and infrastructure efforts need to be made with the scarce resources available to road safety. Focusing on improving urban design for cycling will deliver the greatest health benefits and a modal shift to walking and cycling would ease congestion and parking issues.
- Cycling as with all road use carries risk and because of rising vehicle numbers on our roads provides more chance of a crash occurring, but no one should be killed or seriously injured on our roads. The Safer Journeys strategy is focused on realising this.
- It is too early to speculate if any upward trend in fatal and serious crashes involving cyclists is emerging despite an increase in 2017, as the counts are not outside of past fluctuations. Data for the next couple of years needs to be obtained before any conclusions can be made.
- However, the number of fatalities in 2017 involving trucks is a concern.
- Information gaps about travel by cyclists: Better information about cyclist travel throughout New Zealand needs to be regularly obtained to track and match with crash data. The next HHTS update at the Ministry of Transport at the end of 2017 and potentially census information from Statistics NZ will be pointers in this direction. There is also the opportunity that new technology and crowd sourced data could bring to gain better insight in to cycle use.

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Primary data sources

The following direct sources were used:

- Coroners' reports
- Ministry of Transport (MoT) fatals database
- NZ Transport Agency Crash Analysis System (CAS)
- Police Traffic Crash Reports (TCR)
- Serious Crash Unit (SCU) reports.

Secondary data sources

The in-direct sources were used:

- Accident Compensation Corporation (ACC) claims data
- Crash data from the Department of Infrastructure and regional Development (BITRE), Australia
- District Health Board (DHB) hospitalisation data
- International Road Traffic Accident Database (IRTAD), OECD.

Key websites and literature

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- Cycle Safety Panel Final Report 2014 – Safer Journeys NZ Weblink: http://www.saferjourneys.govt.nz/assets/Safer-journeys-files/Cycling-safety-panel-final-report.pdf
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- Top 10 Countries with Most Cycles per Capita (downloaded May 2018) Weblink: *http://top10hell.com/top-10-countries-with-most-cycles-per-capita/*
- Transport Volume: Walking and cycling – Household Travel Survey. Weblink: https://www.transport.govt.nz/resources/tmif/transport-volume/tv018/
- Urban Cycleways Programme Weblink: *https://www.nzta.govt.nz/walking-cycling-and-public-transport/cycling/for-people-involved-in-cycling-programmes-and-projects/urban-cycleways-programme/*
- Wellington City Council cyclist facts. Weblink: *https://wellington.govt.nz/services/parking-and-roads/cycling/we-support-cycling/facts-and-figures*

Declaration of competing interests

The authors declare no competing financial interests.