Role of Road Features in Cycle-Only Crashes in New Zealand

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Contents

Glossary

ACC: Accident Compensation Corporation

LTSA: Land Transport Safety Authority

AIS: Accident Investigation System, used by organisations such as Opus International Consultants. Data sourced from the AIS database is identified by "AIS" alongside. AIS is the technological forerunner of Crash Analysis System (CAS). Although the structure of AIS is different to CAS, the crash data in both should be the same. Both CAS and AIS are maintained by the Research and Statistics Department of the LTSA of New Zealand.

CAS: Crash Analysis System, used by LTSA.

CCSC: Christchurch Cycle Safety Committee.

Crash v. Accident: Term used in this report for an "accident", and synonymous with it. Accident is used where it is in a quotation from an external source. It is also deliberately used in the Cycle Accident Survey questionnaire (Appendix).

Cycle-only crash: Primary cause of crash is other than by impact with a (moving) motor vehicle.

ICD-10-AM V1: International Classification of Diseases and related health problems, 10th revision, Australian Modification, Version 1, published by NCCH. This is the coding system used by NZHIS, and includes classifications for cycle-only crashes.

NCCH: National Centre for Classification of Health.

NZHIS: New Zealand Health Information Service.

On road: Occurring on a public road, footpath or cycle way, as opposed to on a 4WD track for example. Examples given as "on road" in the questionnaire (Appendix) are**:** on the road in any of a traffic lane, between the road edge and the white lane line, in a marked cycle lane, on a footpath beside the road, and on a separate bicycle path beside the road.

Road feature: Any man-made feature pertaining to the road, including the road surface, adjacent kerb and channel, road furniture, items on the road surface such as lose chip, road marking, slippery surface.

Executive Summary

A survey was carried out in 2001, to identify the causes of cycle-only crashes on our public roads, cycle ways and footpaths. Of particular interest was the role of road features in these crashes. This report presents the findings of this survey.

Details including causes of cycle crashes involving a motor vehicle are reported in the Land Transport Safety Authority's (LTSA) crash analysis system. Cycle-only crashes (i.e. those not involving impact with a motor vehicle) are excluded from this system. Hospital and Accident Compensation (ACC) records distinguish cycle-only crashes from those involving a motor vehicle, and from these records cycle-only crashes appeared to be twice as frequent as cycle and motor vehicle crashes. However insufficient detail was available to determine their causes. A 1989 study of cycle crashes in Christchurch found 20% were due to road features, in particular to loose gravel and poor maintenance. These findings were to be compared with those of our national survey of cyclist accidents *occurring* between 1999 and 2000.

The group surveyed were cyclists who had received either treatment for a cycle-only crash as public hospital inpatients, or compensation from Accident Compensation Corporation (ACC) for specialist treatment or other assistance. The survey was by questionnaire.

Objective 1:

To examine factors related to on-road cycle-only crashes and, where these relate to road features, to identify the feature and its role in causing crashes.

Primary crash cause:

In the study most cyclists (33%) attributed the primary crash cause to their own actions, and road features were attributed as the second greatest cause (by 28% of cyclists), 16% to a cycle problem, 11% to another person (mainly a cyclist), and 7% to avoiding (but not hitting) someone or something moving. Younger cyclists (below 15 years) tended to blame themselves rather than road features for their crash, compared to older cyclists. This may be reticence by the younger cyclist in identifying road features *as causes*, or it may reflect their inexperience.

Road features identified as crash causes:

Of the road features identified as crash causes, loose gravel caused the single greatest number of crashes (34%). Surface irregularities, when considered as a group of features (e.g. corrugations, uneven surfaces, potholes, maintenance and finishing issues), accounted for the largest grouping (39%) of crashes. Together the loose gravel and surface irregularities accounted for the majority of crashes as opposed to road furniture and design. *By comparison road features accounted for 20% of the crashes in the 1989 Christchurch study, which also specifically noted loose gravel and maintenance as causing crashes.*

Cyclist's view of crash prevention:

In suggesting prevention strategies, cyclists regarded it their responsibility to prevent their crash even though they had identified the cause as external to themselves. Most of the cyclists (52%) considered the main prevention strategy was something they could have done, such as being more attentive or travelling slower, particularly with younger cyclists. Some cyclists (22%) considered road improvements as the main means of crash prevention. The remainder considered issues with their cycle (maintenance, adjustment of cycle parts (e.g. pedals, handlebars), unexpected failures, or feet slipping off pedals), and behaviour of other people or animals, in that order, as the main means of crash prevention.

Cyclist injuries:
The most frequently injured body parts were the arms, head, and teeth, each constituting approximately 20% of the injuries. The most frequent injury type was fracture 43%, though concussion featured highly in 20% of the injuries. Over half of the injuries required admission to hospital.

Cyclist demographics:
Of those injured 50% were under 19 years of age, and the majority (62%) were males. This is consistent with the cyclist population in general. Age and cycling experience were both strongly related, i.e. the younger cyclists were the least experienced.

Location and conditions at time of crash:
Most of the crashes (81%) occurred on the road, rather than on footpaths or cycle ways. The crashes tended to be on straight sections of road away from intersections. Most crashes (81%) occurred in light road traffic, and in good weather and visibility conditions, with 90% occurring in dry conditions, 69% in calm winds, and 86% in daylight.

Cycle use and patterns:
Most (58%) of the crashes occurred in 50km/h areas. The main reason for cycling was for transport (53%) as opposed to sport or leisure. A strong relationship existed between cycle use and speed zone in that the majority of cyclists who crashed in 100km/h areas were out training, and most of those who crashed in urban areas were using their cycle for transport.

Helmet use::
Helmets were worn by 85% of the cyclists at the time of the crash, 10% reporting that their helmet had come off during their crash.

Conclusions

- Road features accounted for 28% of cycle-only crashes throughout New Zealand between 1999 and 200. This is slightly higher than the 20% found by the Christchurch study in 1989.
- Of the individual road features, loose gravel caused the greatest proportion of crashes, a finding that is consistent with the Christchurch study.
- Of grouped road features, surface irregularities accounted for 39% of crashes.
- Road furniture does not appear to be a significant primary crash cause.
- The majority of crashes involve those under 19 years old. This age group is of the least experienced cyclists and are the most likely to blame themselves for the crash.
- The majority of crashes were in urban areas (i.e. <60km/h).
- Most of the crashes in urban areas involved cyclists using their cycle for transport (e.g. commuting to work, school, shopping), and most of the crashes in 100km/h speed zones involved cyclists who were out sports training.

Objective 2

To recommend solutions to minimise crash risk presented by these road features to cyclists, for use by road controlling authorities.

Recommendations

- Minimise loose gravel on the parts of the road where cyclists ride.
- Define the:
  - effect of surface irregularities on cycle stability,
  - relationships between surface irregularities and the different cyclist groups, especially those of younger cyclists.
- Better understand the nature and requirements of road riding for different user groups (e.g. leisure, transport and sports cyclists, and younger cyclists), so that problems unique to each group can be identified.
- Verify the results of this survey with the New Zealand cycling population.

Abstract

Research carried out in 2001 examined the causes of cycle crashes on roads, footpaths, and cycle ways throughout New Zealand, through a survey of injured cyclists. Crashes due to impact with a moving motor vehicle were excluded, as the emphasis was on the role of road features in these crashes.

Of these crashes 28% were due to road features, mainly to loose gravel and irregularities in the road surface. Other factors were the cyclists' own actions, bicycle problems, actions of others, and crashing when trying to avoid collision with another being, or object. Most crashes occurred in fine weather and in daylight, on straight roads, away from intersections, in urban areas.

Two cycling crash patterns emerged from the study: crashes in urban areas mainly occurred when cyclists were using their cycle for transport, while crashes in 100km/h speed zones mainly involved those using their cycle for sports training.

The study recommended minimising loose gravel on those parts of roads where cyclists ride, defining the surface irregularities that are unsafe for cyclists, and understanding better the nature and requirements of road riding for the different user groups (for transport, sports, leisure, and for younger cyclists in particular).

1. Introduction

Background

Cycling is a healthy form of exercise and an alternative form of travel to more conventional modes of transport, for example the motor vehicle. On-road cycling is undertaken primarily for commuting and recreation. Cycling, along with walking and use of public transport, is encouraged in a number of cities as a means to assist in reducing pollution and peak hour traffic congestion within urban areas, and also on feeder routes that lead in to these centres, for example in Christchurch. Cyclists contribute to road funding, either through rates or indirectly through ownership and operation of a motor vehicle.

Use of the existing road network, and interaction between cyclists and other vehicles using this network can result in accidents or crashes. "When a road traffic accident involves a motor vehicle and results in someone being injured, then the law requires the accident to be reported within 24 hours" (LTSA 1999). The Land Transport Safety Authority's (LTSA) Crash Analysis System (CAS) records the accident details including location, causative factors and injury severity[1]. CAS is used as an instrument to target road safety improvements, through identifying trends in crash location and causative factors, e.g. for specific road features and driver behaviours. Injury severity and crash frequency are taken into account in prioritising action.

However only crashes involving a motor vehicle are included in the LTSA's Annual Reports: "The accident must involve a motor vehicle and result in death or injury of at least one person. A crash between a cyclist and a pedestrian, for example, would not be included even if one of the people involved was killed or injured" (LTSA 1999). Despite this, CAS does feature the occasional "cycle-only" crash. Although these would have been entered with the best of intentions for cycle safety, they may actually be doing the cycling community a disservice, for they provide the illusion that there are very few cycle-only crashes. The LTSA recognise this omission (as well as overall under-reporting of motor vehicle crashes) in their annual report "Motor Accidents in New Zealand" (LTSA 1999), by including national health statistics as provided by the New Zealand Health Information Service (NZHIS) of the Ministry of Health. These statistics relate to hospital inpatient admissions (serious injuries) occurring on public roads and include cycle-only crashes.

These NZHIS health statistics show that:

- About 200 cyclists are admitted to hospital each year after a crash involving a motor vehicle.

[1] Injuries are classified by the LTSA as fatality, serious and minor:
Serious injuries – fractures, concussion, internal injuries, crushings, severe cuts and lacerations, severe general shock necessitating medical treatment and any other injury involving removal to and detention in hospital. Minor injuries – injuries of a minor nature such as sprains and bruises" (LTSA 1999).

- Approximately 400 cyclists are admitted to hospital each year after a cycle-only crash. This is a 2:1 ratio of cycle-only to motor vehicle-cycle crashes occurring on public roads.
- A further 400 crashes are estimated to occur on-road, a proportion derived from the NZHIS data for crashes which do not record whether they occurred on- or off-road.

Thus the total number of hospital admissions from cycle-only crashes, occurring on-road, is approximately 800 per year, i.e. four times that involving a motor vehicle (source LTSA).

The Accident Compensation Corporation (ACC) maintains a database of accepted entitlement claims. Of 11,300 new claims accepted by ACC between 1995 and 1997 for all types of on-road cycle crashes (both with and without motor vehicle involvement), over 60% (6,780) of these claims were for cycle-only crashes. The database does not include sufficient detail to establish all the factors that cause cycle-only crashes, for example the role of road features in those crashes.

When considered together, the NZHIS and ACC data indicate the incidence of cycle-only crashes is twice that of cycle-motor vehicle crashes. If this ratio is applied to the crashes reported in CAS (i.e. cycle crashes involving a motor vehicle only), then the estimated incidence of cycle-only crashes in 1998 becomes 1252 with 32 fatalities.

Figure 1.1 shows that, while the number of cyclists admitted to hospital due to a crash involving a motor vehicle has steadily decreased between 1994 and 1998, the number of admissions due to cycle-only crashes has remained static. So over this period, cycle-only crashes have increased relative to those involving a motor vehicle. The different trends between cycle-only and cycle-vehicle crashes suggests differences in causes.

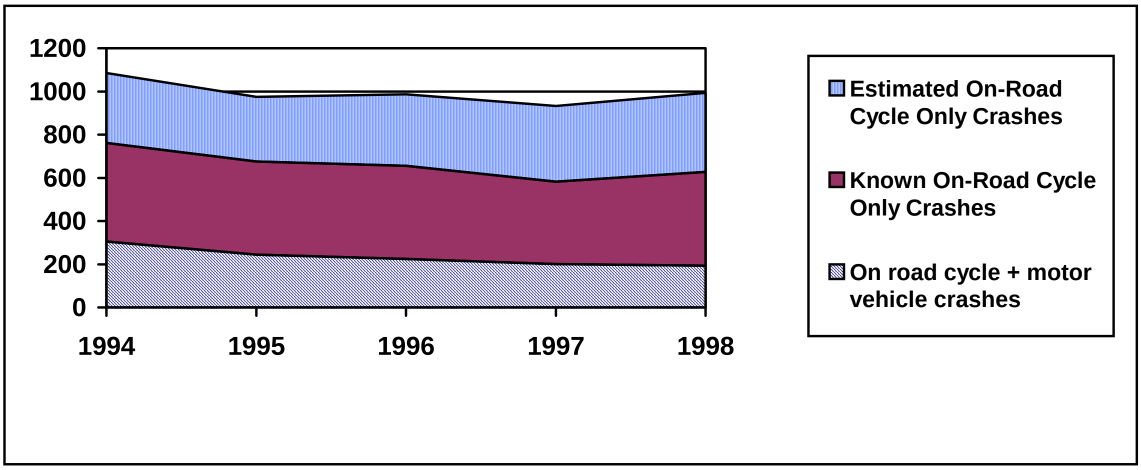


Figure 1.1 Hospital admissions of cyclists after crashes, for 1994-1998.

Source: New Zealand Health Information Service

Recent studies in Australia and the Netherlands indicate that both these countries have a much lower ratio (1:1) of cycle-only crashes to those involving a motor vehicle than the 2:1 ratio for New Zealand (Robert Klein, VicRoads, pers. comm.). Such different crash ratios imply that the cycling environment in New Zealand may present different hazards, and also that overseas research is not entirely relevant.

The questions raised here are: whether New Zealand roads are more hazardous to cyclists than those in Australia and the Netherlands, and are there specific road features that are particularly hazardous to cyclists? If specific problem features could be identified, then the means of reducing the hazard they imposed to cyclists could be explored.

A 1991 study “Cycle use and collisions in Christchurch” (CCSC 1991) found that road features were a main cause in 20% of cycle crashes, and from LTSA data, road features typically account for 15% of all motor vehicle crashes throughout New Zealand. We considered that road features could be responsible for a similar rate of cycle-only crashes throughout New Zealand.

This information was to be obtained through a survey of cyclists who were on ACC or NZHIS records as requiring treatment for a cycle-only crash.

Objectives

The main objectives of this research, carried out in 2001, are:

1. To examine factors related to on-road cycle-only crashes and, where these relate to road features, to identify the feature and its role in causing crashes.

2. To recommend solutions to minimise crash risk presented by these road features to cyclists, for use by road controlling authorities.

2. Ethical Considerations

Both health providers (NZHIS, ACC) supplied names, contact details and brief information about causes of cycle-only crashes. Because this is regarded as confidential information, ethical approval was required. This was obtained through the Wellington Ethics Committee in the case of NZHIS information (ethics approval number 00/09/108) and through ACC Injury Prevention for ACC information.

Ethical requirements of these organisations were incorporated in the survey questionnaire (explicitly in the information sheet) and throughout the project (implicitly).

3. Method of Investigation

The survey instrument was that of a rely-paid posted questionnaire. A prize draw was offered as a response incentive, and approved by the Ethics Committee.

3.1 Survey Participants

The survey sample consisted of those cyclists from NZHIS and ACC databases as requiring treatment for a cycle-only crash. The sample was randomly selected from NZHIS and ACC records.

3.1.1 Population Characteristics

The ACC data were derived from records covering an 18-month period for 1 January 1999 – 30 June 2000. Dates are those of either date of the crash or date of ACC registration. NZHIS data were drawn from a 12-month period for 1 July 1999 to 30 June 2000[2].

3.1.2 NZHIS Criteria

The NZHIS sample was obtained from their national data collection of patients admitted to a hospital ward as a result of an injury to a pedal cyclist on a "public highway" where the primary cause did not involve a motor vehicle. These are classified under their ICD-10-AM V1 (1998) code, which distinguishes traffic crashes (those occurring on public highways) from other locations. A public highway is defined as "the entire width between property lines (or other boundary land) open to the public…for purposes of moving…from one place to the other" and "exclude assault by crashing of a motor vehicle" (NCCH 1998). The survey date selection criterion was the date when the crash was first registered.

3.1.3 ACC Criteria

The ACC sample was sourced from those who had received entitlement claims as a result of cycle-only crashes. The records were selected using the date the claim was first paid (note that entitlement claims include childcare, earnings compensation, specialist (including dental) treatment, but exclude general practitioner visits). The ACC sample included all cycle-related crashes that did not involve a motor vehicle. However no further differentiation was possible because the ACC definition for "on-road" does not exactly match the definition used here (see Glossary). "It does not differentiate between public roads and private roads, although it does distinguish whether the cycle was on a road (public) or off-road, and off-road includes cycle paths and tracks that may or may not be public" (P. Murphy, ACC, pers.comm.).

[2] This was a variation from the intended five-year survey period of 1 January 1994 to 1 July 1999. The adjustment was made following changes to the NZHIS coding system (introduction of ICD-10 coding) that allowed for cycle-only accidents on public roads to be better distinguished from other accidents.

Only 12% of their entries were classified as on-road. Their database also included entries in which the injury was sustained while lifting a cycle.

Survey Questionnaire

The questionnaire consisted of 41 questions of mixed design (requiring both qualitative and quantitative responses). Qualitative questions were coded and rated by the researchers then included in the quantitative analysis. Some questions were asked with a large number of response options that required collapsing for analysis purposes.

The survey instrument was developed based on past research (particularly the Christchurch Cycle Collision Study, CCSC 1991). Initial versions of the survey were peer reviewed, tested then piloted, and minor amendments were made to the order, wording and type of questions.

The final survey instrument consisted of three sections (see Appendix). Part 1 examined the injury sustained as a result of the participant's cycle-only injury. Six questions examined the type and severity of the injuries, how incapacitating these were, and whether they had any permanent effect of the participant's cycling activity.

Part 2 examined the crash cause, location, and conditions as they relate to the road (Speed zone, Traffic volume, Road surface). Other questions examined the weather conditions and time of crash. Participants were asked to draw a diagram of the location and describe the sequence of events leading to the crash to assist researchers in coding the responses to questions concerning cause and other qualitative open-ended questions. A further set of questions examined whether the participants were travelling too fast or were "out of control", or intoxicated. One question asked participants to rate the section of road on a continuous scale from "extremely unsafe" to "very safe". The final question of the section asked participants to provide their thoughts on what could have prevented the crash.

Part 3 of the survey questionnaire asked demographic questions concerning age and gender, type of bicycle and pedals, helmet use, use of protective clothing, lights, and riding experience.

4. Sample Characteristics

A summary of the survey population, sample sizes, and response rates, is presented in Table 4.1. Of the questionnaires received, only 49% met the project criteria of being on-road cycle-only crashes, notwithstanding the criteria used to select the sample population from the NZHIS and ACC databases. Of the 1541 surveys delivered, 335 were returned, giving a response rate of 21.7%. Of the responses, 171 were rejected because they had occurred off the road. The data sources were screened according to individual name and date of accident to ensure that each entry analysed was for a unique accident.

Table 4.1 Summary of survey population and their sources.

Population details	ACC	NZHIS source	In both databases	Unknown	Total
Total in database	2664	1372	N/A	–	4036
Survey sample size	794	730	17	–	1541
Gone: no address	24	40	–	–	64
Responses	148	173	11	3	335
Reponses that are on-road cycle-only crashes	66	91	5	2	164

Table 4.2 outlines the responses rejected from analysis. The main reason for rejection was because the crash did not occur on a public road.

It is important to recognise that the databases developed by the ACC and NZHIS were not designed specifically for this road safety research project. However, the proportion of responses that were rejected significantly impacted on the supposed population size and the response rate. The 164 useable surveys represent 49% of the replies received. Of those that did not reply, many may have been self-selected because they were not involved in an on-road, cycle-only crash and therefore did not return the questionnaire. This may account for the low response rate.

Table 4.2 Survey responses that were rejected from the analysis of the mail-out questionnaire.

Classification	Situation	*N*	Total
Not "cycle-only" crashes	No cycle involved: includes motor vehicle, tricycle, flying fox, motorcycle, pedestrian	11	
	On-road pedestrian injured by cyclist	1	
	Lifting bike	4	
	On-road rejected as happened overseas	2	
	On-road rejected as motor vehicle-cyclist collision	19	
	No crash	2	
	Incomplete	3	42
Not "on-road" crashes	Farm, forest	16	
	Home	27	
	Private road	23	
	School	11	
	4WD track	9	
	Track: Mountain bike track (20), other track (3)	23	
	Park: includes BMX and skate board facilities	16	
	Verge	4	129
Total			**171**

5. Survey Analysis

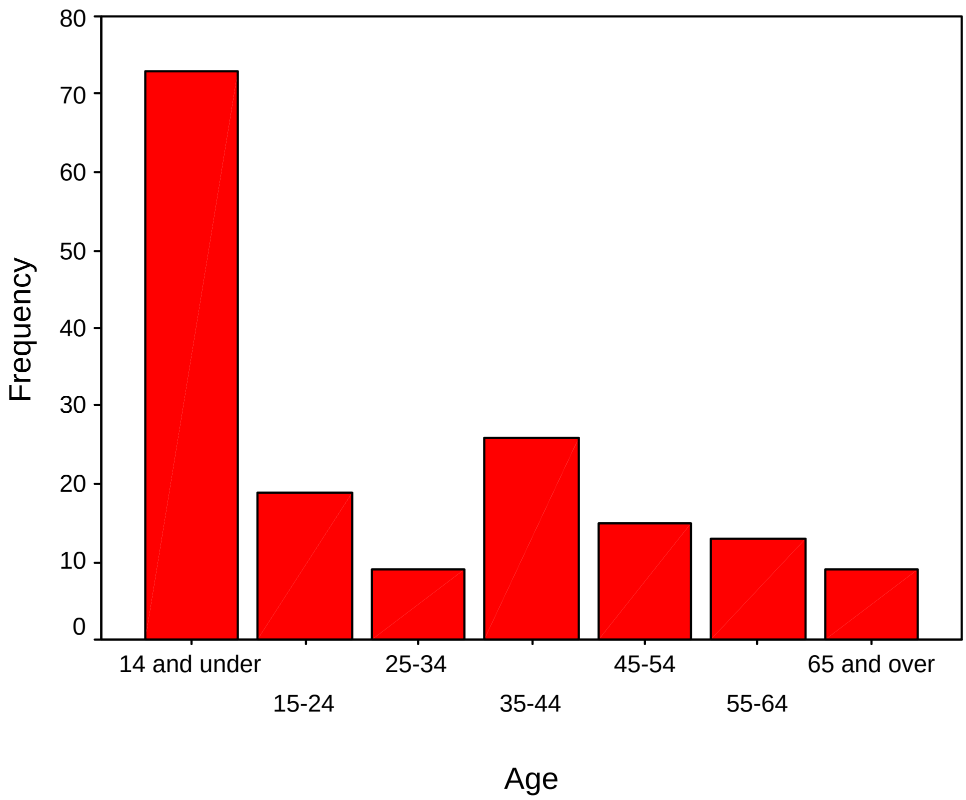
Of the 335 responses, 164 represented cycle-only on-road crashes. These responses represent crashes occurring from 1974 to 2000, with 95% of the crashes occurring in the years between 1998 and 2000.

Results were analysed using a variety of statistical procedures with a Type I error rate (Snedecor & Cochran 1981) set at 0.05 given the relatively small sample. The variety of techniques reflects the mixed design of the survey instrument and the overall exploratory nature of the investigation.

5.1 Age of Survey Participants

The age of participants ranged from under 14 to over 65, with a mean age of 34 years and the median age of 19 years. The distribution is positively skewed with the youngest age group being over-represented in the sample of cycle crashes (Figure 5.1). These data reflect the population of cyclists generally (LTSA 2000, Frith 2000, Statistics New Zealand 1997), and thus of cycle-only crashes.

Figure 5.1 Frequency of cycle-only crashes (n = 164) related to age groups.



Age and cycling experience are strongly correlated. In this sample, age and gender are related in that males are over-represented in the cycling population above the age of 15 years (Fischer's Exact Test, $p < .05$). Males are also over-represented in the sample, accounting for 62% with females accounting for the remaining 38%. The participants averaged 17 years experience of riding a cycle.

The age distribution for cycle-only on-road crashes is a result in itself when considered alongside the general demographics of the cycling population. The age demographics of cycle-only crashes from this study (as shown in Figure 5.1) are compared to reported cycle crashes recorded by the LTSA (1999). A chi-squared (χ^2) analysis of the two crash samples showed a difference in the relationship between age and crash rate (χ^2 (3, n = 783) = 27.89 $p < .01$). The youngest and oldest age groups (those under 15 and those over 35)[3] have a higher than expected rate of cycle-only crashes compared to the rates of crashes involving a motor vehicle (LTSA 1999). Because the hours spent cycling are the same in both conditions, the effect cannot be explained by the relative number of hours that these age groups spend cycling.

5.2 Injuries

Cyclists in the sample were included on either the ACC or NZHIS databases because they had sustained some injury. Of these cyclists 41% had received multiple injuries, and the most frequently occurring injuries were to the head (concussion), teeth and arms, each constituting approximately 20% of all injury types. The most common type of injury was fracture (43%), though concussion featured highly, occurring in 21% of cases. More than half of the crashes resulted in treatment at hospital; *60%* of the cyclists were admitted to hospital with a mean length of stay being 3.17 days (SD = 8.82, n = 164); 31% were required to take time off school or work as a consequence of these injuries. However, this figure is misleading, as a number of respondents indicated they were unemployed or on holiday at the time of the crash. Cyclists who required ongoing treatment at a later date accounted for 28%, and for 50% of these (i.e. 14% of the total sample), this further treatment involved admission to hospital overnight.

5.3 Location and Timing

The on-road cycle-only crashes had occurred mostly in a location not specifically allocated for cycling: for example 48% of crashes had occurred in the traffic lane; 32% on the shoulder (between the road edge and the white edge line); and 13% had occurred on the footpath. Only 7% of crashes occurred within separate cycle lanes dedicated to cyclists. Most cyclists (86%) had cycled through the location of their crash before.

[3] The LTSA's Travel Survey report (LTSA 2000) records data to an age of 40+.
The categories used in this report have been collapsed to match their data.

Of these crashes, 59% happened while the cyclist was riding on a straight piece of road, 19% occurred while the cyclist was riding a winding piece of road, and 23% of crashes occurred at intersections. In contrast the majority of “reported” cycle crashes (i.e. those involving a motor vehicle) between 1996 and 2000, had occurred at intersections. Of 3341 reported cycle crashes, 57% occurred at intersections, 36% on straight roads, and 7% on winding roads (AIS).

Other traffic conditions that may have contributed to the crash were the traffic volume at the time and the speed zone the cyclist was in. Traffic volume was mostly low when crashes took place, with 81% of crashes occurring in light traffic, 16% occurring in average traffic, and only 4% occurring in heavy traffic. Remember that the sample was taken from crashes that did not involve a collision with a vehicle, and so the volume of traffic could be related only indirectly to the incident. Against this, most (59%) of the sample had their crash in a 50km/h zone, while 18% had a crash in a 100km/h zone, and the remaining 24% had crashes in other speed zones ranging from 30km to 80km/h. The cyclists themselves did not regard the speed zone as influencing their safety ($F(2, n = 153) = 0.003$ $p > .05$), e.g. those in a 100km/h speed zone did not regard the road as any less safe than those in a 50km/h zone.

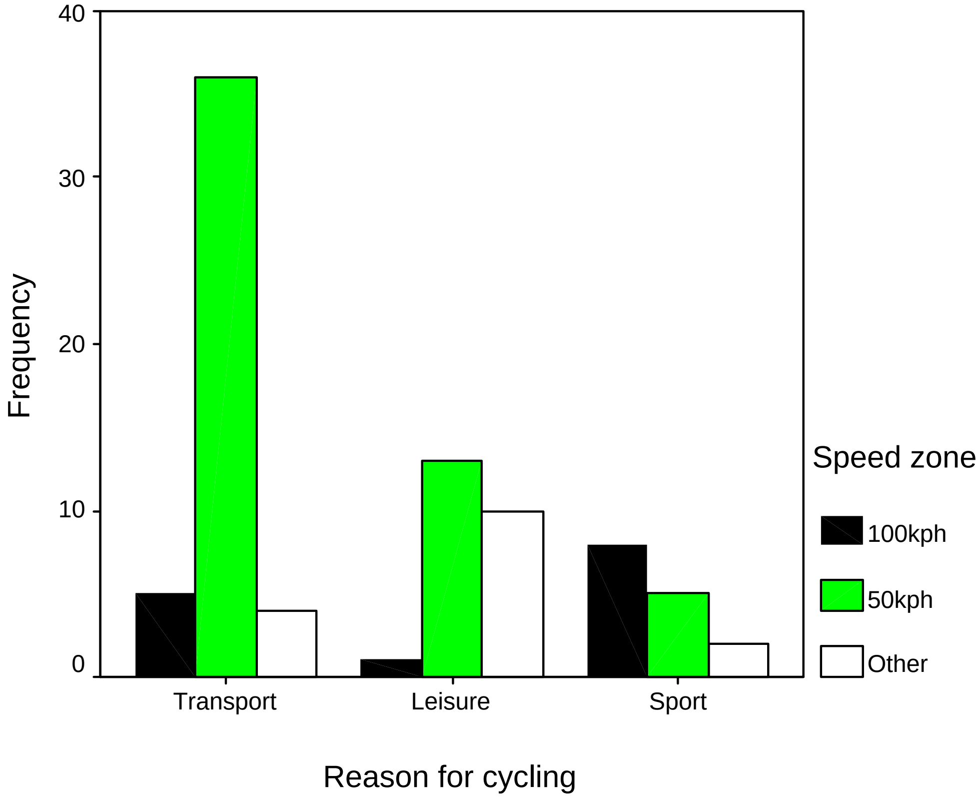
The high crash rate in the 50km/h (urban zone) may reflect that proportionately more cycling is done in urban rather than rural (100km/h) areas. Vehicle-cycle crashes reported by LTSA show an even higher proportion of crashes occurring on urban roads. For example, between 1996 and 2000, 87% of reported cycle crashes occurred in a 50km/h speed zone, and only 8% in a 100km/h zone (AIS). Cyclists appear to be at greater risk from motor vehicle collisions in urban areas, although the rate of reporting these crashes may be also higher in urban areas.

Approximately half (54%) were using their cycle for transport, and the remainder were using the cycle for leisure or sports training. Figure 5.2 illustrates the use of cycles and the speed zone in which crashes occurred. A chi-square analysis reveals that the speed zone of the crash and the use are not independent (χ^2 (4, n = 86) = 28.67 $p < .01$), and the association is strong ($\varphi = 0.58$ $p < .01$). The majority of cyclists who crashed in a 100km/h zone were out for sports training. In contrast, most cyclists who crashed in an urban area were using their cycle for transport. These results reflect the use patterns of cyclists, which need further research. The fact that cycle use and speed zone are not independent may simply reflect the relative frequency of these different uses in these locations.

5.4 Environmental Conditions

Environmental conditions that may have contributed to the crash were lighting and weather. In this sample most of the crashes occurred in good weather conditions, with 90% of the crashes in dry conditions, and 69% of the total occurring in calm wind conditions.

Figure 5.2 Frequency of cycle-only crashes (n = 86) related to reason for cycling by speed zones.



Most crashes (86%) occurred during broad daylight. These trends are similar to those of reported cycle crashes (AIS), 83 % of which occur in daylight, 85% in dry conditions, and 89% without streetlights on. Again, these findings may simply represent the patterns of cycling activity.

5.5 Types of Cycles and Equipment

Approximately 10% of cyclists claimed that their cycle was not in good working order at the time of the crash. The most common types of cycles were mountain bikes (38%), with 27% racing cycles, and 17% road cycles. Only 17% were children's (15%) and BMX (2%) cycles.

Cyclists who had helmets on at the time of the crash accounted for 85%, which compares with a helmet-wearing rate among the New Zealand cycling population of 90% (Scuffham et al. 2000). Several commented that their helmets had saved their lives. Of those who did not wear helmets, several were children (below 10yr) including some who had been cycling around home without a helmet on, thinking they were safe there. Approximately 10% of helmets did not stay on through the crash.

Over 10% of cyclists claimed that their pedals in some way contributed to the crash. However, there was no relationship between the pedal type (e.g. cleats, toe clips) and frequency of these crashes ($\chi^2(1, n = 164) = 1.5$ $p > .05$). Consequently, pedal type does not influence the crash but incidents with pedals (slipping, striking the ground, etc.) are a contributing factor to cycle-only crashes.

5.6 Safety of Crash Site

Cyclists were asked to rate the safety of their crash site on a ten-point scale, with the "extremely unsafe" as the "0" or bottom end of the scale, and "very safe" as "10" or top end of the scale[4]. Most cyclists regarded the road section as safe before their crash (Mean = 7.3 SD = 2.3) with only 6 participants falling in the lower quartile range. None gave a "0" or "extremely unsafe" response.

5.7 Behaviour of Cyclists

Cyclists were also asked if they were going too fast, out of control, and had taken any drugs or alcohol at the time of their crash[5]. A high proportion (41.9%) of cyclists responded they had been travelling too fast when their crash occurred. However, only 22% claimed to have lost control of their cycle. The relationship between travelling too fast and losing control is significant ((χ^2 (1, n = 160) = 13.7 $p < .01$) and strong ($\varphi = 0.298$ $p < .01$) despite the drop in percentages. There is no relationship between a claim to be travelling to fast and admission to hospital (Fischer's Exact Test = 0.146 $p > .05$). (Note that 4% claimed to have been intoxicated.)

5.8 Prevention of Crashes

The cyclists were asked to comment on what they believe could have prevented their crash. The data are illustrated in Figure 5.3. Cyclists regarded their own actions as the main means of preventing their crash. It is interesting to note that while *42%* considered they were going too fast at the time of their crash (see Section 5.7), only 26% considered slowing down would have been the most important means of preventing their crash. Although speed was the single most important preventive strategy, when forced to consider what would have prevented the crash in the light of competing alternatives, these cyclists referred also to other factors.

These included lack of attention, road features, bicycle fault (such as items being caught in wheel spokes, punctures, feet slipping off pedals), the behaviour of other cyclists (e.g. younger out of control cyclists and "pack cyclists"), and incidents such as motor vehicle doors opening.

[4] Appendix A, Part 2, Question 19: "Before the accident, how unsafe did you think the section of road as where you had your accident?"
[5] Appendix A, Part 2, Questions 15, 16 and 18.

Figure 5.3 Crash prevention from the cyclist's view (n = 104).

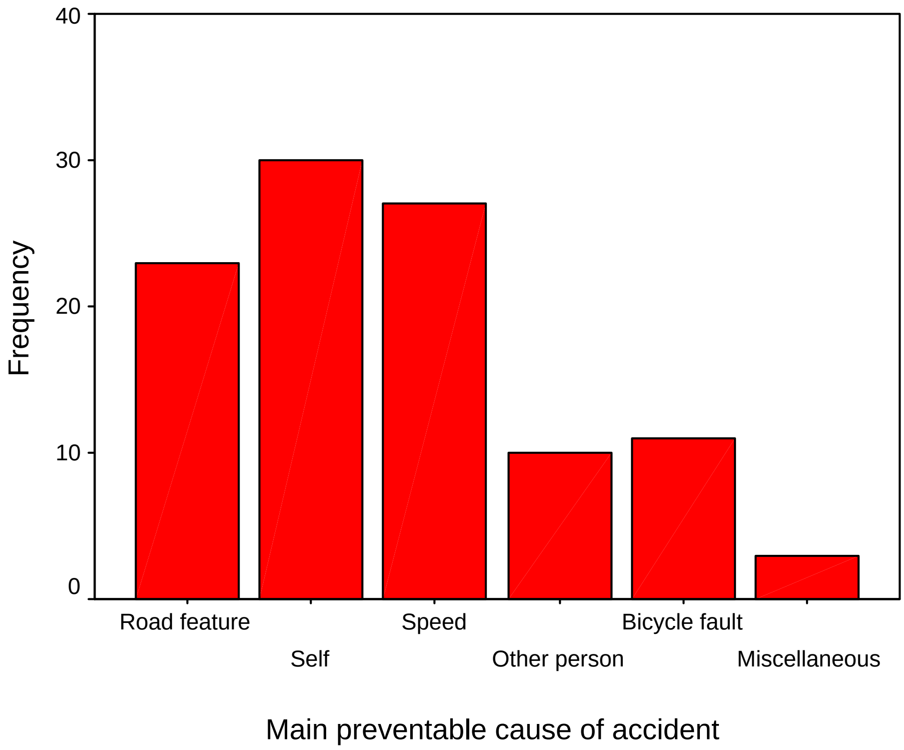


Table 5.1 Crash prevention from the cyclist's view (n = 104).

Cause	Frequency	Percent
Self + Speed	27 + 30=57	26 + 29=55
Road Feature	23	22
Cycle	11	10
Other Person	10	10
Miscellaneous	3	3
Total	**104**	**100.0**

5.9 Causes of Crashes

Some discrepancy was observed between what the cyclists regarded as a strategy to prevent the crash and what they described as the main cause of the incident. Figure 5.4 outlines the main causes of the crashes, in which *cyclists rated their own* actions as the major cause, then road features (Table 5.2). *Road features were more* frequently identified as the main (primary) cause of crashes than as the main way of preventing it (28% identified road features as the main cause, and 22% as the main means of prevention: Tables 5.1, 5.2, Figure 5.4). In identifying preventive strategies, cyclists tended to focus on what action they could have taken (slowing down, paying attention). On the other hand, when asked to comment on the main cause of the crash, they had less regard for their personal involvement, but referred to external sources.

Figure 5.4 Primary crash cause (n = 164).

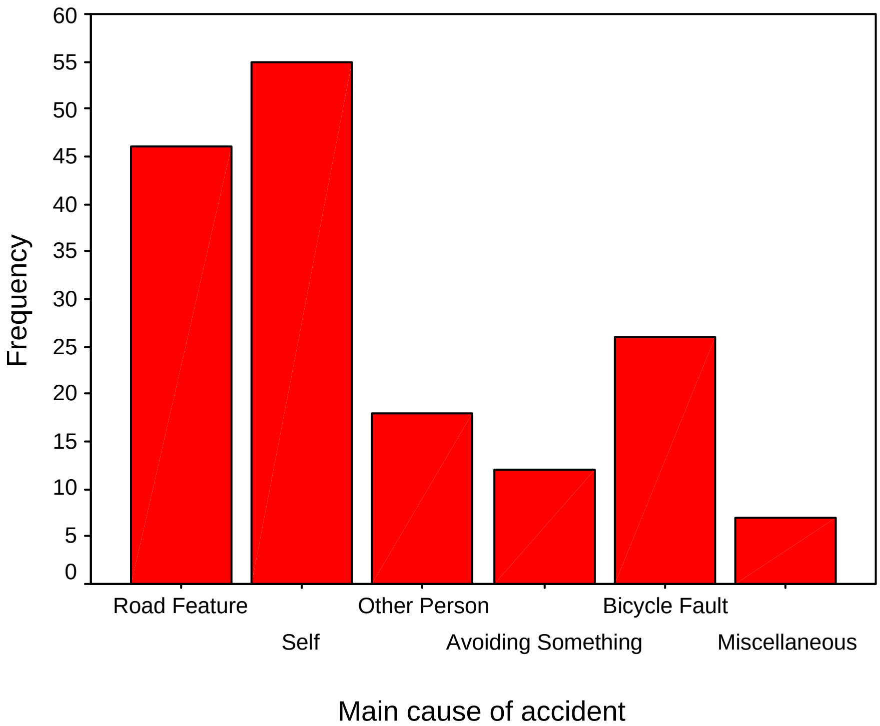


Table 5.2 Primary crash cause (n = 164).

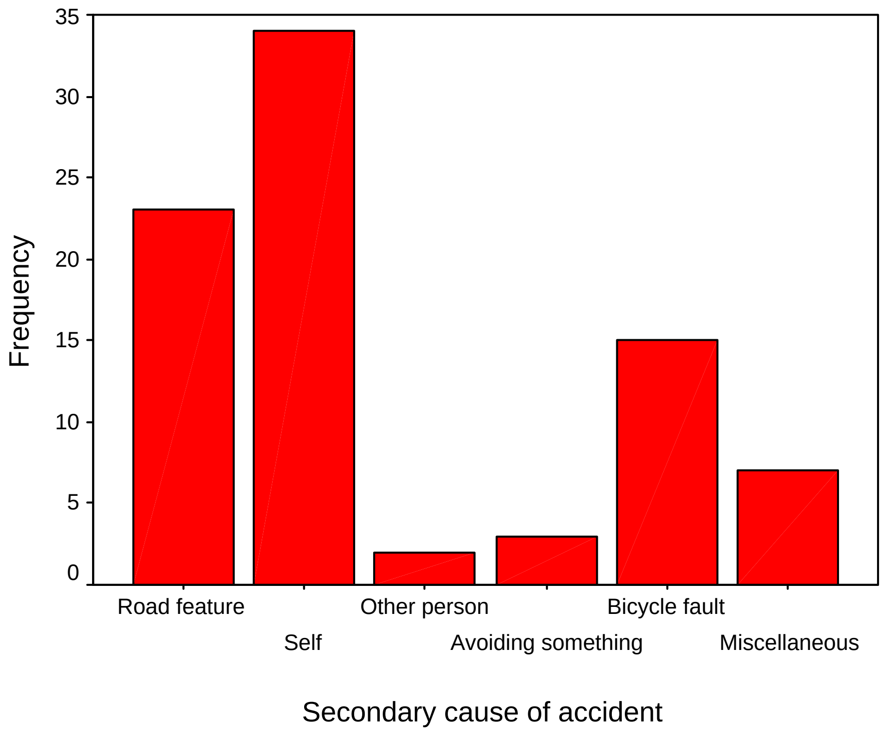
Cause	Frequency	Percent
Self	55	34
Road Feature	46	28
Cycle Problem	26	16
Other Person	18	11
Avoiding Something	12	7
Miscellaneous	7	4
Total	**164**	**100.0**

Of the road crashes that were related to road features (n = 46), the most common feature causing *crashes was gravel (34%). Other causes were collision* with roadwork signs; potholes; cycle wheel becoming caught in railway tracks, cobblestones, joins at the edges of driveways, drains, and other gaps; uneven surfaces, slippery surfaces; or other road features like barriers and judder bars. As a group, surface irregularities (potholes, anything trapping the bicycle wheel, uneven surfaces, judder bars) *accounted* for 39% of road features that *caused* crashes. Table 5.3 and Figure 5.5 outline the secondary causes of crashes, and these mirror the frequencies observed in the primary causes.

Table 5.3 Secondary causes for crashes (n = 84).

Cause	Frequency	Percent
Self	34	41
Road Feature	23	27
Cycle Problem	15	18
Miscellaneous	7	8
Avoiding Something	3	4
Other Person	2	2
Total	**84**	**100.0**

Figure 5.5 Secondary causes for crashes (n = 84).



Crashes related to road features were no more severe, in that they did not relate to hospital admissions, than other causes of crashes ((χ^2(1, n = 104) = 0.95 p> .05).

Older cyclists more often regarded road features as being the source of their crash than younger cyclists (t (102) = 2.404, p< .05) who tended to attribute the cause more to themselves. This difference may reflect a tendency for younger cyclists to blame themselves. However it may also be that they were correctly identifying their actions as the main cause, and this would be a reasonable assumption given that cycling experience was found to increase with age, i.e. the youngest cyclists were the least experienced, as expected.

No trends were observed that linked road features with gender or speed zones. Somewhat paradoxically, cyclists whose injuries were sustained through collision with a road feature did not differ from the others in their evaluation of the safety of the section of road on which they had sustained their injury (F(1, n = 99) = 0.308 p> .05).

6. Discussion

Primary crash causes:
Cyclists most often considered the main cause for their crash to be their own actions (33%), followed by road features (such as loose gravel, roadwork signs, and potholes, 28%), cycle problems, other persons' actions, and avoiding something, in that order. Younger cyclists (under 15 years) tended to blame themselves rather than road features for their crash, compared to older cyclists. As the sample group is over-represented by those under the age of 19 years, *the respondents may have shown reticence in their concerns for* improvements or maintenance of the roads. Yet their lack of experience means they are likely to be the most vulnerable when encountering an errant road feature, and are the least equipped to both recognise and avoid crashes caused by hazardous road features.

Specific road features causing crashes:

Loose gravel was the road feature responsible for the greatest proportion of crashes and accounted for 34%. Unexpected road surface irregularities such as potholes, gaps between surfaces, corrugations in the sealed surface, were the main cause of 39% of road feature-related crashes. These features are mainly maintenance and finishing features rather than overall design or road furniture. However this does not mean that road furniture and design had no role in the crash, as it is possible that the reason the cyclist was riding where they were, was related to constraints of traffic and road furniture and design. *However this sort of information could not be deduced from the questionnaire.*

The cyclist's view of crash prevention:
When asked what could have prevented the crash, a cyclist more often listed personal factors, such as taking more care and paying more attention, than repair or maintenance of the road. This was despite identifying the crash cause as something (e.g. a road feature) external to themselves. This finding indicates that cyclists regard it as their own responsibility to negotiate changes to the road surface, potholes and gravel, which seems to be an unreasonable expectation.

Not only did younger cyclists attribute the crash cause to their own actions, but they also regarded themselves as being the main means of crash prevention. These cyclists seemed to believe that by riding carefully they could navigate around potholes and loose gravel, even when the attempt led to serious injury. However, older cyclists were less willing than younger cyclists to see the crash as preventable by their personal riding behaviour. These findings present an important set of challenges to those responsible for the maintenance of roads since they suggest that cyclists are vulnerable for more reasons than traditionally recognised.

Cycle use & crash patterns:
Cycle use and cycle crash patterns are important to the findings reported here. Just over half of the injuries occurred in urban areas, and these mainly involved cyclists who were using their cycle for transport (e.g. commuting to work or school). Just under half the crashes occurred when the cyclists were using their cycle for other purposes (leisure and mainly sport). Cyclists out for sport training seem to be the most vulnerable "group" in the 100km/h zones. To target road maintenance resources efficiently, the nature of road riding for each of these groups needs to be better understood, and focus on those using their cycle for transport in urban areas, and in 100km/h areas to focus on those using their cycle for sports training.

Helmet use:
Another issue to come out of this study was the importance of correctly fitting helmets, as 10% of the cyclists reported that their helmet came off (as opposed to breaking on impact) at the time of their crash.

Improvements in survey design:
The results of this survey were drawn from a small sample of injured cyclists. A great number of the crashes had not meet the criterion of occurring on public roads, and caused by other than a collision with a moving motor vehicle. However, these findings were consistent with previous cycle studies, and cycle population trends.

If this survey were to be repeated, the records of either ACC or NZHIS (not both) would be used. If we were to use NZHIS records, we would increase the survey sample, to allow for about half of the population having off-road crashes or having a collision with a moving motor vehicle. If we were to use ACC data, we would restrict the survey to their "on-road" incidents and so exclude crashes occurring on cycle ways and footpaths.

Comparison with other studies

Christchurch study – similarities with this study:

In this study, road features were the main cause of 28% cycle-only crashes. Approximately 20% of cycle-only crashes had been expected to be related to road features, based on the findings of the Christchurch cycle study] (CCSC 1991).

The road features identified as crash causes in this study were similar to those of the Christchurch study. The Christchurch study had also shown that loose gravel on the road surface was a significant factor relating to cycle-only injuries, and noted that "Loose gravel was considered to be a factor by 11% of serious and 8.5% of minor collision respondents". As well nearly 10% of respondents in the Christchurch study had listed "poor repair and road maintenance as the most significant concern while cycling" (CCSC 1991, p.20). Of the nine recommendations they made, Recommendation 8 states: "That road controlling authorities make greater efforts to keep the streets clear of loose gravel and other debris" (ibid. p.vi). Although road furniture and design did not feature as a major crash cause in this survey, this does not mean it was not a contributing factor, as discussed above

Differences between this study and the Christchurch Study:

Comparing our crash cause findings with those of the Christchurch study, several notable differences became obvious.

First, the Christchurch study involved cycle collisions with motor vehicles: these were excluded from our study.

Second, the respondents to the Christchurch study were drawn from a variety of sources including General Practitioners, Hospitals, Schools and the general cycling population. Our study drew a sample from NZHIS and ACC records that collate data on injuries serious enough to require medical attention. The difference between the two samples is in the severity of the crash, as this study draws on a smaller population of serious cycle crashes

Third, the Christchurch survey covered the period 1988 – 1989 and since then cycle helmets have been made compulsory by law[6]. The helmet wearing rate has increased over this period to 90% for all age groups, up from 84% (5 –12 yr olds), 62% (13 – 18 yr olds), and 29% (above 18 yr) (Scuffham et al. 2000).

Fourth, trends in cycle use are changing over time. There has been a decline in school-aged children cycling to school, and an increase in recreational cycling (LTSA 2000, Frith 2000).

Finally, the Christchurch sample is not representative of the cycling population because the use of cycling is greater in Christchurch than for the national average (LTSA 2000, Frith 2000, Statistics New Zealand 1997).

Other studies *Ratio of cycle-only crashes: cycle-motor vehicle crashes:*
Studies in Australia and the Netherlands showed a 1:1 ratio between cycle-only and motor vehicle-cycle crashes. Initially the New Zealand study was expected to have a 2:1 ratio. However from the responses that about half the on-road cycle-only crashes had occurred off-road, i.e. *the ratio of cycle-only to cycle-motor vehicle* appears to be nearer 1:1. We could not determine whether this applied to the data set of all cycle-only crashes, *because this kind of ACC or NZHIS information was not accessible, in part due to difficulties of extracting it [ ] from their databases. However our surmise is that this ratio may be in fact closer to 1:1.*

6 Helmet wearing was made compulsory on 1 January 1994.

7. Conclusions

- Of the cyclists 33% tended to consider themselves as the main cause of cycle-only crashes.
- Road features accounted for 28% of cycle-only crashes.
- Of the individual road features, loose gravel caused the greatest proportion of crashes, a finding that is consistent with the 1991 Christchurch study.
- Of grouped road features, surface irregularities accounted for 39% of crashes.
- Road furniture does not appear to be a significant crash cause.
- The majority of crashes involve those under 19 years old. Children are over-represented in the crash figures (which could be expected from cycle use patterns). This age group is of the least experienced cyclists, who are the most likely to blame the crash on themselves.
- The majority of crashes were in urban areas (i.e. <60km/h).
- Most of the crashes in urban areas involved cyclists using their cycle for transport (e.g. commuting to work, school, shopping).
- Most of the crashes in 100km/h speed zones involved cyclists who were out sports training.

8. Recommendations

- Minimise loose gravel on the parts of the road where cyclists ride.
- Define the:

  - effect of surface irregularities on cycle stability by research,

  - relationships between surface irregularities on cycle stability.
- Better understand the nature and requirements of road riding for different user groups (e.g. leisure, transport and sports cyclists, and younger cyclists), so that problems unique to each group can be identified.
- Define the relationships between different cyclist groups, especially those of younger cyclists.

9. References

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Appendix A Survey Questionnaire

Opus International Consultants Cycle Accident Survey
Information Sheet

We invite you to take part in our study that is aimed at making our roads safer for cycling. This study is voluntary, to take part all you need to do is complete this questionnaire, then return it to us in the freepost envelope**.**

IF YOU RETURN IT TO US BY 30 JANUARY 2001 YOU WILL BE PLACED IN A PRIZE DRAW, PRIZES INCLUDE: VOUCHERS FOR PETROL, BOOK AND OUT-DOOR EQUIPMENT. Suitable prizes are available for those living outside of New Zealand.

This questionnaire will take you about half an hour to fill out.

- Please contact me (Diana Munster) **phone: 04 587 0628, fax: 04 587 0604**
- **Email: diana.munster@opus.co.nz**
- **by post: PO Box 30-845 Lower Hutt**

if you:

- need help in filling out this form,
- have any questions about the form or the project itself,
- do not understand the language

Why you have been selected:

Your name was supplied to us by one or both of New Zealand Health Information Service (NZHIS) and/or Accident Compensation Corporation (ACC). These records show you as having been sent to hospital and/or received ACC payments (e.g. compensation for loss of earnings) as a result of a cycle accident that happened between 1st January 1994 and now. Your name was randomly selected from their records as having an accident that was not caused by a motor vehicle.

About us:

We are road safety engineers and scientists from what used to be the Ministry of Works (now Opus International Consultants). This project is funded by Transfund who provide funding for our public roads.

Confidentiality – our assurance

Your name is only needed so we can

- ♦ send the questionnaire to the right person
- ♦ check that you have not also completed a questionnaire sent out through ACC (we do not want to count you twice).
- ♦ send out prizes

This survey is independent of ACC and NZHIS, and even though these organisations have provided us with your name, any information they receive regarding this study will not include names or any other means of identification.

What will happen to your questionnaire:

When we receive your questionnaire we will first check that you have not also completed one sent out through ACC for the same accident. We will then remove page iii of the questionnaire in which you have entered your name and address and accident date. The piece of paper with your name and address on it will be put in a drum for the spot prize draw. When this has been done and the prizes sent out, your name and address will then be destroyed.

Your questionnaire will now have no name. From here on your name will not be included. We will then look at your questionnaire along with all others (well over 1,000) and find out:

- ♦ what the cause(s) of the accidents were and
- ♦ how many accidents were due to the same cause(s).

About this project:

We are trying to find out how to make New Zealand roads safer for cycling

We are doing this by firstly finding out what the causes of cycle accidents on our roads are, then coming up with ideas to try and stop these same accidents happening again.

These ideas will mainly focus on making the roads better designed for cycling. They will be discussed with other road engineers and cycle groups throughout New Zealand to see if they can add anything to these ideas. These will become available for use on our roads as design guidelines.

Cycle accident causes are not well recorded. What we have found is that one third of the cycle accidents that occur on public roads were caused by a motor vehicle. We do not know what caused the other two thirds and it is this group that we are especially interested in. We are trying to get this information by asking those who have had this type of cycle accident to complete the attached questionnaire

Results of our project:

We expect the final results of this project to be published by Transfund as a research project by the end of August 2001.

The results will be reported as number of people surveyed having a cycle accident due to given cause(s) and our ideas to prevent these accidents.

Note:

If you have any queries or complaints regarding this questionnaire or privacy issues, please contact one of the following:

Diana Munster (project leader) at Opus International Consultants 04 5870628

Wellington Ethics Committee if your form has NZHIS on page iii.

If the person to whom this questionnaire is addressed is unavailable or unable to participate, I would be grateful if you could indicate this and return the form.

In completing the form, if you are unable to remember any or all of the events you may either ask another person who was there to help (and indicate that this was done) or if unsure with a response place a question mark beside that response

If there are questions you do not wish to answer for example due to cultural or ethical reasons then there is no compulsion for you to do so and we would respect your decision.

Thank you

Name Sheet – for prize draw

Name:……………………………………………………………………………….

Address:…………………………………………………………………………….

………………………………………………..………………………………….

Date of Accident (if in doubt nearest month or time of year will do) ……………

NOTE: We were given names from both ACC and hospitals, so there is a small chance you may receive 2 forms for **the same accident**. If so apologies please complete only one, and note on the top of this page “have been sent 2 forms for same accident”. However if they are for 2 separate accidents then please fill both out.

BICYCLE ACCIDENT QUESTIONNAIRE

NOTE: If you are unsure or you can not remember enough to answer a question **please do not try and guess** just write “?” “not sure” or “can not remember”

PART 1 – YOUR INJURIES

1) Please use tick box to indicate region(s) of body affected then specify beside tick box the details of your injury (eg for broken left elbow and concussion tick arm, then write broken left elbow in the “details” space next to the tick box, then tick head and write down concussion in the space next to the details tick box

Body part :	Tick part injured	Injury Details
Head (includes neck)		
Upper body		
Lower body		
Arms (includes fingers)		

2) Did this accident result in any of the following (tick boxes that apply)

Treatment in Accident and Emergency	☐
Hospital admission overnight	☐
GP visit (e.g. visit to your doctor)	☐
Hospital Outpatient appointment	☐
ACC cover (wages, childcare, housekeeping)	☐

Other treatment (please specify e.g. physiotherapy)

____.

3) *Did you have to take time off from work or school, or were you prevented from finding work?*

No	☐
Yes	☐

If yes….How long did you to take? ………………………………………

4) If you had to have overnight treatment in hospital, how many nights did you have to stay there in total?

Not Applicable	☐
Number of nights	☐

5) Did you require further treatment at a later date(s)?

No ☐

Yes ☐

If yes did this require an overnight stay in hospital

No ☐

Yes ☐

6) Have your injuries stopped you do anything you used to be able to do before the accident?

No ☐

Yes ☐

7) Do you still bicycle? (Please select the answer which best suits you)

Yes, as much or more than before the accident ☐

Yes, but less often than before the accident ☐

No, I don’t want to because of the accident ☐

No, because I am physically unable ☐

No, for reasons unrelated to the accident ☐

Other (please specify:

____

If yes…

Do you in any way restrict where you ride you bike now as a result of the accident?

No ☐

Yes ☐

If yes…

Please explain

PART TWO – THE ACCIDENT

NOTE: the following section asks similar questions. Please answer them in order. The way they have been designed will help you to remember exactly what happened.

1) What in your opinion caused your accident?

----

2) Did the accident happen on a road (or in any of the places listed in question 3) below

No ☐

Yes ☐

If your answer to question 2 was **NO, (ACCIDENT** was **NOT ON THE ROAD**) please go to **question 7**

If your answer was **YES** please answer the following **ON THE ROAD QUESTIONS:**

ON ROAD ACCIDENTS (QUESTIONS 3-6)

3) Where on the road did your accident happen?

On the road in a traffic lane ☐

On the road between the road edge and the white lane line ☐

On the road in a marked cycle lane ☐

On a footpath beside the road ☐

On a separate bicycle path beside the road ☐

Can't remember ☐

Other (please specify)

----

4) What were you doing on the road at the time of your accident:

- Riding along a road which is straight ☐
- Riding along a road, around a corner ☐
- At an intersection riding straight through it ☐
- At an intersection turning left ☐
- At an intersection turning right ☐

If at an intersection, please describe it were there, traffic lights, give way, stop signs, roundabout, railway crossing? How many roads were intersecting

----

- At a pedestrian crossing, footpath or driveway ☐

Please state which --

- Stationary at an intersection or pedestrian crossing ☐
- Can't remember ☐
- Other (please specify) --

----

5) What speed zone were you in?

- 100km/hr (highway, main road, etc) ☐
- 70km/hr – 80km/hr ☐
- 60km/hr ☐
- 50km/hr (speed zone in town) ☐
- 30km/hr (road works zone) ☐
- Can't remember/ don't know ☐
- other (please specify --

----

6) Was the traffic:

- Peak traffic (rush hour)/ Heavy ☐
- Average ☐
- Light ☐
- Can't remember ☐

7) Please answer this question if your accident was NOT ON THE ROAD

a) where was it:

Cycle lane away from road	☐
Walkway	☐
Can't remember	☐
Other please specify	----------

b) what were you doing

QUESTIONS FROM HERE ON ARE FOR ALL TO ANSWER

8) Please include a diagram of the accident (please give as much information as you can remember, for example street or road names, the direction of the nearest town, the direction you were going in, the direction other things were going in, the type of signs and markings present).

9) Please write in your own words what happened in your accident. We want you to list the **sequence of events** that happened.

For example:

Event Number	*Event details: what was the event and what was the outcome*
1st	*a magpie swooped toward me*
2nd	*I tried to brake to avoid it*
3rd	*My bikes brakes did not work*
4th	*I then tried to swerve*
5th	*I lost control and went off the road and into a duck pond*
6th	*I fell off into the pond landing on top of a sharp rock*
?	*Something else happened cant remember what but woke up in hospital*

Note in the following table:

- If you cannot remember the event number or sequence, cross out the event/action number and put "?"
- If you cannot remember any event details please say so.

Event Number	*Details*
1st	
2nd	
3rd	
4th	
5th	
6th	
7th	
8th	

10) Where was the accident?

Street Name ....

Suburb ....

City/town ....

11) What was the light like at the time of day the accident occurred?

- Dawn ☐
- Daytime – bright ☐
- Daytime – overcast ☐
- Twilight ☐
- Night ☐
- Can't remember ☐

If it was **not** Daytime……

Was the street/ place where you were riding lit?

- No ☐
- Yes ☐
- Can't remember ☐

12) What were the weather conditions like when the accident occurred?

- Fine ☐
- Mist/Fog ☐
- Light Rain ☐
- Heavy Rain ☐
- Snow ☐
- Can't remember ☐
- Other (please specify) --

13) What was the surface of the road like where the accident happened?

- Dry ☐
- Wet ☐
- Icy ☐
- Unsealed ☐
- Can't remember ☐
- Other (please specify) --

14) What were the wind conditions like when the accident occurred?

Windy ☐

Breezy ☐

Calm ☐

Can’t remember ☐

Other (please specify) --

15) Do you think you were travelling too fast (eg for you to stop suddenly if you had to)at the time of your accident?

No ☐

Yes ☐

16) Were you riding out of control (e.g. were wobbling) at the time of your accident ?

No ☐

Yes ☐

17) Was the accident location a place you had cycled through before?

Yes ☐

No ☐

18) Had you had any drugs or alcohol that may have influenced your ability to cycle, before having the accident?

(Please remember that what you answer is confidential.)

Yes ☐

No ☐

19) BEFORE the accident how unsafe did you think the section of road was where you had the accident?

Please put a mark on the line to indicate how safe you think the road was.

Extremely unsafe |____| Very safe

20) What were your reasons for cycling on the day you had the accident?

- Using bicycle for transport ☐
- Leisure ☐
- Sport (training, racing) ☐
- Can't remember ☐
- Other (please specify) ____________

21) Was there an alternative route available?

- Yes ☐
- No ☐
- Don't know ☐

If yes why did you choose your route rather than the alternative?

____

____

____

____

22) What do you think could have stopped this accident from happening, or reduced your injury?

PART 3 – YOU AND YOUR BIKE

Bicycle Equipment

1) What type of bicycle were you riding (may tick more than one box)?

- Road bike ☐
- Racing bike ☐
- Mountain bike ☐
- Child's bike ☐
- Other (please specify) --

2) What type of tyre did you have on this bicycle?

- No tread (e.g., racing bike) ☐
- Some tread ☐
- Lots of tread (knobbly) ☐
- I don't know ☐

3) Approximately how old was your bike? ………………………………..

4) At the time of your accident were the parts of your bike working well?

- No ☐
- Yes ☐
- Can't remember ☐

If no, what was not:

----

5) Were you wearing a bicycle helmet?

- No ☐
- Yes ☐
- Can't remember ☐

If yes…

Did your helmet stay on?

- No ☐
- Yes ☐

6) Were you wearing any other protective clothing? (e.g. gloves, kneepads)

- No ☐
- Yes ☐
- Can't remember ☐

If yes……

Please specify the clothing you where wearing

----

7) Were you using bike lights?

- No ☐
- Yes front only ☐
- Yes back only ☐
- Yes both ☐
- Can't remember ☐

8) Were you wearing reflective clothing?

- No ☐
- Yes ☐
- Can't remember ☐

9) Feet(a) What pedal fittings do you have?

- Pedals ☐
- Toe clips ☐
- Cleats ☐
- Other (please specify) ---------------------

(b) did the pedals in any way contribute to you accident

No ☐

Yes ☐

and if yes please specify how ....

....

10) What was your age group, at the date of the accident?

Under 10 ☐

10 – 14 ☐

15 – 19 ☐

20 – 24 ☐

25 – 34 ☐

35 – 44 ☐

45 – 54 ☐

55 – 64 ☐

65 and over ☐

11) Are you:

Male ☐

Female ☐

12) About how many years had you been riding before the accident occurred?………………

Thank you very much for providing us with this information.

If you have anything further to say please feel free to explain in the space provided below.

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