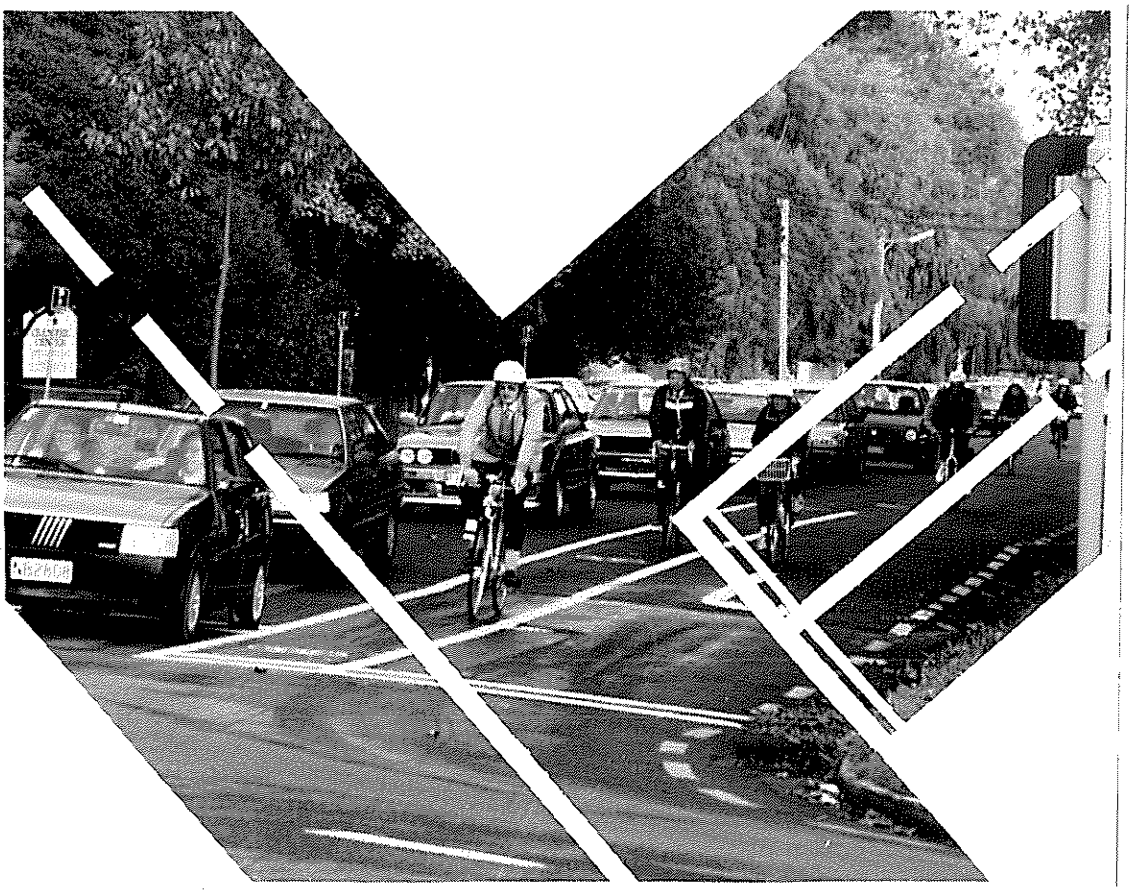
CYCLE USE AND COLLISIONS IN CHRISTCHURCH

CHRISTCHURCH CYCLE SAFETY COMMITTEE



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DISCLAIMER

ABSTRACT

This study explores the patterns of cycle use and collisions among adults and school students in Christchurch, New Zealand. Reporting rates for all cycle collisions are obtained, including those which do not involve motor vehicles. From the results of the survey recommendations are made to improve the safety of cyclists in the city.

Questionnaires were distributed to adult cyclists, school students, and medical practices and hospitals in Christchurch. Cyclists were observed and counted in field surveys at specific locations round the city and Ministry of Transport records of reported cyclist collisions were analysed.

The field surveys provided information on age groups and sexes of cyclists and their helmet-wearing rates. Patterns of cycle traffic flows were also observed.

Results from the questionnaires gave a profile of the cycling population for both adult and school cyclists, as well as the distances they travelled. Details were collected from school and adult cyclists on the collisions they had experienced and average annual distances ridden by adult cyclists were calculated. Using these two pieces of information an exposure rate to the risk of collisions was estimated. This exposure rate is used to compare the relative risk of collisions for cyclists of different age groups and sexes with the risk for the occupants of motor vehicles.

Information collected on collisions included the first object struck, factors contributing to collisions, the road type on which collisions occurred and the time of day. This information is compared with the data on cycle collisions in the Ministry of Transport records.

Data were also collected on the extent to which cyclists wore reflective clothing, whether their cycles had lights and reflectors, and whether they owned and wore cycle helmets. Respondents were asked whether helmets were worn in collisions and whether helmets were felt to be effective in preventing head injuries. From these data and from information collected in the medical survey, the effectiveness of cycle helmets in protecting cyclists from head injury is estimated.

Collisions recorded in the medical survey were compared with those reported to the Ministry of Transport over the same period of time. From this information reporting rates for cycle collisions resulting in injury are estimated.

Recommendations are made for action to improve cycle safety. They include the need to improve systems for collecting information on cycle collisions and for education and publicity for both cyclists and motorists.

EXECUTIVE SUMMARY

Introduction

This study was set up with five main aims:

1. To update a 1979 Ministry of Transport survey of adult cycle use and collisions.
2. To study school students' cycle use and collisions.
3. To ascertain the reporting rates for cycle collisions.
4. To study the relative safety of different types of cycle facilities and to compare these with ordinary roads.
5. To assist in planning and implementing a safer environment for cycling.

A study team was set up consisting of officers from the Christchurch City Council, the Canterbury Regional Council and the Ministry of Transport. Surveys were carried out in Christchurch in 1989. Funding for the project came from the now disbanded Road Research Unit of Transit New Zealand as well as from the Regional and City Councils.

In preparing this report, comments have been made on each survey or data set. Some of these comments are subjective and indicate the conclusions reached by the study team.

Methodology

The survey consisted of five parts. Adult questionnaires were distributed to 3,000 cycles in the city, with nearly 1400 completed forms returned to the study team.

School questionnaires were distributed to one class at each form level in every secondary and intermediate school in Christchurch. Nearly 3,500 school questionnaires were completed and returned.

About 12,000 cyclists were observed in field surveys at specific locations throughout the city, chosen where possible to act as screenlines and give a representative sample of cyclists.

The 466 Ministry of Transport records of reported cyclist collisions for 1988 and 1989 were analysed.

Questionnaires were sent to medical practices and hospitals in Christchurch to be completed for cyclist casualties. Over an eight-month period 86 were returned.

Profile of Cyclists

Adult cyclists typically used a cycle to commute to work or to an educational institution. There were more males than females, especially among those over the age of 25 years. Proportions of male and female cyclists recorded in the field surveys were approximately equal among secondary students, but there were more males than females among primary school and adult cyclists.

The main reason for cycling given by adult respondents was economy. Many of those who used a cycle during the week opted for some other form of transport during the weekend. Most adult cyclists had driver's licences, while nearly half had access to or owned a car, van or motorcycle.

School cyclists answering the questionnaire comprised equal numbers of males and females. About three quarters of them used cycles to get to school and three quarters cycled for pleasure. Nearly 20% had driver's licences.

Safety Equipment

Reflective clothing was worn more commonly by adult cyclists than by school pupils, who hardly ever wore it. About 40% of adult respondents wore it at least sometimes at night. Rear or pedal reflectors were on the cycles of 88% of adult respondents and 93% of school respondents. There was no lighting for the cycles of 15% of adults and 58% of school cyclists.

Helmets were owned by 36% of adults and 37% of school pupils, but always or usually worn by 28% of adults and 29% of school cyclists. A helmet wearing rate of 34% was observed in the field surveys with 36% of secondary school cyclists and 28% of adults wearing them.

Cycling Patterns

The annual average distance cycled by adult males was estimated to be 2232 kilometres and by females 1541 kilometres. Few adult cyclists appeared to give up cycling in winter, although some cycled on fewer days. Males rode 14% and females 15% of their average annual distance in the dark. More cycling seems to be done on major roads than on minor roads, with less than 10% on designated cycle routes.

School cyclists travelled an average distance of about 3.2 kilometres to school. They travelled a greater proportion of their cycling distance on major roads than on minor roads and a very small proportion on cycle routes. School cyclists were, however, more likely to ride on minor roads and less likely to ride on major roads than were adults. School students' cycling patterns varied little between summer and winter.

Collisions

The patterns of cycle collisions in the Ministry of Transport records and in the medical survey corresponded with morning and evening cycle traffic peaks. There were fewer reported collisions at weekends than during the week.

Cycle collisions of some kind, including those not resulting in injury, had been experienced by about half of both school and adult respondents. Although males had more collisions than females, adult female cyclists had more collisions per kilometre travelled than males. Risk of collisions per kilometre travelled seemed to decline with age. Adult cyclists were involved in collisions, resulting in injury, at a rate of over 2,000 per hundred million kilometres. Cyclists appear to be about 12 times more likely per kilometre travelled to be involved in collisions resulting in injury than the drivers of motor vehicles. In any given year, one adult cyclist in 29 is likely to experience a collision serious enough to seek medical attention.

Cyclists appear to have about the same proportions of injury collisions per kilometre travelled on major as on

minor roads. The numbers of collisions on cycle routes were too small to draw conclusions about the safety of cycle routes, but they did not appear to be more dangerous than roads.

Ministry of Transport records showed that the most common collision types for cyclists were right angle and 'right turn against' collisions usually where a motor vehicle turned right across the path of a cyclist.

The questionnaire results showed the main factor contributing to adult cyclists' collisions as not being seen in time, while for school cyclists it was loss of control. In the Ministry of Transport records the main factors were inattention or failure to look, on the part of both motorists and cyclists.

About 40% of adult and 52% of school cyclist collisions resulting in injury did not involve motor vehicles and were not therefore required to be reported to the Ministry of Transport. The opening of car doors into the paths of cyclists and loose gravel on the roads appeared to be significant contributors to adult cyclists' collisions, while bad brakes and other mechanical problems as well as loose gravel contributed to a high proportion of school cyclists' collisions.

The age group having the highest proportion of collisions was 15-19 years in both the Ministry of Transport records and the medical survey. The school questionnaire showed 15 year olds as the single most vulnerable year.

Reporting Rate

Collisions recorded in the medical survey were compared with those reported to the Ministry of Transport over the same period of time. From these data it was estimated that the reporting rate for all cycle collisions resulting in injury was 21%.

Effectiveness of Cycle Helmets

Ninety percent of those respondents involved in minor collisions who hit their heads thought that wearing a helmet reduced the injury. Of those serious collision respondents who hit their heads, 13% wore helmets while 28% of minor collision respondents who hit their heads wore them. It appears that wearing a helmet may have turned some potentially serious collisions into minor ones. However, the numbers of respondents involved were very small and a larger sample would be desirable.

In the medical survey, a much lower proportion of cyclists wearing helmets suffered head injuries (26%) than those without them (47%). This gives a measure of the effectiveness of cycle helmets in reducing the incidence of head injuries in cyclists.

Recommendations

Recommendation 1: That area health organisations collect data on road traffic collision casualties from emergency departments as well as from hospital admissions in such a way that they can be used in association with Ministry of Transport records.

Recommendation 2: That the Ministry of Transport encourage reporting of cycle collisions and collect more data on cycle collisions.

Recommendation 3: That Transit New Zealand modify its Project Evaluation Manual (NRB 1986) to contain an additional figure showing the ratio of reported to actual cycle collisions for those cycle collisions not involving motor vehicles. This figure should be used in assessing projects where there is potential for reducing cycle collisions in which motor vehicles are not involved. The figure of 4.76 would represent the reporting rate of 21% found in this study for cycle collisions of all kinds.

Recommendation 4: That area health organisations code injuries for hospital admissions and emergency department casualties according to an internationally recognised injury severity scale.

Recommendation 5: That organisations involved in road safety carry out education and publicity campaigns aimed at increasing motorists' awareness of cyclists on the road.

Recommendation 6: That organisations involved in road safety carry out education and public awareness campaigns aimed at encouraging cyclists to cycle defensively, to make themselves more visible, and to maintain their cycles.

Recommendation 7: That organisations involved in road safety continue programmes to encourage the wearing of cycle helmets.

Recommendation 8: That road controlling authorities make greater efforts to keep the streets clear of loose gravel and other debris.

Recomendation 9: That further research be carried out by local authorities into the use of cycle routes with a view to either extending the network of cycle routes in the city or increasing the safety of cyclists on arterial roads.

Related Projects

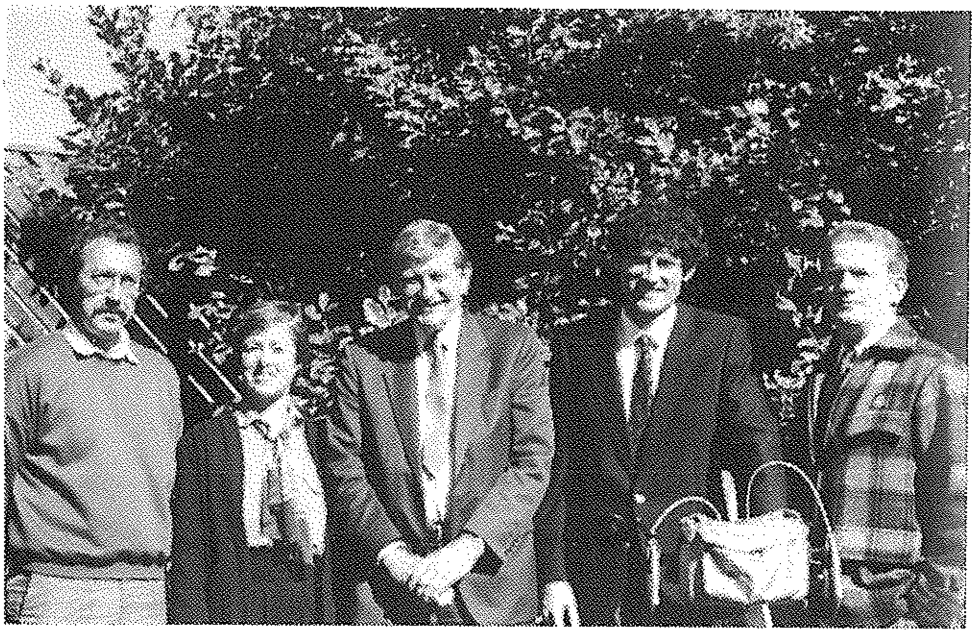
Monitoring of trends in helmet wearing and cycle traffic should be carried out.

Exposure rates to risk of collision should be investigated for different modes of travel.

The use of cycle routes and their safety should be monitored.

Local health authorities should conduct a study into the involvement of alcohol in cycle injury collisions and cyclists should be made aware of their vulnerability when cycling under the influence of alcohol.

The Christchurch Cycle Safety Committee



Left to right : Geoff Holland, Susan Cambridge, Mike Gadd, Andrew Macbeth and Dick Huntington.

The study area. An aerial photograph of the City of Christchurch, looking west over the central business district and Hagley Park.

CHRISTCHURCH CYCLE SAFETY COMMITTEE

Susan Cambridge — Road Safety Co-ordinator (Christchurch City Council)
Mike Gadd — Manager, Traffic Operations (Christchurch City Council)
Geoff Holland — Traffic Engineer (Ministry of Transport)
Dick Huntington — Accident Remedial Officer (Christchurch City Council)
Andrew Macbeth — Transport Policy Analyst (Canterbury Regional Council)

ACKNOWLEDGMENTS

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CYCLE USE AND COLLISIONS IN CHRISTCHURCH

1 INTRODUCTION

1.1 AIMS

The study had five main aims:

1. To update a 1979 Ministry of Transport survey of adult cycle use and collisions.
2. To study school students' cycle use and collisions.
3. To ascertain the reporting rates for cycle collisions.
4. To study the relative safety of different types of cycle facilities and to compare these with ordinary roads.
5. To assist in planning and implementing a safer environment for cycling.

1.2 BACKGROUND

Two major surveys had been conducted on cycling in Christchurch. One was a study in 1979 by J. E. Atkinson and P. M. Hurst (1984), of cycle use and accidents in Christchurch and Palmerston North. The other was a study "Cycling in Christchurch" (1979) carried out in 1977 by the Christchurch City Council.

Changes have occurred since Atkinson and Hurst's study. It focused on adult cyclists rather than school students, particularly in Christchurch, and several issues which are now relevant were not provided for in their questionnaires. Cycles have become capable of greater speeds, and in the last few years helmet wearing has increased dramatically.

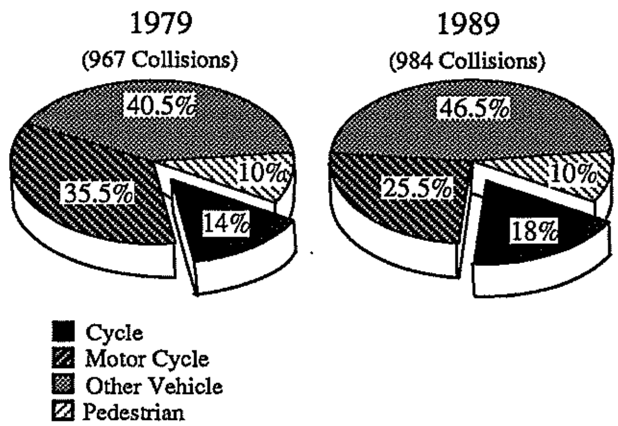
The Christchurch City Council study provided a basis for cycle planning in the greater Christchurch area and made a number of recommendations including the establishment of a network of cycle routes both on- and off-street. These have largely been implemented.

Cycle collisions reported to the Ministry of Transport involving motor vehicles and resulting in injury had increased steadily in pre-amalgamation Christchurch City from 136 in 1979 to 177 in 1988. This represented an increase from 14% of all reported injury collisions in the city in 1979 to 18% in 1988. This increase gave impetus for further cycle collision research.

Atkinson and Hurst stated in their introduction that "various studies in the United States in the 1970s have shown that non-motor vehicle collisions make up 70 - 90 per cent of cycle collisions". In New Zealand, the only cycle collisions required to be reported to the Ministry of Transport are those involving motor vehicles and resulting in injury. The reporting rate even for these collisions is known to be very low and to vary widely from area to area. (Bailey 1991).

Atkinson and Hurst concluded that in Palmerston North riding on off-road cycleways was more dangerous for cyclists than riding on roads, although their study did not show this effect in Christchurch. The network of cycle routes has been established in Christchurch for a number of years but there has been little monitoring of its effectiveness or its relative safety.

FIGURE 1
Reported Injury Collisions for all Travel Modes



Note: Injury collisions in Christchurch City before amalgamation.

1.3 STUDY TEAM

The Transport Technical Committee of the Canterbury United Council (now the Canterbury Regional Council) determined that there was a need to update information on cycling in the city. They resolved in March 1988 that a study team be established to research cycle use and collisions in greater Christchurch.

The study team consisted of:

Susan Cambridge - Christchurch City Council,
Mike Gadd - Christchurch City Council,
Dick Huntington - Christchurch City Council,
Geoff Holland - Ministry of Transport,
Andrew Macbeth - Canterbury Regional Council.

1.4 STUDY AREA

The area used for the study was the recently amalgamated Christchurch City which comprises some 417 square kilometres on the central east coast of the South Island of New Zealand. It is the largest population centre in the South Island containing, at the 1986 Census, 281,854 residents.

The City is geographically suited to cycling with over 1400 kilometres of roads, generally on level ground, the only gradients being the slopes of Banks Peninsula along the southern boundary of the City. The climate is generally temperate with snow rarely falling in winter.

A relatively large proportion of the population in Christchurch travels by cycle. The 1986 Census figures showed that 11% of the workforce were cycling to work. About three quarters of the school students in the city over the age of 10 cycle to school.

1.5 FUNDING

Approximately half the funding for the project came from the Road Research Unit of Transit New Zealand. Both the Regional Council and the City Council allocate funding for cycle-related activities and collision studies. They were therefore able to fund the other half of the project. The two councils together with the Ministry of Transport also contributed significant staff time and in-house facilities.

2 METHODOLOGY

2.1 OVERVIEW

To accomplish the aims of the study, a five part project was set up. These five parts were Ministry of Transport collision data, field surveys, adult questionnaire, school questionnaire, and medical questionnaire. Data were collected in 1989.

In the questionnaires, especially the school questionnaire, a number of respondents did not reply to a particular question or gave invalid answers. Generally the percentages reported in the results are of those who gave valid answers to the particular question.

2.2 MINISTRY OF TRANSPORT COLLISION DATA

Data on reported cycle collisions in Christchurch were obtained by analysing Ministry of Transport records. The information was compared with data from other parts of the study.

2.3 FIELD SURVEYS

Limited field surveys were conducted at count locations around the city. These collected data on helmet wearing, gender and age group of cyclists. They also gave, though only a partial picture, useful information about patterns of cycle traffic flow.

To help collect information on the use of cycle routes, each group of count locations included at least one designated cycle route.

An automatic traffic counter was installed at the signalised cycle crossing of an arterial road, to give information about cycle traffic flow variations over time.

2.4 ADULT QUESTIONNAIRE

A questionnaire was drawn up based on that used in Atkinson and Hurst's 1979 survey, but with additional questions including a number on helmet wearing. This questionnaire was designed to survey adult cyclists on their cycle use and collisions.

Questions seeking information on routes, distances and collisions gave information to help the Christchurch City Council and the Canterbury Regional Council plan a safer cycling environment in the city. Copies of the questionnaire were distributed by attaching them to the seats of parked cycles in various locations around the city.

As an incentive for cyclists to complete and return the survey forms, prizes were awarded to ten randomly selected respondents.

2.5 SCHOOL QUESTIONNAIRE

A questionnaire similar to that used for adults was designed to gather information on cycle use and collisions involving intermediate and secondary school students. Copies were distributed to one class at each form level in every secondary and intermediate school in Christchurch. Intermediate school students are aged about 11 to 13 years. Secondary school students are aged 13-17 or 18 years.

2.6 MEDICAL QUESTIONNAIRE

A form was prepared and sent to general practitioners and to the Emergency Department at Christchurch Hospital to collect data on type, location and severity of injuries. Times and places of collisions were also requested so that individual collisions could be matched with those in Ministry of Transport records to estimate reporting rates for cycle collisions.

Because of the difficulties in collecting these data, the information obtained was not as comprehensive as the study team had hoped.

2.7 SURVEY INSTRUMENTS

The survey forms and questionnaires are included in the appendix.

3 MINISTRY OF TRANSPORT COLLISION DATA

3.1 PURPOSE

The purposes of this part of the study were to:

1. Record Ministry of Transport collision data for the years 1980-89 to give a background for the study.
2. Analyse Ministry of Transport collision data for the years 1988-89 to allow comparison with other parts of the report.

3.2 METHOD

The analyses which follow use data from "injury accidents" in Christchurch City reported to the Ministry of Transport or the Police under the requirements of Section 65 of the Transport Act 1962.

The Act states that collisions arising directly or indirectly from the use of a motor vehicle and resulting in injury or death must be reported to the Ministry of Transport or the Police. Hence, cyclist collisions involving injury must be reported only if they involve a motor vehicle. When a collision is reported a 'Traffic Accident Report' (TAR) form is completed. Information from this form is then computerised.

Collisions which do not involve a motor vehicle or result in injury may still be reported by one of the parties to the incident. Since the beginning of 1988 data from these collisions have been computerised in addition to those required under Section 65, but with less complete information. They are not therefore included in the analyses which follow.

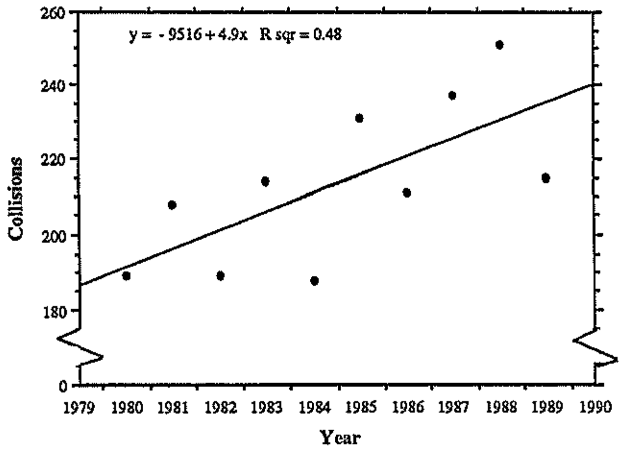
3.3 RESULTS

3.3.1 Historical Trends

Since 1980 the number of reported injury collisions involving cyclists has increased in the ten-year period to 1989 at approximately 2.1% per annum.

This is shown in Figure 2 which depicts cyclist casualty trends in Christchurch for the years 1980 to 1989. Table 1 compares cyclist collisions with all other motor vehicle 'injury collisions' as reported to the Ministry of Transport in Christchurch.

FIGURE 2
Reported Cyclist Injury Collisions in Christchurch, 1980 - 1989



Note: Data for post-amalgamation Christchurch.

TABLE 1
Reported Injury Collisions in Christchurch, 1980 - 1989

Year	Cyclist Collisions	% of Total	Other Collisions
1980	189	13.1%	1249
1981	208	14.6%	1213
1982	189	14.4%	1120
1983	214	16.5%	1084
1984	188	13.2%	1236
1985	231	15.7%	1242
1986	211	15.6%	1142
1987	237	16.7%	1184
1988	251	16.3%	1285
1989	215	15.3%	1192

Note: Data for post-amalgamation Christchurch.

3.3.2 Collision Types

Of the 466 collisions which involved cycles during 1988 and 1989, 309 (66%) occurred at, or within 20 metres of, an intersection. The most common collision types were the 'right angle' (HA) collision, and the 'right turn against' (LB) collision, accounting for 89 (29%) and 87 (28%) respectively. In most (84%) of the right turning cases the motor vehicle was turning right across the path of the cycle. The movement codes for collision types and the numbers of collisions for each type are illustrated in Appendix Figure A-1.

The intersection type at which cyclist collisions most commonly occurred were uncontrolled 'T' junctions (95 collisions) and signal- controlled crossroads (78 collisions).

A stationary object was struck in 65 of the 466 collisions (14%). The objects struck were parked vehicles (60), poles (3) and fences or buildings (2).

3.3.3 Contributing Factors

The contributing factors most commonly associated with cyclist collisions were 'inadequate checking' by motorists which occurred in 178 of the collisions, 'failed to give way or stop' by motorists which occurred in 175 collisions, and 'cyclist factors' which occurred in 123 collisions. More than one factor contributed to many of the collisions, therefore the number of contributing factors is greater than the number of collisions. Table 2 shows that 'inattention' and 'failure to look' were the most common factors for both motorists and cyclists.

TABLE 2
Contributing Factors in Reported Cyclist Injury Collisions, 1988 - 1989

Factor	Factor Attributed To: Motorist	Cyclist
Driver or Rider Factors		
Inattention or failed to look	205	144
Failed to give way	169	41
Skill or experience	40	2
Failed to stop at control device	29	19
Overtaking	17	6
Alcohol	13	8
Too far left or right	8	7
Physical defect	7	2
Speed	6	4
Following too closely	5	2
Vehicle mechanical fault	3	45
Swerved or braked to avoid	2	0
Signalling	1	5
Parked or stopped	1	1
Other Factors		
Weather	26	
Visibility	6	
Other road user	2	
Slippery road	2	
Signs or markings	1	
Other	25	

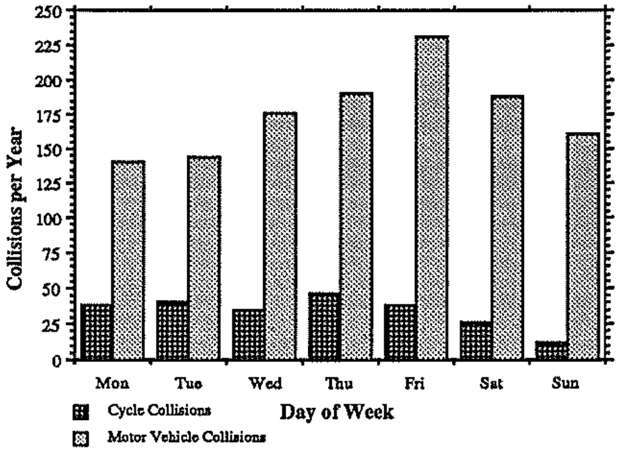
3.3.4 Day and Times of Collisions

When motor vehicle collisions involving cycles were plotted by day of week, it was noted that the shape of the curve was not the same as that for motor vehicle collisions which did not involve cycles. Generally the number of cycle collisions remained relatively constant through the week days with fewer on Saturdays and fewer again on Sundays. This pattern is shown in Figure 3.

Motor vehicle collisions, excluding those involving cycles, were less common on Mondays and Tuesdays, and rose to a peak on Fridays.

Comparison with Figure 6 from the field surveys indicates that the smaller number of collisions on Saturday and Sunday corresponds with a smaller number of cycles on the streets at the weekend. Part of the reason for this is probably the use by cyclists of other modes of transport at the weekend as shown in section 5.5.5.

FIGURE 3
Reported Cyclist Injury Collisions by Day of Week, Average 1988 - 1989



The pattern of cycle collisions through the day on weekdays as shown in Figure 4a corresponds very closely with the patterns of cycle traffic flow in Figure 7. The greatest proportion of collisions occurs at the times of peak cycle traffic flow.

FIGURE 4a
Reported Cyclist Injury Collisions on Week Days by Hour of Day

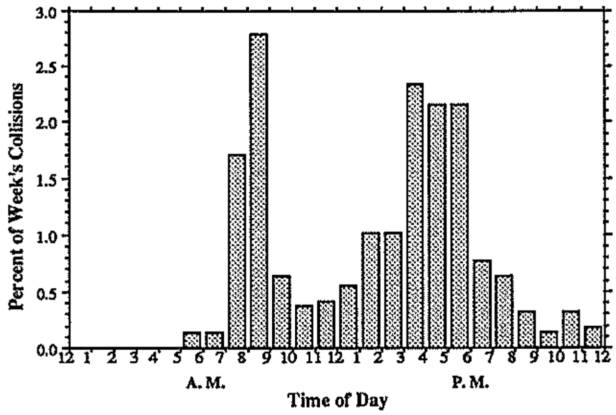
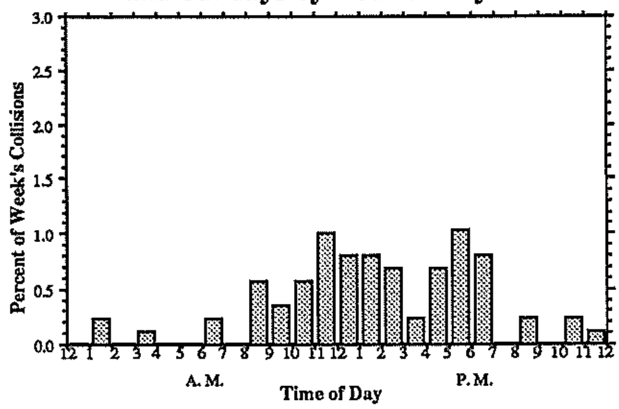


FIGURE 4b
Reported Cyclist Injury Collisions on Saturdays and Sundays by Hour of Day



3.3.5 Environmental Conditions

Three quarters of cyclist collisions took place on dry roads in daylight, while 15% of collisions occurred in darkness, and 14% took place on wet roads.

The weather and road surface conditions prevailing at the time of collision are shown in Table 3.

The second part of Table 3 shows the weather and light conditions for motor vehicle collisions excluding cyclists in Christchurch. It may be seen that the proportions of collisions occurring on wet roads were similar for cyclists and other motor vehicles, but the proportion of collisions in the dark was lower for cyclists. The amount of night cycling would need to be determined to draw any conclusions from this.

TABLE 3
Light and Road Conditions in Reported Injury Collisions in Christchurch, 1988 - 1989

Road Condition	Light		Dark		Total	
Cyclist Reported Injury Collisions						
Dry	348	74.7%	53	11.4%	401	86.1%
Wet	46	9.9%	19	4.1%	65	13.9%
Total	394	84.5%	72	15.5%	466	100%
Motor Vehicle Reported Injury Collisions excluding Cyclists						
Dry	1316	53.4%	683	27.7%	1999	81.2%
Wet	233	9.5%	231	9.4%	464	18.8%
Total	1549	62.9%	914	37.1%	2463	100%

3.3.6 Casualty Type

Casualty data from traffic collisions collected by the Ministry of Transport included age, sex, degree of injury and the type of vehicle in which the casualty was travelling.

A total of 494 casualties resulted from the 466 collisions which involved cyclists. Twenty eight of these casualties were motorists.

3.3.7 Age and Sex of Reported Injured Cyclist

Table 4a shows the age and sex distribution of injured cyclists. The 15-19 year age group has the highest number of reported collisions. In Table 4b, cyclist casualties are divided into primary, secondary and adult age groups to allow comparison with the field surveys.

In most age groups males were involved in about twice as many collisions as females.

TABLE 4a
Age and Sex of Reported Injured Cyclists, 1988 - 1989

Age Group	Male	Female	Total	
0 - 4	1	0	1	0.2%
5 - 9	8	7	15	3.4%
10 - 14	55	37	92	21.1%
15 - 19	84	48	132	30.3%
20 - 24	42	21	63	14.4%
25 - 29	33	9	42	9.6%
30 - 34	22	9	31	7.3%
35 - 39	12	6	18	4.1%
40 - 44	7	2	9	2.1%
45 - 49	3	1	4	0.9%
50 - 54	6	1	7	1.6%
55 - 59	7	1	8	1.8%
60 - 64	2	2	4	0.9%
65 - 69	5	1	6	1.4%
70 & over	3	1	4	0.9%
Total	290	146	436*	100%

TABLE 4b
Age Group and Sex of Reported Injured Cyclists

Age Group	Male	Female	Total	
0 - 12 Primary	31	21	52	12%
13 - 17 Secondary	91	59	150	34%
18 - 29 Adult	101	42	143	33%
30 and over Older	67	24	91	21%
Total	290	146	436*	100%

**The ages of 30 cyclists were not recorded*

3.4 CONCLUSIONS

The collisions discussed here are only a small proportion of the collisions occurring in the city. They are, however, useful for comparison with other parts of the survey. Because they include only those collisions that involved motor vehicles, a relatively high proportion occurred at intersections. The contributing factors show that motorists tend not to check adequately for cyclists and often do not see them.

The bias towards collisions involving motor vehicles in Ministry of Transport statistics obscures other factors contributing to cycle collisions.

4 FIELD SURVEYS

4.1 PURPOSE

Field surveys were carried out in order to improve understanding of cycle use in the city, with particular interest in:

1. Age group and sex of cyclists,
2. Cycle helmet-wearing,
3. The use of cycle route,
4. Daily and hourly cycle traffic variations.

4.2 BACKGROUND

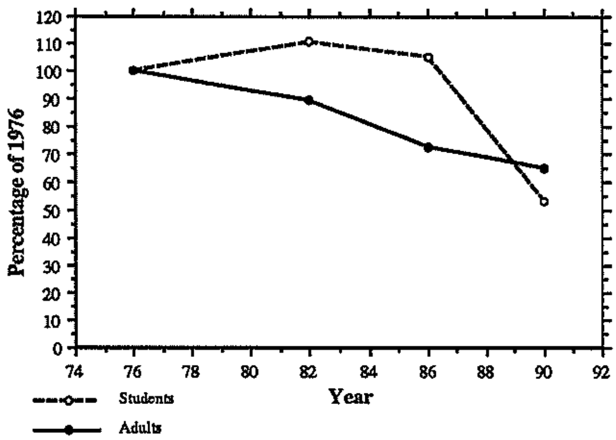
4.2.1 Cycle Helmet Wearing

The Ministry of Transport has monitored cycle helmet wearing in Christchurch since 1986. According to their data, the wearing rate increased from 5% in 1986 to 36% in 1989. The Ministry of Transport surveys were done at several locations but the usefulness of the data is limited because the locations were changed. The study team decided that a larger, more representative group of survey locations would give more reliable data and provide a better data base for future studies. Some 43 stations were surveyed, out of which 25 were selected for detailed analysis.

4.2.2 Changes in Cycling Activity Over Recent Years

Cycle traffic in Christchurch has not been monitored systematically, making long-term trends difficult to establish. However in the central city a number of morning peak hour counts have been done in recent years. These indicate a decline in cycling in this area between 1976 and 1990. Figure 5 shows this trend.

FIGURE 5
Cycle Traffic Trends in Central Christchurch, 1976 - 1990



Note: Based on morning peak hour cycle traffic counts

The relocation in 1986 of Christchurch Girls' High School outside the central area contributed to the decline in the numbers of school cyclists.

The proportion of the work force cycling to work in Christchurch over the whole city increased rapidly from 1976 to 1981 (nearly 8% per annum) and remained relatively static from 1981 to 1986. This is recorded in Table 5.

TABLE 5
Numbers Cycling to Full Time Work

Year	1976	1981	1986
Number employed	118507	115101	107745
Number cycling to work	9335	13020	11589
Proportion cycling to work	7.9%	11.3%	10.8%

* Notes: 1976 & 1981 Working 20 or more hours per week.
1986 Working 30 or more hours per week.
1986 Census data for Christchurch urban area.

Thus while the proportion of the work force cycling to work has increased since 1976, central city peak-hour adult cycling has actually declined. This may be explained by the following trends.

First, the central city has become relatively less dominant as an employment and retail area, as major redevelopment has occurred in the suburbs. Cycle traffic has probably increased in the suburbs but no data exist to show this. However, general traffic volume data show strong suburban growth.

Second, motor vehicle traffic volumes have continued to rise in the central city area. This may have discouraged some cyclists from cycling there, or from cycling at the peak hours.

Surveys were conducted in 1986 and 1988 during morning peak-hour traffic at a large number of streets crossing Christchurch's railway lines, to show trends in cycling since the last Census. The railway screenline surveys included cyclists but did not distinguish cyclists by age group.

A decline of 2.1% in cycle traffic was observed between 1986 and 1988 while motor vehicle traffic volumes increased 6.6%.

In summary, numbers of commuters cycling to work increased between 1976 and 1981 but have probably declined slightly since then. Cycling numbers in the central city in morning peak-hour traffic have definitely declined.

Present day school students appear to be at least as likely as their predecessors to cycle to school.

4.3 METHOD

For the purpose of the this study, surveyors counted cycles manually at 44 locations on dry Tuesdays and Thursdays in September and October 1989 observing about 12,000 cyclists in all. The results recorded in the following section are mainly from 27 of these locations, that seemed to be more representative of the cycling population than the rest as discussed in section 4.4.2. Surveyors recorded the age group (primary and intermediate school; high school; adult), sex and helmet wearing of each cyclist.

Counting was done at the busiest times only, for maximum efficiency. Most of the counts were therefore done from 7.45am to 9.00am with each survey subdivided into 15 minute intervals. A few counts were done initially from 3.00pm to 5.30pm to examine the spread of afternoon peak traffic, but afternoon traffic was less concentrated, making afternoon counts less efficient than those done in the morning.

Members of the Cycle Safety Committee were helped by staff from the Accident Compensation Corporation, the Roadshow Trust and the Automobile Association, who also were interested in the results.

The survey locations consisted of 36 sites on partial screenlines selected by the study team, and 7 sites (all near schools) where the Ministry of Transport had previously carried out helmet surveys. One more site in Hagley Park was chosen because it has often been used for counting in the past.

Partial screenlines were chosen where natural constraints such as railway lines, rivers or road configurations maximised the amount of cycle traffic crossing the lines, thus keeping count locations to a minimum. Each street or cycle track crossing the line was used as a count location. At least one cycle route was included in each line. The partial screenlines were spread evenly around the city across the main flows of cycle traffic.

Figures A-3 and A-4 in the Appendix show the partial screenline count sites in detail, while Table A-1 in the Appendix describes the 44 count locations.

Counts were done at the Hagley Park site to allow comparisons with counts done in previous years.

An electronic traffic counter was set up in Hagley Park at the Harper Avenue cycle crossing to measure cycle traffic over extended periods of time. This site was controlled by signals and cycles could be counted using the signal detectors in the cycle path.

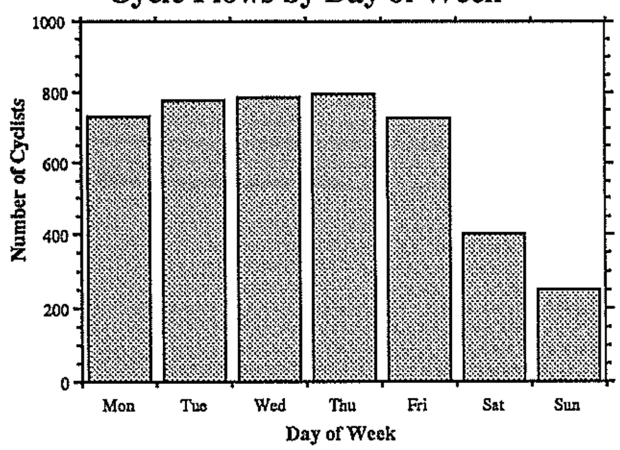
4.4 RESULTS

4.4.1 Daily and Hourly Cycle Traffic Variations

The data from the electronic counter at Harper Avenue were analysed by day of week and hour of day.

Cycle traffic flows over the five week days were fairly constant, with Mondays and Fridays being seven or eight percent lower than the other three days. Weekends were much lower with Saturday being about half week day level, and Sunday around one third. The variations are shown in Figure 6.

FIGURE 6
Cycle Flows by Day of Week

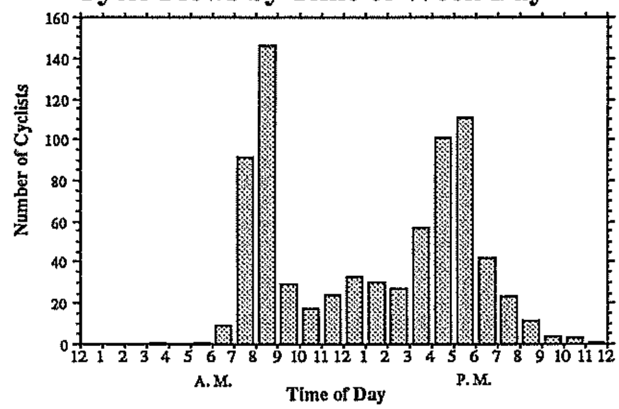


Note: Counts at Harper Avenue Cycle Crossing October, 1989

The morning peak was of shorter duration but of greater intensity than the evening peak. This was caused by the fact that school and commuter cycle traffic peaks coincide in the mornings but not in the afternoons. Cycle traffic in the middle of the day from 9.00am to 3.00pm was relatively constant. Figure 7 shows this pattern. The hour from 7.30am to 8.30am was the busiest period with 23% of cycle traffic.

In the afternoon the busiest period was the hour from 4.30pm to 5.30pm with 16% of the traffic.

FIGURE 7
Cycle Flows by Time of Week Day



Note: Counts at Harper Avenue Cycle Crossing October, 1989

Cycle traffic appears to be more concentrated into peaks than motor vehicle traffic, which typically has only 8% to 10% of daily traffic occurring in the busiest hour, whereas cycle peaks include about 23%.

4.4.2 Representative Count Locations

Because the suburban count locations appeared to be more representative of cycling activity in Christchurch than those done in the central city, only the data from the suburban locations were analysed in the following sections of the report.

The central city counts were dominated by adult cyclists (82%) and were therefore not representative of city-wide cycling. At suburban locations only 46% of the cyclists counted were adults. The inclusion of the central city locations would therefore have biased the sample in favour of adult cyclists.

During analysis it was found that earlier data for the Ministry of Transport stations were not sufficiently detailed to make a valid comparisons with the data from the field survey stations.

TABLE 6
Suburban and Central City Partial Screenline Counts by School Age Group

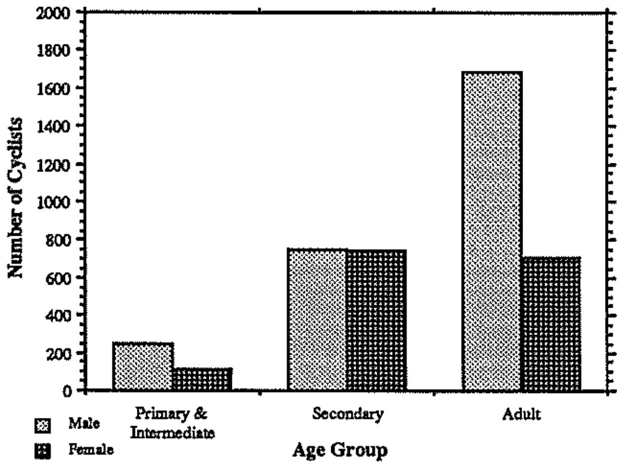
School Age Group	Suburban (27 Locations)		Central City (10 Location)	
Primary	539	10.3%	18	1.1%
Secondary	1520	43.4%	272	17.3%
Adult	1622	46.3%	1285	81.6%
Total	3501	100%	1575	100%

4.4.3 Age Group and Sex of Cyclists

Among the approximately 3500 cyclists surveyed in the morning peak at the 27 suburban locations, the percentages of adults (46%) and high school students (43%) were fairly similar with primary and intermediate school students making up 10%.

The majority of cyclists (61%) were male. Of the adults, 71% were male. This may be partly because there are more men than women in the workforce (see section 5.5.2). It may also be that women find other modes of transport more convenient for activities such as shopping and transporting children. Among secondary school students, numbers of males and females were approximately equal. At primary school level, twice as many males as females were recorded.

FIGURE 8
Age Group and Sex of Cyclist Crossing Partial Screenlines



Note: Counts at locations on 27 suburban screenlines.

4.4.4 Helmet Wearing by Cyclists

Of the cyclists counted at the suburban stations, 34% were wearing helmets in September 1989.

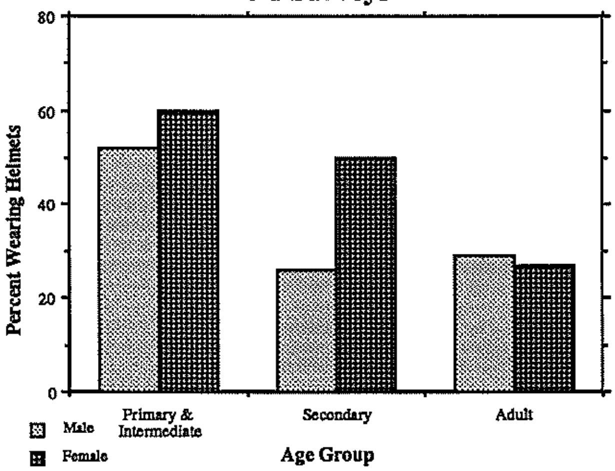
Helmet wearing was highest among primary and intermediate school students (55%) with 36% of high school students and 28% of adults wearing helmets. Helmet wearing was not greatly influenced by sex in the adult and primary student groups, but high school females were more than twice as likely (51%) to wear helmets as males (21%). Helmet wearing rates are shown in Table 7.

At the time of the survey two girls' schools, Rangi Ruru and St. Margaret's, had made helmet wearing compulsory for their students. This may have affected the wearing rate for female high school students slightly, but is unlikely to account for the whole difference in wearing rates between male and female students as the disparity was quite marked across all screen lines. It was probably caused by different attitudes to safety. A number of Christchurch schools made helmet wearing compulsory at the beginning of 1990, and had already announced this decision at the time of the survey in 1989. These included boys', girls' and co-educational schools. Several schools had begun bulk buying of helmets, and promotion of their use among their students.

TABLE 7
Helmet Wearing by Age Group and Sex, from Field Surveys

Age Group	Male	Female	Total
Primary & Intermediate			
Number surveyed	240	119	359
% wearing helmets	51.3%	61.3%	54.6%
Secondary			
Number surveyed	749	771	1520
% wearing helmets	21.5%	50.6%	36.3%
Adult			
Number surveyed	1148	474	1622
% wearing helmets	28.8%	27.2%	28.3%
Total			
Number surveyed	2137	1364	3501
% wearing helmets	28.7%	43.4%	34.5%

FIGURE 9
Helmet Wearing by Age Group and Sex, from Field Surveys



Note: Counts at 27 locations on suburban screenlines

4.4.5 The Use of Cycle Routes

The system of cycle routes in the city consists of roads with light traffic and relatively few busy intersections, chosen to give cyclists an alternative to busy streets. These routes are marked with blue signs and occasionally stencilled with symbolic cycles on sealed 'shoulders'.

Analysis of the suburban screenlines showed that cycle routes were used by larger proportions of school students than of adults, with 40% of primary school students and 43% of secondary students using cycle routes compared with 24% of adults. This was probably because the cycle route network was originally laid out primarily to service school cycle traffic.

Overall 34% of cyclists observed at the suburban survey locations were on cycle routes. The partial screenlines were selected to include at least one cycle route each, with the result that cycle routes were over represented in the sample. Thus more cyclists have been observed on cycle routes than would have been if truly representative screenlines had been selected.

The 1988 railway screenline survey showed about 17% of cycle traffic on cycle routes. This is probably a better estimate of the proportion of cycling done on cycle routes, but it is probably still too high.

The results of the adult questionnaire show 8.0% of cycling on cycle routes, both on and off-street, while the school questionnaire shows 7.9% of the distance in trips to school ridden on cycle routes. However, it was found in the results of the adult questionnaire (section 5.6.2) that cyclists may not have been aware of the significance of the blue cycle signs marking the routes. The percentage of distances ridden on these routes may, therefore have been higher than these results indicate.

There were about 120 kilometres of cycle route in Christchurch in 1989 compared with about 470 kilometres of arterial road and 4430 kilometres of roads in total. Thus 8.3% of road length was official cycle route.

It is current Regional and City Council policy to discourage cycling on arterial roads. If the use of cycle routes is to be promoted they need to be made more convenient by providing links wherever possible to entice cyclists onto the alternative network of routes.

4.6 CONCLUSIONS

The automatic cycle counter showed that the peak time for cycle traffic flows was 7.30am to 8.30am, with a less pronounced afternoon peak from 3.00pm to 6.00pm. These times correspond with the peak times for reported cycle collisions in the Ministry of Transport records.

More men than women rode cycles in the adult age group, but among secondary school students equal numbers of males and females cycled. Half of all the primary and intermediate school cyclists observed were wearing helmets. Among secondary school students nearly twice as many females wore helmets as males. The adult age group had the lowest wearing rates.

Target groups for cycle helmet wearing promotion should therefore be male secondary students and all adults. At the time of the survey a number of schools had made decisions to institute compulsory helmet wearing for their students at the beginning of the following year, but only two private girls' schools had introduced compulsory helmet wearing at the time of the survey in September 1989.

It is important that helmet wearing continue to be monitored in the future, so that changes in wearing rates and patterns can be noted. This will help in targeting groups for cycle helmet promotion campaigns, and evaluation of those campaigns.

Cycle routes were used by a greater proportion of school cyclists than adults. However, the school and adult surveys showed that overall less than 10% of riding may be done on cycle routes.

It is recognised that for many cyclists the most direct route will often follow arterial routes, and that many cyclists will accept greater risk because of the convenience. This can result in conflicting policies since danger points (e.g. signals) on arterials can sometimes be made safer for cyclists, hence possibly attracting more cyclists on to arterials. The cyclists' perception of the relative safety of minor versus main roads and the extent of their willingness to accept risk in return for convenience is an important topic requiring additional research.

5 ADULT QUESTIONNAIRE

5.1 PURPOSE

The adult questionnaire aimed to improve understanding of:

1. The characteristics of people who cycle,
2. Cyclists' travel patterns,
3. Types of cycles and equipment used,
4. Collisions involving cyclists,
5. Cyclists' worries.

5.2 DEVELOPMENT OF QUESTIONNAIRE

Atkinson and Hurst (1984) conducted a major survey of cyclists in Palmerston North and Christchurch in 1979. This is described in section 1.2. The questionnaire used in their survey was based on one originally developed by Kaplan (1975). Atkinson and Hurst's questionnaire was used as a model for the questionnaire in the present study but it was expanded and rephrased in the first person to make it more personal.

Atkinson and Hurst said in their report that they had been "assured that helmets.... were rare". They did not therefore include questions on helmet wearing, although Kaplan's questionnaire had asked about them. However valid that assumption may have been in 1979, both helmet wearing attitudes and practices had clearly changed in 1989, so questions on helmets and reflective clothing were included in the questionnaires for the present study. Further questions were added to find out whether cyclists involved in collisions believed that wearing a helmet had or would have affected the severity of their injuries.

The only types of collisions explored in the earlier study were serious collisions experienced by cyclists. 'Serious' was defined there as "requiring a doctor or hospital visit". The present study used this definition of a serious collision, but incorporated a series of questions for 'minor' collisions as well. A minor collision was defined as "one where the respondent did not need to see a doctor or go to hospital", and therefore included non-injury collisions. These additional questions were added to discover more about the kinds of cycle collisions occurring in Christchurch. Three categories of collisions were thus identified from the adult questionnaire: serious, minor with injury, and minor without injury. Note that these definitions are not the same as the Ministry of Transport's injury definitions for use on Traffic Accident Report (TAR) forms.

The study team thought it would be useful to develop a profile of the kinds of people who use cycles. Standard questions were asked about age, sex and occupation as in the earlier study. Kaplan's original questionnaire included a question on trip purpose, but Atkinson and Hurst decided not to include it as they felt it led to a problem in analysis. The present study included a question on the main purposes for which respondents used their cycles, and a companion question on their main reasons for using a cycle rather than some other mode of transport. Questions on other vehicles owned and used, added to the demographic study of cyclists.

A draft of the questionnaire was tested with a small sample of respondents from the Christchurch City Council and the Canterbury Regional Council and some modifications resulted.

5.3 DISTRIBUTION

On Thursday 13th April 1989 three thousand adult questionnaires, together with covering letters and freepost envelopes, were attached by means of rubber bands to the seats of cycles parked on and off street throughout the city.

It was impractical to cover the whole city so distribution was concentrated in selected typical areas. These included all major shopping centres and inner industrial areas, the central city area inside the four avenues, Christchurch Hospital, the Polytechnic, the University and the College of Education. Thus a wide range of the city's adult cycling population received questionnaires.

The questionnaires were numbered to identify trip destinations and response rates from different areas. Confirmation of cyclists' destinations was established by using the description of the route travelled on that day's trip.

5.4 RESPONSE

Nearly 1,400 completed forms were returned giving a 46% response rate. The chance to win a prize in a draw may have encouraged respondents to complete the forms. However the return of the questionnaires was of course voluntary so the surveyed population may be biased towards cyclists who had collisions to report or those who had a particular point to promote. A personal interview of randomly selected participants may be worthwhile in a future study.

The study population was biased towards tertiary students. They made up 27% of the surveyed cyclists, although tertiary students make up only 4% of the population according to the 1986 Census. Although a higher proportion of tertiary students than other adults may ride cycles, it is felt that tertiary students have been significantly over-represented. The bias probably occurred because of the large number of questionnaires distributed at the University, College of Education and Polytechnic and the high response rate from students. To allow for this bias, tertiary student responses have been analysed separately from the rest of the respondent population where appropriate.

5.5 CHARACTERISTICS OF CYCLISTS

5.5.1 Occupation

The majority of respondents were employed full time (59%) or were tertiary students (27%). Table 8 shows the percentages in each employment category. As has been mentioned earlier (section 5.4), the survey sample contains a greater proportion of tertiary students than might be expected.

TABLE 8
Occupations of Respondents to the Adult Questionnaire

Occupation	Respondents Number	Percent	% Male
School Student	55	4.0%	65.5%
Tertiary Student	375	27.0%	50.9%
Employed Full Time	822	59.1%	65.6%
Employed Part Time	72	5.2%	30.6%
Unemployed	23	1.7%	60.9%
Retired	23	1.7%	73.9%
Homemaker	16	1.2%	0.0%
Other	5	0.4%	unknown
Total	1392	100%	

5.5.2 Age and Sex

The survey population had a higher percentage of males (59%) than females (41%). The proportions of males to females were approximately equal amongst tertiary students of whom 53% were male, while in the other occupational groups 61% were male. Table 9a shows the respondents in the adult survey in five year age groups. Table 9b corresponds with the ages in the field surveys.

TABLE 9a
Five Year Age Groups of Respondents to the Adult Questionnaire

	Tertiary Students		Other Cyclists	
Age Groups	Total	% Male	Total	% Male
0 - 4	0		0	
5 - 9	0		0	
10 - 14	0		17	47.1%
15 - 19	139	51.1%	107	48.6%
20 - 24	179	49.2%	180	45.6%
25 - 29	33	51.5%	175	56.6%
30 - 34	17	64.7%	144	70.8%
35 - 39	5	60.0%	121	74.4%
40 - 44	1	100.0%	90	74.5%
45 - 49	0		63	77.8%
50 - 54	0		46	67.4%
55 - 59	0		34	73.5%
60 - 64	1	0.0%	17	58.8%
65 - 69	0		9	66.7%
70 - +	0		10	80.0%
Unknown	0		7	42.9%
Total	375		1020	

TABLE 9b
Age Groups of Respondents to the Adult Questionnaire

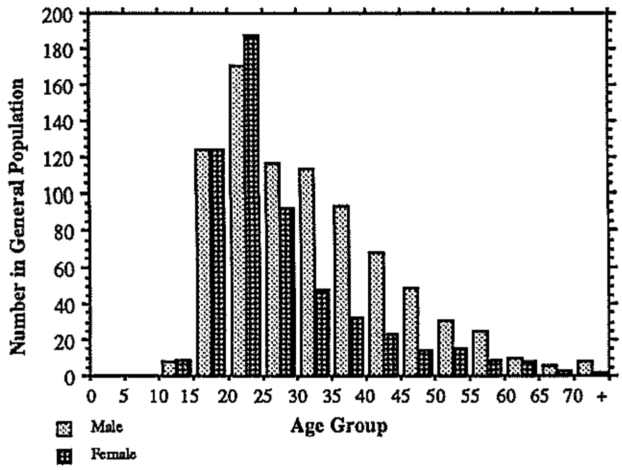
Age Groups	Tertiary Students Total	% Male	Other Cyclists Total	% Male
0 - 12	0	0.0%	2	50.0%
13 - 17	13	30.8%	55	56.4%
18 - 29	338	50.9%	422	49.5%
30 +	24	62.5%	534	72.7%
Unknown	0	0.0%	7	42.9%
Total	375		1020	

Respondents ranged from 12 years to 83 years of age. Up to the age of 25, numbers of males and females were approximately equal in the survey population. Over the age of 25 males outnumbered females.

This may be partly because of the greater proportion of males in the workforce. The 1986 Census figures show that 58% of the total workforce in New Zealand are male and 42% are female. Women may also find other forms of transport more convenient for transporting other family members and shopping.

FIGURE 10a
Age Distribution of Tertiary Respondents

FIGURE 10b
Age Distribution of Respondents to the Adult Questionnaire Excluding Tertiary Students



The average age of tertiary students was 22 years while the average age of all other occupational groups was 34 years.

The average age for males was 31 while for females it was 27 with an average age for the total surveyed population of 30 years.

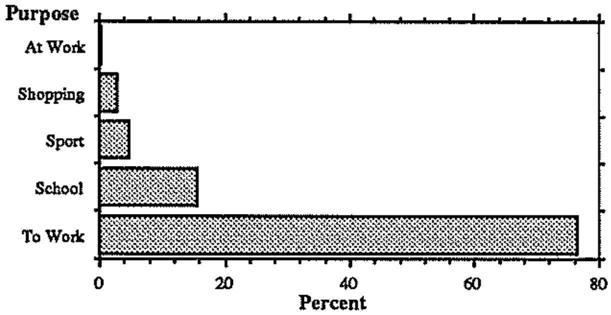
5.5.3 Purposes of Cycling

The primary purpose of cycling for most respondents was to get to and from work (76%) or school (16%). This is shown in Table 10 and Figure 11. Some tertiary students classified their daily journey as work and some as school. Thus most cyclists were using their cycles primarily as a means of commuting. Second choices for purpose of cycling were sport and recreation (46%) and shopping (31%).

TABLE 10
Purposes of Cycling for Adult Respondents

Purpose	1st Choice		2nd Choice		3rd Choice	
To work	998	76.5%	85	7.6%	22	2.7%
School	204	15.6%	37	3.3%	15	1.8%
Sport	62	4.8%	520	46.5%	306	37.0%
Shopping	35	2.7%	343	30.7%	382	46.2%
At work	5	0.4%	134	12.0%	101	12.2%
Total	1304	100%	1119	100%	826	100%

FIGURE 11
Primary Purpose of Cycling for Adult Respondents



Note: Primary purpose only

5.5.4 Reasons for Cycling

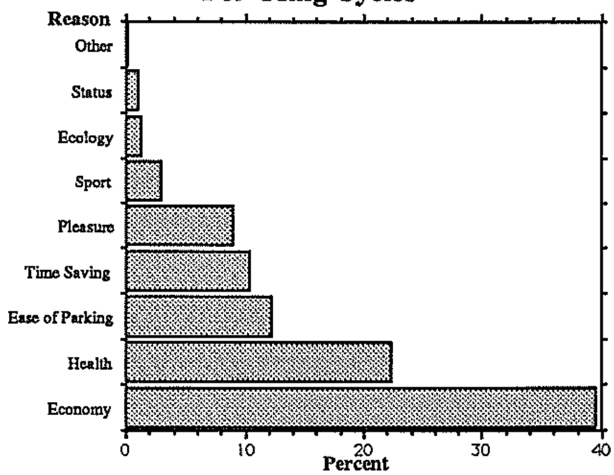
Economy was the prime reason for using a cycle across all occupational groups. It was named as the most important reason for cycling by 41% of respondents. Only about half as many cited health (22%). Very few respondents named either status or ecology (1% each) as most important. In future surveys it may be better to use the word environment rather than ecology, as it may be better understood. The reasons for cycling are shown in Table 11 and Figure 12.

Tertiary students appear to be less concerned than full-time workers about ease of parking. Low motor vehicle ownership amongst tertiary students may place the problem of motor vehicle parking outside the area of their immediate concerns.

TABLE 11
Adult Respondents' Reasons For Cycling

Reason	1st Choice		2nd Choice		3rd Choice	
Economy	475	41.2%	220	17.4%	192	16.0%
Health	257	22.2%	347	27.5%	243	20.3%
Ease of parking	140	12.1%	231	18.3%	235	19.6%
Time saving	119	10.3%	196	15.5%	177	14.8%
Pleasure	104	9.0%	195	15.4%	238	19.8%
Sport	34	2.9%	47	3.7%	5	0.4%
Ecology	15	1.3%	21	1.7%	57	4.8%
Status	12	1.0%	7	0.6%	4	0.3%
Other	1	0.0%				
Total	1157		1264		1200	

FIGURE 12
Adult Respondents' Primary Reasons For Using Cycles



Note: Primary purpose only

5.5.5 Travel Mode

Cyclists in the study population commonly used a cycle during the week and another mode of transport, usually a car or van, at the weekend. Lifestyles at weekends are better served by the convenience and speed of motor vehicles.

Table 12 shows that on weekdays the majority of respondents (94%) made most of their trips by cycle. For tertiary students this figure was even higher (97%), while for those employed full time it was 93% as shown in Table 13.

At weekends , however, only 37% of respondents made most of their trips by bicycle, the majority (61%) using a car or van instead. A much higher proportion of tertiary students (63%) used cycles at weekends than did those employed full time (20%).

TABLE 12
Weekday and Weekend Travel Modes for Most Trips

Mode	Weekdays		Weekends	
Bicycle	1231	94.2%	433	37.2%
Car or van	54	4.1%	706	60.6%
Motorcycle	5	0.4%	14	1.2%
Bus	14	1.1%	10	0.9%
Total	1304	100%	1163	100%

TABLE 13
Weekday and Weekend Travel Modes for Tertiary Students and Full Time Employed

Mode	Tertiary Students		Employed Full Time	
	Weekday	Weekend	Weekday	Weekend
Bicycle	363 97%	217 63%	724 93%	138 20%
Car or van	6 1.6%	119 34%	41 5.2%	537 78%
Motorcycle	1 0.2%	5 1.4%	4 0.5%	8 1.2%
Bus	3 0.8%	5 1.4%	7 0.9%	4 0.5%
Total	373 100%	346 100%	776 100%	687 100%

5.5.6 Other Vehicles Owned

The percentages in this section are of those respondents who were over the age of 15, which is the age at which they are legally allowed to drive in New Zealand.

The majority of respondents (86%) possessed drivers' licences, while 44% had a car or van and 9% had a motorcycle.

The percentage who had motorcycles was much higher than the percentage who used motorcycles for most trips either on weekdays (0.4%) or at weekends (1.2%).

More of those employed full time possessed drivers' licences (91%) and had cars or vans (60%) than did tertiary students of whom 88% had drivers' licences and 21% had cars or vans.

The high percentage of those respondents employed full time who had cars or vans seems to indicate that many of these people cycled from choice though low cost was probably a factor in that choice. Tertiary students, however, seemed less likely to own a motor vehicle.

TABLE 14
Driver's Licence and Vehicle Ownership among Adult Respondents

	Respondents	
Driver's licence holders	1194	85.6%
Car or van*	610	43.7%
Motorcycle*	129	9.2%

** Includes 92 respondents who had both a motorcycle and a car or van*

5.5.7 Cycle Equipment & Visibility

Most (87%) of the cyclists in the survey population had cycles with five or more speeds.

More than three quarters (78%) of respondents said that their cycles were fully equipped with lights, having both head and tail lights, while 3.6% had cycles with headlights only and 3.5% had tail lights only. Only 15% of respondents reported having no lighting at all on their cycles. These proportions are shown in Table 15a.

The percentage of respondents who had cycles without full lighting was therefore about the same as the proportion in Table 16 who said they did not ride at night (17%), but only 40% of those who did not ride at night had no lights. From observation there are numbers of cycles on the streets at night without lighting. Many cycle lights are detachable. Perhaps cyclists have lights and do not use them, while obviously some cyclists have lights but do not ride at night.

Rear or pedal reflectors were said to be on the cycles of 88% of respondents. There were no reflectors at all on the cycles of 12% of respondents.

TABLE 15a
Adult Respondents' Cycle Lighting

Lighting	Respondents		Do not ride at night
Head and tail Lights	1088	78.0%	106
Headlights only	51	3.6%	7
Tail lights only	49	3.5%	30
No lighting	207	14.8%	94
Total	1395	100%	237

TABLE 15b
Adult Respondents' Use of Reflectors

Reflectors	Respondents	
Rear reflectors	1068	76.5%
Pedal reflectors	165	11.8%
No reflectors	162	11.6%
Total	1395	100%

About 40% of respondents never wore reflective clothing at night, while 74% never wore it during the day. Seventeen percent said they did not ride at night.

TABLE 16
Use of Reflective Clothing by Adult Respondents

Worn	Night		Daytime	
Always	233	17.2%	71	5.3%
Usually	160	11.8%	62	4.6%
Sometimes	181	13.4%	214	15.8%
Never	542	40.1%	1004	74.3%
Don't ride at night	237	17.5%		
Total	1353	100%	1351	100%

5.5.8 Frequency of Helmet Wearing

Helmets were owned by 36% of respondents, and always worn by 21%, as shown in Table 17. They were worn usually or sometimes by 7.1% and 7.6% of those surveyed. These figures correspond well with the 34% wearing rate found in the field surveys.

TABLE 17
Frequency of Helmet Wearing by Adult Respondents

Helmet Worn	Respondents	
Always	293	21.5%
Usually	99	7.1%
Sometimes	103	7.6%
Never	869	63.7%
Total	1364	100%

5.6 TRAVEL

5.6.1 Distances Travelled

To determine the annual distances travelled by cyclists, respondents were asked to estimate the number of kilometres they travelled per month and the number of months they cycled during the previous year.

It was realised that the estimated distance would be somewhat subjective. Respondents were therefore also asked to estimate the distance ridden on that day's trip, and to describe the route taken. In this way respondents' estimates could be compared with the measured routes, and factors calculated to compensate for error.

To make this comparison, a 10% sample was extracted from the data files by selecting every tenth form. This ensured that the various distribution areas were equally represented. There was a sampling error of plus or minus 1.6%.

Table 18 shows that the sample was in fact fairly representative of the total respondent population.

TABLE 18
Comparison of Surveyed and Sample Population

	Survey Population		Sample Population	
Respondents	1395		140	
Travel Distance Estimated by Respondent				
Male	823	59.0%	84	60.0%
Female	568	40.7%	55	39.1%
Unknown sex	4	0.3%	1	0.7%
Travel Distance Not Given by Respondent				
Male	42	3.0%	4	2.9%
Female	71	5.1%	9	6.4%
Unknown sex	1	0.3%	1	0.7%
Odometers	54	3.9%	5	3.6%

Respondents were asked to describe their route beginning with the intersection nearest the respondent's home and covering the journey to the point at which the questionnaire was received. In some cases the intersection nearest the home was not the place from which the respondent had set out. This was checked by identifying the route. In future studies this information could be used to plot cyclist routes by converting the route to grid reference points. It was decided not to include this exercise in this study because of time constraints.

The routes were measured on a 1:25,000 street map of Christchurch. This exercise indicated that cyclists over-estimated their distance travelled by 16.1%. On average, males over-estimated the distance travelled by 16.7% and females by 15.4%, as shown in Table 19.

When calculating annual distance travelled, these percentages were used as factors to correct respondents' estimates as shown in Table 20.

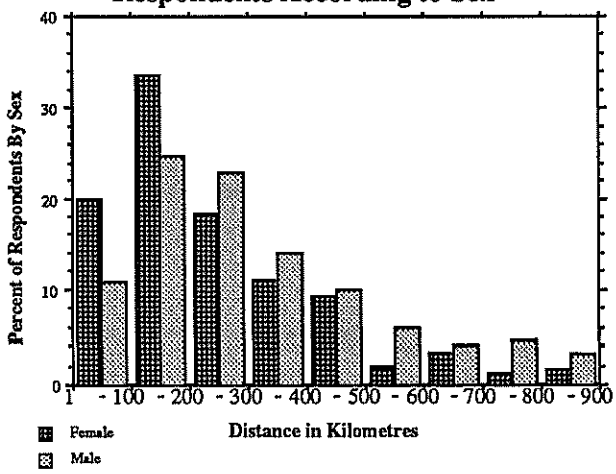
TABLE 19
Distance Estimation Errors for that Day's Trip

Distance (km)	Male	Female	Combined
Average Estimated Distance	4.88	4.94	4.90
Average Measured Distance	4.18	4.28	4.22
Percentage Error	16.7%	15.4%	16.1%

TABLE 20
Annual Distance Cycled by Adult Respondents

Factors	Males	Females	Combined
Estimated annual distance	2232	1541	1947
Correction factor	4.18/4.88	4.28/4.94	4.22/4.90
Corrected annual distance	1912	1335	1677

FIGURE 13
Monthly Cycling Distance for Adult Respondents According to Sex



In all, 771 males and 479 females (90% of respondents) gave both their average monthly distance cycled and the number of months they cycled per year. From their responses the average annual distance cycled was derived by calculating each cyclist's annual distance. This gave a figure of 2232 kilometres for males and 1541 kilometres for females. These distances were then corrected by the factors obtained from the 10% sample. Male cyclists thus averaged 1912 kilometres per year, travelling 43% further than female cyclists, who averaged 1335 kilometres per year. The 1395 cyclists surveyed travelled approximately 2.34 million kilometres during 1988, averaging 1677 kilometres each.

Males used their bicycles, i.e. rode them on three or more days per month on average for 11.0 months and females on average for 10.4 months during the year.

5.6.2 Routes and Facilities

Cycle routes have been established in the city progressively over the last 15 years. They are marked by standard blue cycle signs. These routes were chosen to encourage cyclists to use routes with less traffic and which avoid busy intersections. They provide alternatives to main roads and also link cycleways and cycle tracks.

Of the cyclists who gave their monthly cycling distance, 1254 also indicated the percentage travelled on the various types of road facilities. The number of kilometres cycled on each type of road facility was calculated by taking the annual distance travelled by each cyclist and multiplying that by the percentage of cycling they had done on each of the road types.

It appears from Table 21 that less than 10% of the distance travelled by adult cyclists was along on- and off-street cycle routes.

It is possible that cycle routes were not conveniently located or that cyclists did not realise that they were riding on a cycle route. Some respondents added comments which showed that they did not understand or recognise the blue cycle route signs. It may be that cyclists used these routes without realising it. However, it seems likely that cyclists will choose the shortest or most convenient route to get to their destinations, and this usually is not a cycle route.

In 1989 there were about 120 kilometres of cycle routes, but about four times as many kilometres of arterial road. Cyclists were thus unlikely to find cycle routes more conveniently located than arterial roads for many of their trips.

To attract more cyclists, the cycle route system and its benefits may need more publicity. The network was originally laid out primarily to service school cyclists. It should perhaps be extended by designating more roads as cycle routes, thus providing more direct routes for adult cyclists, the majority of whom are commuters. However, the problem of busy multi-lane intersections remains largely unsolved.

TABLE 21
Road Types Used by Adult Respondents

Road Type	Total Kms	%Ridden
Major roads	1,593,000	68.1%
Minor roads	517,000	22.1%
On-street cycle routes	110,000	4.7%
Off-street cycle ways	77,000	3.3%
Other paths	44,000	1.9%
Total	2,341,000	100%

5.6.3 Seasonal Cycling Variations

Few cyclists seem to give up cycling in winter, though some cycle on fewer days per month, perhaps using other transport on very wet or cold days. Table 22 shows summer and winter cycling patterns. The average number of days per month cycled by respondents in summer was 23, while in winter it was 20.

TABLE 22
Seasonal Cycling Variations of Adult Respondents

Number of Days	Summer		Winter	
Every day	308	23.2%	227	17.1%
21-29	415	31.3%	303	22.8%
11-20 days	521	39.3%	603	45.5%
1-10	81	6.1%	177	13.3%
Zero	1	0.1%	16	1.2%
Total	1326	100%	1326	100%

5.6.4 Trips in Darkness

At least three quarters of adult cyclists said they rode in darkness at some time during the year. Eight trips in the dark were made on average per month in summer, with about half of all respondents making some trips. In winter on average 13 trips per month were made in darkness, with three quarters of respondents making some trips. Table 23 shows the trips made in darkness.

TABLE 23
Trips in Darkness by Season for Adult Respondents

Trips per Month	Summer		Winter	
21 plus	30	2.1%	136	9.7%
11-20	113	8.1%	365	26.2%
6-10	167	12.0%	256	18.3%
1-5	383	27.4%	292	20.9%
zero	702	50.3%	346	24.8%
Total	1395	100%	1395	100%

The average annual distance ridden in the dark by cyclists was calculated by taking the number of trips in darkness for each cyclist, together with the number of trips ridden during the last three days. These were combined with the average monthly distance and the number of days cycled in summer and winter months to estimate the annual distance cycled in the dark for each cyclist.

It was found that females rode on average 13% of their total annual average distance in the dark, and males 14%. This is shown in Table 24. There was no great difference in percentage of night riding between those employed full time and tertiary students.

TABLE 24
Distances Ridden in Darkness by Adult Respondents

Distance (kms)	Male	Female
Av. annual distance	1912	1335
Av. in darkness	275 (14.4%)	258 (12.9%)

5.7 COLLISIONS

5.7.1 Severity of Collisions

As in Atkinson and Hurst's study, a serious collision is defined in this study as "one where the respondent was injured enough to require seeing a doctor or visiting a hospital". A minor collision is defined as "one in which the respondent did not need to see a doctor or go to hospital", and includes non-injury collisions. Almost half (49%) of the minor collisions did not involve injury.

5.7.2 Collision Frequency

The questionnaire asked respondents whether they had ever had a collision while riding a bicycle. More than half (57%) of those who responded said that they had been in a cycle collision of some kind at some time during their cycling careers. About a fifth (18%) of all respondents said they had been in one or more serious collisions. About half of all respondents said they had been in one or more minor collisions and about an eighth had been in both serious and minor collisions. There was no great difference across the occupational groups.

TABLE 25
Number of Collisions Experienced by Adult Respondents

Number of Collisions	Serious		Minor	
Zero collisions	1143	81.9%	757	54.3%
One collision	190	13.6%	251	18.0%
Two collisions	46	3.3%	167	12.0%
Three collisions	9	0.6%	91	6.5%
More than three	7	0.5%	129	9.2%
Total	1395	100%	1395	100%

More males (62%) had been involved in cycling collisions than had females (49%). Six percent of males and four percent of females said they had been in serious collisions only. For minor collisions only, the figures were 40% of males and 35% of females. Sixteen percent of males and ten percent of females said they had been in both serious and minor collisions. Males had thus been involved in more collisions of both kinds than had females. However, when exposure was taken into account, males were less likely than females to be involved in collisions per kilometre travelled. It may be that distance travelled is also a factor in the preferential weighting given to women drivers by some insurance companies in other countries. Figure 14 below and Table A-4 in the Appendix show collision involvement by sex.

FIGURE 14
Collision Involvement for Adult Respondents According to Sex and Severity

5.7.3 Exposure to Risk of Collisions

The 1395 cyclists averaged 1677 kilometres in 1988 (section 5.6.1). The questionnaire asked for the date and year of the last serious collision in which each respondent was involved. The answers to this question showed that at least 48 serious collisions had been experienced by respondents during 1988. They therefore experienced 2052 serious collisions per 100 million kilometres travelled in that year.

This may be compared with the rate of 2120 "cyclist injuries from accidents with motorists" per 10^8 kilometres reported by Atkinson and Hurst (1984). However, the figure of 2052 obtained in the present study reports serious cycle collisions from all causes. At least 59% of serious collisions in the present study did involve a motor vehicle, but the questionnaire did not specifically ask respondents whether a motor vehicle was involved. There may have been a few collisions in which a motor vehicle was struck as a secondary collision object.

In the Ministry of Transport report "Motor Accidents in New Zealand, Calendar Year 1986", the reported motor vehicle collision rate is given as 73.3 injury collisions per 100 million kilometres for the year 1985. These were the latest figures available to the study team. The estimate of distance may not be entirely accurate, but it does give a basis for working out the relationship between motor vehicle and cycle collision rates.

The Road Research Unit's manual for calculating roading benefits and costs (TR9) (National Roads Board 1986) advises in their Table A6-3 that there is on average, an under-reporting rate in injury collisions of 2.25 in urban areas. Using this factor the motor vehicle collision rate can be adjusted to 164.9 collisions per 100 million vehicle kilometres.

This gives a ratio of cyclist to motor vehicle collision rates of about 12.4 : 1 when assessed on distance travelled. Thus it seems that cycles may be about 12 times more likely to be involved in an injury collision per kilometre travelled than motor vehicles.

Cyclists were involved in 6841 minor collisions per 100 million kilometres travelled. This compares with 2052 serious collisions per 100 million kilometres travelled.

Female cyclists were estimated to be 25% more likely to be involved in a serious collisions than males for every kilometre travelled. However, male cyclists were not much more likely than females to be involved in minor collisions per kilometre travelled. This estimate was arrived at in the following way.

The 823 **male** cyclists reported a total of 30 serious collisions and 112 minor collisions during the year 1988. As male cyclists travelled 1912 kilometres on average per year, one serious collision was experienced for every 52,453 kilometres of cycle travel and one minor collision for every 14,050 kilometres. Male cyclists therefore experienced 1906 serious collisions and 7117 minor collisions per 100 million kilometres travelled.

The 568 **female** cyclists reported a total of 18 serious and 52 minor collisions during 1988. As female cyclists averaged 1335 kilometres that year, one serious collision was experienced for every 42,135 kilometres and one minor collision for every 14,582 kilometres of cycle travel. Female cyclists therefore experienced 2373 serious collisions and 6958 minor collisions per 100 million kilometres travelled.

When minor and serious collisions were combined there appeared to be no significant difference in male and female collision rates per kilometre travelled.

Measured over time, 1 in 27 male cyclists is likely to experience a serious collision in any given year, while for female cyclists the ratio is 1 in 32. For serious and minor collisions males were involved in collisions more frequently than females, with 1 in 4 male and 1 in 5 female cyclists experiencing some form of collision, including non-injury, in 1988.

5.7.4 Exposure Rates for Different Age Groups

A cyclist's risk of serious collision appears to diminish with age. When numbers of collisions experienced during the 12 months before the survey were analysed by age group, it was found that cyclists aged 13-17, the age group still at school, had the greatest involvement in collisions with 10% reporting a serious collision in the last year. The next two age groups had considerably fewer collisions. However, the numbers of respondents in the lowest age group were very small.

When distances ridden were taken into account, it was seen that the distances increased steadily over the three age groups, making the differences in collision rates greater.

TABLE 26
Collision Rates According to Age Group for Respondents to the Adult Questionnaire

	13-17	18-29	30 & over
Number of respondents	69	760	558
Number of serious collisions in 1988	7	25	16
Percentage	10.3%	3.3%	2.9%
Total distances travelled	82,000	1,201,000	104,000
Collision rate (collision/10^8 kilometres)	8526	2082	1538

5.7.5 Road Types on which Collisions Occurred

Because the study team wished to get an idea of the relative risk of riding on various road types, respondents were asked to indicate the kind of road facility they were riding along when their last collision occurred. No definitions were given for major and minor roads, and as mentioned earlier in the report (section 5.6.2) respondents may not have understood what was meant by a cycle route. The answers to this question were therefore rather subjective. However respondents were asked to describe the locations of both their riding and their collisions so that when rates of exposure to collisions were worked out, there should have been consistency in the answers.

Table 27 shows the numbers of collisions occurring on different road types. More collisions, both serious and minor, occurred on major roads than on minor roads. However, when the distances ridden on the different road types are considered (Table 21), it may be seen that greater distancs were ridden on major roads.

TABLE 27
Road Types on which Adult Respondents' Collisions Occurred

Road Type	Serious Collisions		Minor Collisions	
Major roads	170	64.4%	418	58.6%
Minor roads	73	27.7%	194	27.2%
On-street cycle routes	8	3.0%	12	1.7%
Off-street cycleways	5	1.9%	37	5.2%
Sports tracks	2	0.8%	4	0.6%
Other paths	6	2.3%	48	6.7%
Total	264	100%	713	100%

In fact when distances ridden were taken into account there was no great difference in safety between major and minor roads, with 1946 serious collisions per 100 million kilometres for major roads and 2321 serious collisions per 100 million kilometres for minor roads. The numbers of collisions occurring in the last 12 months on cycle routes and other paths were so small that no conclusions could be drawn from the results. However, cycle routes do not appear to be more dangerous than other roads. The number of collisions in the last twelve months on the various road types is shown in Table 28, and the collision rate per 100 million kilometres in Table 29.

TABLE 28
Collisions According to Road Type among Adult Respondents for 1988

Road Type	Serious	Minor	Total
Major roads	31	100	131
Minor roads	12	40	52
On-street cycle routes	3	2	5
Off-street cycle ways	0	10	10
Other paths	1	8	9
Unknown	1	4	5
Total	48	164	212

TABLE 29
Adult Respondents' Collision Rates by Road Types per 100 Million Kilometres

Road Type	Serious	Minor	Total
Major roads	1946	6277	8223
Minor roads	2321	7736	10058
On-street cycle routes	2728	1819	4547
Off-street cycle ways	0	1295	1295

5.7.6 Collisions at Intersections

Nearly half of all cycle collisions, both serious and minor, occurred at or near intersections. This proportion is considerably lower than that in the cyclist collisions reported to the Ministry of Transport, where the figure was 66% (section 3.3.2). Of motor vehicle collisions reported in Christchurch for 1988 and 1989, 63% happened at or near intersections.

The lower percentage of intersection collisions in the survey responses probably stems from the fact that the survey responses include collisions that do not involve motor vehicles.

5.7.7 Collision Objects

Fewer than half (43%) of serious collision respondents listed a moving motor vehicle as the first thing with which they collided. For minor collisions the proportion was even smaller (35%). Collisions with stationary motor vehicles included 11% of cyclists who collided with opening vehicle doors. This event seems to be a common hazard for cyclists. Another 6.0% collided with parked vehicles, or those waiting to move.

Nearly a quarter of both serious (24%) and minor (23%) respondents said they struck the road. This included simply falling off, as well as such events as losing control in gravel. Respondents were in collision with other cyclists in 10% of cases for serious collisions and 11% of cases for minor collisions.

Table 30 shows that in 41% of serious collisions a motor vehicle was not the first thing struck, although it is possible that motor vehicles were involved in some of these collisions. Most of these collisions were not therefore required to be reported to the Ministry of Transport. For minor collisions this figure was 47%.

TABLE 30
Adult Respondents' Collision Objects

First Object Struck	Serious		Minor	
Motor Vehicles:				
Moving vehicle	100	42.6%	213	34.7%
Opening vehicle door	25	10.6%	67	10.9%
Parked vehicle	12	5.1%	39	6.4%
Veh. waiting to move	2	0.9%	6	1.0%
Non-Motor Vehicles:				
Road Surface	57	24.3%	141	23.0%
Cycle or cyclist	23	9.8%	66	10.7%
Kerb	10	4.3%	60	9.8%
Pedestrian	4	1.7%	15	2.4%
Dog	2	0.9%	7	1.1%
Total	235	100%	614	100%

5.7.8 Contributing Factors to Collisions

To try and establish the main causes of cycle collisions in Christchurch, respondents were asked to indicate factors which may have contributed to their last serious and minor collisions.

Answers to this question were of course subjective. Comments under 'other' often gave explanations of factors leading to the collision. Many of these comments amplified a category already indicated by the respondent. The results are shown in Table 31.

'Not seen in time' was the contributing factor indicated by the greatest percentages of both serious (43%) and minor (38%) respondents. From the comments in the 'other' category this was seen to include the opening of car doors on parked vehicles, motorists backing from driveways, and motorists and motorcyclists failing to give way.

Failure of motorists to be aware of cyclists is perceived by cyclists to be a major problem. Reflective clothing, helmets and cycle reflectors should therefore be encouraged in daylight as well as in darkness.

Motorists need to be more aware of cyclists and of cyclists' rights as fellow road users. Cyclists need to be educated to cycle defensively, to be aware of riding position and consistency of course and to indicate their intention to turn.

'Lost control' was listed as a factor by 25% of serious and 22% of minor collision respondents. Some respondents commented that they were drunk, not looking or lost concentration. A few cyclists also commented that they deliberately cycled rather than driving if they had been drinking.

Alcohol-impaired cyclists are at risk because they have far less control over their cycles. Cyclists should be made aware of their vulnerability when cycling without full control of their cycles.

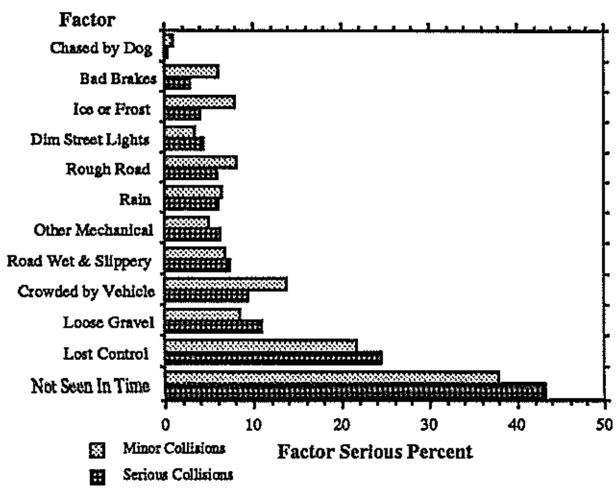
Loose gravel was considered to be a factor by 11% of serious and 8.5% of minor collision respondents. Some respondents indicated that they were crowded by a motor vehicle. Loose gravel occurs at intersections, between traffic lanes and along the sides of roads and also in work zones and recent road re-seals. Perhaps more attention should be paid by road controlling authorities to this problem.

The percentages in Table 31 do not add to a hundred, as they are percentages of those respondents who answered the question (272 serious and 731 minor). A number of respondents indicated more than one contributing factor.

TABLE 31
Contributing Factors to Adult Respondents' Collisions

Factor	Serious		Minor	
Not seen in time	118	43.3%	278	38.0%
Lost control	67	24.6%	159	21.7%
Loose gravel	30	11.0%	62	8.5%
Crowded by vehicle	26	9.5%	101	13.8%
Road wet & slippery	20	7.4%	49	6.7%
Other mechanical	17	6.2%	36	4.9%
Rain	17	6.0%	47	6.4%
Rough roads or bumps	16	5.9%	60	8.2%
Dim street lights	12	4.4%	25	3.4%
Ice or frost	11	4.0%	58	7.9%
Bad brakes	8	2.9%	44	6.0%
Chased by dog	1	0.3%	8	1.0%
Other	38	13.9%	75	10.2%
Total	381	>100%	1002	>100%

FIGURE 15
Contributing Factors to Adult Respondents' Collisions



5.7.9 Light Conditions at Time of Collisions

Table 32 shows the light conditions during which respondents' last serious and minor collisions occurred. It shows that 23% of serious collisions and 18% of minor collisions took place in conditions of poor light.

In section 5.6.4 it was found that when the annual distance cycled in the dark was calculated for each cyclist, about 14% of respondents' cycling on average was done in darkness. However, it is not possible to compare this figure with the light conditions for collisions as it is not known whether cyclists classified dusk and dawn as 'darkness'. There is, however, no evidence to suggest that it is more dangerous to ride in darkness than in daylight, unlike the situation for motor vehicles.

TABLE 32
Light Conditions at Times of Adult Respondents' Collisions

Conditions	Serious		Minor	
Night	21	7.8%	54	7.5%
Dusk	29	10.8%	47	6.5%
Dawn	11	4.1%	32	4.4%
Daylight	207	77.2%	587	81.5%
Total	268	100%	720	100%

5.7.10 Collisions and Helmet Wearing

Of those respondents who had been in collisions, only 23 (8.9%) of the serious collision respondents were wearing helmets as opposed to 106 (15%) of the minor collision respondents.

About half (52%) of the 23 serious collision respondents who wore helmets said they thought the helmet reduced the injury, while 24% of the 223 who were not wearing helmets felt that a helmet would have reduced the injury. The corresponding figures for minor collisions were much lower, being 31% (22 out of 70) and 5.9% (31 out of 521) respectively.

Nearly half (48%) of the serious collision respondents hit their heads or faces, while only 10% of those who had minor collisions did so.

Of those who hit their heads in collisions, 68% (11 out of 16) of serious collision respondents wearing helmets thought the helmet reduced the injury, while 90% (18 out of 20) of minor collision respondents who wore helmets thought so. Of those serious collision respondents who hit their heads, 13% (16 out of 127) wore helmets while 28% (20 out of 72) of minor collision respondents who hit their heads wore them.

It seems probable that the difference shown here between the serious and minor collisions, arises from potentially serious collisions being reduced to minor collisions because a helmet was worn.

5.8 CONCERNS OF CYCLISTS

At the end of the questionnaire respondents were asked to complete the statement "While cycling, what worries me most is...." The replies, which were very subjective, have been categorised and are summarised in Chart 1.

Responses to this question throw light on a variety of safety issues as perceived by cyclists themselves. Ninety seven percent (1355) respondents gave at least one fear or worry, and a total of 2587 concerns were listed by the 1395 cyclists.

Three classes of concern were identified in the responses. Worries about the cycling environment dominate, giving 2492 separate concerns. There were 44 worries about mechanical problems (1.9%) and 51 non-cycling worries (1.7%).

The latter included cycle theft but consisted mainly of worries remote from cycling such as "depletion of tropical rain forests" and "fear of nuclear war". These may have been entered flippantly, but wandering thoughts and inattention contribute to vehicle collisions.

Under the heading of Environment, "faults by other drivers" was the most common type of concern, making up 70% of the total worries while 4.7% of worries were about other cyclists. In 67% of all replies the concern was about inconsiderate drivers, mainly those perceived as violating the cyclist's right of way.

Nearly 10% of the total worries concerned road conditions, mainly road repair or maintenance. This agrees with the number of collisions said to be caused by loose gravel (section 5.7.8).

Twelve percent of worries were about the mere presence of other vehicles on the road. Two fifths of these involved heavy vehicles.

Fourteen percent of worries concerned cyclists' vulnerability. Included in this category were fear of not being seen by motorists, fear of being involved in a collision, and concern about the speed of motor vehicles.

Concern about intersections made up 8.3% of the worries, and concern about the safety of roundabouts appeared in 1.1% of worries. Nearly half of the "intersection worries" were concerns about violations of cyclists' right of way.

Of the 1395 surveyed respondents, nearly 30% were concerned about doors of parked vehicles being opened into their paths. This was the most significant specific concern, making up 16% of the total worries.

One possible reason for the frequency of this response may be that cyclists feel they have little control over this risk. The concern about opening car doors is three times as great as the percentage of collisions with car doors reported in the questionnaire responses (section 5.7.7).

5.9 CONCLUSIONS

Demographic data from the survey show that the typical adult cyclist rides to work or to an educational institution. The numbers of males and females in the sample were approximately equal up to the age of 25, but over that age males ounumbered females. The main reason given for cycling was economy, with health as the second reason.

Adult cyclists tend to use cycles during the week, but some other mode of transport during the weekend. Most cyclists had drivers' licences, while nearly half had a car, van or motorcycle, although this percentage is lower for tertiary students and higher for those in full time employment.

Questions about the visibility equipment of adult cyclists showed that just over three quarters of the riders sampled had both front and rear lights for their cycles. The percentage of cycles said to have no lights was about the same as the percentage of respondents who said they did not ride in darkness. Very few adult cyclists wore reflective clothing in daylight, and only 17% always wore it at night, although 25% wore it sometimes or usually at night

Helmets were owned by 36% of respondents. They were worn always by 21% of respondents, with about 7% wearing them 'usually' and a similar percentage 'sometimes'. It was encouraging to find that this wearing rate corresponded with the 34% wearing rate observed in the field surveys.

Less than 10% of cycling was said to be done on cycle routes, although there is doubt about how well cyclists recognised these cycle routes. More publicity and extensions of the cycle route network may be necessary.

Most cyclists ride in summer and in winter, although some cycle on fewer days in winter. At least three quarters of surveyed cyclists do some riding in darkness.

Male cyclists rode on average further than female cyclists. More than half of the cyclists surveyed had been in an injury collision at some time in their cycling careers. Males experienced more collisions than females, but when distance travelled was taken into account, females had more collisions than males per kilometre travelled. One in every twenty nine cyclists is likely to experience an injury collision in any one year. When data on collisions per kilometre travelled were compared with similar data for motor vehicles, it appeared that cyclists may be about 12 times more likely to experience an injury collision per kilometre travelled, than the drivers of motor vehicles.

Fewer than half of those involved in serious collisions hit a moving motor vehicle. In 40% of serious collisions a motor vehicle was not the first object struck. As the only collisions required to be reported to the Ministry of Transport are those involving motor vehicles, this means that about 40% of collisions in which the cyclist was injured enough to see a doctor or go to hospital were not reportable. This has serious consequences for the analysis of cycle collisions, especially when used for cycle planning and safety programmes.

Taking exposure into account, there does not seem to be much difference in the safety for cyclists of riding on major as opposed to minor roads. The numbers were too small to draw conclusions about the relative safety of cycle routes, but they do not appear to be more dangerous than other roads.

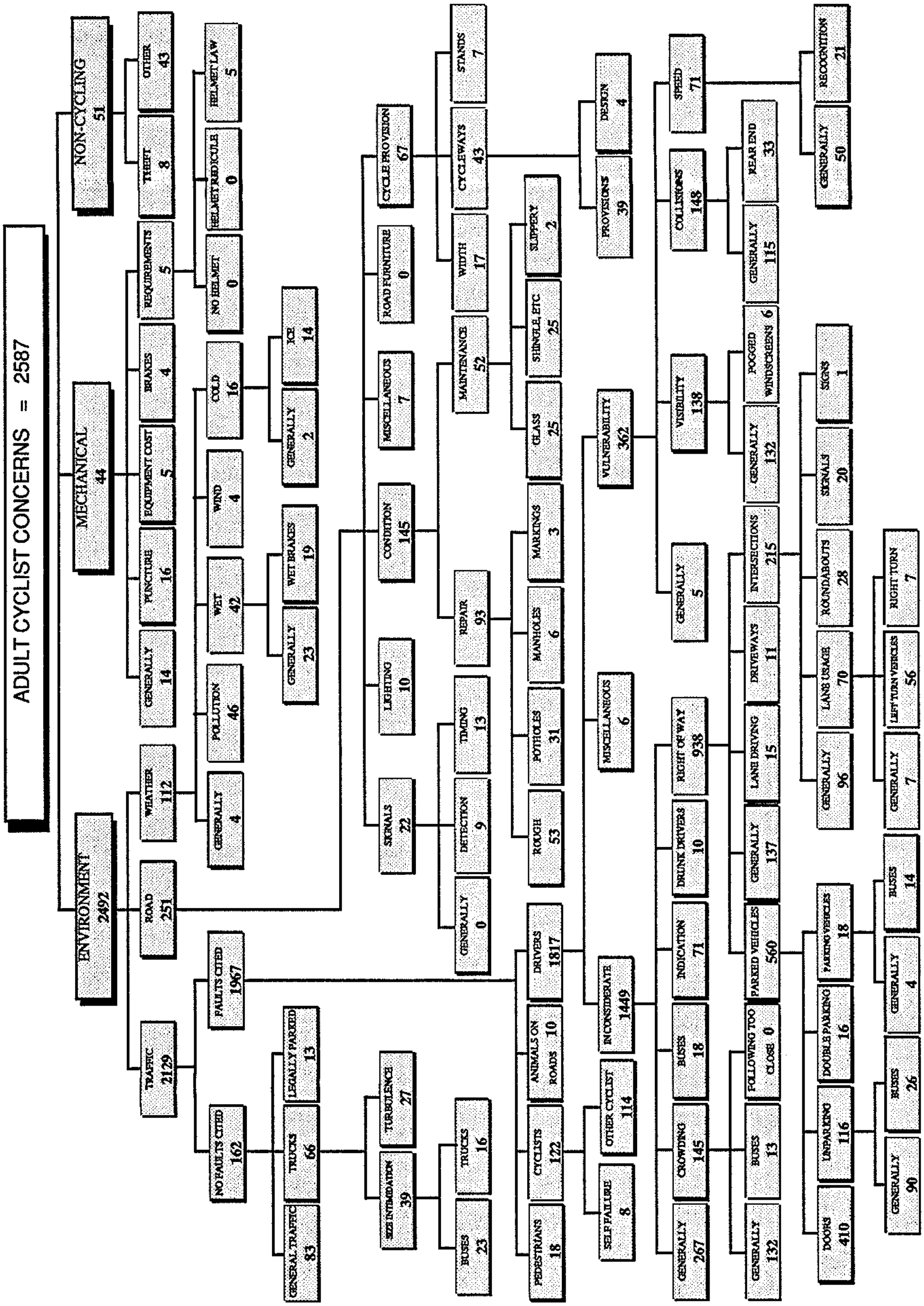
'Not being seen in time' was a contributing factor in nearly half of the respondents' serious collisions. Efforts should be made to promote awareness of cyclists in traffic amongst motorists, and to encourage them to check for cyclists before they open car doors. Cycles are vehicles under the road code and cyclists have the same rights as motor vehicle users. Cyclists, by the same token, have the same responsibilities as drivers of other vehicles. It has been noticed that some cyclists have very poor compliance with road rules, particularly at traffic signals. Cyclists are also drivers. The inference is obvious.

Cyclists should be educated in defensive cycling and encouraged to make themselves as visible as possible. They should also be encouraged to protect their heads from injury by wearing cycle helmets.

A higher percentage of minor collision respondents who hit their heads wore helmets than did serious collision respondents who hit their heads. Most (90%) of those wearing helmets and hitting their heads in minor collisions thought the helmet had reduced the injury, whereas for serious collisions the figure was 68%. These results indicate that potentially serious collisions may have become minor ones because helmets were worn.

When cyclists were asked at the end of the questionnaire, what worried them most when cycling, 'inconsiderate drivers' was the most common worry. Nearly 30% of respondents expressed concern about car doors being opened in front of them. This is three times as great as the proportion of respondents who actually collided with car doors. Perhaps cyclists worried about this hazard because they felt they had little control over it.

CHART 1
Adult Concerns



6 SCHOOL QUESTIONNAIRE

6.1 PURPOSE

The school questionnaire aimed to improve understanding of:

1. School students' travel modes,
2. Their cycling habits,
3. Types of cycles and equipment used by school students,
4. Collisions involving school cyclists,
5. Concerns of school cyclists.

6.2 DEVELOPMENT OF QUESTIONNAIRE

The school questionnaire was developed from the same model as the adult questionnaire (see section 5.2), but simplified in some areas.

The same definitions were used for serious and minor collisions as in the adult questionnaire. A serious collision was defined as one in which the respondent "was injured enough to require seeing a doctor or visiting a hospital", while a minor collision was one in which the respondent "did not need to see a doctor or go to hospital".

However, respondents were asked for details of minor collisions only where they were hurt, while the adult questionnaire collected information on all collisions. This came about because the adult questionnaire was finalised after the schools questionnaire and it was decided to collect extra information.

As in the adult survey, Atkinson and Hurst's questionnaire was taken as a model, and additional questions were incorporated to cover issues which may not have been relevant at the time of the earlier study, but which had now become relevant. Students were asked what mode of transport they used to get to school, and whether they had a drivers' licence, car or van, or motorcycle. Questions were asked about reflective clothing and cycle helmets, including a question to find out whether cyclists involved in collisions believed that wearing a helmet had or would have affected the severity of their injuries.

Respondents were asked to detail the routes they travelled to school, so that their estimated distances could be validated.

A draft of the questionnaire was tested with one class in a secondary school and some modifications were made. The question on kilometres cycled per month was removed (although it was retained in the adult questionnaire), as students in the trial found it difficult to answer, and it was decided that the answers were likely to be inaccurate.

6.3 DISTRIBUTION

Questionnaires were distributed by hand to all secondary and intermediate schools in Christchurch. Teachers at each school were contacted by telephone in advance and asked to have one class at each form level complete the questionnaires in class time under teacher supervision.

6.4 RESPONSE

More forms than necessary were distributed to ensure enough for classes of varying sizes. As a result of excellent co-operation from teachers, 3497 completed forms were collected from the schools, with responses received from 138 classes of the 146 asked for.

Because one class at each form level completed the questionnaires, the sample is biased in favour of small schools which do not have as many classes at each level. The sample is also biased in favour of senior forms, which have fewer classes. Corrections were made for this bias by scaling up the numbers at each form level to the total number in Christchurch schools in each form. The weighted data were used in the three questions most likely to be affected by the bias. These were form level, mode of travel to school and possession of drivers' licences. There was no great difference between the weighted and the unweighted figures, so it was decided to continue analysis using the unweighted data.

A number of students gave facetious or obviously misleading answers to questions. These answers were discarded, with the whole questionnaire being discarded in some cases. The most extreme example was a respondent who said that he was hit over the head by a telephone box with a birthday cake, and collided with a helicopter. The study team was not persuaded to include this specific category of collision.

6.5 CHARACTERISTICS OF RESPONDENTS

6.5.1 Age and Sex

Numbers of males and females in the schools were approximately equal and every student in each class surveyed was asked to complete a questionnaire. The numbers of male and female respondents in the survey sample were therefore approximately equal with 48% saying they were male, 50% saying they were female and 2.2% not answering the question or giving an invalid answer. The results of the field surveys reported in section 4.4.3 show that approximately equal numbers of male and female secondary students were in fact riding cycles.

Table 33 shows the percentages of students in the different age groups. Ages given ranged from 10 to 46, with 96% of respondents aged between 11 and 17.

TABLE 33
Ages of School Respondents

Age	Number	Percent
10	30	0.9%
11	340	9.7%
12	435	12.0%
13	595	17.0%
14	575	16.0%
15	567	16.0%
16	458	13.0%
17	368	11.0%
18	35	1.0%
over 18	21	0.6%
Missing	73	2.1%
Total	3497	100%

Table 34 and Figures 16a and16b show the proportions of the survey population in each form level, and how those proportions changed when the numbers were scaled up to the total numbers of students in the schools. The numbers in forms 1 and 2 were low in both weighted and unweighted populations as some primary schools include Forms 1 and 2 students, but they were not included in the survey.

TABLE 34
Form Levels of School Students

Form	Number Responses		Weighted Responses	
1	348	10.2%	3461	13.1%
2	450	13.1%	3678	13.3%
3	604	17.6%	4199	15.2%
4	563	16.4%	4372	15.8%
5	587	17.1%	5049	18.2%
6	481	14.0%	4172	15.1%
7	392	11.4%	2596	9.4%
Total	3425	100%	27707	100%

FIGURE 16a
Intermediate and High School Respondents by Form Level

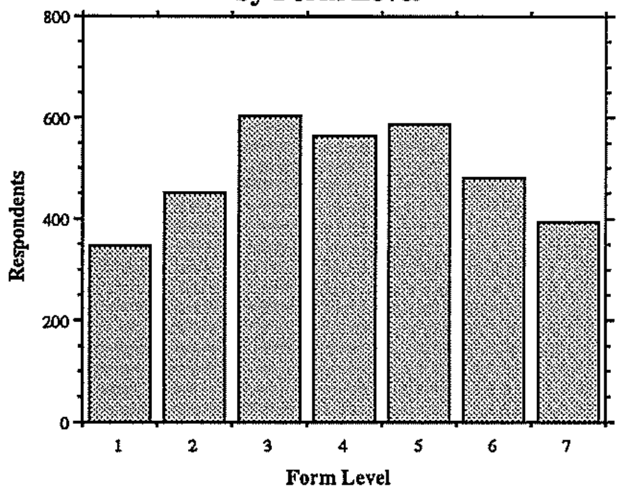
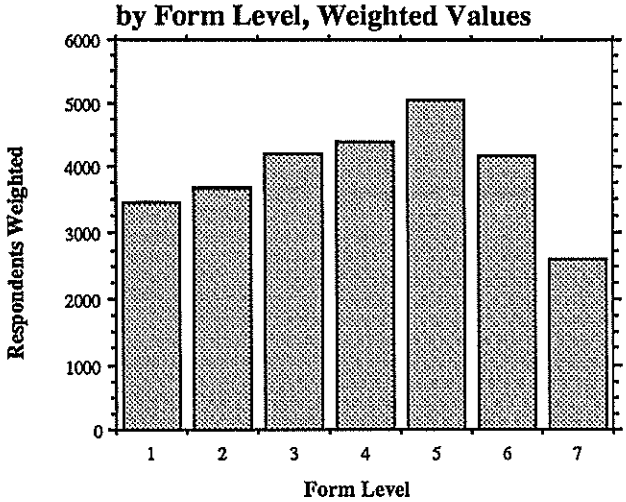


FIGURE 16b
Intermediate and High School Respondents by Form Level, Weighted Values



6.5.2 Travel Mode

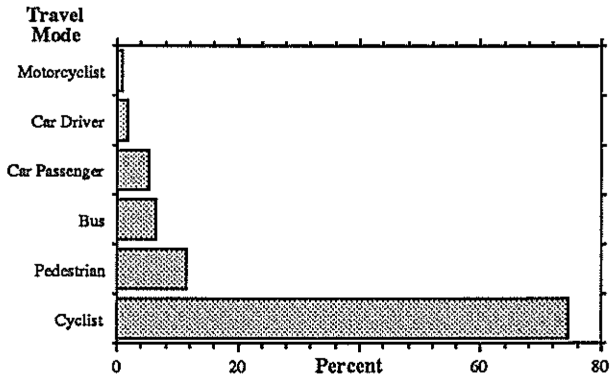
When students were asked for their mode of travel to school it was found that 74% travelled by cycle. Because it was felt that responses to this question would be affected by the bias toward senior forms, the weighted figures were used for the responses to this question. Some respondents indicated more than one mode of travel. Table 35 shows the different modes of travel to school.

TABLE 35
Mode of Travel to School

Travel Mode	Numbers	Percent
Cyclist	18,404	74.3%
Pedestrian	2827	11.4%
Bus passenger	1567	6.3%
Car passenger	1328	5.4%
Driver	428	1.7%
Motorcyclist	208	0.8%
Total	24,762	100%

Note: Weighted figures used

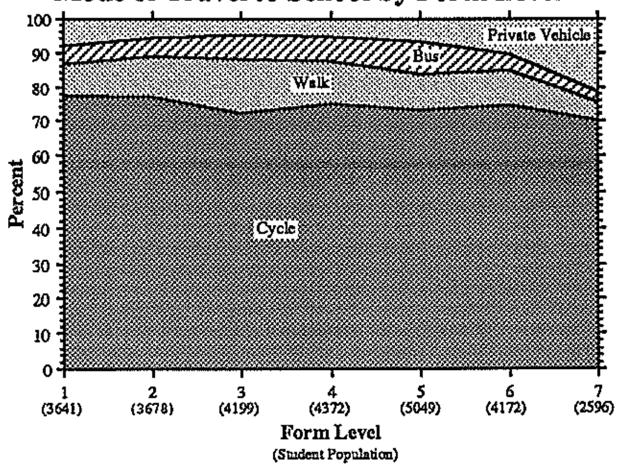
FIGURE 17
Mode of Travel to School



Note: Weighted figures

Mode of travel to school was analysed for each form level to see whether students cycled less as they progressed through the school system. It was found that the percentage of cycling remained fairly constant through the different form levels.

FIGURE 18
Mode of Travel to School by Form Level



Note: Weighted figures used

6.5.3 Cycle Equipment and Visibility

The majority (85%) of those respondents with bicycles, had cycles with 5 or more speeds, while 6.4% had cycles with 2-4 speeds and 8.1% had cycles with one speed only.

Few school students wore reflective clothing even at night. Although the percentages appear to be almost identical for day and night wearing, half the respondents stated that they did not ride at night. Table 36 shows the proportions of students wearing reflective clothing.

Reflective clothing is a valuable aid to cyclist visibility in the daytime as well as at night. Not being seen in time (shown in Table 48) is a contributing factor to cyclist collisions. It may be important to educate cyclists to make themselves more visible.

TABLE 36
School Students' Use of Reflective Clothing

Worn	Day		Night	
Always	103	3.0%	119	3.6%
Usually	74	2.2%	123	3.7%
Sometimes	293	8.8%	285	8.6%
Never	2822	84.8%	1030	30.9%
Don't ride at night			1760	52.9%
Unknown	37	1.1%	12	0.4%
Total	3329	100%	3329	100%

Of those students with cycles, 29% had cycles with complete lighting of both head and tail lights. A further 7.8% had tail lights only, and 5% had headlights only. This means that 58% of school respondents' cycles had no lighting. Table 36 shows that 53% of students said they did not ride at night. However 563 (32%) of those who did not ride at night did have lights for their cycles, so that some students appear to be riding at night without lights. Table 37a shows the proportions of students with lights for their cycles.

Rear or pedal reflectors were on the cycles of 93% of school students. Table 37b shows theproportions of students with reflectors for their cycles.

TABLE 37a
School Students' Cycle Lighting

Lighting	Respondents		Do not ride at night
Head and taillLights	961	29.0%	318
Headlights only	165	5.0%	76
Tail lights only	259	7.8%	169
No lighting	1928	58.1%	1197
Total	3313	100%	1760

TABLE 37b
School Students' Use of Reflectors

Reflectors	Respondents	
Rear reflectors	2587	78.0%
Pedal reflectors only	512	15.4%
No reflectors	214	6.4%
Total	3313	100%

6.5.4 Other Vehicles Owned

Most of the respondents (95%) said they had a bicycle. In the surveyed school population, 19% had a driver's licence, while 5.1% had a car or van and 5.2% had a motorcycle.Of those students in the survey over the age of 15, 46% had drivers' licences. After weighting the responses the percentage with drivers' licences was 18%, almost the same as the unweighted responses.

6.6 CHARACTERISTICS OF CYCLISTS

6.6.1 Definition of Those Who Cycle

Respondents were not asked specifically whether or not they cycled. It was therefore concluded that if they said they cycled to school or answered questions on purpose of cycling or collisions, they were cyclists. It was felt that this was a better measure of cycling than those who had a cycle, as respondents may have used cycles belonging to other people or had cycles and not used them.

Using this method 3329 respondents were classified as cyclists out of 3497 (95%).

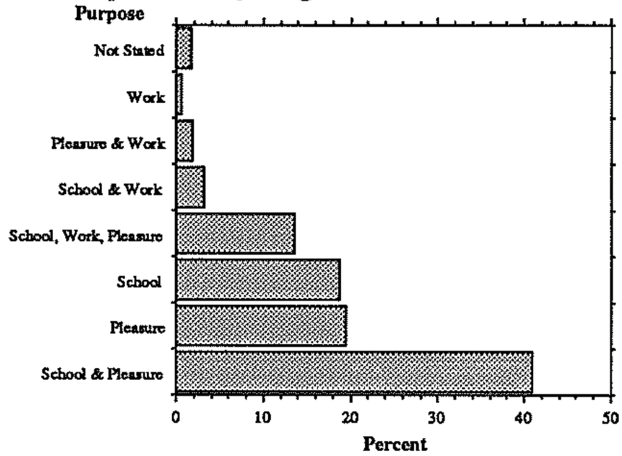
6.6.2 Purposes of Cycling

Of those who rode cycles, 76% of respondents used their cycles for travel to school, while 19% used their cycles for work and 76% cycled for pleasure. These categories were not exclusive and many respondents indicated more than one.

TABLE 38
Purposes of Cycling for School Students

Purpose	Numbers	Percent
School & pleasure	1357	40.8%
Pleasure	650	19.5%
School	625	18.8%
School, pleasure & work	452	13.6%
School & work	107	3.2%
Pleasure & work	63	1.9%
Work	19	0.6%
Nil	56	1.7%
Total	3329	100%

FIGURE 19
Purposes of Cycling for School Students



6.6.3 Helmet Wearing

Helmets were owned by 37% of those respondents who cycled. When respondents were asked whether they wore a helmet, 16% said that they always wore one, 62% never wore one and 19% wore one sometimes or usually. This si shown in Table 39.

School students who have helmets do not necessarily wear them every time they ride, but they do appear to wear them sometimes. As helmet wearing increases, it is hoped that the peer pressure to ride without helmets will be turned round so that there is pressure to conform by wearing them. It would be a positive step if the habit of carrying a helmet on the handlebars of the cycle instead of on the cyclist's head were to disappear.

TABLE 39
Frequency of Helmet Wearing by School Cyclists

Worn	Respondents	
Always	537	16.1%
Usually	396	11.9%
Sometimes	242	7.3%
Never	2079	62.4%
Unknown	75	2.2%
Total	3329	100%

6.7 TRAVEL

6.7.1 Distances Travelled

The average annual distance travelled to school by school cyclists was calculated by taking the estimated distance travelled by each cyclist on their usual route to school and multiplying this by the number of days each respondent said he or she rode to school during the last week. This number was multiplied by 40, the approximate number of weeks in a school year. That number was then doubled to get distance to and from school.

As with the adult questionnaire (section 5.6.1), a 10% sample of responses was extracted from the survey forms.There wa a sampling error of plus or minus 1.6%. The routes described in those responses were measured, and the measured and estimated distances compared. It was found that males over-estimated their distance travelled by 16.5% and females by 14.2%. This percentage became a correction factor for the school population.

When this was applied to the total school population, the average distance travelled to school was 3.28 kilometres for males and 3.09 kilometres for females. The combined average distance was 3.18 kilometres.

The annual average distance ridden by school cyclists both to and from school and outside school times was estimated using the number of days they rode in a month, and the number of trips said to be made in the days before the survey. Each trip was assumed to be the same length as the cyclist's trip to school. This however was an assumption that could not be verified. The annual distances estimated by this method were therefore not considered accurate enough to calculate exposure rates for school cyclists.

In future studies more information should be sought from school students about their riding on trips other than those to and from school.

It was estimated that the total annual cycling distance for school respondents was 2065 kilometres. Males appeared to ride considerably further in total (2339 kilometres) than females (1771 kilometres). The school travel for males was only slightly further than for females so it appears that they travel greater distances in their social and recreational cycling than do females.

The overall distances travelled by school students tended to increase with age up to the age of 15 after which they steadily decreased until the age of 18. No doubt this reflects the change in mode of travel as students begin driving cars.

Table 40 shows the average distances travelled to school and the annual distances for different ages.

TABLE 40
Daily Distances Ridden to School and Annual Distances of School Cyclists

Age	Numbers	School Distance (km)	Annual Distance (km)
10	14	2.16	1321
11	204	2.17	1545
12	296	2.62	1800
13	376	2.97	1991
14	397	3.62	2362
15	391	3.31	2337
16	316	3.67	2186
17	247	3.44	1905
18	25	3.10	1877
Over 18	13	4.84	
Total	1999	3.18	2065
Average for			
Males		3.28	2339
Females		3.09	1771

6.7.2 Routes and Facilities

About 8% of riding during trips to and from school was done on cycleways or cycle routes. The on-street cycle routes in Christchurch, as mentioned earlier in the report (section 5.6.2) are a system of roads recommended for cyclists. They have light traffic density, avoid busy intersections and are marked by standard blue cycle signs.

Table 41 shows the average annual distances ridden on the various road types by students on their trips to and from school. School cyclists appear to ride a greater percentage of their distance on minor roads (32%) than do adults (22%), and a lesser distance on major roads (57%) than adults (68%) (Table 21).

TABLE 41
Road Types Used by School Cyclists

Road Type	Distance (km)	Percent
Major roads	1.80	57.0%
Minor roads	1.03	32.0%
On-street cycle routes	0.13	4.1%
Off -street cycle ways	0.12	3.8%
Other paths	0.10	3.1%
Total	3.18	100%

6.7.3 Seasonal Cycling Variations

To compare summer and winter rates of cycling, respondents were asked for the number of days they cycled in February and March 1989 and the number of days cycled in June and July 1988. This was defined more precisely for school students than for adults, because schools are closed during midsummer. The results were then converted to days per month to correspond with the results from the adult questionnaire. However the answers were approximate, as students may have had trouble recalling their cycling habits from the previous year.

More school students cycled every day in summer than in winter and some students did not cycle in winter, but generally the difference between summer and winter cycling was not great. Table 42 shows the patterns of summer and winter cycling.

TABLE 42
Seasonal Cycling Variations for School Cyclists

Number of Days Cycled per Month	Summer		Winter	
Every day	789	23.7%	687	20.6%
21-29	1305	39.2%	1371	41.2%
11-20	461	13.8%	402	12.1%
1-10	442	13.2%	456	13.7%
Zero	332	10.0%	413	12.4%
Total	3329	100%	3329	100%

6.7.4 Trips in Darkness

Respondents were asked to indicate how many trips they made in darkness in February and March 1989 and in June and July 1988.

As shown in Table 43 the number of trips was similar in summer and in winter with nearly half of the respondents who cycled making some trips in darkness in both summer and winter. This compares with 75% of adult respondents cycling in darkness in winter (Table 23)..

TABLE 43
Trips in Darkness by School Cyclists

Number of Trips per Month	Summer		Winter	
16 plus	127	3.8%	133	4.0%
11-15	72	2.2%	84	2.5%
6-10	222	6.7%	262	7.9%
1-5	1084	32.6%	1024	30.8%
Zero	1821	54.8%	1825	54.8%
Total	3326	100%	3328	100%

6.8 COLLISIONS

6.8.1 Collision Definition

A serious collision was defined in this study as "one where the respondent was injured enough to require seeing a doctor or visiting a hospital". A minor collision was defined as one in which the respondent "did not need to see a doctor or go to hospital" (see section 5.7.1). In the school questionnaire, respondents were asked to record minor collisions only in which they were hurt, so information on non-injury collisions was not collected.

6.8.2 Collision Frequency

Half of those respondents who cycled (51%) said they had been involved in a collision at some time in their cycling careers. This percentage was about the same as that for adult respondents (57%).

More males (59%) than females (43%) had been involved in collisions.

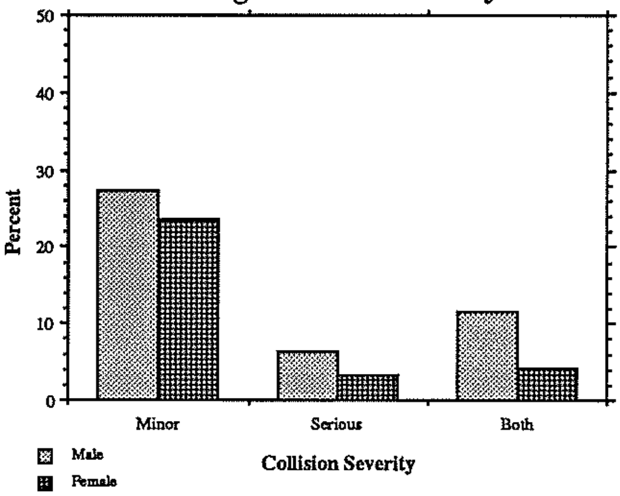
Eleven percent of respondents had been in at least one serious collision between April 1988 and March 1989, while 31% of respondents had been in at least one minor collision during that period.

TABLE 44
Number of Collisions for School Cyclists, April 1988 to March 1989

Number of Collisions	Serious		Minor	
Zero	2930	89.1%	2280	69.3%
One	275	8.4%	585	17.8%
Two	55	1.7%	221	6.7%
Three	11	0.3%	95	2.9%
More than three	17	0.5%	83	2.5%
Total	3288	100%	3288	100%

Males had more collisions, both serious and minor in the 12 months before the survey than did females. Serious collisions were experienced by 18% of males and 7.3% of females, while 39% of males and 28% of females had minor collisions. Figure 20 below and Table A-6 in the Appendix show collision involvement according to sex and severity.

FIGURE 20
School Cyclists' Collision Involvement According to Sex and Severity



6.8.3 Collisions According to Age

The greatest proportion of serious and minor collisions occurred in the 14-and 15-year age groups in the survey sample. Ministry of Transport records for the same period show 17 year olds as having the greatest proportion of collisions. The survey sample contained proportionately fewer 17 and 18 year olds because some of them had left school. It also had a smaller proportion of 10, 11 and 12 year olds because those Forms 1 and 2 students who attended primary schools were not included in the survey.

Table 45 shows the number and percentage of collisions occurring at each age.

The numbers of collisions recorded by respondents as having occurred in the 12 months prior to the survey were much higher than expected. It is probable that school cyclists recorded collisions which occurred outside the 12 month period asked for in the questionnaire. In future surveys greater accuracy would be achieved if students were asked to record all their collisions, and to detail the month and year of their last collision, as the respondents to the adult survey were asked to do.

Because of concern about the accuracy of the collision data and because the method of estimating the annual distance was based on an assumption about trip length, which may not have been accurate, no exposure rate was estimated for school cyclists.

TABLE 45
School Cyclists' Collisions According to Age

Age	Serious		Minor	
10	2	0.6%	12	1.2%
11	28	8.0%	110	11.1%
12	35	10.0%	133	13.5%
13	54	15.5%	149	15.1%
14	62	17.8%	181	18.3%
15	80	23.0%	180	18.2%
16	48	13.8%	136	13.8%
17	33	9.5%	73	7.4%
18	5	1.4%	9	0.9%
Over 18	1	0.3%	4	0.4%
Total	348	100%	987	100%

6.8.4 Road Types on which Collisions Occurred

Respondents were asked to indicate the type of road they were riding along when their collision occurred. 'Major' and 'minor' roads were not defined, and respondents may not have understood what was meant by an on-street cycle route. The answers to this question were therefore rather subjective.

It was not possible to estimate the relative safety of the different road types for school students. The proportions of cycling on different road types shown in section 6.7.2 were only those for cyclists' trips to school, while the collisions shown in Table 46 occurred during all cycling done by respondents.

TABLE 46
Road Types on which School Cyclists' Collisions Occurred

Road Type	Serious		Minor	
Major roads	201	47.9%	382	37.1%
Minor roads	154	36.7%	479	46.5%
On-street cycle routes	7	1.7%	10	1.0%
Off-street cycle ways	14	3.3%	41	4.0%
Sports tracks	27	6.4%	55	5.3%
Other paths	17	4.0%	63	6.1%
Total	420	100%	1030	100%

6.8.5 Collisions at Intersections

Of those who had been involved in serious collisions, 38% said their last such collision occurred at or near an intersection, while for minor collisions this figure was 28%.

These proportions were much lower than those for adult respondents, for whom 49% of serious collisions and 50% of minor collisions occurred at intersections.

For cyclist collisions reported to the Ministry of Transport the percentage was even higher (66%). As discussed in section 5.7.6 the proportion of collisions occurring at intersections was lower in the survey responses probably because the only cyclist collisions reported to the Ministry of Transport were those involving motor vehicles.

6.8.6 Collision Objects

Only 33% of serious collision respondents said that the first object with which they collided was a moving motor vehicle. For minor collisions the proportion was even lower at 17%. This compares with 43% for adults in serious collisions and 35% for adults in minor collisions.

This difference between the school and adult results may be in part because school cyclists tend to travel over roads with less traffic and to avoid busy intersections. It is also possible that the way school cyclists ride, often travelling in groups and sometimes playing the fool, may contribute to the high percentage of collisions with objects other than motor vehicles.

A motor vehicle, moving or stationary, was the first object struck in fewer than half (48%) of serious school cyclist collisions. It is possible that motor vehicles were involved in a few more of these collisions indirectly or as secondary collision objects, but it seems that about half of all serious school student collisions did not involve a motor vehicle and therefore were not required to be reported to the Ministry of Transport. Table 47 shows the objects struck first in collisions by school students.

TABLE 47
School Cyclists' Collision Objects

First object struck	Serious		Minor	
Motor Vehicles:				
Moving vehicle	131	33.2%	168	17.3%
Parked vehicle	31	7.8%	67	6.9%
Opening vehicle door	16	4.1%	51	5.2%
Veh. waiting to move	10	2.5%	33	3.4%
Non-Motor Vehicles:				
Road Surface	97	24.6%	281	28.9%
Cycle or cyclist	48	12.2%	159	16.3%
Kerb	29	7.3%	153	15.7%
Pole or post	17	4.3%	12	1.2%
Dog	12	3.0%	25	2.6%
Pedestrian	4	1.0%	24	2.5%
Total	395	100%	973	100%

6.8.7 Contributing Factors to Collisions

'Lost control' was the factor indicated most often by school students (35% for serious collisions). The proportion indicating this factor was greater than in the adult survey (25%). School students are generally less experienced cyclists than adults and their style of riding is very different. It seems from comments in the 'other' category for this question that school students play the fool with their friends, daydream, and do not always concentrate on their riding. A few school students said that they were drunk (see section 5.7.8).

'Loose gravel' was the second most common contributing factor (26% for serious collisions). As mentioned in the adult survey, loose gravel occurs at intersections, between traffic lanes and at the sides of roads as well as in work zones and areas of recent re-sealing.

'Not seen in time' was third in importance for school respondents. This contrasts with the adult questionnaire results where it was the most common contributing factor. The difference probably results from the routes taken by school students leading them into less conflict with motor vehicles.

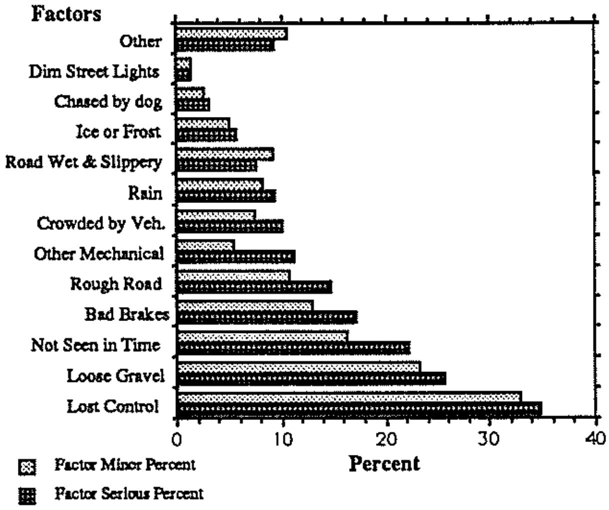
School cyclists appear to have problems with mechanical failures of their cycles. Bad brakes contributed to 17% of their serious collisions and other mechanical problems to 11%. This contrasts markedly with the adult survey where the corresponding figures were 2.5% and 6.5%. Reminders to students that cycles need continuing maintenance and checking may increase their cycling safety. Mechanical problems identified included wheels, seats and pedals falling off and lights and other objects becoming entangled in wheels.

Many respondents indicated that more than one factor contributed to their last collision. The percentages in Table 48 are of respondents and therefore do not add to 100%.

TABLE 48
Contributing Factors to School Cyclists' Collisions

Factor	Serious		Minor	
Lost control	158	34.8%	425	32.9%
Loose gravel	116	25.6%	299	23.2%
Not seen in time	101	22.2%	209	16.2%
Bad brakes	78	17.2%	168	13.0%
Rough road or bumps	67	14.8%	139	10.8%
Other mech. problem	51	11.2%	70	5.4%
Crowded by vehicle	46	10.1%	95	7.4%
Rain	42	9.3%	104	8.1%
Road wet & slippery	35	7.7%	118	9.1%
Ice or frost	26	5.7%	66	5.1%
Chased by dog	14	3.1%	34	2.6%
Dim Street Lights	6	1.3%	18	1.4%
Other	42	9.3%	135	10.5%
Total	782	100%	1880	100%

FIGURE 21
Contributing Factors to School Cyclists' Collisions



6.8.8 Light Conditions at Time of Collision

Light conditions were poor in 23% of serious collisions and 22% of minor collisions. This is similar to the percentages for adult cyclists. Table 49 shows the light conditions in which collisions occurred.

TABLE 49
Light Conditions at Time of School Cyclists' Collisions

Light Conditions	Serious		Minor	
Full daylight	335	77.4%	852	78.4%
Night	23	5.3%	43	4.0%
Dusk	45	10.4%	107	9.8%
Dawn	30	6.9%	85	7.8%

6.8.9 Collisions and Helmet Wearing

For school respondents there seems to be little difference in helmet wearing between those who had serious collisions (20%) and those who had minor collisions (21%).

There was not a great difference in the proportion of those wearing helmets and involved in serious collisions who thought wearing a helmet reduced the injury (65%), and those wearing helmets and involved in minor collisions who thought wearing a helmet reduced the injury (50%).

Of those who were not wearing helmets, 20% of serious and 8.8% of minor collision respondents thought that a helmet would have reduced the injury. These figures are shown in Table 50.

TABLE 50

School Cyclists' Collisions and Helmet Wearing

	Serious Collisions			
Injury Reduced	Wore Helmet		No Helmet	
Yes	55	64.7%	68	19.6%
No	25	29.4%	249	71.9%
Unknown	5	5.8%	29	8.3%
Total	85	100%	346	100%

	Minor Collisions			
Injury Reduced	Wore Helmet		No Helmet	
Yes	119	50.2%	77	8.8%
No	97	40.9%	709	81.4%
Unknown	21	8.8%	85	9.7%
Total	237	100%	871	100%

6.9 CONCERNS OF CYCLISTS

As in the adult questionnaire, respondents were asked to complete the statement "While cycling what worries me most is...." The replies were categorised and summarised in Chart 2 which may be found on page 31.

At least one worry was given by 2897 school respondents, and a total of 3243 concerns were listed by the 3498 respondents.

The worries were classified under three main headings, as they were for the adult responses. Worries about the cycling environment gave 3075 separate concerns, while there were 178 worries about mechanical failures and 90 non-cycling worries.

Mechanical failures made up 5.4% of the worries. This was higher than the percentage of mechanical worries among adult respondents (1.9%). School students worried most in this category about punctures (2.0% of total worries) and inadequate brakes (1.1%).

It may be that school students have poor maintenance habits, or that they believe their cycle equipment is inadequate for the cycling situations they encounter.

Non-cycling worries (2.7%) as in the adult questionnaire, included cycle theft but consisted mainly of concerns which had no connection with cycling.

Under the heading of 'Environment', 'faults by other drivers' was the most common type of concern, as it was in the adult survey, making up 76% of total worries. Other cyclists accounted for 6.8% of worries. In 44% of all worries, inconsiderate drivers were of concern, mainly in terms of violating the cyclist's right of way.

Opening doors on parked vehicles made up 12% of school cyclists' concerns. This was less than for adult cyclists (16%) but as in the adult responses it was greater than the percentage of collisions with car doors (3.5%) reported in the questionnaire responses. One reason for this may be that it is a hazard over which cyclists see themselves as having little control.

Worries expressing the cyclists' feelings of vulnerability made up 23% of concerns. This was greater for school cyclists than for adults (14%).

Intersections generally were not of great concern to school cyclists (2.7% of worries as compared with 8.3% for adult respondents). Nearly two thirds of school cyclists' worries concerning intersections were about roundabouts.

A smaller proportion of school respondents expressed concern about road conditions (4.9%) than did adult respondents (nearly 10%).

Among the school cyclist worries 2.6% were specifically about drunk drivers, compared with 0.3% of adult respondent worries. Secondary school students are probably not often on the roads during the hours when one would expect to find drunk drivers. It may be that road safety advertising campaigns aimed at young people promote the idea that the only unsafe drivers are drinking drivers.

A striking difference between the adult and school responses was in the area of self-criticism. In 4.4% of their worries, school cyclists felt that their own actions or attitudes on the road were of concern. Only 0.3% of adult cyclist worries came into this area.

6.10 CONCLUSIONS

Among school cyclists numbers of males and females were approximately equal. Nearly three quarters of the students in the survey rode their cycles to school. Three quarters of them rode for pleasure. School cyclists rarely wore reflective clothing even at night and 58% of them had no lights for their cycles. However, 53% of students said they did not cycle at night.

Of the students in the sample, 74% travelled to school by cycle. The percentage of students cycling to school remained fairly constant through the different form levels, with only a slight decrease among those in the seventh form where the use of cars increased. Helmets were worn at least sometimes by 36% of school cyclists.

School students cycled on almost as many days in winter as they did in summer and nearly half of them made some trips in darkness even in summer. This suggests that a significant amount of cycling is done by school cyclists apart from trips to and from school.

Half of all school cyclists had been involved in a cycle collision at some time. A smaller proportion of their collisions were with moving motor vehicles, and a smaller proportion of their collisions occurred at intersections than those of adults. One reason for this may be that they travelled over routes with a lower density of traffic and fewer busy intersections than the routes travelled by adult cyclists.

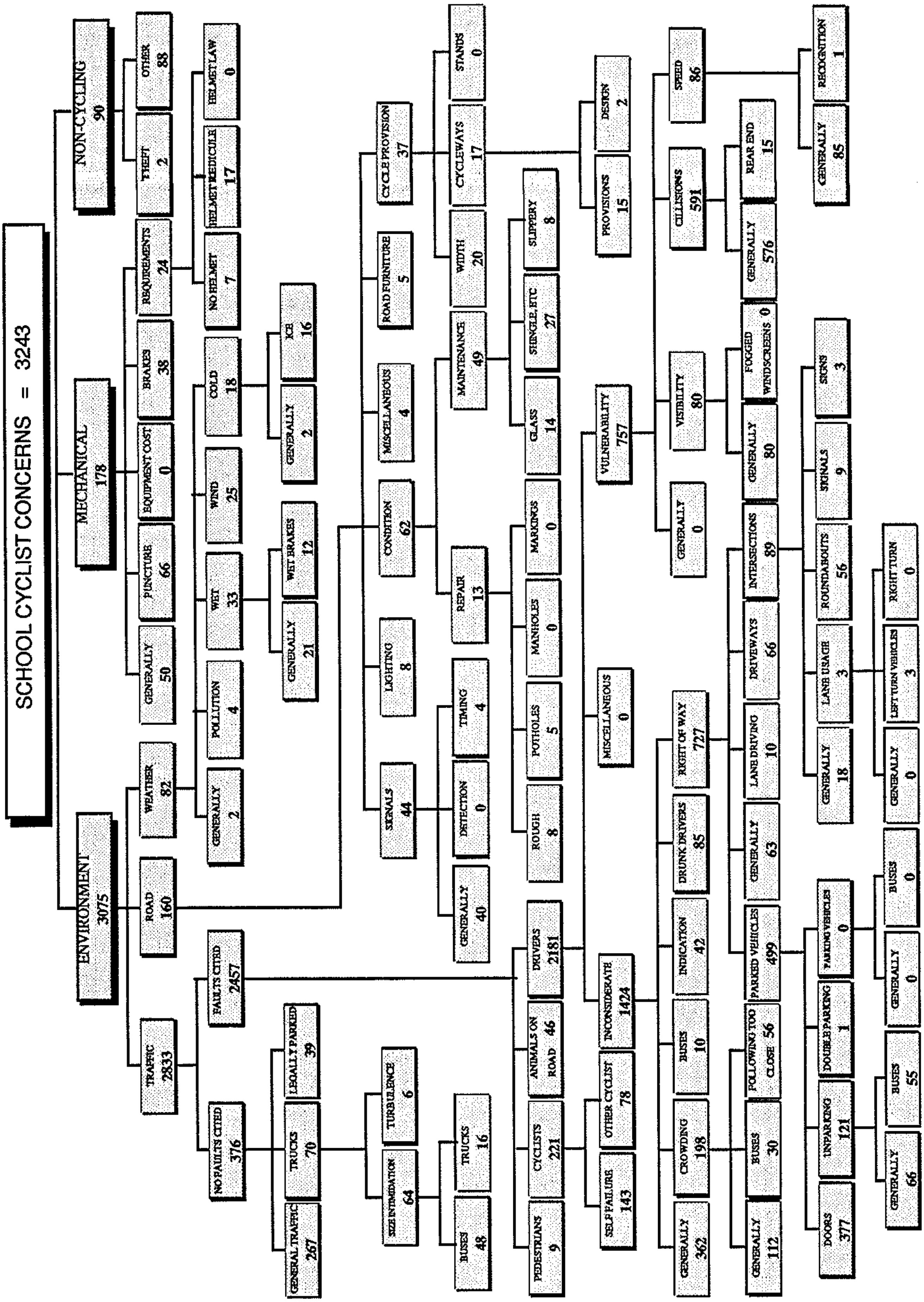
School students were involved in a greater proportion of collisions involving loss of control than were adults, and a smaller proportion where they were not seen in time. These differences may be partly a result of the way school students ride and partly because they tend to come into less conflict with motor vehicles on the routes they travel. They had a greater proportion of collisions resulting from mechanical failure than did adult cyclists and more collisions in which loose gravel was a factor.

Motor vehicles were collision objects in only about half of those school cyclist collisions resulting in injury. It is therefore likely that a smaller proportion of them appeared in the Ministry of Transport records than did adult cyclist collisions. Because the statistics on cyclist collisions collected by the Ministry of Transport are incomplete, collisions resulting from factors such as bad cycle maintenance, loose gravel, wet roads and bad road surfaces probably tend to appear proportionately less in the Ministry records than those caused by conflict with motor vehicles. It is important that more comprehensive data be collected from sources such as hospital emergency departments, so that planning and safety programmes can take account of all kinds of cyclist collisions.

When school cyclists were asked what worried them most when cycling, a total of 3243 concerns were listed by the 3498 respondents. Fear of mechanical failure made up 5.4% of the worries, much higher than among adult respondents. (1.9%). School students may have poor maintenance habits or perhaps they feel that their cycles are not adequate to cope with the situations in which they find themselves.

The percentage of school cyclists who expressed concern about drunk drivers was much higher than for adults. Road safety campaigns in schools have concentrated on awareness of the dangers of driving while affected by alcohol. Students may feel that the only dangerous drivers are those who are drunk. If they extend this idea to their own driving practices there is a danger that they may feel that the way they drive is unimportant, they will be safe as long as they remain sober.

CHART 2
School Student Concerns



7 MEDICAL SURVEY

7.1 PURPOSE

The purpose of the medical survey was to:

1. Estimate the proportion of collisions reported to the Ministry of Transport,
2. Obtain data on the type and severity of cyclist injuries,
3. Determine the effect of cycle helmets on injury type and severity.

7.2 DEVELOPMENT OF QUESTIONNAIRE

To get information from injured cyclists about their collisions and the type of injury sustained, a one page questionnaire was developed after discussion with the Royal New Zealand College of General Practitioners. The questionnaires were bound into books of 50, and distributed to 35 major medical centres in Christchurch as well as to Burwood Hospital and the Emergency Department at Christchurch Hospital. This covered most of the places where injured cyclists were likely to be taken for treatment. Staff were asked to complete a form for each injured cyclist who arrived for treatment.

7.3 RESPONSE

Only one centre declined to assist. The other centres agreed to support the project but only 19 of them returned forms. Some had no system in place to ensure that a form would be completed for all injured cyclists. Others saw no injured cyclists during the survey period. Thus it is likely that some injured cyclists were not surveyed.

It was intended that the forms be completed by medical staff to ensure an objective assessment of injury type and severity. However, because of constraints at Christchurch Hospital cyclist casualties arriving at its emergency department were given forms and asked to complete and return them to the researchers using a prepaid addressed envelope. This meant that the quality of the data varied considerably but it was possible to use some from each form.

The survey was to run for a period of six months from the beginning of May 1989. Because of the small number of responses received the survey period was extended by two months.

A total of 86 completed forms was received. It is not known what percentage of injured cyclists treated at these centres completed forms. The numbers of forms returned by each centre are shown in Table A-8 in the Appendix.

7.4 RESULTS

7.4.1 Reporting Rates

To estimate the proportion of cyclist injury collisions reported to the Ministry of Transport, the data in the Ministry of Transport records for the period 1 May 1989 to 31 December 1989 were compared with the data from the medical survey. During this period 172 cycle collisions were reported to the Ministry of Transport, 128 of which were collisions with motor vehicles involving injury. These are the only collisions which are required by law to be reported (see section 3.2).

In the medical survey there were 31 collisions in which motor vehicles were struck and which resulted in injury. All these should have been reported. Thirteen of these thirty one collisions were identified in Ministry of Transport records. This gives a reporting rate of 42% for cycle collisions involving motor vehicles and resulting in injury.

This is similar to the reporting rate found by John Bailey (1991) of 50% for cyclist collisions involving motor vehicles among patients at Christchurch Hospital Emergency Department. His study covered the months February, March and April 1988 and involved 74 cyclists.

Another five collisions from the medical survey were identified in Ministry of Transport records. These had been reported even though they did not involve motor vehicles. Thus the reporting rate for all injury cycle collisions, whether a motor vehicle was involved or not, was 21%, with 18 of the total 86 collisions in the medical survey successfully identified in Ministry of Transport records.

Ministry of Transport records therefore include only about one fifth of all the injury cycle collisions occurring in the city. This means that less emphasis has been placed on cycle safety programmes than might otherwise have been the case, because of the disparity in reporting rates between motor vehicle and cycle collisions. Table 51 shows the reporting rates found for cycle collisions.

TABLE 51
Collisions from the Medical Survey Matched with Ministry of Transport Data

	Medical Data	Collisions Matched	Reporting Rates
Reportable	31	13	42.0%
Non-reportable	55	5	9.1%
Total	86	18	21.0%

7.4.2 Locations of Collisions

The locations of 23 of the collisions were stated precisely. For 47 of the responses only a street name or suburb was given. The majority (95%) of collisions occurred on a public road. The types of locations where collisions occurred are shown in Table 52.

TABLE 52
Locations of Collisions Recorded in the Medical Survey

Type of Location	Number	
Public road	81	95.2%
Other public land	3	3.5%
Private property	1	1.2%
Total	85	100%

7.4.3 Times of Collisions

A specific time of incident was recorded in most cases. Of the 19 which had no specific time recorded, 7 were reported as "am" and 11 as "pm". In one case no information about the time was given. Table 53 shows the times of collisions.

TABLE 53
Times of Collisions Recorded in the Medical Survey

Morning Hour	Morning Number	Evening Hour	Evening Number
12-1	0	12-1	1
1-2	1	1-2	2
2-3	0	2-3	1
3-4	1	3-4	13
4-5	1	4-5	9
5-6	0	5-6	6
6-7	0	6-7	3
7-8	5	7-8	1
8-9	12	8-9	1
9-10	2	9-10	1
10-11	3	10-11	0
11-12	4	11-12	0
am	7	pm	11
	Unknown	1	

There are two distinct peaks in the distribution, the morning peak and a longer afternoon/evening peak. These peaks correspond to the peak cycle traffic times as seen in the field surveys (Figure 7), with an afternoon peak that begins during the hour that school finishes.

7.4.4 Environmental Conditions

Of the collisions for which the light and road conditions at the time of the incident were given, 80% occurred in daylight and 64% occurred on dry roads. Table 54 shows the light and road conditions at the time of the collisions in the medical survey.

When these figures were compared with the figures for cyclist collisions reported to the Ministry of Transport in Christchurch for 1988 and 1989, as shown in Table 3, it was seen that the number of collisions involving wet roads in the medical survey (36%) was double the proportion reported to the Ministry of Transport (14%). This difference is statistically significant. Presumably the difference occurs because the medical data included those collisions not involving motor vehicles, and wet roads may cause an increase in cycle only collisions.

The proportion of cycle collisions occurring in darkness in the medical data (21%) is not very different from that in the Ministry of Transport records (15%).

TABLE 54
Environmental Conditions for Collisions Recorded in the Medical Survey

	Daylight		Twilight or Dark		Total	
Dry Road	49	58.3%	5	6.0%	54	64.3%
Wet Road	18	21.4%	12	14.3%	30	35.7%
Total	67	79.8%	17	20.2%	84	

7.4.5 Collision Objects

Respondents were asked whether the object struck was moving or stationary. They were also asked to specify all the objects struck in the incident. The collision objects are shown in Table 55.

Only 24% of the collision objects were moving motor vehicles or doors opening in the paths of cyclists. The rest were stationary cars. The road and associated features, i.e. kerbs and poles, comprised 43% of the objects hit, while 17% of the objects hit were other cyclists.

TABLE 55
Collision Objects Recorded in the Medical Survey

Collision Object	Number	Percent
Motor Vehicles:		
Moving motor vehicle	17	18.9%
Vehicle waiting to move	2	2.2%
Parked vehicle	7	7.8%
Opening vehicle door	5	5.6%
Non Motor Vehicles:		
Road surface	25	27.8%
Kerb	14	15.6%
Cycle or cyclist	15	16.7%
Pedestrian	2	2.2%
Pole	1	1.1%
Other	2	2.2%
Total	90	100%

7.4.6 Age and Sex of Cyclists

Ages ranged from 7 to 63. High school students appeared to be especially at risk with 38% of the casualties (Table 56). Between the ages of 5 and 12 the numbers of males and females were equal. Over the age of 12 there were approximately twice as many males as females.

When Table 57 was compared with Table 4 from the Ministry of Transport reported collisions, it was seen that the percentages of casualties by age group were similar, with the 15 - 19 year age group having the greatest proportion of casualties and the 10-14 year age group next.

TABLE 56
Age Group and Sex of Respondents to the Medical Survey

Age Group	Male	Female	Total
0 - 4	0	0	0
5 - 12	5	5	10
13 - 17	21	10	31
18 - 29	20	8	28
30 - +	10	5	15
Total	56	28	84

TABLE 57
Age and Sex of Respondents to the Medical Survey

Age	Male	Female	Total	
0 - 4	-	-	-	
5 - 9	2	1	3	3.5%
10 - 14	13	9	22	26.1%
15 - 19	18	8	26	30.9%
20 - 24	9	2	11	13.0%
25 - 29	4	3	7	8.3%
30 - 34	2	1	3	3.5%
35 - 39	4	2	6	7.1%
40 - 44	1	1	2	2.3%
45 - 49	1	-	1	1.2%
50 - 54	1	-	1	1.2%
55 - 59	-	1	1	1.2%
60 - 64	1	-	1	1.2%
65 - 69	-	-	-	
70 & over	-	-	-	

7.4.7 Safety Equipment

Information was requested on the use of reflective or 'day-glow' material, the use of cycle lights, and the wearing of cycle helmets. Tables 58 and 59 show the use of reflective clothing and cycle lights among the respondents to the medical survey.

Of the 17 cyclists who had collisions in poor light conditions eight were using cycle lights and one was wearing reflective material. Of those riding in daylight 5 (6.0%) were wearing reflective or 'day-glow' material. The proportion wearing reflective clothing in the day time was about the same as the proportion in the adult and school questionnaires, but the proportion wearing it at night was lower than among the respondents to the questionnaires. However the numbers were so small that no conclusions could be drawn.

TABLE 58
Use of Cycle Lights by Respondents to the Medical Survey

Lights	Daylight		Dark		Total	
Yes	1	1.3%	8	10.1%	9	11.4%
No	61	77.2%	9	11.4%	70	88.6%
Total	62	78.5%	17	21.5%	79	100%

TABLE 59
Use of Reflective Material by Respondents to the Medical Survey

Worn	Daylight		Dark		Total	
Yes	5	6.0%	1	1.4%	6	8.1%
No	55	74.3%	13	17.6%	68	91.9%
Total	60	81.1%	14	18.9%	74	100%

The overall helmet-wearing rate was 36%. This was much the same as the wearing rate in the screenline counts. Those who have collisions do not appear to be more or less likely to wear helmets than the general population. Table A-10 in the Appendix shows helmet wearing for medical survey respondents.

7.4.8 Type and Severity of Injury

Of the 86 medical respondents 13 (15%) were said to be severely injured, 71 received minor injuries and in two cases the severity was not given. Table A-11 in the Appendix shows the injury types suffered by respondents to the medical survey.

Abrasions and lacerations made up the largest group of injuries. These accounted for 64% of all the injuries and involved 70% of respondents. Many of the casualties received more than one injury.

7.4.9 Location of Injury on the Body

A diagram of the human body (Figure A-8 in the Appendix) was included in the medical questionnaire to gather information on locations of injuries. Table A-9 in the Appendix shows the numbers of injuries to various parts of the body.

7.4.10 Effectiveness of Helmet Wearing

One of the purposes of the study was to determine the effect of the wearing of cycle helmets on injury type and severity. The locations of injuries as shown on the completed medical questionnaires were used to measure the effectiveness of helmet wearing in preventing head injuries. The responses were divided into those who wore helmets and those who did not.

Among those who wore helmets, 26% sustained head injuries. Of those who did not wear helmets 47% sustained head injuries. These results are shown in Table 60.

Expressed as a probability we see that the probability of an injury other than a head injury to a cyclist is:

42/31=1.35 with a helmet
76/52=1.46 without a helmet

These as might be expected are fairly similar. The probability of a cyclist suffering a head injury is:

8/31=0.26 with a helmet
26/52 =0.50 without a helmet

The difference between the second set of figures is much less similar than the difference between the first set of figures, thus the probability of of a cyclist with a helmet suffering head injury is considerably less than the probability of a cyclist with a helmet suffering some other type of injury.

These figures give a measure of the effectiveness of helmets in reducing head injuries.

TABLE 60
Location of Injury and Helmet Wearing in the Medical Survey

Injury Location	Helmet Worn	Helmet Not Worn	
Head	8 (25.8%)	26 (47.3%)	
Other body areas	42	76	
Total injuries	50	102	
Number of cyclists	31	52	86
Av. per cyclist	1.61	1.96	

7.5 CONCLUSIONS

It was unfortunate that, because of medical and support staff constraints, a much smaller number of medical forms was completed than had been expected. Because some of the forms were not completed by medical personnel, details of injury severity were not as useful as had been hoped. It is clear however that those cyclists wearing helmets suffered far fewer injuries to their heads than those without helmets.

One of the main purposes of the medical survey was to estimate a true and accurate reporting rate for cycle collisions in Christchurch. Only 21% of all the cases in the survey had been reported to the Ministry of Transport. There was a reporting rate of 42% for those collisions in the survey involving motor vehicles.

These low reporting rates mean that not only do the statistics from the Ministry of Transport include only one fifth of all cycle injury collisions, but that they are biased in favour of certain types of collisions as they generally include only those involving motor vehicles.

Perhaps cyclists should be encouraged to report more of their collisions to the Ministry of Transport. At the same time the Ministry should be encouraged to collect more data on cyclist collisions.

However, to get a real perspective on cyclist injury collisions, data from the emergency departments of hospitals, together with hospital admissions, will be necessary. If these data were collected in such a way that they could be compared with Ministry of Transport collision data, the result would be a comprehensive data base for all road traffic injury collisions. This could be used for planning and auditing road safety programmes and traffic engineering. Only area health organisations can provide an independent source of data for these purposes.

8 DISCUSSION

8.1 IMPROVEMENTS FOR REPEAT STUDIES

8.1.1 Introduction

During analysis of the results from the study it was found that there were areas where better information could have been obtained if some questions had been asked in different ways. There were instances where an interesting piece of information was tantalisingly close, but for the lack of one specific question it was unobtainable. Some of these areas have been documented here in the hope that researchers using this survey as a model in the future can improve their surveys.

8.1.2 Collision Reporting

School respondents were asked only for collisions which had occurred in the last twelve months. The question about the last collision experienced by respondents was altered in the adult questionnaire to include collisions during the respondents' entire cycling careers. Respondents were asked for the year and month of their last collision, so it was possible to extract collisions that occurred in the past twelve months when necessary. School cyclists were keen to detail collisions and probably included a number that occurred outside the twelve-month period stipulated.

In future studies, the school questionnaire should ask for collisions that occurred throughout respondents' cycling careers, with additional questions asking for the year and month of their last collision.

The **school** questionnaire asked for only those minor collisions in which the cyclist was hurt. Adult cyclists were asked about all minor collisions, including those in which no injury occurred. They were also asked whether they had been injured. The school questionnaire should collect data on all minor collisions.

8.1.3 Head Injuries

School cyclists were not asked, as adults were, whether they hit their heads in their last collision.

A better indication of the effectiveness of helmets could have been gained if both school and adult respondents had been asked about head and facial injuries in collisions.

8.1.4 Distances Travelled

A pilot test of the school questionnaire showed that students found the question on monthly distances travelled difficult to answer. It was therefore decided to delete the question from the school questionnaire as it was felt the answers would not be accurate. It remained however in the adult questionnaire. Not having this information meant that it was impossible to estimate an exposure to risk of collisions for school students. This meant also that school students were asked only about distances in relation to their travel to school and little information was collected on their travel for other reasons.

A series of simple questions should be asked in the schools questionnaire to estimate distances travelled, and more questions should be asked about cycling outside school travel.

8.1.5 School Cyclists

School cyclists were asked whether they owned a cycle but not whether they cycled.

The question about purpose of cycling in the school questionnaire should have the option 'do not cycle'.

8.1.6 Bias

The school survey was biased towards senior students, because one class at each form level in every school was asked to complete questionnaires, and senior form levels generally contain fewer classes than more junior forms. It is difficult to see how this could be avoided given the distribution system for the school survey. A factor derived from the total population in the schools at each form level was used in key questions to compensate for the bias towards senior forms.

Bias in the adult survey was caused by the method of distribution. A disproportionate number of questionnaires was distributed at tertiary institutions resulting in bias towards tertiary students.

In future surveys, the proportion of forms distributed at tertiary institutions should reflect the proportion of adult cyclists who are tertiary students or, if this information is not available, the proportion of the population who are tertiary students.

8.1.7 Definition of Road Type

In both the school and adult questionnaires cyclists were asked for proportions of distance cycled on major roads, minor roads and cycle routes. The different road types were not defined, so the answers were rather subjective.

Research should be carried out to discover how respondents perceive major and minor roads. Further studies should be conducted into the use and safety of cycle routes relative to other roads.

8.1.8 Occupation

In the adult survey full-time work was not defined in the question on occupation.

In future studies it would be helpful to restrict responses to one choice and to give full time work the same definition as appears in the latest Census. This would allow comparison with Census data.

8.1.9 Motor Vehicles Involved in Collisions

Although respondents were asked in both school and adult questionnaires for the first object struck in their collisions, they were not asked specifically whether the collision involved a motor vehicle.

This is one of the criteria which establishes whether a collision is required to be reported to the Ministry of Transport. For comparison with Ministry of Transport data, it would be helpful in future studies if respondents were asked whether a motor vehicle was involved in their last collision.

8.1.10 Field Surveys

In the field surveys it was found that cyclists at central city count locations were less representative of the city's cycling population than those at suburban locations.

In future studies, count locations in the suburbs rather than central city should be used for surveying cycle traffic so as to get a representative sample of cyclists. Possibly the use of a large cordon, such as the railway screenline, would be appropriate.

8.1.11 Medical Survey

The numbers of responses from the medical survey were not as large as had been hoped. Hospital constraints at the Emergency Department at Christchurch Hospital were such that staff could not complete the forms. Patients were asked to fill in the forms and return them, but the numbers collected were small. Many medical clinics did not have a system in place for completing forms, and did not record all the cyclist casualties passing through the clinic.

In future studies, support for such a survey should be enlisted from the local health authority and from medical practitioners. The most effective way to collect data on injured cyclists is through emergency departments. If area health organisations are serious about reducing road traffic collisions, they need to put systems in place to collect information that will enable planning and safety campaigns to be set up and monitored.

8.2 RECOMMENDATIONS

8.2.1 Reporting Rate

Overseas studies have shown that reporting rates for cycle collisions are low. Stutts (1990) showed that in North Carolina 10.5% of all cycle collisions involving injury appeared in police files, while 59.8% of those cycle collisions involving motor vehicles were reported.

Mills (1989) gave a reporting rate in Britain for "potentially reportable" cycle collisions of 32%.

Bailey (1991) found that 50% of cycle collisions involving motor vehicles and appearing in the records of the emergency department at Christchurch Hospital were also contained in the official records of the Ministry of Transport.

These figures correspond well with the reporting rate found in the present study. About 42% of cycle collisions involving motor vehicles in which someone was injured seriously enough to visit a doctor or go to hospital had been reported to the Ministry of Transport. For all cycle collisions involving injury, whether a motor vehicle was involved or not, the reporting rate was 21%.

This means that only one fifth of the cycle collisions resulting in injury in Christchurch appear in the Ministry of Transport records.

The Ministry of Transport statistics are incomplete and biased because they contain only those collisions which involve motor vehicles. A more complete data base for cycle collisions is essential if safety and planning programmes are to be targeted and measured accurately. Such a data base could best be established using data from hospital emergency departments. Road traffic casualties appearing in emergency department data could be compared with Ministry of Transport data and a comprehensive data base established.

Recommendation 1: That area health organisations collect data on road traffic collision casualties from emergency departments as well as from hospital admissions in such a way that they can be used in association with Ministry of Transport records.

Recommendation 2: That the Ministry of Transport encourage reporting of cycle collisions and collect more data on cycle collisions.

Transit New Zealand's Project Evaluation Manual (NRB 1986) for economic appraisal of roading improvement projects estimates that the expected ratio of actual injury cycle collisions to reported cycle collisions is 2.06. This equates to a reporting rate of 48%. These figures apply only to cycle collisions involving motor vehicles and are similar to the reporting rate for collisions involving motor vehicles in the present study of 42%. However the reporting rate found in the present study for all cycle collisions resulting in injury was 21%, which is equivalent to a ratio of 4.76.

Recommendation 3: That Transit New Zealand modify its Project Evaluation Manual (NRB 1986) to contain an additional figure showing the ratio of reported to actual cycle collisions for those cycle collisions not involving motor vehicles. This figure should be used in assessing projects where there is potential for reducing those cycle collisions in which motor vehicles are not involved. The figure of 4.76 would represent the reporting rate of 21% found in this study for cycle collisions of all kinds.

8.2.2 Injury Severity Index

It is difficult to discuss the severity of injuries received in collisions in the absence of an injury severity index. The terms 'serious' and 'minor' as used on Traffic Accident Report (TAR) forms are not defined precisely and rely on subjective assessment by traffic officers. New Zealand is not alone in having this problem. Mills (1989) shows that in police records in Britain, 30% of cycle casualties reported as slight casualties should have been classified as serious and 18% of those reported as serious casualties should have been reported as slight.

The medical questionnaire asked for an assessment of severity, but it also was subjective.

Research into road traffic casualties could be based on more precise information if the same index of severity were used for all hospital admissions and emergency department casualties. Use of the Abbreviated Injury Scale (AIS) or Injury Severity Scale (ISS) would allow comparisons with international records.

Recommendation 4: That area health organisations code injuries for hospital admissions and emergency department casualties according to an internationally recognised injury severity scale.

8.2.3 Education Programmes

Both motorists and cyclists should be targeted in education and public awareness programmes. This study shows a need for motorists to be made more aware of cyclists as fellow road users, and to check for cyclists in appropriate situations such as before opening car doors, and at intersections.

Recommendation 5: That organisations involved in road safety carry out education and publicity campaigns aimed at increasing motorists' awareness of cyclists on the road.

Cyclists need to know how to cycle defensively and with full concentration. They need to be encouraged to improve their conspicuity by using reflective and fluorescent bands and clothing, cycle lights and reflectors. There appears to be a place for cycle maintenance programmes in schools.

Recommendation 6: That organisations involved in road safety carry out education and public awareness campaigns aimed at encouraging cyclists to cycle defensively, to make themselves more visible, and to maintain their cycles.

This study has shown that cycle helmets appear to be effective in reducing head injury in cycle collisions. The helmet-wearing rate has risen in Christchurch as a result of education and public awareness campaigns.

Recommendation 7: That organisations involved in road safety continue programmes to encourage the wearing of cycle helmets.

8.2.4 Road Maintenance

Loose gravel on the roads contributed to significant proportions of both school and adult cyclists' collisions. Loose gravel occurs frequently on Christchurch streets in the middle of intersections and between lanes as well as along the sides of streets and in recent work zones. Greater efforts by road controlling authorities to keep streets clear of loose gravel and other debris would contribute to cycle safety in the city.

Recommendation 8: That road controlling authorities make greater efforts to keep the streets clear of loose gravel and other debris.

8.2.5 Cycle Routes

The study found that less than 10% of cycling appeared to be on cycle routes. It is important for the planning of cycling in the city that more information be collected on the extent to which cyclists are willing to give up the convenience of taking the most direct route for a safer but possibly longer one. The concept of "green arteries" where vehicular traffic is minimal and landscaped surroundings encouraged may be worth trying in a demonstration project.

Recommendation 9: That further research be carried out by local authorities into the use of cycle routes, with a view to either extending the network of cycle routes in the city or increasing the safety of cyclists on arterial roads.

8.3 RELATED PROJECTS

8.3.1 Monitoring Trends

The results of the field surveys in this study were used to set up a data base to monitor changes in cycle helmet wearing, showing the effects of education and public awareness campaigns and changes in public attitudes. The data is also useful as a base for measuring trends in cycle traffic flows. Cycle counts continue to be conducted at the suburban count locations in the city every six months.

Helmet wearing has risen since the survey. This will be reported in more detail in a separate research project.

Monitoring of trends in helmet wearing and cycle traffic should continue to be carried out.

8.3.2 Exposure Rates for Different Modes of Travel

A project to investigate the exposure rates for different modes of travel has been proposed. This would show whether the safety of one mode of travel increased at the expense of safety in other modes, and would help safety planning in the city.

Exposure rates to risk of collision should be investigated for different modes of travel.

8.3.3 Cycle Routes

The information on the safety of cycle routes was inconclusive, but cycle routes did not appear to be more dangerous than roads. Minor roads did not appear to be safer than major roads per kilometre travelled.

If routes for cycling appear to be safer, more people will use cycles rather than four-wheeled mode of transport. This will result in a lower level of pollution and less use of fossil fuels. Ensuring that people continue to use cycles will have economic and environmental advantages. Making cycling safer has wide implications.

The use of cycle routes and their safety should be monitored.

8.3.4 Alcohol and Cycle Collisions

A number of cyclists in both the schools and the adult surveys said that alcohol contributed to their collisions. Stutts et al,(1990) showed that in their study of cyclists treated in hospital emergency departments, 9.4% of cycle collisions among 15-19 year olds involved alcohol, as did 23.2% of collisions among those cyclists aged 20 or older. The present study did not ask specifically about alcohol involvement. Perhaps in future such a question should be added to the questionnaires.

Local health authorities should conduct a study into the involvement of alcohol in cycle injury collisions and cyclists should be made aware of their vulnerability when cycling under the influence of alcohol.

It might be interesting to assess the risk of cycling under the influence of alcohol relative to driving while alcohol impaired.

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APPENDIX

FIGURE A-1
1988 - 1989 Reported Cycle Collisions in Christchurch Classified by Type of Movement Identified by the Role of the Cycle

TYPE	A	B	C	D	E	F	G	OTHER	TOTAL
A Overtaking or Lane Changing	Pulling out or Changing Lane to Right 12 / 0	Head On 0 / 0	Cutting In or Changing Lane toeft 2 / 7	Lost Control (Overtaking Vehicle) 0 / 2	Side Road 0 / 0	Lost Control (Overtaken Vehicle) 1 / 20			15 / 29
B Head On	On Straight 2 / 2	Cornering 0 / 3	Swinging Wide 1 / 0	Both or Unknown 0 / 0	Lost Control On Straight Or Curve 0 / 1			0 / 1	3 / 7
C Lost Control or Off Straight Road	Out of Control On Road 0 / 0	Off Roadway To Left 0 / 0	Off Roadway To Right 0 / 0						0 / 0
D Lost Control Cornering	Lost Control Turning Right 0 / 0	Lost Control Turning Left 0 / 0	Missed Intersection Off End of Road 0 / 0						0 / 0
E Collision with Obstruction	Parked Vehicle 58 / 1	Collision or Break Down 0 / 0	Non-Vehicular Obstruction Including Animals 0 / 0	Workmens Vehicle 0 / 0					58 / 1
F Rear End	Slow Vehicle 1 / 10	Stopped or Slowed for: Cross Traffic 0 / 0	Pedestrian 0 / 0	Queue 1 / 1	Signals 2 / 0	Other 0 / 0			4 / 11
G Turning Versus same Direction	Rear of Left Turning Vehicle 4 / 0	Left Turn Side Swipe 18 / 0	Stoped or Turning from Left Side 0 / 10	Near Centre Line 0 / 1	Overtaking Vehicle 0 / 11				22 / 22
H Crossing (No Turns)	Right Angle (70 to 110 Degrees) 27 / 62	Acute Angle 0 / 0	Obtuse Angle 0 / 0					0 / 1	27 / 63
J Crossing (Vehicle Turning)	Right Turn Right Side 23 / 11	Right Turn Left Side 0 / 0	Two Turning 1 / 1	Left Turn Left Side 2 / 0	Left Turn Right Side 0 / 0			1 / 1	27 / 13
K Merging	Left Turn In 20 / 8	Right Turn In 2 / 8	Two Turns 0 / 0						22 / 16
L Right Turn Against	Stopped Waiting To Turn 0 / 0	Making Turn 73 / 14							73 / 14
M Manoeuvring	Parking or Leaving 2 / 1	"U" Turn 7 / 12	Reversing Along Road 0 / 0	Driveway Manoeuvre 10 / 4					19 / 17
N Pedestrian Crossing Road	Left Side 0 / 0	Right Side 0 / 0	Left Turn Left Side 0 / 0	Right Turn Right Side 0 / 0	Left Turn Right Side 0 / 0	Right Turn Left Side 0 / 0	Manoeuvring Vehicle 0 / 0		0 / 0
P Pedestrian Other	Walking With Traffic 0 / 0	Walking Facing Traffic 0 / 0	Walking On Footpath 0 / 0	Child Playing (Tricycle) 0 / 0	Attending To Vehicle 0 / 0	Entering or Leaving Vehicle 0 / 0			0 / 0
Q Miscellaneous	Fell While Boarding or Alighting 0 / 0	Fell From Moving Vehicle 0 / 0	Train 0 / 0	Parked Vehicle Ran Away 0 / 0	Equestrian 0 / 0	Fell Inside Vehicle 0 / 0	Trailer or Load 0 / 1	0 / 1	0 / 2
								TOTAL	465

Note: Top figure in each cell is the "KEY" vehicle (Dark Arrow). "KEY VEHICLE" has no bearing on "fault"
Lower Figure in each cell is the second vehicle.
Sebsequent vehicles are not show

FIGURE A2

Cycle Traffic and Helmet Use Survey Form

Road or Cycle Route Counted: ____________ Observer: ____________

Location: ______________________________

Start Time: ________ Finish Time: ________ Day & Date: ________

Comments: ______________________________

Location Diagram:

COMING FROM: ______________________________

	PRIMARY OR INTER—MEDIATE STUDENT		SECONDARY STUDENT		ADULT	
	Male	Female	Male	Female	Male	Female
WITHOUT HELMETS						
	Male	Female	Male	Female	Male	Female
WITH HELMETS						

	Male	Female	Male	Female	Male	Female
WITHOUT HELMETS						
	Male	Female	Male	Female	Male	Female
WITH HELMETS						

COMING FROM: ______________________________

TABLE A1
Field Survey Count Locations

Station Number	Station Type (*)	Station Name	Group Surveyed	Date
1	CW	Armagh at Hagley Park	Control	26-9-89
2	S	Deans north of Kilmarnock	MOT	26-9-89
3	S	Ferry west of Olliviers		
4	S	Milton west of Selwyn		
5	S	Pages west of Rowan		
6	S	Innes west of Brown		
7	S	Hills south of Shirley		
8	CR	Brodie north of Athol		
9	S	Blenheim at Railway	Fendalton	28-9-89
10	S	Riccarton at Railway		
11	CR	Kilmarnock at Railway		
12	CW	Matai at Railway		
13	S	Fendalton at Railway		
14	CR	Lyttelton south of Frankleigh	Spreydon	3-10-89
15	S	Barrington north of Roberta		
16	CR	Simeon south of Roker		
17	S	Selwyn south of Roker		
18	CR	Strickland south of Roker		
19	S	Colombo north of Devon		
20	S	Sullivan east of Ensors	Woolston	10-10-89
21	S	MacKenzie east of Ensors		
22	S	Ferry east of Randolph		
23	CR	Matlock east of Randolph		
24	CW	Linwood Drain east of Randolph		
25	S	Linwood Avenue west of Chelsea		
26	S	Cuthberts west of Nugent	Wainoni	12-10-89
27	S	Pages west of Bickerton		
28	S	Wainoni west of Bickerton		
29	CW	Porritt Park Bridge		
30	S	Locksley north of McBratneys		
31	S	Papanui north of Blighs	Papanui	17-10-89
32	CR	Windermere north of Blighs		
33	CR	Condell north of Blighs		
34	S	Christian south of Aorangi		
35	S	Wairakei south of Aorangi		
36	S	Fitzgerald south of Alexandra	City North	19-10-89
37	S	Churchill north of Cambridge		
38	S	Barbadoes north of Salisbury		
39	S	Madras north of Salisbury		
40	CR	Manchester north of Salisbury		
41	S	Colombo north of Salisbury		
42	S	Durham north of Salisbury		
43	S	Victoria & Montreal north of Salisbury		
44	S	Park north of Salisbury		

* CW = cycleway (off-street)
CR = cycle route (on-street)
S = ordinary road or street

FIGURE A3
Cycle Survey Partial Screenline Locations

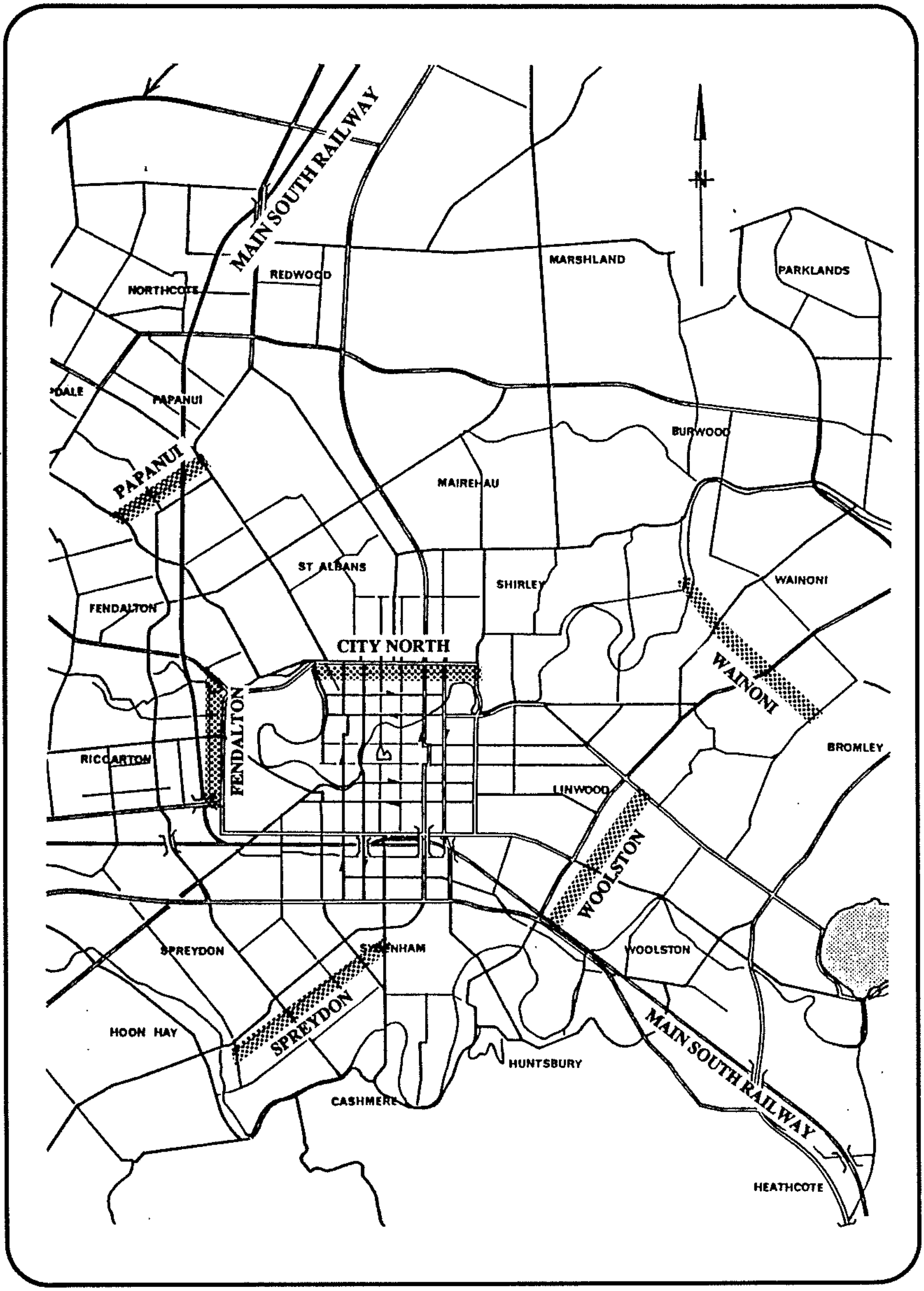


FIGURE A4
Cycle Survey Count Locations

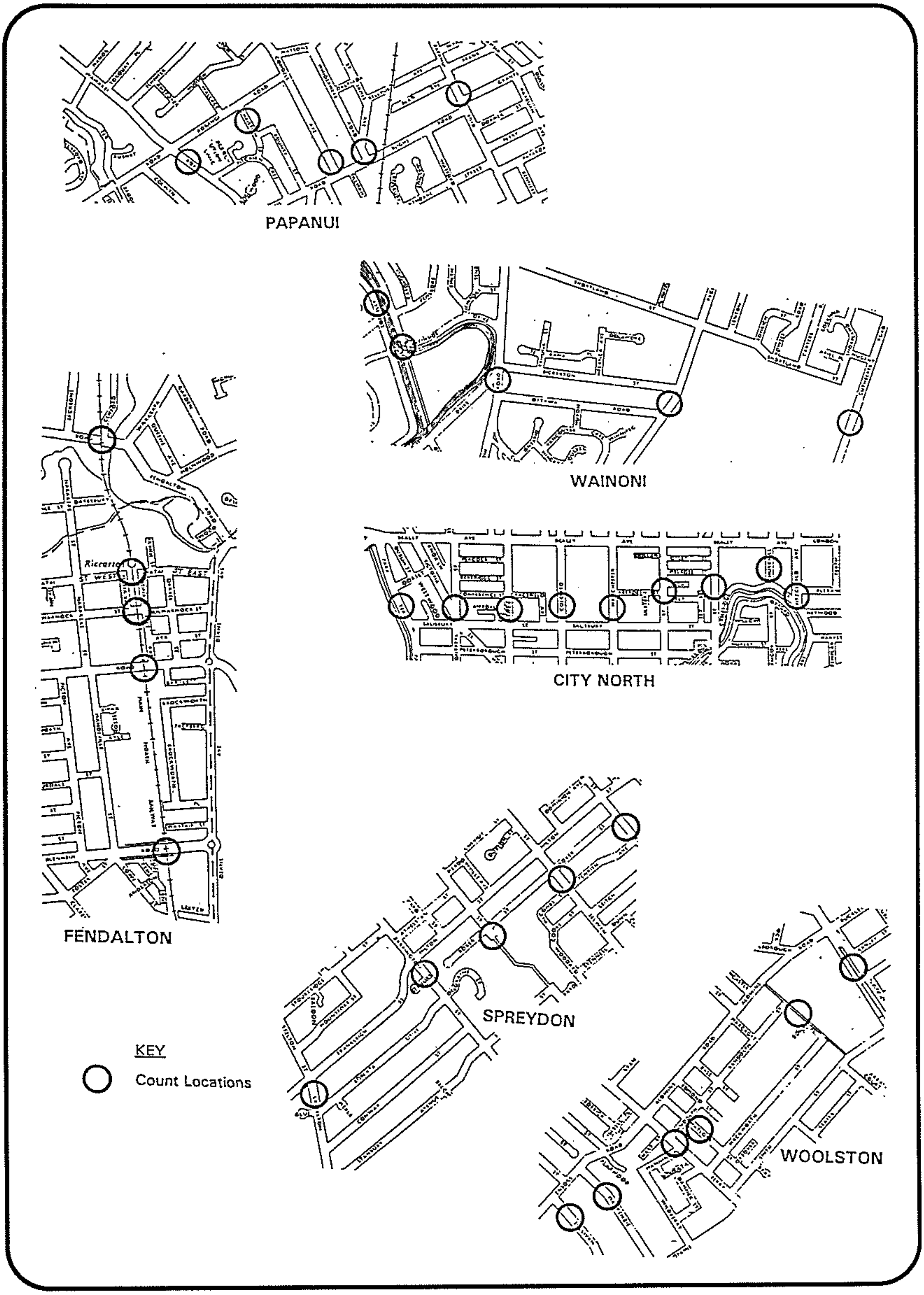


FIGURE A-5
Adult Questionnaire

CHRISTCHURCH CYCLE SAFETY COMMITTEE

CHRISTCHURCH CITY COUNCIL P. O. BOX 237 CHRISTCHURCH (03) 791-660 ext. 835

National Roads Board
Ministry of Transport

Canterbury United Council
Christchurch City Council

Today's date:__________ **Day of the week:**_________

Please tick (√) the boxes or supply the information as appropriate.

Your Travel Patterns

1. Most of my trips during a:

weekday are by:		weekend are by:	
54	car or van	**706**	car or van
5	motorcycle	**14**	motorcycle
14	bus	**10**	bus
1231	bicycle	**433**	bicycle
3	other	**1**	other
88	missing values	**231**	missing values

2. I have used a bicycle regularly for _____ continuous years. (at least three times per month during suitable months)

3. I rode my bicycle last week on:

356	7 days	**80**	3 days
268	6 days	**31**	2 days
484	5 days	**11**	1 day
139	4 days	**14**	No day
		12	Missing Values

4. The nearest intersection to my home is:______________________________

5. The route along which I rode today to the point where I received this questionnaire was:____

   ____

   The total length was about______ kilometers.

6. **When you rode a bicycle today what proportion of the trip did you ride on the types of road listed below?** (Should add up to 100%)

   I rode:
   _____ on major roads
   _____ on minor roads (not marked or sign-posted as a special cycle route).
   _____ on special on-street cycle routes (identified by lane markings or blue cycle route signs)
   _____ on off-street cycleways (no cars allowed)
   _____ on other paths having no motor traffic
   (100%)

7. **How many bicycle trips did you make** (eg. Home -> work -> shops -> home = 3 trips)
   ____ Yesterday?
   ____ The day before yesterday?
   ____ The day before that?

8. During the past 12 months, I regularly rode a bicycle for _____ months. (at least three times per month during suitable months)

9. During this time I averaged about ______ kilometres per month.

Note: The numbers given are the number of respondents making that particular response.

10. During a **summer** month I normally ride ______ days per month.

11. During a **summer** month I ride about ______ times in darkness.

12. During a **winter** month I normally ride ______ days per month.

13. During a **winter** month I ride about ______ times in darkness.

14. Three main reason(s) for my using a bicycle, in their order of importance, are: (1 = most important, 2 = next, etc.)

1st	2nd	3rd	
140	**231**	**235**	ease of parking
119	**196**	**177**	time saving
257	**347**	**243**	health
104	**195**	**238**	pleasure
475	**220**	**191**	economy
34	**47**	**54**	sport
15	**21**	**57**	ecology
12	**7**	**4**	status
1	**0**	**0**	other (please
238	**131**	**195**	missing values

15. Three main purpose(s) of my cycling, in their order of importance are: (1 = most important, 2 = next, etc.)

998	**85**	**22**	to and from work
5	**135**	**101**	during work
204	**37**	**15**	school
35	**343**	**382**	shopping
62	**520**	**306**	sport or recreation
0	**1**	**0**	other (please
91	**274**	**569**	missing values

Your Cycle

16. My bicycle is a:
77 1 speed
90 2 to 4 speeds
1195 5 speeds or more
33 missing values

17. My bicycle has:
53 an odometer (measures distance travelled)
410 Headlight permanently attached
738 Detachable headlight
527 Tail light permanently attached
637 Detachable tail light
1068 Rear reflector or reflective tape
244 Side reflectors
1024 Pedal reflectors
119 Other provision for night visibility

18. I wear reflectorized clothing or material when cycling during the hours of darkness:
233 Always
160 Usually
181 Sometimes
542 Never
237 I do not ride a cycle in the dark
42 Missing Values

19. I wear reflectorized clothing or material when cycling during daylight hours.
71 Always
62 Usually
214 Sometimes
1004 Never
44 Missing Values

20. I have a cycle safety helmet: Yes: **491** No:**870** Missing values: **34**

21. I wear a helmet when cycling:
293 Always
99 Usually
102 Sometimes
868 Never
33 Missing values

22. **Have you ever had an accident while riding a bicycle?**
Yes: **828** No:**567** Missing Values: **1**

Serious Accidents

23. **Have you ever been involved in any SERIOUS accidents or falls while riding a bicycle? ("Serious" means you were injured enough to require seeing a doctor or visiting a hospital).**

Yes: **266** No:**1123** missing values: **6**

24. I have been involved in _____separate serious accidents in which I was hurt. The last one was in ________(month), _________ (Year).

25. In that last serious accident I was riding along a:
170 major road
73 minor road (not marked or sign-posted as a special cycle route).
8 special on-street cycle route (marked with a cycle lane or cycle route sign)
5 off-street cycleway (no cars allowed)
2 race track, BMX track or other sports event
6 other path having no motor traffic
8 Missing Values

26. This incident was:
131 at an intersection or within 20 metres of one.
137 not near an intersection
4 Missing Values

27. The first thing I collided with (or collided with me) was:
100 A moving motor vehicle
2 A motor vehicle waiting to move
12 A parked motor vehicle
25 An opening vehicle door
23 A moving cycle or cyclist
4 A pedestrian
2 A dog
57 The road
10 The kerb
0 A pole or post
0 Other
4 Missing Values

28. **What time of day was it?**

It was during:
207 Full daylight
11 Dawn
29 Dusk
21 Night
4 Missing Values

29. Some of the factors that contributed to my accident were:
118 I was not seen in time
12 Street lights were not very bright - (night)
30 Loose gravel
11 Ice or frost
20 Road wet and slippery
17 Rain
16 Rough road or bumps in road
8 Brakes did not work properly (show if wet)
17 Other mechanical problems (state)
67 Lost control
26 Crowded by car, truck or bus
1 Chased by dog
38 Other

30. My head, face or helmet hit (or was hit by) something. Yes: **138** No: **127** Missing: **7**

31. **23** I **was** wearing a helmet.
   - **11** The helmet reduced the injury.
   - **10** The helmet did not reduce the injury.
   - **2** Missing values

32. **235** I **was not** wearing a helmet
   - **54** A helmet **would have** reduced the injury.
   - **169** A helmet **would not have** reduced the injury.
   - **12** Missing values
   - **8** missing values

Minor Accidents

33. **Have you ever been involved in any MINOR accident(s) or fall(s) while riding a bicycle? (You did not need to see a doctor or go to hospital)**
    Yes: **722** No: **664** **MIssing Values: 9**

34. I have been involved in _____separate minor accidents while riding a bicycle. The last one was in ________ (month) ________ (year).

35. The last time I had a minor accident while riding a bycycle I:
   - **349** was not injured.
   - **369** was injured but not badly enough to see a doctor.
   - **4** Missing values

36. The last time I had a minor accident, I was riding along a:
   - **417** major road
   - **194** minor road (not marked or sign-posted as a cycle route).
   - **12** special on-street cycle route (marked with a cycle lane or cycle route sign)
   - **37** off-street cycleway (no cars allowed)
   - **4** race track, BMX track or other sports event
   - **48** other path having no motor traffic
   - **10** Missing Values

37. This incident was:
   - **358** at an intersection or within 20 metres of one.
   - **362** not near an intersection
   - **2** Missing values

38. The first thing I collided with (or collided with me) was:
   - **212** A moving motor vehicle
   - **6** A motor vehicle waiting to move
   - **39** A parked motor vehicle
   - **67** An opening vehicle door
   - **66** A moving cycle or cyclist
   - **15** A pedestrian
   - **7** A dog
   - **141** The road
   - **59** The kerb
   - **0** A pole or post
   - **0** Other

39. **What time of day was it?**
    It was during:
   - **587** Full daylight
   - **32** Dawn
   - **47** Dusk
   - **54** Night
   - **2** Missing Values

40. My head, face or helmet hit (or was hit by) something. Yes: **72** No: 633 Missing: **17**

41. **106** I **was** wearing a helmet.
- **22** The helmet reduced the injury.
- **48** The helmet did not reduce the injury.
- 36 missing values

42. **594** I **was not** wearing a helmet
- **31** A helmet **would have** reduced the injury.
- **497** A helmet **would not have** reduced the injury.
- **66** Missing values

43. Some of the factors that contributed to my accident were:
- **238** I was not seen in time
- **25** Street lights were not very bright - (night)
- **62** Loose gravel
- **58** Ice or frost
- **49** Road wet and slippery
- **47** Rain
- **60** Rough road or bumps in road
- **44** Brakes did not work properly (show if wet)
- **36** Other mechanical problems (state)
- **159** Lost control
- **101** Crowded by car, truck or bus
- **8** Chased by dog
- **75** Other

General

44. I am ______ years old.

45. I am a: Male: **823** Female:**568** Not Stated: **4**

46. I am:
- **55** a school student
- **375** a tertiary student
- **822** employed full time
- **72** employed part time
- **23** unemployed
- **23** retired
- **16** a homemaker
- **2** other
- **7** Not Stated

47. I have:
- **1194** a Driver's Licence
- **618** a Car or Van
- **137** a Motorcycle

48. While cycling, what worries me most is:____________________________________

____

____

____

Thank you for helping with this survey. The information you have given us will be very helpful in improving cycle facilities and cycle safety in the Christchurch area and in New Zealand.

Happy Cycling!

MIKE GADD
Principal Researcher

SUSAN CAMBRIDGE
Research Coordinator

TABLE A-2
Cycle Lighting of Adult Respondents showing Headlight plus Reflectors

Reflectors	Headlight				
	Fixed	Removable	Both	None	Total
Rear	71	104	1	33	209
Pedal	44	86	0	35	165
Both	252	464	7	136	859
None	34	75	1	52	162
Total	401	729	9	256	1395

TABLE A-3
Cycle Lighting of Adult Respondents showing Headlight plus Tail Light

Tail Light	Headlight				
	Fixed	Removable	Both	None	Total
Fixed	363	104	2	34	500
Removable	20	576	0	14	610
Both	7	13	6	1	27
None	11	39	1	207	258
Total	401	729	9	256	1395

TABLE A-4
Adult Survey Collision Data

Sex	Minor	Serious	Both	Total	Non-Injury
Male	332 40.2%	49 6.0%	129 15.7%	815	238
Female	199 35.0%	24 4.2%	58 10.2%	571	111
Total	531	73	187	1386	349

TABLE A-5
Participating Schools

	School Name	Forms Returned
11	St Bedes College	135
12	Breens Intermediate School	49
13	Mairehau High School	97
14	Shirley Boys High School	98
15	Marian College	65
16	Burnside High School	147
17	Christchurch Boys High School	105
18	Casebrook Intermediate School	65
19	Shirley Intermediate School	51
20	Chisnellwood Intermediate School	58
21	Aranui High School	88
22	Linwood High School	115
23	Catholic Cathedral College	121
24	Branston Intermediate School	57
25	Hornby High School	112
26	Christchurch Girls' High School	120
27	Cobham Intermediate School	66
28	Villa Maria College	144
29	Kirkwood Intermediate School	65
30	Linwood Intermediate School	53
31	Riccarton High School	114
32	St Thomas of Canterbury College	114
33	Middleton Grange School	188
34	Cashmere High School	143
35	Manning Intermediate School	54
36	Hillmorton High School	117
37	Hagley High School	120
38	Christchurch South Intermediate	58
39	St Andrews College	150
40	Rangi Ruru Girls' School	102
41	Heaton Intermediate School	53
42	Christs College	103
43	St Margaret's College	138
44	Avonside Girls High School	122
45	Papanui High School	125
Total School Respondents		3512
Average Number of Respondents Per School		78

FIGURE A-6
Schools Questionnaire

CHRISTCHURCH CYCLE SAFETY COMMITTEE

CHRISTCHURCH CITY COUNCIL P. O. BOX 237 CHRISTCHURCH (03) 791-660 ext. 835

National Roads Board
Ministry of Transport

Canterbury United Council
Christchurch City Council

We need information about bicycle ownership, use and accidents in order to improve cycle safety and cycle routes. You can help by answering these questions about yourself and your bike.

Please tick (√) the boxes or supply the information as appropriate.

Today's date:__________ **Day of the week:** ________________

1. **How do you get to school?**

I go to school:
75 by driving a car or van
211 as a passenger in a car or van
107 by school bus
124 by public bus
25 by motorbike
1793 on a bicycle
391 walk
other (specify)____

2. I have a bicycle Yes: **3313** No: **174**

3. I use a bicycle for:
2541 school
641 work
2522 pleasure riding

Your Cycle

4. My bicycle is a:
254 1 speed
209 2 to 4 speeds
2775 5 speeds or more

5. My bicycle has:
57 an odometer (measures distance travelled)
1126 Headlight
1220 Tail light
2587 Rear reflector or reflective tape
836 Side reflectors
2858 Pedal reflectors
130 Other provision for night visibility (please specify)________________

____

Note: The numbers given are the numbers of respondents answering that particular question

Your Safety Gear

6. During the hours of darkness I wear reflective clothing when cycling:
   119 Always
   123 Usually
   285 Sometimes
   1030 Never
   1760 I do not ride in darkness

7. During daylight hours I wear reflective clothing when cycling:
   103 Always
   74 Usually
   293 Sometimes
   2822 Never

8. I have a cycle safety helmet: Yes:**1227** No:**2081** Missing Values: **189**

9. When I ride a bicycle I wear a helmet:
   537 Always
   396 Usually
   242 Sometimes
   2079 Never

Your Travel Patterns

10. I have used a bicycle regularly for ______ continuous years.

11. During the last 12 months I regularly rode a bicycle for ______ months.

12. I rode a bicycle on about ______ days in June and July of 1988. (= 61 days)

13. During June and July I rode about ______ times in darkness.

14. I rode a bicycle on about _____ days in February and March of 1989. (= 59 days)

15. During February and March of this year I rode about ______ times in darkness.

16. I rode a bicycle to school last week on
   1709 5 days
   259 4 days
   201 3 days
   93 2 days
   77 1 day
   997 No days
   161 Missing Values

17. The nearest intersection to my house is________________________________.

18. The route along which I most frequently ride to get to school is: beginning at home along____

____

The total length is about ______ kilometers.

19. **When you ride a bicycle to school what proportion of the trip do you ride on the types of road listed below? (Should add up to 100%)**

I ride:
______ on major roads
______ on minor roads
______ on special on-street cycle routes
(identified by lane markings or blue cycle route signs)
______ on off-street cycleways (no cars allowed)
______ on other paths having no motor traffic
(100%)

20. **How many bicycle trips did you make** (eg: home -> school -> park -> home = 3 trips)
_____ Yesterday?
_____ The day before yesterday?
_____ The day before that?

21. **Have you ever been involved in an accident while riding a bicyle?**
Yes: **1797** No:**1696** Missing Values: **4** (If "No" skip to 40.)

Serious Accidents

22. **During the last 12 months did you have any SERIOUS accidents or falls on a bicycle? ("SERIOUS" means you were injured enough to require seeing a doctor or visiting a hospital).**
Yes:**454** No:**3043** (If "No" skip to question 31.)

23. During the past 12 months, while cycling, I was involved in _____ separate serious accidents in which I was hurt.

24. The last time was while riding along a:
201 major road
154 minor road
27 race track, BMX track or other sports event
7 special on-street cycle route
14 off-street cycleway (no cars allowed)
17 other path having no motor traffic
22 other area (please specify)______________________
12 Missing Values

25. This incident was:
174 at an intersection or within 20 metres of one.
261 not near an intersection
19 Missing Values

26. Some of the factors that contributed to my accident were:
101 I was not seen in time
6 Street lights were not very bright - (night)
116 Loose gravel
26 Ice/frost
35 Road wet and slippery
42 Rain
67 Rough road/bumps in road
78 Brakes did not work right (show if wet)
51 Other mechanical problems (state)______________________
158 Lost control
46 Crowded by car/truck or bus
14 Chased by dog
42 Other (please state)______________________

27. 85 I **was** wearing a helmet
    55 The helmet reduced the injury.
    25 The helmet did not reduce the injury.
    5 Unknown

28. 346 I **was not** wearing a helmet.
    68 A helmet **would have** reduced the injury.
    249 A helmet **would not have** reduced the injury.
    29 Unknown

29. The first thing I collided with (or collided with me) was:
    131 A moving motor vehicle
    10 A motor vehicle waiting to move
    31 A parked motor vehicle
    16 An opening vehicle door
    48 A moving cycle/cyclist
    4 A pedestrian
    12 A dog
    97 The road
    29 The kerb
    17 A pole or post
    20 Other (please tell us what) ______________________________

30. **What time of day was it?**

    It was during:
    335 Full daylight
    30 Dawn
    45 Dusk
    23 Night
    21 Missing Values

Minor Accidents

31. **During the past 12 months did you have any MINOR accidents or falls in which you were hurt while riding a bicycle? (You did not need to see a doctor or go to hospital)**
    Yes: **1142** No: **2207** Missing Values: **148** (If "**no**" skip to question 40.)

32. During the past 12 months, while cycling, I was involved in _____separate minor accidents in which I was hurt.

33. The last time was while riding along a:
    382 Major road
    479 Minor road
    55 Race track, BMX track or other sports event
    10 Special on-street cycle route
    41 Off-street cycleway (no cars allowed)
    63 Other path having no motor traffic
    80 other area (please specify)______________________
    180 Missing Values

34. This incident was:
    363 at an intersection or within 20 metres of one.
    733 not near an intersection

35. **237** I **was** wearing a helmet
    119 The helmet reduced the injury.
    97 The helmet did not reduce the injury.

36. 871 I **was not** wearing a helmet.
    77 A helmet **would have** reduced the injury.
    709 A helmet **would not have** reduced the injury.

37. Some of the factors that contributed to my accident were:
209 I was not seen in time
18 Street lights were not very bright - (night)
299 Loose gravel
66 Ice/frost
118 Road wet and slippery
104 Rain
139 Rough road/bumps in road
168 Brakes did not work right (show if wet)
70 Other mechanical problems
(state)____________________________________
425 Lost control
95 Crowded by car/truck or bus
34 Chased by dog
135 Other (please
state)____

38. The first thing I collided with (or collided with me) was:
168 A moving motor vehicle
33 A motor vehicle waiting to move
67 A parked motor vehicle
51 A vehicle door opening
159 A moving cycle/cyclist
24 A pedestrian
25 A dog
281 The road
153 The kerb
12 A pole or post
91 Other (please tell us what)
____
226 Missing Values

39. **What time of day was it?**

It was during:
852 Full daylight
85 Dawn
107 Dusk
43 Night

General

40. I am _____ years old and am in Form _______ at ___________________School.

41. Sex: Male: **1670** Female: **1751** Missing Values: **76**

42. I have a:
668 Driver's Licence
178 Car or van
182 Motorcycle

43. While cycling, what worries me most is:_________________________________
____

Thank you for helping with this city wide survey. The information you have given us will be very helpful in improving cycle facilities and cycle safety in the Christchurch area and in New Zealand.

MIKE GADD
Principal Researcher

SUSAN CAMBRIDGE
Research Coordinator

TABLE A-6
School Survey Collision Data According to Sex

Sex	Minor	Serious	Both	Total
Female	413 23.6%	57 3.3%	71 4.1%	1751
Male	456 27.3%	106 6.3%	194 11.6%	1670
Total	531	73	187	3421

TABLE A-7
School Survey Cycle Lighting

	Light				
Reflectors	Head	Tail	Both	None	Total
Rear	23	12	63	33	241
Pedal	24	78	134	35	512
Both	108	149	719	136	2346
None	10	20	45	52	214
Total	165	259	961	1928	3313

TABLE A-8
Participating Medical Centres

Medical Centres	Number of Responses
Christchurch Hospital	25
Burwood Hospital	10
Christchurch Emergency Medical Centre (Bealey Clinic)	9
Linwood Medical Centre	7
St Albans Medical Centre	6
Christchurch South Medical Centre	4
Cashel Street Medical Centre	3
Ilam Medical Centre	3
Papanui Medical Centre	3
Woodham Road Medical Centre	3
High Street Medical Centre	2
Parklands Medical Centre	2
Shirley Medical Centre	2
St Martins Medical Centre	2
Christchurch North Medical Centre	1
Halswell Medical Centre	1
Lincoln Road Medical Centre	1
Redcliffs Medical Centre	1
Selwyn Street Medical Centre	1
Total	86

No forms were received from the following Centres:

Barrington Medical Centre
City Medical Centre
Gayhurst Medical Centre
Ferry Road Medical Centre
Hillmorton Medical Centre
Hoon Hay Medical Centre
Hornby Medical Centre
Main North Road Medical Centre
Mt Pleasant Medical Centre
North Avon Medical Centre
Opawa Surgery
Salisbury Medical Centre
Somerfield Medical Centre
Straven Medical Rooms
Wainoni medical Centre
Waltham Medical Centre
Woolston Medical Rooms

Declined to Participate:

New Brighton Medical Centre

FIGURE A-7
Medical Survey Form

CHRISTCHURCH CYCLE SAFETY COMMITTEE

CHRISTCHURCH CITY COUNCIL P. O. BOX 237 CHRISTCHURCH (03) 791-660 ext. 835

National Roads Board
Ministry of Transport

Canterbury United Council
Christchurch City Council

CYCLE ACCIDENT QUESTIONNAIRE

Please fill in the appropriate gaps/boxes (a tick √ unless otherwise indicated).

Name of Practice

DATE OF INJURY:......................

TIME OF INJURY:.......am ☐ pm ☐

DAYLIGHT: ☐ **TWILIGHT:** ☐ **DARK:** ☐

PLACE WHERE ACCIDENT OCCURRED:
(Please specify the street, intersection or off-street site where accident occurred)

....

(please use reverse side for sketch or description if possible)

- ☐ Public Road
- ☐ Other Public Land
- ☐ Private Property

AGE OF INJURED: ____________ years

SEX OF INJURED:
- ☐ Male
- ☐ Female

HELMET WORN:
- ☐ Yes
- ☐ No
- ☐ Not Known

REFLECTIVE OR DAYGLOW MATERIAL WORN:
- ☐ Yes
- ☐ No
- ☐ Not Known

CYCLIST WAS USING LIGHTS:
- ☐ Yes
- ☐ No
- ☐ Not Known

HOSPITALISATION REQUIRED:
- ☐ Yes
- ☐ No

FRACTURE(S):
- ☐ Yes
- ☐ No

CONCUSSION:
- ☐ Yes
- ☐ No
- ☐ Unknown

CASUALTY SEVERITY:
- ☐ Minor
- ☐ Serious
- ☐ Critical
- ☐ Fatal

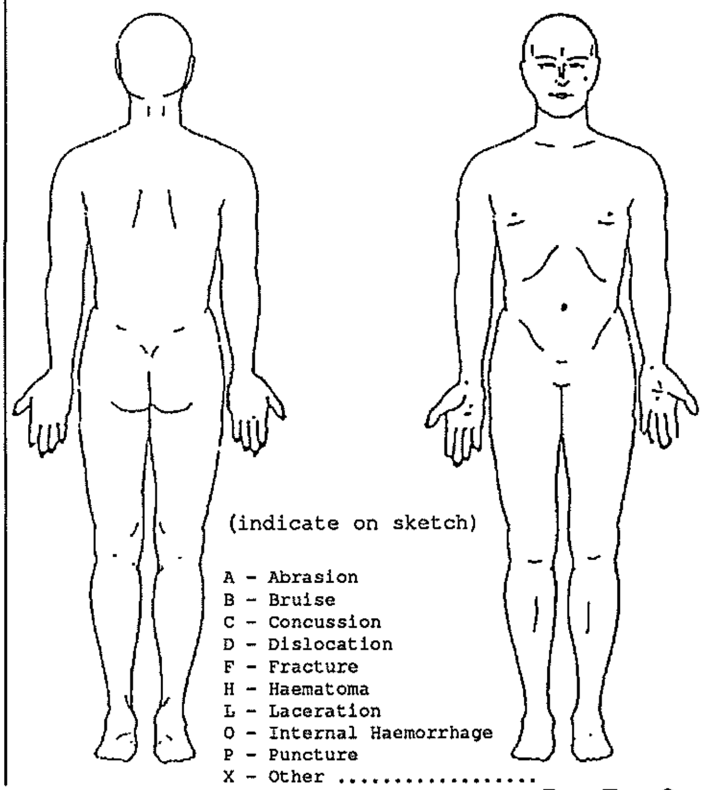
CYCLIST COLLIDED WITH:
- ☐ a moving object
- ☐ a stationary object

OBJECT STRUCK BY OR STRIKING CYCLIST:
- ☐ A moving motor vehicle
- ☐ A motor vehicle waiting to move
- ☐ A parked motor vehicle
- ☐ An opening vehicle door
- ☐ Another cycle or cyclist
- ☐ A pedestrian
- ☐ A dog
- ☐ The road
- ☐ The kerb
- ☐ A pole or post
- ☐ Other (please specify)

....

CYCLING CONDITIONS:
- ☐ Raining
- ☐ Wet Road
- ☐ Dry Road
- ☐ Other:.........

PART OF BODY INJURED:
(Please mark site of more serious injuries on map)



(indicate on sketch)

A - Abrasion
B - Bruise
C - Concussion
D - Dislocation
F - Fracture
H - Haematoma
L - Laceration
O - Internal Haemorrhage
P - Puncture
X - Other ....

P. T. O.

Additional description, comments or diagram: ____________________

____

____

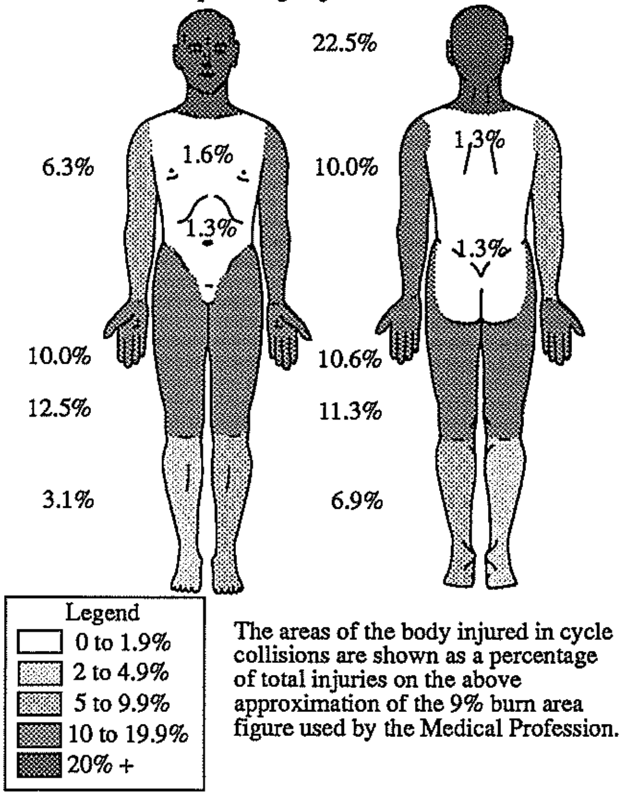
____

____

TABLE A-9
Medical Survey
Location of Indicated Injury

Location of Injury	Helmet Worn	Helmet Not Worn	Helmet Unknown	Total Injuries
Head	8	26	2	36
Upper chest	2	1		3
Upper back		2		2
Abdomen	1	1		2
Lower back		2		2
Left arm	8	8		16
Left hand	5	11	1	17
Right arm	3	6	1	10
Right hand	4	11	1	16
Left thigh	7	12		19
Left leg	4	6	2	12
Right thigh	6	13	1	20
Right leg	2	3		5
Unknown	2			2
Total Injuries	52	102	8	162
Cyclists	31	52	3	86

FIGURE A-8
Map of Injury Locations



The areas of the body injured in cycle collisions are shown as a percentage of total injuries on the above approximation of the 9% burn area figure used by the Medical Profession.

TABLE A-10
Location of Injury and Helmet Wearing

Injury Location	Helmet Worn	Helmet Not Worn	Unknown	Total Injuries
Head	8	26	2	36
Other	42	76	6	124
Unknown	2			2
Total Injuries	52	102	8	162
Cyclists	31	52	3	86

TABLE A-11
Injury Type

	Injuries	%	Cyclists	%
Abrasion	68	41.9	32	37.2
Bruise	18	11.1	17	19.8
Concussion	1	0.6	1	1.2
Dislocation	1	0.6	1	1.2
Fracture	17	10.5	16	18.6
Haematoma	3	1.9	3	3.5
Laceration	36	22.2	28	32.6
Other	2	1.2	2	2.3
Unknown	16	9.9	9	10.5
Total	162 Injuries		86 Casualties	