

Work-Related Fatal Traffic Injuries
in New Zealand 1985-1998

DESCRIPTIVE
EPIDEMIOLOGY

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**NEW ZEALAND ENVIRONMENTAL AND
OCCUPATIONAL HEALTH RESEARCH CENTRE**

INJURY PREVENTION RESEARCH UNIT

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ABSTRACT

Introduction

Overseas studies suggest traffic crashes contribute significantly to the overall burden of fatal work-related injury. In New Zealand these crashes cannot be readily identified from existing databases; previous studies documenting work-related fatal injury have excluded traffic crashes. The absence of information on the number and circumstances of fatal work-related injury in traffic crashes, is a barrier for injury prevention agencies in developing priorities for injury prevention.

Aims

To identify and describe all work-related traffic fatalities that occurred on a public road in New Zealand between 1985 and 1998 inclusive.

Methods

All coronial files involving traffic crashes on a public road between 1985 and 1998 inclusive were reviewed for work-relatedness. The coroners' files were used to estimate the number of work-related fatalities and determine the circumstances of the crash in terms of person (e.g. age), vehicle (e.g. truck, car), contributing factors (e.g. fatigue), and work factors (e.g. occupation). Rates were calculated per 100,000 workers per year.

Results

This study identified 241 working fatalities and 192 commuting fatalities on the public road in New Zealand between 1985 and 1998. In addition, although not engaged in work themselves, 1447 people died in the process of another person's work activity on a public road (bystanders). The overall rate of working fatalities was 1.1 per 100,000 workers and for commuting fatalities the overall rate was 0.9 per 100,000 workers. Work-related traffic fatalities contributed to 29% of all fatal injuries in the workplace in New Zealand during the time period studied. Fatalities were predominantly male. Notable contributing factors included speed, lack of occupant restraints, and fatigue. The industry identified as having the highest rate of working fatalities was road freight transportation.

Conclusions

Work-related traffic fatalities comprise the largest single category of work-related death in New Zealand. Many occupations involve substantial travel on the road, including both professional drivers and occupations in which driving is not the principal activity. This study provides evidence-based information to begin development of strategies for prevention of work-related traffic crashes. It includes information for injury prevention agencies on priority areas where efforts and resources for work-related injury could be directed.

STUDY TEAM

This study was conducted as a collaborative venture between the New Zealand Environmental and Occupational Health Research Centre (NEOH) and the Injury Prevention Research Unit (IPRU). It was funded by the Health Research Council of New Zealand. The study team was:

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LIST OF ABBREVIATIONS

ACC	Accident Compensation Corporation (New Zealand)
ANZSIC	Australian and New Zealand Standard Industrial Classification
BAC	Blood alcohol concentration
CI	Confidence interval
ESR	Environmental Science and Research Limited (New Zealand)
ICD	International Classification of Diseases
ILO	International Labour Organisation
IPRU	Injury Prevention Research Unit (New Zealand)
LTSA	Land Transport Safety Authority (New Zealand)
NEOH	New Zealand Environmental and Occupational Health Research Centre
NOHSC	National Occupational Health and Safety Commission (Australia)
NZHIS	New Zealand Health Information Service (New Zealand)
NZSCO	New Zealand Standard Classification of Occupations
OSH	Occupational Safety and Health Service (New Zealand)
THC	Tetrahydrocannabinol
WRFCS	Work-Related Fatal Child Study (New Zealand)
WRFIS	Work-Related Fatal Injury Study (New Zealand)
WRFTS	Work-Related Fatal Traffic Study (New Zealand)

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I. INTRODUCTION

I.1 The issue of work-related traffic fatalities

Each year about 1000 New Zealanders die as a result of acute unintentional injury.¹ Almost half these fatalities are due to motor vehicle injury.² Work-related injury also contributes markedly to these statistics although routine reliable estimates of the contribution are not available. The Work-Related Fatal Injury Study (WRFIS) determined that at least 80 fatalities per year are due to work-related activity for the period 1985-1994.^{3,4} This is likely to be a serious under-estimate because it does not include work-related fatalities due to crashes that occurred on a public road.^{1} There has been no attempt in New Zealand to count or describe these events. Overseas studies suggest these may contribute to between 25% and 40% of the overall burden of fatal work-related injury.⁵⁻⁷ When bystanders to work^{2} are included, these figures are likely to increase further.

I.2 Why the issue of work-related traffic fatality warrants attention

- i. The New Zealand Health Strategy identifies the Government's key priority areas. Injury prevention is one of its ten primary goals. Specific targets within this goal include reducing the incidence and impact of road traffic injury and workplace injury in New Zealand.⁸ The New Zealand Injury Prevention Strategy also identifies occupational injury as a priority area for prevention.⁹
- ii. The impact of occupational injury in both monetary and other costs is considerable. The costs include medical and emergency services, the loss of income, administrative and legal costs, workplace disruption, and disruption to quality of life. It has been estimated in the United States that costs per motor vehicle injury are about six times the workplace injury average.¹⁰ This is mainly due to higher case fatality rates from motor vehicle injury than other occupational injury.
- iii. Employers have a legal obligation under the Health and Safety Act in Employment (1992) to promote health and safety management in the workplace, and in particular to prevent harm to employees at work. The employer's responsibilities are to identify and control hazards, provide information, training and supervision for staff, and to report 'incidents' to the appropriate regulatory body. Employees are also required to ensure that their actions at work do not result in harm.¹¹ The recent amendment to this Act (2002) confirms that people who are mobile when they work are covered by the Act and highlights that stress and fatigue are potential

{1} Such crashes are by international convention referred to as traffic crashes. This is the usage applied here.

{2} A person who is killed as the direct result of someone else's work activity, e.g. a non-working member of the public is hit by a truck.

work hazards and sources of harm.¹² When driving a vehicle is part of the job undertaken by an employee, the vehicle is an extension of the traditional workplace. The responsibilities of the employer also extend to commuting to or from work, where work activities may contribute to the hazard of being on the road (e.g. shift-work, or overtime work may contribute to fatigue). Section 15 of the Act clearly covers bystanders to work activity.

1.3 Work-related traffic fatality in New Zealand

Currently there are no accurate estimates of the number of work-related traffic crashes in New Zealand. The Land Traffic Safety Authority (LTSA) can only readily identify crashes involving commercial vehicles. Occupational groups other than professional drivers use vehicles as part of their work (e.g. many sales representatives drive extensively in their job). The notifications database maintained by Occupational Safety and Health (OSH) and the national compensated claims database maintained by the Accident Compensation Corporation (ACC) do not have reliable information on the full extent or the nature of work-related traffic incidents. Statistics produced by the International Labour Organisation (ILO) on New Zealand work-related fatalities are based on figures provided by ACC. These have been shown to grossly underestimate the incidence.¹³ The absence of information on the number and circumstances of fatal work-related traffic injury is a major barrier to developing priorities for injury prevention. By using sources such as the LTSA, the New Zealand Health Information Service (NZHIS), and ACC, it is possible to identify the number of fatalities due to specific mechanisms such as 'motor vehicle crash'. For the first two agencies, information on work-relatedness does not exist. For ACC many motor vehicle incidents that are work-related are charged, to the 'motor vehicle account' rather than the 'work account' and although ACC does have an 'at work indicator' its reliability may not be high, thus preventing their identification. New Zealand has no ongoing comprehensive surveillance of work-related fatalities. Cryer et al. 1987¹⁴ identified work-related fatalities for the period 1975-1984 and the WRFIS replicated the study for the period 1985-1994.^{3 4} Because of the difficulties associated with case ascertainment and the associated costs, neither study included work-related traffic incidents. The purpose of the current study was to address this gap in our knowledge and to provide estimates of the burden of work-related traffic fatalities.

2. AIMS

Overall aim:

To identify and describe all work-related traffic fatalities in New Zealand between 1985 to 1998 inclusive.

Specific aims:

- To determine the number and rate of work-related fatal traffic crashes between 1985-1998, inclusive.
- To describe trends in work-related fatal traffic crashes between 1985 and 1998, inclusive.
- To determine the circumstances of the fatal injury in terms of:
 - Personal characteristics of the person killed (e.g. gender, ethnicity, age)
 - Work factors (e.g. industry, occupation)
 - Temporal factors (e.g. time of day, day of week)
 - Vehicle and road factors (e.g. type of vehicle, speed limit)
 - Contributing factors (e.g. alcohol, drugs)
 - Characteristics of fatal injury (e.g. cause of death).
- To determine the contribution of work-related fatal traffic crashes to all fatal road crashes.
- To determine the contribution of work-related fatal traffic injury to the total burden of work-related fatalities from 1985-1994.
- To describe the difficulties associated with obtaining the information needed to make a work-related determination on traffic fatalities from coronial files.

The report describes numbers and rates of death that occurred while the deceased person was either actively working^{3} or commuting^{4} to or from work. Brief consideration is also given to fatalities of bystanders to work activity.

{3} Hereafter referred to as a working death.

{4} Hereafter referred to as a commuting death.

3. METHODS

3.1 Case definition and classification

3.1.1 Background to definitions

To achieve consistency with the WRFIS, the criteria for including and excluding files (with the exception of location of the work-related case) were identical to the WRFIS. Because of the availability of files, the collection period was longer in this study (1985-1998) than in the WRFIS (1985-1994). To allow a comparison of New Zealand data with that collected in other countries, particularly Australia, criteria and definitions in this study and the WRFIS were consistent with those used in the Australian study: “Work-related traumatic fatalities in Australia, 1989 to 1992”. That study included traffic crashes.⁵

The definition of a work-related traffic case was broad. It was subdivided into various categories of work-related activity.

3.1.2 Definition of work-related traffic fatality

“A person, who suffered a non-suicide traumatic death, that occurred on a New Zealand public road and involved a traffic vehicle, to which workplace exposures contributed as a necessary factor to the death, and which can be attributed, to those exposures. The death must have occurred between 1st January 1985 and 31st December 1998.”^{5}

Fatalities that were excluded from the study:

- Aged 85 and above
- Suicide
- Strong evidence that the worker suffered a sudden adverse health effect, which caused the crash (e.g. heart attack)
- Persons performing ‘home duties’
- Criminal activity as work (e.g. burglar on the run)
- Delay of greater than one year between occurrence of the incident and the death of the person
- Domestic violence

{5} This differs from the LTSA definition of a traffic fatality that is limited to motor vehicle fatalities that occurred within 30 days of the incident.

During the review of files, cases that did not fit precisely within the definition of work-related activity were discussed (by the Dunedin research team), on a case-by-case basis. The team comprised an expert on occupational injury (Feyer), the project coordinator (McNoe), and a data coder (Lilley). Colleagues from the Australian, “Work-related traumatic fatalities in Australia, 1989 to 1992” study were consulted where uncertainty existed. Clarifications to the original definition were made where required. When changes to the definition were made, files already coded were reviewed to ensure consistency.

3.1.3 Definitions of type of work-related activity

Work-related activity encompassed most aspects of work, including working, commuting, activity during a recess period (e.g. lunch break), at an employer sponsored social function, and during training or a non-work period if the incident arose because of work (e.g. picking up a pay packet). A four-way classification system was established: workers, commuters, road-bystander, and work-bystander.

Definition of a Worker fatality

- i. *“Persons who work for pay, profit or payment in kind, in a job, business or on a farm, and persons who worked without pay in a family business or on a farm.”
This includes employees, employers and self-employed persons, working full time, part-time and ad-hoc hours.*
- ii. *“Persons who worked in an official volunteer capacity for an organisation.”*
- iii. *“Students, defined as any person who was studying and whose death was the result of an incident, that occurred during school time, while they were performing a task directly connected with their course.”*

Definition of a Commuter fatality

“People who satisfied the worker definition, but died as a result of an incident that occurred while travelling directly from home to work, work to home, or between two jobs. If the incident occurred while the person was travelling in the course of their work duties, the person was not classified as a commuter but as a worker.”

Definition of a Bystander fatality

“All persons who were killed directly as a result of someone else’s work activity, even though the deceased was not working at the time.”

Work-bystander

The deceased was in a mobile workplace at the time of their death (e.g. in a truck cab, in a bus).

Road-bystander

The deceased was not in a mobile workplace, but was on the public road at the time of death (e.g. pedestrian hit by bus, collision between truck and trailer unit and the deceased’s car).

Definition of traffic

“Traffic was defined operationally as a conveyance in which, any person or property may be transported on a public road, that is motor vehicles, horses, bicycles etc. The load on a motor vehicle, or trailer attached to it, was considered part of the vehicle. Tractors and motorised machinery were included while self-propelled in transit or used for transportation.”

Definition of a public road

“A road legally open for use by the general public.”

When it was clear from the file that a case could be included in more than one category of work-related activity, the hierarchical order of inclusion was: worker, commuter, bystander-work, and bystander-road. Where the categorisation of work-relatedness was not clear, the fatality has been included in the category for which there was the strongest evidence.

3.2 Identification of potential cases

Sources of data

Three sources of data were used to identify potential cases; the New Zealand Health Information Service Mortality Database, the Land Transport Safety Authority Traffic Crash Report Database, and the Accident Compensation Corporation Entitlement Claims Database. Each is described in turn below.

- i. New Zealand Health Information Service Mortality Database: The NZHIS maintain a record of all injury fatalities. These fatalities are classified according to the World Health Organisation’s International Classification of Diseases (ICD) supplementary classification of external causes of injury or poisoning injury codes (commonly referred to as E-codes). Records with an E-code of traffic accident or similar (as listed in Table 1) were identified.¹⁵

Table 1: E-codes used to identify potential work-related traffic fatalities

E-code	Definition
810-819	Motor vehicle traffic accidents
820-825	Motor vehicle non-traffic accidents
826-829	Other road vehicle accidents
846	Accidents involving powered vehicles used solely within buildings and premises of industrial or commercial establishments
847	Accidents involving cable cars not running on rails
848	Accidents involving other vehicles not otherwise classified
919	Accidents caused by machinery

- ii. Land Transport Safety Authority Traffic Crash Report Database: The LTSA maintains a database that contains the official police records of reported motor vehicle traffic crashes in New Zealand. It includes details about the vehicle type. In the data collection phase, crashes that were identified as involving a commercial vehicle were flagged and handled differently to non-commercial vehicle traffic crashes (Section 3.4).
- iii. Accident Compensation Corporation Entitlement Claims Database: The Accident Compensation Corporation administers New Zealand’s accident compensation scheme, which provides accident insurance for all New Zealand citizens, residents, and temporary visitors. All work-related fatal vehicle traffic crashes resulting in ACC entitlement claims were identified from the ACC motor vehicle account.

From the three databases, 12,519 potential work-related cases were identified.

3.3 Integration of information

The primary source of data to determine work-relatedness for this study was from coronial inquest files. Potential cases identified from the three source databases, were electronically matched by the victims' name to the coronial register. The commercially available data linkage software Automatch¹⁶ was used for the matching process. Cases that remained unlinked, were manually linked using hand matching where possible. Each identified file was requested from Coronial Services by the Wellington Research Team. The combined total of fatalities from all three sources was 12,519. The electronic matching process produced 10,993 coronial file numbers (88%). The files that could not be matched were no different to those matched in terms of age, year of fatality or gender. Of the 10,993 names, coronial files were identified for 98% of the potential cases (Figures 1 and 2). In addition, on fifteen occasions, an additional fatality was identified from a coronial file reviewed.

3.4 Collection of coronial files

A study team was established in Wellington to review coronial files. Coronial files for all potentially work-related fatalities were requested from the Justice Department in random sequence. The source database of the fatality determined the next step.

'High Probability files'

It was considered highly probable that fatalities identified from the LTSA traffic crash reports as involving a commercial vehicle or from the ACC entitlement database work-related account were work-related. Consequently, files for those fatalities were photocopied without review in Wellington and transferred to the research project headquarters in Dunedin. Figure 1 provides an overview of the process for case determination for high probability files.

'Low probability files'

Files identified from the NZHIS, LTSA (non-commercial vehicles), and vehicle crashes in the ACC database (not classified as work-related), were reviewed by the Wellington team in a random sequence, under broad, pre-determined definitions for work-relatedness (Section 3.1.3). Figure 2 provides an overview of the process for case determination for low probability files. The files were catalogued into one of four categories:

- Definitely work-related – clear statement of work-related activity in the file.
- Potentially work-related – although there was no definite information in the file that work was involved, there was evidence suggestive of work (e.g. time of day and occupation of deceased).
- Indeterminate work-related – there was no information in the file that indicated the activity of the crash victim at the time of the crash.
- Not work-related – there was definite information in the file which excluded work being involved in the crash (e.g. deceased had been visiting friends and hit tree).

Figure 1: Case determination for 'high probability files'

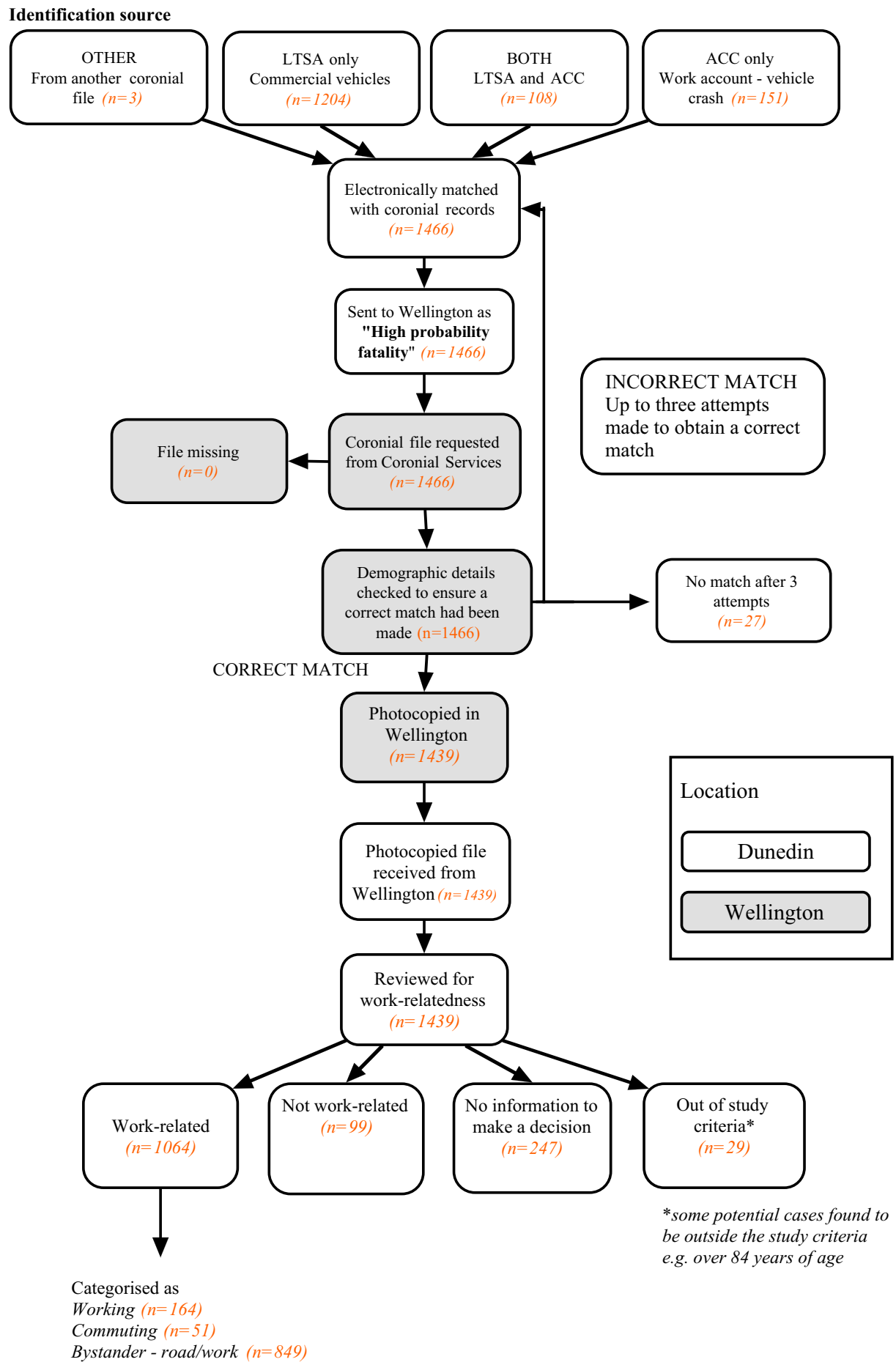
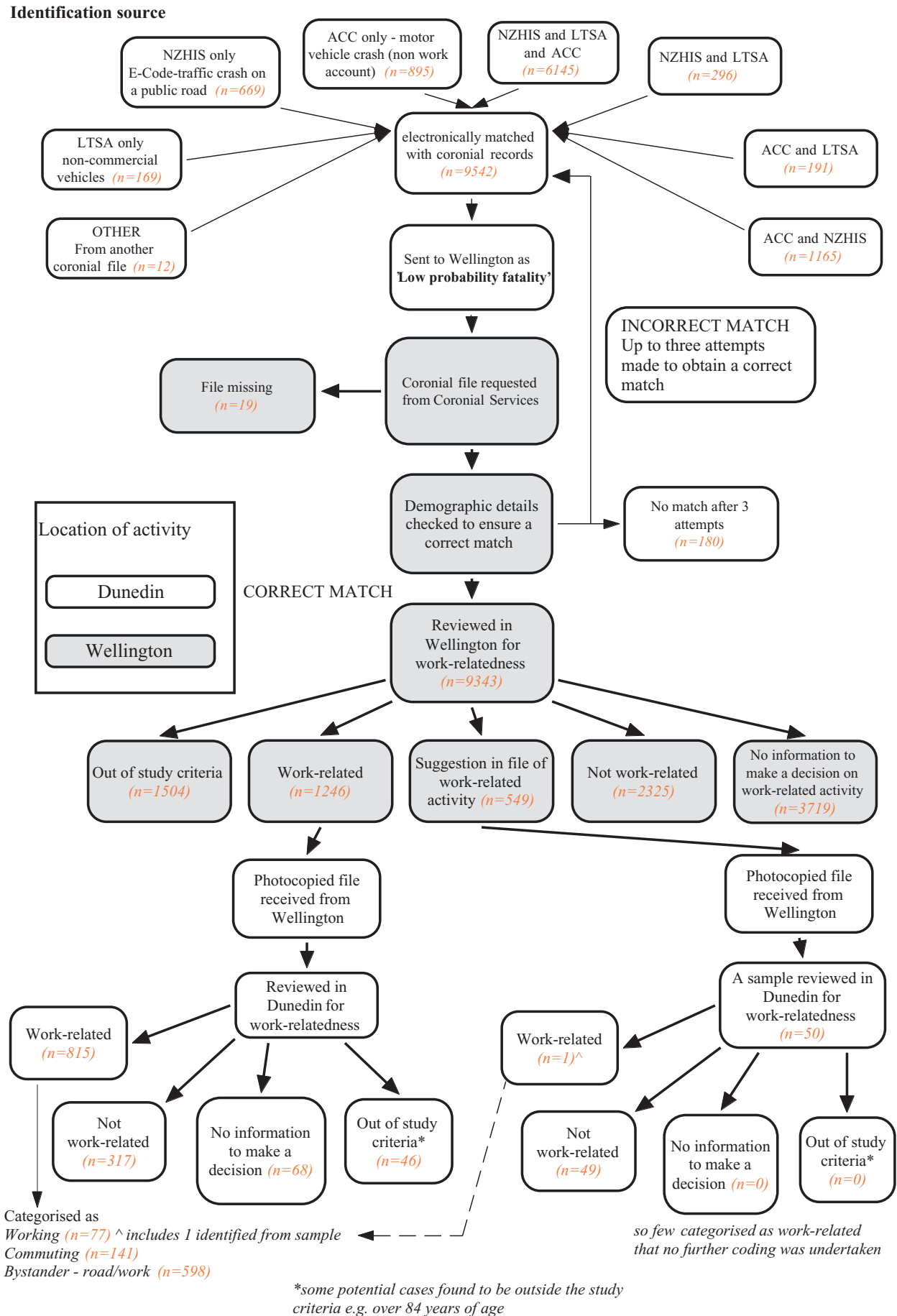


Figure 2: Case determination for 'low probability files'



It should be noted that there were a number of files (37% of all files reviewed) on which no information was available on which to make a decision of work-related activity. These files were excluded from the study.

A description about the circumstances of the death, and the reasoning for the classification was completed for every file. The files classified as definitely or potentially work-related were photocopied and transferred to Dunedin for further review. Files missing from coronial services were re-requested up to three times to ensure maximum coverage.

3.5 Data Coding

Using the study definitions, files were classified as cases, non-cases, or indeterminate. The main criterion for the classification was ‘did someone’s work exposure contribute to the incident?’ Every case identified was coded according to a predefined set of criteria. Standard coding frames were used wherever possible to extract information from coronial records. Information collected from the coronial file included personal and employment details, and circumstances of the injury and crash. The source of the coding framework used to capture information was based on previous work in the area and is listed in Table 2. Additional information about the circumstances of the crash and vehicle details were obtained, where available, from the LTSA database.

Table 2: Variables and source of coding framework

Variable	Source-coding framework
Unique identifier	WRFTS
Coronial number	Coronial registrar
<i>Demographic variables - worker/commuter</i>	
Sex	WRFTS
Age	WRFTS
Domicile code based on residential address	NZHIS
Ethnicity	NZHIS
Marital status	NZHIS
Country of birth	NZHIS
Number of years resident in New Zealand	NZHIS
<i>Details of fatality</i>	
Type of work-related death (working, commuting, bystander - road/work)	WRFTS/WRFIS
Time and date of certified death	WRFTS
Time and date of actual death	WRFTS
Precision of time when death actually occurred	WRFTS
<i>Bystanders only</i> - Did the work activity contribute to the fatal incident	WRFTS/WRFIS
Coder	WRFTS

Table 2 continued

<i>Details of the coronial file</i>	
Checklist of documents in coronial file	WRFIS
Area of coroner	WRFIS
Date of coronial finding	WRFIS
Recommendations made by coroner	WRFIS
<i>Circumstances of death</i>	
Evidence of harm	WRFTS
Involvement of drugs and alcohol by deceased or other	WRFTS
BAC reading	WRFTS
Names of drugs involved	WRFTS
<i>Injury and injury management</i>	
Date and time of injury	WRFTS
Site of death	WRFTS
Nature of gross physiological cause of death	NOHSC
Location of injury leading to death	NOHSC
Pathophysiological cause of death	NOHSC
Was the person alive when found	WRFTS
Duration between injury and person being found	WRFTS
Relevant pre-existing medical conditions and use of appropriate medication	ICD-9 CODES MEDICAL CONDITION
<i>Details of injury event</i>	
Location of incident	NOHSC
Mechanism of injury - physical event that best described the circumstances of the fatal incident	NOHSC
Agency of injury - object, substance or physical condition which made contact with the subject to directly cause the injury	NOHSC
Agency of incident (up to 3) - object, substance, or physical condition that was most responsible for the incident occurring, or that was most intimately involved in the incident. If there were more than three agents of injury the three most important were coded and the others mentioned in the free text	NOHSC
Contributing factors (up to 3) - Factors that contributed to the incident occurring, or made its outcome more severe than it would otherwise have been	LTSA
Were there multiple fatalities in this crash? If so - associated coronial numbers	WRFTS

Table 2 continued

Work arrangements	
Employment - practical employment arrangements e.g. self employed, employed, volunteer	WRFIS
Occupation - at time of crash rather than the task being performed at the time	NZSCO (1995)
Length of time in that job	WRFIS
Industry in which fatality occurred	ANZSIC (1996)
Working hours at time of injury	WRFIS
Did work occur on a casual basis	WRFIS
Usual working schedule	WRFIS
Accident factors	
Movement of vehicles	LTSA
Weather conditions	LTSA
Road surface	LTSA
Road topography	LTSA
Was the driver appropriately licenced	LTSA
Vehicle - type, size, make, year, ownership, registration, WOF	LTSA
Free text description	
What the deceased was doing at time of crash	WRFIS
What went wrong	WRFIS
How did the person die	WRFIS

LTSA	LTSA coding framework
NZHIS	New Zealand Health Information Service Mortality Database
NZSCO	New Zealand Standard Classification of Occupations (1995) ¹⁷
ANZSIC	Australian and New Zealand Standard Industrial Classification (1995) ¹⁸
NOHSC	based on National Occupational Health and Safety Commission's Type of Occurrence Classification System (1990) ¹⁹
WRFIS	based on Work-Related Fatal Injury Study (1985-1994) ³
WRFTS	developed for the current study

3.6 Reliability

Inter- and intra- reliability was assessed for both the reviewing and coding of coronial files. A random sample of 100 coronial files, were independently reviewed by both members of the Wellington team, at the beginning and the end of the review process. The intra coder (within coder) reliability was 97% for both coders. One member of the Dunedin team reviewed the same 100 files. The level of agreement between the Wellington team and the Dunedin reviewer at the end of the review process was 91% (inter coder reliability). In 7%, of the 9% where there was a mismatch the inconsistencies were due to a more liberal inclusion categorisation by the Wellington team.

All three members of the Dunedin team coded 50 files independently. The level of agreement between key variables was high and is reported in Table 3.

Table 3: Reliability agreement between coders

Item	Percent agreement
Work-relatedness	100%
Work-related type	92%
Age	92%
Ethnicity	93%
Agency of injury	80%
Movement of vehicle	94%
Occupation at time of injury	86%
Usual occupation	88%
Industry	80%

The differences in coding for industry and occupation arose because of different interpretations of the same industry/occupational coding. For example, one person was coded to plumbing services by one coder and to non residential building construction by the other two coders. To ensure a higher level of reliability, every work-related coronial file was re-reviewed (McNoe) for occupation and industry, and corrections were made where necessary.

3.7 Analyses

Data were analysed using Statistical Procedures for the Social Sciences (SPSSx v11.0). The number and rate of work-related traffic vehicle crashes are described in Section 4. The circumstances surrounding the crash and the contribution of traffic crashes to the overall burden of work-related injury are also outlined. As working fatalities were the primary focus of this study, the graphs presented have been ordered by the ‘number of working decedents’ rather than the ‘total number of decedents’.

3.7.1 Rates and confidence intervals

Rates and their 95% confidence intervals (CI) for work-related fatal injuries were calculated per 100,000 workers assuming a Poisson distribution for working and commuting fatalities (aged 15-84). Ideally (if it was available), the denominator used to calculate the incident rate of work-related fatal injuries would be the amount of time a worker was exposed to the road. This will vary with the occupation of the worker, and the workers role in that occupation (i.e. time at work may not equal time exposed to traffic). In addition, the varying exposure times of part and full time workers is not readily available from census data. There is evidence that in fact these issues make little difference to the rate calculation.¹⁴ The denominator was the

number of persons of working age, who were employed in the labour force and whose occupation gives some broad indications of exposure to traffic while at work or when going to and from work (Section 3.7.2).

3.7.2 Denominator data

As in the WRFIS, population rates were calculated using census data as the denominator. It is specific for gender, age group, occupation, and industry. Census data was available for 1986, 1991, 1996, and 2001, with the population in the intervening years being determined by interpolation using a linear function for the inter-census years to span the time frame 1985-1998. The numbers of workers in each level were summed over time to give an estimate of person-years at risk. Census data for specific industry groupings was not available for children under the age of 15 therefore, age specific rates for these fatalities have not been calculated.

3.8 Ethical approval and confidentiality

Ethical approval for the project was sought and granted by the Otago Ethics Committee. Training of team members included education about the sensitive nature of the files being reviewed and the need for confidentiality. Anybody involved in the study, who viewed files directly, signed a Department of Courts confidentiality agreement about the use and storage of coronial files. It should be noted that information on coronial files is freely available to the public under the Coroners Act.

4. RESULTS

4.1 Overview of the results section

This chapter provides a descriptive analysis of fatal work-related traffic crashes in New Zealand between 1985 and 1998. The number and rate of fatal work-related injury during the study period is summarised. The personal and injury characteristics, and work factors of the decedents are described. The circumstances of the incident are outlined in terms of temporal factors, vehicle and road factors, and contributing factors to the incident. The burden of work-related traffic crashes in comparison to other fatal occupational injuries is outlined.

4.2 Number and rate of work-related fatal traffic injuries

4.2.1 Number of work-related fatal traffic injuries

Between 1985 and 1998 inclusive, 241 worker fatalities and a further 192 commuting fatalities were identified (Table 4). In addition, although not engaged in work themselves, 1447 people died in the process of another person's work activity on a public road (bystanders). Annually, this is an average of approximately 17 working fatalities, 14 commuting fatalities and 103 bystander fatalities. The following results focus on the working and commuting fatalities.

Table 4: Number of work-related fatal traffic injuries per year (age 0-84):
1985-1998 – working and commuting

Year of death	Working	Commuting	Total
85	16	12	28
86	16	18	34
87	14	11	25
88	19	17	36
89	16	11	27
90	16	7	23
91	20	12	32
92	7	12	19
93	13	13	26
94	24	15	39
95	22	7	29
96	23	18	41
97	17	19	36
98	18	20	38
Total	241	192	433

4.2.2 Incidents involving multiple fatalities

Although many of the incidents involved more than one fatality, in the majority of cases one worker or commuter was fatally injured. For working crashes, 234 incidents resulted in 241 fatalities, and for commuting crashes, 183 incidents resulted in 192 fatalities.

4.2.3 Rate of work-related fatal traffic injuries

The overall rate of work-related fatal traffic crashes of workers and commuters, between 1985 and 1998, was 2.0 per 100,000 workers per year. Working had an overall rate of 1.1 per 100,000 workers per year (Figure 3) and commuting an overall rate of 0.9 per 100,000 workers per year (Figure 4). As census data for the number of children working under the age of 15 was unavailable for the denominator, rates have been calculated excluding the six fatalities that occurred in this age group.

Figure 3: Rate (95% CI) of work-related fatal traffic injuries (age 15-84):
1985-1998 – working (n=241 fatalities)

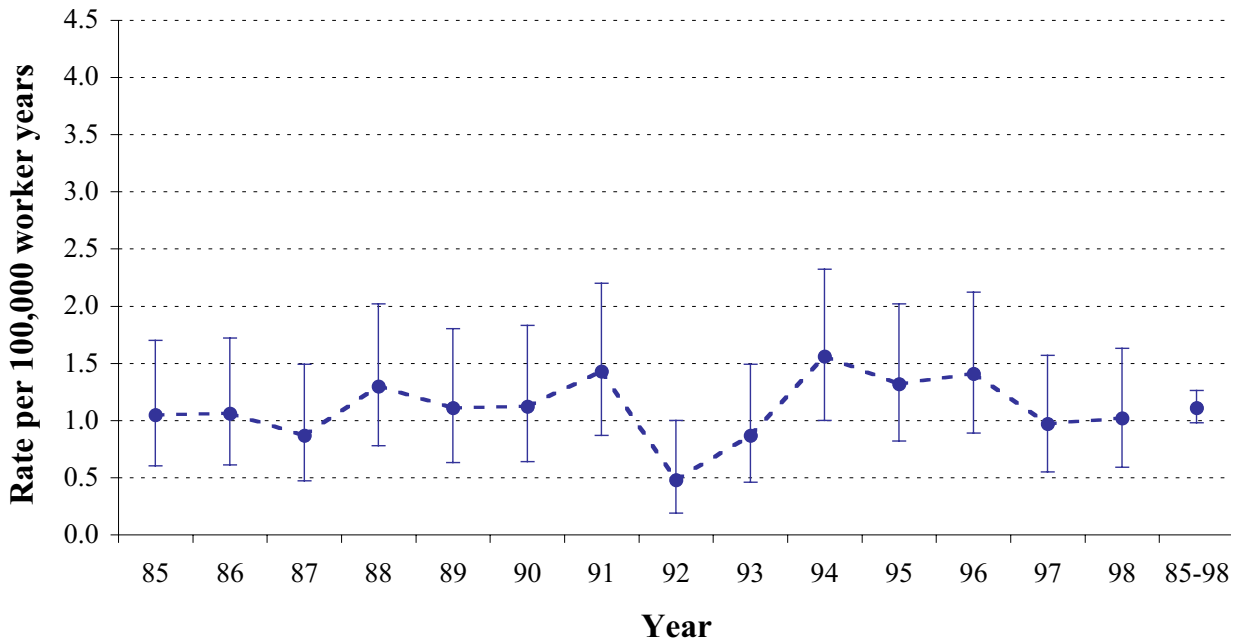
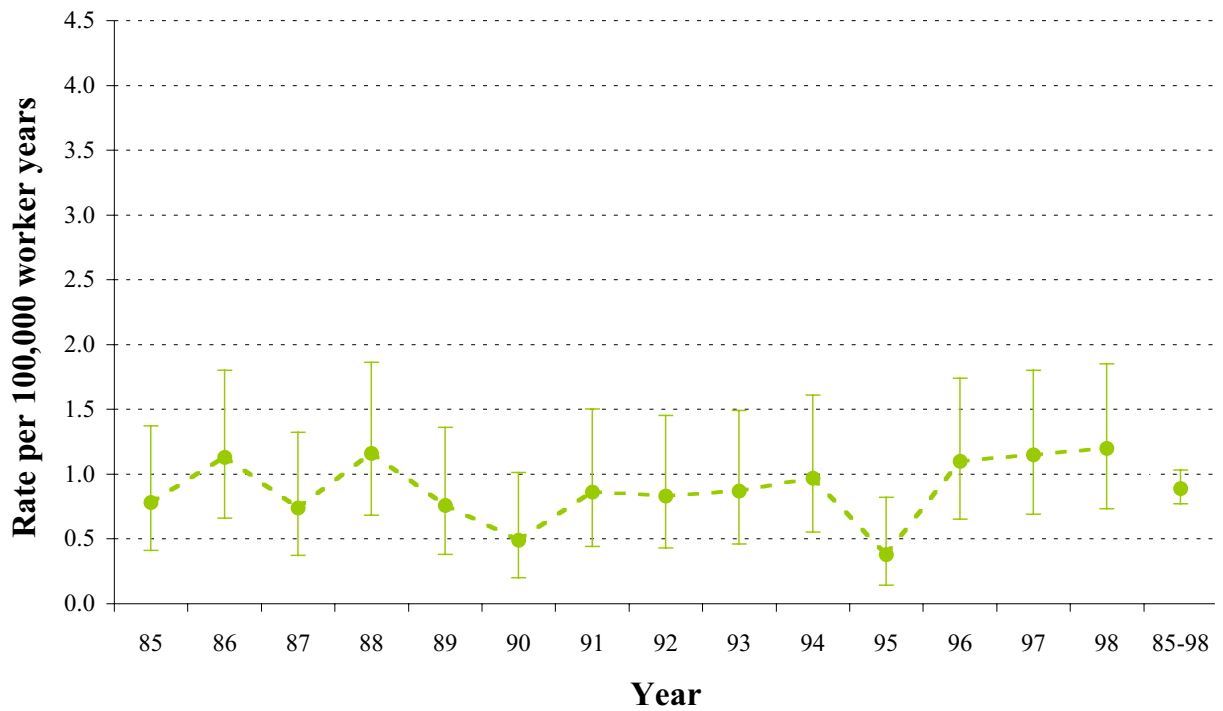


Figure 4: Rate (95% CI) of work-related fatal traffic injuries (age 15-84):
1985-1998 – commuting (n=192 fatalities)



4.3 Trends over time

There were no particular apparent trends over time (Figures 3 and 4).

4.4 Circumstances of the fatal injury – person factors

4.4.1 Gender

The fatalities were predominantly male, comprising 93% of working fatalities and 80% of commuting fatalities.

4.4.2 Ethnicity

About one third (35%) of the coronial files coded, **did not** contain information about ethnicity of the deceased (Table 5). **At least** 47% of fatalities were European, 12% were Māori and 4% were Polynesian.

Table 5: Ethnicity of decedents of work-related fatal traffic injuries (age 0-84): 1985-1998 – working and commuting

	Working		Commuting		Total	
	n	%	n	%	n	%
European	110	46	92	48	202	47
Maori	35	15	15	8	50	12
Polynesian	8	3	9	5	17	4
Other	4	2	9	5	13	3
<i>Unknown</i>	<i>84</i>	<i>35</i>	<i>67</i>	<i>35</i>	<i>151</i>	<i>35</i>
Total	241	100	192	100	433	100

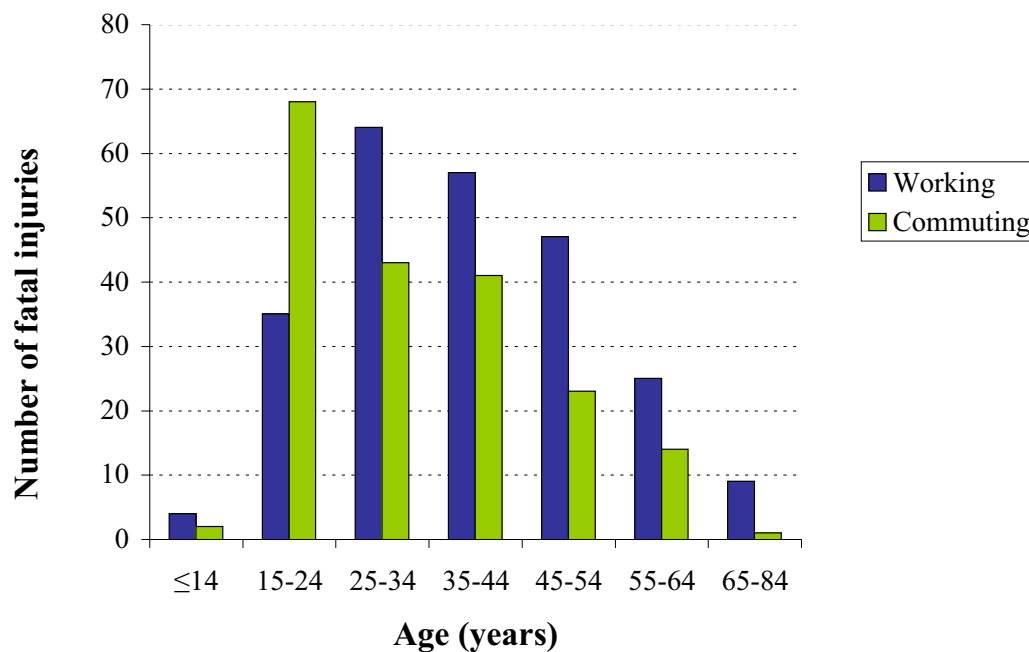
4.4.3 Age

The highest number of working fatalities occurred in the 25-34 year age group (Figure 5). Nearly three quarters of working fatalities (71%) occurred between age 20 and 49.

The highest number of commuting fatalities was in the 15-24 year age group (Figure 5). Nearly three quarters (72%) of the commuting fatalities occurred under age 40.

The mean age was substantially lower for commuting fatalities (33 years) than for working fatalities (39 years).

Figure 5: Age of decedents of work-related fatal traffic injuries (age 0-84):
1985-1998 – working (n=241 fatalities) and commuting (n=192 fatalities)



The age specific rate differed for working and commuting fatalities. For working, the rate of fatal injuries increased with age, with the highest rate observed in the 65-84 year age group (Figure 6). For commuting, the highest rate occurred in the 15-24 year age group and declined as age increased (Figure 7).

Figure 6: Age of decedents of work-related fatal traffic injuries (age 15-84): Rate (95% confidence interval): 1985-1998 – working (n=237 fatalities)

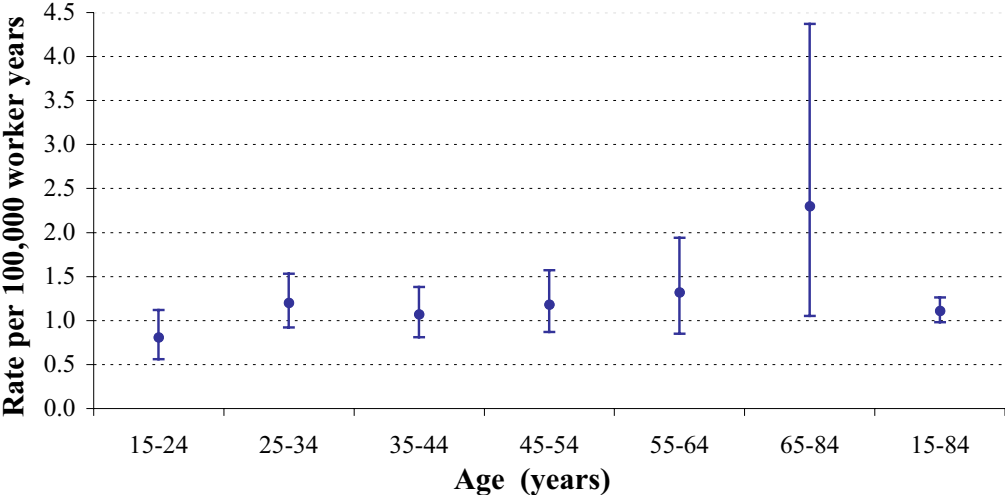
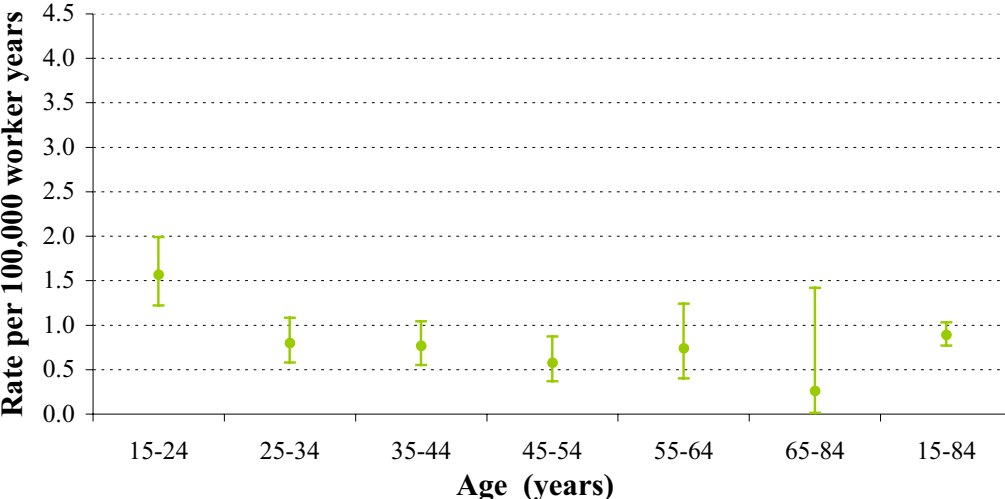


Figure 7: Age of decedents of work-related fatal traffic injuries (age 15-84): Rate (95% confidence interval): 1985-1998 – commuting (n=190 fatalities)



4.5 Circumstances of the fatal injury – work factors

Information on work factors was not readily available in most of the coronial files reviewed.

4.5.1 Employment status

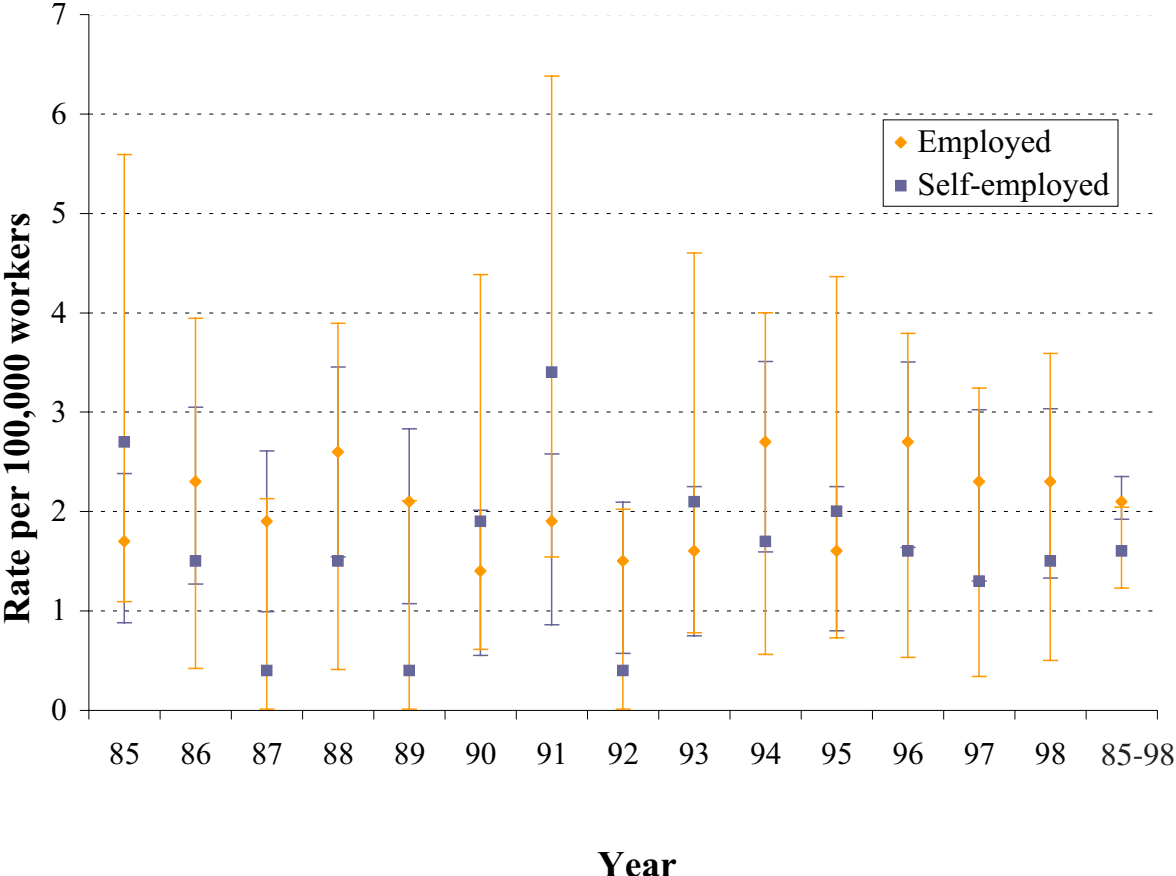
The majority of fatal injuries were to those working in paid employment (97.2% working decedents and 98.5% commuting decedents) (Table 6). In some instances, it was impossible to determine whether paid workers were self-employed or paid employee's (unknown n=57). For analysis purposes, these cases were re-distributed proportionally between those two groups.

Table 6: Employment status of decedents of work-related fatal traffic injuries (age 0-84):
1985-1998 – working and commuting

	Working		Commuting	
	n	%	n	%
<i>Paid workers</i>				
Self-employed	35	15	12	6
Employed	138	57	122	64
Apprenticed Employees	4	2	9	5
<i>Unknown</i>	57	24	46	24
<i>Unpaid workers</i>				
Volunteers	3	1	1	1
Assisting family	3	1	0	0
<i>Unknown whether paid or not</i>				
Assisting family	1	0	0	0
<i>Unknown</i>	0	0	2	1
Total	241	100	192	100

The rates for paid employees were slightly higher than for self-employed persons, although there is the uncertainty associated with small numbers (Figure 8).

Figure 8: Employment status of decedents of work-related fatal traffic injuries (age 15-64): Rate (95% confidence interval): 1985-1998 – working and commuting combined (n=419 fatalities)



4.5.2 Work environment

Information on the decedents experience on the job, working hours or working schedule (such as shiftwork or casual work) was generally not available in the coronial files.

4.5.3 Industry

Working

For working decedents, the highest number and rate of fatal injuries occurred in the '*transport and storage industry*' (10.1 per 100,000 workers per year) (Table 7, Figures 9 and 10). '*Road freight transportation*' had a particularly high number of workers killed (n=83), with a correspondingly high rate of 33.3 per 100,000 workers per year. Although the number of fatalities were small, high rates were observed in '*milk vending*' (19.4 per 100,000 workers per year), '*road and bridge construction*' (8.8 per 100,000 workers per year), '*postal and courier services*' (6.5 per 100,000 workers per year), '*plumbing services*' (6.3 per 100,000 workers per year), and '*taxi and other road passenger transport*' (excluding bus transportation) (6.2 per 100,000 workers per year).

Commuting

Commuting fatalities were more evenly dispersed between industries than working fatalities: hence the numbers in each industry grouping are less (Table 7, Figures 9 and 11). The highest rates were observed in '*livestock farming*' (7.6 per 100,000 workers per year), '*log saw milling*' (7.6 per 100,000 workers per year), '*automotive repair and service*' (4.5 per 100,000 workers per year), '*services to agriculture*' (4.2 per 100,000 workers per year), '*plumbing services*' (4.2 per 100,000 workers per year), '*horticulture and fruit growing*' (2.6 per 100,000 workers per year), and '*meat processing*' (2.4 per 100,000 workers per year).

Table 7: Industry of work-related fatal traffic injury cases: number and rate (95% confidence interval) for industry groupings (ANZSIC 1996)¹⁸
(Age 15-84) With more than 5 fatalities for the study period: 1985-1998 – working and commuting

Industry	Working			Commuting			Total		
	Number	Rate per 100,000	95% C.I.	Number	Rate per 100,000	95% C.I.	Number	Rate per 100,000	95% C.I.
<i>Agriculture, Forestry, Fishing</i>	22	1.1	0.7-1.6	33	1.6	1.1-2.2	55	2.6	2.0-3.4
i. Horticulture and Fruit Growing	2	0.5	0.1-1.9	10	2.6	1.3-4.8	12	3.1	1.6-5.5
i. Grain Sheep and Beef Cattle Farming	12	1.9	1.0-3.2	2	0.3	0.0-1.1	14	2.2	1.2-3.6
i. Other Livestock Farming	1	0.7	0.0-3.9	9	6.3	2.9-11.9	10	7.0	3.3-12.8
ii. Livestock Farming	1	1.1	0.0-6.1	7	7.6	3.1-15.7	8	8.7	3.8-17.1
i. Services to Agriculture	3	1.8	0.4-5.3	7	4.2	1.7-8.7	10	6.1	2.9-11.1
<i>Manufacturing</i>	7	0.2	0.1-0.4	36	1.0	0.7-1.4	43	1.2	0.9-1.6
i. Meat and Meat Product Manufacturing	8	2.1	0.9-4.0	-	-	-	8	2.1	0.9-4.0
ii. Meat Processing	8	2.4	1.0-4.7	-	-	-	8	2.4	1.0-4.7
i. Logging Sawmilling and Timber Dressing	1	0.9	0.0-5.3	7	6.6	2.7-13.6	8	7.6	3.3-14.9
ii. Log Sawmilling	1	1.1	0.0-6.0	7	7.6	3.1-15.6	8	8.7	3.8-17.1
<i>Electricity, Gas, Water Supply</i>	7	4.1	1.6-8.4	-	-	-	7	4.1	1.6-8.4
<i>Construction</i>	24	1.8	1.2-2.7	11	0.8	0.4-1.5	35	2.7	1.8-3.7
i. Non-Building Construction	14	7.0	3.8-11.8	-	-	-	14	7.0	3.8-11.8
ii. Road and Bridge Construction	14	8.8	4.8-14.7	-	-	-	14	8.8	4.8-14.7
i. Installation Trade Services	6	2.4	0.9-5.3	4	1.6	0.4-4.2	10	4.1	1.9-7.5
ii. Plumbing Services	6	6.3	2.3-13.6	4	4.2	1.1-10.7	10	10.4	5.0-19.2
<i>Wholesale Trade</i>	5	0.4	0.1-1.0	1	0.1	0.0-0.5	6	0.5	0.2-1.1
<i>Retail Trade</i>	15	0.6	0.3-1.0	13	0.5	0.3-0.9	28	1.1	0.7-1.6

Major industry groups

- i. Industry groups at 3 digit level
- ii. Industry groups at 5 digit level

cont.

Table 7 cont.

Industry	Working		Commuting		Total	
	Number	Rate per 100,000	Number	Rate per 100,000	Number	Rate per 100,000
i. Specialised Food Retailing	7	2.0	2	0.6	9	2.6
ii. Milk Vending	5	19.4	-	-	5	19.4
i. Motor Vehicle Services	5	1.4	8	2.3	13	3.7
ii. Automotive Repair and Services	2	1.8	5	4.5	7	6.3
Accommodation, Cafes, Restaurants Transport, Storage	-	-	10	1.2	10	1.2
i. Road Freight Transport	96	10.1	8	0.8	104	10.9
ii. Road Freight Transport	83	33.3	3	1.2	86	34.5
i. Road Passenger Transport	83	33.3	3	1.2	86	34.5
ii. Taxi and other Road Passenger Transport	12	6.0	1	0.5	13	6.5
Communication Services	8	6.2	1	0.8	9	7.0
i. Postal and Courier Services	10	3.8	3	1.1	13	4.9
Property, Business Services Government Administration, Defence	9	6.5	1	0.7	10	7.3
i. Government Administration	4	0.2	9	0.5	13	0.7
i. Defence	6	0.7	5	0.6	11	1.3
Education	1	0.2	5	0.9	6	1.1
i. School Education	5	2.2	-	-	5	2.2
Health, Community Services	2	0.2	6	0.5	8	0.6
i. Hospitals and Nursing Homes	2	0.2	4	0.5	6	0.7
Cultural, Recreational Services Personal, Other Services	4	0.3	9	0.6	13	0.9
i. Public Order and Safety Services	2	0.3	7	1.0	9	1.2
	5	1.2	4	0.9	9	2.1
	7	0.8	5	0.6	12	1.3
	5	2.1	1	0.4	6	2.5

Figure 9: Industry (ANZSIC 1996)¹⁸ of work-related fatal traffic injuries (age 0-84): 1985-1998 – working (n=241 fatalities) and commuting (n=192 fatalities)

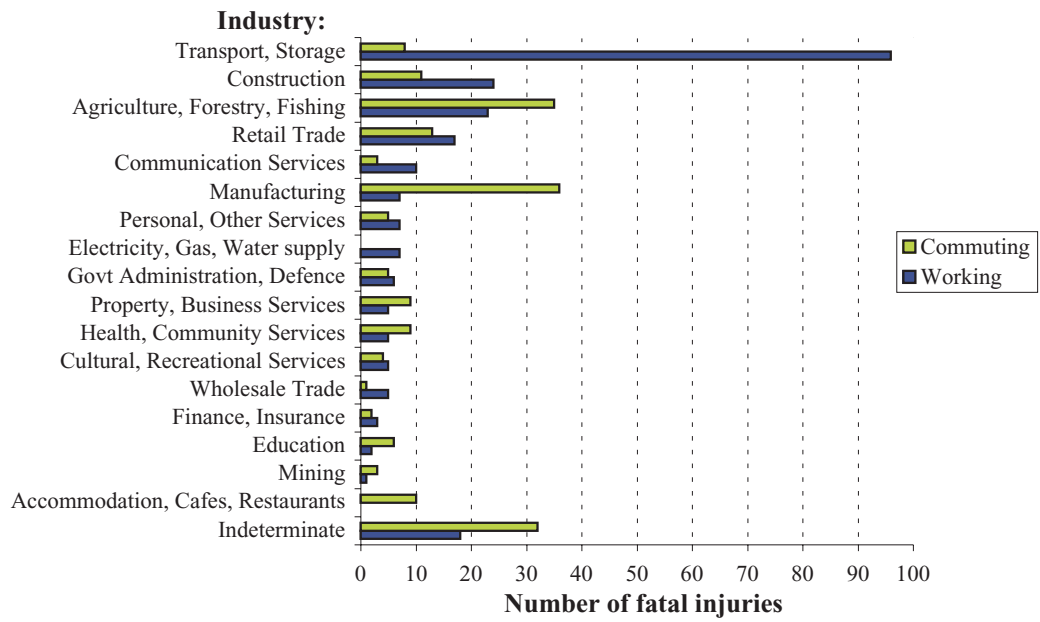


Figure 10: Industry (ANZSIC 1996)¹⁸ of work-related fatal traffic injuries (age 15-84):
Rate (95% confidence interval): 1985-1998 – commuting (n=237 fatalities*)

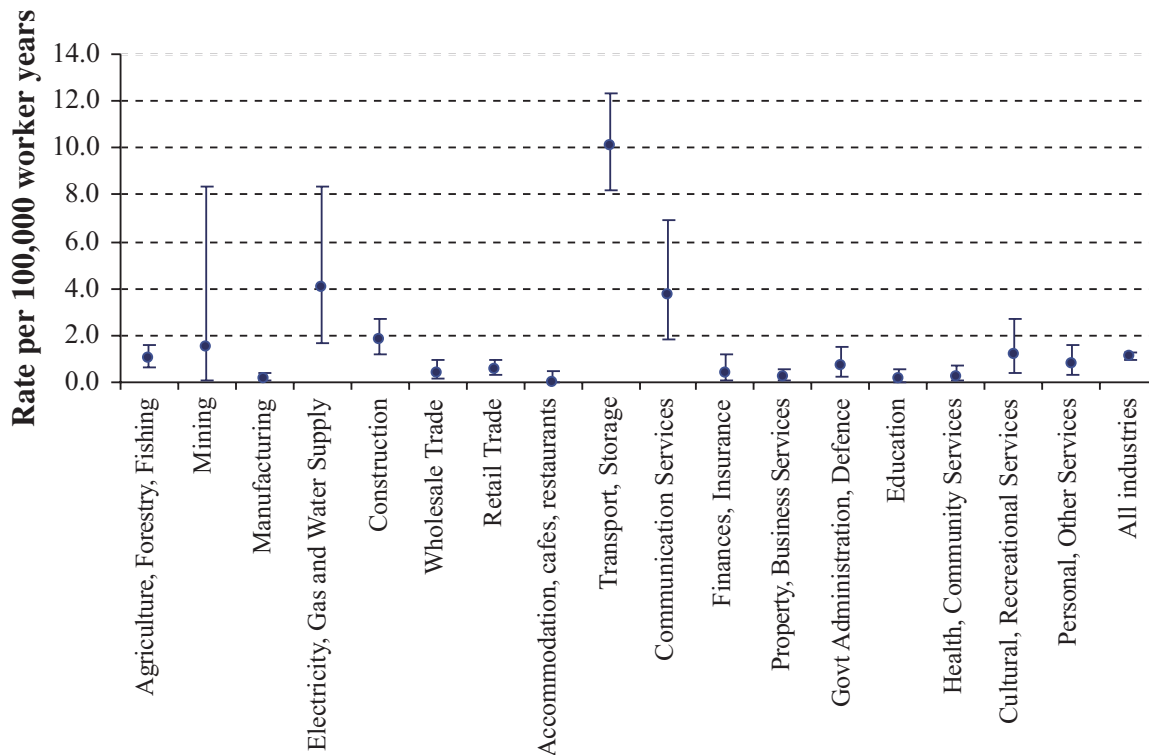
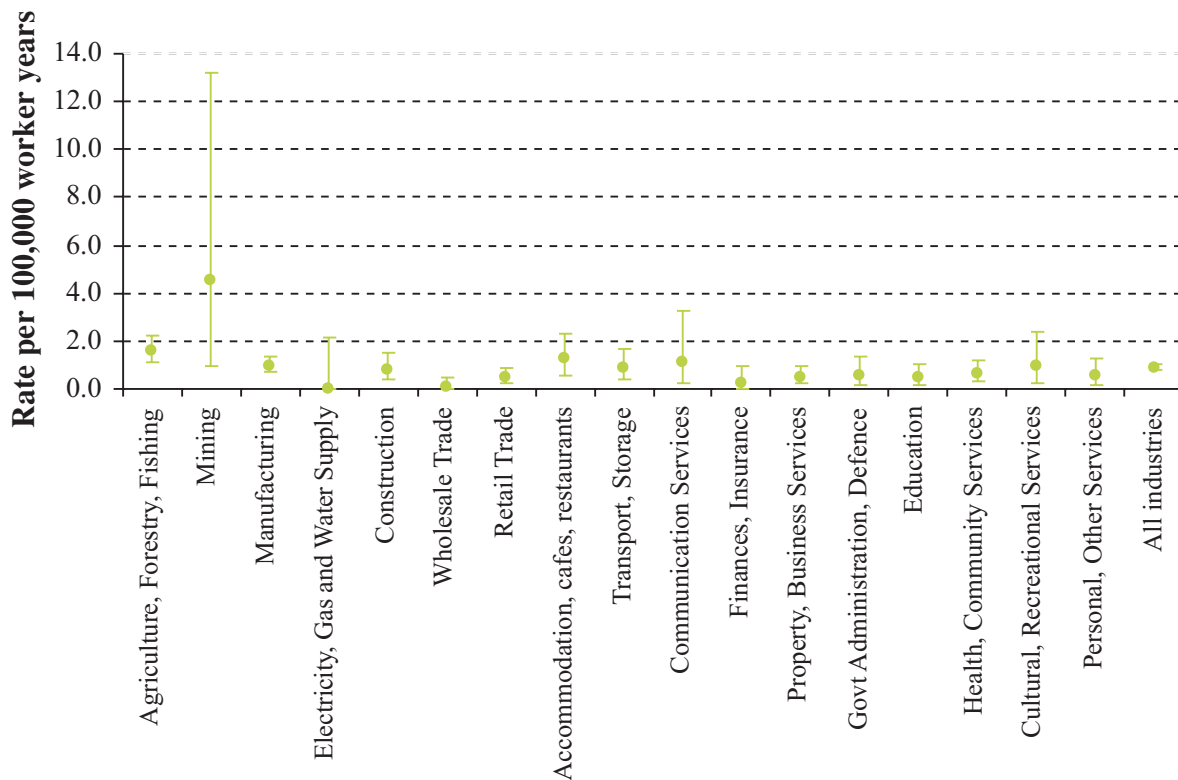


Figure 11: Industry (ANZSIC 1996)¹⁸ of work-related fatal traffic injuries (age 15-84):
Rate (95% confidence interval): 1985-1998 – commuting (n=190 fatalities*)



* 32 missing industry – included in all industries calculation

4.5.4 Occupation

Both ‘usual occupation’ and ‘occupation at the time of the injury’ were recorded for this study. ‘Occupation at the time of injury’ has been used for analysis to allow comparison with other studies. For the working group, the highest number of fatalities occurred in the ‘*plant and machine operators and assemblers*’, most notably to ‘*drivers and mobile machinery operators*’ (111 fatalities) (Figure 12, Table 8).

For commuting, the highest numbers of fatalities occurred in the ‘*plant and machine operators and assemblers*’ and the ‘*agricultural forestry and fishing*’ occupations. In the plant and machine operators the fatalities were predominantly to ‘*stationary machine operators and assemblers*’ (20 fatalities) and in the agricultural industry to ‘*market orientated agricultural and fishery workers*’ (34 fatalities) and ‘*market orientated animal producers*’ (17 fatalities).

Figure 12: Occupation of work-related fatal traffic injuries – Major occupational groups (NZSCO 1995)¹⁷: 1985-1998 - working (n=241 fatalities) and commuting (n=192 fatalities)

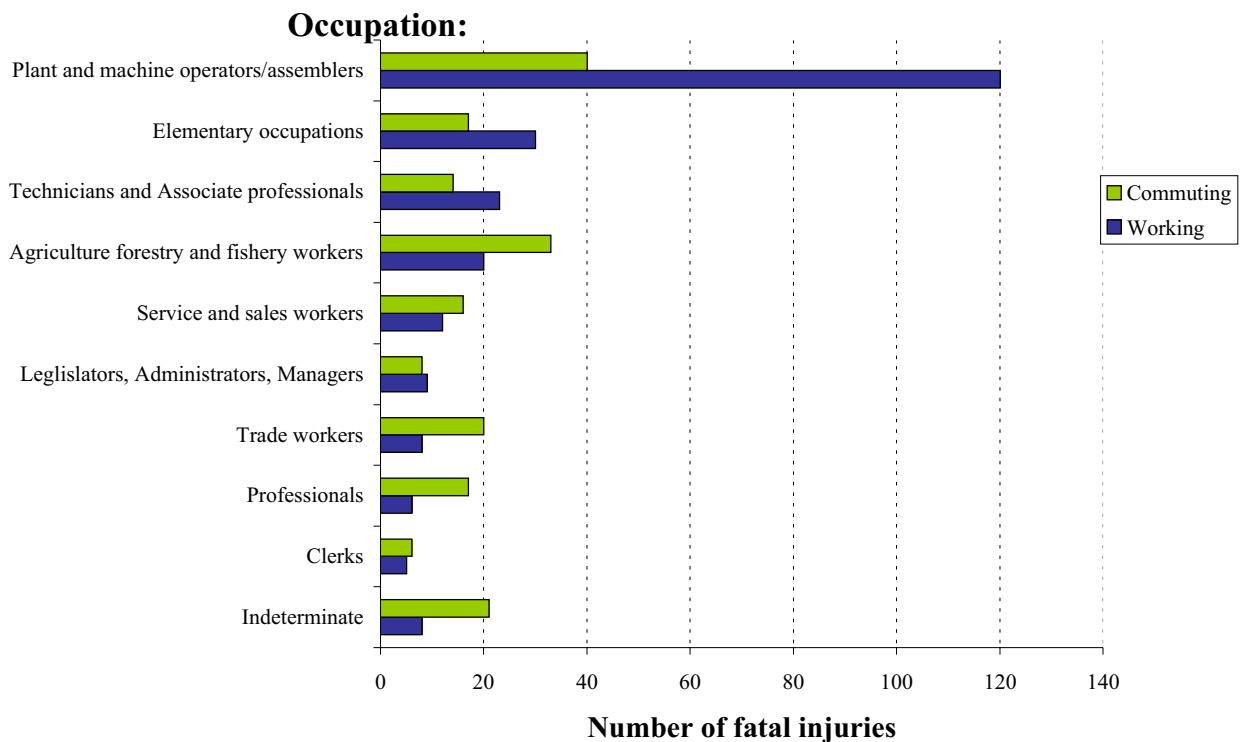


Table 8: Occupation of work-related fatal injury cases: number and rate (95% confidence interval) for occupational groupings (NZSCO 1995)¹⁷ (Age 15-84) With more than 5 fatalities for the study period: 1985-1998

Occupation	Working			Commuting			Working and Commuting		
	Number	Rate per 100,000	95% C.I.	Number	Rate per 100,000	95% C.I.	Number	Rate per 100,000	95% C.I.
<i>Legislators, Administrators, Managers</i>	9	0.4	0.2-0.7	8	0.4	0.2-0.7	17	0.74	0.4-1.2
i. Corporate Managers	7	0.3	0.1-0.7	8	0.4	0.2-0.7	15	0.67	0.4-1.1
ii. Specialised Managers	5	0.3	0.1-0.7	7	0.4	0.2-0.8	12	0.70	0.4-1.2
<i>Professionals</i>	6	0.3	0.1-0.5	17	0.7	0.4-1.1	23	0.96	0.6-1.4
i. Life science and health professionals	1	0.2	0.0-0.9	5	0.8	0.3-1.9	6	0.98	0.4-2.1
i. Teaching professionals	2	0.2	0.0-0.9	4	0.5	0.1-1.3	6	0.73	0.3-1.6
i. Other professionals	2	0.3	0.0-1.2	4	0.6	0.2-1.6	6	0.96	0.4-2.1
<i>Technicians and Associate Professionals</i>	23	1.0	0.6-1.5	14	0.6	0.3-1.0	37	1.56	1.1-2.1
i. Physical Science and Engineering	6	0.9	0.3-2.0	5	0.8	0.3-1.8	11	1.69	0.8-3.0
ii. Physical Science Technicians	3	0.9	0.2-2.6	4	1.2	0.3-3.0	7	2.04	0.8-4.2
i. Other Association Professionals	16	1.1	0.6-1.7	6	0.4	0.2-0.9	22	1.46	0.9-2.2
ii. Finance and Sales Associate Professionals	15	2.2	1.2-3.6	3	0.4	0.1-1.3	18	2.63	1.6-4.2
iii. Commercial Traveller/Sales Representative	11	4.9	2.4-8.7	1	0.4	0.0-2.5	12	5.29	2.7-9.2
<i>Clerks</i>	5	0.2	0.1-0.4	6	0.2	0.1-0.5	11	0.38	0.2-0.7
<i>Service and Sales Workers</i>	12	0.4	0.2-0.8	15	0.5	0.3-0.9	27	0.97	0.6-1.4
i. Personal and Protective Service workers	6	0.4	0.4-0.4	11	0.7	0.4-1.2	17	1.07	0.6-2.4
ii. Housekeeping and Restaurant Services	0	-	-	9	1.3	0.6-2.4	9	1.27	0.6-2.4
ii. Protective Service Workers	5	1.6	0.5-3.7	1	0.3	0.0-1.8	6	1.90	0.7-4.1
i. Salespersons, Demonstrators and Models	6	0.5	0.2-1.1	4	0.3	0.1-0.9	10	0.83	0.4-1.5
<i>Agriculture Forestry and Fishery Workers</i>	21	1.0	0.6-1.6	34	1.7	1.2-2.3	55	2.69	2.0-3.5
i. Market Orientated Agricultural/Fishery workers	21	1.0	0.6-1.6	34	1.7	1.2-2.3	55	2.69	2.0-3.5
ii. Market Farmers and Crop Growers	3	0.6	0.1-1.7	12	2.3	1.2-3.9	15	2.82	1.6-4.7
iii. Fruit Grower, Worker	2	1.1	0.1-4.1	9	5.1	2.3-9.7	11	6.21	3.1-11.1
ii. Market Orientated Animal Products	16	1.2	0.7-2.0	17	1.3	0.8-2.1	33	2.48	1.7-3.5
iii. Crop and Livestock Farmer, Worker	6	2.6	1.0-5.8	10	4.4	2.1-8.1	16	7.05	4.0-11.5

cont.

- Major occupational groups
- i. Submajor occupational groups
- ii. Minor occupational groups
- iii. Unit occupational groups

Table 8 cont.

Occupation	Working			Commuting			Working and Commuting		
	Number	Rate per 100,000	95% C.I.	Number	Rate per 100,000	95% C.I.	Number	Rate per 100,000	95% C.I.
Trades Workers	8	0.4	0.2-0.7	20	0.9	0.6-1.4	28	1.3	0.9-1.9
i. Building Trades Workers	2	0.2	0.0-0.8	10	1.1	0.5-1.9	12	1.3	0.7-2.2
ii. Building Frame and Related Traders Workers	0	-	-	5	1.1	0.4-2.5	5	1.1	0.4-2.5
i. Metal and Machinery Trades Workers	5	0.7	0.2-1.6	8	1.1	0.5-20.9	13	1.7	0.9-3.0
Plant and Machine Operators/Assemblers	121	5.5	4.5-6.5	39	1.8	1.3-2.4	160	7.2	6.1-8.4
i. Industrial Plant Operators	1	0.4	0.0-2.3	9	3.7	1.7-7.0	10	4.1	2.0-7.5
i. Stationary Machine Operators and Assemblers	5	0.4	0.1-1.0	20	1.7	1.0-2.6	25	2.1	1.4-3.1
ii. Food and Related Products Processing Machine	-	-	-	14	3.6	2.0-6.0	14	3.6	2.0-6.0
iii. Slaughterer	-	-	-	8	3.3	1.4-6.5	8	3.3	1.4-6.5
iii. Milk and Other Dairy Products Maker	-	-	-	5	17.3	5.6-40.4	5	17.3	5.6-40.4
i. Drivers and Mobile Machinery Workers	111	17.4	14.3-20.9	8	1.3	0.5-2.5	119	18.6	15.4-22.3
ii. Motor Vehicle Drivers	96	21.8	18.1-27.1	4	0.9	0.3-2.3	100	22.7	18.5-27.6
iii. Heavy Truck or Tanker Driver	81	28.6	22.7-35.5	3	1.1	0.2-3.1	84	29.6	23.6-36.7
iii. Taxi Driver	8	12.4	5.3-24.4	1	1.6	0.0-8.6	9	13.9	6.4-26.4
iii. Light Truck or Van Driver	5	15.1	4.9-35.4	-	-	-	5	15.1	4.9-35.3
ii. Agricultural/Earthmoving/Equipment Operators	15	9.1	6.0-16.5	2	1.2	0.2-4.4	17	10.3	6.0-16.5
iii. Earthmoving Machinery Operator	5	14.1	4.6-32.9	-	-	-	5	14.1	4.6-32.9
iii. Roading/Paving Machine Operator	6	38.6	14.2-84.0	-	-	-	6	38.6	14.2-84.0
Elementary Occupations	27	1.9	1.3-2.8	16	1.1	0.6-1.8	43	3.0	2.2-4.1
i. Labourers and Related Elementary Service Workers	27	1.9	1.3-2.8	16	1.1	0.6-1.8	43	3.0	2.2-4.1
ii. Messengers and doorkeepers	11	9.2	5.8-18.6	-	-	-	11	9.2	4.6-16.5
iii. Courier and Deliverer	12	10.7	6.1-19.7	-	-	-	12	10.7	5.5-18.7
ii. Labourers	14	2.9	1.4-4.5	10	2.0	1.0-3.8	24	4.9	3.1-7.3
iii. General Labourer	11	2.8	1.4-5.1	7	1.8	0.7-3.7	18	4.6	2.7-7.3

Occupation – rates

'Drivers and mobile machinery workers' had the highest rate of work-related fatal injuries for working decedents (Table 8). This rate was 17 times that of the total working population. More specifically, the highest rate was amongst '*professional drivers of motor vehicles*' (21.8 per 100,000 workers) i.e. '*heavy truck or tanker drivers*' (28.6 per 100,000 workers), '*light truck and van drivers*' (15.1 per 100,000 workers) and '*taxi drivers*' (12.4 per 100,000 workers). '*Agricultural/earthmoving and equipment operators*' also had high rates (9.1 per 100,000 workers). Most notably within this group were '*earthmoving machinery operators*' (14.1 per 100,000 workers), and '*roading/paving machine operators*' (38.6 per 100,000 workers). Other occupations that had significantly higher rates of fatal injuries than the total working population were '*couriers and deliverers*' (10.7 per 100,000 workers), and '*commercial travellers and sales representatives*' (4.9 per 100,000 workers).

Amongst persons commuting, occupations showing a significant rate of vehicle crash were '*market orientated agricultural/fishery workers*' (1.7 per 100,000 workers), '*industrial plant operators*' (3.7 per 100,000 workers) and '*stationary machine operators and assemblers*' (1.7 per 100,000 workers) (Table 8).

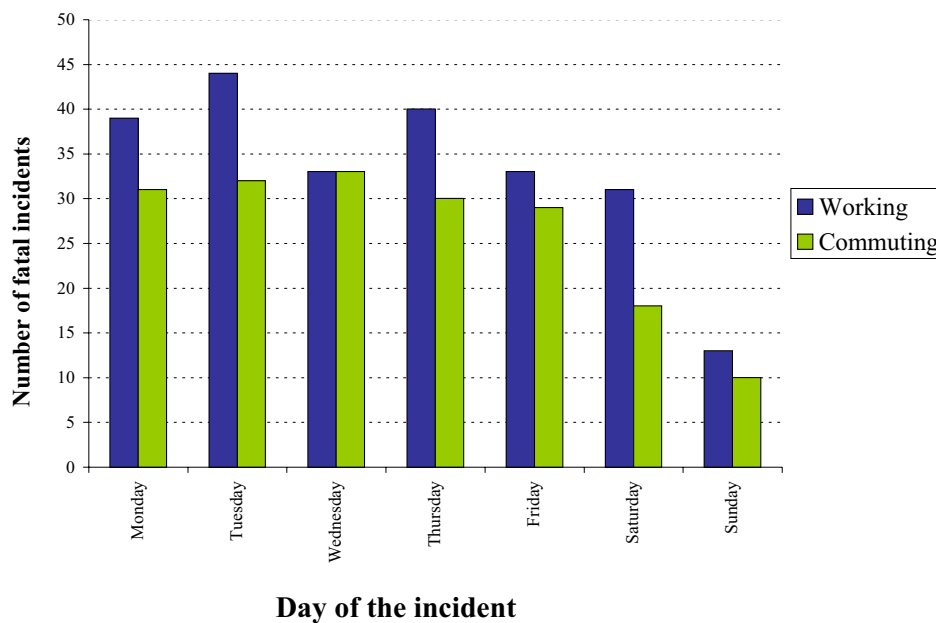
4.6 Circumstances of the crash

Numbers reported in this section of the report, represent the number of incidents, rather than the number of fatal injuries that occurred.

4.6.1 Day of the week

Most working crashes (94%) occurred between Monday and Saturday, and there were similar numbers on each of those days (Figure 13). Most commuting crashes (85%) occurred between Monday and Friday. A minority of working decedents (6%), or commuting (6%), were fatally injured outside the Monday-Saturday working week.

Figure 13: Day of week of work-related fatal traffic crashes (age 0-84):
1985-1998 – working (n=233 incidents*) and commuting (n=183 incidents)



* note – does not include 1 case – missing day of incident

The relevant importance of work-related traffic crashes to other traffic injury is important in terms of prioritising areas for injury prevention interventions. A comparison was made of the contribution of work-related traffic crashes relative to all traffic fatalities in New Zealand. Of all fatal traffic crashes occurring between Monday and Friday, between approximately 4% and 10% were during working or commuting activity. About 5% of all fatal traffic crashes between 1985 and 1998, occurred during either work-related activity or commuting activity (Table 9).

Table 9: Relative significance of work-related fatal traffic crashes to all road crashes for days of the week: 1985-1998 – working and commuting

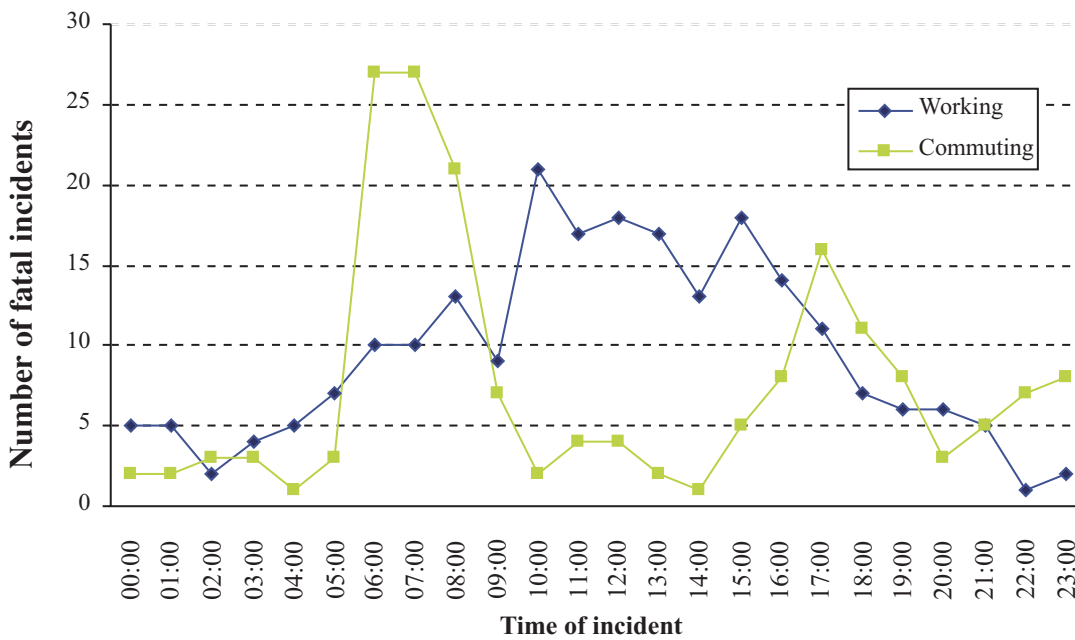
Day	All crashes 1985-1998*	Working crashes		Commuting crashes		Working and Commuting	
		n	% of all crashes	n	% of all crashes	n	% of all deaths
Monday	736	39	5.3	31	4.2	70	9.5
Tuesday	804	44	5.5	32	4.0	76	9.5
Wednesday	868	33	3.8	33	3.8	66	7.6
Thursday	1092	40	3.7	30	2.7	70	6.4
Friday	1434	33	2.3	29	2.0	62	4.3
Saturday	1661	31	1.9	18	1.1	49	3.0
Sunday	1294	13	1.0	10	0.8	23	1.8
Total	7889	233	3.0	183	2.3	416	5.3

* LTSA data 1985-1998²⁰⁻³³

4.6.2 Time of the day

The majority of crashes for working decedents occurred during the workday hours, peaking at around 10am. For commuting, there were two major peaks during the day. The first was between 5am and 8am, and the second around 5pm (Figure 14).

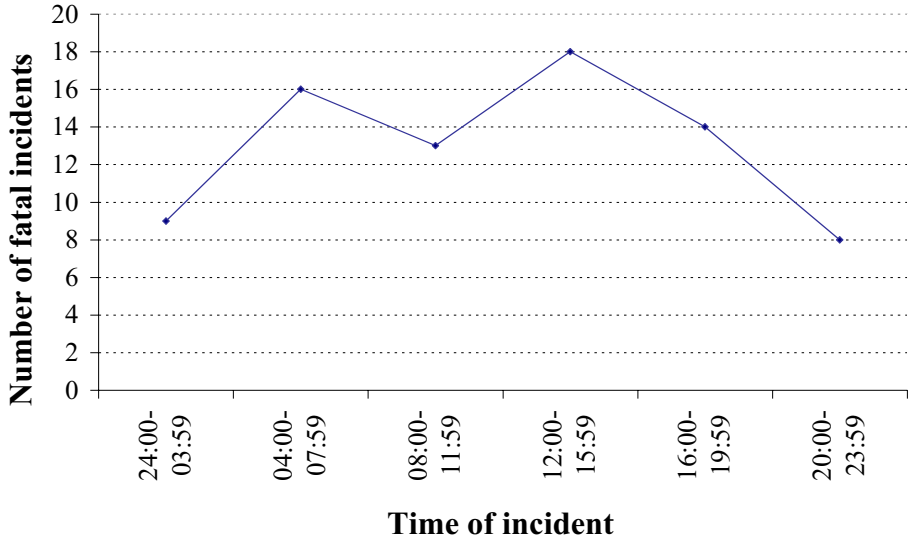
Figure 14: Time of crash - for work-related fatal traffic crashes (age 0-84): 1985-1998 – working (n=226 incidents*) and commuting (n=180 incidents*)



*note – does not include 8 cases (working) and 3 cases (commuting) – missing time of incident

'Heavy truck and tanker drivers' were the only occupational group with sufficient numbers to examine the effect of time of day on crash frequency. Fatal incidents were more common during the daytime for this occupational group, although a sizeable minority also occurred during the night (Figure 15).

Figure 15: Time of crash for work-related fatal traffic crashes to heavy truck and tanker drivers (age 0-84): 1985-1998 – working (78 fatalities*)



*note – does not include 3 truck drivers where time of crash was missing

4.7 Circumstances of the crash – vehicle and road factors

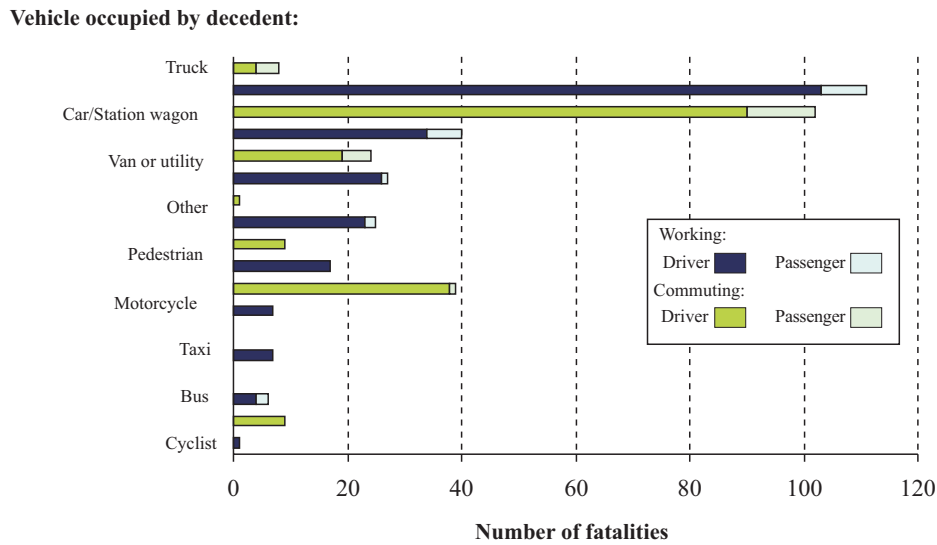
Because the LTSA database records information about vehicle and road factors that originated from the police report made at the scene of the crash, it is likely to be more accurate than a determination made by the study team from coronial records where complete circumstances of the crash were not always available. Thus, the LTSA records for vehicle and road factors were the source of information for detail on the circumstances of crashes.

4.7.1 Type of vehicle

Nearly half the working decedents were truck drivers (n=103, 43%), or truck passengers (n=8, 3%), whereas commuting decedents predominantly occupied cars (n=102, 53%) and motorcycles (n=39, 20%) (Figure 16).

Nineteen working decedents (7.9%), and nine commuting decedents (4.7%), were not in a vehicle at the time of the incident (e.g. milk boys).

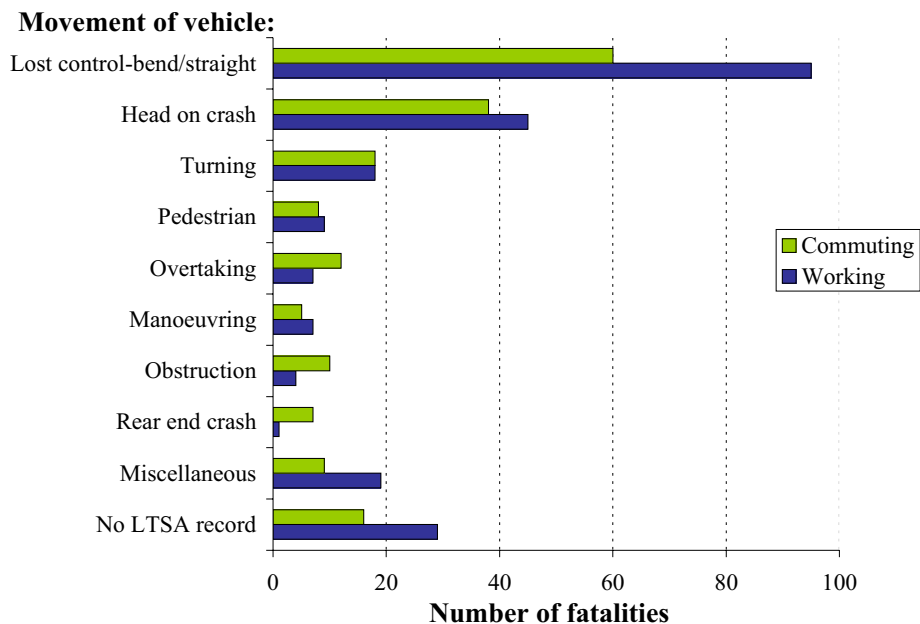
Figure 16: Type of vehicle in which fatal work-related traffic injury occurred (age 0-84):
1985-1998 – working (n=241 fatalities) and commuting (n=192 fatalities)



4.7.2 Movement of the vehicle at the time of the crash

The most commonly reported movement of the vehicle prior to the crash were ‘lost control’ (41% working, 33% commuting) followed by ‘head on crash’ (19% working, 21% commuting) (Figure 17).

Figure 17: Movement of vehicle in fatal work-related traffic crashes (age 0-84):
1985-1998 – working (n=234 incidents) and commuting (n=183 incidents)



4.7.3 Crash Location

Crashes predominantly occurred on a state highway, on a sealed road in motorised transport (Table 10).

Table 10: Crash location for fatal work-related traffic incidents (age 0-84): 1985-1998 – working (n=234 incidents) and commuting (n=183 fatalities)*

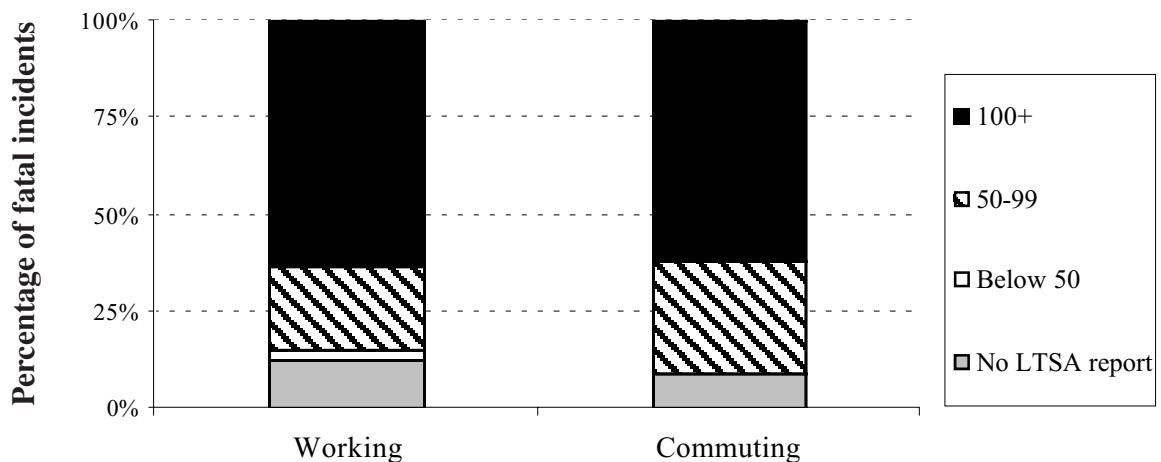
		Working		Commuting		Total	
		n	%	n	%	n	%
State highway	Yes	125	53	82	45	207	50
	No	80	34	85	46	165	40
	Unknown	29	12	16	9	45	11
Road surface	Sealed road	207	88	170	93	377	90
	Other (e.g. footpath, other roadway, bridge)	27	12	13	7	40	10
Locality	Cars/trucks/bikes/buses	191	82	173	95	364	87
	Other mobile vehicle	16	7	1	1	17	4
	Pedestrian	19	8	9	5	28	7
	Other	8	3	0	0	8	2

*% may not add to 100 because of rounding

4.7.4 Speed Limit

The speed limit for the section of road, on which the fatal injury occurred, was available for 89% of cases. Nearly three quarters of fatal injuries (73% working, 69% commuting) occurred on the open road in a 100km/hour speed zone (Figure 18).

Figure 18: Speed limit of the road on which the fatal work-related injury occurred (age 0-84): 1985-1998 – working (n=234 incidents) and commuting (n=183 incidents)



4.8 Circumstances of the crash – contributing factors

4.8.1 Contributing factors

The factors that contribute to a crash occurring are complex and the coding of them is subject to variation by the person identifying them. This study had two sources of information about contributing factors; information in the coronial file and factors recorded in the LTSA database, determined by the police attending the scene of the crash. LTSA records were not available for all the crashes identified as being work-related, but when they were, contributing factors identified by the two sources were compared. The level of agreement was high, except that the LTSA had a large number of contributing factors '*other not specified*'. Because agreement between the two sources was high - coronial files were deemed to provide reliable information on the incident. Up to three contributing factors could be coded for each crash.

The predominant human factors contributing to crashes for both decedents working and commuting were speed (22% and 19%) and failure to keep left (20% and 29%). Vehicle factors contributing to crashes were primarily the driver or passenger being thrown from the vehicle (25% and 18%) and physical components of the vehicle (e.g. tyres and brakes) (13% and 11%). Environmental factors contributing to the crash were predominantly road factors such as a slippery road surface (30% and 31%) (Table 11).

Table 11: Contributing factors* (identified by coronial files) for work-related traffic fatalities (age 0-84):
1985-1998 – working (n=241 fatalities) and commuting (n=192 fatalities)

	Working		Commuting		Total	
	n	%	n	%	n	%
Person factors						
too fast for conditions	52	21.6	36	18.8	88	36.1
failed to keep left	49	20.3	55	28.6	104	42.6
attention diverted	18	7.5	7	3.6	25	10.2
fatigue+	17	7.1	26	13.5	43	17.6
inexperienced or incompetent	16	6.6	13	6.8	29	11.9
physical defect (e.g. blindness, old age)	13	5.4	7	3.6	20	8.2
alcohol or drugs	12	5.0	31	16.1	43	17.6
failed to give way	9	3.7	7	3.6	16	6.6
suddenly (braked, turned or swerved)	8	3.3	11	5.7	19	7.8
fault in handling	7	2.9	2	1.0	9	3.7
did not stop	6	2.5	9	4.7	15	6.1
in or on vehicle (insecure position, opened door)	6	2.5	2	1.0	8	3.3
did not check adequately	5	2.1	7	3.6	12	4.9
overtaking	4	1.7	11	5.7	15	6.1
pedestrian factors	17	7.1	13	6.8	30	12.3
Vehicle factors						
driver or passenger thrown from vehicle	60	24.9	35	18.2	95	38.9
vehicle factors (e.g. tyres, brakes)	32	13.3	21	10.9	53	21.7
load	20	8.3	3	1.6	23	9.4
runaway vehicle	7	2.9	0	0.0	7	2.9
Environmental factors						
road factors	71	29.5	60	31.3	131	53.7
weather	13	5.4	14	7.3	27	11.1
other	14	5.8	15	7.8	29	11.9

*note – up to 3 contributing factors coded per fatality

+ additional cases of fatigued driver were then identified from LTSA records

Because alcohol and fatigue are important contributing factors in road crashes, both the coronial file and the LTSA file were examined to determine whether these factors had played a contributing role in the work-related crashes.

4.8.2 Alcohol

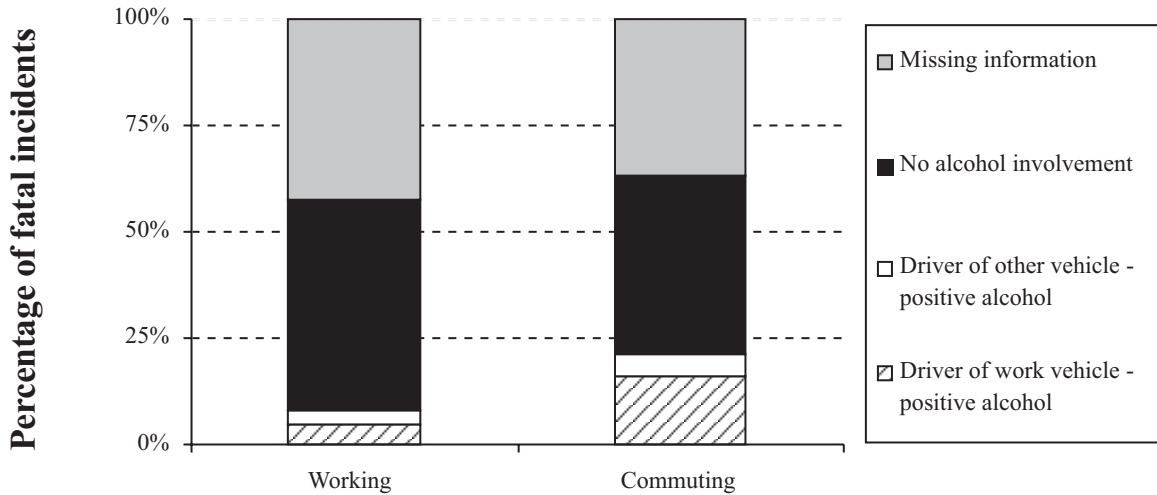
To determine whether alcohol contributed to the crash was not straightforward. Coronial files do not consistently report whether alcohol is a factor in a road crash. In New Zealand the Institute of Environmental Science and Research Limited (ESR), is responsible for testing blood and urine samples from crash victims for blood alcohol concentrations (BAC). In some files there was a report from the ESR stating whether a blood sample taken from the decedent contained alcohol and where relevant, the BAC; in others the pathology or police report might state whether alcohol played a role in the crash. In many files, there was no mention of alcohol, and it was therefore impossible to determine whether alcohol was a factor in the crash, whether it was not measured, or the amount was simply not reported. To complement information available from coronial files, a secondary source of alcohol determination was utilised. The Land Transport Safety Authority Traffic Crash Report collects information from the police attending the scene on whether alcohol was suspected in a crash. Where possible, objective measures (breath alcohol measurements, blood and/or urine concentrations) were used to identify the presence/absence of alcohol. Subjective measures, made by the police, were substituted for alcohol determination, when objective measures were unavailable.

A comparison was made between the coronial files and the LTSA traffic crash reports to determine whether in fact alcohol had been a factor in the crash. Land Transport reports were available for 386 (89%) of the fatal injuries. Wherever there was a suggestion of alcohol involvement, either in the coronial file or in the LTSA database, both files were reviewed together to determine alcohol involvement. An objective blood alcohol concentration measurement in either the coronial file or the LTSA database was taken as the primary determinant of alcohol involvement. Where a BAC was not available, subjective observations by the police or the coroner were used to determine alcohol involvement. Where information from the LTSA and the coronial file conflicted, the LTSA was assumed to be correct unless there was a BAC reading in the coronial file in which case information in the coronial file was used. For the fatalities with no LTSA record, the information from the coronial file alone was used to identify the involvement of alcohol in the crash.

A significant proportion of cases (42% working and 37% commuting) had no information in either the coronial file or the LTSA database stating the presence or absence of alcohol of the decedent (Figure 19). Less than one tenth (8%) of decedents working, on whom alcohol information was available, and 5% of all decedents working, had a positive blood alcohol at the time of the crash. Approximately one quarter (25%) of decedents commuting, on whom

alcohol information was available, and 16% of all decedents commuting, had a positive blood alcohol at the time of the crash.

Figure 19: Alcohol involvement in work-related fatal traffic crashes (age 0-84): 1985-1998 – working (n=241 fatalities) and commuting (n=192 fatalities)



4.8.3 Fatigue

The determination of fatigue involvement in a crash is currently based on a subjective assessment. Fatigue is not systematically recorded in either the LTSA database or the coronial file. Information collected from the LTSA database was used in addition to coronial files to determine whether fatigue was a contributory factor to work-related crashes. All of the fatal injuries identified from coronial files that indicated fatigue as a factor were similarly coded in the LTSA database. The LTSA database contained some additional cases of fatigue related crashes, which were accepted at face value, on the basis that in all cases there was no contradictory evidence in the coronial files. For 377 fatalities, it could not be determined whether fatigue played a role in the incident or not.

Fatigue played a contributory role in 26 working crashes (11%) and 30 commuting crashes (16%).

4.8.4 Other Drugs

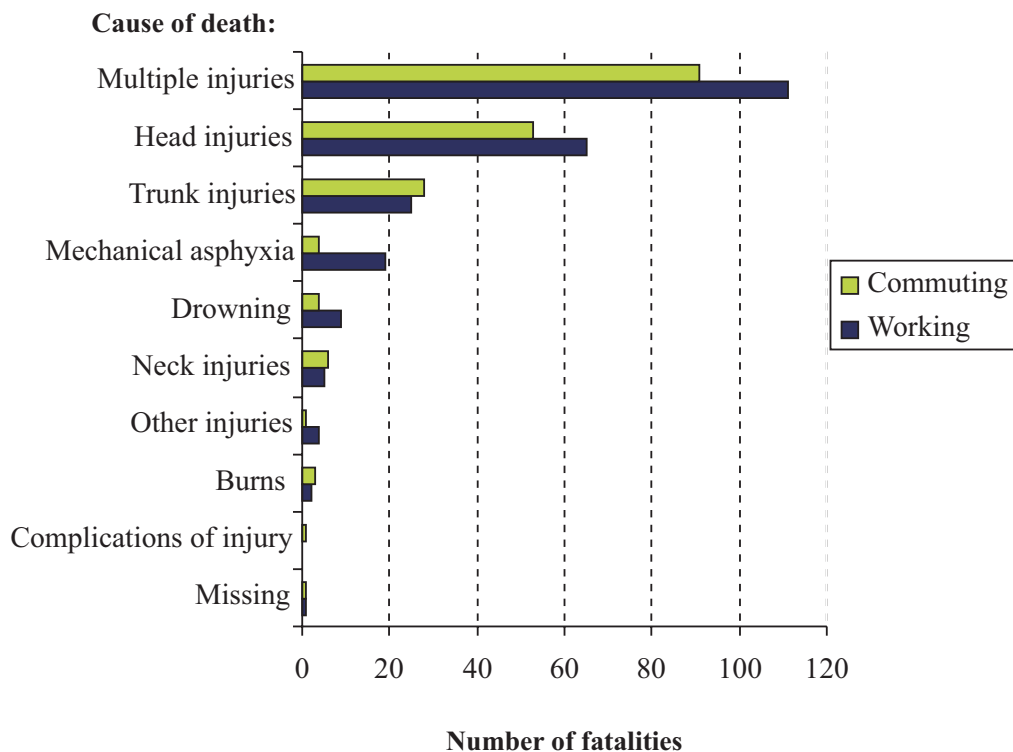
The use of a number of other drugs was indicated in some coronial files, although not recorded in a systematic manner. For 421 fatalities, it could not be determined whether drugs (apart from alcohol) played a role in the incident or not. For the decedents working, two had used tetrahydrocannabinol (THC) (which is the psychoactive ingredient in cannabis) and another had used methadone. Of the decedents commuting, analysis of blood samples found that four had positive levels of THC, one had taken antiepileptic drugs, two had taken antidepressants, and two had taken an unspecified drug.

4.9 Circumstances of the crash – characteristics of the fatal injury

4.9.1 Cause of death

The pathophysiological cause of death was generally recorded in either the coroners finding or the pathology report. The cause of death did not differ between working or commuting decedents. Multiple injuries, head injuries and trunk injuries were the most common cause of death, accounting for 86.2% of all fatalities (Figure 20).

Figure 20: Cause of death for decedents of work-related traffic crashes (age 0-84): 1985-1998 – working (n=241 fatalities) and commuting (n=192 fatalities)



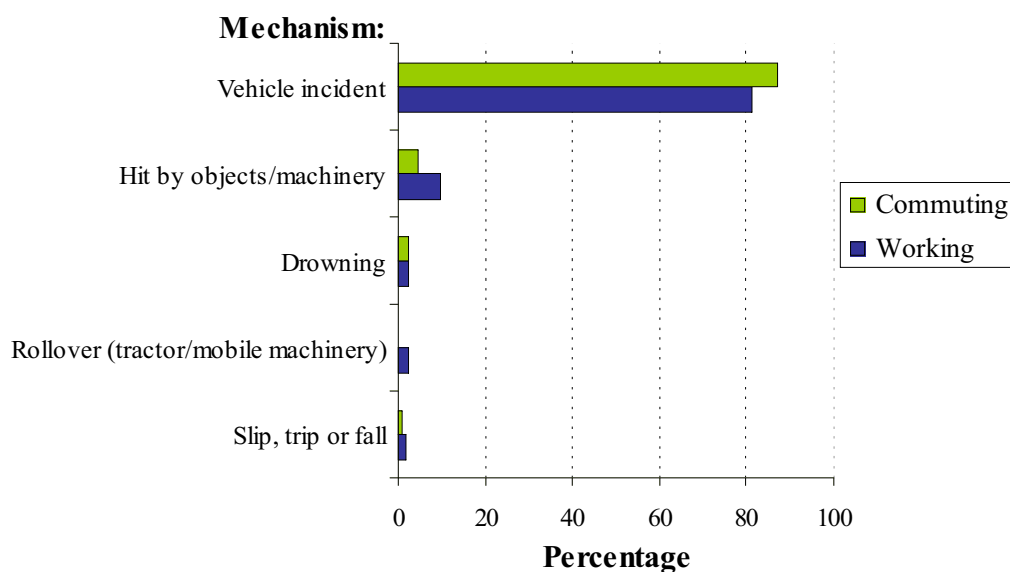
4.9.2 Survival time of decedents

Over three quarters (77%) of the incidents resulted in death at the injury site, 3% died on route to the hospital, and 20% died at the hospital. Most of the crashes, were discovered within 5 minutes of it occurring (79%), with a further 12% were discovered within half an hour of the crash.

4.9.3 Mechanism of fatal injury

The mechanism of the crash describes the physical event that best describes the circumstances of the fatal incident (Figure 21). Over 80% of both the working and commuting crashes were vehicle incidents.^{6} Although the remaining were also vehicle incidents they primarily involved being ‘hit by objects’ or ‘machinery’ (i.e. pedestrians), drowning, rollover and slips trips or falls.

Figure 21: Mechanism of fatal injury for work-related traffic crashes:
1985-1998 – working (n=241 fatalities) and commuting (n=192 fatalities)

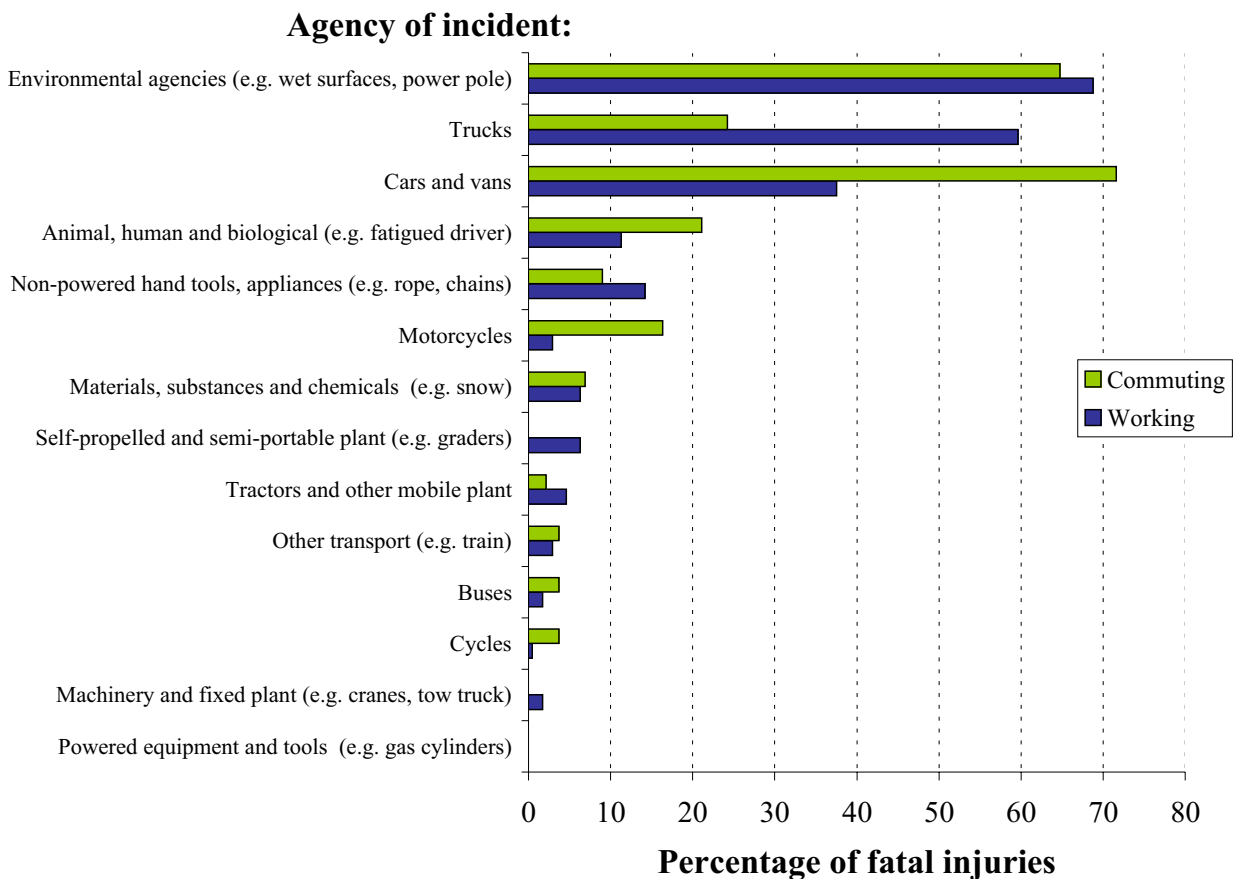


{6} Vehicle incidents include all occurrences in which a moving vehicle was involved except where the decedent was injured as a result of being struck by a vehicle or striking against a vehicle when not travelling in one - these were classified as “hit by objects of machinery” or “rollover”^[19]

4.9.4 Agency of incident

The agency of incident is described as the object, substance or physical conditions, which was responsible for the incident occurring, or that was most closely involved in the crash. Up to three agencies were coded for each case. For working decedents, the major agencies of incident were ‘environmental factors’ (such as weather and road surfaces), and ‘vehicles’ (such as trucks, cars or vans) (Figure 22). For commuting, the major agencies of incident were similar, although in addition, ‘animal human and biological agencies’ played a role. This includes animals on the road or the condition of the driver (e.g. fatigue, alcohol consumption).

Figure 22: Agency of incident for work-related fatal traffic crashes (age 0-84): 1985-1998 – working (n=233 incidents*) and commuting (n=182 incidents*)

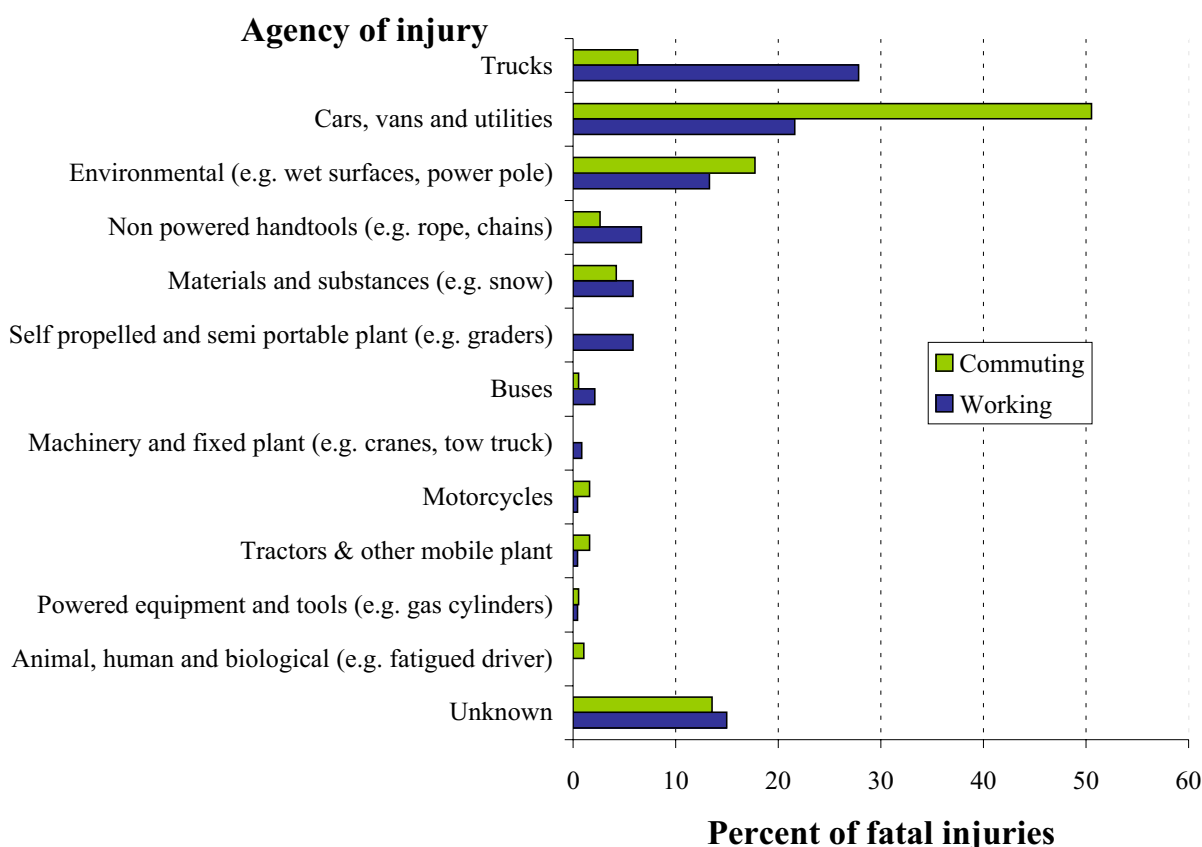


*note - missing information for 2 incidents (1 working, 1 commuting)

4.9.5 Agency of injury

The agency of injury is defined as the object, substance or physical condition that made contact with the person to directly cause the injury. For example, when a decedent was crushed in the cab of a truck, the agency of injury was ‘the truck’. If a decedent was thrown from a motorcycle, into a river and drowned, the agency of injury was ‘fresh water’. For commuting, the major agency of injury was ‘cars/vans or utilities’ (Figure 23). Of the cases in which the agency of injury could be determined, 69% were caused by a ‘road transport motor vehicle’ (trucks, cars, motorcycles or buses). Similarly, for working decedents, the major agency of injury was also ‘cars vans and utilities’, but additionally ‘trucks’. Of the cases in which the agency of injury could be determined, 61% were caused by road transport motor vehicles (i.e. trucks, cars, motorcycles or buses).

Figure 23: Agency of injury - for work-related fatal traffic crashes (age 0-84): 1985-1998 – working (n=241 fatalities) and commuting (n=192 fatalities)



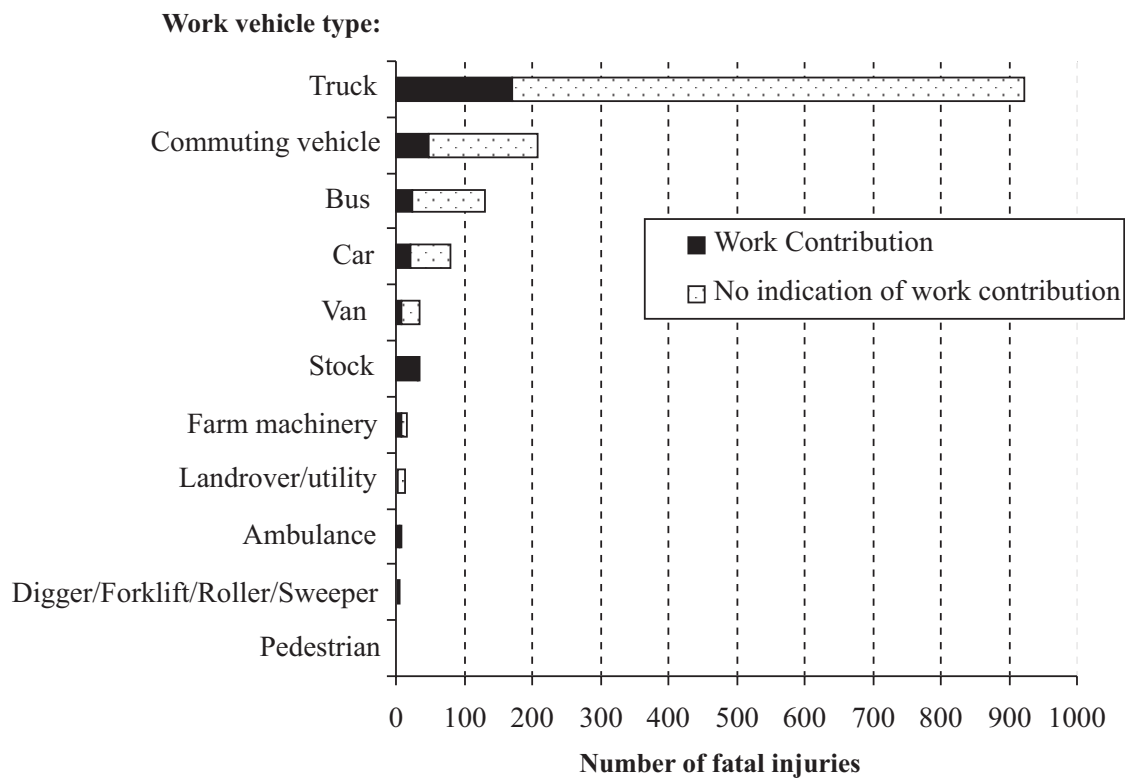
4.9.6 Bystanders

Road bystanders were people that were not working or commuting to or from work themselves but were killed as the result of a traffic crash, in which a working or commuting vehicle was involved. It should be noted that the person in the working or commuting vehicle did not necessarily make an active contribution to the crash. For example, a 'road bystander' may have been driving and overtaken dangerously on a corner, hitting a truck coming in the opposite direction resulting in the 'bystander' death. The truck driver did not actively contribute to the 'bystander' death.

Between 1985 and 1998 inclusively, 1,391 road bystanders, and 56 work bystanders, were fatally injured. Annually this is an average of 99 road bystanders and 4 work bystanders.

The most common vehicle involved in bystander fatalities were trucks, although notably only 18% of truck drivers could clearly be identified as having actively contributed to the crash (Figure 24).

Figure 24: Working/commuting vehicle involved in bystander fatal traffic injury (aged 0-84) (n=1447 fatalities)



4.10 Contribution of work-related fatal traffic crashes to the overall burden of work-related fatal injury

The relevant importance of work-related traffic crashes to other work-related injury is important in terms of prioritising areas for injury prevention interventions. Overseas studies indicate that they contribute 25% to 40% to the burden of all work-related fatal injuries.^{5,6} The WRFIS estimated that approximately 74 fatalities occurred per year as the result of work activity (excluding traffic crash and deaths of those younger than 15 years of age) and a further seven bystander fatalities.^{3,4} The work-related child study (WRFCS) (in progress by NEOH and IPRU) has estimated that annually one child (i.e. person less than 15 years of age) was killed while engaged in work-related activity between 1985 and 1998 and a further five were killed as the result of someone else's work activity at a static workplace. A total of the annual average work-related burden including traffic crash is therefore 106 fatalities per year (excluding bystanders). If the bystanders to work activity are included, this is elevated to 221 fatalities per year (Figure 25, Table 12).

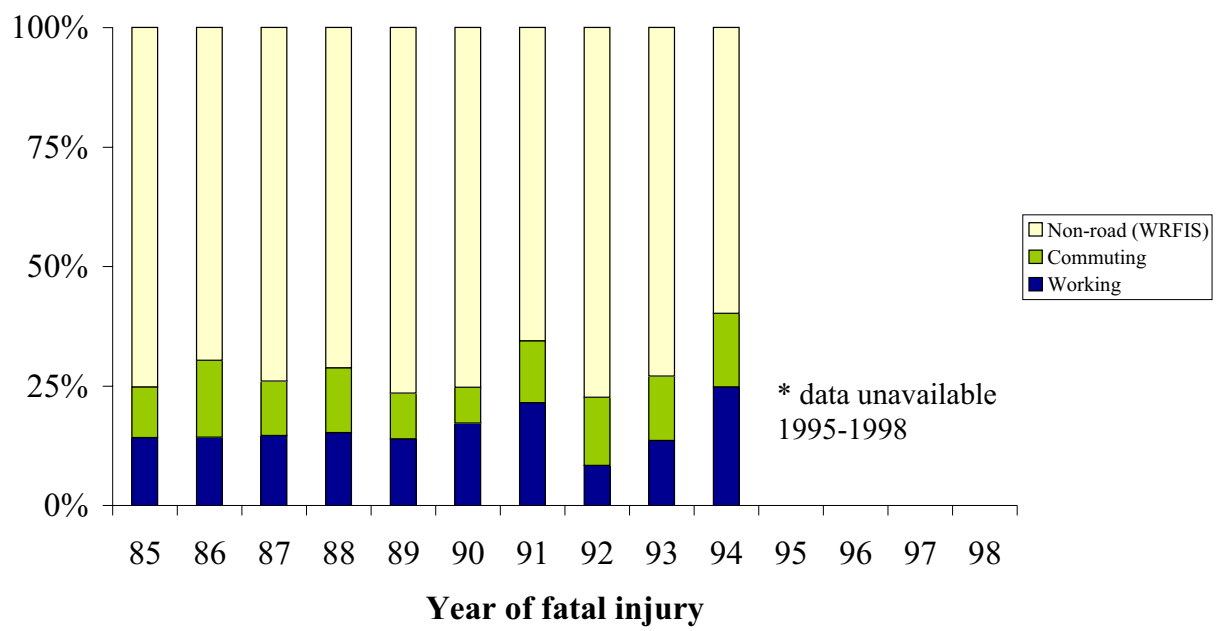
Table 12: Estimate of the mean number of work-related fatal injuries per year

	Source of estimate			Estimated mean
	WRFIS	WRFTS	WRFCS	
Working	74	17	1	92
Commuting	N/A	14	N/A	14
Bystander	7	103	5	115
Total	81	134	73	221

WRFIS Work-Related Fatal Injury Study 1985-1994 (excludes traffic)
 WRFTS Work-Related Fatal Traffic Injury Study 1985-1998 (traffic)
 WRFCS Work-Related Fatal Child Study 1985-1998 (excludes traffic)

In this study, an estimate of the contribution of work-related traffic crash (working and commuting fatalities n=31) to the annual overall burden of work-related fatal injury (n=106) was 29%. This estimate ranged between 24% and 40% for particular years in the time period studied (Figure 25).

Figure 25: Contribution of traffic crashes to the total burden of work-related fatal injury: 1985-1998



note – in 7 cases fatal injuries were included in both studies, for the purposes of this graph the duplicates have been removed from the WRFIS data

5. Discussion

5.1 Numbers, rates, trends

The number of work-related traffic fatalities in New Zealand is significant. This study conservatively estimates that there was an average of 31 fatalities (17 working, 14 commuting) per year over the study period.

Estimating the proportion of all work-related fatalities that can be attributed to traffic injury is important for prioritising target areas for injury prevention interventions. This estimate can only be calculated for the ten years, for which the numbers for traffic and non-traffic fatalities were available.^{3,4} Work-related traffic fatalities accounted for an average of 29% of all work-related fatal injury (yearly estimate ranged: 25% to 40%). If commuting fatalities are excluded from the denominator in the calculation of the proportion of work-related injury (to allow comparability with most international studies where commuting fatalities are not collected), then the working contribution is 18% of all fatal work-related injury. From 1985 to 1998, work-related traffic fatalities accounted for approximately 5.3% of all road fatalities.

The large number of bystander fatalities in the WRFTS (annually 103) should be of concern. The Health and Safety in Employment Act (1992) clearly includes those persons affected by the work of other people as being protected by the legislation. It is impossible (on the basis of the information provided in the coronial file), to make an accurate determination of how much ‘work’ contributed to these fatalities.

The calculation of the rate of work-related traffic injury is important in the comparison of New Zealand data with other populations. The denominator data used in the calculation of the rate (in this study) is the number of people working, rather than the number of person-hours worked, as this is not available. In this study, working had an overall rate of 1.1 per 100,000 workers per year, and commuting an overall rate of 0.9 per 100,000 workers per year. Countries comparable to New Zealand (such as Australia and the United States) have published similar findings in terms of the number of work-related traffic fatalities, the proportion of all motor vehicle traffic fatalities that are work-related, and the relative contribution of bystanders, workers and commuters to work-related fatal traffic fatalities.⁵⁻⁷

5.2 Person factors

The majority of the work-related traffic fatalities were male, for both working decedents (93%) and commuting (80%). A number of factors are likely to explain this greater propensity of male fatalities. Firstly, it may reflect exposure. Males are undertaking nearly twice the number of commuting journeys as females.^{3,4} Secondly, males dominate many of the jobs involving professional driving

(e.g. road transportation). Finally, in particular occupations such as forestry and fishery, commuting is undertaken at riskier times of the day or for longer periods. These occupations are comprised of a predominantly male workforce.

In this study, approximately two thirds of working decedents (66.4%) were under the age of 45. The lower numbers of work-related fatalities observed amongst older workers may reflect the age distribution of driving occupations. Rates of work-related traffic injury were relatively constant between ages 15 and 64 but rose markedly with age 65+. However, caution should be applied when viewing these rates, as the numbers of fatalities in some age bands were very small.

Unlike workers, the number and rate of commuting incidents was highest in the 15-24 year age group and declined with increasing age. Nearly two thirds (64.1%) of commuting decedents were under the age of 44.

In this study, it was not possible to examine ethnicity because of the poor quality of the data. There is no legal requirement for coroners to provide ethnicity information on the decedent, and in 35% of coronial files, these data were missing.

5.3 Work factors

Work factors such as job experience, training, self-employment, working hours or working schedule (such as time constraints) are influential in work-related injury risk.³⁵ A more experienced worker is generally at lower than average risk of work-related injury.³⁶ Self-employed persons have a higher rate of overall work-related injury than wage and salary earners.³⁷⁻³⁹ This may reflect different work processes and practices characteristic of self-employment in general, and self-employment in high-risk settings in particular. For example, being self-employed may result in undertaking hazardous work activities without adequate safety, training and equipment. The self-employed tend to be older and work longer hours. They therefore, have longer exposure to occupational risk factors, than wage and salary earners generally.³⁸

The rates of fatal work-related traffic injury are important for comparing the contribution of work-related fatalities in different industry groups, or across populations. No exposure information for occupation/industry groups on the number of miles driven, or the amount of time spent on the road was available. The proxy value used for the denominator in the calculation of rates was census information on the number of workers in each industry/occupational group. However, these rates may not accurately reflect the risk per unit distance travelled for a particular industry/occupational group. For example, truck drivers will spend more time driving on the road than plumbers, thus based on the number of workers in each occupational category may not accurately reflect risk. The probable effect is to underestimate the risk per unit distance travelled for occupations where driving does not occupy a significant part of the working day. Not surprisingly, given the higher exposure,

the highest industry rates observed in this study, for workers, were in the '*transport and storage*' industry (10 per 100,000 workers). Road freight transportation had particularly high rates. This was also observed in the classification by occupations where '*drivers and mobile machinery workers*' had a rate of 17 per 100,000 workers. These high rates are probably due to increased exposure on the road.

Because workers in all occupations commute to work on the road, fatal injury during commuting is likely to occur in a less regular way for commuting than for working. This was observed in this study, with commuting fatalities spread more evenly across all occupations. Three occupational groups had a statistically higher rate than all occupations. These were '*market orientated agricultural/fishery workers*', '*industrial plant operators*' and '*stationery machine operators and assemblers*'. In industries (such as forestry), workers may have to travel much greater distances than other occupational groups to get to work, at unusual times of the day, thus increasing their risk of injury on the road.

5.4 Temporal factors

Unlike motor vehicle injury generally, where fatalities occur most commonly at the weekend, work-related incidents were most common from Monday to Saturday, and were reasonably evenly distributed between those days. Commuting fatalities occurred most commonly on weekdays, reflecting the traditional working week. Similarly in Australia, the frequency of working and commuting events were twice as great on weekdays as on weekend days.⁴⁰ The proportion of work-related fatalities, to all fatalities on the road that were work-related, was higher during the week than the weekend.

Although working fatalities did occur throughout the day, they were more common during the traditional workday during day-light hours. Time of day for truck driver fatalities was markedly different from 'all workers' in that they were fairly evenly distributed throughout the day and night, reflecting that 'transportation' occurs 24 hours a day. Notably, even among non-transportation workers, a number of fatalities did occur outside the traditional workday, most likely reflecting the well documented stretching of the work day.⁴¹

Commuting fatalities occurred most commonly between 0500 hours and 0800 hours and about 1700 hours. Fatalities occurring at these times are probably due to a combination of circadian and traffic density factors. In general, the higher the traffic volume the greater the frequency of crashes,⁴² as in the morning and afternoon peak traffic periods. The stretching of the morning peak period to include 0500 hours observed in this study most likely reflects commuting needs for specific groups of workers, with shift workers, and in particular night-workers, being likely to commute in these early hours of the morning. Circadian factors potentially also played a role in crashes occurring in the very early morning, with the circadian trough occurring at around this time.

Identification of temporal factors (such as time of day, month and year) is potentially important in the analysis of incidents, in that it may be an indicator of underlying contributing factors. However, to fully realise the information potential of temporal factors, appropriate exposure information is needed. Currently such exposure information is not available in New Zealand. Without appropriate data on the number of people exposed to working/commuting on the road at different times of the day, it is impossible to accurately assess risk.

5.5 Vehicle and road factors

Trucks were the predominant working vehicle and cars the predominant commuting vehicle. The reason for the high number of trucking fatalities is likely to reflect the same sorts of exposure factors as described above, that is the high representation of trucks among working vehicles on the road. Also, the increased risk of a truck crash involving fatalities may be because of the large energy exchanges during the crash phase of the incident with the large mass of a truck⁴³ and because there is a lack of occupant crash protection in most trucks.⁴³

The number of pedestrian fatalities is of concern, contributing to 17% of working and 9% of commuting fatal work-related traffic injuries. This is similar to the 14% reported in the United States between 1992 and 1997.⁴⁴ Pedestrian workers were generally working on the road in occupations such as milk boys or road maintenance workers.

5.6 Contributing factors

Speed, occupant restraints, and alcohol are key priority road safety areas for the LTSA.⁴⁵ These were also examined in the present study.

In this study the number fatalities that involved speed as a contributing factor was similar to that estimated for all fatal road crashes in New Zealand. Approximately 20% in each of working and commuting fatalities involved speed as a contributing factor.

Information about seatbelt use or non-use was not consistently recorded in the coronial files. An assumption (in this study) has been made that when 'being thrown from the vehicle' contributed to the fatal injury, then that person was not restrained by a seatbelt. Of the decedents travelling in a vehicle, in which seatbelt use would be appropriate, 26% of working decedents, and 17% of commuting decedents, were thrown from their vehicle contributing to their death. It is noteworthy that, currently, the law exempts compulsory use of seatbelts for taxi and shuttle vans, and in buses and trucks (unless they have been fitted). A number of organisations both in New Zealand and overseas have recommended that seatbelt use in trucks and other commercial vehicles should be mandatory.⁴⁶

A high proportion of coronial files in this study (42% of working decedents and 37% of commuting decedents) did not contain any information on the BAC. Alcohol was not a contributing factor to the fatal incident for most workers for whom BAC was reported. A sizeable number of the commuting decedents, had a positive BAC (25% of files with known BAC, and 16% of all commuter files). This may reflect, a person commuting home after drinking at work or a work sponsored function, a person commuting to work following heavy intakes the previous evening or alcohol dependence.

Other factors that played a sizeable role in the proportion of fatal incidents were vehicle factors (e.g. tyres or brakes), road factors (e.g. slippery road) and the failure of the person driving a vehicle to keep to the left.

6. Conclusion

Prior to this study, the number of people that died as a result of work-related traffic activity was unknown. This study has determined that traffic fatalities comprise the largest single category of work-related death in New Zealand. Many occupations involve substantial travel on the road; both professional drivers and occupations in which driving is not the principal activity (e.g. repairmen, police, salespeople, emergency services, construction). Information on the number of workers that fall into these categories and the duration of driving exposure for those workers is limited. In addition to workers driving as part of their employment, a number of workers work 'on the public road' (e.g. postal workers, maintenance workers, milk boys). They are thus at risk of being struck by a motor vehicle. Similarly, most of the work force in New Zealand travel to and from work on a public road thus putting themselves at risk of injury.

The work-related traffic fatalities identified in this study confirm the importance of work-related traffic injury to the overall burden of work-related injury in New Zealand.

This study is descriptive and therefore no causal inferences can be made, although the importance of some factors have been highlighted. The environment of a crash is complex and it may be difficult to determine what factors contributed to a crash to provide appropriate interventions. From this study, 'Work-Related Traffic Fatalities' were found to share some similar factors contributing to the incident as do 'all traffic fatalities'. These factors clearly provide targets for prevention activities through both road safety and occupational health and safety mechanisms. The road is not as controllable as other workplaces, however employers have an obligation to manage risk on the road in the same manner in which they manage other occupational health and safety risks, affording workers on the road the same protection enjoyed by their colleagues in a static workplace. Employees must also take responsibility for ensuring that their workplace is safe and take appropriate measures to prevent injury.

With the exception of truck safety which combines both road safety and occupational health and safety efforts, occupations using work-related vehicles have not been typically targeted specifically in traffic injury prevention interventions in New Zealand, although of course they are recipients of broader (i.e. non work-related) national prevention interventions.⁴⁶ The amendment to the Health and Safety in Employment Act clearly specifies mobile units as a place of work as being covered by the Department of Labour Occupational Health and Safety regulations.

The study has produced an estimate of the number of work-related traffic fatalities that occur in New Zealand every year. The resources required to undertake this task were substantial. A work-related indicator should exist on relevant administrative databases so that fatalities could be identified routinely in the future. Such an indicator would also greatly facilitate the identification of non-fatal incidents.

7. References

1. Ministry of Health. Mortality and demographic data: 1998. Wellington: New Zealand Health Information Service, 2001.
2. Land Transport Safety Authority. Motor vehicle accidents in New Zealand. Statistical statement calendar year 1997. Wellington: LTSA, 1997.
3. Feyer A-M, Langley J, Howard M., Horsburgh S., Wright C., Alsop J., Cryer C. Work-related fatal injuries in New Zealand 1985-1994: Descriptive Epidemiology. Dunedin: New Zealand Environmental and Occupational Health Research Centre and The Injury Prevention Research Unit, 1999.
4. Feyer A-M, Langley J., Howard M., Horsburgh S., Wright C., Alsop J., Cryer C. The Work-Related Fatal Injury Study: numbers, rates and trends of work-related fatal injuries in New Zealand 1985-1994. *The New Zealand Medical Journal* 2001;114(1124):6-10.
5. National Occupational Health and Safety Commission. Work-related traumatic fatalities in Australia, 1989 to 1992. Canberra: National Occupational Health and Safety Commission, 1998.
6. United States Department of Labour. Fatal workplace injuries in 1996. A collection of data and analysis. Washington: Bureau of Labor Statistics, 1998.
7. Centers for Disease Control and Prevention. Fatal occupational injuries – United States, 1980-1997. *MMWR Morbidity and Mortality Weekly Report* 2001;50:317-320.
8. Ministry of Health. The New Zealand Health Strategy. Wellington, New Zealand: Ministry of Health, 2000.
9. New Zealand Prevention Injury Strategy. <http://www.nzips.govt.nz/strategycolour.pdf>, 2003.
10. Miller TR, Galbraith M. Estimating the costs of occupational injury in the United States. *Accident Analysis and Prevention* 1995;27(6):741-747.
11. Accident Compensation Corporation. <http://www.acc.org.nz/>. Accessed 2001.
12. Department of Labour. <http://www.workinfo.govt.nz/documents/uploads/keychangesact.pdf>, Accessed 2003.
13. Langley J, Feyer A., Wright C., Alsop J., Horsburgh S., Howard M., Cryer C. Work-related fatal injuries in NZ: can a reliable electronic work-related fatality “register” be established? *Journal of Occupational Health and Safety – Australia and New Zealand* 2000;16(2):145-153.
14. Cryer PC, Fleming C. A review of work-related fatal injuries in New Zealand 1975-84 – numbers, rates and trends. *The New Zealand Medical Journal* 1987;100(816):1-6.
15. World Health Organisation. International Classification of Diseases. Ninth edition. Geneva: World Health Organisation, 1980.
16. AUTOMATCH operationalized record linkage system [program]. USA: Matchware Technologies Incorporated, Silver Spring Med, 1995.
17. Statistics New Zealand. New Zealand Standard Classification of Occupations, 1995. Wellington: Statistics New Zealand, 1995.
18. Statistics New Zealand. The Australian and New Zealand Standard Industrial Classification, 1996 (New Zealand version). Wellington: Statistics New Zealand, 1996.
19. National Occupational Health and Safety Commission. Type of Occurrence Classification System – <http://www.nohsc.gov.au/PDF/Statistics/toocs21-May2002.pdf>, 1990.
20. Land Transport Safety Authority. Motor vehicle accidents in New Zealand. Statistical statement – calendar year 1985. Wellington: LTSA, 1986.
21. Land Transport Safety Authority. Motor vehicle accidents in New Zealand. Statistical statement – calendar year 1986. Wellington: LTSA, 1987.
22. Land Transport Safety Authority. Motor vehicle accidents in New Zealand. Statistical statement – calendar year 1987. Wellington: LTSA, 1988.
23. Land Transport Safety Authority. Motor vehicle accidents in New Zealand. Statistical statement – calendar year 1988. Wellington: LTSA, 1989.
24. Land Transport Safety Authority. Motor vehicle accidents in New Zealand. Statistical statement – calendar year 1989. Wellington: LTSA, 1990.
25. Land Transport Safety Authority. Motor vehicle accidents in New Zealand. Statistical statement – calendar year 1990. Wellington: LTSA, 1991.
26. Land Transport Safety Authority. Motor vehicle accidents in New Zealand. Statistical statement – calendar year 1991. Wellington: LTSA, 1992.
27. Land Transport Safety Authority. Motor vehicle accidents in New Zealand. Statistical statement – calendar year 1992. Wellington: LTSA, 1993.
28. Land Transport Safety Authority. Motor vehicle accidents in New Zealand. Statistical statement – calendar year 1993. Wellington: LTSA, 1994.
29. Land Transport Safety Authority. Motor vehicle accidents in New Zealand. Statistical statement – calendar year 1994. Wellington: LTSA, 1995.

30. Land Transport Safety Authority. Motor vehicle accidents in New Zealand. Statistical statement – calendar year 1995. Wellington: LTSA, 1996.
31. Land Transport Safety Authority. Motor vehicle accidents in New Zealand. Statistical statement – calendar year 1996. Wellington: LTSA, 1997.
32. Land Transport Safety Authority. Motor vehicle accidents in New Zealand. Statistical statement – calendar year 1997. Wellington: LTSA, 1998.
33. Land Transport Safety Authority. Motor vehicle accidents in New Zealand. Statistical statement – calendar year 1998. Wellington: LTSA, 1999.
34. Land Transport Safety Authority. Personal Communication re: 1997 Travel Survey, 2002.
35. Struttman TW, Moon-Hampton E., Scheerer A., Pollack SH., Spurlock C. Occupational fatalities in Kentucky – 1994. *Kentucky Medical Association Journal* 1996;94:395-400.
36. Chi C-F, Wu M-L. Fatal occupational injuries in Taiwan – relationship between fatality rate and age. *Safety Science* 1997;27(1):1-17.
37. Loomis DP, Richardson DB., Wolf SH., Runyan CW., Butts JD. Fatal occupational injuries in a Southern State. *American Journal of Epidemiology* 1997;145(12):1089-1099.
38. Personick ME, Windau JA. Self-employed individuals fatally injured at work. *Monthly Labor Review* 1995;August:24-30.
39. Mendeloff JM, Kagey BT. Using occupational safety and health administration accident investigations to study patterns in work fatalities. *Journal of Occupational Medicine* 1990;32(11):1117-1123.
40. Harrison JE, Mandryk JA., Frommer MS. Work-related road fatalities in Australia, 1982-1984. *Accident Analysis and Prevention* 1993;25(4):443-451.
41. Work and health: the impact of structural workforce changes and the work environment. *Social and Economic Determinants of Health*; 2000 July 10-11; Canberra, Australia.
42. Levine N, Kim KE., Nitz LH. Daily fluctuations in Honolulu motor vehicle accidents. *Accident Analysis and Prevention* 1995;27(6):785-796.
43. Baker SP, O'Neill B., Ginsburgh MJ., Li G. *The Injury Fact Book*. New York: Oxford University Press, 1992.
44. Strotmeyer SJ, Pratt, SG. Occupational Pedestrian-Vehicle Collision Fatalities in the United States, 1992-1997. *National Occupational Injury Research Symposium*. Pittsburgh, Pennsylvania, 2000.
45. Land Transport Safety Authority. www.ltsa.govt.nz, 2002.
46. Herbert R, Landrigan PJ. Work-related death: a continuing epidemic. *American Journal of Public Health* 2000;90(4):541-545.