ROAD SAFETY DATA AND ANALYSIS IN NEW ZEALAND

William J Frith & Stuart Badger
Land Transport Safety Authority

ABSTRACT

The Land Transport Safety Authority (LTSA) keeps and uses a wide range of road safety information It also maintains a Traffic Crash Analysis System for processing and analysing Police traffic crash reports

This paper discusses this information and looks towards future developments including redevelopment of the Traffic Crash Analysis System.

Contact Author

William J Frith
Manager, Research and Statistics
Land Transport Safety Authority
P O Box 2840
Wellington
New Zealand

Ph : 04 494 8731
Fax : 04 494 8601

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Introduction

Road safety data analysis in New Zealand is the responsibility of the Land Transport Safety Authority (LTSA). The LTSA holds and analyses a wide range of data, and maintains a Traffic Accident Analysis System for the processing of Police reports of traffic accidents. This paper discusses the various data bases used by the LTSA and other road safety practitioners and looks towards future developments in this field.

The traffic accident analysis system

Objectives

These are to provide information on trends and patterns of traffic accidents in New Zealand, to assist in the identification of beneficial safety activities and projects, and to evaluate the success of what is done. The system is a fundamental tool in the development of safety policies, standards and strategies.

How accident information is collected and processed

In New Zealand it is mandatory to report to the Police all motor vehicle accidents involving injury. Traffic Crash Report (TCR) forms are filled out by the Police when an accident happens and sent to the offices of the LTSA. They record the details of where, when, how and why the accident happened and include a written account and a diagram drawn by the Police Officer. An example of such a diagram is shown in figure 1. They are then coded and entered into a computer system. The processes are:
:

- The report is read and the accident is given vehicle movement codes and causal factor codes which describe the reasons why the accident happened.
- The information on the report is entered into a computer database.
- The location of the accident, to ± 10 metres, is digitised on a road map and also stored in the computer.
- The report form is photographed and stored for future reference.

Example of an Urban accident drawing.

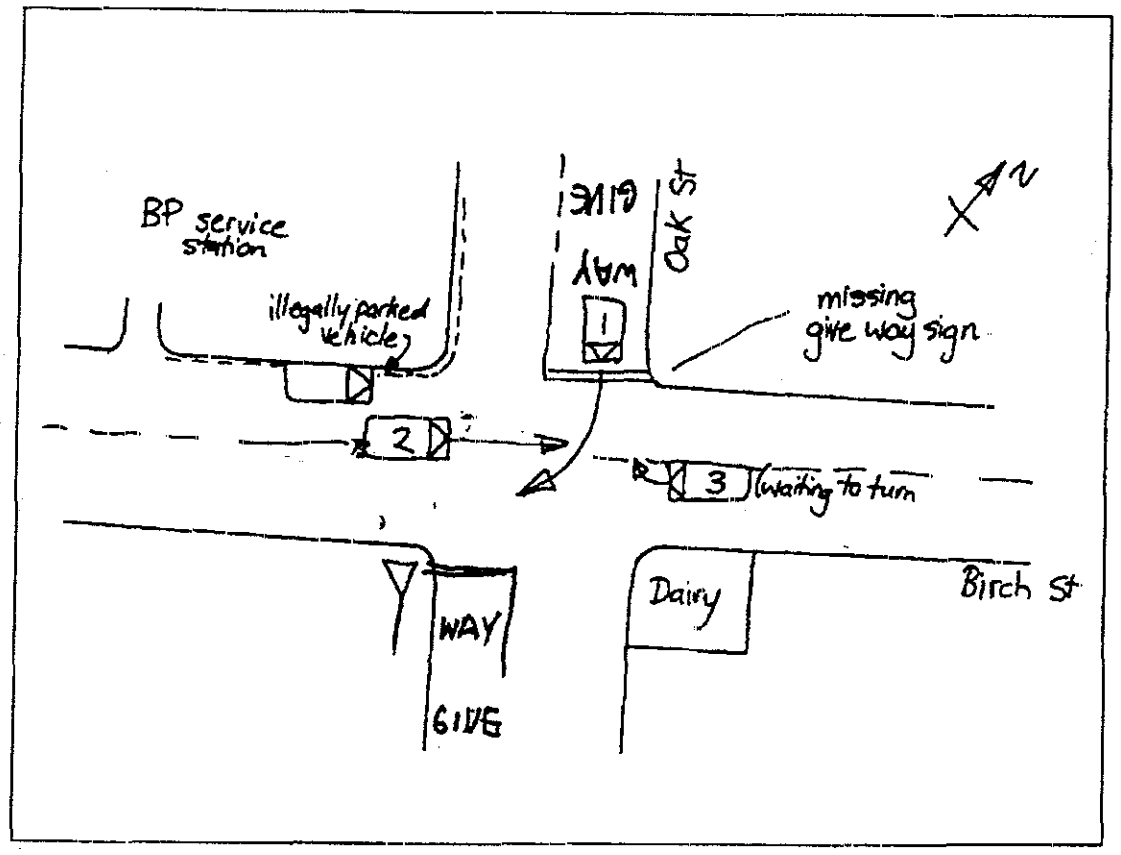


Figure 1
Fatal injury is defined as "death within 30 days of receiving the injury". Other injuries are divided into the categories "serious" and "minor". Serious injuries are those judged by the Police Officer to require hospital treatment. An important characteristic of the system is the classification of accidents according to the movements of the vehicles involved.

The users of the system

1. **Police officers;**
   at the accident scene, as a permanent record to use in the giving of evidence, and to identify locations for effective targeting of enforcement campaigns.

2. **Traffic engineers;**
   to identify sites or routes where remedial action is required, for annual local authority safety reports, for setting standards and monitoring the results of remedial measures.

3. **Researchers;**
   to identify national trends, accident numbers, reporting rates.

4 **Local and Regional Government;**
to evaluate the need for road construction & maintenance.

5. **Central Government;**
for allocating resources and forming safety policy.

6 **Transit New Zealand;**
for targeting spending on road maintenance and construction and accident investigation studies

7. **Consultants, Planners;**
to plan new developments responsibly and with road safety as a priority.

8. **Health Authorities;**
to target road safety initiatives.

9. **Industry Groups;**
to monitor the safety performance of their part of the industry.

10. **The news media;**
to inform the public on road safety issues.

The shape of the system

The system includes three subsystems:

a) **The macroscopic analysis system**
This uses the Statistical package SAS, on both personal and mainframe computers.
The following are examples of the types of analyses carried out:

1. *Broad statistical analyses*

Accidents analysed are aggregated at a macroscopic level. Their precise geographical location is usually of little interest. Some examples are:

- trends in fatal accidents
- trends in the types of road users killed
- trends in incidents involving the elderly
- numbers of incidents involving foreign drivers

2. *Medium level analyses*

This includes a range of detailed analyses that are not location dependent. Examples are:

- analyses of accident performance of local areas compared with other similar areas.
- analyses of railway level-crossing accidents to estimate the impact of improved signs
- analyses of child pedestrian risk of injury versus household income.
- evaluation of safety campaigns and initiatives.

b) The detailed site-analysis system

New Zealand has a systematic programme to identify and improve accident blackspots. AIS (Accident Investigation System) software is used to provide detailed analysis of individual accidents at specific sites to identify blackspots or routes and possible countermeasures Accurate accident locations (map coordinates) are needed to find accident clusters accurately, and good diagrams of the accident circumstances are vital to building an understanding of the inadequacies of the site. The software is written and used within the LTSA and supplied with accident data to 120 external users. Most of these are road controlling authorities and their consultants.

The analysis process involves:

- finding potential blackspot clusters using the automated mechanisms.
- producing a map of these clusters to look for sites that could be combined, for route and area treatments
- production of listings of the accidents at each site
- detailed hand analysis of sites looking for accident patterns - these suggest possible countermeasures
- production of collision diagrams for each site
- supply of this information to site investigation team members

c) The monitoring system for sites with accident remedial measures and sites at which speed cameras are used

This exists to provide ongoing monitoring of the worth of the remedial measures used at specific sites. This involves continual identification of accidents occurring at the 3000 sites in the monitoring system. The system is also used to monitor accidents at 1,000 sites where speed cameras are used. The monitoring system includes a wide variety of analysis routines and reports.

Other injury data held by LTSA

IRTAD data

The International Road Traffic Accident Database (IRTAD), is an international database of traffic accident information maintained by the German Federal Road Research Institute (BAST) for the OECD. It includes information at an aggregated level on most OECD countries and a small number of countries outside the OECD. IRTAD data are received on floppy disk from BAST, transformed into SAS files and stored on the Local Area Network (LAN). It is used extensively to provide international comparisons

Hospitalisation data

This provides information on all people who stay in hospital overnight or longer, and is a rich source of data on the injuries sustained by the victims of road accidents.

Ambulance attendance at accidents

Attendance by ambulance staff at motor vehicle accidents is also logged and coded by Ambulance Authorities and these data are also useful for determining injury numbers. The data are up to date with a delay of only 3 months. As such this is the most recent source of road accident figures. Ambulance records are not available for road casualties in some cases, such as those in which casualty details are not recorded or those in which all casualties were deceased.

ACC Claims

The ACC maintains a database of claims made for injuries, which includes those received in road accidents. This has not yet been found useful for comparisons with other road accident figures, because of its bias towards people in employment and the more seriously injured cases.

Reliability of data

Comparison of ambulance, hospital and police reporting of road accidents

It has long been known that the ambulance services attend more road accidents than are reported by the Police. Similarly, more people are admitted to hospital following road accidents than appear as seriously injured in Police reports. The reasons for the differences are varied:

- Not all accidents are reported to the Police although by law an injury should be reported to the Police within 24 hours
- The Police do not complete reports for all the injury accidents that they actually attend
- Not all Police reports of accidents are sent to the LTSA for entering into the database
- About half the casualties are treated at emergency departments without being hospitalised overnight
- Not all those who are hospitalised are listed as "serious" injuries by the Police (a significant proportion are recorded in the Police reports as "minor" injuries)
- Not all ambulance-attended accidents come to the attention of the Police, nor do all people who go to hospital after road accidents travel by ambulance

Comparison of Police and Ambulance reporting

This is illustrated in table 1 and figure 3.

Comparison of attendances at injury crashes by Police and Ambulance

Period(in half -years)	injury crashes attended by		Reporting rate
	Police	Ambulance	
91/1	6184	8781	70%
91/2	5978	8715	69%
92/1	5670	7561	75%
92/2	5965	7843	76%
93/1	5602	7881	71%
93/2	5392	8014	67%
94/1	5753	8393	69%
94/2	6123	8707	70%

Table 1

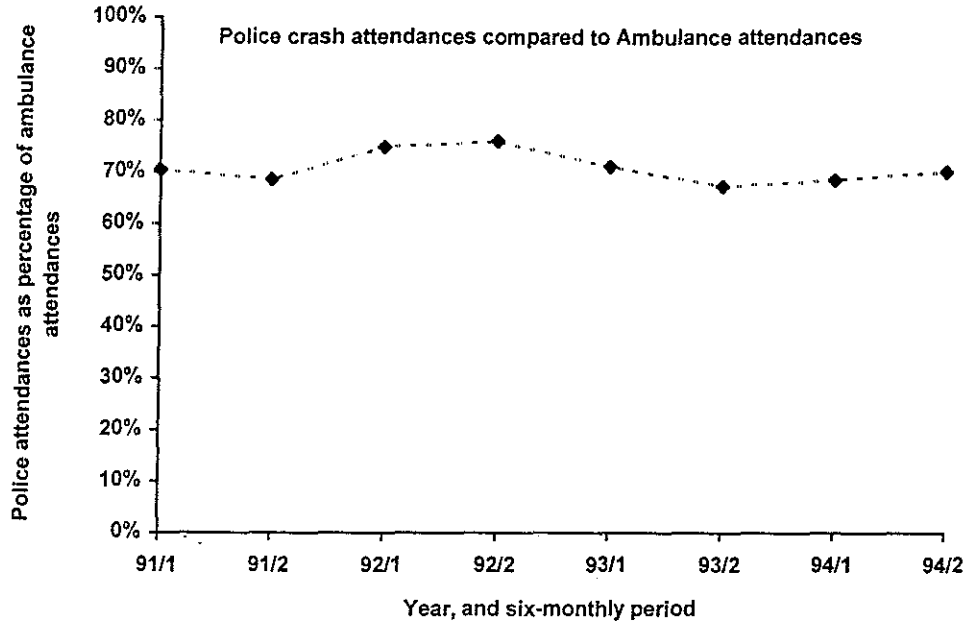


Figure 3

Comparison with hospitalisations

This comparison is a good guide to real trends, but it should be remembered that:

- A "serious" injury should be one requiring hospital treatment but not all Police-reported "serious" injuries are necessarily admitted into hospital

- Not all those who are hospitalised are listed as "serious" injuries (a significant proportion are recorded in the TAR reports as "minor" injuries).

The comparisons can be improved by an extensive and time-consuming accident information matching exercise, which has been carried out from time to time for particular regions or road user types, but not for the country as a whole. This is illustrated in table 2 and figure 4.

Period(in half -years)	TCR serious injuries	Road casualties hospitalised	Reporting rate
91/1	2255	4018	56%
91/2	2187	3650	60%
92/1	1902	3639	52%
92/2	1847	3573	52%
93/1	1651	3473	48%
93/2	1548	3483	44%
94/1	1628	3261	50%
94/2	1640	3225	51%

Table 2: Reporting rates in New Zealand

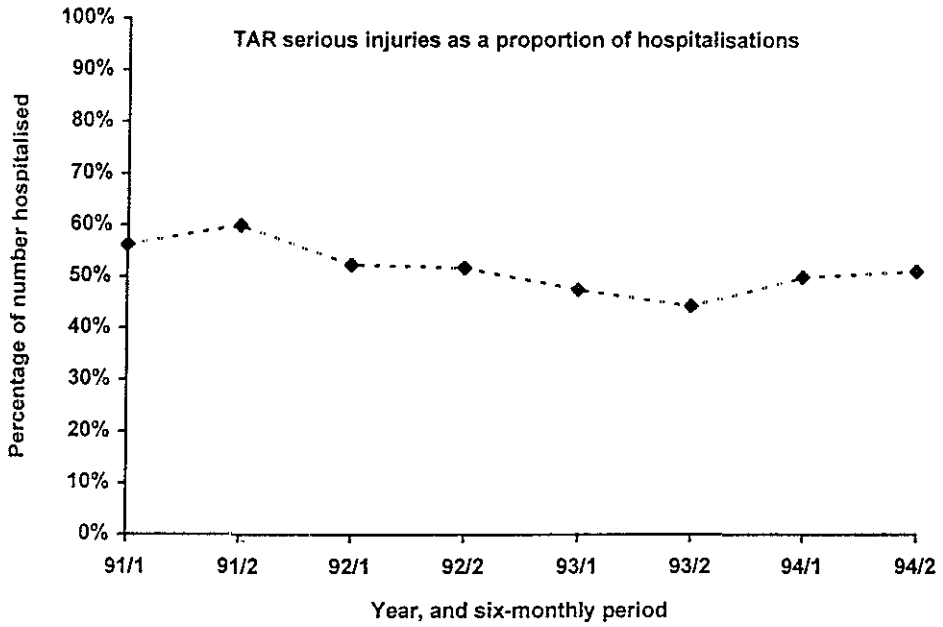


Figure 4

Crash reporting rates by region.

Reporting rates vary across the country, as illustrated in table 3.

LTSA Region	two year period 1993 & 1994	A fatal crashes	B serious injury crashes	C all injury crashes	D serious injuries	E number accident victims admitted to hospital	F hospital reporting rate (D/E)	G crash attendances	H ambulance reporting rate (C/G)
Auckland	1993/4	238	1374	6958	1677	3862	43%	10590	66%
Waikato	1993/4	252	773	3037	1102	2622	42%	6478	47%
Hawkes Bay	1993/4	76	292	1261	358	839	43%	1705	74%
Manawatu	1993/4	118	646	2313	850	1584	54%	3386	68%
Wellington	1993/4	102	735	3242	909	1553	59%	3927	83%
Canterbury	1993/4	145	835	3375	1008	1812	56%	3925	86%
Southern	1993/4	82	446	1671	563	1170	48%	2415	69%
NZ	1993/4	1013	5101	21857	6467	13442	48%	32426	67%

Table 3: Road crash reporting rates by LTSA region

General comment on reporting rates

New Zealand's rates vis-a-vis hospital admissions are within the range of those in other OECD countries and are relatively stable year to year. There appears to be some correlation between the ambulance and hospital admissions reporting rate without any obvious cause for such a relation. However overseas information is sparse as reporting of accidents has only recently become an issue outside New Zealand. European Countries and Australian states know little about variation of reporting rates within their borders and only a few countries have any information at all. The following state the percentage of hospitalised people reported in Police accident reports in various places.

- Hull (UK) 1991 65%,
- Goteburg (Sweden) 1983 60%
- Odense (Denmark) 1983 27%
- Sor-Trondelag(Norway) 1979-80 53%
- Bayern (Germany 1987) 39%
- Odense (Denmark) 1992 18%
- Umea Sweden !985-86 22%
- West Australia 1987-88 64%

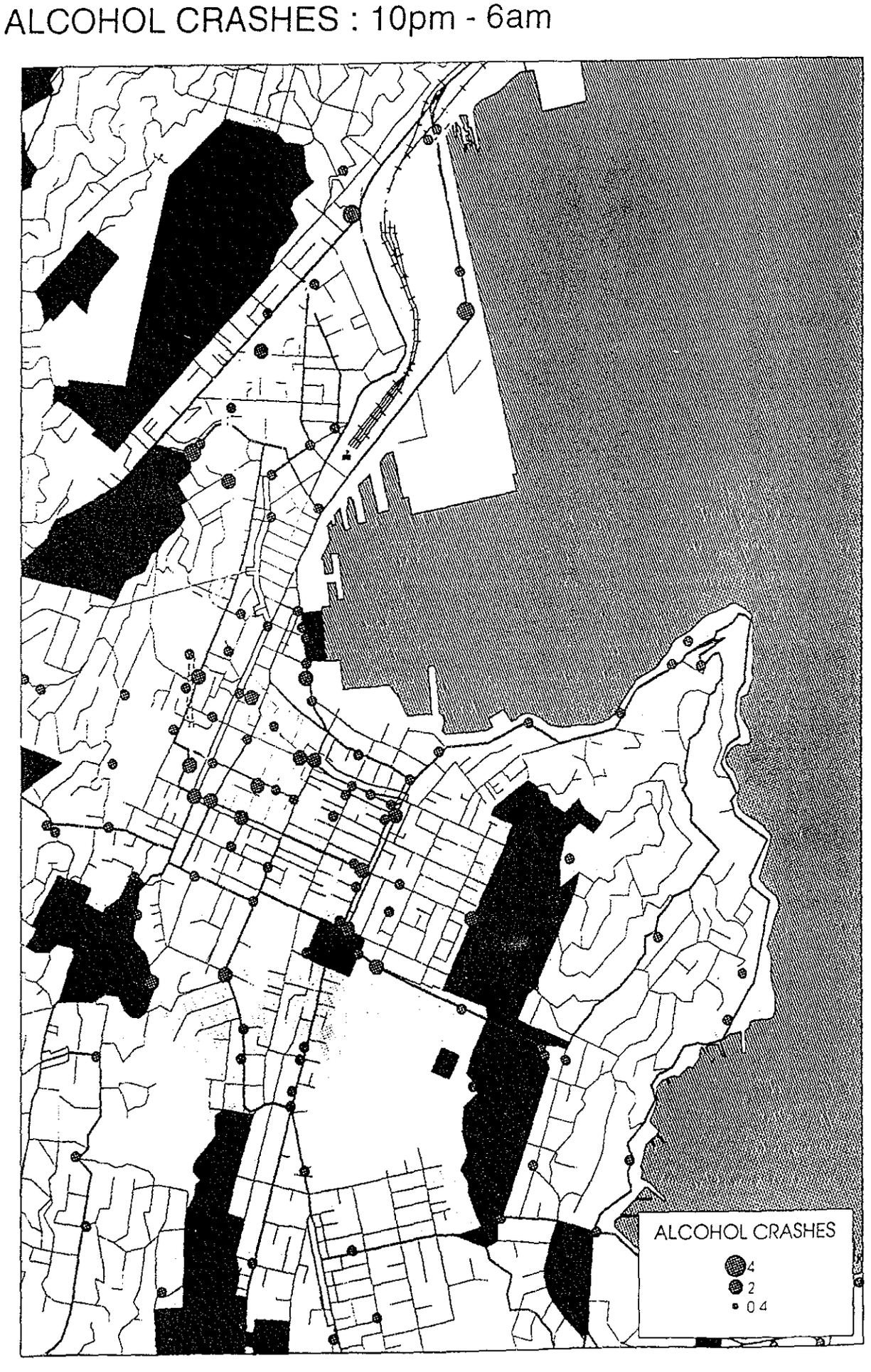
The proposed new system

This is a database closely integrated with a Geographic Information System (GIS). (A GIS is a system which allows the linking, analysis and reporting of geographical information). Unlike the existing system the replacement will make all the data and tools available to all users. It would also be capable of accepting accident reports in electronic form in the likely event of Police moving to such a system in the future.
The GIS will be used to combine accident and road inventory information to allow a wide range of analyses that are not currently possible. The road inventory data will come from existing Transit and Local Authority road inventory systems. The users of the system will make intensive interactive use of accident data, accident diagrams and accident maps. It is intended that CAS will allow users to :

- choose crashes, from a street map on the screen, for listing or analysing
- take crashes selected by database query and view them on a street map on the screen
- select crashes then read their crash diagrams and notes on the screen (these will be supplied by the LTSA on CD-Rom)
- print crash maps

A typical map showing accidents related to alcohol in the Wellington area is shown in figure 5.

Figure 5 Alcohol Crashes in Wellington: 1990 - 1994



It is intended that de-personalised accident information will be made available to users. Access to this information will be integrated with the analysis and GIS tools. The biggest limitation in the information the LTSA can supply users at present is the lack of accident diagrams and explanatory text. These are a vital component of high quality accident analysis and their supply is an integral part of the new system. The likely distribution medium for the accident diagrams and explanatory text is CD ROM.

Travel information

The National Traffic Database

This is a National database, developed by Transit New Zealand to provide information on traffic volumes and types of vehicles on every section of public road in NZ. A sampling scheme was used to measure traffic volumes at randomly selected sites (stratified by traffic volume). Data from this sample were used to estimate annual daily traffic (ADT) for other similar roads. This can give estimates of total travel at various levels of disaggregation from national figures down to the level of the 14 regions into which New Zealand is divided. It is hoped that this will be updated regularly by sample surveys giving a continuing time series of travel on New Zealand roads.

Estimation of vehicle kilometres of travel (VKT) from motor vehicle registration (MVR) data

It is proposed to set up a system to carry out the above. This should be operational by mid 1997. New Zealand has a system of periodic motor vehicle inspection. At the time of the inspections, an odometer reading is recorded by the inspector. Thus, for any given vehicle on the MVR system, an estimate of kilometres travel over the period between inspections can be made by subtracting the earlier odometer reading from the later one. The method for estimating VKT for the entire NZ vehicle fleet requires monitoring a sample of vehicles taken randomly from the MVR system. Approximately 1% of the MVR needs to be sampled. One possible method is to sample initially 1% of all vehicles inspected in any given month and then to update this sample by adding new vehicles (and removing vehicles which are no longer being used).

Home interview travel surveys

These have been carried out in 1976 (a survey of drivers exposure to risk) and 1989/90, (a survey of the travel patterns of all household members over 5 years of age.) These data can give VKT and trip estimates for various road user groups which can then be put together with accident data to produce estimates of risk. Estimates of total VKT can be produced from these surveys which it is intended to repeat from time to time.

Discussion

It is the LTSA's goal to have comprehensive travel information available which will make it possible to analyse the road user risks variables related to the road, the vehicle, the road user, the place, the time of year and other similar variables. We are well on the way to achieving this.

Information on key road user behaviours

Information is collected regularly on the following key road user behaviours:

- Speed
- Breath alcohol level of drivers during main drinking times
- Restraint usage
- Cycle helmet usage

This information is held in a data base so that trends may be monitored. New Zealand is divided into 27 Police Districts. It is the LTSA's goal to have such information available for all 27 Police Districts at a level of accuracy such that meaningful comparisons may be made from year to year for the same district and also between districts. This information is necessary for the Police to monitor the performance of their districts.

Information on public attitudes to road safety

This is also collected regularly and provides meaningful information on what the public think of key programmes at the level of New Zealand's 14 local government regions.

Information on willingness to pay to avoid risk on the road

When the 1989/90 household travel survey was carried out a subsample of the respondents was also surveyed to indicate how much they would be willing to pay to avoid the risk of a road accident. These data were used to form new estimates of the value of statistical life. A unique risk profile of the New Zealand road user community results from combining the measurement of respondents' willingness to pay with their travel and demographic information. The analysis of the responses (Miller and Guria, 1991) provided a new value of statistical life for use in New Zealand of $ (NZ) 2.1 million at June 1995 prices. ($1 NZ =0.67 $US at the time of writing.) This value is consistent with those values found from other surveys overseas. The analysis also indicated that people were willing to pay 56% of the average wage rate for a reduction of an hour in travel time. It is planned to update this survey in conjunction with the next travel survey.

Information held by other agencies

Transit New Zealand, and Local Authorities hold highway inventory data like traffic counts and other safety related information such as skid resistance. Transit New Zealand also has a number of telementary stations which measure speeds and classify the traffic as well as counting. Transit also operates some vehicle weighing stations. Geographical and census information is available from other government agencies.

Conclusion

The Land Transport Safety Authority either collects or holds information on road traffic accidents, key road user behaviours, travel and willingness to pay to avoid risk on the road. Other agencies hold highway inventory information, geographical information and census information. It is planned to combine Police reported accident information, highway inventory information, travel information and geographical information in a new accident analysis system which will make use of all these sources of information simultaneously to provide a significantly improved level of service. This type of analysis, in conjunction with knowledge of key road user behaviours and the opinions of the public on key road safety measures, will provide a sound basis for the evaluation and development of road safety strategies as we approach the 21st century.

References

Ted Miller and Jagadish Guria, *The Value of Statistical Life in New Zealand* Land Transport Division, Ministry of Transport, New Zealand, 1991.