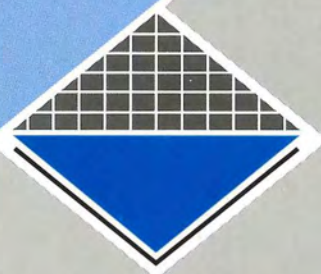
Road Injury Information Program
Report Series, Number 6

Investigation of Improved Exposure Data for the Assessment of Road Safety

by
Max Cameron & Jennie Oxley
Monash University, Accident Research Centre



AUSTRALIAN INSTITUTE OF
HEALTH & WELFARE

NATIONAL INJURY SURVEILLANCE UNIT

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Investigation of Improved Exposure Data for the Assessment of Road Safety

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Abstract:

The objectives of this study were:

1. To catalogue the need for, and availability of, Australian exposure data relevant to a comprehensive assessment of road safety, in particular the exposure data requirements for monitoring of the National Health Goals and Targets (NHG&Ts) and the National Road Safety Strategy (NRSS).
2. To specify, recommend and make cost estimates of systems for collecting currently unavailable exposure data, in particular systems for collecting exposure data by model of vehicle and characteristics of all occupants involved in crashes, whether injured or not.

The study objectives were addressed through a review of the international literature, assessment of national policy documents and a survey of road safety and health agencies nationally.

After examining the possibilities for satisfying multiple needs within exposure data collections, and reviewing the key issues in their design, ten recommendations for collections which would satisfy the national and local needs, in broad terms, were developed. These included surveys of road user mobility (i.e. motorised vehicle use, bicycle use and pedestrian movement), upgrading of vehicle registration databases, improved road inventory systems, monitoring of population trends, general travel surveys and assessment of crash exposure and exposure to severe injury. The report also made a number of specific recommendations concerning the recording of vehicle identification numbers, measurement of impact severity, crash reporting criteria and the recording of uninjured occupants.

The costs involved in undertaking the recommended measures was assessed and funding mechanisms discussed. Priorities were assessed within the context of the National Road Safety Research and Development Strategy which forms part of the NRSS, and the requirements of the NHG&Ts.

INVESTIGATION OF IMPROVED EXPOSURE DATA FOR THE ASSESSMENT OF ROAD SAFETY

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EXECUTIVE SUMMARY

The AIHW National Injury Surveillance Unit has developed a Road Injury Information Program to determine the needs and opportunities for improved road injury surveillance in Australia. This program includes a project to investigate the needs and opportunities for improving road injury exposure data. The Monash University Accident Research Centre was commissioned to undertake an investigation of Australian exposure data relevant to a comprehensive assessment of road safety.

The aims of the project were as follows:

1. To catalogue the need for, and availability of, Australian exposure data relevant to a comprehensive assessment of road safety. In particular, the exposure data requirements for monitoring of the National Health Goals and Targets (NHG&T) and the National Road Safety Strategy (NRSS).

2. To specify, recommend and make cost estimates of systems for collecting currently unavailable exposure data. In particular, systems for collecting exposure data by model of vehicle and characteristics of all occupants involved in crashes, whether injured or not.

A review of the literature identified exposure data as being a measure of the number of opportunities for crashes or injuries to occur. Exposure data is commonly used as the denominator of a rate, which in turn estimates the risk of crash or injury. A distinction was drawn between *pre-crash* exposure (to the risk of a crash) and *crash* exposure (to the risk of injury or death, given that a crash has occurred). The review identified a number of different uses and methods of measuring pre-crash exposure in practice. Information on crash exposure (ie. crashes) is commonly recorded, but the databases suffer from the absence of key factors related to injury.

A review of the NHG&T found ten targets for transport-related injury which require exposure data to monitor them successfully. A key objective of the NRSS is a National Strategic Research and Development Program which requires exposure data in twelve priority areas. In addition to these national needs, the OECD has recommended that continuous national traffic counts and travel surveys be conducted by member countries to provide exposure data to facilitate international comparisons of road trauma rates.

A survey of road safety and health agencies in each State and Territory was conducted to determine the exposure data currently existing and the needs for such data in individual jurisdictions. The survey also included road transport planning authorities because it was anticipated that general road use data may be suitable for measuring exposure to road crashes. A number of agencies needed additional exposure data of a specific type and focussed on their local area. Suggestions were compared to the needs of the NHG&T and the National Strategic Research and Development Program of the NRSS. It was revealed that there were no local needs which could not be met by an appropriate expansion (in the specific jurisdiction) of the recommended exposure data collections to meet the national needs.

GENERAL RECOMMENDATIONS

After examining the possibilities for satisfying multiple needs within exposure data collections, and reviewing the key issues in their design, ten recommendations for collections which would satisfy the national and local needs, in broad terms, were developed:

1. Motorised Vehicle Use Surveys

A National roadside observational and interview survey conducted on a 3-yearly basis of all motorised vehicles including heavy vehicles, passenger cars and car derivatives and motorcycles, focussing on restraint use, use of drugs and alcohol, actual speed and total distances travelled. A link to vehicle databases to provide additional safety-related vehicle details (see recommendation 2).

Options to collect sub-sets of information, which would satisfy the exposure data needs of some key research priorities, are:

Option 1a: Roadside interview survey of drivers including tests of alcohol and drug use (involving laboratory processing of saliva tests for drug presence).

Option 1b: Roadside observation of speeds and interview survey of drivers including tests of alcohol use.

2. Upgraded Vehicle Database

Improvement of National and State databases detailing vehicle registration and manufacturing to include Vehicle Identification Numbers (VINs), safety features (especially air bags and other frontal crash protection), and safety options installed. Specific recommendations for linking data with or enhancing existing VIN codes are given as potential options below.

3. Improved Road Inventory

Improvement to existing Road and Traffic Management Inventory Systems, including addition of automatically-recorded traffic information on a regular basis. Improved display of information using Geographic Information Systems. Recommendations 4, 5 and 6 would provide a source of bicycle and pedestrian flow data.

4. Bicycle Use Surveys

A National roadside observational and subset interview survey conducted on a three-yearly basis detailing frequency of safety equipment use and use of road, footpath and bicycle path environments.

5. Day-time Pedestrian Exposure Surveys

A National observational survey conducted on a three-yearly basis detailing pedestrian characteristics of children, the elderly and people with disabilities in various road environments, focussing on behaviours on the road, and other related risk behaviours for pedestrians. The surveys would be carried out during day-time periods only, because most of the exposure of these pedestrian groups occurs during these times.

6. High-Risk Pedestrian Exposure Surveys

A National survey of high risk pedestrian populations focussing on high risk behaviours, particularly pedestrian alcohol and drug use. A three-yearly survey conducted in conjunction with the Survey of Day-time Pedestrian Exposure through interview techniques (including tests of alcohol and drug use) during late afternoon and night hours.

7. Population Trend Monitor

To determine the impact of demographic changes on road traffic injury, detailed annual interpolation of population and housing data between National five-yearly census information is proposed.

8. General Travel Surveys

A general travel survey would be administered in conjunction with the five-yearly Census of Housing and Population. The method would use trip diaries to cover all transport users, including cars, motorcycles, trucks, buses, trains, trams and other forms of transport including travel by bicycle or by foot. Exposure to injury associated with all modes of transport is an issue for the NHG&T.

9. Occupant Crash Monitor ("Crash Exposure")

Improvement to data collected on vehicles and occupants of vehicles involved in crashes recorded on Police Accident Report Forms to include relevant vehicle occupant safety issues not currently covered. A link to vehicle databases to provide additional safety-related vehicle details (see recommendation 2). Recording of information on impact severity and, in some jurisdictions, expanded reporting of crashes to cover "tow-aways" and recording of uninjured occupants (see specific recommendations ii, iii and iv)

10. Injury Management Monitor ("Injury Exposure to Severe Injury")

Development of a National Road Trauma Database through on-going linkage of State Crash Information Databases (derived from Police Accident Report Forms) with databases covering major trauma (Ambulance Data Collections, Hospital Morbidity Files and Death Records) to gain an overall information source on road trauma from crash to hospital discharge. If a national major trauma database was assembled from State sources, this would greatly facilitate on-going linkage with national crash data files.

When this database is available, it could be used as the "injury exposure" basis for investigations of injury outcomes which were poorer than expected, examining the role of factors such as age and sex, crash type, injury type, and treatment type.

SPECIFIC RECOMMENDATIONS

A number of special issues arose from the general recommendations which led to the following specific recommendations to cover particular needs for exposure information:

i. Vehicle Identification Numbers (from Recommendations 1, 2 and 9)

A standardised VIN has been required on Australian new cars since January 1989 and since then it has been recorded on nearly all State and Territory registration systems. Its value could be enhanced for use in describing exposure data by:

(a) Requiring manufacturers and importers to provide full details of the variant and optional features provided on each vehicle, defined by its unique VIN. It is understood that manufacturers' "build schedules" for their production lines hold this information, and may be available retrospectively. These details could be held in the National VIN Database.

or

(b) Requiring a supplement to the VIN which uniquely defines the variant and specifies the safety features which were fitted to the vehicle during production. Alternatively, manufacturers could be required to code their VINs to encapsulate this information.

ii. Impact Severity Measurement (from Recommendations 9 and 10)

A measure of impact severity should be recorded by Police or ambulance officers for passenger cars which have been towed away following involvement in crashes reportable to the Police (see also specific recommendation iii). An Australian version of the TAD scale developed in the

US for use by Police to record the location and extent of deformation should be developed for this purpose.

iii. Crash Reporting Criteria (from Recommendation 9)

Police forces throughout Australia should record at least a common sub-set of crashes, defined by one or more involved vehicles being towed away. This criterion should operate in parallel with the existing criterion of personal injury which operates in all jurisdictions. Most jurisdictions already have a property damage criterion which covers most tow-aways and could easily record whether vehicles were towed. If a National coverage of occupant "crash exposure" is required, there will be a need for Police forces in two jurisdictions (Victoria and Northern Territory) to expand their requirement for reporting of a road crash to include those resulting in a tow-away.

iv. Recording of Uninjured Occupants (from Recommendation 9)

For a National coverage of occupant crash exposure, there is a need for Police forces in most jurisdictions to change their recording practices regarding uninjured occupants involved in reported crashes (see specific recommendation iii) so that the depth and quality of information on uninjured occupants is the same as if the occupant was injured.

ESTIMATED COSTS

The cost of the ten general recommendations (including, where appropriate, the costs of the related specific recommendations) was estimated to be up to $4.4 - 5.0 million in the first year (if all ten were implemented simultaneously) and the average cost during subsequent years was estimated to be up to $2.1 - $2.4 million per annum.

Some economies could be achieved if related surveys were conducted in parallel. Major savings could be made if one of the options for the Motorised Vehicle Use Survey (Recommendation 1) was taken. Costs could be reduced further by reducing the frequency of some surveys to every five years or by limiting the number of States or regions in which the surveys are carried out. The latter would, of course, make the survey results less representative at the national level but may be sufficient for development and evaluation of countermeasures.

PRIORITIES

The priority research areas identified by the National Road Safety Research and Development Strategy Working Group suggest that priority should be given to implementing the following general recommendations for exposure data collection:

- Improved Road Inventory (including automatically-recorded traffic data)
- Motorised Vehicle Use Surveys: Speed observations and survey of driver alcohol use and occupant belt use (Option 1b)

- High-risk Pedestrian Exposure Surveys (measuring alcohol use only)
- Occupant Crash Monitor
- Upgraded Vehicle Database
- Injury Management Monitor.

FUNDING MECHANISMS

Funding mechanisms include the option of seeking funding contributions from the government agencies endorsing the national research strategy. Another option would be for a national body such as the AIHW's NISU to coordinate existing and planned exposure data collections in individual jurisdictions so that, over time, a national picture is built up.

1. INTRODUCTION

The AIHW National Injury Surveillance Unit (NISU) has developed a Road Injury Information Program to determine the needs and opportunities for improved road injury surveillance in Australia (O'Connor, 1992). This program includes a project to investigate the needs and opportunities for improving road injury exposure data. The Monash University Accident Research Centre was commissioned to undertake an investigation of Australian exposure data relevant to a comprehensive assessment of road safety.

One of the fundamental aims of road safety research is to devise countermeasures and evaluate their effectiveness. However, many traditional approaches to road safety look at crash or injury frequencies alone which provide insufficient information to adequately describe and understand the mechanisms of road trauma. In the past there has been unsatisfactory treatment of traffic exposure and this has been a common failing in determining the potential effectiveness of road trauma countermeasures.

In order to calculate road accident risk there is a need for denominator data concerning exposure. The numerator of an accident risk estimate is usually a count of some undesirable (and perhaps traumatic) event such as road crash involvement, injury or death. The denominator can be thought of as a count of the events to which the risk (or probability) of the undesirable outcome applies. Different types of denominator counts are collectively known as "exposure", but the events being counted can vary depending on the particular type of risk which is of interest. The risk is estimated by the ratio of the numerator to the denominator, ie. the accident rate. Accident rates have considerable value in helping to design effective countermeasures, but their calculation requires the availability of appropriate exposure data.

The aims of the project were as follows:

1. To catalogue the need for, and availability of, Australian exposure data relevant to a comprehensive assessment of road safety

   - in particular, the exposure data requirements for monitoring of the National Health Goals and Targets (NHG&T) and the National Road Safety Strategy (NRSS).

2. To specify, recommend and make cost estimates of systems for collecting currently unavailable exposure data

   - in particular, systems for collecting exposure data by model of vehicle and characteristics of all occupants involved in crashes, whether injured or not.

2. LITERATURE REVIEW

2.1 INTRODUCTION

An international literature review of exposure concepts and data collection methods was undertaken as part of this project. Four computerised databases were accessed in the search for relevant references on exposure in the road context. These included the Literature Analysis System on Road Safety (LASORS), available on the AUSINET system, the INROADS database managed by the Australian Road Research Board, available on the AUSTRALIS system, the International Road Research Documentation (IRRD) and the Transport Research Information Services database (containing the Highway Safety Literature File and Highway Research Information Abstracts) available on the DIALOG system.

Background to the use of exposure measures

Research questions pertaining to crash data are common and detailed traffic safety investigations have traditionally been measured on the most basic information, that is in terms of accident frequencies and severity of injury. Consequently, there is an extensive literature source on road traffic accidents relating to driver, vehicle, road and environmental factors. The problem with many traditional approaches, however, is that accident frequencies (for example, raw accident numbers and locations) alone provide insufficient information to adequately describe and understand road crashes, to assess traffic safety and to develop appropriate countermeasures.

The use of accident frequencies or even simple accident rates in research assumes that firstly, potential hazards are equal (for example, 'before' and 'after' treatment of a hazardous sites are equally risky or dangerous), secondly, it is assumed that accident frequencies measure potential hazard at all locations, and thirdly, the use of frequencies assumes that the effects of differing traffic patterns can be accounted for.

In addition to crash related questions, the road safety system is also asked to comment on more detailed road safety issues or indicators other than crash frequency. For example, questions such as "How does the risk of crash involvement vary as a function of time of week, type of road user and location?", or "What is the relative crash risk pedestrians experience while crossing main arterial roads as opposed to local residential streets?" are often asked. Studies of this nature require not only a measure of crashes or injuries but also a measure of 'crash opportunity' or 'injury opportunity'. That is, more appropriate 'denominator' or 'exposure-to risk' data is required.

The basic concept of exposure denotes the opportunity for road users to become involved in road traffic crashes; that is, when a person occupies the road, that person becomes exposed to risk of crash involvement (Stanton, 1981). With this in mind, it is argued that the more often a person is a road user (or the further one drives), the greater one's chances of being involved in an accident (the greater the exposure to

risk). However, exposure may be measured in a variety of ways. For example, some researchers argue that the more time a person spends on the road, a greater opportunity exists for accident involvement. Equally, other researchers argue that the greater distance travelled, the greater exposure to risk. Still others argue that the number of trips made might be used as an indicator of exposure.

In the past there has been unsatisfactory treatment of traffic exposure and this has been a common failing in evaluations of the potential effectiveness of road accident countermeasures. However, there has been growing interest in the last decade or so for the need to consider exposure to accidents in interpreting data in traffic safety. The use of exposure data has been stressed in studies dating back to the early seventies.

Definition of exposure

A number of general definitions of exposure have been proposed. The most widely used definition of exposure was suggested by Carroll, Carlson, McDole and Smith (1971) who defined exposure as "the frequency of traffic events which create the risk of accident". Chapman (1973) further reviewed definitions and usage of exposure methods, noting that "it is possible to consider the traffic system as having opportunities for accidents to occur. These opportunities are occasions where cars cross each other's path, when they are following one another, or even when a vehicle is travelling by itself on a winding road." In addition he states that "exposure is the number of opportunities for accidents of a certain type in a given time in a given area (ie. it is the possible number of accidents of that type which could occur in that time in that area)".

Wolfe (1982) extended Carroll's definition, suggesting a broader and less active operational definition of exposure as "being in a situation which has some risk of involvement in a road traffic accident", thus able to measure both active and passive elements of the traffic system and includes all relevant vehicle, person and environmental factors.

This concept has been supported by subsequent researchers, while others go further to add propensity or liability (the conditional probability that an accident occurs given the opportunity for one) to the definition (Blunden and Munro, 1976: Hodge and Richardson, 1985a). Still others have extended the definition to describe exposure as a responsibility based concept (Thorpe, 1967; Cerelli, 1973). Haight (1971) further refined the exposure definition by relating it to the size and power of vehicles in the traffic stream, the age and experience of the drivers, weather conditions, time of day, and various classes of accidents.

Rationale for exposure data

Accident risk cannot be adequately assessed from accident frequency counts alone, without relating the occurrence of an accident to some measure of the population exposed to risk. As Hodge and Richardson (1985b) rightly state, "The number of accidents which do occur is highly dependent on the number of opportunities for these accidents to occur". It is now generally recognised that additional information, in exposure and behavioural aspects, has an increasing role to play in road safety research.

The Gerondeau report of the High Level Expert Group for an European Policy for Road Safety believe there should be a coherent policy across the continent of Europe. In an attempt to improve road safety knowledge the Experts Committee have identified four schemes:

- sharing individual member-states' experience
- establishing a detailed database of road accidents
- introducing more suitable instruments of measurement
- identifying European research programs to supplement those being run under the OECD (Gerondeau, 1991).

The Committee acknowledge that indicators in use at present do not allow a comprehensive judgement of the road safety situation within any country. They therefore recommend the introduction of measurements and indicators which are more representative of the level of road safety, in particular adding base data on roads, traffic and vehicle or driver characteristics in order to analyse the level of exposure to risk.

The notion that exposure data is essential for road safety research is reflected in The National Road Safety Strategy endorsed by the Australian Transport Advisory Council in April, 1992. The National Road Safety Research and Development Strategy Working Group (1993) has identified a number of research priority areas involving the use of exposure data. These include: understanding the impact of changes on road injury and trauma as a result of demographic trends; gaining a better understanding of the factors contributing to motorcycle crash involvement and injury severity; reducing bicyclist injury and determining the potential impact of improved bicycle standards and road design on bicycle injury; gaining a better understanding of the pedestrian safety problem; ensuring the needs of pedestrians are recognised in road network and land-use development; increasing the compliance of pedestrians with safe road use practices; improving the efficacy of road injury and exposure data for countermeasure development; and increasing the efficiency of road safety research and evaluation.

Further, the Commonwealth Department of Health, Housing and Community Services' 1993 Goals and Targets for Australia's Health in the year 2000 and beyond (Nutbeam, Wise, Bauman, Harris and Leeder, 1993) make particular reference to: the reduction of exposure of children, older people and people with disability to dangerous traffic and to dangers associated with the need to cross busy roads in new

developments; to increasing the proportion of cyclists with access to safe cycling routes; to decreasing the exposure of the workforce to unsafe traffic conditions associated with journeys to work; and finally, to decrease exposure to injury associated with transport related accidents.

The need for comprehensive and consistent international traffic data for use as a measure of exposure to road accidents has also been recognised by the OECD Road Transport Research Scientific Expert Group (1988). In their report, the group recommended that an international database for accident and exposure data be created. More specifically, they stated that the exposure data required to supplement both an existing aggregated database of the German Federal Highway Research Institute (BASt) and a future disaggregated international accident database entails data at the vehicle level and at the road user level. It was suggested that all OECD countries have two continuous exposure-measuring projects: a National Traffic Count for vehicle data and a National Travel Survey for the road user data.

In 1988/89 the Steering Committee of the OECD Road Transport Research Programme established the International Road Traffic and Accident Database (IRTAD), an extension of the existing German BASt database, in which accident victim as well as exposure data are collected on a continuous basis. The database comprises road traffic and accident data for each OECD country on a yearly basis for each year since 1970 including population figures, vehicle population broken down by vehicle type, kilometrage classified by road and vehicle types, road network lengths, number of injury accidents, fatality figures, those hospitalised or killed, modal split, area of country and risk values (injury related to population or kilometrage figures).

2.2 USE OF EXPOSURE MEASURES IN RESEARCH

Many papers dealing with the concept of exposure are concerned with devising more reliable methods of determining appropriate use of exposure measures with the aim of obtaining workable data in specific categories of road users, vehicles, road environment, times, distances, and weather conditions for example.

When accounting for 'crash' or 'injury' opportunity a problem then arises in the use of the most appropriate expression of exposure measurement. A number of researchers (Hodge and Richardson, 1985a; Chipman, MacGregor, Smiley and Lee-Gosselin, 1992) have discussed earlier failures to take proper account of exposure and noted that when traditional time, distance or traffic flow based exposure measures are used for all groups of road users there is no guarantee that such measures accurately reflect the exposure as defined by the concept of crash or injury opportunity, nor do they reflect the accident exposure of the total road network taking into consideration variance in exposure at particular sites (eg. highways, or intersections).

The measures of exposure to be used in any research depends entirely on the type of road safety study being conducted. It may be that exposure measurements need to

be estimated on the basis of two different frameworks (Hodge, 1983). Firstly, measurements of site exposure which relate to the type of road network, road conditions, environmental conditions and road geometry may be applied. Secondly, driver exposure measurements, that is the number of accident opportunities a particular driver experiences as he drives around the road network may be applied. Further, the concept of exposure as applied to various road users such as truck drivers, bicyclists, motorcyclists and pedestrian safety needs further clarification.

2.2.1 Road User Based Exposure Studies

Exposure surveys may cover all forms of surface travel. The Survey of Day-to-Day Travel in Australia 1985-86 (Adena and Montesin, 1988) tabulated the number of trips, the distance travelled and the time spent travelling classified by mode of travel, and other factors such as sex and age, employment status, country of birth, education, license status, time of day/week/month, season, geographic area and trip characteristics such as trip purpose, distance, duration and start time.

A further report on road fatality rates in Australia (Anderson, Montesin and Adena, 1989) calculated the average number of fatalities per distance travelled, time spent travelling and number of trips, for five groups of road user (car drivers and passengers, motorcyclists, bicyclists and pedestrians) using the FORS Fatal File and the Survey of Day-to-Day Travel in Australia 1985-86. Results were tabulated for sex, age, time of day, day of week, season, location (State or Territory) and holiday/non-holiday period and it was found that for each group, males had higher fatality rates than females and the rates varied with age. Further, it was found that time of day was a major exposure measure in discriminating different levels of risk.

Drivers

The majority of exposure studies have investigated exposure measures applied to drivers of passenger vehicles and distance travelled seems to be the most used general measure of risk exposure. The current literature indicates little agreement among experts on how to incorporate exposure factors in accident analysis. Many different methods are used to measure traffic on the roads, from questioning random samples of drivers about journeys, estimating the number of licensed vehicles on the road, to estimating mileage from fuel sales. In his overview of exposure data collection methods Wolfe (1982) states that there is considerable disagreement on what traffic/road exposure measures are most appropriate to use and how they should be collected. Further, the most easily obtained measures are not often the most desirable ones for developing meaningful accident rates.

The variables typically used for exposure measures have been time, distance, traffic volume and the product of these elements, however, many more aspects of the road-traffic environment system enter into the exposure measure. Chipman and her colleagues (1993) have noted many deficiencies in using distance to quantify exposure to crash risk. The relationship between distance and other aspects of exposure, which often vary substantially among drivers, they state, is not a simple

one. Other aspects include time of day, type of road, speed, the density of traffic conflicts and traffic flow.

Many studies on the relationship between exposure, collision risk and driver characteristics have involved some sort of traffic/road survey. Most exposure surveys obtain information on both time and distances travelled, either incorporated in a diary used to record trips (Federal Office of Road Safety, 1987; The Transport Research Centre, 1992) or by recall (Chipman, 1982). More recent surveys, notably one conducted in France (Fontaine, 1990) have included estimates of accident rates based on the time spent driving as well as by distance travelled.

Postal questionnaires or telephone interviews have been found to be the most successful methods available for collection of detailed exposure information from the general driving population. In a number of papers Chipman and her colleagues (Chipman, 1982; Smiley, MacGregor, Lee-Gosselin, Chipman, Clifford and Duncan, 1991; Chipman, MacGregor, Smiley and Lee-Gosselin, 1992) have described various survey techniques carried out among drivers of Ontario and Toronto, Canada. Mail surveys and telephone interviews were implemented and data was collected on various driver characteristics including time spent driving, distances driven, age, sex, time of day, type of road, speed and location. Differences in driving patterns including speed and amount of driving done were found among age groups, sex and region of residence suggesting that the use of distance alone to define exposure may be deficient. Rather, a definition of exposure to risk of road crash may be required that considers both time and distance appropriately.

Truck Drivers

Most methods of obtaining exposure data imply that for a specific vehicular category, exposure to accidents is caused by travel generated by that type of vehicle only. However, in reality exposure to crashes is caused not only by travel generated by a particular vehicle type, but also by the travel generated by all other types of vehicles present in the traffic flow. It has therefore has been noted (Khasnabis and Al-Assar, 1988) that a problem exists when comparing accident data by different vehicle categories.

Furthermore it has been documented that data collected by major organisations designed for general traffic and safety analysis often lack in detailed data on heavy truck accident characteristics (Abkowitz, 1990). A number of databases available in the United States have been reviewed by Abkowitz (1990). These include databases kept by the Office of Highway Motor Carriers, the National Centre for Statistics and Analysis, (detailing a National Accident Sampling System providing, among data for cars, several data fields describing heavy truck characteristics), and various state regulatory agencies.

A special monitoring study in the United States began in 1983 by the Federal Highway Administration (cited in Abkowitz, 1990) where several states have collected data on accidents and exposure for all combinations of trucks operating on

truck networks, including vehicle miles travelled by route, accident involvement, truck and road features and numbers of fatalities and injuries. This has enabled making of comparisons between accidents among various truck types and across different road features.

Further Abkowitz asserts that the combination of databases, specifically those of the Highway Performance Monitoring System (HPMS) and the Truck Weight Study (TWS) also initiated by the Federal Highway Administration can form a comprehensive national truck exposure data collection system.

A study of truck involvement in accidents for Australia was undertaken by Tan (1984) using vehicles registered and vehicle kilometres travelled, obtained from the Australian Bureau of Statistics (ABS) Survey of Motor Vehicle Usage. A more comprehensive study in Michigan developed an exposure-based technique for analysing truck accident data which used two sources of data to generate Vehicle Miles of Travel (VMT) exposure figures (Khasnabis and Al-Assar, 1988). Total vehicle miles travelled was calculated by multiplying the number of trucks registered in one State by the average travel rate in miles per truck and an assumption was made that statewide rates were representative of the nation. Results suggested that the procedure developed is a viable approach for analysing heavy truck accident data and uses easily accessible data from the US Department of Transportation and the US Bureau of Statistics.

Young Drivers

Driver age is regularly recorded in crash data and has been shown to have a large effect on crash frequency. The circumstances and underlying causes of the high crash rate of young drivers have been the subject of a number of studies and it has been found that young drivers are, on average, much more likely to be involved in crashes than are, say, 40 - 50 year old drivers (Hampson, 1989; Drummond and Jee, 1988). Arguments have been made suggesting that young drivers have a greater risk of accident involvement because they are not as experienced and consequently their driving skills are not as proficient as those of older drivers. Further, the Victorian Expert Working Group on Young and/or Inexperienced Driver Safety recognised the need for the collection of high quality exposure data to supplement mass crash data and support the estimation of casualty crash involvement risk as a function of driving experience (Drummond and Torpey, 1984).

An examination of the involvement of young, inexperienced car drivers in fatal road crashes was undertaken by Hampson (1989). The report expressed risk measurement in terms of involvements in fatal crashes per 100 million kilometres travelled and observed a consistent pattern of differences between young drivers and a group of older drivers. In particular, Hampson noted that young drivers were at highest risk in their first year of licensing, young drivers were at high risk of accident involvement between 9pm and 9am and on weekends, young drivers are more likely to be involved in pedestrian and bicycle crashes and are more likely to lose control on corners or straight sections of road, and they had a higher

involvement of alcohol, especially on weekends, than the control older group of drivers.

Pelz and Schuman (1971) attempted to control for exposure to remove effects associated with mileage and driving conditions when questioning if young drivers are more dangerous on the road. From a questionnaire on annual mileage, including trips taken, their length, purpose, number of hours spent driving, and employment details the study concluded that young drivers spent no more time on the road than other drivers, lending no support to the argument that young drivers (particularly males aged 18 or 19 years) have increased exposure because they do more driving. However, significant age effects were found for young drivers when effects due to mileage and driving conditions were eliminated. Further, when measures of experience were controlled for high risk of accident was associated with age rather than when a person learned to drive.

Elderly Drivers

The problem of traffic injuries in the elderly has received increasing attention in recent years. There is an on-going need to consider the involvement rate of older road users because the oldest drivers, along with young drivers, have been reported to have higher traffic crash risks (van Wolffelaar, 1988; Chipman, 1991; Williams and Carsten, 1991). Further, Evans (1991) noted that elderly drivers (those aged 60 years and over) generally have a relatively low involvement rate per head of population, but a relatively higher involvement rate in terms of kilometres driven. However, in Victoria very little has been reported on the incidence of pedestrian and driver crashes involving older people.

A number of studies have reported that elderly drivers, in an attempt to reduce their risk on the road adopt various strategies and self-imposed limitations (Ernst and O'Connor, 1988). These strategies include travelling at lower speeds, reducing their frequency of everyday driving, reducing their peak hour and night time driving, and making shorter trips. However, very few studies have examined these issues, nor have many adapted these concepts to exposure measures.

One of the few relevant studies measured the times spent driving and distances driven by drivers over 60 years of age and related these issues to their risk of traffic accident and further compared the results to those of other drivers aged 25 to 59 years (Chipman, 1991). Results indicated that in both measures of risk, male and female drivers over 60 years (and in particular those aged over 80 years) have a substantially greater risk of crash than any other group.

Motorcyclists

Much research has been conducted examining issues pertaining to motorcycle crashes, and there are many specific studies looking at issues such as motorcycle conspicuity, licensing requirements, rider attitudes and driver awareness of motorcycles. However, the relative risk of having an accident, particularly adjusted for exposure, has not been addressed widely.

In a study of accident involvement and exposure by type of motorcycle, Rogerson (1991) approached the problem in two parts. Firstly, she used ownership of registered motorcycles as the measure for exposure to accidents to compare the risk of accident involvement by novice riders on 250cc motorcycles of differing engine power and torque. It was found that for Victorian learner permit holders and first year licence holders, motorcycles with 2-stroke engines, motorcycles with horsepower > 35 PS units and motorcycles with 2-stroke engines with > 35 PS units were over involved in road accidents. These conclusions, however, ignored differences between riders such as distance travelled.

The second part of the study looked at the relative distance travelled by riders on motorcycles with differing engine capacity, based on self reported data in the form of a travel diary. The study found that full licence holders travel more often and further than novice motorcycle riders (these results were supported by the 1988 ABS Survey of Motor Vehicle Use).

Another approach to exposure measures for motorcyclists was examined by Cercarelli, Arnold, Rosman, Sleet and Thornett (1992) who suggest it is important to compare multi-vehicle motorcycle crashes with multi-vehicle non motorcycle crashes, noting that the primary error in conspicuity related crashes is not made by the motorcyclist, rather it is a problem experienced by other road users such as car, bus and truck drivers. The report also suggests an alternative explanation for motorcyclists having more crashes during the day compared to night, simply that motorcyclists may ride more during the day. The comparison of day and night distributions did not consistently support the hypothesis, however. Cercarelli et al suggested that the use of motorcycle exposure data and comparisons with other crash types may help clarify uncertainties.

Rana and Quane (1982) attempted to identify sources of motorcycle exposure data, make a determination of its usefulness with respect to available motorcycle accident data and recommend methods of collection. They noted that the National Center for Statistics and Analysis (NCSA) collects motorcycle accident statistics but there is no mechanism for collecting comparable exposure data to be used for computing accident rates and other statistical analysis of crash data. Four 'national' surveys, however, were found to yield varying components of motorcycle exposure data.

Bicyclists

Road safety research tends to focus on accidents involving motorised vehicles, mainly because they are the ones most frequently entered on police files. However, accidents involving bicyclists and pedestrians are also important in understanding the total road system accident risk, and the definition of the concept of exposure should be broad enough to encompass road users other than drivers and motorcyclists.

Although the circumstances of traffic related death or injury are usually known, including information about the injured person, vehicle features, location and weather conditions, there has been sparse research on exposure to risk for pedestrians and bicyclists (Drummond and Ozanne-Smith, 1991). There is little regular monitoring of

distances travelled by bicycle, which location and traffic features create high risks for bicyclists, and which activities are most risky for bicyclists although there are a few isolated studies in which estimates of exposure to risk have been taken into account. Exposure data, in conjunction with comparable crash data, can enable the identification and calculation of high risk behaviours which could be targeted by appropriate road safety measures.

A number of methods have been employed for the actual collection of pedestrian and bicyclist exposure data. The principle techniques available for measurement of bicycle and pedestrian exposure to traffic include: self-reporting, either by keeping a diary or marking journeys on a map (recall methods); monitoring a sample of road sites and recording movements; and, following a sample of people to record activity.

A large study undertaken in Melbourne (Wigan, 1983) deals with the need for comprehensive data on bicycle activity involvement, ownership, use and exposure based on transportation household interview data. The report adopted a definition of exposure as "time spent travelling on the road (by bicycle)" and through extensive analyses Wigan identified bicycle users and households, expressed the quantity and nature of travel in transport and traffic terms, and demonstrated the relative importance of bicycle travel in Melbourne in terms of travel time. Moreover, he recommended that further studies on the relationships between accident rates and exposure be undertaken, not only for Victoria, but for other States of Australia to complete a nationwide integration of bicycles into transport and traffic planning.

A method for the collection of cyclist exposure information in different conditions (for example, time of week, type of road) was developed and conducted by the Monash University Accident Research Centre to establish the relative safety of cycling on the road and footpath and of a variety of cycling behaviours (Drummond and Jee, 1988). The report details the method and results of a study to investigate the relative safety of cycling on the road and footpath.

An observational study was undertaken timing all cyclists (duration of travel) entering a marked zone over a five hour period in 105 randomly selected observation areas in metropolitan Melbourne (Drummond and Jee, 1988). Additional information was collected on site- and cyclist-related information such as land use, age, helmet use, sex, cycling behaviours. An overview of cycling safety issues was presented in the results by combining the exposure estimates from the survey with accident data to calculate accident involvement risks. Results on exposure patterns, accident risks of footpath and road cycling, and behavioural components indicated that road cycling is a much riskier activity than footpath cycling, particularly on arterial roads.

Pedestrians

Data on pedestrian exposure have considerable value for understanding pedestrian accidents and a number of accident studies suggest measurement problems for pedestrian safety, however, the majority have not considered pedestrian's exposure to risk. That is, they do not relate accident frequency in a particular group, time or situation to the relevant amount of pedestrian activity.

Knowledge of the circumstances which place pedestrians at risk are fundamental to improve the pedestrian's environment and safety. Pedestrian exposure can be related to the mobility of pedestrians and the mobility of vehicles. In an attempt to provide more meaningful data a number of recent approaches have been adopted to construct pedestrian accident rates expressed as a function of exposure.

Studies on pedestrian activity to date have included observational studies of pedestrian activity (Cameron, Stanton and Milne, 1976; Cameron, 1981; Jamieson, Croft and Herbert, 1981; Knoblauch, Tobey and Shunaman, undated;), assuming that pedestrian numbers and activity and the number of moving vehicles are the main factors relating to levels of exposure. In these studies randomly selected sites were used to observe a range of site and exposure variables for pedestrians. The results of Knoblauch et al.'s study showed increased relative risk in terms of pedestrian vehicle exposure for streets with no lighting, for residential areas, for the very young and the elderly, for pedestrians who were running, for crossings made within 50 ft. of an intersection, and for crossing against signals.

A pedestrian exposure event may be defined as the event where a pedestrian crosses a road (Cameron, 1981), however, pedestrians are at risk of an accident only when there are vehicles present on the roadway (that is, the event of a pedestrian accident is a function of the traffic flow). Cameron, Stanton, and Milne (1976) recognised this and by observation of the number of vehicles and pedestrians passing through small road sections during five minute intervals, they constructed a measure of accident risk which incorporated vehicular traffic flow. Their exposure survey showed variations in pedestrian accident risk by pedestrian age, sex, grouping, pace and direction of movement, vehicle type and turning movements, location of the road section relative to intersections and traffic controls, time of day and time of week.

A similar methodology for measuring the relative risk of pedestrian accidents was developed by Jonah and Engel (1983) to aid in the definition of target groups for pedestrian safety programs. Police accident report forms, and a household survey, combining telephone and face to face interviews about previous day exposure, gathered data on level of pedestrian activity in terms of walking behaviour, number of trips, distance, duration, number of street crossings, time, light and weather conditions, accompaniment of others and location of crossings. This information then formed the basis of the calculation of relative accident risk for relevant groups.

In their discussion of the measurement of relative exposure risks, Jonah and Engel found that children aged between 3 and 12 years and the elderly had the highest level of accident risk but only when distance travelled, duration and number of streets crossed were used as the exposure index. Further, they demonstrated that exposure data is critical in defining target groups for pedestrian safety programs.

In his study of pedestrian exposure to risk in housing areas, Crompton (1982) examined three methods of data collection to explain the relationships between pedestrian exposure levels and casualty rates in different housing areas. The data

included population and socio-economic characteristics derived from census material, data on land use and layout characteristics from maps and observations, and data on activity characteristics derived from surveys of pedestrian and traffic. He concluded that a model including both pedestrian activity and census variables is the most appropriate method to describe pedestrian risk.

A review on the need for regular monitoring of the exposure of pedestrians and cyclists to traffic recommended that a combination of questionnaire techniques and observations at random sites would provide the best exposure data and lowest cost (Howarth, 1982).

2.2.2 Site Based Exposure Studies

Intersections

There has been growing interest in the technique of conflict analysis for studying crashes at intersections. Hughes (1990) investigated traffic flow based exposure models for important accident types at traffic signals. In his report he looked at the effect of some basic site factors, individual approaches and intersection factors, comparing three techniques of identifying hazardous sites: accident frequency, accident rate and difference from the typical relationship. Hughes concluded that the models he used for exposure relationships can reliably predict ninety percent of accidents at traffic signals.

Data on traffic conflicts and flows and accident histories were analysed for a variety of locations by Blunden and Munro (1976) directed towards seeing if vehicle conflict situations provide a meaningful concept of accident exposure. Part of their report observed conflicts at intersections and confirmed that investigations using connections between conflicts, exposure and accidents can be found and indicated that further research into traffic conflict situations is worth pursuing.

A recent study conducted in Athens (Golias, 1992) explored the effect of traffic stream flows on accident potential at urban priority (unsignalled) road junctions. The results showed that the dominant factor influencing the accident potential of an urban junction was traffic stream characteristics and proposed an exposure index consisting of an expression of the flows of the junction's interacting traffic streams.

Highways

In comparison to analyses of intersection accidents, studies deriving exposure measures for roadways (including mid blocks and highways), have produced differing and conflicting results, probably as the result of different approaches to the problem of estimating accident exposure for road links.

A study on the relationships between injury and fatal accident probabilities and traffic volumes for rural highways in the United States (Brodsky and Hakkert, 1983) determined that accident probabilities simply increased with volume, while

another study in Greece (Frantzeskakis and Iordanis, 1987) concluded that the same traffic flow occurring on road sections with different capacities creates different operating conditions and therefore different probabilities for accidents. They suggested that the volume-to-capacity ratio may offer a better measurement of exposure than traffic volume per se.

Few studies have compared urban roads to rural roads and their relative exposure measures.

2.2.3 "Fringe" Exposure Concepts/Measures

Induced exposure

The concept of induced exposure was introduced by Thorpe in 1967 who stated that "the likelihood of a not-responsible combination (driver-vehicle) being involved in an accident is proportional to the likelihood of meeting that combination on the road". Simply, the induced exposure method attempts to measure the exposure of driver and/or vehicle population to the risk of crashes as a function of their innocent involvement in crashes, assuming that the representation of driver-vehicle combinations among those 'innocently' involved in two-vehicle crashes would be the same as their representation on the road.

It assumes that all drivers involved in two-vehicle collisions can be separated into two groups - responsible and not-responsible, that is, only one driver is responsible in two-vehicle crashes. The model also assumes that the number of not-responsible drivers in any group is proportional to that group's exposure to the risk of a collision. Lastly, it is assumed that the characteristics (for example, driver age) of the driver-vehicle population responsibly involved in two-vehicle crashes are the same as the characteristics of the driver-vehicle population involved in one-vehicle crashes.

This method has received considerable attention due to the fact that it is based on already available accident data, relative exposure measures for any driver-vehicle class can be derived, and finer exposure measurements are possible (Cerrelli, 1973), and seems to give a more balanced picture of risk than does the method of using accidents per mile (Janke, 1991). However, it has been criticised in its restrictive assumption of responsibility for all drivers in single-vehicle crashes. Exposure measures for single-vehicle crashes, pedestrian/vehicle crashes, bicycle/vehicle crashes and the like cannot suitably be derived using this method.

A further refinement of the induced exposure model was tested by Wasielewski and Evans (1985). They developed a modification of the induced exposure model, calling it the induced responsibility model, for the purpose of estimating the role of responsibility as a function of driver age in one-car and two-car crashes.

Within this concept of responsibility, Terhune (1983) evaluated judgements of driver crash responsibility to estimate alcohol and drug impairment effects when exposure data are unavailable to calculate crash risks. Terhune argued that a

method of responsibility analysis can provide useful indications in the absence of exposure data in estimating accident propensities and relative crash risk, particularly in research of the role of drugs and alcohol in road crashes. While stating that there is a relation between tendencies for driver groups to be responsible for crashes and the relative crash risk of those groups, the study acknowledged that responsibility analysis cannot take the place of risk assessments based on exposure and crash data because it is subject to errors of human judgement, it cannot control for effects on responsibility of time and location, and further, a 'non responsible' driver sample provides an imperfect estimate of an exposure sample.

A model of induced exposure was introduced by Brown (1982) who noted several shortcomings of the traditional notion of exposure defined by Carroll (1971) including the assumption that an accident will occur when the system itself makes a demand which the driver is incapable of meeting. He also questioned assumptions in Thorpe's induced exposure measurements stating that the model does not understand fully experiential factors in accident causation.

Brown suggested that crude exposure measures such as distance travelled or driving hours can produce misleading or inadequate results if the objective is to assess individual differences in liability. Driving, he asserts, is basically self-paced and purposeful, thus accident data must be corrected for "self-induced risk exposure" instead. Brown sees self-induced exposure data as accounting or controlling for the specific nature of high-risk driver errors such as lapses in attention, perception, purpose of driving and stress levels.

Measurement of self-induced exposure to risk, however, poses many problems. Practical collection of good exposure data on driver characteristics seems an impossible task.

Traffic Conflicts

Hauer (1982) attempted to overcome the problem of the lack of distinction between "traffic conflict" and "exposure" concepts. He described traffic conflicts as pseudo-accidents or indirect safety measurements where road users cross paths, say at an intersection, and there is a potential for a crash to occur. It is thought that if the conflict event is properly defined, the "expected number of accidents occurring on a system is directly proportional to the number of conflicts occurring on that system".

Simply, Hauer states that on most real systems, accidents occur relatively rarely thus it is impractical to use numbers of accidents occurring because by the time enough accidents have occurred many uncontrolled causal influences have taken effect and they are impossible to identify. Identification of the occurrence of 'near misses' and 'conflicts' rather than actual accidents, Hauer reasons can give more statistically reliable estimates. He further believes that systems with many near misses and conflicts are also expected to have many accidents.

Hauer further argued that the number of accidents is not directly proportional to the number of exposure events (which is more closely related to mobility), the ratio of the expected number of accidents to the number of exposure events is small, variable with characteristics of the exposure participants and is more appropriately called "risk probability".

The traffic conflicts technique has received a measure of popularity in road safety research and has been applied to both pedestrian and vehicular accidents.

Control observations at crash sites

A study method which resembles the collection of exposure data is when data is collected on persons not involved in crashes ("controls") at crash sites. The intention is to compare characteristics of the crash-involved and non-involved persons so that attributes associated with higher relative risks can be seen.

The first good example of this "case-control" method in the road safety context was conducted by Haddon et al (1961) to study the role of alcohol for killed pedestrians. The blood alcohol level was measured in the killed pedestrians and also in randomly selected persons at the same places, walking at the same time of day, same day of week, and moving in the same direction as the fatally injured. Thus the time and environmental factors were matched and could not account for the large differences in alcohol level found in the cases and controls. McCarroll and Haddon (1962) used a similar design to study the role of alcohol for drivers. More recently, Blomberg et al (1979) and Alexander et al (1990) extended the method to cover the role of alcohol in injured pedestrians and each study made use of three types of control pedestrians:

- those matched by age, sex, site and time of the pedestrian injury
- those matched by site and time only
- those chosen at random from the general pedestrian population.

The different results from these three types of "controls" illustrate the difference between control observations and random samples of pedestrian exposure. The fully matched controls, used in conjunction with the blood alcohol levels of the injured pedestrians, indicated the role of alcohol after the other important variables (age, sex, site and time) had been taken into account, and suggested that pedestrian accident risk rises considerably for blood alcohol level above 0.25%. In contrast the random controls used in the same way suggested that the risk rises considerably above 0.15%. The different results are probably due to higher alcohol levels being present among the older male adult pedestrians, which in itself is a risk factor for pedestrian accident involvement.

The matching of control observations is appropriate when there is general agreement that the proposed match variables are no longer of scientific interest (eg. pedestrian age and sex, because these have been found to be risk factors in numerous studies), but the variables have strong confounding effects on risk, and the focus is on the role of another less well-understood factor (eg. pedestrian

alcohol level). However the matching removes the ability to study the role of the match variables, or strong correlates, any further (Wacholder et al 1992). In the examples given, the method would exclude the role of factors related to site and time, as well as age and sex, plus factors strongly related to them. Thus matched control observations, while they have their own distinct methodological advantages, are not a substitute for observations sampled at random from the population of pedestrian exposure. The random controls observed in the studies described above could be considered to represent pedestrian exposure.

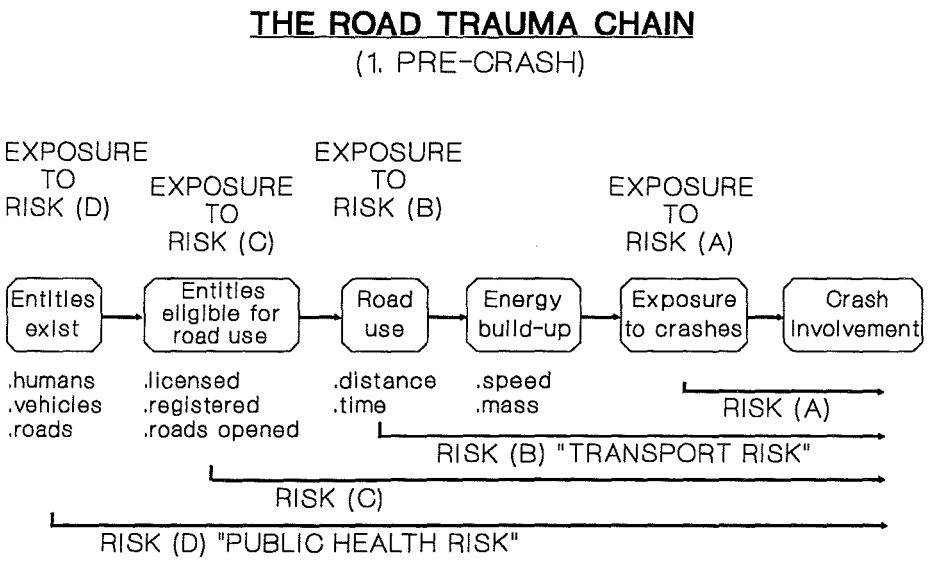
2.2.4 Crash Exposure

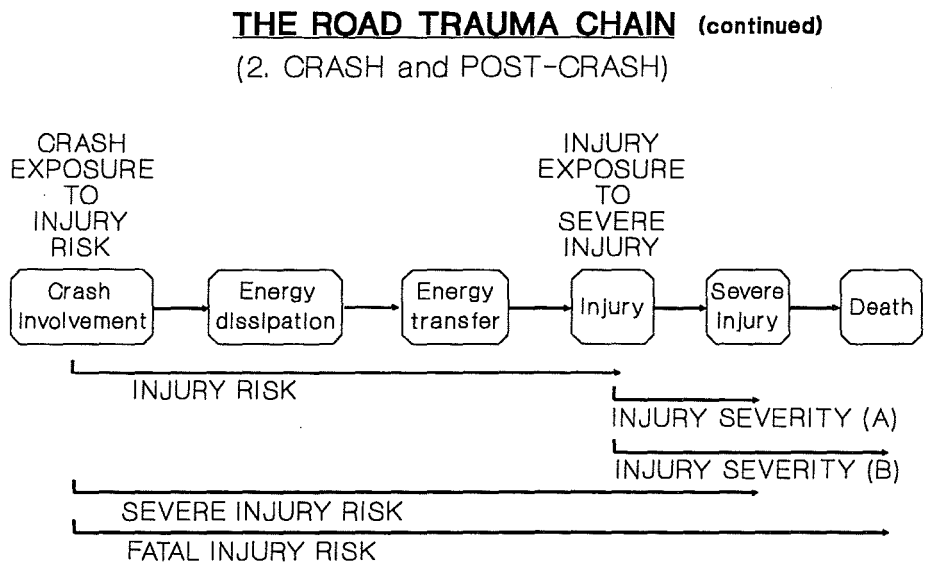
An extension to the traditional concept of exposure is the concept of exposure to injury, or crash exposure. More specifically, once a crash has occurred this provides an opportunity for injury and hence the crash itself represents the exposure to the risk of injury. The event of being injured can itself be considered as exposure to the risk of more severe injury or death and has been labelled 'injury exposure to severe injury' (Cameron, 1991). Factors such as car size and mass (Evans, 1982; Evans and Wasielewski, 1987), speed, seating position, vehicle safety features (such as restraint use, interior design, presence of air bags) are included in crash exposure concepts. For other road users, other measures must be taken into account, such as age, sex, blood alcohol level and additional criteria such as helmet use and other safety apparatus for motorcyclists and bicyclists.

Evans (1986) described a method to determine how occupant characteristics affect fatality risk in traffic crashes. In his report he stated that the most successful approach for making inferences from fatality data is to apply the pedestrian exposure method developed by Evans in 1984. In this approach the number of pedestrians killed in crashes involving cars in some category (for example, in the same mass range) is taken as a measure of the exposure of cars in that category to fatal crashes in general. This method, then, can be applied to comparing risk for any pair of occupants differing in one occupant attribute and for any vehicle. Thus, it can be used to compare safety characteristics such as seat belt usage, helmet wearing for motorcyclists, and age and sex differences.

2.2.5 Summary of Exposure Measures

The following diagrams summarise and illustrate the different types of exposure (pre-crash and crash) and show their role in the chain of events leading to road trauma. The measured exposure of each type is used in the denominator of a rate calculation which estimates the corresponding risk shown.





2.3 AVAILABLE DATA SOURCES AND METHODS OF OBTAINING EXPOSURE MEASURES

There is considerable disagreement on what exposure measures are the most appropriate to use and the methods of collection for road safety research. Unfortunately, the most easily accessible measures are not always the most appropriate for developing meaningful and useful accident rates. Of the two ways of viewing exposure to the risk of accident in the road network (either by road user or by site), different exposure measures might be useful. For example, if the research is looking at road users, distance travelled or time measurements are useful, however for site evaluation, a direct count of road user movements seems more appropriate.

The need to take exposure data into account when using accident statistics has been well established by road safety researchers both in Australia and overseas. Stanton (1981) determined the exposure data then available and the sources of such data in Australia. Stanton found that many record systems created for other purposes are a valuable source of exposure data and he structured an inventory in terms of seven major sections. These included

- Vehicles on Register
- Vehicles in Use
- Population Figures
- Driver's Licences
- Roads Inventory
- Traffic Counts
- Meteorological Data.

The main data collection procedure specifically aimed at providing exposure information, was the Motor Vehicle Usage Survey conducted periodically by the Australian Bureau of Statistics, however this is only published every three years. Information from this source, in conjunction with fuel sales, has been used to provide a monthly estimation of total travel in Victoria (Lambert, 1992). The paper notes that use of data sources such as number of vehicles registered to estimate a measure of travel is insensitive to short term changes in the level of travel as a result of fuel price rises, changes to public transport, relative changes in the cost of living, etc.

A number of limitations were noted in extracting exposure information from existing sources. Firstly, Stanton recognised that due to the nature of databases created for specific purposes, most of the exposure data available described exposure only in the broadest possible terms. Moreover, Stanton found very little uniformity of content, format and definitions used by the various authorities concerned. This is perhaps most notable when comparing data sets between States and Territories. Second, the scope of the study was limited to a selected sample of all the sources of exposure information that exist. Stanton believes there is an almost limitless number of possible sources of exposure data collected by organisations such as Local Government Authorities, consulting engineers, traffic planning and transportation engineers, and organisations in the private and public sector who maintain vehicle fleets and appropriate records. Thirdly, Stanton recognised that new exposure data are continually becoming available and recommended that an exposure inventory be updated at periodic intervals.

Since Stanton's (1981) report, a number of road safety and health agencies have carried out special-purpose exposure surveys to suit their own needs, using methods such as:

- Roadside observations at randomly sampled sites
- Log-books to record travel
- Breath test surveys and interviews
- Pedestrian counts weighted by traffic flows

The method of measuring exposure may depend on the particular road user group, vehicles, or road environments being considered. It also depends on the specific variables required to categorise exposure, and whether these can be obtained accurately through self-reported behaviour or require direct observation or perhaps interviews.

The Melbourne On-Road Exposure Survey (Drummond and Healy, 1986) was undertaken in response to the lack of adequate exposure information to assist in countermeasure choice and development. It aimed to obtain a better understanding of how safely the road transport system is operating, who is using it and to assist in the identification of safety problems on arterial roads in metropolitan Melbourne. The survey was a 'trip-in-process' survey with the unit of measurement being 'distance travelled'. Random sampling of drivers while they were stopped at red lights at 52 carefully selected intersections in the metropolitan area was undertaken. For all drivers passing the sampling point, the exposure measure assigned was obtained directly from a defined length of the arterial road network (known as a link-direction). Sampling was conducted in two-hour blocks covering all single hour blocks in four defined week segments, and one vehicle of all vehicles stopped at the red light was randomly selected. Two interviewers collected separate data including driver age, sex, license status, vehicle ownership, registration details, vehicle occupancy, vehicle type, make and model, time of day and count of non-qualifying vehicles.

Log-book survey methods have been successfully implemented in a number of studies and can provide very useful and detailed characteristics of the road network. Brog et al. (1983) designed the successful "Continuous Survey of Transport Behaviour (KONTIV)" based on the travel diary/log book technique providing information on out-of-house activities. This survey method has been applied in a number of European countries and has been found to be an economical way of obtaining travel behaviour data.

The National Mass Data System in Australia established by the Federal Office of Road Safety incorporates results from the Survey of Day-to-Day Travel in Australia conducted over a complete year from 1 August 1985 to 31 July 1986. Over 18,000 households were asked to complete a diary for one day which recorded all travel activity, including travel as a pedestrian or bicyclist, in terms of distance travelled, duration and number of trips. A paper by Broadbent and Hampson (1988) provides a preliminary view of the tabulations of the relative crash risks using information for the Fatal File and made comparisons in terms of age group, time of day, day of week, and season for drivers, motorcyclists, bicyclists and pedestrians.

The University of Adelaide Road Accident Research Unit have conducted a series of roadside breath test surveys between 1981 and 1991. Observable information on car occupants was recorded for traffic at twenty fixed sites at traffic lights in the Adelaide metropolitan area between the hours of 10pm and 3am on all days of the week. A total of 70,000 drivers were interviewed in the series obtaining details of seat belt usage, number of car occupants, age, sex, seating position. In addition, a breath alcohol test was performed on drivers, with high levels of co-operation.

A pedestrian exposure survey was undertaken within the Sydney metropolitan area (Jamieson, 1980). A total of 156 separate sites were chosen and 8,000 pedestrians and 330,000 vehicular movements were observed. Observable details taken of individual pedestrians included sex, age, walking pace, whether boarding or alighting from a vehicle, whether in pram, etc, whether in group, use of traffic controls and sobriety estimates. Details of vehicular traffic were also collecting including speed, vehicular classification and manoeuvres. Additional associated details at the sites were noted including land use, adjacent traffic facilities, presence of pedestrian controls, road width and geometry and road condition.

The importance of supplying denominator data to calculate accident rates lies in its application to target specific road user groups and road environments to which road safety measures should be aimed. The calculation of accident risks for specific groups of people as well as for people using different modes of transport within the road system remains an essential part of countermeasure development.

3. EXPOSURE DATA NEEDS AT THE NATIONAL LEVEL

A review of the National Health Goals and Targets and the National Road Safety Strategy (including the exposure data needs of the National Road Safety Research and Development Strategy) has been undertaken and data requirements have been documented in detail.

Many of the performance targets included in the NHG&T and the NRSS are phrased in terms of reducing a road transport related risk and hence there is a need for appropriate exposure data series to provide denominators for specific rates which will be monitored over time. Other targets are for reduction in certain high risk behaviour which past research has established their riskiness. In these latter cases the exposure data needed may not be used as a denominator in a rate calculation, because the behaviour is so clearly linked to risk that changes in the exposure alone is all that needs to be monitored.

3.1 NATIONAL HEALTH GOALS AND TARGETS

The National Health Goals and Targets have identified four areas where the health of all Australians can be improved. These are:

- preventable mortality and morbidity
- healthy lifestyles and risk factors
- health literacy and health skills, and
- healthy environments

The Commonwealth Department of Health, Housing and Community Services have identified several problems with the quality and range of health information in Australia, and in the availability of national information. However, despite large improvements in the national health information base in recent years there are still major gaps in the data. Among those gaps highlighted, the National Health Goals and Targets include the need for improved national population data on the incidence and prevalence of disease and risk factors.

In particular, the goal for a healthy environment encompasses the goal to reduce personal risk from transport-related injury. Attempts to reduce this will need to focus on reducing road use, better roads and traffic management, safer vehicles and well directed and enforced traffic laws. Personal behaviours are also noted as important determinants of transport-related injury (including speeding, drink-driving, failing to wear bicycle helmets and seat belts).

Relevant proposed targets to reduce transport-related injury include:

- Priority population: Drivers and passengers of cars and similar vehicles

  To increase the proportion of drivers and passengers who travel in cars with improved frontal protection.

- Priority population: Drivers and passengers of light commercial vehicles and 4-wheel drive vehicles generally used as passenger vehicles

  To increase the proportion of drivers and passengers who travel in light commercial vehicles with frontal protection equivalent to that of cars.

- Priority population: Passengers in centre seating positions in passenger cars and similar vehicles

  To increase the proportion of passengers in centre seating positions who are adequately restrained.

- Priority population: Passengers on long distance passenger coaches

  To increase the proportion of passengers in long distance coaches who can be adequately restrained.

- Priority population: Children, older people, people with disability

  To increase the number of residential areas where pedestrians can move safely.

- Priority population: Children, older people, people with disability

  To reduce exposure to dangerous traffic.

- Priority population: Children, older people, people with disability

  To reduce exposure to dangers associated with the need to cross busy roads in new developments.

- Priority population: All cyclists

  To increase the proportion who have access to safe cycling routes to employment, shops, or recreational centres.

- Priority population: Workforce

  To decrease exposure to unsafe traffic conditions associated with journeys to work.

- Priority population: The whole population

  To decrease exposure to injury associated with transport related accidents.

3.2 NATIONAL ROAD SAFETY STRATEGY

The National Road Safety Strategy is the first national approach by federal, state and local governments to reduce the road toll. The fundamental aim of the strategy is to reduce road crashes and their human and economic costs in real terms during the 1990's and into the next century.

The objectives of the Strategy will be achieved through a number of involvements including working towards safer vehicles, safer roads and safer road users, and through research and development.

Specific goals include a strive for progressive reduction in the road toll, as measured by the international standard of deaths per 100,000 population to below 10 by the year 2001. For this goal to be achieved adequate monitoring of population and demographic changes are required.

Relevant objectives are:

Objective E: Strategies for safer vehicles, safer roads and safer road users:

- encourage new, safe technologies in the operation of vehicles, management of the road system, and in the relationship between these and road users.
- increase appreciation by consumers of options available to improve vehicle safety
- provide greater opportunities for modifying high-risk behaviour

It is recognised that adequate data is needed before solutions can be found to reduce the road toll, further that an integrated framework for road safety planning and action and adequate scientific research are essential to the development of effective programs. A strategic research and development program will fill gaps in existing databases and encourage others to co-ordinate research and development activities.

Objective G: Strategic research and development program:

- accelerate development of a national road crash database which includes hospital morbidity, insurance and crash data
- establish priorities for nationally-relevant research and development needs
- create a program for the training, development and transfer of road safety expertise
- begin planning for the development and implementation of long-term strategies.

National Strategic Research and Development Program

In mid-1993, the National Road Safety Research and Development Strategy Working Group produced a draft research strategy for the eight priority areas identified in the National Road Safety Strategy and other research priority areas identified by the Group. The exposure data needs of this research program were identified and included with the information provided to road safety and health agencies in a survey of their needs carried out during June/July 1993 (see Section 4). Subsequently, the

Working Group published a slightly modified research program (National Road Safety Research and Development Strategy Working Group, 1993).

Relevant National Strategy priority areas include:

- alcohol and drugs:

  to find ways of reducing the involvement of alcohol and drug impaired drivers in crashes by determining the prevalence of drug use and its relation to crash involvement.

- speeding program:

  to gain a better understanding of the speeding problem by examining further the relationship between speed behaviour, with and without alcohol, and accident occurrence, including the effect of changes in traffic speeds and the contribution of alcohol on the incidence of serious crashes.

  to gain a better understanding of the speeding problem by developing comprehensive profiles of groups at high risk from speeding.

  to develop an acceptable system of speed control across the road hierarchy by a review of road design and traffic management procedures to ensure facilitation of driver compliance with speed limit and investigation and evaluation of methods of speed reduction through traffic calming or other techniques in residential, school, commercial and recreational areas.

- vehicle design:

  to continue crash investigations, evaluations and monitoring of vehicle occupant safety issues to maximise the adoption of features in Australian cars by defining data requirements for identification and evaluation of occupant protection methods, and establish appropriate data collections.

  development of consumer information on vehicle safety

- hazardous road locations:

  to optimise procedures for identification and treatment of hazardous road locations.

- heavy vehicles:

  to develop and evaluate technology leading to the safer operation of heavy vehicles.

- novice riders and drivers:

  to develop and evaluate initiatives aimed at minimising the involvement of novice riders and drivers in crashes.

- road trauma management:

  to minimise medically avoidable deaths and impairment through development of an improved road trauma management system including identification of causes and quantum of medically avoidable deaths and impairment.

  to develop a systems study of trauma management from crash to hospital discharge (separation).

Relevant Research Priority areas include:

- demographic and regional factors:

  to understand the impact of changes on road injury and trauma as a result of demographic trends, and develop programmes to deal with the changes.

  to determine the degree to which crash involvement of the elderly and injury outcome separately contribute to the total trauma.

- motorcyclists:

  to gain a better understanding of the factors contributing to motorcycle crash involvement and injury severity by investigating motorcycle travel exposure by motorcycle size and motorcyclist licence/experience category.

- pedestrians:

  to gain a better understanding of the pedestrian safety problem by determining a more comprehensive profile of high risk pedestrian casualty groups and obtaining a clearer indication of pedestrian exposure and relate patterns of pedestrian activity and accidents to the functional hierarchy of roads.

  to ensure the needs of pedestrians are recognised in road network and land-use development by generating information that will encourage among traffic planners a change in emphasis toward pedestrian amenity.

  to increase the compliance of pedestrians with safe road use practices by surveying patterns of pedestrian activity and road crossing behaviour.

- bicyclists:

  to reduce bicyclists injury by encouraging higher levels of compliance with legal and safety requirements.

  to determine the potential impact of improved bicycle standards and road design on bicycle injury such as investigation of bicycle lighting and conspicuity, the potential benefits of separation, road surface improvements, improved traffic signals and developing initiatives to encourage increased appropriate footpath cycling.

- database issues, research methodology, and related issues:

  to improve the efficacy of road injury and exposure data for countermeasure development and evaluation by improving the availability and utility of existing mass data (especially the health sector) on injury and exposure.

  to increase the efficiency of road safety research and evaluation through improved techniques by developing more sensitive statistical tools to allow better and more timely countermeasure development and evaluation.

3.3 OECD RECOMMENDATIONS FOR NATIONAL EXPOSURE SURVEYS

The OECD is constantly involved with international comparisons and its main activities in support of road safety include binding directives (especially in the matter of motor-vehicle construction), training and information for drivers, control of behaviour and corresponding penalties, improvement of road networks, organisation of assistance and, more generally, the actual management of accident prevention.

In 1984 the Bundesanstalt fur Strassenwesen (BASt) established the International Road Traffic and Accident Database (IRTAD) for comparing the road safety of West Germany with other comparable countries. The OECD Road Research Programme adopted this idea in 1987 and in 1989 installed the system in its current form. It is a permanent data source containing annual information from each participating OECD country on its area, population, road networks, road-lengths, number of motor vehicles, kilometrage of motor vehicles, modal split (by cars, public transport, railway, air travel), injury accidents, killed and injured persons, hospitalised persons and exposure data.

An international road safety database allows comparison of road safety between countries, in an attempt to identify special characteristics where further research can lead to road safety improvements.

In addition to a continuous accident database, supplementary exposure data at both the vehicle level and road user level was recommended in 1988 by the OECD Scientific Expert Group (1988). Specifically, two continuous exposure-measuring projects in the form of a National Traffic Count for the vehicle data and a National Travel Survey for the road user data were suggested.

- **The National Traffic Count** comprises continuous traffic counts for a road sample which is representative for road type classification and vehicle type classification and additionally registers date and time of day. This method can be supplemented by periodic odometer readings of a representative vehicle sample.

- **The National Travel Survey** recommends an interview and trip diary method using a population sample representative for age groups, vehicles registered, vehicle-kilometres and occupant-kilometres. Personal details of road users such as age, sex and driving experience, trip details such as purpose, length and duration, and vehicle details such as weight, engine capacity and age would be collected by the interview method.

- **A combination of traffic counts and travel surveys** is moreover recommended. Traffic counts and odometer readings could be used to calculate the absolute level of kilometrage and travel surveys could be used to break this down by those variables not obtainable by the traffic count method.

During this project it was noted that Australia does not have a National Traffic Count and that its triennial "National Travel Survey" (the ABS Survey of Motor Vehicle Use) is based on a sample of registered vehicles and uses the recall method to estimate distances travelled. Thus Australia is not able to provide on-going annual estimates of total vehicle kilometrage to IRTAD, for example during 1989 (Harris and Wegman, 1991) when the ABS survey was not conducted.

4. SURVEY OF EXPOSURE DATA NEEDS AND AVAILABILITY

The investigation involved a survey of the current needs for and availability of exposure data in Australia, consisting of a number of specific tasks. First, contact with relevant Road Safety and Health agencies in each State and Territory and at the National level was made by correspondence. Personal visits were made to relevant agencies in Melbourne, Sydney, Brisbane, Canberra, Adelaide and Perth. Second, an information paper covering the nature and potential use of exposure data was developed. Third, proformas were developed on which agencies could record a description of existing exposure data (both pre-crash and crash exposure) in addition to describing their particular needs for exposure measures.

4.1 ORGANISATIONS COVERED

The first task involved collating a list of relevant Road Safety and Health agencies in each State and Territory and at the National level including contact persons and telephone numbers. In addition to these agencies Road Transport Planning Authorities were included on the list because it was anticipated that their data collections may be suitable for measuring exposure to the risk of accident involvement, especially if the road use can be categorised in qualitative form by key factors related to accident risk such as driver characteristics and the road environment (eg. urban/rural, speed zone, road type). A list of agencies contacted is provided in Appendix A.

Correspondence was made with all relevant Road Safety, Road Transport and Health agencies in each State and Territory describing the survey and requesting descriptions of existing road pre-crash and crash exposure data sets collected during the last ten years and a description of the type of exposure data agencies anticipate needing during the next five years.

Personal visits were made to those agencies in Melbourne, Sydney, Canberra, Adelaide, Perth and Brisbane which were likely to provide information on numerous existing data sources and current uses of exposure data. Agencies in Hobart and Darwin and agencies in other States were consulted by correspondence only because of the limited information likely to be obtained.

During the course of the project, the study team became aware of exposure data needs of the National Road Transport Commission for monitoring road safety performance nationally and for specific research and monitoring of heavy vehicle safety. The first of these needs arose from a meeting of representatives of road safety agencies held in Melbourne in February 1994. The needs for heavy vehicle exposure data were identified in a separate study conducted by Monash University Accident Research Centre for the Commission (Finch and Haworth, in preparation).

4.2 DATA COLLECTIONS FORMS AND INFORMATION PAPER

Before consulting with the relevant health and road safety agencies in each State and Territory and at the national level, three proformas were developed on which agencies could record their current use of exposure data and/or their needs for appropriate exposure data. In addition, a background information paper was collated describing the nature and potential use of exposure data in a broad sense.

Agencies were asked to record a description of existing pre-crash exposure data on one form. Details such as State/Territory the data is available for, a general description of the database, what type of data is covered (eg, road user type, vehicle, road environment), the source and timing of data collection, format of data, published information, available analysis variables and their codes, standard errors of exposure estimates if applicable, limitations of the database and database custodian and telephone numbers were included (Appendix B-1).

A description of pre-crash exposure data needs was also requested on a separate form detailing a general description of the data required, type of data, suggested timing of data collection, region to be covered, and format of data, required variables and any other relevant issues (Appendix B-2).

Further, information was requested covering a description on crash exposure data for both existing and needed data sources. This included details of existing and suggested data availability (State-based or at a National level), details of the reporting criteria for injury data files and crash data files, and the availability of vehicle model and occupant information in road crash and injury data systems (Appendix B-3).

The background document gave a brief outline of the project undertaken focussing on its aims and specifications. It also illustrated the concept of exposure and its role in the calculation of accident and injury rates, the use of these rates for countermeasure development, methods of measuring exposure and its role in the monitoring of the National Health Goals and Targets and the National Road Safety Strategy. Included as an attachment to this document was a review of the National Health Goals and Targets and the National Road Safety Strategy and a checklist of potential exposure data needs by road user groups and behaviours, vehicle type (including model), road types and intersections. This covered crash exposure as well as pre-crash exposure (Appendix C).

This document, along with a covering letter and copies of proformas were sent as initial contact with agencies, forming a springboard for discussions and further correspondence.

4.3 INFORMATION RECEIVED

Agencies were asked to complete and return their forms as soon as possible so that a summary of available and needed exposure data could be listed. Personal visits to agencies proved to be very fruitful in obtaining information available regarding the uses of exposure data in each State and territory and further advice was given regarding other organisations in each jurisdiction who have collected exposure data or related road use information.

The majority of agencies contacted and visited gave information on existing and needed exposure data measures in each State and Territory. A wide range of data sources were reported on by organisations including Population Monitors, Roads Inventory Systems, Culway Reports, Traffic Flow Analyses, Vehicle Databases (Registrations and Licensing), Road Crash Information Data sources (mainly from Police reported crashes), Trauma Service Data sources such as Ambulance data, Hospital Morbidity files and Mortality files, and travel surveys for all road users conducted both at the National level and Statewide. Copies of the completed forms are available on request from MUARC.

4.4 EXISTING PRE-CRASH EXPOSURE DATA SOURCES

From the information received on existing pre-crash exposure data sources in each State and Territory a summary table was developed listing major identifying factors available, organisation responsible and contact person for each data source. Data sources were categorised according to region of availability (ie. State/Territory) and a summary for pre-crash exposure measures available in each State and Territory and on a National level are given in Appendix D.

The summary tables give the name of the database, the period the data covers (timing), the type of data addressed (road user type, vehicle, road environment), a brief general description on the recorded details in the database or survey, the organisation responsible and contact person for upkeep and storage of the data source.

At the National level, the Australian Bureau of Statistics collate State data collections into a National data set. Nationwide data sources collected by the Australian Bureau of Statistics include Population and Housing Censuses, Employment Statistics, Survey of Motor Vehicle Use, Motor Vehicle Registrations, Motor Vehicle Census, Survey of Business Vehicles, Interstate Freight Movement and household expenditure surveys.

The Federal Office of Road Safety also have a number of relevant data sources including the Survey of Day-to-Day Travel in Australia (encompassing persons, house and trip files) and a New Vehicle Data Form. The Bureau of Transport and Communications Economics collects an Environmental Data File and Australian National Highway Inventories.

Each State and Territory has data on Population and Housing, Vehicle Registrations and Licensing, Road Inventory Management Systems, Culway Reporting, Traffic Accident Data Systems, Traffic Counting Systems, Hospital Morbidity and Mortality files. In addition, many States have various other data systems (such as road condition systems, heavy vehicle monitors, roughness database, traffic signal site register, RBT data) or have conducted surveys (such as survey of day-to-day travel, survey of motor vehicle usage, bicycle use and helmet wearing surveys, pedestrian behaviour surveys, free speed surveys, traffic volume surveys and speed and restraint use surveys).

4.5 EXISTING CRASH EXPOSURE DATA SOURCES

From the information received on existing crash exposure data sources in each State and Territory a summary table was developed listing major identifying factors available, organisation responsible and contact person for each data source. Data sources were categorised according to region of availability (ie. State/Territory) and a summary for crash exposure measures available in each State and Territory and on a National level are given in Appendix E.

At the National level the Federal Office of Road Safety holds large system files on Fatal Crashes and Serious Injury Crashes. Within each system file there are three sub-files containing information on the crash (location, time of day, road environment, movement on the road, crash type), vehicle (registration details, type of vehicle, make model and year of manufacture), and person (demographics, injury sustained, medical treatment given, hospitalisation details, hospital discharge status).

The Australian Institute of Health and Welfare and the Australian Bureau of Statistics collect details of Causes of Death in Australia classifying causes of death to the WHO International Classification of Diseases - 9th Revision (ICD9) and conduct an Australian Health Survey detailing the health of all Australians including injuries suffered.

All States and Territories collect details of road crashes reported to the Police, ambulance and hospital admission details. However, the reporting criteria for Police reports, crash files and injury files are different for each State and Territory. Further, vehicle model information and vehicle occupant information are not always recorded in detail and often are not compatible between States and Territories.

4.6 SUGGESTED EXPOSURE DATA NEEDS

A number of agencies also made suggestions for additional exposure measures or data sources which are not currently available. Many were quite specific and focussed on their local area. It appeared that most of these local needs could be satisfied by appropriate data collected at a National level, provided sufficient data

was collected locally to provide exposure estimates with an adequate level of accuracy.

The National Road Transport Commission's needs for national road safety performance monitoring tended to be at a general level of vehicle travel information, categorised by level of urban development (urban v. rural), road classification by vehicle weight (heavy v. light vehicles), age of driver (especially drivers of heavy vehicles), and seat belt wearing rates by seating position.

In contrast, the Commission's needs for heavy vehicle-related exposure data were potentially more specific, covering distances travelled categorised by level of urban development, time of day, trip length and hours driven, driver age, experience, training, and seat belt use, whether a speed limiter is fitted to the vehicle, and the road classification (Finch and Haworth, in preparation).

The suggestions and needs were collated and compared to the needs of the National Health Goals and Targets, the National Road Safety Strategy and the National Road Safety Research and Development Strategy. It was revealed that there were no local needs which could not be met by an appropriate expansion (in the specific jurisdiction) of the recommended exposure data collections to meet the National needs (see Section 5). The National Road Transport Commission's needs could also be met if the other national needs were satisfied, especially the exposure data required to support the national road safety research strategy.

5. COLLECTION OF CURRENTLY UNAVAILABLE EXPOSURE DATA

Currently unavailable exposure data was identified through correspondence and discussions with organisations in each State and Territory. From the descriptions of suggested needs which were provided, the local and National needs were collated.

5.1 SUMMARY OF EXPOSURE DATA NEEDS

Summary tables for identified local and National needs were developed according to nine needs for monitoring of the National Health Goals and Targets and twelve needs of the National Road Safety Research and Development Strategy. These tables are discussed separately below.

5.1.1 Needs for National Health Goals and Targets

A summary of the exposure data needs for monitoring the National Health Goals and Targets is given in Appendix F. Nine needs were identified which related to exposure measures, and local suggestions by individual jurisdictions have been placed according to these needs. The tables show firstly, the National needs and second (in italics) the local suggestions.

Exposure data needs were identified for monitoring the following National Health Goals and Targets:

H1: Increase proportion of drivers and passengers in passenger vehicles with improved frontal protection

H2: Increase proportion of passengers in centre seating positions with adequate restraint

H3: Increase proportion of passengers on long distance coaches with adequate restraint

H4: Increase safety of residential areas for pedestrians (children, elderly and people with disabilities)

H5: Reduce exposure to dangerous traffic (children, elderly and people with disabilities)

H6: Reduce exposure associated with crossing busy roads (children, elderly and people with disabilities)

H7: Increase access to safe cycling routes for bicyclists

H8: Decrease exposure to unsafe traffic conditions when travelling to work

H9: Decrease exposure to injury associated with transport related accidents

5.1.2 Needs for National Road Safety Strategy

A further summary of the pre-crash and crash exposure data needs according to the National Road Safety Research and Development Strategy is given in Appendix G. Nineteen needs were identified which related to exposure measures and, as above, local suggestions by individual jurisdictions have been placed according to these needs. Again, the table shows firstly, the National needs and second (in italics) the local suggestions.

Exposure data needs were identified for the following priority areas in the National Road Safety Research and Development Strategy:

R1: Alcohol and Drugs - prevalence of alcohol and drug use & relation to crash involvement

R2a: Speed - to identify those at high risk from speeding and relate speed behaviour, with and without alcohol, to accident occurrence

R2b: Speed - develop a system of speed control: review road design and traffic management

R3a: Vehicle design - evaluation and monitoring of occupant safety issues

R3b: Vehicle design - development of consumer information on vehicle safety

R4: Hazardous road locations - identification and treatment

R5: Heavy vehicles - technology leading to safer operation

R6: Novice riders and drivers - initiatives to reduce crash involvement

R7: Development of a road trauma management system from crash to hospital discharge

R8a: To determine the impact of demographic changes and road traffic injury

R8b: To investigate how the injury outcome of the elderly contributes to their road trauma

R9: Motorcyclists - the factors contributing to motorcycle crash involvement and injury severity

R10a: Bicyclists - reduce injury by encouraging higher levels of safety equipment use

R10b: Bicyclists - improve bicycle standards, road environment, and appropriate footpath use

R11a: Pedestrians - understanding of high risk groups, pedestrians activity and road hierarchy

R11b: Pedestrians - ensure needs of pedestrians are recognised in road network and land use

R11c: Pedestrians - increase compliance with safe road practices

R12a: Database issues, research methodology and related issues - improvement in availability and utility of existing mass data on injury and exposure

R12b: Database issues, research methodology and related issues - development of more sensitive statistical tools to allow timely countermeasure development.

5.1.3 Possibilities for Satisfying Multiple Needs

From the summaries of National Health Goals and Targets and National Road Safety Research and Development Strategy needs, ten general recommendations were formulated encompassing multiple needs.

Expansion of recommended exposure data collections at the local level to meet National needs involved extensive interpretation of the needs identified by National bodies. Further consideration of the possibilities of combining some related National needs enabled these recommendations to be made encompassing both local and National needs. Table 1 summarises the recommendations and the way each covers the needs of the National Health Goals and Targets and National Road Safety Research and Development Strategy.

A detailed description of the recommendations is given in Sections 5.3 and 5.4. In developing these recommendations, there was a need to review the key issues in the design of exposure data collections, which are outlined in Section 5.2. This section covers issues such as defining the unit of exposure, sampling from the exposure population, obtaining key variables, matching with crash/injury data variables, the accuracy of estimates v. cost and the frequency of data collection.

Table 1: National needs satisfied by the general recommendations for exposure data collections.

RECOMMENDATION	NATIONAL HEALTH GOALS & TARGETS NEEDS	NATIONAL ROAD SAFETY RESEARCH AND DEVELOPMENT STRATEGY NEEDS
1. Motorised Vehicle Use Surveys	H2.	R1, R2a, R3b, R5, R6, R9.
2. Upgraded Vehicle Database	H1, H3.	R5, R12a.
3. Improved Road Inventory	H8.	R2b, R4, R11b, R12b.
4. Bicycle Use Surveys	H7.	R10a, R10b.
5. Day-time Pedestrian Exposure Surveys	H4, H5, H6.	
6. High-risk Pedestrian Exposure Surveys		R11a, R11c.
7. Population Trend Monitor		R8a.
8. General Travel Surveys	H9.	
9. Occupant Crash Monitor ("Crash Exposure")		R3a, R3b, R12a.
10. Injury Management Monitor ("Injury Exposure to Severe Injury")		R7, R8b, R12a.

5.2 KEY ISSUES IN THE DESIGN OF EXPOSURE DATA COLLECTIONS

5.2.1 Defining the unit of exposure

The first issue in designing a collection of exposure data is to define what constitutes a "unit" of exposure. In most cases, as defined earlier, exposure data represents the denominator of a rate which aims to estimate the risk of a road crash or injury outcome. In those situations the focus is usually on the undesirable event (ie. the crash, injury or death) rather than exposure events which may each have a relatively small risk of leading to the undesirable event. Hence the exposure events (and the specific "risk") may not be clearly articulated and defined. A clear definition is necessary, in each context, before exposure can be measured.

Pre-crash exposure events may be continuous (eg. travelling for one kilometre or for one minute) or discrete (eg. passing through an intersection, or a pedestrian crossing a road). Crash exposure events are always discrete because they are specific types of crashes (eg. those resulting in a vehicle being towed away). Whether the events are discrete or continuous, it is necessary to conceptualise in general terms an "exposure event" which has a risk of becoming the undesirable event of interest. This then represents the unit of exposure. It may be very succinct (eg. travelling one metre or one second; intersecting a right-turner's path in an intersection; a pedestrian crossing within five seconds of a vehicle arrival) if this aids the conceptualisation of a single undesirable event arising.

5.2.2 Sampling from the exposure population

It is clear that in most cases the number of exposure events will be many times larger than the number of undesirable events which are recorded in a period. While the total population of exposure events in, say, a year may be difficult to conceptualise, it is not infinite and hence could be enumerated (in theory, at least). An enumerable population can be sampled at random and the sample can be used to make estimates of characteristics of the population.

It is also possible to conceptualise the exposure population in strata, ie. sub-populations. It may turn out that it is relatively difficult or expensive to sample the exposure population which falls in certain strata, eg. exposure in residential streets or by rare classes of vehicles. When thought of in this way, it may be possible to estimate the relative size of these difficult strata (by using surrogate information such as road and traffic inventories, and vehicle register breakdowns) and, if appropriate, make decisions to ignore them or to sample the exposure in the strata in proportion to the cost. The conceptualisation also aids decisions about the appropriate sub-set of undesirable events which should be used in any comparisons.

In summary, once defined, the population of units of exposure should be the basis for the application of standard statistical sampling theory. How, and what strata of this population are sampled may depend on the nature of the key variables which need to be obtained for elements of the population.

5.2.3 Obtaining key variables

The quality of the description of exposure in terms of key variables may determine the method of sampling from the population (other relevant issues are cost and frequency of the information required). Key variables (including the extent of exposure itself) can be obtained from self-reports from sampled subjects, observations, interviews and actual tests of physical condition.

Self-reporting of exposure characteristics and behaviour is adequate for those variables which the subject knows without question, can be expected to report truthfully, and can estimate to an adequate level of accuracy. Examples are personal demographics, region of vehicle use, and estimated total travel in the previous year or estimated time for each trip on a specific prospective day.

Observations of exposure are necessary for those behavioural characteristics for which a respondent may be misleading (perhaps because the specific behaviour is illegal), or could not know with any accuracy. Examples are travel speeds, seat belt use and helmet wearing, and distances travelled through specific speed zones or on categories of road type.

There are some exposure variables which a subject may not provide truthfully but which cannot be determined merely by observation. An example of this would be licence status, which experience has shown can be determined adequately through interviews of drivers (including roadside interviews of those who have been disqualified). There are also exposure variables of this type which cannot be determined by observation nor interview, and require a physical test as part of an interview. An example is blood alcohol level, which has been measured successfully through roadside breath tests of drivers and pedestrians, with high levels of co-operation, in a number of surveys.

5.2.4 Matching with crash/injury data variables

If the exposure data is to be used as the denominator for a rate with number of undesirable events (crashes or injuries) in the numerator, and the rates are to be compared across categories of a key variable, then it is important that the variable be measured in essentially the same way in both sets of data. In particular, the variable measured from the exposure sample needs to be defined and categorised in the same way as the elements of the undesirable events are described, since this latter description is usually not subject to modification.

In practice this requirement, if it applies, is usually not a difficulty for most exposure survey designs. Details of the ways in which the crashes or injuries are recorded can be obtained and similar definitions followed in designing the exposure data collection forms. There may be a need to investigate the operational definitions (sometimes unstated) used by the Police and other relevant agencies, so that these can be emulated in the exposure data. The greatest difficulty would arise in situations where it is not feasible to measure a key variable in the same or similar

way. For example, blood alcohol levels of killed and injured crash victims are usually obtained from blood tests taken by coroners and hospitals, respectively. It would be feasible to request a breath test from road users during an interview, but a request for a blood test is unlikely to be successful in more than a few cases. However a breath test may be satisfactory if the relationship with blood test results has been previously established.

5.2.5 Accuracy of estimates v. cost

Estimates of the exposure population from a sample will have levels of statistical accuracy associated with them, usually expressed as a confidence interval or a standard deviation. These "inaccuracies" arise because the sample is chosen at random from the population, not because of deficiencies in the measurement of the variables (though of course this may be another source of inaccuracy, usually of unknown magnitude).

The accuracy of the estimates may be improved by increasing the size of the sample of exposure, but at the expense of increased cost of the exposure survey. Standard statistical sampling theory may be used to design the most efficient sample which minimises the overall cost, eg. by under-sampling in strata with the smallest variability or the highest cost per sample unit collected. However there is a need for a clear statement of the target level of accuracy required for key variables (perhaps also whether this accuracy is required in each of a number of important sub-populations).

5.2.6 Frequency of data collection

The final and perhaps least critical issue in the design of exposure data collections is consideration of the frequency with which the survey should be repeated. In practice this decision is very subjective, and dominated by financial constraints. In this project, recommended timings have been related to perceptions of the speed at which exposure patterns are changing, the likelihood of substantial change in the near future, or the need for close monitoring. The following frequencies of exposure data collections have been recommended:

- **"one-off":** related to issue which does not change with time
- **every 5 years:** issue changing slowly with time
- **every 3 years:** issue for which change is expected because of active intervention in the near future
- **continuous/annual:** issue constantly changing or requiring close monitoring.

5.3 RECOMMENDATIONS FOR PRE-CRASH EXPOSURE DATA COLLECTION

RECOMMENDATION 1: MOTORISED VEHICLE USE SURVEYS

Nature of Data:

Motor Vehicles Use and Vehicle Drivers/Riders and Passengers Survey

Brief Description:

A National roadside observational and interview survey conducted on a 3-yearly basis of all motorised vehicles including heavy vehicles, passenger cars and car derivatives and motorcycles, focussing on restraint use, use of drugs and alcohol, actual speed and total distances travelled.

Methodology:

For each State and Territory roadside sites would be chosen with appropriate environment (a flat straight or curved section of road with adequate sight distance), a normal distribution of free speeds, and suitable locations for both speed measurement and interviewing. Observations would take place at different times of day and week.

Sites on major arterial roads in both urban and rural settings would be selected to conduct the survey. Those with high volume could accommodate vehicle and traffic flow counts, unobtrusive speed measurement and selective sampling of target drivers for interview would be included. An approximate sample size would be 50,000 vehicles Nationwide.

For urban sites, locations would consist of carefully selected intersections in metropolitan areas. Sites would be selected through a sampling plan producing a representative set of urban arterial link directions (that is, a length of arterial road on one direction between intersections with other arterial roads, and where the length of road is known). For all vehicles passing the sampling point, the vehicle kilometre or passenger kilometre measure would be calculated directly from the distance travelled between the two intersections. In addition, random sampling of drivers while they were stopped at red lights would be undertaken.

For rural sites where intersections are rarely found, locations with appropriate environment (as stated above) would be selected. Information on distances travelled would be obtained through the interview questionnaire to calculate vehicle or passenger kilometres.

The observational stage would incorporate actual speed checks without the knowledge of the driver within the link-direction section. This is considered necessary to avoid the possibility of biased reporting through driver alertness to having their speed recorded. A manual free speed measurement technique involving timing the passage of the vehicle between two fixed points of a known distance apart and converting that time onto travel speed may be used.

When drivers stop at the traffic signal at the end of the link-direction randomly selected vehicles would be approached by an interview team asking permission to conduct an interview. Motorcyclists and heavy vehicle drivers would be over-sampled to allow representative information from these road users to be obtained.

The interview stage would incorporate a questionnaire, and alcohol and drug testing. Due to the length of the interview drivers would be asked to stop on the side of the road. It is expected that about 40% of drivers would agree to a full interview and, of these, about 90% will agree to provide a breath alcohol test and a saliva test for the presence of certain drugs. An interview format including key variables (see below) would be undertaken with participating drivers.

Key Variables:

Questionnaires would include details of driver demographics, license details, restraint use, speed and drink driving behaviour and attitudes, distance and time travelled in current trip, purpose of trip, geographic area, safety features of vehicle and vehicle details (make, model, year of manufacture, registration number, number of car occupants, seating positions and restraint use). In addition, testing of breath alcohol levels and a test of drug use (eg. saliva sample) would be administered. Laboratory tests on the saliva samples would detect the presence of cannabis, amphetamines, and possibly other common drugs. A link to the Vehicle Registration file would be made to obtain additional vehicle details (eg. by decoding the VIN; see Section 5.5.1).

Further, for heavy vehicle drivers, additional questions would be asked such as driver training undertaken, load details, and additional vehicle details such as weight, ownership details and safety features of the vehicle (including fitting of speed limiters).

For motorcyclists, additional questions would include use of headlight, additional vehicle details such as engine capacity, safety equipment use and details of pillion passenger.

Options:

The proposed survey would satisfy a number of exposure data needs (see Section 5.1.3) simultaneously, especially the needs for the following priority research areas:

R1: Alcohol and Drugs - *prevalence of alcohol and drug use* and relation to crash involvement

R2a: Speed - to identify those at high risk from speeding and relate *speed behaviour, with and without alcohol,* to accident occurrence.

However there are options to collect sub-sets of the information, each of which could satisfy one of these key needs at lower cost:

Option 1a: Roadside interview survey of alcohol and drug use (preliminary interviews of 50,000 drivers; full interviews with 20,000 drivers including breath and saliva tests; laboratory processing of saliva tests).

Option 1b: Roadside observation of speeds and interview survey of alcohol use (speed measurements and preliminary interviews of 50,000 drivers; full interviews with 20,000 drivers including breath tests).

RECOMMENDATION 2: UPGRADED VEHICLE DATABASE

Nature of Data:

Upgrading of Existing Registration and Vehicle-based Data Sources

Brief Description:

Improvement of National and Statewide databases detailing vehicle registration and manufacturing to include Vehicle Identification Numbers, safety features (especially air bags and other frontal crash protection), and safety options installed.

Methodology:

A one-time monitoring of existing Statewide registration and vehicle manufacturing databases for all vehicles (trucks, buses, cars and car derivatives and motorcycles) would be conducted to assess the feasibility of upgrading data sources to improve the availability and utility of mass data on exposure measures.

Once feasibility has been established Statewide data sources would be upgraded to allow compatibility between databases in each State and Territory and allow key variables (see below) to be included. Variables included would be added to databases on a continuous basis.

Key Variables:

Registration and vehicle based data sources currently record information on make, model (limited information), size, mass, weight, owner details, year of manufacture and, for some States, VIN has recently been included. It is proposed that vehicle information variables be included on Registration databases which are compatible for all States and Territories. Further, for vehicles registered prior to 1989, other vehicle identification sources could be included in the Registration files (eg. engine number, chassis number).

Vehicle safety features including frontal crash protection devices in cars and seat belts in buses would be added to existing databases in each State and Territory. In addition, details of options available in vehicles and what proportion of vehicles have these options would be recorded. The possibility of creating an additional character in VIN to indicate safety options fitted to specific vehicles may make the availability of this information more accessible (see Section 5.5.1).

RECOMMENDATION 3: IMPROVED ROAD INVENTORY

Nature of Data:

Improvement to existing Road and Traffic Management Inventory Systems, including addition of traffic flow information on a continuing basis. Improved display of information using Geographic Information Systems.

Brief Description:

Improvement to existing road environment and traffic databases to include more up-to-date information on road environment changes, identification of hazardous locations and changes in traffic flow and speed distribution. Annual monitoring of traffic flow on major arterial roads of cities and major towns in each State and Territory to provide regular traffic flow (including all motorised vehicles) and bicycle and pedestrian flow information.

Methodology:

Traffic counts and observations of traffic characteristics on major arterial roads of cities and major towns in each State and Territory would be conducted on a yearly basis for two weeks at each site. For each jurisdiction, roadside sites would be chosen with appropriate traffic flow, speed zone and road design to provide a representative sample. Items automatically recorded for vehicles would include a count of all vehicles passing, type and weight of vehicle, time of day/week/month, travel speeds and headway lengths, making use of current developments in "Culway" technology and similar systems. The sites would be electronically linked to central data storage and processing systems to handle the large volumes of data. If warranted, observers could be stationed at a sample of sites to record number of vehicle occupants. In addition, bicycle and pedestrian flow would be monitored (Recommendations 4, 5 and 6, if implemented, would provide a source of this data).

Details and observations of vehicle, bicycle and pedestrian flows and the road environment would be added to existing Road Inventory Systems. Improved coding of road environment in Road Inventory Systems would additionally be undertaken on a continuous basis. Improvements in these areas will allow prompt identification of traffic characteristics producing hazardous locations for timely countermeasure development, an improved display and review of road design and traffic management, provide a system to make allowances for pedestrians in the road network and land use, and allow a system of speed control to be developed (see variables below).

The large amount of location-specific information which would then be available makes it imperative that Geographic Information Systems be applied to the Road Inventory Systems. This will allow good displays of information specific to the road environment at each location and allows the various types of "exposure" (ie. road features, traffic flows and other characteristics) to be compared with the crashes which occurred.

Key Variables:

Traffic counts and observations will include details of vehicle, bicyclist and pedestrian flows, speed and speed zones, headway lengths, time of day/week/month and number of vehicle occupants.

Improvements to existing Road Inventory Systems will include variables collected through traffic counts and observations in addition to road environment details such as width of road, type of road, road hierarchy, geographic area, road design, median refuges for pedestrians, number of pedestrian crossings, pedestrian and bicyclist amenities and footpath condition.

RECOMMENDATION 4: BICYCLE USE SURVEYS

Nature of Data:

Surveys of Bicycle Use, Safety Equipment Use and Cycling Routes

Brief Description:

A National roadside observational and subset interview survey conducted on a three-yearly basis detailing frequency of safety equipment use and use of road, footpath and bicycle path environments.

Methodology:

For each State and Territory a sample of roadside sites on roads giving a selection of various bicycle environments in the road hierarchy would be chosen. Major arterial roads in cities and towns, non-arterial roads with average traffic flow, and residential streets would be selected to conduct the observational survey. In addition, observations would be conducted on selected bicycle pathways.

All bicyclists and bicyclist behaviour in the observation zones, regardless of age, direction or side of road would be observed and recorded in the observational stage. Observations would be conducted at all times of the day and evening/night to give a representative sample of presence use of lights, in addition to a representative sample of day and night bicycle use. An appropriate sample size would be 10,000 bicyclists Nationwide.

In addition to the observational survey, a subset of 2,000 bicyclists observed at sites where there are multiple environment options (ie, roadway, footpath and bicycle path nearby), would be interviewed. The interview would consist of a small questionnaire incorporating key variables (see below) which would be undertaken with participating bicyclists on the side of the road.

Key Variables:

Key variables recorded through observation would include frequency and volume of bicyclists, bicyclist demographics such as age and sex, road use (road, footpath or bicycle path), helmet type and use, use of other safety equipment, particularly conspicuity aids, presence and use of lights, location details and time of day/week/month.

In addition to data collected through observation, questionnaires completed in the interview stage with bicyclists at sites with multiple environments would provide detailed bicyclist demographics, bicycle usage (frequency, time and distance travelled), purpose of trip information, road, footpath and bicycle path condition, and attitude and preference for various cycling environments as well as helmet type and use and use of lights and conspicuity aids on bicycles.

RECOMMENDATION 5: DAY-TIME PEDESTRIAN EXPOSURE SURVEYS

Nature of Data:

Surveys of Day-time Pedestrian Behaviour and Exposure

Brief Description:

A National observational survey conducted on a three-yearly basis detailing pedestrian characteristics of children, the elderly and people with disabilities in various road environments, focussing on behaviours on the road, and other related risk behaviours for pedestrians. The surveys would be carried out during day-time periods only, because most of the exposure of these pedestrian groups occurs during these times.

Methodology:

For each State and Territory footpath sites on all road environments including major arterial roads, non-arterials roads and residential streets in cities and towns would be selected to conduct observations of pedestrian exposure and behaviour. Appropriate sites may include sites where pedestrian crossings and/or signalised intersections are close by, in addition to sites with pedestrian safety features such as median refuges, warning signs and other pedestrian amenities.

Child pedestrians, elderly pedestrians and pedestrians with disabilities would be targeted in the survey (ages would need to be estimated during observational periods by trained observers). The survey would consist of extensive observations of the targeted populations during day time hours as these times are considered the times when exposure is high in these populations.

Observations would provide details of pedestrian flow in all road environments, pedestrian demographics behaviour on the road (particularly road crossing behaviour), road type and features, and other key variables (see below). An approximate sample size would be 5,000 child pedestrians, 5,000 elderly pedestrians and 2,000 pedestrians with disabilities; an additional 8,000 adult pedestrians would also be observed, making a total National sample of 20,000 pedestrians.

Key Variables:

Observational recordings would include details of pedestrian demographics (such as sex and estimated age), traffic and pedestrian flow at each site, road details (such as speed zone, hierarchy, width of road, number of lanes, etc.), footpath condition, pedestrian road crossing behaviour, and location of pedestrian crossings and other safety features (such as barrier fences, median refuges and pedestrian amenities).

RECOMMENDATION 6: HIGH-RISK PEDESTRIAN EXPOSURE SURVEYS

Nature of Data:

Surveys of High Risk Pedestrian Behaviour

Brief Description:

A National survey of high risk pedestrian populations focussing on high risk behaviours, particularly pedestrian alcohol and drug use. A three-yearly survey conducted in conjunction with the Survey of Day-time Pedestrian Behaviour and Exposure through interview techniques during late afternoon and night hours.

Methodology:

For each State and Territory footpath sites where high risk pedestrian populations, namely pedestrians with high alcohol and drug use, are likely to be found (perhaps dense urban areas with high numbers of public bars or nightclubs) would be selected on arterial and non-arterial roads in cities and major towns.

Interviews would be conducted during late afternoon and night hours as these times are considered to be the times when these populations are at highest risk. An approximate sample size would be 10,000 pedestrians Nationwide.

High risk pedestrians (young adults and the elderly) would be selected and approached by a small interview team asking permission to conduct an interview. An interview format including key variables (see below) would be undertaken with participating pedestrians. In addition to an interview, participants would be asked for tests of alcohol (ie. breath test) and drug use (eg. saliva sample).

Key Variables:

In addition to recordings of geographic location, time of day/night, road environment and road features, lighting and weather conditions, and traffic flow details, questionnaires would include details of pedestrian demographics, activity prior to walking, drinking pattern and drug use, pedestrian attitude and behaviour details and use of safety measures (such as conspicuity aids).

Tests of BAC level and drug use would be administered to give details of alcohol consumption and drug use and type.

RECOMMENDATION 7: POPULATION TREND MONITOR

Nature of Data:

Continuous Monitor of Population Data

Brief Description:

To determine the impact of demographic changes on road traffic injury, detailed annual interpolation of population and housing data between National five-yearly census information is proposed.

Methodology:

For each State and Territory, the State Offices of the Australian Bureau of Statistics would update their data containing details of the five-yearly Census of Housing and Population, which includes vehicle use estimates. This would be conducted on a yearly basis to provide more detailed annual population figures for each State and Territory.

Key Variables:

Key variables are currently available in existing census data. These include person demographics, age and sex, marital status, educational level, residence (postcode), license details, vehicle ownership, employment status, fuel consumption and vehicle use.

RECOMMENDATION 8: GENERAL TRAVEL SURVEYS

Nature of Data:

Travel Surveys covering all forms of surface travel.

Brief Description:

A general travel survey would be administered in conjunction with the five-yearly Census of Housing and Population.

Methodology:

The method attempts to capture all transport users, including cars, motorcycles, trucks, buses, trains, trams and other forms of transport including travel by bicycle or by foot.

The population selected would be obtained by randomly sampling addresses from Census Collectors' Districts in a number of Local Government Areas in cities and towns throughout Australia, or from the Electoral Commission List.

Mail-out questionnaires would be despatched to selected households in each State and Territory by the Australian Bureau of Statistics in conjunction with the Census of Population and Housing throughout Australia. Questionnaires would be of a self-administered design based on the KONTIV instrument developed in West Germany. A travel diary would be included requesting details of prospective trip information. An approximate sample size would be 40,000 households Nationwide.

Key Variables:

Questionnaires would include details of demographics of travellers in the household, details of vehicles registered by household members (make, model, registration number), and license details of vehicle owners (type of license held, experience).

In addition to a questionnaire, respondents would receive a trip diary asking household members to record their trips on a specific day. Recordings would include details of time of travel, major travel mode used, road user type, road environment, purpose of trip, seating position in vehicles, geographic location of trips, types of road travelled on and fares paid if using public transport for all trips made on that day.

5.4 RECOMMENDATIONS FOR CRASH EXPOSURE DATA COLLECTION

RECOMMENDATION 9: OCCUPANT CRASH MONITOR ("CRASH EXPOSURE")

Nature of Data:

Improvement to Existing Data Sources on Occupant Crashes and Consumer Information on Vehicle Safety

Brief Description:

Improvement to data collected on vehicles and occupants of vehicles involved in crashes recorded on Police Accident Report Forms to include relevant vehicle occupant safety issues not currently covered.

Methodology:

Police Departments in each State and Territory currently record details on all Police reported vehicle crashes. However, in most States additional data items would be desirable to collect. Improvements to the report forms and subsequent crash information databases derived from Police forms held at State Road Transport Authorities would be made to include details of impact severity (see Section 5.5.2), safety measures available, occupant details (number in vehicle, seating position, restraint use, injury severity and details of uninjured occupants).

In addition, linkages of Crash Information Databases to State Registration and Licensing Systems would be made possible to include license details (license type and experience) and vehicle details such as VIN (see Section 5.5.1), make, model, size, mass, year of manufacture, safety features and safety options available in vehicles.

Further, crash, vehicle and person details collected would be compatible for each State and Territory to provide information at a National level. Key issues for National compatibility would be the criteria for reporting the crashes to the Police (see Section 5.5.3) and for recording of information about the involved occupants (see Section 5.5.4). For the data to be useful as crash exposure of occupants, neither of these criteria should depend on whether persons are injured or not.

Key Variables:

Improved databases would link Registration, License and Crash databases and include Nationally compatible variables detailing impact severity of crash, safety features of vehicles (especially options available), crash details, occupant details (occupant demographics, injury, seating position, restraint use) and details of uninjured occupants and vehicle details (VIN, registration details, make, model, size, mass and year of manufacture).

RECOMMENDATION 10: INJURY MANAGEMENT MONITOR ("INJURY EXPOSURE TO SEVERE INJURY")

Nature of Data:

Improved Road Trauma Management System detailing Injury Outcome

Brief Description:

Development of a National Road Trauma Database through on-going linkage of State Crash Information Databases (derived from Police Accident Report Forms) with databases covering major trauma (Ambulance Data Collections, Hospital Morbidity Files and Death Records) to gain an overall information source on road trauma from crash to hospital discharge. If a national major trauma database was assembled from State sources, this would greatly facilitate on-going linkage with national crash data files.

When this database is available, it could be used as the "injury exposure" basis for investigations of injury outcomes which were poorer than expected, examining the role of factors such as age and sex, crash type, injury type, and treatment type.

Methodology:

Each State and Territory has an existing Road Crash Information Database. In addition, there are databases recording major trauma (not necessarily road-related) such as Ambulance Data Collections, Hospital Morbidity Files and Death Records. Improvement of the first data source on a continuous basis (see Recommendation 9), including providing a technique for linkage, would provide the basis of a detailed Road Trauma Management Monitor.

Through the linkage, Nationally compatible variables would be incorporated including details of impact severity, safety measures available, severity and pattern of injury, occupant details (number in vehicle, seating position, restraint use), crash details, casualty details, road user type, ambulance details including treatment given, and time taken from crash to hospital, and hospital details including length of stay, treatment type and discharge status. While the data recorded by individual jurisdictions in their crash files is reasonably compatible, this is not the case for their major trauma databases. The creation of a national major trauma database would overcome this difficulty and would facilitate the linkage to the crash data files.

This database would represent the "injury exposure" for a one-off research study looking in particular at the injury outcome of the elderly (see priority research area R8b in Section 5.1.2). A mass data analysis would be undertaken focussing on injured road users over 55 years of age. Severity of injury, hospitalisation,

discharge details and long-term prognosis would be related to the impact severity and road user type. An approximate sample size would be 10,000 elderly Nationwide.

Key Variables:

Linkage of data sources to develop Statewide and National Road Trauma Management Systems would include relevant injury exposure variables such as vehicle and crash details, medical treatment given at the scene of the crash by Ambulance personnel, injury and hospitalisation details such severity of injury, type of injury sustained, length of hospital stay, treatment type and discharge status.

5.5 SPECIAL ISSUES ARISING FROM RECOMMENDATIONS

5.5.1 Vehicle Identification Numbers (Recs. 1, 2, and 9)

Recommendations 1, 2 and 9 include the need for passenger cars to be described to a specific level of detail related to their safety features. This goes beyond their make, model and year of manufacture to desirably cover whether features like anti-lock braking systems or driver-side air-bags are always fitted or have been optionally fitted when the car was purchased.

Since January 1989, a seventeen-character Vehicle Identification Number (VIN) has been required on the Compliance Plate of cars certified for sale in Australia indicating that the manufacturer has met certain safety standards. The first three characters identify the manufacturer and country of origin, the next six identify the general attributes of the vehicle (eg. model, series, body type, and engine type) and are determined by the manufacturer, and the next eight characters uniquely identify the vehicle and usually commence with a code for the model year (ISO 1983, SAE 1986). Some manufacturers also position the VIN where it can be read externally, since the Compliance Plate is usually located in the engine compartment.

From the beginning of 1989, most Australian registration authorities commenced recording VINs on the vehicle register for 1989 model cars onwards. South Australia, which commenced recording VINs in July 1990, is planning to backdate its records to January 1989. New South Wales is also retrospectively adding VINs from pre-1989 vehicles which appeared in seventeen-character form as a chassis number. A number of State registers have recorded chassis numbers and/or engine numbers for many years. It is understood that some importers have used a VIN which meets the ISO standard as the chassis number for some time.

When first produced or imported, each new car model (and its variants) is certified by the Federal Office of Road Safety as being acceptable for registration by the Australian States and Territories. Forms NVD1 issued since 1985 specify the variants of each make, model and body type which are offered for sale, together with the standard and optional features available which affect the registered mass of the car. The VIN assigned to the car (in particular, the middle six characters) reflects these variants in many cases, but not uniquely for some manufacturers. The codes used by each manufacturer are held in the "National VIN Database" operated in NSW on behalf of all State and Territory registration authorities.

Thus VIN has the potential to define models of cars related to their safety features, but suffers from not being available in consistent form prior to 1989 models, not specifically identifying variants of models in some cases, not recording any optional safety features fitted, and not always being observable from outside the vehicle. The latter problem could be overcome in exposure surveys by recording the registration number and later obtaining the VIN from the vehicle register. Alternatively, in the case of log-book surveys, the respondent could record the VIN from the Compliance Plate (though the accuracy of this should be questioned). The

deficiencies in current VINs for identifying specific variants and optional safety features could be overcome by either:

1. Requiring manufacturers and importers to provide full details of the variant and optional features provided on each vehicle, defined by its unique VIN. It is understood that manufacturers' "build schedules" for their production lines hold this information, and may be available retrospectively. These details could be held in the National VIN Database.

or

2. Requiring a supplement to the VIN which uniquely defines the variant and specifies the safety features which were fitted to the vehicle during production. Alternatively, manufacturers could be required to code their VINs to encapsulate this information (as, for example, done by General Motors to record airbags fitted to their US cars).

5.5.2 Impact Severity Measurement (Recs. 9 and 10)

The severity of impact on the car is an important attribute to describe crashes ("crash exposure") because it has a strong relationship with the risk of injury and hence is a critical part of the recommended Occupant Crash Monitor (Recommendation 9). Impact severity also affects the risk of severe injury outcome for occupants who are injured ("injury exposure") and hence it is highly desirable that it be measured and included in the recommended Improved Road Trauma Management System as well (Recommendation 10).

McLean (1975) and Cameron (1981) reviewed a number of impact severity measures suitable for road crash injury research. The most suitable measure which could be collected by reporting Police officers was a scale of car deformation developed by the US National Safety Council (1971) as part of its Traffic Accident Data (TAD) Project. The TAD scale has since been used by many Police forces in the US, especially in North Carolina where its availability for nearly every car recorded in Police crash files, together with precise details of each vehicle via its VIN, has provided very valuable crash exposure data for use by the Highway Safety Research Centre in studying occupant injury and factors affecting it (McLean 1975).

The TAD scale made use of a series of graduated photographs, from two different angles, showing deformation to real crashed cars (Appendix H). There were eighteen different categories of impact (eg. front end damage distributed across the full width) and seven levels of deformation for each. Photographs were provided to illustrate only alternate levels of deformation, namely levels two, four and six. The Police officer was asked to choose the most appropriate category of impact to describe the damaged car, then to judge the closest level of deformation. Other official persons attending the crash scene, such as ambulance officers, could collect the same information. There are issues related to multiple impacts, reliability of coding, relationship with other measures of impact severity, and the need to develop a set of photographs for modern Australian cars (McLean 1975). However it is clearly feasible to develop an Australian version of the TAD scale using similar principles,

and to add the coding of car damage levels to the information collected by Police or ambulance officers in Australia. To minimise the additional effort required, it would still be useful for the recommended Occupant Crash Monitor if the damage coding was provided only for cars damaged beyond a specified level (see Section 5.5.3).

5.5.3 Crash Reporting Criteria (Rec. 9)

There are a variety of criteria for reporting road crashes to the Police in Australia, and the criterion to record each crash on the analysis database also varies between jurisdictions. The criteria may depend on whether the crash has resulted in injury, property damage above a certain amount (ranging from $500 to $1000), a vehicle being towed away, or a Police prosecution may result. Other less tangible factors also affect the reporting and recording.

For Police reports to form the basis of a useful Occupant Crash Monitor (Recommendation 9), there is a need for Police forces to record at least a common sub-set of crashes defined by a criterion not related to injury. In the case of crashes representing a threat of injury to occupants of passenger vehicles, a suitable criterion would be crashes resulting in a vehicle being towed away. This criterion is expected to cover crashes from a higher level of impact severity than the more commonly used criteria of property damage above certain amounts. It would not preclude the additional criterion of injury occurrence, and this is more likely to be operative in the case of crashes involving pedestrians, bicyclists and motorcyclists. However, most single-car and car-car crashes would be recorded, under these two reporting criteria, principally because a car has been towed away (the few crashes involving occupant injury but no vehicle was towed away would be readily identifiable in the data).

In summary, the recommended Occupant Crash Monitor could be based on Police crash reports from those jurisdictions where crashes are recorded if a vehicle is towed away (or if tow-aways can be identified in a broader set of crashes which have been reported because of property damage). If a National coverage of occupant "crash exposure" is required, there will be a need for Police forces in two jurisdictions (Victoria and Northern Territory) to expand their requirement for reporting of a road crash to include those resulting in a tow-away.

The coding of impact severity (ie. the TAD scale of type and extent of deformation) could be confined to those passenger cars which have been towed away. Such information would be very useful in the recommended Occupant Crash Monitor, but limiting it to cars which have been towed away would minimise the additional effort required of Police or ambulance officers (see Section 5.5.2). The proposal to confine TAD coding to the towed-away cars in tow-away crashes would omit information on the severity of the impacts of the cars which were not towed away, but this is unlikely to be a substantial loss from the information about occupant crash exposure.

5.5.4 Recording of Uninjured Occupants (Rec. 9)

Even in jurisdictions where crashes are recorded by the Police for reasons other than injury occurrence, there are a variety of practices for recording information about the

involved persons, especially uninjured occupants. These range from no information, through injured occupants only, to all involved occupants, and typically note the seating positions and/or the total number of occupants present. The most comprehensive and reliable information is recorded if the occupant is injured, or if the person is a driver (no matter whether injured or uninjured).

To provide "crash exposure" information by each seating position in the recommended Occupant Crash Monitor, there is a need for information on each car occupant which is unrelated to his/her injury outcome. If a National coverage of occupant crash exposure is required, there will a need for Police forces in most jurisdictions to change their recording practices regarding uninjured occupants involved in the crashes to be included in the Occupant Crash Monitor (see Section 5.5.3). The depth and quality of information on uninjured occupants should be the same as if the occupant was injured.

5.6 ESTIMATED COSTS OF RECOMMENDED DATA COLLECTIONS

Estimates were made of the approximate costs of implementing the above general recommendations for exposure data collections (including, where appropriate, the costs of the related specific recommendations). In most cases the total cost was dominated by the proposed number of cases to be included in the recommended survey or other data collection (see Sections 5.3 and 5.4). The costs could be reduced by decreasing the sample sizes or by sampling from the data, but it should be noted that this would also reduce the accuracy of the estimates derived from the sample. At this stage the required accuracy has not been specified for any exposure data need, so in practice there will be a balance between the funds available and the accuracy which can be achieved for those funds.

The approximate costs of each of the recommended data collections with the proposed numbers of cases are given in Table 2.

Table 2: Estimated costs of the recommended exposure data collections.

RECOMMENDATION	Frequenc	No. of Cases	APPROXIMATE COST ($'000)
1. Motorised Vehicle Use Surveys	3 yearly	50,000 speed measures an prelim. interviews; 20,000 full interviews an breath/saliva tests	400-500
Option 1a: Survey of driver alcohol and drug use	3 yearly	50,000 prelim. interviews 20,000 interviews and breath/saliva tests	270-330
Option 1b: Speed observations and surve of driver alcohol use	3 yearly	50,000 speed measures an prelim. interviews; 20,000 interviews and breath tests	230-280
2. Upgraded Vehicle Database	On-going	NA	100-150 initially (Govt. cost only)
3. Improved Road Inventory	On-going (Annual surveys)	320 automatic recording sites; vehicle data recorde 2 weeks p.a.	600-650 to establish system; 120-150 per annu to operate
4. Bicycle Use Surveys	3 yearly	10,000 observations; 2,000 interviews	120-150
5. Day-time Pedestrian Exposure Surveys	3 yearly	20,000 observations	100-120
6. High-risk Pedestrian Exposure Surveys	3 yearly	10,000 interviews and breath/saliva tests	140-160
7. Population Trend Monitor	5 yearly	NA	30-40

Table 2 (continued): Estimated costs of the recommended exposure data collections.

RECOMMENDATION	Frequency	No. of Cases	APPROXIMATE COST ($'000)
8. General Travel Surveys	5 yearly	40,000 initial log-books sent and followed-up; 20,000 finally received	1400-1500
9. Occupant Crash Monitor ("Crash Exposure")	On-going	7,000 extra tow-away crashes reported in Victoria and NT; TAD scale coding of 200,000 towed-away cars	1100-1200 per annum
10. Injury Management Monitor ("Injury Exposure to Severe Injury")	On-going	Not known (estimated based on expansion of WA linked records system)	400-500 to establish systems; 300-400 per annum to operate

The average cost per annum of the ten recommendations was estimated by examining the total cost over a 16 year period, assuming that all ten were implemented in the first year and repeated (where appropriate) with the frequency indicated. The total cost in the first year was estimated to be $4.4 - 5.0 million and the average cost during subsequent years was estimated to be $2.1 - $2.4 million per annum.

Some economies may be achievable if related surveys were conducted in parallel, eg. if the two Pedestrian Exposure Surveys were conducted together and, in turn, if these proposed triennial surveys were conducted in conjunction with the triennial Bicycle Use Surveys. Major savings could be made in the cost of the Motorised Vehicle Use Survey (Recommendation 1) if the exposure data collected was limited to that satisfying only some key research priorities (Option 1a or 1b).

Costs could be reduced further by reducing the frequency of the surveys proposed in Recommendations 1, 4, 5 and 6 to every five years (eg. to coincide with each population census) or by limiting the number of States or regions in which the surveys are carried out. The latter would, of course, make the survey results less representative at the national level but may be sufficient for development and evaluation of countermeasures.

5.7 PRIORITIES FOR EXPOSURE DATA COLLECTION

The ten general recommendations and four specific recommendations represent a substantial investment of road safety resources. It is unlikely that all of the required funds could be found to implement the recommendations in their entirety immediately. Thus there is a need to consider the priority which should be given to

individual recommendations on the basis of current requirements expressed by potential users.

The National Road Safety Research and Development Strategy Working Group (1993) reviewed the priorities for key areas in a national research program. They judged the following areas to be the most "attractive" in terms of the potential benefits to road safety in Australia, and the ability of the authorities to convert research outputs into safety returns:

- Hazardous locations
- Speeding
- Alcohol
- Licensing/training/education
- Seat belts
- Vehicle interior design
- Road trauma management.

The general and specific recommendations which would contribute needed exposure data to these priority research areas are given in Table 3.

Table 3: Priority research areas and the general and specific exposure data recommendations contributing needed information.

Priority Research Area	GENERAL RECOMMENDATION	SPECIFIC RECOMMENDATION
• Hazardous Locations • Speeding	**3.** Improved Road Inventory (including automatically-recorded traffic data)	
• Speeding • Alcohol • Licensing/training/educ. • Seat belts	**1b.** Motorised Vehicle Use Surveys: Speed observations and survey of driver alcohol use (also occupant belt use)	
	6. High-risk Pedestrian Exposure Surveys (measurin alcohol use only)	
• Vehicle Interior Design	**9.** Occupant Crash Monitor	**i.** Vehicle Identification Numbers
	2. Upgraded Vehicle Databas	**ii.** Impact Severity Measurement **iii.** Tow-away Crash Reporting Criteria **iv.** Recording of Uninjured Occupants
• Road Trauma Management	**10.** Injury Management Monitor	**ii.** Impact Severity Measurement

5.8 FUNDING MECHANISMS

The National Road Safety Research and Development Strategy is an important springboard for the funding of the recommended exposure data collections, at least so far as the road safety agencies are concerned. While the National Health Goals and Targets include implicit needs for road exposure data to monitor whether progress has been achieved, the health agencies have yet to endorse a research strategy which includes collecting such data.

The National Road Safety Research and Development Strategy represents an attempt to rationalise the research needs of all States and Territories, and to plan the conduct of that research so that duplication is avoided and economies of scale are achieved. The funding of exposure data collections should be able to capitalise on the existence of this strategy, because such collections are usually most cost-effective if carried out on a broad scale. In addition, the nature of the data is frequently the case that even if it is collected in one jurisdiction, it usually has relevance to other like jurisdictions in Australia.

Thus an option for funding the recommended exposure data collections (especially those related to the priority research areas; see Table 2) would be to seek funding contributions from the government agencies endorsing the national research strategy. Each agency would benefit directly from the sub-set of data collected in their jurisdiction, as well as from the ability to make valid interstate comparisons. In addition, the planning, management and analysis costs would be divided between all the agencies involved. As a first step, the key agencies could be sent a copy of this report and the national research strategy, and their views sought on their willingness to contribute to exposure data collections at the national level.

Another option would be for a national body such as the AIHW's NISU to coordinate existing and planned exposure data collections in individual jurisdictions so that, over time, a national picture is built up. This would involve developing agreed standards for survey methods and other data capture, for the nature and coding of key variables, and for the reporting criteria and linkages of crash/injury data. This option capitalises on the likelihood that individual jurisdictions are more likely to mount their own exposure data collections with time frames and foci which match their own needs, rather than to await national collections with necessarily broad focus. For example, VIC ROADS are planning to conduct a "comprehensive" pre-crash exposure survey during 1994 with a focus on motorised vehicles, especially passenger cars and motorcycles. The survey method and key variables are yet to be defined. National consultation regarding the general planning of this survey may result in a product which other jurisdictions would find useful and be willing to follow.

6. CONCLUSION

Exposure is a measure of the number of opportunities for crashes or injuries to occur. Exposure data is commonly used as the denominator of a rate, which in turn estimates the risk of crash or injury. There is a distinction between *pre-crash* exposure (to the risk of a crash) and *crash* exposure (to the risk of injury or death, given that a crash has occurred). There are a number of different uses and methods of measuring pre-crash exposure in practice. Information on crash exposure (ie. crashes) is commonly recorded, but the databases suffer from the absence of key factors related to injury.

The National Health Goals and Targets (NHG&T) include ten targets for transport-related injury which require exposure data to monitor them successfully. A key objective of the National Road Safety Strategy (NRSS) is a National Strategic Research and Development Program which requires exposure data in twelve priority areas. In addition to these national needs, the OECD has recommended that continuous national traffic counts and travel surveys be conducted by member countries to provide exposure data to facilitate international comparisons of road trauma rates.

A survey of road safety and health agencies in each State and Territory was conducted to determine the exposure data currently existing and the needs for such data in individual jurisdictions. The survey also included road transport planning authorities because it was anticipated that general road use data may be suitable for measuring exposure to road crashes. A number of agencies needed additional exposure data of a specific type and focussed on their local area. Suggestions were compared to the needs of the NHG&T and the National Strategic Research and Development Program of the NRSS. It was revealed that there were no local needs which could not be met by an appropriate expansion (in the specific jurisdiction) of the recommended exposure data collections to meet the national needs.

After examining the possibilities for satisfying multiple needs within exposure data collections, and reviewing the key issues in their design, it was concluded that ten recommended collections would satisfy the national and local needs. A number of special issues arose from the general recommendations which could be satisfied by four specific recommendations to cover particular needs for exposure information.

The cost of the ten recommendations was estimated to be up to $4.4 - 5.0 million in the first year (if all ten were implemented simultaneously) and the average cost during subsequent years was estimated to be up to $2.1 - $2.4 million per annum. Some economies could be achieved if related surveys were conducted in parallel. Major savings could be made if one of the options for the Motorised Vehicle Use Survey (Recommendation 1) was taken. Costs could be reduced further by reducing the frequency of some surveys to every five years or by limiting the number of States or regions in which the surveys are carried out. The latter would, of course, make the survey results less representative at the national level but may be sufficient for development and evaluation of countermeasures.

The priority research areas identified by the National Road Safety Research and Development Strategy Working Group suggest that priority should be given to implementing the following general recommendations for exposure data collection:

- Improved Road Inventory (including automatically-recorded traffic data)
- Motorised Vehicle Use Surveys: Speed observations and survey of driver alcohol use and occupant belt use (Option 1b)
- High-risk Pedestrian Exposure Surveys (measuring alcohol use only)
- Occupant Crash Monitor
- Upgraded Vehicle Database
- Injury Management Monitor.

Funding mechanisms include the option of seeking funding contributions from the government agencies endorsing the national research strategy. Another option would be for a national body such as the AIHW's NISU to coordinate existing and planned exposure data collections in individual jurisdictions so that, over time, a national picture is built up.

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APPENDICES

APPENDIX A: Health and Road Safety Agencies Surveyed

HEALTH AND ROAD SAFETY AGENCIES INCLUDED IN THE SURVEY OF EXPOSURE DATA NEEDS AND AVAILABILITY

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Transport, Tourism and Energy Section,
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APPENDIX B-1: Data Collection form for Existing Pre-Crash Exposure Data Sources

DESCRIPTION OF EXISTING PRE-CRASH EXPOSURE DATA
(Including Road Transport Data)

1. **State/Territory:** .....

2. **Name of Database:** .....

3. **General Description:** .....
.....
.....
.....

4. **Type of Data:** Road User - driver ☐
- vehicle passenger ☐
- heavy vehicle driver ☐
- motorcyclist ☐
- bicyclist ☐
- pedestrian ☐

Vehicles ☐

Road Environment ☐

5. **Source:** .....
.....

6. **Timing of Data Collection:** .....

7. **Region of Availability:** .....

8. **Format of Data:** .....
.....

9. **Published Information:** .....
.....

10. **Supplementary Information:** .....
.....
.....

11. **Limitations:** .....
.....
.....
.....

PTO

12. Available Variables:

NAME	VARIABLE LEVELS/CODES
e.g. sex	Male, Female, Unknown

13. Table Formats:

Published (Reference: .....) Unpublished (Location: .....)

eg. Age by Sex by Seating Position

1. ..... 1. .....
2. ..... 2. .....
3. ..... 3. .....

14. Other Relevant Issues (e.g. standard errors of estimates):

.....

.....

15. Database Custodian: .....

Contact Tel: ..... fax: .....

16. Person providing information: .....

Contact Tel: ..... fax: .....

17. Organisation: .....

APPENDIX B-2: Data Collection form for Needed Pre-Crash Data Sources

DESCRIPTION OF PRE-CRASH EXPOSURE DATA NEEDS

(Including Road Transport Data)

1. **State/Territory:** .....

2. **General Description:** .....
   .....
   .....
   .....
   .....

3. **Type of Data:** Road User - driver ☐
   - vehicle passenger ☐
   - heavy vehicle driver ☐
   - motorcyclist ☐
   - bicyclist ☐
   - pedestrian ☐

   Vehicles ☐

   Road Environment ☐

4. **Suggested Timing of Data Collection:** .....

5. **Suggested Region Covered:** .....

6. **Suggested Format of Data:** .....
   .....
   .....

7. **Required Variables:**
   1. .....
   2. .....
   3. .....
   4. .....
   5. .....
   6. .....

PTO

8. **Other relevant issues:** .....
.....
.....
.....
.....

9. **Person Providing Information:** .....
Contact Tel: ..... fax: .....

10. **Organisation:** .....
.....

APPENDIX B-3: Data Collection form for Existing and Needed Crash Exposure Data Sources

DESCRIPTION OF CRASH EXPOSURE DATA

(Existing and Needed Data)

1. **State/Territory:** .....

2. **Organisation:** .....
   .....

3. **Reporting Criteria:**

Police Reports of a) road crashes: .....
b) injured persons: .....

Other Reporting systems (name: .....)
a) road crashes: .....
b) injured persons: .....

4. **Vehicle Model Information:**

DATA SYSTEM	Type of model data recorded (include years of manufacture covered)
Injury Data File (Name: .....)	
Crash Data File (Name: .....)	
Road Use Survey (Name: .....)	
Registration File	

5. **Vehicle Occupant Information:**

DATA SYSTEM	Whether occupant recorded (by seat)	
	Injured Occupants	Uninjured Occupants
Injured Data File (Name: .....)		
Crash Data File (Name: .....)		
Road Use Survey (Name: .....)	N/A	

6. **Person Providing Information:** .....
   Contact Tel: ..... fax: .....

APPENDIX C: Information Paper on the Project

Monash University Accident Research Centre

INVESTIGATION OF IMPROVED EXPOSURE DATA

for the National Injury Surveillance Unit, Australian Institute of Health and Welfare

The National Injury Surveillance Unit (NISU) has developed a Road Injury Information Program to determine the needs and opportunities for improved road injury surveillance in Australia (O'Connor, 1992). This program includes a project to investigate the needs and opportunities for improving road injury exposure data. The Monash University Accident Research Centre has been commissioned to undertake an investigation of Australian exposure data relevant to a comprehensive assessment of road safety.

The aims of the project are as follows:

1. To catalogue the need for, and availability of, Australian exposure data relevant to a comprehensive assessment of road safety

   - in particular, the exposure data requirements for monitoring of the National Health Goals and Targets (NHG&T) and the National Road Safety Strategy (NRSS).

2. To specify, recommend and make cost estimates of systems for collecting currently unavailable exposure data

   - in particular, systems for collecting exposure data by model of vehicle and characteristics of all occupants involved in crashes, whether injured or not.

Background

One of the fundamental aims of road safety research is to devise countermeasures and evaluate their effectiveness. However, many traditional approaches to road safety look at accident frequencies alone which provide insufficient information to adequately describe and understand the mechanisms of road crashes. Thus, in the past there has been unsatisfactory treatment of traffic exposure and this has been a common failing in determining the effectiveness of road accident countermeasures.

In order to calculate road accident risk there is a need for denominator data concerning exposure. The numerator of an accident risk estimate is usually a count of some undesirable (and perhaps traumatic) event such as road crash involvement, injury or death. The denominator can be thought of as a count of the events to which the risk (or probability) of the undesirable outcome applies. Different types of denominator counts are collectively known as "exposure", but the events being counted can vary

depending on the particular type of risk which is of interest. The risk is estimated by the ratio of the numerator to the denominator, ie. the accident rate.

The basic concept of exposure denotes the opportunity for road users to become involved in road traffic crashes; that is, when a person occupies the road, that person becomes exposed to risk of crash involvement (Stanton, 1981). With this in mind it is argued that the more often a person is a road user the greater the exposure to risk. However, exposure may be measured in a variety of ways. For example, some researchers argue that the more times a person spends on the road, a greater opportunity exists for accident involvement. Equally, other researchers argue that the greater distance travelled, the greater exposure to risk. Still others argue that the number of trips made might be used as an indicator of exposure.

A number of general definitions of exposure have been proposed. The most widely used definition of exposure was suggested by Carroll, Marlson, McDole and Smith (1971) who defined exposure as "the frequency of traffic events which create a risk of accident". This definition allows the possibility that the exposure event may be continuous (eg. travelling for one kilometre or for one minute) or discrete (eg. passing through an intersection, or a pedestrian crossing a road). Wolfe (1980) extended Carroll et al.'s definition, suggesting a broader and less active definition of exposure as "being in a situation which has some risk of involvement in a road traffic accident", thus including all relevant vehicle, person and environmental factors.

When accounting for "crash" or "injury" opportunity a problem arises in the use of the most appropriate expression of exposure measurement. Traditionally, exposure has been measured in terms of road use (most commonly, kilometres travelled, assuming that each unit of distance travelled involves the same level of risk). The approach of using time, distance or traffic flow has been criticised by many researchers, many stating that there is no guarantee that such measures accurately reflect the exposure as defined by the concept of crash or injury opportunity, nor do they reflect the accident exposure of the total road network. For example, driving in darkness in heavy rain could be expected to involve a greater number of opportunities for accident involvement when compared to daytime driving in dry weather with unimpaired visibility even though the distance travelled may be identical.

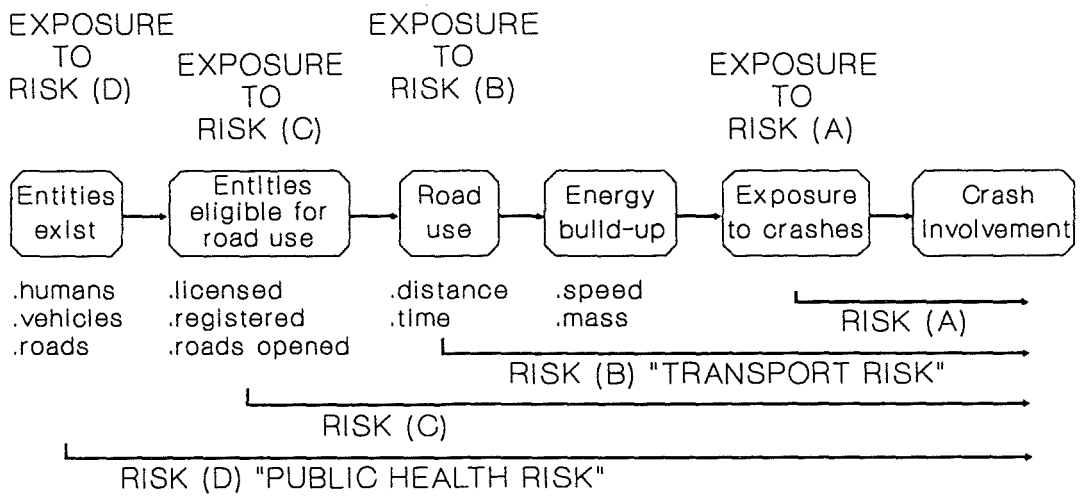
It is therefore necessary to view exposure in an overall framework or setting. In some special circumstances, exposure has been measured discretely as counts of events, eg. pedestrian interactions with passing vehicles (Cameron, Stanton and Milne, 1976), and vehicle-vehicle interactions at intersections (Council, Stewart and Rodgman, 1987).

To these pre-crash measures of exposure the concept of crash exposure should be added. Crash involvement represents exposure to the risk of injury and hence can be thought of as "crash exposure". The event of being injured can itself be considered as exposure to the risk of more severe injury or death and has been labelled "injury exposure to severe injury" (Cameron, 1991). Factors such as make and model, car size, vehicle mass, speed, seating position, use of restraints and safety apparatus (such as helmets), and vehicle safety features can all be included in crash exposure concepts.

The different types of exposure (pre-crash and crash) are illustrated in Figures 1 and 2 which show the chain of events leading to road trauma.

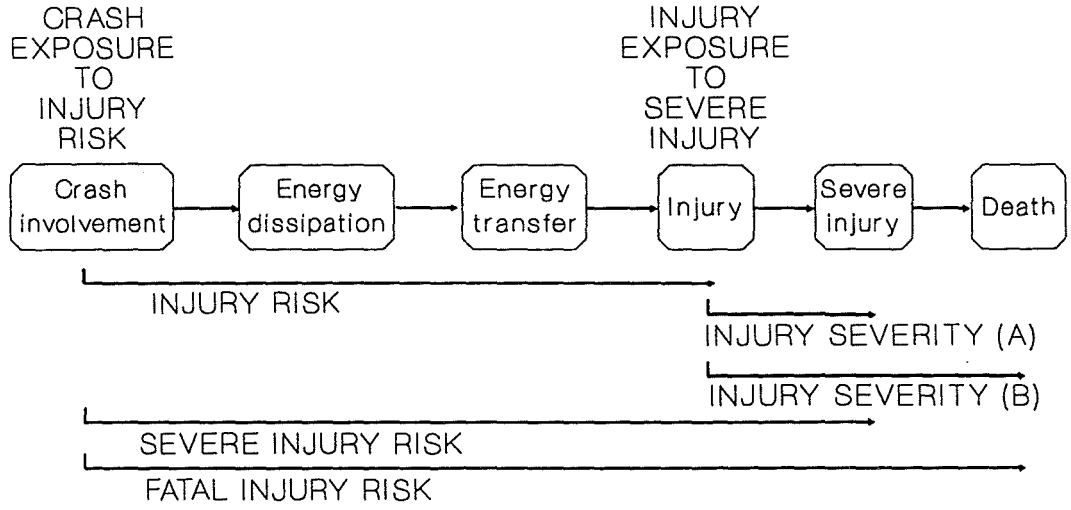
THE ROAD TRAUMA CHAIN

(1. PRE-CRASH)



THE ROAD TRAUMA CHAIN (continued)

(2. CRASH and POST-CRASH)



Rationale for Collection of Exposure Data

The assessment of accident risk in various situations of road use should not be based on raw accident data alone. It is now generally recognised that additional information, in exposure and behavioural aspects, has an increasing role to play in road research.

Internationally, the OECD has recognised the need for comprehensive and consistent international traffic data for use as a measure of exposure to road accidents, recommending that an international database for accident and exposure be created. In 1988/89 the Steering Committee of the OECD Road Transport Research Programme established the International Road traffic and Accident Database (IRTAD) in which accident outcomes as well as exposure data are collected on a continuous basis.

Similarly, the National Health Goals and Targets, the National Road Safety Strategy and the National Road Safety Research and Development Strategy have reflected the notion that exposure data is essential for road safety research. Many of the performance targets are phrased in terms of reducing a road transport related risk and note the need for appropriate exposure data series to provide denominators for specific rates which can be monitored over time. Other targets and strategies call for a reduction in certain high risk behaviours (Attachment A).

Stanton (1981) summarised four main reasons why exposure information should be collected:

- Accident risk cannot be adequately assessed from accident frequency data alone, without relating accident experience to some measure of the population exposed to risk.
- The measurement of exposure is aimed at defining the population as risk.
- Exposure data enables us to express accident risk in terms of a chosen exposure parameter.
- Exposure data can be used to determine whether there is a significant difference between two or more categories of road usage risk. Exposure facilitates not only the identification of road usage situations where countermeasures are needed, but also the measurement of effectiveness of such countermeasures once implemented.

Methods of Measuring Exposure

More than a decade ago, Stanton (1981) determined what exposure data were available and the sources of such data in Australia. He found that many record systems created for other purposes were a valuable source of exposure data, including:

- Vehicles on Register
- Vehicles in Use
- Population Figures
- Drivers' Licences
- Roads Inventory
- Traffic Counts
- Meteorological Data

In addition, a number of road safety and health agencies have carried out special-purpose exposure surveys to suit their own needs, using methods such as:

- Roadside observations at randomly sampled sites
- Log-books to record travel
- Breath test surveys and interviews
- Pedestrian counts weighted by traffic flows

The method of measuring exposure may depend on the particular road user group, vehicles, or road environments being considered. It also depends on the specific variables required to categorize exposure, and whether these can be obtained accurately through self-reported behaviour or require direct observation or perhaps interviews. A checklist of potential exposure data needs, classified in this way, is given in Attachment B for consideration.

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ATTACHMENT A

REVIEW OF NHG&T AND NRSS NEEDS FOR MONITORING

A review of the National Health Goals and Targets and the National Road Safety Strategy, plus the exposure data needs of the National Road Safety Research and Development Strategy has been undertaken and data requirements have been documented in detail.

Many of the performance targets included in the NHG&T and the NRSS are phrased in terms of reducing a road transport related risk and hence there is a need for appropriate exposure data series to provide denominators for specific rates which will be monitored over time. Other targets are for reduction in certain high risk behaviour which past research has established their riskiness. In these latter cases the exposure data needed may not be used as a denominator in a rate calculation, because the behaviour is so clearly linked to risk that changes in the exposure alone is all that needs to be monitored.

NATIONAL HEALTH GOALS AND TARGETS FOR AUSTRALIA'S HEALTH IN THE YEAR 2000 AND BEYOND (1993)

The National Health Goals and Targets have identified four areas where the health of all Australians can be improved. These are:

- preventable mortality and morbidity
- healthy lifestyles and risk factors
- health literacy and health skills, and
- healthy environments

The Commonwealth Department of Health have identified several problems with the quality and range of health information in Australia, and in the availability of national information. However, despite large improvements in the national health information base in recent years there are still major gaps in the data. Among those gaps highlighted, the National Health Goals and Targets include the need for improved national population data on the incidence and prevalence of disease and risk factors.

In particular, the goal for a healthy environment encompasses the goal to reduce personal risk from transport-related injury. Attempts to reduce this will need to focus on reducing road use, better roads and traffic management, safer vehicles and well directed and enforced traffic laws. Personal behaviours are also noted as important determinants of transport-related injury (including speeding, drink-driving, failing to wear bicycle helmets and seat belts).

Relevant proposed targets to reduce transport-related injury include:

- Priority population: Drivers and passengers of cars and similar vehicles

To increase the proportion of drivers and passengers who travel in cars with improved frontal protection.

- Priority population: Drivers and passengers of light commercial vehicles and 4-wheel drive vehicles generally used as passenger vehicles

  To increase the proportion of drivers and passengers who travel in light commercial vehicles with frontal protection equivalent to that of cars.

- Priority population: Passengers in centre seating positions in passenger cars and similar vehicles

  To increase the proportion of passengers in centre seating positions who are adequately restrained.

- Priority population: Passengers on long distance passenger coaches

  To increase the proportion of passengers in long distance coaches who can be adequately restrained.

- Priority population: Children, older people, people with disability

  To increase the number of residential areas where pedestrians can move safely.

- Priority population: Children, older people, people with disability

  To reduce exposure to dangerous traffic.

- Priority population: Children, older people, people with disability

  To reduce exposure to dangers associated with the need to cross busy roads in new developments.

- Priority population: All cyclists

  To increase the proportion who have access to safe cycling routes to employment, shops, or recreational centres.

- Priority population: Workforce

  To decrease exposure to unsafe traffic conditions associated with journeys to work.

- Priority population: The whole population

  To decrease exposure to injury associated with transport related accidents.

THE NATIONAL ROAD SAFETY STRATEGY

The National Road Safety Strategy is the first national approach by federal, state and local governments to reduce the road toll. The fundamental aim of the strategy is to reduce road crashes and their human and economic costs in real terms during the 1990's and into the next century.

The objectives of the Strategy will be achieved through a number of involvements including working towards safer vehicles, safer roads and safer road users, and research and development.

Relevant objectives are:

Objective E: Strategies for safer vehicles, safer roads and safer road users:

- encourage new, safe technologies in the operation of vehicles, management of the road system, and in the relationship between these and road users.
- increase appreciation by consumers of options available to improve vehicle safety
- provide greater opportunities for modifying high-risk behaviour

It is recognised that adequate data is needed before solutions can be found to reduce the road toll, further that an integrated framework for road safety planning and action and adequate scientific research are essential to the development of effective programs. A strategic research and development program will fill gaps in existing databases and encourage others to co-ordinate research and development activities.

Objective G: Strategic research and development program:

- accelerate development of a national road crash database which includes hospital morbidity, insurance and crash data
- establish priorities for nationally-relevant research and development needs
- create a program for the training, development and transfer of road safety expertise
- begin planning for the development and implementation of long-term strategies.

NATIONAL STRATEGIC RESEARCH AND DEVELOPMENT PROGRAM

The National Road Safety Research and Development Strategy workshop has provided a draft research strategy for the eight priority areas identified in the National Road Safety Strategy and other research priority areas identified by Working Groups in Melbourne.

Relevant National Strategy priority areas include:

- speeding program:

  - to gain a better understanding of the speeding problem by examining further the relationship between speed behaviour and accident occurrence

- to gain a better understanding of the speeding problem by developing a comprehensive profile of target groups at high risk from speeding.

- vehicle occupants:

  - to continue crash investigations, evaluations and monitoring of vehicle occupant safety issues tomaximise the adoption of features in Australian cars

  - to define data requirements for identification and evaluation of occupant protection measures, and establish appropriate data collections

- novice riders and drivers:

  - to develop and evaluate initiatives aimed at minimising the involvement of novice riders and drivers in crashes

  - to determine the relative importance of the various components of the driving task, in particular cognition and its relation to hazard perception

- road trauma management:

  - to minimise medically avoidable deaths and impairment through development of an improved road trauma management system including identification of causes and quantum of medically avoidable deaths

Relevant Research Priority areas include:

- demographic trends and road traffic injury:

  - to understand the impact of demographic changes on road injury and trauma, and develop programmes to deal with the changes.

  - to determine the degree to which crash involvement of the elderly and injury outcome separately contribute to the total trauma.

- motorcyclists:

  - to gain a better understanding of the factors contributing to motorcycle crash involvement and injury severity by investigating motorcycle travel exposure by motorcycle size and motorcyclist licence/expiry category.

- pedestrians:

  - to gain a better understanding of the pedestrian safety problem by determining a more comprehensive profile of high risk pedestrian casualty groups and obtaining a clearer indication of pedestrian exposure and relate patterns of pedestrian activity and accidents to the functional hierarchy of roads.

- to ensure the needs of pedestrians are recognised in road network and land-use development by generating information that will encourage a change in emphasis toward pedestrian amenity.

- to increase the compliance of pedestrians with safe road use practices by surveying patterns of pedestrian activity and road crossing behaviour.

- database issues, research methodology, and related issues:

- to improve the efficacy of road injury and exposure data for countermeasure development and evaluation by improving the availability and utility of existing mass data on injury and exposure.

- to increase the efficiency of road safety research and evaluation through improved techniques by developing more sensitive statistical tools to allow more timely countermeasure development and evaluation.

ATTACHMENT B

CHECKLIST OF POTENTIAL EXPOSURE DATA NEEDS

Road User Groups

- **Drivers**
  - Driver Characteristics
  - Age and Sex
  - Car Size and Mass
  - Vehicle Type - make, model and year
  - Vehicle Performance
  - Speed Behaviour and Driver Attitudes to Speed
  - Speed Zones
  - Seating Position
  - Restraint Use
  - Time of Day/Week
  - BAC Reading
  - Kilometres Driven
  - Fuel Consumption
  - Trip Purpose

- **Motorcyclists**
  - Rider Characteristics
  - Age and Sex
  - Rider Experience
  - Licence Status
  - Size of Motorcycle
  - Engine Capacity
  - Motorcycle Weight/Power Ratio
  - Use of Helmet
  - Use of Headlamp in Daytime
  - Speed Behaviour
  - Speed Zones
  - Time of Day/Week
  - BAC Reading
  - Kilometres Driven
  - Weather Conditions/Visibility

- **Heavy Vehicle Drivers**
  - Driver Characteristics
  - Truck/Bus Size and Mass
  - Load Factors
  - Time of Day/Week
  - Restraint Use
  - Speed Zones
  - Road Features

- **Bicyclists**
  - Cyclist Characteristics
  - Age and Sex
  - Helmet Type and Use
  - Use of Other Safety Features (eg. reflectors, headlamp)
  - Trip Purpose
  - Road Use Behaviour (eg. ride-outs, footpath cycling)
  - Time Spent on Road
  - Time of Day/Week
  - Weather Conditions/Visibility

- **Child Pedestrians**
  - Pedestrian Characteristics
  - Road Crossing Behaviour
  - Age and Sex
  - Lighting Conditions
  - Weather Conditions
  - Road Features
  - Speed Zone

- **Adult and Elderly Pedestrians**
  - BAC Level
  - Drinking Pattern
  - Pedestrian Characteristics
  - Age and Sex
  - Conspicuity
  - Road Crossing Behaviour
  - Lighting Conditions
  - Weather Conditions
  - Road Features
  - Speed Zone

<u>Vehicle Characteristics - all vehicles</u>

- Vehicle Make and Model
- Vehicle Type
- Vehicle Size and Mass
- Vehicle Safety Performance Features
- Vehicle Performance/Top Speed
- Vehicle Registration
- Owner of Vehicle
- Speed Zone
- Road Features
- Time of Day/Week/Month
- Geographic Area - Urban/Rural

Road Types/Environment

Traffic Flow
Speed Zone
Road Features
Pedestrian Flow
Signage
Intersections
- Signalisation
- Turning Movements
- Presence of Tram Lines
- Traffic Flow
- Signage
- Geographic Area
- Headway Lengths
- Speed Zone

APPENDIX D: Description of Existing Pre-Crash Exposure Data Sources

DESCRIPTION OF EXISTING PRE-CRASH EXPOSURE DATA SOURCES - National

NAME OF DATABASE	PERIOD COVERED (TIMING)	TYPE OF DATA	GENERAL DESCRIPTION	ORGANISATION RESPONSIBLE	CONTACT PERSON
Survey of Day-to-Day Travel in Australia	1985 - 1986	All Road Users	Twenty five cities and towns throughout Australia were sampled through self-administered mail-back survey giving details on trip information.	Statistics and Analysis, Federal Office of Road Safety	Steve Ginpil
Motor Vehicle Registrations, Australia (Cat. 9303.0)	1980 July 1993 June monthly	Drivers	National details on new motor vehicles are provided including particulars of passenger vehicles, light commercial vehicles and buses, articulated trucks and motorcycles.	Transport, Tourism and Energy Section, Australian Bureau of Statistics.	David Lengyel
Motor Vehicle Registrations, Australia (Cat. 9304.0).	1948 1991-1992 annual	Drivers	National details on new motor vehicles are provided including particulars of passenger vehicles, light commercial vehicles and buses, articulated trucks and motorcycles.	Transport, Tourism and Energy Section, Australian Bureau of Statistics.	David Lengyel
Motor Vehicle Census (Cat. 9309.0)	1976 1991 Sept. three-yearly	All Vehicles	For each State and Territory, details are provided on the number of vehicles on register by type of vehicle and year of manufacture, by type of vehicle and make, and selected models by type of vehicle and tare/gross mass, by type of vehicle and fuel type.	Transport, Tourism and Energy Section, Australian Bureau of Statistics.	David Lengyel

DESCRIPTION OF EXISTING PRE-CRASH EXPOSURE DATA SOURCES - National

NAME OF DATABASE	PERIOD COVERED (TIMING)	TYPE OF DATA	GENERAL DESCRIPTION	ORGANISATION RESPONSIBLE	CONTACT PERSON
TranStats	1988 Sept. 1991 Sept.	Vehicles	Database provides selected data obtained from the 1991 Motor Vehicle Census including make and type of vehicle, year of manufacture and postcode of registered owner.	Transport, Tourism and Energy Section, Australian Bureau of Statistics.	David Lengyel
Survey of Motor Vehicle Usage (SMVU) (Cat. 9208.0)	1971 Sept. 1991 June three-yearly	Registered Vehicles (excluding caravans, trailers, tractors and plant equipment	Survey comprises national transport and transport related statistics for private and commercial vehicles. Includes vehicle usage data, vehicle types, weight and mass, fuel consumption, kilometers travelled, driver characteristics and main area travelled.	Transport, Tourism and Energy Section, Australian Bureau of Statistics.	David Lengyel
Interstate Freight Movement, Australia, 1991-92 (Cat. 9212.0)	1980-1981 1991-1992 annual	All Freight Vehicles	Publication presents statistics on interstate freight movements by road, air sea and rail within Australia. Road information was derived from the Interstate Road Freight Movement Survey which undertook over 200,000 tonnes of movements.	Australian Bureau of Statistics.	Ian Castles
Interstate Road Freight Movement, Australia (Cat. 9214.0)	1982 quarterly	All Freight Vehicles	Catalogue contains quarterly data on road freight (tonnes) movements between interstate locations, collected from major road freight operators and freight forwarders.	Australian Bureau of Statistics.	Ian Castles

DESCRIPTION OF EXISTING PRE-CRASH EXPOSURE DATA SOURCES - National

NAME OF DATABASE	PERIOD COVERED (TIMING)	TYPE OF DATA	GENERAL DESCRIPTION	ORGANISATION RESPONSIBLE	CONTACT PERSON
Census of Population and Housing, 1991	1991	All Road Users	Provides demographic details of households for each State and Territory	Australian Bureau of Statistics	Ian Castles
Census of Population and Housing, Expanded Community Profile, 1991	1991	All Road Users	Census provides national details of method of travel to work by age and structure of dwelling by number of motor vehicles by number of persons.	Australian Bureau of Statistics.	Ian Castles
Census of Population and Housing, Working Population Community profile, 1991	1991	All Road Users currently employed	Census provides national details of method of travel to work by age and sex	Australian Bureau of Statistics.	Ian Castles
Census of Population and Housing, Journey to Work, 1991	1991	All Road Users currently employed	Census provides national details of method of travel to work	Australian Bureau of Statistics	Ian Castles
Census of Population and Housing, Journey to Work, School and Shop, 1984	1984	All Road Users	Census provides national details of method of travel to work, school and shop.	Australian Bureau of Statistics	Ian Castles
Census of Population and Housing, Basic Community Profile, 1991	1991	All Road Users	Census provides national details of method of travel to work by sex and household type by family type by number of motor vehicles.	Australian Bureau of Statistics.	Ian Castles

DESCRIPTION OF EXISTING PRE-CRASH EXPOSURE DATA SOURCES - National

NAME OF DATABASE	PERIOD COVERED (TIMING)	TYPE OF DATA	GENERAL DESCRIPTION	ORGANISATION RESPONSIBLE	CONTACT PERSON
Foreign Trade, Australia. Merchandise Imports (Cat. 5426.0)	1977-1978 to 1992-1993 annual	Vehicles	Catalogue contains detailed merchandise imports information for the last three years. Also includes imports of selected major commodities by country, imports by industry of origin, imports by country and imports by State.	Australian Bureau of Statistics.	Ian Castles
Consumer Price Index (Cat. 6401.0)	1960 - 1993 quarterly	Vehicles	Catalogue details movements in retail prices of goods and services commonly purchased by metropolitan wage and salary earner households in Australia.	Australian Bureau of Statistics.	Ian Castles
Average Retail Prices of Selected Items, Eight Capital Cities (Cat. 6403.0)	1962 - 1993 quarterly	All Vehicles	Catalogue provides average retail prices of selected items included in the Consumer Price Index for each of the six State capitals, Canberra and Darwin.	Australian Bureau of Statistics.	Ian Castles
Australian Health Survey	four-yearly	All Road Users	Survey details the health of all Australians including injuries suffered. Enables comparisons of health conditions suffered by the population.	Australian Institute of Health and Welfare and Australian Bureau of Statistics.	
New Vehicle Data Form (1986 onwards)	1986 continuous	Motorcyclists	Maximum power output of engine and tare mass of every type of motorcycle sold in Australia is recorded.	Federal Office of Road Safety, Department of Transport and Communications.	

DESCRIPTION OF EXISTING PRE-CRASH EXPOSURE DATA SOURCES - National

NAME OF DATABASE	PERIOD COVERED (TIMING)	TYPE OF DATA	GENERAL DESCRIPTION	ORGANISATION RESPONSIBLE	CONTACT PERSON
National Pollution Inventory		Road Environment	Database covers some transport information.	Department of Environment, Sport and Territory.	Peter Cheng
Transport Industry Survey (TIS)	1983-1984.	Vehicles	An economic survey which will be repeated for 1984-1985.	Transport, Tourism and Energy Section, Australian Bureau of Statistics.	David Lengyel
Survey of Business Vehicles	1983-1984.	Vehicles	An economic survey run at the same time as TIS, aimed at business vehicles.	Transport, Tourism and Energy Section, Australian Bureau of Statistics.	David Lengyel
Household Expenditure Survey		Vehicles	Survey provides details on household expenditure including fuel sales and purchase of motor vehicles.	Transport, Tourism and Energy Section, Australian Bureau of Statistics.	David Lengyel
Exposure Survey - House File	1985-1986	All Road Users, Vehicles	Survey of day-to-day travel with distances travelled for all road users by age, sex, time of day, day of week, season, State and holiday/non-holiday period.	Statistics and Analysis Section, Federal Office of Road Safety	R Schneider
Exposure Survey - Trip File	1985-1986	All Road Users, Vehicles	Survey of day-to-day travel with distances travelled for all road users by age, sex, time of day, day of week, season, State and holiday/non-holiday period.	Statistics and Analysis Section, Federal Office of Road Safety	R Schneider

DESCRIPTION OF EXISTING PRE-CRASH EXPOSURE DATA SOURCES - National

NAME OF DATABASE	PERIOD COVERED (TIMING)	TYPE OF DATA	GENERAL DESCRIPTION	ORGANISATION RESPONSIBLE	CONTACT PERSON
Exposure Survey - Persons File	1985-1986	All Road Users, Vehicles	Survey of day-to-day travel with distances travelled for all road users by age, sex, time of day, day of week, season, State and holiday/non-holiday period.	Statistics and Analysis Section, Federal Office of Road Safety	R Schneider
Environmental Data	1976, 1979, 1982, 1985, 1988, 1991 three yearly	Vehicles and Road Users	Database gives estimates of travel, freight and passenger movements, fuel consumption and vehicle emissions by vehicle types for Australia (both urban and rural areas)	Bureau of Transport and Communications Economics	D Cosgrove
Australian National Highway Inventories	1989, 1990	Road Environment	Database of 2,200 records covering physical inventory details and traffic information for the NHS. GIS information is also contained within the database	Bureau of Transport and Communications Economics	J Miller
1988 Occupant Restraint Survey	1988	Drivers and Passengers	Survey of seat belt wearing rates around Australia.	Statistics and Analysis Section, Federal Office of Road Safety.	R Schneider

DESCRIPTION OF EXISTING PRE-CRASH EXPOSURE DATA SOURCES - Australian Capital Territory

NAME OF DATABASE	PERIOD COVERED (TIMING)	TYPE OF DATA	GENERAL DESCRIPTION	ORGANISATION RESPONSIBLE	CONTACT PERSON
ACT Vehicle Registration Records	Continuous	All Vehicles	Information held contains name and address of vehicle owners and vehicle details obtained from applications to register and renew motor vehicles.	Department of Urban Services	L Palmer
ACT Licensing System	Continuous	All Drivers and Motorcyclists	Database contains the name and address of all license holders in the ACT. Information is also held on the license holders health and license category.	Department of Urban Services	L Palmer
Intersection Peak Hour Classified Traffic Counts	Continuous	Vehicles	Survey provides information on traffic volumes at peak hour at selected intersections. Shows intersection legs, traffic (light and heavy) volumes, turning movement and pedestrian movement.	Roads and Transport Branch, Department of Urban Services	Wayne Daly
Asset Maintenance Management System	Continuous	Road Environment	Database is a complete inventory of road pavement assets with condition data. Includes location, extent, classifications, traffic, and pavement condition.	Traffic and Roads Section, Department of Urban Services	R Jarvis
Speed in the ACT	Continuous	Drivers	Database is a compilation of speed information covering local and arterial roads in the ACT.	Department of Urban Services	T Gill

DESCRIPTION OF EXISTING PRE-CRASH EXPOSURE DATA SOURCES - Australian Capital Territory

NAME OF DATABASE	PERIOD COVERED (TIMING)	TYPE OF DATA	GENERAL DESCRIPTION	ORGANISATION RESPONSIBLE	CONTACT PERSON
Traffic Count Automated Processing System (TCAPS)	1984 - 1993 annual	Vehicles	System provides current and historical traffic volume counts in midblock sections on ACT roads. Data collected by counter or tube on road and collects average weekday, weekend and peak hour traffic volumes on selected roads.	Roads and Transport Branch, Department of Urban Services	Wayne Daly
Intersection Count Automated Processing System (ICAPS)	1980 - 1993	Vehicles and Pedestrians	Data compiled from manual observation of traffic/pedestrian movement through intersections in peak hours (am and pm).	Roads and Transport Branch, Department of Urban Services	Wayne Daly

DESCRIPTION OF EXISTING PRE-CRASH EXPOSURE DATA SOURCES - Queensland

NAME OF DATABASE	PERIOD COVERED (TIMING)	TYPE OF DATA	GENERAL DESCRIPTION	ORGANISATION RESPONSIBLE	CONTACT PERSON
Traffic Volume Surveys		Vehicle	Databases detailing vehicle type (classification) and vehicle speed.	Road Vehicle and User Safety Branch, Queensland Transport	
Free Speed Surveys	On request	Vehicle		Road Vehicle and User Safety Branch, Queensland Transport.	
Driver Licensing Information System	1987 - 1993 continuous	Drivers	Database designed to record information of all current driver licenses in Queensland. Also contains details of licenses no longer current and particulars of traffic offence notices associated with the driver license.	Registration and Licensing, Queensland Transport	A Buttazzoni
Motor Vehicle Registration System	Continuous	All Vehicles	Details are recorded in categories - Vehicle details, Ownership details & Current Registration details. Includes make, model, body type, engine & chassis numbers, VIN, name, address, postcode, due date, fees (current & outstanding) & concessional data.	Road Vehicle and User Safety Branch, Queensland Transport.	
SEPTS		Road User	Survey of trip purpose	Transport Studies, Queensland Transport	

DESCRIPTION OF EXISTING PRE-CRASH EXPOSURE DATA SOURCES - Queensland

NAME OF DATABASE	PERIOD COVERED (TIMING)	TYPE OF DATA	GENERAL DESCRIPTION	ORGANISATION RESPONSIBLE	CONTACT PERSON
Community Drink Driving Surveys		Drivers	Self-reported exposure to police enforcement for drink driving	Road Vehicle and User Safety Branch, Queensland Transport	
Bus Surveys		Bus Driver and Passengers, Vehicle.	Survey gives information on vehicle characteristics, age, safety equipment etc.	Road Vehicle and User Safety Branch, Queensland Transport	
Transport Licensing System					
ARMIS - Road Management Database	Continuous	Road Environment, Vehicle	Database gives information on traffic census, signage and the road network environment	Road Vehicle and User Safety Branch, Queensland Transport	
CHIMP - subset of ARMIS	1981 - 1992 (June) annual	Road Environment and Vehicles	Database gives a physical inventory on road and bridge conditions/ characteristics, eg lanes, width, length of road. This covers only declared roads (state roads), all other roads (undeclared) are handled by local council/regions.	Roads Division, Queensland Transport	Alex Pelerin
PHYLAX - subset of ARMIS	Continuous	Road Environment	Database is another subset of ARMIS which can be linked to CHIMP		

DESCRIPTION OF EXISTING PRE-CRASH EXPOSURE DATA SOURCES - Queensland

NAME OF DATABASE	PERIOD COVERED (TIMING)	TYPE OF DATA	GENERAL DESCRIPTION	ORGANISATION RESPONSIBLE	CONTACT PERSON
Survey of Red Light Running		All Drivers	A limited before and after study only covering Brisbane city area (limited sites and times) giving details of number of cars going through intersection on amber and red lights, and timing (secs).	Road Vehicle and User Safety Branch, Queensland Transport	
Culway - Statewide	Continuous, annual reports	Vehicles (particularly Heavy Vehicles)	Culway uses culverts as dynamic weigh-in motion scales unmanned 24 hours a day. The system collects data on traffic composition for freight vehicles, type, speed, classification, number of axles, and estimated payload.	Regional Offices, Queensland Transport	David Ryan
RBT Database	Continuous	Drivers	Database gives details of all drivers tested for RBT and offences. Data can be broken down in a number of ways.	Queensland Police Department	
Heavy Vehicle Safety Checks		Heavy Vehicles	Records from random checks around the South East Queensland area. Limited.	Road Vehicle and User Safety Branch, Queensland Transport.	
Town Planning Data		Road Environment	Data source created by local authorities which shows land use.	Department of Housing and Local Government Planning	

DESCRIPTION OF EXISTING PRE-CRASH EXPOSURE DATA SOURCES - Queensland

NAME OF DATABASE	PERIOD COVERED (TIMING)	TYPE OF DATA	GENERAL DESCRIPTION	ORGANISATION RESPONSIBLE	CONTACT PERSON
Household Travel Survey	1979 1986 1992	Road Users, Vehicles	Surveys gather household person and travel information at a detailed level. Sample surveys have been in specific areas - Rural areas (Cairns and Townsville) included in 1986, Brisbane metro & Sunshine & Gold Coast in 1992 survey.	Transport Studies and Projects, Queensland Transport	B Henderson
Traffic Census	1992 annual	Road Environment, Vehicles	Census conducted by each region giving detailed information on traffic counts, volumes, road conditions and characteristics, speed & speed zoning data and intersection information. VIDAS classification also conducted.	Transport Studies and Projects, Queensland Transport	Colin Jensen
Road Reference and Road Inventory System (RIS)	current at 1993 June continuous	Road Environment and Vehicles	Inventory replacing CHIMP database giving details of road characteristics data, eg. carriageway, lanes, location and ownership relationships with local authorities.	Roads Division, Queensland Transport	Barry Hey
Public Transport Information System		Heavy Vehicles, Road Environment	Database giving information on number of buses, frequencies, routes and timetable. Available for metropolitan Brisbane and soon for Sunshine & Gold Coasts (GIS)	Queensland Public Transport	
School Transport Services		Heavy Vehicles	System monitors school buses. Can give average loadings plus routes.		

DESCRIPTION OF EXISTING PRE-CRASH EXPOSURE DATA SOURCES - Queensland

NAME OF DATABASE	PERIOD COVERED (TIMING)	TYPE OF DATA	GENERAL DESCRIPTION	ORGANISATION RESPONSIBLE	CONTACT PERSON
Metropolitan Pavement Data System (MPDS)	1989 - 1993 continuous	Road Environment	A road information database with road reference, road inventory and road condition system together with reporting facilities and an interface to allow production of files for use with a graphic display tool.	Pavements and Assets Strategy Branch, Queensland Transport	P Purdon
Roughness Database	1974 - 1993 annual	Road Environment	Database consists of raw roughness counts with corresponding through distances for individual roads.	Pavements and Assets Strategy Branch, Queensland Transport	E Baran
Condition Reporting System (CORS)	1989 - 1993 annual	Road Environment	A road condition database with reporting facilities where roughness and visual conditions including cracking, rutting, defects (patches/potholes) and texture are stored.	Pavements and Assets Strategy Branch, Queensland Transport	P Purdon
Traffic Analysis and Reporting System (TARS)	1994 June	Vehicles	Database holds all traffic count information and longitudinalised traffic estimates derived from actual counts (in development Stage 1)	Roads Division, Queensland Transport	G Smith
Bicycle Helmet Wearing Surveys	1991	Bicyclists	Regular series of surveys (6 now completed). Gives details of helmet wearing rates.	Road Vehicle and User Safety Branch, Queensland Transport.	
Seat Belt Surveys	1991 1992 1993	Drivers of passenger cars		Road Vehicle and User Safety Branch, Queensland Transport	

DESCRIPTION OF EXISTING PRE-CRASH EXPOSURE DATA SOURCES - Queensland

NAME OF DATABASE	PERIOD COVERED (TIMING)	TYPE OF DATA	GENERAL DESCRIPTION	ORGANISATION RESPONSIBLE	CONTACT PERSON
Bicycle Offence Notices		Bicyclists	Database of offences for non helmet wearing from Police. This data is also on the Driver Record System (a traffic related offence system)	Queensland Police Department	
Queensland Integrated Employment Register	Continuous	All road users	Database containing information on workforce by employment location, industry, occupation, etc.	Australian Bureau of Statistics, Queensland Branch	
Queensland School/Education Enrolment Data	Continuous	All road users	Database containing school/education enrolment details by location of institution	Queensland Department of Education	

DESCRIPTION OF EXISTING PRE-CRASH EXPOSURE DATA SOURCES - New South Wales

NAME OF DATABASE	PERIOD COVERED (TIMING)	TYPE OF DATA	GENERAL DESCRIPTION	ORGANISATION RESPONSIBLE	CONTACT PERSON
Integrated Vehicle Survey System				Information Services Branch, Roads and Traffic Authority of NSW	
Pedestrian and Bicycle helmet wearing surveys.		Pedestrians and Bicyclists		Health Promotion Unit, Health Department of NSW	Jan Elkington
Elderly and Child Pedestrian safety at "WOMBAT"crossings (South-west Sydney only)	1993	Pedestrians		Health Department of NSW	Dianna Messum
DRIVES - Driver Licensing and Vehicle Registration System	Continuous	Vehicle and Drivers	Database contains details of driver/riders, driver/rider licenses and examinations, testing and driving instructor details. Also contains vehicle and vehicle registration details.	Registration and Licensing, Roads and Traffic Authority of NSW.	
Transport Study Group Survey System - Sydney metropolitan area only	Continuous	Vehicle, and Road Environment	System provides management of transport survey information for commercial vehicle drivers and the community in the Sydney metropolitan area.		
ROADLOC - Road Data Location System	Continuous	Road Environment	The system is primarily a link-node system for the major roads of NSW. It is based on the segmentation of the roads into manageable lengths.	Information Services Branch, Roads and Traffic Authority of NSW.	

DESCRIPTION OF EXISTING PRE-CRASH EXPOSURE DATA SOURCES - New South Wales

NAME OF DATABASE	PERIOD COVERED (TIMING)	TYPE OF DATA	GENERAL DESCRIPTION	ORGANISATION RESPONSIBLE	CONTACT PERSON
ROCOND - Road Condition System	Continuous	Road Environment	The system stores surveyed data on the road, including data relating to pavement cracking, rutting, roughness, surface type and wear as well as details on drainage, road shoulder and traffic facilities (line marking, guideposts, etc.).	Information Services Branch, Roads and Traffic Authority of NSW.	
IVSS - Integrated Vehicle Survey System	Continuous	Vehicles	IVSS is a reporting system containing detailed information on traffic, volumes, vehicle speed, classification and weight. Information comes from Culway weighing stations, automatic traffic counters and manual counts.	Information Services Branch, Roads and Traffic Authority of NSW.	
1991 Sydney Travel Survey	1991	All Road Users, Vehicles	Survey of 17,000 households in Sydney, Newcastle and Wollongong by personal interview. Data recorded for all days for one year on trip information and demographic information.	Transport Studies Group, Roads and Traffic Authority of NSW.	Gillian Akers
Ped. Refuges	1991 - 1992	Road Environment	A small database of pedestrian crossing refuges in southern Sydney including installation dates	Roads and Traffic Authority of NSW	G Pattison
Bicycle Helmet Wearing Survey		Bicyclists		Road Safety Bureau, Roads and Traffic Authority of NSW	Dallas Fell

DESCRIPTION OF EXISTING PRE-CRASH EXPOSURE DATA SOURCES - Northern Territory

NAME OF DATABASE	PERIOD COVERED (TIMING)	TYPE OF DATA	GENERAL DESCRIPTION	ORGANISATION RESPONSIBLE	CONTACT PERSON
Road Inventory Management System (RIMS) - Road Inventory	Continuous	Road Environment	Inventory of all road conditions including road furniture, design, signage, traffic signals, rainfall and floodway, traffic information, ADT counts, vehicle categories, road condition, bridge conditions, road usage, intersections & network status.	Department of Transport and Works	R Miller

DESCRIPTION OF EXISTING PRE-CRASH EXPOSURE DATA SOURCES - South Australia

NAME OF DATABASE	PERIOD COVERED (TIMING)	TYPE OF DATA	GENERAL DESCRIPTION	ORGANISATION RESPONSIBLE	CONTACT PERSON
Roadside Alcohol Surveys 1979-1993	1979 - 1993	All drivers	Survey with a total of 70,000 drivers interviewed. Variables include seat belt usage, number of people in vehicle, BAC, age, sex, seating position and seat belt usage.	NHMRC Road Accident Research Unit, University of Adelaide	Jack McLean
NCAP					
Speed Case Control Study and Risk of Severe and Fatal Injuries (Adelaide metropolitan area only)		All drivers and passengers	Thirty to forty sites around Adelaide area where accidents have occurred resulting in injury or death have been observed.	NHMRC Road Accident Research Unit, University of Adelaide.	Jack McLean
Driver Attitude Questionnaire on Drink Driving	1984	All Drivers	A report on RBT in South Australia, including details on the effects of drinking, accidents and casualties.	NHMRC Road Accident Research Unit, University of Adelaide.	Jack McLean
Register of Motor Vehicles and Driver Licenses	1990 - 1993 continuous	All Vehicles, all Drivers/Riders	The database contains motor vehicle registration and driver license information for SA.	Registration and Licensing, South Australian Ministry of Transport and Development.	R Frisby

DESCRIPTION OF EXISTING PRE-CRASH EXPOSURE DATA SOURCES - South Australia

NAME OF DATABASE	PERIOD COVERED (TIMING)	TYPE OF DATA	GENERAL DESCRIPTION	ORGANISATION RESPONSIBLE	CONTACT PERSON
TARS Database (also known as ACDAL and RMLIB?)	1980-1993 continuous	Vehicles and Drivers	Database of information from police reported accidents. Details of reportable accidents includes accident type, road condition, location, road user type & movement, vehicle, accident severity, driver details, seating position and BAC.	Office of Road Safety, South Australian Department of Road Transport.	Fred Tiong
Traffic Signals Site Register	1991-1993 continuous	Road Environment	Database contains information on all traffic signal sites in South Australia. Information recorded includes a location inventory, equipment inventory and information on operating times and types.	South Australian Department of Road Transport	G Wooldridge
Road Inventory Management System (RIMS)	1987-1993 continuous	Road Environment	The database provides an inventory of road related data for all departmentally maintained roads. Linked to the Road Reference System and provides additional data to support planning, maintenance, operations & design of roads.	South Australian Department of Road Transport.	N Smith
1986 Adelaide Travel Survey	1986	Vehicle, Road User	Survey of all household members in approximately 7,000 households detailing trip information for about 2 months. Information collected by personal interview	Office of Transport, Policy and Planning, Ministry of Transport	Lindsay Oxlad

DESCRIPTION OF EXISTING PRE-CRASH EXPOSURE DATA SOURCES - South Australia

NAME OF DATABASE	PERIOD COVERED (TIMING)	TYPE OF DATA	GENERAL DESCRIPTION	ORGANISATION RESPONSIBLE	CONTACT PERSON
Series of Roadside Surveys	1981, 1982, 1983, 1987, 1989, 1991, 1993	Drivers and passengers	Roadside surveys conducted at 20 Adelaide metropolitan sites at intersections recording observable information on drivers and passengers between 10pm and 3am, all days of the week	NH&MRC Road Accident Research Unit, University of Adelaide	C Kloeden

DESCRIPTION OF EXISTING PRE-CRASH EXPOSURE DATA SOURCES - Tasmania

NAME OF DATABASE	PERIOD COVERED (TIMING)	TYPE OF DATA	GENERAL DESCRIPTION	ORGANISATION RESPONSIBLE	CONTACT PERSON
Classified Road Traffic Database	Continuous	Road Environment, Vehicles	Database provides information on 770 sites where traffic has been counted. Includes average daily traffic on State roads, every 5 km on average, vehicle type and speed estimates	Transport and Works	Ray Dyer
Motor Registry System	Continuous	All Drivers, Riders and Vehicles	Motor vehicle/licensing registry records providing Information covering all registered vehicles and licensed drivers in Tasmania	Transport and Works	Peter Snow
State Roads Inventory	Continuous	Road Environment	Inventory records details of all State roads, links and section, location points, features of interest, cattle grids, bridges, rail crossings and AADT and roughness readings within the concept of a loose hierarchy of data records held on separate files.	Transport and Works	Brian Howell

DESCRIPTION OF EXISTING PRE-CRASH EXPOSURE DATA SOURCES - Victoria

NAME OF DATABASE	PERIOD COVERED (TIMING)	TYPE OF DATA	GENERAL DESCRIPTION	ORGANISATION RESPONSIBLE	CONTACT PERSON
Melbourne Bicycle Exposure Surveys	Nov - Jan 1987 - 1988, May/June, 1990 May/June, 1991 May/June, 1992	Bicyclists	Survey gives estimated bicycling time on roads or footpaths during non-holiday periods in Melbourne. Direct observation at a representative sample of sites for two weeks duration.	Monash University Accident Research Centre	Caroline Finch
Melbourne Area Personal Travel Survey, Pilot Survey Final Report - Melbourne metropolitan only	1992 December	All Road Users	Using a self-administered mail-back questionnaire (KONTIV method) household members of approx. 380 households in 5 LGAs in Melbourne reported trip information in a 2-day travel data sample. Data sampled on all days for 2 weeks.	Vic Roads	Geoff Anson
Victorian Activities and Travel Survey (VATS) - Melbourne metropolitan only	1993 (for 5 years)	All Road Users	Using a self-administered mail-back survey travel information is reported by all household members in approx. 6,000 households in Melbourne area (1st year only). Trip data for all days for each year will be collected.	The Transport Research Centre	Liz Ampt

DESCRIPTION OF EXISTING PRE-CRASH EXPOSURE DATA SOURCES - Victoria

NAME OF DATABASE	PERIOD COVERED (TIMING)	TYPE OF DATA	GENERAL DESCRIPTION	ORGANISATION RESPONSIBLE	CONTACT PERSON
Culway - Statewide	Continuous, annual reports	All Vehicles (particularly Heavy Vehicles)	Culway uses culverts as dynamic weigh-in motion scales unmanned 24 hours a day. The system collects data on traffic composition for freight vehicles, type, speed, classification, number of axles, and estimated payload.	Road Information Services, Vic Roads	David Ryan
Sydney Road Travel Time Surveys - Melbourne metropolitan only	1992 June	All Vehicles and Road Environment	Four to five travel surveys are conducted along Sydney Road each year detailing traffic characteristics, road improvements, effectiveness of traffic management strategies, fuel consumption and travel times.	Traffic Engineering, RACV	M L Lee
State Traffic Estimation Program (STEP) - Statewide	1979 - 1990	All Vehicles	System provides traffic counts, AADT estimates, usage and other traffic parameters from 1979-1988 for metro. area and 1979-1990 for rural areas, based on the RMIS location referencing system.	Road Information Services, Vic Roads	David Farrow
Road Management Information System (RMIS) - Statewide	1989	All Vehicles and Road Environment	System contains inventory data describing the nature and conditions of the road network. Includes references and location data, administration & classification, alignment, crossings, traffic lanes, line marking, pavement, structures & road condition.	Road Information Services, Vic Roads	Terry Gathercole

DESCRIPTION OF EXISTING PRE-CRASH EXPOSURE DATA SOURCES - Victoria

NAME OF DATABASE	PERIOD COVERED (TIMING)	TYPE OF DATA	GENERAL DESCRIPTION	ORGANISATION RESPONSIBLE	CONTACT PERSON
TIDES - rural Victoria only	Continuous	All Vehicles	TIDES is a database providing details of rural traffic information including volume, length, classification and speed classification.	Road Information Services, Vic Roads	David Ryan
SMARTT - Melbourne metropolitan areas only	On request	All Vehicles	SMARTT is a system for maintenance, analysis and reporting of travel time information including location, route, link and mode details.	Road Information Services, Vic Roads	Lynette Wells
Traffic Statistics - Statewide, but predominantly Melbourne metropolitan	Continuous	All Vehicles	Database describes traffic volumes, type (length, etc.) and speed data for fixed term intervals in the Melbourne metro. area. Includes 15 min/60 min directional flows and daily and yearly summaries.	Road Information Services, Vic Roads	Tim Strickland
Vehicle Registration Database - Statewide	Continuous	All Vehicles	Database of details of all registered vehicles in Victoria, including name and address of owner.	Registration and Licensing, Vic Roads	Warwick Bull
Driver License - Statewide	Continuous	All Passenger car drivers, heavy vehicle drivers and motorcyclists.	Database providing details of all holders of various driver licenses in Victoria	Registration and Licensing, Vic Roads	Warwick Bull

DESCRIPTION OF EXISTING PRE-CRASH EXPOSURE DATA SOURCES - Victoria

NAME OF DATABASE	PERIOD COVERED (TIMING)	TYPE OF DATA	GENERAL DESCRIPTION	ORGANISATION RESPONSIBLE	CONTACT PERSON
Victorian Integrated Travel, Activities and Land-Use Toolkit (VITAL) - urban areas of Victoria.	1993	All Road Users and Road Environment	Survey data provides information on behaviour patterns and an analytical base to assist transport decision-making in Victoria. Incorporates VATS, GIS, land-use information, system monitoring, transport network information & special surveys.	Transport Research Centre, University of Melbourne.	Liz Ampt
Before and after count of Swanston Walk		Drivers, vehicles and pedestrians.	Study looked at changes after changing Swanston Street into a pedestrian mall. Includes speed survey, traffic volumes and vehicle classification variables.	Road Information Services, Vic Roads.	David Ryan
Journey To Work, School and Shops	1984 Nov. 1991 Nov.	All Road Users	Statistics on travel to work, schools and shops gathered by surveys of individuals and households.	Strategic Transport Planning Department, Vic Roads	S Erikson
Cyclists' Characteristics and Cycling Patterns	1986 June	Bicyclists	A telephone survey of 2,000 individuals/households was conducted obtaining information on cyclists, characteristics and cycling patterns.	State Bicycle Committee, Vic Roads.	H Tew
Traffic Performance Studies	1990	Vehicles	Studies provide information on traffic counts such as single day counts at intersections, turning movements at intersections, flows through traffic signals and truck flows on major arteries.	Traffic Services, Vic Roads	F Crook
Random Breath Test Data Information	Continuous	Drivers	Database provides details on random breath testing in Victoria country and metropolitan areas from Victoria Police records.	Road Safety Division, Vic Roads	John Lambert

DESCRIPTION OF EXISTING PRE-CRASH EXPOSURE DATA SOURCES - Victoria

NAME OF DATABASE	PERIOD COVERED (TIMING)	TYPE OF DATA	GENERAL DESCRIPTION	ORGANISATION RESPONSIBLE	CONTACT PERSON
Traffic Accident Data System	Continuous	Drivers, Vehicles and Road Environment	Database provides person, vehicle and environment details of road accidents reported to Victoria Police	Road Information Services, Vic Roads	Uma Rao
1990 Melbourne Restraint Wearing Survey	1990 November	Drivers, passengers and vehicles	Observation and driver interviews at signalised intersections provides details of characteristics of vehicle, driver and passengers for car derivatives on arterial roads in Melbourne, 20 sites, 9,993 vehicles & 15,576 people sampled.	Road Safety Division, Vic Roads	Pat Rogerson
Restraint Use Survey - Rural open roads	1989 Nov (pilot) 1990 June to 1991 June (main)	Drivers, passengers and vehicles	Pilot and main survey included observation at construction site and some signalised intersections providing characteristics of vehicle, driver and passengers for cars and car derivatives	Road Safety Division, Vic Roads	Pat Rogerson
1989 Rural town Restraint Use Survey	1989 Oct-Nov.	All drivers,, passengers and vehicles	Survey conducted observations at intersections and service stations, 10 sites in each of 12 towns, providing characteristics of vehicle, driver and passengers for cars and car derivatives	Road Safety Division, Vic Roads	Pat Rogerson
Melbourne On-road Exposure Survey	1984 - 1989	All Road Users		Road Safety Division, Vic Roads	Pat Rogerson

DESCRIPTION OF EXISTING PRE-CRASH EXPOSURE DATA SOURCES - Victoria

NAME OF DATABASE	PERIOD COVERED (TIMING)	TYPE OF DATA	GENERAL DESCRIPTION	ORGANISATION RESPONSIBLE	CONTACT PERSON
Vehicle Safety Attitudes Survey	1992 June	Drivers (owners) and vehicles	Telephone surveys providing information on purchase of private cars and car derivatives, knowledge of safety features, reason for purchase and ratings of importance of certain safety features	Road Safety Division, Vic Roads	Pat Rogerson
New Registrations	1992 April	Drivers (owners) and vehicles	Database provides a list of all new registrations Nov 1991 - Apr 1992 including names and addresses of owners (private cars and car derivatives only)	Road Safety Division, Vic Roads	Pat Rogerson
Motorcycle and Owner Details	1992 February	Motorcyclists and motorcycles	Databases provide information of motorcycles on register in Victoria as at 15 Feb 1992 with extra licensing details of owners and extra power and weight data of motorcycle.	Road Safety Division, Vic Roads	Pat Rogerson
Pedestrian Accident Study	1985 July - 1986 December	Pedestrians, vehicles and road environment	Interview with victims admitted to hospital and hospital records providing details of pedestrian crashes and injury.	Road Safety Division, Vic Roads	Pat Rogerson
P' plate Drivers in Geelong	1991 December to 1992 March	Novice drivers and vehicles	Survey of novice drivers in the Geelong areas only	Road Safety Division, Vic Roads	Mike Hull
Motorcycle Exposure	1988 June	Motorcyclists and motorcycles	Survey via mailed out questionnaire providing 3-day travel diary	Road Safety Division, Vic Roads	Pat Rogerson

DESCRIPTION OF EXISTING PRE-CRASH EXPOSURE DATA SOURCES - Victoria

NAME OF DATABASE	PERIOD COVERED (TIMING)	TYPE OF DATA	GENERAL DESCRIPTION	ORGANISATION RESPONSIBLE	CONTACT PERSON
Motorist Restraint Use Surveys	1988, 1989, 1990	All Drivers and Passengers	Surveys conducted of 7,000 to 10,000 vehicles per year covering vehicle occupant, restraint use, driver characteristics and vehicle characteristics information.	Road Safety Division, Vic Roads	Pat Rogerson
Victoria Open Road - Motorist Restraint Use - rural Victoria only	Pilot: Nov-Dec 1989 Main: June 1990 - June1991	All Drivers and Passengers	Survey of 20,000 individuals on rural highways only, detailing age, sex, time of day, seat belt use, type of restraint, seating position, type of vehicle, weather and location information.	Road Safety Division, Vic Roads	Pat Rogerson
Rural Towns - Motorist Restraint Use - Victorian country towns only	1989	All Drivers and Passengers	Survey of 12 Victorian country towns and cities covering details of age, sex, time of day, seat belt use, type of restraint, seating position, type of vehicle, weather and location information.	Road Safety Division, Vic Roads	Pat Rogerson

DESCRIPTION OF EXISTING PRE-CRASH EXPOSURE DATA SOURCES - Victoria

NAME OF DATABASE	PERIOD COVERED (TIMING)	TYPE OF DATA	GENERAL DESCRIPTION	ORGANISATION RESPONSIBLE	CONTACT PERSON
Bicycle Helmet Wearing Rate Surveys	1983-1991 (commuter metro. Melb.) 1987-1991 (recreation metro. Melb.) 1985-1991 (commuter country Vic.) 1987-1991 (recreation country Vic.)	Bicyclists	Series of studies looking at bicycle helmet wearing rates in metropolitan Melbourne (from 1983) and in country Victoria (from 1985). Annual surveys generally conducted in March of each year. The surveys separate out commuter and recreational bicyclists.	Road Safety Division, Vic Roads	Andrea Anderson
Arterial Road Speed Survey (Divided Roads)	1984	Drivers	Survey of speed	RACV	Sanderson
Arterial Road Speed Survey (Undivided Roads)	1986	Drivers	Survey of speed	RACV	Sanderson
Speed Attitude Survey	1990	Drivers	Sample data on range of driver and vehicle characteristics by observed travel speed	Monash University Accident Research Centre	B Fildes

DESCRIPTION OF EXISTING PRE-CRASH EXPOSURE DATA SOURCES - Western Australia

NAME OF DATABASE	PERIOD COVERED (TIMING)	TYPE OF DATA	GENERAL DESCRIPTION	ORGANISATION RESPONSIBLE	CONTACT PERSON
Motor Drivers Licenses	Continuous	All Drivers and Motorcyclists	Database providing details of all Western Australian drivers license holders.	Research and Statistics, WA Police Department	
Vehicle Registration Database	Continuous	All Vehicles	Database providing details of all motor vehicles on register on Western Australia	Research and Statistics, WA Police Department	
Traffic Counting System		Road Environment	System processes and stores vehicle volume data for the arterial road network and some high volume local roads in Western Australia.	Traffic Strategies Branch, Main Roads, Western Australia.	Peter Willett
Signs Inventory System / Control Device Inventory System	1987 - 1993 Continuous	Road Environment	System processes and stores data on traffic signs in Western Australia including location details and maintenance information. The system in the near future will be extended to include traffic signals and pedestrian crossings.	Traffic Strategies Branch, Main Roads, Western Australia.	Peter Willett
Road Safety Management System		Road Environment	System identifies hazardous locations, determines accident type problems, evaluates alternative improvement projects on cost/benefit basis and evaluates improvement programmes.	Traffic Strategies Branch, Main Roads, Western Australia.	Peter Willett

DESCRIPTION OF EXISTING PRE-CRASH EXPOSURE DATA SOURCES - Western Australia

NAME OF DATABASE	PERIOD COVERED (TIMING)	TYPE OF DATA	GENERAL DESCRIPTION	ORGANISATION RESPONSIBLE	CONTACT PERSON
Video Traffic Data System	Continuous	Drivers, Motorcyclists, Pedestrians, Bicyclists and Road Environment	System collects and analyses driver and pedestrian behaviour using pole mounted video equipment. System is also used for traffic patterns, counting of vehicle movements and volume information.	Traffic Strategies Branch, Main Roads, Western Australia.	Peter Willett
Travel Time System		Road Environment	System collects and processes peak period private vehicle travel times in the Perth arterial road network.	Traffic Strategies Branch, Main Roads, Western Australia.	Peter Willett
Culway		Vehicles	Culway uses culverts as dynamic weigh-in motion scales unmanned 24 hours a day. The system collects data on traffic composition for freight vehicles, type, speed, classification, number of axles, and estimated payload.	Programs and Strategies, Main Roads, Western Australia.	Derek Fitzpatrick
Road Roughness System	1972-1993 Biennial	Road Environment	System processes and stores road roughness data on rural arterial roads in Western Australia.	Programs and Strategies, Main Roads, Western Australia.	Derek Pitzpatrick

DESCRIPTION OF EXISTING PRE-CRASH EXPOSURE DATA SOURCES - Western Australia

NAME OF DATABASE	PERIOD COVERED (TIMING)	TYPE OF DATA	GENERAL DESCRIPTION	ORGANISATION RESPONSIBLE	CONTACT PERSON
Classified Road Inventory System	Continuous	Road Environment	System provides details of the classified road network and urban arterial roads in the State. Includes road widths, formation details, pavement details, alignment, medians, lanes, kerbing, land use, speed limits, roadside furniture and access control.	Programs and Strategies, Main Roads, Western Australia.	Derek Fitzpatrick
Unclassified Road Inventory System	Continuous	Road Environment	System maintains inventory for all public unclassified roads in the State. Includes road number, length, class, point items, formation width, pavement width, seal width & type, speed, terrain, land use and drain type.	Programs and Strategies, Main Roads, Western Australia.	Derek Fitzpatrick
Railway Crossing System	Continuous	Road Environment	System processes and stores data on road crossings in WA. Includes road and railway details such as location, type of protection, number of trains, volumes and speed, number of tracks & line type information.	Programs and Strategies, Main Roads, Western Australia.	John Moore
Perth Travel Time Survey, 1991-92		Drivers	As part of a continuous travel time monitoring system a peak period survey of private vehicle travel times on Perth arterial roads was conducted using the 'test car' method.	Traffic Strategies Branch, Main Roads, Western Australia.	Peter Willett

DESCRIPTION OF EXISTING PRE-CRASH EXPOSURE DATA SOURCES - Western Australia

NAME OF DATABASE	PERIOD COVERED (TIMING)	TYPE OF DATA	GENERAL DESCRIPTION	ORGANISATION RESPONSIBLE	CONTACT PERSON
Motorcycle Daytime Running Lights Survey		Motorcyclists	Documenting the proportion of motorcyclists using daytime running lights in the Perth metropolitan area, May, 1990	Road Accident Prevention Research Unit, UWA Department of Medicine.	Rina Cercarelli
Perth Travel Survey - Household Interview Survey (Perth metropolitan area only)	1986	All Road Users	Survey of households in Perth metropolitan area using self-administered mail-back method. Details trip information for household members.	Policy Section, WA Department of Transport	Hugo Wildermuth
Bicycle Usage Database	1982 1989	Bicyclists	Two studies carried out by the ABS for the WA Department of Transport, 1982 (metro & rural separate) and 1989 (statewide). Household survey supplemented general survey.	Policy Section, WA Department of Transport	Hugo Wildermuth

APPENDIX E: Description of Existing Crash Exposure Data Sources

DESCRIPTION OF EXISTING CRASH EXPOSURE DATA SOURCES - National

NAME OF DATABASE	PERIOD COVERED (TIMING)	TYPE OF DATA	GENERAL DESCRIPTION	ORGANISATION RESPONSIBLE	CONTACT PERSON
Causes of Death, Australia (Cat. 3302.0)	1963 - 1992 annual	All Road Users	Details of number of deaths by sex, selected age groups, and cause of death classified to WHO International Classification of Diseases provided. Major causes are shown as a proportion of total deaths and as age-specific death rates.	Australian Bureau of Statistics.	Peter Petryk
Australian Health Survey	four-yearly	All Road Users	Survey details the health of all Australians including injuries suffered. Enables comparisons of health conditions suffered by the population.	Australian Institute of Health and Welfare and Australian Bureau of Statistics.	
Fatal Crashes - Crashes	1989 continuous	Road Environment, Vehicle and Road User	System provides information relating to all fatal road crashes including crash data such as the environment, major factors, prior movement and type of crash.	Statistics and Analysis Section, Federal Office of Road Safety	R Schneider
Fatal Crashes - Vehicles	1989 continuous	Road Environment, Vehicle and Road User	System provides information relating to all fatal road crashes including crash data such as the environment, major factors, prior movement and type of crash.	Statistics and Analysis Section, Federal Office of Road Safety	R Schneider
Fatal Crashes - Persons	1989 continuous	All Road Users	System provides information relating to all fatal road crashes for the particular year including age, sex, employment, use of drugs, injuries sustained and timing of death.	Statistics and Analysis Section, Federal Office of Road Safety	R Schneider

DESCRIPTION OF EXISTING CRASH EXPOSURE DATA SOURCES - National

NAME OF DATABASE	PERIOD COVERED (TIMING)	TYPE OF DATA	GENERAL DESCRIPTION	ORGANISATION RESPONSIBLE	CONTACT PERSON
Serious Injuries - Crashes	1989 continuous	Road Environment, Vehicle and Road User	System provides information relating to all serious injury road crashes including crash data such as the environment, major factors, prior movement and type of crash.	Statistics and Analysis Section, Federal Office of Road Safety	R Schneider
Serious Injuries - Vehicles	1989 continuous	Road Environment, Vehicle and Road User	System provides information relating to all serious injury road crashes including crash data such as vehicle details, major factors, prior movement and type of crash.	Statistics and Analysis Section, Federal Office of Road Safety	R Schneider
Serious Injuries - Persons	1989 continuous	All Road Users	System provides information relating to all serious injury road crashes reported by Police for the particular year including age, sex, employment, use of drugs, injuries sustained and timing of death.	Statistics and Analysis Section, Federal Office of Road Safety	R Schneider
Casualty Crashes - Crashes	1989 continuous	Road Environment, Vehicle and Road User	System provides information relating to all casualty road crashes reported by Police including crash data such as the environment, major factors, prior movement and type of crash.	Statistics and Analysis Section, Federal Office of Road Safety	R Schneider
Casualty Crashes - Vehicles	1989 continuous	Road Environment, Vehicle and Road User	System provides information relating to all casualty road crashes including crash data such as vehicle details, major factors, prior movement and type of crash.	Statistics and Analysis Section, Federal Office of Road Safety	R Schneider

DESCRIPTION OF EXISTING CRASH EXPOSURE DATA SOURCES - National

NAME OF DATABASE	PERIOD COVERED (TIMING)	TYPE OF DATA	GENERAL DESCRIPTION	ORGANISATION RESPONSIBLE	CONTACT PERSON
Casualty Crashes - Persons	1989 continuous	All Road Users	System provides information relating to all casualty road crashes for the particular year including age, sex, employment, use of drugs, injuries sustained and timing of death.	Statistics and Analysis Section, Federal Office of Road Safety	R Schneider
Hospital Morbidity Files (South Australia)	Continuous	All Road Users	Database provides details of all injuries requiring hospital admission including traffic-related injuries	National Injury Surveillance Unit	Peter O'Connor
Ambulance Data (South Australia)	Continuous	All Road Users	Database provides details of all ambulance attendance and transport to hospital including attendance at road accidents	National Injury Surveillance Unit	Peter O'Connor
Hospital Attendance Database (South Australia)	Continuous	All Road Users	Database provides estimates for road injury hospital attendances	National Injury Surveillance Unit	Peter O'Connor
Blood Alcohol Reporting System (South Australia)	Continuous	Drivers Passengers Pedestrians	Database provides estimates of BAC for road injury cases	National InjurySurveillance Unit	Peter O'Connor

DESCRIPTION OF EXISTING CRASH EXPOSURE DATA SOURCES - Australian Capital Territory

NAME OF DATABASE	PERIOD COVERED (TIMING)	TYPE OF DATA	GENERAL DESCRIPTION	ORGANISATION RESPONSIBLE	CONTACT PERSON
Traffic Accident Reporting System	1980 - 1993 continuous	All Road Users, Vehicles and Road Environment	Database details all reported traffic related accidents reported by the Police. Includes crash location details, driver/vehicle details and casualty details such as age, sex, BAC, severity of injury, hospital admission and seating position. *	Roads and Transport Branch, Department of Urban Services	Wayne Daly
Hospital Admission Data	continuous	All Road Users	Database details hospital records of all people admitted to hospital including those related to traffic related accidents. Records injuries, accident and emergency presentations, hospital admissions, length of stay and discharge details.	FORS Systems?	

* Reporting Criteria:
Up until 1992 all Police reported accidents were included on the database (including parking and off-road crashes).
A new system is currently being designed which will include all Police reported crashes except off-road and parking crashes.
In addition, bicycle path crashes will be recorded.

DESCRIPTION OF EXISTING CRASH EXPOSURE DATA SOURCES - New South Wales

NAME OF DATABASE	PERIOD COVERED (TIMING)	TYPE OF DATA	GENERAL DESCRIPTION	ORGANISATION RESPONSIBLE	CONTACT PERSON
ISIS	Continuous	All Road Users	An injury surveillance system which details injury information including cause of injury, accident and emergency attendances, hospitalisation, severity, discharge details.	Health Department of NSW.	Victor Carey
ROADACCS (Road Accident System)	Continuous	All Road Users	Traffic accident reporting systems containing detailed information about Police reported road accidents from NSW including general, traffic unit and casualty information. *	Information Services Branch, Roads and Traffic Authority of NSW	
Inpatient Statistics Collection	Annual	All Road Users	Database provides a record of all hospital separations from NSW hospitals	NSW Health Department	D Lyle

* Reporting Criteria:
Only crash details from P4 forms filled out by Police attending crashes are selected.
Of those crashes only those where a person is killed, injured or the vehicle is towed away are entered into database.

DESCRIPTION OF EXISTING CRASH EXPOSURE DATA SOURCES - Northern Territory

NAME OF DATABASE	PERIOD COVERED (TIMING)	TYPE OF DATA	GENERAL DESCRIPTION	ORGANISATION RESPONSIBLE	CONTACT PERSON
Vehicle Accident Databse	Continuous	All vehicles, road environment and occupants	Police reported road accident database containing accident, vehicle, and injured person details. *	Road Safety Council, Department of Transport and Works (NT)	John Hewitt

* Reporting Criteria:
For a crash to be recorded by the Police it must have been:
1. any person injured or killed
2. a crash with circumstances where a bridge of the law was apparent
3. a crash with a result of damage to a vehicle of government department, semi government department of municipality

Only crashes involving fatality are recorded on the Crash database.
The Road Safety Council access the Police database to obtain information on any other crash due to the small number of crashes in NT.

DESCRIPTION OF EXISTING CRASH EXPOSURE DATA SOURCES - Queensland

NAME OF DATABASE	PERIOD COVERED (TIMING)	TYPE OF DATA	GENERAL DESCRIPTION	ORGANISATION RESPONSIBLE	CONTACT PERSON
Queensland Causes of Death Data Collection	continuous	All Road Users	Mortality file detailing causes of death including traffic related deaths.	Epidemiology and Health Information Branch, Queensland Health	Jim Snodgrass
Road Crash 1	1991 continuous	Road Environment, Vehicle and Road User	Details of Police reported crashes. Crash details - identification & characteristics of crashes. Unit details - characteristics of all units involved in the crash. Injury details - identifies injured individuals, severity of injury & safety devices. *	Road Vehicle, User and Safety Branch, Queensland Transport	Ross Maunder
Queensland Hospital Morbidity Data Collection	continuous	All Road Users	Morbidity file detailing injured persons including those injured in traffic related accidents admitted to hospital.	Epidemiology and Health Information Branch, Queensland Health	Jim Snodgrass
Queensland Injury Surveillance and Prevention Project (QUISPP)	continuous	All Road Users	Data collected includes all age, all injury data from presentations to the emergency departments of seven hospitals in Brisbane South Health Region. Includes demographic details, cause, time and place of injury, severity of injury and treatment required.	QUISPP, National Better Health Program	Denise Jones

* Reporting Criteria:
The Police record anything that is reported to them. Anything that is a tow-away or any 'major' crash (in terms of casualty and dollars) will be extracted from the Police database and entered onto the Road Crash 1 database.

DESCRIPTION OF EXISTING CRASH EXPOSURE DATA SOURCES - South Australia

NAME OF DATABASE	PERIOD COVERED (TIMING)	TYPE OF DATA	GENERAL DESCRIPTION	ORGANISATION RESPONSIBLE	CONTACT PERSON
Data on Admissions to Royal Adelaide Hospital	Continuous	Drivers and Motorcyclists	Database of hospital admission records and patient interviews collecting accident and demographic details, driving characteristics, and hospital details for 370 drivers and riders	NHMRC Road Accident Research Unit, University of Adelaide	Oksana Holubowycz
Injury Surveillance System	Continuous	All Road Users	Database provides details of all injuries requiring hospital admission in a subset of hospitals including traffic-related injuries.	SA Health Commission.	Ron Somers
Road Accidents in South Australia, 1991	1991	All Road Users	Database of Police reported accident data for South Australia Including casualty severity, time of day, location, light conditions, traffic controls, speed limit, road user type, vehicle details, driving experience, nature of injury & seating position. *	Office of Road Safety, SA Department of Road Transport.	Peter Cleal
Road Fatalities in South Australia	1993	All Road Users	Database includes tabulations of road fatalities by age, sex, month, location, road user type and accident type.	Office of Road Safety, SA Department of Road Transport	Peter Cleal
TARS database (also known as ACDAL and RMLIB?)	1980-1993 continuous	Vehicles and Drivers	Database of information from police reported accidents. Details of reportable accidents includes accident type, road condition, location, road user type & movement, vehicle, accident severity, driver details, seating position and BAC.	Office of Road Safety, South Australian Department of Road Transport.	Fred Tiong

DESCRIPTION OF EXISTING CRASH EXPOSURE DATA SOURCES - South Australia

NAME OF DATABASE	PERIOD COVERED (TIMING)	TYPE OF DATA	GENERAL DESCRIPTION	ORGANISATION RESPONSIBLE	CONTACT PERSON
Adelaide In-Depth Studies	1975 - 1979	All Road Users	Studies detailing accidents by time of day, effect of wet weather and population.	NHMRC Road Accident Research Unit, University of Adelaide.	Jack McLean

* Reporting Criteria:
Legislation requires that all accidents involving casualties and involving over $600 property damage are reported to the Police.
All Police reported accidents are entered into database.

DESCRIPTION OF EXISTING CRASH EXPOSURE DATA SOURCES - Tasmania

NAME OF DATABASE	PERIOD COVERED (TIMING)	TYPE OF DATA	GENERAL DESCRIPTION	ORGANISATION RESPONSIBLE	CONTACT PERSON
Tasmanian Injury Surveillance and Prevention Programme (TISPP) - Hobart metropolitan area only.	Continuous	All Road Users	Injury surveillance system collected for presentations at Royal Hobart Hospital including traffic crash related injuries. Information is collected on cause of injury, accident & emergency presentations, hospital admission, severity of injury, discharge.	Menzies Centre for Population Health Research, University of Tasmania	Jim Langford
Crash Data File	Continuous	All Road Users	Database recording information from Police Accident reports of road crashes giving details of type of vehicle, registration details, injured and uninjured occupants. *	Transport and Works	

* Reporting Criteria:
Any crash resulting in injury or property damage damage that is reported to the Police is entered into the database.

DESCRIPTION OF EXISTING CRASH EXPOSURE DATA SOURCES - Victoria

NAME OF DATABASE	PERIOD COVERED (TIMING)	TYPE OF DATA	GENERAL DESCRIPTION	ORGANISATION RESPONSIBLE	CONTACT PERSON
ACCREP		All Vehicles, Road Environment and Occupants.	Police reported road accident database from 1983 to present containing accident, location, vehicle and person details. *	Road Information Services, Vic Roads	Peter Green
TAC Injury Claims Database	Continuous	All Road Users	Database provides crash details, injury, hospitalisation and medical treatment and injury compensation.	Transport Accident Commission	David Atwood
MUARC Merged Database	1983-1990	Passenger car drivers and passengers	Matched and extended files with data provided by Victoria Police and TAC giving details on road crashes involving death or injury, injury compensation, seating positions of those injured.	MUARC	Max Cameron
Hospital Morbidity File	Continuous	All Road Users	Database provides details of all hospital admissions including traffic related admissions. Includes details on cause of injury, hospital stay, discharge.		
Victorian Crashed Vehicle File (Passenger Cars)	1989-1992	Passenger car drivers and passengers	Retrospective sample of Melbourne crash data where an occupant was either hospitalised or killed	Federal Office of Road Safety/ Monash University Accident Research Centre	B Fildes
Australian Crashed Vehicle File (Passenger Cars)	1989-1992	Passenger car drivers and passengers	Victorian Crashed Vehicle file expanded to represent all Australian crashes of all injury levels.	Monash University Accident Research Centre	M Cameron B Fildes

DESCRIPTION OF EXISTING CRASH EXPOSURE DATA SOURCES - Victoria

NAME OF DATABASE	PERIOD COVERED (TIMING)	TYPE OF DATA	GENERAL DESCRIPTION	ORGANISATION RESPONSIBLE	CONTACT PERSON
Victorian Van and Four-wheel-drive Crashed Vehicle File	1993 -	Vehicle occupants	Representative sample of Melbourne crash data where vehicle was either towed or salvaged.	Federal Office of Road Safety/ Monash University Accident Research Centre	B Fildes
Bicycle Study	1992-1994	Bicyclists	Case-control study collecting exposure data (trip details and time on bicycle) for population-based sample of injury cases and control children on bicycles, aged 5-14 years.	Clinical Epidemiology & Biostatistics Unit, Royal Children's Hospital	J Carlin

* Reporting Criteria:
Anything that has been recorded by the Police with the following criteria:
1. must be a crash that has occurred on a road that the public have access to
2. must be a crash involving at least one moving vehicle on the road
3. must be an accident, not caused by natural causes (eg. heart attack, epilepsy, earthquake, etc.)

Certain accidents that are unacceptable are flagged and left off the database.

DESCRIPTION OF EXISTING CRASH EXPOSURE DATA SOURCES - Western Australia

NAME OF DATABASE	PERIOD COVERED (TIMING)	TYPE OF DATA	GENERAL DESCRIPTION	ORGANISATION RESPONSIBLE	CONTACT PERSON
Road Injury Database (RID)		All Road Users	Database providing details of all injured persons involved in a road accident, linked to Hospital Morbidity Data System, St. John Ambulance Association and death records and hospital databases.	Road Accident Prevention Research Unit, UWA Department of Medicine.	Delia Hendrie
ROTARS/TAS	1976-1993 Continuous	Road Environment, Vehicles and Road Users	Database providing details of vehicles and persons involved in a Police reported accident. Includes accident, location, road feature, vehicle, injury and hospitalisation details. *	Traffic Strategies Branch, Main Roads Western Australia.	Peter Willett
Road Accident Display and Analysis System		Road Environment	System uses Geographical Information Systems technology to display and map accident details in the State road network.	Traffic Strategies Branch, Main Roads, Western Australia.	Peter Ingversen
MRWA Fatal Accident Report		All Road Users	Provides details of fatal accidents at sites where Main Roads is directly involved.	Traffic Strategies Branch, Main Roads, Western Australia.	Peter Willett
Child Pedestrian Injury Database - Traffic Factors		Vehicles and Road Environment	A record of traffic features at various sites in the Perth Metropolitan area, Dec '91 to Dec '93.	Centre for Advanced Studies in Health Science, Curtin University of Technology	Mark Stevenson

DESCRIPTION OF EXISTING CRASH EXPOSURE DATA SOURCES - Western Australia

NAME OF DATABASE	PERIOD COVERED (TIMING)	TYPE OF DATA	GENERAL DESCRIPTION	ORGANISATION RESPONSIBLE	CONTACT PERSON
Child Pedestrian Injury Database		Pedestrians and Road Environment	Documentation of a child pedestrian exposure to the road environment	Centre for Advanced Studies in Health Science, Curtin University of Technology	Mark Stevenson
Vehicle Repair Database (property damage)		Vehicles	Database has 9,000 records from insurance claim forms. Gives details on vehicle driver characteristics.	Road Accident Prevention Research Unit, UWA Department of Medicine.	Diana Rosman

* Reporting Criteria:
The legal requirement for a crash to be recorded by the Police is any property damage over $1,000 and crashes requiring medical treatment.
Everything that is on the Police system is recorded on ROTARS

APPENDIX F: Exposure Data Needs for Monitoring National Health Goals and Targets

SUGGESTED PRE-CRASH AND CRASH EXPOSURE DATA NEEDS

NATIONAL HEALTH GOALS AND TARGETS

1. Increase proportion of drivers and passengers in passenger vehicles with improved frontal protection

NATURE OF EXPOSURE DATA NEEDED	SUGGESTED TIMING	SUGGESTED REGION	REQUIRED VARIABLES
Database detailing manufacture of new passenger vehicles including safety features	Annual	Each State and Territory	VIN, vehicle make and model, year of manufacture safety features(especially frontal crash protection)
Improved Vehicle Characteristic Data	*Every 3 years*	*Urban and rural areas of Western Australia*	*Vehicle type, make and model, size and mass* *safety performance features* *vehicle performance* *registration and ownership*

2. Increase proportion of passengers in centre seating positions with adequate restraint

NATURE OF EXPOSURE DATA NEEDED	SUGGESTED TIMING	SUGGESTED REGION	REQUIRED VARIABLES
Survey of vehicle occupants and restraint use	Annual survey	Each State and Territory	Seating position restraint use number of car occupants occupant demographics
Survey on child restraint devices	*On demand*	*Urban and rural areas of Victoria*	*seating position* *incidence of availability* *appropriate restraint use* *occupant demographics*
Survey on occupant restraint	*Every 5 years*	*All States and Territories*	*Seating position* *occupant demographics* *restraint type (esp. for children)*

3. Increase proportion of passengers on long distance coaches with adequate restraint

NATURE OF EXPOSURE DATA NEEDED	SUGGESTED TIMING	SUGGESTED REGION	REQUIRED VARIABLES
Monitor coach usage	Every 3 years	Each State and Territory	Average number of passengers frequency of coach use vehicle safety features (especially seat belts)

4. Increase safety of residential areas for pedestrians (children, elderly and people with disabilities)

NATURE OF EXPOSURE DATA NEEDED	SUGGESTED TIMING	SUGGESTED REGION	REQUIRED VARIABLES
Monitor pedestrian behaviour and facilities on residential streets	Every 3 years	Residential areas of urban and rural cities in each State and Territory	Traffic flow pedestrian flow speed zone pedestrian demographics road crossing behaviour location of pedestrian crossings safety features (median refuges, warning signs, speed reduction devices)

5. Reduce exposure to dangerous traffic (children, elderly and people with disabilities)

NATURE OF EXPOSURE DATA NEEDED	SUGGESTED TIMING	SUGGESTED REGION	REQUIRED VARIABLES
Monitor pedestrian exposure	Every 3 years	Major roads in cities and towns in each State and Territory	Pedestrian flow pedestrian demographics vehicle flow speed and speed zone road type and hierarchy road crossing behavour presence of pedestrian crossings and other safety features
Travel Time Surveys	*Annual survey*	*Urban and rural areas of Victoria*	*Pedestrian flow*
Data on Travel Paths of Visually impaired Pedestrians	*On demand*	*Sydney metropolitan areas*	*Streets used* *volumes of pedestrians* *mobility levels*

6. Reduce exposure associated with crossing busy roads (children, elderly and people with disabilities)

NATURE OF EXPOSURE DATA NEEDED	SUGGESTED TIMING	SUGGESTED REGION	REQUIRED VARIABLES
Survey of pedestrian exposure	Every 3 years	All States and Territories	Pedestrian demographics road crossing behavour geographic area location of pedestrian crossings safety features (median refuges, barrier fencing) vehicle traffic flow road features (width, lanes, etc.) speed zone
On Road Walking Behaviour Surveys	*Every 5 years*	*All States and Territories in Australia*	*Classification of behaviours by standard variables focus on variables which have some relationship to risk (eg. road crossings, pedestrian characteristics)*
Improved Pedestrian Exposure Data	*Every 3 years*	*Urban and rural areas of Western Australia*	*Pedestrian characteristics and demographics* *road crossing behaviour* *geographic area* *lighting and weather conditions* *road features and speed zone*
Improved data on traffic signs, traffic signals and pedestrian crossings	*Continuous*	*Urban and rural areas of Western Australia*	*As currently collected, but with the addition of data on non-regulatory traffic signs on local roads need to be more selective in what signs are to be covered*

7. Increase access to safe cycling routes for bicyclists

NATURE OF EXPOSURE DATA NEEDED	SUGGESTED TIMING	SUGGESTED REGION	REQUIRED VARIABLES
Bicycle usage survey	Annual survey	Major roads in cities and towns in each State and Territory	Bicycle usage (frequency, trip purpose etc) location of bicycle paths use of bicycle paths bicyclists demographics helmet use time of day/week/month footpath cycling
Data on estimated bicycling time on roads or footpaths	*1994 March (country towns)* *1994 May/June (Melbourne)*	*Melbourne metropolitan areas and Country Towns in Victoria*	*Helmet use* *helmet type* *helmet carrying* *age and sex* *trip purpose (time of week)* *road hierarchy*
Bicycle and Helmet Use Monitor	*Every 5 years*	*All States and Territories in Australia*	*number of bicycles in each State and Territory* *demographic information* *helmet and safety equipment use* *frequency of bicycle usage* *geographic area*

8. Decrease exposure to unsafe traffic conditions when travelling to work

NATURE OF EXPOSURE DATA NEEDED	SUGGESTED TIMING	SUGGESTED REGION	REQUIRED VARIABLES
Monitor of traffic flow on major arterial roads	Annual survey	Major arterial roads of cities in each State and Territory	Traffic flow pedestrian and bicyclist flows speed and speed zone headway lengths time of day/week/month number of vehicle occupants
Peak Period Travel Times and Speeds of Private Vehicles (Perth arterial road network)	*Continuous*	*Perth metropolitan areas*	*Average speed by area where average speed is weighted by traffic volume*

9. Decrease exposure to injury associated with transport related accidents

NATURE OF EXPOSURE DATA NEEDED	SUGGESTED TIMING	SUGGESTED REGION	REQUIRED VARIABLES
General travel surveys	Every 3 years	All States and Territories	travel mode road user type demographics of travellers traffic flow and volume geographic location road environment/features trip length (time and distance travelled) time of day/week/month purpose of trip vehicle characteristics

Trip Data	*Every 5 years*	*All States and Territories in Australia*	*Origin and destination* *trip length (kms and time)* *demographics of road users (eg. age, sex, occupation)* *road user type* *quality of exposure (eg. main road, local road, country road etc.)*
Road Inventory (GIS)	*Every 5 years*	*All States and Territories in Australia*	*Road length by type of road* *volume of traffic* *type of vehicles*
Improved Road Environment Data	*Every 3 years*	*Urban and rural areas of Western Australia*	*Geographic area* *traffic flow* *speed zone* *signage* *intersection features* *bicycle paths*
Display and mapping of accident detail on the road network (GIS)	*On demand*	*Urban and rural areas of Western Australia*	*Accident inventory* *traffic data items*
Data on hazardous locations (system currently in development)	*Annual survey*	*Urban and rural areas of Western Australia*	*Hazardous locations* *accident type* *alternative treatments*
Improved Traffic Flow Data	*Every 5 years*	*Urban and rural areas of Western Australia*	*As currently collected, but with the addition of vehicle classification (AUSTROADS classes)*
Inferred Accident Rates for different curves and classes of road where no accident history exists	*On demand*	*Urban and rural areas of Queensland*	*Model road state* *accidents/vehicle km travelled* *horizontal curvature* *vertical curvature*

Travel time and cost data	*On demand*	*Urban areas of Victoria initially, then rural*	*type of road user* *occupation* *purpose of travel* *type of journey*
Origin-destination travel survey	*continuous*	*Urban areas of Melbourne*	*origin and destination of trip* *travel mode* *departure and arrival time* *trip purpose* *number of vehicle occupants* *cost information* *socio-demographic details of household and persons*

APPENDIX G: Exposure Data Needs of the National Road Safety Research and Development Strategy

SUGGESTED PRE-CRASH AND CRASH EXPOSURE DATA NEEDS
NATIONAL ROAD SAFETY RESEARCH AND DEVELOPMENT STRATEGY

1. Alcohol and Drugs - prevalence of alcohol and drug use & relation to crash involvement

NATURE OF EXPOSURE DATA NEEDED	SUGGESTED TIMING	SUGGESTED REGION	REQUIRED VARIABLES
Survey of alcohol and drug use	Every 5 years	Urban and rural areas of each State and Territory	Road user demographics use of drugs and alcohol (frequency and type) geographical area crash involvements
Data on heavy vehicle driver drug taking		*Urban and rural areas of each State and Territory*	*Driver age and sex* *usual trip distance* *owner/employee* *type of drugs taken* *frequency of drugs taken* *number of years driving (experience)*
Drink driving Monitor	*Annual survey*	*Urban and rural areas of South Australia*	*Driver/rider attitudes and behaviour* *demographics* *geographical area*

2a. Speed - to identify those at high risk from speeding and relate speed behaviour, with and without alcohol, and accident occurrence

NATURE OF EXPOSURE DATA NEEDED	SUGGESTED TIMING	SUGGESTED REGION	REQUIRED VARIABLES
Driver speed behaviour survey	Every 5 years	Urban and rural areas in each State and Territory	Driver demographics driver behaviour and attitude offences actual speed (relative to speed zone) accident history license and registration details vehicle details (make, model, size, performance) number of vehicle occupants
On Road Driving Behaviour Surveys	*every 5 years*	*All States and Territories in Australia*	*Classification of behaviours by standard variables focus on variables which have some relationship to risk (eg. speeding, tail-gating, vehicle manoeuvres)*

2b. Speed - develop a system of speed control: review road design and traffic management

NATURE OF EXPOSURE DATA NEEDED	SUGGESTED TIMING	SUGGESTED REGION	REQUIRED VARIABLES
Road and Traffic Management Inventory	Continuous	Major roads in each State and Territory	speed distribution road features speed zone hazardous locations road design traffic flow by time of day/week/month
Population Speed Data	*On-going*	*All States and Territories*	*road type* *road setting* *urban/rural environment* *vehicle characteristics* *driver demographics*

3a. Vehicle design - evaluation & monitoring of occupant safety issues

NATURE OF EXPOSURE DATA NEEDED	SUGGESTED TIMING	SUGGESTED REGION	REQUIRED VARIABLES
Data on occupants of vehicles involved in road crashes (Crash Exposure)	Every 3 years	Each State and Territory	impact severity driver and passenger demographics seating position safety measures available restraint use vehicle details (make, model, size and mass) severity and pattern of injury crash type
Data on Occupant Restraint	*Every 5 years*	*All States and Territories in Australia*	*Seating position* *driver and passenger demographics* *restraint type (especially for child restraint)*

3b. Vehicle design - consumer information on vehicle safety

NATURE OF EXPOSURE DATA NEEDED	SUGGESTED TIMING	SUGGESTED REGION	REQUIRED VARIABLES
Characteristics of passenger vehicles involved in crashes (Crash Exposure)	Annual survey	Each State and Territory	VIN impact severity safety features (esp. options) vehicle details (make, model, size, mass, performance) crash details (speed zone, time, location, type) occupant injury severity occupant demographics occupant seating position occupant restraint use
Survey of distances travelled by passenger vehicles	Every 3 years	Each State and Territory	VIN safety features (especially options) vehicle details (as above) driver demographics occupancy (by seat) geographic area speed zone time of week

4. Hazardous road locations - identification and treatment

NATURE OF EXPOSURE DATA NEEDED	SUGGESTED TIMING	SUGGESTED REGION	REQUIRED VARIABLES
Road and Traffic Management Inventory	Continuous	Major roads in each State and Territory	road features speed zone signage road design intersection design traffic flow by time of day/week/month pedestrian flows geographic area accident history
Road Inventory (GIS)	*Every 5 years*	*All States and Territories in Australia*	*Road length by type of road* *volume of traffic* *type of vehicles*
Improved Road Environment Data	*Every 3 years*	*Urban and rural areas of Western Australia*	*Geographic area* *traffic flow* *speed zone* *signage* *intersection features* *bicycle paths*
Display and mapping of accident detail on the road network (GIS)	*On demand*	*Urban and rural areas of Western Australia*	*Accident inventory* *traffic data items*
Data on hazardous locations (system currently in development)	*Annual survey*	*Urban and rural areas of Western Australia*	*Hazardous locations* *accident type* *alternative treatments*
Improved Traffic Flow Data	*Every 5 years*	*Urban and rural areas of Western Australia*	*As currently collected, but with the addition of vehicle classification (AUSTROADS classes)*

Inferred Accident Rates for different curves and classes of road where no accident history exists	*On demand*	*Urban and rural areas of Queensland*	*Model road state* *accidents/vehicle km travelled* *horizontal curvature* *vertical curvature*

5. Heavy vehicles - technology leading to safer operation

NATURE OF EXPOSURE DATA NEEDED	SUGGESTED TIMING	SUGGESTED REGION	REQUIRED VARIABLES
Database detailing features of new heavy vehicles manufactured	Continuous	Each State and Territory	year of manufacture VIN, make, model, size, mass, weight owner details safety features (especially options)
Survey of Heavy Vehicle Travel	Every 3 years	Each State and Territory	Vehicle details (make, model, size, mass, weight) load details owner details driver demographics safety features of truck distance and time travelled day/week/month geographic area of travel speed behaviour alcohol and drug use restraint use speed zones

Data on estimated kilometres travelled by drivers of heavy vehicles (in particular articulated trucks)	*One year*	*Urban and rural areas of Victoria*	*Driver age, sex, experience, license status* *truck size, mass* *load mass and type* *geographic area of travel* *time of week* *driver seat belt use* *speed zone of travel* *road alignment and features*
Improved Heavy Vehicle Driver Exposure Data	*Every 3 years*	*Urban and rural areas of Western Australia*	*Driver characteristics and demographics* *truck/bus size and mass* *load factors* *time of day/week* *restraint use* *speed behaviour* *geographic area* *experience*

6. Novice riders and drivers - initiatives to reduce crash involvement

NATURE OF EXPOSURE DATA NEEDED	SUGGESTED TIMING	SUGGESTED REGION	REQUIRED VARIABLES
Characteristics of novice riders/drivers	Every 5 years	Each State and Territory	Licence type (experience) Driver/rider demographics speed & drink driving behaviour/attitude nature, number and frequency of offences crash involvements time of day/week/month purpose of trip distance and time travelled geographic area headlamp use
Linkage of riders' driving history/behaviour to accident records	*Continuous*	*Urban and rural areas of Western Australia*	*Age and sex* *nature of riding offences* *number of riding offences* *frequency of riding offences*

7. Development of a road trauma management system from crash to hospital discharge

NATURE OF EXPOSURE DATA NEEDED	SUGGESTED TIMING	SUGGESTED REGION	REQUIRED VARIABLES
Road Trauma Database (linkage of Police Accident reports with Ambulance, Hospital Morbidity and Death Records) (Crash Exposure)	Continuous	Each State and Territory	crash details - location, type, no. injured, impact severity vehicle details - make, model, size, mass no. of occupants casualty details - severity of injury, road user type, seating position, age, sex, restraint use, discharge status, long-term prognosis hospital and ambulance details

8a. To determine the impact of demographic changes on road injury and trauma

NATURE OF EXPOSURE DATA NEEDED	SUGGESTED TIMING	SUGGESTED REGION	REQUIRED VARIABLES
Continuous monitor of population data	Annual survey	Each State and Territory	age and sex marital status educational level residence (postcode) license details vehicle ownership employment status vehicle fuel consumption

8b. To investigate how the injury outcome of the elderly contributes to their road trauma

NATURE OF EXPOSURE DATA NEEDED	SUGGESTED TIMING	SUGGESTED REGION	REQUIRED VARIABLES
Survey of crash involvements of the elderly (Crash Exposure)	One-off Survey	Each State and Territory	Road user demographics (age, sex) crash details (type, location, impact severity) injury - severity, hospitalisation, outcome road user type (pedestrian, occupant, etc)

9. Motorcyclists - the factors contributing to motorcycle crash involvement & injury severity

NATURE OF EXPOSURE DATA NEEDED	SUGGESTED TIMING	SUGGESTED REGION	REQUIRED VARIABLES
Motorcyclist exposure survey	Every 3 years	Each State and Territory	Rider (incl. pillion passenger) demographics rider characteristics vehicle details (size, weight, power, engine capacity) registration details, VIN license details (experience) road use - time and distance travelled geographic area trip purpose time of day/week/month safety equipment use use of headlights speed and drink-driving behaviour
On Road Riding Behaviour Surveys	*Every 5 years*	*All States and Territories in Australia*	*Classification of behaviours by standard variables focus on variables which have some relationship to risk (eg. tail-gating, vehicle manoeuvres)*
Improved Motorcyclist Exposure Data	*Every 3 years*	*Urban and rural areas of Western Australia*	*rider characteristics and demographics* *rider experience and license status* *motorcycle details (eg. size, engine capacity, weight/power ratio)* *use of helmet and other safety features* *speed behaviour* *trip purpose* *weather conditions* *pillion passenger*

10a. Bicyclists - reduce injury by encouraging higher levels of safety equipment use

NATURE OF EXPOSURE DATA NEEDED	SUGGESTED TIMING	SUGGESTED REGION	REQUIRED VARIABLES
Survey of helmet wearing rates, bicycle lighting and conspicuity aids	Every 2 years	Each State and Territory	Rider demographics (age, sex, postcode) bicycle usage (frequency, time & distance travelled) road use (road, footpath, bicycle path) helmet type and use use of other safety equipment (conspicuity aids) geographic area time of day/week/month presence and use of lights
Data on Bicycle helmet wearing rates	*Every 3 years*	*Capital cities and a sample of rural cities in each State and Territory*	*Helmet use* *helmet type* *rider demographics* *age and sex* *road, footpath and bicycle path use*
Bicycle and Helmet Use Monitor	*Every 5 years*	*All States and Territories*	*number of bicycles in each State and Territory* *demographic information* *helmet and safety equipment use* *frequency of bicycle usage* *geographic area*

10b. Bicyclists - improve bicycle standards, road environment, & appropriate footpath use

NATURE OF EXPOSURE DATA NEEDED	SUGGESTED TIMING	SUGGESTED REGION	REQUIRED VARIABLES
Survey of bicycle use and ownership	Annual survey	Each State and Territory	Rider demographics (age, sex, postcode, ownership) bicycle travel (distance, time, frequency, purpose) rider characteristics road, footpath and bicycle path use traffic flow road features use of lights and conspicuity aids
Bicycle use Survey	*Annual survey*	*South Australia*	*Age and sex* *region* *kilometres of bicycle travel per week*
On Road Riding Behaviour Surveys	*Every 5 years*	*All States and Territories in Australia*	*Classification of behaviours by standard variables* *focus on variables which have some relationship to risk (eg. ride-outs, footpath cycling)*
Improved Bicyclist Exposure Data	*Every 3 years*	*Urban and rural areas of Western Australia*	*Cyclist characteristics and demographics* *helmet type and usage* *use of other safety features* *trip purpose* *road use behaviour* *time spent on road* *weather conditions/visibility* *geographic area*

Bicycle and Helmet Use Monitor	*Every 5 years*	*All States and Territories*	*number of bicycles in each State and Territory* *demographic information* *helmet and safety equipment use* *frequency of bicycle usage* *geographic area*

11a. Pedestrians - understanding of high risk groups, pedestrian activity and road hierarchy

NATURE OF EXPOSURE DATA NEEDED	SUGGESTED TIMING	SUGGESTED REGION	REQUIRED VARIABLES
Survey of pedestrian exposure	Every 3 years	Urban and rural areas of each State and Territory	Pedestrian demographics (age, sex, postcode) pedestrian flow traffic flow time of day/week/month pedestrian behaviour (road crossing) geographic area type of road, road features, level in hierarchy speed zone lighting and weather conditions pedestrian alcohol and drug use
Travel Time Surveys	*Annual survey*	*Urban and rural areas of Victoria*	*Pedestrian flow*
On Road Walking Behaviour Surveys	*Every 5 years*	*All States and Territories in Australia*	*Classification of behaviours by standard variables focus on variables which have some relationship to risk (eg. road crossings, pedestrian characteristics)*

Improved Pedestrian Exposure Data	*Every 3 years*	*Urban and rural areas of Western Australia*	*Pedestrian characteristics and demographics* *road crossing behaviour* *geographic area* *lighting and weather conditions* *road features and speed zone*
Improved data on traffic signs, traffic signals and pedestrian crossings	*Continuous*	*Urban and rural areas of Western Australia*	*As currently collected, but with the addition of data on non-regulatory traffic signs on local roads need to be more selective in what signs are to be covered*
Data on Travel Paths of Visually impaired Pedestrians	*On demand*	*Sydney metropolitan area*	*Streets used* *volumes of pedestrians* *mobility levels*

11b. Pedestrians - ensure needs of pedestrians are recognised in road network & land use

NATURE OF EXPOSURE DATA NEEDED	SUGGESTED TIMING	SUGGESTED REGION	REQUIRED VARIABLES
Details of road environment	Continuous	Each State and Territory	Road environment (type, level in hierarchy) land use traffic flow/volume width of road, median refuges footpath condition number of pedestrian crossings geographic area pedestrian flow speed zone amenity factors

11c. Pedestrians - increase compliance with safe road practices

NATURE OF EXPOSURE DATA NEEDED	SUGGESTED TIMING	SUGGESTED REGION	REQUIRED VARIABLES
Survey of pedestrian behaviour	Every 3 years	Each State and Territory	pedestrian demographics pedestrian activity road crossing behaviour drinking pattern (BAC level) geographic area use of safety measures(conspicuity aids)

12a. Database issues, research methodology and related issues

Improvement in availability & utility of existing mass data on injury & exposure

NATURE OF EXPOSURE DATA NEEDED	SUGGESTED TIMING	SUGGESTED REGION	REQUIRED VARIABLES
Improve vehicle-based data sources	Continuous	Each State and Territory	VIN, make and model size, mass and performance safety options available
Improve data collected on Police Accident Report Forms (Crash Exposure)	Continuous	Each State and Territory	Crash, vehicle and person details compatible for each State and Territory impact severity measures uninjured occupants
Linkage of crash information files with ambulance, hospital and insurance data (Crash Exposure)	Continuous	Each State and Territory	Crash, vehicle and injury details compatible for each State and Territory

Profile of distances driven by drivers (not vehicle-based information)	*One year*	*Urban and rural areas of each State and Territory*	*Driver age and sex* *distance driven (without change of driver)* *time driving commenced* *time driven (without change of driver)* *origin and destination*
Travel Time Surveys	*Annual survey*	*Urban and rural areas of Victoria*	*Driver characteristics, age and sex* *speed behaviour and driver attitudes to speed* *trip purpose* *wearing of child restraints*
Travel Surveys	*Bi-or tri-ennial*	*Urban and rural areas of each State and Territory*	*Annual number of kilometres driven* *age and sex* *separate counts for drivers of cars, vans and heavy vehicles* *other demographic variables (eg. blue/white collar workers)*
Linkage of drivers' driving history/behaviour to accident records	*Continuous*	*Urban and rural areas of Western Australia*	*Age and sex* *nature of driving offences* *number of driving offences* *frequency of driving offences*
Improved Police Accident Report Forms	*Continuous*	*All States and Territories in Australia*	*inclusion of seating position for all drivers and passengers in car whether injured or uninjured* *clarification of definition of injury and severity descriptions* *include non-injured occupants as well as injured occupants by seating position*
Improved Driver Exposure Data	*Every 3 years*	*Urban and rural areas of Western Australia*	*Driver characteristics and demographics* *vehicle type, make, model, size and mass, performance* *speed behaviour & driver attitudes to speed* *seating position* *restraint use* *trip purpose* *fuel consumption* *experience*

National Road Traffic Offence File	*Continuous*	*All States and Territories in Australia*	*Offense type (including drink driving, traffic infringement, non-helmet wearing)* *road user type* *total offences per person for year* *road user demographics*
Travel Time Surveys	*Annual survey*	*Urban and rural areas of Victoria*	*Kilometres driven* *fuel consumption*
Vehicle Model Data - routinely through State Registration Departments	*Continuous*	*All States and Territories in Australia*	*Driver age and sex (demographics)* *vehicle type (eg. car, truck, motorcycle)* *model* *distance travelled by model etc.* ** Need facility to link accident files with registration and licensing files.*
Mass of Vehicles using the road	*Continuous*	*Urban and rural areas of Western Australia*	*Vehicle classification (AUSTROADS classes)* *axle and gross vehicle mass* *speed measurements*
Travel Time Surveys	*Annual survey*	*Urban and rural areas of Victoria*	*Speed zones* *road features* *geographic area* *traffic flow by time of day/week/month* *signage* *intersections*
Traffic Data	*Continuous*	*Urban and rural areas of South Australia*	*Classification mix of AADT (AUSTROADS classification*
Improvement in vehicles kilometres travelled data	*Annual*	*Urban and rural areas of South Australia*	*Separation of metropolitan, country and total vehicle kilometres travelled*

12b. Database issues, research methodology and related issues

Development of more sensitive statistical tools to allow timely countermeasure development.

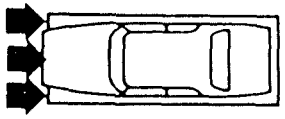
NATURE OF EXPOSURE DATA NEEDED	SUGGESTED TIMING	SUGGESTED REGION	REQUIRED VARIABLES
Improve road environment databases, GIS	continuous	Each State and Territory	A system to recognise hazardous locations promptly to allow countermeasure development

APPENDIX H: Example of TAD Scale of Impact Severity

SEVERITY SCALE

FD

Front End Damage
Distributed Impact

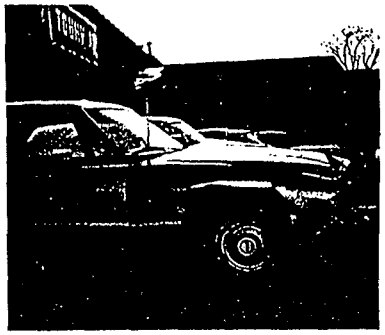


This scale is applicable to damage to front of subject vehicle due to distributed impact resulting from full contact with other vehicle or broad object

Damage Rating

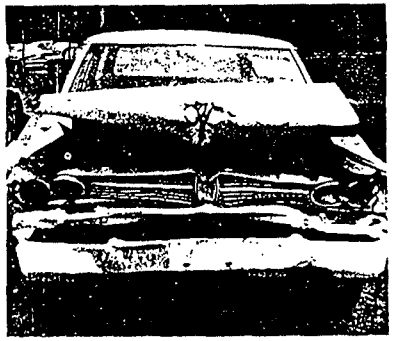
FD

FD-1



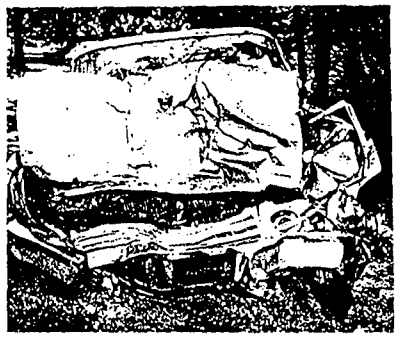
FD-2

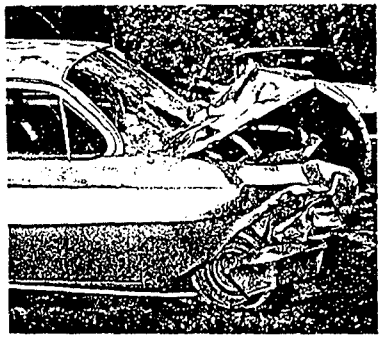
FD-3



FD-4

FD-5





FD-6

FD-7

Page from TAD Scale which Chapel Hill will use. The Scale is published in smaller, compact size for easier use by busy traffic police officers.