DEVELOPMENT OF ROAD SAFETY BEHAVIOUR, TRAVEL AND EXPOSURE SURVEYS IN VICTORIA

by
I. Bobevski
B. Clark
M. Lenné
M. Keall
K Diamantopoulou
M. Cameron

October, 2007
Report No. 269
Development of Road Safety Behaviour, Travel and Exposure Surveys in Victoria

Author(s):
Irene Bobevski, Belinda Clark, Michael Lenné, Michael Keall, Kathy Diamantopoulou & Max Cameron

Sponsoring Organisation(s):
This project was funded through the Centre’s Baseline Research Program for which grants have been received from:
Department of Justice  Roads Corporation (VicRoads)
Royal Automobile Club of Victoria (RACV)  Transport Accident Commission

Abstract:
This report documents a three stage project commissioned by the Baseline Committee, which commenced in mid 2002. The overall aim of this three-stage project was to explore existing data collection systems in Victoria that collect behaviour, travel and exposure data, identify gaps in these data collection systems and recommend collection measures to complement the existing data collection surveys. On-road behaviour is a key variable in road safety research for both the design and evaluation of road safety initiatives. This type of data traditionally utilises observational collection methods. Exposure data is traditionally measured using travel surveys and is vital in road safety research as it provides an accurate measure of risk exposure.

The research findings are reported in three stages, each stage evolved from the findings and recommendations of the previous stage. The aims of each stage of this research program were as follows:

- **Stage 1** - Review current collection of behaviour, travel and exposure data in Victoria and relevant literature and experiences from other regions;
- **Stage 2** - Prepare a survey design and implementation plan for collection of behaviour, travel and exposure data in Victoria; and
- **Stage 3** - Facilitate a Behaviour, Travel and Exposure Forum with key stakeholders regarding a collaborative approach to data collection and to establish MUARC’s future role in this area.

The Stage 1 section of this report is a review of the current data collections and surveys conducted within Victoria that identify behaviour, travel and exposure patterns. This review identified a current lack of systematic collection of this type of data within Victoria. Following this, in Stage 2 the follow issue were explored: identify the essential data to be collected; identify what essential data is not currently collected; propose methodologically sound data collection methods for this data collection; and provide estimates of the cost associated with collection of this data. While exploring these issues it was discovered that the Department of Infrastructure (DOI) were in the process of designing and implementing a travel and exposure survey in the Melbourne Statistical Division and that VicRoads was exploring the collection of comparable data in rural Victoria. Stage three of this report documents the resulting Behaviour, Travel and Exposure Forum conducted by MUARC bringing together these key stakeholders. This includes an umbrella framework designed by MUARC and presented at the forum that outlines a data collection strategy for collaborative Victoria wide behaviour, travel and exposure data collection by DOI, VicRoads and MUARC.

Following on from the detailed background work conducted in earlier stages, one of the major successes arising from this research has been the agreement reached by all stakeholders on the value of a collaborative approach to the collection of behaviour, travel and exposure data, and the agreement of an optimal sampling methodology. MUARC’s role in this collaborative approach will assist in providing a more complete landscape for the collection of behaviour, travel and exposure data in Victoria.

Key Words:  
Travel survey; observational survey; behavioural survey; on-road survey

Reproduction of this page is authorised.
Preface

Project Manager / Team Leader:

Dr Max Cameron

Research Team:

• Dr Irene Bobevski
• Ms Belinda Clark
• Dr Michael Lenné
• Dr Michael Keall
• Ms Kathy Diamantopoulou

Acknowledgements:

The authors wish to acknowledge and thank Pat Rogerson from VicRoads and Fotios Spiridonos from the Department of Infrastructure for their valuable assistance.
## Contents

**EXECUTIVE SUMMARY**.........................................................................................................................XIII

1 **INTRODUCTION** .................................................................................................................................1
  1.1 **BACKGROUND** ...............................................................................................................................1
  1.2 **AIMS OF THE STUDY** ......................................................................................................................3

2 **STAGE ONE** ........................................................................................................................................5
  2.1 **BACKGROUND** ...............................................................................................................................5
  2.2 **AIMS OF STAGE 1** ...........................................................................................................................5

3 **EXPOSURE DATA** ................................................................................................................................7
  3.1 **ISSUES IN MEASURING EXPOSURE TO RISK** ............................................................................7
  3.2 **DEFINITIONS OF RISK AND EXPOSURE** .................................................................................7
  3.3 **MEASURING EXPOSURE** ................................................................................................................8
    3.3.1 Aggregated Measures of Exposure .................................................................................................8
    3.3.2 Distance Travelled as a Measure of Exposure ...............................................................................9
    3.3.3 Some Disaggregate Approaches to Measuring Exposure: trip-kilometres ....................................9
    3.3.4 Time Spent Travelling as a Measure of Exposure ......................................................................10
    3.3.5 Situational Conflicts as a Measure of Exposure .........................................................................10
    3.3.6 Traffic Volumes ............................................................................................................................11
    3.3.7 Pedestrian and Bicyclist Exposure ..............................................................................................11

4 **BEHAVIOUR, TRAVEL AND EXPOSURE DATA** ..............................................................................13
  4.1 **METHODOLOGIES OF COLLECTING BEHAVIOURAL, TRAVEL, AND EXPOSURE DATA** ..........13
  4.2 **OBSERVATIONAL SURVEYS** .........................................................................................................13
  4.3 **SELF-REPORT SURVEYS** ...............................................................................................................14
    4.3.1 Face-to-face interviews ...............................................................................................................15
    4.3.2 Mail surveys ................................................................................................................................15
    4.3.3 Combination of mail surveys and brief interviews ....................................................................15
    4.3.4 Telephone surveys .......................................................................................................................15
    4.3.5 Combination of telephone and mail surveys .............................................................................16
  4.4 **CASE-CONTROL STUDIES** .............................................................................................................16

5 **SUMMARY OF EXISTING TRAVEL AND EXPOSURE SURVEYS IN VICTORIA** .....................17
  5.1 **OBSERVATIONAL SURVEYS** .........................................................................................................17
    5.1.1 The Melbourne On-Road Exposure Surveys (MORES) ..............................................................17
    5.1.2 An Observational Study in Melbourne in 2001 (Whelan, Diamantopoulou, & Senserick, & Cameron, 2003) .................................................................................................................................19
    5.1.3 An Observational Study of Mobile Phone Use Among Melbourne Drivers (Taylor, Bennett, Crater & Garewal, 2003) ..................................................................................................................20
    5.1.4 An Observational Study of Child Pedestrians And Cyclists (Drummond & Ozanne-Smith, 1991) .................................................................20
    5.1.5 An Observational Study of Bicycle Use and the Influence of the Helmet Wearing Law in Melbourne from 1987 to 1992 (Finch, Heiman, & Neiger, 1993) .........................................................21
    5.1.6 An Observational Study of Road and Footpath Cycling (Drummond & Jee, 1988) .................22
    5.1.7 An Observational Study of Bicycle Helmet Wearing (Kerryn Alexander, 1999) .................22
5.2 SELF-REPORT SURVEYS ................................................................. 23
  5.2.1 The Victorian Activity and Travel Survey (VATS) ................. 23
  5.2.2 The New Zealand Travel Survey ........................................ 24
5.3 ON-Road MONITOrING ................................................................. 24
  5.3.1 Speed Measurements on Metropolitan Freeways .................. 25
  5.3.2 Metropolitan Speed Zone Indicators .................................. 25
  5.3.3 Rural Speed Data ............................................................... 25
  5.3.4 School Speed Zones .......................................................... 25
  5.3.5 Traffic Volume Data at Traffic Lights ............................... 25
  5.3.6 Ozlink Project ................................................................. 25
5.4 RANDOM BREATH TESTS .............................................................. 26
5.5 RELEVAnt POPuLATION SURVEYS ................................................ 26
  5.5.1 ABS Survey of Motor Vehicle Usage .................................. 26
  5.5.2 Australian Bureau of Statistics (ABS) Census: Journey to Work Information .... 26
  5.5.3 Deliveries of Fuel to Selling Points .................................. 26
5.6 CASE CONTROL STUDIES ............................................................ 27
  5.6.1 A Case-Control Study of Motorcycle Crashes in Melbourne (Haworth, Smith, Brumen, & Pronk, 1997) ................. 27
  5.6.2 A Case-Control Study of the Contribution of Alcohol Consumption to Pedestrian Accidents (Struick & Rogerson, 1988): Pedestrian Accident Project ................. 27
6 RECOMMENDATIONS ................................................................. 29
  6.1 PROPOSAL FOR STAGE 2 OF THE BEHAVIOURAL, TRAVEL, AND EXPOSURE SURVEYS PROJECT: SURVEYS DESIGN ................. 29
  6.2 RECOMMENDATIONS FOR SELF-REPORT SURVEYS ................... 30
  6.3 RECOMMENDATIONS FOR OBSERVATIONAL SURVEYS ............... 31
  6.4 RECOMMENDATIONS FOR CASE CONTROL STUDIES ............... 32
  6.5 PROJECTION FOR FUTURE YEARS ........................................... 32
7 STAGE TWO ................................................................. 33
  7.1 BACKGROUND ................................................................. 33
  7.2 AIMS OF STAGE 2 ............................................................... 33
8 DESIGN OF A HOUSEHOLD INTERVIEW TRAVEL SURVEY ................. 35
  8.1 AIM OF THE HOUSEHOLD INTERVIEW TRAVEL SURVEY ............... 35
  8.2 VARIABLES TO BE COLLECTED IN THE SURVEY ................. 35
    8.2.1 Demographics of each person in the household: ............... 35
    8.2.2 Exact address of work (for main job)/educational institution attended ............... 35
    8.2.3 Travel: Day 1 & 2 (from 4am day1 to 4am day2) ............... 35
    8.2.4 Alcohol ................................................................. 36
    8.2.5 Accidents ............................................................... 36
  8.3 TARGET POPULATION ........................................................ 36
    8.3.1 Sampling Units ......................................................... 36
    8.3.2 Sampling Frame ......................................................... 36
    8.3.3 Sampling Methods ..................................................... 36
    8.3.4 Sample Size ............................................................ 38
  8.4 DATA COLLECTION ........................................................... 39
    8.4.1 Procedure ............................................................... 39
    8.4.2 Frequency of Data Collection ...................................... 40
8.5 DATA BENEFITS RESULTING FROM THE HOUSEHOLD SURVEY ................................. 40

9 DESIGN OF THE OBSERVATIONAL SURVEY OF MOTOR VEHICLES ...................... 41
  9.1 AIMS OF THE OBSERVATIONAL SURVEY .............................................................. 41
  9.2 BEHAVIOURS TO BE OBSERVED IN THE SURVEY ............................................. 41
  9.3 TARGET POPULATION ......................................................................................... 43
    9.3.1 Sampling Units ......................................................................................... 43
    9.3.2 Sampling Frame ....................................................................................... 43
  9.4 OBSERVATION TIME SCHEDULE ....................................................................... 43
  9.5 OBSERVATION METHODOLOGY ....................................................................... 43
  9.6 DATA BENEFITS RESULTING FROM THE HOUSEHOLD SURVEY ....................... 44

10 RECOMMENDATIONS ........................................................................................... 45
  10.1 COLLABORATION OPPORTUNITIES .................................................................. 45
  10.2 AGENCIES WITH INTERESTS IN TRAVEL DATA ............................................ 45
  10.3 PROPOSAL FOR STAGE 3 OF THE BEHAVIOURAL, TRAVEL AND EXPOSURE SURVEYS PROJECT: DEVELOPMENT OF AN UMBRELLA FRAMEWORK FOR BEHAVIOUR, TRAVEL AND EXPOSURE SURVEYS IN VICTORIA ............................................ 46

11 STAGE THREE ..................................................................................................... 47
  11.1 BACKGROUND .................................................................................................. 47
  11.2 AIMS OF STAGE 3 ............................................................................................ 47

12 DEVELOPMENT OF AN UMBRELLA FRAMEWORK .............................................. 49
  12.1 DIMENSIONS OF TRAVEL .............................................................................. 49

13 BEHAVIOUR, TRAVEL AND EXPOSURE FORUM .................................................. 51
  13.1 FORUM ORGANISATION .................................................................................. 51
  13.2 FORUM GUEST SPEAKERS SUMMARY ......................................................... 51
    13.2.1 Welcome – Dr. Michael Lenné ................................................................. 51
    13.2.2 Introduction – Dr Max Cameron ............................................................... 51
    13.2.3 Department of Infrastructure VISTA 07 Survey – Mr Fotios Spiridonos ......... 52
    13.2.4 Discussion of VicRoads Rural and Motorcycle Surveys ............................... 53
    13.2.5 Behaviour, travel and exposure Methodologies and Analysis – Dr Michael Keall .... 54
  13.3 ROUND TABLE DISCUSSION ......................................................................... 55
    13.3.1 Summary of main discussion ..................................................................... 55
    13.3.2 Summary of discussion regarding MUARCs future role ............................ 58
  13.4 KEY OUTCOMES OF FORUM ......................................................................... 60
    13.4.1 Collaboration ............................................................................................ 60
    13.4.2 Sampling Methodology ........................................................................... 60

14 RECOMMENDATIONS .......................................................................................... 63
  14.1 BACKGROUND .................................................................................................. 63
  14.2 PROPOSAL FOR ON-ROAD DRIVER ALCOHOL AND DRUG SURVEY PROGRAM IN MELBOURNE ............................................................... 64
  14.3 PROPOSAL FOR ROADSIDE VEHICLE OBSERVATION STUDY ...................... 65
Figures

FIGURE 1.1: NEW ZEALAND ADVERTISING AND ENFORCEMENT EFFORT TOGETHER WITH INTERMEDIATE
OUTCOME MEASURED BY SURVEYS OF DRIVER ALCOHOL USE..................................................................1
FIGURE 1.2: NEW ZEALAND RISK OF CRASH INVOLVEMENT PER KM DRIVEN BY AGE OF MALE AND FEMALE
DRIVERS DRIVING AT NIGHT ON MAIN URBAN ROADS (FROM KEALL AND FRITH, 2004). ............................2
FIGURE 13.1: CONCEPTUAL POPULATION OF TRAVEL IN VICTORIA ..................................................................52
FIGURE 13.2: DIMENSIONS OF TRAVEL........................................................................................................54
FIGURE 13.3: UMBRELLA FRAMEWORK SAMPLING APPROACH.......................................................................56

Tables

TABLE 6.1: COSTING FOR DIFFERENT OPTIONS FOR REGULAR SURVEYS.................................................................31
TABLE 6.2: PROJECTION OF SURVEY PROGRAMS COSTS FROM 2005 TO 2009.........................................................32
TABLE 8.1: SAMPLING ERROR FOR VARIOUS SAMPLE SIZES ESTIMATED AS A PERCENTAGE ERROR PER TOTAL
KILOMETRES TRAVELLED WITH A 95% CONFIDENCE LEVEL........................................................................39
TABLE 12.1: DIMENSIONS OF TRAVEL AND POTENTIAL MEASUREMENT INSTRUMENTS..........................................50
EXECUTIVE SUMMARY

For over five years MUARC has been conducting a series of studies that have focussed on the behaviour, travel and exposure data needs of the Victorian stakeholders. This fundamental methodological research, funded by the Baseline Research Program, is a three stage project that commenced in mid-2002. The aim of this report is to draw together all of the work conducted under this research program over the previous five years and to present proposals for MUARC to conduct observational surveys in line with the interests of the baseline sponsors.

The three distinct stages of this research program are as follows:

- **Stage 1** - Review current collection of behaviour, travel and exposure data in Victoria and relevant literature and experiences from other regions;
- **Stage 2** - Prepare a survey design and implementation plan for collection of behaviour, travel and exposure data in Victoria; and
- **Stage 3** - Facilitate a Behaviour, travel and exposure Forum with key stakeholders regarding a collaborative approach to data collection and to establish MUARC’s future role in this area.

Stage 1 of the research program outlined the importance of regular measurements of on-road behaviours and exposure to risk for the advancement of road safety. A review of existing travel surveys and other relevant data was provided with the conclusion that Victoria was lacking in an integrated and representative program that can provide accurate behavioural and exposure measurements. A future survey program was recommended to collect behavioural, travel, and exposure data across a number of road safety priority areas.

The recommendations derived in Stage 1 were based on a methodology of conducting ongoing smaller scale self-report surveys, by interviewing household members, with less frequent observational surveys carried out every several years to calibrate the results of the self-report surveys. This model was based on the travel surveys program that was successfully implemented in New Zealand to the benefit of several different road safety organisations in that country. It was then proposed that the observational survey be designed as an extension of the MUARC benchmarking survey which was carried out in 2001 (Establishing a benchmark for safety on Melbourne roads during 2001, Whelan, Diamantopoulou, Senserrick & Cameron, 2003), and that the household interview survey be modelled on the New Zealand household interview survey and on the VATS mail surveys that were carried out in Victoria. A report on this stage of the research program was delivered to the baseline sponsors in [insert date].

Stage 2 of the project focussed on the development of a design for both household interview surveys and observational surveys and derived recommendations for the implementation of the surveys. In addition to presenting the templates for the various data collection forms, this report presented considerable detail about how the household and observational surveys should be structured and conducted and included discussion under the following headings: what data should be collected; the target population; sampling units, frame and methodology; data collection procedures; sample size estimates; frequency of data collection; the benefits of having these data; and an implementation plan.

In addition the presenting the surveys and methodology, the stage 2 report presented a number of recommendations, the most critical being that MUARC attempt to collaborate
with other parties active in this area of research, particularly the Department of Infrastructure (DOI) and VicRoads. The stage 2 report (Survey design and implementation plan) was submitted to the baseline sponsors in May 2006. The benefits of pooling resources and working collaboratively were discussed by the PAC and acknowledged by all parties. The feasibility of such an approach, and a mechanism for achieving it, became the focus of the third stage of this research program.

Stage 3 of the research, conducted during the second half of 2006, began from the agreed platform that it was desirable for MUARC to collaborate with DOI, VicRoads and other bodies such as VMAC who were planning travel/exposure surveys of various types. An important aim noted for MUARC was to assist and influence these organisations to design their surveys in ways that would contribute to overall objective of MUARC’s baseline-funded research.

The first task here was to define the umbrella concept of total land transport travel/exposure in Victoria per annum, under which each of the planned travel/exposure surveys could be considered to lie. The conceptual population would be each of the kilometres of out-of-house surface travel by persons in Victoria, whether by foot, bicycle, motorcycle, motor vehicle or railed public transport, on each of the days of the year, and for each of the years in future.

The second task, and the key process in Stage 3, was the convening by MUARC of a forum to outline this umbrella concept and to persuade the travel/exposure survey organisers to position their planned surveys as sub-sets of the conceptual population. The advantages of being able to see their survey results in the context of total travel, and make appropriate adjustments to ensure representativeness, was explained in addition to suggested modifications to their surveys to improve the overall data collection landscape. The forum was a great success, with some of the key outcomes from the forum including the attainment of the following: roundtable support for a collaborative approach whereby VicRoads and DOI would use a similar data collection tool; roundtable agreement that household surveying, across 365 days of the year, was the optimal method for collection high quality travel/exposure data (with the exception of behavioural data); and agreement of MUARC’s future role through both involvement in the DOI project steering group and through the direction and collection of the observational data.

The MUARC project team subsequently developed a number of proposals to conduct observational surveys in line with the recommendations arising from the forum. It is proposed that the first of the behavioural surveys recommended under this project be an on-road driver alcohol and drug survey program in Melbourne. This Project is recommended to be conducted by MUARC due to its timely ability to complement a current traffic enforcement monitoring and strategy plan for Region 1, being developed by MUARC in collaboration with the Victorian Police. MUARC has been commissioned to develop a traffic enforcement plan, including an evaluation of potential major drink-driving initiatives for Region 1, Melbourne during 2007. Earlier work by MUARC comparing the five Regions has shown that RBT is most effective in Region 1 compared with the other regions, presumably because drink-driving is more of an issue in that region. The surveying of both BAC levels and drug levels is proposed because of the potential substitution effect when drivers feel threatened by increased RBT. In addition to supporting the planned Region 1 study, there is also the potential for the collection of drug use data to provide valuable insights that would complement the outputs from the current Baseline funded drugs in crashes study and could also have implications for random drug testing strategies.
At the conclusion of stage 3 it was deemed timely to present a synthesis of all of the work conducted by MUARC under this five year research program. Following on from the detailed background work conducted in earlier stages, one of the major successes arising from this research has been the agreement reached by all stakeholders on the value of a collaborative approach to the collection of travel and exposure data, and the agreement of an optimal sampling methodology. The proposals for further MUARC work in this area are entirely consistent with MUARC’s agreed role in the collaborative approach to provide a more complete landscape for the collection of travel and exposure data in Victoria.
1 INTRODUCTION

1.1 BACKGROUND

Regular measurements of specific on-road behaviours related to road trauma risk have the potential to provide indications to road safety organisations of the effectiveness of current road safety initiatives, as well as how to best formulate future programs to target at-risk behaviours and road user groups.

There are several uses of such surveys that are available in other jurisdictions that collect these data, but are not available in Victoria. These include:

1. Road safety strategy formulation including the setting of targets for intermediate outcomes (speed, alcohol use by drivers, helmet wearing etc.)
2. Monitoring of these targets over time.
3. Monitoring of Police performance by geographical areas to measure the success of Police enforcement activity, which are not able to be measured in terms of crash data. For example, vehicle speeds and driver alcohol use can be monitored at the Police district level. Figure 1.1 shows a graph using New Zealand data that tracks enforcement and advertising effort alongside the intermediate measure of drivers over the legal limit.

4. Identifying likely mobility impacts of road safety measures e.g., implications of changes in licensing regimes for younger drivers.
5. Assessing Victorian risk on certain types of road under given conditions. An example derived from New Zealand data, collected from a large-scale survey of household travel, shows the risk curve by age of male and female drivers driving at night on main urban roads (Figure 1.2). This clearly indicates that there is a nighttime problem of high-risk young male drivers in New Zealand.
Figure 1.2: New Zealand risk of crash involvement per km driven by age of male and female drivers driving at night on main urban roads (from Keall and Frith, 2004).

While there has been considerable emphasis on evaluation of Victoria’s road safety initiatives in terms of reported crashes, in many cases it has not been clear whether the targeted behaviour has really changed or whether some other factor is responsible. As shown in the examples above, regular measurements of on-road behaviours can greatly enhance road safety evaluations by allowing stronger conclusions to be reached about the effectiveness of each initiative.

A dominant factor explaining fluctuations in crash frequencies on Victoria’s roads is the amount of road use or the exposure to risk. The exposure survey program aims to develop survey techniques that would allow driver exposure surveys to be conducted more frequently allowing changes over time to be monitored. An example of a successfully implemented behavioural and exposure survey is the ongoing household survey conducted by the (former) Land Transport Safety Authority and then the Ministry of Transport in New Zealand since 2002. Prior to this ongoing survey, one-off annual surveys were conducted in 1978, 1989 and 1997. This survey obtains highly detailed travel and behaviour data from a representative national sample through personal interviews and a logbook (or travel diary) with high response rates. The results of the household survey have been compared to other large scale observational surveys and have been found to be reliable. The ongoing household survey has provided the New Zealand government with an excellent understanding of the performance of their safety programs and has provided the basis for road safety formulation and monitoring (National Road Safety Committee, 2003). The New Zealand program enables the provision of regular reports to the New Zealand Police, the Ministry of Transport, and other government organisations. These reports assist in the evaluation and planning of road safety initiatives, as well as in transport and road planning, including the development of safe cycling and pedestrian networks.

In Victoria, six large observational surveys have been conducted since 1984 to estimate driving exposure, the most recent in 2001 (e.g. Drummond, 2003a). Some observational surveys were also conducted in the 1990s to measure bicyclist and pedestrian exposure, such as Drummond and Ozanne-Smith (1991) and Drummond and Jee (1988). The Victorian Activities and Travel Survey (VATS), a more detailed household survey that utilised a self-reported travel behaviour logbook was conducted yearly from 1994 to 2002.
by the former RMIT Transport Research Centre. The VATS collected data from 5000 households each year. This survey has now stopped, although the Department of Sustainability and Environment is now planning a new survey to replace the VATS. However, at present this appears to be at a preliminary planning stage and it is envisioned that any new self-report surveys may be carried out every two or three years rather than yearly due to budgetary constraints (personal communication with the Department of Sustainability and Environment). Also, at present a variety of speed and vehicle count data is collected by VicRoads, mainly for planning reasons. However, most of these data are not designed to be representative of exposure to risk and are limited to a very small number of variables, such as speed and vehicle counts. Thus, at present no integrated and representative program exists in Victoria to provide accurate behavioural and exposure measurements.

1.2 AIMS OF THE STUDY

This Fundamental Methodological Research Study, which is funded by the Baseline Research Program, is a 3 phase project that commenced in mid 2002.

The three stages of the project are:

Stage 1

Review current data collection of behaviour, travel and exposure data in Victoria and relevant literature and experiences from other regions. Make recommendations for second phase of this project.

Stage 2

Prepare a survey design and implementation plan for collection of behaviour, travel and exposure data in Victoria (recommendations from Stage 1).

Stage 3

Facilitate a Behaviour, travel and exposure Forum with interest groups regarding collaborative data collection. Explore what data will not be addressed in this collaborative collection and make recommendations to sponsors regarding MUARC collecting this data (recommendation from Stage 2).
2 STAGE ONE

2.1 BACKGROUND

The Stage 1 section of this report provides a review of issues in measuring road users’ exposure to crashes, followed by a summary of methodologies of behavioural, travel, and exposure surveys, as well as the existing research in Victoria. The ongoing survey program in New Zealand is also discussed as an example of a successful program. Finally, recommendations are made about future methodologies and surveys in Victoria and for the second phase of the present project.

2.2 AIMS OF STAGE 1

The first phase of this project aimed to:

- Collate as many details as possible regarding what behavioural, travel, and exposure data is being collected, how, and by whom
- Update the 1994 review by Cameron & Oxley on exposure methodology
- Investigate cost-effective methods of combining small-scale interview or questionnaire surveys with large scale observational surveys
- Investigate the feasibility of integrating special surveys of pedestrian and bicyclist exposure and behaviour into the motor vehicles surveys
- Propose a behavioural survey program and a travel and exposure survey program

This project aimed to focus on the following road safety areas:

- road users mode of travel (e.g. motorised, bicycle, pedestrian), including number of trips per week, weekend versus weekday travel, time of day travel, and road user demographics
- driver and rider exposure
- drink-driving
- use of hand-held mobile phones while driving
- pedestrian exposure on road crossings and use of bicycle paths
- pedestrian behaviours at road crossings
- bicyclist exposure on roads, road crossings and use of bicycle paths
- bicyclists behaviour on road crossings
- helmet usage and whether the reduction in teenage cycling associated with the introduction of compulsory helmet wearing still persists
3 EXPOSURE DATA

3.1 ISSUES IN MEASURING EXPOSURE TO RISK

It is important to understand and consider the issues associated with measuring exposure, as this would play a role in how surveys are planned to collect exposure data. Studies of road users' exposure to crashes can answer questions about which travel activities, sites, times, and demographic groups are most risky. Answers to such questions are imperative in enhancing road safety by indicating what problem areas need to be targeted. In addition to studying crashes, it is also important to gain an understanding of how road users not involved in crashes behave, because when this data is combined with comparable crash data it enables a better understanding of high risk behaviours. The use of exposure data in policy formulation can also assist in determining the appropriate remedial strategy. For example, a low risk behaviour may result in a high number of crashes because of high exposure, whereas a high risk behaviour with low exposure can result in fewer crashes. Therefore the two behaviours may need to be dealt with in different ways, as the low risk behaviour has less impact on overall road trauma. Moreover, without the use of exposure information, some high risk but low exposure behaviours may never be brought to the attention of road safety program developers, even though they may represent a real problem and the chances of being able to intervene successfully may be high (Drummond & Ozanne-Smith, 1991).

3.2 DEFINITIONS OF RISK AND EXPOSURE

In the field of road safety, often risk is estimated as a way of quantifying the level of road safety (Hakkert & Braimaster, 2002). Risk can be defined as the probability of a crash occurring (Hauer, 1982). The risk of a crash occurring can be estimated by dividing the number of crashes by the road users' exposure to opportunities for crashes. Thus, exposure can be defined as a measure of the number of opportunities for crashes or injuries to occur (Cameron & Oxley, 1994).

Therefore, in order to estimate the risk of a crash, it is necessary to obtain both a measure of exposure of motorists, pedestrians, or bicyclists to crashes, or exposure to risk, as well as a measure of the frequency of crashes. A distinction can be made between pre-crash exposure (i.e. to the risk of crash occurrence) and crash exposure (exposure to the risk of injury or death, given that a crash has occurred) (Cameron & Oxley, 1994). Similarly a distinction can be made between the risk of a crash occurring and the risk of an injury occurring (Hakkert & Braimaster, 2002). Based on the above definitions, countermeasures to improve road safety can come from activities along any one of these dimensions: that is, from measures to reduce exposure, measures to reduce risk to a crash, and measures to reduce the risk to an injury or death once a crash has occurred (Hakkert & Braimaster, 2002).

However, the definition of exposure, and therefore the way that exposure is measured, can vary depending on the particular type of risk which is of interest and on the type of road safety study conducted. Some examples of factors to consider in measuring exposure are: type of road and environmental conditions at particular sites (site exposure); number of crash opportunities a particular driver experiences as they drive around the road network (driver exposure); also distance travelled, time of day/year, speed, density of traffic, number of traffic conflicts, and traffic flow (Cameron & Oxley, 1994). Cameron and Oxley suggest that exposure measurements may need to be estimated on the basis of two different
frameworks (e.g. Hodge, 1983). Firstly measurements of site exposure may need to be estimated, relating to type of road network, road conditions, environmental conditions, and road geometry. Secondly, driver exposure measurements should be estimated, such as the number of crash opportunities a particular driver experiences under defined road and environmental conditions of the road network. Further, exposure measures applied to various groups of road users, such as drivers, motorcyclists, bicyclists, and pedestrians need to be considered (Cameron & Oxley, 1994). Often the required information of a specific type of exposure for a specific group or situation may not be available or very difficult and costly to obtain and may have to be imputed or estimated from surrogate measures. Thus, the definition of exposure has often presented a major problem in measuring risk in road safety studies (Haight, 1986), because of difficulties both of obtaining and comparing exposure measures that are not compatible.

3.3 MEASURING EXPOSURE

The use of common measures of exposure enables the risks of different driving situations and of different driver groups to be compared (Wolfe, 1982). An ideal exposure measure should have the characteristic that the estimated risk should not change given different amounts of the same type of exposure. For instance, an exposure measure that does not discriminate between night and day driving is not ideal for comparing younger versus older drivers, the risk of the younger drivers will be overestimated since they have more high risk exposure at night (Keall, 2005).

Exposure is often quantified as amount of travel, such as distance travelled or hours of travel, but sometimes other measures, such as the number of interaction or conflicting situations at an intersection. What should serve as a “correct” measure of exposure will depend mainly on the intended use (Hakkert & Braimaister, 2002). A summary of widely used exposure measures and their advantages and disadvantages, as well as appropriateness of use in different situations, is presented below.

3.3.1 Aggregated Measures of Exposure

Because it is more difficult and costly to obtain detailed measures of particular travel groups or types of roads, readily available aggregated measures of exposure, such as total population, the number of registered vehicles, fuel sales, and the number of registered drivers are often used as a rough overall indicator of exposure. Unfortunately these most easily obtained exposure measures are often recognised as poor surrogates for estimating crash risk (Wolfe, 1982). The disadvantage of such aggregated measures is that it is not possible to estimate the risks for specific groups of road users or for specific situations. For example, when such exposure measures are used to produce crash risks for different age groups, they almost always show a considerable over involvement of younger drivers in crashes relative to their numbers in the licensed population. However, it is not possible to deduce whether this over involvement is primarily a result of highly risky driving behaviour or primarily a result of above average distances travelled, or increased driving in risky conditions (Wolfe, 1982). Hakkert and Braimaister (2002) point out that aggregate exposure measures are only useful in obtaining a very coarse picture of the safety situation. Furthermore, these aggregated exposure measures are usually not even available for pedestrians and bicyclists. For studies relating to specific research questions more detailed exposure data is required, such as the data obtained from travel surveys.
3.3.2 Distance Travelled as a Measure of Exposure

The most frequently used exposure measure is distance travelled, measured as number of vehicle kilometres travelled. This measure has enabled many meaningful comparisons to be made between the risks of different driver groups and driving situations (Wolfe, 1982). Distance travelled is particularly useful in allowing disaggregations of travel to be made: e.g. by road type, traffic conditions, or demographic groups. Some limitations of distance travelled as an exposure measure have been identified by Janke (1991). According to Janke, this measure tends to exaggerate the apparent risk of low mileage groups, such as teenagers and the elderly. Thus, Janke suggests that the relationship between distance travelled and crashes does not appear to be linear. Janke further suggests that people driving shorter distances tend to drive mostly on more congested city streets with more conflict opportunities, whereas longer distance drivers tend to spend more time on highways and freeways where driving is simpler and therefore the crash rate lower. Further problems can occur with using distance travelled as a measure of exposure if drivers are aggregated by age and sex and then the average risks per distance travelled are estimated. Also, there is the potential problem that the mean risk for the whole group will not adequately represent a typical member of the group (Hakamies-Blomqvist, Johansson & Lundberg, 1998).

The above issues are discussed in more detail by Keall (2005): some of these problems can be overcome by disaggregating risk through separating out different demographic and environmental factors, such as sex, age, different times of day, road types, and road conditions. Despite some shortfalls of distance driven as an exposure measure, road safety researchers often recommend this measure because of its statistical convenience, especially if disaggregation of travel (as described above) can be achieved (e.g., Risk & Shaoul, 1982).

3.3.3 Some Disaggregate Approaches to Measuring Exposure: trip-kilometres

As was pointed out above, it is often important to disaggregate exposure data to more accurately estimate risks for different groups of road users and for different situations.

Kam (2003) has proposed a disaggregate approach to crash rate analysis based on the use of a Geographic Information System (GIS) to relate crash records to travel data collected via the VATS surveys. Kam based this approach on the premise that a crash has to be understood as the interaction of three sets of environmental factors: the internal car environment; the external physical environment; and the dynamic road traffic environment. Each trip is unique in respect to these three factors. Thus, Kam proposed a measure predicated on the “number of crashes per trip-kilometre” instead of the conventional “number of crashes per kilometre”. Using the GIS, Kam linked a map layer of travel routes derived from the 1994-1997 Victorian Activity and Travel Survey (VATS) to a map layer showing crash locations from the Victorian accident database (CrashStat).

The derivation of a crash rate or a crash risk exposure measure using the GIS comprised four major tasks. Firstly, the travel path of each trip from the VATS data was generated with the GIS. This was possible as in the VATS surveys respondents were asked to state the address of each origin and destination of their trips. Secondly, a travel corridor was derived for each travel path, centred on the alignment of the travel path.
Thirdly, the corresponding records of crashes falling within the boundaries of each defined travel corridor and in which persons of comparable demographic characteristics were involved were extracted. Finally, the crash rates for each of the defined travel corridors were computed.

The results showed a different pattern from analysis of the same data based on per unit travel distance, rather than on disaggregating the data by kilometres travelled by trip. While the more traditional method of analysis indicated that drivers below 21 and above 70 years of age had the highest crash rates, the disaggregated analysis suggested that persons in their 20s had a higher crash rate than those under 21 (even though the latter group were also among the riskier groups). The disaggregate analysis also showed that drivers above 70 were less risky than the conventional analysis revealed. In most instances the crash rates of the older drivers were comparable to those in their late 30s and early 40s.

Although Kam (2003) does not claim his disaggregate analysis to be necessarily the “true” picture, he emphasises the importance of choosing appropriate exposure measures depending on the population group studied, as different exposure measures can produce different results. This can have important implications for planning and policy making (Kam, 2003). This study also demonstrates that a variety of exposure measures can be derived from a self-report diary survey, such as the VATS that can be used to calculate risks for different socio-demographic groups and for different situations. Some of the unusual patterns identified by Kam may also be an artefact of non-response bias. For example, older people are often more willing and available as respondents, leading to higher reported travel for this group, particularly with the low response rates of mail-back questionnaires (discussed further below).

3.3.4 Time Spent Travelling as a Measure of Exposure

Some road safety researchers have suggested that exposure should be quantified as time spent travelling (e.g. European Transport Safety Council, 1999), to reflect better the number of crash opportunities encountered by a driver. Since the speeds for various modes of transport (walking, cycling, motor vehicles) are widely different, it has been suggested to normalise exposure by multiplying vehicle kilometres travelled by speed (Hakkert & Braimaister, 2002). However, time spent driving has been used relatively rarely in the road safety field, as Keall (2005) has pointed out. Even proponents of travel time as an exposure measure, such as Chipman, MacGregor, Smiley and Lee-Gosselin (1993), have acknowledge that a time-based exposure measure leads to the paradoxical conclusion that driving at higher speeds (with lower defined exposure in terms of time driving) leads to fewer crashes, contrary to research on the relationship between speed and crash risk.

3.3.5 Situational Conflicts as a Measure of Exposure

The study of traffic conflicts or near misses at specific locations, such as intersections, has sometimes been used as a proxy of crashes, when at a specific location the number of crashes is very small and subject to large chance variations (Hakkert & Braimaister, 2002). By using conflicts and near misses as a proxy for crashes, statistically reliable estimates can be obtained within relatively short periods of time (Hauer, 1982). In the study of traffic conflicts, exposure is usually measured as traffic flow or volume through the studied location. At intersections it is more difficult to decide on appropriate measures of exposure. Usually some combination of the traffic flows on the intersecting roads is used, such as the sum or the combined daily traffic volumes, sometimes subdivided into separate turning movements. The study of traffic conflicts has been applied to both pedestrian and
motor vehicle safety. A major disadvantage of the study of situational conflicts is its high cost. But it may be becoming increasingly feasible with the advances of automated observation methods, such as video observation and pattern recognition, which are already applied in systems of incidence detection on some motorways around the world (Hakkert & Braimaister, 2002). Another difficulty with the study of conflicts is that it is not always clear how to define "conflicts" (e.g. Hauer, 1982).

3.3.6 Traffic Volumes

Traffic volumes have often been used as an exposure measures on stretches of roads. However, such studies have utilised different approaches to estimate crash exposure and have produced differing results (Cameron & Oxley, 1994). As an example, a study of the relationships between injury and fatal crash probabilities and traffic volumes for rural highways in the US (Brodsky & Hakkert, 1983) determined that crash probabilities increased with volume. On the other hand, another study in Greece (Frantzeskakis & Iordanis, 1987) concluded that the same traffic flow occurring on road sections with different capacities creates different operating conditions and therefore different probabilities for crashes. This second study suggests that the volume-to-capacity ratio may offer a better measurement of exposure than traffic volume per se.

3.3.7 Pedestrian and Bicyclist Exposure

Measuring the risk of pedestrians often differentiates between moving along footpaths and crossing roads. For pedestrians moving along footpaths a measure of pedestrian kilometres travelled along the footpath can be derived, similar to the vehicle kilometres travelled discussed earlier, although Keall (1995) argued that the most risky pedestrian behaviour is crossing the road, therefore the number of road crossings is a more appropriate exposure measure. For pedestrians crossing the road, some measure of vehicular traffic along the road is often also necessary. Cameron (1982) and Hakkert and Braimaister (2002) suggest that a measure of exposure could be obtained which is a product of the traffic flow and the number of crossing pedestrians. Similarly, for bicyclists a distinction is usually made between distance travelled or time spent on footpaths versus roads, as well as crossing roads.
4 BEHAVIOUR, TRAVEL AND EXPOSURE DATA

4.1 METHODOLOGIES OF COLLECTING BEHAVIOURAL, TRAVEL, AND EXPOSURE DATA

Behavioural, travel, and exposure data can be collected in a number of different ways. The most commonly used methods include: direct on-road observations, self-report surveys, and case-control studies. These methods, along with their advantages and disadvantages are discussed next. Then, in the following section, a summary of the methodology and findings of behavioural, travel, and exposure surveys conducted in Victoria in the last two decades is also provided.

4.2 OBSERVATIONAL SURVEYS

Observational surveys involve direct on-road observation, either by researchers, video technology, or various on-road monitoring equipment. In these observations, usually data is collected about the number of vehicles passing the observation point, as well as behaviours, such as seatbelt or helmet wearing, mobile phone use, number of passengers. At locations such as intersections information about conflicting situations can be collected as well. For pedestrians and bicyclists, travel on footpaths, as well as crossing roads, is also observed. More detailed behavioural information is sometimes collected in observational surveys by conducting brief interviews, usually while they are waiting at traffic lights.

The observational method can produce reliable measures of behaviour because the behaviours are directly observed, rather than inferred by surrogate measures or less reliable self-reports. Furthermore, observational surveys are advantageous for studying behaviours such as seatbelt use, helmet wearing, and the use of hand held mobile phones. It may be less reliable to obtain data on these behaviours from self-report surveys, as people may be reluctant to report illegal behaviours.

Observational surveys only produce representative measures when they have adequate samples. A truly representative sample of on-road observations would require that a large number of different kinds of roads and numerous observations made at different times of day, week, and year. Thus, observational surveys tend to be costly.

An important limitation of observational surveys is that some more detailed types of behavioural information cannot be obtained. Although some observational surveys often include a very brief interview with drivers stopped at traffic lights, because of the time limit and safety issues, it is not feasible to collect more detailed behavioural information, such as the details for each trip, and information on drinking behaviours.

Also, with observational on-road surveys it is usually not feasible to obtain good quality information about pedestrians and bicyclists at the same time as information about motor vehicles. Therefore, separate surveys need to be conducted to study the travel and behaviours of pedestrians and bicyclists, adding on to the cost. Pedestrian and bicyclist observational surveys have never been carried out on a regular basis in Victoria. In fact, Victorian pedestrian and bicyclist exposure measures have not been updated during the last decade, although more recent motor vehicle exposure measures exist.
4.3 SELF-REPORT SURVEYS

Self-report travel and exposure surveys are usually conducted by telephone interviews, by mail, by face-to-face interviews, or by a combination of these methods. Most often these surveys take the form of a travel diary, whereby respondents are asked to recall details of all trips they took in the last day or the last few days, including walking and cycling. Diaries have been considered as the best means of obtaining information on travel behaviours, as they cover a more extended period of time and are not retrospective. If travel information is collected retrospectively, respondents tend to recall typical behaviour, rather than provide an accurate record (Richardson, Ampt, Meyburg, 1995). The survey can apply to a subsample of household members. Households must be carefully sampled from the population to ensure representativeness. Different days of the week and different times of year must be well covered as well, as for the observational surveys.

Self-report logbook surveys can provide rich information. An important disadvantage of these surveys is that they rely on self-report data, which is only a surrogate for a direct behavioural observation. The quality of the self-report data is dependent on the honesty and thoroughness with which respondents answer the survey questions. Furthermore, the representativeness of the survey depends not only on the sampling method, but also on the response rate. There often is, for instance, a tendency for young males not to respond to telephone surveys. Therefore, the groups with the lower response rates are often under-represented in such surveys. This problem can to some extent be rectified by using statistical weighting on the sampled data and can also be improved by various other methods, although the disadvantages of low response rates cannot be fully addressed by any statistical adjustment.

Self-report surveys can be carried out on an ongoing basis (as they are in New Zealand, for instance), but it is possible to conduct frequent (e.g. twice per year) smaller scale surveys as well, within more limited budgetary constraints. A small regular survey may be preferable to a large infrequent one if the richness of the information is preserved, careful sampling is carried out, and the response rate is maximised. In such surveys high response rates are more important than a large sample. Money saved on large samples can be dedicated to obtaining response rates as high as possible, especially if the characteristics studied are quite variable (e.g. Fogliani, 1999).

Another advantage of the self-report surveys is that information about the travel behaviours of bicyclists and pedestrians can also be derived, whereas with the observational surveys it is difficult to obtain this. The self-report surveys can also be used for the disaggregated analysis of the kind proposed by Kam – with the GIS.

It is necessary to validate the results of self-report surveys by comparing them to the results of observational surveys, which have been carried out within the same time frame and have studied some of the same travel behaviour. As discussed earlier in this report, this has been done in New Zealand, where the self-report surveys have been proven to be reliable when compared against the observational surveys. Thus, the smaller and more detailed self-report surveys can be supplemented by less frequent observational surveys to combine the different perspectives provided by the different survey methods into a more comprehensive picture.
The advantages and disadvantages of various methodologies of self-report surveys are discussed in more detail below.

4.3.1 Face-to-face interviews

It has been shown that face-to-face interviews are more effective in improving response rates compared to telephone interviews and mail surveys (e.g. Richardson et al., 1995). Face-to-face interviews have also been found to be most effective in producing more honest and thorough answers, as rapport is built between the interviewer and the respondent. The face-to-face interview methodology is also the most costly compared to telephone interviews and mail surveys, this being its main disadvantage.

4.3.2 Mail surveys

The main advantage of mail surveys is that they are the least costly method. The trade-off of this is that response rates are often poor. Mail surveys also have the further disadvantage that they undersample less educated or literate people in the population. Therefore, it is imperative that more effort be put in the design of mail survey forms, with extra attention being paid to presentation, simplicity, and visual aids (Richardson et al., 1995). The quality of data collected from mail surveys tends to be poorer compared to telephone or face-to-face interviews due to incomplete or incorrectly completed questionnaires. The response rates of telephone surveys can be increased with mail reminders.

4.3.3 Combination of mail surveys and brief interviews

Response rates and the quality of data can be much more substantially increased by the questionnaires being dropped off and later collected in person by an interviewer (Richardon et al., 1995; Stopher, 1985). In this way the interviewer can briefly go over any incomplete or incorrect responses with the household members, as well as answer any queries. This significantly adds to the cost of the survey, although it is still cheaper than the face-to-face interview method, as the interviewers need to spend shorter amounts of time at each household. However, when a high response rate and good data quality are essential this method may be the most cost effective (Richardson et al., 1995). This combination of methodologies has been used in a National Travel Survey in the UK (UK Department of Transport, 1993).

4.3.4 Telephone surveys

Telephone surveys are more costly than mail surveys, but cheaper than face-to-face interviews. A main disadvantage of telephone surveys is the often poor response rate, as with mail surveys. Another disadvantage is the limit on the length of the survey. It has been found that the overall response rates drops rapidly after about 10 to 15 minutes of interviewing (Stopher, 1985). Furthermore, it is usually only possible to carry the interview with one person in the household, rather than all the household members. This further biases the sample. Proxy interviewing where one person reports on behalf of others is not recommended in travel surveys (Richardson et al., 1995). Although the quality of the data may be better than with mail surveys due to the interviewers checking and clarifying responses, it is only practical to collect travel data for the current day, as a diary has not be kept and detailed recall of travel behaviour is often unreliable. The response rates of telephone surveys can be somewhat improved by initially calling to make a later appointment for the interview, as respondents may find this less disruptive.
4.3.5 Combination of telephone and mail surveys

A combination of telephone and mail travel surveys has been used in some countries, such as Sweden. This involved mailing an explanatory letter and travel to the sampled households. Later each household was contacted by telephone as well to collect the information from the travel diary through a telephone interview. The diary forms did not need to be mailed back. Response rates and data quality were improved. However, this methodology is dependent on being able to sample addresses and telephone numbers simultaneously, which may not be feasible in Australia.

4.4 CASE-CONTROL STUDIES

Case-control studies involve the comparison of two groups: cases and controls. In road safety research the cases are usually people who have been involved in crashes; and the controls are people who have not been involved in crashes but who are of similar demographics and are exposed to similar road situations as the cases. Most of the road safety case-control studies in Victoria have been done on pedestrians and bicyclists, with some studies also being carried out with motorcyclists. These studies are described in a later section of the report.

Case-control studies allow the behaviours and travel patterns of those who are not involved in crashes to be compared to a similar group of road users who have been involved in crashes. This enables us to separate out important factors that have contributed to crash involvement. However, case-control studies can be costly and it is not always feasible to carry them out because of practical reasons.
5 SUMMARY OF EXISTING TRAVEL AND EXPOSURE SURVEYS IN VICTORIA

5.1 OBSERVATIONAL SURVEYS

A large observational survey (MORES) was carried out in Victoria at regular intervals between 1985 and 2001, but has now been discontinued. Other, smaller observational surveys have been also carried out in Victoria on one-off basis in the last two decades. The observational surveys are described in the following sections.

5.1.1 The Melbourne On-Road Exposure Surveys (MORES)

In the last two decades a series of observational surveys, MORES, have been conducted, the first one in 1984 and subsequently in 1985, 1986, 1988, 1994, and more recently in 2001. VicRoads commissioned Steer Davies Gleave (2002) with the Urban Transport Institute (TUTI) to conduct the most recent 2001 survey.

The purposes of these surveys have been to:

1. estimate the relative crash risk per distance travelled for sub-groups of driver/occupant/vehicle characteristics by matching the survey data with crash data

2. estimate on-road frequency of factors not recorded in crash databases that might increase crash risk (e.g. factors such as the usage of mobile phones in observed vehicles)

3. monitor seatbelt wearing rates.

The MORES surveys are intercept exposure surveys, that is, surveys based on a snapshot of information collected from vehicles stopped at traffic signals (Drummond, 2003a). The MORES surveys have been limited to two months of the year in autumn (April-May). The sampling unit consisted of drivers intercepted mid-journey, while stopped at intersections on a subset of arterial roads in Melbourne. The intersections that were included had to have a median wide enough for a field surveyor to stand on safely, as well as pedestrian operated signal on the median to be able to stop traffic when the vehicle volume in the adjacent lane was low. Then drivers from the lane adjacent to the median were intercepted. If drivers agreed to participate in the survey, they were briefly interviewed for approximately 20 seconds. This meant that most of the intersections available to be sampled were right turn lanes from a major arterial road. In the 2001 survey, two sites were sampled from each of the 32 Local Government Areas (LGA), in a way that avoided very high and very low flow sites but also met the above practical constraints of the road characteristics. The 1994 survey predominantly included sites in the inner South-Eastern metropolitan area. The 1994 survey covered 20 sites of arterial roads, whereas the 2001 survey covered 64 sites. Different times of day were sampled for every day of the week, although the sampling was uneven across the days of the week. Also, lower response rates were obtained during the night time hours. Since it is not possible to sample all, weighting processes were used to correct for differential sampling rates. Imputation procedures were used for missing values.
The MORES 2001 surveys have collected the following data:

- vehicle type, size, year of manufacture, and frontal protection
- Learner or Probationary plates displayed
- number of vehicle occupants
- driver's age/date of birth
- type of driver's licence
- how long ago the driver obtained their licence
- whether the driver had a mobile phone and whether the phone was switched on or off
- number of hour since the driver last woke up
- purpose of trip
- driver's seatbelt usage
- restraint use of children under the age of six years
- vehicle maintenance

A manual count of all vehicles going past each survey site was also obtained. Only non-commercial vehicles and vehicles that can be driven without additional endorsement on a Victorian driving licence were selected. Similar data, with some variations, was also collected by the older surveys.

The MORES methodology and design has varied somewhat over the years of each survey. Steer Davies Gleave (2002) undertook a comparison of the 1994 and the 2001 surveys, as well as a comparison between each of these two surveys and the VATS.

A total distance travelled for all vehicles was estimated from the MORES surveys as a measure of exposure, rather than estimating exposure levels for individual vehicles. Total exposure was measured as kilometres travelled by week. Weekly kilometres travelled by various driver demographics and characteristics, vehicle occupancy rates, and vehicle types were estimates. Similarly, weekly kilometres travelled by time of day, by day of week, and by LGA were estimated. Estimates of the total exposure (kms per week) for several factors that may be considered to contribute to crash rates, but which are not recorded in Victorian crash statistics were also obtained for different age and sex groups. These factors included mobile phone availability, fatigue (measured as number of hours since driver last woke), vehicle maintenance, pedestrian-friendly vehicles, and trip purpose.

The MORES surveys data has been also analysed to produce estimates of crash risk per kilometre driven. Recently, Drummond (2003a) estimated the crash and injury risk outcomes using reported casualty crash data for the 2000 to 2002 period and the estimates of distance travelled calculated from the 2001 exposure survey. Drummond has presented the crash involvement risk and the driver injury risk estimates as relative risks. The relative risks were estimated separately for crash risk and for injury risk. Drummond (2003b) has also prepared an interactive software tool for estimating relative risks for various groups of drivers.

The most recent MORES results estimated that a total of approximately 327 million kilometres of travel are driven in an average week on arterial roads, with about 60% driven by males. It must be remembered that the MORES results only apply to arterial roads, as that is where the observations are made. Males are more likely to drive on arterial roads than females and may be over-represented. The largest distances driven on arterial roads
were in the larger LGAs of Yarra Ranges and Mornington Peninsula. It was found that over 60% of kilometres were driven with a mobile phone in the possession of the driver and switched on. Another 12% of drivers had a mobile phone with them which was switched off, while 26% of drivers did not have a mobile phone with them. The possession of a mobile phone varied significantly with age, with over 80% of drivers aged between 18 and 35 having one, and less than 60% of drivers over 65. The probability of having a mobile phone switched on fell consistently with increasing age, with males being more likely to have the mobile phone switched on than females. Seat belt compliance was very high, close to a 100% (Steer Davies Gleave, 2002).

Drummond (2003a) combined the MORES distance travelled estimates from 2001 with casualty crash data for the period 2000 to 2002 to estimate the risks of crashing while driving around Melbourne. Crash risks were estimated as driver involvement in a casualty crash per million kilometres travelled. Injury risks were estimated as driver injury in a crash per million kilometres travelled. Drummond found female drivers to have 16% higher risk of crashing relative to males. Females also had 70% higher risk of injury. Most driver age groups had significantly higher risks of crashing relative to the 40-49 years age group. Age was found to be a powerful determinate of crash risk. Late night and early morning periods were associated with substantially higher risks of crashing and injury relative to the middle of the day. Drivers with one passenger had lower risk of crashing compared to solo drivers or drivers with two or more passengers.

5.1.2 An Observational Study in Melbourne in 2001 (Whelan, Diamantopoulou, & Senserick, & Cameron, 2003).

This study aimed to provide benchmark data for driver, motorcyclist, and bicyclist road safety indicators on Melbourne roads. An observational survey was carried out in 2001 on select metropolitan roads in 60 km/h speed zones to collect data on the following behaviours:

- levels of seat belt use by drivers and passengers
- levels of child restraint usage
- levels of helmet and conspicuous clothing use by bicyclists
- levels of helmet and protective clothing used by motorcyclists
- vehicle occupancy rates
- age of vehicle

Whelan et al.’s (2003) study had initially aimed to compare and calibrate the findings of the observational survey with those of telephone surveys which were to be carried out at about the same time. However, due to the rising costs and the low response rates of telephone surveys, only the observational survey was carried out.

Observations were obtained from five sites in Melbourne, one in each Victorian Police Region. A total of 4,665 observations were made, of which 4,595 were cars, 45 were motorbikes, and 25 were bicycles. The findings of the study indicated that most vehicles observed had a single occupant (i.e. driver only), with somewhat higher occupancy rates being observed on weekends and the weekday evening peak periods. Seatbelt usage was found to be fairly high at about 98%, with about 91% of belts being worn correctly. All motorcyclists and pillion passengers were observed to wear a helmet, although very few wore the full recommended combination of protective clothing.
Among bicyclists, however, only 40% wore helmets and just over half (56%) wore protective clothing. As very small numbers of motorcyclists and bicyclists were observed, the extent to which these conclusions can be generalised to the whole Melbourne population of motorcyclists and bicyclists is limited.

5.1.3 An Observational Study of Mobile Phone Use Among Melbourne Drivers (Taylor, Bennett, Crater & Garewal, 2003)

Taylor et al., (2003) carried out an observational study in Melbourne to estimate drivers' use of hand-held mobile phones while driving. Twelve observational sites were chosen to provide a variety of highways geographically spread across the city: four major metropolitan roads, four central business district roads, and four freeway exit ramps. Data was collected on three consecutive Fridays in October 2002 three times a day from all motor vehicles (except motorcycles) in the lane closest to the curb. Drivers' age and sex group were also recorded. The study estimated that 18.5 of each 1,000 drivers (or 1.85%) used hand-held mobile phones while driving. This rate was substantially lower for drivers over 50 (4.8/1,000), compared to younger drivers (approximately 22/1,000). The rate of mobile phone use was significantly higher in the evening (23.5/1,000) than in the morning (16/1,000) or in the afternoon (15.2/1,000). The higher evening rates may be due to slower speeds in peak traffic and to the transition for many divers from workplace to home (Taylor et al., 2003). Men had slightly, but non-significantly higher rates than women. Also, central business district drivers had slightly, but non-significantly, higher rates of mobile phone use compared to drivers on the other observed roads. According to the authors, it is possible that communication requirements of central business district drivers and the slower driving speed increase the rate of phone use. The authors concluded that hand-held mobile phone use is common among Melbourne metropolitan drivers, despite restrictive legislation. The use of mobile phones while driving represents an important road hazard. Mobile phone use and alcohol intoxication (BAC 0.05%) have been found to increase the risk of collision and fatality by a similar amount (Violanti, 1998; Redelmeier & Tibshirani, 1997). Further research is required to determine why many drivers continue to use their mobile phones while driving despite fines and demerit points (Taylor et al., 2003).

5.1.4 An Observational Study of Child Pedestrians And Cyclists (Drummond & Ozanne-Smith, 1991)

Drummond and Ozanne-Smith (1991) carried out an observational exposure study of child pedestrians and bicyclists aged 0-17 years in Victoria in June 1990. This study took place just a month prior to the commencement of the mandatory wearing of bicycle helmets. Thus, adult helmet wearing data was also collected as part of the study to serve as a pre-legislation baseline. The study focused on traffic behaviours, exposure on roads for pedestrians and on roads and footpaths for bicyclists, and the nature and extent of injuries. Crash involvement risks were estimated for pedestrians and cyclists by combining the observed exposure data with comparable Police reported casualty crash data. The survey was conducted at 80 randomly selected observation zones across metropolitan Melbourne. Data was collected on both the quantity (e.g. time spent on roads/footpaths) and quality (various behaviour) of child pedestrian and bicyclists exposure.
The following information was collected for each child pedestrian or bicyclist trip within the observation zone:

- road user code
- estimated age; sex
- helmet worn or not
- time in seconds spent on road/footpath
- number of road crossings/road entries, both intersection and midblock
- presence of conflicting vehicles
- parked car/other obstruction to road entry
- quality of pedestrians road crossing behaviour (e.g. monitoring of traffic)
- time spent on road (playing or crossing)
- child alone or accompanied and whether supervised or not
- pedestrian motion – walking or running
- traffic control devices used/not used /not applicable
- weather conditions, time of day, day of week

The study found that the presence of child pedestrians on roads increases with age, with primary and secondary school aged children having approximately ten times the exposure of children less than five years of age. However, the risk of casualty crash involvement per billion seconds of exposure for child pedestrians less than five years of age was three times higher than the older age groups. Two thirds of child pedestrian exposure was found to be on local streets. Children expressed greater frequency of less safe road crossing behaviours on local streets than on arterial road, with 50% of road entries on local streets being made in the presence of potentially conflicting vehicles. The 5-17 age groups displayed higher crash involvement risks on arterial roads by a factor of three to five. However, the less than five years age group demonstrated a 50% higher risk on local streets. About 70% of all bicyclists observed over the age of 5 years, including adults were not wearing helmets (Drummond & Ozanne-Smith, 1991).

5.1.5 An Observational Study of Bicycle Use and the Influence of the Helmet Wearing Law in Melbourne from 1987 to 1992 (Finch, Heiman, & Neiger, 1993)

From 1987 to 1992 a series of observational surveys of bicycle usage and helmet wearing in metropolitan Melbourne were conducted to evaluate the impact of the compulsory helmet wearing law introduced in July 1990 on both bicycle usage and helmet wearing. Observations were made at 64 metropolitan sites. Exposure was measured in a similar way to the study of Drummond and Ozanne-Smith (1991) described above. The surveys found that the mandatory helmet wearing law had achieved its goal of increasing bicycle helmet wearing rates for all groups of bicyclists throughout metropolitan Melbourne. Two years after its introduction, high levels of helmet wearing were maintained among adults, teenagers, and children. It was found that during the first year of introduction of the law there was a reduction in bicycle riding or exposure (estimated as billions of seconds of riding per week). However, two years after the law in 1992, bicycle riding was approaching pre-law level in adults and children but was still greatly reduced in teenagers.
5.1.6 An Observational Study of Road and Footpath Cycling (Drummond & Jee, 1988)

Drummond and Jee (1998) carried out an observational study of road and footpath cycling to investigate the relative safety of cycling on the road and footpath and of a variety of different cycling behaviours. Drummond and Jee developed a method for the collection of cyclist exposure (measured as duration of travel) and cyclist behaviour information. Observational data was collected from 105 randomly selected locations in metropolitan Melbourne. The collected exposure data was used in conjunction with Police and hospital data of crashes to estimate casualty crash involvement risk for various cyclist behaviours and different types of crashes. Helmet wearing rates were also collected. Other data collected included age, sex, time spent on road/footpath, pedestrians passed, cyclists passed, side roads crossed, midblock rideouts, driveways passed, cars passing, side streets passed. Drummond and Jee found road cycling to be a much riskier activity than footpath driving by a factor of 2.6 overall. However, the safety improvement of footpaths was the least for cyclists under 11 years of age. Cycling on-road on arterial roads was three times more dangerous than cycling on arterial footpaths. Arterial roads were found to be the most dangerous cycling location, especially for 11-17 years olds whose risk was nearly three times greater than the under 11 years and the 18 years and over age groups. Cycling on arterial footpaths was found to be riskier than cycling on non-arterial roads, because of the enormous danger of transitional cycling (i.e. going over intersections and midblocks). Drummond and Jee suggested the safety benefits of allowing footpath cycling along arterial roads would be much greater than in the non-arterial environment. Significant improvements in the safety of footpath cycling could be accomplished if effective strategies to reduce the incidence of transitional cycling could be implemented.

5.1.7 An Observational Study of Bicycle Helmet Wearing (Kerryn Alexander, 1999)

Bicycle helmet wearing surveys have been conducted in Victoria since 1983, the most recent one being conducted by Kerryn Alexander in 1999. Kerryn Alexander observed a total of 8956 cyclists in Melbourne and 676 in Ballarat at various school, commuter and recreation sites. A total of 128 sites were observed in Melbourne and 14 sites in Ballarat. Primary and secondary school students, adult commuters, and child and adult recreational cyclists were observed at each location. The study measured the proportion of school, commuter, and recreational cyclists in Melbourne and Ballarat wearing bicycle helmets while cycling. The highest helmet wearing rate was found in adult commuters (98%) and the lowest in secondary school cyclists (69%). The key finding of the study was that helmet wearing by all cyclist groups had increased since 1994, continuing the upward trend identified since 1983. It was, however, of concern that the wearing of helmets in improper ways, such as with the straps unfastened or a cap or a beanie worn under the helmet, had increased, mainly among secondary school students in Melbourne. Conspicuous clothing was worn by fewer than half of the cyclists, indicating that further education may be necessary in relation to these issues. While most primary school students cycled on the footpath, the road or bike lane was used by a substantial number of secondary students. Adult commuters tended to use a bike lane on the road or bicycle tracks where available. In Melbourne only 2.8% of school students were found to cycle to school, a substantial reduction from 1994 (6.3%). The authors attributed this to the 1999 survey being conducted in winter, while the 1994 survey was conducted in the warmer months. The trend whereby teenage cyclists were discouraged from cycling after the compulsory helmets legislation (Finch et al., 1993) was not discussed in the Kerryn Alexander report.
5.2 **SELF-REPORT SURVEYS**

The main travel self-report survey conducted in Victoria was the VATS, which is now discontinued. This survey is described in the following section. A description of the ongoing travel survey that is being conducted in New Zealand is also included in this chapter, as an example of a successful program.

### 5.2.1 The Victorian Activity and Travel Survey (VATS)

The VATS was a large ongoing household based questionnaire survey, conducted from 1994 to 2002 by the former Royal Melbourne Institute of Technology (RMIT) Transport Research Centre. This survey was designed to provide a detailed description of daily travel and activity patterns of household members in Victoria. The VATS recorded all travel by all modes by all people in responding households in the survey samples. The survey was run continuously for 365 days a year, enabling seasonal variations in travel and activity patterns to be observed. Each person in each household that was sampled was asked to provide information for one specified travel day. The survey used a mail self-report questionnaire. In order to increase response rates and the quality of the data, telephone interviews were also conducted with responding households with incomplete questionnaires. Furthermore, a sample of responding households was selected for validation by face-to-face interviews to assess the quality of the self-reported data. A sample of non-responding households was also contacted personally to find out the reasons for non-response.

Detailed data in the following seven major categories was obtained: household information; person information; stop (trip-stage) information; trip (all stages on a single purpose trip) information; vehicle information; trip chain information; and route information. The data included:

- demographic information
- all travel made during the designated day (including motor vehicles, bicycles, pedestrian, and public transport travel, stops made for each trip, reason for each trip, times of trip, and start/stop destinations)
- vehicle occupancy numbers

The VATS households were sampled from the Melbourne Statistical Division by stratified random sampling. Every calendar year approximately 5000 households were sampled, although this number varied somewhat from year to year. The response rate ranged from 30% to 50%. A series of weighting factors were calculated to account for non-reported trips and for the effect of late responses and non-responses.

The estimated distance travelled from the VATS surveys has been found to be less than from the MORES surveys, perhaps due to the differences in methodology. An important methodological difference is that the MORES sampled only travel on arterial roads, whereas VATS sampled travel on all roads. The VATS results also have estimated lower proportions of kilometres driven by males compared to females, probably because males are more likely to drive on arterial roads. The VATS survey has also estimated higher proportion of travel in the peak hours compared to the MORES survey, probably because arterial roads tend to carry a higher proportion of the traffic in the off-peak periods.
However, both the VATS and the MORES results indicate that the proportion of kilometres driven by younger drivers (under 40) has been falling over the past seven years, while the proportion driven by older drivers has been increasing (Steer Davies Gleave, 2002).

5.2.2 The New Zealand Travel Survey

A summary of the New Zealand Travel Survey, conducted by the NZ Ministry of Transport, is included here as an example of a successful ongoing observational survey, which perhaps can provide a model for future behavioural, travel, and exposure surveys in Victoria.

The New Zealand Travel Survey is conducted on an ongoing basis and provides regular data to assist in the development of policy and evaluation of road use and safety programs. The survey data is regularly combined with existing crash data to estimate the crash risk of different groups of road users. Personal interviews are used to gather travel data from approximately 2000 carefully sampled households each year. The households are sampled using the New Zealand census lists of geographical units from which households are sub-sampled. Initially, a letter is sent to each selected household by the Ministry of Transport informing them of the forthcoming interviews and briefly describing the aims and contents of the survey. Next, an interviewer calls at each address to gather information. The interviewer nominates two consecutive travel days for which each member in the household is to record their travel information and leaves a survey form for each household member. Finally, as soon as possible after the travel days the interviewer returns to conduct the interviews. By utilising the interview method, a fairly high response rate of 66% has been achieved. The survey collects data on car, motorcycle, bicycle, and pedestrian travel. Information is collected on a range of behaviours, including drinking during the nominated travel days. The drinking questions, however, are not directly related to driving activities, but are more general about quantities and times of drinking during the nominated days. This is in order to increase the honesty of responses. No questions are included on helmet wearing, as it was considered that it is unlikely to get reliable answers on this activity. Estimates of drink-driving are made based on these responses and on responses to the travel questions. This method of estimating drink-driving through self-reports has been found to be reliable. Frith and Povey (2002) found that drink-driving estimates from the survey (23 occasions of likely illegal blood alcohol levels out of 10,000 trips) were comparable to roadside alcohol measurements during the same time periods, as well as with another New Zealand survey of alcohol use.

When the New Zealand Travel Survey has been compared to observational surveys, it has been found to underestimate travel by about one third. A contributing factor to this may be that the people who travel the most are likely to be at home the least, and therefore may have been under-represented in the sample. A household-based survey may also underestimate commercial vehicle travel. This points out to the importance of calibrating the results of self-report surveys with the results of observational surveys every few years.

5.3 ON-ROAD MONITORING

Various data is collected by the Traffic Information Systems (TIS) at VicRoads on an ongoing basis for planning purposes and to monitor on-road speeds, vehicles counts, and flow of traffic. Such data is also frequently collected on a one-off basis to meet specific needs of projects or requests. This data can be useful in various road safety research for example; speed data has been used in the evaluation of road safety programs. However, on-
road monitoring data collection is usually not specifically designed for the purposes of measuring exposure to risk and travel behaviours, and therefore is of much more limited use for these purposes than surveys such as the MORES and the VATS. A summary of these on-road surveys is provided below.

5.3.1 Speed Measurements on Metropolitan Freeways

On selected metropolitan freeways, traffic volume and vehicle speed measurements are made on every lane every 20 seconds for 24 hours every day. This data is collected by Transport and Traffic Information (TTI) department of VicRoads. The data is collected regularly at 60 sites and further sites are sampled from another 168 sites. Moving monthly free speed averages are calculated, aggregated by volume over a number of sites. The data is archived on CDs and it is possible to obtain samples of the data on request.

5.3.2 Metropolitan Speed Zone Indicators

Free flowing speed data is collected with manual laser equipment on selected metropolitan 60km/h, 70km/h and 80km/hr roads. Most sites are, however, in the 70km/h and the 80km/hr limits, with very few 60km/hr sites. Data is collected twice a year for a few hours on each road or until speeds of about 200 vehicles have been collected. This data has been previously used in the evaluation of road safety programs to provide an indication of speed changes over time. However, the data is limited in its representativeness. Nevertheless, by better coordination of the available resources, these data collections can become representative with relatively little additional cost.

5.3.3 Rural Speed Data

Speed data is collected with electronic detection loops on some rural roads. Collected data includes vehicle speed, length of vehicle (for classifying the vehicle type), and traffic volume. On some sites this data is collected on an ongoing basis, whereas on other sites it is collected for a fraction of the year. As for section 5.3.4, by better coordination of the available resources, these data collections can become representative with relatively little additional cost.

5.3.4 School Speed Zones

Data on school speed zones is not regularly collected. However, speed and traffic volume data has been collected before and after the introduction of selected school speed zones.

5.3.5 Traffic Volume Data at Traffic Lights

Data is collected on an ongoing basis at traffic lights on traffic volume only. This data is used for information on delays and road congestion.

5.3.6 Ozlink Project

As part of Ozlink, a Federal project which aims to develop and improve the movement of freight on the network of roads linking Australia, data is collected on an ongoing basis mainly from 100km/h roads throughout the country. Data is collected on traffic volumes only.
5.4 RANDOM BREATH TESTS

As part of their enforcement the Police gather drink-driving data, including number of tests conducted, number of people tested who exceed the .05 BAC limit, day and time of testing, and the Police region and division in which testing was carried out. Selections of individual cars for testing are made on a random basis. As long as sites are randomly selected and sites and times do not vary substantially from year to year, the above data can be used by matching with the approximate locations of observational and self-report surveys to make estimates about drink-driving and to calibrate or validate the survey data. A similar approach has been used with success in New Zealand.

5.5 RELEVANT POPULATION SURVEYS

5.5.1 ABS Survey of Motor Vehicle Usage

The Survey of Motor Vehicle Usage is conducted quarterly by the Australian Bureau of Statistics (ABS) with the aim to satisfy the information needs of Commonwealth and State government agencies responsible for the allocation of funds for road development, crash exposure, and energy use analysis. The data collected by the survey is often used as a proxy for road use to provide the broad context for projects on road use, mobility, and traffic congestion. Pre-advice (as opposed to recall) methodology is used to collect the data. The population from which the survey sample is taken includes all private and commercial vehicles registered for normal road use. The following data is collected quarterly and published annually:

- number of vehicles
- total and average kilometres travelled
- driver demographic characteristics
- vehicle usage
- fuel consumption
- load carried

5.5.2 Australian Bureau of Statistics (ABS) Census: Journey to Work Information

As part of the Australian Census of Population and Housing, information is collected on the patterns of respondents' journeys from their home to their place of work. The most frequent users of this information are State Transport Authorities. The data is used to identify travel patterns, model fuel usage, forecast public transport patronage, and plan alterations to existing transport systems. From the census questionnaire, each respondent's departure point, destination, and means of transport are obtained on the date specified by the census.

5.5.3 Deliveries of Fuel to Selling Points

Deliveries of fuel to selling points data is regularly collected for Victoria and the other states by the Department of Industry, Tourism, and Resources. Data is collected on the monthly total kilolitres of petrol and diesel sold. This data can be used as a rough measure
of exposure. MUARC has developed a method of converting the monthly fuel figures of each type into estimates of total kilometres travelled in Victoria, by calibrating the calculation against the ABS Survey of Motor Vehicle Usage results at various times (Newstead, 1994).

5.6 CASE CONTROL STUDIES

5.6.1 A Case-Control Study of Motorcycle Crashes in Melbourne (Haworth, Smith, Brumen, & Pronk, 1997)

Haworth at al. (1997) conducted a case control study of motorcycle crashes in Melbourne metropolitan areas. The cases in this study were 222 motorcycle crashes occurring on public roads from late November 1995 to 30 January 1997 in which the rider or pillion was taken to a hospital and died. Controls were 1195 motorcyclist trips passing the sites where cases had crashed at the same time of day and day and day of week as the crash. The study collected three types of information: detailed descriptive information about the crash and the resultant injuries; comparison of features of cases and controls; and motorcycle exposure information, gathered as part of collecting the control data. Exposure estimates were calculated based on observations of 1121 motorcyclists during 325 hours of sampling at or near the crash sites. Exposure was measured as the average number of motorcycles per hour. Motorcyclists were found to represent a very low overall proportion of the traffic, about 0.5%. This proportion was similar across road types. The proportion of traffic that motorcyclists comprised was greatest on weekend days. The average number of motorcycles per hour was greatest during weekday and weekend days. The mean number of motorcycles per hour accounted for 79% of the variance in the number of crashes (per time period or per road type). The results did not clearly indicate any changes in the exposure patterns of riders from 1988 to 1996. The study also collected data on types of crashes, helmet wearing, type of injuries, and rider, pillion, motorcycles, and trip factors associated with crashes.

5.6.2 A Case-Control Study of the Contribution of Alcohol Consumption to Pedestrian Accidents (Struick & Rogerson, 1988): Pedestrian Accident Project

This study investigated the contribution of alcohol to pedestrian accidents by comparing alcohol consumption of accident victims with that of control subjects. This was a case control study, which included two groups of injured pedestrians (cases): pedestrians admitted to each of five Melbourne hospitals; and pedestrians treated only in casualty. There were also two control groups: age, sex, and accident site matched controls; and accident site and accident time matched controls. The rationale for choosing the two control groups was based on an earlier study by Blomberg, Preusser, Hale & Ulmer (1979), which suggested that age, sex, and site matched controls provided the most rigorous test of the role of alcohol in a specific group of pedestrian accidents, while the site matched controls demonstrated the role of alcohol for pedestrians at a specific group of sites. Blomberg et al. (1979) also suggested the use of a third control group: randomly selected pedestrians to allow comparison of alcohol use in the total population. However, selecting the third control group was beyond the scope of the Struick and Rogerson (1988) study. Interviews were conducted with the cases at the hospitals and with the controls at the appropriate sites. The pedestrians in the control groups were also asked to volunteer for a breath test. The blood alcohol levels of the injured pedestrians at the time of the accident were available from hospital records. Police crash reports were also obtained for the study.
The study found that 40% of adult victims had been drinking and 24% had blood alcohol levels exceeding 0.15. Pedestrian accident risk was found to increase at BAC levels between 0.08 and 0.12. Pedestrians with BAC levels exceeding 0.10 had twice the accident risk of those below this level. For levels exceeding BAC of 0.15 the risk was 15 times greater. Among the 24% of victims whose BAC levels exceeded 0.15, it was found that beer drinking in hotels close to the victims' homes tended to immediately precede a notable proportion of the accidents.
6 RECOMMENDATIONS

The importance of regular measurements of on-road behaviours and exposure to risk was outlined in Section 2 and some examples were given. In summary, such measurements have the potential to provide indications to road safety organisations of the effectiveness of current road safety initiatives, as well as how to best formulate future programs to target at-risk behaviours and road user groups. In other jurisdictions where these measurements are available they have been used to set targets and monitor behaviours such as speed, alcohol use, helmet wearing, etc.; to measure the success of enforcement Police activity by geographical areas where it is not possible to do this in terms of crash data; to identify likely mobility impacts of road safety measures; and to assess risk on certain type of roads under given conditions. While there has been considerable emphasis on evaluation of Victoria's road safety initiatives in terms of reported crashes, in many cases it has not been clear whether the targeted behaviour has really changed or whether some other factor is responsible. Regular measurements of on-road behaviours can greatly enhance road safety evaluations by allowing stronger conclusions to be reached about the effectiveness of each initiative.

Although large regular travel survey programs have been carried out in Victoria in the past (the main ones being the MORES and the VATS), these have now discontinued. Some on-road measurements are also carried out by VicRoads on an ongoing basis.

However, most of these data are not designed to be representative of exposure to risk and are limited to a very small number of variables, such as speed and vehicle counts. Thus, at present no integrated and representative program exists in Victoria to provide accurate behavioural and exposure measurements.

The final aim of the present project was to make recommendations regarding future programs to collect behavioural, travel, and exposure data in the priority areas identified earlier in this report. As part of these recommendations, Stage 2 of the project is proposed, involving the design and planning of self-report and observational surveys. A number of alternatives are proposed for the self-report surveys, with different methodologies and costing. The recommendations are discussed in detail in the following sections. Finally, the recommendations and costing are summarised as projections into future years.

6.1 PROPOSAL FOR STAGE 2 OF THE BEHAVIOURAL, TRAVEL, AND EXPOSURE SURVEYS PROJECT: SURVEYS DESIGN

It is proposed that Stage 2 of the Behavioural, Travel, and Exposure Surveys project be implemented in 2005. The aim of Stage 2 of the project will be to design and pilot a regular and integrated survey program, based on the recommendations listed in the next section. Sampling frames will also be designed for both the questionnaire and the observational surveys in order to obtain samples that are as representative as possible within budgetary constraints. The previous observational and household surveys that have been conducted in Victoria will be reviewed, so that future observation methods and survey questionnaires are designed in such a way, that the new data will be comparable to previous data as much as possible, to enable long term monitoring of road safety trends. After the survey designs are completed, pilots will be carried out to refine and finalise the observational procedures and questionnaires and the data collection methods. Future surveys will also be designed in such a way that they complement or supplement already existing surveys, such as some of the ones discussed earlier.
6.2 RECOMMENDATIONS FOR SELF-REPORT SURVEYS

Based on the advantages and disadvantages of various survey methodologies discussed above, on previous survey experiences in Australia and overseas, and on the issues concerning the measurement of risk and exposure discussed earlier in the present report, recommendations are made below about future travel behaviour, and exposure survey methodology in Australia.

It is proposed that regular self-report surveys be carried out, similar to the New Zealand and VATS surveys, but on a smaller scale. These self-report surveys can measure most of the variables of interest, as specified by the aims of this project. These variables include: mode of travel (motorised; bicycle; pedestrian), road use demographics, individual trip details (length and time of trip; roads and bike/pedestrian paths used; reason for trip). Road users' alcohol consumption during each surveyed trip can also be estimated through less direct questions, as has been done in New Zealand. Thus, the self-report surveys can provide measures for all three road user groups of interest: drivers, bicyclists, and pedestrians. Although it is possible to include questions about helmet wearing and mobile phone use, it is not known to what extent self-reports of this behaviour will be reliable, as it will involve the admission of an illegal activity.

As discussed earlier, self-report, logbook type surveys can be carried out either through interviews, by mail, or by telephone. The interview method achieves the highest response rate and highest data quality, but involves a higher cost than the other two methods. The mail method, although cheaper than the interview method, is likely to result in a much lower response rate and therefore a bigger error or bias in the survey results. The telephone method only allows for briefer interviews, and there is usually a greater sampling bias and low response rates with this method. Also, in recent years the cost of telephone surveys has risen. A combined methodology, such as a mail survey where the questionnaire is dropped off and collected in person may be effective in increasing response rates and data quality, while being relatively cost effective.

It is recommended that a self-report survey be conducted twice a year. Several options of conducting regular self-report surveys are recommended, in order of the preferred option in terms of data quality, but in order of decreasing costs. The advantages and disadvantages of each recommended method were discussed in an earlier section.

When considering different survey options, it is essential to consider that high response rates are more important than a large sample. Money that would have been spent on large samples can be dedicated to obtaining response rates as high as possible, especially if the characteristics studied are quite variable (e.g. Fogliani, 1999). Sample design and recruitment are also of major importance.

The costs of different methodologies of self-report surveys are summarised in the following table. The estimated costs for each survey are yearly, assuming that half the data is collected during the spring/summer months and the other half during the autumn/winter months.
Table 6.1: Costing for Different Options for Regular Surveys

<table>
<thead>
<tr>
<th>Type of Survey</th>
<th>Sample Size per Year</th>
<th>Cost Estimate per Year</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mail</td>
<td>2,000</td>
<td>$40,000</td>
<td>- low cost</td>
<td>- low response rates</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- lower data quality</td>
</tr>
<tr>
<td>Telephone</td>
<td>2,000</td>
<td>$80,000</td>
<td>- lower cost than phone &amp; mail or interviews</td>
<td>- low response rates</td>
</tr>
<tr>
<td>Mail &amp; Personal Questionnaire Collection</td>
<td>500</td>
<td>$95,000</td>
<td>- improved response rates</td>
<td>- higher cost</td>
</tr>
<tr>
<td></td>
<td>1,000</td>
<td>$155,000</td>
<td>- improved data quality</td>
<td></td>
</tr>
<tr>
<td>Interviews</td>
<td>500</td>
<td>$131,000</td>
<td>- best response rates</td>
<td>- highest cost</td>
</tr>
<tr>
<td></td>
<td>1,000</td>
<td>$227,000</td>
<td>- best data quality</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- smaller sample needed</td>
<td></td>
</tr>
</tbody>
</table>

6.3 RECOMMENDATIONS FOR OBSERVATIONAL SURVEYS

It is also recommended that observational surveys are carried out every three years to calibrate and supplement the results of the regular self-report surveys. Once the results are well calibrated it may be possible to carry out the observational surveys at less regular intervals, for example every five years. It is recommended that the first observational surveys are carried at the same time as the first self-report survey. It is proposed that the observational survey of motor vehicles is conducted as an extended version of the observational survey carried out by a previous Baseline project: "Establishing a Benchmark for Safety on Melbourne Roads During 2001" (Whelan et al., 2003). A similar methodology will be used with the road sites included in the earlier surveys for comparison purposes, as well as new sites being added. The new sites will also include selected bicycle paths in Melbourne to allow observation of the pedestrian-cyclist mix and of cyclists' use of roads adjacent to bicycle paths.

The following behaviours will be observed and recorded for motor vehicle drivers at each road site: mode of travel, sex, estimated age group, seatbelt use, use of hand-held mobile phones, day of week, time of day, and helmet use for motorcyclists. The number of vehicle kilometres travelled will be estimated for each motor vehicle as a measure of exposure. Bicycles and pedestrian behaviours that will be observed include: pedestrian behaviours at road crossings; pedestrian use of bicycle paths; bicyclists' behaviours at road crossings, bicyclists' use of bicycle paths; helmet usage.

Observational data on drink-driving could be obtained from Police enforcement data. As part of their enforcement the Police gather drink-driving data, including the number of hours of random enforcement with booze buses and the number of drivers exceeding the legal limit. Selections of individual cars for testing are made on a random basis. As long as the sites are randomly selected and surveyed, and as long as site and time selection procedures do not vary substantially from year to year, the above data can be used by
matching with the approximate locations of the observational and self-report surveys to make estimates about drink driving and to calibrate the surveys. These estimates can then be calibrated against the self-report surveys. A similar approach has been used with success in New Zealand.

The cost of an extended observational survey is expected to be $120,000.

6.4 RECOMMENDATIONS FOR CASE CONTROL STUDIES

To supplement observational surveys with more detailed information and to answer specific questions of interest case control studies can also be carried out, perhaps every five years. For example, case-control studies about pedestrians' drinking can be designed and conducted, similar to the Struick and Rogerson (1988) study in which the blood alcohol level of injured pedestrians was compared to breath tests of volunteer pedestrians at the site of injury. The feasibility and cost of such a study can be investigated as part of the proposed Stage 2 of this project.

6.5 PROJECTION FOR FUTURE YEARS

The following table provides a summary of the costs of the design and implementation of the survey programs from 2005 to 2009, based on the above estimates and recommendations.

Table 6.2: Projection of Survey Programs Costs from 2005 to 2009.

<table>
<thead>
<tr>
<th>TASK</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surveys Design &amp; Planning</td>
<td>$45,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surveys Piloting</td>
<td>$35,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observational Survey</td>
<td>$120,000</td>
<td></td>
<td></td>
<td></td>
<td>$120,000</td>
</tr>
<tr>
<td>Self-Report Surveys (household interviews)</td>
<td>$40,000 (for N=500) to $212,000 (for N=1000)</td>
<td>$40,000 (for N=500) to $212,000 (for N=1000)</td>
<td>$40,000 (for N=500) to $212,000 (for N=1000)</td>
<td>$40,000 (for N=500) to $212,000 (for N=1000)</td>
<td></td>
</tr>
<tr>
<td>Analysis &amp; Calibrations</td>
<td>$25,000</td>
<td>$15,000</td>
<td>$15,000</td>
<td>$15,000</td>
<td>$25,000</td>
</tr>
<tr>
<td>Reporting</td>
<td>$15,000</td>
<td>$15,000</td>
<td>$15,000</td>
<td>$15,000</td>
<td>$15,000</td>
</tr>
<tr>
<td>Totals</td>
<td>$95,000</td>
<td>$200,000 (for N=500) to $372,000 (for N=1000)</td>
<td>$80,000 (for N=500) to $252,000 (for N=1000)</td>
<td>$80,000 (for N=500) to $252,000 (for N=1000)</td>
<td>$200,000 (for N=500) to $372,000 (for N=1000)</td>
</tr>
</tbody>
</table>
7 STAGE TWO

7.1 BACKGROUND

This is a report of the second phase of the Behaviour, travel and exposure Surveys project, which is part of the Fundamental Methodological Research of the Baseline Research Program. The first phase of the project focused on review and planning for a Behaviour, travel and exposure Survey Program and outlined the importance of regular measurements of on-road behaviours and exposure to risk for the advancement of road safety. A review of existing travel surveys and other relevant data was provided concluding that an integrated and representative program that can provide accurate behavioural and exposure measurements is currently lacking in Victoria. A future survey program was recommended to collect behavioural, travel, and exposure data in the road safety priority areas identified in the Stage 1 project. These recommendations with projected costing for future years are summarised in Table 6.2 above. The objective of the second phase of this project was to prepare survey designs and implementation planning for the survey program.

These recommendations are based on a methodology of conducting on-going smaller scale self-report surveys by interviewing household members with less frequent observational surveys carried out every several years to calibrate the results of the self-report surveys. This model was based on the travel surveys program that is currently successfully implemented in New Zealand to the benefit of several different road safety organisations in that country. It was proposed that the observational survey be designed as an extension of the MUARC benchmarking survey which was carried out in 2001 (Establishing a benchmark for safety on Melbourne roads during 2001, Whelan et al., 2003), and that the household interview survey is modelled on the New Zealand household interview survey and on the VATS mail surveys that were carried out in Victoria.

7.2 AIMS OF STAGE 2

This stage of the report outlines the development of a design for the self-report surveys and makes recommendations for the implementation of these surveys. The design and implementation of the household interview survey is discussed first, followed by the design and implementation of the observational survey.
8 DESIGN OF A HOUSEHOLD INTERVIEW TRAVEL SURVEY

8.1 AIM OF THE HOUSEHOLD INTERVIEW TRAVEL SURVEY

The aim of the household interview travel survey is to collect ongoing data about the following road safety areas:

- road users mode of travel (e.g. motorised, bicycle, pedestrian), patterns of travel and distance travelled
- driver and rider exposure (including number of trips per week, weekend versus weekday travel, time of day travel, and road user demographics)
- drink-driving
- pedestrian exposure on road crossings
- bicyclist exposure on roads, road crossings and use of bicycle lanes.

8.2 VARIABLES TO BE COLLECTED IN THE SURVEY

A sample form of the survey questionnaire has been designed and is contained in Appendix A. The survey aims to collect the following data:

8.2.1 Demographics of each person in the household:

- age group
- educational status
- work status
- marital status
- income group

8.2.2 Exact address of work (for main job)/educational institution attended

8.2.3 Travel: Day 1 & 2 (from 4am day1 to 4am day2)

Any time that the respondent left the house, driving, walking, cycling, catching public transport etc. to go anywhere, including the exact address of each departure and destination point. For each trip made during the day (for each day):

- departure time
- address of destination
- any stops on the way
- arrival time
- what respondent did at destination (e.g. home/work/study/shop/social/medical/recreational/accompanied someone/etc.)
- how did respondent get there
- how far is the destination it from the point of departure (in km)
- what route did the respondent take
- if driving, how many people were in the vehicle, including self (sex and age of each passenger)
- if driving, where did respondent park
- if passenger, who was the driver
- how many roads did respondent cross
- for pedestrians, how many pedestrian crossings did respondent use
8.2.4 Alcohol

At the end of the survey each respondent will be asked questions related to alcohol consumption close to and during the allocated travel days in order to estimate drink-driving behaviours. Respondents will be asked about drinking times starting from 6pm on the day before the first allocated travel day, where did they drink, and how many standard drinks they had on each occasion. These questions are modelled on the alcohol related questions in the New Zealand household travel survey. As discussed in the original report, drink-driving estimates from that household survey were close to drink-driving estimates obtained from random breath testing data (based on questions similar to the ones listed above). It is believed that by not relating this question directly to driving and by asking them at the end of the survey the honesty of the respondents' answers can be increased.

8.2.5 Accidents

At the end of the survey respondents will also be asked about their accident involvement in the last 12 months as a driver, a passenger, a pedestrian, or a cyclist.

8.3 TARGET POPULATION

The target population is the entire group of people that the survey aims to collect data about. The target population of this survey is the population of Victoria, as the survey aims to obtain information on travel patterns and behaviours in Victoria, including driving, riding a motorcycle, cycling, and walking.

8.3.1 Sampling Units

The sampling units are the individual elements of the surveyed population. The sampling units for this survey will be a representative subset of households in Victoria. All members of each household will be interviewed.

8.3.2 Sampling Frame

A sampling frame is a list that identifies every sampling unit in the survey population. In this survey lists of residential dwellings in selected Census Collection Districts will be used as sampling frames. This process is explained further in the following section on sampling methods.

8.3.3 Sampling Methods

The aim of sampling is obtain a small sample of the population of interest that is representative of this entire population. In this particular survey the aim is to obtain a sample that is representative of the travel patterns and behaviours of the population of Victoria. It is proposed that this is achieved by a two-stage stratified sample. This is a sampling technique which is based on selecting a sample in two stages. This enables a more efficient and less costly sampling process without the need to list every household in the state, but only those households in the selected strata (Richardson et al., 1995).

It is proposed that the sample strata be geographically based on the census collection areas defined by the ABS. At present the geographical boundaries of these areas are available from the last Australian Census conducted in 2001. This information is publicly available
from the ABS website and ABS offices. It is of importance to note here that the geographic boundaries defined by the may change with each new census. The next Australian Census will be conducted later in 2006. It is therefore recommended that if this travel survey is not to be carried out before the end of 2006, updated information on census collection areas is obtained from the ABS following the 2006, along with population sizes and community profiles for each area.

The ABS has developed the Australian Standard Geographical Classification (ASGC) for the collection and dissemination of geographical statistics. It is a hierarchically structured classification with geographical classification units that cover all of Australia, ordered from the largest units from States down to Collection Districts (CDs) that are the smallest units and cover an average of 225 dwellings each. Data on population sizes and community profiles is available for free from the ABS for each unit defined by the ASGC. Detailed maps depicting the geographical boundaries of each of the above main structures are also available from the ABS.

The ASGC defines the following five main hierarchical levels for Census data collection in ascending order of size:

- Collection District
- Statistical Local Area
- Statistical Subdivision
- Statistical Division
- State/Territory

In Victoria there are 12 Statistical Divisions, 46 Statistical Subdivisions, 200 Statistical Local Areas, and 8,642 Collection District. There are about 225 dwellings on average in each Collection District. For the sampling purposes of this survey it is proposed that the Collection Districts be used as the first stage sampling units and that the larger areas defined above represent the strata and substrata from which the sampling units will be drawn. Thus, the Collection Districts will be sampled independently within each Statistical Local Area proportional to population size of each Statistical Local Area. In this way the sample sizes in each stratum will be proportional to the population size in that strata and a more representative sample will be obtained.

Households within the randomly selected Collection District will represent the second stage sampling units. It is proposed that a random sample of households is obtained in each selected Collection District by randomising a list of all dwellings in the Collection District.

Once the Collection Districts are sampled, a list of private dwellings on each street/plot located in a Collection District can be obtained from the Victorian Spatial Council (VSC). This information can be obtained freely by using the geographic software on the VSC website or alternatively a report can be obtained from the VSC for a fee. The ABS does not provide lists of private dwellings for their Collections Districts.

Only residential dwelling will be surveyed and only people permanently residing at a sampled dwelling will be interviewed, excluding visitors. Hospital patients, nursing home residents, hotel guests, prisoners, and residents of various other institutions will not be
surveyed. These groups of people are usually not surveyed in travel surveys due to practical difficulties. Also some of them (e.g. hospital patients) have the chance of being surveyed at home. Usually, because of the exclusion of visitors, hotel guests, and people who are not at home, household based travel surveys may be somewhat biased towards under-estimating the total travel in the general population. This tends to happen because the excluded groups, such as people who are not at home, visitors, and hotel guests may be the ones that tend to travel the most (e.g. professional drivers, business travellers, etc.).

8.3.4 Sample Size

As was discussed in the Stage 1 report for this project, when designing a survey it is essential to consider that high response rates are more important than a large sample size. Money that would have been spent on large samples can be dedicated to obtaining response rates as high as possible, especially if the population characteristics studied are quite variable (e.g. Fogliani, 1999). Therefore, by focusing more of the survey resources on personal interviews and attempts to obtain full responses from as many of the sampled households as possible the need for a very large sample size is reduced. When considering sample size it is also important to estimate sampling errors for samples of various sizes. The sampling error is defined as the error of estimates made from the sample (e.g. estimated distances travelled) that arises we are dealing with a sample rather than with the entire population. The sampling error is an indication of how precise the estimates made from the sample are. It affects the variability around the estimated values from the sample and the confidence that can be placed on these estimates. Sampling error is primarily a function of the sample size (Richardson et al., 1995). Sampling errors for various sample sizes have been estimated in Table 2 below based on data from the New Zealand household travel survey that has a design similar to the one proposed here. Table 1 presents the proportion of error of the estimated total distance travelled at the 95% confidence interval. For example, if the sampling error is 12%, this means that the 95% confidence interval is plus or minus 12% of the total estimated distance travelled. The sampling error has been calculated for the overall sample, as well as separately for males, females, and teenagers for sample sizes ranging from 500 to 2000 households. As teenagers usually tend to make a smaller proportion of the sample of travel surveys, there is a larger error associated with estimates related to them.
Table 8.1: Sampling error for various sample sizes estimated as a percentage error per total kilometres travelled with a 95% confidence level

<table>
<thead>
<tr>
<th>Sample Size (no. of households)</th>
<th>% Error of Estimated Total kms. Travelled</th>
<th>Type of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>500</td>
<td>+/-12%</td>
<td>all</td>
</tr>
<tr>
<td></td>
<td>+/-20%</td>
<td>males</td>
</tr>
<tr>
<td></td>
<td>+/-19%</td>
<td>females</td>
</tr>
<tr>
<td></td>
<td>+/-64%</td>
<td>teenagers</td>
</tr>
<tr>
<td>800</td>
<td>+/-10%</td>
<td>all</td>
</tr>
<tr>
<td></td>
<td>+/-16%</td>
<td>males</td>
</tr>
<tr>
<td></td>
<td>+/-15%</td>
<td>females</td>
</tr>
<tr>
<td></td>
<td>+/-50%</td>
<td>teenagers</td>
</tr>
<tr>
<td>1000</td>
<td>+/-9%</td>
<td>all</td>
</tr>
<tr>
<td></td>
<td>+/-14%</td>
<td>males</td>
</tr>
<tr>
<td></td>
<td>+/-13%</td>
<td>females</td>
</tr>
<tr>
<td></td>
<td>+/-45%</td>
<td>teenagers</td>
</tr>
<tr>
<td>1500</td>
<td>+/-7%</td>
<td>all</td>
</tr>
<tr>
<td></td>
<td>+/-11%</td>
<td>males</td>
</tr>
<tr>
<td></td>
<td>+/-11%</td>
<td>females</td>
</tr>
<tr>
<td></td>
<td>+/-37%</td>
<td>teenagers</td>
</tr>
<tr>
<td>2000</td>
<td>+/-6%</td>
<td>all</td>
</tr>
<tr>
<td></td>
<td>+/-10%</td>
<td>males</td>
</tr>
<tr>
<td></td>
<td>+/-9%</td>
<td>females</td>
</tr>
<tr>
<td></td>
<td>+/-32%</td>
<td>teenagers</td>
</tr>
</tbody>
</table>

As can be seen from Table 8.1, there is a trade off in survey costs between larger sample sizes with decreased and smaller sample sizes associated with a larger error. It is recommended that a sample of about 1000 household per year (at least) is collected. As was estimated in the Stage 1 report, the cost of an interview survey with 500 households would be about $131,000, whereas with a sample of 1000 households the cost rises to about $227,000.

8.4 DATA COLLECTION

8.4.1 Procedure

Introductory letters with an explanation of the study and the information that will be collected should be mailed to each selected household about a week prior to interviewers approaching the household. Two consecutive travel days should be systematically allocated to each household in a way that that maintains an even spread of days of week among the selected households. This must be also done in such a way that travel distance between households is minimised for the interviewers.

On the day prior to the first allocated travel day a trained interviewer will visit the household and leave a travel diary form (see Appendix A) for each household member. The interviewer will then return two days later, at a time prearranged with the household, to collect the survey forms and to go over the responses with each household member. If interviewers carry laptops to immediately record the survey responses substantial time and
money will be saved on data entry and the quality of the data will be greatly improved by reducing data entry and coding mistakes. Although it will be more consuming (and therefore more costly) to interview the household members, rather than just collect the form, this will to a large extent eliminate missing data and improve the accuracy of responses. Interviewers should make at least three to four attempts to contact people who are not at home.

If budgetary restraints do not allow travel to more remote rural regions, it is possible to use different sampling methods can be used on different strata of the sample. For instance, in more remote Statistical Local Areas the sampling fraction in these areas can be reduced to reduce costs. As an alternative more remote areas can also be surveyed by mail or telephone. However, if a different method is used to survey households in the more remote strata, it will be necessary to analyse this data separately from the data obtained through household interviews because of the differences in the methodology.

8.4.2 Frequency of Data Collection

It is proposed that household data collection is spread out so that households are interviewed continuously during the year to achieve an even spread of travel days across the year and to allow for estimating seasonality effects. However, if budgetary restraints or resources do not allow this, it is recommended that interviews are carried out at least bi-annually.

8.5 DATA BENEFITS RESULTING FROM THE HOUSEHOLD SURVEY

The survey will enable the estimation of several important variables. In order to make estimates of exposure to crash risk distance distances travelled will be estimated for each leg of each trip. As noted earlier, the closest possible addresses will be reported for each leg of each trip. More accurate estimates of distance travelled can be made by using GPS technology to obtain geographic coordinates for each trip and to then calculate the distance between the address of origin and the address of destination.

One of the main advantages of a household based travel survey is that it allows the estimation of travel distances and exposure to risk not only for motorists, but for cyclists and pedestrians as well. The survey also allows some conclusions to be drawn about various driving behaviours, such as drink driving.

When making estimates from the household sample it will be necessary to weight the sample based on the population size and characteristics of each Statistical Local Area. Households need to also be weighted by dwelling type and number of occupants based on the community profile data for the Statistical Local Area that the household is in. Individual respondent’s weights would be based on the age and sex of each respondent and population sizes for each age and sex in the respondent's Statistical Local Area. The weighting process is necessary in order to be able to use the sample to make inferences about the population from which the sample was drawn.
9 DESIGN OF THE OBSERVATIONAL SURVEY OF MOTOR VEHICLES

9.1 AIMS OF THE OBSERVATIONAL SURVEY

The aims of the observational survey are to collect data through observation of vehicles, pedestrians, and cyclists on the following road safety issues:

- mode of travel
- driver and rider exposure
- usage of seat belts and child restraints
- use of hand-held mobile phones while driving
- usage of protective gear by motorcyclists and bicyclists
- bicyclist exposure on roads and road crossings

It is intended that observational surveys be carried out every three years to calibrate and supplement the results of the ongoing household interview survey. Once the results are well calibrated it may be possible to carry out the observational surveys at less regular intervals, for example every five years. In the Stage 1 report of this project it was proposed that the observational survey is conducted as an extended version of the observational survey carried out by the previous Baseline project: "Establishing a Benchmark for Safety on Melbourne Roads During 2001" (Whelan et al., 2003) for comparison purposes.

9.2 BEHAVIOURS TO BE OBSERVED IN THE SURVEY

Car and driver characteristics and behaviours to be observed were determined following a workshop among the various interested parties. An observation form has been prepared and is contained in Appendix B. A summary of variables to be observed is presented below:

**site Details**
- date/time/day of week
- location of observation
- how long observation lasted (from… to …)
- weather conditions
- driver age & sex

**no. of occupants (including for motorcycles)**
- seating locations (front, rear, rear facing)
- age & sex of each occupant
- correct adjustment of headrests for drivers and passengers [must define what is correct adjustment]
- seatbelt use, including type of incorrect use
  - type of seatbelt
child restraints (for children under 6 years)

vehicle type and year

- presence of license plate (L,P)
- size
- headlights on/off
- front/end protection: bull bar; nudge bar

plate details (no reg.)

motorcyclists (see Appendix D)

- rider age & sex
- rider helmet
- rider protective clothing
- rider conspicuous clothing
- passenger age & sex
- passenger helmet
- passenger protective clothing
- passenger conspicuous clothing

cyclists (see Appendix E)

- age & sex
- helmet
- wearing or carried
- fastened and positioned correctly/incorrectly
- conspicuous clothing
- on-road or on path
- in bike lane if on-road

use of hand-held mobiles

cars going into bicycle lanes (where present)

crossing behaviours of pedestrians and cyclists

- count
- lights colour
- j-walking
- car behaviour
- other observed
- cyclists crossing on red, other cyclist behaviour e.g. if riding between lanes etc. (if cyclist on path/cycling lane/road)
9.3 TARGET POPULATION

The population that we are interested in is the population of all drivers in Melbourne. Pedestrians, bicyclists, and motorcyclists will also be observed at the selected observation sites and will be given a priority in observation, as they tend to be less frequent.

9.3.1 Sampling Units

The sampling units will consist of a representative subset of intersections of arterial roads in Victoria that meets various safety criteria for the observers. Vehicles will be observed while stopped at traffic lights at suitably selected intersections. The following criteria, identified by the Benchmarking survey, will be used for site selection: (a) be comprised of an intersection with traffic lights; (b) be located in a 60km/h speed zone; (c) allow clear visibility for observers, including the absence of tram tracks and slip lanes; (d) exclude any other features which might interfere with observations (e.g.) as a result of the intersection layout or roadside obstructions, including trees and construction work; and (e) exclude any features that might risk the safety of the observers (e.g. narrow pedestrian paths and/or nature strips that would necessitate the close proximity of observers to passing vehicles).

9.3.2 Sampling Frame

The sampling frame will consist of the list of Arup sites that were used for the 2001 Benchmarking survey. In their 1999 "Design and Specification for a Vehicle Restraint Usage Study" Arup identified 40 metropolitan and 40 rural sites, selected in such a way as to obtain a representative cross section of Victoria's roads based on their declared road classification and giving preference to sites with higher sample sizes, in order to obtain a broader representation of road and vehicle types, direction of travel and demographic characteristics of geographic areas such as age and gender. Preference also will be given to sites with higher traffic volumes in order to maximise the amount of data that could be collected over short periods of time. The sites will be reviewed as part of the pilot survey, giving preference to sites that meet safety criteria for the observers and with large sample sizes. While the Benchmarking survey only used five of the Arup sites (one in each Police Region) due to budgetary constraints, the proposed survey will aim to make observation at all or most metropolitan and rural sites.

9.4 OBSERVATION TIME SCHEDULE

Similar to the Benchmarking survey, the observation periods will be limited to daylight hours to allow for more accurate descriptions of drivers, riders, and their behaviour. Observations will be carried out in 1.5 hour blocks at different times of day and week at each site. A total of 10.5 hours of observations will be carried out at each site (7.5 hours on weekdays and 3 hours on weekends). Time periods will be randomly distributed across sites so that each site would be observed during each of the five time periods during the week and the two time periods on the weekend.

9.5 OBSERVATION METHODOLOGY

Similar observation methodology will be followed to the Benchmarking study. Some vehicles, such as buses (more than 10 seats), trucks, and emergency vehicles will be excluded from the study. Observers will work in pairs for safety reasons and to increase inter-rater reliability. Observers will also aim to be as unobtrusive as possible by avoiding eye contact with road users and by standing as far from vehicles as practical.
Observations will be made at intersections when vehicles are stopped at a red light signal. As many vehicles as possible will be observed at each red light phase. In the Benchmarking study an average of five vehicles were observed at each red light phase between two observers. Only vehicles in the left hand lane will be observed, as median strips do not exist at all intersection and where they exist they are seen as more obtrusive and presenting a higher safety risk to the observers. Priority will be given to observations of pedestrians, bicycles and motorcycles due to their low frequency. Cars and vans will be selected on the basis of their queue position, beginning with the vehicle closest to the traffic light and then progressing down the queue.

The fact that only left-hand lane observations are made is not expected to impact significantly on the data, but it is possible that particular drivers may have left-hand lane preference and that these drivers may differ in demographic or behavioural characteristics from other drivers. Thus, this possibility may need to be taken into account when considering generalisations based on the survey data (Whelan et al., 2003).

9.6 DATA BENEFITS RESULTING FROM THE HOUSEHOLD SURVEY

The number of vehicle kilometres travelled will be estimated for each observed motor vehicle as a measure of exposure. Road speed data, enforcement data, and crash data can also be used in combination with the survey data to estimate risks and to investigate various behaviours associated with enforcement. Inferences can be drawn about use of hand held mobiles, protective clothing, and patterns of the changes in these behaviours over time.
10 RECOMMENDATIONS

10.1 COLLABORATION OPPORTUNITIES

Frequent behavioural travel and exposure surveys require relatively large funding that is disproportionate to the Baseline budget. Hence as part of the implementation plan for this project, other interested parties have been consulted and collaborations sought out where common needs exist between organisations to collect behavioural travel and exposure data. The New Zealand survey which is funded by the NZ LTSA is a good example of a similar collaboration, where road planners obtain a direct return for their investment in the NZ travel survey, while at the same time the survey also meets the needs of various NZ organisations involved in road safety. Similar collaborations between MUARC and other organisations, where common goals for behavioural travel and exposure data are met should be sought out to enable the implementation of such surveys.

10.2 AGENCIES WITH INTERESTS IN TRAVEL DATA

As part of the implementation planning of the interview travel survey, discussions were held with the Department of Infrastructure (DOI). From these discussions it has become apparent that DOI is also currently planning a large travel survey based on household interviews. DOI's purposes for conducting a household travel survey are related to infrastructure planning, rather than being directly related to road safety. However, the kind of travel data that they intend to gather is very similar to the contents of the questionnaire that has been designed for the intended MUARC survey. The proposed DOI household survey would not obtain data regarding specific behaviours such as seatbelt usage and drink/drug driving which require observational data collection methods.

Currently, DOI is applying for a $3,000,000 internal funding, which will include putting out a tender for the detailed design and implementation of a large scale household travel survey. The proposed sample size is 5,000 households. DOI plans to conduct such a survey every three to five years to coincide with each Australian Census. The reason for aligning it with the Australian Census is to be able to combine the travel survey with useful Census data, including the Journey to Work survey that is part of each Census.

From the discussions with DOI it appears that at this stage DOI is prepared to discuss a collaborative relationship with MUARC in designing and implementing the large scale survey that will run every five years. It is therefore strongly recommended that the liaison with DOI be continued in a way that meets the need of all interested parties. In the best interest of road safety research this would mean MUARC being in a partnership/advisory role, rather than bidding for a tender set out by DOI.

DOI intends to conduct this large scale survey every five years. For the purposes of road safety analysis it is important that data is collected across an entire year and on a continuous basis, as is done in New Zealand. It is, however, possible to run smaller scale surveys with small samples in the years intervening between the large scale surveys. For example, the smaller sample sizes suggested in the household survey design proposed earlier will be adequate for this purpose. In this way it is possible to derive the benefits of the large sample size and concurrence with the Australian Census every three to five years, while still being able to obtain continuous travel and behaviour data for road safety purposes. This is consistent with the methodology of frequent smaller surveys combined with larger less frequent ones that has been proposed as part of this Stage 2, Behavioural
Travel and Exposure project. The large scale survey and the smaller intervening surveys will have to be designed in a consistent manner so that the data is comparable.

Recently VicRoads has completed a roads classification system by grading roads and roads safety in both rural and metropolitan areas in view of improving roads. VicRoads has also completed a risk assessment of various road types based on crashes per kilometre and crashes per million vehicle kilometres at mid block sections and intersections based on the above classification system of roads. Furthermore, funding for an exposure study by road type in rural Victoria has been approved by the VicRoads Research and Development program for 2006-2008, allowing for up to $200,000 for implementation and data collection.

At present VicRoads is interested in collaborating with MUARC on the design of the rural survey. Although VicRoads current interest is only in the rural survey, they may be able to help with the selection of metropolitan sites as well. A VicRoads metropolitan survey is not likely to eventuate for another three years. This proposal for collaborating with VicRoads on the observational survey and modifying the design for the observational survey proposed earlier in this report should be considered.

10.3 PROPOSAL FOR STAGE 3 OF THE BEHAVIOURAL, TRAVEL AND EXPOSURE SURVEYS PROJECT: DEVELOPMENT OF AN UMBRELLA FRAMEWORK FOR BEHAVIOUR, TRAVEL AND EXPOSURE SURVEYS IN VICTORIA

It is proposed that Stage 3 of the Behaviour, travel and exposure Surveys project be implemented. The aim of the Stage 3 project will be to facilitate a Behaviour, travel and exposure Forum. Interested parties from other agencies such as DOI, VicRoads, TAC, VicPolice, RACV will be invited to attend, MUARC staff with expertise in this area will also be invited to attend the forum.

The 2 main aims of the forum will be:

- That MUARC collaborate with the DOI regarding designing and implementing the large-scale household-based interview survey that it intends to run every five years. MUARC could carry out smaller scale surveys with the same design during the intervening years in order to provide continuous travel and behaviour data for road safety purposes.

- That MUARC give consideration to collaborating with VicRoads in the design of its observation-based survey of rural exposure in Victoria planned for 2006-2008. This may assist with the design of an observational survey in the Melbourne metropolitan area, although a VicRoads survey of this type is not likely to eventuate for another three years.
11 STAGE THREE

11.1 BACKGROUND

The Project Advisory Committee meeting on 22 May 2006 reviewed the Stage 2 recommendations and accepted that it was desirable for MUARC to collaborate with DOI, VicRoads and other bodies such as VMAC who were planning travel/exposure surveys of various types, with a view to assisting and influencing these organisations to design their surveys in ways that contribute to MUARC’s overall objective. To facilitate this process, it was desirable for MUARC to undertake a number of steps:

1. Definition of an umbrella concept of total land transport travel/exposure in Victoria per annum, under which each of the planned travel/exposure surveys could be considered to lie. The conceptual population would be each of the kilometres of out-of-house surface travel by persons in Victoria, whether it be by foot, bicycle, motorcycle, motor vehicle or railed public transport, on each of the days of the year, and for each of the years in future.

2. Convene and facilitate a forum to outline this umbrella concept and to persuade the travel/exposure survey organisers to position their planned surveys as sub-sets of the conceptual population. The advantages of being able to see their survey results in the context of total travel, and make appropriate adjustments to ensure representativeness, would be explained as well as suggested modifications to their surveys to improve the overall situation.

3. MUARC to design and undertake small-scale surveys to interpolate between main surveys and fill gaps in their coverage (e.g. times, areas, road user types, etc.) not covered by main surveys. MUARC should also provide on-going management of the framework and conceptual integration of survey results.

11.2 AIMS OF STAGE 3

The first step was to develop an umbrella framework to a sufficient conceptual level that it could be used as the basis of discussion at the forum. It was proposed that this be done in conjunction with Dr Michael Keall when next in Melbourne on 14-16 June. Michael was the architect of the New Zealand LTSA’s on-going household travel/exposure surveys and the complementary program of observational surveys covering drink-driving, speeding, occupant restraint wearing and bicycle helmet use. A document was prepared outlining the framework, the conceptual population of total travel/exposure in Victoria, and how the planned surveys related to these concepts.

The second step was to facilitate a one-day forum to discuss the concepts and framework, the detailed plans for upcoming surveys, the opportunities for integration with the framework, and the gaps which needed to be filled. The aim of the forum was to win commitment to the idea that each planned survey should support and contribute to fleshing out the framework with real data. It was envisaged that the forum would be held in late July or early August depending on key participants’ availability.
The final step was to complete the framework document with detailed information of the planned surveys in context with the overall objective, and outline plans for special MUARC surveys to fill the gaps.
12 DEVELOPMENT OF AN UMBRELLA FRAMEWORK

12.1 DIMENSIONS OF TRAVEL

Every trip made in Victoria has several dimensions that are of interest to different agencies. From the point of view of the Police and other road safety agencies, the proportion of trips undertaken while speeding, as well as the degree of speeding, needs to be known. Such behaviour should be influenced by the deterrent effects of sanctions, by attitudes to speeding, drink-driving and by attitudes to risk taking generally. Any policies and interventions that seek to change any of these factors can be expected to affect the level of speeding to some way, possibly more so for particular targeted groups (and young males are often targeted). Thus, measurements of speeds and drink-driving can be used to monitor and direct the efforts of road safety agencies. Transportation agencies will be interested in the choice of mode (e.g., why not public transport?), the use (congestion) of particular parts of the road network, the emissions of the vehicle, the purpose of the trip, etc.

The dimensions of each trip considered of interest were:

- Who is travelling?
- How are they travelling (trip mode, vehicle type, etc)?
- When do they travel?
- Where do they travel (use of the road or rail network)?
- Is the trip of high risk (conforming to road rules or not)?
- Why are they travelling (trip purpose)?
- With whom are they travelling (vehicle occupancy)?

Potentially all these dimensions can be measured to some degree. Table 12.1 shows some examples of measurement instruments and their strengths and limitations with respect to the measurement of these dimensions. The most comprehensive instrument is potentially the self-report travel survey. If the quality of the responses can be maximised through the use of thorough survey procedures and on-the-spot validation of addresses, then this instrument is potentially the foundation that supports - and provides context for - the other measurements. Its disadvantage is its high cost and its inability to measure illegal behaviours, such as speeding. Illegal behaviours, or any behaviours that are unlikely to be self-reported accurately, may be measured using inconspicuous observational surveys.
Table 12.1: Dimensions of travel and potential measurement instruments

<table>
<thead>
<tr>
<th>Survey instruments</th>
<th>Who is travelling?</th>
<th>How do they travel?</th>
<th>When do they travel?</th>
<th>Use of road or rail network</th>
<th>High risk (conforming to laws or not)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Travel survey</strong></td>
<td>Detailed information on where they live, with whom they live, profession, income, number of vehicles, etc., but heavy vehicle and commercial vehicle travel underestimated</td>
<td>Detailed information on mode and also vehicle make and model</td>
<td>Detailed information on when travel occurs – when trip started and finished</td>
<td>Depends on accuracy of address data and mapping algorithms; potentially good data</td>
<td>Self-report of illegal behaviours not thought to be reliable and not usually collected – need observational data. Trip speed can be derived – but includes stoppages, so not very useful.</td>
</tr>
<tr>
<td><strong>Inconspicuous observational surveys (speed, alcohol, helmets, restraints)</strong></td>
<td>Generally poor information on driver age/sex unless driver is stopped</td>
<td>By broad vehicle type and only</td>
<td>Coverage usually restricted to certain times of day / night and days of the week</td>
<td>Coverage usually for only restricted part of the network</td>
<td>Only way of collecting data without bias due to behaviour change of those observed</td>
</tr>
<tr>
<td><strong>On-road vehicle counts or surveys</strong></td>
<td>Not known unless vehicle is stopped</td>
<td>If observational, broad vehicle types may be recorded; if automatic, heavy vehicle types can be identified</td>
<td>Coverage may be restricted to certain times of day / night and days of the week</td>
<td>If road network is completely represented, VKT data can be reliable but poor efficiency</td>
<td>Not collected</td>
</tr>
<tr>
<td><strong>Licensing database with odometer readings</strong></td>
<td>Often owner is also driver</td>
<td>Extremely good data even by make and model</td>
<td>Not known</td>
<td>Not known</td>
<td>Not known</td>
</tr>
<tr>
<td><strong>Other administrative data: public transport trips; freeway counts; etc</strong></td>
<td>Not known</td>
<td>Good public transport data</td>
<td>Potentially good data</td>
<td>Coverage of network restricted to very high volume sites for traffic counts</td>
<td>Some data on speeds and red light running</td>
</tr>
</tbody>
</table>
13 BEHAVIOUR, TRAVEL AND EXPOSURE FORUM

13.1 FORUM ORGANISATION

The Behaviour, travel and exposure Forum, facilitated by MUARC, was convened at the Monash Conference Centre, Collins St, Melbourne on Tuesday 15th August, 2006. Representatives from agencies with potential collaborative interests and the members of the Project Advisory Committee (PAC) were invited. The PAC members represented the following agencies: VicRoads, TAC, RACV, Victorian Police and Department of Infrastructure. Several MUARC staff, with expertise in surveys, road safety statistical analysis and data collection methodology attended. Dr. Mike Keall an expert in behaviour, travel and exposure survey design and analysis was invited to share his experiences from his work in New Zealand. (See Appendix F for Forum Program). This section of the report documents the proceedings and outcomes of the Forum.

13.2 FORUM GUEST SPEAKERS SUMMARY

13.2.1 Welcome – Dr. Michael Lenné

The Forum was opened by the Facilitator Michael Lenné. Mike L introduced the attendees, the day’s agenda and identified the aims of the forum. Two main aims were identified firstly; MUARC delivering an umbrella framework concept that would incorporate major government agencies undertaking collaborative collection of behaviour, travel and exposure data within Victoria. Secondly, to inform key parties regarding the advantages of a collaborative approach, to outline this umbrella concept and to encourage the travel/exposure survey organisers to design their planned surveys to fit into this umbrella framework. Mike L proposed that in the course of the Forum, the advantages of being able to see their individual survey results in the context of total travel would be explained and discussed. Also to be discussed would be the importance of making appropriate adjustments to survey design and weights to ensure representativeness and adequate coverage of road user groups of interest.

13.2.2 Introduction – Dr Max Cameron

Max Cameron introduced the history of MUARC’s involvement in the Behaviour, travel and exposure field. This history was traced back to the Benchmark of Safety Study (Whelan et al., 2003), then the Behaviour, travel and exposure Study Stage 1 (MUARC, 2005) and more recently the recommendations resulting from the Behaviour, travel and exposure Surveys Project Stage 2 (MUARC, 2006). Stage 1 of the project had outlined the importance of regular measurements of on-road behaviours and exposure to risk, in order to assist policy decisions about risky situations and also to evaluate programs in terms of changes in behaviour. The Stage 1 report reviewed previous data collection methods and the availability of existing travel surveys, and generally concluded that a program of observational and self-report surveys, carried out in a coordinated and cost-effective way, is needed in Victoria.

Stage 2 of the Behaviour, travel and exposure Survey project for the MUARC Baseline Research Program Committee has recommended:

1. That MUARC collaborate with the Department of Infrastructure (DOI) in designing and implementing the large-scale household-based interview survey that it intends to run every five years. MUARC could carry out smaller scale surveys with the
same design during the intervening years in order to provide continuous travel and
behaviour data for road safety purposes.

2. That MUARC give consideration to collaborating with VicRoads in the design of
This may assist with the design of an observational survey in the Melbourne
metropolitan area, although a VicRoads survey of this type is not likely to
eventuate for another three years.

While following the recommendation that MUARC explore the opportunity to collaborate
with the Department of Infrastructure and VicRoads, the concept of an umbrella
framework evolved (See Appendix G for Forum Introduction Presentation and Stage 1 & 2
of this report for detailed explanation of project history).

Max discussed a definition of an umbrella concept that incorporated total land transport
travel/exposure in Victoria per annum, under which each of the planned travel/exposure
surveys could be considered to lie. The conceptual population would be each of the
kilometres of out-of-house surface travel by persons in Victoria, whether it is by foot,
bicycle, motorcycle, motor vehicle or railed public transport, on each of the days of the
year, and for each of the years in future.

A key point to emerge from this presentation was the importance of considering this
conceptual population across the entire year (See Figure 13.1), as opposed to the restricted
scope of only a small number of times during the year.

![Figure 13.1: Conceptual population of Travel in Victoria](image)

13.2.3 Department of Infrastructure VISTA 07 Survey – Mr Fotios Spiridonos

Fotios Spiridonos (DOI) was the next speaker to address the forum. Fotios introduced the
planned *Victorian Integrated Survey of Travel and Activity 2007 (VISTA 07)* (See
Appendix H). The VISTA 07 will sample for 365 days of the year. The current aim is to
administer the survey between February 2007 and February 2008, and while it is a one-off
survey, the possibility of making this an ongoing survey (eg. biennial) will be explored at a
later date. The survey will be piloted around October this year for one month, and outcomes of this pilot will be reviewed and necessary modifications made. Raw data from the survey are expected to be available around March to April 2008. The sample size estimates for each region are:

<table>
<thead>
<tr>
<th>Region</th>
<th>No. of households</th>
</tr>
</thead>
<tbody>
<tr>
<td>Melbourne</td>
<td>12,000</td>
</tr>
<tr>
<td>Geelong</td>
<td>70,000</td>
</tr>
<tr>
<td>Ballarat</td>
<td>32,000</td>
</tr>
<tr>
<td>Bendigo</td>
<td>38,000</td>
</tr>
<tr>
<td>Latrobe Valley</td>
<td>28,000</td>
</tr>
</tbody>
</table>

A steering committee will be formed and the offer of a MUARC representative on that committee was accepted. MUARC has also offered the availability of Dr Mike Keall for the position of peer reviewer if required.

Key points to emerge from this presentation included:

- The importance from a methodological viewpoint of DOI’s strategy to sample households across the 365 days of the year was noted as a major strength.
- That DOI is planning to sample key regional centres in addition to the Melbourne Statistical Division (MSD).

### 13.2.4 Discussion of VicRoads Rural and Motorcycle Surveys

Pat Rogerson (VicRoads) provided a handout outlining the objectives of the proposed VicRoads study to examine the travel patterns of rural Victorians (see Appendix I). To further clarify the needs of the study Mike Lenné presented power point slides outlining the overall aims and needs of the study as perceived by MUARC. Pat explained that her study aimed to cover travel occurring in rural Victoria outside the MSD and at this point would exclude travel that originated in a rural area if it entered the MSD. They were interested in sampling from 5 major Victorian towns: Geelong; Ballarat; Bendigo and; Latrobe Valley (which are all included in the DOI sampling frame) and also Benalla. Fotios stated that the DOI had also considered the possibility of including Benalla. Different road types (eg. M, A, B, C, & local) would need to be identified as well as information regarding mobile phone use. VicRoads aims to tender out the entire project including: survey design; survey administration; data collection; data analysis and; report submission. The current aim is for data collection from February 2007 to February 2008 (the same timeframe as DOI).

The handout provided by Chris Brennan (VicRoads) outlining the objectives of the proposed motorcycle exposure study was discussed (see Appendix J). Three types of data collection were identified as relevant for this study: observational (behavioural), travel survey, and traffic counts. The sampling timeframe would be between 9-12 months with the observational study completed by 2008. Chris identified that the variables of interest included: type of motorcycle; engine size; roads travelled on including origin and destination (these variables of interest would be accommodated using the VISTA 07 if
scooter was included in the type of vehicle list but also if vehicle make and model are adequately recorded for the household vehicles).

Chris explained that because the motorcycle funding was coming from a specific levy, that outcomes from this spending would have to be identifiable as having positive motorcycle safety benefits. Therefore, for his department to agree to any project it would have to be clear to VMAC that this process was achieving these aims.

13.2.5 Behaviour, travel and exposure Methodologies and Analysis – Dr Michael Keall

Mike Keall delivered three presentations. Presentation 1 covered the broad data collection methods that can be utilised, under an umbrella framework, to more comprehensively conduct behavioural, travel and exposure studies. Presentations 2 and 3 covered how these methodologies have been used in New Zealand. (See Appendices K, L, & M)

Regarding presentation 1, key points to emerge were the definition of a trip, whereby travel (walking/cycling/driving/passenger) on public road/rail in Victoria is defined by four dimensions:

- who is the person travelling
- where and when travel takes place
- mode / vehicle type
- behaviour (especially high risk/illegal)

Mike K discussed these four dimensions in some detail, as summarised in Figure 13.2.

Mike K linked these four dimensions of travel with different surveying methodologies. For example, a high quality travel survey would incorporate the collection of who, where, and mode data, while the behavioural data would be collected via roadside observational surveys.
This information was used to inform the proposed collaborative approach outlined in the following section entitled ‘roundtable discussion’.

13.3 ROUND TABLE DISCUSSION

13.3.1 Summary of main discussion

Mike Lenné set the stage for the afternoon discussion session by summarizing some of the salient points raised by the various speakers in the morning sessions and focusing on the similarities of objectives within these parties. Some points of note that emerged from the morning session included:

- the importance of not overlooking the serendipitous timing of interested parties in collecting travel and exposure data in Victoria
- the commonalities in timelines for data collection by both DOI and VicRoads
- face-to-face interviews being the gold standard surveying method for travel surveys
- how some of the behaviours of interest especially illegal behaviours are not well measured using this survey method
- DOI is interested in conducting household interviews
- VicRoads are open to consider various data collection methods including household surveys

Mike L then introduced a slide depicting the various timeline data collection commitments of DOI, VicRoads and VMAC. Both DOI and VicRoads (rural) are aiming to collect data from February 2007 – February 2008. VMAC is exploring 2 separate elements to their data collection with a traffic count project occurring to be completed by June 2007 and a possible observational study to be completed by June. He highlighted that while there were some gaps, there was the potential to satisfy all 3 parties using a collaborative approach from a timeframe perspective.

Mike then listed some important issues (relevant to each organisation) to keep in mind during the umbrella framework discussion, including:

- The differences between aims have differing methodological and statistical implications. For example, Max mentioned the of issues of research focused on problem identification versus measurement of behaviour change over time and how each aim has different methodical and statistical ramifications (to be discussed further later)
- the collaborative approach would result in sampling the wider road user population (providing more representative data for individual organizations and also the other road safety organizations)
- individual organizations’ potential to adapt timeframes to facilitate collaboration
- Funding issues related to collaborative approach (will not be discussed today but important to keep in mind)
• Pooling of resources

• Data ownership

Mike L then presented a slide (see Figure 13.3 below) capturing: examples of the type of data each organisation is interested in collecting; what additional data may be needed to complete the overall picture and; who will benefit from this collaborative data collection process. This slide captured each of the four dimensions of travel discussed by Mike Keall and presented above in Figure 13.2, whereby resources from DOI and VicRoads would be directed toward the collection of the who, where, and mode data via household surveys, with MUARC to seek separate funding to conduct targeted observational studies to collect the behavioural data.

Mike L focused on the similarities in aims between the various parties and how collaboration would result in a larger more representative data set for all concerned. Mike also suggested that it would be worth exploring if MUARC could fill any gaps especially with MUARC’s strong track record in the area of conducting observational studies.

---

**Figure 13.3: Umbrella framework sampling approach**
Max then addressed the group to further clarify the umbrella framework’s concept of sampling all travel in Victoria (see Fig. 13.4 below). The upper row of boxes in represent all Victorian households (MSD, Regional Centres e.g., Geelong, Ballarat, and other Rural areas).

![Figure 13.4: Sampling frame example](image)

DOI aim to sample the first 2 boxes (MSD and Regional centres) and this sample will include people travelling within these areas, however, people will also travel between these regions, e.g., travelling from Geelong to Melbourne for work. So already some of the households of interest to Pat’s rural survey will already be interviewed by Fotios’ DOI survey.

What MUARC are suggesting is if DOI’s funding gets pooled with VicRoads and VMAC funding, then we can effectively sample every household in the state. A sample will be drawn from each of these groups (see second row of boxes) and the relative population sizes could be calculated from the Census data. From this data we can also define the subset of the houses that have motorcycles (it is recognised that VMAC will have an interest in sampling motorcycles with sufficient reliability to justify their contribution to the project).

For example, if DOI sample 1% of households in the MSD, we could sample 10% of motorcycle households, 5% in regional areas and 15% in rural areas depending on budget constraints. If we know these sample sizes we can accurately calculate how much more accurate the motorcycle study will be from these subsamples. Total travel in Victoria will still be represented it is just that motorcycle data will be more precise. Following this approach it doesn’t matter if motorcycles are travelling in one area or across the three areas.

Looking back at Figure 13.3, potentially DOI and VicRoads could use the same household survey, providing that the DOI survey contained the necessary data items to support VicRoads’ aims. The result is a much greater combined sample size, greater sample coverage (cf Figure 13.4), and the adoption of a high-quality methodology.
This is a grand plan that satisfies the original objectives of data collection spanning 365 days, Victoria wide for potentially every Victorian household. MUARC is suggesting that by making the appropriate arrangements between DOI, VicRoads and VMAC that we can satisfy all interested parties needs while satisfying the greater needs of having coverage of every household in Victoria.

Max also suggested that this licensing information is already available in vehicle registers and driver licensing files but there may be privacy issues to sort out. He also noted that what was apparent was how closely the DOI survey would satisfy the needs of VicRoads. Because of the impending deadlines for the DOI survey, Max suggested that VicRoads not propose the over sampling of motorcycles (unless they felt strongly otherwise); alternatively that they rely on Mike K’s proposition that they would obtain adequate numbers of motorcyclists in the current sampling framework plan. The VMAC money could be used to fund further over sampling of the motorcycle subpopulation in the VicRoads Rural survey.

Max suggested that what VMAC would get out of the DOI survey would be motorcycle exposure measured from a sample in proportion to the motorcycle appearance in households. From the VicRoads survey VMAC would get motorcycle exposure measured with a much larger sample of motorcycle travel throughout Victoria.

Max suggested that over sampling the motorcycle strata in the DOI sample could still be discussed in the negotiation phase between VicRoads and DOI, where VicRoads provide the motorcycle orientated households (as identified through the vehicle register) to the successful tender.

Max acknowledged the need to incorporate motorcycle exposure in the surveys but highlighted the importance of being pragmatic about how this could be accomplished given the DOI deadlines. He also stated that if there was a focus on rural motorcycles in rural areas motorcycle, rural exposure data should be more than adequately covered.

It was explained that DOI was conducting their own data analysis whereas VicRoads was considering tendering out the analysis; this would enable quite rapid access to the raw data.

Max highlighted the importance of surveys and data sets that are compatible and can be analysed together thus the importance of working together with DOI. Weighting factors would have to be carefully considered and attached to every individual record so that they are automatically weighted in the analysis phase.

Max proposed that if these ideas were accepted by DOI and VicRoads and hopefully VMAC that it was extremely important that the general framework concept be written into tenders to make the process viable. It would ensure that each interested party gets a sample size commensurate with the amount of money they contribute. While Pat seemed very keen to commit to the idea and to talk with DOI about the possibility it can’t be stressed enough that the design needs to keep to the recommended framework for the sampling to be successful.

13.3.2 Summary of discussion regarding MUARC’s future role

Mike L highlighted that at this point MUARC’s commitment ceases following the writing up of the report from the forum, as MUARC’s budget allocation finishes. He reiterated that MUARC’s interest had been in ensuring appropriate data collection but also that MUARC
has an interest in continuing to be proactive in finding a mechanism to ensure the long- 
term commitments form all parties to the framework, made at the forum.

Richard asked if exploring the proposal that MUARC fill the gaps in the framework by 
exploring potential observational studies eg. mobile phone usage while driving was 
something that should be talked about at the forum. Max acknowledged that the topic of 
MUARC and observational studies had not been explored to a great extent during the day. 
He summarized that what MUARC had achieved during the day was that instead of doing 
the traditional behavioural surveys at *sites of convenience* MUARC had discovered a way 
of relating them to the context of the total population of travel in Victoria by linking them 
to the travel survey. This would allow MUARC to be more confident that each of these 
behavioural surveys, when undertaken, would be appropriately weighted to represent 
behaviour over a broader population rather than just specific sites eg. The Great Ocean 
Road etc.

Further, Max reiterated that MUARC’s future role in data collection would focus on the 
observational surveys designed to measure targeted behaviours, that is, the fourth 
dimension of travel (Figure 13.4) that is not covered by proposed DOI and VicRoads 
activities. A costed proposal will be submitted to the baseline sponsors in the coming 
months.

Max proposed that the observation studies will come from different funding than that of 
DOI, VicRoads and VMAC, except that VMAC might fund its own observational 
component (which we haven’t done justice today but could be elaborated on further). What 
we have gained is a mental picture of how the special observational surveys like drink 
driving, seat belts, bicycle use might be put in context.

**If the 3 agencies (DOI, VicRoads and VMAC) follow MUARC’s sampling 
recommendations and cover the whole of Victoria then this will provide a useful 
framework for the MUARC observational surveys.** Max suggested that the other 
obvious omission was to explore what would occur for future years after the proposed 
2007 surveys. MUARC could offer more of the same but with potentially smaller samples.

Mike L continued that there had been an overriding focus on methodology and that Chris 
would need to think about his commitment to the framework but that it was obvious that 
Pat and Fotios were heading down compatible paths and that their agreement to this 
framework had been a significant achievement. Mike stressed that the time frame for DOI 
was tight and he asked for details about what needs to be undertaken following the 
cessation of the forum. He summarised that MUARC have committed to write up a 
summary report from this forum which will capture the salient points from each 
presentation but the main focus will be on providing the methodological details discussed. 
He acknowledged that Fotios’ key role in the success of the process but asked the PAC 
representatives if this was role MUARC should take on. The need for further discussion 
with Fotios was acknowledged. Mike also acknowledged that importance of Pat promptly 
making contact with Fotios to discus their collaboration and also the inclusion of licensing 
questions.

Max agreed with Mike explaining that MUARC staff could discuss with Fotios the 
inclusion of extra questions relevant to Pat and Chris but this would be better coming from 
them directly. Pat agreed with Max stating that VicRoads would conduct their own 
negotiations with Fotios. She re-iterated that she would not be emphasizing the sampling 
frame but also acknowledged the usefulness of having a Victorian wide sample to analyze
Max concluded that he hoped from Fotios, Pat and Chris’s point of view that the forum had highlighted the benefits of a collaborative approach and that by working together they would achieve a lot more than individually. He also stressed to Pat that if her study does face budgetary constraints to seriously consider Mike K’s cluster strategy because if she doesn’t sample the whole of rural Victoria, at least conceptually, then there will be a gap in the framework.

Mike L closed the day by acknowledging MUARC’s efforts in organizing the forum and the hope that it was a useful event for the attendees in demonstrating that the conceptual framework would be beneficial for all parties including MUARC and its sponsors. He expressed his appreciation to everyone for attending, thanked the presenters, especially Mike for his expertise and his trip from New Zealand and Belinda for organizing the event.

13.4 KEY OUTCOMES OF FORUM

13.4.1 Collaboration

- All were in support of the benefits of developing a collaborative approach, whereby VicRoads and DOI would use a uniform data collection tool and collaborate on the sampling districts across regional centres and rural Victoria.

- It was acknowledged that extra information may be need to be added to the DOI survey design to satisfy VicRoads and VMAC data needs. DOI had acknowledged that this was possible however, associated costs would need to be discussed between the key parties.

- It was agreed that it was appropriate for VicRoads and DOI to hold urgent discussions to ensure that the needs of VicRoads could be met through the use of the DOI survey, including the addition of items (particularly for the motorcycle survey). These discussions also need to address issues of data ownership/control, survey variables, data analysis and suitable timeframes.

- The importance of including MUARC in the collaboration process for their expertise in statistical sampling frameworks. DOI have agreed to provide the MUARC with the opportunity to be represented on the VISTA Project Steering Committee (especially with regards expertise in designing the sampling framework to ensure total Victorian travel will be measured).

- That MUARC play a role in the collaborative approach by submitting proposal(s) to their Baseline Sponsors for observational studies to fill-in the gaps not covered by the DOI and VicRoads travel survey data collection.

13.4.2 Sampling Methodology

- All were in agreement that household surveying was the optimal method for collection of high quality travel/exposure data (with the exception of behaviours that are difficult to measure such as illegal behaviours, MUARC will explore collection of this type of data)

- All acknowledged the importance, from a methodological viewpoint, to sample households across the 365 days of the year
• DOI is planning to sample key regional centres in addition to the Melbourne Statistical Division (MSD)

• For the umbrella framework (measuring the total population of travel in Victoria) to be effective it is imperative that VicRoads sample from rural areas outside the regional centres covered in the DOI sample. Mike Keall has offered to advise VicRoads on cluster sampling if budget restraints threaten this sampling design (it was stressed that sampling cutting would leave gaps in the sampling framework)

• MUARC will maintain some involvement in the overarching project (statistical advisors on the VISTA Project Steering Committee), but will primarily be involved in the direction and collection of the behavioural/observational data. Separate funding for the behavioural/observational studies will be sought from the baseline sponsors.
14 RECOMMENDATIONS

14.1 BACKGROUND

The Stage 1 Report was a review of the current data collection and surveys currently conducted to identify Victorian travel, behaviour and exposure patterns. This review identified that these data were not systematically collected in Victoria. The final recommendation from this project was that MUARC should undertake a further study (Stage 2) to: identify the essential data to be collected; propose methodologically sound data collection methods; and provide estimates of the cost of this data collection (see Section 6 for comprehensive summary).

During the course of the Stage 2 project it was found that DOI was in the process of designing and implementing travel and exposure data collection in the Melbourne Statistical Division (MSD) with the possible inclusion of Geelong, using a similar format to the VATS surveys that had ceased in 2002. The DOI data collection objective was to assess and forecast Victorian travel for use in public transport policy formation and road traffic flow predictions. However, it was obvious that, with the addition of a few questions this survey could play a key role in providing travel exposure data that could be utilised for evaluation and forecasting from a road safety perspective. It was also identified that VicRoads had available funding to explore travel and exposure within rural Victoria. The possibility of collecting Victoria wide travel and exposure data in a collaborative proposal involving these 2 agencies became apparent (see Section 10 for comprehensive summary). The recommendations from the Stage 2 project were that MUARC would undertake a Stage 3 project to further explore the concept and working practicalities of a Victoria-wide collection of travel, behaviour and exposure data.

During the design phase of the Stage 3 project (Behaviour, travel and exposure Framework) it was decided that MUARC would facilitate a one-day Behaviour, travel and exposure Forum involving representatives of key Government and road safety agencies, to discuss future goals for data collection in this domain. There were 3 main aims for the forum:

1. Define an umbrella concept of total land transport travel and exposure in Victoria

2. Propose and discuss the concepts of this umbrella framework with the objective of fostering a collaborative approach to travel, exposure and behaviour data collection that would encompass the entire Victorian population

3. Identify gaps in the coverage of the data collection proposed by other agencies and to make recommendations to our Baseline Sponsors regarding small-scale surveys to be conducted by MUARC to fill in these gaps. Following this process MUARC would submit proposals to the Baseline Committee to address the design, implementation and associated costs of the recommended small-scale surveys. (see Section 10.3 for comprehensive description)

The forum was a great success resulting in the accomplishment of all three of the above aims.

The MUARC research team devised an outline of an umbrella framework, based on the work of Dr. Mike Keall. He had devised extensive Behaviour, travel and exposure data collection instruments for use in New Zealand. This Framework provided a springboard for
the discussions at the Forum. A detailed definition and explanation of the umbrella framework measuring total land transport travel/exposure in Victoria can be found above in sections 12 & 13.

In a further development resulting from fostering a collaborative approach to data collection (aim 2 of Forum), DOI and VicRoads are currently working together on the VISTA 07 Survey. This Survey is to be piloted in February 2007 with the aim of collecting data for the Melbourne Statistical Division and 4 or 5 regional centres (still to be decided) for 365 days from March 2007 to February 2008. VicRoads is currently deciding on the rural sampling procedure that they will fund to enhance this collection.

With reference to the third aim of the forum (MUARC’s role), the forum provided an opportunity for the various key road safety agencies to identify the essential data items to be collected and what data would be omitted from the proposed VISTA 07 survey. It was apparent that behavioural travel and exposure data relating to illegal behaviours (such as alcohol and drug use, speeding, mobile phone use, seat belt usage) and behaviours unlikely to be accurately self-reported (such as wearing of protective clothing by motorcyclists/cyclists and use of bull bars) were the key areas not covered by the proposed survey. Collection of these data by MUARC using small-scale observational studies, combined with the DOI and VicRoads collaborative survey data would result in a comprehensive coverage of travel, behaviour and exposure data throughout the entire Victorian population.

While, several key areas had been identified that currently lacked regular and reliable observational data collection, it was important to recognise the costs associated with designing and implementing these types of studies and MUARC’s reliance it’s on Baseline Sponsorship to meet these costs. Taking into consideration MUARC’s awareness of other road safety initiatives that were being formulated within Victoria the research team recommended a hierarchy of importance and/or relevance for these various small-scale behavioural/observational studies with the aim of co-ordinating these studies to best meet the various needs of our Sponsors.

14.2 PROPOSAL FOR ON-ROAD DRIVER ALCOHOL AND DRUG SURVEY PROGRAM IN MELBOURNE

From the recommendations resulting from the Stage 3 Behaviour, travel and exposure Framework, it was proposed that the first of the MUARC behavioural surveys should be an On-Road Alcohol and Drug Survey Program conducted in the Melbourne Statistical Division.

This project was recommended as the first of the observational studies to be conducted by MUARC due to its timely ability to complement a traffic enforcement monitoring and strategy plan for Region 1, concurrently being developed by MUARC in collaboration with the Victorian Police. MUARC had been commissioned to develop a traffic enforcement plan, including an evaluation of potential major drink-driving initiatives for Region 1, Melbourne during 2007. Earlier work by MUARC comparing the five Regions had shown that RBT is most effective in Region 1 compared with the other regions, presumably because drink-driving is more of an issue in that region.

As discussed at the Forum, this study will be based on adaptations of the models used in New Zealand in 1995 and 1996. (Keall and Frith, 1997; Keall Frith & Perkins, 1996). These road side surveys were sponsored by a joint partnership between the Land Transport
Safety Authority and the New Zealand Police and have been invaluable in providing data on illegal behaviours not measured by their travel survey method. New Zealand roadside survey data assisted the identification of the problem of drink driving in the mornings after high alcohol hours and also the trend of drink drivers using local streets to avoid detection by the RBT units on the arterial roads. Data from this study will form a critical part of the evaluation of the Region 1 RBT initiative.

The surveying of both BAC levels and drug levels was proposed because of the potential substitution effect when drivers feel threatened by increased RBT. In addition to supporting the planned Region 1 study, there was also the potential for the collection of drug use data to provide valuable insights that would complement the outputs from the current Baseline funded drugs in crashes study. Furthermore, the current roadside drug testing protocol excludes drug testing of drivers found to be over the .05 BAC level. The ability to drug test this group of drivers could enhance the accuracy of current drug driver data and provide some insight into polydrug use and driving.

The Baseline Committee approved funding for the design phase of this proposed project during February 2007. The design phase of the project titled *On-Road Driver Alcohol and Drug Survey Program in Melbourne* has commenced.

14.3 PROPOSAL FOR ROADSIDE VEHICLE OBSERVATION STUDY

Based on the recommendations from the Stage 3 Behaviour, travel and exposure Framework, the research team proposed that the second of the behavioural surveys should be the design of a Roadside Vehicle Observation Survey Program, to be conducted in the Melbourne Statistical Division.

This project was given priority in recognition of the history of the Baseline Sponsor’s interests in the overall Behaviour, travel and exposure Research Program, especially the TAC. Vehicle observation was chosen to gather data on mobile phone usage and also the presence of bull bars fitted to the vehicle, both of which are recognised by the TAC as emerging road safety issues.

The original MUARC Report into on-road behaviours, “Establishing a Benchmark of Safety on Melbourne Roads During 2001” (Whelan et. al., 2003), piloted this type of roadside observational survey in Melbourne and made recommendations regarding sample sizes, and observation sites. Stage 1 of this report recommended the implementation of this type of survey for its cost effectiveness and feasibility in measuring behaviours not identified in the self-report Travel Surveys eg VISTA 07 (see Section 6.3). Initial design recommendations were presented in Stage 2 of this report (see Section 9). The road-side observation record forms would incorporate all items included in the Benchmark Study to allow comparison of results over time. The additional items proposed for collection would provide data on mobile phone and bull bar use.
It was proposed that the road-side observation record forms would be the same as those
designed for the Benchmark Study, permitting for comparison over time (see Appendices
B & C), but also incorporating additional data eg. mobile phones and bull bars.

The overall proposal was not approved by the Baseline Committee in their February 2007
funding allocation meeting however, the Committee did allocate funding to design a
roadside study aimed at observing bullbars, seatbelt wearing and child restraint use. This
project has now commenced.
15 REFERENCES


APPENDIX A: TRAVEL DIARY

TRAVEL DIARY

DAY 1

1. Did you travel anywhere on Day 1?
   □ YES   □ NO  (If No, Go to Day 2)
   If YES please fill in the following information

2. Where did you start the day on Day 1?

   Address: ____________________________________________________________
   ___________________________________________________________________

3. In the last 12 months, could you estimate how many kilometres you have done as the driver of any motor vehicle eg. car, truck, motorcycle, bus? ___________ km

4. Do you currently hold a licence to drive:

   A car  □ YES  □ NO  ? is it a full licence  □  probationary licence  □  learners permit  □
          □  How long have you had it?
          □  years  □  months

   A motorcycle □ YES  □ NO  ? is it a full licence  □  probationary licence  □  learners permit  □
                 □  How long have you had it?
                 □  years  □  months

   A truck    □ YES  □ NO  ? is it a full licence  □  probationary licence  □  learners permit  □
               □  How long have you had it?
               □  years  □  months

   A bus     □ YES  □ NO  ? is it a full licence  □  probationary licence  □  learners permit  □
             □  How long have you had it?
             □  years  □  months
<table>
<thead>
<tr>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>A) What time did you commence your travel for the day?</td>
<td>am / pm</td>
</tr>
</tbody>
</table>
| B) What was your first stop? | □ A bus stop  
□ A tram stop  
□ A train station  
□ My workplace  
□ Another workplace  
□ Pre-school/childcare  
□ School  
□ Tertiary institution  
□ A shop/retail outlet  
□ My home  
□ Someone else's home  
□ Other (please specify) |
| C) What time did you arrive at Stop 1? | am / pm |
| D) How did you get to stop 1? | □ Car  
□ Motorcycle  
□ Other vehicles (please specify) |
<p>| E) How many roads did you cross? | □ Other (please specify) |
| F) How many pedestrian crossings did you use? | □ Other (please specify) |
| G) How long did it take you to reach your destination? | □ Other (please specify) |
| H) How long did it take to walk from your transport stop/parking spot to your destination? | □ Other (please specify) |
| I) Estimate how far you traveled? | □ Other (please specify) |</p>
<table>
<thead>
<tr>
<th>D) Why did you go to Stop 1 (repeat for each stop)?</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ To catch a bus/train</td>
</tr>
<tr>
<td>☐ Accompany someone</td>
</tr>
<tr>
<td>☐ Shopping</td>
</tr>
<tr>
<td>☐ Collect something</td>
</tr>
<tr>
<td>☐ To pick up or drop off someone</td>
</tr>
<tr>
<td>☐ To eat or drink</td>
</tr>
<tr>
<td>☐ Education</td>
</tr>
<tr>
<td>☐ Work</td>
</tr>
<tr>
<td>☐ Work-related visit</td>
</tr>
<tr>
<td>☐ Social visit</td>
</tr>
<tr>
<td>☐ Sport – participating</td>
</tr>
<tr>
<td>☐ Sport – watching</td>
</tr>
<tr>
<td>☐ Medical/Dental</td>
</tr>
<tr>
<td>☐ Recreational</td>
</tr>
<tr>
<td>☐ Social welfare</td>
</tr>
<tr>
<td>☐ Left country</td>
</tr>
<tr>
<td>☐ To arrive home</td>
</tr>
<tr>
<td>☐ Other (please specify)</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>F) Were you the</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ Driver/rider</td>
</tr>
<tr>
<td>☐ Passenger/pillion</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>G) If passenger/pillion who was the driver/rider?</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ Partner/spouse</td>
</tr>
<tr>
<td>☐ Relative</td>
</tr>
<tr>
<td>☐ Friend</td>
</tr>
<tr>
<td>☐ Colleague</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>H) How many people were there in the vehicle (including yourself)?</th>
</tr>
</thead>
<tbody>
<tr>
<td>___________ people</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>I) Where was the vehicle parked?</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ Not parked</td>
</tr>
<tr>
<td>☐ Off street parking</td>
</tr>
<tr>
<td>☐ Resident parking</td>
</tr>
<tr>
<td>☐ Private (eg. business premises)</td>
</tr>
<tr>
<td>☐ On street free parking</td>
</tr>
<tr>
<td>☐ Time limit</td>
</tr>
<tr>
<td>☐ No time limit</td>
</tr>
<tr>
<td>☐ On street ticketed/metered parking</td>
</tr>
</tbody>
</table>

**GO TO QUESTION L**

<table>
<thead>
<tr>
<th>O) What route did you take to get there?</th>
</tr>
</thead>
<tbody>
<tr>
<td>________________________________________</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>P) Was this the end of your first stop?</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ YES</td>
</tr>
<tr>
<td>☐ NO</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Q) What was your destination address?</th>
</tr>
</thead>
<tbody>
<tr>
<td>_____________________________________</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>R) When did you eventually leave stop one?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date ________________________________</td>
</tr>
<tr>
<td>Time ___________ am / pm</td>
</tr>
</tbody>
</table>

**GO ON TO STOP 2**
Alcohol

5. Thinking about the day before your first travel day, did you drink any alcohol at all after 6pm on that day, e.g. socially or at home?

☐ YES  ☐ NO (If No, Go to Question 9)

6. What times did you drink?

Between

☐☐☐☐ am/pm start time  ☐☐☐☐ am/pm start time
☐☐☐☐ am/pm finish time  ☐☐☐☐ am/pm finish time

(record start and finish of all drinking sessions)

7. Where were you when you had these drinks?

☐ At home
☐ Someone else’s home
☐ Hotel/bar/tavern
☐ Sports club
☐ Nightclub
☐ At another type of club
☐ Restaurant, café or coffee shop
☐ Work or workplace
☐ Sports event or outdoor activity
☐ Other (please specify)

8. How many standard drinks did you have? ----------------- standard drinks

9. Thinking about the your first travel day, did you drink any alcohol at all after 6pm on that day, e.g. socially or at home?

☐ YES  ☐ NO (If No, Go to 13)

10. What times did you drink?

Between

☐☐☐☐ am/pm start time  ☐☐☐☐ am/pm start time
☐☐☐☐ am/pm finish time  ☐☐☐☐ am/pm finish time

(record start and finish of all drinking sessions)
11. Where were you when you had these drinks?

- At home
- Someone else's home
- Hotel/bar/avenue
- Sports club
- Nightclub
- At another type of club
- Restaurant, cafe or coffee shop
- Work or workplace
- Sports event or outdoor activity
- Other (please specify)

12. How many standard drinks did you have?

13. Thinking about your second travel day, did you drink any alcohol at all after 6pm on that day, eg. socially or at home?

- YES
- NO (If No, Go to 17)

14. What times did you drink?

Between

- ☐ ☐:☐☐ am/pm start time
- ☐ ☐:☐☐ am/pm finish time

(record start and finish of all drinking sessions)

15. Where were you when you had these drinks?

- At home
- Someone else's home
- Hotel/bar/avenue
- Sports club
- Nightclub
- At another type of club
- Restaurant, cafe or coffee shop
- Work or workplace
- Sports event or outdoor activity
- Other (please specify)

16. How many standard drinks did you have?
Accidents

17. Have you been involved in an accident over the last 12 months (as driver, passenger in a car/bus/taxi etc, pedestrian, cyclist)?

☐ YES ☐ NO (If No, End of travel diary)

18. How many accidents have you been involved in last 12 months?

For each accident:

19. Date of accident

______________________________

20. Time of day

☐ ☐ am/pm

21. Where did the accident occur?

Address

______________________________

22. Did anyone die as a result of accident?

☐ YES ☐ NO

23. Did you or anyone have to go to hospital as a result of the accident?

☐ YES ☐ NO

24. Did you or anyone have to spend any nights in hospital as a result of the accident?

☐ YES ☐ NO

25. Did anyone receive any injuries at all as a result of the accident?

☐ YES ☐ NO

26. Were you personally injured as a result of the accident?

☐ YES ☐ NO

27. In the accident were you:

☐ driver
☐ passenger
☐ rider
☐ pillion
☐ pedestrian
☐ cyclist
☐ Other (please specify)

______________________________
28. Altogether how many of each of the following were involved in the accident? (Enter numbers in boxes)

How many cars
How many vans
How many trucks
How many motorcycles
How many 4 wheel drive vehicles
How many bicycles
How many pedestrians
How many other objects
(please specify number)

----------------------------------------

29. How would you describe the accident?
A vehicle hitting a parked vehicle
A vehicle hitting the back of another vehicle (not parked)
A vehicle hitting the back of another (parked)
A head-on collision
Vehicles hitting each other at an angle
Hitting an object of some sort
Other (please specify)

----------------------------------------

30. In what speed zone did the accident happen? ---------- km/hr

31. Was the accident reported to police at any time?

☐ YES  ☐ NO

32. What would the cost of the total damage to all vehicles and bicycles would have been? $-------------
APPENDIX B: SITE DETAILS FORM

SITE DETAILS:

SITE NO: □ □ □ □

DATE: □ □/□ □/□ □ □ □ □

Day of week: ____________

Location

First Observation Number

Site diagram

Last Observation Number

Time - commence □ □:□ □ am / pm

Time - complete □ □:□ □ am / pm

SURVEY OBSERVERS ________________ ________________

CONDITIONS:

<table>
<thead>
<tr>
<th></th>
<th>HOUR 1</th>
<th>HOUR 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sunny</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Cloudy</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Rain</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Other</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>HOUR 1</th>
<th>HOUR 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dawn</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Day</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Dusk</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Night</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

Weather Comments: ____________________________________________

Street Lights: On / Off / None Speed zone: _________ Kph

Special Circumstances:

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________
APPENDIX C: VEHICLE OBSERVATION FORM

VEHICLE OBSERVATION FORM

Observation no:____

CAR CHARACTERISTICS

<table>
<thead>
<tr>
<th>Plate State</th>
<th>Type of vehicle</th>
<th>Size of car</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 VIC</td>
<td>1 Car 4WD</td>
<td>1 Small</td>
</tr>
<tr>
<td>2 NSW</td>
<td>2 Minibus</td>
<td>2 Medium</td>
</tr>
<tr>
<td>3 QLD</td>
<td>3 Utility/Panel Van</td>
<td>3 Large</td>
</tr>
<tr>
<td>4 Tas</td>
<td>4 Commercial Van</td>
<td></td>
</tr>
<tr>
<td>5 SA</td>
<td>5 Taxi</td>
<td>Headlights</td>
</tr>
<tr>
<td>6 NT</td>
<td>6 Unknown</td>
<td>1 On</td>
</tr>
<tr>
<td>7 WA</td>
<td></td>
<td>2 Off</td>
</tr>
<tr>
<td>8 Unknown</td>
<td></td>
<td>3 Unknown</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Plate displayed</th>
<th>Year of vehicle</th>
<th>Front end protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 None</td>
<td>1 1996-2001</td>
<td>1 Bull bar</td>
</tr>
<tr>
<td>2 L</td>
<td>2 1990-1995</td>
<td>2 Nudge bar</td>
</tr>
<tr>
<td>3 P</td>
<td>3 1980-1989</td>
<td>3 None</td>
</tr>
<tr>
<td></td>
<td>4 1970-1979</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5 &lt;1970</td>
<td></td>
</tr>
</tbody>
</table>

DRIVER CHARACTERISTICS

<table>
<thead>
<tr>
<th>Age estimate</th>
<th>Mobile Phone Use</th>
<th>Headrest</th>
<th>If incorrectly worn</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 YES</td>
<td>1 Correct adjustment</td>
<td>1 Straps not firm</td>
</tr>
<tr>
<td></td>
<td>2 NO</td>
<td>2 Incorrect adjustment</td>
<td>2 Straps twisted</td>
</tr>
<tr>
<td></td>
<td>3 UNKNOWN</td>
<td>3 Unknown</td>
<td>3 Straps not level/above shoulder</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sex</th>
<th>Mobile Phone Method</th>
<th>Seat belt use</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 Hand held</td>
<td>1 YES Correctly worn</td>
<td>4 Straps in contact with neck</td>
</tr>
<tr>
<td></td>
<td>2 Ear piece</td>
<td>2 YES Incorrectly worn</td>
<td>5 Strap crosses stomach (not hip)</td>
</tr>
<tr>
<td></td>
<td>3 Speaker phone</td>
<td>3 YES Can’t tell</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4 Unknown</td>
<td>4 NO Not worn at all</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 UNKNOWN if worn</td>
<td>5</td>
</tr>
</tbody>
</table>
## PASSENGER CHARACTERISTICS

<table>
<thead>
<tr>
<th>Sex</th>
<th>Seating location</th>
<th>Seat Belt Used</th>
<th>If incorrect</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Male</td>
<td>1 Front</td>
<td>1 YES correctly worn</td>
<td>1 Straps not firm</td>
</tr>
<tr>
<td>2 Female</td>
<td>2 Rear passenger</td>
<td>2 YES incorrectly worn</td>
<td>2 Straps twisted</td>
</tr>
<tr>
<td>3 Unknown</td>
<td>3 Rear driver</td>
<td>3 YES can’t tell</td>
<td>3 Straps not level/above shoulder</td>
</tr>
<tr>
<td></td>
<td>4 Centre back</td>
<td>4 NO</td>
<td>4 Straps in contact with neck</td>
</tr>
<tr>
<td></td>
<td>5 Tick if rear facing</td>
<td>5 UNKNOWN</td>
<td>5 Strap across stomach (not hip)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age</th>
<th>Seat belt type</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 0-3</td>
<td>1 Lap/sash</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 4-7</td>
<td>2 Lap belt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 8-13</td>
<td>3 Harness alone</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 14-17</td>
<td>4 Booster with lap/sash</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 18-25</td>
<td>5 Booster with harness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 26-39</td>
<td>6 Child seat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 40-59</td>
<td>7 Capsule</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 60+</td>
<td>8 Tick if rear facing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 Unknown</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sex</th>
<th>Seating location</th>
<th>Seat Belt Used</th>
<th>If incorrect</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Male</td>
<td>1 Front</td>
<td>1 YES correctly worn</td>
<td>1 Straps not firm</td>
</tr>
<tr>
<td>2 Female</td>
<td>2 Rear passenger</td>
<td>2 YES incorrectly worn</td>
<td>2 Straps twisted</td>
</tr>
<tr>
<td>3 Unknown</td>
<td>3 Rear driver</td>
<td>3 YES can’t tell</td>
<td>3 Straps not level/above shoulder</td>
</tr>
<tr>
<td></td>
<td>4 Centre back</td>
<td>4 NO</td>
<td>4 Straps in contact with neck</td>
</tr>
<tr>
<td></td>
<td>5 Tick if rear facing</td>
<td>5 UNKNOWN</td>
<td>5 Strap across stomach (not hip)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age</th>
<th>Seat belt type</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 0-3</td>
<td>1 Lap/sash</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 4-7</td>
<td>2 Lap belt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 8-13</td>
<td>3 Harness alone</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 14-17</td>
<td>4 Booster with lap/sash</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 18-25</td>
<td>5 Booster with harness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 26-39</td>
<td>6 Child seat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 40-59</td>
<td>7 Capsule</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 60+</td>
<td>8 Tick if rear facing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 Unknown</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### APPENDIX D: MOTORCYCLE OBSERVATION FORM

#### MOTORCYCLE OBSERVATION FORM

<table>
<thead>
<tr>
<th>Site No.</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Date</th>
<th>First Observation Number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Day of week</th>
<th>Last Observation Number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time — commence</th>
<th>Time — complete</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**SURVEY OBSERVERS**

#### MOTORCYCLE CHARACTERISTICS

<table>
<thead>
<tr>
<th>No. of occupants</th>
<th>Plate displayed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Plate displayed</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
</tr>
<tr>
<td>P</td>
</tr>
<tr>
<td>None</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Headlamp</th>
</tr>
</thead>
<tbody>
<tr>
<td>On</td>
</tr>
<tr>
<td>Off</td>
</tr>
<tr>
<td>Unknown</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>No. of occupants</th>
<th>Plate State</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Plate State</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIC</td>
</tr>
<tr>
<td>NSW</td>
</tr>
<tr>
<td>QLD</td>
</tr>
<tr>
<td>Tas</td>
</tr>
<tr>
<td>SA</td>
</tr>
<tr>
<td>NT</td>
</tr>
<tr>
<td>WA</td>
</tr>
<tr>
<td>Unknown</td>
</tr>
</tbody>
</table>

#### RIDER

<table>
<thead>
<tr>
<th>Age</th>
<th>Protective clothing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Upper body</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sex</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Helmet</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES Full</td>
</tr>
<tr>
<td>YES</td>
</tr>
</tbody>
</table>

#### PILLION

<table>
<thead>
<tr>
<th>Age</th>
<th>Protective clothing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Upper body</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sex</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Helmet</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES Full</td>
</tr>
<tr>
<td>YES</td>
</tr>
</tbody>
</table>
## APPENDIX E: BICYCLE OBSERVATION FORM

### BICYCLE OBSERVATION FORM

<table>
<thead>
<tr>
<th>Observation no:</th>
<th>Site diagram</th>
</tr>
</thead>
</table>

**SITE NO:**  □ □ □

**DATE:** □ □/□ □/□ □ □

**Day of week:**

**First Observation Number:**

**Last Observation Number:**

**Time – commence** □ □ : □ □ am / pm

**Time – complete** □ □ : □ □ am / pm

**SURVEY OBSERVERS**

<table>
<thead>
<tr>
<th>OPTIONS AVAILABLE</th>
<th>OPTIONS USED</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Road</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>main road car lane</td>
<td>2</td>
</tr>
<tr>
<td>service road</td>
<td>3</td>
</tr>
<tr>
<td>Shared pedestrian/cyclist pathway</td>
<td>4</td>
</tr>
<tr>
<td>Pathway for cyclist only</td>
<td>5</td>
</tr>
<tr>
<td>Footpath for pedestrians only</td>
<td>6</td>
</tr>
</tbody>
</table>

### RIDER

<table>
<thead>
<tr>
<th>Age</th>
<th>Helmet worn</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Yes</td>
</tr>
<tr>
<td>2</td>
<td>No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sex</th>
<th>Helmet carried</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Male</td>
</tr>
<tr>
<td>2</td>
<td>Female</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Conspicuous</th>
<th>Helmet done up correctly</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Yes</td>
<td>1 Yes</td>
</tr>
<tr>
<td>2 No</td>
<td>2 No</td>
</tr>
<tr>
<td>3 Unsure</td>
<td>3 Unsure</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Helmet positioned correctly</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Yes</td>
</tr>
<tr>
<td>2 No</td>
</tr>
<tr>
<td>3 Unsure</td>
</tr>
</tbody>
</table>

### PILLION

<table>
<thead>
<tr>
<th>Age</th>
<th>Helmet worn</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Yes</td>
</tr>
<tr>
<td>4</td>
<td>No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sex</th>
<th>Helmet carried</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Male</td>
</tr>
<tr>
<td>2</td>
<td>Female</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Conspicuous</th>
<th>Helmet done up correctly</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Yes</td>
<td>1 Yes</td>
</tr>
<tr>
<td>2 No</td>
<td>2 No</td>
</tr>
<tr>
<td>3 Unsure</td>
<td>3 Unsure</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Helmet positioned correctly</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Yes</td>
</tr>
<tr>
<td>2 No</td>
</tr>
<tr>
<td>3 Unsure</td>
</tr>
</tbody>
</table>
### APPENDIX F: FORUM PROGRAM

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Speaker/Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.30 – 9.45</td>
<td>Arrival</td>
<td>Coffee and tea</td>
</tr>
<tr>
<td>9.45 – 10.00</td>
<td>Welcome</td>
<td>Facilitator - Mike Lenné, MUARC</td>
</tr>
<tr>
<td>10.00 – 10.15</td>
<td>Introduction</td>
<td>Max Cameron, MUARC</td>
</tr>
<tr>
<td>10.15 – 10.45</td>
<td>Victorian Integrated Survey of Travel and Activity (Vista 07) DOI</td>
<td>Fotios Spiridonos, Department of Infrastructure</td>
</tr>
<tr>
<td>10.45 – 11.00</td>
<td>VicRoads Surveys</td>
<td>VicRoads - Pat Rogerson (rural), Chris Brennan (motorcycle)</td>
</tr>
<tr>
<td>11.00 – 11.30</td>
<td>MORNING TEA</td>
<td></td>
</tr>
<tr>
<td>11.30 – 12.45</td>
<td>Behaviour, Travel and Exposure Methodologies and Analysis</td>
<td>Mike Keall, MUARC</td>
</tr>
<tr>
<td>12.45 – 1.45</td>
<td>LUNCH</td>
<td></td>
</tr>
<tr>
<td>1.45 – 3.45</td>
<td>Round Table Discussion</td>
<td>Chair – Mike Lenné, MUARC</td>
</tr>
</tbody>
</table>
APPENDIX G: INTRODUCTION PRESENTATION

Benchmark of Safety

- During 2001, MUARC conducted observational surveys on Melbourne roads
  - Adult seat belt use
  - Child restraint use
  - Bicyclist helmet use and conspicuous clothing
  - Motorcyclist helmet use and protective clothing
  - Speed profiles
- Provided benchmark of key safety-related behaviours; however limited samples
- At “sites of convenience”, not representative

Overlap of Behaviour Surveys with Travel (or Exposure) Surveys

- During late 2001, the overlap was recognised and seen as an opportunity to collect data more cost-effectively
- Can the key safety-related behaviours be measured in travel surveys?
- Can the behaviour surveys be used to measure travel (or exposure-to-risk)?
- Can one survey do both?

Proposal for Fundamental Research to MUARC’s Baseline Committee

- A program of integrated behavioural and travel (exposure) surveys over 2002-2005
  - Observational and telephone surveys of safety-related behaviours
  - Telephone interview survey to extrapolate VicRoads observational surveys
  - Complemented by observational surveys of pedestrian and bicyclist exposure
- Deferred in lieu of further review of existing transport surveys, and further planning

Stage 1 – Review and Planning

- Delayed due to staff shortages
- Telephone surveys became expensive
- Stage 1 report (2005) recommended:
  - Regular, small-scale, on-going household logbook survey of travel (following NZ)
  - Large-scale observational surveys every 2-3 years to calibrate the household surveys and provide behavioural data
  - Design and piloting of program (Stage 2)

Stage 2 – Design and Piloting

- Workshop (September 2005) defined safety-related behaviours wanted now and in future (technological change)
- Desirable collaborations identified
  - DoI and VicRoads developing plans
- Stage 2 report (2006) provided designs of:
  - Household interview travel survey
  - Observation survey of motorised traffic
- Recommended collaboration with DoI & VR
Development of Umbrella Framework

- To form the basis of collaboration, an umbrella framework of behaviour, travel and exposure surveys was developed
  - To see the planned travel surveys in the context of total travel (exposure) in Victoria
    - Coverage in time and space
    - Sample weights to make representative
  - To encourage/design of behaviour surveys to be representative of total exposure, not “samples of convenience”

CONCEPTUAL POPULATION OF TRAVEL (EXPOSURE) IN VICTORIA
All out-of-house surface travel by persons in Victoria, by foot, bicycle, motorcycle, motor vehicle or railed public transport

And to measure change over 10 years:

Day 1  Day 2  Day 365
Day 3286  Day 3287  Day 3650
1. **PURPOSE**

The purpose of this assignment is to undertake the design, conduct and processing of the Victorian Integrated Survey of Travel and Activity 2007 (VISTA 07). The VISTA 07 will be a multi-modal survey of personal travel activity and demand across the Melbourne Statistical Division (MSD), the City of Greater Geelong and the regional centres of Ballarat, Bendigo and the Latrobe Valley, to identify **how**, **why**, **when**, **where** and **how much** travel is undertaken on a typical day, for use in transport model development and on-going transport policy and project development and assessment.

The MSD component of the VISTA 07 will provide the latest data and information on the travel and activity patterns of Melburnians, for the specific use by the Department of Infrastructure (DoI) to recalibrate and update the Melbourne Integrated Transport Model (MITM) modules of trip generation, trip distribution and mode split.

In addition, the VISTA 07 will provide detailed data and information on travel and activity across the MSD and regional Victoria, for infrastructure planning and project development appraisal and policy and strategy development.

2. **BACKGROUND**

It is important that the transport dollar is spent in areas that provide the greatest return. Capital investment in transport infrastructure projects must be underpinned by good information about travel patterns (how, why, when, where and how much people travel) and of the movement of goods. Such information can only be obtained from comprehensive and regularly updated surveys of travel and activity.

Comprehensive and reliable travel and activity information is also vital for the development of transport models, themselves used to underpin the analysis, assessment and performance of the existing transport system and of proposed transport infrastructure. Up-to-date information is therefore crucial in maintaining the currency and credibility of transport models and associated analyses.

The DoI has relied heavily on the Victorian Activity and Travel Survey (VATS) to provide activity and travel data and patterns of Melburnians. The primary use of the VATS data has been for the development of the DoI’s transport modelling system, the MITM.

As the most recent version of VATS relates to the 2002 collection, there are concerns that this data does not accurately reflect current travel and activity patterns. The current freight movement model development project will address the freight component of the metropolitan transport task and will incorporate this component into the MITM.

3. **SCOPE OF VISTA 07**

The VISTA 07 will be conducted as a survey of travel and activity of the entire household. The VISTA 07 will collect data at the ‘stop’ level of all travel for one pre-selected day of the week, with all seven days of the week being covered in the survey sample.

3.1 **VISTA07 Design**

The VISTA 07 shall be designed to collect data on all travel and out-of-home activities by all persons living in the responding households. The survey design shall define a representative sample of households to be surveyed across the MSD (see Section 3.4) and regional Victoria and shall, as a minimum, collect the data shown below.
<table>
<thead>
<tr>
<th>Household information</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• dwelling type</td>
<td></td>
</tr>
<tr>
<td>• ownership status of dwelling</td>
<td></td>
</tr>
<tr>
<td>• household size</td>
<td></td>
</tr>
<tr>
<td>• number of registered motor vehicles</td>
<td></td>
</tr>
<tr>
<td>- make, model, year of manufacture, number of cylinders,</td>
<td></td>
</tr>
<tr>
<td>privately owned or company car, e-tag available</td>
<td></td>
</tr>
<tr>
<td>• number of bicycles</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Data about people in the household</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• age</td>
<td></td>
</tr>
<tr>
<td>• gender</td>
<td></td>
</tr>
<tr>
<td>• relationship to ‘Person 1’</td>
<td></td>
</tr>
<tr>
<td>• employment status</td>
<td></td>
</tr>
<tr>
<td>• resident or visitor</td>
<td></td>
</tr>
<tr>
<td>• licence holding</td>
<td></td>
</tr>
<tr>
<td>• occupation</td>
<td></td>
</tr>
<tr>
<td>• industry of employment</td>
<td></td>
</tr>
<tr>
<td>• personal income</td>
<td></td>
</tr>
<tr>
<td>• if currently studying (primary, secondary, tertiary)</td>
<td></td>
</tr>
<tr>
<td>• undertaking other activities</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Trip data for all travel made on the travel day</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• on a ‘stop’ basis</td>
<td></td>
</tr>
<tr>
<td>• where did the travel start and end?</td>
<td></td>
</tr>
<tr>
<td>- geocoded origin and destination</td>
<td></td>
</tr>
<tr>
<td>• time of travel (at each origin and destination)</td>
<td></td>
</tr>
<tr>
<td>• purpose of travel</td>
<td></td>
</tr>
<tr>
<td>- work</td>
<td></td>
</tr>
<tr>
<td>- education (i.e. pre-school, primary, secondary, tertiary)</td>
<td></td>
</tr>
<tr>
<td>- recreation</td>
<td></td>
</tr>
<tr>
<td>- shopping</td>
<td></td>
</tr>
<tr>
<td>- other (to be stated)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mode of transport used</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• private vehicle</td>
<td></td>
</tr>
<tr>
<td>• public transport</td>
<td></td>
</tr>
<tr>
<td>- tram</td>
<td></td>
</tr>
<tr>
<td>- train</td>
<td></td>
</tr>
<tr>
<td>- bus</td>
<td></td>
</tr>
<tr>
<td>- taxi</td>
<td></td>
</tr>
<tr>
<td>• non-motorised travel e.g. walk, cycle (to be stated)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>If travel made by private vehicle</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• vehicle used</td>
<td></td>
</tr>
<tr>
<td>- private car</td>
<td></td>
</tr>
<tr>
<td>- company car</td>
<td></td>
</tr>
<tr>
<td>- truck</td>
<td></td>
</tr>
<tr>
<td>- van</td>
<td></td>
</tr>
<tr>
<td>- motor cycle/scooter</td>
<td></td>
</tr>
<tr>
<td>- other</td>
<td></td>
</tr>
<tr>
<td>• number of occupants</td>
<td></td>
</tr>
<tr>
<td>• roads used (name up to 6 roads used)</td>
<td></td>
</tr>
<tr>
<td>• any toll paid and by whom</td>
<td></td>
</tr>
<tr>
<td>• type of parking and location</td>
<td></td>
</tr>
<tr>
<td>- any parking fee paid and by whom</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>If travel made by public transport</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• type of ticket</td>
<td></td>
</tr>
<tr>
<td>• type of fare paid</td>
<td></td>
</tr>
<tr>
<td>• type of zone ticket</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reason for not travelling on the travel day</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• not working</td>
<td></td>
</tr>
<tr>
<td>• ill</td>
<td></td>
</tr>
<tr>
<td>• other (to be stated)</td>
<td></td>
</tr>
</tbody>
</table>
3.2 VISTA07 Study Area
The VISTA 07 will cover the MSD, the City of Greater Geelong and the regional centres of Ballarat, Bendigo and the Latrobe Valley (see below).
APPENDIX I: TRAVEL PATTERNS OF RURAL VICTORIANS OUTLINE – VICROADS

Travel Patterns of Rural Victorians - Pat Rogerson - VicRoads

Approved for funding within the 2006-08 VicRoads R&D Program

The project is to address the Government Response to the Parliamentary Road Safety Committee’s Report (May 2005): “Inquiry into the Country Road Toll”. On page 67, the report lists:

“Recommendation 2: That VicRoads investigate and report on the:

- travel patterns of rural Victorians; and the
- relationship between crash propensity, driver occupation and purpose of journey in country Victoria.”

When I applied for funding to carry out this project, I thought Fotios Spiridonos (DoI) would be doing a household diary survey (continuation of VATS) outside Melbourne. I thought the Travel Patterns of Rural Victorians project would include on-road observation/interview surveys outside Melbourne. Hence, by making the two projects compatible, together they would provide extra information, as set out in the MUARC report. This, of course, is now less straightforward as the DoI survey is for Melbourne residents.

‘Travel Patterns of Rural Victorians’ has been allocated $179,000 this financial year and $90,000 next financial year for external contracts. The deadline for the completion is 30 June 2008.

The following variables need to be collected from Victorians living and travelling outside the MSD:

- driver occupation
- purpose of journey
- unspecified characteristics of person/accompanying persons
- unspecified characteristics of travel mode
- unspecified characteristics of road/place
- unspecified characteristics of time of day/year
* Mobile phone use and categorising road type into M, A, B, C & Local class roads would also be useful. This information could then be used to estimate crash risks by driver, road type and vehicle characteristics.

It is recognised that on-road interviews and even on-road observations in rural Victoria are difficult to perform and may not be cost effective. The original idea was to interview a sample of drivers at sites on the outskirts of the 5 major towns and ask about trip details so that the travel could be apportioned to various road types within and outside the urban area. If on-road interviews are not feasible due to OH&S issues and time constraints, then household surveys or telephone surveys may be the only way of getting such information. Any observation-only surveys would need to be done on road segments with volume counts. More counts on C and Local Roads would be needed. Given the funding and time available, can the Forum provide advice on how best to achieve useful outcomes?
APPENDIX J: MOTORCYCLE EXPOSURE STUDY OUTLINE – VICROADS

Motorcycle Exposure Study - Chris Brennan

VicRoads currently has funding to conduct a motorcycle exposure study. When the study was scoped, it was initially intended to be predominantly an observation study, incorporating a small survey component. The project brief is still taking shape, however the potential to include an analysis of traffic count data has increased the potential ways in which motorcycle exposure could be measured. The total budget for the project (to include observations, surveys and traffic counts) is approximately $170,000.

Aims:

- To provide an accurate measure of the level of motorcycling across different road types and time periods.
- To establish an exposure measure which can be used to assess the risk of motorcycle activity in differing circumstances and the risk reduction potential of accident countermeasures.

We aim to identify the relationship between exposure and crash risk along some of Victoria’s more popular motorcycling roads, and also to identify those roads which have a high motorcycle exposure rate but a low number of crashes.

Timelines: Results from the travel survey must be available by June 2007

The variables required include:

- Age
- Sex
- Type of bike (e.g., sports, cruiser, tourer, naked)
- Type of journey (commuting, recreational)
- Length held licence
- Crash history
- Approximate number of journeys per year
- Estimated kilometres travelled per trip (by trip type)
- Estimated kilometres travelled per year

From this forum, we hope to gain information about out:

- how a household survey could assist in the process of determining motorcycle exposure
- whether any suitable exposure data for motorcyclists can be obtained without the use of observations
- what sample size of motorcyclists would be required, and if that sample size is achievable within the project’s budget.

Overall, we are looking for a framework under which we can conduct a travel survey with motorcyclists to identify travel behaviour patterns, and which may contribute to the development of a reliable exposure measure for motorcycle travel.
APPENDIX K: PRESENTATION 1, MIKE KEALL

DIMENSIONS OF VICTORIAN TRAVEL: BEHAVIOUR AND EXPOSURE
Dr Michael Keall

Brief CV (Michael Keall)
- Currently work for MUARC and for Otago University (NZ) Department of Public Health (School of Medicine)
- Worked for Statistics NZ, NZ Ministry of Transport, Vic Roads, NZ Land Transport Safety Authority
- Designed national surveys to measure: travel speed, alcohol, VKT (on-road measures)

Recent relevant work
- Designed NZ Ongoing Travel Survey
- PhD (2005) analysing driver risk from travel and behavioural survey data
- Advising Statistics NZ on Time Use Survey
- 4WD risk and patterns of use (MUARC)
- Old and young drivers’ driving patterns

Definition of a trip
Travel (walking/cycling/driving/passenger) on public road/rail in Victoria
Defined by four dimensions
- who is the person travelling
- where and when travel takes place
- mode / vehicle type
- behaviour (especially high risk/illegal)

Dimensions of travel
Who is travelling:
- Age/sex
- Occupation
- Income
- Trip purpose
Where and when:
- Origin and destination
- Parts of network (road or rail)
- Time of travel
- Congestion/efficiency
Mode:
- VKT
- Public transport vs private car
- Passenger vehicle type (crashworthiness)
- Emissions
Behaviour:
- Restraint use
- Helmet use
- Speed choice
- Drink/drugs

High quality travel survey
Who is travelling:
- Age/sex
- Occupation
- Income
- Trip purpose
Where and when:
- Origin and destination
- Parts of network (road or rail)
- Time of travel
- Congestion/efficiency
Mode:
- VKT
- Public transport vs private car
- Passenger vehicle type (crashworthiness)
- Emissions
Behaviour:
- Restraint use
- Helmet use
- Speed choice
- Drink/drugs
Roadside observational surveys

Who is travelling:
- Age/sex
- Occupation
- Income
- Trip purpose

Where and when:
- Origin and destination
- Parts of network (road or rail)
- Time of travel
- Congestion/efficiency

Mode:
- VKT
- Public transport vs private car
- Passenger vehicle type (crashworthiness)
- Emissions

Behaviour:
- Restraint use
- Helmet use
- Speed choice
- Drink/drugs
Outline of talk

Applications of survey data
- Behavioural:
  - Speed
  - Alcohol
  - Helmets/restraints
- Travel (exposure)

Speed survey data
- NZ hidden camera trial
- Annual estimates of speeds by
  - Speed limit zone (urban/rural)
  - Region
  - Year (trends)

Distribution of speeds at speed camera areas 5 months into trial
Changes in net general speeds relative to 1996 (pre-trial)

-6 -5 -4 -3 -2 -1 0 1997 1998 1999

Crash and casualty results: trial relative to control areas

Generally:
- 11% fall in injury crashes
- 19% fall in casualties

At sites:
- 22% fall in injury crashes
- 29% fall in casualties

New Zealand Rural Winter Speeds

Conclusion - Speed survey applications
- Measure the effects of interventions (hidden speed camera trial)
- Monitor changes in driver speed choice over time
- Determine effectiveness of strategies (Police deterrence / advertising)
Alcohol “surveys”

- Similarities / differences between CBT (RBT) and survey operation
- Data collected
- Some applications of data

NZ Roadside alcohol data: Background

- CBT operation run jointly by NZ Police and Ministry of Transport
- CBT operation monitors how effective Police strategies are
- Provide evidence to Government of changes in drink drive
- Leads to Government funding decisions

Police CBT check point sites

- Aim for maximum deterrent value
- High profile
- High traffic volume
- Aim to increase public awareness of Police presence

Random CBT operation

- To collect
  - BAC data, not just pass/fail information
  - DOB, ethnicity, vehicle type and number of occupants
  - for drink drivers in the whole community
  - for near-fail drink drivers
  - for non-drinkers
- To monitor trends

Site selection

To give a statistically valid sample
- Sites are randomly selected
- Site is allocated a specific night and time (Friday or Saturday, before or after midnight)
- Same site visited each time
- Inconspicuous sites
Similarities...

- Run as a legal CBT operation
- Police stop vehicles and breath test drivers
- Failed drivers are further processed - Evidential Breath Test
- Drivers trying to avoid the operation are chased and processed

Differences...

- Surveyor is present to collect additional information
- Surveyor provides the properly calibrated Police breathalyser
- Active tests only (with mouthpiece) are carried out on drivers

Results from 2004 and previous surveys

% over limit


% over limit by time of night


% over limit by gender


% over limit by age

15-24 25-34 35-49 50 plus
Results 1995-2002: distribution of drivers over 80mg/dL by road volume within time period

Further estimates from alcohol data
A statistical model produced estimates for 273 driver groups (defined by age, gender, time of night, urbanisation, road volume, year)

Estimates were percentages within each driver group at each BAC level

e.g., in the year 2000, female drivers aged 40-59 in Auckland driving between 10pm and midnight on low volume roads were estimated to be distributed as follows:

- 66% at BAC =0,
- 27% between 0 and 30
- 2.3% between 30 and 50,
- 2.6% between 50 and 80
- 0.7% between 80 and 100,
- 1.1% over 100

When the 273 driver groups are ranked by estimated % over 80mg/dL, 5 groups estimated to have >5%:

<table>
<thead>
<tr>
<th>Time of night</th>
<th>M/F</th>
<th>Age</th>
<th>Location</th>
<th>Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>midnight-2</td>
<td>M</td>
<td>30-39</td>
<td>Auckland</td>
<td>low</td>
</tr>
<tr>
<td>midnight-2</td>
<td>M</td>
<td>40-59</td>
<td>Auckland</td>
<td>low</td>
</tr>
<tr>
<td>midnight-2</td>
<td>F</td>
<td>25-29</td>
<td>Auckland</td>
<td>low</td>
</tr>
<tr>
<td>midnight-2</td>
<td>F</td>
<td>60+</td>
<td>Auckland</td>
<td>low</td>
</tr>
<tr>
<td>midnight-2</td>
<td>M</td>
<td>&lt; 20</td>
<td>Auckland</td>
<td>low</td>
</tr>
<tr>
<td>midnight-2</td>
<td>M</td>
<td>&lt; 20</td>
<td>Cities</td>
<td>low</td>
</tr>
<tr>
<td>midnight-2</td>
<td>M</td>
<td>&lt; 20</td>
<td>Rural</td>
<td>low</td>
</tr>
<tr>
<td>midnight-2</td>
<td>M</td>
<td>&lt; 20</td>
<td>Towns</td>
<td>low</td>
</tr>
</tbody>
</table>

Female groups with highest estimated % over 80mg/dL:

<table>
<thead>
<tr>
<th>Time of night</th>
<th>M/F</th>
<th>Age</th>
<th>Location</th>
<th>Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>midnight-2</td>
<td>F</td>
<td>30-39</td>
<td>Auckland</td>
<td>low</td>
</tr>
<tr>
<td>midnight-2</td>
<td>F</td>
<td>40-59</td>
<td>Auckland</td>
<td>low</td>
</tr>
<tr>
<td>midnight-2</td>
<td>F</td>
<td>25-29</td>
<td>Auckland</td>
<td>low</td>
</tr>
<tr>
<td>10-midnight</td>
<td>F</td>
<td>30-39</td>
<td>Auckland</td>
<td>low</td>
</tr>
<tr>
<td>midnight-2</td>
<td>F</td>
<td>60+</td>
<td>Auckland</td>
<td>low</td>
</tr>
</tbody>
</table>

Teenage groups with highest estimated % over 80mg/dL:

<table>
<thead>
<tr>
<th>Time of night</th>
<th>M/F</th>
<th>Age</th>
<th>Location</th>
<th>Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>midnight-2</td>
<td>M</td>
<td>&lt; 20</td>
<td>Auckland</td>
<td>low</td>
</tr>
<tr>
<td>10-midnight</td>
<td>M</td>
<td>&lt; 20</td>
<td>Auckland</td>
<td>low</td>
</tr>
<tr>
<td>midnight-2</td>
<td>M</td>
<td>&lt; 20</td>
<td>Cities</td>
<td>low</td>
</tr>
<tr>
<td>midnight-2</td>
<td>M</td>
<td>&lt; 20</td>
<td>Rural</td>
<td>low</td>
</tr>
<tr>
<td>midnight-2</td>
<td>M</td>
<td>&lt; 20</td>
<td>Towns</td>
<td>low</td>
</tr>
</tbody>
</table>
Groups with lowest estimated % over 80mg/dL:

<table>
<thead>
<tr>
<th>Time of night</th>
<th>M/F</th>
<th>Age</th>
<th>Location</th>
<th>Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-midnight</td>
<td>F</td>
<td>&lt; 20</td>
<td>Rural</td>
<td>med</td>
</tr>
<tr>
<td>10-midnight</td>
<td>F</td>
<td>&lt; 20</td>
<td>Towns</td>
<td>med</td>
</tr>
<tr>
<td>10-midnight</td>
<td>F</td>
<td>&lt; 20</td>
<td>Cities</td>
<td>high</td>
</tr>
<tr>
<td>10-midnight</td>
<td>F</td>
<td>&lt; 20</td>
<td>Towns</td>
<td>high</td>
</tr>
<tr>
<td>10-midnight</td>
<td>F</td>
<td>&lt; 20</td>
<td>Rural</td>
<td>high</td>
</tr>
</tbody>
</table>

Results of analysis

- Highest BAC groups were:
  - male
  - driving after midnight
  - on low volume roads
  - There was a trend over time for drinking drivers to prefer lower volume roads

Results (continued)

Implications for countermeasures:

- New Zealand already has a well-established CBT programme on principal roads, which is deterring much drinking and driving. But it may be motivating some drinking drivers to use more minor roads
- Need to police lower volume roads after midnight despite limited opportunity for general deterrence

Alcohol measurements: In conclusion

- These measurements provide essential information to track the effect of road safety measures on drink driving
- They also provide information invaluable for Police tactics on the road
- This information is vitally important to Police & other road safety partners

Restraint and helmet surveys

- Restraint surveys need to be done covertly (as people put on seatbelts if they suspect enforcement activity)
- Sites may be chosen deliberately to represent traffic
- Key statistic is change over time, valid by using same sites
- May be very low cost if volunteers used (e.g., child restraints in NZ)

NZ travel surveys

- 1989/90
- 1997/98
- 2002 and ongoing

Personal interviews based on travel diary
Primary sampling units are meshblocks (blocks) sampled proportional to size
Households subsampled - all household members interviewed
New Zealand Travel Survey 1997/98
- 14,000 respondents
- 75% full response from household
- details of all trips in 2 days
- trip distance calculated from geocoded addresses - geocoded route used to allocate trip distance by road type: Major Urban, Minor Urban, Motorway, Divided State Highway, Undivided State Highway and Other rural roads
- for drivers, alcohol consumption recorded

Travel survey questionnaire excerpt

Mobility
Between 1988/90 and 1997/98:
- People have become more mobile
- Driving has increased by 35%
- Bus travel has increased by 16%
- But cycling has decreased by 19%

Dependence on cars
- 90% of all road travel is by car
- 55% by car drivers
- 35% by car passengers

Driving is safer
- Risk of a fatal or injury crash has fallen by 38%
- Biggest gains for the young and the old

Cars are more powerful
- In 1997-1998, 59% of household cars were over 1600cc
- In 1989-1990, only 47% were over 1600cc
- Larger cars are favoured by male drivers aged 35-54
- Smaller, older cars are driven mainly by young people, and predominantly by females
Driving by region

- Travel dominated by large centres
- 30% of all driving in Auckland
- Wide variations in average distances driven

Ethnic variations

- 89% of Europeans drive, compared to 74% of Maori and 63% of Pacific peoples
- Hospitalisation risk per kilometre driven is 3 times higher for Maori and Pacific drivers
- Pacific children of school age do much less bus travel than Europeans

Risk by travel mode

- Motorcycle by far the most dangerous mode of travel
- Motorcycle travel is 18 times riskier than car travel per hour driven

Travel to school

- Number of children driven to school has nearly doubled since 1989-1990
- Car now the most common way to school for 5 - 12 year-olds

Travel to school in cities - children aged 5 - 12

Alcohol

- Men more likely than women to drive while alcohol impaired
- Wide variations in drinking patterns according to age
- Large drop in drinking times for under 30s - increase in drinking times for older age groups
If one age group adopted another’s driving pattern

Data-related reasons for diminishing risk with age on motorways?
- If older drivers avoid motorways (but the shortest route is via motorway), then could some travel be misclassified?
- Analysis of trip speed by age, controlling for distance and time of day (congestion)
  - Older drivers only slightly slower on trips involving motorways

Female drivers on week days

Male and Female night and day

Conclusions
- There are limitless applications of travel and behavioural survey analyses to:
  - Plan transportation infrastructure
  - Monitor and guide road safety programmes and performance
  - Identify high risk groups
  - To focus policy and resources best on areas where they will have most effect
TRAVEL SURVEYS - experience from NZ

Dr Michael Keall

Outline

- Developments in NZ travel surveys over time
- Geocoding and route generating
- Deterioration in travel survey data quality
- Improvement in travel survey technology
- Travel survey cost and advantages of pooling resources

NZ changes in travel survey methodology

- 1989/90 under-fives not surveyed
- Addresses and routes not geocoded
- 1997/98 under-fives included (proxy)
- Paper forms
- Geocoding of addresses and algorithm for route generation
- 2002-ongoing
- Laptop computers to capture data during interview - checking of address data - other data checks

Geocoding routes

Geocoding routes

Geocoding routes

Geocoding routes
Geocoding routes
- Origin and destination must be accurately defined as geocodable addresses
- If trip is longer than certain distance, an intermediate point should be specified to define route
- Pedestrian trips may not use road network – straight line technique?

Deterioration in travel survey quality
- Over time, response rates have dropped for all surveys (attitudes to authority, respondent fatigue, ...)
- Academics have become consultants
- “Gold standard” of personal interviews often seen as too expensive

Developments ...
- But sophisticated techniques demand accurate data
- Expensive/important applications demand accurate data
- Geocoding and route generation need accurate addresses
- Bottom line: some form of on-the-spot verification of addresses
- And high response rates are imperative as levels of mobility strongly correlated with non-response

Travel survey technology is advancing inversely to data quality

Travel survey costs
- Typically fixed cost (administration) plus sample size-dependent cost
- Total cost = A + (Bx n)
- “A” includes general set-up costs, instrument design, piloting survey method, interviewer training, sample design, data weighting and cleaning
- Therefore there are considerable efficiencies in pooling resources (to boost n)
- Other advantages:
  - Compatibility
  - Ease of analysis