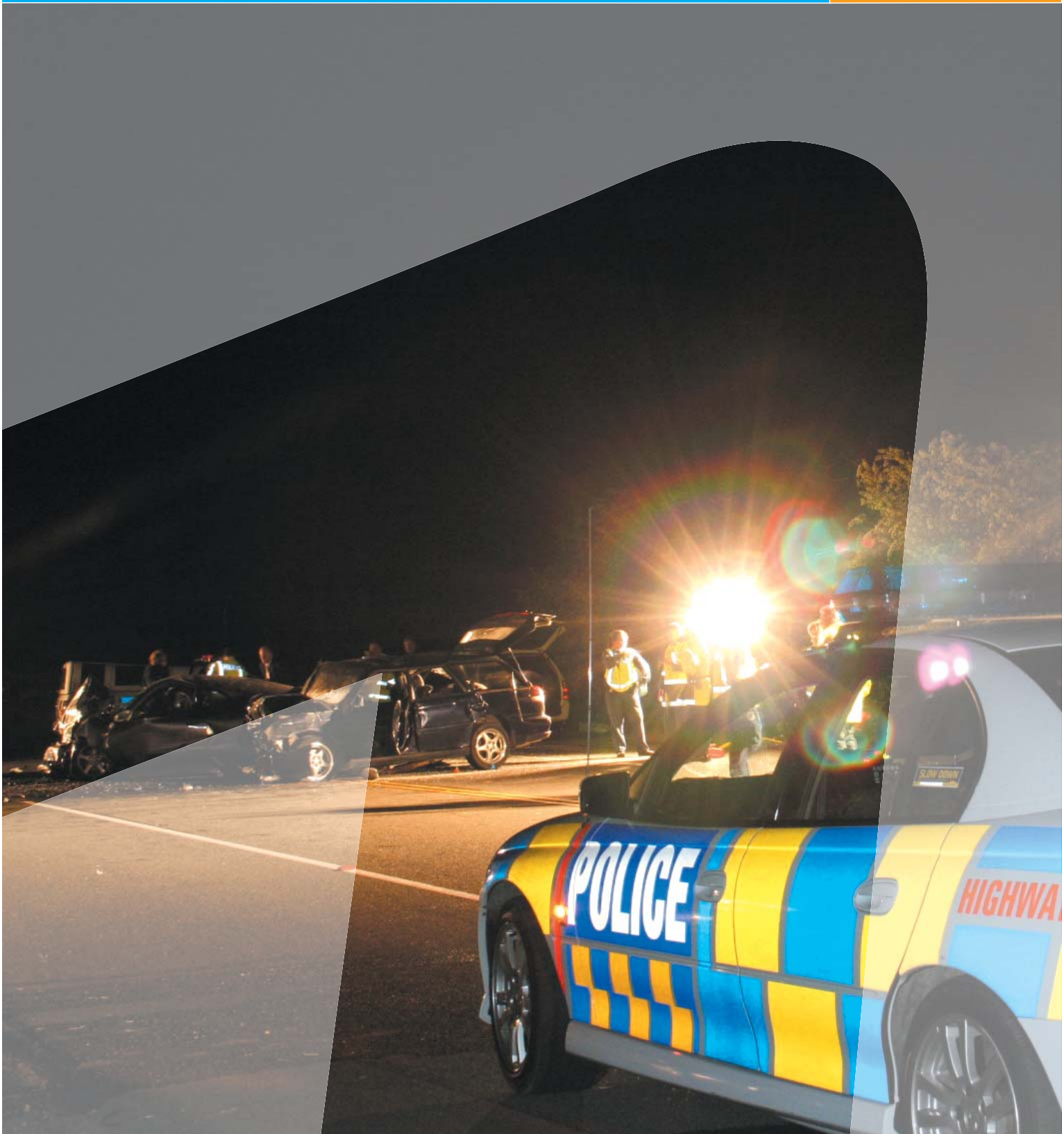


New Zealand Road Safety Research 2005

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YEARLY REPORT
2006



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FOREWORD

I am pleased to present the 2005 edition of New Zealand Road Safety Research. The information in this publication is collected each year in a survey of New Zealand research and funding organisations. It includes all reported research with a New Zealand component on any aspect of road safety being undertaken or completed during the year under review.

The Ministry of Transport is responsible for fostering and coordinating road safety research in New Zealand. We welcome this responsibility and see the production of this document as one of the many ways we can work towards fulfilling it. This summary report is published annually and distributed widely to New Zealand and international road safety contacts.

Research projects described here are arranged alphabetically by title under six main subject areas: alcohol and drugs, data analysis, economics, engineering, human factors and miscellaneous.

This information is also provided in electronic form to ARRB Transport Research Ltd, which produces the bibliographic database, Australian Transport Index database (ATRI). ATRI represents the holdings of the ARRB Transport Research Library as well as a number of other transport-related libraries. It covers both Australian and overseas material to do with land transport and contains records of books, reports, individual journal articles and conference papers.

I trust you will find the New Zealand Road Safety Research 2005 report useful and informative. Your comments or suggestions on its content would be most welcome; please address them to the Manager, Research and Statistics, Ministry of Transport, PO Box 3175, Wellington, New Zealand.



Robin Dunlop
Secretary for Transport

ALCOHOL AND DRUGS

| Alcohol case control study | |
|-----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Ministry of Transport |
| Principal investigators | Keall, M D; Frith, W J; Patterson, T L. |
| Aims/objectives | To estimate the fatal crash risk of drivers at various blood alcohol levels using crash data combined with roadside alcohol data. |
| Progress/status | Completed |
| Commencement | January 2000 |
| Scheduled completion | March 2003 |
| Publications | Keall, M D, Frith, W J, Patterson T L (2004) The influence of alcohol, age and number of passengers on the night-time risk of driver fatal injury in New Zealand. <i>Accident Analysis and Prevention</i> 36 (1), 49-61. Keall M D, Frith W J (2005) A method for estimating crash risk associated with driver BAC. <i>Transportation Research Part E</i> , 41: 409-420 (Special Issue on Alcohol, Road Safety, and Public Policy). Keall, M D, Frith, W J; Patterson, T L (2005) The contribution of alcohol to night-time crash risk and other risks of night driving. <i>Accident Analysis and Prevention</i> , 37: 816-824. |
| Address for copies | Research and Statistics, Ministry of Transport, PO Box 3175, Wellington |

| Auckland regional exit breath survey | |
|---------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Centre for Social and Health Outcomes Research and Evaluation (SHORE); Massey University |
| Supporting organisation | Ministry of Health |
| Principal investigators | Casswell, S; Conway, K; Greenaway, S; Huckle, T. |
| Aims/objectives | Investigating breath alcohol levels of people under the age of 25 years exiting On Licence premises (nightclubs, taverns and rural hotels) in the Auckland Region. |
| Progress/status | Completed |
| Commencement | July 2004 |
| Scheduled completion | June 2005 |
| Publications | Casswell, S; Conway, K; Greenaway, S; Huckle, T. (2005). <i>Auckland Regional Exit Breath Survey 2005</i> . Centre for Social and Health Outcomes Research and Evaluation (SHORE) & Te Ropu Whariki, Massey University |
| Address for copies | http://www.shore.ac.nz/projects/projects_1.html |

Drugged drivers: relationship with motor vehicle fatalities

| | |
|-----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Institute of Environmental Science & Research (ESR); NZ Police |
| Supporting organisation | Ministry of Research, Science and Technology; Foundation for Research, Science and Technology |
| Principal investigators | Dickson, S; Lea, R; Fernando, D; Poulsen, H; Gosse, M. |
| Aims/objectives | To examine the relationship between motor vehicle crashes and illicit drugs and licit drugs (certain prescription and over-the-counter drugs). |
| Progress/status | Active |
| Commencement | July 2004 |
| Scheduled completion | June 2007 |

Illicit drug monitoring system

| | |
|-----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Centre for Social and Health Outcomes Research and Evaluation (SHORE); Massey University |
| Supporting organisation | NZ Police |
| Principal investigators | Butler, R; Girling, M; Sweetsur, P; Wilkins, C. |
| Aims/objectives | To provide timely information on trends in illicit drug use and drug related harm in New Zealand. |
| Progress/status | Active |
| Commencement | July 2005 |
| Scheduled completion | Ongoing |
| Publications | Butler, R; Girling, M; Sweetsur, P; Wilkins, C (2005). Methamphetamine and Other Illicit Drug Trends in New Zealand: Findings from the Methamphetamine Module of the 2005 Illicit Drug Monitoring System (IDMS). Centre for Social and Health Outcomes Research and Evaluation (SHORE) & Te Ropu Whariki, Massey University Butler, R; Girling, M; Sweetsur, P; Wilkins, C (2005). Cannabis and Other Illicit Drug Trends in New Zealand: Findings from the Cannabis Module of the 2005 Illicit Drug Monitoring System (IDMS). Centre for Social and Health Outcomes Research and Evaluation (SHORE) & Te Ropu Whariki, Massey University Butler, R; Girling, M; Sweetsur, P; Wilkins, C (2005). Hallucinogens and Other Illicit Drug Trends in New Zealand: Findings from the Hallucinogen Module of the 2005 Illicit Drug Monitoring System (IDMS). Centre for Social and Health Outcomes Research and Evaluation (SHORE) & Te Ropu Whariki, Massey University |
| Address for copies | http://www.shore.ac.nz/projects/IDMS%20study.htm |

DATA ANALYSIS

| Monitoring the effectiveness of road safety countermeasures | |
|--------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Ministry of Transport |
| Principal investigators | Frith, W J; Jones, W R; Keall, M D. |
| Aims/objectives | Use of crash data and other information including behavioural measures to monitor the effectiveness of road safety countermeasures |
| Progress/status | Active |
| Commencement | July 1994 |
| Scheduled completion | Ongoing |
| Publications | <p>Mara, M K; Davies, R B; Frith, W J. Evaluation of the Impact of Compulsory Breath Testing and Speed Cameras in New Zealand. Proceedings Roads '96 Conference, Part 5, pp. 269-82.</p> <p>Povey, L J; Frith, W J; Graham, P G (1999). Cycle helmet effectiveness in New Zealand. Accident Analysis and Prevention 31, 763-770.</p> <p>Keall, M D; Povey, L J; Frith W J (2001). The relative effectiveness of a hidden versus a visible speed camera programme. Accident Analysis and Prevention 33 (2) 277-284.</p> <p>Keall, M D; Povey, L J; Frith W J (2002). Further results from a trial comparing a hidden speed camera programme with visible camera operation. Accident Analysis and Prevention 34 (6) 773-777.</p> |
| Address for copies | Research and Statistics, Ministry of Transport, PO Box 3175, Wellington |

ECONOMICS

| Risk trend analysis | |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Ministry of Transport |
| Principal investigators | Guria, J C; Quazi, A. |
| Aims/objectives | To analyse the trend in fatality risk by time and space: weekday vs weekend, night vs day and state highway vs local roads, and also by Police districts. |
| Progress/status | Active |
| Commencement | January 2003 |
| Scheduled completion | Ongoing |
| Publications | <p>Guria, J C; Mara, M K (2004). Trends in road travel risk in recent years in New Zealand by time and space. Towards Sustainable Land Transport Conference, Wellington, New Zealand</p> <p>Quazi, A (2004). Risk trend analysis by time, space, alcohol and speed Road Safety Research, Policing and Education Conference 2004, Perth, Western Australia.</p> |
| Address for copies | Economic Evaluation, Ministry of Transport, PO Box 3175, Wellington |

Road safety resource allocation model

| | |
|-----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Ministry of Transport |
| Principal investigators | Guria, J C; Leung, J. |
| Aims/objectives | To develop and refine a resource allocation model for road safety funding |
| Progress/status | Active |
| Commencement | June 1995 |
| Scheduled completion | Ongoing |
| Publications | 1. Bliss, A G; Guria, J C; Jones, W R; Rockliffe, N A. (1998). A Road Safety Resource Allocation Model – Working Paper 1: Principles and Structure/ Enforcement Results. 2. Bliss, A G; Guria, J C; Jones, W R; Rockliffe, N A. (1999). A Road Safety Resource Allocation Model. Transport Reviews, vol. 19, no. 4, 281-303. |
| Address for copies | 1. www.ltsa.govt.nz/publications/docs/sdwp1.pdf 2. Economic Evaluation, Ministry of Transport, PO Box 3175, Wellington |

Social costs of crashes and injuries

| | |
|-----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Ministry of Transport |
| Principal investigators | Leung, J; Badger, S; Graham, P; Guria, J; Jones, W; Quazi, A. |
| Aims/objectives | To provide estimates of the average social cost per injury and crash and the average social cost per reported crash and injury |
| Progress/status | Active |
| Commencement | June 1999 |
| Scheduled completion | Ongoing |
| Publications | The social cost of road crashes and injuries: June 2005 update. Ministry of Transport |
| Address for copies | Economic Evaluation, Ministry of Transport, PO Box 3175, Wellington www.transport.govt.nz/business/multimodal/economic/socialcost.php |

ENGINEERING

| Accident benefits of sealing unsealed roads | |
|----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Beca Infrastructure Ltd |
| Supporting organisation | Land Transport New Zealand |
| Principal investigators | Bradshaw, P; Turner, S A. |
| Aims/objectives | To determine if there is sufficient data available to enable the accident benefit or cost of sealing a road to be calculated with a desired level of confidence. |
| Progress/status | Active |
| Commencement | January 2006 |
| Scheduled completion | April 2006 |
| Publications | Bradshaw, P; Turner, S A (2006). Accident benefits of sealing unsealed roads |
| Address for copies | Email research@landtransport.govt.nz |

| Analysis of spatial distributions of accidents | |
|-------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Department of Civil Engineering, Canterbury University |
| Principal investigators | Nicholson, A J; Arampamoorthy, H. |
| Aims/objectives | To develop and evaluate statistical analysis techniques for detecting spatial patterns of accident occurrence, to identify the most cost-effective form of accident reduction plan |
| Progress/status | Completed |
| Commencement | July 1993 |
| Scheduled completion | February 2005 |
| Publications | Nicholson, A J. Analysis of Spatial Distributions of Accidents. Safety Science 30. Nicholson, A J (1998). Selection of the Appropriate Accident Reduction Plan Type. Proceedings 9th REAAA Conference, Wellington, May. |
| Address for copies | Department of Civil Engineering, Canterbury University, Private Bag 4800, Christchurch |

Assessing the crash risk implications of roadside hazards

| | |
|-----------------------------------|---------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Beca Infrastructure Ltd |
| Supporting organisation | Land Transport New Zealand |
| Principal investigators | Turner, S A. |
| Aims/objectives | To collect data on roadside hazards to estimate the number and types of hazards adjacent to New Zealand roads |
| Progress/status | Completed |
| Commencement | December 2003 |
| Scheduled completion | March 2005 |
| Publications | Turner, S A (2005). Assessing the Crash Risk Implications of Roadside Hazards |
| Address for copies | Land Transport New Zealand, PO Box 2840, Wellington |

Behavioural adaptation to road width

| | |
|-----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Department of Psychology, University of Waikato |
| Supporting organisations | Road Safety Trust |
| Principal investigators | Charlton, S; Lewis Evans, B. |
| Aims/objectives | To assess behavioural adaptation in drivers' speed and lateral displacement in response to manipulations of road width. |
| Progress/status | Completed |
| Commencement | March 2004 |
| Scheduled completion | March 2005 |
| Publications | Charlton, S; Lewis Evans, B. (2005). Explicit and implicit processes in behavioural adaptation to road width. <i>Accident Analysis and Prevention</i> (38) 3, pp 610-617 |
| Address for copies | Department of Psychology, University of Waikato, Private Bag 3105, Hamilton |

Benefits of brighter markings

| | |
|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Opus International Consultants |
| Supporting organisations | Land Transport New Zealand |
| Principal investigators | Dravitzki, V. |
| Aims/objectives | To identify the safety benefit of making existing markings brighter. A before and after type crash study examined the benefit of reflectorising markings in seven Transit NZ regions. Some indications of small benefits were obtained but findings were also inconsistent. |
| Progress/status | Completed |
| Commencement | July 2003 |
| Scheduled completion | December 2004 |
| Publications | Dravitzki, V; Lester, T; Wilkie, S (2005). The safety benefits of brighter road markings. |
| Address for copies | Email: research@landtransport.govt.nz , Land Transport New Zealand, PO Box 13-364, Christchurch, (\$20) |

Crash rates at rural junctions

| | |
|-----------------------------------|-------------------------------------------------------------------------------------|
| Investigating organisation | Beca Infrastructure Ltd |
| Supporting organisation | Road Safety Trust |
| Principal investigators | Turner, S A; Roozenburg, A P. |
| Aims/objectives | To develop accident prediction models for the more common rural intersection types. |
| Progress/status | Active |
| Commencement | January 2005 |
| Scheduled completion | February 2006 |

Crash risk relationships for improved safety management of roads

| | |
|-----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Opus International Consultants Ltd |
| Supporting organisation | Land Transport New Zealand |
| Principal investigators | Cenek, P; McLarin, M W; Loader, M; Davies, R B. |
| Aims/objectives | To develop new and refine existing models that are available for assessing crash risk attributable to road geometry and road surface characteristics. |
| Progress/status | Completed |
| Commencement | July 2002 |
| Scheduled completion | March 2005 |
| Publications | Cenek, P D and Davies, R B (2004). Crash risk relationships for improved safety management of roads. Towards Sustainable Land Transport Conference, Wellington, New Zealand (1) Cenek, P D; Davies, R B; Henderson, R J. (2005) The effect of skid resistance and texture on crash risk.(2) |
| Address for copies | (1) Land Transport New Zealand, PO Box 2331, Wellington, New Zealand (2) www.surfacefriction.org.nz |

Curve speed management

| | |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Transport Engineering Research New Zealand Ltd; Traffic & Road Safety Research Group, Waikato University |
| Supporting organisation | Land Transport New Zealand |
| Principal investigators | Charlton, S G; Baas, P H; de Pont, J; de Jong, D. |
| Aims/objectives | The research involves taking the multiple threads of road geometry, current vehicle speeds around curves, crash rates, driver judgements of appropriate speeds, vehicle dynamics, road camber, and the results of earlier studies to identify and evaluate potential treatments. |
| Progress/status | Active |
| Commencement | July 2004 |
| Scheduled completion | May 2006 |

Delineation investment priorities

| | |
|-----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Transport Engineering Research New Zealand Ltd |
| Supporting organisation | Land Transport New Zealand |
| Principal investigators | Charlton, S G; Baas, P H; Mackie, H. |
| Aims/objectives | To develop a management tool that will assist road controlling authorities and their consultants to prioritise where and what type of delineation treatments should be used to obtain the greatest road safety benefits. |
| Progress/status | Active |
| Commencement | July 2005 |
| Scheduled completion | August 2006 |

Effect of rainfall and contaminants on road pavement skid resistance

| | |
|-----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Department of Civil and Environmental Engineering, University of Auckland |
| Supporting organisation | Land Transport New Zealand |
| Principal investigators | Wilson, D. |
| Aims/objectives | To effectively quantify the rainfall/contaminants phenomenon by developing better understanding of the combined effect that contaminants and rainfall have on measured skid resistance. To develop statistical methods to be able to quantify confidence limits from one or more skid resistance measurements given certain environmental information. Objectively quantify the contaminant materials and source obtained from road surfacing samples in the Northland Region and propose ways of mitigating their effects in terms of skid resistance and the receiving environment. |
| Progress/status | Active |
| Commencement | July 2004 |
| Scheduled completion | February 2006 |

Effect of road cross-section geometry on heavy vehicles

| | |
|-----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Transport Engineering Research New Zealand Ltd |
| Supporting organisation | Land Transport New Zealand |
| Principal investigators | De Pont, J; Milliken, P; Latto, D; Baas, P H; Triggs, C. |
| Aims/objectives | Road cross-sectional geometric characteristics such as seal width, cross-slope and shoulder treatment can have a significant impact on the safety performance of heavy vehicles, which is not well understood. This project will quantify these safety impacts with the aim of optimising road design in terms of safety and cost. |
| Progress/status | Completed |
| Commencement | July 2003 |
| Scheduled completion | June 2004 |
| Publications | Milliken, P and de Pont, J (2004). The effect of cross-sectional geometry on heavy vehicle performance and safety. Transfund New Zealand Research Report 263. |
| Address for copies | Land Transport New Zealand, PO Box 2331, Wellington, New Zealand |

Flush median safety

| | |
|-----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Auckland City Council |
| Supporting organisation | Land Transport New Zealand; Auckland City Council |
| Principal investigators | Cleaver, S; Jurisich, I. |
| Aims/objectives | Research on the safety of flush median barriers in Auckland City, to see if there are reductions in crash severity, and whether they prevent certain types of crashes from occurring. |
| Progress/status | Active |
| Commencement | July 2004 |
| Scheduled completion | July 2005 |

Improving the road crossing practices of pedestrians using virtual reality

| | |
|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Department of Psychology, University of Canterbury |
| Supporting organisation | Road Safety Trust |
| Principal investigators | Owen, D; Lamb, S. |
| Aims/objectives | Literature shows that children are over-represented in accident statistics and make systematic errors when crossing the road. The research involved designing a road-crossing training programme using virtual reality. |
| Progress/status | Completed |
| Commencement | February 2004 |
| Scheduled completion | February 2005 |
| Publication | Lamb, S (2004). Improving the road crossing practices of pedestrians using virtual reality |
| Address for copies | Department of Psychology, University of Canterbury, Private Bag 4800, Christchurch |

Incorporating safety into rural highway design

| | |
|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Dept of Civil Engineering, University of Canterbury |
| Supporting organisation | University of Canterbury; Road Safety Trust |
| Principal investigators | Koorey, G F; Nicholson, A J. |
| Aims/objectives | To explore ways to assess the safety performance of (predominantly two-lane) rural highways in New Zealand and in particular identify driver/road/environmental factors affecting crashes on rural curves. Road environment, geometry, crash, and traffic data will be analysed to identify the key parameters affecting crashes at rural sites and empirical relationships will be determined. Driver behaviour will be observed on selected rural curves, particularly speed choice and lateral placement, and these will be related to measurable road/environment factors. The findings from these investigations will be used to develop a suitably robust model for predicting the relative safety of a rural road alignment. |
| Progress/status | Active |
| Commencement | January 2002 |
| Scheduled completion | December 2006 |
| Publications | Koorey, G F. The Use of Road Geometry Data for Highway Applications (submitted). 3rd International Symposium on Highway Geometric Design, Chicago, June 2005 |
| Address for copies | Dept of Civil Engineering, University of Canterbury, Private Bag 4800, Christchurch |

Keep left

| | |
|-----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Department of Psychology, Canterbury University. |
| Principal investigators | Owen, D; Billinghamurst, M; Belcher, J. |
| Aims/objectives | Explore situations that set the occasion for unintentional wrong-side driving, simulate these in a virtual driving reality simulator, and study methods to reduce wrong-side driving. |
| Progress/status | Active |
| Commencement | January 2005 |
| Scheduled completion | June 2006 |

Log truck safety

| | |
|-----------------------------------|------------------------------------------------------------------------------|
| Investigating organisation | Transport Engineering Research New Zealand Ltd; Log Truck Safety Council |
| Supporting organisation | Forest Owners Association |
| Principal investigators | Baas, P H; Wilshier, W. |
| Aims/objectives | Improve the safety of log trucks |
| Progress/status | Active |
| Commencement | 1998 |
| Scheduled completion | Ongoing |
| Publications | Baas, P H; Wilshier, W (2005). Achievements in improving log truck safety |
| Address for copies | www.ternz.co.nz/reports.htm |

Performance of New Zealand road markings

| | |
|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Opus International Consultants |
| Supporting organisations | Road Safety Trust |
| Principal investigators | Dravitzki, V K; Munster, D E; Wood, B; Potter, S; Laing, J. |
| Aims/objectives | To develop guidelines for road marking performance. These will be able to be used by roading authorities to provide markings which assist safe and comfortable driving. |
| Progress/status | Completed |
| Commencement | March 2001 |
| Scheduled completion | March 2005 |
| Publications | Dravitzki, V K; Laing, J; Potter, S; Wood, B (2003). Guidelines for performance of New Zealand markings |
| Address for copies | Research and Statistics, Ministry of Transport, PO Box 3175, Wellington |

Predicting accident rates for cyclists and pedestrians

| | |
|-----------------------------------|----------------------------------------------------------------------------------------------------|
| Investigating organisation | Beca Infrastructure Ltd; Francis & Cambridge Ltd |
| Supporting organisation | Land Transport New Zealand |
| Principal investigators | Turner, S A; Roozenburg, A P; Francis, T. |
| Aims/objectives | To investigate accidents involving pedestrians and cyclists and develop accident prediction models |
| Progress/status | Active |
| Commencement | July 2002 |
| Scheduled completion | April 2005 |

Public lighting for safe and attractive pedestrian areas

| | |
|-----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Opus International Consultants |
| Supporting organisations | Land Transport New Zealand |
| Principal investigators | Dravitzki, V. |
| Aims/objectives | This project will develop guidelines for using public lighting to create safe and attractive pedestrian areas. The guidelines will be prepared through a review of national and international lighting strategies and projects and will provide information to assist lighting designers to select lighting to improve pedestrians' sense of comfort and safety. |
| Progress/status | Active |
| Commencement | July 2004 |
| Scheduled completion | July 2006 |

Relationship between road geometry, observed travel speed and rural crashes

| | |
|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Beca Infrastructure Ltd; MWH NZ Ltd |
| Supporting organisation | Land Transport New Zealand |
| Principal investigators | Tate, F; Turner, S A. |
| Aims/objectives | To investigate the relationship between observed free speed, the 'safe' driving speed and 'speed related' crashes on various elements of rural roads. |
| Progress/status | Active |
| Commencement | July 2005 |
| Scheduled completion | June 2006 |
| Publications | Tate, F; Turner, S A (in press). Relationship between Road Geometry, Observed Travel Speed and Rural Crashes. |
| Address for copies | Email research@landtransport.govt.nz |

Risk analysis in accident reconstruction and prediction

| | |
|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Department of Civil Engineering, Canterbury University |
| Principal investigator | Nicholson, A J. |
| Aims/objectives | To use risk analysis techniques to assess the effect of uncertainty in variables involved in accident reconstruction and accident prediction. |
| Progress/status | Active |
| Commencement | January 2001 |
| Scheduled completion | Ongoing |

Road lighting assessment

| | |
|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Opus International Consultants Ltd |
| Supporting organisation | Road Safety Trust |
| Principal investigators | Dravitzki, V. |
| Aims/objectives | This project evaluated the extent to which mobile measurement systems could be used to establish compliance of road lighting with AS/NZS Standards. |
| Progress/status | Completed |
| Commencement | April 2004 |
| Scheduled completion | February 2005 |
| Publications | Harte, D; Kean, R (2005). High speed mobile collection of street lighting illumination data |
| Address for copies | Research and Statistics, Ministry of Transport, PO Box 3175, Wellington |

Roundabout accident prediction models – the influence of speed and visibility

| | |
|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Beca Infrastructure Ltd |
| Supporting organisation | Land Transport New Zealand |
| Principal investigators | Roozenburg, A P; Turner, S A. |
| Aims/objectives | To expand the current accident prediction models already developed by the study researchers for roundabouts, based on traffic, pedestrian and cycle flows, to include geometric design (e.g., deflection, approach alignment), visibility and approach and negotiation speed variables. |
| Progress/status | Active |
| Commencement | July 2005 |
| Scheduled completion | June 2006 |
| Publications | Roozenburg, A P; Turner, S A (in press). Roundabout Accident Prediction Models – The Influence of Speed and Visibility |
| Address for copies | Email research@landtransport.govt.nz |

Rural crash prediction model – next generation

| | |
|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Beca Infrastructure Ltd; MWH NZ Ltd |
| Supporting organisation | Land Transport New Zealand |
| Principal investigators | Tate, F; Turner, S A. |
| Aims/objectives | The objective of this study is to develop a series of crash prediction models similar to those developed internationally, notably in the United States, that may be used to identify and evaluate engineering related road safety issues. |
| Progress/status | Active |
| Commencement | February 2006 |
| Scheduled completion | July 2006 |

Spatial-temporal modelling of road traffic accidents in Christchurch

| | |
|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Departments of Geography and Civil Engineering, Canterbury University |
| Supporting organisation | University of Canterbury |
| Principal investigators | Sabel, C E; Kingham, S; Nicholson, A J; Dantas, A S. |
| Aims/objectives | To develop and extend spatial modelling techniques to describe the variability of road traffic accidents. To examine the impact of transport policy initiatives (e.g., engineering treatments, social interventions) on road traffic accidents in Christchurch. |
| Progress/status | Active |
| Commencement | July 2004 |
| Scheduled completion | June 2007 |

Speed change management

| | |
|-----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Transport Engineering Research New Zealand Ltd; Traffic & Road Safety Research Group, Waikato University |
| Supporting organisation | Land Transport New Zealand |
| Principal investigators | Charlton, S G; Baas, P H; de Jong, D. |
| Aims/objectives | This research examined the driver compliance afforded by various speed change and treatment regimes in support of self-explaining roads initiatives in New Zealand. The aim of this project was to establish the best possible designs for speed management and speeding countermeasures at and beyond speed change zones including at rural towns, on arterial roads and at motorway off-ramps. |
| Progress/status | Completed |
| Commencement | July 2004 |
| Scheduled completion | June 2005 |
| Publications | Charlton, S G; Baas, P H (in press). Speed change management: final report |
| Address for copies | Land Transport New Zealand, PO Box 2331, Wellington |

Surfacing selection process for high-stress corners

| | |
|-----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Opus International Consultants |
| Supporting organisation | Land Transport New Zealand |
| Principal investigators | Herrington, P; Ball, G; McClarin, M. |
| Aims/objectives | To develop a process for the categorisation of the severity of such sites, and for the selection of the most appropriate surfacing type. The research is proceeding in two stages: stage 1 involves the development of a systematic means of ranking the severity of any particular site by calculating the traffic stresses acting on the surface. Stage 2 is to consist of measuring the strength of different chip seal designs (and binder types) in the laboratory. By comparing seal strengths to site stresses the most appropriate surfacing type for a particular site can be selected. The final task in stage two is to bring together the work of both stages into a set of guidelines and software for practical application. |
| Progress/status | Active |
| Commencement | July 2001 |
| Scheduled completion | July 2005 |

Sustainable transportation – engineering safety in roads

| | |
|-----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Opus International Consultants Ltd |
| Supporting organisation | Foundation for Research, Science and Technology |
| Principal investigators | Cenek, P; Fong, S; Koorey, G; McLarin, M; Thomas, J; Walton, D. |
| Aims/objectives | To determine how vehicles and drivers interact and interface with any particular combination of roading elements in order to facilitate proactive identification of high-risk situations and the development of cost-effective road engineering solutions to road safety management. |
| Progress/status | Completed |
| Commencement | July 2000 |
| Scheduled completion | June 2004 |
| Publications | Cenek, P; Fong, S; Jamieson, N J; McLarin, M W (2001). Integration of road and tyre design – overview of New Zealand research Walton, D; Thomas, J A (2005). Naturalistic observations of driver hand positions |
| Address for copies | Opus Central Laboratories, PO Box 30845, Lower Hutt |

HUMAN FACTORS

| Analysis of the safety benefits of heavy vehicle accreditation | |
|-----------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Transport Engineering Research New Zealand Ltd; Ian Wright and Associates |
| Supporting organisation | Austrroads |
| Principal investigators | Baas, P H; Wright, I. |
| Aims/objectives | To determine the safety benefits of the heavy vehicle accreditation schemes in Australia, such as: NHVAS Mass Management, NHVAS Maintenance Management, the Western Australia Heavy Vehicle Scheme and Trucksafe. |
| Progress/status | Active |
| Commencement | February 2005 |
| Scheduled completion | June 2006 |

| Cycle safety – reducing the crash risk | |
|-----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Beca Infrastructure Ltd |
| Supporting organisation | Land Transport New Zealand |
| Principal investigators | Turner, S A; Roozenburg, A P. |
| Aims/objectives | To establish what additional reductions in crash risk for cyclists can be achieved by reducing traffic speeds, installing cycle lanes, cycle paths and intersection cycle facilities. |
| Progress/status | Active |
| Commencement | July 2005 |
| Scheduled completion | June 2006 |
| Publication | Turner, S A; Roozenburg, A P (in press). Cycle safety – reducing the crash risk |
| Address for copies | Email research@landtransport.govt.nz |

Evaluation of New Zealand's road safety advertising/policing package

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|-----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Ministry of Transport |
| Principal investigators | Guria, J C; Leung, J. |
| Aims/objectives | To evaluate the effects of a high-intensity enforcement and advertising programme targeting alcohol-impaired drivers, speeding and seatbelt use. |
| Progress/status | Active |
| Commencement | July 1995 |
| Scheduled completion | Ongoing |
| Publications | <p>Cameron, M; Vulcan, P (1996). Review of the evaluation of the SRSP and its outcomes. Report to the Land Transport Safety Authority.</p> <p>Cameron, M; Vulcan, P (1998). Evaluation Review of the SRSP and its outcomes during the first two years. Report to the Land Transport Safety Authority.</p> <p>Cameron, M; Guria, J; Leung, J (2002) An evaluation of the Supplementary Road Safety Package: July 1995 to June 2000.</p> <p>Guria, J C; Leung, J (2003). An evaluation of a supplementary road safety package. Accident Analysis and Prevention (36) 5, 893-904.</p> |
| Address for copies | Economic Evaluation, Ministry of Transport, PO Box 3175, Wellington |

Identifying barriers to car driver licensing among Maori

| | |
|-----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Injury Prevention Research Unit, University of Otago |
| Supporting organisation | Health Research Council of New Zealand |
| Principal investigators | Begg, D; Broughton, J; Williamson, P. |
| Aims/objectives | To identify barriers to obtaining a car driver's licence among Maori, strategies for overcoming these barriers, and how to implement the strategies. |
| Progress/status | Active |
| Commencement | July 2004 |
| Scheduled completion | June 2007 |

Investigating safety policies versus efficiency targets

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|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Opus International Consultants |
| Supporting organisations | Foundation for Research, Science and Technology |
| Principal investigators | Dravitzki, V. |
| Aims/objectives | The hypothesis is that the public perceives bigger (not necessarily heavier) vehicles to be safer than smaller cars. Further, it is hypothesised that a concern for safety alters mode choice away from more fuel-efficient choices, such as cycling and walking. These concerns are being investigated as part as a broader programme of research addressing New Zealanders' travel behaviour. |
| Progress/status | Active |
| Commencement | January 2005 |
| Scheduled completion | June 2006 |

Lowering the drinking age: the New Zealand example

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|-----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Pacific Institute for Research & Evaluation; Injury Prevention Research Unit, University of Otago |
| Supporting organisations | National Institute on Alcohol Abuse and Alcoholism (NIAAA) (United States of America) |
| Principal investigators | Voas, R; Tippets, S; Kypri, K; Langley, J; Begg, D; Stephenson, S. |
| Aims/objectives | To determine whether the reduction in the drinking age from 20 to 18 has increased alcohol consumption of youths aged 15-19, increased alcohol-related traffic crashes involving drivers aged 15 to 19, or increased alcohol-related non-traffic hospitalisations of youths aged 15 to 19. |
| Progress/status | Active |
| Commencement | January 2004 |
| Scheduled completion | December 2005 |
| Publication | Begg, D; Davies, G; Kypri, K; Langley, J; Stephenson, S; Tippets, S; Voas, R (2006). Minimum purchase age for alcohol and traffic crash injuries among 15-19 year olds in New Zealand. American Journal of Public Health. 96:126-131 |
| Address for copies | Email IPRUNZ@otago.ac.nz, Injury Prevention Research Unit, University of Otago, PO Box 913, Dunedin, New Zealand |

Monitoring the ACC Stop Bus programme

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|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Injury Prevention Research Unit, University of Otago |
| Supporting organisation | Accident Compensation Corporation |
| Principal investigators | Begg, D; Brookland, R; Russell, D; Davie, G. |
| Aims/objectives | To investigate the effectiveness of the ACC Stop Bus programme to reduce the incidence and severity of alcohol-related road crashes in New Zealand |
| Progress/status | Active |
| Commencement | January 2003 |
| Scheduled completion | December 2005 |
| Publication | Brookland, R; Begg, D; Davie, G; Russell, D. (2005). Monitoring the ACC Stop Bus Programme |
| Address for copies | Accident Compensation Corporation, PO Box 242, Wellington |

Motor vehicle traffic crash submersions

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|-----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Injury Prevention Research Unit, University of Otago |
| Supporting organisation | Public Health Theme, University of Otago |
| Principal investigators | Chalmers, D; Begg, D; Gulliver, P. |
| Aims/objectives | To determine the feasibility of undertaking an investigation into the frequency and circumstances associated with motor vehicle traffic crash submersions. |
| Progress/status | Active |
| Commencement | 2005 |
| Scheduled completion | 2006 |

New Zealand drivers study: a follow-up study of newly licensed drivers

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|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Injury Prevention Research Unit, University of Otago; Ngai Tahu Maori Health Research Unit; School of Population Health, Auckland |
| Supporting organisation | Health Research Council of New Zealand, Accident Compensation Corporation, Road Safety Trust |
| Principal investigators | Ameratunga, S; Begg, D; Brookland, R; Broughton, J; Langley, J; McDowell, A. |
| Aims/objectives | The primary objective of this study is to examine risk and protective factors for traffic-related injury among newly licensed drivers in New Zealand, and from this identify factors that can be targeted to reduce these injuries. |
| Progress/status | Active |
| Commencement | November 2005 |
| Scheduled completion | September 2009 |

Regional alcohol project

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|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Centre for Social and Health Outcomes Research and Evaluation; Te Ropu Whariki, Massey University |
| Supporting organisation | Ministry of Health |
| Principal investigators | Casswell, S; Conway, K; Greenaway, S; Huckle, T. |
| Aims/objectives | Reducing alcohol-related harm for young people in the Auckland region, including harm related to drink driving. |
| Progress/status | Completed |
| Commencement | July 2002 |
| Scheduled completion | June 2005 |
| Publication | Casswell, S; Conway, K; Greenaway, S; Huckle, T; Sweetsur, P (2005). Auckland Regional Community Action Project on Alcohol Evaluation Report: Final Report. |
| Address for copies | www.shore.ac.nz/projects/projects_1.html |

Road user behaviour and attitude monitoring

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|-----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Ministry of Transport |
| Principal investigators | Frith, W J; Graham, P G; Keall, M D; Povey, L J. |
| Aims/objectives | Monitoring of road user behaviour/attitudes including roadside surveys of drivers' speed and breath alcohol, road users' restraint use and cyclists' use of helmets. Also includes surveys of peoples' attitudes to various issues related to road safety and enforcement. |
| Progress/status | Active |
| Commencement | July 1994 |
| Scheduled completion | Ongoing |
| Publications | Keall, M D; Frith, W J (1999). Measures of Exposure to Risk of Road Crashes in New Zealand. IPENZ Transactions, Wellington. Ministry of Transport (2005) Public attitudes to road safety: highlights of the 2005 survey. http://www.transport.govt.nz/business/land/research/ public-attitudes/2005.php |
| Address for copies | Research and Statistics, Ministry of Transport, PO Box 3175, Wellington |

Urban environments for intensified living

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|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Opus International Consultants |
| Supporting organisations | Foundation for Research, Science and Technology |
| Principal investigators | Dravitzki, V; Walton, D; Laing, J. |
| Aims/objectives | Determine the framework of a model which can be used to predict the suitability and attractiveness of streets for commuter walking. The framework is to be developed by observation and surveys of pedestrians, by experiments and by measurement of physical parameters. The overall research is directed at identifying key factors in the urban environment that make it 'walkable', and in developing a methodology that allows walkability to be assessed and predicted. |
| Progress/status | Completed |
| Commencement | July 2002 |
| Scheduled completion | June 2004 |
| Publications | Laing, J (2002). Assessing route walkability from a commuter perspective: literature review Dravitzki, V; Walton, D; Cleland, B; Laing, J (2003). Measuring commuting pedestrians concerns for personal safety and the influence of lighting on these concerns |
| Address for copies | Opus Central Laboratories, PO Box 30845, Lower Hutt |

Vehicle-pedestrian conflict: lane priority issues

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|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Opus International Consultants |
| Supporting organisation | Transfund New Zealand |
| Principal investigators | Tate, F; Thomas, J; Wilkie, S; Potter, S; Walton, D. |
| Aims/objectives | This research sought to improve road safety by reducing vehicle-pedestrian conflicts, through improved design of local area traffic management and shared spaces. |
| Progress/status | Completed |
| Commencement | August 2002 |
| Scheduled completion | May 2004 |
| Publications | Thomas, J A; Tate, F N (2004). Reducing conflict through improved design of pedestrian-vehicle spaces. (1) Thomas, J A; Tate, F N (2004). Improving the Design of Pedestrian and Vehicle Spaces (Brochure) (2) |
| Address for copies | (1) Email research@landtransport.govt.nz (\$20) (2) Opus Central Laboratories, PO Box 30845, Lower Hutt |

Work-related fatal injury deaths due to motor vehicle traffic crashes 1985-1998

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|-----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Injury Prevention Research Unit & NZ Occupational Health Research Centre, University of Otago |
| Supporting organisations | Health Research Council of New Zealand |
| Principal investigators | McNoe, B; Langley, J D; Feyer, A-M. |
| Aims/objectives | To identify and describe all work-related traffic fatalities that occurred on a public road in New Zealand between 1985 and 1998 inclusive. |
| Progress/status | Active |
| Commencement | January 2001 |
| Scheduled completion | June 2003 |
| Publication | McNoe, B; Langley, J D; Feyer, A-M (2005). Work-related traffic injuries in New Zealand 1985-1998 New Zealand Medical Journal, 2005; 118 No.1227. www.nzma.org.nz/118-1227/1783/ |
| Address for copies | IPRUNZ@otago.ac.nz, Injury Prevention Research Unit, University of Otago, PO Box 913, Dunedin |

MISCELLANEOUS

| Control charts for assessing the effectiveness of police traffic safety activities | |
|-------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Ministry of Transport |
| Principal investigators | Mara, M K; Guria, J C; Quazi, A. |
| Aims/objectives | To establish the statistical methodology for providing a monitoring tool for the effect of Police enforcement activity on traffic safety. |
| Progress/status | Active |
| Commencement | July 1997 |
| Scheduled completion | Ongoing |
| Publications | Mara, M K; Guria, J C (1998). An Application of Control Charts in Monitoring Road Safety Performance at National and District Levels. Road Safety Research Policing Education Conference, Wellington. Guria, J C; Mara, M K (2000). Monitoring performance of road safety programmes in New Zealand. Accident Analysis and Prevention (32) 5, 695-702 Guria, J C; Mara, M K (2001). Predicting performance of annual safety outcomes. Accident Analysis and Prevention (33) 3, 387-392. |
| Address for copies | Economic Evaluation, Ministry of Transport, PO Box 3175, Wellington |

| Study on the Future Options for Roadworthiness Enforcement in the European Union (AUTOFORE) | |
|----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Investigating organisation | Transport Engineering Research New Zealand Ltd |
| Supporting organisation | FRST International Investment Opportunities Fund; European Union and EU member states |
| Principal investigators | Baas, P H. |
| Aims/objectives | The purpose of the Autofore project is to recommend improvements in roadworthiness enforcement in the European Union that will ensure that the benefits that accrue from the original design and manufacture of vehicles are retained throughout the life of those vehicles. |
| Progress/status | Active |
| Commencement | February 2005 |
| Scheduled completion | February 2007 |

the 1990s, the number of publications on the topic of the present review has increased steadily (see Figure 1).

The present review is organized as follows. Section 2 describes the epidemiology of the disease. Section 3 discusses the pathogenesis of the disease. Section 4 describes the clinical picture of the disease. Section 5 discusses the laboratory diagnosis of the disease. Section 6 describes the treatment of the disease. Section 7 discusses the prognosis of the disease. Section 8 discusses the prevention of the disease. Section 9 discusses the future of the disease. Section 10 discusses the conclusion of the review.

2. Epidemiology

The disease is a worldwide disease, but it is most prevalent in the tropical and subtropical regions. The disease is most prevalent in the tropical and subtropical regions of Africa, Asia, and South America.

The disease is most prevalent in the tropical and subtropical regions of Africa, Asia, and South America.

The disease is most prevalent in the tropical and subtropical regions of Africa, Asia, and South America.

The disease is most prevalent in the tropical and subtropical regions of Africa, Asia, and South America.

3. Pathogenesis

The disease is caused by a parasite that is transmitted from one person to another.

The disease is caused by a parasite that is transmitted from one person to another.

The disease is caused by a parasite that is transmitted from one person to another.

The disease is caused by a parasite that is transmitted from one person to another.

4. Clinical picture

The disease is characterized by a variety of symptoms and signs.

The disease is characterized by a variety of symptoms and signs.

The disease is characterized by a variety of symptoms and signs.

The disease is characterized by a variety of symptoms and signs.

5. Laboratory diagnosis

The disease can be diagnosed by a variety of laboratory tests.

The disease can be diagnosed by a variety of laboratory tests.

The disease can be diagnosed by a variety of laboratory tests.

