The Big Impact
Edition 4, December 2013

From the Director

THE final Big Impact for 2013 features completed, ongoing and recently commenced research that specifically address cyclist and motorcyclist safety. In relation to cycling, we are seeing increasing rates of cycling throughout Australia especially for commuting and recreational purposes, with the consequent increase in the burden of injury. The increased burden is not unexpected given cyclists need to travel on a road network not designed to accommodate the increasing mix of transport modes.

We have recently been awarded a large Australian Research Council grant to investigate the contributing factors associated with cyclist crashes in urban road environments and importantly, to identify features of the urban road environment that increases the risk of a cyclist crash. We will use the information gleaned from this research to develop road infrastructure prototypes that will improve cyclists’ safety and these prototypes will be evaluated using a world first bicycle simulator. It is through research such as this, where findings are directly translated into practice, and where both government and cycling not-for-profit organisations are intimately involved in the research and translation process, that we will begin to see a road network system that safely accommodates the more vulnerable users of the road network.

The year has flown by and as we did last year, the year concluded with the running of another successful road safety management and leadership program. Delegates from Australasia as well as senior staff from the World Bank attended a week-long residential program. The program highlighted the considerable opportunities to reduce road trauma and the importance for individuals and agencies to take a leadership role. As it did last year, the program highlighted to us, the importance of our ongoing research and the translation of such into policy and practice.

Finally, on behalf of all of the Centre staff, we wish you a relaxed holiday period and safe travels wherever you may be heading.

Professor Mark Stevenson
Director, MUARC

Below are a sample of recent MUARC publications.


The thin green line: Making urban cycling safer

Cycling – with its health and environmental benefits – is on the rise. In 2011, an estimated 4 million Australians (18%) rode bicycles. However, cycling remains a dangerous pursuit.

In Australia, most cyclist fatalities and serious injuries involve collisions with a motor vehicle (86% of fatalities & 75% of serious injuries). Moreover, cyclist casualty collisions cost the Australian community an estimated A$10.5 million each year. A world-first study is beginning this year in Melbourne and Perth looking at the contributing factors to collisions and to develop and evaluate countermeasures to reduce Australia’s rising cyclist road toll.

The study will be the first to use a combination of in-depth crash investigation, naturalistic cycling studies and a bicycle simulator to dissect how urban environments impact on the safety of cyclists.

The majority of cyclist crashes occur in the urban road environment and crashes involving motor vehicles lead to the most serious outcomes for cyclists. The stats are alarming: the risk of a fatality for cyclists is 4.5 times greater than car occupants and a cyclist’s risk of serious injury is 3.6 times greater in a collision with a vehicle compared with all other non-vehicle cyclist crash types.

Much of the research into cyclist safety in Australia has focused on behaviour, with less research focus on the impact of the urban transport environment on cyclist safety.

Current attempts at cycling safety have had mixed success for instance:
• painted bike boxes at intersections are not observed by drivers
• bike lanes are often positioned alongside parallel parking bays that expose cyclists to the risk of opening vehicle doors

Researchers from the Monash University Accident Research Centre, the School of Civil Engineering and the School of Public Health and Preventive Medicine, Monash University are working with Curtin University – CMAARC, the Amy Gillett Foundation, the Cycling Promotion Foundation as well as the West Australian governments and international researchers to study how the urban road environment can be enhanced to reduce injuries to cyclists. The specific objectives of the research are:
1. To describe the contributing factors to cyclist crashes in urban road environments
2. Identify features of the urban road environment that increases the risk of a cyclist crash
3. To develop road infrastructure prototypes that improves cyclists’ safety
4. To evaluate the effectiveness of the prototypes in a bicycle simulator (BikeSim)

The innovative use of multi-methods represents a fundamental shift in the approach to cyclist safety. By matching cyclist behaviour and crash experience with the actual road environment, the outcomes will have substantial positive implications for the long-term individual and societal costs of cyclist injuries. Retrofitting roads to incorporate space for cyclists is expensive and it is important that any investment provides the greatest safety and mobility outcomes to all road users. Findings from the analysis of existing cyclist crash data and the naturalistic cycling study will inform prototypes of new road designs. These prototypes will be evaluated in a cycling simulator (BikeSim). Building the BikeSim for this project will provide a safe laboratory environment to trial and evaluate prototypes of road designs suitable for safe cycling. This testing will help to ensure any changes to the road space will achieve actual cyclist safety improvements and maximise the benefits of the financial investment in retrofitting roads.

The BikeSim will be integrated into the existing Monash University Accident Research Centre (MUARC) high fidelity vehicle-based simulator and be available for use in future cycling-related research.
Unravelling why motorcyclists crash: Age, experience, seasons?

There are more motorcycle accidents in summer than at any other time of the year. The months from December to March account for 37% of all crashes compared to 27% from June to September.

NICER weather means more opportunities to ride – people leave the car at home and hop on their bikes.

Researchers at the Monash University Accident Research Centre are conducting a study investigating the causes of non-fatal motorcycle crashes – involving a case-control study of motorcycle crashes occurring within a 150km radius of Melbourne. The characteristics of crashed riders and the relevant road environment will be compared with a similar group of riders who have not crashed and road environments where crashes have not occurred. The study aims to reveal how the roads and motorcycle riding can be made safer – in an effort to reduce the injuries related to this increasingly popular form of transport.

What’s more – the age of people who now ride motorcycles has changed in the last decade. Between 2003 and 2008 there has been a 34% increase in riders aged between 60 and 69 and a 24% increase in those aged 70 plus. Combined with the dramatic changes to the road and traffic environments, and motorbike design, in recent years in Australia, the findings of earlier studies on factors related to motorcycle crash risk may no longer be applicable.

Associate Professor Lesley Day and her colleagues at MUARC have published a study protocol in the latest issue of BMC Public Health which has highlighted some gaps in motorcycle safety research. These include: road infrastructure; licensing regulations; the emergence of new motorcycle designs and technologies and the role of speed.

The MUARC study will be the most comprehensive research, in Australia or elsewhere, examining the role of speed in the causation of motorcycle crashes, or the interaction between speed, rider characteristics, and the road infrastructure in motorcycle crashes. According to Professor Day, “the study will establish the contemporary evidence on rider risk factors relevant to the changing rider population and their environment as well as looking at the effect of speeding and road infrastructure.” Associate Professor Day believes the new study “will be the most rigorous and comprehensive to date.”
Monash-Alfred study reveals ways to cycle and stay alive

More than 1 million Victorians cycle each week and the rate of people embracing the bicycle is increasing at 5% a year. This also means an increase in cyclists injured and killed each year with more than 100 cyclists admitted to hospital after crashes in Melbourne in the past 12 months and five cyclist deaths in the 12 months to the end of September 2013 in Victoria.

Given that as few as 1 in 30 crashes are reported to Police and many cyclist crashes occur off road so do not appear in official statistics it is likely this figure is seriously underestimated.

The Melbourne City Council’s 2012-2016 bicycle plan commits the city “to becoming a cycling city with safe and connected bicycle routes” yet we know little about why these crashes occur.

The Monash Alfred Cycle Crash Study (MACCS) reported on last year revealed data from an in-depth crash investigation study focused on cyclists. Data were collected from 158 patients presenting to The Alfred and Sandringham Hospital Emergency Departments who were riders of bicycles involved in a crash. The Australia-first study collected information covering factors that can lead to a crash or affect injury outcomes in the crash such as the environment and cyclist/driver behaviour and crash mechanism. Injury outcomes were gathered from hospital records.

The study, led by Dr Paul Beigler with Associate Professor Stuart Newstead and Dr Marilyn Johnson, was undertaken in South East Melbourne with a particular focus on the Beach Road Corridor between Port Melbourne and Mordialloc - an extremely popular route for recreational, training and commuting cyclists used by more than 9000 cyclists each weekend.

MACCS is a pilot study that aimed to address the deficiencies in current cyclist crash databases such as underreporting to police and underreporting by medical staff that an accident has been the result of a cycling crash and to inform effective countermeasures. The pilot study has provided a unique, in-depth data base of bicycle crash causes and outcomes, as well as providing a template for similar future studies both in Australia and internationally. Regionally, MACCS aims to provide government at local and state levels with data to assist their development of cycle safety measures.

Patients were asked to participate if they presented to the emergency departments of either The Alfred or Sandringham Hospital with injuries sustained as the rider of a bicycle involved in a crash. Instances included single vehicle crashes (the patient’s bicycle was the only vehicle), crashes with single or multiple collision partners (including motor vehicles, motorcycles, other bicycles and pedestrians), and both on-road and off-road crashes.

Study participants were administered an in-depth questionnaire covering demographic details, prior health issues, cycling experience, bicycle and clothing used in the crash, events leading up to the crash and the road environment, and the events of the crash itself. Hospital records for the crash instance were retrieved and injuries recorded and coded using an international benchmark for trauma scoring.

Analysis of the data revealed that crashes were more associated with:

- failure to use lights and the presence of cloudy weather
- head injury risk was associated with bicycle speed before the crash, with higher bicycle speeds associated with greater head injury risk
- helmet use was also associated with lower head injury risk. This result was, however, not statistically significant due to high rates of helmet wearing in the study sample.
- Multiple vehicle crashes were associated with on-road crash location, familiarity with the crash site and separation from the bicycle during the crash.
- Off-road crash location was associated with off-road tyre use, the bicycle being the only vehicle involved, failure to use lights and low travel speed.

The study revealed a number of areas of focus for improving rider safety including increased bike light use by cyclists riding both on and off-road may have benefits in reducing crash severity. Off-road cyclists need to be conscious of environmental...
Monash-Alfred study reveals ways to cycle and stay alive

Factors to avoid single vehicle (bicycle) crashes. Benefit may also follow review of the maintenance and physical design of off-road cycling facilities, for example, bike paths, to improve safety.

Skills for on-road cyclists need to focus on reading and adapting to the traffic environment to avoid crashes with other road users. Additional education of drivers of motorised vehicles about road rules and other measures that encourage safe cyclist interactions may also prove beneficial. This aim would also be furthered by provision of road designs that assist safe driver-rider interaction. The utility of helmets in protecting against head injury is also a critical area of focus.

Crash Data

- At the time of the crash most participants were commuting (30%), riding for fitness (20%), or riding for recreation (19%).
- 93% of riders wore a helmet, of whom 45% sustained helmet damage as a result of a head strike during the crash.
- 57% of riders were travelling at 20 kilometres per hour or greater at the time of the crash.
- 18% of riders indicated there was debris on the road or path surface at the crash site. 44% of those who encountered debris thought it was a contributing factor in the crash.
- 18% were riding in a bunch at the time of the crash.
- 61 cyclists (39%) were involved in multi road user crashes with the most common collision partners being moving cars (21 cases), other bicycles (16 cases), parked cars (11 cases) and stationary cars (5 cases).
- 94 cyclists (60%) were involved in single road user crashes, that is, the rider’s bicycle was the only vehicle involved.
- The most common mechanism for all crashes was striking an object on a carriageway (20%), with the most common objects being tram tracks, potholes, grates and tree branches.
- 10 cyclists (6%) crashed after striking the opened doors of parked cars. In total, therefore, parked cars were involved in 21 (13%) crashes.
- 9 cyclists (6%) crashed as a result of a bicycle malfunction, most commonly a dropped or broken chain.
- 9 cyclists (6%) crashed after clipping the rear wheel of a cyclist in front.
- When the collision partner was a moving car (21 cases), the most common crash mechanisms were side swipe by a parallel left turning vehicle (5 cases); side swipe by a parallel vehicle from the same direction (4 cases); and being hit by cross traffic at intersection (4 cases).
- 96% of cyclists sustained relatively minor injuries with an injury severity score of 9 or less.
- The most commonly injured body regions were upper extremity (80%), lower extremity (42%), face (19%), abdomen/pelvis (13%), head (10%) and chest (10%).

The riders

- 74% of riders were male, of whom 64% were aged between 35 and 54.
- Of the 145 participants aged 18 or over nearly all (99%) held a car driver’s licence.
- 81% of participants usually cycled at least 2-3 times per week, with 62% of participants cycling more than 3 times per week.
- 65% of participants cycled on average more than 50 kilometres weekly with 41% cycling more than 100 kilometres weekly.
- In the preceding 5 years 46% of participants had no crashes, 20% one crash, 13% two crashes, and 21% more than two crashes.
- The bicycle types most frequently involved in crashes were drop bar road bikes (44%), hybrids (25%), mountain bikes (14%) and flat bar road bikes (9%).
- Lesser visibility colours above the waist (i.e. black, blue, grey and “dark”) were worn by 41% of participants. 3 riders (2%) wore high visibility “fluoro” yellow or green jerseys.