Title

Developing a Safer Cycling Strategy for the ACT

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Abstract

In the ACT, the number of people cycling is increasing. At the same time, crash statistics indicate that cyclists represent a disproportionate number of crash casualties. Cycling safety is an important issue for the local community. In 2010, GTA Consultants obtained a research grant from the NRMA-ACT Road Safety Trust and the ACT Government (represented by the Justice and Community Safety Directorate and the Environment and Sustainable Development Directorate) to identify a strategy to promote safer cycling and safer interaction between cyclists and other road and path users throughout the ACT. The aim of the study was to help the Government achieve its goal to reduce road trauma rates. The project involved three stages. In Stage 1, key issues were identified through data analysis and a literature review, and in Stage 2, these issues were further explored via local community and stakeholder engagement. During Stage 3, issue-specific strategies were identified guided by best practice, cost estimates and feasibility analysis, and prioritised via a qualitative assessment led by expert opinion. Short-term initiatives included upgrading bicycle infrastructure at minor intersections, implementing 'low speed zones' on shared paths, and increasing cyclist compliance at traffic lights via induction loop technology.

Keywords

Cyclists, cycling safety, bike riders, strategy development, infrastructure, education.

Introduction

Cycling has numerous health, environmental and social benefits, not only for individuals but for a community as a whole. As a mode of transport in Australian cities, cycling is becoming increasingly popular (De Rome et al, 2011; Johnson et al, 2010a). In the ACT, comparatively high cycling participation rates are experienced, and appear to be growing. This is reflected by ABS data on cycling to work and recreational cycling (Austroads, 2011), independent on-road and off-road cycling counts undertaken by Roads ACT (2009), and Australian Bicycle Council data (2011) which shows that ACT residents have the highest level of bicycle access in Australia.

Currently, crash statistics in the ACT indicate that cyclists represent a disproportionate number of all road user casualties (Henley and Harrison, 2009). Disproportionate numbers of cycling casualties comparative to rates of cycling is not unique to the ACT, nor to Australia generally – for example, in the US, crash risks associated with cycling are estimated at being double that of travelling by passenger vehicle (Bhatia and Weir, 2011; Beck et al, 2007). Throughout Australia in 2006–07, land transport accidents accounted for 11% of all hospitalisations due to injury. Of these, 35% were car occupants, 26% were motor cyclists,

7% were pedestrians and 18% were cyclists (Henley and Harrison, 2009). These figures include both traffic and non-traffic accidents, and a range of crash types. In terms of traffic (on-road) accidents resulting in serious injury, 15% involved a cycling casualty - cyclists do not typically account for 15% of road users in Australia, hence the concern with cycling safety. A number of studies have looked at the characteristics of bicycle crashes to try to understand what the risks are and how they can be minimised (for examples, see ARRB, 2002; De Rome et al, 2011; Johnson et al, 2010b; Wood et al, 2009; Parkin and Meyers, 2010).

According to Henley and Harrison (2009), almost as many off-road cycling accidents (not involving motor vehicles) as on-road cycling accidents result in serious injury to a cyclist. In the ACT, higher injury severity has been attributed to cycling accidents on shared paths (De Rome et al, 2011). De Rome et al (2011) found that only 10% of all bicycle crashes resulting in hospitalisation were reported to police. The vast majority of these involved a motor vehicle, despite single-vehicle accidents (resulting in hospitalisation) accounting for 60% of all bicycle crashes in transport-related environments.

Similarly, Richardson (2008) found that bicycle-related road trauma is 'grossly under-reported' to police, even after considering the high number of off-road accidents. Richardson (2008) also reported that most cycling crashes reported to police involve a motor vehicle. An international study by Jeffrey et al (2009) concluded that cyclists were most likely to be missed by police reporting. In NSW, Boufous (2008) found that cyclists typically have the lowest linkage rates between police and hospital data. This raises significant issues; police records tend to miss the majority of cycle crashes whilst hospital data is limited in terms of information related to the circumstances and characteristics of crashes, which informs infrastructure, behavioural and educational responses.

A number of recommendations based on infrastructure, education and safety campaigns have arisen from the various cycling studies undertaken in the ACT, nationally and internationally. These include improving cycling skills (Heesch et al, 2010), managing bicycle speeds (De Rome et al, 2011), improving clothing and visibility (Wood et al, 2009), increasing bicycle maintenance knowledge (Heesch et al, 2010; De Rome et al, 2011), education through line-marking, regulation and enforcement (Jordan and Leso, 2000), awareness campaigns (Johnson et al, 2010b), and improving police reporting (Richardson, 2008), among many others.

This paper summarises research carried out by GTA Consultants to develop a strategy to promote safer cycling and safer interaction between cyclists and other road and path users throughout the ACT, helping to achieve the government's goals to reduce road trauma rates.

Methodology

The project was undertaken in three stages. In Stage 1, key issues were identified through data analysis and a review of relevant literature. Once isolated, these issues were further explored via local community and stakeholder engagement in Stage 2. In Stage 3, issue-specific strategies were identified, guided by best practice, cost estimates and feasibility analysis. A qualitative method was developed to allow each strategy to be prioritised, further informed by expert opinion and key project stakeholder input.

Stage 1

Data analysis was undertaken for two separate sets of bicycle crash data. The first was sourced from ACT Police records, obtained from the Territory and Municipal Services (TAMS) database. The TAMS data contained details on all crashes in separate Excel files for five consecutive years between 2005 and 2009. These were combined, ensuring exact cross matching between vehicle, casualty and location details, and fields were allocated for multi-vehicle crashes. Detailed cross-checking was undertaken to ensure data matching accuracy and 728 bicycle crashes were isolated for detailed crash patterns analysis.

The second data set was sourced from records kept by Professor Drew Richardson at The Canberra Hospital, on people presenting at Canberra Hospital's emergency department as a result of a cycling accident. Ethics approval for this research had previously been obtained from the ACT Health Research Ethics Committee. The available data was from two separate periods - 2001 to 2003 and 2006 to 2007. No hospital data was available for 2004 and 2005. The data was combined, resulting in 2,102 cycling crashes over the period. Unfortunately, the database had many cases where there was insufficient information on the type of crash, including where and how it occurred. This made it difficult to determine whether the collision occurred in a transport-related environment. All data with insufficient information was removed from the database, along with crashes that occurred in parks or during a race, leaving 505 bicycle crashes for further analysis.

As a significant proportion of crashes was eliminated from the hospital database, the results presented in this paper may not accurately reflect actual percentages of crash types. No attempt was made to link police and hospital data in this study, due to the large number of hospital crashes that had to be omitted due to insufficient information, and the inability to obtain data from both sources for the same period.

Stage 2

Stage 2 involved local community and stakeholder engagement to further explore the issues identified in Stage 1. Consultation was led by Jane Seaborn of Landscape Research and Communications on behalf of GTA Consultants. Conversations were recorded to allow for accurate review and analysis following each workshop.

Three moderated focus groups of ten people each (total of 30 participants) were conducted. Each group was comprised of men and women from all parts of Canberra, aged between 18 and 65. Participants were selected from Landscape Research's existing database and defined by bicycle use, as follows:

- Non-cyclists – no cycling at all
- Occasional cyclists – cycle irregularly, perhaps on weekends with children
- Regular cyclists – cycle frequently, cycling is the primary mode of transport, long rides, includes training or competitive cyclists.

Separate discussions were held for the different user groups in order to scope a wide range of views amongst the community, and avoid 'moderation' of ideas by holding discussions with different types of bicycle user together. A discussion structured around the following topics guided each workshop:

- Salience of road safety / cycling safety in the national /ACT issues agenda
- Attitudes towards cycling / impressions of 'cyclists' versus 'bike riders'
- Benefits of and barriers to cycling participation
- Awareness and understanding of cycling issues

- Responsibility for delivering cycling safety messages and what kinds of messages are expected
- Recall and discussion of previous cycling safety campaigns
- Interaction between pedestrians and cyclists on shared paths.

Consultation in this format does not intend to quantitatively measure the prevalence of an opinion or attitude but rather, seeks to scope the range of views and non-expert ideas about issues and countermeasures which existing within the community. Results from these sessions were summarised by predetermined themes, based on Stage 1.

The stakeholder workshop was conducted post-community consultation and involved representatives from Roads ACT, the Justice and Community Safety Directorate (JACS), Pedal Power, Heart Foundation, Transport Planning and the cycling education industry, among others. As with the community workshops, a structured discussion format was used. This allowed for consideration of stakeholder view in relation to community views which was taken into account when developing the potential initiatives.

Stage 3

In Stage 3, a range of initiatives was proposed to respond to the issues identified in earlier stages. These initiatives were identified through consideration of key themes, implementation factors and feasibility. A qualitative method for prioritising these initiatives was developed, guided by expert opinion and key project stakeholder input to ensure that, a) appropriate priorities were assigned to projects, and b) projects could be measured against one another. A priority evaluation matrix, allowing equal standing to be given to hard and soft infrastructure projects, was applied (refer to Table 1).

Table 1: Priority evaluation matrix

Cost Estimate (Hard Infrastructure)		Potential Safety Benefits			Cost Estimate (Soft Infrastructure)	
		High	**Medium**	**Low**		
< $200,000	**Low**	Priority 1	Priority 1	Priority 2	**Low**	< $100,000
$200,000 - $1,000,000	**Medium**	Priority 1	Priority 2	Priority 3	**Medium**	$100,000 - $500,000
> $1,000,000	**High**	Priority 2	Priority 3	Priority 3	**High**	> $500,000

The costs estimates were based on the previous project experience of GTA Consultants. As hard infrastructure projects are typically more expensive to undertake than soft infrastructure projects (education, awareness, promotion etc), different cost levels were assigned by project type. It is acknowledged that it is not a standard approach to adopt different cost ratings within the same evaluation tool, however this was done to ensure the strategy would feature a broad selection of both hard and soft infrastructure initiatives for further development. Consequently, the ratio of hard to soft infrastructure initiatives may have been affected.

In rating potential safety benefits as high, medium or low, projects were considered relative to each other. Considerations included; who was likely to be affected, the size of the anticipated target audience, whether the initiative was site-specific, potential for the project to be used as a prototype for other areas, the likelihood of the initiative not improving bicycle safety, and the possibility of the initiative having a negative impact. Increased cycling numbers, environmental, community and other benefits could also arise as a consequence of improving bicycle safety, however these were not determinants of assigned benefit levels.

Once the priorities were established, each initiative was considered in relative terms of engineering feasibility, political feasibility, community and stakeholder support, and conflicting priorities and needs. Combined, this allowed priorities to be translated into short,

medium and long term actions, as shown in the action evaluation matrix (Table 2). Timeframes were used to indicate which initiatives should be progressed first.

Table 2: Action evaluation matrix

Priority	Project Feasibility		
	High	**Medium**	**Low**
Priority 1	Short term	Short term	Medium term
Priority 2	Short term	Medium term	Long term
Priority 3	Medium term	Long term	Unlikely to Proceed

Feasibility is generally affected by different factors, dependent on the project type. The feasibility of each initiative was established in line with the opinions of an expert team. As a guide, the timeframes in Table 3 were identified as short term (within 1-2 years), medium term (within 5 years) or long term (within 10 years). Project feasibility, or the degree of difficulty for implementation, should avoid overlap with cost considerations where possible.

Results and Discussion

Stage 1

The data analysis carried out in Stage 1 of the project identified a number of trends, including:

- An increase in the number of bicycle crashes over time.
- A higher number of injuries to male cyclists and female cyclists – Police data had a 73% to 27% split whilst hospital data had a 75% to 25% split.
- A higher proportion of crashes recorded on weekdays, and in particular mid-week.
- A higher number of crashes during daylight hours and in dry conditions, than at night and/or in wet weather conditions.
- Crashes with motor vehicles were most common in police data. Hospital data recorded nearly as many single bicycle crashes, as bicycle crashes with motor vehicles.

A summary of other results in relation to crash characteristics and locations is provided below.

<u>Crash characteristics</u>

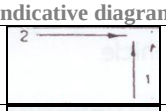
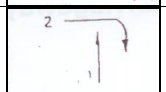
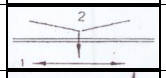
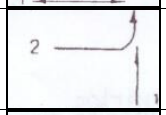
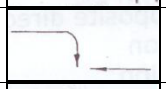
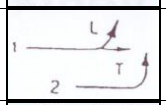
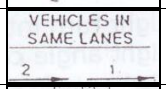
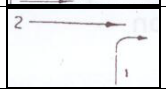
Crashes recorded by Police were most likely to occur in uncontrolled traffic conditions (42%), at give-way signs (30%) or at traffic lights (16%). Crashes were found to be most common within intersections, with 41% of intersection crashes occurring at T-intersections (22% of all crashes), 32% at cross-intersections (17% of all crashes) and 20% at roundabouts (10% of all crashes). Of the top ten road user movement (RUM) codes, five involved crashes at intersections.

RUM 101 (intersection: thru-thru) and RUM 104 (intersection: thru-right) were the most common group of bicycle crashes. This may indicate a lack of understanding of, or compliance with right-of-way rules or the inability of cyclists and motorists to accurately judge the speed of other vehicles, and calculate whether there is adequate time for their desired movement. Alternatively, poor visibility could be an issue.

Manoeuvring from a footway (RUM 408) was recorded in 11% of crashes. In the ACT, cyclists are legally allowed to ride on footpaths, however their movement between the footpath and the road may not be expected by motorists, or may be misjudged by cyclists. RUM codes 305, 309 and 301 accounted for 120 crashes. The frequency of these crash types suggests that drivers passing cyclists may be paying inadequate attention, or leaving

insufficient room for cyclists. Table 3 shows the most common crash types recorded by RUM code.

Table 3: Top 10 crashes types by RUM code

RUM Code	Number of Crashes	Indicative diagram
101 (Intersection: thru-thru)	166	
104 (Intersection: thru-right)	83	
408 (Manoeuvring: from footway)	79	
107 (Intersection: thru-left)	60	
202 (Vehicles from opposing directions: thru-right)	52	
305 (Vehicles from one direction: vehicles in parallel lanes, lanes side sweep)	43	
309 (Vehicles from one direction: left turn side sweep)	39	
301 (Vehicles from one direction: rear end)	38	
406 (Manoeuvring: leaving driveway)	21	
102 (Intersection: right-thru)	19	

Hospital data specifies crash location as on-road, shared path, off-road, driveway, gravel, or unknown. Of the crashes analysed, 63% were classified as on-road whilst 32% were classified as off-road or on a shared path.

Crash locations

Specific crash locations were not recorded in the hospital data. As shown in Table 4, Police data recorded the most crashes in Braddon at 80 (11%), followed by the City (6%) and Dickson (5%).

Table 4: Top 10 suburbs for crashes involving cyclists

Suburb	Number of crashes	Suburb	Number of crashes
Braddon	80 (11%)	Lyneham	24 (3%)
City	47 (6%)	Yarralumla	24 (3%)
Dickson	37 (5%)	Barton	22 (3%)
Ainslie	31 (4%)	Belconnen	21 (3%)
Turner	29 (4%)	Deakin	19 (3%)

Bicycle crashes were recorded in 83 different suburbs, with all of the top 10 suburbs within close proximity to the CBD and other major employment and activity generating centres. The highest proportion of crashes occurs in Braddon, with nearly double the crashes of the next five suburbs, all of which adjoin Braddon. The accident numbers are likely to relate both to exposure and road / traffic conditions. Braddon is a trade and commercial area and is on several major routes to the city from the northern suburbs where there is a high level of motor vehicle traffic. As an example, 74 accidents (10%) were recorded on Northbourne Avenue (in a number of suburbs, including Braddon).

Stage 2

The data analysis and literature review identified a series of key issues to be investigated through community consultation and stakeholder workshops. The goal was to scope the range of views amongst the community rather than to determine the prevalence of such views. It is also not suggested that all groups held the same views. The outcomes from these sessions can be summarised as follows:

- Cycling safety was not seen as a high priority compared to other issues. After discussion, participants felt that cycling safety should be regarded with more importance.
- A perceived lack of safety was seen as a key barrier to the greater uptake of cycling. It was considered that infrastructure improvements would generally make cyclists feel safer which in turn would be likely to result in increased cycling uptake.
- Certain road user behaviours (cyclists and motorists) were seen to cause, or avoid, accidents – such as compliance with road rules and speeding. Participants agreed that changes to bad behaviours would reduce the risk of accidents.
- Younger cyclists were seen to take more risks whilst older cyclists were considered more risk averse.
- Intersections were considered a logical place for accidents to occur.
- Hotspots for crashes were seen as related to higher volumes of traffic, greater interaction between different modes, more distractions, high stress levels, narrower streets and fewer bike paths.
- Single bike crashes were related to lapses in concentration, risk-taking, insufficient lighting and poor path maintenance.
- Participants demonstrated different understandings of the road rules and believed that many drivers and cyclists did not know the rules. There was general consensus that cyclists break the road rules to suit their own needs.
- Participants identifying as cyclists indicated a belief that current road rules do not reflect the realities of on-road and off-road cycling.
- Inadequate or piecemeal data on cycling was seen as problematic and a barrier to improving cycling safety.
- Frequent cyclists were considered more likely to respond to safety messages through television advertising than less regular cyclists or non-cyclists.

In general, the attitudes of non-cyclists toward cyclists shifted noticeably, to be more positive, after discussion about cycling safety. Participants felt that key messages to cyclists should focus on obeying the road rules, visibility, predictability and preparedness, and key messages to drivers should focus on awareness, and leaving adequate room for cyclists.

Development of Initiatives

Stages 1 and 2 of the study enabled a number of hard infrastructure and soft infrastructure initiatives to be identified. Each initiative was evaluated in line with the priority and action evaluation tables detailed in the methodology section of this paper, as shown in Table 5.These initiatives were identified to guide further advancement of the strategy.

Table 5: Initiatives developed

	Potential Benefits	Cost Estimate	Priority	Project Feasibility	Action Time Frame
Hard Infrastructure Initiatives					
i1a – Upgrade bicycle infrastructure at major intersections	High	High	2	Medium	Medium Term
i1b – Upgrade bicycle infrastructure at minor intersections	High	High	2	Medium	Medium Term
i2 – Provide more dedicated bicycle infrastructure	High	High	2	Medium	Medium Term
i3 – Complete key missing links in the bicycle network	High	High	2	Medium	Medium Term
i4 – Increase separation between bike riders in bicycle lanes and cars	Medium	Medium	2	Medium	Medium Term
i5 – Audit, review and implement consistent signage and linemarking guidelines	Medium	Medium	2	Medium	Medium Term
i6 – Implement traffic calming and reduce vehicle speed limits	High	Medium	1	Medium	Short Term
i7 – Implement low speed zones on shared paths	Medium	Low	1	Medium	Short Term
i8 – Adopt a regular path maintenance program	Medium	Low	1	Medium	Short Term
i9 – Report-a-hazard smart phone application	Medium	Low	1	High	Short Term
Soft Infrastructure Initiatives					
e1 – Develop an effective advertising campaign to promote safer cycling	Medium	High	3	High	Medium Term
e2 – Develop an information guide for bike riders in the ACT	Low	Low	2	High	Short Term
e3 – Provide subsidised training courses for bike riders	High	High	2	Medium	Medium Term
e4 – Road rule review and amendment	Medium	Low	1	Low	Medium Term
e5 – Increase road rule compliance	Medium	Medium	2	High	Short Term
e6 – Develop and promote a shared path code-of-conduct	Low	Low	2	High	Short Term
e7 – Improve cycling data collection in the ACT	Low	Medium	3	Low	Long Term

A summary of each initiative is provided below. Further development and evaluation of these initiatives, including benefit-cost analysis, will be required, as outlined in 'next steps'.

i1 – Upgrade bicycle infrastructure at intersections

This initiative is about improving bicycle infrastructure at intersections with high crash histories, in response to the data collected in Stage 1 and community feedback in Stage 2. Research by ARRB (2002) shows that infrastructure at intersections can increase safety for cyclists, dependant on the extent to which the intersection poses a high risk to cyclists and the economic feasibility of implementing the improvement. More recently, findings from the International Transport Forum Working Group on Cycling Safety recommend that safer cycling policies consider intersection design, particularly in terms of visibility, predictability and speed reduction (ITF, 2012).

Initiative i1 would involve pilot projects in those suburbs with the highest crashes rates, with vehicle behaviour and crash rates monitored to gauge success. Infrastructure requirements differ significantly between intersection types and as such, this initiative would be divided into two sub-categories; major and minor intersections.

i2 – Provide more dedicated bicycle infrastructure

Initiative i2 would be carried out as a pilot project in an area with high crash numbers, with a view to expanding dedicated bicycle infrastructure provision ACT-wide. An example of such a project would be a separated cycle facility on a major road. There is evidence that dedicated bicycle infrastructure delivers strong cycling safety benefits (for example, see CoS, 2008; SWOV, 2010; Wijnen et al, 2010; Lusk et al, 2011). However, dedicated facilities are not always suitable – this initiative would require a significant review of literature and best practice to ensure any implemented facility is the most appropriate. It is noted that the ACT

Government has recently contracted a consultant to develop an ACT Strategic Cycle Network Plan. It is envisaged that the works comprised in initiative i2 would form part of the broader network plan.

i3 – Complete key missing links in the bicycle network
Initiative i3 seeks to complete key missing links in the bicycle network, focusing on locations with high crash rate histories. As detailed above, providing bicycle infrastructure has been correlated with strong cycling safety benefits (e.g. CoS, 2008; SWOV, 2010; Wijnen et al, 2010; Lusk et al, 2011). A pilot project would be carried out in Braddon where 11% of all crashes in the ACT were recorded (Police data).

i4 – Increase separation between bike riders in bicycle lanes and cars
Community members and stakeholders indicated that insufficient separation between bike riders and vehicles lead to perceptions of vulnerability and actual threats to safety at certain locations in the ACT. Research undertaken in Victoria has shown that separation techniques can reduce the proportion of motor vehicles encroaching on cycle lanes, leading to improved perceptions of, and actual levels of safety (SKM, 2011). Initiative i4 would be undertaken in site-specific areas where there are existing bicycle lanes, with the objective of increasing separation between bike riders in bicycle lanes and cars in adjacent lanes. A review of separation techniques would be undertaken to determine what type, if any, would be most suitable.

i5 – Audit, review, and implement consistent signage and linemarking guidelines
Initiative i5 involves an audit and review of the existing network, in line with national guidelines and standards, to identify existing wayfinding and linemarking issues. Signage is a critical component of safe and legitimate cycle networks – installed at the right locations along a bicycle route, they allow cyclists to make informed decisions and direct cyclists to the most appropriate routes (Salomon, 2009). A program of works would be developed to implement a consistent wayfinding and linemarking program across the ACT for existing and new facilities.

i6 – Implement traffic calming and reduce motor vehicle speed limits
Initiative i6 focuses on reducing vehicle speed limits in areas with high bicycle crash concentrations. A review of speed limits in these areas would be undertaken, followed by a feasibility assessment of reducing motor vehicle speed limits. The International Transport Forum Working Group on Cycling Safety recently reported that traffic speed affects cycle crash risk and injury, referring to speed management as a ‘valuable hidden infrastructure’ that protects cyclists (ITF, 2012).

Roads ACT has investigated, and recently implemented a number of 40km/h speed limit zones in ACT town centres on a permanent basis. These projects would be reviewed as part of initiative i6 – recommendations may include extending existing 40km/h speed zones, or reducing speeds to less than 40km/h in certain locations.

i7 – Implement low speed zones on shared paths
The aim of initiative i7 is to reduce cycling speeds on shared paths, particularly in locations with high pedestrian activity. Speed reduction on shared paths has been correlated with safer shared environments (for example, see Austroads, 2006). A review of speed management techniques (e.g. speed advisory signage, electronic speed signage, infrastructure treatments etc) in other cities would be undertaken to determine the most effective way of controlling

speeds on shared paths. Low speed zones on sections of paths with high actual or potential conflict would be implemented on a pilot basis and, following a period of review and refinement, extended to other locations where deemed necessary. This initiative would inevitably include an educational component.

i8 – Adopt a regular path maintenance program
This initiative responds to the high number of single vehicle crashes reported in hospital data, and feedback from community members about poor path conditions and their role in crashes. Poor levels of path and road maintenance have been linked to bicycle accidents (for example, see CED, 2012; Austroads, 2006). The initiative involves a review of existing maintenance policies for shared paths and off-road cycleways in the ACT, as well as in other cities in Australia. A consistent and regular maintenance program would be developed.

i9 – Report-a-hazard smart phone application
Initiative i9 aims to develop a user-friendly report-a-hazard tool (app) for bike riders, and pedestrians where applicable. The need for this initiative was identified in Stage 2 – community members indicated that current programs were not user friendly and not widely known about or used. As mentioned above, better maintained paths and roads are likely to reduce the incidence of bicycle accidents (CED, 2012).

The current reporting program, Fix My Street, is available via Canberra Connect – a website which aims to help / advise residents on a range of different issues. A smart phone version is not currently available, meaning that hazards are rarely reported as they are seen or experienced. A simple and easily-accessible smart phone tool would be developed which uses the GPS capabilities of the phone to provide location details to a central maintenance database. Similar apps have been developed recently in other states.

e1 – Develop an effective advertising campaign to promote safer cycling
An abundance of road safety campaigns have been developed to address road safety in general, and bicycle safety more specifically, both in Australia and overseas (for example, see CoS, 2007). There are some examples of campaigns that have been successful – and more that have been unsuccessful. Both provide valuable lessons for the development of initiative e1.

During the consultation process, it was established that any new advertising campaign needs to create an impact in order to be effective, make non-bike riders interested in bicycle safety, have personal relevance, have a focused and uncomplicated message, have a clear target audience, and cut through communication clutter. It is important that any advertising campaign does not categorise issues as ‘bike riders’ versus ‘motorists’. One example would be a “we are one” campaign.

e2 – Develop an information guide for bike riders in the ACT
This initiative aims to develop an informative guide for bike riders in the ACT. During consultation, it became apparent that bike riders felt there was inadequate information currently available, or that it was difficult to obtain. The ACT Government has developed cycling brochures in the past (for example, see TAMS, 2012). These will be reviewed, and potentially updated, as part of initiative e2. A simple, yet informative website, smartphone app or brochure-style guide would be developed.

e3 – Provide subsidised training courses for bike riders

Research has shown that improving cycling skills and maintenance knowledge can have positive safety impacts (Heesch et al, 2010; De Rome et al, 2011). Initiative e3 aims to improve levels of cycling competency in the community by re-introducing cycling competence and safety to the school curriculum and offering subsidised training courses to adults. For example, courses aimed at university students would address the high number of injuries involving cyclists aged 20-29, as recorded in police data, identified during Stage 1 of this study.

e4 – Road rule review and amendment

Initiative e4 seeks to address community concerns that different road users understand road rules differently, and in particular, that current road rules do not reflect the realities of on-road and off-road cycling – a view supported by bicycle advocacy groups such as Bicycle Network Victoria (2012). The initiative would involve a review of existing cycling road rules to identify potential amendments. Any recommendations would need to be progressed via the national road rule development processes.

e5 – Increase road rule compliance

Research indicates that red light infringements can contribute to collisions between bike riders and motorists (Watson and Cameron, 2006). This initiative aims to increase compliance with traffic lights by increasing bike rider awareness of, and use of, inductive loops in the road surface along bicycle routes (e.g by markings on the road or pavement) or reducing wait times for bike riders at red lights, especially for crossings with cycle lanterns. Small-scale observation studies would be used to measure changes in compliance before and after changes are implemented at various intersections.

e6 – Develop and promote a shared path Code of Conduct

Initiative i6 responds to community feedback that there is a low level of respect between shared path users in the ACT. Furthermore, there appears to be a relatively high number of crashes on shared paths (for example, see De Rome et al, 2011). Although it is recognised that codes of practice are difficult to enforce, there is general agreement that a level of etiquette is required on shared paths (Austroads, 2006).

This initiative seeks to improve relations and increase mutual respect between bike riders, pedestrians and other path users on shared paths. A Code of Conduct provides clear and concise information relating to acceptable pedestrian and cyclist behaviour – it needs to be a simple yet effective guide to the rights and responsibilities of all shared path users. Distribution needs to be wide to capture the largest possible audience and the widest range of users. Ideally, the Code of Conduct would be implemented alongside an enforcement or compliance campaign, and could be developed as part of a wider education program.

e7 – Improve cycling data collection in the ACT

Bicycle-related road trauma is significantly under-reported (for example, see Richardson, 2008). Initiative e7 aims to improve the collection and storage of data relating to cycling in the ACT - in particular, the collection and storage of data relating to cycling numbers and cycling crashes needs to be improved. Key considerations include the reliability of regular spot counts, data usage requirements and issues with centrally accessible databases. Although this initiative would not directly result in a safer cycling environment, it would enable research to better target programs aimed at improving cycling and increasing cycling

participation. Good data would also facilitate evaluation of initiatives, including new infrastructure.

Conclusion and Next Steps

Cycling safety is an increasingly important issue in the ACT, and indeed Australia-wide, particularly as cycling numbers increase and cyclists continue to be represented in a disproportionate number of transport accidents. The purpose of this project was to develop a strategy to promote safer cycling and safer interaction between cyclists and other road and path users throughout the ACT, to help achieve the government's goals to reduce road trauma rates and increase the proportion of trips made by sustainable modes.

The three stage project progressed through literature review, data analysis and community and stakeholder consultation to arrive at a number of issue-specific initiatives, prioritised via an analysis of feasibility. The complex nature of cyclist safety means that a number of countermeasures are required.

The next steps require the further development of these initiatives. This will include consideration of the following:

- Current conditions and planning in the ACT
- Best practice and experience, including specific literature review for each initiative
- Selection of pilot study locations and / or identification of the target audience
- Cost benefit analysis
- Development of an implementation strategy
- How to determine success factors
- Identification of supportive initiatives required

This framework should be used to analyse each initiative in order to progress the project to the next stage – implementation.

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References

ACT Government, 2004, *The Sustainable Transport Plan for the ACT*, ACT Government, Canberra.

Amy Gillett Foundation (AGF), 2011. 'A metre matters' campaign, *Education*. Accessed online at http://www.amygillett.org.au/a-metre-matters

ARRB Transport Research (ARRB), 2002. Investigation of cyclist safety at intersections, report prepared for Austroads - publication no. AP-R206/02.

Australian Bicycle Council (ABC), 2011, *Australian Cycling Participation 2011*. Accessed online at: http://www.austroads.com.au/documents/AP-C91-11.pdf

Austroads, 2006. *Pedestrian-Cyclist Minimisation on Shared Paths and Footpaths.* Accessed online at: http://www.austroads.com.au/abc/images/pdf/pedcyclist_conflict_minimisation_on_shared_paths.pdf

Austroads, 2011. *Australian Cycling Data and Indicator Tables.* Accessed online at: http://www.austroads .com.au/abc/index.php?type=main&id=87

Bhatia, R. and Wier, M. 2010. Safety in numbers re-examined: Can we make valid or practical inferences from available evidence?, *Accident Analysis and Prevention*, 43, pp. 253-240.

Bicycle Network Victoria (BNV), 2012, *Bicycle Victoria Position: Road Rules.* Accessed online at: http://www.bicyclenetwork.com.au/general/bikes-and-riding/40840/

Boufous, S., Finch, C., Hayen, A. and Williamson, A. 2008. Data linkage of hospital and police crash datasets in NSW, *NSW Injury Risk Management Research Centre*, University of NSW.

City of Sydney (CoS), 2007, *Cycle Strategy and Action Plan 2007-2017*, City of Sydney Council.

City of Sydney (CoS), 2008, *Bourke Street Cycleway - Lord Mayor Briefing*, 13 June 2008.

Cycling Embassy of Denmark (CED), 2012, *Collection of Cycle Concepts*, Cycling Embassy of Denmark.

De Rome, L., Boufous, S., Senserrick, T., Richardson, D. and Ivers, R. 2011. The Pedal Study: Factors Associated with Bicycle Crashes and Injury Severity in the ACT (Final Report), The George Institute for Global Health, University of Sydney and Medical School, Australian National University.

Heesch, K., Garrard, J. and Sahlqvist, S. 2010. What factors are associated with cyclists getting injured? Correlates of cyclist injuries in Queensland, *2010 Australasian Road Safety Research, Policy and Education Conference*, National Convention Centre, Canberra.

Henley, G. and Harrison, J. 2009. Serious injury due to land transport accidents, Australia 2006-07. Report prepared for the Australian Institute of Health and Welfare, Canberra.

International Transport Forum, 2012. *Cycling Safety: Key Messages.* International Transport Forum Working Group on Cycling Safety.

Jacobsen, P. 2003. Safety in numbers: more walkers and bicyclists, safer walking and bicycling, *Injury Prevention*, 9, 3, pp.205-209.

Johnson, M., Charlton, J. and Oxley, J. 2010a. 'The application of a naturalistic driving method to investigate on-road cyclist behaviour: A feasibility study', *Road and Transport Research*, 19, 2, pp. 33-41.

Johnson, M., Charlton, J., Newstead, S. and Oxley, J. 2010b. Painting a designated space: cyclist and driver compliance at cycling infrastructure at intersections, *Journal of the Australasian College of Road Safety*, pp. 67-72.

Johnson, M., Newstead, S. Charlton, J., and Oxley, J. 2010c. Riding through red lights: the rate, characteristics and risk factors of non-compliant urban commuter cyclists, *Accident Analysis and Prevention*, 43, pp. 323-328.

Jordan, G. and Leso, L. 2000, 'Power of the line: Shared-use path conflict reduction', Transportation Research Record, Paper No. 00-1446. Accessed online at: http://www.americantrails.org/resources/ safety/Trail-yellow-center-line-safety.html

Leden, L., Garder, P., and Pulkkinen, U. 2000. An expert judgement model applied to estimating the safety effect of a bicycle facility, *Accident Analysis and Prevention*, 32, 4, pp. 589-599.

Lusk, A., Furth, P., Morency, P., Miranda-Moreno, L., Willet, W. and Dennerlein, J., 2011, Risk of injury for bicycling on cycle tracks versus in the street, *Injury Prevention*. Accessed online at: http://injuryprevention.bmj.com/content/early/ 2011/02/02/ip.2010. 028696.full.pdf

Parkin, J. and Meyers, C. 2010. The effect of cycle lanes on the proximity between motor traffic and cycle traffic, *Accident Analysis and Prevention*, 42, pp. 159-163.

Richardson, D. 2008. Amalgamation of Police and Hospital Trauma Data in the Australian Capital Territory 2001-2003 (Final Report). Report prepared for the NRMA-ACT Road Safety Trust, Canberra.

Robinson, D. 2005, Safety in numbers in Australia: More walkers and bicyclists, safer walking and bicycling, *Health Promotion Journal of Australia*, 16, 1, pp. 47-51.

Salomon, W. 2009, *A Guide to Signing Cycle Networks*. Report prepared for the Department of Transport and Main Roads, Queensland.

Sinclair Knight Merz (SKM), 2011, *St Kilda Road and Royal Parade Bicycle Lane Monitoring*. Report prepared for VicRoads.

SWOV, 2010, *Factsheet - Bicycles on Distributor Roads*. Accessed online at: http://www.swov.nl/rapport/Factsheets/UK/FS_Bicycle_facilities.pdf

Territory and Municipal Services (TAMS), 2012, *Cycling Information for Transport and Recreation.* Accessed online at: http://www.tams.act.gov.au/move/cycling/cycling_information

Walker, I. 2007. Drivers overtaking bicyclists: objective data on the effects of riding position, helmet use, vehicle type and apparent gender, *Accident Analysis and Prevention*, 39, 2, pp. 417-425.

Wijnen, W., Mesken, J. & Vis, M.A. (red.) (2010). Effectiviteit en kosten van verkeersveiligheids-maatregelen. R-2010-9. SWOV, Leidschendam. Accessed online at: http://www.swov.nl/rapport/R-2010-09.pdf

Wood, J., Lacherez, P., Marsalek, R. and King, M. 2009. Drivers and cyclists experiences of sharing the road: incidents, attitudes and perceptions of visibility, *Accident Analysis and Prevention*, 41, pp.772-776.