Identifying Traffic Enforcement Practices and Opportunities in Western Australia

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This report describes a three phase project that aimed to identify traffic enforcement practices in Western Australia (WA) and the opportunities for improvement reflecting best practice elsewhere and scientific evidence of effectiveness. Phase 1 was a review of effective Australian and international practice in traffic enforcement. It also reviewed the extended role that traffic police could play in the Safe System approach to road safety. This phase led to a number of recommendations for WA Police based on the major operational conclusions from the research. Phase 2 was workshops with WA traffic police to identify issues and opportunities based on practice elsewhere, as well as the unique characteristics of traffic policing in the State. Phase 3 aimed to bring together the external and local experience to identify opportunities for improved traffic enforcement practice and any further research and investigation necessary in WA. It should be noted that the workshops were exploratory research of a qualitative nature only and the findings were not intended to be representative of the whole of WA Police. The opportunities identified are presented for consideration by WA Police only.

Traffic enforcement, best practice, effectiveness, Safe System, qualitative research.

This report is disseminated in the interest of information exchange. The views expressed here are those of the authors and not necessarily those of Curtin University or Monash University.
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EXECUTIVE SUMMARY

This report describes a three phase project that aimed to identify traffic enforcement practices in Western Australia and the opportunities for improvement reflecting best practice elsewhere and scientific evidence of effectiveness. Phase 1 was a review of effective Australian and international practice in traffic enforcement. It also reviewed the extended role that traffic police could play in the Safe System approach to road safety. Phase 2 was workshops with Western Australia traffic police to identify issues and opportunities based on practice elsewhere, as well as the unique characteristics of traffic policing in the State. Phase 3 aimed to bring together the external and local experience to develop strategies for potential improvement in traffic enforcement practice and any further research and investigation necessary in Western Australia.

PHASE 1: REVIEW OF AUSTRALIAN AND INTERNATIONAL PRACTICE IN TRAFFIC ENFORCEMENT

The most extensive research on Australian traffic enforcement has been conducted in Victoria, covering the random breath test (RBT) program and most types of speed enforcement (mobile and fixed speed cameras; moving mode radar speed detectors; and laser speed detection devices). Phase 1 also reviewed research on RBT and speed cameras in other Australian States and New Zealand, and on fixed speed cameras in Great Britain and elsewhere in Europe.

Seat belt enforcement research has been extensively reviewed in the ESCAPE (2003)\(^1\) and PEPPER (2008)\(^2\) projects for the European Commission. These projects and other sources also provided information on traffic enforcement related to heavy vehicles, fatigue, pedestrians, motorcyclists, and mobile phone use. In general, the information available regarding these latter enforcement areas was not definitive regarding effects on road trauma nor on best practice in each area.

Best practice regarding the most effective methods of enforcement was most clearly apparent for RBT and speed enforcement. For RBT, this report includes principles regarding:

- Intensity of testing
- Time of testing
- Visibility of testing stations
- Use on booze buses in rural areas
- Role of supporting mass-media publicity.

Regarding speed enforcement, this report gives best practice principles for:

- Mobile speed cameras (covert versus overt operations; effects related to intensity of operations; and role of supporting publicity)
- Fixed speed cameras (range of influence of spot-speed and point-to-point systems)

\(^1\) Enhanced Safety Coming from Appropriate Police Enforcement project (ESCAPE)
\(^2\) Police Enforcement Policy and Programmes on European Roads project (PEPPER)
• Moving mode radar (immediate and residual effects; marked versus unmarked cars; and strong influence of supporting publicity)

• Laser speed detectors (intensity of enforcement per site; appropriate type of road).

The project also reviewed strategic approaches to choosing packages of road safety initiatives, including enforcement programs, and concluded that greatest economic value is obtained from packages in which the components have marginal benefits (road trauma reductions, appropriately valued) greater than marginal costs. Traffic enforcement initiatives with variable levels of intensity should be analysed to determine marginal benefit-cost ratios to decide the appropriate types and levels of operation for inclusion in an overall road safety program.

This report includes evidence that road safety programs with major traffic enforcement components implemented in Victoria, New Zealand, U.K. and Ireland are very cost-beneficial as well as achieving substantial reductions in road trauma.

The final section of Phase 1 outlines the substantial role that traffic police could play in the Safe System approach to road safety that underlies Western Australia’s Towards Zero strategy. Traffic policing could extend its role beyond enforcing illegal unsafe road behaviours and take actions which help to reduce unsafe behaviours by all participants in the road transport system, not just by road users but also by the bodies responsible for providing the road infrastructure, vehicular and social environments. To perform this role, traffic police need to have the capacity to capitalise on their front-line view of road trauma, in four key areas:

• Understanding crashes and resulting injuries from a broad perspective going beyond illegal road user behaviours which precipitate a crash

• Synthesis of crash investigations to produce global conclusions about causal factors

• Defining opportunities for and the relative merits of potential countermeasures

• Preparation of countermeasure recommendations while recognising policy constraints and barriers.

Major operational conclusions identified in the report are summarised below. Only in the areas of drink-driving and speeding enforcement has there been sufficient scientific research to clearly identify best practice with a strong evidence base (the evidence for effective seat belt enforcement is weaker). However, the principles of deterrence that can be gleaned from research in these two key traffic enforcement areas can be applied in many other areas aimed at unsafe illegal behaviours.

<table>
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<tr>
<th>Best Practice in Traffic Enforcement – Major Operational Conclusions</th>
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**Drink Driving enforcement**

*Intensity of random breath testing (RBT):*

• There is a threshold for the intensity of car-based RBT in urban areas before it is certain that crash reductions will result. This threshold for the intensity of testing is no more than about 20 hours per 100 square kilometres per week.

• Car-based RBT in urban areas has residual effects on crashes in the area of testing operations for at least two weeks after the operations cease.
Time of testing

- RBT carried out during times of the week when drink-driving is frequent is highly likely to produce crash reductions, whereas there is less certainty about its effects when carried out at other times.

Visibility of the testing stations

- The visibility of the RBT operations, and/or the capacity of the testing station to test high proportions of passing motorists, are important factors in increasing the general deterrence effect of RBT.
- However the use of booze buses in rural areas needs to be considered with caution operationally, as outlined below.

Booze buses in rural areas

- The effectiveness of car-based RBT in rural areas appears similar to that achieved by RBT (both car- and bus-based) in metropolitan areas. This may relate to the perceived ability of the cars to cover broad areas and to raise the perceived risk of detection above a threshold level.
- Police should schedule RBT operations on minor as well as on major roads in rural areas. Greater emphasis should be placed on the use of car-based RBT, particularly near hotels and clubs, with patrol cars operating on minor roads in concert with booze buses located in provincial cities and towns.

Targeted alcohol screening testing

- Car-based testing of intercepted suspect drivers and/or at targeted locations and times is less effective on crashes than RBT (6% reduction in casualty crashes compared with 10% reduction from RBT and 17% reduction in fatal crashes).
- Targeted testing has a key role in apprehending those drink-drivers with very elevated BAC (> 0.15 g/100ml). These “problem” drink-drivers now represent the greatest proportion of killed drink-drivers, especially in rural areas.

Speed enforcement

Covert, mobile speed cameras in Victoria

- If supported by a high-profile launch and on-going mass media publicity, the threat of covert speed cameras can be established and maintained at high levels for short term periods, even if actual levels of camera use are low.
- Covert speed cameras, when used intensely and supported by high-profile mass media publicity, produces wide-spread and long term reductions in crashes and their severity (i.e. a "general effect").
- The principal mechanism through which the Victorian mobile speed camera program achieves its effects on crashes is via the actual detection of speeding drivers and the subsequent issuing of penalties (fines, immediate licence loss in some cases, and demerit points leading ultimately to licence loss if sufficient are gained), i.e. specific deterrence.
- Supporting mechanisms are provided by actual camera operations (to the extent that they are visible, e.g. to the drivers travelling in the opposite direction) and mass-media publicity emphasising the risks of speeding and detection by a speed camera, i.e. general deterrence.
Comparison of overt and covert speed cameras in New Zealand

- Covert operation of speed cameras increases uncertainty about the presence and location of the threat of detection, thus spreading the general deterrence effect over a broader area than overt operations.

Intensity of speed camera operations

- Covert, mobile speed camera operations are both effective in reducing road trauma and are highly cost beneficial. The 50% increase in the level of speed camera activity in Victoria during 2001/2002 is likely to have further increased the economic benefit of the mobile speed camera program.

Point-to-point fixed speed cameras

- Overt fixed speed cameras measuring spot speeds are very effective in reducing speeds and road trauma in the immediate vicinity of camera sites but are unlikely to have a general effect unless their density is very high.
- Point-to-point speed cameras measuring average speeds over a route are effective in reducing speeds and road trauma throughout the route under surveillance.
- Point-to-point camera systems remove the incentive for drivers to brake and then accelerate rapidly after passing an overt camera site, with the attendant risks this behaviour may produce.

Moving mode radar speed detectors - marked versus unmarked cars

- Mobile radar (and associated publicity) was found to have the greatest effect during the four days immediately following the enforcement with the effect diminishing between five and seven days after the enforcement presence. This suggests the existence of a four-day residual enforcement effect on casualty crashes.
- Casualty crash reductions were found following mobile radar operations involving either covert activity (unmarked cars) or both overt and covert activity (marked and unmarked cars operating together).
- No statistically significant effect on casualty crashes was found on the actual day of mobile radar activity in rural Victoria. It is not clear that enforcement on the actual day of mobile radar activity is effective in reducing casualty crashes.
- The most significant impact on casualty crashes occurred when high public awareness of media publicity accompanied mobile radar. The effect was greater when high publicity awareness levels were specific to mobile radar enforcement as opposed to when the high publicity awareness levels related to general, speed-related road safety themes.
- The strongest effect of casualty crashes was found on the same day as enforcement when high levels of mobile radar publicity accompanied mobile radar operations involving both overt and covert activity (marked and unmarked cars).

Hand-held laser speed detectors

- Laser speed detectors are successful in reducing crashes on arterial roads in metropolitan areas when conducted at low- to medium-intensity levels (sessions typically less than one hour, for up to 15 hours per site per year).
- The effect of laser detection devices may be localised in space suggesting that overt forms of speed enforcement have a general deterrent effect that is limited to the location at which enforcement activity is observed.
- To expand the general effect of overt speed detection programs, a more extensive geographical coverage may be required.
• It follows from the above that low- to medium-intensity, overt speed enforcement (defined as up to 15 enforcement hours per site per year) at multiple sites on the arterial road network will have a greater effect on crashes than high intensity enforcement at fewer locations.

Seat belt enforcement

• Seat belt checks should be standard procedure when stopping motorists for other reasons
  – Random breath tests
  – Targeted alcohol screening and drug tests
  – Apprehension of detected speeders
  – Licence and vehicle condition checks.
• Blitz periods of seat belt checking should be implemented regularly and highly publicised, emphasising the above standard checks.

RECOMMENDATIONS FOR WA POLICE BASED ON THE RESEARCH REVIEW

The following recommendations for traffic policing in WA are based on the major operational conclusions that emerged from Phase 1.

1. Random breath testing (RBT) in urban areas should be conducted for at least 20 hours per 100 square kilometres per week.

2. Scheduling of RBT in urban areas should make use of the residual effect of at least two weeks and not necessarily return to the same testing area within two weeks.

3. RBT operations should be very overt, including high visibility and testing a substantial proportion of passing motorists. However, maximising the number of tests should not be at the expense of covering broad urban areas and achieving the minimum testing hours per unit area.

4. Car-based RBT should be preferred in rural areas, covering both minor and major roads. If booze buses are operated in rural areas, they should not operate alone and should undertake RBT in conjunction with car-based RBT on alternative roads.

5. Targeted alcohol screening testing should principally aim to apprehend drink-drivers with very elevated BACs and should not be seen as a substitute for RBT in contributing to the total number of preliminary breath tests conducted.

6. Mobile speed cameras should be operated covertly and rotated across a large number of sites at varying times of day so that the enforcement operations are unpredictable and are perceived to cover broader areas than the specific camera sites.

7. If mobile speed cameras are operated overtly, camera sessions should be randomly scheduled to times of week and numerous sites in each area in order to maximise their unpredictability.

8. Mobile speed camera sites should not be publicised in any form. Even information about the limited number of specific routes to be enforced in a coming period provides implicit information about where cameras will probably not operate, thus reducing the unpredictability of the enforcement operations.
9. Overt fixed speed cameras measuring spot speeds should be located at serious casualty crash “black spots” and not expected to affect crashes beyond the immediate vicinity.

10. Point-to-point speed camera systems measuring average speeds between two points should be used to enforce speeding over substantial route lengths on which the serious casualty crash density is sufficient to justify the cost of implementation and offence processing.

11. Moving mode radar should be operated in unmarked patrol cars or from marked and unmarked cars operating together on the same highway.

12. Scheduling of moving mode radar units should make use of the residual effect of four days and not necessarily return to the same highway within that period.

13. Hand-held laser-based speed detectors should be operated at low- to medium-intensity levels (sessions typically less than one hour, for up to 15 hours per site per year) and cover multiple sites in order to achieve a broad effect on speeds and crashes.

14. Seat belt checks should be standard procedure when stopping motorists for other reasons.

15. Blitz periods of seat belt checking should be implemented regularly and highly publicised.

16. Traffic enforcement programs and investments in new technologies should be planned strategically. Priority should be given to components of the package that have marginal benefits (road trauma reductions, based on scientific evidence) greater than marginal costs.

17. Traffic policing should extend its role beyond enforcing illegal unsafe road behaviours and take actions which help to reduce unsafe behaviours by all participants in the road transport system, not just by road users but also by the bodies responsible for providing the road infrastructure, vehicular and social environments.

**PHASE 2: WORKSHOPS WITH WA POLICE**

Workshops were conducted with operational police officers in selected parts of WA using the following procedure in each case:

1. The range of enforcement options (‘operational conclusions’) aimed at improving enforcement strategies in the areas of drink-driving, speeding and seat belt non-use, identified in Phase 1, were formally presented – with responses from police officers then invited.

2. Responses effectively evaluated each set of conclusions in light of on-the-ground enforcement experiences. Evaluations used three basic criteria:
   - relevance and practicality of the conclusions;
   - congruence with current practices;
   - recommendations regarding the conclusions
3. This evaluation process was conducted separately for drink-driving, speeding and seat belt enforcement, and then for some of the following enforcement areas, as time permitted at each workshop:
   - Drug-driving
   - Mobile phone use
   - Unlicensed driving
   - Heavy vehicles
   - Fatigue
   - Pedestrians
   - Motorcyclists

Three workshops were conducted with officers in regional WA (two in Albany and one in Karratha) and in Perth (two workshops).

PHASE 3: ENFORCEMENT OPPORTUNITIES FOR WA TRAFFIC POLICE

The following is a summary of the apparent opportunities for improved traffic policing that emerged from the responses at the workshops. Some opportunities represent changes in operational practice and management that WA Police could implement unilaterally, whereas others require legislative or regulatory change to provide a better basis for effective traffic policing to produce real reductions in road trauma in WA. Some opportunities for research and investigation of beneficial new enforcement practices or legislation were also apparent.

1. Car-based RBT should be used in Perth in conjunction with booze buses in order to provide a broader coverage of the metropolitan road system for a greater number of hours per week and hence achieve a general deterrence effect. Car-based RBT should also be conducted on sub-arterial roads and residential streets where it is perceived that booze buses are not operated.

2. Severe drink-driving offences (BAC at least 0.08g/100ml) should be added to the Hoon Legislation offences because vehicle impoundment would be an effective sanction and constraint on “problem” drink-drivers. (Note: Immediate Licence Disqualification for all drivers detected driving with a BAC of 0.08 and above was passed by the WA Parliament in late 2010 so will be implemented in future.)

3. There is a need to develop KPIs that reflect the research connecting drink-driving enforcement inputs and outputs with real reductions in alcohol-related crashes through decreases in drink-driving on the road. The contributions of RBT hours and coverage, not just number of tests, need to be balanced against the effectiveness of apprehending drink-drivers, given the available sanctions to discourage or inhibit re-offending.

4. If mobile speed cameras were operated covertly on regional roads, there would be a need to publicise their efficiency and cost-effectiveness to off-set negative community attitudes. There should also be speed enforcement involving intercepts by traffic officers to provide some personal contact of offenders with police.

5. Sufficient speed camera offence processing resources should be provided to complete the follow-up of high level (45 km/h in excess) speed offences and apparently unlicensed driver-owners, all of which could result in vehicle impoundment and other sanctions.
6. New methods should be developed to detect and apprehend “hoon” speeders (those travelling 45 km/h in excess of speed limits) because of difficulties to conduct pursuits exceeding 140 km/h. The new TruCam laser speed measurement and video recording device is an effective tool to prosecute the high level offences, but there is a need to overcome difficulties with use of the device at night.

7. There is a need to develop KPIs that reflect the research connecting speeding enforcement methods and inputs with real reductions in crashes and injuries through decreases in speeding (especially high level speeding). The generation of fine revenue should be incidental to achieving these KPIs.

8. Investigations should be undertaken into the merits of:
   • positive reinforcement of good speeding behaviour (such as demerit point credits if offence free in a previous period)
   • mandatory speed awareness course as an option or alternative to current speeding sanctions
   • speed limiting all new vehicles to a maximum speed of 110 km/h and requiring the retro-fitting of this technology to the vehicles owned by recidivist speeders.

9. Seat belt checks should be required to be standard procedure when stopping motorists for other reasons (such as random breath tests, targeted alcohol screening and drug tests, apprehension of detected speeders, and licence and vehicle condition checks).

10. Because of difficulties that regional police have with vigorously enforcing seat belt laws locally, a strategy to rotate rural police to towns where they are not based nor known should be implemented in all regions.

11. There should be greater and on-going publicity about the reasons for the penalties for seat belt offences and the benefits of complying.

12. There should be a process of rationalisation of the penalties associated with all key illegal behaviours and offences to reflect the risk of consequential road trauma in each case. The outcome of this rationalisation should be widely published to put the seat belt offence penalties in context.

13. A central traffic advisory service should be established to provide specialist advice in complex areas of drug-driving enforcement (such as the Field Impairment Test and preliminary drug test procedures).

14. There should be legislative change to allow a suspected drug-driver to be conveyed to a nearby booze/drug bus, if operating, for a preliminary drug test.

15. WA Police should investigate the establishment of a regional or central processing system to receive automated ANPR records from traffic patrols, in order to more efficiently process suspected owner/drivers and vehicles and to relieve traffic patrol officers from follow-up activities that inhibit their on-road patrol time.

16. To overcome the loss of specialist trained police with the skills to adequately enforce the heavy vehicle safety regulations, there should be joint operations with DPI heavy vehicle inspectors to provide expert support for traffic police.
17. In order to control driver fatigue, consideration should be given to a requirement that car drivers carry and complete log books to record the start and finish times of their journeys in remote areas.

18. To minimise the severity of pedestrian injuries, there should be a requirement that roof-bars be removed from vehicles operating in Perth.

19. Patrol motorcycles should be reintroduced for pursuits of motorcyclist offenders and enforcing motorcycle-specific regulations.

20. Rear-facing speed cameras should be introduced to allow the motorcycle number plate to be captured, and full owner-onus for motorcycle offences should apply. Increased sanctions for false motorcycle number plates should be implemented.

21. Motorcyclist hoon behaviours should be added to the list of behaviours prohibited under the Hoon Legislation.

It should be noted that Phase 2 was exploratory research of a qualitative nature only and the findings were not intended to be representative of the whole of WA Police. The apparent opportunities from this phase are presented for consideration by WA Police only. There were a limited number in the sample of WA police officers canvassed and their responses were relied upon to develop the apparent opportunities. There appeared to be some contradiction in the officers’ responses relating to their perception of operational activities and strategies. This issue may give rise to additional recommendations in areas such as communication, training and professional development.
1 INTRODUCTION

This report describes a three phase project that aimed to identify traffic enforcement practices in Western Australia and the opportunities for improvement reflecting best practice elsewhere and scientific evidence of effectiveness. Phase 1 was a review of effective Australian and international practice in traffic enforcement. It also reviewed the extended role that traffic police could play in the Safe System approach to road safety. Phase 2 was workshops with Western Australia traffic police to identify issues and opportunities based on practice elsewhere, as well as the unique characteristics of traffic policing in the State. Phase 3 aimed to bring together the external and local experience to develop strategies for potential improvement in traffic enforcement practice and any further research and investigation necessary in Western Australia.
2 REVIEW OF TRAFFIC ENFORCEMENT PRACTICES

2.1 DRINK DRIVING ENFORCEMENT IN VICTORIA

Legislation allowing breath alcohol level measured by a Breathalyser to be used as evidence of blood alcohol concentration was first introduced in Victoria during 1961. A blood alcohol concentration (BAC) limit of 0.05 g/100ml of blood was introduced in 1966 to provide an objective criterion for driving “under the influence” or “while intoxicated”, however it was not until random breath testing (RBT) became available that large scale testing of breath alcohol levels of drivers and motorcycle riders was possible.

RBT enforcement was first introduced in Victoria in 1976. The introduction of this legislation allowed police officers to stop and test all drivers for BAC without the need for prior suspicion of impairment. In 2006, MUARC conducted a review of drink driving enforcement (Delaney, Diamantopoulou, & Cameron, 2006). They explored RBT enforcement using the following concepts: the number of tests conducted (driver exposure); variations in testing times, e.g. high and low alcohol hours; differences between metropolitan and rural areas; media campaigns; and individual driver attributes.

2.1.1 Number of random breath tests conducted

The number of RBTs conducted has been affected by two areas, firstly, steady increases in police enforcement including designated intensive operations and, secondly, the introduction of the booze buses.

From July 1976 to 1978 an average of 8 hours/week was dedicated to RBT in metropolitan Melbourne. In addition, during two periods in 1977 lasting 6 and 7 weeks respectively, there was an increase in RBT operations to an average of 32 hours per week on Tuesday, Thursday, Friday and Saturday nights. Some additional RBT was also conducted in rural Victoria. A further three periods of “intensified” RBT operations were conducted during 1978 and 1979 on Thursday, Friday and Saturday nights. These three periods of intensified enforcement last for 7, 4 and 8 weeks respectively with the average number of RBT hours per week ranging from 74 to 100 during these periods. The increased hours were targeted at areas representing about one-quarter of urban Melbourne and during these periods, the intensity of testing per unit area ranged from 17 to 23 hours per 100 square kilometres per week (Cameron and Sanderson, 1982).

The majority of testing during the early years was car based, however the introduction of RBT legislation allowed for the setting up of roadside breath testing stations and thus a larger number over of drivers were being tested. During this period the use of random testing had somewhat of a general deterrence effect for motorists passing the RBT sites however, specific deterrence through the personal experience of being tested and/or convicted was the predominant mode of deterrence. The effectiveness of this type of deterrence was relative to the number of motorists who were exposed to RBT.

Booze buses were first introduced in 1989, and car based operations were progressively replaced by thirteen, highly visible, bus-based RBT stations. These buses were custom built for conducting large numbers of roadside RBTs and were designed to be highly visible. This highly visible enforcement method aimed at increasing the general deterrence effects for

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3 “Nights” were defined as the period from 6:00 pm to 3:59 am.
motorists who drove past the sites by increasing their perception of their chances of being detected if drink driving, even if they were not stopped for an RBT. As the numbers of booze buses increased the specific deterrence effects also increased as the numbers of drivers tested increased. In 1994, 1.8 million Victorian drivers were stopped and tested at an RBT site. Since 1990, at least one in three Victorian drivers are tested annually. See figure 2.1 below for annual number of RBTs conducted in Victoria (please note that car based RBT data is not available from 1996 on). There were 3.03 million RBT screening tests (car and bus data) conducted in Victoria during the year 2006-07 (Victoria Police Annual report 2006-07).

![Figure 2.1. Annual Number of Random Breath Tests: Victoria 1983-2003](image).

### 2.1.2 Variations in RBT session times and site selection

RBT enforcement activity and analysis commonly rely on the concepts of high alcohol hours (HAH) and low alcohol hours (LAH), identified in research conducted by Harrison (1990). An evaluation was carried out in Melbourne during October to December 1983 to determine the relative effectiveness of RBT during the afternoon and evening (4pm to 8pm), when the operations were visible to high traffic volumes, compared with RBT carried out at night (8pm to 4am) when drink-driving is more common (Armour, et al., 1985). Two Melbourne inner city areas were chosen one in which RBT was conducted in HAH Thursday to Saturday night from 8 pm to 4 am, and the other for LAH Sunday to Wednesday. A mass media campaign accompanied the operations. Analysis of the operation revealed a 24% reduction in casualty crashes in the HAH in the corresponding area and a 13% casualty crash rate reduction in the LAH in that corresponding area.

Elliott (1992) has suggested that altering the mechanisms for deploying enforcement resources may result in improved effectiveness of RBT. In particular, he suggests that adopting a randomised scheduling approach, whereby enforcement resources are allocated randomly in time and space across the road network, may generate additional road safety benefits. The aim of such an approach is to maximise the general deterrence effect of enforcement operations by improving visibility across the road network and to increase the risk of apprehension by decreasing the ability of road users to predict the timing and location
of enforcement activities. There has been little research regarding the effectiveness of such an approach in the drink-driving domain. However, this approach has been used successfully as part of the Random Road Watch enforcement program in Queensland. This program involved the randomised scheduling of general enforcement operations (including drink-driving enforcement) from marked Police vehicles. Evaluation of this program found that it resulted in statistically significant crash reduction across Queensland at various severity levels (Newstead and Cameron, 1999). Recent discussion amongst Victoria Police and MUARC have focussed on the importance of re-exploring the HAH and LAH with the increase of 24 hour drinking venues around Melbourne (the definition of alcohol hours was based on 1988-89 data). A project designed to explore the current HAH and LAH will be undertaken by MUARC later this year.

Testing times also need to take into account annual changes in drink driving numbers such as the increase in drink driving over the summer months compared to winter, and also local events such as the Spring (horse) Racing Carnival and AFL football finals.

Another variable identified as warranting updating is the selection of testing sites. Roadside alcohol surveys commenced in New Zealand in 1995 and have been conducted on a regular basis since then. These roadside surveys were jointly sponsored by the New Zealand Police Department and the former Land Transport Safety Authority. Data obtained from these surveys has led to the identification of road safety issues such as the relocation of drink drivers from arterial roads to local streets (in attempts to avoid detection) and the identification of drink driving in the mornings following high alcohol hours. While the use of highly visible booze buses works well from a general deterrence perspective, choices regarding using viable and safe sites to locate the buses has led to a somewhat predictable pattern for drivers attempting to avoid RBT. Recent intensive “corral” RBT initiatives undertaken in Region 1 support this concern with high numbers of illegal BAC readings resulting from satellite car tests conducted on drivers attempting to avoid the highly visible booze bus sites. MUARC is currently undertaking a Roadside Alcohol Survey which includes data obtained from more novel car based testing sites such as smaller collector roads and residential streets.

2.1.3 Rural RBT enforcement

The shift from traditional car-based to bus-based RBT operations predominantly occurred in metropolitan Melbourne whilst in rural areas of Victoria the introduction of bus-based tests was delayed until 1990 and occurred on a smaller scale than in metropolitan Melbourne (Cavallo & Cameron, 1992). Until 1993, the growth in RBT in country Victoria had been relatively slow compared with Melbourne. However, in November 1993, the Victoria Police in conjunction with the Transport Accident Commission launched a program of substantially increased RBT in country Victoria supported by mass media publicity. The country RBT and publicity program was evaluated in terms of implementation characteristics and its effects on road trauma (Cameron, Diamantopoulou, Mullan & Gantzer, 1996). Substantial variation in RBT activity patterns between country Police Districts was also found. The crash-based component of the evaluation found evidence of a statistically significant 22% reduction in high alcohol hour serious casualty crashes when RBT was conducted by cars operating alone, during the weeks and in the regions when enforcement was present (Cameron et al., 1996.)

Further analysis, in which crashes by road type were examined, found evidence that some drink-drivers faced with intense enforcement (i.e. bus and car combinations), heightened by intense drink-driving publicity, changed their travel behaviour and used relatively unsafe minor roads (Diamantopoulou & Cameron, 1998). Under these circumstances, in rural areas
of Victoria, significant increases in high alcohol hour serious casualty crashes occurred on minor roads but not on major roads. In response to this analysis, Victoria Police and the TAC introduced a program of strategic RBT blitzes targeting ‘high risk’ rural communities where ‘booze buses’ acted in tandem with covert ‘satellite’ cars in order to promote a ‘no escape’ message.

Further research examining the effect of booze bus operations in the major provincial cities and the rest of rural Victoria separately was commissioned (Diamantopoulou et al., 1999). Using the same data as that for the evaluation of the country RBT and publicity program, the study aimed to compare the effects of booze bus operations on crashes in major provincial cities and in other rural areas of Victoria, on both minor and major roads. The main findings of this research were as follows:

- Cars operating alone are apparently effective in both provincial cities and in other rural areas of Victoria. A statistically significant net 25% reduction in HAH serious casualty crashes occurred when cars alone were in operation in provincial cities during the RBT program (as compared to the pre-RBT program period). A smaller net 18% reduction occurred in rural areas other than provincial cities, but this reduction was not statistically significant.

- Cars were also apparently effective on both major and on minor roads both in provincial towns and the other rural areas, particularly:
  - On major roads in rural areas other than provincial cities, where a marginally statistically significant net 28% reduction (p=0.0862) in HAH serious casualty crashes occurred for car-only operations, and
  - On minor roads in provincial cities, where a statistically significant net 31% reduction (p=0.0580) occurred for car-only operations.

- Booze buses operating alone appear to be effective only in provincial cities and not in the other rural areas of Victoria,
  - i.e. A net 46% reduction in HAH serious casualty crashes occurred when booze buses were operating alone in major provincial towns during the country RBT program. Conversely when buses were operating in other rural areas of Victoria, a net 19% increase in HAH serious casualty crashes resulted. Neither of these net percentage changes was statistically significant, but the results suggest that bus operations are more effective in major provincial cities than in less built-up rural areas of Victoria.

- Booze buses operating alone were also apparently effective on both major and on minor roads in provincial cities, but not on major nor on minor roads in less built-up rural areas of Victoria.
  - i.e. A net 43% reduction in HAH serious casualty crashes occurred on major roads in provincial cities when TAS or District buses were in operation alone. Conversely, in other rural areas of Victoria there was no evidence of a reduction in crashes on major roads for bus-only operations, and
  - In provincial cities, a net 49% reduction in HAH serious casualty crashes occurred on minor roads during the country RBT program. Conversely there was no evidence of a reduction on minor roads in rural areas other provincial towns when buses were operating alone.
• There was no evidence of crash reductions when cars and booze buses were operating together in rural Victoria, neither in provincial cities nor in other rural areas. In addition, car/bus combinations did not appear to be effective on major roads nor on minor roads in either large provincial cities or in less built-up rural areas of Victoria.

2.1.4 Media campaigns

RBT enforcement operations were also supported by Melbourne-wide publicity campaigns targeting drink-driving offences (Cameron and Strang, 1982).

To coincide with the introduction of booze buses, a high profile state wide publicity campaign using all mass media was launched in December 1989 and reinforced throughout 1990 and 1991. The key theme of the media campaign was “If you drink then drive, you’re a bloody idiot”.

There was also some evidence of an interaction between the effects of the enforcement operations and the levels of awareness of drink-driving television advertising in country Victoria. Medium levels of awareness appear to increase the effects of the “car only” enforcement operations (33% reduction). Conversely, in regions and weeks influenced by car and bus combinations, a statistically significant net increase in high alcohol hour serious casualty crashes occurred when high publicity awareness accompanied the enforcement (Cameron et al, 1996).

2.1.5 Individual driver attributes

Behavioural characteristics play a key role in the effectiveness of enforcement ranging from a driver’s: perception that they will be detected for illegal driving behaviours, the extent of influence that media campaigns play, and existing attitudes regarding the road safety risks associated with various illegal driving behaviours.

Publicity campaigns focused on drink driving were launched during increased enforcement initiatives in 1977 and 1978. According to surveys taken during these intensive enforcement initiatives, there was an increase in the general driving public’s perceptions regarding their chances of being detected if drink driving (Armour, Monk, South, Chomiac, 1985).

The relationship between direct exposure to enforcement activity and the perceived risk of detection is relevant to an understanding of the mechanisms that operate in successful RBT operations. A survey of 3,700 drivers in four Police Districts in Victoria was conducted as part of an evaluation of a specific enforcement program (Harrison et al, 1998). The survey data suggested that:

• The perceived risk of detection was related to the number of times respondents saw drink-drive enforcement activity.
• On average, respondents reported seeing 1.3 instances of drink-drive enforcement activity in the four weeks prior to the survey.
• One cluster of respondents (8% of the sample) saw a lot of enforcement activity, perceived there to be a high risk of detection for drink-driving, but were more likely than others to report drink-driving.
• A separate cluster (17%) had a low perceived risk of detection and tended to live in rural areas.
The application of recent developments in decision-making theory and psychology to drink-driving enforcement suggest that, the direct experience of enforcement activity or detection act at a different point in the decision-making process to the threat of detection or indirect experiences and knowledge of others’ experiences of enforcement. Direct experiences and detection are more likely to influence decisions such as drink-driving decisions (Harrison, 1998b).

A number of MUARC research projects have examined the involvement of personality factors in drink driving (Harrison, 1996 and Harrison, 1998). A key conclusion arising from this research is that, in the current high enforcement and high publicity environment, particular personality orientations are associated with continued drink-driving behaviour in Victoria. Rural drink-drivers were more likely to fall into the largest personality cluster associated with drink driving than metropolitan drink-drivers. These personality factors are especially predictive of drink driving amongst male drivers and may serve to immunise offenders from the more-general effect on behaviour of the current enforcement and publicity program.

Surveys of licensed drivers drawn from patrons of rural hotels (Harrison, 1996 and Harrison, 1998) revealed the following:

- Many rural hotel patrons actively avoid enforcement activity if possible, regardless of their self-reported alcohol consumption. Many (especially patrons defined as high-risk) believe others do the same.
- Knowledge of others’ contact with drink-drive enforcement was common.
- About two-thirds of patrons had been tested at RBT stations.
- Any relationship between enforcement activity and self-reported behaviour is more likely to be the result of lifestyle factors than the result of any effect of contact with enforcement on behaviour.
- Avoidance behaviours (using alternative routes) were successful for patrons identified as potential drink-drivers. High-risk patrons reported less contact with drink-drive enforcement activity than other groups, in spite of their higher likelihood of driving after drinking relatively large amounts at the hotel.

It is clear that lifestyle and social factors play a role in drink-driving, that experience with enforcement increases the perceived risk of detection, that there are still drivers who drink-drive in spite of current levels of enforcement, that rural drivers may be more persistent in this than metropolitan drivers, that the avoidance techniques used in rural areas do help offenders or potential offenders avoid direct contact with enforcement, and that indirect or threatened exposure to enforcement or detection may be insufficient to change the behaviour of persistent offenders.

2.1.6 Evaluations of RBT

Surveys aimed at determining motorists’ subjective risk of detection for drink driving offences were also conducted during the periods of intensified RBT enforcement in Melbourne. In both 1977 and 1978 the perceived probability of detection for drink-driving offences increased. This suggests that RBT operations operate through a general deterrence mechanism. That is, potential offenders are influenced by a fear of detection and the consequences to avoid offending.

Analysis of the two periods of increased RBT enforcement revealed a 36 percent reduction in night-time serious casualty crashes in the enforcement areas during the week of RBT enforcement and for two weeks following. Night-time serious casualty crashes were used as a
proxy for alcohol-involved crashes in this study as it was not possible to reliably determine alcohol involvement in crashes. In contrast, analysis of the effect of the three periods of intensified RBT focused on reductions in road crash fatalities. The results indicated a net reduction in crash fatalities of 59 percent in the testing areas both during operations and for the subsequent two weeks. Reductions in crash fatalities were greatest on Thursday, Friday and Saturday nights. Statistically significant reductions in serious casualty crashes were also identified during the period of RBT enforcement and the subsequent two weeks. In addition, there was a net 31 percent reduction in the proportion of driver casualties in single vehicle crashes with an illegal BAC (>0.05) on the nights of RBT enforcement and for the two subsequent weeks.

During this period after the introduction of booze buses (and the “drink drive, bloody idiot” advertising by TAC), the number of drivers tested more than doubled from around 500,000 in 1989 to over 900,000 in 1990 and 1,100,000 in 1991. The number of sessions conducted in Melbourne did not change, however, the number of session hours increased by modest amounts and the number of person hours spent testing increased substantially.

Analysis of alcohol related crashes during this period indicated that the program had substantial, positive effects on both fatal and serious injury crash frequency. In particular, high alcohol hour fatal crashes fell by between 19 and 24 % in Melbourne during 1990. There was also some evidence of a reduction in serious injury crashes in high alcohol hours in both metropolitan Melbourne and rural Victoria. Analysis of high alcohol hour crashes in 1991 found a reduction in serious injury crashes in rural Victoria only. There was no statistically significant reduction in fatal crashes in either metropolitan Melbourne or rural Victoria during this period.

Subsequent research has linked monthly serious casualty crashes in Melbourne during high alcohol hours with monthly numbers of random breath tests, monthly alcohol sales, and awareness of drink-driving publicity placed during the month and previous months. (Cameron et al, 1994). In addition, research using similar methods, but separating bus-based and car-based random breath tests, has shown a statistically significant link with the bus-based tests but a weaker relationship with the car-based tests (Newstead et al, 1995).

### 2.1.7 Targeted alcohol screening testing

Another form of drink-driving enforcement is alcohol screening testing conducted typically by car-based operations upon interception of a suspect driver and/or at targeted locations and times based on an intelligence strategy about the likelihood of encountering illegal drink-drivers. This type of operation could be an alternative to large-scale, wide-spread RBT, with tests mainly conducted from booze buses, which has been clearly shown to be a very effective counter-measure to drink-driving (see Section 2.1.6 above).

#### 2.1.7.1 Relative effectiveness of targeted and random breath testing

A review of drink-driving enforcement measures conducted as part of the European PEPPER project (Erke et al 2008) considered the effectiveness of DUI patrolling aimed at apprehending drink-drivers, and the effectiveness of DUI-checkpoints (of which Australian RBT is a classical type). The subset of 11 evaluations with good study design showed that DUI patrolling reduced casualty crashes by 6% and there was no statistically significant reduction in fatal crashes. All studies were conducted prior to 1982 reflecting a trend to the use and evaluation of checkpoints as a more effective approach to drink-driving.
The same review found that 73 evaluations with good study design showed that DUI-checkpoints reduced casualty crashes by 10% and fatal crashes by 17% (both effects were statistically significant). The effect on casualty crashes was almost doubled when the checkpoints were supported by paid media publicity about drink-driving.

2.1.7.2 Nature of the remaining drink-driving problem in Victoria

After years of progress in Victoria by deterring drink-driving through RBT, the remaining drink-drivers appear to be predominantly an intransigent group difficult to deter. Recent data indicates 87% of killed drivers with illegal BACs above 0.1 g/100ml and 69% above 0.15 g/100ml, the latter level being indicative of alcohol-dependence. Drivers with such high BAC levels may be dependent on alcohol to a substantial degree and hence may not be capable of the rational decision-making required for the general deterrence associated with RBT to operate. However, this is not to say that general deterrence has had no effect on their drink-driving because the number of drink-drivers killed with very elevated BACs has also reduced along with the number killed with lower illegal BAC.

Thus there is a case for some degree of targeted alcohol screening testing aimed at apprehending such drink-drivers with very elevated BACs if intelligence exists to identify their nature, location and time of offending (or potential offending) reliably. These targeted operations should not be aimed at general deterrence, but rather aimed at apprehending such drivers for the purpose of treating their alcohol dependence and/or sanctioning their drink-driving to specifically deter them from such illegal behaviour in future. However, these targeted operations should complement, and not replace, on-going random breath testing which has been shown as indicated above to be a very effective general deterrent for all forms of drink-driving.

2.1.7.3 Comparison of “problem” drink-driving in Melbourne and country Victoria

During 2003-07, the proportion of killed drivers and motorcycle riders with illegal BACs who also had BACs above 0.15 g/100ml was 64% in country Victoria compared with 48% in Melbourne (TAC, June 2008). Thus these “problem” drink-drivers, discussed in the previous section, appear to be a greater share of the remaining drink-driving problem in rural areas compared with the metropolitan area. This suggests that any targeted alcohol screening testing aimed at apprehending such drivers should give priority to focusing on locations in country Victoria.

It has been found in previous research on bus- and car-based operations in rural Victoria (see Section 2.1.3) that the use of a booze bus (especially alone) in a small country town can destabilise existing drink-driving practices, resulting in some intoxicated drinkers driving home on minor back roads for which they are relatively unfamiliar and increasing the risk of serious crashes. Booze buses operated in large provincial cities (more than 10,000 population) appear to be equally effective as in Melbourne. Car-based RBT has been found to be effective in small country towns and apparently does not destabilise the situation to the same degree.

The counterproductive effect of booze buses in small country towns suggests that hotels and clubs in these areas are likely to be specific target locations for alcohol screening testing aimed at apprehending “problem” drink-drivers. Such drivers are probably captive to their cars to travel home after drinking, and their alcohol dependence and/or high BAC probably causes them to be immune from any perceived fear of detection, as could be achieved by RBT operations if present.
2.2 DRINK DRIVING ENFORCEMENT IN OTHER STATES

Although RBT was first introduced in Victoria, successful RBT operations now exist throughout Australia. A study examining the long-term impact of RBT on crashes was conducted using Police enforcement and crash data from 1976 to 1992 from four Australian states (Henstridge et al., 1997). The dates of introduction of RBT in these four states are as follows;

- **NSW**: RBT introduced 17th December 1982;
- **Queensland**: RBT introduced 1st December 1988;
- **Western Australia**: RBT introduced 1st October 1988; and
- **Tasmania**: RBT introduced 6th January 1983.

The nature of RBT operations differed across these four states. NSW and Tasmania introduced RBT early in the 1980s and tested all drivers who passed through Police roadblocks. In contrast, in Western Australia and Queensland, “de facto RBT” operated prior to 1989 and involved only those drivers who Police suspected of drinking being tested. In the late 1980s RBT was introduced in these states, however, there is evidence that universal testing of drivers did not occur even after the introduction of RBT.

Further differences between states existed in relation to the level of publicity associated with RBT operations in these states. NSW launched an expensive media publicity campaign at the time of introduction of RBT whereas Tasmania relied on word of mouth and press coverage to enhance the general deterrence message. Western Australia and Queensland has less intense levels of both enforcement and publicity than NSW and Tasmania. For these reasons, the authors of the report defined NSW and Tasmania as revolutionary states Western Australia and Queensland as evolutionary states.

Given the differences in the nature and extent of RBT enforcement and publicity across the four states it is not surprising that the impact of the enforcement campaigns also differed across states. A time series analysis of fatal and serious injury road crashes examined the initial impact of RBT on various crash types. Statistically significant initial reductions in crashes varied across states and the types of crashes analysed but ranged from 13% to 48%. In NSW, RBT operated from both stationary and mobile testing stations. A 26% initial reduction in single vehicle night-time crashes and a 19% initial reduction in all serious casualty crashes was attributed to these operations. The impact of the introduction of RBT on single vehicle night-time crashes was reduced to 5% of its original value after 10 years. The enforcement effect was estimated to impact upon single vehicle night-time crashes for a period of up to 18 months. In contrast, the impact of RBT operations on all serious casualty crashes was sustained for an average of only 200 days (about 6.5 months) in NSW. The analysis of the three other states produced results consistent with those for NSW. The impact of RBT was immediate and persisted for a minimum of one year. The enduring effect of RBT operations was particularly evident for single vehicle night-time crashes (i.e. those crashes most likely to be related to excessive alcohol consumption).

This research also examined the effect of increasing levels of RBT operations. In NSW, the impact of RBT operations declined throughout the 1980s despite initial, large decreases in single vehicle night-time crashes following the introduction of RBT. At the same time the number of RBTs conducted increased only slightly. However, from 1987 enforcement intensity was increased and, by 1992, an average of 5742 RBTs were conducted daily in NSW. An 18% reduction in serious casualty crashes and a 22% reduction in single vehicle...
night-time crashes followed. In more general terms, it was estimated that an increase of 1,000 tests per day would reduce single vehicle night-time crashes by 19.3%. In addition, it was estimated that serious injury crashes could be reduced by around 3.5% given a 10% increase in existing testing levels (1997).

2.3 MOBILE SPEED ENFORCEMENT

In this section, the mobile speed camera program in Victoria is reviewed, as is the mobile speed camera experience in the Netherlands – both these programs are considered overt in nature. In contrast speed camera operations in Queensland and in New Zealand are primarily covert. A comparison between these two types of speed camera operations (overt and covert) is also addressed.

In addition, operations in Victoria involving mobile radar speed detectors and those involving hand-held lasers are reviewed.

2.3.1 Covert speed camera operations

2.3.1.1 Victorian Mobile Speed Camera Program

Since the inception of the mobile speed camera program in Victoria in 1989, the use of mobile speed cameras has become a pivotal component of speed enforcement operations in Victoria. Early evaluations of the effectiveness of the mobile speed camera program showed significant reductions in casualty crash frequency and severity (Cameron et al., 1992). In particular, from December 1989 to March 1990, there was a statistically significant 15% reduction in low alcohol hour casualty crashes on arterial roads. This coincided with low levels of both speed camera enforcement and speed related publicity. During the period April 1990 to June 1990, when the publicity campaign was launched but prior to extensive enforcement operations, low alcohol hour crashes were reduced by 34% on Melbourne arterial roads and 21% in country towns. Reductions in the severity of injuries sustained in these crashes were also found in Melbourne during this period.

Following the high levels of both publicity and enforcement experienced from July 1990, low alcohol hour casualty crashes were reduced on arterial roads in Melbourne, country towns and on rural highways by 32%, 23% and 14% respectively. The injury severity of these crashes was also found to have decreased, principally in Melbourne. The effect of the speed camera enforcement program on high alcohol hour crashes is less clear.

Since these early evaluations the mobile speed camera program has continued to grow and in recent times some operational changes have been made. In particular, between the years 2000 and 2002, the number of operating hours increased from 4,200 to 6,000. Other changes to the program involved the introduction of flashless cameras during daytime hours and reducing the speeding offence detection threshold in three stages. These changes were complemented by a program of speed-related advertising carried out by the Transport Accident commission (TAC). It is the effect of the increase in mobile speed camera operating hours that is of particular relevance here. A recent study of the changes to the mobile speed camera program considered casualty crash and severity effects over the period 1998 to 2003 on a monthly basis (Bobevski et al., 2007). The analysis was appropriately structured to consider the

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4 Low-alcohol hours are times of the week when alcohol related crashes are less likely to occur, whereas high-alcohol hours of the week are those periods when alcohol related crashes are more likely to occur.
effects across Police regions and across time and the effects of individual changes to the mobile speed camera program. The results of the analysis are presented as elasticities and the appropriate interpretations are provided below.

In general, the analysis revealed that on average a 1% increase in mobile speed camera hours is significantly associated with a 0.09% decrease in casualty crash frequency. This 0.09% reduction in casualty crash frequency is known as an elasticity. When applied to the total increase in mobile speed camera hours from 4,200 to 6,000 hours over the period 2000 to 2002, this equates to an estimated 3.25% reduction in casualty crash frequency. Similar estimates of program effects were estimated for the odds of a fatal outcome in these crashes. In that case the results indicate that every 1% increase in camera hours was significantly associated with a 2.03% reduction in the risk of a fatal outcome in a casualty crash. When applied to the total increase in hours this equates to an estimated 51.44% reduction in the risk of fatal outcome in a casualty crash.

Area of operation of the mobile speed camera program

Given these estimates of program effectiveness it is useful to consider the area in which the mobile speed camera program operated to achieve these effects. Previous evaluations of the mobile speed camera program in Victoria have demonstrated that the impact of camera operations extends beyond camera operating sites (Rogerson et al, 1994; Newstead et al, 1995). Therefore, in defining the length of road which may be influenced by mobile camera operations it is necessary to consider all road types on which these cameras may operate effectively. Previous research has indicated that mobile, speed cameras are most effective in urban areas (Cameron et al., 2003a & 2003b). Therefore, streets and roads with speed limits up to 80 km/h in Melbourne and rural Victoria may be considered the most suitable targets as well as rural highways with speed zones of 60 and 70 km/h located in towns. The ability to identify the length and traffic volumes of such roads would provide reliable information about potential areas that would likely benefit from mobile speed camera operations.

In addition to the general (network wide) effects of the mobile speed camera program there is some evidence that the program also has a localised effect at mobile speed camera sites (Rogerson et al., 1994 and Newstead et al., 1995). In particular for the period from July 1990 to December 1991 during the two weeks following the receipt of Traffic Infringement Notices (TINs) by offending motorists, a statistically significant 10% reduction in high alcohol hour casualty crashes was experienced on arterial roads within one kilometre of the camera site. However, there was no reliable evidence of casualty crash reductions within one kilometre of the camera site during the week immediately following a speed camera enforcement session. In addition, no localised reductions in low alcohol hour casualty crashes or the severity of crashes were found during this period. Analysis of the mobile speed camera program during the period from July 1990 to December 1993 evaluated the localised effects of speed camera enforcement in rural towns and metropolitan Melbourne separately (Newstead et al., 1995). In metropolitan Melbourne but not in rural towns, the speed camera program was estimated to results in statistically significant casualty crashes reductions following enforcement operations or the receipt of TINs. The influence of TINs was evident during the three weeks following their receipt and was greatest on all roads during high alcohol hours. An 8.92% reduction in casualty crashes was experienced in high alcohol hours, on all roads, during the week following the receipt of TINs. These potential, additional localised effects would need to be accounted for in any estimation of the effectiveness of mobile speed camera per unit area per hour of enforcement.

2.3.1.2 Mobile Speed Cameras in the Netherlands
As part of a new regional enforcement program in the Netherlands first introduced in January 1998, speed enforcement using inconspicuous mobile speed cameras on rural roads in the Dutch province of Friesland was conducted. The enforced road sections contained signage warning drivers of the potential for speed enforcement activity. However, the enforcement operations may be classified as semi-covert as the enforcement itself was conducted from inconspicuous cars on the roadside. A comprehensive review of the speed and crash effects of the enforcement has been published (Goldenbeld and van Schagen, 2005). The program involved the enforcement of approximately 116km of 80km/h and 100km/h single carriageway rural roads with a history of high numbers of casualty crashes. On average each road length was enforced for between one and two hours each week. The enforcement program was supported by extensive publicity and information campaigns.

The evaluation of the enforcement program considered crash and speed effects over the five-year period following commencement of the program (1998-2002). Enforcement levels varied over this period ranging from 5,486 hours in 1998 to 14,439 hours in 2001. Further, from 2000 onwards, a number of modes of enforcement were adopted. These included the mobile speed camera described above, hand-held laser devices, radar devices located on hidden tripods outside police cars and other surveillance mechanisms. However, the majority of enforcement continued to be undertaken by inconspicuous mobile speed cameras. No information on enforcement hours was available for 2003.

The impact of the enforcement program on all casualty crashes and serious casualties was estimated separately by the authors. A 21% reduction in both all casualty crashes and serious casualties was estimated over the five year period. A number of cautionary notes are issued by the authors for those interpreting the results. In particular, the effect may be over-estimated due to regression to the mean effects and the influence of road engineering measures was not considered. Nevertheless the results of the study are consistent with those of other studies examining similar enforcement efforts on rural roads. Therefore, these results must be considered the best estimates of crash reductions due to the new speed enforcement program.

2.3.2 Overt speed camera operations

2.3.2.1 The Queensland Speed Camera Program

The use of speed cameras in Queensland can generally be described as overt in nature as cameras operate from marked vehicles and signs advising motorists of the presence of camera operations are posted within 10 meters of them. The speed camera program first commenced in May, 1997 at which time cameras were deployed to 500 sites located only on state controlled roads where a speed limit review had been completed. Speed camera zones were chosen on the basis of crash history and were approved by Traffic Advisory Committees. The operation of cameras at particular sites was determined using a randomised scheduling procedure with some scope for variation. By December 2003, the number of speed camera sites in use had grown to over 2,900. An alternative measure of the intensity of the speed camera program is the number of speed camera operating hours achieved per month. In line with the increase in speed camera sites, there has been a substantial increase in the number of mobile speed camera hours per month, particularly during 2003. Over this period mobile speed camera hours have shown a general increasing trend, however growth in hours has not been smooth with peaks and troughs in operating hours evident over the period which display no distinct pattern. On average over the period 1998 to 2002, mobile speed cameras operated 2,017 hours per month, but this increased to 5,993 hours per month during 2003.
The effectiveness of the camera program has been evaluated in terms of crash reductions by crash severity (Newstead and Cameron, 2003 and Newstead, 2004). Estimates of crash reductions by crash severity were calculated for each year after program implementation using a quasi-experimental treatment and control design and divided into three separate annuli, 0km to <2 km, 2km to <4km and 4km to <6km from approved camera sites. The results show that the crash reductions experienced are greatest nearest the camera sites particularly at higher severity levels (fatal or medically treated crashes). Further, crash reductions attributable to the speed camera program appear to have increased over time. This is expected as the number of speed camera sites defined in the treatment operational speed camera sites has also steadily increased over that period.

Specific results from the study estimate reductions in the order of 35% for combined fatal, hospital and other medically treated crashes within 2km of the speed camera site. Whilst this is an average effect the impact of the speed camera program was estimated to increase over the five years of the evaluation. The estimated impact of the speed camera program on other injury and non-injury crashes within 2km of the speed camera sites in the later years of the program was around 20% or less. These results were considered unlikely to be affected by other road safety initiatives in operation during the evaluation period in particular the Random Road Watch program described below. It was expected that the Random Road Watch program would have the same influence on crashes within both the treatment and control areas used in the speed camera evaluation.

Other interesting results from the study refer to the relationship between crash effects and the intensity, coverage and scheduling of the enforcement identified through analysis of the crash effects by police region. In particular, increased coverage of the crash population, increased density of enforced areas per crash and strict adherence with the randomization process were all associated with increased crash reductions.

2.3.2.2 The Queensland Random Road Watch Program

Prior to the introduction of the speed camera program in Queensland, the Random Road Watch program (RRW) of traffic policing was in operation. The program was first introduced in the rural areas of the Southern Police Region December 1991. Since that time the program has been extended to operate throughout the State. The program aims to allocate enforcement resources in a random way so as to maximise road safety benefits. The approach is implemented by using the existing Police structure of regions and districts to select a number of road segments (approximately 40) that will be the subject of enforcement. These road segments are chosen to ensure that roads covering over 50 percent of all road crashes are included in the program. The central aims of this approach are to decrease the ability of road users to predict the location and timing of enforcement activities and to enable the police to cover larger parts of road network than would be the case with conventional policing.

The RRW program has been evaluated in terms of the effect of its implementation on crash frequency over the period of December 1991 to July 1996 (Newstead et al, 1999). The analysis indicated that for all non-metropolitan areas of Queensland the RRW program resulted in statistically significant crash reductions at all severity levels. The crash reductions increased as the severity level of the crash increased. Examining crash reductions for rural and urban areas separately produced some interesting results. In rural areas, there was a statistically significant 34.3% reduction in fatal crashes but reductions in other crash categories were not statistically significant. On the other hand, urban areas experienced crash reductions for all categories except fatal crashes. However, the failure to identify statistically significant reductions in fatal crashes may be due to insufficient data.
In addition to the variations between metropolitan and rural areas, the outputs and crash effects of the program differed across Police regions. The relationship between the outputs of the program, such as the number of hours of enforcement, and the crash effects of the program in each region was investigated with the aim of determining the mechanisms that drive the program. Significant variations in the offences detected per crash treated and enforcement hours per crash treated were identified across regions. Treated crashes are defined as crashes in the year prior to the introduction of RRW on routes and in time bands enforced by RRW. It was found that the crash coverage of the program (i.e. the percentage of previous crashes in the region covered by the program) was positively related to both the total number of crashes saved and the percentage of crashes saved in the region. The analysis also indicated that total crashes saved and the percentage crash savings are positively related to offences detected and hours enforced, however, these associations were not statistically significant.

The effects of the program over time have also been analysed. The results show that the effect of the RRW program on all crash types except those involving fatalities has increased over time. The effect of the program on fatalities appears to be fairly consistent across the three years immediately following the implementation of the scheme.

Due to data insufficiency it proved difficult to produce conclusive results on the effect of the RRW program in the Metropolitan South Police region that forms part of metropolitan Brisbane. However, in general terms the overall effects in this region appear to be consistent with those experienced in the rest of Queensland. That is, reductions in overall crashes were experienced along with reductions within each year of the programs operation and within each of the crash severity crashes.

In conjunction with the results of the Queensland speed camera program described in section 2.3.2.1, these results suggest that optimum program effect can be achieved through the randomisation of enforcement scheduling and coverage of a large proportion of the crash population. Finally, it is noted that similar programs have been conducted in other jurisdictions and although the outcomes of these are not conclusive they indicate that reductions in crash frequency can be achieved by implementing randomly scheduled police enforcement.

2.3.2.3 Mobile speed cameras in New Zealand

The introduction of mobile speed cameras in New Zealand commenced in late 1993. The operation of the cameras was restricted to roads classified as ‘speed camera areas’ based on a record of speed related crashes. Entrances to these roads were clearly sign posted to ensure that motorists were aware of the potential presence of the speed cameras. Further, the majority of speed cameras were mounted on police cars and operators were prohibited from hiding the cameras. In urban areas, limited use was made of fixed position speed cameras mounted on poles, however, these were subject to the same signage requirements as the mobile camera operations. In total, 13 fixed and 31 mobile cameras have been operating in New Zealand since 1993. Prior to July 2000, the enforcement threshold was set at the 85th percentile speed for each site as determined by speed surveys of that site. Financial penalties (but no demerit points) were imposed where vehicles were detected travelling at or above the enforcement threshold. However, since 1 July 2000 a flat 10 km/h enforcement threshold has been in operation.

An evaluation of the effect of the speed camera program described above, found that fatal and serious crashes on roads with speed limits of 70 km/h or less were reduced by an estimated
13% during low alcohol times of day (Mara et al., 1996). In speed camera areas, the reduction in fatal and serious low alcohol hour crashes was 23.3%. Less substantial reductions in all injury crashes were experienced in speed camera areas on roads with speed limits of 100 km/h. No effect on crashes was identified on these roads when non-speed camera areas were included in the analysis.

Christchurch

A further evaluation of the speed camera program described above was conducted for the city of Christchurch only (Gunarta, S and Kerr, G, 2005). As the study was undertaken many years after the introduction of the speed camera program, the study considers the difference in speeds at speed camera sites and speeds measured at sites without a speed camera in operation. It was not possible to examine the crash impacts of the program directly. The comparison of speeds was conducted on minor 50km/h arterial or collector roads with 2-way traffic and 2 traffic lanes.

On average across the speed camera sites, mean speeds were 1.7km/h lower than at non-speed camera sites. The speed differences measured were greater in conditions involving wet roads (3.2km/h) or poor visibility (2.37km/h). In conditions of both wet roads and poor visibility the estimated mean speed reduction was 3.82km/h. Whilst the authors were not able to directly estimate the crash reductions attributable to the speed camera program in Christchurch they approximate the anticipated reductions using the relationship between injury accidents and speeds established by Andersson and Nilsson (1997). Using these relationships they estimate that in normal conditions the speed camera operations reduce casualty crashes by approximately 6% and fatal crashes by approximately 12% in the area surrounding the camera sites. These estimates appear similar to those obtained in the study by Mara et al described above for roads with speed limits of 70km/h. In conditions of poor visibility and wet roads, casualty crashes were estimated to be reduced by approximately 15% and fatal crashes by 28%.

2.3.3 Mobile radar speed detectors

Between 1995 and 1996 a total of 73 mobile radar units (moving mode radar) became operational in Victoria. The mobile radar devices were used primarily in rural areas on two-way, undivided, 100 km/h speed limit roads and involved police intercepting vehicles travelling above the speed limit and issuing an on the spot fine. During this enforcement program all rural Police Districts in Victoria and some Police Districts covering outer metropolitan areas were issued with the mobile radar units. The devices were used on both marked and unmarked patrol vehicles. In particular, during the 1995/96 period, 81% of the operational hours were completed by marked patrol cars. This decreased slightly to 72% during the 1996/97 period. In November 1996 the TAC launched a television advertisement specific to the enforcement program. This advertisement was shown in both rural and metropolitan areas of Victoria. During the same period other advertisements relating to speeding generally were also shown in both rural and metropolitan areas.

For the period from July 1995 to June 1996, 48 mobile radar units were in operation for a total of approximately 902 hours per week. That is, a total of 47,136 hours of operation were achieved over the 12-month period. This number increased to 904 hours per week during the July 1996 to June 1997 period when the number of devices in operation increased to 73.

The enforcement program and associated publicity was evaluated in terms of its effect on casualty crashes on undivided roads in 100 km/h speed zones in Victoria (Diamantopoulou et
The preliminary analysis found no change in the number of casualty crashes in outer metropolitan regions where the mobile radar devices were used. Therefore, the following results relate to casualty crashes in rural Victoria only.

The analysis determined that the enforcement program had a positive effect on casualty crashes in rural Victoria for a period of approximately four days following the enforcement. The effect of the program diminished after this period. In addition, the effect of the program varied with the level of public awareness of the two advertising campaigns.

The most noticeable effect on casualty crashes occurred when there were high levels of awareness of the specific mobile radar publicity. This corresponded to the period of November 1996 to June 1997. During this period a 28% net reduction in casualty crashes was observed one to four days after the enforcement was present. However, this reduction was only marginally statistically significant. The net reduction found for casualty crashes occurring on the same day as the enforcement was not statistically significant. Further, when there was low public awareness of the specific mobile radar advertising no evidence of casualty crash reductions was found.

Similarly, during the period July 1996 to June 1997 there were weeks of high-level awareness of general speed-related publicity (including mobile radar publicity) and the strongest effect on casualty crashes was found during the four days after the enforcement was present. However, the effect was not as strong as that experienced when the publicity was specific to mobile radar activity. In fact, the 11% reduction in casualty crashes that occurred during this period was found not to be statistically significant.

The results for the combined period from July 1995 to June 1997 also indicate that the strongest effect occurred when awareness of the general speed-related enforcement was high. However, the 8% reduction in casualty crashes detected was found not to be statistically significant. A comparison with high awareness levels of specific mobile radar publicity over the full two-year period cannot be made given that this type of publicity was only introduced in November 1996.

Finally, the results detailed above should be considered as somewhat conservative given a number of technical decisions that were made relating to the evaluation (Diamantopoulou et al., 1998).

2.3.4 Hand-held laser speed detection devices

The use of laser speed detection devices was introduced in Victoria in 1996 to overcome the difficulties associated with enforcement in busy traffic areas such as arterial roads. The laser devices were operated overtly and aimed to increase the risk of detection rather than the number of speeding vehicles detected. The research conducted on the effectiveness of laser speed detection devices relates to three main areas: the overall effect of enforcement on crashes, the effect of different enforcement levels on crashes and the effect of enforcement activities on crashes on different road types. Each of these will now be discussed in turn.

The laser speed enforcement program has been found to have a positive overall impact on the number of casualty crashes occurring (Fitzharris et al. 1999). A statistically significant 8.28% reduction in all casualty crashes was found during 1997 in the areas where laser speed detection devices were used. In addition, the similar crash reductions found for the two categories of casualty crash suggest that the enforcement program affected the number of crashes rather than the severity of crashes.
In terms of the intensity level of enforcement, the laser speed enforcement program was apparently effective in reducing casualty crashes only for low and medium levels of enforcement. It is noted that, low enforcement is defined as up to three hours of enforcement activity at a given site during the year whereas medium intensity enforcement was defined as more than three but no more than fifteen hours of enforcement at a given site per year.

The final set of results relate to the type of road on which the enforcement activity was carried out. The three road types were defined as freeways, arterial roads and other roads. The laser enforcement program led to a statistically significant 8.23% reduction in all casualty crashes on arterial roads only. The crash reductions on other types of roads were similar in magnitude but not statistically significant. However, the analysis for freeways and other roads was based on relatively few observations and may therefore have statistical power problems.

Finally, it is noted that the results presented in terms of the intensity level of enforcement and road type may have some interaction with each other. In 1997 enforcement intensity was highest on freeways and lower on arterial and other roads. Therefore, the analysis of the effect of laser speed enforcement as it relates to road type will be affected by the differing intensity levels of enforcement for each road type. Similarly, the analysis in respect of the intensity of enforcement will be affected by the road type on which the enforcement took place. Separating these effects has not been possible to date. However, given that the aim of using the laser devices was to provide more effective enforcement in busy traffic areas it was considered more appropriate to focus on the results as distinguished by road type, in particular the results for arterial roads.

2.3.5 Comparison of overt and covert mobile operations

The second key issue in relation to the operation of mobile speed cameras is the contrast between overt and covert operations. There has been little research directly comparing the impact of the mode of operation on the effectiveness of a mobile enforcement program. However, some evidence does exist and is discussed below.

2.3.5.1 New Zealand

As detailed above the operation of mobile speed cameras in New Zealand is conducted in a highly visible manner. However, from mid-1997 to mid-2000 a trial of the covert use of speed cameras was conducted in one of the four police regions in New Zealand on roads with speed limits of 100 km/h. This involved adding to existing signage an indication to motorists that hidden cameras may operate in the speed camera areas. In addition to the extra signage, there were high levels of newspaper and radio publicity relating to the trial prior to its commencement. It is also noted that in the first year of operation there was a 26% increase in the operational hours of speed cameras in the trial region. In the second year of operation, the number of operational hours decreased by 13% from the first year level. There were no changes in the operation of speed cameras during the trial period in other areas of New Zealand. In particular, on all roads in non-trial speed camera areas, speed camera operations remained overt. Further, on roads with speed limits of 70 km/h or less in the trial region, speed cameras were operated overtly.

An evaluation of the hidden camera trial in terms of vehicle speeds and reportable crashes demonstrated that during the first two years of the trial, improved road safety outcomes were experienced (Keall et al., 2002). First, average speed in the trial regions decreased by an estimated 1.3 km/h over the first two years of the trial. The speed below which 85 percent of vehicles travelled in the trial region fell by an estimated 4.3 km/h. In addition, reportable
crashes in the trial region fell by 11% in comparison to reportable crashes in the control regions. Further, it was found that the number of casualties in the trial region fell by 19% in comparison to casualties in the control regions. The number of casualties per crash fell by 9% on open roads in the trial region compared to open roads in the control regions. It is noted that these results relate to reductions across the treated region and not only at camera sites. This indicates that the covert mobile operations were able to generalise the effect of the New Zealand program beyond the speed camera sites.

Despite the above results it is difficult to draw conclusions from this study on the relative effectiveness of overt and covert automated speed enforcement programs. During the trial period, enforcement levels in the trial region were higher than in the non-trial regions. Further, the number of penalties issued in relation to incidents in the trial areas increased four fold (Keall et al., 2002). Therefore, based on previously established relationships between speed enforcement and crashes (Cameron et al., 1995), it is not unexpected that improvements in road trauma would occur as the level of enforcement increases. Nevertheless, the authors point to three factors which they believe together support the conclusion that the introduction of covert speed cameras influenced the casualty crash reductions. First, the fall in the frequency of casualty crashes coincided with the introduction of the covert program. Second, mean and high percentile speeds fell significantly during the trial. Finally, the reduction in the number of casualties per crash also confirms that speeds fell during the trial period.

2.3.5.2 Victoria

To clarify the comparative effect of covert and overt mobile speed enforcement operations, it is useful to examine some related Victorian research although it is noted that it does not relate directly to mobile speed cameras.

The effect of mobile (moving mode) radar speed detection devices on road trauma in rural Victoria has been examined in terms of the type of enforcement operation. That is, the effect of covert (unmarked car), overt (marked car) and mixed (marked and unmarked cars) mobile radar operations has been examined to identify any differences between the outcomes of different types of enforcement activity (Diamantopoulou and Cameron, 2002).

The analysis was conducted using crash data from July 1995 to June 1997 which was divided into two periods. These periods were July 1995 to June 1996 and July 1996 to June 1997 and corresponded with the use of 48 and 73 mobile radar devices respectively. Analysis was also conducted on the two periods combined when up to 73 mobile radar device were in operation.

A net 20.7% reduction in casualty crashes occurring one to four days after a covert enforcement presence was identified during the period from July 1995 to June 1996. The presence of overt enforcement also had a positive effect on crashes occurring one to four days after enforcement however, the effect was less pronounced. During the period from July 1996 to June 1997, the largest reductions in casualty crashes occurred following mobile radar enforcement operations involving both marked and unmarked police cars. This effect was greatest on the day on which the enforcement activity took place (40.2% reduction).

The results of the combined period in which up to 73 mobile radar devices were in operation found that the most significant reductions in casualty crashes occurring one to four days after enforcement resulted from covert mobile radar enforcement. However, a mix of overt and covert enforcement was also found to be effective in reducing casualty crashes during this period.
It is noted that the crash reductions presented above are not statistically significant. Nevertheless the results are indicative of the likely relationships between overt, covert and mixed mobile radar enforcement and casualty crashes in rural Victoria.

2.4 FIXED SPEED CAMERAS

Fixed speed cameras operate extensively in a number of jurisdictions. In Australia, evaluations of the fixed digital speed camera program in NSW and fixed speed cameras on tollways operated by CityLink in Victoria have been conducted. Internationally, there have been several evaluations of the use of fixed speed cameras in the U.K. Each of these programs will now be considered in turn.

2.4.1 United Kingdom

Speed cameras were first introduced in the UK in 1992. Currently, speed camera operations in the UK are predominately fixed rather than mobile, however, the exact number of speed cameras currently in use is unclear. Regardless of the type of speed camera in use, speed cameras must be operated overtly with strict regulation surrounding the visibility of camera sites. Further, since April 2000, speed cameras and red-light cameras, collectively known as safety cameras, have been operated under cost recovery partnerships enabling local authorities to recover enforcement costs through fine revenue. The introduction of cost recovery partnerships enabled widespread, coordinated data collection and has led to the regular evaluation of the safety camera program. The most recent evaluation examines the first fours years of operation of the cost recovery partnerships including the impact of the safety camera program on both speeds and casualties at camera sites (Gains et al., 2005). The evaluation considers data from 38 participating partnerships that had been operational for at least one year at the time of the evaluation.

Examining the program in terms of casualty effects, there was an estimated 42% reduction in the number of people killed or seriously injured at the camera sites over and above that which might ordinarily be expected. Further, casualty crashes (where at least one participant was at least slightly injured), were estimated to have fallen by 22%. The authors state that the above reductions are slightly over-stated due to regression to the mean effects that resulted from the analysis method. Estimates of the extent of this effect indicate that, whilst it does account for some of the estimated casualty reduction, safety cameras still result in substantial improvements in casualty frequencies. Interestingly, the casualty and crash reduction experienced were greatest at fixed camera sites with somewhat lower reductions experienced at the mobile camera sites. This result is consistent with those found in earlier evaluations of the UK safety camera program (Gains et al., 2003). The earlier study also showed much greater reductions in the proportion of vehicles exceeding the speed limit at fixed camera sites compared to mobile camera sites which may help to explain the greater crash reductions experienced at these sites.

The program was estimated to have a similarly positive impact on speeds at the camera sites. Across the 38 partnerships a total of 20,000 speed surveys had been collected over the four year implementation period. Analysis of this data estimated an average speed reduction of 6% (2.2 mph) at new sites with the reduction being greater at site with speed limits of 30 or 40 mph (7%) compared to sites with higher speed limits (3%). Excessive speed (15 mph more than the speed limit) fell by an average of 51% at new speed camera sites with the effect being greatest at fixed camera sites (91%) and lowest at mobile camera sites (36%).
It is noted that the estimates of effect discussed above are attributable to a combined speed camera and red-light camera program.

Finally, in addition to the impact of the fixed speed camera program on casualty crashes at the camera sites, earlier studies of the program indicated that the effects of the overt cameras may generalise across the whole of the trial areas, with the average number of fatal and serious injuries in each trial area being 4% below the long-term trend in serious road trauma in the rest of Great Britain (Gains et al., 2003). While the camera sites were located in speed-related “accident hot spots”, the density of their locations and/or their threat to speeding motorists appeared to be sufficient to produce a general effect which extends beyond the camera sites. This result has not been identified in the later evaluations of the UK safety camera program.

2.4.2 Victoria

Fixed speed cameras were first introduced in Victoria on CityLink and the Monash freeway in 2000. Since that time further fixed speed cameras have been positioned on other major freeways and highways in Victoria, however the operation of these cameras and their potential impact on crashes has not been evaluated in detail. Further, the effectiveness of the fixed speed cameras positioned on CityLink has been evaluated only in terms of the impact on vehicle speeds in the Domain tunnel (Diamantopoulou and Corben, 2001). The overall effect of the fixed-position speed cameras was to reduce the proportion of those drivers exceeding the speed limit and to reduce the average speed of vehicles in the tunnel. Average vehicle speeds fell from 75.05 km/h to 72.50 km/h. The proportion of drivers exceeding the 80 km/h speed limit fell by 66%. In addition, the proportion of drivers exceeding speeds of 90 and 110 km/h were also significantly reduced by 79% and 76% respectively. Previous research has highlighted the relationship between speed and casualty crash risk reductions.

2.4.3 Norway

Automatic speed enforcement was first introduced in Norway in 1988 and is operated in an overt manner. Photo radar units are mounted in roadside boxes and notification of their presence is by way of roadside signs on the enforced section of road. The speed cameras do not operate at all times, however, it is not possible for a driver to determine whether a camera unit is in operation when approaching or passing it. Since 1993 the selection of camera locations has been subject to three criteria relating to the crash rate, injury crash frequency per kilometre of road per year (crash density) and the mean speed at the enforcement site. Not all operational speed camera sites meet these three criteria. An evaluation of the effectiveness of this form of automated speed enforcement has been completed by Elvik (1997).

The evaluation considered 64 sections of road totalling 336.3 km in length. Due to the lack of available speed data the results are presented primarily in terms of crash reductions attributed to the automated speed enforcement and speed reductions are not considered in detail. Further the author was unable to determine those enforcement sites that met the criteria for selection on the basis of the mean speed at the site. The principal result of the analysis was that across all 64 road sections there was a statistically significant 20 percent reduction in the number of injury crashes. More detailed analysis was also conducted on the basis of compliance of the road section with the criteria for selection as a speed camera location. The results suggest that greater injury crash reductions are experienced at those speed camera sites meeting the criteria for selection as a speed camera site (26%) than at crash sites not meeting the criteria for selection (5%). That is, the greatest crash reductions were achieved at those sites experiencing higher crash frequencies and densities prior to the commencement of enforcement.
Unfortunately, as noted by Elvik no data was available concerning the frequency or duration of enforcement using these cameras. However, it is clear that the cameras did not operate at all times. Therefore, it is not possible to directly estimate the effectiveness of this type of overt speed camera enforcement per unit area per hour of operation.

### 2.4.4 New South Wales

Fixed digital speed cameras were first introduced in NSW in 1997 in the Sydney Harbour Tunnel. By 2005, the fixed digital speed camera program had grown to include at least 111 cameras (ARRB, 2005), all operating overtly with three signs advising of camera operations placed on approaches to speed camera locations. Sites for fixed digital speed cameras are selected on the basis of crash rates, crash severity and travel speeds at the camera location and the digital technology used enables the cameras to operate up to 24 hours a day (RTA, 2006).

An evaluation of the crash effects of the fixed digital speed camera program was conducted using a representative sample of 28 fixed digital speed camera sites (ARRB, 2005). The authors used a quasi-experimental before and after, treatment and control design. The analysis estimated that across the 28 camera sites examined there was a 22.8% statistically significant reduction in casualty crash frequency along the camera road length (usually 1-3 kilometres surrounding the camera site). When estimating the crash effect across both the camera road length and adjacent road lengths there was a non-statistically significant casualty crash reduction of 7.8%. All casualty crash reductions were estimated for the two years following the installation of the fixed digital speed cameras. Statistically significant estimates of fatal crash reductions were also calculated (89.9% on camera road lengths) however the associated confidence limits were wide (22.1-98.7%). Nevertheless, the result was statistically significant and indicates that the fixed digital speed cameras did reduce the incidence of fatal crashes occurring on the speed camera road lengths with the best estimate of the reduction being 89.9%. Marginally statistically significant fatal crash reductions were also estimated for the combined camera and adjacent road lengths.

### 2.4.5 Point-to-Point Speed Cameras

#### 2.4.5.1 Operation of Point-to-Point Speed Cameras

Point-to-point camera technology uses a number of cameras mounted at staged intervals along a particular route. The cameras are able to measure the average speed between two points or the spot speed at an individual camera site. In order to measure the average speed between two points the cameras must be linked to one another and the time clocks on both machines must be synchronised. The average speed is then determined by dividing the distance travelled by the time taken to travel between the two points. The distance between two camera sites may vary from as low as 300 meters to up to tens of kilometres. An enforcement threshold may also be implemented to allow for acceptable variations in driver speed along the route. Potentially, a lower enforcement threshold could be considered for the average speed measured by this technology than the spot speeds measured by mobile and fixed speed cameras.

In the U.K., point-to-point camera technology, using digital imaging, was first installed on Nottingham’s main link road from the M1 Motorway in July 2000, as part of a trial program of additional speed cameras in eight Police areas. Two cameras were mounted along the enforced 40 mph road length approximately 0.5 kilometres apart. In a comparison with traditional wet-film spot-speed fixed cameras, Keenan (2002) found that reported casualty crashes at the Nottingham digital camera site fell from 33 during the year before installation to 21 during the year after, a reduction of 36%. In addition, both mean and 85th percentile
speeds were below the 40 mph speed limit along the 0.5km road length enforced by the two cameras. In contrast, crashes at the spot-speed camera sites studied appeared to increase, but not statistically significantly so.

Commenting on the relative merits of the new technology, Keenan (2002) noted that the spot-speed fixed cameras have a site-specific effect whereas the point-to-point camera system has a link-long influence on drivers and their speeds despite enforcement being visible only at the start and end of the enforced road length. Further, Keenan (2002) noted from his study that “around the [spot-speed camera] sites a significant proportion of the drivers observed manipulated their behaviour in close vicinity to the installations, suddenly applying their brakes 50 metres before the camera and then promptly accelerating away from it. Most alarming was the fact that the accident statistics at some of the [spot-speed camera] sites had worsened since the camera installation”. While the crash data were probably too few for Keenan to claim that the situation had worsened, it is possible that any speed and crash reduction benefits at the overt fixed spot-speed camera sites were eroded by some drivers behaving in the way Keenan suggests. However, given the policy in the U.K. of making fixed camera sites conspicuous and the placing of advance camera warning signs a requirement of the scheme, there should be less likelihood of drivers being taken by surprise. This effect may be even less likely to be a significant consequence of the point-to-point camera systems.

2.4.5.2 Evaluations of U.K. Systems

Point-to-point speed camera systems measuring average speeds between two or more fixed cameras have the potential to produce a general effect well beyond the localised effect at overt fixed camera sites. They have been installed at a few sites as part of the comprehensively-evaluated UK Cost Recovery Program, but apart from information which can be gleaned from the detailed information in that program’s evaluation reports, there is little scientific evidence of their effects on road trauma. Gains et al (2003) indicated that the two 0.5 km apart point-to-point cameras in Nottingham produced 31% reduction in serious casualties (not statistically significant) which was not significantly different from the road trauma reduction from speed cameras of all types. Keenan (2002) found 36% reduction in casualty crashes at the Nottingham site.

The manufacturer of the UK point-to-point speed camera systems, Speed Check Services, have claimed that systems in Nottinghamshire (now 48 pairs of cameras), Northamptonshire (four pairs of cameras on a 4 km section) and South Yorkshire (eight pairs of cameras on an 11 km section of highway) have substantially reduced speeding and road trauma on the road sections they cover. It is understood that each pair of cameras needs to be hard-wired together in some way, and that this requirement constrains the distance over which the average speed can be measured.

In July 2005, the Scottish government launched a pilot scheme of 15 Speed Check Services SPECS cameras on a 46 km section of the A77 highway in the Strathclyde area. It is described as a complex route including single and dual carriageways with varying speed limits. The southern section is a winding and challenging coastal road in South West Scotland. The route had experienced 20 road deaths and 95 serious injuries over the five-year period 2000-2004. Published descriptions of the system are unclear: apparently there are 14 camera sections, averaging 0.5 mile in length, between which the pairs of cameras are switched on periodically. The cameras are supported by around 50 safety camera warning signs with the message “average speed – speed cameras” and a camera symbol. The intention is to deter speeding along the full length of the route. However, the system does not appear to
measure average speeds along contiguous sections of the route nor over the whole route. This may relate to the varying speed limit zones along the highway covered.

A preliminary evaluation of the Strathclyde A77 system by Transport Scotland has found that there was a statistically significant 20% reduction in reported injury crashes (including fatal) during the first two years of operation on the route, compared with crash experience during the previous three years (A77 Safety Group, 2007). Fatal and serious injury crashes each fell by one-third and road deaths were more than halved; however none of these reductions were statistically significant, perhaps due to the small frequencies in each case. A full assessment of the effects of the system on crashes and casualties on the A77 route was planned when three years’ experience had been accumulated in July 2008.

To date, the Speed Check Services SPECS point-to-point speed camera system is the only such system to receive Home Office Type Approval in the UK. In 2003, their website indicated that a pair of point-to-point cameras costs £70,000 and requires at least another £100,000 for the computer network to support it. In 2005, Speed Check Services suggested around £290,000 for a fully installed SPECS system, compared to around £45,000 for a single spot-speed camera. There may be economies of scale with larger numbers of cameras because the Scottish government has reported that the 15 camera system in Strathclyde cost £775,000 in 2005.

### 2.4.5.3 Evaluations in Austria and the Netherlands

A careful evaluation has been conducted of the point-to-point camera system covering speeds through a 2.3 km long urban tunnel in Austria (Stefan, 2006). While there are limits on the generalisability to other non-tunnel road environments, the results indicate strong effects consistent with those seen in the preliminary evaluation of the Strathclyde A77 system.

The Austrian tunnel has separate tubes with 3-4 lanes in each direction and carries a total of 91,900 vehicles per day. There is one camera above each of three lanes at the beginning and end of the tunnel, and a separate laser scanner to differentiate between passenger cars and heavy goods vehicles because of the different speed limits applicable to each vehicle type (80 km/h for cars and 60 km/h for HGVs). The system is designed to operate with speeds up to 250 km/h and a maximum traffic flow rate of two vehicles per second and lane. Vehicle detection is independent of the position of a vehicle in or between lanes.

During the first year of operation, average speeds fell by 10-15 km/h and then levelled at average speeds about 5 km/h below the applicable speed limit for each vehicle type. During the same period, 29.4 million vehicles passed through the tunnel and 40,900 drivers were charged with speeding, suggesting a detection rate of 0.139%.

The evaluation found that injury crashes (including fatal) were reduced by one-third, fatal and serious injuries by 49% and slight injuries by 32%. These figures are consistent with those found elsewhere (see section 2.2) and with the expectation that a greater effect is expected on more serious injury crashes than those resulting in minor injury.

The capital cost of the Austrian system was €1.2 million (in 2002) and annual costs of operation and maintenance are about €60,000. When the capital costs were amortised over 10 years at 4% p.a. discount rate, Stefan (2006) estimated that the annual cost of the system is €207,950. Using relatively modest costs for the economic value of crashes prevented, at each level of severity (e.g. €949,900 for a fatality), Stefan’s analysis indicated a benefit-cost ratio of 4.9 (or 5.3 if the social benefits of reduced traffic emissions were included).
In the Netherlands, a point-to-point system was installed on the motorway between Rotterdam and Delft in support of a new 80 km/h speed limit. No comprehensive evaluation of the system has been published, apart from information that the proportion of offenders declined to less than 1% (RWS, 2003). This result, and the low detection rate observed in the Austrian tunnel, suggests that point-to-point camera systems have the capacity to reduce speeding transgression rates to a lower level than that achieved by overt fixed speed cameras enforcing spot-speeds (1.2% exceeding speed limits by at least 10 km/h in the case of the NSW fixed cameras).

2.4.5.4 The Victorian Experience

Victoria launched a point-to-point speed camera system on the initial section of the Hume Freeway north of Melbourne on 5 April 2007. Four contiguous sections of lengths 8, 14, 7 and 25 km are covered by five double-camera banks, one at the beginning and end of each section in each direction. Three traffic lanes are covered by each bank of cameras; one camera per lane (but not the emergency stopping lane, which is sometimes used by vehicles trying to avoid surveillance). Vehicle detectors in the road pavement trigger each camera imaging. Some camera banks have cameras facing rearward, some facing forward, and some with cameras facing in both directions. The forward facing cameras are aimed at capturing truck prime-mover number plates, and rearward facing to capture motorcycle number plates. Over the four contiguous sections, the number plates of all types of vehicle are captured more than once, but not necessarily at the beginning and end of each section.

Every vehicle passing a camera is digitally photographed, the image stored, the number plate is optically character recognised (OCR’d) on-site and the characters transmitted to a central computer in Melbourne where they are then matched (where possible) with the registration number captured in the same way by a downstream camera. Following a successful match, if the calculated average speed exceeds the enforcement threshold (same as that used with spot-speed cameras), the two matched images are transmitted from the on-site camera systems and are referred to the infringement processing agency for manual verification. An infringement notice is issued in the same way as other camera-detected speeding offences. Because of this form of operation, apparently there has been no constraint on the length of the section over which average speed is measured, unlike the SPECS systems in the UK.

The system used is the Redflex HDX system which comprises the cameras, OCR computers, transmission equipment and the central computer. Redflex hosts and maintains the central computer, but has no access to the registration numbers, images and other information protected for legal integrity reasons. Redflex also maintains the field cameras and supporting equipment. A type approval system is not used in Victoria, but the Redflex system has been subjected to an equivalent test and acceptance plan. The central computer has the capacity to handle more camera banks and it is understood that the Department of Justice has plans to extend the lengths of highway covered. The camera banks are capable of measuring spot speeds and this extension of their use is being considered; a current Victorian requirement for secondary verification of fixed digital speed camera detected offences inhibits this. The system could also measure average speed over any combination of the four contiguous sections; currently up to four separate assessments could be made, in which case the highest detected illegal speed is prosecuted if more than one offence is detected.

The criteria for installing the system on the Hume Freeway were a relatively high number of fatalities and serious injuries, and a high proportion of heavy vehicle traffic with the attendant potential for severe injury outcomes in crashes. Other criteria were relatively few opportunities (or incentives) to enter or leave the highway between a pair of cameras, so that a
substantial proportion of traffic has its average speed assessed. In Victoria, another current operational requirement is that the speed limit be fixed for the entire length of the section between pairs of cameras. It is understood that this requirement relates to the current absence of an “average speed offence” in the relevant legislation, which could be used to prosecute such an offence over multiple speed limit zones. Currently, the Victorian system is turned off during periods of lowered speed limits due to road works.

About 1,000 offences per day are detected when the system is operational, suggesting an offence detection rate of 1-2% from an estimated 50,000 to 100,000 vehicles per day on the highway. This detection rate is similar to that detected by the covert mobile speed cameras in Victoria. The shorter sections have somewhat higher detection rates, perhaps because there are fewer benefits to speeders who try to avoid detection by stopping or leaving the highway.

The Victorian point-to-point speed camera system appears to differ fundamentally from the Strathclyde A77 system in that it appears to be aimed at deterring speeding over long sections of highway (minimum 7 km) rather than relatively short sections (average 0.5 mile in Strathclyde). While the Strathclyde system also appears to be aimed at covering the full route, less than half of the route (even if allowing for a “halo” effect) is actually apparently enforced by their conspicuous high-mounted cameras. In a sense, the Strathclyde system may be viewed as a variation of the much more common, overt fixed speed cameras operating in the UK. While the “spot” at which the average speed is measured is in fact about 0.5 mile in length, on average, the Strathclyde system apparently does not aim to average the speed over long sections of highway, unlike the Victorian system. The only constraint on the length of the Victorian sections appears to be the current legislative restriction to lengths with a fixed speed limit throughout.

2.5 SUMMARY OF SPEED ENFORCEMENT IMPACTS

2.5.1 Overview of Effective Enforcement Operations

All modes of speed enforcement discussed above have led to at least some positive impact on either casualty crash frequency, crash severity or driver behaviour (as measured by speed). In most cases this effect has been significant. However, whilst many of the enforcement programs share similar traits, there are also some significant differences in the programs. These differences centre around the technology used, whether the operations are overt or covert, the intensity of operation and the target crash population. It is suggested that it is some of these differences that influence the effectiveness of the enforcement programs in the road environments in which they operate. In this context the research suggests the following conclusions:

- The covert operation of mobile speed cameras is effective in reducing casualty crash frequency on arterial roads metropolitan areas and country towns and, to a lesser extent, on highways in rural areas. These devices are also effective in reducing crash severity in metropolitan areas.

- The overt operation of mobile speed cameras is also effective in reducing casualty crash frequency. The impact of the speed camera is greatest closest to the camera site and diminishes with distance from the speed camera site.

- The overt and semi-overt operation of fixed speed cameras has been shown to be effective in reducing casualty crashes in black-spot areas.
Mobile radar devices are effective in reducing casualty crashes in rural areas on undivided roads in 100 km/h speed zones. Analysis of the effects of mobile radar devices in outer metropolitan areas was inconclusive.

Hand-held laser speed detection devices are effective in reducing casualty crash frequency, but not severity, on arterial roads in metropolitan Melbourne.

The Random Road Watch program is effective in reducing crashes of all severity levels in non-metropolitan areas. The effect of the program in metropolitan areas is unclear.

Initial evaluations of point-to-point speed cameras measuring average speeds along a road length indicate the potential of this technology to effectively treat speeding issues along a road length.

The duration of the impact of speed enforcement is another important factor to consider in planning enforcement operations. The analysis of mobile speed cameras and mobile radar devices in Victoria has produced important results in this area as there are some key differences in the operation of these devices. First, the use of speed cameras in Victoria is largely covert and infringement notices issued as a result of speed camera operations are usually received one to two weeks after the offence occurs. In addition, speed cameras are able to detect large volumes of speeding motorists per enforcement hour. In contrast, an offender detected speeding by a mobile radar device is issued with an on-the-spot fine in a deliberately overt manner. Also, the volume of speeding motorists detected by mobile radar devices per enforcement hour is lower than that for speed cameras. Differences in the duration of the enforcement effects are also evident. Speed camera enforcement operations have been shown to impact upon casualty crash frequency during the two weeks after the infringement notices are received. The exact duration of the effect is unclear. On the other hand, mobile radar enforcement was found to have the greatest effect during the four days immediately following the enforcement operations.

Finally, fixed speed cameras generally operate on a continuous basis and where this is not the case, drivers are unable to determine whether a fixed camera is in operation. Therefore it is not reasonable to discuss the duration of the enforcement effects of fixed speed camera operations as the enforcement is never perceived to be removed.

Although it is unclear which of the differences between the mobile speed camera and mobile radar enforcement programs result in the different duration of the enforcement effects, it likely that the duration of the effect of overt speed enforcement programs resulting in visible issuance of on-the-spot fines issued at the time of the offence is likely to be more immediate but shorter than the effect generated by a delayed issuance of infringement notices resulting from covert operations which detect many offences per enforcement hour.

2.5.2 Effects of Overt Speed Enforcement

As with any form of enforcement program, the effectiveness of overt speed enforcement may be due to the effect of specific deterrence, general deterrence or some combination of the two. There appears to have been some conflict as to whether overt enforcement has a significant general deterrence effect. Given the extensive use of overt speed enforcement in many jurisdictions some discussion of this issue is necessary.
First it is noted that the initial introduction of the speed camera program in Victoria involving the overt use of mobile cameras had no overall impact on casualty crash frequency. In addition, some research indicated that no relationship between the amount of enforcement seen by drivers and a driver’s perceived risk of detection could be found. These results indicate that overt speed enforcement operations may not have a general deterrence effect.

On the other hand, more recent research relating to laser speed detection devices found that the use of these devices resulted in a significant decrease in casualty crashes. This supports the proposition that overt enforcement activity can have a significant impact on casualty crashes and has a general deterrence effect that may be localised in space. Further, early evaluations relating to the overt use of fixed safety camera in the UK suggested that the influence of these cameras extended beyond the speed camera sites. It is noted that this effect has not been found in more recent evaluations of the UK safety camera program.

In addition to the localised, general deterrence effect of overt speed enforcement, it has been suggested that some forms of speed enforcement have a specific deterrence effect. This effect is primarily used in the Victorian speed camera program where the receipt of TINs and has been shown to impact on subsequent speeding behaviour, and consequently on the number of casualty crashes occurring. Early research relating to the period from 1990 to 1993 showed that the receipt of TINs for speeding offences resulted in reductions in casualty crashes. However, similar analysis using data from 1994 to 1996 found evidence of reductions in crash severity but not crash frequency as a result of the receipt of TINs.

The change in the effect of the receipt of TINs suggests that the specific deterrence effect of speed camera enforcement may have declined over time. This decline may be in part due to changes in the public’s attitudes towards receiving TINs. The public may have become accustomed over time to receiving TINs and consequently may no longer adjust their driving behaviour. Alternatively, the magnitude of the penalties may not have been sufficient to deter speeding behaviour. Further research into this area is required to determine whether speed enforcement programs continue to have adequate specific deterrence effects.

### 2.5.3 Summary of Speed Camera Operational Modes and their Effects

Table 2.1 shows the diversity of modes of operation of speed camera systems in the Australian states, New Zealand and Great Britain, most of which have been described in previous sections along with evidence of their effectiveness.

<table>
<thead>
<tr>
<th>Fixed installations, usually signed (fixed cameras)</th>
<th>Overt operations</th>
<th>Covert operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>New South Wales</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Great Britain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Known fixed sites - “accident black spots” (mobile cameras)</td>
<td>New South Wales Western Australia South Australia Great Britain</td>
<td></td>
</tr>
<tr>
<td>Fixed sites, randomly allocated cameras (mobile cameras)</td>
<td>Queensland</td>
<td></td>
</tr>
<tr>
<td>Signed speed camera zones</td>
<td>New Zealand</td>
<td>New Zealand hidden</td>
</tr>
</tbody>
</table>
Table 2.2 summarises the effects on crashes at different levels, and the effects on crash injury severity, which have been found in scientific evaluations of the speed camera systems in Table 2.1. Speeding can affect both crash risk and the injury outcome, so many studies have measured two crash criteria reflecting this dual role of speed. A distinction is drawn between whether the research has found the crash effect to be localised around the speed camera site (local effect), whether the effect is generalised over the jurisdiction (general effect), or whether both effects have been evaluated.
Table 2.2: Measured effects of speed cameras on crashes and crash injury severity
(percentage reductions in road trauma shown as negative values)

<table>
<thead>
<tr>
<th>Type of site: Effects On crashes:</th>
<th>OVERT OPERATIONS</th>
<th>COVERT OPERATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jurisdictions operating automatic cameras in this way</td>
<td>Fixed installations, known fixed sites, signed sites/ zones</td>
<td>Fixed sites, randomly allocated operations</td>
</tr>
<tr>
<td>Great Britain New Zealand New S. Wales W. Australia S. Australia</td>
<td></td>
<td>Queensland (3000 hours per month)</td>
</tr>
<tr>
<td>Serious casualty crashes</td>
<td>Local effect [GB]: - 65% (fixed cameras) - 28% (mobile cameras)</td>
<td>Doubling camera hours (2003) - Added general effect: - 9%</td>
</tr>
<tr>
<td>Serious casualty crashes</td>
<td>Local effect [NZ]: - 23% (mobile cameras). General effect: - 13%</td>
<td></td>
</tr>
<tr>
<td>Casualty crashes</td>
<td>Local effect: - 35%. General effect: - 26%</td>
<td>Added general effect: - 11%</td>
</tr>
<tr>
<td>Casualties per casualty crash</td>
<td></td>
<td>Added general effect: - 9%</td>
</tr>
<tr>
<td>Serious casualties per crash</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fatalities per crash</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material damage crashes</td>
<td>Local effect: - 20%. General effect: ≈ - 10%</td>
<td></td>
</tr>
</tbody>
</table>

2.6 SEAT BELT ENFORCEMENT

2.6.1 Australia
In Australia the majority of vehicle occupants use a seat belt (96%). According to Victoria’s Transport Accident Commission’s TAC’s website (www.tacsafety.com.au) seat belt usage amongst vehicle occupants killed remains a major issue. In recent years, approximately 20% of vehicle occupants killed were not wearing a seat belt – on average 45 people per year. A higher proportion of those killed were unrestrained rear-seat passengers compared to driver and front seat passengers.

The law regarding seat belt use requires that:

- Every person traveling in a car must wear a seat belt or a child restraint if one is available;
- The driver must ensure that the law is observed by each passenger under 16 years of age;
- A child less than one year old must be restrained in an approved child restraint;
- A passenger at least one year old and under 16 years of age must be held in a child restraint or seat belt.
- Seat belts and child restraints must be properly fitted and adjusted.

A TAC study on seat belt usage found that over 50% of vehicle occupants involved in fatal crashes were intoxicated. Of the 44 drivers and passengers killed in 2007 who were not wearing a seat belt (and whose BAC reading was known), 59% were intoxicated.

Market research studies conducted in 2007 found that the most common reasons that people gave for not wearing a seat belt were that they forgot (34%); they were only traveling a short distance (22%) or they could not be bothered (10%). In addition, some rear-seat passengers falsely believe that being in the back seat is safer than being in the front seat.

The TAC aims to increase the wearing of seat belts by working with other organizations and community groups such as Victoria Police and VicRoads. The TAC supports the increased enforcement of seat belt use particularly in rural areas, and aims to work closely with police in high risk areas to address a number of road safety issues including targeting seat belt wearing.

A review of the Australian and international literature relating to seat belt enforcement was given in Zaal (1994). The Zaal study reviewed Australian and international literature relating to traffic law enforcement including seat belt enforcement.

Zaal (1994) stated that increasing the level of seat belt usage requires a co-ordinated approach involving enforcement, educational and engineering measures.

The recommendations and conclusions reached from this review were as follows:

i) Legislation should be based on the policy of ‘primary’ enforcement in order to support the increased use of more active enforcement operations;
   o Wearing rates of over 90% can be achieved where seat belt laws are actively enforced.
   o The compulsory use of laws for all seating positions should be an immediate priority.
   o The fitting and wearing of child restraints such as baby capsules, child seats and booster seats should be mandatory.
ii) Information obtained from automated speed enforcement operations should be used as a means of detecting seat belt offences and significantly increasing the actual and perceived risk of apprehension;
   o This is because seat belt offenders tend to be high-risk road users who may have incurred speeding offences.
   o Also seat belt effectiveness and speeding are directly related because the greater the speed the higher the chance of sustaining a serious injury by not wearing a seat belt.

iii) The most cost effective enforcement strategy is one which ensures seat belt checks are adopted as a standard operational procedure when undertaking other traffic policing activities that require roadside stopping of motorists;
   o It should be noted that this enforcement strategy may be difficult to implement because of the potential reluctance or poor motivation by police to actively enforce seat belt laws.
   o It is recommended, therefore, that the implementation of police education programs, performance incentive schemes and supporting publicity may help increase motivation towards seat belt enforcement.

iv) Periodic high intensity enforcement strategies (‘blitzes’) should be developed and implemented;
   o Zaal (1994) quotes that “This type of enforcement operation has been shown to be the most effective means of bringing about sharp and sustained increases in seat belt wearing rates”.
   o These ‘blitzes’ should also be supported by police education programs, sustained high levels of publicity and evaluation studies of seat belt enforcement.

v) Enforcement activities should be supported by high levels of publicity and program evaluations should be undertaken to provide police and public with feedback;
   o Publicity programs can improve the effectiveness of seat belt enforcement operations by increasing the perceived risk of apprehension.

vi) Police education programs should be developed to promote the safety and cost benefits associated with seat belt enforcement operations;
   o Education programs are necessary to increase Police motivation and raise awareness regarding the benefits of seat belt enforcement.
   o These programs should provide police with structured guidelines regarding the development of the most effective and appropriate seat belt enforcement strategies.

vii) The implementation of seat belt incentive programs should be more extensive;
   o Zaal (1994) states that incentive programs are an effective alternative to enforcement operations, and may have a more sustained long term effect on wearing rates.
   o Also the use of incentive programs combined with enforcement operations may be effective in increasing seat belt wearing rates.

viii) The use of feedback devices designed specifically to remind occupants to use their seat belts, should be actively promoted. These feedback devices include in-vehicle
seat belt warning devices, seat belt usage stickers on dashboards and seat belt interlock devices.

2.6.2 Europe and North America

The European Union’s PEPPER project on traffic law enforcement included a systematic review of evaluation studies concerned with seat belt enforcement (PEPPER D9, 2008). This review applied meta-analysis techniques to assess the best estimates of enforcement measures on crashes and behaviour. The findings of this review are summarized as follows:

The PEPPER review considered the following types of seat belt enforcement measures:

- Stationary control at a roadside – mostly combine with speed-related or DUI (Driving Under the Influence) enforcement.
- Canadian and U.S.A. STEP Program
- Combinations of checkpoints and mobile controls
- Educational enforcement of use of child restraints with leaflets and warnings instead of fines.

The majority of the studies considered in this review investigated the effects of seat belt law enforcement on seat belt wearing, under the following conditions:

**Drivers, front and back seat passengers:** Effects of seat belt enforcement have been investigated on car occupants in different seating positions: drivers, front seat occupants, front seat passengers, and back seat passengers.

**Daytime vs. night time:** Most studies have not specified whether effects have been investigated at day or at night. Three studies have investigated effects on seat belt wearing at day and at night separately.

**Visibility of enforcement:** Most studies have investigated seat belt enforcement that was not signposted or there where no information whether or not signposting was used. Only two studies have specified that seat belt enforcement was signposted.

**Randomization:** In most of the studies randomization procedures are not clearly specified. Subgroup analyses have therefore not been conducted.

**Change of type or amount of enforcement:** All studies refer to either increased seat belt enforcement or to a combination of increased and changed seat belt enforcement.

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5 Meta-analysis is a technique that is used to calculate best estimates of the effects of a particular enforcement measure by a weighted average across a large number of studies. The weights reflect the degree of reliability of each estimate of effect found in the individual studies.
Country: Most studies have been conducted in the Netherlands or USA. Some studies have also been conducted in Australia, Belgium and Canada. Subgroup-analyses are conducted for each of these countries.

Publicity: The studies have been classified according to the amount of accompanying publicity resulting in four subgroups: A) No publicity B) Local publicity C) Publicity campaign, i.e. enforcement is accompanied by a campaign incl. a mass media component, and D) Seat belt enforcement is part of a wider enforcement program, most likely including publicity.

Study methodology: All studies have compared seat belt wearing rates before and after the amount of seat belt enforcement has been increased/changed. Six studies have used a control group and in the remaining studies no control group has been used.

The meta-analysis of seat belt enforcement in Europe and Northern America found a statistically significant overall increase in wearing rates of 21% ‘during’ the enforcement period, and a 15% increase in the period ‘after’ the enforcement had taken place across all the seat belt enforcement studies.

Other findings included:

- seat belt enforcement was found to be more effective in the USA than in other countries when regarding before-during comparisons, and least effective in Belgium,

- in before-during comparisons a larger increase of seat belt use was found in studies which have not applied a control group; however, in before-after comparisons the difference between studies with and without a control group was only small,

- there were systematic differences between the effects of the enforcement on drivers and on front seat passengers,

- seat belt enforcement was found to be more effective in increasing seat belt use at night; this result refers only to before-during comparisons and is based on only one study,

- an increase of seat belt enforcement is more effective than a simultaneous increase and change of the type of enforcement,

- seat belt enforcement that is conducted without sign-posting (covert) is more effective than sign-posted (overt) enforcement,

- local publicity and publicity campaigns increase the effectiveness of seat belt enforcement compared to no publicity accompanying the enforcement.

The study that investigated the effect of enforcement on the use of child restraints found a non-significant 15% increase in the use of child restraints. It should be noted however that drivers of vehicles in which child restraints were not properly used received warnings rather than fines.
In conclusion, the overall result was a significant increase in the seat belt usage rates following police enforcement. Larger increases in seat belt usage were consistently found in comparisons of seat belt use before and during the implementation of enforcement measures.

**Seat Belt Enforcement Data in Europe**

The European Commission’s ESCAPE project, included an overview of the type of seat belt enforcement data that should be collected by European Police (ESCAPE D9, 2001). This is summarized below.

Enforcement data collected by European Police include Police working hours and sanctions produced (such as infringement tickets/notices and warnings). There is also a need to collect more detailed data to provide a description of police enforcement and to estimate the various indicators of enforcement activity. These indicators can be collected and reported on a weekly, monthly or yearly level applied to the whole road network or to specific enforcement sites.

With regard to the enforcement of seat belt use it is recommended by European Police that citation numbers are collected for each car occupant involved as well as the total number of drivers controlled by police. If sufficient data is collected separate estimates of seat belt use can be made by day/night hours; by weekday/weekend use; by rural versus urban areas; by enforcement areas (as indicated by the administrative subdivision of the police); by different vehicle types and by sub-groups of apprehended drivers.

The measures of enforcement of seat belt usage should be compared with the objective measures of traffic such as the number of vehicle-kilometres traveled, the number of registered vehicles, the number of licensed drivers or the general length of the road network. This analysis should be performed annually, and the estimates of seat belt usage should be collated and compared over the years.

It is also recommended that a periodic general overview of the available police resources in each country be made. This would involve comparing the available number of the police resources with the objective measures of the need for traffic enforcement services annually. Based on traffic predictions, some evaluations of the future police needs can be supplied. The overview of police resources would influence all types of enforcement not just that of restraint use.

Data on changes in drivers’ behaviour, changes in drivers’ attitudes and changes in road trauma can then by analysed to evaluate the enforcement effects.

The ESCAPE Working Paper 12 recommends regular behavioural surveys of seat belt usage. The surveys should be conducted in fine weather during a non-holiday period and last on average two weeks. A wide range of sites should be covered to provide representative samples for urban and rural areas; for long-distance and local traffic; for high and low traffic volumes and for weekday/weekend travel. The observations are carried out during the red phase of traffic lights at intersections (or when the vehicle stops/slow down before traffic signs), and at entrances to car parks and shopping centres. Usually the observer registers the seat belt usage that can be observed through the vehicle window. However, it is also possible for the observer to ask the vehicle occupant’s age and other demographic details or when the vehicle is stopped by the police in connection with other operations, e.g. drink-driving blitzes. The number of hours of observation per site varies depending on traffic volume and sample demands. At least several ten thousands of vehicles should be sampled in total. Wearing
rates should be estimated for drivers, front- and back-seat passengers, and for children wearing child restraints. Separate estimates should be made, if possible.

2.6.3 France

The European Traffic Police Network (TISPOL) gave an overview of good practice of seat belt enforcement in France (www.tispol.org).

In France, enforcement of seat belt use is usually an integrated part of all kinds of traffic operations. However, seat belt enforcement activities can also be performed as an enforcement activity combined with the check on mobile phone usage. For these enforcement operations at least 5 police officers are required. One police officer in an unmarked patrol car is positioned at a spot where the traffic and the non-wearing of a seatbelt can be observed.

Another example of good practice of seat belt enforcement involves the following types of operations:

a. **An unmarked patrol car at a fixed location:** This location is usually at traffic lights where a motorist stops at a red traffic light signal. In addition to seat belt wearing behaviour, the use of mobile phones, ignoring red traffic lights and other driver behaviours can be observed, as well as the status of the vehicle. For these operations, four uniformed police officers on motorcycles will be on surveillance on the specific road and will be informed by radio about the offenders detected by the officer in the unmarked car. The preventive value of this kind of enforcement is the visibility of the four motorcyclists riding on the road, as well as the unmarked patrol car.

b. **An unmarked patrol car in floating traffic:** The unmarked car is driving on the road and observing other motorists. On the road not too far ahead from the unmarked patrol car, two pairs of police motorcyclists are doing traffic surveillance and are awaiting instructions from their colleague in the unmarked vehicle. The officer in the unmarked car detects specific traffic offences such as non-use of seat belts, red-light running, illegal overtaking, tailgating, mobile phone use, speeding and other dangerous behaviours. The observer then sends this information to the motorcyclists after which the offending driver will be stopped by one or two of the motorcycle police. This procedure can be quite complex as the observer has to observe and detect the improper behaviour, identify the type of vehicle and its number plate and be able to identify the offending driver. Depending on the situation, motorists stopped by the police can also be breath tested for alcohol.

2.6.4 The Netherlands

Research by SWOV in the Netherlands (SWOV, 2007) has found that more intensive police enforcement of seat belt wearing has improved seat belt use. This is partly because the extra police enforcement was supported by national and regional mass media campaigns.

During the 1980s seat belt wearing campaigns in the Netherlands consisted of a combination of police enforcement and publicity (Goldenbeld, 1993). These campaigns led to an increase in seat belt use which continued at least three to six months after the campaign. More recently, Mathijszen and De Craen (2004) found that front seat belt use in cars was 8-14%
greater in police regions with a regional traffic enforcement plan than in regions that did not have such a plan. In addition they estimated the effect of the intensified police enforcement of seat belt wearing and its effects on reducing road trauma. For the Netherlands as a whole they estimated that the increased seat belt use resulting from intensified police enforcement in combination with publicity campaigns, saved 3% of all road fatalities – approximately 30 deaths annually between 1994 and 2001.

2.6.5 Other European Studies

Many studies have shown that police enforcement increases seat belt use, especially if combined with other activities such as publicity campaigns. Substantial increases have been achieved in studies reported by Jonah, Dawson and Smith (1982), Jonah and Grant (1985) and Gundy (1988).

It is recommended by the European Transport Safety Council, that the best way to achieve increases in seat belt use is through intensive, highly visible and well publicised enforcement. Studies have shown that “blitzes” lasting one to four weeks, can be very effective in producing sharp increases in seat belt wearing. To achieve long-term effects they should be repeated several times a year. High levels of publicity are crucial for optimizing the effects of the enforcement (ETSC, 1999). Gundy (1988) found that seat belt wearing rates remained above the original baseline level after two years. The STEP enforcement and publicity campaigns carried out in Canada have also been shown to be effective (ETSC, 1996).

The European Commission recommends that seat belt enforcement operations be carried out at least three times a year, with each operation lasting at least two weeks. The operations should be carried out predominantly in those locations where there is an increased crash risk. Seat belt enforcement operations can be combined with other types of enforcement such as drink-driving or speeding operations. It is important that every detected offence be properly followed up and that sanctions are appropriate and dissuasive.

During 2006, the cost-benefit ratio for seat belt enforcement was 1:10 according to European Commission Recommendations. This ratio was estimated under the assumption that universal seat belt use could prevent 6,000 deaths and 380,000 injuries in Europe annually.

As an alternative to enforcement, incentive programs have been devised in which seat belt use is monitored and seat belt wearers are eligible for a reward – such as lottery tickets, video recorders or free holidays. In general, these incentive programs appear very effective. Hagenzieker (1997) conducted a meta-analysis of 34 studies investigating the effects of incentives on seat belt use and found the effect size to be related to the target population, the initial baseline rate and the immediacy of the rewards. Incentive programs were generally found to have a higher level of acceptance that strict enforcement programs.

It is also recommended by ETSC (1999) that the last 10% of unbelted occupants that cannot be reached by enforcement or incentive programs be targeted through technological solutions. For instance, based on Swedish studies, intelligent warning systems when seat belts are not used, provide an effective method if the warning is sufficiently aggressive. An even better result could be achieved by compulsory interlock systems.

In summary the ETSC (1999) study found that:
• police enforcement appears effective in increasing wearing rates;
• blitz campaigns involving very high levels of enforcement over a short period of time can result in long-term effects;
• high levels of publicity optimize the effects of the enforcement;
• incentive programs are a viable and effective addition to enforcement;
• activities to increase seat belt wearing rates are highly cost-effective.

2.6.6 Seat Belt Legislation in the European Union

European Union legislation that is currently in force requires that all occupants of passenger cars and light vans use seat belts. Children under 12 years of age have to be restrained by an approved restraint system suitable for the child’s height and weight.

In 2003, legislation was passed that requires the mandatory use of seat belts to occupants of all motor vehicles including trucks and coaches. It also mandates the use of appropriate child restraints for all children traveling in passenger cars and light vans. The only permissible exemption concerns children under 3 years of age who may or may not wear seat belts (lap belts) in coaches.

2.7 HEAVY VEHICLE ENFORCEMENT

2.7.1 New Zealand

In New Zealand enforcement relating to heavy vehicles is managed nationally by the Commercial Vehicle Investigation Unit (CVIU). This unit monitors enforcement for trucks, buses, taxis, couriers, mobile cranes and mobile homes. The unit employs 88 Enforcement Officers and four Vehicle Safety Officers.

“The primary activities of the CVIU are:

• Certified pilot scheme
• Driving hours and logbooks
• Investigation of serious commercial vehicle crashes
• Road user charges
• Road and bridge weight limits
• Vehicle fitness
• Transport licensing
• Vehicle and load dimensions
• Passenger safety
• Load security and
• Dangerous goods” (CVIU, 2008)

Annual inspection rates average about 140,000 vehicles per year and result in approximately 25,000 offences/yr. Vehicles are examined for safety compliance and road user compliance. Safety compliance includes the following: evidence that vehicle inspection is current; there is no obvious vehicle safety defect; the load is secure; and driver and passenger restraints are worn (when fitted). Road user compliance is examined in relation to holding and displaying the correct licence in relation to the vehicle and load specifications, and that a distance...

2.7.2 Singapore

In recognition of the high fatality rates associated with heavy vehicle crashes, the Singapore Land Transport Authority (LTA) in conjunction with the Police Department are developing public education material and targeting education campaigns within the industry at heavy vehicle associations, vehicle owners and drivers. Coinciding with this increased educational focus has been legislative changes such as increased penalties and a greater emphasis on enforcement activities. Heavy vehicles are restricted to 60 km/hr and must travel in the left lane of the carriageway unless overtaking. First time offenders face fines ranging from $100 to $1000, with repeat offenders facing fines of $2000 and jail sentences of up to six months. Enforcement targeting speeding, tampering with speed limiters and road hogging resulted in over 1,400 summonses during the first six months of 2008. Crash trends and traffic violation data are regularly analysed to monitor the effectiveness of these initiatives, as well as regular reviews of speed limits and current traffic conditions. (Tay & Lim, 2008).

2.7.3 Europe

The following European information was extracted from the Commercial Motor Vehicle Size and Weight Enforcement in Europe technical report (American Trade Initiatives, 2007). “The European Traffic Police Network (TIPSOL) provides a framework for multinational, coordinated highway enforcement actions. The European Union and FEHRL provide the framework for administration of large-scale, multiyear coordinated research efforts.

2.7.3.1 Slovenia Bridge Weigh-in-Motion (Slovenia, France)

B-WIM was initially identified in the late 1970s in the United States and developed in the WAVE Project. European researchers continued to advance field testing and applied research of the concept, leading to its widespread deployment in Slovenia. B-WIM is a vital component of Slovenia's commercial motor vehicle weight monitoring system and is used to prescreen commercial vehicles for weight enforcement purposes. SiWIM in Slovenia was developed and implemented through a partnership between staff at the National Building and Civil Engineering Institute's (ZAG) Research Department and a private engineering firm, CESTEL. Deployment of Slovenian SiWIM targets short-deck (5- to 10-meter) orthotropic bridges. Extensive research into the bridge deck's reaction to weights has led to the ability to estimate, within acceptable levels of accuracy for prescreening, a vehicle's static weight. Analysis and data collection leading to this capability centered on the behavior of the "influence line" when truck weights are applied to the bridge's deck. Weight-detection instrumentation is applied at the under-deck location of the structure, eliminating the need to disrupt traffic flow during installation. Multiple sensors are used to monitor travel lanes, and a sensor data hub or cabinet feature draws readings from the individual sensors and generates a composite of the deck loading readings. Axle weights, gross vehicle weights, axle spacing, vehicle speed, and vehicle class are captured through this data collection approach.

The Netherlands is analyzing its inventory of structures to determine the number and location of bridges where B-WIM could be deployed. Recently, one bridge WIM system was installed for testing under Dutch highway conditions. In France, significant applied research efforts are concentrated on advancing the use of B-WIM on multiple-span, multiple-lane structures and steel orthotropic deck bridges. The target of research is the filtering of sensor readings from several vehicles on the bridge deck simultaneously. The scan team visited the Autreville
orthotropic steel bridge site on the A31 motorway outside of Nancy, France. French hosts provided a tour of the site layout and demonstrated the SiWIM under testing.

Because it eliminates the need to disrupt traffic flow and minimizes the worker risk involved in installing traditional roadway telemetry, B-WIM was seen to possess major benefits over U.S. practices. Also, as seen in Slovenia, the time required for installation is not significant and, once bridge deck superstructures are instrumented, BWIM is highly portable. In Slovenia, five SiWIM devices are used to collect data for 1 week at 30 locations twice a year. Applications of B-WIM in the United States would enhance pre-screening capabilities for commercial motor vehicle weight enforcement, as well as provide important information to bridge management systems. The choice of a suitable bridge and the development of an appropriate instrumentation plan and related calibration procedures may be challenging and require a high expertise level.

2.7.3.2 Swiss Heavy Goods Vehicle Control Facility (Switzerland)

In an effort to protect highway tunnel facilities and roadway infrastructure from the impacts of heavy trucks, Switzerland has developed and implemented an efficient and effective approach to simultaneously measuring commercial vehicle size and weight at stationary enforcement locations. The system also includes a high-speed WIM (HS-WIM) and video (VID) technology component used to prescreen strategically selected trucks requiring additional measurements.

Mobile enforcement details escort vehicles into the facility for additional measurements using the HS-WIM/VID prescreening capability. Vehicles are directed onto a weigh bridge (i.e., static scale pad instrumented with several load cell scales) that provides simultaneous axle and gross vehicle weight measurements. An overhead gantry fitted with laser scanners capable of capturing commercial vehicle length, height, and width measurements is used simultaneously.

An attractive element of the Swiss heavy goods control facility operation is the user-friendly presentation of data to enforcement officers operating the system. A horizontal line on the computer screen represents legal axle and gross vehicle weight allowances with violations clearly shown as exceeding this allowance line. Size dimensions exceeding legal allowances are highlighted in red on a three-dimensional model of the vehicle. Size- and weight-related citations are generated automatically for issuance to the vehicle operator and submission to the appropriate judiciary officials. Swiss enforcement personnel described the advantages of this system over the traditional portable scale and manual measurements efforts. More accurate measurements are achieved with less manpower, resulting in more effective enforcement in considerably less time. The Swiss operate three control centers, with additional centers in the planning and development stages.

2.7.3.3 Prescreening for Mobile Enforcement (Slovenia, Switzerland, the Netherlands, and France)

Similar mobile enforcement activities are used in: Slovenia, Switzerland, the Netherlands, and France with common features and elements in each. High-speed WIM technology is used in each case for mainline prescreening of suspected overweight commercial motor vehicles. Video capture (i.e., digital photo images) of the vehicle is triggered by overweight detections. Both weight and image data are transmitted via short-range communications to enforcement
personnel, allowing them to identify appropriate commercial vehicles in the traffic stream and escort them off of the mainline for further investigation. Such systems are referred to as WIM/VID in Europe. Such approaches were embraced by the COST 323 action and are used widely by EU member nations.

(https://international.fhwa.dot.gov/pubs/pl07002/vsw_eu07_06.cfm)

2.7.3.4 Behavior-Based Enforcement Activities (the Netherlands and France)

Using the European WIM/VID (photo) approach of simultaneously capturing a digital image of the vehicle when an overweight condition is detected, officials in the Netherlands and France have gained additional knowledge of the trucking firms most frequently operating in an overweight condition. This information is captured continuously (i.e., 24 hours a day, 7 days a week), regardless of whether a mobile enforcement activity is taking place. Historical WIM information is reviewed, typically on a monthly basis, to determine trucking firms that most frequently engage in overloading practices. Enforcement officials contact the most frequently offending firms to encourage compliant loading behavior. Following this contact, the trucking firm then begins a probationary period. If no positive change is observed through continued monitoring by the WIM/VID systems, graduated enforcement actions are taken. France is just beginning a 3-year study to determine the effectiveness of this process.

(https://international.fhwa.dot.gov/pubs/pl07002/vsw_eu07_06.cfm)

2.7.3.5 Synthesis of Safety Implications of Oversize/Overweight Commercial Vehicles (Belgium)

Justification and authority for the conduct of commercial vehicle weight enforcement are vested in the public's interest in preserving highway infrastructure and promoting a climate of equity and fairness among trucking firms (e.g., not allowing violators to be rewarded at the expense of law-abiding firms). These same principles and interests were reported in each of the European countries visited. In addition, several countries visited identified safety as a primary motivator for commercial vehicle size and weight enforcement. In Belgium, officials have linked weight enforcement activities to the public's interest in safe operating conditions on the highways. After years of weight and speed data collection and analysis, Belgium officials noted direct relationships between excessive speed by overweight vehicles involved in highway accidents and the frequency of fatalities occurring in accidents including such vehicles. As such, they were able to build the case to their legislative leaders that weight and speed needed to be aggressively regulated. To control speed, governors, or speed-monitoring devices, are installed on trucks to control their maximum speed. Speed violations are treated as criminal offenses because excessive speeds can be achieved only as a result of tampering with the speed-control devices.

(https://international.fhwa.dot.gov/pubs/pl07002/vsw_eu07_06.cfm)

2.7.3.6 Effective Use of WIM Data: The Dutch Case Study (the Netherlands)

In the Netherlands, every Wednesday morning at 7 a.m., an e-mail with an attachment detailing the frequency of truck weight violations by location, time of day, and day of the week is distributed to enforcement personnel responsible for scheduling enforcement actions and transportation personnel charged with infrastructure condition monitoring and multimodal freight planning and forecasting. The data report is a product of an extensive database management operation constructed by Dutch officials. Extensive quality control and quality assurance protocols have been built into the operation of this data management system.”

(https://international.fhwa.dot.gov/pubs/pl07002/vsw_eu07_06.cfm)
2.7.3.7 Heavy vehicles and overload enforcement (Finland)

Although the Finnish National Police have been undertaking heavy vehicle enforcement for over 50 years, around 100 fatal heavy vehicle crashes occur annually. Even though the cause of the crash is often attributed to the other smaller vehicle there is still a high likelihood of fatalities due to the mass inequality between the two vehicles. Articulated vehicles in Finland are amongst the longest and heaviest in the EU.

In response to the increased numbers of heavy vehicles on the roads and to align with the standardised EU regulations the Finnish Police are required to meet the following enforcement criteria:

- check up 1,500 transports of dangerous goods per year
- perform 14,000 road side checks per year
- check that the drivers are following the rules of the daily rest (segment of 100,000 work days)
- When performing the heavy vehicles enforcement the police will check:
  - overall condition of the driver and the vehicle
  - overloads and cargo securing
  - driving and resting times
  - valid operation permits
  - the following of ADR/VAK -regulations (special transportations and transportations of dangerous goods)

(Finnish Police, 2008)

2.7.4 Australia

2.7.4.1 New South Wales

“Heavy trucks travel more than 3.5 billion kilometres per year in NSW. Although they make up around 2% of vehicles registered in NSW, heavy trucks represent 6% of the kilometres travelled in the State and are involved in on average 17% of fatal crashes. In NSW an estimated 75% of heavy truck fleets are short distance operations (ie less than 100km from base), with only 25% being long haul. The heavy truck industry is characterised by a small number of large trucking companies and a large number of small companies (ie often one truck and driver). A high proportion of heavy truck fatal crashes are head on crashes (first impact type) (40%). In the vast majority of these, the vehicle on the wrong side of the road is not the heavy truck. The majority of heavy truck drivers involved in fatal crashes are from NSW (75%). Highways account for over half (55%) of the heavy truck fatal crashes in the State, with the majority of fatal truck crashes in each RTA Region, except Sydney, occurring on highways. Increased speed means an increased risk of crashing and increased severity of the crash. About 12% of heavy truck fatal crashes involve a speeding heavy truck. Data from RTA speed surveys show that a high proportion of heavy vehicles on highways/freeways exceed the speed limit, while a small but significant number travel at very high speeds.”

(RTA, 2003)

The Enhanced Enforcement Program (EEP) is a joint initiative between the NSW Police and the RTA. The target of the EEP on the Pacific Highway is to increase police visibility and has resulted in providing one extra hour of enforcement for every five baseline traffic policing hours. Between October 2003 and February more than 7000 heavy vehicles were inspected on this highway. The RTA has introduced an enforcement strategy that spans from Sydney to the
Queensland border with enhanced enforcement along the Pacific, F3 and New England Highway.

The RTA Inspectors key role is to:

- Monitor heavy vehicle driving hours
- Inspect heavy vehicles for roadworthiness
- Inspect heavy vehicles for mass and load restraint
- Inspect heavy vehicles for dimensions
- Detect incidents of heavy vehicle speeding through Safe-T-Cam
- Collect information to build profiles on operators and drivers
- Investigate and report on heavy vehicle crashes
- Monitor and report on heavy vehicle Safe-T-Cam avoidance.

(RTA, 2004)

The RTA inspectors check logbooks at the roadside cross referencing with RTA records using in vehicle computer equipment. Safe-T-Cam is used to monitor heavy vehicle passage and detect any avoidance attempts. Mechanical inspection are undertaken to check for roadworthiness especially regarding brakes as in a 2003 survey 5% of trucks sampled were found to have brake defects. Mobile vehicle Inspection Trailers with roller brake testing equipment are used for these checks.

Enhanced police enforcement is also planned between the Police Co-ordinator and the RTA to maximize the effectiveness of enhanced enforcement activities. The main focus of the police is on Heavy vehicle speeding, dangerous driving behaviour and the use of illegal drugs by heavy vehicle drivers. (RTA, 2004)

2.7.4.2 South Australia

The following information is extracted from a presentation by Rhodes (2007).

“South Australia Police introduced a ‘Heavy Vehicle Enforcement Liaison Group’ which is chaired by police and includes Transport SA Safety Compliance Inspectors and Transport Safety Investigators, Workplace Services Inspectors and Heavy Vehicle Examiners/Accreditation/Permits Inspectors. This group meets every month to discuss heavy transport compliance and enforcement issues particularly relating to targeted enforcement. Verification of compliance and persistence in targeting recidivist noncompliance is considered essential to maximise enforcement potential and road safety outcomes. Good intelligence to sustain interception of targets is also invaluable to maximise efficient enforcement resource deployment.

South Australia Police have formed a Heavy Vehicles Enforcement Group to investigate issues that are determined to negatively impact upon road safety.

“The enforcement response must be tailored, but this requires resources, skill and time. Enforcement can also be more focused by developing risk based enforcement strategies, for example by concentrating enforcement efforts on high risk firms.”

The Group focuses upon the road freight transport sector and targets certain drivers and operators who have been assessed by intelligence analysis to provide higher road safety risk. The number of personnel allocated to this Group is dynamic and staffed according to identified task needs. This Group is supported by the permanent allocation of a Field Intelligence Officer from the Traffic Intelligence Section.
Data accessible to the TAC Group is collated from a wide variety of sources. These include industry contacts, informants, criminal history, traffic offence history, road crashes, traffic volumes, vehicle classifications, information on culture and practice, driver and operator preferences and route selection. Safe-T-Cam traffic camera journey information and checking station sightings can assist.

A management process has been developed which allocates responsibility and accountability. Operators and drivers determined to be high risk are identified by content provided within intelligence target packages produced by the Traffic Intelligence Section who have collated, analysed and formed assumptions from the available data.

Intelligence analysis about emerging patterns by individuals, groups or organisations is then provided to a management team at Traffic Support Branch who determine prioritisation of police resources. A target package that has been authorised for action is then provided to the Heavy Vehicle Enforcement Group. The management team provide parameters to indicate timeframe, feedback requirements, resources and priority to the task. The Group investigators determine shifts, locations and tactics to locate and process targets. Enforcement actions result in a number of outcomes, including the grounding of drivers (for up to 24 hours) and the issuing of Infringement notices, court prosecutions, seizure and forfeiture of property, referral to drug diversion counselling and vehicles being defected (major/minor).

Issues:

- Identified significant none compliance to ADR 65 Speed Limiting
- provisions – tampering, bypass and devices
- Located illicit drugs – possession for sale
- Located illicit drugs – personal use
- Located additional regulation log books
- Located radar detectors
- Located weapons
- Located Cash
- Located ‘Chop Chop’ Illicit tobacco product
- Dangerous Goods (mixed DG cargo with food produce)
- Brakes of prime movers wound off
- Evidence of poor vehicle maintenance
- Seat belts removed
- Brake and cabin lights isolation switches
- Hinged registration number plates
- Tampering and removal of compliance plates
- Grinding off of trailer identifiers
- Lack of adherence to fatigue management regulations and guidelines
- Speeding
- Attempts at avoidance
- Prevalence of recidivists offenders

Police frequently conduct mechanical examinations (involving climbing in, around and under the vehicle) at the roadside interception in an attempt to locate any equipment modifications suspected to contribute in noncompliance to ADR 65 or examine for vehicle roadworthiness.
Many causal factors may contribute to the frequency and occurrence of the issues listed above routinely discovered by police. Those mentioned here are not exhaustive and are mentioned to evoke discussion.

- Profit motivation (how much is enough?)
- Fierce competition (low margins)
- Poor business acumen (know your costs)
- Perception of Risk (likelihood of being caught wrongdoing?)
- Risk Taker culture (a proportion of risk takers – law breakers)
- Workplace culture (reluctance to change?)
- Drug addiction (frequency of use, more you take – more you need)
- Communication (Knowledge of changing regulatory requirements)
- Driver standards (shortage of skilled drivers)

South Australia Police consider the Heavy Vehicle Enforcement Group approach demonstrates a relatively low cost strategy which provides best use of resources. This Group targets high-risk drivers and operators. South Australia Police work together with the Department for Transport, Energy and Infrastructure (DTEI) and other enforcement agencies to pursue road crash reduction strategies targeting those within the transport chain who may negatively and routinely influence unsafe on road performance. It is imperative that those who are in a position to influence safe on road behaviour and operations by transport drivers be held accountable for deliberate inappropriate decisions and intentional disregard for road safety.

South Australia Police continue to work together with representatives of the road transport sector and our community, striving to contribute to road crash reduction and improve conformity to road laws to achieve a safer on road environment.” (Rhodes, 2007).

2.7.4.3 Victoria

By focussing on improving compliance and changing behaviours within the heavy vehicle industry in Victoria there is an aim to reduce the heavy vehicle fatalities by 22 lives per year by 2017. The Road Safety Task Force Highway Unit releases a quarterly bulletin titled Highway 318. This bulletin details information on heavy vehicle enforcement operations (Millar, 2008).

Vic Roads Transport Safety Services (TTS)

The aim of VicRoads Transport Safety Services (TSS) is to improve heavy vehicle road safety and protect roads and bridges from damage, by ensuring that heavy vehicles comply with heavy vehicle regulations. This is done by providing industry liaison, education, accreditation and management of overmass/overdimension load movements, and is complemented by enforcement. The TSS:

- Intercepts about 61,500 heavy vehicles a year, checking them for weight, dimensions, roadworthiness, work diary compliance, and other safety related issues;
- Works with other government departments such as the Victoria Police, WorkSafe and EPA Victoria;
- Facilitates the accreditation of operators to schemes such as the mass and maintenance modules of the National Heavy Vehicle Accreditation Scheme;
- Issues about 15,000 mass and dimension permits each year to allow the safe movement of large vehicles and indivisible loads, and special purpose vehicles; and
• Escorts vehicles carrying very large loads.

(Vic Roads 2008a)

Heavy Vehicle Licence

After you obtain your heavy vehicle endorsement you can drive the vehicle under certain conditions and restrictions. When driving you must:

• only drive a vehicle fitted with synchronmesh transmission (B restriction) if you were tested in a vehicle with synchronmesh transmission
• drive a vehicle fitted with any type of transmission if you were tested in a vehicle fitted with non-synchronmesh transmission
• have a zero blood alcohol limit when driving any bus or any truck that exceeds 15 tonnes gross vehicle mass
• carry your licence at all times while driving any bus or any truck greater than 15 tonnes gross vehicle mass. This requirement does not apply if the vehicle is being used on a journey wholly within a 80 kilometre radius from the place of business or wherever the vehicle normally operates.

(VicRoads, 2008b)

Speeding and heavy vehicles

The registered operator of a bus above 5 tonnes gross vehicle mass or a truck above 12 tonnes gross vehicle mass detected at a speed of more than 115km/h will incur a rising scale of penalties described in the table below:

<table>
<thead>
<tr>
<th>Breaches</th>
<th>Speed Limited Vehicle</th>
<th>Non-Speed Limited Vehicle</th>
</tr>
</thead>
<tbody>
<tr>
<td>First breach</td>
<td>Warning issued</td>
<td>Warning issued</td>
</tr>
<tr>
<td>Second breach</td>
<td>Required to demonstrate the speed limiter is working correctly</td>
<td>Required to fit speed limiter</td>
</tr>
<tr>
<td>Third breach</td>
<td>Suspension of registration for 28 days</td>
<td>Required to demonstrate the speed limiter is working correctly</td>
</tr>
<tr>
<td>Fourth breach</td>
<td>Suspension of registration for 3 months</td>
<td>Suspension of registration for 28 days</td>
</tr>
<tr>
<td>Subsequent breaches</td>
<td>Suspension of registration for 3 months</td>
<td>Suspension of registration for 3 months</td>
</tr>
</tbody>
</table>

These penalties are vehicle specific and apply for a rolling three year period. This period starts from the date on which an offence first occurs. A vehicle which is not involved in a speeding breach for a period of three years will be given a ‘clean slate’.

A vehicle’s registration will be suspended after the third breach in the case of a speed-limited vehicle and after the fourth breach for a vehicle not initially fitted with a speed limiter. (VicRoads, 2008b)
Where an operator fails to comply with any of these penalties, a maximum fine of $2,000 will be imposed on the vehicle owner. The vehicle penalties are in addition to any driver related penalties for speeding.

**Weight Enforcement**

Effective from 1 July 2006, Austroads has replaced the former National Association of Australian State Road Authorities (NAASRA) 'administrative tolerance' used for heavy vehicle mass enforcement with a Measurement Adjustment that is based solely on weighing equipment accuracy and site characteristics.

Enforcement action may be taken when a vehicle's assessed mass exceeds the legal limit. The assessed mass is calculated by subtracting the measurement adjustment from the vehicle's mass as shown on the measurement equipment. There are three categories of measurement adjustment that are designed to take into account the variations in measuring equipment and site characteristics.

Enforcement officers determine, which category of weighing applies to a given situation and apply the appropriate measurement adjustment to calculate the assessed mass. (VicRoads, 2008c)

### 2.8 ENFORCEMENT RELATED TO FATIGUE

#### 2.8.1 Background

Due to the subjective nature of fatigue it has remained difficult to operationally define, and measure its effects. While the links between fatigue and crash risk are widely accepted, this inability to accurately identify and measure fatigue hinders police and coroners in attributing fatigue as a cause in crashes. The challenge of accurately measuring fatigue has also hindered the introduction of legislation and thus enforcement. Latest research suggests that if a driver hasn’t slept for 17 hours the fatigue effects will be similar to driving with a BAC of .05, twentyfour hours of sleep deprivation is equivalent to a BAC of 0.1 g/100ml, double the legal limit (Vic Roads, 2008d). The importance of identifying driving lulls (common when driving between 1-6am) and sleep debt, is now being highlighted within a road safety context. Sleep debt occurs when someone has not obtained their full sleep requirement (6-8 hrs/24 hrs), so to reduce the fatigue related crash risk this sleep debt needs to be recovered.

The fatigue Expert Group (Dawson, Feyer, Gander, Hartley, Haworth, Willamson, Baas, Nolan, Moore, Brooks, Foley & Bottomley, 2001) recommend a maximum of 12-14 hours driving this includes incorporating regular breaks. Drivers sampled in the Second National Survey of Long Distance Road Transport (Department of Infrastructure, Transport, Regional Development and Local Government, 2001) reported feeling the effects of fatigue in the first ten hours of driving, especially in the early hours of the morning. One in five drivers reported working in excess of the current working hours regulations.

Frequently when fatigue is identified as a causal factor in a heavy vehicle crashes the records do not distinguish between truck driver fatigue and other vehicle driver fatigue. However when this distinction is made, it is estimated that over half of the total contribution to fatal heavy vehicle crashes is attributable to the fatigued driver of the other vehicle (Dawson et. al., 2001). Although driving while fatigued affects all road user groups it continues to be a
difficult concept to measure and enforce, for this report the information relating to fatigue will focus on heavy vehicles.

2.8.1 Europe

Work hours legislation has been introduced in the European heavy vehicle industry as a response to reducing fatigue related heavy vehicle crashes (EU 3820/85 and 3821/85). Drivers are restricted to 9 hours work per 24 hours, with 45 consecutive hours of rest after six working days. While these regulations play a key role in educating the industry about the minimal guidelines regarding fatigue they have come into question because of the inability to monitor sleeping patterns on days off and thus the risk of sleep debt is still an issue. The European Transport Safety Council (ETSC) highlights that under the current regulations that drivers can average 13 hour shifts when research has shown that the crash risk doubles after 11 hours of driving. (European Road Safety Observatory, 2008)

2.8.2 Comparative research

In 2005, a comparative study was undertaken exploring the work hour limitations relating to four forms of transport (road, rail, aviation and marine) in Australia, Canada, USA and the UK. (Jones, Dorrian, Shantha, Rajaratnam and Dawson, 2005). Individual country legislation was compared against the eight fatigue-related factors outlined in the NTSB report (1999). These criteria were: time of day; the 24-hour rhythm; duration of sleep; quality of sleep; predictability of sleep; sleep deprivation; duration of task performance; and presence of short breaks. The authors conclude that for neither of four transport modalities (road, air, water, rail) legislation takes these criteria fully into account. They argue for a mix of prescriptive legislation and non-prescriptive guidelines (e.g. fatigue management programs) in order to obtain the best counter-fatigue strategy (European Road Safety Observatory, 2008)

2.8.3 Victoria

New heavy vehicle fatigue laws were introduced in Victoria in September 2008, with the aim of improving the management of fatigue within the heavy vehicle industry. All parties in the supply chain are legally responsible for preventing driver fatigue. The three scheme options: Standard Hours; Basic Fatigue Management (NHVAS accredited); and Advanced Fatigue Management (NHVAS accredited) provide prescribed requirements regarding driving hours, rest breaks and the number of shifts worked per week. For example a driver must have four nights rest, including 2 consecutive nights, in a fourteen day period (Standard Hours scheme). Drivers are also required to maintain a work diary outlining all rest and work activities (if more than 100km from depot). Work diaries are to be kept for three years and readily accessible by authorized officers and police officers on request. (VicRoads, 2008d)

2.8.4 Fatigue detector/warning system

A promising countermeasure designed to reduce the incidence of drowsiness-related crashes is a system that can detect drowsiness and issue warnings accordingly. Sleep Diagnostics, Pty Ltd, have developed an in-vehicle drowsiness detection and warning system called Optalert. MUARC was approached by Sleep Diagnostics to conduct an evaluation of the Optalert system (glasses version 5, software version 4.1.5, algorithm version 08075) in terms of its effectiveness in predicting a breakdown in driving performance, using the MUARC advanced driving simulator.

The Optalert system comprises ordinary spectacle frames housing light emitters and sensors that objectively measure eye and eyelid movements. From the many parameters measured, a
continuous measure of drowsiness, the Johns Drowsiness Scale (JDS), is derived. The JDS ranges from zero to 10, where an increase in JDS corresponds to an increase in drowsiness.

The Optalert system is designed to emit an auditory warning that informs the drivers of approaching drowsiness. Two different warnings are emitted. The optimum JDS level at which the warnings are given has been determined by Sleep Diagnostics in previous research. The first warning is cautionary, and occurs when the JDS reaches a level of 4.5. The second warning is emitted when the JDS reached 5.0, and indicates that the driver has reached a critical level of drowsiness and should stop driving. Through these warnings, drivers are alerted to take action to safely manage their drowsiness. (Stephan, Hosking, Regan, Verdoom, Young, & Haworth, 2006)

Optalert is a world leader in fatigue detection technology with their Optalert glasses which “continuously measure drowsiness by using invisible pulses of light to detect eye and eyelid movement.

Tiny light emitters and receivers are built into the frames of Optalert glasses worn by the driver. The glasses are connected to the Optalert Vehicle System, installed within the vehicle, which processes all the information being transmitted from the glasses.

Whenever Optalert detects the onset of drowsiness – usually before the driver becomes aware of it – a loud beeping noise and a voice message warns the driver immediately.

Warnings can include:

- Level 1 – Cautionary warning (Click to hear sample)
- Level 2 – Critical warning (Click to hear sample)
- Inattention
- System warnings
- Glasses not working

The processor

The processor is the information hub of the system and processes all the data obtained from the Optalert glasses. The data is analysed to determine the driver’s level of drowsiness using Optalert’s patented algorithm. Warnings are triggered as soon as the driver shows signs of drowsiness.
The connection point

The connection point is where the driver plugs the Optalert glasses into the Optalert Vehicle System. It allows multi-positioning for driver comfort and includes a quick release system in case of an emergency.

The indicator

The indicator reports the status of Optalert. It indicates 'normal operation' with a blue light, 'drowsiness warnings' with a red light, and a 'check glasses' warning with an orange light. Indicator brightness is automatically adjusted for day and night operation.

The speaker

The speaker provides the driver with audible beeps and voice messages, such as "Caution, you are showing signs of drowsiness". Warnings are played at between 95 and 120 decibels (depending on the environment) to allow the driver to hear them clearly, even in loud industrial environments.” (Optalert website 2008)

While Optalert may be suitable to reduce fatigue related crashes for all vehicle drivers currently its potential within the heavy vehicle industry is being actively promoted. With the chain of responsibility legislation trucking companies are being encouraged to use the device to monitor and identify fatigue before the risk of crashing escalates.

2.9 PEDESTRIAN ENFORCEMENT

2.9.1 USA

2.9.1.1 Washington DC

“Street Smart is an annual public education, awareness and behavioral change campaign in the Washington, DC, suburban Maryland and northern Virginia area. The aim of the campaign is to build safer streets and sidewalks, enforce laws, and train better drivers, cyclists, and pedestrians Since its beginning in 2002, the campaign has used radio, newspaper, and transit advertising, public awareness efforts, and added law enforcement, to respond to the challenges of pedestrian and bicyclist safety” (Streetsmart, 2008).

A major focus of the campaign is Police enforcement:

- The press loves to report it
- Ads get more attention if there is enforcement
- Enforcement gets more attention if there are ads
- COG Police Chiefs Committee has been briefed regularly
- February 28 Pedestrian Enforcement Workshop at COG attended by more than 50 Police Officers
- At least 2400 warnings and citations issued
- 15 police agencies distributed 50,000 safety tips cards
  (Farrell, 2008)

An example of the type of briefing that police officers receive for this month long initiative is as follows:
“On Tuesday, March 27, 2007, from 7:00 a.m. to 9:00 a.m., officers with the Arlington County Police Department’s Special Operations Section will be conducting a pedestrian safety enforcement detail at the intersection of N. Lynn Street and Lee Highway in Rosslyn. Members of the media are invited to attend to cover the detail.

Officers will ticket motorists who speed or do not yield for pedestrians in crosswalks. In addition, Auxiliary Police officers will hand out safety information to drivers, pedestrians and bicyclists who commute through this busy intersection.” (Arlington County Police Department, 2007)

2.9.1.2 Maryland

The Maryland Safety Enforcement Initiative was initiated in response to the high rates of pedestrian fatalities and injuries within the Region. After reviewing pedestrian enforcement initiatives in other States they found that enforcement activates that focused solely on pedestrians had minor safety benefits and created public resentment whereas campaigns that targeted drivers as well were more successful. (Branyan, 2004).

The following data was obtained from a before and after study conducted in Washington State after a targeted crosswalk enforcement campaign in 2003 (see Table 2.3).

Table 2.3: Percentage of drivers stopped during targeted pedestrian enforcement

<table>
<thead>
<tr>
<th>TARGETED PEDESTRIAN ENFORCEMENT STUDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERCENT OF DRIVERS STOPPING</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CITY</th>
<th>TYPE OF SITE</th>
<th>STUDY PHASE</th>
<th>PERCENT STOP FOR PED</th>
</tr>
</thead>
<tbody>
<tr>
<td>BELLINGHAM</td>
<td>CONTROL</td>
<td>BEFORE</td>
<td>40.4%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DURING</td>
<td>59.6%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AFTER</td>
<td>65.5%</td>
</tr>
<tr>
<td></td>
<td>ENFORCEMENT</td>
<td>BEFORE</td>
<td>49.3%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DURING</td>
<td>63.1%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AFTER</td>
<td>74.4%</td>
</tr>
<tr>
<td>OLYMPIA</td>
<td>CONTROL</td>
<td>BEFORE</td>
<td>26.4%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DURING</td>
<td>31.7%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AFTER</td>
<td>19.7%</td>
</tr>
</tbody>
</table>

Source: Branyan (2004)

The above mentioned Washington campaign is based on the Three “e’s” philosophy namely education, enforcement, engineering. They stressed the importance of the enforcement factor highlighting that unenforced laws will be ignored and that the enforcement component gives credibility to the campaign. The following reasons were provided by police officers as reasons for not enforcing pedestrian laws:

- **Peer Pressure** – “Ped violations aren’t real crimes, it’s not real police work.”
• **Social Pressure** – Questions from the public, “Why aren’t you out catching robbers and murderers?”
• **Police Administration** – “My Chief (Lt., Sgt., etc.) doesn’t want me to do it.”
• **Courts** – “My calendar is crammed and you bring me this petty matter?”
• **Fines** – Fines may be too high or too low. May require a “must appear.”


A Maryland Pedestrian Safety Law Enforcement Initiative Program Manual was produced as a training manual for police officers in how to set up intersection enforcement and how to enforce laws on pedestrians. The campaign was strongly supported by local media and educational brochures.

The campaign resulted in:

• 13 police departments participating
• Over 40 crosswalk enforcement events
• Nearly 750 citations and 536 warnings given to drivers at crosswalk enforcement events
• 258 warnings and 748 educational brochures given to pedestrians
• Over 2000 speeding citations
• 19 arrests, including 7 unlicensed drivers, 1 stolen car, 1 DUI arrest

After evaluating the Maryland campaign the following recommendations were made:

• Get your state highway safety office to create a pedestrian safety enforcement program!
• Enlist partners that can help increase publicity about enforcement, e.g. county governments, police PIOs, sympathetic reporters, etc.
• Good training is important
• Recognition is a must with cops!
• Enlist partners that can help with media campaigns, such as MPOs.
• Remove statutory obstacles & educate the judiciary

(Branyan, 2004)

2.9.1.3 **Miami Beach**

Comparative research into enforcement initiatives involving drivers who failed to yield to pedestrians has shown that, enforcement based on citations alone showed short term effects lasting only for the duration of the initiative whereas enforcement initiatives resulting in written and verbal warnings showed effects for up to a year (Nau, 1983, cited in Van Houten & Malenfant, 2004). The “‘Courtesy Promotes Safety” program is a pedestrian safety program used in both Canada and the USA. The program has both an engineering component as well as an police enforcement component. The engineering component includes:

(a) pavement markings and signs prompting motorists to yield farther back from the crosswalk,
(b) signs prompting pedestrians to extend their arm to signal their intention to cross the street,
(c) signs prompting pedestrians to thank drivers who yielded, and
(d) signs posting the percentage of drivers yielding to pedestrians during the past week.

The program has been linked with significant reductions in pedestrian involved crashes. Van Houter and Melenfant (2004) conducted research to explore whether the police enforcement
component alone could result in significant and long-term changes in drivers’ yielding for pedestrians’ behaviour.

**Police enforcement outline**

Police enforcement was conducted with teams that included “(a) a decoy pedestrian (plainclothes police officer) who crossed when other pedestrians were not present, and (b) a spotter located on the sidewalk who radioed failure to yield violations to (c) other officers who flagged violators and gave them an enforcement flyer and either a verbal warning or a citation (ticket associated with a fine). Most motorists received the flyer and a warning; however, flagrant violators who endangered a pedestrian by passing too close, swerving around the pedestrian, honking the horn at the pedestrian, or travelling above the speed limit were cited. Vehicles were pulled over within a block from the crosswalk and therefore were visible to drivers approaching the crosswalk. ….. Motorists who were pulled over were informed that they failed to yield a pedestrian in a crosswalk and were given a warning flyer, which included information on the number of pedestrians killed or injured in Miami Beach and asked the driver to help make the community a safer place for themselves and loved ones. The police officer quickly summarized the content of the flyer, and if the violation was not flagrant, issued a verbal or written warning ticket and asked the violator to help keep pedestrians safe by yielding in the future.…..Police also issued a press release during the end of the 2nd week of the enforcement program, which generated coverage by electronic and print media. A favourable story was run on the Fox network for an entire day, and a story with pictures appeared in The Miami Herald. The Miami Beach police also placed announcements publicizing the program on the community television channel” (Van Houten & Malenfant, 2004, p.356). A maintenance phase was introduced following the intensive enforcement involving one enforcement session every six weeks and occasional newspaper article about the program. The evaluation of the enforcement program indicated that the effects of the enforcement were apparent up to one year post initiative.

2.9.2 Europe

2.9.2.1 Germany and The Netherlands

Pucher and Dijkstra (2000) compared pedestrian safety in USA with that in both Germany and the Netherlands finding that even though pedestrians are more predominant in these European countries, the pedestrian fatality rate per billion kms walked is ten times higher in the USA compared to Germany and the Netherlands. Pedestrian safety in Germany and the Netherlands has received a lot of support over recent years and this is evident in the 72% (the Netherlands) and 79% (Germany) reduction in pedestrian fatalities between 1975 to 1998.

**Traffic Regulations and Enforcement**

Legislation within these countries favours pedestrians and bicyclists over motor vehicles. In a traffic accident involving a pedestrian, even if the pedestrian is found to be at fault, the motorist is still attributed some blame. This attribution of blame on the motorist is based on the notion that drivers should anticipate unsafe and illegal pedestrian behaviour. Motor vehicle drivers are usually found to be totally at fault in accidents involving children or the elderly. In the Netherlands and Belgium the motor vehicle driver’s insurance company is obliged to pay costs for any crash involving a pedestrian irrespective of who is found to be at fault (Pucher and Dijkstra, 2000).

Another suggestion for the lower rates of pedestrian injuries within these countries is the active role of police enforcement toward both motorist and pedestrians. Citations and warnings are commonly delivered to pedestrians for disregard of the traffic laws. Motorist
offences pertaining to pedestrians such as failing to give way, even if the pedestrian has just approached the intersection, are considered serious offences resulting in relatively high penalties. (Pucher and Dijkstra, 2000).

2.10 MOTORCYCLIST ENFORCEMENT

2.10.1 Victoria

According to Victoria’s Arrive Alive Strategy (Arrive Alive 2008-2018) motorcyclists face a significantly higher risk of being involved in a fatal crash or being seriously injured than drivers. Motorcyclists are approximately 30 times more likely to sustain a fatal or serious injury per kilometre travelled than other vehicle occupants.

The “First Action Plan 2008-2010” of Victoria’s Arrive Alive Strategy delivers some new initiatives aimed at reducing the incidence and severity of motorcycle crashes. Included in these are the following police enforcement actions:

- To improve strategic enforcement that is location and season specific, with a focus on high risk motorcycle routes;
- Better enforcement through regulatory or legislative change to require clear identification of motorcycles.

To address the issue of motorcyclist safety the Victoria Police plan to conduct five state-wide targeted operations annually in Victoria as well as five regionally-targeted operations (Millar 2008). The police operations should also have an education component and be accompanied by media support.

Other enforcement initiatives planned by the Victoria Police include:

- Non-rider police Traffic Management Unit operatives to undertake motorcycle awareness training
- 10 additional police motorcycles funded by Victoria Police to be allocated amongst the five Victoria police regions targeting motorcycle trauma.

2.10.2 United Kingdom

In the United Kingdom, Police Forces adopt many differing strategies when dealing with motorcyclists. This can sometimes create a lack of focus on key safety issues and can lead to distrust and animosity amongst motorcyclists.

The Motorcycle Casualty Reduction Working Group published a strategy document in 2006 examining motorcycle enforcement issues in the United Kingdom (ACPO, 2006). The recommendations and goals of this strategy are summarized below:

- There is a need for a co-ordinated approach to education, enforcement, engineering and engagement of motorcyclists.
- The aim is to deliver a consistent approach and to build upon best practices, share intelligence and research.
- Enforcement activities should be focused on key motorcycle collision causation factors and a nationally agreed approach to enforcement should be introduced.
• The broad objective is to reduce road trauma amongst motorcyclists who have a greater risk of death or serious injury than other road users. In 2003, in the United Kingdom, the relative risk of a motorcycle rider being killed or seriously injured per kilometre traveled was almost 50 times greater than that of a car driver.

• Clear guidelines need to be introduced to alleviate animosity between Police and motorcycle groups.

• There needs to be a reduction in the level of anti-social behaviour associated with a small number of motorcyclists that affect the quality of life in some communities.

• Enforcement should be intelligence led and targeted. Police need to be consistent and transparent about what enforcement action is undertaken and why.

• Police in neighbouring districts/divisions should work together to share intelligence and adopt a consistent approach to enforcement recognizing that motorcyclists frequently cross Police boundaries.

• Enforcement should be proportionate to the risks to individuals, property and the degree of the seriousness of the offence.

The strategy also gives guidelines to the effective targeting of motorcyclists related to road safety. It recommends that targeting should not just focus on motorcyclists whose behaviour poses the greatest risk or focus only on identifiable locations. Targeting needs to take full advantage of a wide range of information sources to properly inform, focus and prioritise enforcement activities. Effective targeting of motorcyclists should ensure the following:

• Road risks be objectively identified and prioritized for appropriate action;
• Suitable resources should be deployed;
• Appropriate monitoring and evaluation should take place to ensure that costs and benefits can be properly assessed and future decision making enhanced.

Motorcyclist enforcement should be consistent by adopting a similar approach nationally in similar circumstances to achieve a desired outcome. Inconsistency in enforcement undermines public confidence and contributes to resentment and alienation.

A highly visible presence and instant intervention is more effective than covert monitoring, remote camera detection or postal receipt of a traffic offence (ACPO, 2006).

2.10.3 USA

Washington

In response to an increasing trend in the number of motorcycle fatalities since 1997 in the state of Washington, U.S.A, the Washington State Patrol (WSP) joined forces with other state agencies and citizen groups to form the Governor’s Motorcycle Safety Task Force during 2006. The objectives of this task force were to determine the main causes of fatal motorcycle crashes and to provide recommendations for reducing fatalities and serious injuries involving motorcyclists.

The main recommendations of the task force (Washington State Patrol, 2008) were:
• To undertake an evaluation of the motorcycle rider training program, including increased training opportunities;
• To undertake a public education campaign;
• To increase traffic law enforcement targeted at rider accountability.
• To ensure that traffic law enforcement be supported by strong educational programs to effectively change rider behaviour.

The task force identified the motorcyclist problem through an analysis of crash and licence data, and based their policy recommendations on data results not on anecdotal or emotional evidence.

The results of the 1993-2004 analysis of motorcycle crashes found the following:

• Majority of fatalities occurred during daylight hours in dry weather between April-September (spring-summer).
• More than 50% were single-vehicle crashes
• 51% of fatalities involved drug and/or alcohol involvement
• 39% of motorcyclists were not licensed;
• most common contributing factors were speeding, alcohol, inattention and lane error.

The led the task force to conclude the following: “While there are multiple contributions to motorcycle crashes that result in fatalities and serious injuries, it appears that the most important factors are within the control of the motorcycle rider. Efforts to reduce fatalities and serious injuries should focus on rider skill and behaviour.”

In response to these recommendations and data findings, the Washington State Patrol:

• Provided additional training to its police officers on the detection of alcohol and drug-impaired motorcycle riders;
• Co-sponsored legislation to authorize impoundment of motorcycles operated by unlicensed motorcycle riders (i.e. Police should impound motorcycles operated by unlicensed riders).
• Raised awareness of motorcycle safety through the media – police sent consistent messages to the public that they were serious about motorcycle safety.
• Issued press releases at the beginning of the motorcycle riding season and just before the start of busy holiday weekends;
• Reactively followed motorcycle crashes;
• Focused on serious traffic offences by motorcyclists, and significantly increased their enforcement of speeding, alcohol and drug-impaired driving, and licence violations.

As a result of these actions by the end of 2007 there was a 17.5% reduction in motorcycle fatalities from the previous year. In addition the motorcyclist fatality rate (i.e. fatalities per 100,000 registered motorcycles) decreased from 42 in 2006 to 32 in 2007 in Washington.
Ohio

Motorcycle crashes in Ohio, U.S.A. increased by about 19% between 2000 and 2004. To address this increasing trend, a Motorcycle Safety Strategic Plan was developed by the Governor’s Highway Safety Office during 2005 (Ohio Department of Public Safety, 2006). This strategy included a section on the police enforcement of drug and alcohol-impaired motorcycle riders. The aim was to reduce motorcycle crashes in which the rider was impaired by alcohol and other drugs through effective and well-publicized impaired riding enforcement activities. The following police enforcement actions were recommended:

- The Governor’s Highway Safety Office (GHSO) would meet with police in motorcycle crash “hot spots” to encourage an emphasis on officer education, motorcycle enforcement planning, and encourage the implementation of available countermeasures.
- The GHSO would work with police and motorcycle rider groups to pilot test a highly visible law enforcement presence at rider events.
- The GHSO would work with the Ohio State Highway Patrol to offer regional meetings with police officers focusing on behavioural cues of alcohol-impaired motorcyclists and unlicensed riders.
- The GHSO would conduct training sessions for police task forces on the detection of impaired motorcyclists.

New York

There has been a 70% increase in motorcycle registrations in New York during the 10 year period 1998-2007. However motorcycle rider and passenger fatalities have also increased by 54% over the same decade. To address this large increase a section on motorcycle safety was included in the New York State’s Highway Safety Strategic Plan (New York State, 2009). The main aim in the area of motorcycle safety was to reduce the number of motorcycle crashes and fatalities. To achieve this reduction the actions in the strategic plan included:

- Continued expansion of motorcycle rider education opportunities;
- Increased motorcyclist enforcement initiatives;
- Greater motorist awareness of motorcyclists on the road;
- The identification of motorcyclist behaviours that are contributing to crashes;
- Improvements in the motorcycle rider education program.

The long-term performance goals included a 12% reduction in the number of motorcycle fatal and serious injury crashes and in the number of motorcycle fatalities by 2013.

The police enforcement initiatives to achieve these goals include:

- **Motorcycle Enforcement Checkpoints:**
  Motorcycle safety checkpoints would be set up in strategic locations to check for licence and registration offences; for the non-compliance of helmet wearing; for faulty or illegal equipment and other offences by motorcyclists. Variable message signs and other methods including aerial enforcement (police aircraft) may be used to ensure mandatory compliance with the checkpoint.

- **Police Officer Training and Local Enforcement**
Police officer training on motorcycle enforcement issues and techniques will be conducted. The training will focus on safety violation such as unapproved helmets, equipment violations (e.g. tyres and lights), and altered motorcycles (e.g. those with loud exhaust systems). Trained officers would be deployed to enforce these laws and issue infringement notices to offenders.

2.11 ENFORCEMENT OF MOBILE PHONE USE

2.11.1 New South Wales

The restriction of mobile phone usage rule as described in The Australian Road Rules ARR 300 is as follows:

“The driver of a vehicle (except an emergency vehicle or police vehicle) must not use a hand-held mobile phone while the vehicle is moving, or is stationary but not parked, unless the driver is exempt from this rule by another law of this jurisdiction”.

Recently this law has been extended to include the use of a mobile telephone for text messaging as using a hand-held phone.

Hartley (2007) addressed a variety of driver distraction issues from a law enforcement perspective in New South Wales including mobile phone use.

High visibility policing accompanied with extensive advertising campaigns can reinforce safer driving practices. Recently the New South Wales Police has increased its focus on these high visibility operations and introduced initiatives to impact on road safety. One such operation is “Operation Compliance”. Hartley states that this is an “on-going state-wide high visibility operation that requires all police, regardless of duty type, to target specific traffic safety offences such as the use of mobile phones as their duties permit”.

The New South Wales Police is also looking at utilizing its resources in the most effective manner. For instance, police motorcycle units have been used to detect the use of hand held mobile phones by drivers in which the elevated position of the police motorcycle rider allows for a more clear observation of the interior of the vehicle including the detection of mobile phone texting.

Hartley (2007) concluded that high visible policing has a positive effect on driver behaviour by increasing the perceived risk of being caught and assisting in getting the driver’s attention back to the road.

2.11.2 North America

As reported in Hedlund et al (2005), only one Canadian province (Newfoundland and Labrador), and three American States (Connecticut, New Jersey and New York) and the District of Columbia prohibit all drivers from using hand-held mobile phones.

The effects of laws banning hand-held mobile phone use have been studied recently in New York and in the District of Columbia (McCartt, 2005).

In New York, the law reduced hand-held mobile phone usage by about 50% shortly after the law came into effect. The law incurred a fine of up to $100 (U.S.) but did not prohibit dialing or using a hand-held mobile phone when stopped or when using a hands-free device.
However, a year later mobile phone use in vehicles had returned to its pre-law levels. Initially there was media publicity accompanying the law. But shortly after the law was enacted there was no statewide intensive, publicized enforcement program targeting mobile phone use. This suggests that mobile phone laws require continued publicity and enforcement if they are to achieve long-term compliance (McCartt, 2005).

The District of Columbia’s recent law also reduced mobile phone use by about half soon after it became effective. There was some media coverage when the law took effect but little since then.

Hedlund et al (2005) concluded that while laws prohibiting hand-held mobile phone use were popular they may have little effect on either mobile phone use or crashes. They likely require continued police enforcement and accompanying media publicity to have a long-term effect on public behaviour.
3 BEST PRACTICE IN TRAFFIC ENFORCEMENT

Only in the areas of drink-driving and speeding enforcement has there been sufficient scientific research to clearly identify best practice with a strong evidence base. However, the principles of deterrence that can be gleaned from research in these two key traffic enforcement areas can be applied in many other areas aimed at unsafe illegal behaviours.

3.1 DRINK DRIVING ENFORCEMENT

True “random” breath testing (i.e. preliminary breath tests administered to drivers chosen at random from the traffic stream, at stationary breath test stations) appears to produce its effects through general deterrence, i.e. influencing potential drink-drivers, through their fear of detection and the consequences, to avoid drink-driving in future. The driver’s perceived risk of detection is the key issue, not the actual risk. RBT detects relatively few drink-drivers per hour of testing, because the proportion of drivers with illegal blood alcohol levels on the road is in fact quite low, and hence the mechanism of specific deterrence has very limited effect.

The key operational parameters in achieving general deterrence appear to be the intensity of testing, the time of testing, and the visibility of the testing stations. The influence of these parameters may differ in urban and rural areas.

3.1.1 Intensity of testing

When RBT was first introduced in Victoria in July 1976, testing was carried out from patrol cars with limited signage for an average of only 8 hours per week in Melbourne. There was only weak evidence of an effect of RBT on alcohol-involved crashes during the first six months of the legislation. Evaluations were also carried of the effects on crashes during the periods of increased, but concentrated, RBT in 1977, and of effects during periods in 1978 and 1979 when the hours of testing were further increased but targeted at areas representing about one-quarter of urban Melbourne. During these periods, the intensity of testing per unit area ranged from 17 to 23 hours per 100 square kilometres per week. In most periods there was accompanying Melbourne-wide mass media publicity with drink-driving themes. The evaluations were able to show statistically significant reductions in serious casualty crashes (those crashes resulting in death or hospital admission) at night in the areas tested during the weeks of testing and for at least two weeks after testing finished. The magnitudes of reductions during four separate periods in 1977-1979 ranged from 21% to 36% (Cameron and Strang 1982).

The major operational conclusions from this research were:

- There is a threshold for the intensity of car-based RBT in urban areas before it is certain that crash reductions will result. This threshold for the intensity of testing is no more than about 20 hours per 100 square kilometres per week.
- Car-based RBT in urban areas has residual effects on crashes in the area of testing operations for at least two weeks after the operations cease.

3.1.2 Time of testing

An evaluation was carried out in Melbourne during October to December 1983 to determine the relative effectiveness of RBT during the afternoon and evening (4pm to 8pm), when the operations were visible to high traffic volumes, compared with RBT carried out at night (8pm to 4am) when drink-driving is more common.
The night-time testing was carried out on Thursday to Saturday in urban areas north of the Yarra River and the afternoon/evening testing was carried out on Monday to Wednesday in areas south of the Yarra. The total hours of testing in the north area was relatively greater, and the area relatively smaller, resulting in an intensity of RBT around 16 hours per 100 square kilometres per week. In the south area, the intensity of testing was about one-third of the level in the north area. Melbourne-wide mass media publicity about RBT accompanied the operations.

Separate evaluations of effects in the two areas showed a statistically significant 24% reduction in serious casualty crashes at night in the north area, compared with a non-significant 13% reduction in crashes of the same type in the south area (Armour et al 1995). While the difference in time of RBT operations is confounded with a difference in the intensity of operations in the two areas, the results suggest the following operational conclusion:

- RBT carried out during times of the week when drink-driving is frequent is highly likely to produce crash reductions, whereas there is less certainty about its effects when carried out at other times.

### 3.1.3 Visibility of the testing stations

Commencing in late 1989, there was a shift in Victoria to the use of bus-based RBT stations staffed by a greater number of personnel conducting tests. Four existing buses were progressively replaced by 13 purpose-built highly visible "booze buses" during 1990. The proportion of tests in Melbourne conducted from buses rose rapidly to almost 100% in 1991, whereas the increase was more gradual in country Victoria. This change in method of testing was promoted by high-profile and intensive mass media campaigns about drink-driving and the new buses.

There was a rapid increase in the number of tests conducted each year. However, the number of testing hours increased by only modest amounts in Melbourne in 1990 and 1991, and remained approximately the same in country Victoria. Compared with the car-based RBT operations, the new buses are highly visible to passing drivers and, due to the relatively high staffing levels, a high proportion of drivers could expect to be tested. Thus the general deterrence effect of bus-based RBT, per hour of operation, may be greater than car-based RBT.

Evaluations have found that the new "booze bus" initiative, and accompanying publicity, was effective in reducing serious casualty crashes during the "high alcohol" hours of the week in both Melbourne and country Victoria. In Melbourne, there was a statistically significant 18% reduction during 1990 and a non-significant 13% reduction during 1991. In country Victoria, there were significant reductions of 13% and 24% during 1990 and 1991, respectively (Cameron et al 1992a).

Subsequent research has linked monthly serious casualty crashes in Melbourne during high alcohol hours with monthly numbers of random breath tests, monthly alcohol sales, and awareness of drink-driving publicity placed during the month and previous months (Cameron et al 1994). Later research using similar methods has separated bus-based and car-based random breath tests, and has shown a statistically significant link with the bus-based tests but a weaker relationship with the car-based tests (Newstead et al 1995).
Recently published New Zealand research has confirmed the additional effect of adding booze buses to an RBT program (known as compulsory breath testing, CBT, in that country). When car-based CBT was introduced, together with a zero BAC requirement for drivers under age 20, there was a 22% reduction in night-time casualty crashes (Miller et al 2004). A further 14% reduction in these crashes was achieved when supporting, high-profile drink-driving publicity was added as part of the SRSP. When booze buses were added to the CBT program, principally in the northern half of the North Island where most drink-driving crashes occurred, there was a further 18% reduction in night-time crashes nation-wide (27% reduction in north North Island).

The estimated benefit-cost ratio was 14 for car-based CBT, 19 for car-based CBT plus supporting mass-media publicity, and 26 for the full package of car- and bus-based CBT plus supporting publicity. The incremental benefit-cost ratio of adding the supporting publicity to car-based CBT was estimated as 37. The incremental benefit-cost ratio of adding booze buses was estimated as 125, suggesting this is a very good investment adjunct to an already very cost-effective enforcement program.

Together the Victorian and New Zealand research on the effects of "booze bus" initiatives suggest the following operational conclusion:

- The visibility of the RBT operations, and/or the capacity of the testing station to test high proportions of passing motorists, are important factors in increasing the general deterrence effect of RBT.

However the use of booze buses in rural areas needs to be considered with caution operationally, as outlined below.

3.1.4 Booze buses in rural areas

In November 1993, the Victoria Police launched a program of substantially increased RBT in rural Victoria, supported by mass media publicity. The Melbourne-based booze buses were sent to rural areas for a weekend at a time and appeared to display considerable deterrent value for drink-driving, by random breath testing a greater number of drivers per hour than either the rural-based buses or cars across rural Victoria.

The evaluation found evidence of a statistically significant 22% reduction in high alcohol hour serious casualty crashes when RBT was conducted by cars operating alone, during the weeks and in the regions when enforcement was present (Cameron et al 1996). There was also some evidence of an interaction between the effects of the enforcement operations and the levels of awareness of drink-driving television advertising in rural Victoria. Medium levels of awareness appear to increase the effects of the “car only” enforcement operations (33% reduction). Conversely, in regions and weeks influenced by car and bus combinations, a statistically significant net increase in high alcohol hour serious casualty crashes occurred when high publicity awareness accompanied the enforcement.

Further analysis, in which crashes by road type were examined, found evidence that some drink-drivers faced with intense enforcement (i.e. bus and car combinations), heightened by intense drink-driving publicity, changed their travel behaviour and used relatively unsafe minor roads (Diamantopoulou and Cameron 1998). Under these circumstances, in rural areas of Victoria, significant increases in high alcohol hour serious casualty crashes occurred on minor roads but not on major roads.
Subsequent analysis found that booze buses operating alone in provincial cities in rural Victoria had similar effects to booze buses operating in Melbourne (Diamantopoulou and Cameron 2000). However booze buses operating outside provincial cities appeared to be ineffective (and even counterproductive in some circumstances).

The operational conclusions from this research on RBT in rural areas were:

- The effectiveness of car-based RBT in rural areas appears similar to that achieved by RBT (both car- and bus-based) in metropolitan areas. This may relate to the perceived ability of the cars to cover broad areas and to raise the perceived risk of detection above a threshold level.
- Police should schedule RBT operations on minor as well as on major roads in rural areas. Greater emphasis should be placed on the use of car-based RBT, particularly near hotels and clubs, with patrol cars operating on minor roads in concert with booze buses located in provincial cities and towns.

### 3.1.5 International drink driving enforcement review

A MUARC study reviewed Australian and international literature relating to traffic law enforcement including drink-driving enforcement (Zaal, 1994). This review concluded that the use of enforcement is generally regarded as being the most effective means of deterring drink-driving behaviour. However, the most effective operations were found to be those supported by legislation enabling police to randomly test any driver for alcohol impairment. In addition, to maximise the effects of RBT, a large proportion of drivers should be stopped and all breath tested.

Zaal suggests that RBT maximises the perceived risk of apprehension by creating an awareness among road users that enforcement is highly active and can be encountered at any time and any place. Therefore, RBT operations should be highly visible and accompanied by sustained high levels of publicity. Such publicity is likely to be most effective when it raises the awareness of the likelihood of apprehension & the severe consequences of apprehension (i.e. punishment and increased crash risk). Further, Zaal concludes that the most effective RBT operations are those that are highly intensive and maintained over a longer period of time. Finally, RBT operations should be rotated among a number of fixed locations and undertaken for a period of no more than one hour at any location.

The author also considers the effectiveness of different forms of punishment. He concludes that the most effective drink driving sanction is the combined use of fines & licence actions such as suspension/cancellation. The suspension and/or cancellation of licences removes potentially high-risk drivers from the road system thus potentially reducing crash risk. Further, the introduction of special legislation for road users with higher alcohol-related crash risk can be effective in reducing alcohol-related crashes. Examples of such special legislation include: lower BAC limits for young/inexperienced drivers and for drivers with special risks/responsibilities/high traffic exposure such as heavy vehicle drivers. The research by Zaal provides consistent results with that conducted within Australia.

A meta-analysis of 39 studies that evaluated the effect of drink-driving enforcement (either alone or in combination with other measures) has been conducted by Elvik (2001). Using the meta analysis technique, it is possible to combine results from previous studies to provide a single estimate of the effectiveness of a given countermeasure. Table 3.1 below presents estimated percentage reductions in crashes (including confidence intervals) attributable to drink-driving enforcement.
Table 3.1. Estimates and confidence intervals (95% CI) of the effects on accidents of drink-driving enforcement. (Elvik et al 1997, as cited in Elvik 2001)

<table>
<thead>
<tr>
<th>Accident Severity</th>
<th>Accident types affected</th>
<th>Best estimate</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatal accidents</td>
<td>All</td>
<td>-9</td>
<td>(-11; -6)</td>
</tr>
<tr>
<td>Injury accidents</td>
<td>All</td>
<td>-7</td>
<td>(-8; -6)</td>
</tr>
<tr>
<td>Property-damage-only accidents</td>
<td>All</td>
<td>-4</td>
<td>(-5; -3)</td>
</tr>
</tbody>
</table>

The results of the meta-analysis show that, across a large number of drink-driving enforcement programs, significant reduction in all crash types can be achieved. However, the magnitude of the reductions appear to be smaller than those estimated for individual drink-driving enforcement programs in Australia. Those enforcement programs included in the analysis include ASAP (Alcohol Safety Action Projects), STEP (Selective Traffic Enforcement Project) and RBT. Although alternative enforcement programs to RBT involve education and rehabilitation aspects, the enforcement component of these programs is often implemented in a less than optimal way. That is, enforcement is not always conducted in a random way and testing of drivers may be restricted to those suspected of exceeding the legal BAC limit. Therefore, the inclusion of these programs is a likely contributor to the magnitude and range of enforcement effects reported in this study.

Another international review of drink-driving enforcement measures compared the effectiveness of DUI patrolling aimed at apprehending drink-drivers, and the effectiveness of DUI-checkpoints (of which Australian RBT is a classical type). The 11 evaluations with good study design showed that DUI patrolling reduced casualty crashes by 6% and there was no statistically significant reduction in fatal crashes (Erke et al 2008). The same review found that 73 evaluations with good study design showed that DUI-checkpoints reduced casualty crashes by 10% and fatal crashes by 17% (both effects were statistically significant).

### 3.1.6 Australasian drink driving enforcement review

A review of drink driving enforcement in Australia and internationally was conducted by MUARC in 2006 (Delaney, Diamantopoulou & Cameron, 2006). From this study operational principles of drink driving enforcement were developed in order to emphasise best practice principles. The following key strategic principles were developed:

- **Random breath testing (RBT) achieves its effects principally through the mechanism of general deterrence.** It detects relatively few drink-drivers per hour of testing because the proportion of drivers with illegal blood alcohol levels on the road is in fact quite low. Hence the mechanism of specific deterrence has very limited effect.

- When conducted intensively, random breath testing can result in substantial reductions in fatal and serious injury crashes at night. The impact of the testing persists for at least two weeks following the enforcement presence.

- RBT operations in urban areas must reach a threshold intensity of about 20 hours per 100 square kilometres per week to achieve significant crash reductions.

- The visibility of the RBT operations, and/or the capacity of the testing station to test high proportions of passing motorists, are important factors in increasing the general deterrence effect of RBT.
Given the success of randomised scheduling of enforcement operations in other domains, further investigation of the potential benefits of adopting this approach for drink-driving enforcement is warranted.

In provincial cities, RBT operating through booze buses alone and RBT operating through cars alone have successfully reduced serious casualty crashes during high alcohol hours. However, booze buses operating alone generate the greatest crash reductions in provincial cities across both major and minor roads. Car based RBT operated alone has its greatest effect on minor roads in provincial cities.

Car-based RBT operating alone is the only enforcement method that resulted in crash reduction in the less built up areas of rural Victoria (i.e. outside provincial cities). There was no evidence of crash reductions during booze bus operations or combined booze bus/car RBT operations in these areas.

Social and lifestyle factors are very important issues in rural drink driving. There is a need to minimise the success of avoidance behaviours in the presence of known enforcement activity, as this type of behaviour is likely to be self-perpetuating.

Contact with enforcement does influence the perceived risk of detection. There is a high-risk cluster of drivers who continue to offend despite their perceptions about the risk of detection. In addition, in rural areas a group of drivers continue to perceive a relatively low risk of detection.

Combined with the estimated duration of the initial effects and the enforcement effects described, it appears that RBT testing levels must be increased over time to maintain significant reductions in the target crash population.

Compulsory (random) breath testing in New Zealand is a very cost-effective countermeasure. However, the total program effect is greatest when CBT involves the use of booze buses and is supported by intense media publicity.

The benefit-cost ratio of the Victorian RBT program is unknown. However, international research suggests that RBT enforcement will achieve the greatest crash reductions and be most cost beneficial when conducted at high intensities in a highly visible manner. Supporting media publicity also appears to improve the BCR of RBT enforcement.

The use of RBT enforcement is generally regarded as the most effective means of deterring drink-drive behaviour. In particular, the use of sustained and highly intensive random breath testing operations is the most effective means of drink-drive enforcement.

### 3.2 SPEED ENFORCEMENT

#### 3.2.1 Mobile speed cameras

Mobile speed cameras can be operated in many different ways, but the critical parameter is whether the camera units are operated covertly (i.e. relatively indistinguishable by passing drivers) or overtly (ranging from conspicuous marked vans to the presence or absence of advanced warning signs or signs advising that a camera just has been passed). Covert speed cameras appear to achieve their effects through specific deterrence, i.e. encouraging detected speeders, through their actual experience of detection and punishment, to avoid re-offending.
If active enough, covert speed cameras may also achieve general deterrence through word-of-mouth communication between apprehended speeders and those not recently detected for speeding.

Overt speed cameras aim to achieve their effects through a localised form of general deterrence, i.e. the visibility of the operations or the advance warning signs persuades the potential speeder at the camera location to conform with the speed limit. If general deterrence does not work for some chronic speeders, then specific deterrence comes into operation; however this is thought to be a relatively minor contributor to the effect of overt speed cameras. While the focus of most overt speed camera programs is to achieve a local effect on speeds and crashes at specific “accident black spot” locations, they may also achieve a general effect on speeds throughout broader areas. This may occur if the density of the overt cameras is sufficient or, as has been apparently achieved in Queensland, persuading drivers that there is a risk of detection anywhere at any time through randomisation of the placement of the cameras in time and space.

Other key operational parameters related to the effects of mobile speed cameras are the extent of any residual effects (after camera presence or after receipt of a speeding infringement notice, in the case of overt and covert operations, respectively) and the intensity of speed camera operations before diminishing returns occur.

### 3.2.1.1 Covert, mobile speed cameras in Victoria

When speed cameras were initially introduced in Victoria in 1985, a small number of cameras with advance warning signs were trialled at high crash frequency sites (Portans 1988). The effects on speeds were limited to relatively short distances (1-2 km) from the camera sites. No statistically significant reductions in crashes in the vicinity of the camera sites could be found. The Victoria Police opted to operate speed cameras in a less conspicuous way when the situation arose that a much more wide-spread effect on speeding motorists was needed.

The new speed camera program launched in December 1989 combined covert operations with a promise to Victorian motorists that cameras would be numerous and wide-spread. However, it was not until January 1991 that all 54 new slant radar cameras were in operation. In April 1990, high-profile and intensive mass media publicity about speeding and the speed cameras was launched. However, it was not until June 1990, when the new Traffic Camera Office to process the camera photographs was established, that the increasing number of available cameras could be used vigorously. After that time the number of camera-detected speeding TINs (Traffic Infringement Notices) issued per month escalated rapidly.

When evaluated for the period between December 1989 and December 1991, this program had a significant effect on casualty crash frequency and severity (Cameron et al 1992b). In particular, from December 1989 to March 1990, there was a statistically significant 15% reduction in low alcohol hour casualty crashes on arterial roads. This coincided with low levels of both speed camera enforcement and speed related publicity. During the period April 1990 to June 1990, when the publicity campaign was launched but prior to extensive enforcement operations, low alcohol hour crashes were reduced by 34% on Melbourne arterial roads and 21% in country towns. Reductions in the severity of injuries sustained in these crashes were also found in Melbourne during this period.

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6 Low-alcohol hours are times of the week when alcohol related crashes are less likely to occur, whereas high-alcohol hours of the week are those periods when alcohol related crashes are more likely to occur.
Following the high levels of both publicity and enforcement experienced from July 1990, low alcohol hour casualty crashes were reduced on arterial roads in Melbourne, country towns and on rural highways by 32%, 23% and 14% respectively. The injury severity of these crashes was also found to have decreased, principally in Melbourne. The effect of the speed camera enforcement program on high alcohol hour crashes is less clear.

The mechanisms that drive the reductions in casualty crashes have been identified. Based on 1990-91 data, relationships between the monthly level of low alcohol hour casualty crashes and the inputs of the enforcement program have been established. Crash frequency was related to the number of speeding TINs issued (generally 2-3 weeks after the offence occurred) and the publicity levels in the same month. Also, crash severity was related to camera operating hours and the number of speeding TINs issued (Cameron et al. 1992b). These results imply that actual detection of speeding drivers, as evidenced by the number of TINs issued, is a key driver of the frequency of casualty crashes. TINs issued as a result of speed camera operations were estimated to contribute reductions in serious casualty crashes of 8-9% during the 1990-1993 period (Newstead et al 1995).

A more recent study has confirmed the key role of the number of speeding TINs detected having an influence on crashes in subsequent periods (Cameron et al 2003a, b). During 1999, the Victoria Police varied the levels of speed camera activity substantially in four Melbourne police districts according to a systematic plan. Camera hours were increased or reduced by 50% or 100% in respective districts for a month at a time, during two separate months when speed-related publicity was present and during two months when it was absent. Monthly casualty crashes (all times of day) during 1996-2000 in the ten Melbourne police districts were analysed to test the effects of the enforcement, publicity and their interaction. Monthly levels of speeding offences detected by cameras varied substantially over time in all districts, but the most extreme variations occurred in the four districts as planned. Changes in crash frequency were found to be inversely associated with changes in the levels of speeding TINs detected in the same district during the previous month (Figure 3.1). Also, the risk of fatal outcome of the casualty crashes was reduced by more than 40% when the level of speeding TINs detected during the previous month was at relatively high levels (more than 30% greater than average).
The major operational conclusions from this research were:

- If supported by a high-profile launch and ongoing mass media publicity, the threat of covert speed cameras can be established and maintained at high levels for short term periods, even if actual levels of camera use are low.
- Covert speed cameras, when used intensely and supported by high-profile mass media publicity, produces wide-spread and long term reductions in crashes and their severity (i.e. a "general effect").
- The principal mechanism through which the Victorian mobile speed camera program achieves its effects on crashes is via the actual detection of speeding drivers and the subsequent issuing of penalties (fines, immediate licence loss in some cases, and demerit points leading ultimately to licence loss if sufficient are gained), i.e. specific deterrence.
- Supporting mechanisms are provided by actual camera operations (to the extent that they are visible, e.g. to the drivers travelling in the opposite direction) and mass-media publicity emphasising the risks of speeding and detection by a speed camera, i.e. general deterrence.

3.2.1.2 Comparison of overt and covert speed cameras in New Zealand

The introduction of mobile speed cameras in New Zealand commenced in late 1993. The operation of the cameras was restricted to roads classified as ‘speed camera areas’ based on a record of speed related crashes. Entrances to these roads were clearly sign posted to ensure that motorists were aware of the potential presence of the speed cameras. Further, the majority of speed cameras were mounted on police cars and operators were prohibited from hiding the cameras. In urban areas, limited use was made of fixed position speed cameras mounted on poles, however, these were subject to the same signage requirements as the mobile camera operations. In total, 13 fixed and 31 mobile cameras have been operating in New Zealand since 1993. Prior to July 2000, the enforcement threshold was set at the 85th percentile speed for each site as determined by speed surveys of that site. Financial penalties
(but no demerit points) were imposed where vehicles were detected travelling at or above the enforcement threshold. However, since 1 July 2000 a flat 10 km/h enforcement tolerance has been in operation.

An evaluation of the effect of the speed camera program described above, found that fatal and serious crashes on roads with speed limits of 70 km/h or less were reduced by an estimated 13% during low alcohol times of day (Mara et al 1996). In speed camera areas, the reduction in fatal and serious low alcohol hour crashes was 23%. Less substantial reductions in all injury crashes were experienced in speed camera areas on roads with speed limits of 100 km/h. No effect on crashes was identified on these roads when non-speed camera areas were included in the analysis.

From mid-1997 to mid-2000 a trial of the covert use of speed cameras was conducted in one of the four police regions in New Zealand on roads with speed limits of 100 km/h. This involved adding to existing signage an indication to motorists that hidden cameras may operate in the speed camera areas. In addition to the extra signage, there were high levels of newspaper and radio publicity relating to the trial prior to its commencement. It is also noted that in the first year of operation there was a 26% increase in the operational hours of speed cameras in the trial region. In the second year of operation, the number of operational hours decreased by 13% from the first year level. There were no changes in the operation of speed cameras during the trial period in other areas of New Zealand. In particular, on all roads in non-trial speed camera areas, speed camera operations remained overt. Further, on roads with speed limits of 70 km/h or less in the trial region, speed cameras were operated overtly.

An evaluation of the hidden camera trial in terms of vehicle speeds and reportable crashes demonstrated that during the first two years of the trial, improved road safety outcomes were experienced (Keall et al 2002). First, average speed in the trial regions decreased by an estimated 1.3 km/h over the first two years of the trial. The speed below which 85 percent of vehicles travelled in the trial region fell by an estimated 4.3 km/h. In addition, reportable crashes in the trial region fell by 11% in comparison to reportable crashes in the control regions. Further, it was found that the number of casualties in the trial region fell by 19% in comparison to casualties in the control regions. The number of casualties per crash fell by 9% on open roads in the trial region compared to open roads in the control regions. It is noted that these results relate to reductions across the treated region and not only at camera sites. This indicates that the covert mobile operations were able to generalise the effect of the New Zealand program beyond the speed camera sites.

A number of issues influence the conclusions from this study on the relative effectiveness of overt and covert automated speed enforcement programs. During the trial period, enforcement levels in the trial region were higher than in the non-trial regions. Further, the number of penalties issued in relation to incidents in the trial areas increased four fold (Keall et al 2002). Therefore, based on established relationships between speeding infringement notices and crashes (Cameron et al 2003a, b), it is not unexpected that improvements in road trauma would occur as the level of enforcement increases. Nevertheless, three factors together support the conclusion that the introduction of covert speed cameras influenced the casualty crash reductions. First, the fall in the frequency of casualty crashes coincided with the introduction of the covert program. Second, mean and high percentile speeds fell significantly during the trial. Finally, the reduction in the number of casualties per crash also confirms that speeds fell during the trial period.
The major operational conclusion which can be drawn from this research is:

- Covert operation of speed cameras increases uncertainty about the presence and location of the threat of detection, thus spreading the general deterrence effect over a broader area than overt operations.

3.2.1.3 Intensity of speed camera operations

Given the substantial effects of mobile speed cameras on speeding and road trauma, in particular when the cameras achieve a broad, general effect, it seems that camera programs should be operated as intensely as possible until diminishing returns set in. Elvik (2001), in a comprehensive review of a large number of studies of the effects of varied levels of traffic enforcement on casualty crashes, concluded that the relationship is of the form shown below in figure 3.2. Some forms of enforcement have more powerful effects than others, but in every case the relationship with crash reductions is not linear. Because of this, there is a level of enforcement activity where the additional saving in crashes may not be worth the additional cost of extra enforcement.

A relationship of this type was calibrated for a cost benefit analysis of the Victorian mobile speed camera program as it operated up to 2000 (Gelb et al, 2000). The study aimed to evaluate whether the existing speed camera operations involving approximately 4000 hours of operation per month was best practice. This was done using a marginal benefit-cost analysis in terms of both hours of operation and TIN issuance (a similar analysis was subsequently carried out on the Irish speed camera program; Smith, Cameron and Bodinnar 2002). The economic analysis was limited to the effects of cameras on casualty crashes in Melbourne during low alcohol hours because most speed camera activities occurred in Melbourne during these hours. Crash trends from 1987 to 1998 were analysed along with data relating to the actual costs of running the speed camera program and the costs of casualty crashes to society in general.

Figure 3.2 General relationship between traffic enforcement and crashes identified by Elvik (2001)
It was determined that, in order to reduce the total social costs (camera operations plus casualty crash costs), the number of TINs issued per month should fall within the range of 37,000 to 66,000. This corresponds to a range of 3,592 to 6,408 enforcement hours per month and an optimal average investment per month of 5,146 enforcement hours. This would be expected to result in a reduction in monthly levels of low alcohol hour casualty crashes of 13%. Further, the program benefit-cost ratio was estimated to be 6.3. That is, by investing in an average of 5,146 operational hours per month the benefits obtained in reduced social costs from casualty crashes would be 6.3 times the cost of investment.

During August 2001 to February 2002, the number of hours per month planned for mobile speed cameras to operate was increased from 4,200 to 6,000 hours. There were few other changes in mobile speed camera operations, apart from the use of cameras without flash assistance during daylight conditions, and reductions in speeding offence detection thresholds (both changes likely to increase, rather than decrease, the number of speeders detected per hour, at least in the short-term). Research based on the increased speed camera hours in some Melbourne police districts during specific months in 1999 provides support for likely reductions in crashes following a 50% increase in camera hours (Cameron et al 2003a, b). The increased number of hours per month is consistent with the range of estimates for the optimal investment of camera hours per month, based on the economic analysis described above. This suggests the following operational conclusion:

- Covert, mobile speed camera operations are both effective in reducing road trauma and are highly cost beneficial. The 50% increase in the level of speed camera activity in Victoria during 2001/2002 is likely to have further increased the economic benefit of the mobile speed camera program.

3.2.2 Fixed speed cameras

3.2.2.1 Spot-speed fixed speed cameras

Most of the research knowledge about the effects of fixed speed cameras comes from the U.K. safety camera program, which uses predominantly overt fixed cameras at an estimated 6000 locations (ICF Consulting 2003), a small proportion of which are covered by mobile overt cameras. Experience in Victoria has been relatively limited, with the first fixed cameras commencing operation in April 2000 in one of the CityLink tunnels. While the program has since expanded to include sites on Melbourne urban freeways and rural highways, the Victorian research conducted has been limited to behavioural effects at the first tunnel sites.

However, in New South Wales there has been substantial experience with over 100 very overt, fixed speed cameras installed on “black” lengths of road. The Roads and Traffic Authority have conducted an evaluation of the effects on speeds at and adjacent to the first 28 sites and also the effects on reported crashes (ARRB, 2005). In the immediate vicinity of the cameras, there were crash reductions and the effect on crashes resulting in a casualty (death or injury) appeared larger (23% reduction) than the effect on crashes resulting only in a vehicle being towed away, but no injury (17% reduction). There was nearly 90% reduction in fatal crashes in the immediate vicinity of the cameras during the two years after installation.

The effect of the cameras on mean speeds was a 6 km/h reduction at the camera sites. The proportion exceeding the speed limit was reduced by 72%, and even higher reductions occurred in the proportions exceeding the limit by 10 km/h (88% reduction), by 20 km/h (87% reduction) and by 30 km/h (80% reduction). These reductions in excessive speeds
confirm that the fatal and injury crash reductions at the camera sites were highly likely to be due to the overt fixed cameras.

3.2.2.2 Point-to-point fixed speed cameras
While overt fixed speed cameras measuring “spot” speeds appear to be very effective in reducing speeds and road trauma at specific sites, in general they do not influence drivers at other than those sites (unless the density of fixed cameras is high and above a critical threshold, as may be the case in the U.K.). If the intention is to reduce speeds along a substantial “black” route using overt fixed cameras, there is a case for installing point-to-point camera systems to enforce speeding along the whole route.

The technology uses a number of cameras mounted at staged intervals along a particular route. The cameras are able to measure the average speed between two points or the spot speed at an individual camera site. Spot-speed fixed cameras have a site-specific effect whereas the point-to-point camera system has a link-long influence on drivers and their speeds. In the U.K. it has been observed that “around the [spot-speed camera] sites a significant proportion of the drivers observed manipulated their behaviour in close vicinity to the installations, suddenly applying their brakes 50 metres before the camera and then promptly accelerating away from it” (Keenan 2002). This effect is less likely to be a significant consequence of the point-to-point camera systems.

The major operational conclusions from experience with fixed speed cameras are:

- Overt fixed speed cameras measuring spot speeds are very effective in reducing speeds and road trauma in the immediate vicinity of camera sites but are unlikely to have a general effect unless their density is very high
- Point-to-point speed cameras measuring average speeds over a route are effective in reducing speeds and road trauma throughout the route under surveillance
- Point-to-point camera systems remove the incentive for drivers to brake and then accelerate rapidly after passing an overt camera site, with the attendant risks this behaviour may produce.

3.2.3 Moving mode radar speed detectors
Relatively few studies have been published on the effects of moving mode (or mobile) radar units for detecting speeding. Studies in Victoria have shown effects on crashes on rural highways (including residual effects) and identified the key role of supporting publicity. They have also assessed the relative effects of marked and unmarked cars with mobile radar units, and considered operations where there was a mixture of marked and unmarked cars.

3.2.3.1 Immediate and residual effects
Analysis of crashes on rural, undivided 100 km/h highways in Police areas where mobile radar units were operating was carried out for 1995/96 (43 units) and 1996/97 (75 units, supported by a specific television advertisement about the mobile radar operations). The enforcement program had a positive effect on casualty crashes in rural Victoria for a period of approximately four days following the enforcement. The effect of the program diminished after this period and the effect varied with the level of public awareness of speed-related advertising (Diamantopoulou et al 1998).
3.2.3.2 Influence of supporting publicity

The strongest effect on crashes occurred when there were high levels of awareness of the specific mobile radar publicity introduced in November 1996. During this period a 28% net reduction in casualty crashes was observed one to four days after the enforcement was present. The reduction found for crashes occurring on the same day as the enforcement was not statistically significant. When there was low public awareness of the specific mobile radar advertising, no evidence of crash reductions was found.

Similarly, during 1996/97 there were weeks of high awareness of general speed-related publicity (including mobile radar publicity) and the strongest effect on casualty crashes was found during the four days after the enforcement was present. However, the effect was not as strong as that experienced when the publicity was specific to mobile radar activity. In fact, the 11% reduction in casualty crashes that occurred during this period was found not to be statistically significant.

3.2.3.3 Marked versus unmarked cars

The effect of mobile radar was subsequently examined in terms of the type of enforcement operation (Diamantopoulou and Cameron 2002), i.e. the effect of covert (unmarked car), overt (marked car) or mixed (marked and unmarked cars in same traffic region) mobile radar operations.

A 21% reduction in crashes occurring one to four days after covert enforcement presence was identified during 1995/96. The presence of overt enforcement also had a positive effect on crashes occurring one to four days after enforcement, however the effect was less pronounced. During 1996/97, the largest reductions in casualty crashes occurred following mobile radar enforcement operations involving both marked and unmarked police cars. This effect was greatest on the day on which the enforcement activity took place (40% reduction).

The results of the combined period (1995/96 and 1996/97) found that the most significant reductions in casualty crashes occurring one to four days after enforcement resulted from covert mobile radar enforcement (22% reduction). However, a mix of overt and covert enforcement was also found to be effective in reducing casualty crashes during this period (19% reduction).

The interaction between type of mobile radar enforcement and the supporting publicity was examined as part of the same study. The strongest crash reductions occurred on the same day as enforcement operations involving both overt and covert activity, and 1-4 days later, when high levels of mobile radar publicity awareness accompanied this type of enforcement (over 70% reduction).

The major operational conclusions from this research were:

- Mobile radar (and associated publicity) was found to have the greatest effect during the four days immediately following the enforcement with the effect diminishing between five and seven days after the enforcement presence. This suggests the existence of a four-day residual enforcement effect on casualty crashes.
- Casualty crash reductions were found following mobile radar operations involving either covert activity (unmarked cars) or both overt and covert activity (marked and unmarked cars operating together).
• No statistically significant effect on casualty crashes was found on the actual day of mobile radar activity in rural Victoria. It is not clear that enforcement on the actual day of mobile radar activity is effective in reducing casualty crashes.
• The most significant impact on casualty crashes occurred when high public awareness of media publicity accompanied mobile radar. The effect was greater when high publicity awareness levels were specific to mobile radar enforcement as opposed to when the high publicity awareness levels related to general, speed-related road safety themes.
• The strongest effect of casualty crashes was found on the same day as enforcement when high levels of mobile radar publicity accompanied mobile radar operations involving both overt and covert activity (marked and unmarked cars).

3.2.4 Hand-held laser speed detectors

Laser speed detection devices were introduced in Victoria following some difficulties with hand-held radar devices. It was envisaged that the laser devices would be more effective than the radar devices in busy traffic areas such as arterial roads. Further, given the overt nature of the enforcement program, the objective was to increase the perceived risk of detection rather than the number of speeding vehicles detected. The use of laser devices commenced in Melbourne in November 1996 and was the subject of detailed research during 1997. The research related to three main areas: the overall effect on crashes, the effect of different enforcement levels on crashes, and the effect on different road types.

3.2.4.1 Overall effect on urban crashes

The laser speed enforcement program has been found to have a positive overall impact on crashes, with a statistically significant 8.3% reduction in casualty crashes in the areas where laser speed detection devices were used (Fitzharris et al. 1999). Similar crash reductions were found for both serious and minor casualty crashes, suggesting that the enforcement program affected the number of crashes rather than their severity.

3.2.4.2 Intensity of enforcement

In terms of the intensity level of enforcement, the laser speed enforcement program was apparently effective in reducing casualty crashes only for low and medium levels of enforcement. Low enforcement was defined as up to three hours of enforcement activity at a given site during the year whereas medium intensity enforcement was defined as more than three but no more than fifteen hours of enforcement at a given site per year. 70 percent of enforcement sessions were conducted for less than one hour and 23 percent of sessions were conducted for between one and two hours.

3.2.4.3 Type of road

Three types of urban road were examined: freeways, arterial roads and other roads. The laser enforcement program led to a statistically significant 8.2% reduction in casualty crashes on arterial roads only. The crash reductions on other types of roads were similar in magnitude but not statistically significant. However, the analysis for freeways and other roads was based on relatively few observations.
The major operational conclusions from this research were:

- Laser speed detectors are successful in reducing crashes on arterial roads in metropolitan areas when conducted at low- to medium-intensity levels (sessions typically less than one hour, for up to 15 hours per site per year).
- The effect of laser detection devices may be localised in space suggesting that overt forms of speed enforcement have a general deterrent effect that is limited to the location at which enforcement activity is observed.
- To expand the general effect of overt speed detection programs, a more extensive geographical coverage may be required.
- It follows from the above that low- to medium-intensity, overt speed enforcement (defined as up to 15 enforcement hours per site per year) at multiple sites on the arterial road network will have a greater effect on crashes than high intensity enforcement at fewer locations.

3.2.5 Mass-media publicity

It is generally agreed that mass-media publicity is most effective in support of enforcement of illegal behaviours. The European Commission (2003) recommended that the enforcement of speeding, drink-driving and seat belt non-use should be combined with publicity campaigns to raise public consciousness. Two comprehensive meta-analyses of the literature on publicity effects concluded that the presence of relevant enforcement increased the effect (Elliott 1993, Delhomme 1999).

Key operational parameters affecting the effectiveness and cost-effectiveness of mass-media publicity are the style of the advertising materials, the intensity of advertising, residual effects after advertising finishes, and the role of research in decision making. The two mass-media publicity programs in which these issues have been most comprehensively assessed are the Transport Accident Commission’s (TAC) advertising program in Victoria, and the advertising component of New Zealand’s Supplementary Road Safety Package, both making extensive use of television with parallel messages in supporting media (radio, press, bill-boards, etc.).

3.2.5.1 Overall effects of publicity supporting enforcement

A variety of studies during 1992-1998 using different research methods have considered the road safety benefits of TAC’s advertising, both alone and in support of Police enforcement in Victoria. The methods have ranged from econometric models in which levels of television advertising have been included with other factors to explain road trauma trends, to estimates of enforcement effects in circumstances in which awareness of related advertising is high or low. The direct effects of advertising supporting the speed camera program, during the early months when camera activity was very low, have also been measured. These studies are summarised by Delaney et al (2004).

Collectively the published research confirmed the conclusion of MUARC’s early research in this area, namely that the TAC advertising with drink-driving and speeding themes supporting Police enforcement aimed at these behaviours has made an effective contribution to reducing road trauma (Cameron et al 1993). The extent of this contribution, especially in synergy with the enforcement efforts, has been difficult to measure, but some overall estimates have been provided by econometric modelling. Newstead et al (1995) estimated that drink-drive publicity contributed to about 7% reduction in serious road trauma in Victoria in 1990-93. The speed-related publicity was estimated to have contributed to 6-9% decrease in serious crashes each year. An increase in restraint use has also been found during the period, the
greatest increase being for rear seat passengers aged 18-25 (from 56% to 84%) (Diamantopoulou, Dyte, & Cameron, 1996).

3.2.5.2 Style of advertising

The mix of styles of TAC’s advertising has changed since the earlier MUARC studies found effects see figure 3.3. The use of almost exclusively emotive-style advertisements during the early to mid-1990’s has changed to include a greater proportion of those with enforcement-style and those combining emotion with enforcement or instructive elements. Thus the findings relating to predominantly emotive-style TAC advertising up to the mid-1990’s may be applicable only to the emotive-style advertisements used during more recent years, and not to advertisements with other styles.

![Figure 3.3. Styles of TAC television advertising in Melbourne, December 1989 to December 2001](image)

A more recent study which considered different styles of speed-related advertising has suggested that it is the emotive style which has the strongest effects. During 1999, the Victoria Police increased the speed camera operations in two Police Districts for a month at a time, during two selected months when TAC speed-related advertising was present and two months when it was absent. The intention of this systematic plan was to allow MUARC to examine the interacting effect of the enforcement and publicity on crashes. MUARC’s analysis ultimately considered the monthly variations throughout 1996-2000 of the speed camera activity, measured by the number of speeding TINs detected in each District, and of awareness of the TAC anti-speeding advertising, in total and for the emotive-style and enforcement-related advertising separately (Cameron et al 2003a).
With respect to the influence of the speed-related advertising on the frequency and severity of crashes, the study concluded that:

1. High levels of awareness (more than 500 Adstock units) of TAC speed-related publicity with emotive styles produced a 12-13% reduction in casualty crashes in Melbourne during the months in which it occurred.

2. There was no evidence of an effect of the emotive-style speed-related publicity on the injury severity outcome of the casualty crashes.

3. There was no evidence that awareness of the speed-related publicity with enforcement styles contributed to casualty crash reductions during 1996-2000.

4. There was no evidence of an interaction in the effects of the enforcement and the publicity on casualty crash frequency.

5. There was an interaction effect on fatal casualty crash outcome when there were very high levels of speeding TINs detected in the previous month and high levels of awareness of enforcement-style speed-related publicity. The reduction in risk of fatal outcome was greater than expected from effects estimated when the enforcement and publicity operated alone at these levels.

6. Drivers’ perception of the risk of detection, when speeding, was increased by high levels of awareness (more than 750 Adstock units) of the speed-related publicity, compared with the perception when the awareness was at medium levels.

The study also found an association between the level of speeding TINs detected by speed cameras in each Police District during the previous month and reductions in casualty crashes in the same District (as described previously). There was also 40% reduction in the risk of fatal outcome of the crashes when the level of speeding TINs detected during the previous month was at very high levels (Cameron et al 2003a, b).

This and other research suggests that mass media publicity can play a valuable role in supporting speed camera operations. In such situations, the publicity may magnify the perceived risk of detection and add to the deterrent effect achieved by the enforcement. The key role of publicity with an emotive style portraying the traumatic consequences of speeding is apparent. Such publicity appears to play a different kind of supporting role by persuading the community to be more receptive to increased camera surveillance rather than directly affecting perceptions of enforcement presence. The recent research also suggests that emotive-style speed-related publicity can have a direct effect on casualty crash risk, independent of any role in support of speed enforcement.

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7 Adstock is a function of television advertising intensity, in turn measured by TARPs (Target Audience Rating Points), which has been shown to measure awareness of current advertising and retained awareness of past advertising (Broadbent 1979), in this case assuming a “half-life” of five weeks.
4 OVERALL ENFORCEMENT STRATEGIES

4.1 STRATEGIC APPROACHES TO CHOOSING PACKAGES OF ROAD SAFETY PROGRAMS

A jurisdiction can choose to package its road safety initiatives with the aim of achieving a short-term reduction in road trauma, a medium- to long-term reduction, or both (Hendrie and Ryan 1997). Programs aimed at improving road user behaviour principally aim to achieve an improvement in the short-term (hopefully being maintained in at least the medium-term), whereas programs aimed at improving the road infrastructure and vehicles generally aim to reduce road trauma in the medium- to long-term and maintain this effect for a substantial period.

A jurisdiction can also choose the initiatives to include in its road safety package according to a number of strategies, independent of whether it aims to achieve short-term or medium- to long-term improvements. Elvik and Amundsen (2000) and Elvik (2002) have defined three general strategies:

1. **The Cost-Benefit Strategy** consists of all road safety measures whose marginal benefits are greater than their marginal costs. The benefits include the total monetary benefits for safety (reduced crashes and injuries, appropriately valued), mobility and the environment.

2. **The Vision Zero Strategy** consists of applying, as consistently as possible, the road design principles of Vision Zero, and Vision Zero speed limits. The aim of Vision Zero is to provide a forgiving road environment, and limit vehicle speeds, so that death or serious injury to humans involved in crashes is not possible. The main emphasis is put on cost-effectiveness in terms of reducing fatalities and serious injuries.

3. **The Maximum Safety Potentials Strategy** involves implementing all potentially effective road safety measures to the maximum conceivable extent. This strategy would produce the maximum improvement in road safety, but would be without consideration of whether the marginal cost of full implementation exceeds the marginal benefits.

Elvik and Amundsen (2000) reviewed all potentially effective road safety measures for assessment of their safety potential, cost-effectiveness and benefit-cost ratio. Of the 139 measures considered, 15 had unknown effects, 25 measures were ineffective, 18 overlapped with other measures, and 15 were fully implemented in the jurisdiction considered (Sweden). They then developed packages of the remaining measures, chosen according to the three general strategies outlined above. They found that only the Cost-Benefit strategy produced a package of measures whose overall benefits exceeded the cost of implementation (package benefit-cost ratio of 1.25). The other two strategies led to packages with very small benefit-cost ratios close to zero. In both cases the establishment and operating costs of the package were substantially greater than for the cost-benefit package, and increased travel times (principally due to reduce speeds) contributed substantial negative benefits. However, the projected reduction in fatalities in future years was substantially less with the Cost-Benefit strategy compared with the other two strategic approaches.
Elvik (2002) presented details of the benefit-cost ratio for each measure if used optimally in Norway and Sweden (separate estimates for each country).

### Table 4.1 Benefit-cost ratio by enforcement measure for Norway and Sweden

<table>
<thead>
<tr>
<th>Measure</th>
<th>BCR in Norway</th>
<th>BCR in Sweden</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed cameras (fixed site, overtly operated)</td>
<td>4.75</td>
<td>1.60</td>
</tr>
<tr>
<td>Random breath testing</td>
<td>1.51</td>
<td>1.50</td>
</tr>
<tr>
<td>Stationary speed enforcement (using hand-held speed detectors)</td>
<td>3.62</td>
<td>2.89</td>
</tr>
<tr>
<td>Seat belt enforcement</td>
<td>3.85</td>
<td>2.67</td>
</tr>
</tbody>
</table>

Public information campaigns using the mass-media were considered by Elvik and Amundsen (2000) to be an ineffective measure, except in some cases when combined with other measures such as new legislation or police enforcement. Elliott (1993) found that increased enforcement in conjunction with mass-media publicity increased the effect, but he also found cases of effective television campaigns without enforcement. Delhomme (1999) concurred with this finding, noting that alcohol-related campaigns reduced crashes by 6.9% during the campaign, speeding-related campaigns by 16.9%, and that the effects were greater when accompanied by enforcement and/or legislative initiatives. However neither of these studies attempted to estimate benefit-cost ratios for mass-media publicity, either alone or in support of enforcement operations.

### 4.2 EUROPEAN COMMISSION RECOMMENDATIONS ON ENFORCEMENT STRATEGIES

The European Commission has funded comprehensive reviews of behavioural and enforcement-related programs through the GADGET (2000) [Guarding Automobile Drivers through Guidance Education and Technology] and ESCAPE (2003) [Enhanced Safety Coming from Appropriate Police Enforcement] projects, respectively. There was also a review of Police enforcement strategies by the European Transport Safety Council (1999) which led to proposals for effective traffic law enforcement in the EU countries (European Commission 2002). The Commission gave priority to enforcement of speeding, drink-driving and seat belt non-use to the exclusion of other illegal road behaviours. Following a comprehensive cost-benefit analysis of potential enforcement initiatives in each Member Country (ICF Consulting 2003), the Commission issued a formal “Recommendation” on enforcement in the field of road safety (European Commission 2003). The Recommendation proposed that the enforcement of the above illegal behaviours should be combined with publicity campaigns to raise public consciousness of the subject concerned.

This Recommendation was welcomed by the European Transport Safety Council (ETSC), the Association of Chief Police Officers (ACPO), and the European Traffic Police Network (TISPOL) who saw adoption of the Recommendation as being essential to achieve the EU’s objective of halving the annual road deaths by 2010. However these bodies stated that they believed that the Commission should have issued a “Directive” on the subject, a legally binding instrument which would have obliged all Member Countries to implement the proposed enforcement actions (ETSC, ACPO and TISPOL 2004). These statements indicate the strength of feeling about the definitive nature of effective enforcement of speeding, drink-driving and seat belt non-use to contribute to real and sustained road trauma reductions.
Regarding the extent of implementation in each Member Country, the Commission recommended that best practice in enforcement and publicity in the fields of speeding, drink-driving and seat belt non-use should be implemented throughout the EU. Best practice in reducing speeding was found to be through the use of [overt] speed cameras as used in the U.K. (6000 fixed and mobile camera sites covering about 15% of traffic and 20% of casualty crash locations). Best practice in drink-driving enforcement was found to be through random breath testing as practised in Sweden and Finland (where the number of tests each year was about 22% of licensed drivers)\(^8\). Best practice in reducing seat belt non-use was found to be in Sweden through a combination of enforcement checks and publicity campaigns (2 Euros per driver per year spent on enforcement and 0.75 Euros per driver per year spent on publicity).

The analysis conducted for the Commission estimated the benefit-cost ratios if each of the above enforcement initiatives (and supporting publicity) were implemented throughout the EU to the extent as in the best practice country (ICF Consulting 2003):

- Overt, fixed and mobile speed cameras: 6.8
- Random breath testing: 8.1
- Seat belt checks and publicity campaigns: 13.1

### 4.3 EFFECTIVENESS AND COST-EFFECTIVENESS OF IMPLEMENTED PACKAGES INCLUDING ENFORCEMENT INITIATIVES

#### 4.3.1 Victoria

During 1989/90, Victoria commenced implementation of a package of new initiatives:

- intensified random breath testing using 13 new high visibility “booze buses”
- progressive introduction of 54 mobile speed cameras operated covertly, together with a new Traffic Camera Office capable of processing a large number of offences
- high-profile, intensive multi-media publicity support for each program

Cameron, Newstead and Vulcan (1994) provided estimates of the percentage reductions in serious casualty crashes in Victoria during each of the years 1990 to 1993 due to the speed camera and random breath testing programs (see figure 4.1), including the supporting mass media publicity in each case. The separate contributions of the speed camera operations (Traffic Infringement Notices issued) and speeding-related publicity (“speed” and “concentration” themes\(^9\)) are shown, as are the individual effects of the booze buses and alcohol-related publicity. The anti-speeding and drink-driving programs together were estimated to have contributed reductions in serious casualty crashes of at least 25% each year. The estimated total saving in serious casualty crashes during the four years was 10,820. (In addition, there were probably considerable savings in the less serious injury crashes, but these could not be assessed.)

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\(^8\) However, all Australian states have a level of random breath testing in excess of European best practice.

\(^9\) The messages of the “concentration” advertisements included speeding images and references to speed cameras, and hence they may have been confused and interpreted as speeding-related messages.
The benefit-cost ratio of this package of programs has been estimated (Cameron 1995). The average social cost of a serious casualty crash, using the human capital approach, was estimated as $200,000 in 1992 prices. Thus the total benefit from the package during 1990-1993 was estimated to be $2160 million. During the years 1989/90 to 1992/93, the total cost of the increased random breath testing and speed camera programs, including the supporting publicity and establishment of the Traffic Camera Office and its operating costs, was estimated to have been $98 million (Vulcan 1993). Thus the package was estimated to have a benefit-cost ratio of 22 over its initial four years.

4.3.2 New Zealand

In 1990, the New Zealand Road Safety Plan set a target of 32% reduction in deaths (from a relatively high base level) by the year 2000. By 1994/95 it had become apparent that they were unlikely to achieve that level of improvement, and during 1995/96 they added a Supplementary Road Safety Package (SRSP) of initiatives which were modelled on the successful Victorian programs introduced during the 1990’s. The New Zealand Package was initially focused on enforcement activities aimed at drink-driving and speeding, supported by mass media advertising generally following the Victorian approach. Enforcement and advertising initiatives aimed at seat belt non-use were added in 1996/97.

The essential features of the SRSP were:

- increased hours of speed camera operations, conducted by overt camera units located in signed speed camera zones on rural highways, and a limited number of overt fixed cameras in urban areas
- introduction of advanced laser speed detectors to augment the speed cameras
- improved targeting of the speed camera and compulsory [random] breath testing (CBT) programs
- additional breath testing devices to support the CBT program
- sustained, intensive mass-media publicity to support the speed camera and CBT programs
A time series analysis found that the SRSP was associated with 10% reduction in serious casualties during 1995/96 and 24% reduction during 1996/97, compared to the expected trend in casualties without the SRSP, see figure 4.2 (Cameron and Vulcan 1998).

It was estimated that the SRSP saved 109 fatalities and 1,029 serious injuries during its first two years. The Land Transport Safety Authority valued the social benefit of these savings at NZ$611 million, with a benefit-cost ratio of 28 (Graham 1998).

Subsequent analysis showed that the benefits of the SRSP continued to be sustained over at least the next three years, to 1999/2000. Cameron, Guria and Leung (2002) estimated that over the first five years, the SRSP saved 393 fatalities (range 285 to 516) and 1810 serious injuries (range 1680 to 1980). The benefit-cost ratio for the package over the full five years has not been estimated, but probably exceeds 20. A review of operational measures and behavioural outcomes associated with components of the SRSP suggests that the drink-driving programs (CBT and supporting publicity) achieved their targets, but the anti-speeding (overt speed cameras) and seat belt programs did not and made a lesser contribution to the road trauma reductions achieved.

4.3.3 U.K. safety camera program

While not strictly a package of road safety initiatives, the U.K. safety camera program is a package of speed camera enforcement and local-level supporting publicity which has been carefully evaluated and its cost-effectiveness assessed. Both fixed and mobile speed cameras operate overtly in the UK. New camera visibility rules were introduced in June 2002 to further increase the visibility of speed camera operations. These rules required that camera housing be yellow and visible from specified distances from the camera sites. There was a clear intention that drivers be aware of the location of the cameras.
A cost benefit analysis of the speed camera program in ten police force areas conducted in 1996 (Hooke et al 1996) determined that accidents at the speed camera sites fell by 28% following the installation of the cameras. The speed of vehicles at camera sites also decreased by an estimated average of 4.2 mph (6.8 km/h) at each site. In financial terms the cost incurred in installing the cameras were returned five-fold after one year of operation. After five years, the speed cameras had generated a return 25 times the initial investment. It was noted, however, that the full benefits of speed cameras were not being achieved due to budgetary constraints. It was also noted that the fine revenue could cover the costs of an expansion in the program.

In response to a recommendation of the 1996 study concerning the constraints being placed on expanding the camera enforcement activity by the costs of cameras and their operation, the relevant authorities agreed to allow a two-year trial in eight areas of Great Britain in which the costs of camera enforcement and prosecution could be recovered from fine revenue. In each area an operational partnership was formed to run the “safety camera scheme” comprising the police force for the area, the highway authorities and the courts.

The results from the first two years in the pilot areas allowed the effects of the fixed and mobile cameras to be compared (Gains et al 2003). The fixed cameras being permanent could be expected to affect speeds and crashes at all times, but the mobile cameras may have an effect only at the time they are present and for a period thereafter. (However the study examined effects throughout the year at mobile camera locations [as has Newstead and Cameron (2003) in Queensland]; it is not known how frequently each mobile site was enforced.)

Over the two years, average speed at camera sites fell by 10% or 3.7 mph (6 km/h). The decrease in average speed was slightly greater at fixed camera sites, but there was a much greater fall in the proportion of vehicles speeding at fixed camera sites (67%) than at mobile camera sites (37%). When excessive speeding was examined (exceeding the speed limit by more than 15 mph), the proportion of vehicles fell by 96% at fixed camera sites and by 55% at mobile camera sites.

Serious casualty reductions were substantial over the two years (35% reduction in fatal and serious injuries at camera sites), but the results showed that the reduction was greater at fixed camera sites (65%) than at mobile camera sites (28%), as could be expected given the relative magnitudes of the speed behaviour changes. The crash effects were similar in urban and rural areas, with pedestrians being particular beneficiaries of the program (56% reduction in fatal and serious injuries at camera sites).

The effects of the overt cameras appeared to generalise across the whole of the trial areas, with the average number of fatal and serious injuries in each area being 4% below the long-term trend in serious road trauma in the rest of Great Britain. While the camera sites are located in speed-related “accident hot spots”, the density of their locations and/or their threat to speeding motorists appeared to be sufficient to produce a general effect which extended beyond the camera sites to some extent.

A study of the first three years of the program, which had expanded to 24 areas, showed slightly weaker but still very substantial effects of the cameras on speeds and crashes at camera sites (Gains et al 2004). No results were presented indicating a general effect extending beyond the immediate vicinity of the camera sites. It was estimated that the value of the casualties saved by the program was £221 million per annum. The program released £54 million per annum to the local partnerships to invest in the safety cameras and supporting
publicity. These two figures indicate that the marginal benefit-cost ratio of the program is about 4.

### 4.3.4 Ireland

In 1998, the Republic of Ireland set a target of at least 20% reduction in both the number of road fatalities and serious injuries by 2002, compared with 1997 levels. This was planned to be achieved by initiatives aimed at speed, drink-driving and seat belt non-use:

- extending the use of [principally mobile] automatic speed detection systems including installation of fixed speed cameras
- evidential breath testing for drink-driving
- extending on-the-spot fines to non-wearing of seat belts
- developing a penalty points system which would trigger disqualification following repeated driving offences
- support for each of the above by high-profile mass-media campaigns

A preliminary economic analysis of this road safety package indicated a benefit-cost ratio of about 4.5 during its implementation period, rising to an annual figure of about 8.3 when fully implemented (Peter Bacon and Associates 1999).

A detailed economic analysis of the benefits and costs of expanding the overtly-operated mobile speed camera program by up to nine times its existing level in 2001 was conducted (Smith, Cameron and Bodinnar 2002). It was found that the decrease in the risk of a casualty crash was linked to the tripling of speeding infringement notices between 1997 and 2000. The analysis showed that, in terms of total social benefit, the marginal benefit-cost ratio always exceeded one if the speed cameras were operated to detect speeding infringements up to five times the then current level, and that the program benefit-cost ratio would always exceed 10. If only the benefits of the tangible cost savings (medical expenses and victims’ forgone income losses) were considered, the program could still expand by four times before diminishing returns occurred (marginal benefits less than marginal costs).
5 TRAFFIC ENFORCEMENT IN THE SAFE SYSTEM APPROACH

Western Australia’s Towards Zero strategy subscribes to the Safe System approach to road safety. This approach “aims to create a much safer road environment in which alert and responsible road users should not lose their lives – or be permanently disabled – as a result of a crash on our road system.” A Safe System should take human error into account, whether it be accidental or deliberate.

The Safe System approach includes:

- Designing and maintaining roads and roadsides to reduce risk to as low as reasonably practical - [including advising the road authority about emerging design problems]
- Setting speed limits according to the safety of the road and roadside - [including advising of necessary reductions in speed limits due to changed traffic conditions]
- Advising, educating and encouraging road users to comply with road rules, be unimpaired and alert, and drive according to the prevailing conditions - [including enforcing those unsafe behaviours which are illegal, and advising of necessary new laws proscribing currently legal unsafe behaviours which could be enforced]
- Encouraging consumers to purchase safer vehicles with primary safety features that reduce the likelihood of a crash … and secondary safety features that reduce injury severity in a crash - [including advising vehicle safety regulators about emerging vehicle-related crash or injury problems which should be addressed by new designs].

The inclusions in square brackets indicate additional contributions which traffic police, who are often have a front-line view of road trauma, could make to achieving a Safe System in areas which are traditionally the role of road and vehicle engineers and behavioural experts.

At a minimum, the Safe System approach envisages that traffic enforcement will protect the wider community from the actions of a minority of road users who repeatedly put the community at risk with anti-social behaviour. However, this is a narrow view of the contribution which traffic enforcement, and traffic policing more generally, could contribute to achieving the Safe System in WA.

5.1 A BROADER ROLE FOR TRAFFIC POLICING IN THE SAFE SYSTEM

The Safe System philosophy places emphasis on preventing serious road trauma (especially death), including those that may not be the result of any illegal behaviour or “fault” of any participant in the road transport system. It accepts that “errors” will occur. Road trauma can be considered to be the end result of a chain of events which leads to death and severe injury. This “road trauma chain” is shown schematically below in Figure 5.1. The first part of the chain (the pre-crash phase) is associated with various risks of going from one step to the next and ultimately there is the risk of crash involvement.
The second part of the chain (crash and post-crash phases) represents the transfer of kinetic energy built up during the pre-crash phase to the humans involved in the crash. This physical process can be represented as the risk of injury in a crash, which in turn is associated with the risk that the injury may result in severe injury (e.g. permanent disablement) or death (if emergency rescue is not timely). Some humans are particularly susceptible to fatal outcome from a given level of injury: the elderly, the very young, the highly intoxicated, and unprotected road users generally (pedestrians and cyclists) who are not surrounded by a vehicle body to absorb some energy before they do.

This simple model illustrates that there are numerous places where traffic policing can break the chain (i.e. reduce the risk of the next step) and hence prevent road trauma. Traditionally traffic policing has focused on illegal/unsafe behaviours on the road known to have high risk of crash involvement (essentially behaviours in the box “exposure to risk (A)” in the pre-crash phase) with the aim of reducing those exposure events. More recently, traffic policing has focused on speeding because of its role in kinetic energy build-up (which is clearly associated with the risk of injury in crashes) as well as its role as a risk-increasing behaviour sometimes resulting in crash involvement.
Traffic policing can also play a significant role in ensuring that entities not eligible for road use (e.g. under-age and disqualified drivers, and illegally registered and unroadworthy vehicles) do not use the roads, thus breaking the chain early in the pre-crash phase. The role of speed enforcement to reduce energy build-up during the pre-crash phase has already been mentioned, and could be complemented significantly by mass-limit enforcement of heavy vehicles and/or more stringent enforcement of their speed limits.

Related to the crash phase, traffic policing can play a significant role by ensuring that adult and child restraint wearing laws are complied with, and that motorcycle and bicycle helmets are worn. Rapid and effective post-crash emergency rescue of road crash victims can be substantially improved by traffic police providing emergency communications and site management.

A feature of this simple model of road trauma is that traffic policing can play a substantial role by deterring illegal (and unsafe) traffic behaviours across the whole traffic system, not necessarily focus on a small part of the system where collisions are thought likely to occur (assuming such locations can be identified reliably) or where illegal/unsafe behaviours are more frequent. Another important feature is the key role of speeding in contributing to the build-up of kinetic energy and hence to the risk of serious injury occurring as a result of a crash, no matter whether the crash involved illegal behaviour or nobody was “at fault”. The one-sided transfer of the kinetic energy to an unprotected road user participant (or even a passenger car occupant participating in an impact with a truck) places emphasis on keeping separate the traffic units of incompatible mass.

Traffic policing can play an even more significant role by extending its activities beyond enforcing illegal unsafe behaviours to actions which help to reduce unsafe behaviours by all participants in the road traffic system, not just the road users but also the bodies responsible for providing the road infrastructure, vehicular and social environments. This broader role for traffic policing, perhaps going well beyond traditional police activities, is justified by their immediate and front-line interaction with road trauma, putting traffic police in a powerful position to take action and/or demand changes to break the road trauma chain before it manifests itself again and results in future road trauma.

5.2 IMPLICATIONS OF THE SAFE SYSTEM APPROACH FOR TRAFFIC POLICING

The observations in section 5.1 need to be translated into the essence of what traffic policing needs to achieve in WA to follow the Safe System philosophy and contribute to achieving the Towards Zero strategy. It is expected that a paradigm shift will be clearly apparent that will point to the need for police officers involved in traffic enforcement to understand this new approach, perhaps be retrained, and take extended responsibilities.

Traffic police are at the front line of interactions with crash victims, traffic offenders, road infrastructure deficiencies, and inadequate vehicle design. They see the breakdowns in the Safe System resulting in death or serious injury first-hand and are in the best position to define corrective action to break the road trauma chain. Their recommendations for action could go beyond their current responsibilities for traffic law enforcement aimed at offenders, and even beyond their current training, so they need to be equipped with this responsibility and training. They also need to be empowered to exercise this responsibility because of their front line role, a role which is not shared by the other WA road safety agencies responsible for implementing the Towards Zero strategy.
Traffic police need to see themselves as part of a broader road safety delivery system and to prompt reflection on the big question of what police should do and who they should be in this system. But if we encourage traffic police to think in this creative way about road trauma and their role in preventing it, it is important that they do not have limits on their capacity and responsibility to address the issue.

5.3 EXTENDED CAPACITY OF TRAFFIC POLICE

There is the broad question of what additional capacities traffic police need to have to capitalise on their front line view of road trauma, understand the processes leading to serious injury in each case, synthesise the understanding gained from experience with many crashes, define opportunities to break the road trauma chain (or at least substantially weaken some links), and take action or demand changes to prevent future road trauma. The answer may be that they need to have in-depth technical knowledge of each of the professional areas (road, vehicular and “social” engineering) that have specialist responsibility for the elements of the road transport system.

Wood and Bradley (2008) have emphasised that an important principle is that formal, “professional” forms of knowledge cannot be allowed to trump the views of those who are most affected, in this case the views of front-line traffic police. While ultimately the best (or most cost-effective) action to break the road trauma chain may be taken by another road safety agency, it is critical that traffic police have the capacity to understand the problem from a broad perspective and that their creative thinking not be constrained in any way.

5.3.1 Understanding crashes and injuries

To illustrate the type of new thinking processes which traffic police need to be equipped with, their investigations of crash causes need to move beyond “precipitating” factors (e.g. those unsafe, possibly illegal, behaviours with high risk (A) in the road trauma chain) to looking for “predisposing” factors (those factors which set the scene for the specific behaviours with risk (A) to occur). A focus on only illegal behaviours, which are usually of the precipitating type, is too narrow. There is also a need for traffic police to think about the systemic interaction of humans, vehicles, roads and roadsides which make up the road transport system, which we all too often take for granted as unchangeable, and address whether the behaviours/elements with high risks (B), (C) or (D) in the road trauma chain are the most critical predisposing factors. Finally, with a focus on preventing road trauma, not only preventing crashes, there is a need to address the human, vehicle and road infrastructure interactions which increase the risk of severe injury, in particular the roles of speed and mass of the traffic units that can collide with each other (and the road design that allows opportunities for them to collide).

5.3.2 Synthesis of crash investigations

It would be very unusual for a single serious crash, even if investigated in depth, to be a sufficient basis for a countermeasure recommendation to be put forward by traffic police. Even the crashes at a single location, assuming many are the same type, may not be an adequate basis unless the number of such crashes is relatively large. This is because, from a broad Safe System point of view, breaking the road trauma chain at some links (especially those relating to road infrastructure or vehicle design) may be unacceptable unless there is substantial evidence of a problem at a specific link (let alone evidence that a countermeasure to the problem will be effective).

It is important that this synthesised thinking be developed among traffic police in order to avoid over-reaction (or premature reaction) to single serious crashes and/or a number of
crashes at a single location. Otherwise there would be tendency for traffic police to fall back on the response tools that they know so well: increased enforcement (or education) about the specific unsafe behaviour which they judged to increase risk (A) in the case of the single crash or single location which they investigated. Such a response may be ineffective, or only temporarily effective, because the most critical factor leading to the serious road trauma outcome may in fact be another link in the chain and may not be a behavioural “precipitating” factor. For example, it may be a social factor which results in a sub-group being more likely to engage in the precipitating behaviour, it may be a road factor allowing excessive kinetic energy build-up through travel speed, or it may be a vehicle factor provides inadequate energy dissipation before it is transferred to the humans involved in the crashes.

Thus ultimately the most effective response in each of these scenarios may be for action to be taken by “social engineers” (e.g., Office of Road Safety advertising staff), road engineers, or vehicle regulators and engineers, respectively. Of course, the timing of implementation of these responses may be relatively long-term and action by traffic police may be most relevant in the short-term. Addressing issues of this type is another skill which traffic police will need to develop as part of extending their capacity. These important issues will be covered further in the following sections.

5.3.3 Defining opportunities and relative merits of potential countermeasures

A general truism in road trauma countermeasure development is that the most effective (or cost-effective) way to break the road trauma chain in a type of serious crash/injury (defined through the investigations and synthesis outlined above) may not be at a link where the risk is highest, but at another link before the crash occurs, or at a link before serious injury occurs after the crash.

This type of thinking appeared in the road safety domain as a result of the involvement of medical epidemiologists who brought their approach to preventing disease to bear on the problem (Haddon, 1968). Haddon conceived of the three phases ultimately leading to serious injury outcome in a crash, namely:

- Pre-crash phase
- Crash phase
- Post-crash phase (including emergency rescue and treatment of the injured),

and suggested that countermeasures to the progression of events through each of these phases could lie in the road user behaviour, vehicle, or road infrastructure domains (later commentators added the social domain). Up to that time, most road trauma countermeasures focused on road user behaviour during the pre-crash phase.

The road trauma chain in Figure 5.1 expands on Haddon’s three phases. It makes transparent that kinetic energy build-up occurs during the pre-crash phase (through speeds and masses) but, apart from the role of speed as a crash risk-increasing factor, the principal role of the built-up kinetic energy is in making the injuries during the crash phase more severe, unless the energy can be dissipated before it is transferred to the humans involved.

Defining the opportunity for the most effective countermeasure to serious road trauma may require lateral thinking and, in the case of traffic police, consideration of opportunities outside changing road user behaviour during the pre-crash phase. Evidence of the likely effectiveness of potential countermeasures should also be sought. Traffic police need to be armed with knowledge about proven effective countermeasures across the full range of possibilities.
included in Haddon’s framework, as well as the increasing availability of new countermeasures due to technological developments.

The final step in consideration of opportunities to break the road trauma chain, having first established likely effectiveness, is the relative cost. There are well established methods of economic analysis which allow the expected savings in road trauma to be valued in dollar terms, then compared with the capital and operating costs of the countermeasure, and a benefit-cost ratio calculated. These methods are equally applicable to behaviour change initiatives, such as types of traffic law enforcement, as they are to road infrastructure and vehicle design initiatives.

It is generally accepted that the estimated benefit-cost ratio should (well) exceed one before a countermeasure is proposed, and that the countermeasure with the highest benefit-cost ratio should be supported. Traffic police need to understand this process of decision-making to have a full understanding of the role of their crash investigations and synthesis in ultimately leading to countermeasures. This understanding will become more acute during the implementation of the Safe System philosophy, which in theory puts almost infinite value on preventing road deaths and disabling injuries, but in practice some form of benefit-cost analysis of countermeasure options will be needed in our society because of limited resources.

5.3.4 Countermeasure recommendations and policy constraints/barriers

The Safe System approach is a fundamentally different philosophy for the road safety agencies in WA to operate under, and because of this many of the key players (including WA Police) will need to learn new roles. Because all of the existing agencies have operated under previous approaches, there is need for traffic police to understand what they were so that when they encounter any residual thinking and constraints, they can be challenged.

Proposals for major new road trauma countermeasure initiatives or responsibilities are submitted principally by one of the WA government agencies through the Road Safety Council. In the past, this mechanism may have impeded WA’s traffic police in having countermeasure proposals accepted in areas which were perceived as lying outside the purview of police, i.e., the enforcement of traffic law defined by the legislature. Proposals for road infrastructure initiatives are viewed as appropriately coming only from Main Roads WA, and proposals for mass-media road safety advertising may be viewed as appropriately coming only from the Office of Road Safety. Other agencies may make proposals in these areas, but it is likely that the proposals are often viewed as being outside their area of expertise.

It is important that traffic police recognise that these barriers and constraints are artificial and that they should not deter WA Police from submitting countermeasure proposals in any area under the Safe System approach aimed at achieving the objectives of the Towards Zero strategy. The Safe System approach requires so much creative and lateral thinking to achieve the strategy goals, especially thinking by those with a front-line view of road trauma, that it is critical to the success of the strategy that traffic police not be constrained in any way.

5.4 ACCEPTANCE OF THE EXTENDED TRAFFIC POLICE ROLE BY OTHER ROAD SAFETY AGENCIES

Acceptance of an extended role for the WA traffic police, as outlined above, will be a critical issue affecting the extent to which traffic police can make a significant contribution. There are at least three issues likely to affect acceptance by the other WA agencies:
1. Acceptance that a front-line view of road trauma is the basis of valuable information about the contributory factors, is unbiased (not constrained or distorted by police’s traditional focus on illegal road user behaviours), and cannot be obtained in similar depth cost-effectively from other sources (including current Police crash reports).

2. Acceptance that traffic police understand the contributory factors behind road trauma from a broad perspective, covering the roles of the road users, vehicles, road infrastructure and social environment, and the mechanisms during the pre-crash, crash and post-crash phases of the road trauma chain.

3. Acceptance that traffic police have the capacity to synthesise their understanding of the contributory factors in individual road trauma events, into global summaries of patterns of factors generally applicable to major groups of crashes, injuries or elements of the road transport system. This ability to synthesise goes beyond information collected in typical traffic (and crime) investigations of individual events, which all police are well trained to do. It is a strategic problem-oriented way of thinking (Wood and Bradley 2008).

The Safe System approach is a fundamentally different philosophy and way of thinking about road safety in WA. Even in jurisdictions like Sweden, where “Vision Zero” was accepted by the Parliament about a decade ago, they are a long way short of meeting their targets for reductions in deaths and serious injuries. This is because in practice there has been a lack of commitment to strong speed management and delays in treating the road infrastructure to make it more “forgiving” (Tingvall and Lie 2008). The government road safety agencies in WA are going to find the Towards Zero strategy targets a similar challenge.

Against this background, it is important that traffic police in WA be fully equipped to understand the Safe System approach in depth. A comprehensive understanding of all of the issues outlined in section 5.3 will be necessary to maintain credibility among the other road safety agencies. The establishment of a School of Traffic Policing in WA may be necessary. Its very existence would give credibility to an extended traffic police role and make their actions and recommendations more acceptable.
6 WORKSHOPS WITH WA POLICE

6.1 STRUCTURE OF THE WORKSHOPS

Workshops were conducted with operational police officers in selected parts of WA using the following procedure in each case:

1. The range of enforcement options (‘operational conclusions’) aimed at improving enforcement strategies in the areas of drink-driving, speeding and seat belt non-use, identified in Phase 1, were formally presented – with responses from police officers then invited.

2. Responses effectively evaluated each set of conclusions in light of on-the-ground enforcement experiences. Evaluations used three basic criteria:
   • relevance and practicality of the conclusions;
   • congruence with current practices;
   • recommendations regarding the conclusions

3. This evaluation process was conducted separately for drink-driving, speeding and seat belt enforcement, and then for some of the following enforcement areas, as time permitted at each workshop:
   • Drug-driving
   • Mobile phone use
   • Unlicensed driving
   • Heavy vehicles
   • Fatigue
   • Pedestrians
   • Motorcyclists

6.2 PRESENTATION OF OPERATIONAL CONCLUSIONS

The PowerPoint presentation used to display the operational conclusions from previous research is given in Appendix A. This aimed at providing a short summary of the research documented in chapters 2 to 5 of this report. (These chapters had been provided to WA Police as a report on Phase 1 of the project, but it was not expected that all workshop attendees would have digested all of this material.) It covered the following major issues and findings, and provided blank slides to allow the project team to record the police officers’ responses:

• The Safe System approach and the role of traffic policing
• Drink-driving enforcement, speed enforcement, and seat belt non-use
• For each of these major enforcement areas, officers’ responses on:
  o Relevance to WA and practicality
  o Consistency with current practice in WA
  o Conclusions and opportunities for WA
• Other traffic offences
  o Nature of traffic offences: Transient or fixed
  o Specific and general deterrence
Global findings about the effects of traffic enforcement aimed at specific and general deterrence on the fixed and transient offences

- Enforcement aimed at drug-driving, mobile phone use, unlicensed driving, heavy vehicles, fatigue, pedestrians and motorcyclists

- For each of these other enforcement areas, officers’ responses on:
  - Strengths and weaknesses of current enforcement practice in WA
  - Improvements and opportunities for WA

### 6.3 WORKSHOPS CONDUCTED DURING 2010/11

Three workshops were conducted with officers in regional WA (two in Albany and one in Karratha) and in Perth (two workshops). Time did not permit all of the enforcement areas to be covered in each workshop (and the Karratha workshop was curtailed because of an impending cyclone demanding Police attention). The officers’ responses as recorded on the blank PowerPoint slides are given in Appendix B. A summary is given in the following chapter.
7 ENFORCEMENT OPPORTUNITIES FOR WA TRAFFIC POLICE

The following sections attempt to summarise the WA police officers’ responses following their exposure to the research-based operational conclusions in terms of their perceptions of relevance, practicality, consistency with current practice, and new opportunities. The biggest differences in their responses related to whether the officers were regionally-based or located in the Perth metropolitan region. Conclusions regarding the implications of the research and the officers’ perceptions are also given.

7.1 DRINK-DRIVING ENFORCEMENT

7.1.1 Random breath testing (RBT)

Regional officers
Booze buses seldom visit regional police districts and hence the operational conclusions were viewed as irrelevant. Car-based RBT is required by police management to achieve a minimum number of tests and this constrains its use to places and times to relatively high traffic locations. However, high alcohol times and high alcohol-related crash locations are given priority and are also targeted.

The research suggests that a minimum number of hours of testing per week is required before crash reductions result from RBT. Performance criteria for regional RBT should reflect this indicator of the general deterrence effect. (However, the urban-area minimum of 20 hours per 100 square kilometres per week should not be imposed in regional WA, except perhaps in the larger towns.) Criteria to achieve a minimum number of tests may constrain car-based RBT from achieving broadly-based general deterrence across the whole road system.

Metropolitan officers
Booze bus operations are the principal form of drink-driving enforcement in Perth. Management demand to achieve a minimum number of tests requires the bus operations to focus on highly-trafficked roads and to be staffed by many testing officers. It was suggested that achieving 20 hours of RBT per 100 square kilometres per week in Perth would be impossible with current resources and operational requirements and practices.

Car-based RBT should be used in Perth in conjunction with booze buses in order to provide a broader coverage of the metropolitan road system for a greater number of hours per week and hence achieve a general deterrence effect. Car-based RBT should also be conducted on sub-arterial roads and residential streets where it is perceived that booze buses are not operated. Performance criteria for metropolitan RBT should relate to hours of testing and breadth of coverage rather than the number of tests achieved.

7.1.2 Targeted alcohol testing

Regional officers
Regional police recognised that targeted testing is the most efficient way to apprehend drink-drivers. There is no constraint on the use of these operations near clubs and pubs. High BAC level drivers are recognised as the primary target because of their high risk of crash involvement. Some police management place emphasis on the quality of the drink-driver apprehension, measured by the BAC level, rather than the quantity of apprehensions or the number of breath tests performed.
There was general dissatisfaction with the sanctions imposed on apprehended drink-drivers, with some magistrates considered too liberal in the face of repeated recidivism and driving disqualified. It was proposed that severe drink-driving offences (BAC at least 0.08g/100ml) be added to the Hoon Legislation offences because vehicle impoundment would be an effective sanction and constraint on “problem” drink-drivers. Some officers favoured a requirement for alcohol interlocks to be fitted to the cars of problem drink-drivers and were aware that such a provision has been before the WA Parliament for many years.

Metropolitan officers

Metropolitan police agreed that targeted testing is the most efficient way to apprehend drink-drivers, but were also uncertain about the effectiveness of subsequent sanctions, especially for high BAC offenders. Targeted testing indicates that there are still many drink-drivers on the road and that they avoid the locations where RBT is regularly operated.

There was concern that substantial time was required to process an apprehended drink-driver, apparently due to a recent increase in the required documentation. Because of this, less time was available for patrol officers to conduct targeted testing and achieve what some perceived to be their principal role, namely to apprehend illegal drink-drivers.

7.1.3 General drink-driving enforcement issues

The major issue for officers undertaking drink-driving enforcement was lack of clarity regarding whether operations were aimed at general deterrence (by raising the perceived chance of detection, principally through RBT) or specific deterrence of drink-drivers (by apprehension of them and their experience of the consequences, to discourage re-offending). The same key performance indicator (KPI) is applied to all drink-driving enforcement operations, namely the number of breath tests achieved (sometimes also the number of drink-driver apprehensions). There is a need to develop KPIs that reflect the research connecting drink-driving enforcement inputs and outputs with real reductions in alcohol-related crashes through decreases in drink-driving on the road. The contributions of RBT hours and coverage, not just number of tests, need to be balanced against the effectiveness of apprehending drink-drivers, given the available sanctions to discourage or inhibit re-offending.

Another issue that emerged during workshop discussions, not just in the context of drink-driving enforcement, was a concern that those officers perceiving themselves as “traffic police” were no longer dedicated to traffic responsibilities compared with past practice. Their KPIs spanned non-traffic as well as traffic activities, and this has apparently resulted in traffic KPIs being over-simplified and indirectly related to road trauma reductions (as outlined in the previous paragraph for drink-driving enforcement). There was also concern that their non-traffic KPIs (especially in crime-related areas) demanded that they give lower priority to traffic enforcement when there is a conflict of resource availability.

7.2 SPEED ENFORCEMENT

7.2.1 Speed cameras

Regional officers

There were ambivalent attitudes to mobile speed cameras among regional officers. Some believed that their use stops “full policing”, in that compared with speeding intercepts there are lost opportunities to detect other traffic offences and crimes. Some felt that while cameras may be more efficient than intercept speed enforcement (more offences detected per hour),
they are not as effective as intercepts in deterring subsequent speeding. Other officers believed that there is little difference in relative effectiveness.

Some regional officers felt that speed cameras create animosity between the public and police, this being of particular concern in rural communities. Mobile speed cameras need to be operated overtly to be publicly acceptable. In addition, there should also be speed enforcement involving intercepts by traffic officers and this provides some personal contact of offenders with police, making all speed enforcement acceptable. Speed cameras should supplement traffic officers for speed enforcement in rural areas, but not operate alone.

Metropolitan officers
These officers had a broader view of speed camera enforcement, being aware of fixed spot-speed and (potentially) point-to-point average speed cameras as well as traditional mobile cameras. They believed that fixed camera systems should be used to address speeding at black spots and that point-to-point systems would be acceptable to the community and very effective in controlling speeds, especially on rural highways.

While it was agreed that the random allocation of the current overtly-operated mobile cameras across the road system would increase effectiveness, this would work against District management expectations for high numbers of speeding detections that favours locations with high detection rates per hour.

The metropolitan officers were concerned that constraints on speed camera offence processing resources were preventing the follow-up of high level (45 km/h in excess) speed offences and apparently unlicensed driver-owners, all of which could result in vehicle impoundment and other sanctions. The labour-intensive follow-ups were being discarded if a brief for prosecution could not be completed within 12 months of the offence.

7.2.2 Intercept speed enforcement

Regional officers
These officers generally favoured intercept methods of speed enforcement using moving mode radar in patrol cars or hand-held speed detection devices. Since these methods involve interviewing an offending driver after signalling him/her to stop, they were troubled by their inability to pursue vehicles travelling at more than 140 km/h for intercept (permission from a senior officer needs to be sought).

Regional officers view the interception of a speeding driver as an opportunity to educate and encourage better behaviour, as well as enforce, and sometimes exercise discretion and issue warnings in the case of relatively low level speeding. Such discretion would not be available for offences above the offence detection threshold set on a speed camera.

Metropolitan officers
These officers favoured marked patrol cars for speed detection operations, notwithstanding research indicating that unmarked cars (or a combination of unmarked and marked) used for moving mode operations are most effective.

Like the regional officers, the Perth officers would welcome new methods to detect and apprehend “hoon” speeders (those travelling 45 km/h in excess of speed limits) because of difficulties to conduct pursuits exceeding 140 km/h. They acknowledged that the new TruCam laser speed measurement and video recording device is an effective tool to prosecute
the high level offences that they witness, but believe that there are difficulties with the use of the device at night.

7.2.3 General speed enforcement issues

There was a recognition that there is a need to raise the perception that drivers can be detected and apprehended for speeding anywhere at any time, and that unpredictable methods of speed enforcement can play a key role, especially in rural areas (e.g., moving mode radar using unmarked cars on highways, randomised scheduling of mobile speed cameras, and covert mobile speed cameras near/in towns). The focus should be on reducing speeding, not necessarily on catching speeding motorists.

However, the rural officers mentioned that they were required to apprehend a certain number of speeders to provide fine revenue to offset the investment in speed enforcement through STEP [Strategic Traffic Enforcement Program] funding. As with drink-driving enforcement in WA, there appears to be a lack of clarity regarding whether particular forms of speed enforcement are aimed at general deterrence of speeding or at specific deterrence (and the production of fine revenue as well as deterring re-offending). There is a need to develop KPIs that reflect the research connecting speeding enforcement methods and inputs with real reductions in crashes and injuries through decreases in speeding (especially high level speeding). The generation of fine revenue should be incidental to achieving these KPIs.

Linked to this, it was mentioned frequently in the context of speed enforcement by those considering themselves “traffic officers” that it would be better if traffic enforcement responsibilities were returned to a “Traffic Board” (Road Traffic Authority) or the Department of Transport. Of all the key safety-related behaviours that they enforce, they felt that speeding was given a low priority within WA Police compared with non-traffic crime or even the more severe traffic offences (e.g. drink- and drug-driving).

Regarding new opportunities for speeding enforcement in WA, the officers suggested that there should be positive reinforcement of good speeding behaviour (such as demerit point credits if offence free in a previous period) and a mandatory speed awareness course as an option or alternative to current speeding sanctions. Some officers suggested speed limiting all new vehicles to a maximum speed of 110 km/h and requiring the retro-fitting of this technology to the vehicles owned by recidivist speeders.

7.3 SEAT BELT ENFORCEMENT

The regional and metropolitan police did not differ substantially in their attitudes to the enforcement of seat belt (including child restraint) offences. The fine penalties introduced in recent years, making the unbelted driver or unrestrained adult passenger liable for a minimum $500 fine, were considered to be unacceptably high by the public and by many police, especially general duties officers. Many traffic police are uncomfortable with enforcing the seat belt laws and because of this exercise (at least partial) discretion in some offending cases.

The research literature suggests that seat belt checks should be standard procedure when stopping motorists for other reasons (such as random breath tests, targeted alcohol screening and drug tests, apprehension of detected speeders, and licence and vehicle condition checks). The metropolitan officers agreed that seat belt checks are sometimes done as part of interventions for other offences, but are not required to be regularly carried out as part of all driver interactions.
Because of difficulties that regional police have with vigorously enforcing seat belt laws locally with a public viewing the penalties as unacceptably high, a strategy to rotate rural police to towns where they are not based nor known was suggested and has been implemented in some regions.

While the officers accepted that the WA Government has recognised the importance of seat belt wearing in preventing serious road trauma and hence has made the penalties for non-compliance severe, it was suggested that there be greater and on-going publicity about the reasons for the penalties and the benefits of complying. It was also suggested that there be a process of rationalisation of the penalties associated with other unsafe illegal behaviours and offences to reflect the risk of consequential road trauma in each case. The outcome of this rationalisation should be widely published to put the seat belt offence penalties in context.

7.4 DRUG-DRIVING ENFORCEMENT

Regional police recognised the availability of roadside saliva testing as a valuable new tool for drug-driving enforcement, but regretted the apparent absence of government funding to support an adequate testing level to provide a threat of apprehension for drug-drivers. The absence of trained drug testing officers in rural areas was also mentioned, meaning that drug testing operations generally needed to be linked to occasional visits of booze/drug buses to each region.

Metropolitan police noted that not all traffic officers were yet trained and experienced in carrying out drug tests, and suggested that a central traffic advisory service be established to provide specialist advice in related complex areas (such as the Field Impairment Test and preliminary drug test procedures). It was suggested that there be legislative change to allow a suspected drug-driver to be conveyed to a nearby booze/drug bus, if operating, for a preliminary drug test.

7.5 MOBILE PHONE ENFORCEMENT

Regional police were troubled by the enforceability of the (then) current mobile phone use legislation and were concerned about the amendments due to come into operation from 1 March 2011. In practice, they believed that only the obvious hand-held use of a mobile phone while driving could be prosecuted. It would be impractical to enforce the new regulation requiring a driver not to touch the phone (unless secured in a mounting) because the police officer may not have actually seen how the driver started or received the call and must surmise that the unsecured phone was touched to initiate the call while driving.

The officers also felt that the penalties for illegal mobile phone use were considered harsh by the public and some police, and even so were apparently not deterring the behaviour. They noted that CB radio use involves hand-held operation and can be similarly distracting as a mobile phone, but is not illegal.

7.6 ENFORCEMENT OF UNLICENSED DRIVING

Regional police expressed concern about some magistrates being reluctant to impose higher level vehicle impoundment sanctions (including forfeiture) on serial unlicensed driving offenders, instead imposing further licence suspensions that these offenders fragrantly ignored. In response, the police have conducted targeted observations of the home and work of known unlicensed drivers who are likely to re-offend.
The officers welcomed the availability of TADIS on-board patrol car computers to allow selective rapid checks of a vehicle owner’s licence status, but claimed that checks of the full traffic stream using ANPR technology had produced a high hit rate of suspected unlicensed owners and the follow-up processes were labour intensive. No comment was made about the proportion of suspects detected by ANPR that turned out to be unlicensed and/or driving an unregistered vehicle.

The availability of ANPR and on-board computer/communication technology is an important new automated tool for the enforcement of unlicensed driving and unregistered vehicles. Consideration of a regional or central processing system should be investigated by WA Police in order to more efficiently process suspected owner/drivers and vehicles and to relieve traffic patrol officers from follow-up activities that may inhibit their on-road patrol time.

7.7 HEAVY VEHICLE ENFORCEMENT

Metropolitan police expressed concern that there has been a loss of specialist trained police with the skills to adequately enforce the heavy vehicle safety regulations. They suggested that a partial answer to this is the scheduling of joint operations with DPI heavy vehicle inspectors to provide expert support for traffic police.

7.8 ENFORCEMENT OF FATIGUED DRIVING

Regional police noted that fatigued driving may be a substantial problem in WA because of the long travel distances in rural and remote areas. They believed that tactile edge lining is very effective in warning drivers that they are near the road edge, but this road treatment is not common in the remote areas of the State.

The police suggested that consideration should be given to a requirement that car drivers carry and complete log books to record the start and finish times of their journeys in remote areas, in much the same way as heavy vehicle drivers are required to do.

7.9 PEDESTRIAN ENFORCEMENT

Metropolitan officers believed that their management gives very low priority to apprehending pedestrians committing offences on urban streets and at intersections. Instead, they recognised that pedestrians are particularly threatened by speeding cars and that the most effective contribution that traffic police could make to pedestrian safety is to enforce speeding.

From their experience, police officers have observed that roo-bars fitted to the front of impacting vehicles contribute to the increased severity of pedestrian injuries. They suggested a requirement that roo-bars be removed from vehicles operating in Perth, but recognised that this requirement would produce an emotive response from vehicle owners and the Government.

7.10 MOTORCYCLIST ENFORCEMENT

Metropolitan police noted that intercepting offending motorcyclists can be difficult because of their high acceleration and top speed, leading to existing policy to abort motorcycle pursuits using cars. Patrol motorcycles are no longer used by WA Police, and the officers suggested that they be reintroduced for pursuits and enforcing motorcycle-specific regulations (e.g. lane-splitting).
Regarding automatic surveillance of motorcycle speeding, the officers suggested rear-facing cameras to allow the motorcycle number plate to be captured, however the identification of the motorcyclist is difficult because of helmet use, so full owner-onus for motorcycle offences would need to apply. Increased sanctions for false motorcycle number plates were also suggested.

The officers noted that the Hoon Legislation does not include motorcycle-specific offences that represent hoon behaviour. They suggested that motorcycle hoon behaviours should be added to the Hoon Legislation.
8. RECOMMENDATIONS AND OPPORTUNITIES

8.1 RECOMMENDATIONS BASED ON THE RESEARCH REVIEW

The following recommendations for traffic policing in WA are based on the major operational conclusions that emerged from Phase 1: review of Australian and international practice and research on traffic enforcement.

1. Random breath testing (RBT) in urban areas should be conducted for at least 20 hours per 100 square kilometres per week.

2. Scheduling of RBT in urban areas should make use of the residual effect of at least two weeks and not necessarily return to the same testing area within two weeks.

3. RBT operations should be very overt, including high visibility and testing a substantial proportion of passing motorists. However, maximising the number of tests should not be at the expense of covering broad urban areas and achieving the minimum testing hours per unit area.

4. Car-based RBT should be preferred in rural areas, covering both minor and major roads. If booze buses are operated in rural areas, they should not operate alone and should undertake RBT in conjunction with car-based RBT on alternative roads.

5. Targeted alcohol screening testing should principally aim to apprehend drink-drivers with very elevated BACs and should not be seen as a substitute for RBT in contributing to the total number of preliminary breath tests conducted.

6. Mobile speed cameras should be operated covertly and rotated across a large number of sites at varying times of day so that the enforcement operations are unpredictable and are perceived to cover broader areas than the specific camera sites.

7. If mobile speed cameras are operated overtly, camera sessions should be randomly scheduled to times of week and numerous sites in each area in order to maximise their unpredictability.

8. Mobile speed camera sites should not be publicised in any form. Even information about the limited number of specific routes to be enforced in a coming period provides implicit information about where cameras will probably not operate, thus reducing the unpredictability of the enforcement operations.

9. Overt fixed speed cameras measuring spot speeds should be located at serious casualty crash “black spots” and not expected to affect crashes beyond the immediate vicinity.

10. Point-to-point speed camera systems measuring average speeds between two points should be used to enforce speeding over substantial route lengths on which the serious casualty crash density is sufficient to justify the cost of implementation and offence processing.

11. Moving mode radar should be operated in unmarked patrol cars or from marked and unmarked cars operating together on the same highway.

12. Scheduling of moving mode radar units should make use of the residual effect of four days and not necessarily return to the same highway within that period.
13. Hand-held laser-based speed detectors should be operated at low- to medium-intensity levels (sessions typically less than one hour, for up to 15 hours per site per year) and cover multiple sites in order to achieve a broad effect on speeds and crashes.

14. Seat belt checks should be standard procedure when stopping motorists for other reasons.

15. Blitz periods of seat belt checking should be implemented regularly and highly publicised.

16. Traffic enforcement programs and investments in new technologies should be planned strategically. Priority should be given to components of the package that have marginal benefits (road trauma reductions, based on scientific evidence) greater than marginal costs.

17. Traffic policing should extend its role beyond enforcing illegal unsafe road behaviours and take actions which help to reduce unsafe behaviours by all participants in the road transport system, not just by road users but also by the bodies responsible for providing the road infrastructure, vehicular and social environments.

8.2 OPPORTUNITIES FOR IMPROVEMENTS IN WA TRAFFIC POLICING

The following is a summary of the apparent opportunities for improved traffic policing that emerged from presenting the research-based operational conclusions to WA police and receiving their responses. Some opportunities represent changes in operational practice and management that WA Police could implement unilaterally, whereas others require legislative or regulatory change to provide a better basis for effective traffic policing to produce real reductions in road trauma in WA. Some worthwhile opportunities for research and investigation of beneficial new enforcement practices or legislation were also apparent.

1. Car-based RBT should be used in Perth in conjunction with booze buses in order to provide a broader coverage of the metropolitan road system for a greater number of hours per week and hence achieve a general deterrence effect. Car-based RBT should also be conducted on sub-arterial roads and residential streets where it is perceived that booze buses are not operated.

2. Severe drink-driving offences (BAC at least 0.08g/100ml) should be added to the Hoon Legislation offences because vehicle impoundment would be an effective sanction and constraint on “problem” drink-drivers. (Note: Immediate Licence Disqualification for all drivers detected driving with a BAC of 0.08 and above was passed by the WA Parliament in late 2010 so will be implemented in future.)

3. There is a need to develop KPIs that reflect the research connecting drink-driving enforcement inputs and outputs with real reductions in alcohol-related crashes through decreases in drink-driving on the road. The contributions of RBT hours and coverage, not just number of tests, need to be balanced against the effectiveness of apprehending drink-drivers, given the available sanctions to discourage or inhibit re-offending.

4. If mobile speed cameras were operated covertly on regional roads, there would be a need to publicise their efficiency and cost-effectiveness to off-set negative community attitudes. There should also be speed enforcement involving intercepts by traffic officers to provide some personal contact of offenders with police.
5. Sufficient speed camera offence processing resources should be provided to complete the follow-up of high level (45 km/h in excess) speed offences and apparently unlicensed driver-owners, all of which could result in vehicle impoundment and other sanctions.

6. New methods should be developed to detect and apprehend “hoon” speeders (those travelling 45 km/h in excess of speed limits) because of difficulties to conduct pursuits exceeding 140 km/h. The new TruCam laser speed measurement and video recording device is an effective tool to prosecute the high level offences, but there is a need to overcome difficulties with use of the device at night.

7. There is a need to develop KPIs that reflect the research connecting speeding enforcement methods and inputs with real reductions in crashes and injuries through decreases in speeding (especially high level speeding). The generation of fine revenue should be incidental to achieving these KPIs.

8. Investigations should be undertaken into the merits of:
   - positive reinforcement of good speeding behaviour (such as demerit point credits if offence free in a previous period)
   - mandatory speed awareness course as an option or alternative to current speeding sanctions
   - speed limiting all new vehicles to a maximum speed of 110 km/h and requiring the retro-fitting of this technology to the vehicles owned by recidivist speeders.

9. Seat belt checks should be required to be standard procedure when stopping motorists for other reasons (such as random breath tests, targeted alcohol screening and drug tests, apprehension of detected speeders, and licence and vehicle condition checks).

10. Because of difficulties that regional police have with vigorously enforcing seat belt laws locally, a strategy to rotate rural police to towns where they are not based nor known should be implemented in all regions.

11. There should be greater and on-going publicity about the reasons for the penalties for seat belt offences and the benefits of complying.

12. There should be a process of rationalisation of the penalties associated with all key illegal behaviours and offences to reflect the risk of consequential road trauma in each case. The outcome of this rationalisation should be widely published to put the seat belt offence penalties in context.

13. A central traffic advisory service should be established to provide specialist advice in complex areas of drug-driving enforcement (such as the Field Impairment Test and preliminary drug test procedures).

14. There should be legislative change to allow a suspected drug-driver to be conveyed to a nearby booze/drug bus, if operating, for a preliminary drug test.

15. WA Police should investigate the establishment of a regional or central processing system to receive automated ANPR records from traffic patrols, in order to more efficiently process suspected owner/drivers and vehicles and to relieve traffic patrol officers from follow-up activities that inhibit their on-road patrol time.
16. To overcome the loss of specialist trained police with the skills to adequately enforce the heavy vehicle safety regulations, there should be joint operations with DPI heavy vehicle inspectors to provide expert support for traffic police.

17. In order to control driver fatigue, consideration should be given to a requirement that car drivers carry and complete log books to record the start and finish times of their journeys in remote areas.

18. To minimise the severity of pedestrian injuries, there should be a requirement that roof bars be removed from vehicles operating in Perth.

19. Patrol motorcycles should be reintroduced for pursuits of motorcyclist offenders and enforcing motorcycle-specific regulations.

20. Rear-facing speed cameras should introduced to allow the motorcycle number plate to be captured, and full owner-onus for motorcycle offences should apply. Increased sanctions for false motorcycle number plates should be implemented.

21. Motorcyclist hoon behaviours should be added to the list of behaviours prohibited under the Hoon Legislation.

It should be noted that Phase 2 was exploratory research of a qualitative nature only and the findings were not intended to be representative of the whole of WA Police. The apparent opportunities from this phase are presented for consideration by WA Police only.

There were a limited number in the sample of WA police officers canvassed and their responses were relied upon to develop the apparent opportunities. There appeared to be some contradiction in the officers’ responses relating to their perception of operational activities and strategies. This issue may give rise to additional recommendations in areas such as communication, training and professional development.
REFERENCES


Elliott, B. (1992) *Achieving high levels of compliance with road safety laws: a review of road user behaviour modification*.


ETSC (1999). *Police Enforcement Strategies to reduce traffic casualties in Europe.* The European Transport Safety Council


Keall, M.D., Povey, L.J. and Frith, W.J. (2002). Further results from a trial comparing a hidden speed camera programme with visible camera operation. Accident Analysis and Prevention, Vol. 34, 773-777.


APPENDIX A: POWERPOINT SLIDES PRESENTED AT WORKSHOPS

IDENTIFYING TRAFFIC ENFORCEMENT PRACTICES AND OPPORTUNITIES FOR WESTERN AUSTRALIA

Max Cameron
Jim Langford

AGENDA
- Welcome – Superintendent Randall, WA Police
- Introductions - All
- Overview of project – Jim Langford, MUARC
- Setting the stage: Enforcement in a Safe System – Prof. Max Cameron, MUARC
- Identifying enforcement options for WA – Facilitated by Jim Langford, presentations by Max Cameron
- Wrap-up and next steps – Supt. Randall

THE SAFE SYSTEM APPROACH AND THE ROLE OF TRAFFIC POLICING

WA’s Towards Zero Road Safety Strategy
- Long term vision of a road system where death and serious injury are virtually eliminated
- Safe System approach
  - It is not acceptable for a road user to be killed or maimed for making a mistake
  - Recognises that road users make mistakes, whether accidental or deliberate
  - Recognises limits of human performance and physical tolerance to violent forces

The Road Trauma Chain

(1. PRE-CRASH)

(2. CRASH AND POST-CRASH)

Crash Involvement

Energy Dissipation

Energy Transfer

Injury

Severe Injury

Death

Injury Risk

Injury Severity (A)

Injury Severity (B)

Severe Injury Risk

Fatal Injury Risk

Risk (A) “Transport Risk”

Risk (B) “Transport Risk”

Risk (C) “Public Health Risk”

Risk (D) “Public Health Risk”
Role of traffic policing

- Front-line view of road trauma in the field
- Traditional focus on illegal traffic behaviours
  - Mainly offences with high pre-crash risks
- Traffic offences are sub-set of "precipitating factors" causing high risk
  - There are also "predisposing factors" that set the scene for precipitating factors to occur
- Traffic policing should look beyond only illegal precipitating factors in crash investigations

Random breath testing – intensity and time of testing

- There is a threshold for the intensity of car-based RBT in urban areas before it is certain that crash reductions will result
  - About 20 hours per 100 square kilometres per week.
- Car-based RBT in urban areas has residual effects on crashes in the area of testing operations for at least 2 weeks
- RBT carried out during times of the week when drink-driving is frequent is highly likely to produce crash reductions, whereas there is less certainty about its effects when carried out at other times

RBT – visibility of testing stations

- The visibility of the RBT operations, and/or the capacity of the testing station to test high proportions of passing motorists, are important factors in increasing the general deterrence effect of RBT
  - "Booze buses" aim to achieve this additional effect
- However, the use of booze buses in rural areas needs to be considered with caution
  - Booze buses operating alone in small rural towns can destabilise drink-driving and increase crashes

Booze buses in rural areas

- The effectiveness of car-based RBT in rural areas appears similar to that achieved by RBT (both car- and bus-based) in metropolitan areas
  - The ability of the cars to cover broad areas may raise the perceived risk of detection above a threshold level
- Police should schedule RBT operations on minor as well as on major roads in rural areas
- Greater emphasis should be placed on the use of car-based RBT, particularly near hotels and clubs
- Patrol cars should operate on minor roads in concert with booze buses located in provincial cities and towns

Targeted alcohol screening testing

- Car-based testing of intercepted suspect drivers and/or at targeted locations and times
- Less effective on crashes than RBT
  - 6% reduction in casualty crashes
  - Compared with 10% reduction from RBT (and 17% reduction in fatal crashes – more alcohol involved)
- Role of targeted testing in apprehending those drunk-drivers with very elevated BAC (> 0.15 g/100ml)
  - These "problem" drunk-drivers now probably represent the greatest proportion, especially in rural areas
C-MARC

Relevance to WA and practicality

Consistency with current practice in WA

C-MARC

Conclusions and opportunities for WA

SPEED ENFORCEMENT

C-MARC

Various objectives and modes of speed enforcement

• Operational modes
  - fixed location or "mobile" (movable) or moving mode
  - overt or covert operations
  - signs indicating enforcement sites or zones
  - public announcements of mobile camera locations
  - current practice in Western Australia

• Objectives
  - local effects, or general effect over road system
  - specific deterrence (punish speeders to discourage re-offending), or
  - general deterrence (deter speeders)

C-MARC

Mobile speed enforcement

• Mobile speed cameras
  - Covertly operated
  - Overtly operated
  - Overtly operated at known locations
  - Signed speed camera zones
  - Publicly announced routes (suburb and road)

• Moving mode (mobile) radar
  • Hand-held radar
  • Hand-held lasers
Fixed location speed enforcement

- Fixed speed cameras
  - Overt operations can range from signs to the strong UK visibility rules
  - Unsigned covert locations will rapidly become known through media reports and speeding tickets identifying location of the offence
- Point-to-point speed cameras
  - Measure average speed between camera sites
  - Route can be 300 metres to 10's of Kilometres
  - Most suitable for roads with limited access/egress

Conclusions about speed camera effects on road trauma

- Overt operations have strong local effects
  - Especially fixed speed cameras
- Overt mobile cameras can have general effects across the road system
  - Especially if operations are randomly scheduled in time and space
- Hiding the cameras adds to the general effect
- Covert mobile cameras reduce crash injury severity (especially fatal outcome) as well as a general effect on crashes

Conclusions about covert mobile speed cameras in Victoria

- Principal mechanism to achieve its effects on crashes is via the actual detection of speeding drivers and the subsequent issuing of penalties, ie. specific deterrence
- Supporting mechanisms are provided by the camera operations (to the extent that they are visible) and mass-media publicity emphasising the risks of speeding and detection by a speed camera, ie. general deterrence

Conclusions about moving mode radar

- Greatest effect during the four days immediately following the enforcement operations with the effect diminishing five to seven days after the enforcement presence
  - Suggests the existence of a four-day residual enforcement effect on casualty crashes
- Crash reductions were found following mobile radar operations involving either overt activity (unmarked cars) or both overt and covert activity (marked and unmarked cars together)

Publicity support for moving mode radar

- The most significant impact on casualty crashes occurred when high public awareness of media publicity accompanied mobile radar
  - Effect was greater when high publicity awareness levels were specific to mobile radar enforcement
- Strongest effect was found on the same day as enforcement when high levels of mobile radar publicity accompanied mobile radar operations involving both overt and covert activity (marked and unmarked cars)

Conclusions about laser speed detectors

- Laser speed detectors are successful in reducing crashes on arterial roads in urban areas when conducted at low-to-medium-intensity levels (sessions typically less than one hour, for up to 15 hours per site per year)
- Loss certainty about more intense levels
- The effect of laser detection devices appears to be localised in space
  - Overt forms of speed enforcement have a general deterrent effect that is limited to the location at which enforcement activity is observed
Conclusions about laser speed detectors

- To expand the general effect of overt laser speed detector programs, a more extensive geographical coverage may be required.
  - many sites rather than few black-spot locations
- Low- to medium-intensity, overt laser speed enforcement (defined as up to 15 enforcement hours per site per year) at multiple sites on the arterial road network will have a greater effect on crashes than high intensity enforcement at fewer locations

Rural v. urban enforcement

- Rural road system is much greater than the total urban area in each State
  - Hence a need for enforcement operations which
deter the key unsafe behaviours over broad areas
- "Visible" operations can target towns and highway sections with high crash rates
  - Overt mobile speed cameras
  - Fixed speed cameras
  - Point-to-point speed cameras

Rural v. urban enforcement

- General effects can be achieved by unpredictable speed enforcement
  - Moving mode radar on highways
  - Covert mobile speed cameras near/in towns
  - Covert cameras in signed camera zones or other
    publicly announced road sections (sites not publicised)
  - Randomised scheduling (time & space)
- Mass media publicity can magnify the general effect of enforcement
  - especially of moving mode radar

Consistency with current practice in WA

Relevance to WA and practicality

Conclusions and opportunities for WA
Seat belt enforcement

- Little evidence of different effective strategies
- Seat belt checks should be standard procedure when stopping motorists for other reasons
  - Random breath tests
  - Targeted alcohol screening and drug tests
  - Apprehension of detected speeders
  - Licence and vehicle condition checks
- Blitz periods should be implemented and highly publicised, emphasising above standard checks
- Police education may be necessary to increase motivation and awareness of the benefits

Relevance to WA and practicality

Consistency with current practice in WA

Conclusions and opportunities for WA

OTHER TRAFFIC OFFENCES
**Nature of Traffic Offences**
- Transient (offender can stop offending rapidly)
  - Speeding
  - Mobile phone use
  - Red-light running
  - Seat belt non-use? (perhaps fixed in practice)
- Fixed (offender continuously offending)
  - Drink-driving
  - Drug-driving
  - Unlicensed driving
  - Fatigued driving
  - Helmet non-use

**Specific Deterrence**
Process of encouraging apprehended offenders, through their actual experience of detection and the consequences, to avoid re-offending.

**General Deterrence**
Process of influencing potential traffic law offenders, through their fear of detection and the consequences, to avoid offending.

**Global Findings about Effects of Traffic Enforcement**

<table>
<thead>
<tr>
<th>Nature of Traffic Offence</th>
<th>Enforcement Aimed at General Deterrence (Raise Fear of Detection and Punishment)</th>
<th>Enforcement Aimed at Specific Deterrence (Apprehend and Punish Offenders to Discourage Re-offending)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed Offences</td>
<td>General effect if overt. Magnified if publicised.</td>
<td>Weaker general effect.</td>
</tr>
<tr>
<td>Transient Offences</td>
<td>Local effect if overt. General effect from multiple local effects.</td>
<td>General effect if covert &amp; many apprehensions. Magnified if publicised.</td>
</tr>
</tbody>
</table>

**Drug-driving**
- Fixed offence
- Technology exists to detect illegal drugs in a driver’s body

**Strengths and Weaknesses of Current Enforcement Practice in WA**
Improvements & opportunities for WA

Mobile phone use
- Transient offence
- Illegal use of hand-held mobile phone is clearly defined and observable

Strengths and weaknesses of current enforcement practice in WA

Improvements & opportunities for WA

Unlicensed driving
- Fixed offence
- Requirement to carry licence when driving?
- Technology to check licence status?

Strengths and weaknesses of current enforcement practice in WA
C-MARC

Improvements & opportunities for WA

C-MARC

Heavy vehicles
- Safety-related regulations for heavy vehicles
  - Maximum loads
  - Maximum speeds
  - Vehicle condition
- Generally fixed offences

C-MARC

Strengths and weaknesses of current enforcement practice in WA

C-MARC

Improvements & opportunities for WA

C-MARC

Fatigued driving
- Fixed offence
- Absence of definition in legislation
- Absence of technology to measure fatigue
- Priority for heavy vehicle driver fatigue?

C-MARC

Strengths and weaknesses of current enforcement practice in WA
Pedestrians
- Important pedestrian offences & risky behaviours
- Clear link to crash risk and/or injury outcome
- Usually transient behaviours

Improvements & opportunities for WA

Strengths and weaknesses of current enforcement practice in WA

Motorcyclists
- Important motorcyclist offences & risky behaviours
  - Clear link to crash risk and/or injury outcome
  - Mixture of transient and fixed offences/behaviours
THANK YOU

Any questions
or further contributions?
APPENDIX B: OFFICERS’ RESPONSES TO OPERATIONAL CONCLUSIONS PRESENTED AT THE WORKSHOPS

Three workshops were conducted with officers in regional WA (two in Albany and one in Karratha) and in Perth (two workshops). Time did not permit all of the enforcement areas to be covered in each workshop (and the Karratha workshop was curtailed because of an impending cyclone demanding Police attention). The officers’ responses are summarised in the dot-points recorded in the following sections.

First Albany workshop (General Duties officers) (Greater Southern Region)

Drink-driving enforcement

Relevance to WA and practicality

- Mix of targeted testing and RBT best
  - So drivers appreciate chance of test either way
- Management demand for number of RBTs constrains places/times of operation
  - Offence/test ratio also important
  - Places emphasis on targeted testing
- General duties operations using vans constrains traffic enforcement manoeuvres
  - Result of merge of traffic and general duties

Consistency with current practice in WA

- Booze buses seldom used in GS district
- Car-based operations as sub-districts see fit
- No constraint on alcohol testing near clubs and pubs
- Balance between apprehending drink-drivers and deterring them in first place

Conclusions and opportunities for WA

- More specialised traffic officers and responsibilities would enhance traffic enforcement
- RBT performance criteria: hours per week
- Targets necessary to encourage traffic enforcement action
- High level BAC drivers – primary target in rural

Speed enforcement

Relevance to WA and practicality

- Cameras stops “policing” (full policing)
  - Lost opportunity to detect other offences/crimes when driver intercepted
  - Perceived to be revenue raisers and produce statistics
  - Create animosity between public and police
  - Lost personal contact with offenders
  - May be efficient, but not as effective as intercepts
• Cameras should not replace traffic officers
  – Supplement OK

Consistency with current practice in WA
• Has become more difficult to detect speeders, especially high level speeds, in GS district
  – Due to increased speed enforcement?
• One speed camera in GS district
• Can’t pursue vehicles > 140 km/h for intercept
• Discretion exercised for low level speeders following intercept
  – Educative objective when appropriate
• General duties officers have traffic responsibilities without specialist knowledge, and many others
  – Specialist officers necessary, if interested
  – Training implications for consistency across WA

Conclusions and opportunities for WA
• Cameras should be overt to be publicly acceptable
  – Immediately effective and longer term
• General support for 2nd slide on rural enforcement [see Appendix]
• Specialised central traffic police could “fly in” to support local police
  – Allows locals to cover full responsibilities without pressure to achieve traffic PIs
  – Insulates locals from local public animosity
• Camera system should not be privatised
  – Company would have focus on profit, not traffic enforcement effects

Seat belt enforcement
Relevance to WA and practicality
• High fine penalty makes difficult to prosecute large number of seat belt offences per vehicle
  – Discretion exercised
  – Practicality of driver controlling all passengers?
• Penalty seems inconsistent with other offences, say mobile phone

Consistency with current practice in WA
• No further response

Conclusions and opportunities for WA
• Rationalisation of fine penalties reflecting relative crash and injury risks
• And role of discretion, cautions and infringements
Second Albany workshop (Traffic officers) (Greater Southern Region)

**Drink-driving enforcement**
Relevance to WA and practicality

- Alcohol interlock provision before Parliament for many years (drafted 2004)
- Place of last drink pubs/clubs have changed attitudes of publicans to alcohol control
- Impoundment results if caught driving while unlicensed, including drink-driving penalty
- Booze buses seldom used in GS district and set up only in Albany urban area

Consistency with current practice in WA

- Prohibition orders issued to troublesome persons not to entered licence premises
  - Not currently applicable to problem drink-drivers
  - Liquor Act provision, not Road Traffic Act
- RBT targets high alcohol times and high risk locations
  - Place of last drink recorded from intercepts

Conclusions and opportunities for WA

- Add severe drink-driving offence (BAC >= 0.08) to Hoon offences
- Vehicle impoundment is effective sanction/constraint on problem drink-drivers
- Increased consistency of drink-driver offence penalties by courts needed within district
  - Other liberal magistrates throughout the state

**Speed enforcement**
Relevance to WA and practicality

- Radar detectors and laser jammers are not illegal in WA; erode operation of radar/lasers
  - Clear intention to offend
- Little difference of effectiveness of camera enforcement v. intercept speed enforcement

Consistency with current practice in WA

- Randomised scheduling of district mobile camera used
- Mobile camera operated overtly (signed) and semi-covertly (unsigned)
- Local media (newspaper, radio and regional TV) used to support themes of enforcement programs
  - Not necessarily linked with statewide media

Conclusions and opportunities for WA

- Speed limiting all new vehicles to 110 km/h and retrofitting to vehicles of speeders
  - Also RPM limited
- Speed limit reduction on rural highways to 100
• Speed limit reduction on gravel roads to 80 km/h
  – However very few serious crashes on them

**Seat belt enforcement**
Relevance to WA and practicality
• New seat belt laws are not well known by public
  – Publicity required
  – Fine receivers shocked by size of penalty
• Police uncomfortable with enforcing seat belts
  – Local police operations in local area
  – Cautions (recorded) were not permitted, so belt enforcement activity was not apparent
  – Now cautions are high proportion in regions
Consistency with current practice in WA
• Exchange of officers between towns for seat belt enforcement offsets personal discomfort of local officers
  – And local attitudes to local policing generally
Conclusions and opportunities for WA
• Rationalisation of severity of other penalties with seat belt offences
  – Reflecting risk and severity of each offence

**Drug-driving**
Strengths and weaknesses of current enforcement practice in WA
• Lack of government funding to support adequate testing level
• Trained drug testing operator required
  – Linked to booze/drug bus operations
Improvements and opportunities for WA
• No further response

**Unlicensed driving**
Strengths and weaknesses of current enforcement practice in WA
• Targeted observations of home and work of known unlicensed drivers
• Magistrate weak on enforcing serial offenders
  – Discretion to impose further suspensions or forfeiture of vehicles
• In-board car computers (TARDIS) allow rapid check of owner’s licence status
  – ANPR found to have too high hit rate and labour intensive; returns vehicles requiring attention for many reasons
Improvements and opportunities for WA
• No further response
**Karratha workshop (Pilbara Region)**

**Drink-driving enforcement**

Relevance to WA and practicality

- Targeted testing is best way to catch drink drivers in Pilbara
  - Thursday, Friday, Saturday nights
  - But also most active for other policing
- Booze buses don’t detect many drivers for amount of testing (in Karratha)
  - Drivers divert to side roads
- Fly-in-fly-outs (FIFOs) are irregularly exposed to enforcement, so don’t get deterred as much

Consistency with current practice in WA

- Focus is on quality of drink-drive enforcement, not quantity
  - Measured by apprehension numbers
- Pubs/clubs provide buses home
  - Responsible serving practice has increased
- More taxis and now more active
- All days of week now, because benefits and wages can be received anytime

Conclusions and opportunities for WA

- Strategies to maximise apparent presence of enforcement
  - Necessary because of insufficient staff
  - Parking cars with lights on near pubs/clubs
- Competing priorities from non-traffic policing activity (patrol car priority requirement)
- Vehicle impoundment would have more teeth than licence disqualification
  - Including drink-driving offenses

**Speed enforcement**

Relevance to WA and practicality

- Marked flashing car has strong effect with residual effect
- Focus on reducing speeding, not necessarily catching speeding
  - However still a need for fine revenue

Consistency with current practice in WA

- Schools targeted with laser speed detectors
- General policy doesn’t target speeding
• STEP funding requires some return (fine revenue) on investment. [This misconception on the part of some police may be affecting best practice deployment. This suggests that all Police should be made aware of the criteria for approval of a STEP funded operation.]

Conclusions and opportunities for WA
• Dedicated traffic cell staff and equipment in Karratha (3-4 staff)
  – Would allow targeted focus on speed enforcement best practice

**Mobile phone use**
Strengths and weaknesses of current enforcement practice in WA
• Can only prosecute obviously hand-held mobile phone
  – Hands-free phone must be in certified cradle from 1 March 2011
  – Impractical to enforce hands-free use if became illegal
• CB radio use similar distraction, but legal

Improvements and opportunities for WA
• Penalties harsh, but apparently not deterring

**Fatigued driving**
Strengths and weaknesses of current enforcement practice in WA
• Truck drivers require log books, not car drivers
• Ripple edge lining very effective, but not common on Pilbara roads
• Few good road houses between Pilbara and Perth

Improvements and opportunities for WA
• Log books for car drivers ??
• Ripple edge lining and median strip barriers
• Additional road houses

**First Perth workshop (Traffic Officers) (Metro Region)**

**Drink-driving enforcement**
Relevance to WA and practicality
• Previous focus on getting number of tests, but finding a drink-driver inhibits further testing
• Targeted testing gets more drink-drivers
• **No longer dedicated to traffic responsibilities**
• Some management still prefer max test numbers
• Conflict between traffic deterrence and processing detected offenders, and non-traffic operations (priority to crime)

Consistency with current practice in WA
• Patrolls need to cover non-traffic operations with priority over traffic conflict
• Unclear whether role is to educate and deter traffic offenders OR detect traffic offenders (and provide fine revenue)
• Resource constraints
• STEP funding puts emphasis on fine revenue to justify investment

Conclusions and opportunities for WA
• Zero BAC for all drivers
  – Because people don’t understand effect of alcohol intake on BAC for them personally (mass/gender)
  – Successful in Scandinavian countries
• More targeted operations to catch many drink drivers (but unclear about subsequent sanctions, especially high level drink drivers)
• Processing drink driver time needs to be improved to free patrol to return to road

**Speed enforcement**

Relevance to WA and practicality
• Unmarked cars used for MMR are conspicuous because of aerials and high conspicuity uniform required for urban operations
• Speed camera offence processing resource constraints prevents follow-up of high level 45+ km/h offences and unlicensed driver/owners
  – Briefs more than year old discarded
  – Too few police to follow-up

Consistency with current practice in WA
• “District expectations” puts pressure on detecting speeding numbers
  – Works against random operations across system
  – Favour locations with high detection rates
• Still aim to deter speeding at specific locations, even at cost of catching speeders at easy spots
  – However, numbers of detected speeders go on increasing (program not working?)

Conclusions and opportunities for WA
• Return traffic enforcement responsibilities to a “Traffic Board” (Road Traffic Authority) or Dept of Transport
  – General issue for traffic enforcement
  – Perceived low priority within WAPol
• Share of fine revenue to return to traffic police funding
• Mandatory speed awareness course as option instead of current sanctions
  – Particularly for novice drivers
• Greater intelligence-led operations (methods and locations)
  – Including input from other agencies (Councils, MR)
• Positive re-inforcement (demerit point discounts if offence free or registration discounts)

**Seat belt enforcement**
Relevance to WA and practicality
• Seat belt checks done as part of other interventions, but not regularly required of all driver interactions

Consistency with current practice in WA
• New restraint legislation did not have sufficient input from Police regarding enforceability
  – Especially child restraint part
• Penalties unacceptably high
  – Perceived by Police, especially GD officers
• However, size of penalty is government decision and not concern of Police

Conclusions and opportunities for WA
• Equipment to video/photograph occupant seat belt status at each interception
  – Otherwise court must rely on officer’s evidence
  – However, magistrates would then require of all prosecutions
  – Generally, drivers accept ticket from officer
• Debate regarding discretion should be available for seat belt offences

**Drug-driving**
Strengths and weaknesses of current enforcement practice in WA
• Not all traffic officers trained to do drug tests
  – Trial period being reviewed
  – Preliminary saliva test has false positives
  – Field Impair Test not often used, also requires training
• Blood tests provide evidentiary result

Improvements and opportunities for WA
• Legislative change to allow driver to be conveyed to Drug bus for preliminary test
  – Only detections are drivers caught at Drug Buses
  – Police medical support to take blood tests at dedicated Police centres
• Central traffic advisory service to provide specialist advice in complex areas like drug tests (FIT and preliminary tests)

**Heavy vehicle enforcement**
Strengths and weaknesses of current enforcement practice in WA
• Specialist trained police unit has been lost
• Joint operation with DPI would provide traffic police with support expertise
• Truckalyser testing device – one only

Improvements and opportunities for WA
• No further comment

Pedestrian enforcement
Strengths and weaknesses of current enforcement practice in WA
• Very low priority for apprehending pedestrian offences in urban streets/intersections
• Resource constraints mean priority given to perceived more serious offences
  – However recognised that pedestrians particularly threatened by speeding cars

Improvements and opportunities for WA
• Roo-bars contribute to pedestrian injuries
  – But recognised that removal would be emotive for vehicle owners and the government

Second Perth workshop (Traffic Officers) (Metro Region)

Drink-driving enforcement
Relevance to WA and practicality
• Minimum testing level per week impossible to achieve in Perth
• Booze buses represent most of drink-driving enforcement
  – Do they supplement car RBT to achieve minimum?
• Paperwork to process illegal drink driver has increased and inhibits on-road enforcement
  – Must be done back in office
  – Fewer on-road cars than previously

Consistency with current practice in WA
• Management require quotas for number of tests – requires focus on high volume roads
  – Relatively low number of positives
• RBT used to measure drink-driving on road
  – KPI requires hit rate to be low (< 2%)
• Targeted testing shows that still many drink drivers out there
  – Smart enough to avoid regular RBT locations
  – But not so many high level BACs

Conclusions and opportunities for WA
• More sensible KPIs for drink driving enforcement needed, reflecting real progress (outcomes, not inputs and outputs)
• Streamline processes to handle drink drive offenders
• Rationalisation of KPIs across traffic and non-traffic activities to avoid low traffic priority
• Improved and more comprehensive training in traffic matter at the Academy
  – Low status of traffic among training staff
• “What you blow is what you go” to be evidence of BAC level (“failing the test”)

**Speed enforcement**

Relevance to WA and practicality
• Fixed cameras should be used to address speeding at black spots
• Marked patrol cars preferred for deterring speeding and other offences
• Motorcycle patrols were conspicuous but had a random element - unpredictable

Consistency with current practice in WA
• Traffic patrol cars are high-profile, conspicuous vehicles unsuitable for covert operations
• TEG is metro focused and each District has own traffic responsibilities (only some have a traffic unit)
  – State-wide coordination not usual
• Requirement for traffic patrols to make >4 contacts per hour
  – To detect any type of offence

Conclusions and opportunities for WA
• P2P speed enforcement acceptable and very effective, especially rural highways
  – Conspicuous and drivers know average speed being measured (not just one-time spot-speed)
• Minimum police time to be dedicated to traffic (17% compared with current 7%?) and quarantined from other police activities
• New methods to detect/apprehend hoon speeders
  – Pursuits can’t exceed 140 km/h without clearance
  – TruCams good, but can’t be used at night. [There may be confusion about utilisation of the device. If so, various aspects and characteristics of speed camera detection devices should be clearly communicated to all Police.]

**Seat belt enforcement**

Relevance to WA and practicality
• Government has recognised importance of the offence and made penalties for unbelted drivers and unbelted adult passengers much more severe

Consistency with current practice in WA
• Difficult to justify $500 fine for seat belt offence
  – Compared with $150 for red-light running and $200 for mobile phone offence
• Recent change to make driver responsible if anyone unrestrained is improvement
Conclusions and opportunities for WA

- Rationalisation of fine penalties to reflect perceived danger of the offence
- Seat-belt interlocks (or warning systems)
- Greater attention to seat belt wearing in rural areas
  - But difficult for local police to enforce
  - Swapping towns is useful strategy

Motorcyclist enforcement

Strengths and weaknesses of current enforcement practice in WA

- Rear facing cameras allow motorcyclist offenders to be detected (e.g. speeders)
  - However person ID difficult due to helmet use
  - OR full owner onus for motorcycles (not nec. cars)
- Difficult to pursue because of high acceleration and top speed
  - No motorcycle patrol bikes for pursuit
  - Policy to abort motorcycle pursuits by cars
- Hoon riding behaviours not legislated against
- Low fine for not wearing approved helmet

Improvements and opportunities for WA

- Re-introduce Police motorcycles
- Include specific motorcycle offences in hoon laws
- Increased sanctions for false number plates
- Lane-splitting legislation
  - Road safety issue not clear
- Intelligence chips required on motorcycles to allow monitoring by road surveillance systems
  - E.g. for speeding, lane-splitting