REVIEW OF THE *ROAD SAFETY TO 2010* STRATEGY

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FINAL REPORT

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Contents:

EXECUTIVE SUMMARY

1. Introduction

The purpose of this three-stage independent review is to assess the progress of the *Road Safety to 2010* Strategy (LTSA, 2003) towards achieving the 2010 targets and, secondly, to identify improvements to existing interventions and potential new interventions which could form the basis of a third implementation plan.

Road safety in New Zealand over the last decade has benefited from an enlightened lead agency for road safety, an assiduous national police force, concerted focus on evidence-based approaches and the development of highly successful partnerships, particularly between the LTSA and the Police.

Between 1990 and the period marking the start of the new strategic plan in 2002, there have been significant achievements. Over a decade, despite traffic growth, road deaths have fallen by 39%; road death rates have nearly halved per 100,000 population and hospitalisations have fallen by around 33%. Notable results include low cost engineering at 2000 high risk sites, resulting in a 50% reduction in fatal crashes at those sites; skid resistance programmes leading to an average 29% reduction in wet-skid crashes at treated sites since 1995; improvements in the safety of imported vehicles (as a result of regulatory and consumer information drives elsewhere) and more than a 50% reduction in levels of alcohol-related deaths as a result of compulsory breath testing supported by targeted advertising between 1990 and 2002.

However, despite this marked progress and the commonality of New Zealand road safety statistics with citizens in many other highly-motorised countries, New Zealanders currently pay a high societal price for their mobility. The social cost of road traffic injury in New Zealand, including a valuation for pain, grief and suffering, currently is as much as 2.4% of GDP. Road traffic crashes cause more years of life to be lost than any other source of injury in New Zealand. Motor vehicle traffic crashes are the leading cause of death to children – comprising 45% of deaths in the 0-14 and 15-24 year age group (IPRU, 2001). Road crashes are a leading cause of disability for people aged 15-44 (MoH, 1999). While the majority of deaths involve car occupants, vulnerable road users bear a disproportionate share of risk in the traffic system.

In terms of overall performance, New Zealand has a substantial distance to go before achieving the Government's stated goal in the Transport Strategy 'to provide New Zealand with a road safety outcome that is among the best in the world' (MoT, 2002).

International Comparison between death rates in New Zealand and other countries – 2002

Country	Deaths per 100,000 population	Deaths per 10,000 vehicles	Deaths per billion vehicle km
Great Britain	6.0	1.2*	7.06
Netherlands	6.1	1.2	7.55
Norway	6.9	1.1	8.25*
Sweden	6.0	1.1	8.50**
Australia	8.8	1.4	8.96
New Zealand	10.3	1.5	10.80
New Zealand (*Road Safety to 2010* Strategy targets)	6.1	1.1	7.30

Source: Data from International Road Traffic and Accident Database maintained by Bundesanstalt für Strassenwesen, Germany. All data is for 2002 unless otherwise noted. * 2001 data ** 2000 data

At the same time, the *Road Safety to 2010* Strategy has five years further to run; public understanding and support for continued intervention is high (National Research Bureau, 2004); the evidence-based approach to road safety in New Zealand is firmly established; there are many measures and tools available to policymakers for implementation and, not least, there is acceptance at senior level

amongst the key Government stakeholders that much more could and should be achieved.

2. Road safety and the New Zealand Transport Strategy

New Zealand's Transport Strategy outlined a vision of a transport system that is affordable, integrated, safe, responsive and sustainable, to be realised by means of an integrated approach that is forward-looking, collaborative, accountable, and evidence-based objectives which include: assisting economic development; assisting safety and personal security; improving access and mobility; protecting and promoting public health and ensuring environmental sustainability (MoT, 2002). Other countries, particularly in Europe, have also embarked upon similarly ambitious integrated transport strategies.

The integration of these objectives is being established both in new government institutional arrangements and funding arrangements for transport in New Zealand which, while making things more complicated for road safety, also bring many opportunities. In addition to continuing and reinforcing efforts to achieve safer road user behaviour through education, training and public information, road safety now needs to address the following factors to further improve the inherent safety of the road infrastructure: interrelating with public health and the environment; reconciling the safety and mobility needs of pedestrians and cyclists in a road network which has not been designed to cater safely for increased walking and cycling; taking account of the growth in heavy traffic; the need to ensure strong links between safety outputs and safety outcomes; staying one leap ahead of technological advances, meeting changing needs and expectations of customers and stakeholders, and matching the progress in road safety outcomes internationally. The transport strategy provides a formal opportunity for road safety to be taken up as core business by new actors which will strengthen and expand the effort directed at it.

The major strategic theme of the *Road Safety to 2010* Strategy is the integration of safety into the road traffic system and into other Government policies impinging on its safety quality. The rationale for this is to ensure that safety is planned for in the nucleus of the traffic system design and operation rather than as an adjunct or afterthought. Reducing serious public health loss from road crashes thereby becomes not just a matter of coping with a negative spin-off to the more weightily lobbied concerns of efficient mobility and environmental protection, but at least an equal partner. The *Road Safety to 2010* Strategy is, thus, well aligned with the vision and objectives of the New Zealand Transport Strategy.

Safety underpins New Zealand's Transport Strategy. The potential impact on safety of all activities aimed at the other four transport strategy objectives will now need to be considered formally, necessitating the introduction of formal safety impact assessments on transport and land use projects (Wegman 1994, Allsop ed., 1997). Road safety also needs to be fully integrated with the other four objectives into national, regional and local transport strategies and plans involving enhanced collaboration between central and local government agencies. It is in these and related ways that the strategy provides a new mechanism for ensuring that road safety is a central concern in Government policymaking.

3. The design of *Road Safety to 2010* Strategy

The key to achieving better performance in road safety globally is seen by the World Health Organisation and the World Bank (Peden et al eds, 2004) as addressing the main risk factors, (specifically speed) and adopting proven measures systematically by:

- Using long-term visions, system-wide strategies, targeted plans and performance indicators to implement measures which take greater account of human limitations.
- Implementing more widely and efficiently those safety principles and measures that are known to be correct and effective.
- Finding new opportunities for increased road safety activity through multi-sectoral approaches and synergies with environmental and public health policies.
- Using new delivery mechanisms to complement existing tools.
- Encouraging the health sector to become a leading champion for road safety.

Many of these system-wide approaches are to be found in the *Road Safety to 2010* Strategy which is, in general, well-designed, aligned to real needs, consistent in its approach with international best practice and already achieving road safety outcomes in key areas. The strategy is the product of an extensive and thorough consultation process where the response from the community was predominantly a call for increased road safety through a mix of engineering, education and enforcement. The analytical framework of the strategy is generally robust and is in line with international good practice, both in content and organisation and, for most parts, in coverage. The range of interventions underpinning the target-setting estimates are system-wide; adopted broadly in countries active in road safety; evidence-based and selected with due consideration to their public acceptability and cost, as implemented elsewhere (LTSA, 2000).

Visions: The use of long-reaching visions can provide a context for strategies and targets and can communicate the strategy's philosophy and rational to key stakeholders and the wider public. While there is currently no specifically stated Government vision for road safety in the *Road Safety to 2010* Strategy implicit in the Transport Strategy, it is implied that it should be *a sustainably safe traffic system for all, which is amongst the best in the world and affordable, integrated and responsive to user needs.* Bringing the road safety vision into line with the Government's aspiration for its Injury Prevention Strategy (ACC, 2003) would mean *a sustainably safe traffic system for all, which is amongst the best in the world, which seeks the elimination of serious public health loss from road crashes at the same time as being affordable, integrated and responsive to user needs.* For the foreseeable future, these last requirements of the transport strategy imply acceptance of some (though of course greatly reducible) continuing loss from injury in road crashes.

Targets: The New Zealand target-setting hierarchy is widely perceived by road safety professionals internationally as state of the art in target-setting. New Zealand was the first to specifically target reductions in social cost; however, this is an underlying consideration in many road safety strategies. Targeting social cost provides the opportunity to reflect social concern about road injury risk via 'willingness to pay' and 'willingness to accept' considerations. Updating the Value of Statistical Life (VOSL) on the basis of latest survey in New Zealand (1998) to reflect current knowledge about 'willingness to pay' and 'willingness to accept' considerations instead of the basis in average wage rate, would give a truer indication of the cost effectiveness of road safety measures. The resulting higher cost effectiveness should lead to increased allocation of resources to road safety, to the extent that resources are allocated among competing objectives on the basis of cost effectiveness. The current VOSL is $2.8 million at June 2004 prices. Should the VOSL value be updated to take account of this survey data, the revised VOSL at June 2004 prices would be $4.16 million (GST excl). Long-term targets for speed management, drink driving, restraint use, user group and regional outcomes could now be formally set, even though these are implicit in the target-setting analysis. Unlike the situation in New Zealand, some countries have placed the target-setting framework and the strategy itself within a legislative framework and with concomitant Parliamentary interest and support.

Strategic themes: The strategy's themes are generally in line with international best practice and the following observations are made.

Integrating safety into the transport system: *A*rea-wide safety impact assessments of land-use planning decisions and transport projects would provide a key tool to integrating road safety into the transport system, alongside existing impact assessment for efficiency and the environment.

Accommodating human error: This theme is very much in line with the long-term road safety strategies in the best performing countries and represents an important part of the global paradigm shift in road safety; i.e. that common driving errors and common pedestrian behaviour should not lead to death and serious injury; the traffic system should help users to cope with increasingly demanding conditions; and, all parts of the world without exception, a traffic system better adapted to the physical vulnerabilities of its users needs to be created with the use of more crash protective vehicles and roadsides (Peden et al eds., 2004). Accelerating improvements in vehicle safety would also greatly assist the strategic aim of better accommodating the consequences of human error in the transport system.

Improving road user behaviour: Securing compliance with key road safety rules is recognised globally as being one of five key strategic elements to improve road safety, and as the *Road Safety to 2010* Strategy rightly recognises, its maintenance is key. Government acknowledged in the strategy that it would soon have to get tougher on major driver behaviour problems such as drink-driving, speeding and serious repeat offending in order to meet targets. The effects of other important issues such as drugs and driving fatigue and potential countermeasures to reduce these are receiving more research attention internationally and as such this research should continue to be monitored. While, for example, evidence-based practical advice for drivers is emerging on driving fatigue which provides the basis for public information in New Zealand, speed, drinking and driving and the non-use of occupant restraints remain the most pressing behavioural issues for attention.

Devolving safety management: Devolving more safety management regionally and locally is a key element of the strategy. However, while national and regional responsibilities are set out in legislation – Transit has a clear duty to provide a safe and sustainable highway network – territorial authorities are not subject to any general statutory road safety objectives, and their legal obligations for the safety of the roading network remain a mixture of contractual, voluntary and common law legal obligations. While local authority activity is central to achieving good national performance and the different situations faced by various local authorities lead to differences in scope of and priorities for casualty reduction; experience in other countries shows that unevenness in safety performance can be much greater than is accounted for by these understandable differences.

***Communicating with partnerships*:** The Ministry of Health is notable by its absence amongst the senior delivery partnerships established in the National Road Safety Committee. The Ministry of Justice and the Department of Labour (occupational road safety) also have core business in road safety and are encouraged to be represented at chief executive level in this forum.

Implementation: While targeted outcomes and underlying assumptions (published in Working Paper 7), strategic themes and Government commitments to priority areas for action are clear, the *Road Safety to 2010* Strategy is not a targeted programme as it does not set out explicitly how the 2004 and 2010 targets are to be achieved. While this is not uncommon, better clarity and transparency is recommended for the third implementation package.

Making the best use of resources: The linkage between forecasts, outcomes and outputs; the commitment to research and evidence-based action, and the development of further strategic monitoring tools all prepare the way for making an exceptionally well justified use of public resource.

4. Progress in meeting the 2004 targets

Given the short timeframe between initiating the *Road Safety to 2010* Strategy activities and this review, which is being conducted some months before the end of 2004, it has not been possible for any significant quantitative evaluation of the effectiveness of *Road Safety to 2010* Strategy initiatives to date, although some evaluation is now underway. In many cases, therefore, best expert judgements are made on the basis of the information which does exist in conjunction with the international evidence base.

Final outcomes

***Social cost, deaths and hospitalisations**:* Of the 2004 targets for social cost, only the target for social cost per vehicle has been met. Of the 2004 target for deaths, only the per 10,000 vehicles target has been met, which can be explained by the marked increase of 4% in the vehicle fleet for the 12 months to August 2004. This has given an average annual increase in vehicle numbers of 3.5% in the three years 2001–2004. While annual 'road crash admissions to hospital' fell to a record low in 2000, they have returned to 1996 levels. However, this does not necessarily signify a change in underlying injury risk. 2004 targets for 'hospitalisations for over one days and three days' have been met, confirming a continuation of the long-term downward trend. If the total to December 2004 matches the 12 months' rolling total to May used here, vulnerable road user targets for hospitalised pedestrians and cyclists will have been met, with the exception of the total number of hospitalised pedestrians.

These developments seem to be explained by a combination of factors, which include effects of short-term fluctuation on target setting (the sharp drop in deaths in 2002 which has since reversed may be a statistical blip); changes in injury reporting procedures and better recording; the fact that higher levels of traffic than expected have not been matched by enough new and effective implementation effort to make a difference in the short-term; and that the take up of valuable strategy and tool development begun since 2002 will not materialise into casualty savings for some time.

***- the choice of target*:** Developing the short-term target of no more than 400 deaths by 2004, a starting point death rate of 425 deaths per year for the end of 2001 was taken to be the best estimate. Four hundred and twenty five is the average of the number of deaths in the two years 2001 and 2002 and, at the time, was the best estimate of the underlying fatality risk. However, looking back with the benefit of hindsight, it appears this was an overly optimistic assessment. The road toll dropped from 455 in 2001 to 405 in 2002 and then rose again to 461 in 2003. Throughout this period serious hospital admissions continued to fall. This suggests the changes in fatality totals may have at least in part been due to statistical fluctuation rather than a change in the underlying fatality risk.

- changes in traffic: When developing the targets, historical traffic count data over a decade (which is usual good practice) was used to provide a projection of an overall annual traffic growth of 3.3%. The historical data was limited to vehicle counts on state highways and thus could not provide separate urban and open road projections that would be representative of all road types. From estimates for 2004 vehicle kilometres travelled (VKT), based on the latest survey results for 2001 and 2003 and the increase in gasoline deliveries since then, the annual increase in traffic growth from 2001 to 2004 was 3.8% – a higher percentage growth than the 3.3% projection based on the historical data. The VKT surveys also provide a good urban/open road breakdown of travel. Over the two years between the surveys there was an average annual increase of 5.8% in open road travel compared to only 1% for urban roads. As part of the data gathering for a heavy vehicle safety strategy, a separate projection was made of the increase in travel for heavy vehicles. At an annual rate of 4.5% this was higher than the general 3.3% used in developing the targets. The higher than projected general traffic growth, the urban/open road difference and the separate heavy vehicle rate would all affect the 2004 target of no more than 400 deaths. With these rates there would be 16 more road deaths in 2004 than predicted.

Intermediate outcomes

Speed: The 2004 speed targets have been met. The 2.4 km/h decrease compared with the base year in mean speed for open roads, and the 2.3 km/h reduction in urban mean speed compared with base years, will have translated into useful casualty reductions. A 1% decrease in mean speeds in urban areas will result in an 8% reduction in deaths and it is estimated that 27 lives would have been saved. A 1km/h reduction in open road mean speeds will result in a 4% decrease in deaths, which will translate into a saving of 31 lives (based on the fatality total for the 12 months to October 2004). Enforcement activity has been accompanied by high-impact advertising and publicity campaigns. Increased ticketing as a result of the reduced tolerances to 10 km/h introduced in 2000 (tolerances remain high compared with international best practice), the increased police visibility brought about by the efforts of the Highway Patrol and the deployment of other enforcement techniques have, no doubt, had an effect. Policy development in late 2003 concentrated on penalties and a changed basis for speed camera deployment.

Seat belt use: There has been success through combined police enforcement, publicity and community effort in meeting the 2004 targets and securing useful increments in seat belt use. In 2004, 94% car occupants wore front seat belts, 81% of rear seat occupants were restrained (which is high by international standards) and a high child restraint usage total of 97% was achieved.

Drinking and driving: The number and proportion of fatally injured drivers with excess alcohol since the baseline year has increased sharply and the 2004 target has not been met. In 2003, excess alcohol was present in 28% of fatally injured drivers. There is some evidence of lower levels of high visibility CBT policing during several quarters of 2003 than targeted for, despite increases in police numbers focussed on rural alcohol and commercial vehicle enforcement. The booze buses in the first

implementation plan have not yet been put into operation. Policy development during the period has been focussed on penalties. Government decided not to reduce the legal BAC limit from 80mg/100ml to 50mg/100ml in December 2003, which ruled out the opportunity for early savings.

5. Progress towards 2010 targets

Again, it needs to be stated that it has not been possible for any significant quantitative evaluation of the effectiveness of *Road Safety to 2010* Strategy initiatives to date, although some evaluation is now underway. In many cases, therefore, best expert judgements are made on the basis of the information that does exist and with reference to the international evidence base.

An overview of progress to date in each of the strategy's priority areas in reaching the 2010 targets is given in the table below. Current progress is set against the target-setting estimates for the contribution of new measures/developments in the priority activity areas which underpin the strategy. In several priority areas, there has been significant progress towards the 2010 targeted reductions for reduced social cost. In other priority areas a significant shortfall towards reaching the social cost target is identified.

It is estimated that with no further evidence-based road safety initiatives over and above those planned to date, taking into account increases in traffic and using a multiplicative approach towards estimates of interventions, there is about a 23% shortfall in meeting 2010 targets for reductions in social cost.

Progress towards reducing 2010 social cost target from new measures

	Original estimate	**Shortfall to 2010 target**
Engineering safer roads	18.8% (mixed option)	-7% even after recent increased budgeting for safety-oriented road engineering
Reducing speed • open road speed management • urban road speed management	14.9% 11.6% (99km/h(eng. option) 3.3% (53km/h)(eng option) NB. 55km/h was the 2004 target	On course, but activity needs expansion in view of traffic growth
Combating drinking and driving	7.9%	-4.7%
Dealing with serious offenders	3.4%	-0.6%
Improving the vehicle fleet – light vehicles	15.5%	Actions in place but new activity recommended
Improving the vehicle fleet – heavy vehicles	0.5%	-0.1%
Encouraging seat belt use	4.2% (98%)	On course if current levels of activity maintained
New and better targeted education initiatives	Benefits included in other initiatives	
Pedestrian and cyclist safety		
Young novice drivers	3.7%	-4.6%
Improving trauma care	0.9%	On course
Efficiency gain	9%	On course
Performance assessment	2%	On course

Overview: The range of interventions in the priority areas

The review has collected information on the implementation packages, which have been funded since the start of the strategy in February 2002 into the next financial year 2004/5. To date there have been two implementation schedules funded by the Safety Administration Programme and the National Land Transport Programme. In general, new activity has covered all the priority areas of the strategy. The focus, however, has been on continuing police enforcement and publicity, the development of new strategies, frameworks for activity and tools to improve the quality of safety work.

A review has been carried out of the main actions and mix of measures taken to implement the *Road Safety to 2010* Strategy in the key priority areas. A short introductory perspective is given in the report on the international state of the art in each area; followed by recall of the target-setting assumptions and estimates (WP7) and strategy commitments (*Road Safety to 2010* Strategy). An outline of action taken to date is presented, followed by a list of observations which try to assess whether activity to date is sufficient to meet the 2010 targets. Initial suggestions, where appropriate, are made for the deepening of existing activity or for new strands of action. The conclusions are as follows:

Engineering safer roads

- *The percentage contribution of safer road engineering to the 2010 target for social cost was 18.8%.*
- *Based on current activity, the strategy is on course to deliver 11.9%. The gap between expectation and delivery in road safety engineering to 2010 is roughly estimated at 7% based on current information, even after recent increased budgeting for safety-oriented road engineering.*
- *Government is proposing increased transport funding of around $5 billion over the next 10 years.*
- *The new and more flexible transport funding arrangements and the increases in funding recently introduced by Transfund open up new opportunities for longer term planning in road safety engineering and more scope for take up of projects by local authorities.*
- *Self-explaining roads and forgiving roadsides can help shape the road network to provide large improvements in road safety. Such approaches are being adopted increasingly in long-term strategies in the best performing countries in road safety.*
- *Given the high expectation in the Road Safety to 2010 Strategy of delivering long-lasting improvements from road safety engineering, considerable and appropriate emphasis has been placed in work to date on developing strategies and tools and identifying measures which will help to improve the safety quality of the road network. However, implementation will need to be expedited in key areas if 2010 goals are to be reached. There is much potential for further investment in safety engineering in New Zealand, not least in the modestly funded road safety engineering schemes at single sites, which still generate very high ratios of benefit to cost; cost-effective pro-active mass action on speed zoning, median barriers and roadside hazard treatment; and area-wide urban safety management which can deliver good benefit to cost ratios both in town centres and residential areas.*
- *The further development and application of a national functional road classification system where speed limits, road design and self-explaining layouts match road function could provide a rational framework to take forward the current discussion about speed limits and road design. A lead agency could be appointed by the Ministry of Transport with a target date for implementation to conduct this task with the full co-operation of all key stakeholders.*
- *At the same time, considerable safety benefits could be achieved if all the road controlling authorities were able to perform at the level of the best performing authorities.*
- *In view of the rational framework, which the SMS tool provides to encourage road safety engineering expertise to be applied widely and systematically and the encouraging take-up to date, there would be benefit in trying to achieve 100% take up as soon as possible. Transfund New Zealand could consider requiring the use of SMS as a condition for receiving grant for road safety with an appropriate lead time.*
- *The Crash Reduction Analysis system and its linkage with the RAMM data base is a most valuable tool and should continue to receive full support*

- *Monitoring shows that there has been successful implementation of minor safety works at high-risk sites. Such high benefits to cost have been achieved from work to date on local and state roads which has been subject to crash analysis study, that this area is likely to deliver good returns well into 2010. Transfund has recently doubled the minor safety works allocation, and low cost/high return safety schemes deserve as much additional resource as can be found.*
- *In view of the problem roadside hazards create for law-abiding road users, finalised national roadside hazard management guidelines, together with appropriate resource, would allow the roll out a national mass action programme on state highways.*
- *The use of median barriers has proven to be an effective road safety engineering intervention elsewhere and Transit is currently conducting trialling various options. As with roadside hazard treatments, a mass action programme of median barriers could deliver important safety benefits.*
- *The Safe Roads approach of Wellington City Council, which has adopted a targeted area-wide approach and which envisages urban speed limit reductions to 40km/h, is encouraging (Safer Roads 2004). The use of area-wide 30km/h, traffic-calmed zones is more common in Europe and has delivered very substantial safety benefits (some 15–80% reduction in injury crashes (Kjemtrup and Herrstedt 1992, Brilon and Blanke 1993)). There is much experience in urban safety management in Europe and several guidelines produced by the engineering profession set out the key principles (e.g. DfT et al, 2003).*
- *National professional engineering bodies have played a key role in countries active in road safety in identifying and disseminating best practice.*
- *Further study of the relationship between crash rates, traffic flows and geometric design towards more consistent design and treatment on two-lane rural state highways for crash rate reduction is an identified need.*

Reducing speed

- *Speed is acknowledged globally to be the single most important determinant of road safety and its management is, therefore, crucial to the success of the Road Safety to 2010 Strategy in delivering a level of road safety which is amongst the best in the world.*
- *The contribution of measures to reduce speed to reaching the 2010 goals was estimated at 14.9%.*
- *The combination of publicity and police enforcement has contributed to useful reductions in average mean speeds both on open and urban roads and 2004 targets have been met. It is estimated that this activity has saved 58 lives since the base year.*
- *Based on this activity, the strategy is on course to deliver the 2010 estimated potential. However, with many factors at play, e.g. traffic growth, the level of current activity will need to be increased to deliver the 2010 goal.*
- *The proportion of fatal crashes with excess speed rose to 35% of fatal crashes in 2003 in New Zealand. In the case of teenage drivers, the proportion has risen to 44%.*
- *New legislation introduced in 2004 empowers road controlling authorities to set their own speed limits on local roads, although there are central powers to reverse decisions if necessary.*
- *Upper speed limits on open roads and the range of speed limits operating in urban areas are much higher in New Zealand than in the best performing countries in road safety. Appropriate upper speed limits to match road function, in line with international best practice, could be reviewed in the context of establishing the new national road hierarchy or classification mentioned previously.*
- *Area-wide, traffic-calmed 30km/h zones are commonly implemented in Europe within an urban safety management approach and, if implemented in New Zealand, could make a significant improvement both in the safety of vulnerable road users and car occupants.*
- *The progress to date provides opportunity for improvement to average mean speeds of 51 km/h in urban areas and 93 km/h in rural areas to save many more lives over the remaining five years of the strategy.*
- *Through the widespread use of speed camera technology to detect and penalise speeding offenders, drivers are not given 'a sporting chance' in avoiding detection and prosecution for speeding offences in countries active in road safety.*

- *Well publicised, area-wide speed camera operations are an efficient and cost-effective means of achieving reductions in speed-related crashes and injuries. The important things seem to be: highly visible national programmes which are rolled out with adequate equipment resource, and efforts to secure a deterrent effect of the operations. Some jurisdictions place priority on the placement of some cameras at camouflaged locations so that they are not obvious to speeding drivers and have achieved a network effect with good return (e.g. Victoria, Delaney et al, 2003)). Such operations are estimated by Vulcan et al (2003) to decrease deaths by 4.7%, i.e. saving 20 lives and 170 injuries annually, which represents $107 million in social cost. Others, e.g. the UK, have rolled out an extensive, well publicised overt camera programmes targeted at sites with especially bad casualty records which have achieved useful returns (see Tables 34 and 35).*
- *A review of speed camera applications by the Police is planned. Digital speed camera technology and automatic number plate recognition are technologies which have been used widely overseas for the last 15 years. Urgent consideration should be given to increasing the number of speed cameras and speed cameras hours, given the importance of this technology as a speed management tool. LTSA analysis shows that 11 deaths and 226 injuries could be prevented for an additional 80 camera hours per week leading to a saving of $63 million (2001 prices) and a 2.1% reduction in social cost. Ten deaths and 190 injuries could be prevented if 20 additional cameras were made available (Vulcan et al, 2003) which would lead to saving of $55 million – a reduction of around 1.8% in total social cost.*
- *Speed enforcement by laser and radar complements speed camera operations and current levels should, at least, be maintained.*
- *Allocating demerit points for all speeding offences, irrespective of the means of detection, is common international practice. That speed demerit points cannot be allocated in speed camera operations, but can be in laser and radar operations, is anomalous and gives mixed messages to the general public. Introducing demerit points for speed camera offences is estimated by the LTSA to save 7 lives and 110 injuries annually, which represents $43 million in social cost (Vulcan et al, 2003).*
- *The mandatory fitment of in-vehicle speed limiters on heavy goods vehicles would be in line with best international practice. If the current average mean speed of 93km/h could be reduced to 90km/h through an in-vehicle limiter, then it is roughly estimated that there would be a 6% reduction in HGV-related deaths or a 3% reduction for all casualties in HGV-involved crashes, giving a social cost reduction of 0.6%.*
- *In New Zealand, awareness of the importance of enforcing speed limits is high – about 80% believe that this lowers road death and a majority are in support of speed camera deployment. It is important, therefore, that minority groups who oppose camera enforcement vigorously do not have disproportionate influence on policy development, since their accommodation would impede progress towards a larger societal benefit.*

Combating drink driving

- *The contribution of measures to reduce alcohol-related crash injury to reaching the 2010 targeted reductions in social cost was 7.9%.*
- *Based on current activity, the projected shortfall to reaching the target for social cost reduction is 4.7%.*
- *In New Zealand, awareness of the importance of enforcing drink-driving legislation is high. 76% of New Zealanders think that compulsory breath testing helps to lower the road toll.*
- *A high public perception of the risk of being detected above a blood alcohol limit that reflects up to date epidemiological considerations, is the principal means of combating drinking and driving.*
- *Continued highly visible CBT activity at the current rate, combined with publicity at the current level, is needed to reach the 2010 target.*
- *To date there have been insufficient new interventions to allow the 2010 target to be reached.*
- *Reducing the blood alcohol level from 80 to 50mg/100ml in line with international best practice would give a 4.5% reduction in social cost by 2010 (a reduction of $103million annually) and save 14 lives and 260 injuries annually. In view of the importance of this measure, a concerted effort is*

needed to increase awareness and levels of support in the community for this measure.

- *Reducing the BAC for young drivers from 30/100ml to 10mg/100ml (effectively zero), as recommended in the Vulcan report) would save at least one life and prevent 26 injuries annually.*
- *Requiring alcohol interlock devices to be installed in the vehicles of all repeat drink/driving offenders (two offences within 5 years) and those convicted on BAC of 160mg/100ml would provide an 8% reduction in alcohol-related crashes (if the interlock were required to be used for two years after conviction and assumed to be 50% effective in reducing drinking and driving (Vulcan et al, 2003). This would correspond to an average annual reduction of 4.5 deaths and 20 serious injuries with an annual social cost saving of $26.2 million. However, a change in legislation to provide for an experimental trial would be necessary.*
- *Experimentation with alcohol interlock devices in commercial and public transport operations may provide a more direct route to realising casualty reduction potential of alcohol interlocks to 2010.*
- *Evidential breath testing equipment at the roadside would improve the operational efficiency of enforcement.*

Dealing with serious offenders

- *The contribution of measures to deal with serious offenders to reaching the 2010 target was 4%.*
- *There is a shortfall in reaching this target, based on current activity of 0.6%.*
- *Dealing with serious offenders translates into small road safety benefits but addresses social justice considerations.*
- *Legislative changes are being put in place to bring about initiatives to deliver the 2010 targets.*
- *The potential for alcohol interlock devices to reduce recidivism is well established, but any future implementation in New Zealand may not be in time to deliver results before 2010.*

Encouraging seat belt use

- *The contribution of measures to encourage seat belt use to reaching the 2010 target was 4.2%.*
- *Based on current and maintained activity, the strategy is on course to deliver the target.*
- *Since the forecasting was conducted, new research indicates that the effectiveness of seat belts in reducing fatal injury is higher than the original estimate – 61% compared with 40%. When combined with airbags, it is estimated that the injury-reducing effect is 68% compared with 46% in the original estimate. The potential 4.2% of social cost savings from increased seat belt use are likely to be an underestimate and could be updated.*
- *Police and advertising efforts nationally and locally have been highly successful and current levels of support need to be maintained.*
- *The increasing fitment of seat belt reminders in vehicles (particularly in European vehicles) should provide an important additional tool for encouraging higher levels of use and associated casualty reductions.*
- *87% of people surveyed in New Zealand in 2003 believed that seat belt enforcement helps to lower the road toll.*

Improving safety for pedestrians and cyclists

- *The pedestrian and cyclist strategy is broad based and covers a wide range of activity.*
- *Health and environment strategies related to increased cycling, walking and reducing congestion should be integrated and compatible with safety strategies. Implementation of activities should be co-ordinated to ensure safety is addressed in 'at risk' areas prior to the promotion of walking and cycling.*
- *The safety engineering interventions in the pedestrian and cyclist strategy will need to be strong and foremost in the implementation plan to offset the increase in exposure to risk brought about by more cycling and walking.*
- *The importance of 30km/h as the threshold for severe pedestrian injury needs to be widely understood and the benefits of area-wide 30km/h zones in town/city centres and residential areas could be promoted via demonstration projects in the Safer Routes strategy.*

- *Cycle helmets reduce head and brain injury by 63%-88% and continuing high wearing rates in New Zealand will lead to further casualty reduction.*

Improving the vehicle fleet – light vehicle safety

- *The potential contribution of improved light vehicle safety to reaching the 2010 target was originally estimated to be around 15.5%.*
- *Given the limitations of the data on New Zealand fleet crashworthiness and the fact that forecasting in this area is very complex, it has been difficult to make firm assessments concerning the actual and potential contribution of vehicle safety within the timescale of this review. Further in-depth analysis involving independent multi-disciplinary expertise is recommended.*
- *Actions to achieve improvements are in place; however further measures will be needed to ensure that this 15.5% contribution and more is reached.*
- *It is clear that despite the progress achieved in recent years, New Zealand is not yet maximising its opportunity to receive levels of vehicle crash protection in its fleet, which could prevent many more deaths and serious injuries. It is estimated that with new measures the further social cost reduction potential would be in the order of 10% or greater.*
- *Unlike many other highly motorised countries, New Zealand has not gone down the route of requiring specific legislative standards covering a range of key improvements, e.g. side impact protection, improved frontal impact testing in cars; pedestrian protection; the latest improvements in child restraints and daytime running lights or adapting key standards to technical progress, e.g. the full-width barrier test of the Frontal Impact Rule.*
- *However, New Zealand has a unique opportunity to identify and adopt a mix of implementation strategies to bring the world's best practice in crashworthiness and consequent reduction in likelihood of vehicle occupant injury nationally.*
- *A possible mix of strategies is:*
    - *regulation on used imports which constitute approximately 80% of registrations in New Zealand*
    - *compelling consumer information programmes, using outcomes of Used Car Rating and ANCAP/ EuroNCAP*
    - *leading by example with a high safety-rated government (and providers of services to government) passenger car flee*
    - *limited regulation on new vehicles.*

- ***Regulation on used imports:*** *One option by which New Zealand could ensure that it receives the level of in-vehicle safety provided in other highly motorised countries is the introduction of a complex set of regulatory vehicle safety standards (as is the case for most other highly motorised countries). However, given that New Zealand is so far behind in this practice, this would require a significant effort to introduce and to monitor, and there may be difficulties with functional equivalents of various regulations. An alternative is to explore the potential casualty reduction value and feasibility of a simple real-world, performance-based regulatory regime, taking advantage of the fact that vehicles in the used car imports scheme have been on the roads long enough for their 'real world' crash performance to be determined. An illustrative and possible scenario is as follows:*

A strategy for safer vehicle imports

Regulation on used imports

- Reducing, in two stages, the average age of the New Zealand car fleet, which is estimated at 12 years and twice the age of vehicle fleets in other developed countries (e.g. UK), by mandating that no vehicle older than the desired average fleet age is to be imported. E.g.
  - from 2006, no used car imports to be more than seven years old
  - from 2008, no used car imports to be more than five years old.
- Ensuring that used car imports provide a reasonable level of safety performance by requiring from 2006:
  - categories of large car, medium car, people mover, luxury and prestige cars, and four wheel drive vehicles to have an average probability of driver serious injury based on published data of less than 3.00. The rating of 3.00 is chosen because it both represents a cut off of the worst performing vehicles in that category and still allows choice. From 2008, reduce the rating to 2.8
  - categories of light and small cars to have an average probability of driver serious injury based on published data of less than 4.20. From 2008, reduce rating to 4.00.
  - cars less than two years old, and new cars, to be required to have a rating in ANCAP (which is similar to EuroNCAP) of not less than three stars
  - cars which are not rated in either ANCAP or the Australian New Zealand Used Car Rating would need to be tested to ANCAP protocols.

- ***Compelling consumer information programmes:*** *In New Zealand, there is a local car manufacturing industry, and a large proportion of the vehicles are imported used cars where the vehicle manufacturer does not have contemporaneous control of the crashworthiness of those cars. In this environment, it is judged that New Zealand will have to do something extra to make NCAP programmes work. The suggested 'extra' is for NCAP and Used Car Ratings of vehicles to be given more emphasis by more conspicuous labelling on vehicles. While experience with safety ratings to date may not show a significant influence on purchasing decisions, vehicle manufacturers have to allow for the possibility that the public may be strongly influenced by NCAP programmes and hence, aim to build good crashworthiness into their vehicles to achieve good ratings.*

Mandatory windscreen stickers

- The strongly recommended labeling protocol is a dual labeling system where one label is a large temporary label required by consumer legislation for display on windscreens at point of sale. This would list the crashworthiness safety features of the vehicle as fitted. It would include the vehicle's overall ratings from both NCAP and the Used Car Rating, if known. It would also include comparison to overall fleet average and overall category average.
- The second label would be a permanent label including all the above information but in smaller type, so that the label can be fitted to an interior part of the vehicle such as the glove box etc.
- This would list the crashworthiness safety features that the vehicle has fitted, e.g. side impact airbag curtains for head protection and the legislative regime to which the vehicle was manufactured.
- These labels could be fitted to new vehicles and on used imported vehicles.

- ***Leading by example with safer Government fleets:*** *An effective way for the government to stimulate demand for safer vehicles is for the government to set safe workplace standards for its own vehicle fleet. The New Zealand Government could create a Vehicle Fleet Safety Strategy which it markets to all government and private fleets using safe workplace (occupational health and safety) leverage to push aggressively for the introduction of the safety measures in the package. A possible scenario is outlined below:*

A NZ Government vehicle fleet safety strategy

From 2006:

- New Zealand Government vehicles to have a four-star rating in the ANCAP system or a Used Car Rating of less than 3.00.
- All new and existing government vehicles to be fitted with daytime running lights to a new NZ specification.
- All new government vehicles to be fitted with seatbelt reminder systems.
- From 2007: all new government vehicles to be fitted with driver's side head curtain airbags and driver and front seat passenger airbags.

Limited regulation on new vehicles:

- *From 2008, all new cars to have an ANCAP rating of not less than 4 stars, based on the current star rating system, and side impact head curtain bags for driver and passenger.*
- *From the year 2006, all new vehicles, with no exemptions by category, could be fitted with daytime running lights to a new NZ specification. The use of LED technology would remove concerns about small environmental costs.*
- *To offer children levels of protection in accordance with world's best practice, cars in New Zealand could offer top tether anchorages. From 2006, all new and used/imported vehicles sold in New Zealand could provide for three top tether anchorages on a rear row of seating.*

New and targeted education initiatives:

- *Informing and educating road users can improve knowledge about the rules of the road and such matters as purchasing safer vehicles and equipment. Basic skills on how to control vehicles can be taught. Road safety education in schools can help to bring about a climate of concern and develop sympathetic attitudes towards effective interventions. Consultation with road users and residents is essential in designing urban safety management schemes.*
- *While, in the past, considerable emphasis has been placed on efforts to reduce road user error through traffic safety education – an example being in pedestrian and cycle education for school children and in advanced and remedial driver training schemes – there is no evidence that they have been effective in reducing rates of road traffic crashes.*
- *It is often the case that more effort in the area of education and publicity is promoted as an alternative rather than an adjunct to more effective action.*
- *However, when used in combination with police enforcement, such as the national advertising programme on speed, education can help to bring about important reductions in casualties.*
- *The development of strategies for the new Land Transport New Zealand crown agency for improving the safety of the Maori and Pacific people should be treated as a matter of urgency in order to maintain the confidence of the Maori and Pacific people who have worked with LTSA on previous strategies.*
- *Creating awareness of the consequences of speeding, drinking and driving and failing to wear a seat belt in the general population (rather than focusing on serious offenders) is in line with best international practice.*

Young and novice drivers:

- *The contribution of young and novice driver measures to reaching the 2010 target was 3.7% and there is a 4.6% shortfall in measures to reach this target (the original estimate of a social cost reduction potential of 2.6% for raising the age from 15 to 17 years of access to a motor vehicle having been revised upwardly).*
- *Nearly every evaluation of young driver crash involvement has noted that the most influential factor is the age of access to the driving system – the older a driver is before they get access to the system, the greater the reduction in crash involvement. At age 15, New Zealand's driver access to the system is significantly younger than world's best practice.*
- *Factors such as the remoteness of many rural settlements in New Zealand have influenced the adoption so far of the unusually low minimum age and it is recommended that an urgent*

independent review be undertaken of the non-safety advantages and disadvantages of the low minimum age in order to inform further consideration of the powerful road safety arguments for raising it.

- *If crashes involving licensed drivers of the directly affected age group are removed then the savings in terms of percentage of total social cost would be 0.9% for increase to 16 years and 4.1% for increase to 17 years. If some allowance is made for less unsupervised driving in the age group immediately above the directly affected age group (learner drivers who have to be supervised have a lower crash rate per driver than those allowed to drive unsupervised), the savings in terms of percentage of total social cost would be a 1.2% for increase to 16 years and 4.6% for increase to 17 years.*
- *A phased raising of the young driver age might be considered. For example, raising the age for access to 16 in 2006, and to 17 in 2008.*

Older drivers:

Older drivers are more vulnerable to serious and fatal injury in the event of a crash than other age groups. OECD experts (OECD, 2001) have concluded that a strategy to ensure the safe mobility of older drivers should include:

- *support and funding to enable lifelong mobility*
- *support for older people to continue driving safely*
- *provision of suitable transport alternatives to the private car*
- *involvement of older people in policy development*
- *safer vehicles for older people*
- *development of safer roads*
- *appropriate land use practices*
- *educational campaigns to ensure maximum mobility and safety for older people.*

Trauma management:

- *The contribution of trauma management to reaching the 2010 social cost target was originally estimated at around 0.9%.*
- *There is not so much a 'golden hour' for post-impact care but a chain of opportunities for intervention across a longer timescale. The chain involves bystanders at the scene of the crash; emergency rescue; access to the emergency care system; and trauma care and rehabilitation.*
- *Since the social cost of death and disability are high, improved trauma management can have a large effect on social cost.*
- *The Vulcan review recommended a study in at least one of the five regional networks to ascertain if there are similar problems in the management of major road trauma, as found in a recent Victorian study, and the extent of potentially preventable deaths.*

HGV safety:

- *The contribution of improved heavy vehicle safety to reaching the 2010 target was 0.5% based on new vehicle rules. While new Static Roll Threshold (SRT) requirements have been introduced, there is a small shortfall compared with the original estimate.*
- *HGVs are involved in 20% of road deaths in New Zealand. Given that the rate of growth in the volume of heavy vehicles is double than the rate of overall traffic growth, new action is essential.*
- *With reference to the NRTC Truck Safety Benchmarking study which covered a period 1995-1999, the Vulcan review indicated that trucks were grossly over-represented in deaths and serious injuries in New Zealand compared to other developed countries. The New Zealand death rate per 100,000,000 kms of travels was over three times higher than that of the best performer. While the New Zealand death rate per 100,000,000 kms of travel has decreased to around 3.2% in 2002, this is still higher than that of the said developed countries in 1995-99 (which may also have improved during the period after the study – 1999 to 2006).*
- *In general, heavy goods vehicle transport safety in New Zealand has been significantly under-*

regulated in key areas when compared to the best performing countries in road safety. This may explain its poorer performance.

- *A number of heavy goods vehicle safety issues are being discussed. The Vulcan review called for the early implementation of a New Zealand heavy goods vehicle safety strategy and this recommendation is re-iterated here.*
- *Effective strategies for improving heavy goods vehicle safety in New Zealand include:*
- *The introduction of a significantly enhanced inspection system for vehicle defects and safety performance to result in the likelihood of a heavy vehicle being subjected to a random check once each year. Preliminary analysis indicates that this would be highly cost effective.*
- *Incentives for semi-trailer use rather than low tare multi-axle trailers. Road user charges (RUCs) in New Zealand encourage low tare multi-axle set trailers, which have lower handling performance characteristics and higher crash rates than the semi-trailer configuration used more widely overseas. At the same time more attention is given to reducing RUCs than fuel use, providing less incentive to driver at safer fuel economy speeds.*
- *The fitment of in-vehicle speed limiters on heavy goods vehicles would be in line with best international practice. If the current average mean speed of 93km/h could be reduced to 90km/h through an in-vehicle limiter, then it is roughly estimated that there would be a 6% reduction in HGV-related deaths or a 3% reduction for all casualties in HGV-involved crashes, giving a social cost reduction of 0.6%.*
- *Mandatory provision for fitment of frontal, rear and side under-run guards. It has been estimated that the provision of energy-absorbing front, rear and side under-run protection could reduce deaths by about 12% (Knight, 1998). The benefits would exceed the costs even if the safety effect of such measures were as small as 5% (Elvik, 1999).*
- *Mandatory seat belt use.*
- *Legislative restrictions on working and driving time which better reflect needs identified by research to reduce cumulative fatigue, and the use of tachographs for law enforcement.*
- *Ongoing multi-disciplinary, in-depth study of heavy vehicle crashes in New Zealand is recommended to identify more fully the factors influencing crash and injury causation.*

Motorcycle safety:

- *Motorcycling is a very high risk activity compared with other travel modes.*
- *Motorcycle registrations have increased recently in New Zealand.*
- *Motorcycling is often promoted by the lobby as being an economical and environmentally clean form of transport. The cost of crashes shows that, in fact, it is a highly subsidised form of transport, with other road users providing that subsidy.*
- *The Accident Compensation Corporation could consider significant increases in motorcycle and moped premiums to more closely reflect their claims and in order to recoup their costs.*
- *The minimum age for access to moped and motorcycle learner permits should be increased from 15 to 17 years and engine size for novice drivers should be reduced from 250cc to 125cc in line with international best practice.*
- *The fitment of twin dedicated daytime running lights using LED technology should be required on all new two-wheeled motor vehicles in line with international best practice.*
- *Best practice in road environment treatments needs to be identified, particularly at junctions.*

Driving fatigue:

- *Fatigue is recognised as a key impairment factor, which contributes to crashes in the general driving population as well as in commercial road transport.*
- *Knowledge as to how to effectively address this problem in the general driving population using evidence-based measures (aside for road engineering) is still developing.*
- *Given the difficulty associated with identifying or recognising fatigue as contributing to a crash and the range of factors involved this area, continuing efforts should be made through periodical in-depth research to identify and evaluate interventions.*

6. The main partnerships in practice

Effective implementation of a strategy requires the involvement of the key stakeholders in developing the strategy and targets and the clear allocation and acceptance of responsibility on their part.

One of the identifiable features of the progress made in New Zealand in the last decade is the early successful partnership developed particularly between the LTSA and the New Zealand Police, and additionally with key stakeholders such as local authorities, Transit NZ and Transfund in some of the road safety engineering arrangements. The leadership provided by the LTSA since its inception since 1993 and the extent to which road safety has become the core business of the police are international success stories, with around 23% of the police budget being allocated to road safety-related activities in 2003/4. New Zealand road safety policing has led to a substantial reduction of road trauma through pro-active on-road enforcement with benefits to cost estimated within the range of 8:1 – 13.1 (with enforcement aimed at excessive speed and drink-driving yielding ratios at the upper end of this range) (Guria, 1998; Vulcan et al, 2003). One of the key strengths of the *Road Safety to 2010* Strategy is the partnerships established in the National Road Safety Committee (NRSC). The NRSC, which meets frequently, brings together the chief executives of the main Government stakeholders of the strategy, which has provided the opportunity for excellent understanding of the task in hand and good cross-sectoral collaboration.

New Zealand recently signed up to World Health Assembly Resolution EB 113.R3, (WHO, May 2004) on road safety and health, which urges ministries of health to be involved in the framing of policy on the prevention of road traffic injuries. It calls for the public health sector and other sectors – government and civil society alike – to actively participate in programmes for the prevention of road traffic injury through injury surveillance and data collection, research on risk factors of road traffic injuries, implementation and evaluation of interventions for reducing road traffic injuries, provision of pre-hospital and trauma care and mental health support for traffic injury victims, and advocacy for prevention of road traffic injuries. In view of this development it seems appropriate to suggest that there would be benefit for road safety if the Ministry of Health joined and played an active role in the National Road Safety Committee in the future development of road injury prevention policy. The Ministry of Justice and the Department of Labour also have key responsibilities in this area which would enhance NRSC activity.

- *In the last decade, New Zealand's road safety work has been driven by highly successful governmental partnerships at national, regional and local levels.*
- *The leadership provided by the LTSA since its inception since 1993, and the extent to which road safety has become the core business of the New Zealand Police, are international success stories.*
- *While the Ministry of Health is represented on the National Road Safety Advisory Group, it does not participate in multi-sectoral road safety policymaking in New Zealand at the highest level, being absent from the National Road Safety Committee, despite its key role in trauma care and road injury prevention policy and the large cost of road injury to health.*
- *The developing New Zealand strategy for workplace health and safety to 2015 (DoL, 2004) provides a new opportunity for the Department of Labour to contribute more directly to the Road Safety to 2010 Strategy via the National Road Safety Committee, given the prominence of motor vehicle crashes as a source of occupational injury and in view of developing government strategies for in-house health and safety policies.*
- *The Ministry of Justice also has key responsibilities for road traffic law enforcement and should be represented at a chief executive level on the National Road Safety Committee.*
- *The quarterly road safety progress report issued by the LTSA is perceived to be highly useful by all stakeholders and represents the best source of regular factual information ever seen by the reviewer.*
- *Further observations are made about institutional arrangements and delivery partnerships in section 12.2.*

7. Unforeseen developments

Consultation with the government stakeholders has produced the following observations:

- A loss of focus on the importance in the medium to long term of continuing to be innovative in road management and engineering to meet more than just the impact of growing traffic volumes. There was an absence of new and innovative initiatives until the recent advent of speed zoning and the relatively low priority/imperative associated with safety retro-fitting. Similarly, there has been a significantly greater proportional increase in the allocation of funds to congestion relief, and reduced comparative attention to safety has not drawn the level of discussion that might be expected.
- The perception amongst some commentators about revenue raising from speed camera deployment, which is having an unhelpful influence. Yet, as the Controller and Auditor-General's report (2002) concluded: there is no evidence to support this view. The Police have no incentives to maximise revenue generated by the programme because infringement fees are paid directly to the Crown and are not available to the Police to spend on operations, and the police performance targets for the programme bear no relationship to the revenue collected. While a vocal minority object, public opinion surveys continue to show a good level of support for police enforcement, although demerit points require public educational effort, given the importance of securing a rational and consistent speed penalty policy.
- Concern has been expressed by some stakeholders that recent policy decisions and announcements in light of the above are leading to mixed messages on road safety to the media and the wider public. Furthermore, that these may be unhelpful to securing progress in the Strategy. Concern about deviating from evidence-based measures has also been articulated.

8. Achieving a mutually supportive institutional climate for road safety

In western democracies, the lengthy campaigns for many road injury prevention measures show that political decisions are not made merely on the basis of good evidence. Important road safety measures rarely come about in the normal order of things or as a result of consensus of all stakeholders. Time after time and in many countries, opposition from powerful sources has been an important barrier to introducing evidence-based measures, even when these are demonstrably cost-effective and acceptable to the public (Breen, 2004).

However, as noted by the World Bank and World Health Organisation, institutional arrangements can be established to advance the case of road safety and to help provide the conditions for successful and efficient implementation of road injury prevention measures. Most of the better performing countries in road safety have most, if not all, of these institutional elements, which comprise:

- multi-sectoral government administration with a lead agency giving strong political leadership
- well supported national research sector providing impartial information for decision making and public debate
- well informed Parliamentary legislative committee on road safety providing all-party initiative, support and scrutiny
- pro-active non-governmental coalitions of professionals and citizens to stimulate demand for safety and to scrutinise the detail of Government policy.

To the outside observer, New Zealand has been operating since 1990 on the basis of only one of four of these key institutional elements – multi-sectoral government agency leadership. Outside Government, there does not seem to be any other day-to-day champion for road safety. While research in New Zealand clearly informs the agenda, and LTSA's own research and the watching brief it has kept on overseas research have been excellent and influential, there is no lead non-governmental research organisation which can contribute routinely and authoritatively to public debate

on road safety. A review of road safety research in New Zealand in 2003 indicates that 58% of research projects were carried out by Government agencies or crown entities, with only 24% by the New Zealand university sector. Clearly, there is Parliamentary interest in road safety but New Zealand currently does not have an all-party road safety committee, which other countries have found to be valuable. While many non-governmental organisations have interests in road safety, there is no national coalition of professionals and organisations which actively works to identify and promote research-based measures to the wider community. It is, therefore, suggested that:

- *An all-party Parliamentary approach to road safety formalised in an all-party road safety committee has delivered important improvements to road safety in Australia and Europe, and Parliamentarians might want to consider if this would be appropriate to road safety in New Zealand.*
- *The encouragement and development of a lead research organisation in New Zealand for road safety could be considered, which could contribute information that is impartial and perceived to be impartial to policy and public debate.*
- *The appropriately ambitious nature of the Road Safety to 2010 Strategy means that road safety, health professionals and researchers in the non-governmental sector together with non-governmental organisations with a strong interest in road safety could come together formally and nationally to be a champion for road safety, in order to overcome structural barriers to publicly acceptable, evidence-based road injury prevention measures.*

9. Summary of problems, gaps and opportunities to be addressed

The systems approach: The *Road Safety to 2010* Strategy is an excellent strategy and progress is being achieved. The strategy provides for the systems approach outlined in Table 3, which requires fundamental, wide scale, long-term re-working of various aspects of the design and operation of the national traffic system, to achieve better interface between human, vehicle and road environment. Most of the casualty reduction progress to date, however, has been achieved through securing compliance with key safety rules through a combination of police enforcement and publicity and realising benefits in the vehicle fleet from vehicle improvements arising, in the main, from overseas regulation and consumer information. Reaching 2010 targets, against rising traffic, will mean that these two strategies will need additional initiatives (and both hold much further potential). In the other three key strategies of the systems approach – managing exposure to risk (e.g. restrictions on licensing, access to powerful vehicles, area-wide safety impact assessment on land use and transport planning provisions, and encouraging choice of safer transport modes), shaping the road environment for injury prevention; and post impact care – implementation and monitoring needs to be put in place as soon as possible in several areas to achieve the systems approach rationale.

Quantitative and qualitative gaps: There are both quantitative and qualitative gaps in the programme as set out in previous sections. It is estimated that with no further evidence-based road safety initiatives over and above those planned to date, and taking into account increases in traffic and using a multiplicative approach towards estimates of interventions, there is about a 22% shortfall in meeting 2010 targets for reductions in social cost.

A long-term vision: The creation of a long-term vision for road safety beyond 2010, which draws together those visions in existing transport and health strategies, could be useful given that these visions for transport and injury prevention might be perceived to be in conflict.

Renewed political leadership and policy packages: The gaps provide opportunities for renewed political leadership in road safety in rolling out a series of evidence-based policy packages with new and current measures, covering the priority areas of the strategy, especially in relation to engineering safer roads, improving vehicle safety, managing vehicle speed, improving pedestrian and cyclist safety, improving young and novice rider and driver safety and combating drinking and driving.

Priority measures early savings: Large casualty savings and reduction in social cost could be obtained quickly from individual measures such as reducing the blood alcohol limit to 50mg/100ml, increasing the age of access to a provisional motor vehicle riding and driving licence, and increasing speed enforcement operations.

Institutional arrangements: The new organisational arrangements for transport in Government seem to open up a timely opportunity for review by Government and professionals of other key institutional arrangements as far as road safety is concerned (see section 12.2.1).

Sharing responsibility with new partners: Notwithstanding the fact that the Accident Compensation Corporation leads the injury prevention strategy, the review has found a lack of evidence that road injury prevention is core business in terms of policy development. The Ministry of Health should consider participating in the National Road Safety Committee, along with the Ministry of Justice and the Department of Labour who also share key responsibilities for road safety.

Data needs: As a result of the information-gathering process of this of the *Road Safety to 2010* Strategy and the current review by Statistics NZ of data systems, a range of recommendations are made about improvements in New Zealand's crash reporting systems (Section 12.2.2).

REPORT

1. Introduction

This independent review of 'Road Safety to 2010' has been commissioned by New Zealand's National Road Safety Committee, comprising the key Government stakeholders of the strategy. The review was carried out between 20 September and 19 November 2004.

The purpose was, first, to review the progress of the strategy towards achieving the stated 2010 goals and second, to identify improvements to existing interventions and potential new interventions which could form the basis of a third implementation plan to help reach the 2010 goals. The independent review process comprises three stages, the terms of reference of which are set out in Section 2.

The independent review team comprised four members – Jeanne Breen (Jeanne Breen Consulting, UK) with advisory support from Professor Richard Allsop (University College London, UK), Fred Wegman (Institute for Road Safety Research (SWOV) in the Netherlands) and Michael Griffiths (Road Safety Solutions, Australia) (See Appendix 1). The review team is grateful to NRSC Chair David Wright and Secretary for Transport Robin Dunlop for the wholehearted support they have given to this independent review and the resource being made available to the review team. Thanks are given to the representatives of all National Road Safety Committee members for making time for a first meeting and providing key documents and briefing. Thanks are due to Martin Small and his team at the LTSA for providing an office and, in view of the short timescale of the first stage of the review, making it possible for meetings with key stakeholders to be arranged (see Appendix 2) and for technical assistance to be provided on request to suit the convenience of the review team. The review team also thanks Ted Preston for his administrative support and advice.

As requested, the review has taken account of previous reviews relating to road safety in New Zealand as well as international best practice, which provides a reference point for the New Zealand activity and which may help to inform future planning. Reference is made, in particular, to the Vulcan et al report (2003), the Bielby report (2003) and to the World Health Organisation/World Bank Report on Road Traffic Injury Prevention (2004). The review has also taken account of the current economic, social and political environment, the level of public support as measured by public opinion survey, the implementation process, the commitments of key stakeholders in the *Road Safety to 2010* Strategy partnership and the quality of the delivery mechanisms.

The structure of this report is as follows: a brief summary of international perspectives about best practice in road safety management and visions, strategies and target setting; the past achievements and future challenges of road safety in New Zealand; and an outline of where road safety sits in the New Zealand's Transport Strategy, before embarking on an quantitative and qualitative analytical review of the *Road Safety to 2010* Strategy and the potential for future casualty reduction.

2. Terms of reference for the review of *Road Safety to 2010* Strategy

Stage 1

To focus on analysing progress and determining whether or not the mix of interventions being employed under the Road Safety to 2010 Strategy is right, using empirical evidence where possible. The key questions to be addressed:

- Does the Road Safety to 2010 Strategy remain well designed, aligned to real needs and likely to improve outcomes?
- How well is the Road Safety to 2010 Strategy aligned with the vision and objectives of New Zealand's Transport Strategy?
- Is the Road Safety to 2010 Strategy consistent with international best practice?
- Does the quantity, quality and coverage of the Road Safety to 2010 Strategy outputs match the intervention logic?
- Are the short-term results and outcomes improving in the areas anticipated?
- How strong is the evidence that change resulted from the Road Safety to 2010 Strategy or outputs?
- How effectively have road safety partners aligned themselves with the Road Safety to 2010 Strategy?
- Are there unplanned consequences (positive or negative?)

Stage 2

To focus on addressing the issues identified in stage 1, with a view to identifying ways to bridge the gap between current projections and the Government's 2010 road safety goals.

- Check the findings of stage 1 with National Road Safety Committee.
- Determine how to refocus existing interventions to achieve improved effectiveness.
- Identify the extent to which current resources can be re-prioritised.
- Identify areas where new interventions are required.
- Identify potential new interventions which could form the basis of a third implementation plan to help reach the 2010 goal.

Stage 3

Amalgamate the results of the first two stages into a report that will:

- Outline the progress of the Road Safety to 2010 Strategy towards the 2010 goal.
- Outline areas for improvement in existing programmes.
- Detail proposals for policy development and a third implementation package.

3. Addressing the problem of road crash injury – the new global perspective

Risk is largely explained by human error within the traffic system; the scope and nature of the change in speed to which users are exposed in impacts as a result of errors; the tolerance of the individual to this impact force; and the quality and availability of emergency services and acute trauma care.

The dominant factors influencing risk in road traffic globally are identified in a joint report by the World Health Organisation and World Bank on World Road Traffic Injury Prevention released on World Health Day on 2004 (Peden et al eds, 2004) (See Table 1). The report concludes that "the main road injury problems are being sustained worldwide by people who make similar mistakes, share the same human tolerance to injury limits and have the same inherent behavioural limitations. While the problems are different both qualitatively and quantitatively, the main risk factors appear to be the same worldwide".

Table 1: The main risk factors for road injuries (Peden et al eds, 2004)

Factors influencing exposure to risk

-Economic factors including social deprivation
-Demographic factors
-Land use planning practices which influence length of trip and travel mode choice
-Mixture of high speed motorised traffic with vulnerable road users
-Insufficient attention to integration of road function with decisions about speed limits, road layout, design

Risk factors influencing crash involvement

-Inappropriate or excessive speed
-Presence of alcohol, medicinal or recreational drugs
-Fatigue
-Being a young male
-Being a vulnerable road user in urban and residential areas
-Travelling in darkness
-Vehicle factors – such as braking, handling and maintenance
-Defects in road design, layout and maintenance, which can also lead to unsafe road user behaviour
-Inadequate visibility due to environmental factors (making it hard to detect vehicles and other road users)
-Poor road user eyesight

Risk factors influencing crash severity

-Human tolerance factors
-Inappropriate or excessive speed
-Seat belts and child restraints not used
-Crash helmets not worn by users of two-wheeled vehicles
-Roadside objects not crash protective
-Insufficient vehicle crash protection for occupants and for those hit by vehicles
-Presence of alcohol and other drugs

Risk factors influencing severity of post-crash injuries

-Delay in detecting crash
-Presence of fire resulting from collision
-Leakage of hazardous materials
-Presence of alcohol and other drugs
-Difficulty rescuing and extracting people from vehicles
-Difficulty evacuating people from buses and coaches involved in crash
-Lack of appropriate pre-hospital care
-Lack of appropriate care in the hospital emergency rooms

While the elimination of road crash injury is for the foreseeable future a remote prospect, there is a substantial body of evidence that a very large proportion of deaths and serious injuries in the shorter term can be prevented by known, available, publicly acceptable and cost-effective means.

Articulated by the WHO and World Bank report and a companion report by the WHO Europe office, a major paradigm shift has taken place in road safety thinking over the years (Peden et al eds, 2004, Racioppi et al, 2004). Early road safety policies placed considerable emphasis on information and publicity effort, generally used in isolation and without much success, to try and persuade users to behave safely. These gave way in several countries in the 1970s and 1980s to increasingly successful strategies recognising the need for infrastructure, vehicle and user measures and targeting, systematically, evidence-based interventions at crash prevention, reducing injury severity and post-crash care. In the 1990s, this systems approach was refined further in Europe, to one that recognised speed management and human limitations – both behavioural and physical – as core issues for the design and operation of the road traffic system. Growing acceptance that serious public health loss from road traffic injury is a feature of poor traffic system design and operation represents a major shift in professional understanding about what has to be done to avert the high socio-economic costs of road traffic injury and to enhance performance in safety management.

The WHO/World Bank's new global perspective on road safety is as follows:

- The paradigm shift at world level is that whilst road crashes may happen and cannot all be prevented, serious and fatal road crash injury can be predicted and prevented. Good data and a scientific approach allows for rational analysis and effective remedial action.
- Rather than just being the preserve of the transport sector, road crash injury is a problem of such consequence that many more sectors, including health, need to be fully engaged in responsibility, activity and advocacy for road crash injury prevention.
- The traffic system providers should build in safety to cope with commonly made errors, take better account of the vulnerability of the human body and acknowledge that speed management is central. Even sober, responsible drivers following the speed limit and using seat belts often die on the roads.
- Road crash injury is a social equity issue – equal protection to all road users should be aimed for to avoid an unfair burden of injury and death for poorer people and vulnerable road users. Even in high-income countries, the risk of road injury for children in low-income families is 5 times that of those who are better off in terms of income.
- Technology transfer must look to existing local problems, conditions and traffic mixes and needs to be informed by local knowledge.
- Intervention at the local, state, national and regional levels is required to ensure effective and rapid responses to local conditions.

While highlighting much successful practice in high-income countries, the World Report urges countries starting out in road safety not to repeat past mistakes, such as:

- Failure to adopt strategies or interventions based on evidence.
- Expenditure on ineffective but easy policy options.
- Focus on the mobility of motor vehicle users at the expense of the safety of vulnerable road users.
- Insufficient attention to the design of traffic systems.
- Insufficient professional scrutiny of the detail of traffic safety policy and standards.
- Missed opportunities to prevent deaths and injuries by measures such as the design of better. Vehicles, less hazardous roadsides and improving trauma care systems.

The key to achieving better performance in road safety is to address systematically the main risk factors, especially speed, and adopting proven measures more widely by:

- Using long-term visions, system-wide strategies, targeted plans and performance indicators to implement measures which take greater account of human limitations.
- Implementing more widely and efficiently those safety principles and measures that are known to be correct and effective (see Table 3).
- Finding new opportunities for increased road safety activity through multi-sectoral approaches and

synergies with environmental and public health policies.
- Using new delivery mechanisms to complement existing tools.
- Encouraging the health sector to become a leading champion for road safety.

4. International perspectives of road safety visions, strategies and targets

Experience in Europe indicates that complacency about death and injury can be shaken and sights raised by adopting a vision or philosophy for road safety which can relate to the general public (Allsop ed., 2003). Some countries have enshrined national policies and targets within legislation, such as the long-term and far-reaching Swedish Vision Zero and Dutch Sustainable Safety strategies. These confirm it is unrealistic to think that all crashes can be prevented for, however careful we may try to be, we all make mistakes. On the other hand, serious and fatal injuries can more easily be predicted and prevented and the principal means of doing this is by speed management and crash protection through road and vehicle engineering. These strategies, supplemented with casualty reduction targets, specifically require fundamental and wide-scale re-working of various aspects of the design and operation of the national traffic system, to achieve better interface between human, vehicle and road environment (Wegman and Elsenaar, 1995; Tingvall, 1995). These concepts are being adopted increasingly in long-term road safety policies in Europe and more recently in Victoria, Australia and, while challenging, attempt to deliver a fuller systems approach.

Table 2: Example of management of targeted programming (Tingvall, 2003)

Shared vision	Quantitative target	Performance criteria	Measures/processes	Decisions
A safe system	50% reduction in deaths	Infrastructure Vehicles Use of system	Engineering Economic incentives Enforcement	Funding Political decision Re-allocation

The setting of challenging but achievable quantitative targets can strengthen motivation to contribute to casualty reduction and this can be maintained by regular and transparent monitoring of progress towards targets (Allsop ed., 2003). Research shows that quantitative targets lead to better programmes, a more effective use of scarce resources and an improvement in road safety performance at local and national level (OECD 1994, Elvik 2001). Safety performance indicators, causally related to crashes or injuries, are being used increasingly to provide a further useful mechanism to policymakers to help ensure that their actions are as effective as possible and make best use of public resource (Wegman ed., 2001).

Road safety targets differ widely internationally as to performance indicator, timescale and degree of challenge, but target periods are typically about ten years. Most targets are set at national level, but regional and local targets are also set, especially where the direct influence of national government programmes is limited.

A recent analysis of the road safety records of Sweden, the UK and the Netherlands in road safety (Koornstra et al, 2002) has indicated that each:
- has adopted quantitative targets to reduce road deaths and injuries within a defined future period
- has integrated the road safety plan in the road transport plan
- has decentralised responsibilities for the national road safety plan to regional and local authorities under some central financial support
- regards road traffic death and serious injury as to a large extent avoidable by road safety measures that have affordable costs and are known to be effective.

Table 3: Key intervention strategies and measures (Peden et al eds, 2004)

Managing exposure to risk through land use and transport policies:

- Providing efficient land use and networks where the shortest/quickest/safest routes coincide, e.g.
  - using 'smart' land use policies for long term planning
  - introducing area-wide safety impact assessments on new projects.
- Encouraging people to move from higher-risk to lower-risk modes of transport
- Placing restrictions on users; vehicles or infrastructure to reduce exposure to high risk, e.g.
  - restricting access to parts of the network and giving priority to higher occupancy vehicles
  - restrictions on power to weight capabilities of motorised two wheelers
  - introducing graduated driver licensing systems (GDL).

Shaping the road network for road injury prevention:

- Safety-conscious planning of road networks such as
  - classifying roads and setting speed limits to match road function
  - separating out motorised from non-motorised traffic wherever possible.
- Incorporating safety features into road design such as
  - self-explanatory road layouts
  - area-wide speed reduction and traffic calming
  - Providing crash protective roadside objects
  - introducing safety audit.
- Implementing remedial low cost/high return remedial measures at high risk sites

Providing visible, crash-protective, 'smart' vehicles:

- Improving the visibility of vehicles
  - fitting daytime running lights in cars
  - fitting high mounted stop lamps in cars
  - fitting daytime running lights for motorised two wheelers
  - improving non-motorised vehicle visibility.
- Crash protective vehicle design
  - providing safer car fronts for pedestrians and cyclists and developing safer bus and truck fronts
  - providing front, rear and side under-run guards in trucks
  - improving frontal and side impact protection for car occupants
  - protecting car occupants against roadside objects
  - providing seat belts, child restraint anchorages and airbags
  - improving vehicle to vehicle compatibility , fitting front, rear and side underrun guards on trucks.
- 'Intelligent' vehicles
  - providing smart seat belt reminders, intelligent speed adaptation, alcohol interlocks, electronic stability braking.

Setting and securing compliance with key safety rules:

- enforcement of speed limits, using stationary and automated enforcement e.g. speed cameras
- alcohol impairment laws: setting appropriate limits and deterring excess alcohol offenders through random and sobriety checkpoints combined with mass media publicity
- mandatory seat belt and child restraint laws and their enforcement
- mandatory helmet use laws and their enforcement
- driving and working time rules and their enforcement.

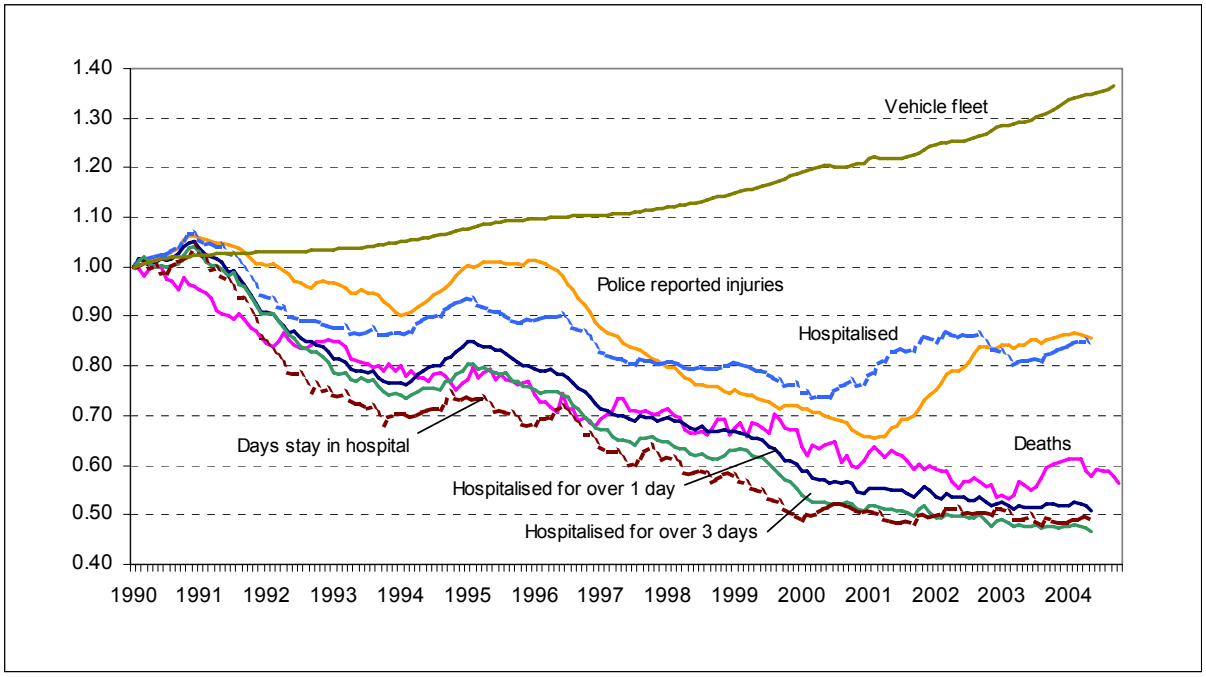
Delivering post crash care

5. Road safety in New Zealand – past activity and future challenges

Road safety in New Zealand over the last decade has benefited from an enlightened lead agency for road safety, an assiduous national police force, concerted focus on evidence-based approaches and the development of highly successful partnerships. Between 1990 and the period marking the start of the new strategic plan in 2002, there have been significant achievements. Since 1990, despite traffic growth, road deaths have fallen by 39%; road death rates have nearly halved per 100,000 population and hospitalisations have fallen by around 33%. This has occurred as a result of the combination of enforcement, engineering (both road network and vehicle) and education comprising measures, which include:

- Low cost engineering at 2000 high risk sites which resulted in a 50% reduction in fatal crashes at those sites; skid resistance programmes have led to an average 29% reduction in wet-skid crashes at treated sites since 1995 and median barrier programmes on high volume motorways.
- Improvement in the safety of imported vehicles.
- A more than 50% reduction in levels of alcohol-related deaths achieved as a result of compulsory breath testing supported by targeted advertising between 1990 and 2002.
- An increase in rear seat belt usage levels from 58% between 1996-1998 to 80% in 2002, again as a result of police enforcement and supporting publicity.

Figure 1: Road casualty and vehicle trends 1990-2004

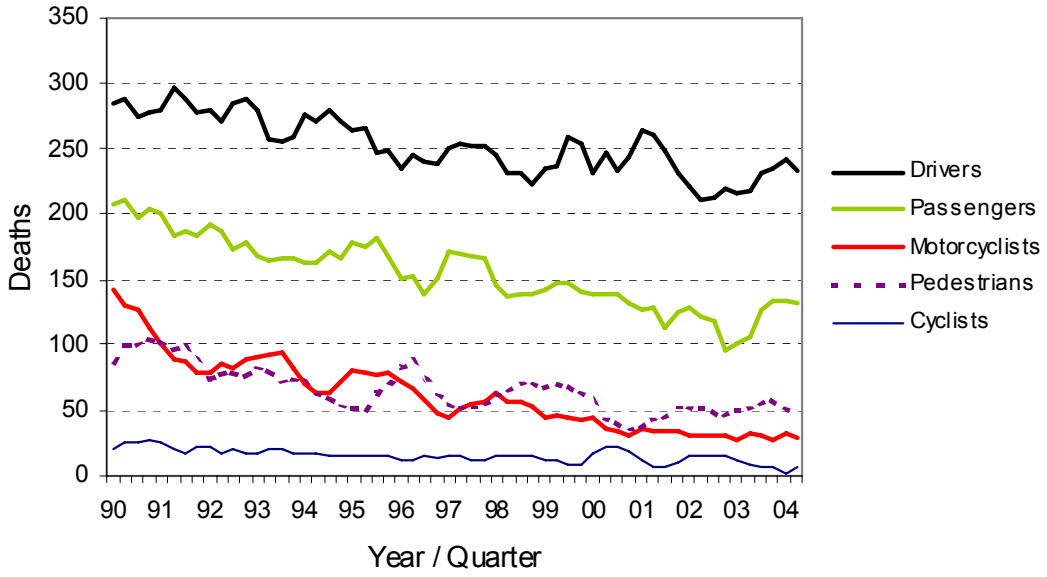


Note: The vertical axis does not begin at zero.

New Zealand has around 2.7 million licensed drivers, 3.6 million licensed motor vehicles and over 90,000 kilometres of public road, 72% of which comprises minor open roads compared with state roads at 11%, major urban roads at 3% and minor urban roads at 14%. The network carries around 45 billion vehicle kilometres of traffic annually.

While major urban roads and state highways comprise only 14% of the road network, they account for 60% of the social cost of road crashes. Car occupants represent over 70% of all road deaths in New Zealand and are involved in 70% of fatal crashes. Over 50% of serious crashes are on open roads.

Figure 2: Rolling 12-month road tolls by type of road user – plotted quarterly – up to mid 2004



Despite the marked progress in safety which has been achieved in the last decade New Zealanders, like citizens in many other highly motorised countries, pay a high price for their mobility. The social cost of road traffic injury in New Zealand includes a valuation for pain, grief and suffering and is currently as much as 2.4% of GDP. Road traffic crashes cause more years of life to be lost than any other source of injury or accident in New Zealand. Motor vehicle crashes are the single largest cause of death for children under 14 years old and for the 15-24 age group (IPRU, 2001). Road crashes are a leading cause of permanent disability for people aged 15-44 (MoH, 1999).

There is a downward trend for all classes of road user deaths since 1990, but car occupant deaths have started to rise in numbers since 2003. At the same time, pedestrians and cyclists are vulnerable road users and bear substantially higher risks than car occupants in the road system. The risk of death while of riding a motorcycle is as much as 29 times as high as that that of driving a car, which makes this a very high-risk mode of travel. Overseas research indicates that the societal cost of motorcycle injury is disproportionately great to the cost of other injuries (Miller et al, 1999). Experience shows that exposure control is a key strategy to reduce the exceptionally high risks associated with motorcycle use and costs to the health service (Peden et al eds, 2004).

Reducing inequity in the different levels of road user risk needs to be addressed by acknowledging the physical limitations of pedestrians and cyclists through better provision of separate facilities in the system and improving the safety of shared road space. As the Minister of Transport emphasised in his foreword to the Transport Strategy, future effort must be better directed at increasing the safety of non-motorised vulnerable users such as pedestrians and cyclists in addition to motorised users.

Table 4: Road user death rates in New Zealand 1997/1998

	Deaths per 100 million person-hours	Deaths per 100 million person-km
Motorcycle	960	29
Pedestrian	29	7.3*
Cycle	54	4.9
Car/ van occupants	34.6	0.9
Bus passengers	0.8	0.03
Total above categories	36.4	1.02

Sources: Hours & km: NZ household travel survey, 1997/98 (LTSA) Deaths: LTSA's Crash Analysis System. (1997/98 average). Note: Pedestrian trip distances were not recorded in the household travel survey. This estimate is based on an assumed average walking speed of 4 km/h for walk trips by all age groups and for all purposes.

As Table 5 indicates, New Zealand has a way to go before reaching its stated aim in the Transport Strategy of reaching performance which is amongst the best achieved in the world in road safety, and to the goals reflecting this ambition in *Road Safety to 2010* Strategy.

Table 5: International comparison between death rates in New Zealand and other countries

Country	Deaths per 100,000 population	Deaths per 10,000 vehicles	Deaths per 100 million km
Great Britain	6.0	1.2*	7.06
Netherlands	6.1	1.2	7.55
Norway	6.9	1.1	8.25*
Sweden	6.0	1.1	8.50**
Australia	8.8	1.4	8.96
New Zealand	10.3	1.5	10.80
New Zealand (*Road Safety to 2010* Strategy target set in 2002)	6.1	1.1	7.30

Source: Data from International Road Traffic and Accident Database maintained by Bundesanstalt für Strassenwesen, Germany. All data is for 2002 unless otherwise noted. * 2001 data ** 2000 data

Road safety is a key concern for New Zealanders. Fear of being run over by a drunk driver was the lead concern of all other concerns about victimisation from crime for people surveyed in the National Survey of Crime Victims in 2001.

Public understanding and support, when measured by survey, is high in New Zealand for continued intervention (National Research Bureau, 2004). In 2004, for example:

- 76% of New Zealanders thought that compulsory breath testing helps to lower the road toll
- 77% agreed that enforcing the speed limit helps to lower the road toll
- 87% believed that seat belt enforcement helps to lower the road toll
- 90% of people wanted police enforcement effort to either be maintained or increased
- 92% of people wanted advertising to either be maintained or increased
- 57% think speed cameras help to lower the road toll
- 56% support the use of hidden cameras
- 59% believe speed cameras are operated fairly
- 85% want the urban 50km/h speed limit to be retained or lowered
- 80% want the 100km/h to be retained or lowered.

6. *Road Safety to 2010* and the New Zealand Transport Strategy

New Zealand's first Transport Strategy, published in December 2002, set out the road safety targets (first announced in September 2002) and established the Government's objective for a road safety outcome by 2010 that is among the best in the world.

The strategy outlined a vision of a transport system that is affordable, integrated, safe, responsive and sustainable to be realised by means of an integrated approach that is forward looking, collaborative, accountable and evidence-based to the following five objectives.

- assisting economic development
- assisting safety and personal security
- improving access and mobility
- protecting and promoting public health
- ensuring environmental sustainability.

The integration of these objectives is being established both in new changes in the organisation and

funding of transport, which makes things more complicated for road safety but also brings many opportunities. Other countries, particularly in Europe, have also embarked upon similarly ambitious integrated transport strategies.

A new land transport agency – Land Transport New Zealand (LTNZ) – will undertake the operational activities of Transfund New Zealand and the Land Transport Safety Authority at the end of 2004. The Safety Administration Programme (SAP) is to be integrated into the National Land Transport Programme (NLTP). A single land transport planning and funding framework is thus established within which road safety concerns will be integrated into other objectives – into land transport planning, funding, management, and community planning processes. As the Minister for Transport Safety noted in his foreword, it is important that in achieving full integration of the SAP programme with the NTLP, the hallmark strengths of the SAP – the unparalleled levels of transparency and key partner involvement – are not compromised.

In addition to continuing and reinforcing efforts to achieve safer road user behaviour through education, training and public information, road safety now needs to address improving the inherent safety of the road infrastructure; interrelating with public health and the environment; reconciling the safety and mobility of pedestrians and cyclists in a road network which has not been designed to cater safely for increased walking and cycling; taking account of the growth in heavy traffic; the need to ensure strong links between safety outputs and safety outcomes; staying one leap ahead of technological advances, meeting changing needs and expectations of customers and stakeholders, and matching the progress in road safety outcomes internationally. The strategy thus provides an opportunity for road safety to be taken up as core business by other new actors which will strengthen and expand the effort directed at it.

Safety underpins New Zealand's Transport Strategy. The potential impact on safety of all activities aimed at the other four transport strategy objectives will now need to be considered formally, necessitating the introduction of formal safety impact assessments on transport and land use projects (Wegman 1994, Allsop ed., 1997). Road safety also needs to be fully integrated with the other four objectives into national, regional and local transport strategies and plans involving enhanced collaboration between central and local government agencies. It is in these and related ways that the strategy provides a new mechanism for ensuring that road safety is a central concern in Government policymaking.

7. The design of Road Safety to 2010

The *Road Safety to 2010* Strategy is the Government's long-term road safety strategy which was published in October 2003. It is the product of an extensive and thorough consultation process launched in October 2000, with the announcement of a first implementation package in February 2002, followed by announcement of the targets by the Hon Paul Swain, Minister of Transport in September 2002.

The emphasis of the strategy is mixed approaches, principally through engineering and enforcement measures backed up by publicity and education, to be considered alongside the five transport objectives of the NZ transport strategy outlined previously. The strategy aims to provide direction for the road safety component of the Government's Transport Strategy; provides the avenue for addressing the road injury prevention objective of the Government's Injury Prevention Strategy and its Crime Reduction Strategy objective of reducing serious traffic offending. The different elements of the strategy and framework are considered in the following sections.

7.1. A vision for road safety?

The use of long-reaching visions can provide a context for strategies and targets and can communicate the strategy's philosophy and rational to key stakeholders as well as to a wider public. Both the New Zealand Injury Prevention Strategy and the Transport Strategy have visions, but these may be seen to be in conflict. The former is for a safe New Zealand becoming injury free and the New Zealand transport strategy vision is for an affordable, integrated, safe, responsive and sustainable transport system by 2010. While there is currently no specifically stated Government vision for road safety in the *Road Safety to 2010* Strategy, implicit in the transport strategy is that it should be *a sustainably safe traffic system for all which is amongst the best in the world and affordable, integrated and responsive to user needs.* Bringing the road safety vision into line with the Government's aspiration for injury prevention strategy would mean *a sustainably safe traffic system for all which is amongst the best in the world, which seeks the elimination of serious public health loss from road crashes and is affordable, integrated and responsive to user needs.* For the foreseeable future, these last requirements imply acceptance of some (though of course greatly reducible) continuing loss from injury in road crashes.

7.2. Key strategic themes

7.2.1. Integrating safety into the transport system

The major strategic theme of the *Road Safety to 2010* Strategy is one of building safety into the traffic system and into other government policies impinging on its safety quality. The rationale for this is to ensure that safety is planned for in the first instance in traffic system design and operation rather than an adjunct or afterthought. Reducing serious public health loss from road crashes thereby becomes not just a matter of coping with a negative spin-off to the more weightily lobbied for concerns of efficient mobility and environmental protection, but at least an equal concern of transport policy.

At the same time as continuing with all existing approaches to road safety, which have been proven to be correct and effective, the strategy foresees integrating road safety into land-use planning. Safety impact assessments on land-use planning decision and transport projects would provide an additional useful tool to supplement other impact assessment, such as environmental impact assessment (Wegman, 1994; Allsop eds, 1997).

Road safety also needs to be integrated into pedestrian and cyclist policies which aim for better access and mobility. There is no inconsistency between these objectives, although strategies will need to be multi-disciplinary ad comprehensive. Without due caution, however, it will be all too easy to increase mobility without concomitant improvements in road safety.

Synergies with road safety will need to be found in the issues of speed management in policies which address environmental sustainability (by supporting non-polluting modes) and public health issues through improved health outcomes from better exercise as well as safety and personal security policies.

All these objectives are in line with international road safety professional thinking as outlined in Section 3.

7.2.2. Accommodating human error

In modern traffic, road users have to deal with a multitude of complex and often conflicting demands. The strategy sees an extension of focus from trying to change people's driving habits to systemic improvements in road and vehicle safety to address inherent human limitations, both behavioural and physical, which accommodate and lessen the severity of the consequences of common mistakes often made inadvertently by the most law abiding of road users. To achieve this, speed becomes a central design parameter for the traffic system and the single most important determinant of road safety (Peden et al eds, 2004; Racioppi et al, 2004).

Behind road user errors are natural limitations, such as vision in night traffic, detection of targets in the periphery of the eye, estimation of speed and distance, processing of information or physiological factors associated with age and gender that affect crash risk. Other influences such as the design of the road, the vehicle, traffic rules or their enforcement also influence the probability and consequence of human error (Rumar, 1999). Mature and quality assured man-machine systems, therefore, are characterised by an in-built tolerance of human error (Tingvall, 1995). At the same time, injury is non-linearly related to the change in speed to which the human frame is subjected in a collision, so small increases in speed produce major increases in the risk of injury.

As section 3 illustrates, these themes are very much in line with the long-term road safety strategies in the best performing countries and represent an important part of the paradigm shift in road safety, i.e. that common driving errors and common pedestrian behaviour should not lead to death and serious injury; that the traffic system should help users to cope with increasingly demanding conditions and that in all parts of the world, without exception, a traffic system better adapted to the physical vulnerabilities of its users needs to be created with the use of more crash protective vehicles and roadsides (Peden et al eds., 2004).

The *Road Safety to 2010* Strategy highlights attention to road infrastructure in particular to better accommodate human error and its consequences, assuming that improvements in vehicle safety will materialise in due course without the need for much intervention. Accelerating improvements in vehicle safety would greatly assist this strategic aim and this is discussed further in Section 9.7.

7.2.3 Improving road user behaviour

New Zealand has made important progress in securing compliance with key road safety rules, such as drinking and driving, seat belt use and average mean speeds, through a combination of evidence-based strategies for police enforcement, penalty and publicity. This is recognised globally as being one of five key strategic elements to improve road safety, and as the *Road Safety to 2010* Strategy rightly recognises, its maintenance is key. Government acknowledged additionally that it would soon have to get tougher on our major driver behaviour problems, such as drink driving, speeding and serious repeat offending, to meet targets. The effects of other important issues, such as drug driving, fatigue and potential countermeasures to reduce these are receiving more research attention internationally and this research should continue to be monitored. While, for example, evidence-based practical advice for drivers is emerging on driving fatigue which provides the basis for public information in New Zealand, speed, drinking and driving and the non-use of occupant restraints remain the most pressing behavioural issues for attention worldwide.

7.2.4. Devolving safety management

In practice, road safety is a shared responsibility at international, national, regional or state, local and individual road user levels. Local authority activity is central to achieving good national performance. While the different situations faced by various local authorities lead to differences in scope of and priorities for casualty reduction, experience in other countries shows without clear legislative responsibilities, contractual arrangements to deliver set tasks, appropriate funding mechanisms and a range of technical guidelines, devolving safety management can lead to unevenness in safety performance which can be much greater than is accounted for by these understandable differences.

As a recent report carried out for Government points out, while national and regional responsibilities are set out in legislation – Transit has a clear duty to provide a safe and sustainable state highway network – territorial authorities are not subject to any express statutory safety objectives, and their legal obligations for the safety of the roading network are a mixture of contractual, voluntary and common law legal obligations (Buddle Finlay 2004). For example, the land transport programme now requires the formal inclusion of land transport safety in communities' 'desired outcomes' and the representation of land transport safety is to be included in long-term community plans. As road infrastructure providers, as the Bielby report (2003) underlined, regional and local authorities in road

safety are of high importance and their performance is central to achieving the 2010 strategy goals for road safety engineering, in particular.

In setting regional targets, the *Road Safety to 2010* Strategy makes provision for the assumption of greater road safety responsibilities through regional land transport strategies and the support and guidance of central government. In order to support the strategy, territorial authorities are expected to develop safety management systems; apply crash reduction studies and safety audit procedures; undertake detailed analysis to develop implementation strategies towards meeting targets with appropriate priority given in funding for road safety activity.

In other countries, e.g. the United Kingdom, the Netherlands and Sweden, responsibilities for road safety at local level are defined in legislation which can facilitate interaction and contractual arrangements for positive road safety outcomes while still leaving local authorities free to decide how to carry out that duty in all their local circumstances. For example, in the UK, the road safety functions of local highway authorities were set out in legislation in the 1970s. The UK also had a specific annual allocation in transport grants to local government for high-risk site treatments or local safety schemes, which required formal justification in road casualty reduction terms, as opposed to that required for minor works. One of the key findings of the recent review of the casualty reduction performance of local highway authorities in the UK was that the better performers used their crash databases in an appropriate way to make an objective judgement of where casualty reduction funding could be spent most effectively (DfT, 2004).

In the Netherlands, central and local government agreed highly successful contractual targets between1997-2002 and with a specific budget to re-classify the road network according to function and thereafter to implement 50 km/h zones in residential access roads.

In practice, a mixture of legislative duty, funding mechanism and mutually supportive partnership has contributed to a wealth of international best practice in countries who are slowly upgrading networks to be more responsive to user needs. This experience could help to inform the management of shared road safety responsibilities in New Zealand and to expedite the use of the excellent tools that have been developed to date under the *Road Safety to 2010* Strategy.

7.2.5 Implementation

While the target-setting process established a range of available well tested measures underpinning the choice of target, and the strategy set out the Government's commitment to broad themes and priority areas, it does not set out explicitly how the targets are to be achieved to 2010. While this is not uncommon in road safety strategies, the targeted programmes in Denmark and Finland are the model here. The introduction of several implementation packages were, however, envisaged to 2010 with 'fine-tuning' monitoring anticipated every two years.

7.2.6. Communicating with partnerships

Achieving an achievable but challenging target requires a sound relationship to be established between targets and measures and the ownership and commitment of all the affected stakeholders. A strong alliance between political leadership and professional management is crucial (Allsop ed., 2003).

A full consultation process took place in late 2000 on the draft *Road Safety to 2010* Strategy (NRSC, 2000). The response from the community was predominantly a call for increased road safety through a mix of engineering, education and enforcement.

The strategy sets out the potential for a formidable alliance at senior levels of the key government stakeholders. The Minister of Transport has responsibility for overseeing the implementation of the strategy, with monitoring and co-ordinating being carried out by the National Road Safety Committee comprising the chief executives of the key government stakeholders, with the notable exception of the Ministry of Health, Department of Labour and the Ministry of Justice. A Government-chaired National Road Safety Advisory Group provides the forum to bring together other governmental (including

Health) and non-governmental agencies with road safety interests, which is in line with best international practice.

7.2.7. Making the best use of resources

The linkage between forecasts, outcomes and outputs; the commitment to research and evidence-based action, and the development of further strategic monitoring tools all prepare the way for making an exceptionally well justified use of public resource.

The Safety Administration Programme is one of the most detailed, publicly available accounts of the use of public monies which has ever been presented in road safety worldwide. Indeed, taxpayers in New Zealand can be sure that money spent on road safety is likely to have represented a more evaluated dollar than for many other areas of expenditure.

7.2.8. Observations

- *The key themes of the strategy are generally very much in line with international thinking as outlined in Section 3.*
- *Area-wide safety impact assessments of land-use planning decisions and transport projects would provide a key to integrating road safety into the transport system, alongside existing impact assessments for efficiency and the environment.*
- *Accelerating improvements in vehicle safety would greatly assist the strategic aim of accommodating human error.*
- *Devolving management regionally and locally is a key feature of the strategy. However, while national and regional responsibilities are set out in legislation, territorial authorities are not subject to any express statutory safety objectives and their legal obligations for the safety of the roading network are a mixture of contractual, voluntary and common law legal obligations. While local authority activity is central to achieving good national performance, experience in other countries shows that uneven safety performance can follow.*
- *Securing compliance with key road safety rules is recognised globally as being one of five key strategies to improve road safety and, as the strategy rightly recognises, its maintenance is key. The Government acknowledged that it would soon have to get tougher on our major driver behaviour problems such as drink driving, speeding and serious repeat offending to meet targets.*
- *While targeted outcomes and underlying assumptions (published in Working Paper 7), strategic themes and government commitments to priority areas for action are clear, the Road Safety to 2010 Strategy is not a targeted programme as such, since it does not set out explicitly what policies and measures are to be introduced to meet the 2004 and 2010 targets. Better clarity and transparency is recommended for the third and final implementation package.*
- *The Ministry of Health, Ministry of Justice and Department of Labour are notable by their absence from the senior delivery partnership established in the National Road Safety Committee.*
- *The linkage between forecasts, outcomes and outputs; the commitment to research and evidence based action, and the development of further strategic monitoring tools all prepare the way for making an exceptionally justified use of public resource.*

7.3. The analytical framework for target setting

The target-setting process requires a robust analytical framework for the following reasons. If the target-setting methodology is unsound, targets will lack credibility and the strategy will be jeopardised. If the target is out of reach, stakeholders will lose motivation. If the target is too easy then a major opportunity for saving life will have been missed.

Forecasts representing the continuation of recent trends showing what may be expected if efforts were to continue at broadly the same rate in the coming years are the starting point for assessing what may realistically be achieved in future with additional effort.

Target-setting forecasting typically comprises, under various assumptions, the forecasting of exposure (traffic volume) for the main groups of road user, levels of risk, public acceptability and available evidence-based information about cost-effective measures from practical trials or from national or overseas experience of successful implementation effectiveness of policies. In this way, targets can be identified which achieve a balance between challenge, achievability, and public and political acceptability (Allsop ed., 2003).

7.3.1. Assessment of the Road Safety to 2010 Strategy analytical framework

As the Honourable Paul Swain emphasised in his Foreword to the *Road Safety to 2010* Strategy, there are known and cost-effective ways to implement this ambitious strategy, which have wide public support.

The target-setting methodology and modelling activity underpinning the strategy is set out in Working Papers 6 and 7 published in 2000. The review teams comprised government officials in road safety and the independent advice and guidance of independent road safety experts from Australia and the United Kingdom of high international reputation in this field and with substantial experience of national and regional strategic planning in road safety. Expert analysis of benefits, costs and funding demonstrated that the overall safety target to 2010 could be reached by an appropriate mix of engineering, enforcement and education interventions.

7.3.2. Observations

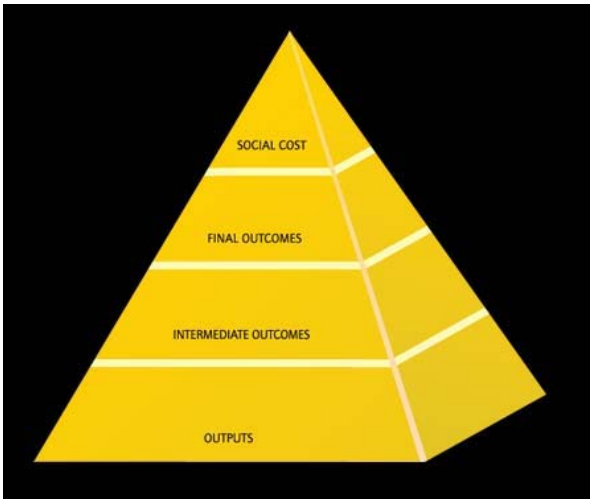
- *The analytical framework is generally robust and is in line with international good practice, both in content and organisation and, for most parts, in coverage.*
- *The estimate of the number of deaths to 2004 was based on two years' data which probably should have been at least three years' data.*
- *The coverage of interventions is system wide and the interventions selected are evidence based with reference to the World Road Traffic Injury Prevention report (Peden et al eds, 2004) and publicly acceptable (based on acceptance of measures internationally).*
- *Since the preparatory work for the target in 2000, important new studies on excess alcohol crash risk (Compton et al, 2003; Keall et al, 2002), speed and crash risk relationships for different road types (Taylor et al 2000, 2002) and seat belt effectiveness studies (Cummings et al, 2002) which either provide further confirmation for or increase the casualty reduction potential of the identified intervention.*
- *Since the preparatory work for the target in 2000, there has been further confirmation of positive experience with new implementation tools, which can accelerate the rate of progress of implementation of key intervention and have marked potential to increase their contribution to the 2010 targets (see section 9.7).*

7.4. The target hierarchy

7.4.1. Assessment of the Road Safety to 2010 Strategy target hierarchy

In New Zealand, the *Road Safety to 2010* Strategy adopts an outcomes management framework through its target hierarchy, which establishes four levels of targets:

New Zealand's target hierarchy



- The overall target is to reduce the socio-economic costs of road crashes.
- To be achieved by meeting the second level of targets, requiring specific reductions in the numbers of fatalities and serious injuries.
- A third level of targets consists of performance indicators (including those related to speed, drink driving and rates of seat-belt wearing) that are consistent with the targeted reductions in final outcomes.
- A fourth level of targeting is concerned with institutional delivery outputs such as the enforcement outputs that are required to achieve the third-level targets.

7.4.2. Observations

- *The New Zealand target-setting hierarchy is widely perceived by road safety professionals internationally as the state of the art in target setting.*
- *New Zealand was the first to target reductions in social cost, although this is an underlying consideration in many road safety strategies. Targeting social cost provides the opportunity reflect social concern about road injury risk via 'willingness to pay' and 'willingness to accept' considerations.*
- *Updating the Value of Statistical Life (VOSL) on the basis of latest survey in New Zealand (1998) to reflect current knowledge about 'willingness to pay' and 'willingness to accept' considerations instead of a basis in average wage rate would give a truer indication of the cost effectiveness of road safety measures. The resulting higher cost effectiveness should lead to increased allocation of resources to road safety, to the extent that resources are allocated among competing objectives on the basis of cost effectiveness. The current VOSL is $2.8 million at June 2004 prices. Should the VOSL value be updated to take account of this survey data, the revised VOSL at June 2004 prices would be $4.16 million (GST excl).*
- *The inclusion of targets for deaths and hospitalisation by different measures of exposure allows policymakers to deepen their understanding of system performance than is allowed by the use of numbers alone*
- *The intermediate outcomes targets are the most commonly used indicators which relate to behavioural characteristics such as speed levels, the rate of drink driving and the use of seat belts. In addition, a number of infrastructure, vehicle or trauma-related indicators are relevant. Such indicators, in general, provide a more straightforward means of monitoring the impact of a measure or programme and enable early, target-oriented adjustments of specific interventions. In addition, they allow for a more detailed understanding of the reasons for safety problems than is possible through final outcomes monitoring. Table 6 indicates the range of indicators considered to be best practice by European colleagues, which may be useful to consider for use in the developing strategy.*
- *Long-term targets for speed management drink driving, restraint use, user group and regional outcomes could now be formally set, even though these are implicit in the target-setting analysis.*
- *Unlike the situation in New Zealand, some countries have placed the target-setting framework and*

the strategy itself within a legislative framework, as mentioned previously and with concomitant Parliamentary interest and support.

Table 6: Best practice road safety performance indicators (Wegman ed. 2001)

Category	Subject	Indicator	Details
Behaviour	Speed	% above legal limit	1) Representative speed monitoring has to be carried out throughout a country using a stratified sample: different vehicle classes and road categories. Actual speeds have to be compared with existing speed limits and policy targets, if appropriate. Agreements have to be made about data collection protocols.
	Alcohol	% above limit	2) To monitor drinking and driving requires a methodology by which, in a stratified sample, random tests are carried out by the Police. In order to allow for international comparisons, existing data collection protocols have to be harmonised (road user, road category, measurement period, etc.). Drinking and driving behaviour has to be compared with the alcohol laws and the policy targets, if appropriate.
	Seat belts	% car occupants	3) Data on seat belt usage must make the following distinctions: drivers, front seat passengers, back seat passengers, child restraints. Observations have to give a representative picture all over the country for different road categories and for different vehicle classes.
Vehicles	Passive safety	EuroNCAP	4) EuroNCAP tests the crashworthiness of cars and a combination of the star rating in EuroNCAP and the composition of the vehicle fleet in a country indicates the quality of the passive safety of a country. Annual measurements are recommended via the collection of data at a European level.
Road	Road design quality	% of roads meeting design standards	5) Many countries do have road design guidelines for different road categories. This indicator tries to assess the quality of the existing road network in the perspective of existing guidelines or standards. Per definition, international comparisons are not meaningful, because guidelines and standards differ per country. Of interest is to measure the actual safety quality and compare this with the self-induced 'reference'. Of course, this yardstick has to distinguish different road categories.
	Road network quality	% of roads fitting in road network hierarchy	6) Accepting the philosophy behind a 'functional hierarchy of roads' as a component of a road safety policy, a performance indicator has to be developed to measure the safety quality of a road network. It is recommended that such an indicator should be developed
Trauma management	Arrival time	% meeting targets or regulations/law	7) A combination of notification time and response time result in an arrival time. Emergency services, especially qualified doctors, have to reach the accident spot within a (legally established) period. A comparison has to be made between this 'target' and actual arrival times indicating the performance (compliance) of the trauma management system.
	Quality of medical treatment	% meeting target or regulations/law	8) For life-threatening accidents, a (timely) high quality medical care is of importance as is the availability of specialised trauma centres. It is recommended to develop a performance indicator for the quality of medical treatment of severe injuries. This indicator should be developed not just for road transport, but also for other transport modes and occupational accidents.

8. Progress in meeting the 2004 targets

An overview follows of the outcomes with discussion of changes in traffic and external factors. This is followed by consideration of the first implementation package. Conclusions are drawn about progress made towards the 2004 targets in light of all these considerations on the basis of the available information.

It is important to note, however, that given the short timeframe between initiating the *Road Safety to 2010* Strategy activities and this review, which is being conducted some months even before the end of 2004, there has not been any significant evaluation of the effectiveness of the *Road Safety to 2010* Strategy initiatives considered in this review (although some evaluation is underway).

8.1. Final outcomes

8.1.1. Social cost of crashes

Having reached the lowest point in 2000 since the early 1990s, the social cost of road crashes has been increasing. The latest available 12-month rolling totals show that the total cost is currently $2.92 billion (2001 prices). The only outcome target which has been met is social cost per vehicle.

Table 7: Social costs of crashes: targets and outcomes 2003/2004

	Base	Outcomes			Targets	
	2001	2002	2003	2004 #	2004 not exceeding	2010 not exceeding
Social Cost (2001 prices *)						
$ billion	3.02	2.83	3.01	2.92	2.75	2.15
Cents per vehicle-km	8.4	7.5	7.8	7.2	6.7	4.4
$ per person	783	717	750	718	700	650
$ per vehicle	1145	1043	1074	989	1020	940

* To maintain consistency with the 2001 base year hospital data has been used to adjust the reporting rate for later years.
# 2004 social cost is based on fatality data for the 12 months to October 2004 and injury data for the 12 months to May 2004
The calculation of social cost includes both the cost per injury and estimates of the reporting rates for injuries. The social cost targets are expressed in terms of 2001 prices. To maintain consistency with the 2001 base year, the ratio of Police reported serious injuries and the number of people hospitalised for over one day has been used to adjust the social costs for later years. While the ratio itself is not a direct measure of the reporting rate it is a good indicator of changes in reporting rate, at least for serious injury crashes and subject to changes in hospital admission practices.
All social cost refers to the social cost of road injuries or injury crashes only (i.e. it excludes property damage crashes).

It should be noted, however, that in 2001 there was an improvement in police reporting of injury crashes. This is evidenced by the sharp increase in police-reported injuries without any coincident increase in the number of people hospitalised for more than one day as a result of road crashes. At this time the police, in some areas in particular, worked hard to improve the reporting of crash casualties. The police and LTSA also agreed to limit the use of the abbreviated one-page crash report form to self-reported crashes. Prior to this the one page form was used for non-injury crashes. This led to some injury crashes being reported as non-injury crashes to avoid the more extensive paper work required by the injury crash form. This underlying factor goes some way to explaining why the targets for social costs and hospitalisations (other than hospitalisations over one day and three days) have not been met. Another explanatory factor is the change in classification of patients as admissions in some hospitals.

8.1.2. Deaths

The number of deaths occurring during the 12 months to October 2004 indicates that three out of four 2004 targets are not likely to be met. However, while road deaths increased rapidly in the latter half of 2003, a continuing longer downward trend remains.

Table 8: Road deaths and death rates: targets and outcomes 2003/2004

	Base	Outcomes			Targets	
	2001	2002	2003	2004 #	2004 not exceeding	2010 not exceeding
Deaths						
Number	455	404	461	428	400	300
Deaths per billion veh-km	12.6	10.8	11.9	10.6	9.9	6.1
Deaths per 100,000 people	11.8	10.3	11.5	10.5	10.2	7.3
Deaths per 10,000 vehicles	1.7	1.5	1.6	1.5	1.5	1.1

2004 fatality data is for the 12 months to October 2004

Progress towards the 10,000 vehicles target can be explained by the marked increase of 4% in the vehicle fleet for the 12 months to August 2004. An average annual increase in vehicle numbers of 3.5% exists in the three years 2001-2004.

Aside from any considerations of road safety activity conducted in the period, a review of the target-setting process and the choice of 400 as the short-term 2004 goal, together with available traffic data, shed considerable light on why the other three targets have not been met.

- **The choice of target**

First, when developing the short-term target of no more than 400 deaths by 2004, a starting point death rate of 425 deaths per year for the end of 2001 was used. The 425 is the average number of deaths in the two years 2001 and 2002 and, at the time, was the best estimate of the underlying fatality risk. However, looking back with the benefit of hindsight, it appears that this was an overly optimistic assessment. The road toll dropped from 455 in 2001 to 405 in 2002 and then rose again to 461 in 2003. Throughout this period serious hospital admissions continued a downward trend. This suggests the change in fatality totals may have at least in part been due to statistical fluctuation rather than a change in the underlying fatality risk. The difference of 50 between 455 and 405 has a standards error of $\sqrt{860} = 29.3$ and could, therefore, fairly easily have arisen by chance.

- **Changes in traffic**

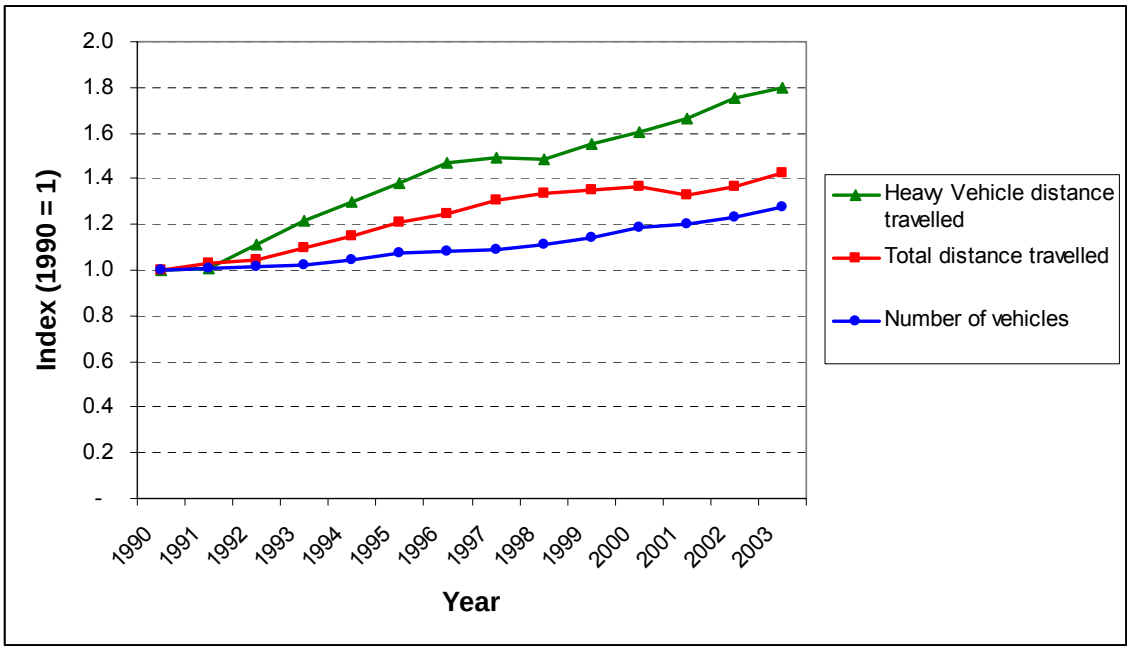
A further consideration concerns traffic data. When developing the targets, historical traffic count data over a decade was used to provide a projection of an overall annual traffic growth of 3.3%. The historical data were limited to vehicle counts on state highways and thus could not provide separate urban and open road projections that would be representative of all road types. Estimates for 2004 vehicle kilometres travelled (VKT), based on the latest survey results for 2001 and 2003 and the increase in gasoline deliveries since then, the annual increase in traffic growth from 2001 to 2004 was 3.8%, higher than the 3.3% projection based on the historical data.

The VKT surveys also provide a good urban/open road breakdown of travel. Over the two years between the surveys there was an average annual increase of 5.8% in open road travel compared to only 1% for urban roads. As part of the data gathering for a heavy vehicle safety strategy, a separate projection was made of the increase in travel for heavy vehicles. At an annual rate of 4.5% this was higher than the general 3.3% used in developing the targets.

The higher than projected general traffic growth, the urban/open road difference (with increases in open road traffic creating higher exposure to risk of crash and increased crash severity) and the separate heavy vehicle rate would all affect the 2004 target of no more than 400 deaths. With these rates there would be 16 more road deaths in 2004 than predicted. If these factors are projected out to 2010 there would be an additional 25 deaths in 2010.

The longer term estimate of 3.3% is still likely to be a better estimate of average future growth to 2010 than the short-term estimate from only two surveys. However the urban/open road difference and the separate heavy vehicle estimates are likely to be more reliable than using an overall growth rate of 3.3% for all vehicle and road types.

Figure 4: Growth in vehicle fleet and distance travelled



Notes: Number of vehicles: Registered cars, vans, trucks, buses, motor caravans, motorcycles and mopeds, but excluding those with exempt or restoration licence. Prior to 1998 numbers are estimates based on new vehicle registration data.
Total distance travelled: Based on a national traffic count survey. Prior to 2000 the values are estimates based on annual measures of state highway traffic growth (provided by Transit NZ). Heavy Vehicle distance travelled: Based distances purchased for Road User Charges.

- **Potential savings from the first implementation package**

The first implementation schedule was published with the strategy in October 2003 and was designed to contribute to targets established for 2004 and to lay the groundwork for the 2010 goals. The *First Steps towards 2010* package comprised a package of measures, in fact, spanning the pre-strategy period 2002 – June 2004, comprising a combination of education and police enforcement (including realising the full benefits of a dedicated Police State Highway Patrol comprising 225 additional staff); dedicated strategic enforcement activity and new equipment; the development of strategic tools for road safety management and engineering and the development of pedestrian and cyclist strategies, a heavy vehicle safety strategy; a devolution to the regions strategy, standards development and human factors research and a review of administrative penalties.

In the implementation bid (July 2002), potential savings from new education and engineering measures were estimated at between 14-17 deaths and between 320-625 injuries. However, this package has not yet been fully evaluated.

8.1.3. Observations

- *The fact that most short-term targets for reductions in social cost and deaths for 2004 have not been met seem to be explained by a combination of effects of short-term fluctuation on target setting; changes in injury reporting procedures; the fact that increases in traffic to higher levels than were expected have not been matched by enough new and effective implementation effort to make a difference in the short term; and that the take up of valuable strategy and tool development begun since 2002 will not materialise into casualty savings for some time.*
- *In combined police enforcement and publicity, there has, however, been some success in casualty reduction and the targets for reducing average mean speeds have been met. Increased ticketing as a result of the reduced tolerances to 10 km/h introduced in 2000 and the increased police visibility brought about by the Highway Patrol initiated in 2000 has, no doubt, had an effect. Enforcement activity, including radar, laser and camera operations, has been accompanied by high-impact advertising and publicity campaigns. Policy development in late 2003 has concentrated on penalties and a changed basis for speed camera deployment.*
- *There has also been success through combined police enforcement and publicity in meeting the 2004 target and securing useful increments in seat belt use (See Table 18).*
- *With regard to excess alcohol, there is some evidence of lower levels of high visibility CBT policing during several quarters of 2003 than targeted for, despite increases in police numbers, focussed on rural alcohol and commercial vehicle enforcement (See Figure 6, Table 17). The proportion of fatally injured drivers with excess alcohol since the baseline year has increased sharply. The booze buses in the first implementation plan have not yet been put into operation. Policy development during the period has been focussed on penalties. Government decided not to reduce the legal BAC limit from 80mg/100ml to 50mg/100 in December 2003, perceiving a lack of community support for the measure, which ruled out the opportunity for early savings. A full discussion of implementation in the priority areas of the strategy is to be found in Section 9.3.*
- *Against the background of large safety benefits associated with the measure, general public support indicated in opinion surveys and the majority support of professionals in the consultation process on the strategy, a section of the community comprising the alcohol and hotel industry, farmers and a motoring organisation opposed the introduction of legal limit changes.*

8.1.3. Hospitalisations

Annual road crash admissions to hospital fell to a record low in 2000 but have returned to 1996 levels, notably in the densely populated Auckland area. The 12 months to May 2004, giving a total of 6580 admissions, exceeds the 2004 target by a long way, but this is likely to be more a reflection on hospital administrative changes in the Auckland area than a genuine reversal in trend.

Following consultation based around the Road Safety Strategy 2010 consultation document, Government adopted a target of no more than 4500 hospitalisations in 2010 as a result of road crashes. During 2000, before the final strategy document was produced, there was a sharp increase in the number of people hospitalised without any concurrent increase in the number hospitalised for more than day or in the total number of days' stay in hospital. This increase was due to an administrative change in some hospitals, which involved changing the criterion for classifying a patient as an admission.

While the target for no more than 4500 hospitalisations remained, two additional hospitalisation targets were adopted, one for the number of people hospitalised for more than one day and another for the number of people hospitalised for more than three days. In representing serious injuries, these classifications are likely to be more insulated from administrative changes than the total admissions data.

Table 9: Hospitalisations and rates following road crashes: targets and outcomes 2003/2004

	Base	Outcomes			Targets	
	2001	2002	2003	2004 #	2004 not exceeding	2010 not exceeding
Hospitalisations						
Number hospitalised	6700	6520	6535	6580	5870	4500
Hospitalised per billion veh-km	186	174	168	163	140	90
Hospitalised per 100,000 people	174	166	163	162	150	110
Hospitalised per 10,000 vehicles	25	24	23	22	22	16
Number hospitalised for over one day	2880	2740	2715	2656	2750	2200
Number hospitalised for over 3 days	1794	1740	1697	1657	1750	1400

2004 Hospital data is for the 12 months to May 2004

The rates per vehicles kilometres travelled, per 100,000 population and per 10,000 vehicles for the numbers hospitalised for over one day and over three days, and the total number of days stay, have also been monitored even though they are not official targets.

Table 10: Hospitalisations and rates following road crashes: targets and outcomes 2003/2004

	Base	Outcomes			Monitoring targets	
	2001	2002	2003	2004 #	2004 not exceeding	2010 not exceeding
Hospitalisations for over 1 day						
Hospitalised per billion veh-km	79.8	73	70	66	65.6	44.0
Hospitalised per 100,000 people	74.8	70	68	65	70.3	53.8
Hospitalised per 10,000 vehicles	10.9	10.1	9.7	9.0	10.3	7.8
Hospitalisations for over 3 days						
Hospitalised per billion veh-km	49.7	46	44	41	41.7	28.0
Hospitalised per 100,000 people	46.6	44	42	41	44.7	34.2
Hospitalised per 10,000 vehicles	6.8	6.4	6.1	5.6	6.6	5.0

2004 Hospital data is for the 12 months to May 2004.

Both 2004 targets for hospitalisations for over one day (apart from per veh km) and three days have been met, confirming the continuation of the long-term downward trend as shown in Figure 1. The number of one-day admissions to hospital has decreased by 5%-6% each year since 1994. In view of the fact that changes in the reporting system, both in police operations and hospitals are frequently underestimated in road safety strategies, then this must be carefully monitored in view of the uncertainty it creates for the progress of the strategy.

8.1.4. Vulnerable road users

Table 11: Vulnerable road user hospitalisations 2001-2004

	Base	Outcomes			Target
	2001	2002	2003	2004 #	2004 not exceeding
Pedestrians					
Number hospitalised	724	760	748	728	700
Number hospitalised for over one day	394	387	391	360	390
Number hospitalised for over 3 days	298	285	301	265	290
Cyclists					
Number hospitalised	291	280	242	241	270
Number hospitalised for over one day	128	135	91	91	130
Number hospitalised for over 3 days	77	90	49	56	90

2004 Hospital data is for the 12 months to May 2004 Note: Travel survey data is not yet available to calculate rates per hour walked for pedestrians or per kilometre travelled for cyclists.

If the total to December 2004, matches the 12-month rolling total to May used here, then vulnerable road user targets for hospitalised pedestrians and cyclists will have been met with the exception of the total number of hospitalised pedestrians. The 'Auckland effect' described earlier also applies.

8.2. Intermediate outcomes

The targets for speed, alcohol and seat belt use underpin much of the *Road Safety to 2010* Strategy. These have been set to 2004, with the expectation that further targets would be set to 2010. Further discussion on these policy areas is to be found in Section 9.

8.2.1. Speed

Table 12: Speed outcomes 2001-2004

	Base	Outcomes			Target
	2001	2002	2003	2004	2004 not exceeding
Speed					
Open road mean speed (km/h)	100.2	99.1	98.0	97.8	99
Open road 85th percentile (km/h)	109	107	105	105	107
Urban mean speed (km/h)	55.2	54.3	53.7	52.9	55.2
Urban 85th percentile (km/h)	61.5	60.5	59.5	58	61

As Table 13 indicates, average mean speeds have been falling over the last eight years and the 2004 targets have been met. The 2.4 km/h decrease compared with base year in mean speed for open roads and the 2.3 km/h reduction in urban mean speed compared with base years will have translated into useful casualty reduction. A 1% decrease in mean speeds in urban areas will result in an 8% reduction in deaths and it is estimated that 27 lives would have been saved. A 1km/h reduction in open road mean speeds will result in a 4% decrease in deaths which will translate into a saving of 31 lives (based on the fatality total for the 12 months to October 2004).

Excess speed is detected in New Zealand by a range of devices including Hawk Radar and Lasers as well as speed cameras. Hours of speed camera operation at 73265 hours in the 12 months ending March 2004 were 1% below the 2003/4 target of 74,000 hours. At Easter 2004, the New Zealand Police changed the operational guidelines for the deployment of speed cameras. Speed camera zones and warning signs have been removed and speed cameras are now deployed on an anywhere, anytime basis.

Table 13: Speed survey results 1995-2003

Speed	1995	1996	1197	1998	1999	2000	2001	2002	2003
Rural speed, % over 110km per hour	25%	24%	21%	21%	19%	17%	13%	9%	6%
Rural speed, mean (km/h)	102.2	102.3	101.6	102.2	101.8	101.1	100.2	99.1	98
Rural speed, 85th percentile (km/h)	114	115	113	113	112	111	109	107	105
Urban speed, mean (km/h)		56.5	56.3	55.9	55.8	55.3	55.2	54.3	53.7
Urban speed, 85th percentile (km/h)		63.5	63	63	62.5	62	61.5	60.5	59.5

Figure 5. Speed infringements 1999-2004

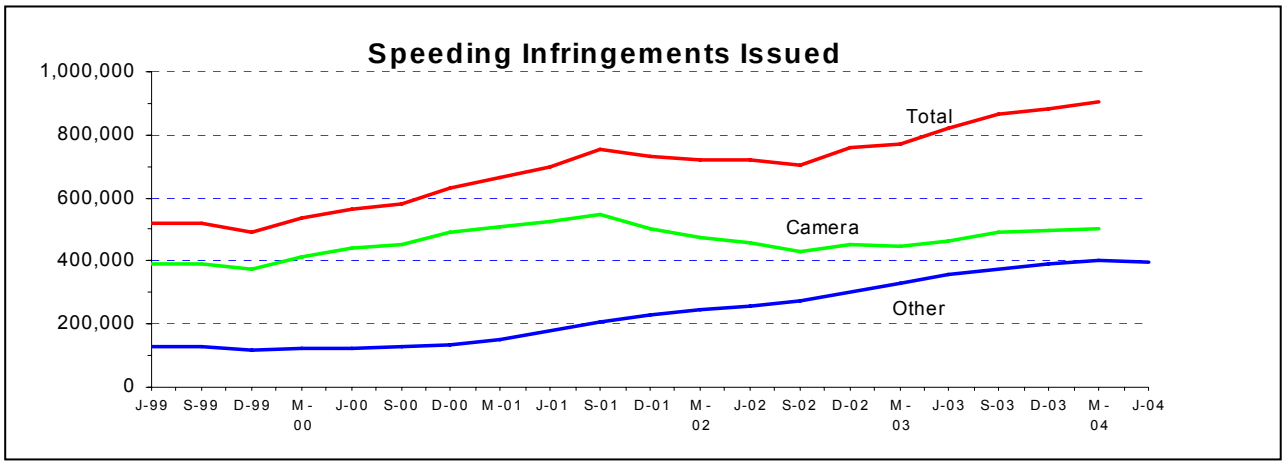


Table 14: Targets and outputs in speed enforcement 2001-2005

Speed	2001/2	2002/3	2003/4	2004/5
hours to be delivered	310,380	316,950	321,980	304,430
speed camera hours	74,000	74,000	74,000	74,000
on-road speed TONs and IONs to be issued	110-130K	200-250K	275-325K	350-400K
speed camera IONs to be issued	515-610K	500-550K	400-460K	480-550K
offence notices issued	176,684	259,323	356,193	NK
speed camera infringement notices	523,362	458,618	466,409	NK

*speed camera hours - approx 40% of this is delivered by mobile cameras in the rural environment or 100kph roads.

8.2.2. Alcohol

Table 15: Excess alcohol-related deaths 2001-2003

	Base	Outcomes			Target
	2001	2002	2003	2004 #	2004 not exceeding
Alcohol					
Percent of driver deaths with excess alcohol	21%	24%	28%		21%
Number of driver deaths with excess alcohol	55	60	73		48

2004 crash data and post-mortem blood test data not yet available.

The current blood alcohol limits in New Zealand are 80mg/100ml for the general driving population and 30mg/100ml for drivers under 19 years.

Against a trend of large reductions in over the limit driving and excess alcohol-related deaths since 1990, the number of driver deaths with excess alcohol has increased from a baseline average of 21% to 28% in 2003. At the same time, the results of random Compulsory Breath Test (CBT) operation survey conducted shows that there has been a decrease of 0.5% in the overall DUI rate from 1.2% in 2002 to 0.7% in the main drinking hours in 2004, with the change taking place mainly in metropolitan areas with little change in provincial and rural cities and towns. Crash analysis of possible changes in age effects, urban/rural splits etc, conducted on behalf of the review, did not offer any obvious explanation for the difference in the excess alcohol death figures and the results of roadside random check. However, as Figure 6 indicates, the fact that compulsory breath testing checks reduced during the winter of 2002, picking up again in December 2003 may provide some explanation. Twelve-month

rolling totals for the numbers of compulsory breath tests issued for March, June and September of 2003 indicate that these were below target outcomes by 8%, 11% and 7% respectively. For the same period, mobile breath tests were 54%, 47% and 9% above output targets.

Table 16: CBTs and MBTs 2002/2003 rolling totals

	12mths to Sept, 2002	12mths to Dec 2002	12mths to march 2003	12mths to June 2003	12mths to Sept 2003	12mths to Dec 2003
CBTS	1583059	1524000	1462000	1425000	1485000	1581000
Target	within	within	8% below	11% below	7%below	within
MBTS	806405	819000	806000	772000	817000	835000
Target	54% above	56% above	54% above	47% above	9% above	12% above

In the twelve months ending March 2004 both compulsory breath testing and mobile breath testing enforcement targets were exceeded. Mobile breath testing targets (2.2-2.5 million) were exceeded by 16% and the effect to the end of 2004 remains to be seen.

At current levels of breath testing in New Zealand every licensed driver can be expected to provide a breath test on an annual basis, compared with one in three drivers in many other jurisdictions such as Finland and the State of Victoria (although the population and traffic levels may be different between countries), which is an active enforcement regime.

Figure 6: Excess alcohol enforcement and offence notices

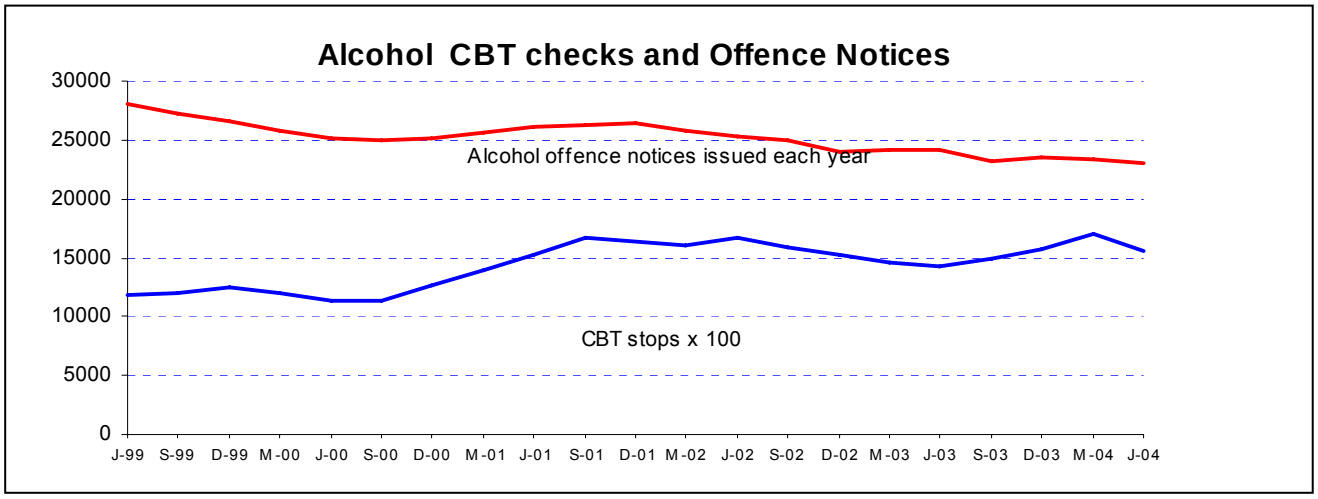


Table 17: Police enforcement of excess alcohol: targets and outputs 2000/01 to 2004/05.

	2000/01	2001/02	2002/03	2003/04	2004/05
Alcohol					
hours to be delivered	508,785	505,920	543,025	574,140	616,715
number of CBTs to be conducted	1.4-1.6M	1.4-1.6M	1.5-1.7M	1.5-1.7M	1.5-1.7M
number of MBTs to be conducted	370-410K	370-410K	500-550K	500-550K	800-900K
offence notices to be issued		26-30,000	23-26,000	23-26,000	23-26,000
CBTs conducted		1,522,115	1,677,168	1,424,816	NK
MBTs conducted		669,772	800,355	771,878	NK
offence notices issued		25,348	24,744	25,505	NK

8.2.3. Safety belt and child restraint use

Front seat belt wearing rates have increased both for drivers and passengers since the base year. The highest rates achieved were in Waitakere (98%), but most metropolitan areas were above the national average.

Table 18: Restraint use survey results 2001-2004

	Base	Outcomes			Target
	2001	2002	2003	2004	2004 - At least
Restraints					
Safety belts – front	92%	92%	92%	94%	92%
Safety belts – rear	70%	78%	81%	81%	75%
Children (under 15) restrained	89%	94%	96%	97%	90%

Figure 7: Seat belt offences 1999-2004

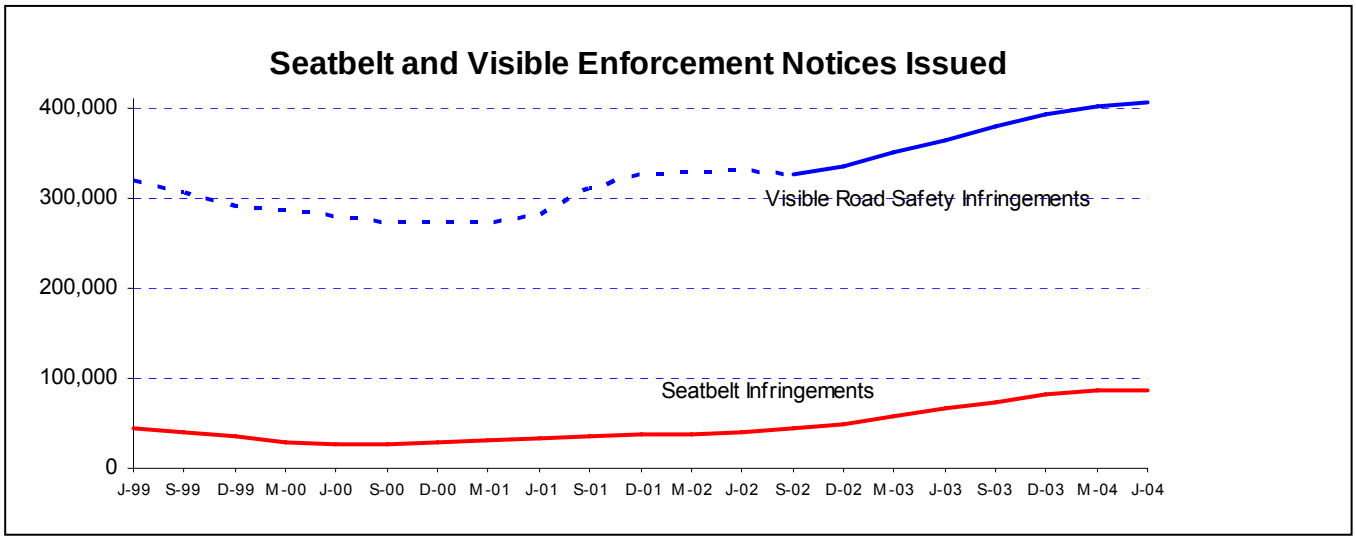


Table 19: Police targets and outputs for seat belt enforcement 2002/3-2004/5

Seatbelts	2001/2	2002/3	2003/4	2004/5
hours to be delivered	116,965	116,085	121,415	112,040
offence notices to be issued	50-60,000	40-55,000	50-60,000	60-70,000
offence notices issued	40,224	66,977	89,671	83,340

8.2.4. Regional outcomes

The regional outcomes shown in Table 20 show a slightly mixed picture but with most regions reflecting the national picture with regard to numbers of deaths and hospitalisations.

Table 20: Regional hospitalisation outcomes to 2004

	Deaths plus hospitalised		Deaths plus hospitalised over 1 day		Deaths plus hospitalised over 3 days	
	2004 # outcome	2004 target "not exceeding"	2004 # outcome	2004 target "not exceeding"	2004 # outcome	2004 target "not exceeding"
Northland	503	440	198	200	119	120
Auckland	2556	2120	821	840	573	600
Waikato	841	740	407	420	303	320
Bay of Plenty	567	490	277	270	169	160
Gisborne	91	70	47	40	30	30
Hawkes Bay	210	250	142	140	99	100
Taranaki	131	120	86	70	55	50
Manawatu/Wanganui	360	390	222	240	150	160
Wellington	325	320	203	200	109	120
Nelson Marlborough	155	140	89	80	65	50
West Coast	75	90	35	40	17	20
Canterbury	819	700	408	380	294	260
Otago	249	250	147	150	98	100
Southland	136	150	68	100	40	60
National	7018	6270	3150	3150	2121	2150

2004 Hospital data is for the 12 months to March 2004.

9. Quality, quantity and coverage of outputs in the key priority areas

The review has collected information on the implementation packages which have been funded since the start of the strategy in February 2002 and plans for funding into the next financial year 2004/5. To date there have been two implementation schedules funded by the Safety Administration Programme and the National Transport Funding Programme.

This section examines action taken to implement the *Road Safety to 2010* Strategy in the key priority areas. A short introductory perspective is given on the international state of the art followed by recall of the forecasting assumptions, target-setting estimates and strategy commitments. An outline of action taken to date is presented, followed by a series of observations. These will include an assessment of whether activity to date is sufficient to meet the 2010 targets and initial suggestions, where appropriate, for the deepening of existing activity or new strands of action.

9.1. Engineering safer roads

9.1.1. International perspective

Road safety considerations are central to the planning, design and operation of the road network. By adjusting the design and layout of the road and road networks to accommodate human characteristics such that they are ‘self explaining’ and more ’forgiving‘ if an error is made, road safety engineering strategies can make a major contribution to road injury prevention and mitigation (Peden et al eds, 2004).

In the past, countries active in road safety have focused on the third and reactive strategy of implementing remedial low cost/high return measures at high-risk sites. In recognition of the limitations of this approach and missed opportunities for improving network safety quality, policymaking and budgetary attentions are being turned increasingly to pro-active action, and safety audit provides a

good example of this, directed at safety conscious planning and incorporating safety features into road design. The range of road safety engineering treatment considered to reflect best practice approaches is shown in Table 21.

Table 21: Road safety engineering strategies (World Report on Road Traffic Injury Prevention, 2004):

Shaping the road network for road injury prevention:

- Safety-conscious planning of road networks such as:
  - classifying roads and setting speed limits to match road function
  - separating out motorised from non-motorised traffic wherever possible.
- Incorporating safety features into road design such as:
  - self-explanatory road layouts
  - area-wide speed reduction and traffic calming
  - providing crash protective roadside objects
  - introducing safety audit.

- **Self-explaining roads**

Classifying the road network according to the primary road functions; setting appropriate speed limits according to those road functions, and improving road layout and design to encourage better use, is increasingly providing the framework for systemic road safety management in high-income countries (Wegman and Elsenaar,1997; Ogden, 1996; World Bank, 2002; Peden et al eds, 2004). Within this framework, safety engineering and traffic management can then work to:

- prevent use that does not match the functions for which the road is designed
- manage traffic mix, by separating different kinds of road users in order to eliminate conflicting movements except at low speeds
- prevent uncertainty amongst road users concerning appropriate road use.

A road hierarchy can be established according to functions, taking account of land use, location of crashes, vehicle and pedestrian flows, and safety objectives including management of speed. This helps in the detailed design of each road to increase safety, in particular by encouraging appropriate choice of speed within the posted limits. An example of the Dutch road hierarchy is presented in Table 31. A Dutch study concluded that a reduction of more than one third in the average number of injury crashes per million vehicle km, driven on all types of road in the Netherlands, could be achieved in these ways (SWOV, 1993). The re-classification of the Dutch network took place in the Start-Up programme of their road safety strategy. To a timetable agreed between national government and the road controlling authorities, a re-classification system was put in place within two years.

A large body of knowledge and information exists internationally in support of such a framework and is available in the form of design standards and best practice guidelines and manuals.

- **Forgiving roadsides**

Research and experience indicate that the siting and design of off-road objects can play a major role in reducing such collisions and the severe consequences that are typically associated with them. The principles for minimising the occurrence and mitigating the severity of vehicle occupant injury in collisions with street furniture have universal application but are not yet being widely applied. These are:

- designing roads without dangerous roadside objects by using safety audit
- introducing a clear zone at the side of the road, where possible
- designing roadside objects so that they are more ‘forgiving‘, e.g. collapsible lamp posts
- protecting roadside objects with barriers to absorb part of the impact energy, e.g. median cable barrier, crash cushions
- protecting vehicle occupants from the consequences of collisions with roadside objects, through better interface between vehicle and roadside furniture design.

Early research conducted in the United States indicated that break-away columns could result in reductions in injuries of around 30% in the number of fatal and serious crashes at the treated sites (Cirillo, 1984). The removal of roadside obstacles in Norway led to ratios of benefit to cost of around 19:1 (Elvik, 2002). Central cable rails are being installed to an increasing degree in Sweden to prevent dangerous overtaking on single carriageway roads. On two-lane roads with grade-separated crossings, the use of central cable rails has produced estimated reductions of 45–50% in fatal and serious casualties (Carlsson and Bruder, 2003). In Birmingham, England, installing crash cushions resulted in a 40% reduction in injury crashes, and a reduction (from 67% to14%) in the proportion of fatal and serious crashes at the treated sites (Proctor,1994).

Fatal crash rates by road type indicate that crash rates are fairly similar for Britain, Sweden and Netherlands with higher rates found in New Zealand. The risk on Swedish roads is about half as great as on New Zealand roads.

Table 22: Fatal crash rates per billion vehicle kilometres using 30-day definition (1999-2001)

Road Type	GB	NL	S	NZ (99-03)
Motorway	1.9	1.7	1.7	3.0
Standard 2 lane	12.4	11	7.7	16

*New Zealand category other open roads was used to compare to standard two lanes.

Table 23: Fatal and serious crash rates per billion vehicle kilometres (adjusted for reporting differences) for different road types

Road Type	GB	NL	S	NZ (99-03)*
Motorway	12	10	11	19.5
National A Road	44	45	52	102
Single carriageway	80	72	50	108

* State Highways used as the best functional comparison for National A roads and other open roads for single carriageway.
Note: Practice differs between countries on the definition of a serious injury. Many countries use the definitions of one night spent in a hospital. The accident rates were adjusted using the ratios of fatal plus serious injury crashes to fatal crashes in each country. (In New Zealand State Highways the ratio is 4, Motorways 5, Other open road 5.2. The adjustment factors are calculated using Britain's rate of 6.5 the same for all road types. The adjustment factors are State Highways 1.62, Motorways 1.30, and Other Open Road 1.25).

9.1.2 Road Safety to 2010 Strategy – target-setting estimates and strategy commitments

The strategy envisages significant effort going into in engineering develop a safer and more forgiving road network by 2010 than previously.

As the *Road Safety to 2010* Strategy underlines, in view of New Zealand's largely two-way, two-lane, undivided rural network, improving safety needs to address infrastructural investment or vehicle operating speeds. International comparisons for the safety performance of different roads in New Zealand compared with best performers in Europe indicate that substantial improvement in these areas needs to be put in place if New Zealand is to achieve the international level of performance sought in the *Road Safety to 2010* Strategy.

Through targeting roads with both high-risk and high-cost density, major urban road and state highways are identified as the most cost effective for making safety improvements. The safety benefits from road engineering are expected to come from retro-fit, minor safety works, new construction and walking and cycling projects. The estimated contribution of road safety engineering to targeted reductions in social cost is given in Table 24.

The mixed enforcement and engineering approach, favoured in the consultation process, forecasts a total 18.8% contribution for road safety engineering through a mixed approach. The percentages forecast for black spot treatment and existing construction shown in Table 24, however, rather oddly remain the same across the approaches, rather increasing from left to right as might be expected.

Table: 24: Expectations of social cost reduction

Social cost reduction expected from interventions in *Road Safety to 2010* Strategy				
	Business as usual to 2010	Enforcement	Mixed	Engineering
black spot treatments	2.1%	2.1%	2.1%	2.1%
existing construction programme	5%	5%	5%	5%
new construction programme			11.7%	18%
total	7.1%	7.1%	18.8%	25.1%

Road engineering in New Zealand is conducted by the road controlling authorities (Transit New Zealand (state highways) and by local authorities (local roads). The work is funded by the National Land Transport Fund through Transfund (100% for state highways and, on average, around 50% for local roads, with the rest coming from local rates).

The majority of the safety benefits from road engineering come from new construction, black spot treatments and other minor safety works. The proportion of benefits from general road construction was estimated to be around 30%-35% for state highways and 20%-25% for local roads, as opposed to congestion relief projects which have only approximately 10% safety benefits.

Following the 'Moving Forward' land transport package announced in February 2002, fuel consumption tax was increased by 4.2 cents in March 2002. At the same time, the Government also announced the NZTS priorities for the National Land Transport Fund. As a result, the current forward (non-block) program has a particular focus on congestion relief, most of which will not be open to traffic until after 2010. Owing to the diversion of funds to congestion relief, the social cost reduction to 2010 expected from general road construction is greatly reduced.

In December 2003, the Government announced the 'Package for Transport, Growth, and Development' As a result; there will be an additional funding of around $297 million per annum nation-wide (excluding the effect from inflation indexation). This funding will become available from the middle of 2005 onwards. Work is currently underway to assess the safety impact of the additional funding. A very preliminary assessment suggests the additional funding would further reduce the road trauma by approximately 1.5% by 2010. This projection has yet to be confirmed and should be treated with caution at this stage.

Table 25: Central Government funding for transport projects in New Zealand since 2002

Output Type	**2002/03**	**2003/04**	**2004/05**
	($M)	**($M)**	**($M)**
Maintenance			
local roads	264.31	282.20	329.09
state highways	289.04	305.60	336.85
Improvement and replacement–local roads			
minor safety projects	10.01	10.55	27.21
commitments	15.59	7.28	17.42
new works	32.40	46.00	48.00
Improvement and replacement–state highways			
minor safety projects	10.19	10.97	23.41
commitments	103.35	155.11	241.87
new works	107.04	93.97	91.70
property purchase	70.00	65.00	42.40
Passenger transport	85.00	101.08	118.10
Alternatives to roading	29.00	28.00	53.00
Regional development	26.67	23.16	25.00
Promotion of walking and cycling	3.67	3.80	4.00
Research, education, training		2.75	3.92
Administration	53.73	54.73	58.03
Total (gst excl)	1100.00	1190.00	1420.00

9.1.3. Road Safety to 2010 Strategy initiatives

Since February 2002 nine main initiatives have been introduced aimed at improving the safety of the road network in the two *Road Safety to 2010* implementation schedules (S1 and S2).

- ***Road network performance (S1)***

The focus of this activity is on establishing relevant benchmark data and information about the extent and characteristics of the road network and the traffic it carries. Ongoing work is focussing on the development of national road classifications, performance targets and measures, risk profiles and an assessment of roadside hazards.

- ***Functional road classification***

A final report for a road classification system for trial within the Crash Analysis System to assist in analysing and improving road safety was produced in May 2004.

The Dutch functional road hierarchy mentioned previously differs in that it has taken a critical look at its road network and has set out appropriate speed limits, geometric design, road layout standards and operating conditions for roads with flow, distributor and access functions (See Table 31). For urban areas, a distinction is made between residential access roads (where low, area-wide speed limits could apply) and other access roads. While a long-term goal, the classification provides a rational framework for re-engineering the road network to better address road user needs and human limitations.

The New Zealand work at the moment merely provides a functional framework for the existing system, modified for traffic volume. The classification system is based on how roads currently operate, as opposed to how they are expected to or desired to function in the future. A more ambitious classification would involve the setting out of framework to enable road function to be matched with appropriate speed limits and appropriate layouts and designs. As in the Netherlands, it might be the case that a significant part of the urban road network needs to be re-classified specifically as urban residential access roads deserving lower speed limits and requiring appropriate road layouts and management.

- ***Roadside hazards***

Roadside objects are involved in 50% of all rural crashes and in 28% of urban crashes in New Zealand. Even in the best designed car on the road, the injury threshold is 70km/h. A more forgiving environment is needed for those who are involved in crashes whilst driving within the law. Guidelines and the preparation of a programme for the identification and treatment of roadside hazards are to be completed by 2005 and are being carried out by LTSA and Transit.

- ***Safety Management Systems (S1)***

The LTSA has led the development of a voluntary Safety Management System (SMS) regime for road controlling authorities (RCAs) to ensure that decisions about construction, maintenance and management of the road network leads to improved safety performance. A Safety Management System comprises:

- the strategic direction of the RCA including the vision and plans and partnerships needed to achieve a road safety engineering toolbox of delivery, including crash reduction studies, safety audits, data collection, adopted standards and guidelines
- management control system and responsibilities for the SMS, including the road safety engineering processes that will be used
- continuous improvement/audit regimes to ensure delivery of best practice.

Transit was the first authority to have an SMS in place and has since continued to develop and refine it in co-operation with the LTSA. Transit intends to review the SMS manual in 2004 to reflect changes to its structure and the adoption of more rigorous Road Safety Audit (RSA) procedures.

By the end of June 2004, 43 out of the 74 RCAs were in the process of developing SMSs and it is anticipated that by June 2005, there will be 58 SMSs.

- ***State highways – special safety initiatives***

Led by Transit New Zealand, this project aims to develop innovative engineering solutions focusing on lower cost strategic safety improvements on the state highway network. The deliverables have been met, and include the trial and installation of a median cable barrier 2+1 with the aim of reducing head-on crashes, a roadside clearance trial and the development of draft safety retrofit guidelines.

Transit has developed a State Highway Geometric Design Manual (GDM). Road design standards are used as a means to achieve consistent and operationally effective roads. The GDM details the design standards and procedures which apply to Transit's state highway network. The design standards and procedures must be used for all state highway work. There are circumstances where the standards cannot be fully implemented because of construction, financial or other constraints. In these situations formal approval must be sought from the Highway Strategy and Standards Manager to alter design details that do not comply with mandatory design standards and practices. Some of the benefits from the application of the design standards will include:

- improved consistency of road standards to match the road function
- road safety engineering practices which provide a forgiving environment
- greater safety for the mix of heavy and light vehicles
- a safe maintenance environment.

- ***Speed zoning (S2)***

A feasibility study is to be conducted to investigate a change in current speed limit practice so that the setting of speed limits would take greater account of restrictions imposed by road geometric features and the surrounding terrain, known in New Zealand as speed zoning. This is not to be confused with speed zoning in Europe, which comprises area-wide speed limit and engineering treatments. A draft policy will be developed by late 2004 with the aim of initiating trials in early 2005. The outcomes of the trials will be used to determine more clearly the benefits, costs and practical implications of a speed zoning approach. Speed zoning initiatives by Transit New Zealand, who view speed zoning as an urgent priority, are already underway.

- ***Minor safety works (S2)***

The 'business as usual' forecast envisaged treatment of between 1200-2000 sites across the black spot programme to 2010 to result in 600-1000 fewer crashes at a social cost reduction of around 2.1%. It is estimated that around 250-300 sites are selected each year on the basis of poor crash records. Between 150 and 250 sites are investigated annually and 80% of these receive remedial treatments. However, the level of activity is determined by decisions made by the road controlling authorities and the funding incentives provided by the funding authority – Land Transport New Zealand.

Black spot treatments are funded as part of minor safety works, which are completed by road controlling authorities using data from a variety of sources (including crash reduction studies). These are funded by a bulk allocation from central government via Transfund to road controlling authorities who, on average, contribute 50% funding.

The Government announced a two-year programme of engineering safety funding through the National Land Transport Programme in October 2003, with increased resource of $47 million for minor safety projects. The Minor Safety Works allocation was increased from 4% to 8% of the respective approved maintenance programmes. This provides a higher financial assistance rate for road controlling authorities, the lead agencies of which are Transit New Zealand and Local Government New Zealand, which means an increase in the contribution that Transfund will make to RCA safety

engineering activity. To meet local demand, the funding to local authorities for minor safety projects has, in effect, been increased from 50% to 60% and the project maximum from $75,000 to $150,000. The developments are encouraging and need to be maintained.

Table 26: Central Government funding for minor safety works since 2002

Output Type	2002/03	2003/04	2004/05
	($M)	($M)	($M)
Minor Safety projects – local roads	10.01	10.55	27.21
Minor Safety projects – state highways	10.19	10.97	23.41

Note: The figures shown in this Table come from the National Land Transport Programme.

For 2002/03 and 2003/04 the benefit to cost of projects submitted has been estimated at three to one. A Transfund report (Technical Review of Minor Safety Works 2002/3 report PM/02/1096T) contained criticism that many projects, however, were not driven by crash data analysis.

The Land Transport Safety Authority, Transit New Zealand and local authorities are partners in the Crash Reduction Study Programme in New Zealand. The original programme was established in 1985 to identify sites for treatment based on the crash history at each site, and to recommend low-cost engineering treatments aimed at reducing those crashes. A monitoring system has been developed progressively since 1989 to gather crash data on treated sites. Results from the latest Crash Reduction Study (LTSA, 2004) indicated an average 35% reduction in injury crashes over and above the crash trend. Mean annual saving associated with sites active in last 10 calendar years (1994-2003) has been estimated at $203 million per annum. As Tables 28 and 29 indicate, the benefits to cost of remedial treatment at sites between 1998-2002 remain very high, which indicates the large scope for further work of this kind.

Table 27: Sites with recommended works still to be fully implemented

Full years since works recommended	Road classification		
	Local road	State Highway	All sites
Under 3 years	211	120	331
3-4 years	162	59	221
5-6 years	148	113	261
7-8 years	152	103	255
9-10 years	127	72	199
11-13 years	122	36	158
14+ years	14	20	34
Total	936	523	1459

Crash Reduction Study Monitoring: Overall results September 2004.

Note: Most black spot sites contain a number of recommendations, i.e. erect bend warning sign, erect chevron, paint edge line and install raised reflective pavement markers rrpm (cat's eyes). If however, the TLA decides not to put in the rrpm the site will be tagged as incomplete as is the case with most of the 936 local and 525 state highway sites.

Table 28: Benefit cost ratio for sites with known or estimated costs, by total cost of site works

		Benefit: cost ratio		
	Number of sites	Open road sites (80-100 km/h)	Urban sites (70km/h or less)	All sites with known cost
$20,000 or less	*1671*	306	70	161
$20,001 to $75,000	*458*	55	12	28
$75,001 to $150,000	*129*	22	8	14
Over $150,000	*85*	5	3	4
All sites with known cost	*2343*	37	17	28

Crash Reduction Study Monitoring: Overall results September 2004.
Note: Actual cost where available; otherwise estimated cost. Costs have been adjusted for inflation to 2002 prices.

Table 29: Crash reduction monitoring sites completed in the five-year period 1998-2002.

By Cost of works at site (actual cost if known, otherwise estimated cost).

Cost of works	Number of sites	Number of crashes in 'after' period	Estimated BC
Up to $20,000	250	664	450
$20,001 - $75,000	89	287	60
$75,001 or more	49	186	10

By speed limit zone (urban / rural)

Speed limit zone	Number of sites	Number of crashes in 'after' period	Estimated BC
Open road (80-100km/h)	185	483	100
Urban road (Up to 70km/h)	203	654	20
Overall	388	1137	70

By both cost of works and speed limit zone

	Open road		Urban road		All sites	
	BC	*Num sites*	BC	*Num sites*	BC	*Num sites*
$20k or less	1200	*(124)*	70	*(126)*	470	*(250)*
$20k+ to $75k	100	*(33)*	30	*(56)*	60	*(89)*
$75k+	20	*(28)*	3	*(21)*	10	*(49)*
All	100	*(185)*	20	*(203)*	70	*(388)*

- ***Evaluation of engineering safety benefits (S1)***

Transfund NZ's project is to audit crash reduction benefits in project evaluations to confirm the accuracy of benefits attributed to road improvements and to improve the crash prediction methods in Transfund NZ's Project Evaluation Manual for different types of safety improvement.

- ***Improving the take up of safety audits (S1)***

Safety audits are not mandatory on new road schemes as they are in many other countries. Transfund, however, will increase the uptake of safety audits through the requirement in the National Land Transport Funding programme that the completion of a road safety audit should be a condition of funding for new projects. Transit's Safety Management System already has an implemented and rigorous approach to safety audit.

- ***Predictive accident analysis (S1)***

The purpose of Transfund's project is to develop procedures to move project evaluation from a reactive to a more predictive focus. This will allow a road controlling authority to apply for funding for a site which has certain risk characteristics whether or not a crash has actually occurred.

- ***Local authority road safety management (S2)***

Work is to be carried out to promote best practice in local authority safety management, consistent with the Peter Bielby Review of Local Authority Road Safety Management (2003), which will involve:

  - a review of the LTSA database and information gathering and reporting process for implementation of safety projects identified through crash reduction studies
  - revised guidelines for Crash Reduction Studies (which will be completed in 2005)
  - revised safety audit guidelines (which have been completed and are soon to be printed)
  - promotion of an integrated safety management approach for local authorities (in line with the Road Safety Action Plan model used by Wellington City Council).

9.1.4. Observations

- *Self-explaining roads and forgiving roadsides can help shape the road network to provide large improvements in road safety. Such approaches are being adopted increasingly in long-term strategies in the best performing countries in road safety.*
- *The new and more flexible transport funding arrangements and the increases in funding recently introduced by Transfund open up new opportunities for longer term planning in road safety engineering and more scope for take up of projects by local authorities.*
- *Given the high expectation in the Road Safety to 2010 Strategy of delivering long-lasting improvements from road safety engineering, considerable and appropriate emphasis has been placed in work to date on developing strategies and tools which will help to improve the safety quality of the road network. However, policy development and implementation will need to be expedited in key areas if 2010 goals are to be reached. There is much potential for further investment in safety engineering in New Zealand, not least in the modestly funded road safety engineering schemes at single sites which still generate very high ratios of benefit to cost; cost-effective pro-active mass action on speed zoning, median barriers and roadside hazard treatment and area-wide urban safety management which can deliver good benefit to cost ratios.*
- *The further development and application of a national functional road classification system where speed limits, road design and self-explaining layouts match road function could provide a rational framework to take forward the current discussion about speed limits and road design. A lead agency could be appointed by the Ministry of Transport with a target date for implementation to conduct this task with the full co-operation of all key stakeholders.*
- *Considerable safety benefits could be achieved if all the road controlling authorities were able to perform at the level of the best performing authorities.*
- *In view of the rational framework which the SMS tool provides to encourage road safety engineering expertise to be applied widely and systematically and the encouraging take-up to date, there would be benefit in trying to achieve 100% take up as soon as possible. Transfund could consider requiring the use of SMS as a condition for receiving grant for road safety with an appropriate lead time.*
- *The Crash Reduction Analysis system and its linkage with the RAMM data base is valuable tool and should continue to receive full support.*
- *Monitoring shows that there has been successful implementation of minor safety works at high-risk sites. Such high benefits to cost have been achieved from work to date on local and state roads which has been subject to crash analysis study, that this area is likely to deliver good returns well into 2010. Transfund has recently doubled the minor safety works allocation and low cost/high return safety schemes deserve as much additional resource as can be found.*
- *In view of the problem roadside hazards create for law-abiding road users, finalised national roadside hazard management guidelines together with appropriate resource would allow the roll out a national mass action programme on state highways.*
- *The use of median barriers has proven to be an effective road safety engineering intervention elsewhere and Transit is currently trialling various options. As with roadside hazard treatments, a mass action programme of median barriers could deliver important safety benefits.*

- *The Safer Roads approach of Wellington City Council, which has adopted a targeted area-wide approach and which envisages urban speed limit reductions to 40km/h, is encouraging (Safer Roads 2004). The use of area-wide, traffic-calmed 30km/h zones is more common in Europe and has delivered very substantial safety benefits (some 15%-80% reduction in injury crashes (Kjemtrup and Herrstedt 1992, Brilon and Blanke 1993)). There is much experience in urban safety management in Europe and several guidelines produced by the engineering profession exist (e.g. DfT, 2003).*
- *Further study of the relationship between crash rates, traffic flows and geometric design towards more consistent design and treatment on two-lane rural state highways for crash rate reduction is an identified need.*

9.2. Reducing speed

9.2.1. International perspective

Excess speed is driving over the legal limit and inappropriate speed is driving at a speed too fast for the conditions but within the posted speed limit. Speed is at the core of the road crash problem and is widely understood by professional and policymakers in the best performing countries as the single most important determinant of road safety.

The causal relationship between speed and road safety is explained by the laws of physics. The probability of a crash involving an injury is proportional to the square of the speed. The probability of a serious crash is proportional to the cube of the speed. The probability of a fatal crash is related to the fourth power of the speed (Nilsson 1982, Nilsson and Andersson 1997). The crash risks associated with speed are outlined below in Table 30. Environmental damage from exhaust emissions and traffic noise are also greater at higher than at moderate speeds. Speed management is, therefore, required to balance these disadvantages with the shorter journey times offered by higher speeds.

Table 30: Speed – the risks Source: Eds M Peden et al, World Report on Road Traffic Injury Prevention, 2004

- An average increase in speed of 1 km/h is associated with a 3% higher risk of an injury crash (Finch 1997, Taylor,2000).
- An average increase in speed of 1 km/h leads to a 5% higher risk of serious or fatal injury (Taylor,2002).
- Travelling 5 km/h faster above a road speed of 60 km/h results in an increase in the relative risk of injury crash involvement that is comparable to having a blood alcohol concentration of 0.05 g/dl (McLean J, Kloeden, 2002).
- For car occupants in a crash, the likelihood of death at an impact speed of 80 km/h is 20 times that of an impact speed of 32 km/h (IIHS, 1987).
- Pedestrians have a 90% chance of surviving car crashes at 30 km/h or less but less than a 50% chance of surviving a crash at around 45 km/h (Ashton and Mackay, 1983).
- The probability of a pedestrian being killed rises by a factor of 8 as the impact speed of the car increases from 30 to 50 km/h (Ashton and Mackay, 1979).

Successful countermeasures to reduce vehicle speeds aimed at deterrence, prevention and injury mitigation include the setting of speed limits according to road function, better road design, the enforcement of limits by the Police using radar and speed cameras and supporting publicity to increase the awareness about the consequences of speed. Research and experience shows that the imposition of lower speed limits usually leads to a reduction in the frequency and severity of crashes, while increasing or removing speed limits usually leads to increased crashes and crash severity.

Speed limitation devices in vehicles such as HGVs can improve road safety by automatically controlling the maximum speed at which a vehicle can travel. Vehicle crash protection can also help, although there are limits. The best designed vehicle on the road today provides crash protection currently up to 70km/h for car occupants wearing seat belts in frontal impacts and 50 km/h in side impacts. The human tolerance to injury for a pedestrian hit by even the best designed car will be exceeded if the vehicle is travelling at over 30km/h (Tingvall and Haworth, 1999). Studies show that the probability of a pedestrian being killed rises by a factor of eight as the impact speed of the car

rises from 30km/h to 50km/h. Successful speed management therefore, needs to carefully balance human limitations with the existing limitations of vehicle and road design to offer protection.

- ***The framework for setting speed limits according to road function and design***

As indicated previously, the classification of the road network where speed limits match road function provides a rational framework for decision making on road design standards, speed limits, road layouts and operational conditions. Some of the detail needs adapting to New Zealand conditions but the principles are wholly transferable. Table 31 illustrates how this works in practice with reference to the Dutch road hierarchy where three main traffic functions can be distinguished:

Table 31: The Dutch road hierarchy

- **Flow:** to go from place of departure to destination – *through -roads* – roads with a flow function for through traffic without interruption. For these roads no speeds at above 100-120 km/h with complete separation of traffic streams.
- **Access:** to enter and leave an area – *distributor roads* – with the needs of moving traffic continuing to pre-dominate, *local distributor roads* – giving equal importance to motorised and non-motorised local traffic but separating users wherever possible. Roads with a connecting function for car traffic to and from large urban districts, villages and rural areas with traffic interchange at limited sections. Speeds should not exceed 50km/h within built-up areas and 80km/h outside. Separate paths for pedestrians and cyclists, dual carriageways as standard, with stream separation on the full length and speed management on major crossings and right of way.
- **Residential access**: to reach an individual dwelling, shop, or company – where the needs of non-motorised users predominate – *residential access roads.* Roads with an access function for vehicles with constant traffic interchange, comprising the vast majority of roads. For these roads no speeds over 30km/h in towns and villages. No speeds of over 40km/h at crossings and entries in rural areas, otherwise 60km/h may be acceptable. Where a road performs a mixture of functions, the appropriate speed is normally the lowest of the speeds appropriate to the individual functions.

Source: CROW, 1997.

Attention in countries active in road safety is being drawn increasingly to the performance of single carriageway rural roads which present the highest risks for drivers together with speed management in urban areas, where the balance between vehicle user mobility and the safety of vulnerable road users is problematic.

- ***Single carriageway rural roads***

Speed limits on undivided single-carriageway rural roads in the best European countries in road safety and for New Zealand are set out below in Table 32. Single carriageway roads rural roads in Norway, Sweden and New Zealand comprise much of the national road network, whilst those in the UK and the Netherlands are typically secondary routes in the network. Upper limits in the best performing countries are between 70-90 km/h. In general, numbers of casualties and rates are much higher than on motorways, given large speed differences between different kinds of user and loss of control crashes are also frequent.

Because much lower speeds are appropriate at particular times and places, upper limits are typically supplemented by variable local speed limits operating in line with weather, traffic and road conditions. A range of engineering measures is needed in addition to the general limit to encourage appropriate speed and make hazards perceptible. These include provision for slow moving traffic and vulnerable road users; overtaking lanes and lanes for vehicles waiting to turn across the path of oncoming traffic; median barriers to prevent overtaking and to eliminate head-on crashes, improving hazard perception by means of road lighting at junctions, roundabouts, improved vertical alignment, advisory speed limits at sharp bends; regular speed limit signs, rumble strips and ‘clear zoning’: the systematic removal of roadside hazards such as trees, utility poles, and other solid objects. Much standardisation has been carried out on such measures.

Table 32: Speed limits and death rates in selected countries

Country	*Speed limit (km/h)*	*Deaths(on all roads) per 10,000 vehicles*
Norway	80	1.2
Sweden	70-90	1.1
Netherlands	80	1.1
United Kingdom	96	1.2
New Zealand	100	1.5

- ***Urban roads***

On urban roads speed limits are typically 50km/h. Access roads and residential areas in European towns and cities are often designed to achieve very low speeds. Such roads are typically narrower than the wide and typically straight access roads in New Zealand's residential areas. Speed limits in these areas are normally around 30km/h, but in special cases a speed limit of 15km/h or even lower is prescribed. The limit chosen is always dependent on physical self-enforcing measures to encourage compliance. Measures differ in cost, and the need to treat a vast total area in towns and cities through-out the EU favours inexpensive but demonstrably effective measures. Experience in several European countries over the last 15 years has shown that crash reductions of between 15% and 80% can be achieved by comprehensive area-wide treatments. The benefits to cost of treatments in a British town are set out in Table 33.

Table 33: Area-wide speed reduction a UK town and residential area – benefit to cost

	Town centre	**Residential area**
Number of prevented injury accidents/year	53	145
Saving-accident costs (25 years,5%)	33,350,000	91,260,000
Increased costs-travel time (£25 years,5%)	21,900.00	53,250,000
Loss of consumers' surplus of travel	2,415,000	9,300,000
Total benefits	9.035,000	28,710,000
Costs of implementing measures (£)	4,910,000	2,955,000
Benefit/cost ratio	1.84 to 1	9.72 to 1

Source: Elvik, 1999

- ***Police enforcement, speed cameras, intelligent speed adaptation***

Research and experience internationally shows that bringing average mean speeds down on rural roads can be a highly cost-beneficial activity. A meta-analysis of speed enforcement practice using radar or instruments that measure mean speed between two fixed points and stopping points staffed by uniformed police officers and cars (stationary speed enforcement) indicates that fatal and injury crashes can be reduced by 14% and 6% respectively (Elvik and Vaa, 2004). The use of a long-term, speed enforcement strategy on rural roads in Tasmania, Australia resulted in a reduction of speeding behaviour and in a statistically significant 3.6 km/h reduction in overall average speed. A large, significant reduction of 58% in serious casualty crashes (fatal and hospital admission crashes), was also reported. It was estimated that the two-year enforcement programme resulted in a benefit-cost ratio of 4:1 (Leggett, 1988).

The use of speed tolerances is common practice internationally. In general, speed tolerances should be as low as equipment limitations and public attitudes allow. Victoria Police, for example use a 3km/h tolerance. In the Netherlands a 6% over the limit tolerance is allowed.

Speed cameras are being provided increasingly in many countries as a highly effective and cost-efficient means of supplementing police radar activity to reduce excess vehicle speed and road crash injury. In countries active in road safety information, campaigns and demonstration projects have led to a high level of public acceptance about the importance of speed management. However, opposition from a vociferous minority urging that 'a sporting chance' should be given in matters of compliance with speed limits is typical in countries active in road safety and, if tolerated, can be counter productive. Strong political and professional leadership, with the public interest most in mind, has led

to achievement of a network effect of covert deployment of speed cameras on urban arterial roads in Victoria, Australia, and the extensive roll out of widely publicised overt speed camera deployment in the UK. It is the case, however, that both approaches are demonstrably effective in delivering large casualty savings and have proved to be acceptable to the wider community. The well-publicised use of such equipment in areas where non-compliance and associated crash risk are high has been shown to reduce crashes substantially and to be publicly acceptable. Monitoring in the UK has shown that cameras at fixed sites have been more effective at reducing deaths and serious injuries (-50%) at high risk sites than mobile camera deployment (-28%) (Gains et al, 2004). The strong deterrent effect can keep the number of recorded offences within the range that can be dealt with administratively. An appropriate use of the two approaches would deal with most scenarios where speed cameras could be expected to contribute significantly to crash reduction.

In Europe in-vehicle speed limitation of heavy goods vehicles and public service vehicles is required by law and much experimentation with intelligent speed adaptation (ISA) in vehicles is taking place in several European countries and Australia. Global positioning systems can be used either to warn drivers of unsafe speeds or to limit vehicle speed directly. In the first instance, ISA would assist the driver to conform to the posted speed limit.

Table 34: Estimated safety benefits of speed cameras

Country or region	System level crash reductions	Site crash reductions	Reference
Europe (Various)	50% of all crashes		PIARC (2000)
Australia	22% in New South Wales 30% of all crashes on urban arteries in Victoria 34% reduction in fatal crashes in Queensland.		CERTU (2001) Delaney et al, (2003)
United Kingdom		40% reduction in deaths and serious injuries., 33% reduction in personal injury collisions at camera sites	Gains et al, Department for Transport, 2004
New Zealand		11% reductions in crashes from hidden speed camera trial and 20% reduction in casualties	Keall et al, 2001
Meta-analysis -Various	17% of injury crashes 28% urban areas 4% rural areas		Elvik and Vaa, 2003
Korea		28% reduction in crashes and 60% reduction in deaths at high risk sites	Yang et al, 2003

Source: OECD, 2003, Keall et al, 2001; Elvik and Vaa, 2004 ;Yang et al, 2003), Gains et al, 2004 ; Delaney et al, (2003)

Table 35: Speed camera deployment in selected countries

Country	Number of mobile cameras	Number of fixed cameras	Number of vehicles (000)	Cameras/ Vehicles
Austria	77	79	4 953	0.31
Great Britain	1155	1041	28 140 (UK)	0.78
New South Wales (2004)	24	97 (+ 14 in school zones)	3 956.5	0.34
New Zealand (2004)	31	13	2 801	0.16
Victoria (2004)	150+	Nil	4 300	0.35
Tasmania	13	2	329.6	0.46
ACT (2004)	4	9	240	0.54

Sources (except for 2004 data, obtained direct): Austroads (2001) Speed enforcement in Australasia, AP-R189, Sydney; Nilsson, G. (2000), Gains et al, 2004, Automatic enforcement use and its issues across EU-countries, The "Escape" Project, VTI Sweden (funded by European Commission).

9.2.2. Road Safety to 2010 Strategy – target-setting estimates and strategy commitments

Table 36: Estimation of contribution of speed management in *Road Safety to 2010* Strategy target-setting

Social cost reduction expected from interventions in Road Safety to 2010 Strategy			
	Enforcement	Mixed	Engineering
Urban speed management	5.3%	5.3%	3.3%
Open road speed management	19.1%	11.6%	11.6%

The target-setting estimate was based on achieving a mean speed of 53 km/h on urban roads (engineering) and a mean speed of 99 km/h (engineering). The 2004 targets in the *Road Safety to 2010* Strategy were for 55 km/h and 99 km/h and these have been met.

The strategy observed that in view of New Zealand's largely two-way, two-lane undivided road network, either infrastructural investment or vehicle operating speed needed to be addressed if 2010 targets were to be reached. The Government stated that reducing actual vehicle speeds was one of the most effective ways of reducing road trauma and New Zealand needed a comprehensive effort targeting inappropriate and excessive speed if the 2010 goals were to be achieved.

Around 84% of New Zealand's network comprises undivided open road. Speed designs on the roading network are frequently lower than the posted speed limit since most of the network was constructed under an 80km/h open road speed limit, which has subsequently risen to 100 km/h with an additional 10km/h prosecution threshold. Around 9% of rural drivers exceed 100km/h. In urban areas, the posted speed limits are 50 km/h with around 15% of drivers exceeding 60km/h on 50km/h limit roads. The proportion of fatal crashes with excess speed rose to 35% of fatal crashes in 2003 in New Zealand. In the case of teenage drivers, the proportion has risen to 44%.

Achieving the Government's 2010 road safety targets will require further efforts to reduce average motor vehicle mean speeds on New Zealand's road network.

9.2.3. Road Safety to 2010 Strategy Initiatives

In this priority area, five main initiatives have been introduced to date:

- ***A new approach to road safety advertising (S2)***

Since 1995, the LTSA advertising programmed has supported strategic police enforcement in the areas of speeding, drink driving and seat belt use. During this time, the campaign has used vivid, realistic road safety advertisements aimed at offenders. These advertisements have mostly shown offences being committed and the consequences for the offender. An additional $2 million was allocated to the campaign as part of the first implementation package to take account of the effects of inflation (i.e. increased media, production and research costs) on the existing campaign.

Since February 2004, the focus of the advertising campaign has changed the target audience from offenders to the general public, with the objective of creating community demand for a change in the behaviour of persistent offenders. In support of police enforcement activity, New Zealand advertising has targeted: drinking and driving, speeding, safety belt wearing and failure to give way at intersections. The approach focuses on facts, figures and risks, the impact on the victim, families and communities, emotion and rationality, credibility and personality. While the objective of the new advertising campaign is to reduce speeding, the main aim is to get stronger community ownership and rejection of speeding. This approach is consistent with that adopted in other countries who are tackling the problem of excess and inappropriate speed.

- ***Deployment of 'anywhere, anytime' speed cameras (S2)***

Speed cameras were introduced in New Zealand in 1993 and detect approximately 60% of the speed infringements issued by police. In urban areas, both mobile and pole-mounted fixed cameras are used. Until recently, speed cameras were deployed in a well-publicised overt way. Following a Government decision (16.12.03 PN), speed cameras are used 'anywhere, anytime' rather than only in signposted areas but they are not to be camouflaged. The cameras will be fixed as they are now in cars and vans. The aim is that these should improve the deterrent effect of the cameras, as drivers will no longer have any warning of where cameras may be deployed. The perception that a speed camera may be encountered 'anywhere, anytime' aims to encourage motorists to drive within the prescribed speed limit throughout the whole journey.

Speed monitoring is being carried out on an area-wide basis which is in keeping with the wider deterrent aims of the 'anywhere, anytime' initiative. Police have always been able to locate cameras at sites that have a history of speeding as well as those that have a history of speed-related crashes. They also tend to use cameras at sites where other methods of speed enforcement would be impracticable or dangerous. This kind of targeting appears to be working: nationally, since both ticketing levels and speeds are declining.

The Government also decided that there would be no demerit points on speed cameras (as there are for offences detected by radar or laser technology), having perceived difficulties associated with driver identification and potential for an increase in court appeals, thus creating an anomaly in the speed penalty system (16.12.03 PN).

Since 1994, resources for speed camera deployment have been fixed at 31 mobile cameras and 13 static cameras nationally, which is a small outlay compared with camera deployment in other countries (Table 35). Potential enhancements to the speed camera programme are now to be examined by the Police, including new technologies, and resource allocation. Information gathering and scoping to inform future proposals for additional and/or replacement speed cameras and their deployment will be led by the Police and supported by the MoT and LTSA.

- ***Tougher enforcement of speed limits for high level offenders (S2)***

New legislation has been introduced for immediate roadside license suspension by speeding drivers and riders who exceed the permanent posted speed limit by 40km/hour. The legislation is currently before Parliament but is expected to be passed by the end of 2004. The current roadside license suspension threshold applies to motor vehicle users apprehended for exceeding the speed limit by 50km/hour.

- ***Increasing the heavy vehicle speed limit***

A uniform 90km/h speed limit for all heavy vehicles except school buses was introduced in May 2004, which increased the speed limit from 80km/h to 90km/h for certain types of heavy goods vehicle. Lower enforcement tolerances for heavy vehicles were introduced at the same time with the Police now enforcing truck speeds using a 5km/h tolerance, instead of the 10km/h tolerance that applies to other vehicles.

9.2.4. Observations

- *Speed is acknowledged globally to be the single most important determinant of road safety and its management is, therefore, crucial to the success of the Road Safety to 2010 Strategy in delivering a level of road safety which is amongst the best in the world.*
- *The combination of publicity and police enforcement has contributed to useful reductions in average mean speeds both on open and urban roads such that the 2004 goals have been met. It is estimated that this activity has saved 58 lives since the base year.*

- *Based on the activity which has delivered 2004 targets, the strategy is on course to deliver the 2010 estimated potential. However, with many factors at play, e.g. traffic growth, the level of current activity will need to be increased to deliver the 2010 goal.*
- *The proportion of fatal crashes with excess speed rose to 35% of fatal crashes in 2003 in New Zealand. In the case of teenage drivers, the proportion has risen to 44%.*
- *New legislation introduced in 2004 empowers road controlling authorities to set their own speed limits on local roads, although there are central powers to reverse decisions if necessary.*
- *National classification of the road network, where speed limits and road design and layout match road function, would provide a rational framework for speed management;*
- *Upper speed limits on open roads and the range of speed limits operating in urban areas are much higher in New Zealand than in the best performing countries in road safety.*
- *Area-wide traffic-calmed 30km/h zones are commonly implemented in Europe within an urban safety management approach and, if implemented in New Zealand, could make a significant improvement in the safety of vulnerable road users and car occupants.*
- *The progress to date provides opportunity for improvement to average mean speeds of 51 km/h in urban areas and 93 km/h in rural areas to save many more lives over the remaining five years of the strategy.*
- *Through the widespread use of speed camera technology to detect and penalise speeding offence in countries active in road safety, drivers are not given 'a sporting chance' in avoiding detection and prosecution for speeding offences.*
- *Speed enforcement by laser and radar complements speed camera operations and current levels should, at least, be maintained.*
- *Well-publicised area-wide speed camera operations are an efficient and cost-effective means of achieving reductions in speed-related crashes and injuries. The important things seem to be: highly visible national programmes which are rolled out with adequate equipment resource and efforts to secure a deterrent effect of the operations. Some jurisdictions place priority on the placement of some cameras at camouflaged locations so that they are not obvious to speeding drivers and have achieved a network effect with good return (e.g. Victoria, Delaney et al, 2003)). Such operations are estimated by Vulcan et al (2003) to decrease deaths by 4.7%, i.e. saving 20 lives and 170 injuries annually, which represents $107 million in social cost. Others, e.g. the UK, have rolled out extensive, well publicised overt camera programmes targeted at sites with especially bad casualty records which have also achieved useful returns (see Tables 34 and 35).*
- *The forthcoming review of speed cameras applications by the Police is timely. Digital speed camera technology and automatic number plate recognition are technologies which have been used widely overseas for the last 15 years. Urgent consideration should be given to increasing the number of speed cameras and speed cameras hours, given the importance of this technology as a speed management tool. LTSA analysis shows that 11 deaths and 226 injuries could be prevented for an additional 80 camera hours per week. Ten deaths and 190 injuries could be prevented if 20 additional cameras were made available (Vulcan et al, 2003).*
- *Allocating demerit points for speeding offences, irrespective of the means of detection, is common international practice. That speed demerit points cannot be allocated in speed camera operations, but can be in radar operations is anomalous and gives a mixed message to the general public. Introducing demerit points for speed camera offences is estimated by the LTSA to save seven lives and 110 injuries annually, which represents $43 million in social cost (Vulcan et al, 2003).*
- *Consideration should be given to the fitment of in-vehicle speed limiters on heavy goods vehicles in line with best international practice. If the current average mean speed of 93km/h could be reduced to 90km/h through an in-vehicle limiter, then it is roughly estimated that there would be a 6% reduction in HGV-related deaths or a 3% reduction for all casualties in HGV involved crashes giving a social cost reduction of 0.6%.*
- *In New Zealand, awareness of the importance of enforcing speed limits is high – about 80% believe that this lowers road death and the majority are in support of speed camera deployment. It is important, therefore, that minority groups who oppose camera enforcement vigorously (present*

at different times in most countries active in road safety) do not have disproportionate influence on policy development, since their accommodation impedes progress towards a larger societal benefit.

9.3. Combating drink driving

9.3.1. International perspective

It is widely acknowledged, both in the scientific literature and in national road safety programmes, that a package of measures is necessary to reduce alcohol-related crashes and injuries (WHO.WB, 2004).

The basis of any package to reduce alcohol impairment in road crashes is establishing a legal blood alcohol content (BAC) limit, and in many countries a breath limit is used for evidential purposes. The BAC level gives clear formal guidance to drivers about safe driving practice. The risk of crash involvement starts to increase significantly at BACs of 0.04 g/dl compared with zero alcohol for the general driving population in crashes (Compton et al, 2002, Keall et al, 2001). The World Health Organisation states that an upper limit of 50mg/100ml for the general driving population represents best practice (Peden at al, eds, 2004). Legal limits at 80mg/100ml allow twice as much risk than 50mg/100ml limits.

A review of published studies found that laws that establish a lower illegal BAC (between zero and 20mg/100ml) for young or inexperienced drivers leads to reductions in crashes of between 4% to 24% (Shults et al, 2001).

Random, high-visibility breath testing at roadside checkpoints combined with hard-hitting publicity is well established as the most effective means of achieving reductions in alcohol-related casualties. Roadside evidential breath testing equipment provides an important means of improving the operational efficiency of enforcement. Targeted testing directed at high risk offenders is also necessary.

Action directed specifically at persistent offenders has a numerically small impact. Increasingly, however, in-vehicle breath alcohol ignition interlock devices are found to be effective in reducing recidivism. The wider use of alcohol interlocks in public and commercial transport in the future could extend the potential impact of this tool in dealing with the problem of drink driving. With this in mind, Sweden, Germany and some Australian states have experimental programmes in progress, using such devices in connection with public transport and commercial road transport. In Sweden, alcohol interlocks are now installed in over 1500 vehicles and two major truck suppliers have offered interlocks as standard equipment on the Swedish market since 2002 (Tingvall and Lie, 2003)

While severe penalties have been used in the past in Sweden, the USA, Canada and Australia, research indicates their lack of success in general in deterring drinking drivers or reducing recidivism (Ross 1984, Homel, 1988).

9.3.2. Road Safety to 2010 Strategy – target-setting estimates and strategy commitments

Table 37: Social cost reduction expected from excess alcohol interventions in *Road Safety to 2010* Strategy

Social cost reduction expected from interventions in Road Safety to 2010 Strategy			
	Enforcement	Mixed	Engineering
Compulsory breath testing	3.3%	3.3%	3.3%
Reduced blood alcohol content	4.5%	4.5%	
Zero BAC for young drivers	0.1%		
Alcohol interlocks	0.6%		

The WP7 report estimated that increased CBT would reduce alcohol-related casualties by 13%, which would produce a 3.3% reduction in social cost.

9.3.3. Road Safety to 2010 Strategy initiatives

In this priority area, and in addition to existing hard-hitting advertising in support of police enforcement activity, three initiatives have been introduced to help address the problem of driving while under the influence of alcohol. These are:

- ***More severe penalties for high level and repeat drink drivers***
  (see Section 9.4. for 2010 estimates of benefit)

The Police, MoT and LTSA are the lead agencies for this initiative. Legislation has been introduced to Parliament that would introduce a tougher penalty regime for serious and repeat drink-drive offenders.

The legislation, which is expected to be passed into law before the end of 2004 would make the following changes:

- Immediate license suspension for blood alcohol levels exceeding 130 mg/100ml. The current threshold for immediate license suspension is 160mg/100ml.
- Immediate license suspension for a second drink-drive offence within four years.
- Vehicle impoundment for third or subsequent drink-drive offences within four years.

- ***Alcohol interlocks (S2)***

Additionally to this above work on legislative sanctions, Government agreed to further work by the Police, MoT and LTSA to investigate methods for encouraging repeat drink drivers to change their behaviour. In particular, a feasibility study would be conducted on the use of alcohol interlocks as part of a driver parole regime in New Zealand. A change in legislation to provide for an experimental trial would be necessary, however. This issue is examined elsewhere in relation to heavy goods vehicle and public transport operations.

- ***Drink driving toilet billboards in pubs and hotels***

In a joint initiative between LTSA and the Hotel Association of New Zealand, drink-driving billboards were installed in urinals in nearly 260 pubs and hotels throughout NZ during September 2004. The aim of these advertisements is to get men to think of the consequences of drinking and driving before they make the wrong decision. One of two messages is revealed at the urinal: either ‘if you drink then don’t drive you’re a bloody legend’ or ‘if you drink then drive you’re a bloody idiot.’

9.3.4. Observations

- *In New Zealand, awareness of the importance of enforcing drink-driving legislation is high. 76% of New Zealanders think that compulsory breath testing helps to lower the road toll.*
- *A high public perception of the risk of being detected above a blood alcohol limit which reflects up to date epidemiological considerations is the principal means of combating drinking and driving.*
- *Continued highly visible CBT activity at the current rate, combined with publicity at the current level, is needed to reach the 2010 target.*
- *Evidential breath testing equipment at the roadside would improve the operational efficiency of enforcement.*
- *To date there have been insufficient new interventions to allow the 2010 target to be reached.*
- *Reducing the blood alcohol level from 80 to 50mg/100ml in line with international best practice would give a 4.5% reduction in social cost by 2010 (a reduction of $103million annually) and save 14 lives and 260 injuries annually. In view of the importance of this measure, a concerted effort is needed to increase awareness and levels of support in the community for this measure.*
- *Reducing the BAC for young drivers from 30 to 100mg/100ml, as recommended in the Vulcan report) would save at least one life and prevent 26 injuries annually.*

- *Requiring alcohol interlock devices to be installed in the vehicles of all repeat drink/driving offenders (two offences within five years) and those convicted on BAC of 160mg/100ml would provide an 8% reduction in alcohol-related crashes (if the interlock were required to be used for two years after conviction and assumed to be 50% effective in reducing drinking and driving (Vulcan et al, 2003). This would correspond to an average annual reduction of 4.5 deaths and 20 serious injuries with an annual social cost saving of $26.2 million. A change in legislation to provide for an experimental trial would be necessary, however.*
- *Experimentation with alcohol interlock in commercial and public transport operations may provide a more direct route to realising the casualty reduction potential of alcohol interlocks to 2010.*

9.4. Dealing with serious offenders

9.4.1. Road Safety to 2010 Strategy – target-setting estimates and strategy commitments

Table 38: Estimates of the contribution of penalty changes to social cost reduction by 2010

Social cost reduction expected from interventions in Road Safety to 2010 Strategy				
	Business as usual to 2010	Enforcement	Mixed	Engineering
Vehicle impoundment	1.9%	1.9%	1.9%	1.9%
Licence suspensions	1.5%	1.5%	1.5%	1.5%
Alcohol interlocks		0.6%		

9.4.2. Road Safety to 2010 Strategy initiatives

Initiatives that help deal with serious offenders are discussed above, and include:
- immediate licence suspension for blood alcohol levels exceeding 130 mg/100ml
- immediate licence suspension for a second drink-drive offence within four years
- vehicle impoundment for third or subsequent drink-drive offences within four years
- immediate roadside licence suspension for exceeding the permanent posted speed limit by 40km/hour.

9.4.3. Observations
- *Dealing with serious offenders translates into small road safety benefits but addresses social justice considerations.*
- *Legislative changes are being put in place to bring about the above initiatives to deliver the 2010 targets, with the exception of alcohol interlocks.*
- *As mentioned previously, the potential for alcohol interlock devices to reduce recidivism is well established but needs legislative authority for trialling.*

9.5. Encouraging seat belt use

9.5.1. International perspective

Following the experience of Victoria, which introduced mandatory seat belt use in 1971, the introduction of mandatory seat belt laws in many countries has led to hundreds of thousands of lives saved worldwide. Many countries, including New Zealand have worked to achieve high levels of front seat belt use and increasingly high levels of rear seat belt use.

Recent crash studies indicate that the use of seat belts have a fatal injury-reducing effect of around 61% (Cummings et al, 2002). When combined with air bags, they have been found to reduce the risk of death in frontal crashes by 68%. Crash research also indicates that rates of seat-belt wearing are substantially lower in fatal collisions than the general average rate in normal traffic. For example, while the overall proportion of occupants wearing seat belts in traffic is around 90%, only around 55% of

drivers in fatal crashes in Finland wore seat belts (Valtonen,1991), and about 35% in Sweden (Kamrèn,1992).

Studies have shown that enforcement can achieve incremental increases in usage increases seat-belt use if it meets certain conditions. The enforcement needs to be risk targeted, highly visible and well publicised, conducted over a sufficiently long period and repeated several times during a year. Studies indicate that the benefit to cost ratio of such seat-belt enforcement programmes is of the order of 3:1 or more (ETSC, 1996).

Seat-belt reminders are intelligent visual and audible devices that detect whether seat belts are in use in various seating positions, and give out increasingly urgent warning signals until the belts are used. They are being fitted increasingly in new cars as an efficient means of further improving seat-belt use. In Sweden, for example, some 35% of all new cars sold currently have seat-belt reminders and it has been estimated there that reminders in all cars could lead to national levels of seat-belt use of around 97%, contributing to a reduction of some 20% in car occupant deaths (Lie and Tingvall,2003, Larsson and Nilsson, 2000). A 6:1 benefit to cost was estimated for requiring seat belt reminders in the front seat of cars in EU countries (ETSC, 2003).

9.5.2. Road Safety to 2010 Strategy – target-setting estimates and strategy commitments

Table 39: Estimates of the contribution of seat belt use to social cost reduction by 2010

Social cost reduction expected from interventions in Road Safety to 2010 Strategy			
	Enforcement	Mixed	Engineering
Restraint wearing	4.2%	4.2%	2.9%

The strategy acknowledges that while New Zealand has a relatively high rate of safety belt use, the rate could be further improved. The forecasting assumption was that a nationwide rate of 95% (engineering emphasis) and a 98% rate (mixed and enforcement emphasis) would be achievable by 2010 (which had been reached in some parts of New Zealand) to give a social cost reduction of 2.9% and 4.2% respectively.

2004 targets were set for 92% (front), 75% (rear) and children (90%) and have been met. Only around 6% of front seat occupants do not wear their seatbelts and around 19% do not wear a restraint in the rear seat.

9.5.3. Road Safety to 2010 Strategy initiatives

- ***Combined police enforcement and publicity***

The advertising and police enforcement programmes were extended to include restraint use in 1996 and have been highly effective in securing incremental increases in seat belt use. National and community campaigns have targeted both adult and child use of appropriate restraints.

- ***Expansion of restraint wearing surveys (S1)***

The LTSA conducts annual surveys to determine the safety belt wearing rate for front and back seat vehicle occupants and the restraint survey programme was significantly expanded from 114 sites to 274 sites in 2003. The increase in sites has enabled the reporting of results by territorial local authority wherever practicable.

9.5.4. Observations

- *Since the forecasting was conducted, new research indicates that the effectiveness of seat belts is higher than the original estimate, at 61% compared with 40% and 68% compared with 46%, when combined with airbags. The potential social cost saving from increased seat-belt use is likely to be an underestimate.*
- *Police and advertising efforts nationally and locally have been highly successful and current levels of support need to be maintained.*
- *The increasing fitment of seat-belt reminders in vehicles (particularly in European vehicles) should provide an important additional tool for encouraging higher levels of use and associated casualty reductions (see further information on this and child restraint top tethers in Section 9.7).*

9.6. Improving safety for pedestrians and cyclists

9.6.1. International perspective

Most pedestrian crashes occur within 1.6 km of the victim's home or place of business (Allsop, RE, ed 1999, NHTSA, 1998). The principal risk factor for unprotected road users is the mixing of unprotected people with motor vehicles capable of high speeds. The risk of a crash on roads without pavements separating pedestrians from motorised traffic is twice that on roads with pavements (Ossenbruggen and Pendharkar, 2001).

The survival of unprotected users depends upon ensuring either that they are separated from the high speeds of motor vehicles or – in the more common situation of shared use of the road – that the vehicle speed at the point of collision is low enough to prevent serious injury on impact with crash-protective car fronts (which are slowly becoming available through European legislation). At speeds of less than 30km/h, pedestrians and cyclists can mix with motor vehicles in relative safety. The absence of adequate separate pedestrian and cyclist facilities, such as footpaths or cycle tracks, creates a high risk for these road users. Poor provision at crossings and junctions is also a feature of unsafe shared use. In urban areas, most fatal or serious cyclist crashes occur at junctions.

However, underlying all other problems is the fact that the modern traffic system is designed largely from a car-user perspective. Mass motorisation since the 1960s has created a traffic system which caters mainly for motor vehicle users. Only since the 1980s has there been understanding about the need for coherent planning of route networks for pedestrians and cyclists, and only since the 1990s has long-term planning for sustainable transport policies got off the ground (OECD, 2001).

The safety of people walking in urban areas is now being considered in many countries active in road safety in the context of policies for encouraging people to travel on foot, by cycle or by public transport rather than by car, in order to reduce environmental damage, improve public health and enhance the quality of life in towns and cities. There is synergy between different objectives in several areas that can increase benefit to cost ratios and the case for implementing measures.

One example is reducing health risks related to sedentary lifestyle by implementing strategies for safer walking and cycling. European road safety experts have concluded that by implementing known strategies (as outlined in Figure 8) and countermeasures it should be possible to achieve considerable increases in the use of healthier and more environmentally friendly means of transport and still reduce the numbers of deaths and injuries among pedestrians and cyclists. However, it is emphasised that concerted evidence-based action needs to be taken by policymakers at local, national and international levels if a positive scenario is to be brought about.

Figure 8: Key strategies for pedestrian and cyclist safety (Allsop ed., 1999)

Key strategies for pedestrian and cyclist safety

- Land use planning which minimises exposure to risk in the course of pedestrian and cycling journeys.
- Creating safer, attractive, connected pedestrian and cycling routes within urban safety management framework.
- Managing traffic mix, by separating different kinds of road use to eliminate conflicts, where conditions are favourable to separation.
- Creating safer conditions elsewhere for integrated use of road space, e.g. through area-wide speed and traffic management, increased pedestrian, cyclist and vehicle conspicuity, and vehicle engineering and technology.
- Mitigating the consequences of crashes through better crash protection and encourage the use of protective equipment.
- Modifying the attitudes and behaviour of drivers of motor vehicles through information, training and the enforcement of traffic law.
- Consulting and informing pedestrians and cyclists about changes being made for their benefit, and encouraging them in steps that they can take to reduce their risk.

Some European countries have reported an effect known as the safety in numbers effect. It is thought that motorists are more aware and considerate of pedestrians and cyclists when there are more of them using an area. This creates a situation where increased numbers of pedestrians and cyclists using the road environment may result in fewer crashes per person. In some cases the actual numbers of pedestrian and cyclist crashes have increased (along with a reduction in the rate of crashes), but when promotional programmes are supported by appropriate traffic management in the form of area-wide traffic calming, speed reduction and other safety facilities, safety benefits can be achieved in both the number and the rate of injury and death.

In addition, from 2005, pedestrians and cyclists in Europe will benefit from Phase 1 of new legislation to require safe car fronts for pedestrians and cyclists in the event of a crash, with an injury-reducing effect of around 3% fewer deaths and 13% less serious injuries. Section 7.9 discusses how this and other vehicle measures could be expedited for the benefit of New Zealanders.

The fitment of daytime running lights on light vehicles will contribute to pedestrian and cyclist safety, since failing to see a motor vehicle is a well established contributory factor in crashes. A meta-analysis of the effects of daytime running lights concluded that 15% fewer pedestrians and 10% fewer cyclists were hit by cars (Elvik and Vaa, 2004).

New technology LED lighting systems would now make it practical to require better night time lighting systems on pedal cycles; however, more work would need to be done to be able to assess social cost reduction for this kind of intervention.

9.6.2. Road Safety to 2010 Strategy – target-setting estimates and strategy commitments

The Government highlights the need to ensure that urban road environments are safer for pedestrians and cyclists as well as for motor vehicle users, and notes the importance of reducing vehicle speeds in built-up areas. The development of a strategic framework is foreseen.

Social cost reduction expected from interventions in Road Safety to 2010 Strategy
Benefits included in other interventions

9.6.3. Road Safety to 2010 Strategy initiatives

In this priority area, four main initiatives have been introduced to help improve safety for pedestrians and cyclists. These are:

- ***Pedestrian and cyclist safety framework (S1)***

A framework has been established with the aim of providing a clear strategic platform for managing the safety of pedestrians and cyclists through best practice initiatives in the areas of engineering, education and enforcement.

- ***Safer routes (S1)***

Pedestrian and cyclist trips account for about all 20% of all trips made. Started in October 2002, the purpose of this project is to establish an environment that will encourage the delivery of well founded, integrated, community-based pedestrian and cyclist safety improvements to the road environment. Projects are initiated in communities with demonstrated safety issues, and solutions implemented involve engineering, enforcement, education and promotional strategies. Best practice guidelines for the development of Safer Routes have been agreed. The first four trial projects will be evaluated following the implementation of their Safer Routes strategies in 2006.

- ***Pedestrian and cyclist best practice standards and guidelines (S1)***

Best practice standards and guidelines are being developed for the planning of networks and the engineering of facilities for pedestrians and cyclists. The development and promotion of best practice is considered a basic step towards providing nationally consistent and safe walking and cycling.

9.6.4. Observations

- *The pedestrian and cyclist strategy is broad based and envelops a wide range of activity.*
- *Health and environment strategies related to increased cycling, walking and reducing congestion should be integrated and compatible with safety strategies. Implementation of activities should be co-ordinated to ensure safety is addressed in 'at risk' areas prior to the promotion of walking and cycling.*
- *The safety engineering (both road and vehicle) interventions in the pedestrian and cyclist strategy will need to be strong and foremost in the implementation plan to offset the increase in exposure to risk brought about by more cycling and walking.*
- *The importance of 30km/h as the threshold for severe pedestrian injury needs to be widely understood and the benefits of area-wide, traffic-calmed 30km/h zones in town/city centres and residential areas could be promoted via demonstration projects in the Safer Routes strategy.*
- *Cycle helmets reduce the risk of head and brain injuries by between 63% and 88% (Peden et al eds, 2004) and continuing high wearing rates achieved in New Zealand should be maintained.*

9.7. Improving the vehicle fleet

The vehicle design elements of heavy goods vehicle safety are dealt with in Section 9.9.3.

9.7.1. Light vehicle safety- International perspective

Substantial improvements in vehicle safety design internationally have taken place over the last 10 years leading to a large reduction in fatal and serious injury risk amongst car occupants. These results are due, principally, to heightened activity in Europe during the 1990s with spin-offs internationally. This comprises the effects of new legislative standards and the impact of new predictive and retrospective consumer information systems providing objective data on the performance of cars in state of the art crash tests and in real crashes. In the UK and Sweden, for example, vehicle safety improvements have produced a 15%-20% reduction in car occupant fatalities over the last two decades (Lie and Tingvall, 2003; Larsson and Nilsson, 2000).

In 1993, it was estimated that international vehicle safety standards were around 20 years behind the needs identified in in-depth crash injury research (ETSC, 1993). Since then, the take-up of state of the

art crash test procedures for a frontal offset deformable barrier test front and side impact protection in cars, either in European legislation or in European and Australian New Car Assessment (NCAP) programmes, have led to significant decreases in crash injury risk for car occupant internationally. It has been estimated that three- and four-star EuroNCAP (and Australian NCAP given its alignment with EuroNCAP) new cars offer a 30% lower risk of injury than cars with a lower rating or no rating (Tingvall and Lie, 2002).

While, in general, vehicle crash protection rather than accident avoidance measures continues to be the best hope for reductions in the next five years, legislation requiring the use of daytime running lights by cars and motorcycles has been enacted by many jurisdictions, which has resulted in useful reductions in casualties irrespective of the country's latitude. An Australian study of the use of DRL found crash reduction benefits of more than 10% (Paine, 2003). A Norwegian meta-analysis concluded that the introduction of DRL would lead to a reduction in the number of multi-party daytime crashes of between 10% and 15% (Elvik and Vaa, 2004). Analysis by SWOV (1997, 2004a, 2004b) and ETSC (2003) concluded that fitment of DRL could reduce deaths by 24.6% and 20% respectively.

The European and Australian NCAP programmes award additional point in their star rating scheme for the take up of audible seat belt reminders, improvements in child restraints and a pole test to replicate the risk of impact with roadside hazard. All these are beginning to result in improvements in car design in a variety of car models and will result in increasing percentage improvements in the best performing vehicles.

In Europe, the first phase of new legislation on pedestrian protection forecast to produce a 3% saving in deaths and a 13% reduction in serious injuries comes into effect for new designs in 2005. It is expected that the combination of this new legislation with the state of the art testing in EuroNCAP and Australian NCAP will start to have an impact on car design very soon.

Experience to date shows that while NCAP rating programmes may not have a significant influence of purchasing decisions, vehicle manufacturers have to allow for the possibility that the public may be strongly influenced by the NCAP programmes and, hence, aim to build good crashworthiness into their vehicles to achieve good NCAP ratings. In the US, Europe and Australia, consumer information programmes are being successfully used to influence the vehicle industry to provide safer vehicle packages.

Countries whose vehicle fleets are lagging behind world's best practice have the greatest potential for rapid increase in occupant protection through the introduction of compelling consumer information programmes. This is because vehicle manufacturers have developed the capacity for improved crashworthiness in most vehicle makes and models; however, often vital elements of the safety package are left out for some markets. A good example of this is that in the 1980s in Australia the imported variants of European and Japanese vehicles did not have airbags and other crashworthiness features of the exact same model vehicles which were being imported into the US and Europe. The introduction of Australian NCAP brought about rapid improvements in a short time frame of one to two years. While pedestrian protection and other safety devices will be available on European cars next year, it is not clear whether Japanese and Australian manufactured vehicles will also now start to provide this protection in response to ANCAP.

An effective way for the government to influence consumer choice of safer vehicles is for the government to set safe workplace standards for its own vehicle fleet. A very significant effect is that fleet vehicles are generally resold to private buyers in a three- to five-year time frame, so that they become a good source of safer, second hand vehicles for private buyers. The concept of government vehicle fleets setting an example is not new. In 1990, New South Wales' lead road safety agency, the Roads & Traffic Authority, introduced a government fleet safety strategy. Typical requirements were hard-wired headlights (surrogate daytime running lights), airbags etc. This was part of their Road

Safety 2000 strategy, which commenced in 1990. The NSW fleet safety strategy eventually led to development of a national fleet safety strategy. The NSW strategy at the time was to progressively spread the requirements to the entire state government fleet, then using occupational health and safety leverage to influence minimum safety specifications for all vehicles in private vehicle fleets.

Another example is that in 2003, the Swedish Government demanded high levels of safety for its vehicle fleet. In particular, for heavy vehicles, they require that all new heavy vehicles in their fleet have breath alcohol interlocks fitted. Furthermore, they require that any people contracting for government work have their vehicles fitted to the same specification.

The most influential factor in obtaining high levels of safety for child restraint systems is the use of a top tether strap fastened to a secure upper child restraint anchorage. The benefits of top tether anchorages are now well- recognised internationally, and were adopted many years ago in Australia and Canada. Whilst many countries did not follow the same early adoption of top tether anchorages, almost all vehicles produced since 1990 have had the anchorages in the vehicles whether required or not (in which case hidden under a cosmetic panel). New Zealand participates in the Australian and New Zealand standards process, and actively participates in the development of those standards, which require top tether straps. Cars in New Zealand could offer top tether anchorages to offer children levels of protection in accordance with world's best.

9.7.2. Road Safety to 2010 Strategy – target-setting estimates and strategy commitments

In view of all the rapid developments over the last decade, the estimates though, already large, probably underestimate the potential contribution of improvements in light vehicle safety to reaching the 2010 target.

Table 40: Estimates of the contribution of light vehicle safety to social cost reduction by 2010

Social cost reduction expected from interventions in Road Safety to 2010 Strategy				
	Business as usual to 2010	Enforcement	Mixed	Engineering
Standards and rules – light vehicles	15.5%	15.5%	15.5%	15.5%

The *Road Safety to 2010* Strategy notes that vehicle safety can be introduced more quickly by prohibiting imports of vehicles that do not comply with set standards and by improving consumer awareness of vehicle safety.

9.7.3. Road Safety to 2010 Strategy initiatives

The safety of the New Zealand vehicle fleet is gradually improving as a result of action in three main areas:

- Improvements in vehicle safety design and standards in overseas countries from where New Zealand sources its vehicles. With no major vehicle manufacturing industry, New Zealand has benefited from the research, development, field testing time and cost factors being covered by other countries.
- Regulatory action in New Zealand requires vehicles to be manufactured to approved vehicle standards and to be inspected before being imported into the country. Unlike most other OECD countries, New Zealand has a policy of accepting cars to many different international standards (Australia, US, Japan, EU and UNECE). However, these can differ quite a lot in safety quality. The crash tests and sub-system tests used in European and Australian consumer information programmes, based on world leading standards, are generally considered by independent professionals to be best practice.

- Consumer information programmes which have encouraged the international car manufacturing industry to make substantial improvements in crash protection for car occupants in various models, over and above the requirements of legislation.

Though the age of New Zealand's fleet has reduced over the years, the average fleet age remains high when compared with other highly motorised countries (See Table 40a).

Table 40a Average fleet age for selected highly motorised countries

USA	5
United Kingdom	6
European Union countries (15)	7
Canada	8.5
Australia	11
New Zealand	12

- ***Regulatory action***

Most often, responsibility falls on governments to achieve improvements in vehicle occupant safety and to ensure a level of consumer protection through regulation. In 1993, New Zealand introduced vehicle identification numbers and in 1995 introduced regulations clarifying a regime of vehicle inspection for registration purposes. Between 1997 and 2002, a series of new vehicle safety standards for active and passive safety (the Frontal Impact Rule requiring accelerated take up of a full-width barrier test rather than the offset deformable barrier test mentioned previously and which is more representative of 'real world' conditions) requirements related to safety belts, airbags, tyres, wheels, brake and vehicle inspections were put into place. The introduction and enforcement regimes of these rules firmly established a strategy of bringing New Zealand's vehicles towards world's best practice safety factors.

- ***Consumer information on vehicle safety***

The need to improve consumer awareness of vehicle safety is a key component of the *Road Safety to 2010* Strategy. The LTSA has promoted two major pieces of work in this area:

- Australian New Car Assessment Programme (ANCAP) crash results

The LTSA is a member of ANCAP, which is an organisation of government transport departments, motoring organisations and clubs. ANCAP tests in frontal impact, side impact and pedestrian tests, the crash performance of the vehicle structure and the occupant restraint system as well as awarding points in the safety rating for other in-vehicle safety devices. The LTSA regularly provides detailed ANCAP crash test results with the aim of encouraging buyers to make more informed decisions and encourages manufacturers to improve and promote product safety.

- *The Buyer's Guide to Used Car Safety Ratings*

In August 2004, the LTSA introduced the *Buyer's Guide to Used Car Safety Ratings* which stimulated substantial public interest. The guide uses data from over one million crashes on New Zealand and Australian roads to rate 255 popular used cars on how well they protect their drivers and how badly they injure the drivers of other cars. This publication complements the ANCAP programme.

9.7.4. Observations

- *The potential contribution of improved light vehicle safety to reaching the 2010 target was originally estimated to be around 15.5%.*
- *Given the limitations of the data on New Zealand fleet crashworthiness and the fact that forecasting in this area is complex, it has been difficult to make firm assessments concerning the actual and potential contribution of vehicle safety within the timescale of this review and further in-depth analysis involving independent multi-disciplinary expertise is recommended.*

- *Actions to achieve improvements are in place, but it is recommended that further measures be implemented to ensure that this 15.5% contribution and more is reached.*
- *What is clear is that despite the progress achieved in recent years, New Zealand is not yet maximising its opportunity to receive levels of vehicle crash protection in its fleet which could prevent many more deaths and serious injuries. It is estimated that with new measures, the further social cost reduction potential would be in the order of 10% or greater.*
- *Unlike many other highly motorised countries, New Zealand has not gone down the route of requiring legislative standards in line with technical progress covering a range of key improvements, e.g. side impact protection, improved frontal impact testing in cars, pedestrian protection, the latest improvements in child restraints and daytime running lights.*
- *However, New Zealand has a unique opportunity to identify and adopt a mix of implementation strategies to bring world's best practice in crashworthiness and consequent reduction in likelihood of vehicle occupant injury nationally.*
- *A possible mix of strategies is:*
  - *regulation on used imports, which constitutes approximately 80% of registrations in New Zealand*
  - *compelling consumer information programmes, using outcomes of Used Car Rating and ANCAP*
  - *leading by example, a high safety-rated government (and providers of services to government) passenger car fleet*
  - *limited regulation on new vehicles.*

- ***Regulation on imports**. One option by which New Zealand could ensure that it receives the level of in-vehicle safety provided in other highly motorised countries is the introduction of a complex set of regulatory vehicle safety standards (as the case for most other highly motorised countries). However, given that New Zealand is so far behind in this practice, this would require a significant effort to introduce and to monitor, and there may be difficulties with functional equivalents of various regulations. An alternative is to look at the potential and feasibility of a simple, real-world performance-based regulatory regime, taking advantage of the fact that vehicles in the used car imports scheme have been on the roads long enough to determine their real-world crash performance. An illustrative and possible scenario is as follows.*

A strategy for safer vehicle imports

Regulation on used imports

- Reducing, in two stages, the average age of the New Zealand car fleet which is estimated at 12 years compared with age of vehicle fleets in other developed countries which can be as low is 6 years (e.g. UK). Therefore, no vehicle older than the desired average fleet age to be imported).
  - From 2006, no used car imports to be more than 7 years old.
  - From 2008, no used car imports to be more than 5 years old.

- Ensuring that used car imports provide a reasonable level of safety performance by requiring from 2006:
  - Categories of large car, medium car, people mover, luxury and prestige cars, and four wheel drive vehicles to have an average probability of driver serious injury based on published data of less than 3.00.
    The rating of 3.00 is chosen because it both represents a cut off of the worst performing vehicles in that category, and still allows choice). From 2008, reduce the rating to 2.8.
  - Categories of light and small cars to have an average probability of driver serious injury based on published data of less than 4.20. From 2008, reduce rating to 4.00.
  - Cars less than two years old and new cars, to be required to have a rating in ANCAP (which is similar to EuroNCAP) of not less than three stars.
  - Cars which are not rated in either ANCAP or the Australian New Zealand Used Car Rating shall need to be tested to ANCAP protocols.

- ***Compelling consumer information programmes****. In New Zealand, there is no local manufacturing industry, and a large proportion of the vehicles are imported used cars, where the vehicle manufacturer does not have contemporaneous control of the crashworthiness of those cars. In this environment, New Zealand will need to do something extra to make NCAP programmes work. The suggested 'extra' is for NCAP and Used Car Ratings of vehicles to be given more emphasis by more conspicuous labelling on vehicles. It is important to understand that while experience with safety ratings to date may not show a significant influence of purchasing decisions, vehicle manufacturers have to allow for the possibility that the public may be strongly influenced by NCAP programmes and, hence, aim to build good crashworthiness into their vehicles to achieve good ratings.*

Mandatory windscreen stickers

- The strongly recommended labeling protocol is a dual labeling system where one label is a large temporary label required by consumer legislation for display on windscreens at point of sale. This would list the crashworthiness safety features of the vehicle as fitted. It would also include the vehicle's overall ratings from both NCAP and Used Car Rating if known. It also would include comparison to overall fleet average, and overall category average.
- The second label would be a permanent label including all the above information but in smaller type, so that the label can be fitted to an interior part of the vehicle, such as the glove box etc.
- This would list the crashworthiness safety features that the vehicle has fitted, e.g. side impact airbag curtains for head protection.
- These labels could be fitted to new vehicles and on used imported vehicles.

- ***Leading by example with safer government fleets***

An effective way for the Government to influence consumer choice of safer vehicles is to set safe workplace standards for its own vehicle fleet. A Vehicle Fleet Safety Strategy could be created, which is marketed to all government and private fleets using safe workplace (occupational health and safety) leverage to push aggressively for the introduction of the safety measures in the package. A possible scenario is outlined below:

A NZ Government Vehicle Fleet Safety Strategy

From 2006:

- New Zealand Government vehicles to have a 4 star rating in the ANCAP system or a Used Car Rating of less than 3.00
- All new and existing government vehicles to be fitted with daytime running lights to a new NZ specification
- All new government vehicles to be fitted with seatbelt reminder systems.
- From 2007: all new government vehicles to be fitted with driver's side head curtain airbags all new government vehicles to be fitted with driver's and front seat passenger's airbag

- ***Limited regulation on new vehicles***
  - *From 2008, all new cars to have an ANCAP rating of not less than 4 stars, based on the current star rating system and side impact head curtain bags for driver and passenger.*
  - *From the year 2006, all new vehicles, with no exemptions by category, could be fitted with daytime running lights to a new New Zealand specification. The use of LED technology would remove concerns about small environmental costs.*
  - *To offer children levels of protection in accordance with world's best practice, cars in New Zealand could offer top tether anchorages. From 2006, all new and used/imported vehicles sold in New Zealand could provide for three top tether anchorages on a rear row of seating.*

9.8. New and better targeted education initiatives

9.8.1. International perspective

- ***The role of education, information and publicity***

The World Report on Road Traffic Injury Prevention serves as a reference point for current international professional thinking about the role of education, information and publicity in road safety which is reproduced below in full.

> *'Public health sector campaigns in the field of road injury prevention have encompassed a wide range of measures, but education has always featured as the mainstay of prevention. In the light of ongoing research and experience of the systems approach to road injury prevention, many professionals in the field have re-examined the role that education plays in prevention. It is clear that informing and educating road users can improve knowledge about the rules of the road and about such matters as purchasing safer vehicles and equipment. Basic skills on how to control vehicles can be taught. Education can help to bring about a climate of concern and develop sympathetic attitudes towards effective interventions. Consultation with road users and residents is essential in designing urban safety management schemes. …..when used in support of legislation and law enforcement, publicity and information can create shared social norms for safety. However, when used in isolation, education, information and publicity do not generally deliver tangible and sustained reductions in deaths and serious injuries. Historically, considerable emphasis has been placed on efforts to reduce road user error through traffic safety education – for example, in pedestrian and cycle education for school children, and in advanced and remedial driver training schemes. Although such efforts can be effective in changing behaviour, there is no evidence that they have been effective in reducing rates of road traffic crashes.'*

It is often the case that more effort in the area of education and publicity is promoted as an alternative rather than an adjunct to more effective action.

9.8.2. Road Safety to 2010 Strategy – target-setting estimates and strategy commitments

Social cost reduction expected from interventions in Road Safety to 2010 Strategy
Benefits included in other interventions

9.8.3. Road Safety to 2010 Strategy initiatives

These fall into four broad areas: the national strategic advertising programme, information services, education programmes and media services, all of which are directed at supporting improved safety performance. Several initiatives have been introduced to better help educate people about various road safety issues comprising:

- ***Road safety education in schools***

The *Road Sense – Ata Haere* project is a road safety programme being offered to primary and intermediate schools in New Zealand and is a joint initiative between the LTSA, NZ Police, Ministry of Education, and schools, teachers, children and communities. The programme:

- offers an integrated cross-curricular approach to road safety education
- provides a meaningful context in which the curriculum can be delivered
- increases the amount of road safety education taking place in primary and intermediate schools
- builds and supports the work police education officers are doing in schools
- helps to develop life-long road safety thinking and learning
- empowers schools to teach more road safety and address road safety issues
- aims to create a safety culture in schools and communities.

The *Road Sense – Ata Haere (RSAH)* project is based on research completed in the UK in the early 1990s (TRL for DETR, *Road Safety Education in Schools – Good Practice Guidelines)* and subsequent research and trialing completed in New Zealand by Massey University, which sought to apply the UK models in the New Zealand setting. The main purpose of the RSAH project was to increase the amount and quality of road safety education taking place in primary and intermediate schools, and to thereby develop a sympathy and value for road safety and the various interventions that seek to improve it. It was not specifically designed to deliver any training in road user skills directly, which is generally delivered by police education officers, but to complement that training through a more frequent and regular delivery model. The programme is now in its third year, and there are strong indications that it has increased the quantity of road safety learning opportunities that children are exposed to in the 1000 participating schools. Evaluations of the quality of those experiences are yet to be completed.

The delivery of school road safety education has been the subject of a major review sponsored by the National Road Safety Committee, although the outcomes of that review have yet to be considered by the committee. The LTSA and Police have formed a working committee to plan the future of school road safety education.

- ***'Up to Scratch' driver education initiative (S2)***

This initiative is a voluntary test to help improve motorists' knowledge of the road code and road safety, and is targeted at the majority of drivers who receive no driver education between obtaining their licence and turning 80. Motorists receive an 'Up to Scratch' test every time they renew their licence, re-license their vehicle, or renew their vehicle's warrant of fitness. Prizes are offered as an incentive to complete the test.

- ***'Safety at work' programme (S2)***

The LTSA plans to enhance programmes for employers and employees on occupational road safety. The key deliverables for this initiative are:

- carrying out a campaign to expand on the speeding and other messages in the *Your Safe*
- *Driving Policy* booklet that has been jointly produced by ACC, OSH and the LTSA and distributed to over 2,500 employers
- working with regions to identify and provide resources to assist them to expand on their
- existing programmes with local employers.

- ***'Safe driving is good business' programme***

This is a programme jointly developed by the LTSA, ACC, OSH and the Insurance Council, which encourages employers to adopt best practice in implementing safe driving policies in the workplace.

- ***Improving road safety for Maori and Pacific peoples***

The LTSA has developed a Treaty of Waitangi strategy and a cultural strategy. Both strategies are designed to commit the LTSA to engage and working with Maori and Pacific peoples to address land transport safety issues in a culturally responsive way. In light of the Transport Sector Review and the impending dissolution of the LTSA, the printing and publication of the strategies and implementation plans have been cancelled. The development of similar strategies for the new Land Transport New Zealand crown agency is now being considered. This should be treated as a matter of urgency in order to maintain the confidence of the Maori and Pacific people who have worked with LTSA on the strategies.

9.8.4. Observations

- *Informing and educating road users can improve knowledge about the rules of the road and such matters as purchasing safer vehicles and equipment. Basic skills on how to control vehicles can be taught. Road safety education in schools can help to bring about a climate of concern and develop*

sympathetic attitudes towards effective interventions. Consultation with road users and residents is essential in designing urban safety management schemes.

- *While, in the past, considerable emphasis has been placed on efforts to reduce road user error through traffic safety education – for example, in pedestrian and cycle education for school children, and in advanced and remedial driver training schemes – there is no evidence that they have been effective in reducing rates of road traffic crashes.*
- *Road safety education in schools can help to bring about a climate of concern and develop sympathetic attitudes towards effective interventions.*
- *It is often the case that more effort in the area of education and publicity is promoted as an alternative rather than an adjunct to more effective action.*
- *However, when used in combination with police enforcement, such as the national advertising programme on speed, education can help to bring about important reductions in casualties.*
- *The development of strategies for the new Land Transport New Zealand crown agency for improving the safety of the Maori and Pacific people should be treated as a matter of urgency in order to maintain the confidence of the Maori and Pacific people who have worked with LTSA on previous strategies.*
- *Creating awareness of the consequences of speeding, drinking and driving and failing to wear a seat belt in the general population (rather than at serious offenders) is in line with best international practice.*

9.9. Other priorities

9.9.1. Young and novice drivers

9.9.1.1. International perspective:

All over the world, young and novice drivers are over-represented in total road crash casualties. As mentioned previously, in the absence of a firm evidence base to suggest that driver and rider education and training, compulsory or otherwise, reduces road crash risk for the general population, licensing arrangements remain an important means for managing exposure to risk. There has been considerable recent interest, however, in the value of elevated levels of supervised driving experience by novice drivers based on Swedish experience (Gregersen, 1997).

New Zealand was the first country in 1987 to introduce a graduated licensing system (GDL) for novice drivers and motorcyclists. Since then, such systems have been introduced in many countries, though the age of access to driving and riding is typically much higher elsewhere. In New Zealand, access is permitted at 15 rather than 17–18, which is usual in countries active in road safety. Commonly imposed restrictions include limits on night-time driving, limits on the number of passengers and a prohibition against driving after drinking any alcohol. These restrictions are lifted as new drivers gain experience and teenage drivers mature, gaining a full licence.

Many high-income countries restrict speed and engine performance for mopeds and motorcycles, with the aim of reducing rates of crashes and injury. Restricting the engine capacity for learner motorcyclists has proved to be a successful intervention. In the United Kingdom in the early 1980s, for instance, the maximum engine size of a motorcycle that learners could ride was reduced from 250 cc to 125 cc; this was accompanied by a limitation on the maximum power output (to 9 kW). As a result, many inexperienced motorcyclists transferred to less powerful vehicles, leading to an estimated 25% reduction in casualties among young motorcyclists (Broughton, 1987).

9.9.1.2. Road Safety to 2010 Strategy – target-setting estimates and strategy commitments:

Table 41: Estimates of the contribution of young and novice driver measures to social cost reduction by 2010

Social cost reduction expected from interventions in Road Safety to 2010 Strategy				
	Business as usual	Enforcement	Mixed	Engineering
Driving age		2.6%		
Stricter licensing conditions	1.1%	1.1%	1.1%	1.1%

9.9.1.3. Road Safety to 2010 Strategy initiatives:

- ***Novice Driver Education Pilot (S1)***

Novice drivers in New Zealand are involved in 16% of fatal crashes. The purpose of this project is to trial new approaches to driver education that enhance the value of the graduated driver licensing system as a progressive preparation of novice drivers for driving independently. The novice driver education pilot consists of two main areas of work. The first is a trial of an information campaign for novice drivers (primarily 15–19 year olds) and a trial of a competency-based training and assessment (CBTA) approach to graduation through the system.

- ***Information campaign***

Since the introduction of graduated licensing in 1987, there has been little local (New Zealand) promotion of the benefits, requirements and rationale for GDL. This is equally true for both novice drivers and the parents of novice drivers. The information campaigns for learner drivers and for restricted drivers are designed to provide information for both novice drivers and their parents and caregivers that will improve their understanding of and compliance with the requirements of the GDL and increase the levels of supervised driving experience gained by learners. Information is provided at relevant times in the GDL process. Participants in the learner stage of the campaign report levels of supervised driving up to 50% higher than non-participants over the period of their learner licence. The trial restricted campaign is still being evaluated although response rates (uptake by the target audience) have remained higher than expected and the information resources are rated highly by recipients.

- ***Trial of CBTA***

The trial of CBTA was initiated primarily in response to a recommendation from an independent ministerial review of the GDL. The trial was conducted in both the general population and in secondary schools. The trial is currently being evaluated.

- ***Observations***
  - *Nearly every evaluation of young driver crash involvement has noted that the most influential factor is age of access to the driving system – the older a driver is before they get access to the system, then the greater the reduction in crash involvement. At age 15, New Zealand's driver access to the system is significantly younger than world's best practice.*
  - *Factors such as the remoteness of many rural settlements in New Zealand have influenced the adoption so far of the unusually low minimum age and it is recommended that an urgent independent review be undertaken of the non-safety advantages and disadvantages of the low minimum age in order to inform further consideration of the powerful road safety arguments for raising it.*
  - *If crashes involving licensed drivers of the directly affected age group are removed then the savings in terms of percentage of total social cost would be 0.9% for increase to 16 years and 4.1% for increase to 17 years. If some allowance is made for less unsupervised driving in the age group immediately above the directly affected age group (learner drivers who have to be supervised have a lower crash rate per driver than those allowed to drive unsupervised) then*

the savings in terms of percentage of total social cost would be a 1.2% for increase to 16 years and 4.6% for increase to 17 years.

9.9.2. Older drivers

9.9.2.1. International perspective:

For many countries, over 20% of the population will be 65 years or above by 2030. While older drivers are more vulnerable to injury, contrary to popular belief, research has shown that a healthy older driver is no more likely to be in a crash than a younger driver. Healthy older drivers typically try to compensate for deficiencies by self regulation, e.g. by driving slower and avoiding rush-hour traffic or poor lighting conditions, or avoiding risk taking in general (Hakamies-Blomqvist, 2003).

However, many of these observations have been on a post-war generation of drivers who have some acceptance of the concept that they should retire gracefully from driving once their driving skills are diminished. With respect to the upcoming generation of older drivers (‘baby boomers‘), social researchers are suggesting that they may not voluntarily relinquish driving in the same manner as the previous generation. Planning for safer environments within the traffic system – in the network and in vehicles – thus becomes even more important.

An OECD Report (2001) highlighted the need for:

- support and funding to enable lifelong mobility
- support for older people to continue driving safely
- provision of suitable transport alternatives to the private car
- involvement of older people in policy development
- safer vehicles for older people
- development of safer roads
- appropriate land-use practices
- educational campaigns to ensure maximum mobility and safety for older people.

9.9.2.2. Road Safety to 2010 Strategy – target-setting estimates and strategy commitments:

The strategy foresaw work continuing on better ways of addressing older drivers’ abilities and on ways of assisting them to make informed decisions on whether to retire from driving.

9.9.2.3. Road Safety to 2010 Strategy initiatives:

The LTSA has worked on several initiatives in this area since 2002, including policy changes and operational changes. The Government has agreed to review the older driver licensing system, which requires people aged 80 and over to renew their license every two years in the context of the safety, accessibility and mobility objectives in the New Zealand Transport Strategy. In announcing the review, the Minister expressed his support for several changes to the current system which could be introduced next year, including the option of a conditional license which would allow older people to drive within a 10km radius of their home. Recommendations will be made to the Minister of Transport in June 2005.

9.9.2.4. Observations:

OECD experts have concluded that a strategy to ensure the safe mobility of older drivers should include:

- *support and funding to enable lifelong mobility*
- *support for older people to continue driving safely*
- *provision of suitable transport alternatives to the private car*
- *involvement of older people in policy development*

- *safer vehicles for older people*
- *development of safer roads*
- *appropriate land-use practices*
- *educational campaigns to ensure maximum mobility and safety for older people.*

9.9.3 Trauma management

9.9.3.1. International perspective:

The aim of post-impact care is to avoid preventable death and disability, limit the severity and suffering due to the injury and to ensure optimal functioning of the crash victim and re-integration into the community. The appropriate management of victims injured in road crashes following a crash is a crucial determinant of the chance and quality of survival. A review of European countries indicates that about 50% of deaths from road traffic collisions occur within minutes at the scene or in transit and before arrival at hospital. For those patients who are taken to hospital, some deaths occur within the first four hours after the crash (15%) but the majority occur after four hours (35%) (Buylaert ed., 1999). In reality, therefore, there is not so much a 'golden hour' (Lerner and Muscat, 2001) but a chain of opportunities for intervention across a longer timescale. The chain involves bystanders at the scene of the crash; emergency rescue; access to the emergency care system; and trauma care and rehabilitation. Effective trauma management is thus characterised by:

- efficient emergency notification
- fast transport of qualified medical personnel
- correct diagnosis at the scene
- stabilisation of the patient
- prompt transport to point of treatment
- access to rehabilitation services.

Since the social cost of death and disability are high, improved trauma management can have a large effect on social cost, even if the proportional reduction in death or disability rates is small (WP7). A UK study found that a 12% reduction in disability could be achieved by better post impact care (McKibbin B et al,1993).

9.9.3.2. Road Safety to 2010 Strategy – target-setting estimates and strategy commitments:

Table 42: Estimates of the contribution of post-impact care to social cost reduction by 2010

Social cost reduction expected from interventions in Road Safety to 2010 Strategy				
	Business as usual to 2010	Enforcement	Mixed	Engineering
Trauma management	0.9%	0.9%	0.9%	0.9%

The target-setting process estimated that a 2% reduction in deaths could be achieved by improvements in trauma care (0.9% reduction in social cost). The New Zealand Committee of the Royal Australasian College of Surgeons has indicated that the casualty reduction potential could be higher at 5%.

9.9.3.3. Road Safety to 2010 Strategy initiatives:

No specific projects have been undertaken under the auspices of the *Road Safety to 2010* Strategy to improve the trauma management of road crash victims. However, both ACC and the Ministry of Health are involved in work aimed at improving trauma management activities generally and have a particular focus on road accident victims. In 1999 ACC, the Health Funding Authority and the Ministry of Health jointly produced a strategy 'Roadside to Bedside – a 24-Hour Clinically Integrated Acute Management System for New Zealand' and since that time have been working on implementing such a system in New Zealand. Its features include:

- five regional networks centred on the five main (tertiary) medical centres (Dunedin, Christchurch, Wellington, Waikato and Auckland)
- delivering patients to the nearest hospital capable of providing definitive care
- capability for 'rescue'
- integration of services
- appropriate emergency transport systems
- agreed protocols, guidelines and standards
- workforce development and training
- access to telecommunications and emergency response.

9.9.3.4. Observations:

- *There is not so much a 'golden hour' for post-impact care but a chain of opportunities for intervention across a longer timescale. The chain involves bystanders at the scene of the crash; emergency rescue; access to the emergency care system; and trauma care and rehabilitation.*
- *Since the social cost of death and disability are high, improved trauma management can have a large effect on social cost.*
- *The Vulcan review recommended a study in at least one of the five regional networks to ascertain if there are similar problems in the management of major road trauma, as found in a recent Victorian study, and the extent of potentially preventable deaths.*

9.9.4. HGV safety

9.9.4.1. International perspective:

Heavy goods vehicles are over-involved in fatal crashes, since their high mass leads to severe consequences for other road users in collisions. In view of this and the growth in heavy good vehicle traffic internationally over the last 20 years, the safety of heavy goods vehicles continues to be heavily regulated in the best performing countries in road safety.

In European Union countries for example, in-vehicle speed limitation is required, and it has been estimated that speed governors on heavy goods vehicles could contribute to a reduction in 2% of all injury crashes (Elvik et al, 1997). Legislation covers braking and lighting standards. The fitment of front (rigid), side and rear under-run guards is also common. Increasingly, retro-reflective devices are being fitted. In Europe legislation to require spray-suppressant flaps has been passed to help improve visibility in wet weather and soon mirrors will have to be fitted to eliminate blind spots, which contribute to vulnerable road user crashes. In some countries, e.g. some of the Australian states, legislation also requires lower blood alcohol limits for drivers of heavy commercial transport, and the Swedish Government demands alcohol interlocks to be fitted to all contracting heavy goods vehicles. The European Union has recently passed legislation to require the fitment and use of seat belts in heavy goods vehicles.

HGV inspection regimes have been put in place internationally as the prime means of dealing with the problem of vehicle defects. In New South Wales, where in-depth research confirmed that a major factor was inadequate brake systems, a new regime of more vigilant inspections was put in place in association with widespread use of lower speeds (40 km/h for trucks on steep downgrades) and mandatory engagement of lower gear. New brake-testing equipment was introduced, and in particular new portable low-speed, dynamic, brake-testing equipment was developed so as to be able to conduct semi-random roadside brake tests. The combination of these restrictions, which led to vehicles being taken out of service, led to a rapid significant decrease in truck crashes related to brake defects.

Driving fatigue has been identified as a special problem for commercial transport, given the long distances that need to be covered and irregular shift patterns, which affect sleep. Research indicates that fatigue is most prevalent in long-distance lorry driving (Maycock, 1995) and a factor in 20%–30% of commercial road transport crashes in Europe and the United States (ETSC, 2001; NHTSA, 1996). International experts believe that crash risk data demonstrate that after 11 hours of work span the risk of being involved in a crash doubles, although drivers' hours regimes often permit a much longer working span. Increased crash risk occurs at night (peak levels at night can be 10 times daytime levels), the longer the working day and with irregular hours. European experts believe that the most important factor that will ensure safety is to effectively implement and enforce regulation which simultaneously addresses working time and driving time. Legislation to this effect is being introduced at European Union level.

9.9.4.2. Road Safety to 2010 Strategy – target-setting estimates and strategy commitments:

Table 43: Estimates of the contribution of HGV safety to social cost reduction by 2010

Social cost reduction expected from interventions in Road Safety to 2010 Strategy				
	Business as usual to 2010	Enforcement	Mixed	Engineering
Standards and rules – heavy vehicles		0.5%	0.5%	0.5%

The conservative assumption of 0.5% for new measures includes HGV under-run guards and visibility improvements.

With reference to the NRTC Truck Safety Benchmarking study, which covered a period 1995–1999, the Vulcan review indicated that trucks were grossly over-represented in deaths and serious injuries in New Zealand compared to other developed countries. While the New Zealand death rate per million km has decreased to around 3.2 in 2002, this remains higher than the performance of these countries in 1995–1999. It is possible that these other countries will also have improved too.

Deaths per 100,000,000 km of travel rates for truck-related fatalities were:-

NZ	5.5
Australia	2.5
USA	1.7
UK	1.8

In terms of the ratios of fatalities of trucks versus cars, the comparative figures were:-

NZ	3.30
Australia	2.07
USA	1.72
UK	1.49

In terms of what percentage of the fatalities trucks represented, this was reportedly:-

NZ	20.3%
Australia	14.9%
USA	13.0%
UK	16.3%

9.9.4.3. Road Safety to 2010 Strategy initiatives:

Minimum requirements in the Dimensions and Mass Rule were introduced in July 2002 aimed at improving heavy vehicle stability and safety and to reduce the high percentage (30%) of rollover

crashes in New Zealand compared with other countries. The LTSA estimated that the new requirements could prevent around 30 heavy vehicle loss of control and rollover crashes where no other vehicle was involved.

The LTSA is leading the development of inter-agency work on heavy vehicle safety. A discussion paper on heavy vehicle safety is to be released shortly. A scoping study for an operator safety rating system has been completed. In the last decade, the reduction in the number of heavy vehicle crash deaths per million kilometres travelled has not been more than 16% owing to the substantial growth in the total distance travelled by heavy vehicles. New Zealand's heavy goods vehicle safety record is worse than many other OECD countries.

The cost of heavy vehicle at fault crashes is $172 million. HGV driver speed is a major contributory factor in crashes and contributes to 18% of fatal crashes where only the HGV driver was involved or primarily at fault. Driving fatigue is reported as contributing to 9% of truck drivers at fault in fatal crashes. Countermeasures to reduce the incidence and severity of crashes with other motor vehicles and vulnerable road users include: education, divided highways, under-run protection, improvements in heavy vehicle field of view, braking and stability, reduction in frontal aggressivity, improved wheel guards, and greater separation of trucks and pedestrians at intersections.

9.9.4.4. Observations:

- *The contribution of improved heavy vehicle safety to reaching the 2010 target was 0.5%, based on new vehicle rules. While new Static Roll Threshold (SRT) Requirements have been introduced there is a small shortfall compared with the original estimate.*
- *HGVs are involved in 20% of road deaths in New Zealand and, given that the rate of growth and the volume of heavy vehicles is double the rate of overall traffic growth, new action is essential.*
- *With reference to the NRTC Truck Safety Benchmarking study which covered a period 1995–1999, the Vulcan review indicated that trucks were grossly over-represented in deaths and serious injuries in New Zealand compared to other developed countries. The New Zealand death rate per 100,000,000 kms of travel was three times higher than that of the best performer. While the New Zealand death rate per 100,000,000 kms of travel has decreased to around 3.2 in 2002 this remains higher than the performance of these countries in 1995–1999 which may also have improved.*
- *In general, heavy goods vehicle transport safety in New Zealand has been significantly under-regulated in key areas, when compared to the best performing countries in road safety which may explain its poorer performance.*
- *A number of heavy goods vehicle safety issues are being discussed. The Vulcan review called for the early implementation of a New Zealand heavy goods vehicle safety strategy and this recommendation is reiterated here.*
- *Effective strategies for improving heavy goods vehicle safety in New Zealand include:*
  - *The introduction of a significantly enhanced inspection system for vehicle defects and safety performance to result in the likelihood of a heavy vehicle being subjected to a random check once each year. Preliminary analysis indicates that this would be highly cost-effective.*
  - *Incentives for semi-trailer use rather than low tare multi-axle trailers. Road user charges (RUCs) in New Zealand encourage low-tare, multi axle set trailers which have lower handling performance characteristics and higher crash rates than the semi-trailer configuration used more widely overseas. At the same time more attention is given to reducing RUCs than fuel use providing less incentive to driver at safer fuel economy speeds.*
  - *The fitment of in-vehicle speed limiters on heavy goods vehicles would be in line with best international practice. If the current average mean speed of 93km/h could be reduced to 90km/h through an in-vehicle limiter, then it is roughly estimated that there would be a 6% reduction in HGV-related deaths or a 3% reduction for all casualties in HGV-involved crashes, giving a social cost reduction of 0.6%.*

- *Mandatory provision for fitment of frontal, rear and side under-run guards. It has been estimated that the provision of energy-absorbing front, rear and side under-run protection could reduce deaths by about 12% (Knight, 1998). The benefits would exceed the costs even of the safety effect of such measures were as small as 5% (Elvik, 1999).*
- *Mandatory seat belt use.*
- *Legislative restrictions on working and driving time which better reflect needs identified by research to reduce cumulative fatigue, and the use of tachographs for law enforcement.*

- *Ongoing multi-disciplinary in-depth study of heavy vehicle crashes in New Zealand is recommended to identify more fully the factors influencing crash and injury causation. The earlier comparisons to other countries show that the New Zealand heavy vehicle fleet has a significant over-involvement in crashes compared to heavy vehicle fleets in other countries.*

9.9.5. Motorcycle safety

9.9.5.1. International perspective:

Motorcyclists are particularly vulnerable road users, as are pedal cyclists and pedestrians. However, the difference is that motorcyclists travel at the same higher range of speeds as do car occupants.

The social cost of injuries among motorised two-wheeler users is much higher than for any other mode (Miller, 1999).

Table 44: Traffic crash cost per passenger-kilometres (Miller, 1999)

Mode of transport	*Cost per passenger km in $US*
Commercial aviation	0.01
Rail	0.06
Bus	0.23
Car	0.28
General aviation	0.39
Motorcycle	1.52

The principal successful means of reducing motorcyclist crashes and injuries employed seem to be in managing exposure to risk through licensing and testing controls; the encouragement of safer modes as an alternative to motorcycling; road engineering measures; the fitment and use of daytime running lights and requiring the compulsory use of crash helmets to standards that reflect 'real world' conditions. Despite the widespread belief that compulsory motorcycle training is an effective countermeasures and the focal point this has played in many road safety strategies, there is no evidence to show that it results in reduced deaths and serious injuries.

9.9.5.2. Road Safety to 2010 Strategy – target-setting estimates and strategy commitments:

The strategy envisages improving safety for motorcyclists through targeted research, trials of community–based projects and new approaches to licensing and training to allow effective motorcycle injury prevention programmes.

9.9.5.3. Road Safety to 2010 Strategy initiatives:

In New Zealand, a person may apply for a motorcycle learner permit at age 15 (the same age as for cars). Permit holders are restricted to a maximum speed of 70km/h, no alcohol, no pillion and an engine capacity of 250cc and under. After six months, they are able to apply for a restricted licence that retains the pillion and engine capacity limitations and does not allow night riding.

The Accident Compensation Corporation (ACC) is the lead agency on motorcycle safety (in addition to running several road safety educational programmes, supporting road safety community work and funding various safety equipment). In the late 1980s ACC levies on motorcycle licensing had a marked effect on registrations. Registrations reduced from around 30,000 in 1980 to around 2,500 in 1993 and

are now at around 5,000. The ACC is leading a project as part of the first *Road Safety to 2010* implementation schedule that aims to reduce the number and severity of injuries sustained by motorcyclists through strategies targeting key injury issues. The project aims to deliver strategies to target key injury issues for motorcyclists, including targeting licensing and training issues, protective gear, engineering issues and community delivery models. This includes the completion and evaluation of a community project pilot, and a competency-based training and assessment trial.

New Zealand injury insurer statistics indicate that motorcyclists have 10 times the injury claim per motorcycle compared to car occupants, and the costs of a typical motorcyclist's claim is similar to that of typical car occupant's claim, so that per motorcycle, the overall costs of injury claims are 10 times that of car occupants. The Vulcan review noted that the ACC premium collected for motorcycle use is currently set at 150% of the car rate, with the moped premium being 135% of the car rate. The ACC had also reported that motorcycle premiums fund only 13% of the motorcycle claims cost.

Reportedly, in recent years ACC has recorded increases in claims for motorcyclists, particularly for the motorcyclist 35 years and above. This mirrors recent research published by the US Insurance Institute of Highway Safety indicating that there is an increase of older motorcyclists being injured in crashes. In the United Kingdom, after a long-term downward trend in both motorised two-wheeler traffic and deaths related to their use, a resurgence of interest in these vehicles over the last decade has been accompanied by sharp increases in motorised two-wheeler deaths and serious injuries. The national level of deaths and serious injuries among users of motorised two-wheelers in 2003 was 50% above the average for 1994–1998. If New Zealand follows the trend such as in the UK and in other jurisdictions, injuries amongst older riders are likely to become an increasing problem. There are already indications that a significant number of motorcyclists are returning to riding around age 40 after many years of not riding.

9.9.5.4. Observations:

- *Motorcycling is a very high-risk activity compared with other travel modes.*
- *Motorcycle registrations have increased recently in New Zealand.*
- *Motorcycling is often promoted by the lobby as being an economical and environmentally clean form of transport. The cost of crashes shows that in fact it is a highly subsidised form of transport, with other road users providing that subsidy.*
- *The ACC could consider increasing motorcycle and moped premiums to more closely reflect their claims in order to recoup their costs.*
- *The minimum age for access to moped and motorcycle learner permits should be increased from 15 to 17 years and engine size for novice drivers should be reduced from 250cc to 125cc in line with international best practice.*
- *The fitment of twin, dedicated, daytime running lights using LED technology should be required on all new two-wheeled motor vehicles in line with international best practice*
- *Best practice in road environment treatments needs to be identified, particularly at junctions.*

9.9.6. Driving fatigue

9.9.6.1. International perspective:

Reference has been made to driving fatigue as an important cause of crashes for HGV drivers in Section 9.9.3. Fatigue or sleepiness is also present in crashes involving the general driving population, and is associated with a range of factors including long-distance driving, sleep deprivation and the disruption of circadian rhythms (Peden et al, 2004). High-risk groups have been identified as young people, particularly males, aged 16–29 years; shift workers whose sleep is disrupted by working at night or working long, irregular hours; people with untreated sleep apnea syndrome or narcolepsy (NHTSA, 2001). Estimates of the proportion of car crashes attributable to driver sleepiness vary, depending on the type of study and the quality of data. A population-based case-control study in New

Zealand found that factors that substantially increased the risk of a fatal crash or a crash with serious injuries were: driving while feeling sleepy; driving after less than five hours of sleep in the preceding 24 hours; driving between 2am and 5am. The study concluded that a reduction in all three of these behaviors could reduce the incidence of crashes involving injury by up to 19% (Connor et al, 2002).

9.9.6.2. Road Safety to 2010 Strategy initiatives:

In addition to the case-controlled study mentioned previously, various activities are underway by LTSA and the Community Road Safety Programme to create awareness about the dangers of driving fatigue and to implement engineering interventions on state highways including:

- An LTSA fact sheet on fatigue (available in hard copy and on the internet).
- Continual monitoring by LTSA of the international and New Zealand fatigue literature for new developments in fatigue research and statistics on the involvement of fatigue in crashes to assess the size of the problem.
- Engineering – rumble strips (audio-tactile thermoplastic edge lines) have been placed on sections of state highway to warn drivers who fall asleep or lose concentration and run off the road.
- Fatigue campaigns at community level are well resourced through the Community Road Safety Program which carries out a range of initiatives that deal with fatigue, such as:
  - fatigue stops – permanent and temporary
  - billboards – on state highways
  - pilot programme (drowsy drivers) working with employers of shift workers and their families
  - safe driving policy
  - police and transit fatigue tip cards.

As indicated previously, the LTSA's Community Road Safety Programme (CRSP) has played a strong role in this area. This programme has, as its primary objective, the mobilisation of the community and the building of grass roots support to help achieve *Road Safety to 2010* Strategy goals. A review of the CRSP was completed in March 2002 with the aim of enhancing its future capacity to support the *Road Safety to 2010* Strategy. Most of the recommendations in this report have now been implemented as part of the 'Community Road Safety Programme – Review Implementation' project that is part of the first *Road Safety to 2010* implementation schedule.

9.9.6.3. Observations:

- *Fatigue is recognised as a key impairment factor that contributes to crashes in the general driving population.*
- *Knowledge as to how to effectively address this problem by evidence-based measures (aside for road engineering) is still developing.*
- *Given the difficulty associated with identifying or recognising fatigue as contributing to a crash and the range of factors involved this area, continuing efforts should be made through periodical in-depth research to identify and evaluate interventions.*

9.9.7. Efficiency gain

9.9.7.1. Road Safety to 2010 Strategy – target-setting estimates and strategy commitments:

Table 45: Estimates of the contribution of efficiency gain to social cost reduction by 2010

Social cost reduction expected from interventions in Road Safety to 2010 Strategy				
	Business as usual to 2010	Enforcement	Mixed	Engineering
Efficiency gain	9%	9%	9%	9%

The 9% contribution of efficiency gain to the targeted reduction in social cost continues to be a reasonable assumption. The Vulcan review identified efficiency and effectiveness improvements which could reduce deaths by around 17%–25% to 2006 (5% social cost reduction). Most of these

improvements were in the region of strategic enforcement categories of speed control, drinking or drugged driver control, restraint management and visible enforcement. In addition, digital speed cameras, safety management systems, and the wider availability of evidential breath-testing equipment would go some way to achieving returns in this area.

10. The main partnerships in practice

10.1. The *Road Safety to 2010* Strategy government partnerships

Effective implementation of a strategy requires the involvement of the key stakeholders in developing the strategy and targets, and the clear allocation and acceptance of responsibility on their part.

One of the identifiable features of the progress made in New Zealand in the last decade is the early successful partnership developed particularly between the LTSA and the Police, and additionally the engineering partnership established with key stakeholders such as local authorities and Transit NZ. The extent to which road safety has become the core business of the New Zealand Police is an international success story with around 22% of the police budget being allocated to road safety-related activities in 2004/2005. New Zealand road safety policing has led to a substantial reduction of road trauma through pro-active on-road enforcement with a benefit to cost estimated at 8:1. Enforcement aimed at excessive speed and drink driving has yielded even higher ratios.

Table 45: The Government stakeholder partnership

National Road Safety Committee (NRSC) The NRSC is the Minister of Transport's highest-level road safety advisory group. It comprises the Chief Executive Officers of seven key agencies involved in road safety: •The Commissioner of Police: New Zealand Police is the national force policing New Zealand's road network, funded and managed through the New Zealand Road Safety Programme. This Programme will shortly be merged with the National Land Transport Programme to be managed by the new Land Transport Management Authority which will come into existence on 1st December 2004. •Secretary for Transport: the Ministry of Transport leads policy advice to government and prepares and manages road safety legislation. •Director of Land Transport Safety Authority (Chairman): The LTSA regulates and manages road safety, including administering the New Zealand Road Safety Programme which has funded and managed road policing, safety education and strategic services. LTSA is shortly to merge with Transfund to form the Land Transport Management Authority. •Chief Executive of Transit; Transit New Zealand manages the safety maintenance and improvement of the state highway network through the State Highway Programme. •Chief Executive of Accident Compensation Corporation (ACC): The ACC aims to prevent and manage motor vehicle injury through the Motor Vehicle Account, funding specific road safety initiatives and leading implementation of the NZ Injury Prevention Strategy. •Chief Executive of Transfund: managing the national Land Transport programme which funds network safety maintenance and improvement on state highways and local roads as well as walking and cycling projects, public transport and alternatives to roading and regional development. Transfund is shortly to merge with the LTSA to for the Land Transport Management Authority. • Chief Executive of Local Government New Zealand. Local Government New Zealand represents 12 regional council areas and 74 territorial and local authorities whose regional land transport strategies integrate safety into regional transport planning, and whose local land transport programmes manage the safety of local road networks.

One of the key strengths of the *Road Safety to 2010* Strategy is the partnership established in the National Road Safety Committee (NRSC) (Table 45). The NRSC, which meets frequently, brings

together the chief executives of the main government stakeholders of the strategy, which has provided the opportunity for excellent understanding of the task in hand and good cross-sectoral collaboration. The terms of reference for the NRSC are set out in a memorandum of understanding. Road safety is clearly identified as core business for each of the partners in their documentation. To date, the LTSA has provided successful leadership of this inter-governmental group but, due to the re-organisation of delivery for the transport field, the Ministry of Transport will take on this responsibility shortly.

While this is a time of major change in New Zealand in the way transport activity is organised and funded, which has placed new demands on chief executives, there are many examples of successful interaction between stakeholders in road safety activity and in transitional efforts to meet the challenges and opportunities of New Zealand's new transport strategy. The new opportunities for road safety offered by increased flexibility, new resource, and new mechanisms to secure improved road safety quality in the new funding arrangements for road controlling authorities put in place by Transfund will, no doubt, have benefited from this partnership.

New Zealand has recently signed up to World Health Assembly Resolution EB 113.R3, (May 2004) on road safety and health, which urges ministries of health to be involved in the framing of policy on the prevention of road traffic injuries. It calls for the public health sector and other sectors – government and civil society alike – to actively participate in programmes for the prevention of road traffic injury through injury surveillance and data collection, research on risk factors of road traffic injuries, implementation and evaluation of interventions for reducing road traffic injuries, provision of pre-hospital and trauma care and mental-health support for traffic-injury victims, and advocacy for prevention of road traffic injuries. In view of this development, the Ministry of Health might join and play an active role in the National Road Safety Committee in the future development of road injury prevention policy, in addition to the role it plays on the National Road Safety Working Group.

The developing New Zealand strategy for workplace health and safety to 2015 (DoL, 2004) also provides a new opportunity for the Department of Labour to contribute more directly to *Road Safety to 2010* Strategy via the National Road Safety Committee, given the prominence of motor vehicle crashes as a source of occupational injury and in view of the developing government strategies for in-house health and safety policies. The Department of Justice also has key responsibilities for road traffic law enforcement and should be represented at chief executive level on the National Road Safety Committee.

The NRSC has a National Road Safety Working Group made up of representatives of the NRSC organisations, which sets the agenda and prepares papers for quarterly NRSC meetings as well as setting up working groups on specific issues.

The LTSA also chairs a National Road Safety Advisory Group (NRSAG) which meets infrequently. The NRSAG provides advice and brings specific issues to the attention of the NRSC. The NRSAG includes representatives from NRSC agencies and the Ministry of Youth Affairs, the New Zealand School Trustees Association, New Zealand Automobile Association (AA), Ministry of Justice, Alcohol Liquor Advisory Council (ALAC), Te Puni Kokiri, the Ministry of Health, Department of the Prime Minister and Cabinet, Road Safety Co-ordinators, New Zealand School Trustees Association and Cycle Support New Zealand.

10.2. Observations

- *In the last decade, New Zealand's road safety work has been driven by highly successful governmental partnerships at national, regional and local levels.*
- *The leadership provided by the LTSA since its inception since 1993 and the extent to which road safety has become the core business of the New Zealand Police are international success stories.*
- *While the Ministry of Health is represented on the National Road Safety Advisory Group, it does not*

participate in multi-sectoral road safety policymaking in New Zealand at the highest level, being absent from the National Road Safety Committee despite its key role in trauma care and road injury prevention policy and the large cost of road injury to health.

- *The developing New Zealand strategy for workplace health and safety to 2015 (DoL, 2004) provides a new opportunity for the Department of Labour to contribute more directly to Road Safety to 2010 Strategy via the National Road Safety Committee, given the prominence of motor vehicle crashes as a source of occupational injury and in view of developing government strategies for in-house health and safety policies.*
- *The Ministry of Justice also has key responsibilities for road traffic law enforcement and should be represented at chief executive level on the National Road Safety Committee.*
- *The quarterly road safety progress report issued by the LTSA is perceived to be highly useful by all stakeholders and represents the best source of regular factual information ever seen by the reviewer*
- *Further observations are made about institutional arrangements and delivery partnerships in section 12.2.*

11. Unforeseen developments

Consultation with the government stakeholders has produced the following observations:

- A loss of focus on the importance in the medium to long term of continuing to be innovative in road management and engineering to meet more than just the impact of growing traffic volumes. Until recently, there was absence of new and innovative initiatives until the recent advent of speed zoning and the relatively low priority/imperative associated with safety retrofitting. Similarly there has been a significantly greater proportional increase in the allocation of funds to congestion relief and reduced comparative attention to safety has not drawn the level of discussion that might be expected.
- The perception amongst some commentators about revenue raising from speed camera deployment, which is having an unhelpful influence. Yet, as the Controller and Auditor-General's report (2002) concluded, that there is no evidence to support this view. The Police have no incentives to maximise revenue generated by the programme because infringement fees are paid directly to the Crown and are not available to the Police to spend on operations, and the Police's performance targets for the programme bear no relationship to the revenue collected. While a vocal minority object, public opinion surveys continue to show a good level of support for police enforcement, although demerit points require public educational effort, given the importance of securing a rational and consistent speed penalty policy.

Concern has been expressed by some stakeholders that recent policy decisions and announcements in light of the above are leading to mixed messages on road safety to the media and the wider public. Furthermore, that these may be unhelpful to securing progress in the Strategy. Concern about the possibility of deviating from evidence-based measures has also been articulated.

12. Conclusions

12.1. Progress towards the 2010 targets

It needs to be re-stated that it has not been possible for any significant evaluation of the effectiveness of *Road Safety to 2010* Strategy initiatives to date, although some evaluation is now underway. In many cases, therefore, best expert judgements are made on the basis of the information which does exist and with reference to the international evidence base.

An overview of progress to date in reaching the 2010 targets is given in the table below. Current progress is set against the target-setting estimates for the contribution of new measures/developments in the priority activity areas which underpin the strategy. In several priority areas, there has been significant progress towards the 2010 targeted reductions for reduced social cost. In other priority areas a significant shortfall towards reaching the social cost target is identified.

It is estimated that with no further evidence-based road safety initiatives over and above those planned to date, taking into account increases in traffic and using a multiplicative approach towards estimates of interventions, there is about a 23% shortfall in meeting targets for reductions in social cost.

Table 46 provides a summary of the progress made towards the 2010 targets in each of the priority action fields of the strategy. The detailed estimates for each priority area of the strategy are given for each area in Tables 47-57.

Table 46: Progress towards reducing social cost 2010 target from adopting new measures (mainly mixed option)

	Original Estimate	*Shortfall to 2010 Target*
Engineering safer roads	18.8% (mixed option)	-7% even after recent increased budgeting for safety-oriented road engineering
Reducing speed -open road speed management -urban road speed management	14.9% 11.6% (99km/h(eng. option) 3.3% (53km/h)(eng option) NB. 55km/h was the 2004 target	On course, but activity needs expansion in view of traffic growth
Combating drinking and driving	7.9%	-4.7%
Dealing with serious offenders	3.4%	-0.6%
Improving the vehicle fleet – light vehicles	15.5%	Actions in place but new activity recommended
Improving the vehicle fleet –heavy vehicles	0.5%	-0.1%
Encouraging seat belt use	2.9% (95%) 4.2% (98%)	On course if current levels of activity maintained
New and better targeted education initiatives	Benefits included in other initiatives	
Pedestrian and cyclist safety		
Young novice drivers	3.7%	-4.6%
Improving trauma care	0.9%	On course
Efficiency gain	9%	On course
Performance assessment	2%	On course

Table 47: Engineering safer roads

Social cost reduction expected from interventions in Road Safety to 2010 Strategy					
			Original estimate (OE)		
	Gap	Projection to 2010, 2004	Enforcement	Mixed	Engineering
Remedial works for sites identified under crash reduction studies (i.e. black spot treatments)	On course	2.1%	2.1%	2.1%	2.1%
General reading construction programme (including other minor safety works and excluding the effect from fuel tax increases (1)	0.5% above OE	5.5%	5%	5%	5%
Additional reading construction needed to achieve goal	-11.7% below mixed OE			11.7%	18%
Expected increases in reading construction from increases in fuel tax (2)	+ 2.8%	2.8%			
Expected increases in black spot treatments and other Maws (3)	+ 1.4%	1.4%			
TOTAL	**-7% off course**	**11.8%**	**7.1%**	**18.8%**	**25.1%**

(1) The safety benefits to be expected from other Minor Safety Works are included in these estimates. Information is not available on the amount of safety benefit to be expected from road construction for 1999-2001. The "pro-rated" estimates from 1999 to 2010 are obtained by assuming the annual incremental safety benefits for the three years to 2001 were similar to those from 2002-2010. (2) The additional safety benefits to 2010 as a result of the increases in fuel tax (that goes to the National Land Transport Fund) in March 2002 and in April 2005 were estimated at 1.3% and 1.5% respectively. The 1.5% estimate is a preliminary estimate only. (3) This is a policy change announced in September 2003 and the increase in the funding for MSW (black spots + other MSW) only applies to 2003/04 onwards. (4) Maw's - Minor Safety Works.

Table 48: Reducing speed

Social cost reduction expected from interventions in Road Safety to 2010 Strategy					
			Original estimate (OE)		
	Shortfall	2004 projection to 2010	Enforcement	Mixed	Engineering
Urban speed management	On course,	3.3%	5.3%	3.3% Target average mean speed = 53km/h NB 2004 target was 55km/h	3.3%
Open road speed management	On course	11.6%	19.1%	11.6% Target average mean speed = 99 km/h	11.6%
TOTAL	**On course**	**14.9%**	**24.4%**	**14.9%**	**14.9%**

Table 49: Combating drink driving

Social cost reduction expected from interventions in Road Safety to 2010 Strategy					
	Shortfall	2004 projection to 2010	Enforcement	Mixed	Engineering
Compulsory breath testing	On course	3.3%	3.3%	3.3%	3.3%
Reduced blood alcohol content	-4.5%	4.5%	4.5%	4.5%	4.5%
Zero BAC for young drivers	-0.1%	0.1%	0.1% (GDL review planned)		
TOTAL	**-4.6% off course**	**7.9%**	**7.9%**	**7.8%**	**7.8%%**

Table 50: Dealing with serious offenders

Social cost reduction expected from interventions in Road Safety to 2010 Strategy						
	Shortfall	Projection to 2010 as at 2004	Business as usual to 2010	Enforcement	Mixed	Engineering
Vehicle impoundment	On course	1.9%	1.9%	1.9%	1.9%	1.9%
Licence suspensions	On course	1.5%	1.5%	1.5%	1.5%	1.5%
Alcohol interlocks	-0.6% off course(see previous table)	0.6%		0.6%		
TOTAL	**-0.6% off course**	**4%**	**3.4%**	**4%**	**3.4%**	**3.4%**

Table 51: Encouraging seat belt use

Social cost reduction expected from interventions in Road Safety to 2010 Strategy					
	Shortfall	Projection to 2010 as at 2004	Enforcement	Mixed	Engineering
Restraint use	2004 target met. On course	4.2%	4.2%	4.2% Based on 98% front seat belt use	2.9%
TOTAL	**On course**	**4.2%**	**4.2%**	**4.2%**	**2**

Table 52: Improving the vehicle fleet

	Shortfall	Projection to 2010 as at 2004	Enforcement	Mixed	Engineering
Standards and rules – light vehicles	Actions in place but further activity recommended	+10% but only with new measures	15.5%	15.5%	15.5%
Standards and rules – heavy vehicles	-0.1%		0.5%	0.5%	0.5%
TOTAL	**-0.1%**		**16%**	**16%**	**16%**

Table 53: New and better targeted education initiatives

Social cost reduction expected from interventions in Road Safety to 2010 Strategy
Benefits included in other interventions

Table 54: Pedestrian and cyclist safety

Social cost reduction expected from interventions in Road Safety to 2010 Strategy
Benefits expected to match costs of increased exposure to risk from more walking and cycling

Table 55: Young and novice drivers

Social cost reduction expected from interventions in Road Safety to 2010 Strategy						
	Shortfall	Projection to 2010 as at 2004	Business as usual	Enforcement	Mixed	Engineering
Driving age	-2.6% original estimate)			2.6%		
Stricter licensing conditions			1.1%	1.1%	1.1%	1.1%
TOTAL	-4.6%		1.1%	3.7%	1.1%	1.1%

Table 56: Improving trauma care

Social cost reduction expected from interventions in Road Safety to 2010 Strategy						
	Shortfall	Projection to 2010 as at 2004	Business as usual to 2010	Enforcement	Mixed	Engineering
Trauma management	On course	2%	0.9%	0.9%	0.9%	0.9%

Table 57: Efficiency gain

Social cost reduction expected from interventions in Road Safety to 2010 Strategy						
	Shortfall	Projection to 2010 as at 2004	Business as usual to 2010	Enforcement	Mixed	Engineering
Efficiency gain	On course		9%	9%	9%	9%

12.2. Problems, gaps and opportunities

12.2.1. Overview

- **The systems approach:** The *Road Safety to 2010* Strategy is an excellent strategy and progress is being achieved. The strategy provides for the systems approach outlined in Table 3 which requires fundamental, wide-scale, long-term re-working of various aspects of the design and operation of the national traffic system, to achieve better interface between human, vehicle and road environment. Most of the casualty reduction progress to date, however, has been achieved through securing compliance with key safety rules through a combination of police enforcement, publicity and realising benefits in the vehicle fleet from vehicle improvements arising, in the main, from overseas regulation and consumer information. Reaching 2010 targets, against rising traffic, will mean that these two strategies will need additional initiatives (and both hold much further potential). In the other three key strategies of the systems approach – managing exposure to risk (e.g. restrictions on licensing, access to powerful vehicles, area-wide safety impact assessment on

land use and transport planning provisions and encouraging choice of safer transport modes), shaping the road environment for injury prevention, and post impact care – implementation and monitoring needs to be put in place as soon as possible in several areas to achieve the systems approach rationale.

- **Quantitative and qualitative gaps:** There are both quantitative and qualitative gaps in the programme as set out in previous sections. It is estimated that with no further evidence-based road safety initiatives over and above those planned to date, and taking into account increases in traffic and using a multiplicative approach towards estimates of interventions, there is about a 22% shortfall in meeting 2010 targets for reductions in social cost.
- **A long-term vision:** The creation of a long-term vision for road safety beyond 2010, which draws together those visions in existing transport and health strategies, could be useful given that these visions for transport and injury prevention might be perceived to be in conflict.
- **Renewed political leadership and policy packages:** The gaps provide opportunities for renewed political leadership in road safety in rolling out a series of evidence-based policy packages with new and current measures covering the priority areas of the strategy, especially in relation to engineering safer roads, improving vehicle safety, managing vehicle speed, improving pedestrian and cyclist safety, improving young and novice rider and driver safety, and combating drinking and driving. Developing and implementing evidence-based packages in no way excludes innovative measures (properly monitored so as to learn from them) to try to address problems such as fatigue, where research has provided only limited pointers so far to effective countermeasures, and new phenomena such as the mobile phone, where early action seems plausibly to be required ahead of longer term research. But of course, such interventions should not divert resources from the mainstream packages.
- **Priority measures early savings:** Large casualty savings and reduction in social cost could be obtained quickly from individual measures, such as reducing the blood alcohol limit to 50mg/100ml, increasing the age of access to a provisional motor vehicle riding and driving licence, and increasing speed enforcement operations.
- **Institutional arrangements:** The new organisational arrangements for transport in Government seem to open up a timely opportunity for review by Government and professionals of other key institutional arrangements as far as road safety is concerned (see section 12.2.1).
- **Sharing responsibility with new partners:** Notwithstanding that fact that the Accident Compensation Corporation leads the injury prevention strategy, the review has found a lack of evidence that road injury prevention is core business, in terms of policy development. The Ministry of Health should consider participating in the National Road Safety Committee, along with the Ministry of Justice and the Department of Labour who also share key responsibilities for road safety.
- **Data needs:** As a result of the information-gathering process of this of *Road Safety to 2010* Strategy and the current review by Statistics NZ of data systems, a range of recommendations are made about improvements in New Zealand's crash reporting systems (Section 12.2.2).

12.2.2. Achieving a mutually supportive institutional climate for road safety

The lengthy campaigns for many road injury prevention measures in many countries show that political decisions are not made merely on the basis of good evidence. In western democracies, important road safety measures rarely come about in the normal order of things or as a result of consensus of all stakeholders. Time after time, opposition from powerful sources has been an important barrier, even in those countries most active in road safety, and even when these are demonstrably cost effective and acceptable to the public, to introducing evidence-based measures (Breen, 2004).

Opposition can come from approaches which undermine health at the expense of economic considerations, where legislating in a high level of protection into products or operations may be seen as red tape or a barrier to trade, irrespective of the socio-economic benefit to be derived (Chapman and Lupton, 1994). Secondly, vociferous minorities perceiving state interference with civil liberties, and

which sometimes include motoring organisations, have played a part in delaying or preventing major road injury prevention policies. While such organisations in many different countries have opposed measures such as compulsory seat-belt use or random breath testing, public opinion surveys have usually shown a high level of support for interventions. Thirdly, vested commercial interests have a strong influence. Industry provides the products and services and thus, ultimately, shares responsibility for aspects of road safety. However, it can often be as much a part of the problem as a potential partner in delivering solutions. Examples include lobbying by the alcohol industry against reductions in legal blood alcohol limits for driving and the activity of the car industry in delaying or even preventing effective vehicle safety legislation (Breen, 2002, 2004).

Against the background of these influences, present in most democracies, achieving a mutually supportive institutional climate for road safety seems a tall order. However, as the World Bank and World Health Organisation, institutional arrangements can be established to advance the case of road safety and to help provide the conditions for successful and efficient implementation of road injury prevention measures. Most of the better performing countries in road safety have most if not all of these institutional elements, which comprise:

- Multi-sectoral government administration giving strong political leadership; identifying a lead agency in government to guide the national road traffic safety effort; assessing the problem and policies, using good data systems and research, as well as institutional settings; supporting the development of national capacity in public and private sectors and international co-operation; allocating financial and human resources to address the problem.
- Well supported national research sector providing impartial information for decision making and public debate that is assisted by a national transport research strategy, includes road safety developed with the advice of an independent advisory panel and support of independent multi-disciplinary research. For example – behavioural; road crash injury research, biomechanics and vehicle design; road safety engineering; demonstration projects; legislative development; continued appropriate levels of human and financial resource from Government.
- Well informed Parliamentary legislative committee on road safety providing all-party initiative, support and scrutiny, such as the Victorian Joint Standing Committee on Road Safety and the Parliamentary STAYSAFE Committee of New South Wales.
- Pro-active non-governmental coalitions of professionals and citizens to stimulate demand for safety and to scrutinise the detail of government policy which publicise the scale of the road injury problem; provide impartial information for policymakers and media; identify and promote effective, acceptable solutions; challenge ineffective policy options; form effective coalitions of organisations with a strong interest in casualty reduction; and measure their success by their ability to get things done, e.g. the National Society for Road Safety in Sweden.

To the outside observer, New Zealand has been operating since 1990 on the basis of only one of four of these key institutional elements – multi-sectoral government agency leadership. Outside Government, there is no leading champion for road safety.

While research in New Zealand clearly informs the agenda, and LTSA's own research and the watching brief it has kept on overseas research have been excellent and influential, there is no lead non-governmental research organisation that can contribute to public debate. A review of road safety research in New Zealand in 2003 indicates that 58% of research projects were carried out by government agencies or crown entities, with only 24% by the New Zealand university sector.

Clearly, there is Parliamentary interest in road safety but New Zealand currently does not have an all-party road safety committee which other countries have found to be valuable. While many non-governmental organisations have interests in road safety, there is no national coalition of professionals and organisations which actively work to identify and promote research-based measures to the wider community.

Observations:

- *An all-party Parliamentary approach to road safety has delivered important improvements to road safety in Australia and Europe. Parliamentarians are invited to consider if this would be appropriate to road safety in New Zealand.*
- *The appropriately ambitious nature of the Road Safety to 2010 Strategy means that road safety, health professionals and researchers in the non-governmental sector together with non-governmental organisations with a strong interest in road safety need to come together formally and nationally to champion road safety in order to overcome structural barriers to publicly acceptable, evidence-based road injury prevention measures. The ACC might consider pump-priming resource towards the establishment of a new non-governmental organisation.*
- *Consideration should be given to the encouragement and development of a lead research organisation in New Zealand for road safety which could contribute impartial information to policy and public debate. The ACC might consider a supporting role in such activity.*

12.2.3. New Zealand's crash reporting systems

As a result of the information-gathering process of this *Road Safety to 2010* Strategy and the current review by Statistics NZ of data systems, the following recommendations are made about New Zealand's crash reporting systems.

- The database of police-reported crashes treats injury and non-injury crashes differently, which limits analysis of vehicle and injury factors. For example, it is not possible to make an evaluation of the likelihood of an injury occurring, given the fact that a crash has occurred. This means the data presents significant difficulties for comparisons of vehicle crashworthiness amongst different vehicle models or to other fleets. It is recommended that there are the same data collection requirements for injury and non-injury crashes.
- A large number of injury crashes are not reported to the Police – the ACC receives claims for approximately three times as many injury crashes than are reported to the Police. It is recommended that a mandatory requirement is introduced to require that a claim to ACC is accompanied by a copy of the police report or reference number.
- It is recommended that the ACC database requires the police report number, so that the police data can be matched to the ACC data (this is a routine requirement in other state-wide injury insurance data bases, such as the Motor Accidents Authority in New South Wales, Australia).
- It is recommended that injuries be routinely coded, using descriptions of the injury and the Abbreviated Injury Scale, so that there is potential for matching this to the police crash database (this occurs in NSW MAA).
- It is recommended that police crash records should include a hospital admission number, and that hospital admission should include a police crash report number. This would then allow the matching of these two databases. In particular, because the hospital data includes descriptions of injuries, and records of admission etc., this would greatly increase the accuracy of estimating the costs of different crash types
- It is recommended that ongoing in-depth crash studies are carried out in New Zealand. These are typically carried out by researchers with scientific training and an objective, often multi-disciplinary approach involving behavioural scientists, traffic and mechanical engineers, and injury biomechanics professionals. They can be restrospective or 'on-the-spot' studies (necessary in the case of vulnerable road user crashes). New South Wales, as an example, has been conducting in-depth crash studies since the early 1970s and in the last 10 years has re-trained 100 of its heavy vehicle inspectors in crash investigation techniques.

12.3. Main recommendations

The following recommendations are made for the development of a third implementation package:

Recommendation 1
It is estimated that with no further evidence-based road safety initiatives over and above those planned to date and taking into account increases in traffic, the shortfall in the Government's targeted social cost reduction to 2010 is around 23%.

A range of new interventions has been studied and discussed nationally, many of which are known to be effective and practicable. It is recommended that an ambitious third implementation package be introduced to address this challenging but probably still achievable target (Section 12.2).

Recommendation 2
The third implementation package should comprise a series of well developed evidence-based stand-alone policy packages covering the priority themes of the *Road Safety to 2010* Strategy, which need to be rolled out as soon as possible. It is recommended that the contribution of each package to meeting the 2010 targets should be clearly identified (12.2).

Recommendation 3
Long-term targets, which are more ambitious than the 2004 goals for speed management, drink driving, restraint use, user group and regional outcomes, could now be formally set, as envisaged in *Road Safety to 2010* Strategy, even though these are implicit in the target-setting analysis.

Recommendation 4
The potential impact on safety of all activities aimed at the other four strategic objectives in the New Zealand Transport Strategy will need to be considered formally. It is recommended that formal area-wide safety impact assessments of land-use planning, transport projects and decisions be introduced to provide a key tool, alongside existing impact assessment for efficiency and the environment in order to integrate road safety into the transport system (Section 6).

Recommendation 5
The establishment of a vision for road safety, which brings together the aspirations of the two government visions set out in the Transport and Injury Prevention strategies which, currently, might be perceived to be in conflict, has the potential to boost road safety work (Section 7.1).

Recommendation 6
Updating the Value of Statistical Life (VOSL) on the basis of latest survey in New Zealand (1998) to reflect current knowledge about 'willingness to pay' and 'willingness to accept' considerations instead of a basis in average wage rate would give a truer indication of the cost effectiveness of road safety measures. The resulting higher cost effectiveness should lead to increased allocation of resources to road safety, to the extent that resources are allocated among competing objectives on the basis of cost effectiveness. The current VOSL is $2.8 million at June 2004 prices. Should the VOSL value be updated to take account of this survey data, the revised VOSL at June 2004 prices would be $4.16 million (GST excl) (Section 7.4.2).

Recommendation 7
While national and regional responsibilities are set out in legislation – Transit has a clear duty to provide a safe and sustainable state highway network – territorial authorities are not subject to any general statutory road safety objectives, and their legal obligations for the safety of the roading network remain a mixture of contractual, voluntary and common law legal obligations. The responsibilities of local authorities for road safety should be set out clearly in legislation. Such legislation would establish a duty, but would leave local authorities free to decide how to best carry out that duty in their local circumstances (Section 7.2.4).

Recommendation 8
In view of the core responsibilities of the Ministries of Health and Justice, and the Department of Labour, for key areas of road safety delivery, these government stakeholders should be members of the National Road Safety Committee at chief executive level (Section 10.1).

Recommendation 9
Traffic growth and the administrative changes for recording hospital admissions need to be monitored closely in view of the uncertainties these create for the progress of the strategy (Section 8).

Recommendation 10
It is recommended that the projected spend $5 billion for road engineering over the next 10 years takes full account of the high benefits to costs of further investment in road safety engineering, not least in the modestly funded road safety engineering schemes at single sites, which still generate extraordinarily high ratios of benefit to cost; cost-effective pro-active mass action on speed zoning, median barriers and roadside hazard treatment and area-wide urban safety management (Section 9.1).

Recommendation 11
The further development and application of a national functional road classification system where speed limits, road design and self-explaining layouts match road function, could provide a rational framework to take forward the current discussion about speed limits and road design. It is recommended that a lead agency be appointed by the Ministry of Transport with a target date for implementation to conduct this task with the full co-operation of all key stakeholders (Section 9.1).

Recommendation 12
In view of the good framework which the safety management system tool provides to encourage road safety engineering expertise to be applied widely and systematically and the encouraging take-up to date, it is recommended that Transfund considers requiring the use of SMS as a condition for receiving grants for road safety with an appropriate lead time (Section 9.1).

Recommendation 13
Upper speed limits on open roads and the range of speed limits operating in urban areas are much higher in New Zealand than in the best performing countries in road safety. Appropriate upper speed limits to match road function, in line with international best practice, could be reviewed in the context of establishing the new national road hierarchy or classification mentioned previously (Section 9.2).

Recommendation 14
Area-wide, traffic-calmed 30km/h zones are commonly implemented in Europe within an urban safety management approach and, if implemented in New Zealand, could make a significant improvement in the safety of vulnerable road users and car occupants (Section 9.2).

Recommendation 15
The progress to date provides opportunity for improvement to target to 2010 average mean speeds of 51 km/h in urban areas and 93 km/h in rural areas which will save many more lives over the remaining five years of the strategy (Section 9.2).

Recommendation 16
Well publicised area-wide speed camera operations are an efficient and cost-effective means of achieving reductions in speed-related crashes and injuries. Urgent consideration should be given to increasing the number of speed cameras and speed cameras hours in support of the ‘anytime anywhere policy’ aimed at a 3.9% reduction in social cost. Flexibility should be given to the Police to obtain an appropriate balance between overt and camouflaged operations at individual sites (Section 9.2).

Recommendation 17
It is recommended that further consideration be given to allocating speed demerit points in speed camera operations as they can be in other speed enforcement operations to achieve consistency in the speed penalty policy (Section 9.2).

Recommendation 18
The mandatory fitment of in-vehicle speed limiters on heavy goods vehicles would be in line with best international practice. If the current average mean speed of 93km/h could be reduced to 90km/h through an in-vehicle limiter, then it is roughly estimated that there would be a 6% reduction in HGV-related deaths or a 3% reduction for all casualties in HGV-involved crashes giving a social cost reduction of 0.6% (Section 9.2).

Recommendation 19
To date there have been insufficient new interventions to combat drinking and driving to allow the 2004 and 2010 targets to be reached. Reducing the blood alcohol level from 80 to 50mg/100ml in line with international good practice is the only drinking and driving countermeasure not yet implemented which could produce significant savings – in this case a 4.5% reduction in social cost by 2010 (a reduction of $103 million annually) – and save 14 lives and 260 injuries annually (Section 9.3).

Recommendation 20
Reducing the BAC for young drivers from 30 to 10mg/100ml (effectively zero), as recommended in the Vulcan report) would save at least one life and prevent 26 injuries annually (Section 9.3).

Recommendation 21
Given that a high public perception of the risk of being detected above a blood alcohol limit is a key means of combating drinking and driving, continued highly visible CBT activity at the current rate, combined with publicity at the current level will be needed to reach the 2010 target. Evidential breath testing equipment at the roadside would improve the operational efficiency of enforcement (Section 9.3).

Recommendation 22
Experimentation with alcohol interlock devices in commercial and public transport operations may provide a more direct route than for repeat offenders (which requires enabling legislation for trialling and which should be put in place) to realising the casualty reduction potential of alcohol interlocks to 2010, but this potential needs to be assessed (Section 9.4).

Recommendation 23
Police enforcement and advertising efforts nationally and locally have been highly successful in securing incremental increases in seat belt use and current levels of support need to be maintained for these activities (Section 9.5).

Recommendation 24
The increasing fitment of seat belt reminders in vehicles (particularly in European vehicles) provides an important additional tool for encouraging higher levels of use and associated casualty reductions and their provision in new vehicle imports should be strongly encouraged (Section 9.5).

Recommendation 25
Health and environment strategies related to increased cycling, walking and reducing congestion should be integrated and made compatible with safety strategies. Implementation of activities should be co-ordinated to ensure safety is addressed in ‘at risk’ areas prior to the promotion of walking and cycling (Section 9.6).

Recommendation 26
The safety engineering (both road and vehicle) interventions in the pedestrian and cyclist strategy will need to be strong and foremost in the implementation plan to offset the increase in exposure to risk brought about by more cycling and walking. The importance of 30km/h as the threshold for severe pedestrian injury needs to be widely understood. The benefits of area-wide, traffic-calmed 30km/h zones in town/city centres and residential areas should be promoted via demonstration projects in the Safer Routes strategy. Cycle helmets reduce the risk of head and brain injuries by between 63% and 88% and continuing high wearing rates achieved in New Zealand should be maintained (Peden et al eds, 2004) (Section 9.6).

Recommendation 27
Despite the progress achieved in recent years, New Zealand is not yet maximising its opportunity to receive levels of vehicle crash protection in its fleet, which are being experienced abroad and could prevent many more deaths and serious injuries. With a unique opportunity to identify and adopt a mix of implementation strategies to bring world's best practice in crashworthiness and consequent reduction in likelihood of vehicle occupant injury nationally it is recommended that New Zealand employs the following mix of strategies: a strategy for regulating used imports, compelling consumer information programmes, using outcomes of Used Car Rating and ANCAP including mandatory windscreen labelling, leading by example a high safety-rated government (and providers of services to government) passenger car fleet and limited regulation on new vehicles as set out in (Section 9.7).

Recommendation 28
Early implementation of a New Zealand heavy goods vehicle safety strategy is recommended which should include: an effective inspection system for vehicle defects and penalties which improve performance; incentives for semi-trailer use rather than low tare multi-axle trailer; the mandatory fitment of in-vehicle speed limiters on heavy goods vehicles; the mandatory provision for fitment of frontal, rear and side under-run guards; mandatory seat belt use; legislative restrictions on working and driving time which better reflect needs identified by research to reduce cumulative fatigue and the use of tachographs for law enforcement; and the introduction of an operator safety rating system (which also reflects early voluntary take-up of these measures) (Section 9.9.4).

Recommendation 29
A phased raising of young driver age should be considered; for example, raising the age for access to 16 in 2006 and to 17 in 2008. Factors such as the remoteness of many rural settlements in New Zealand have influenced the adoption so far of the unusually low minimum age and it is recommended that an urgent independent review be undertaken of the non-safety advantages and disadvantages of the low minimum age in order to inform further consideration of the powerful road safety arguments for raising it (Section 9.9.1).

Recommendation 30
A strategy to ensure the safe mobility of older drivers should include support and funding to enable lifelong mobility; support for older people to continue driving safely; provision of suitable transport alternatives to the private car; involvement of older people in policy development; safer vehicles for older people; development of safer roads, safer pedestrian routes and lower speed limits in residential areas; appropriate land-use practices; and educational campaigns to ensure maximum mobility and safety for older people (Section 9.9.2).

Recommendation 31
The Vulcan review recommended a study in at least one of the five regional networks to ascertain if there are similar problems in the management of major road trauma, as found in a recent Victorian study, and the extent of potentially preventable deaths, which is supported (Section 9.9.3).

Recommendation 32
Motorcycling is a very high-risk activity, motorcycle registrations have increased recently in New Zealand and motorcycling is often promoted by the lobby as being an economical and environmentally

clean form of transport. However, the cost of crashes shows that in fact it is a highly subsidised form of transport, with other road users providing that subsidy and this needs to be acknowledged in public policy (Section 9.9.5).3

Recommendation 33
The Accident Compensation Corporation should consider increasing motorcycle and moped premiums to more closely reflect their claims in order to recoup their costs; the minimum age for access to moped and motorcycle learner permits should be increased from 15 to 17 years in line with international best practice; the permitted engine size for novice drivers should be reduced from 250cc to 125cc; the fitment of twin dedicated daytime running lights using LED technology should be required on all new two-wheeled motor vehicles in line with international best practice; and best practice in road environment treatments needs to be identified, particularly at junctions. International experience shoes that investment in educational approaches has shown little return (Section 9.9.5).

Recommendation 34
It is recommended that the chief executives of the Ministries of Health andJustice, and the Department of Labour join the National Road Safety Committee at chief executive level to assist in realising the Government's road safety objectives outlined in the *Road Safety to 2010* Strategy (Section 10.2).

Recommendation 35
The new organisational arrangements for transport in Government seem to open up a timely opportunity to review other key institutional arrangements as far as road safety is concerned. An all-party Parliamentary approach to road safety formalised in an all-party road safety committee has delivered important improvements to road safety in Australia and Europe, and parliamentarians may wish to consider if this would be appropriate to road safety in New Zealand (Section 12.2.1).

Recommendation 36
Consideration should be given to the encouragement and development of a lead research organisation in New Zealand for road safety which could contribute impartial information to policy and public debate. The ACC might consider a supporting role in such activity (Section 12.2.1).

Recommendation 37
The appropriately ambitious nature of the *Road Safety to 2010* Strategy means that road safety and health professionals and researchers in the non-governmental sector, together with non-governmental organisations with a strong interest in road safety, should come together formally and nationally to be an additional champion for road safety in order to overcome structural barriers to publicly acceptable, evidence-based road injury prevention measures. The ACC might consider pump-priming resource towards the establishment of a new non-governmental organisation (Section 12.2.1).

Recommendation 38
As a result of the information-gathering process of this *Road Safety to 2010* Strategy and the current review by Statistics NZ of data systems, the following recommendations are made about New Zealand's crash reporting systems. It is recommended that:

- There are the same data collection requirements for injury and non-injury crashes.
- A mandatory requirement is introduced to require that a claim to ACC is accompanied by a copy of the police report or reference number.
- The ACC database requires the police report number.
- Injuries be routinely coded, using descriptions of the injury and the Abbreviated Injury Scale.
- Police crash records include a hospital admission number, and that hospital admission include a police crash report number.
- Ongoing in-depth crash studies are carried out in New Zealand (Section 12.2.2).

13. References

Land Transport Safety Authority (2003), *Road safety to 2010*, Wellington October, 2003

Injury Prevention Research Unit (2001), University of Otago, IPRU Fact sheet 22, ISSN -1172-8388, 2001

Ministry of Health (1999) Our health Our Future, MoH, Wellington, 1999

Ministry of Transport (2002), *New Zealand Transport Strategy*, Wellington, December 2002

National Research Bureau (2004), Survey of New Zealanders' attitudes to road safety, Oct-Nov, 2004

Wegman FCM et al (1994). *Road safety impact assessment*. Leidschendam, Institute for Road Safety Research, 1994 (SWOV Report R-94-20).

Allsop R (1997). *Road safety audit and safety impact assessment*. Brussels, European Transport Safety Council, 1997.

Land Transport Safety Authority (2000), *Safety Directions, Estimated effects of interventions on road safety outcomes to 2010, Working Paper 7, October 2000*

Eds. Peden M, Scurfield R, Sleet D, Mohan D, Hyder A, Jarawan E and C Mathers (2004) : *World Report on Road Traffic Injury Prevention*, World Health Organisation, Geneva, 2004.

Land Transport Safety Authority (2000), *Safety Directions Predicting and costing road safety outcomes Working Paper 6, October 2000*

Accident Compensation Corporation *(2003) New Zealand Injury Prevention Strategy*, June 2003

Kjemtrup K, Herrstedt L (1992*). Speed management and traffic calming in urban areas in Europe: a historical view*. *Accident Analysis and Prevention*, 1992, 24:57–65.

Brilon W, Blanke H (1993). *Extensive traffic calming: results of the accident analyses in six model towns.* In: *ITE 1993 Compendium of Technical Papers*. Washington, DC, Institute of Transportation Engineers, 1993:119–123.

Department for Transport, TRL Ltd, Institution of Highways and Transportation (2003) *Urban safety management guidelines Road Safety Strategies for Urban Communities* HMSO, London, 2003

Delaney A.. Diamantopolou K, Cameron M. (2003) *MUARC 's speed enforcement research:principles learnt and implications for practice* .Melbourne,Monash University Accident Research Centre,2003 (Report No.200).

Vulcan P, Hayes I W, Haworth N, Mclean J.(2003) *Assessment of Strategies, Policies and Programmes Affecting Road Safety.* Land Transport Safety Agency of New Zealand report, 2003.

European New Car Assessment Programme (Euro-NCAP) (2004) [web site]. (http://www.euroncap.com/ results.htm,

Australian New Car Assessment Programme [web site]. (2004) (http://www.mynrma.com.au/motoring/cars/crash_tests/ancap

OECD (2001). Ageing *and transport: mobility needs and safety issues*. New Zealand Road Safety Research, LTSA, 2003, ISSN 1174-6017, June 2004

Knight I (2001). *A review of fatal accidents involving agricultural vehicles or other commercial vehicles not classified as a goods vehicle, 1993 to 1995*. Crowthorne, Transport Research Laboratory, 2001 (TRL Report No. 498).

Elvik R. (1999) *Cost-benefit analysis of safety measures for vulnerable and inexperienced road users*. Oslo, Institute of Transport Economics, 1999 (EU Project PROMISING, TØI Report 435/1999).

Guria J (1998) *An economic evaluation of incremental resources to road safety programmes in New Zealand*. Accident Analysis and Prevention, Volume 31 (1-2), 1998, pp 91-99.

World Health Organisation (2004), *World Health Assembly Resolution EB 113.R3*, (May 2004)

Department of Labour (2004). *Workplace Health and Safety Strategy for New Zealand to 2015: Draft for Consultation*, August 2004.

Controller and Auditor-General (2002) *Bringing Down the Road Toll: the Speed Camera Programme.* Report of the Controller and Auditor-General, Wellington, New Zealand, 2002.

Breen J (2004) *Road safety advocacy*, BMJ 2004;328;888-90

Peter Bielby Consulting Ltd (2003), A *review of local authority road safety management for local government New Zealand,* September 2003

Racioppi F, Eriksson L, Tingvall C, Villaveces A. (2004) *Preventing Road Traffic Injury: A Public Health Perspective For Europe.* World Health Organisation, 2004.

Allsop R.E. Ed (2003). *Risk assessment and target setting in EU transport programmes,* European Transport Safety Council, Brussels, 2003.

Wegman F, Elsenaar P (1997). *Sustainable solutions to improve road safety in the Netherlands.* Leidschendam, Institute for Road Safety Research, 1997. (SWOV Report D – 097 – 8).

Tingvall C. The Zero Vision. In: van Holst H, Nygren A, Thord R, eds (1995). *Transportation, traffic safety and health: the new*

mobility. *Proceedings of the 1st International Conference, Gothenburg, Sweden, 1995.* Berlin, Springer-Verlag, 1995:35–57.

Tingvall C (2003), *Targeted Road Safety Programmes in the EU.* Brussels. European Transport Safety Council, *Best in Europe Conference proceedings,* 2003.

OECD (1994), *Targeted road safety programmes*. Paris, Organisation for Economic Co-operation and Development, 1994.

Elvik R. (2001) *Quantified road safety targets: an assessment of evaluation methodology*. Oslo, Institute of Transport Economics, 2001 (Report No. 539).
Wegman F Ed, (2001) *Transport safety performance indicators*. Brussels, European Transport Safety Council, 2001.

Koornstra MK et al. (2002) *Sunflower: a comparative study of the development of road safety in Sweden, the United Kingdom and the Netherlands.* Leidschendam, Institute for Road Safety Research, 2002.

National Survey of Crime Victims (2001), New Zealand

Miller T et al (1999) *.Is it safest to travel by bicycle, car or big truck?* Journal of Crash Prevention and Injury Control,1999,1:25 –34.

Rumar K. (1999) *Transport safety visions, targets and strategies: beyond 2000*. [1st European Transport Safety Lecture]. Brussels, European Transport Safety Council, 1999 (http://www.etsc.be/ eve.htm, accessed 30 October 2003).

Buddle Findlay (2004) Legal *Obligations For The Safety Of The Roading Network,* A Report by Buddle Findlay for the Land Transport Safety Authority 26 July 2004

Department for Transport (2004), *Assessing the casualty reduction performance of local highway authorities*, Road Safety Research Report No 53, IISSN 1468-8138, www.dft.gov.uk, London, September 2004.

Compton RP et al (2002). Crash risk of alcohol impaired driving. In: Mayhew DR, Dussault C, eds. *Proceedings of the 16th International Conference on Alcohol, Drugs and Traffic Safety, Montreal, 4–9 August 2002*. Montreal, Société de l'assurance automobile du Québec, 2002:39–44

Taylor MC, Lynam DA, Baruya A. (2000) *The effects of drivers' speed on the frequency of road accidents*. Crowthorne, Transport Research Laboratory, 2000 (TRL report 421).

Taylor MC, Baruya A, Kennedy JV. (2002)*The relationship between speed and accidents on rural single-carriageway roads*. Crowthorne, Transport Research Laboratory, 2002 (TRL Report 511).

Ogden KW. (1996) *Safer roads: a guide to road safety engineering*. Melbourne, Ashgate Publishing Ltd, 1996.

World Bank (2002), *Cities on the move: a World Bank urban strategy review*. Washington, DC, The World Bank, 2002.

SWOV (1993) *Towards a sustainable safe traffic system in the Netherlands*. Leidschendam, Institute for Road Safety Research, 1993.

Elvik R, Rydningen U. (2002)*Effektkatalog for trafi kksikkerhetstiltak. [A catalogue of estimates of effects of road safety measures]*. Oslo, Institute of Transport Economics, 2002, (TØI Report 572/2002) (http://www.toi.no/toi

Cirillo JA, (1986)Council FM. Highway safety: twenty years later. *Transportation Research Record*, 1986, 1068:90–95.

Carlsson A, Brüde U. (2003)*Utvärdering av mötesfri väg [Evaluation of roads designed to prevent head-on crashes* Linköping, Swedish National Road and Transport Research Institute, 2003 (VTI Report No. 45-2003)(http://www.vti.se/PDF/reports/ N45-2003.pdf

Proctor S (1994), *Research on loss of control accidents on Warwickshire motorways and dual carriageways*. Coventry, TMS Consultancy, 1994.

Transfund (2003)*Technical Review of Minor Safety Works 2002/3 report PM/02/1096T*

LTSA (2004) Overall Results of the Crash Reduction Study Safety Improvements, LTSA, September 2004

Allsop RE ed. (1995) *Reducing traffic injuries from inappropriate speed.* Brussels, European Transport Safety Council, 1995.

Nilsson G (1982). *The effects of speed limits on traffic accidents in Sweden*. Sartryck, Swedish National Road and Transport Research Institute, 1982.

Andersson G, Nilsson G (1997). *Speed management in Sweden*. Linköping, Swedish National Road and Transport Research Institute, 1997.

McLean J, Kloeden C (2002). Alcohol, travelling speed and the risk of crash involvement. In: Mayhew DR, Dussault C, eds. *Proceedings of the 16th International Conference on Alcohol, Drugs and Traffic c Safety, Montreal, 4–9 August 2002*. Montreal, Société de l'assurance automobile du Québec, 2002:73–79 (http://www.saaq.gouv.qc.ca/t2002/actes/pdf/(07a).pdf

Finch DJ et al (1987) *Speed, speed limits and accidents*. Crowthorne,Transport Research Laboratory,1994 (Project Report 58).

IIHS (1997*) IIHS Facts: 55 speed limit* .Arlington,VA, Insurance Institute for Highway Safety,1987.

Ashton SJ, Mackay GM (1983).Benefits from changes in vehicle exterior design.In:Proceedings of the Society of Automotive Engineers .Detroit,MI,Society of Automotive Engineers,1983:255 –264 (Publication No.121).

Ashton SJ ,Mackay GM. (1979)Car design for pedestrian injury minimisation.In:Proceedings of the Seventh Experimental Safety of Vehicles Conference,Paris,5 –8 June 1979 Washington,DC, National Highway Traffic Safety Administration,1979:630 –640.

Tingvall C, Haworth N. (1999) *Vision Zero: an ethical approach to safety and mobility*. [Paper presented to the 6th Institute of Transport Engineers International Conference on Road Safety and Traffic Enforcement: Beyond 2000, Melbourne, 6–7 September 1999] (http://www.general.monash.edu.au/MUARC/

CROW (1997) *Handboek: categorisering wegen op duurzaam veilige basis. Deel I (Voorlopige): functionele en operationele eisen [Handbook: categorizing roads on long-lasting safe basis. Part I (Provisional): functional and operational demands]*. Ede, Stichting centrum voor regelgeving en onderwoek in de grond-, water- en wegenbouw en de verkeerstechniek, 1997 (CROW Report 116).

Gains A, B Heydecker, J Shrewsbury and S Robertson (2004) , *National Safety Camera Programme -3 year Evaluation Repor*t, PA Consulting and University College London for the Department for Transport

Elvik R (1999) Cost-benefit analysis of safety measures for vulnerable and inexperienced road users Oslo,Institute of Transport Economics,1999 (EU Project PROMISING,TØI Report 435/1999)

Elvik R, Vaa T.(2004) *Handbook of road safety measures*. Amsterdam, Elsevier, 2004.

Leggett LMW (1988). The effect on accident occurrence of long-term, low-intensity police enforcement. In: *Proceedings of the 14th Conference of the Australian Road Research Board, Canberra*. Canberra, Australian Road Research Board,1988,14:92–104.

OECD (2003) *Road safety: impact of new technologies*.Paris,Organisation for Economic Co-operation and Development

Keall MD, Povey LJ, Frith WJ (2001). The relative effectiveness of a hidden versus a visible speed camera programme. *Accident Analysis and Prevention*, 2001, 33:277–284.

Shults RA et al (2001). Reviews of evidence regarding interventions to reduce alcohol-impaired driving. *American Journal of Preventive Medicine*, 2001, 21:66–88.

Ross HL. (1984)*Deterring the drinking driver: legal policy and social control*. Lexington, DC Heath, 1984.

Homel RJ (1998). Random breath testing in Australia: a complex deterrent. *Australian Drug and Alcohol Review*, 1988, 7:231–241.

Lie A, Tingvall C. (2003) Governmental status report, Sweden.In: *Proceedings of the 18th Experimental Safety of Vehicles Conference, Nagoya, Japan, 19–22 May 2003*. Washington, DC, National Highway Traffic Safety Administration, 2003 (http://www-nrd.nhtsa.dot.gov/pdf/ nrd-01/esv/esv18/CD/Files/18ESV-000571.pdf

Cummings P et al. (2002) Association of driver air bags with driver fatality: a matched cohort study. *British Medical Journal*, 2002, 324:1119–1122.

Valtonen J. (1991)*The use of safety belts and their effect in accidents*. Helsinki, Central Organization for Traffic Safety, 1991.

Kamrèn B (1992). *Seat belt use among fatally injured in the county of Stockholm 1991–1992*. Stockholm, Folksam, 1992.

Larsson J, Nilsson, G (2000). *Bältespåminnare: en lönsam traf ksäkerhetsåtgärd? [Seat-belt reminders: beneficial for society?]*. Linköping, Swedish National Road and Transport Research Institute, 2000 (VTI Report 62-2000).

ETSC (1996), *Seat-belts and child restraints: increasing use and optimizing performance*. Brussels, European Transport Safety Council, 1996.

Ossenbruggen PJ, Pendharkar J, Ivan J.(2001) *Roadway safety in rural and small urbanized areas*. *Accident Analysis and Prevention*, 2001, 33:485–498.

National Highway Traffic Safety Administration (1998) , *Zone guide for pedestrian safety shows how to make systematic improvements*. Washington, DC, 1998 (Technology Transfer Series Number 181)

OECD (2001) *Safety of vulnerable road users.* Paris, Organisation for Economic Co-operation and Development, 2001 (http://www.oecd.org/dataoecd/24/4/2103492.pdf

Allsop RE, ed (1999). *Safety of pedestrians and cyclists in urban areas.* Brussels, European Transport Safety Council, 1999 (http://www.etsc.be/rep.htm.

ETSC, (1993) reducing traffic injuries through vehicle safety improvements - the role of car design, Brussels, 1993

Lie A, Tingvall C.(2002) How do Euro NCAP results correlate with real-life injury risks? A paired comparison study of car-to-car crashes. *Traffic Injury Prevention*, 2002, 3:288–291.

Koornstra M, Bijleveld F, Hagenzieker M. (1997) *The safety effects of daytime running lights*. Leidschendam, Institute for Road Safety Research, 1997 (SWOV Report R-97-36).

ETSC (2003) *Cost-effective EU transport safety measures*. Brussels, European Transport and Safety Council, 2003 (http://www.etsc.be/costeff.pdf

Elvik R, Mysen AB,Vaa T (1997) *Handbook of traffi c safety* ,3rd ed *]*.Oslo, Institute of Transport Economics,1997.

SWOV (2004a) State of the art with respect to implementation of daytime running lights, SWOV Institute for Road Safety Research, Leidschendam, the Netherlands, June 2004

SWOV (2004b) Scenarios for the implementation of daytime running lights in the European Union, SWOV Institute for Road Safety Research, Leidschendam, the Netherlands, June 2004

Gregersen N.P (1997) *Evaluation of 16-years age limit for driver training. First report* Report No. 418A, Linkoping, Sweden: VTI),

Broughton J. (1987) *The effect on motorcycling of the 1981 Transport Act*. Crowthorne, Transport and Road ResearchLaboratory, 1987 (Research Report No. 106).

Hakamies-Blomqvist L (2003). *Ageing Europe: the challenges and opportunities for transport safety* [The 5th European Transport Safety Lecture]. Brussels, European Transport Safety Council, 2003 (http://www.etsc.be/)

Buylaert W, ed. (1999) *Reducing injuries from post-impact care*. Brussels, European Transport Safety Council, Working Party on 0Post Impact Care, 1999.

Lerner EB, Moscati RM.(2001) *The golden hour: scientific fact or medical "urban legend".* Academic Emergency Medicine, 2001, 8:758–760.

McKibbin B et al (1992). *The management of skeletal trauma in the United Kingdom*. London, British Orthopaedic Association, 1992.

McDonald N, ed. (2001)*The role of driver fatigue in commercial road transport crashes*. Brussels, European Transport Safety Council, 2001.

Connor J et al (2002) .*Driver sleepiness and risk of serious injury to car occupants:population-based control study*.*British Medical Journal* ,2002, 324:1125.

National Center on Sleep Disorders Research/National Highway Traffic Safety Administration (1996), Expert Panel on Driver Fatigue and Sleepiness. *Drowsy driving and automobile crashes* .Washington DC,National Highway Traffic Safety Administration,1996 (http://www.nhtsa.dot.gov/people/injury/drowsy_driving1/Drowsy.html)

Maycock, G. (1995). Driver Sleepiness as a Factor in Car and HGV Accidents, Transport Research Laboratory (TRL), Crowthorne, Berkshire, UK.

Chapman S,Lupton D.(1994) *The fight for public health* .London:BMJ Books,1994.

Breen J (2002) *Protecting pedestrians* [editorial]. BMJ 2002;324:1109-11.

APPENDIX 1. The review team

Principal reviewer

Jeanne Breen is an international road safety policy consultant with 26 years of national and international expertise and experience in road safety. Graduating with Joint Honours (Arts) in 1974, she entered the transport field in 1978 as a Research Associate at Birmingham University's Road Accident Research Unit. Between 1982 and 2003, Jeanne Breen played a key role in establishing two successful independent non-governmental road safety organisations which she subsequently directed – the UK Parliamentary Advisory Council for Transport Safety (PACTS) and the European Transport Safety Council (ETSC) which are associated with the introduction of a range of evidence-based road safety measures in the UK and Europe. During her 11 years directing ETSC, she supervised the production of and contributed to over 20 international best practice reviews on key aspects of traffic safety, based on European-wide independent professional consensus. Since 2003, she has continued to work in the public sector as the principal consultant of Jeanne Breen Consulting, developing road injury prevention advocacy courses for the World Health Organisation (2003); in the role as principal author of the World Report on Road Traffic Injury Prevention (WHO/World Bank April 2004); running a road safety course for senior African policymakers; conducting research on European road safety policy development; serving on the Editorial Board of the Injury Prevention and Promotion journal and acting as an external adviser on road safety research for the UK Department for Transport.

Advisory team

Professor Richard Allsop has extensive experience of research, training and advisory work on road safety and traffic management. He has a first in Mathematics from Cambridge, and a PhD in Optimisation of Traffic Signal Control and a DSc in Engineering from UCL (University College London), where he has been Professor of Transport Studies since 1976 and was Director between then and 1997 of what is now the Centre for Transport Studies. He is a member of the British Government's Road Safety Advisory Panel and chairs its Statistics Group, having previously chaired the group which developed numerical advice to Ministers on the setting of Britain's current road casualty reduction targets. He is a director of PACTS (the British Parliamentary Advisory Council for Transport Safety) and is active at a senior level in the European Transport Safety Council (ETSC), chaired the group which produced ETSC's recent paper on assessing risk and setting targets in transport safety programmes and is now co-chairing its work on the evaluation of national road safety strategies. He has visited New Zealand regularly in the road safety context since 1997.

Fred Wegman holds a Master of Sciences degree in civil and traffic engineering. Starting in traffic safety as a traffic engineer, he has worked from 1977 to date for the SWOV Institute for Road Safety Research in the Netherlands. Starting as researcher and research manager between 1977 and 1989, he became SWOV's Research Director in 1989 and its Managing Director in 1999. He has extensive national and international experience in road safety policy research, development and evaluation. He is currently an advisor to the Dutch Ministry of Transport, the Dutch Parliament and the European Commission in road safety; a member of the National Advisory Board on Road Safety in the Netherlands, member of the Forum of the European Road Safety Research Institutes (FERSI); former Chairman of the OECD-scientific expert group "Targeted road safety programmes" (1994; former Chairman of the OECD-scientific expert group Safety strategies for rural roads (1999); Lecturer Delft University of Technology, Faculty of Civil Engineering; Member of the Joint OECD/ECMT Transport Research Committee (2004); Chairman of ETSC working party on Road safety performance indicators (2000); Member of the PHARE Multi-Country Road Safety Project (1998); Advisor to WHO/World Bank World Report on Road Traffic Injury Prevention (2004).

Michael Griffiths originally trained as a Mechanical Engineer and has a Masters in Bio-Medical Engineering. He commenced his road safety career in 1976 in multi-disciplinary in-depth crash investigation and in 1983 took on management responsibilities as Principal Research Scientist in charge of the Traffic Accident Research Units, Engineering and Medical Section of the New South Wales (NSW) Road Traffic Authority (RTA). He brought its test and research facilities up to date, and expanded the facility to include a full scale crash barrier. He established formal and informal liaisons with road safety professionals in Europe and North America. His principal achievements are: initiating and establishing the Australian New Car Assessment Program; establishing the Australian consumer program for child restraint systems (CREP); co-initiator and co-founder of the Used Car Rating Program in Australia; and founded restraint fitting stations in Australia. In the early 1990s as General Manager of Vehicle and Equipment Safety in the NSW, RTA's Road Safety Bureau, he was a senior member of the team which developed the first comprehensive Road Safety Strategy in Australia.

APPENDIX 2 - Meetings held in New Zealand

Invitations to meet Jeanne Breen, the principal reviewer, were extended to members of:

1. The National Road Safety Committee (NRSC)
The NRSC is the highest-level road safety advisory group. It comprises the chief executive officers of the seven key agencies involved in road safety:

- Land Transport Safety Authority (Chair of NRSC)
- Ministry of Transport
- NZ Police
- Transit NZ
- Accident Compensation Corporation
- Transfund NZ
- Local Government New Zealand.

2. The National Road Safety Working Group
This group is made up of managers and advisors employed in the NRSC organisations.

3. The National Road Safety Advisory Group (NRSAG)
Chaired by the LTSA this group provides advice and brings specific issues to the attention of the NRSC. The NRSAG includes representatives from the NRSC agencies and other central government, local government and various road safety interest groups.

4. The Industry Consultative Group (ICG)
The ICG is a forum for road transport industry groups to meet with LTSA and discuss policy or issues of concern

5. Other government agencies and road safety interest groups

Meetings were held with:

Minister of Transport (Hon Pete Hodgson) and the Minister for Transport Safety (Hon Harry Dynhoven).

Organization	***Representative***
Land Transport Safety Authority	David Wright (Director), managers and advisors
Ministry of Transport	Robin Dunlop (Secretary), managers and advisors
NZ Police	Rob Robinson (Commissioner), Steve Long (Deputy Commissioner)and senior officers
Transit NZ	Rick van Barneveld (CE) and Dennis Davis
Accident Compensation Corporation	Garry Wilson (CE), managers and advisors
Transfundi NZ	Wayne Donnelly (CE) and Ian Appleton
Local Government NZ	Tim Davin for Eugene Bowen (CE)]
NZ Automobile Association	George Fairbairn and Darren Baars
Road Transport Forum NZ	Tony Friedlander
Motor Industry Association	Perry Kerr
NZ Contractors Federation	Richard Michael
NZ Road Markers Federation	Alister Harlow
TRAFINZ – Local Authority Traffic Institute	Andy Foster
BikeNZ	Stephen Knight
Cycling Advocates Network	Jane Dawson and Robert Ibell
Road Safety Coordinator	Sue Johnson
IPENZ (Engineers) Transportation Group	Fergus Tate
Treasury	Wayne Heerdegen
State Services Commission	Shahla Motadel
Ministry of Health	John Wren and telephone discussion with Ruth Richards
Department of Labour (Workplace Health and Safety)	Carol Slappendel and Phillipa Campbell
Road Safety advocate/Retired surgeon	Win Beazley
Paul and Pat Duigan	Consultants