AUCKLAND REGIONAL ROAD SAFETY PLAN 2009/12

CREATING A SAFER TRANSPORT SYSTEM FOR AUCKLANDERS

RoadSafe Auckland

www.roadsafeauckland.org.nz

ARTA

Auckland Regional Transport Authority

www.arta.co.nz

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The Auckland Regional Transport Authority (ARTA) was established in 2004 to plan, fund, develop and operate the regional land transport system in a manner which contributes to an integrated, safe, responsive and sustainable transport system for the Auckland region

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Roadsafe Auckland is a region wide road safety working group convened by ARTA and made up of representatives from Auckland's seven territorial authorities, Auckland Regional Council, New Zealand Transport Agency, New Zealand Police, Accident Compensation Corporation, Auckland Regional Public Health Services and Safekids.

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Acknowledgements:
ARTA and RoadSafe Auckland would like to thank all those who made submissions on the Draft Regional Road Safety Plan and the following key contributors: Martin Dawe (Health and Safety Developments), Katy Marriott (Marriott Consulting), Chris Hewitt (New Zealand Transport Agency), Sarah Wheaton (Ministry of Transport), Fergus Taite (MWH Consultants), and Professor Ian Johnstone (Monash University).

Disclaimer:
ARTA has used every endeavour to ensure that the funding, expenditure and crash data figures are as accurate as possible at time of printing. However, values are highly dependent on the data sources of a variety of agencies

Auckland Regional Road Safety Plan 2009 – 2012 at a Glance

Our Vision (see diagram overleaf)

A safer transport system in which no law-abiding road users are killed or seriously injured on Auckland roads

Our Mission

By 2012 the Auckland region, using proven cost effective interventions, leads the country in road safety by achieving a 3% decline in the number of casualties per 10,000 people and per kilometres traveled, to take the nation closer to the Government goal of reduced deaths and serious injuries from road crashes

Regional 2012 Goal

By 2012 there will be fewer than 400 fatal and serious crashes, an equivalent 18% decrease from the three year annual average recorded between 2005 and 2007

ROAD SAFETY STRATEGIES AND KEY ACTIONS FROM 2009 TO 2012 (see Regional Road Safety Plan for a complete list of actions)

1. Increased Safety Engineering

ARTA, road controlling authorities and NZ Transport Agency to develop a crash risk assessment rating and priority for local arterial roads

Implement a prioritized three year programme of safety engineering projects on local arterial roads that have high crash risk, equating to an annual safety engineering investment of 4% of the total Regional Land Transport Programme

Implement safety engineering measures at high-crash risk rural state highway locations

2. Improved Speed Management

ARTA, NZ Transport Agency and road controlling authorities to develop a regional speed management policy around safer and survivable speeds

Foster urban design, landuse and engineering measures to encourage survivable lower vehicle speed environments of 30 to 40 km/h for pedestrians, cyclists and public transport users in and around town centres, schools and residential areas

Increased speed enforcement on high risk arterial roads, and rural state highways

Advise government to:

- to introduce demerit points for safety camera infringements
- extend use of fixed safety cameras
- lower the tolerance when enforcing posted speed limits

3. Reduced Drink & Drugged Driving

Well targeted Police enforcement of illegal drink driving

Proactive liquor licensing enforcement and visible host responsibility in organisations and communities

Integrated rehabilitation programmes and penalties for first-time and recidivist drink drivers

Advise government to:

- lower the blood alcohol limit for drivers to 0.05
- set a zero alcohol limit for drivers younger than 20 years
- raise the minimum alcohol purchasing age to 20 years
- improve alcohol and drug testing of drivers involved in crashes

4. Improved Pedestrian Safety

Road controlling authorities will implement widespread upgrades of pedestrian facilities through:

- a regional crash cluster programme
- use of a road user hierarchy
- innovative engineering technology

5. Improved Intersection Safety

Road controlling authorities with NZ Transport Agency assistance will initiate crash reduction studies and safety audits at high-risk intersections, and implement engineering improvements, accompanied by Police enforcement and educational campaigns

Introduce technology to deer drivers from running red lights region-wide

6. Safer At-risk Road Users

Road controlling authorities will implement safe cycle facilities for key cycle routes and destinations, and deliver cycle safety skills training

Advise government to:

- raise the legal driving age to 16 years
- extend the Learner license period to 12 months
- implement RoadSense education in all high crash risk schools

7. Public Transport and Travel Demand Management Safety

ARTA will encourage use of safer transport choices through improved access to public transport, and regional travel demand management programmes including workplace and school travel plans, and ride-sharing

ARTA will encourage road controlling authorities and KiwiRail to upgrade railway level crossings to make them safe, particularly crossings at high pedestrian locations

ARTA will encourage passenger rail and bus operators to improve rail safety through a regular forum

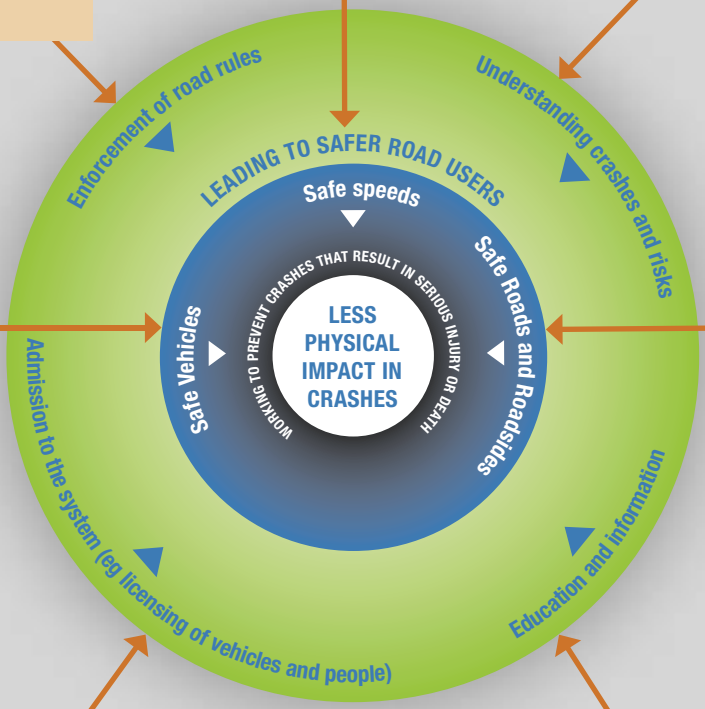
Creating a Safer Transport System for the Auckland Region

- Lower the legal blood alcohol driving limit to 0.05
- Raise the legal alchol purchasing age to 20 years
- Increase Police enforcement of legal speed and sober driving, including liquor licensing
- Increase safety cameras (speed & red-light) and introduce demerit points for camera offences
- Ban hand-held mobile phone use
- Continue enforcement of safety belt use
- Vehicle confiscation & tougher penalties for high risk drivers

SAFER VEHICLE CRASH SPEEDS

- 30/40 km/h for pedestrian and cyclist
- 50 km/h for vehicle side impact
- 70/80 km/h for head-on collision
- Interactive speed feedback signs
- Self-explaining roads

- Risk assessment & 'star ratings' for roads
- Risk assess transport modes
- Risk assess vehicle technology
- Risk assess age groups, road users and communities
- Safety impact assessments of landuse developments
- Monitor crash trends & adapt planning to match



VEHICLE SAFETY RATINGS

- Electronic Stability Control
- Safety belts and child restraints
- Crumple zones
- ABS breaking
- Pedestrian and cycle impact
- Safer Heavy Vehicles

URBAN ARTERIAL CRASH RISK FOCUS:

- Intersection speeds < 50km/h, controlled turns & roundabouts
- School, town centre & residential speeds <40km/h
- Self-explaining roads & interactive technology
- Pedestrian improvements via traffic calming & road user hierarchy
- Safer cycling infrastructure
- Improved network safety using traffic signals and warning systems
- Improved landuse planning & urban design

RURAL STATE HIGHWAY CRASH RISK FOCUS:

- Separation, use of median barriers, improved skid resistance & bends
- Clearzones, roadside hazard removal, & rest areas

- Raise the legal driving age to 16 yrs
- Extend learner driver period to 12 months
- 140 hours of driving experience for young novice drivers before going solo
- Introduce mandatory daytime running lights for motorcycles
- Improve public transport access
- Introduction of road pricing for key routes
- Improve commercial fleet safety culture
- Introduce 'compulsory third party' and 'pay as you drive' vehicle insurance

- Driver education: speed, alcohol, drugs, young drivers, fatigue & distraction, child restraints, vehicle safety, and recidivist drink drivers
- Motorcyclists: visibility & risk education
- Cyclists: visibility and cycle skills training
- Pedestrians: RoadSense education in schools, & town centres
- Encourage public transport use, Travel Plans and ride-sharing
- Encourage road crash victim advocacy
- Improve commercial fleet safety culture
- Educate roading authorities, road users, police & emergency services about a Safer System

Creating a safer transport system involves the purposeful limitation of physical impact on the human body in vehicle crashes through the development of safer vehicles, safer speeds, safer road users, and safer roads and roadsides. In such a forgiving transport system, regular mistakes by road users do not result in serious or fatal injury.

CHAIRMAN'S FOREWARD

Road safety is a shared responsibility between communities, families and individuals, government agencies, local government and many other organisations.

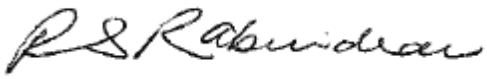
The Auckland Regional Transport Authority (ARTA) is committed to creating a transport system that enables safe, healthy and sustainable transport choices so that people can access employment, education and health, commercial and recreational opportunities.

While mobility is crucial for the economic, social and cultural well being of our region, we are currently paying too high a price for the transport system in terms of road safety. Road crashes place a heavy burden on the regional economy, families and individuals with an annual estimated social cost of $1 billion, which is greater than the annual economic cost of congestion. It is the second leading cause of hospitalisations in the region, most of which occur from crashes on local roads. Improvements in road safety are needed to reduce this overall social cost, as well as enhance the economic development and productivity of the region.

Safety is therefore a high priority for ARTA. This Auckland Regional Road Safety Plan 2009–2012 will have a significant effect on road safety activities by influencing funding decisions and focusing the efforts of a range of road safety agencies, local government and community groups to reduce fatal and serious crashes.

The Auckland region has been successful in reducing road trauma in the past and this plan builds on these previous successes with the aim of providing a vehicle for co-operation and collaboration among all agencies working to improve road safety in the region and to provide a starting point for planning and action at a local level. It is my belief that this new Regional Road Safety Plan will re-energise road safety to further reduce unacceptable road trauma levels and act as a catalyst for all agencies working in this field.

The inception of ARTA in 2004, with its objective to provide a leadership role in the transport sector in the Auckland region, strengthens this purpose and resolve in the midst of current road safety challenges. This plan will also provide a solid foundation for road safety planning in the future under Auckland's new governance structure.



Rabin Rabindran
Chairman ARTA

EXECUTIVE SUMMARY FOR AUCKLAND REGIONAL ROAD SAFETY PLAN 2009–2012

The Auckland Regional Road Safety Plan 2009–2012 has been prepared by the Auckland Regional Transport Authority (ARTA) in collaboration with the region's road-controlling authorities, other transport and public health stakeholders, and communities.

This plan has been developed from the 2005 Auckland Regional Land Transport Strategy (RLTS), and recognises the significant role that the promotion of road safety plays in the performance of the region's transport network, and the contribution road safety makes to the region's wider social and economic outcomes. This plan links to other supporting plans, including the national Road Safety to 2010 strategy, Road Policing Strategy 2010, Regional Arterial Roads Plan, Regional Sustainable Transport Plan, and seven local Road Safety Action Plans.

The purpose of the Regional Road Safety Plan is five-fold:

> To outline the most important road safety issues for the region; and to determine cost-effective interventions for addressing them with current resources.

> To establish regional and local road safety targets to 2012 based on the region's most important issues and the Government's transport strategy; and to develop goals and strategies for achieving them.

> To provide a road safety management framework that will monitor coordinated efforts to address the most important issues, and to reach the 2012 targets.

> To allocate key actions and responsibilities for planning, engineering, enforcement, education and advocacy for reduced road trauma[1].

> To develop a rationale for funding further improvements in safety engineering on local roads.

Overall, the Regional Road Safety Plan aims to provide improved accountability for road safety measures in the Auckland region. It acknowledges the growing need to address local road safety issues by integrating the work of the many organisations that share responsibility for reducing road trauma.

The Regional Road Safety Plan will be used mainly by members of the RoadSafe Auckland working group convened by ARTA (ARTA, Local Authorities, Auckland Regional Council, New Zealand Police, the New Zealand Transport Agency, the Accident Compensation Corporation, Safekids, Auckland Regional Public Health Services, Automobile Association) to guide the planning, funding, and delivery of actions that reduce road trauma, as outlined in Appendix 4. An expert panel will review collective progress annually, and a substantial review of the Regional Road Safety Plan will take place in 2012.

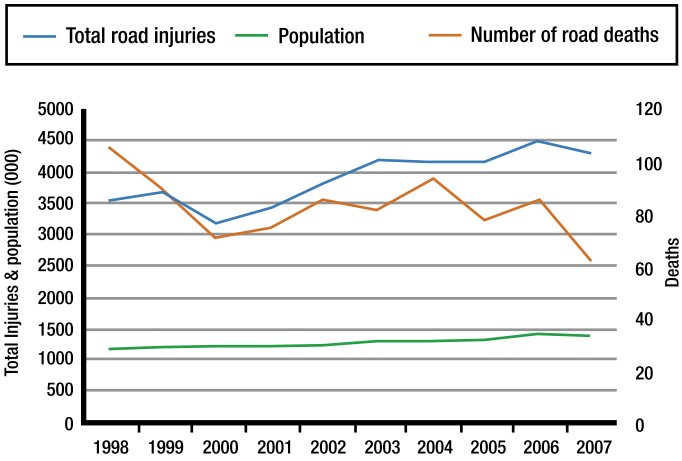


Chart 1. Road deaths and total road injuries between 2000 and 2008 in the Auckland region, with Auckland region population growth (000) (Source: Land Transport New Zealand, 2009)

Trends and issues

In developing this plan, ARTA and RoadSafe Auckland have taken into account the many trends and issues that influence road trauma and its regional management.

> The Auckland region has made good progress in reducing road trauma since 2000 with a 21% decrease in numbers of deaths, and a 12% decrease in serious injuries (fracture, concussion, severe cuts or other injuries requiring medical treatment or admission to hospital). That progress has been even more significant given that it was achieved during a period of substantial population growth, increasing car ownership and more travel, as shown in Chart 1.

> However, numbers of minor injuries increased by 35% since 2000; and recent trends show a reversal of road safety gains in areas such as speed- and alcohol-related crashes.

> Some road users in the region have a higher risk of road trauma according to their age, ethnicity, socio-economic status, or mode of transport e.g. young male drivers, lower decile school children, young Maori, child pedestrians, motorcyclists, and cyclists.

> Many road users place themselves and others at increased risk by ignoring traffic laws, e.g. 80% of Auckland drivers travel faster than the posted urban speed limit of 50 km/h, and the number and percentage of 'driver deaths with excess alcohol' are increasing. The number of alcohol-related casualties for drivers aged between 15 to 19 years has also increased dramatically since 2000.

[1]Road trauma is the all-encompassing term for casualties (death, serious injury or minor injury) resulting from road traffic crashes.

- Most of the region's road trauma occurs on arterial roads, for which investment in safety engineering has not kept pace with RLTS guidelines. The main factors for which safety engineering is required are related to speed, intersections, crashes at bends, loss of control, and crashes with roadside hazards.
- Attempts to increase walking and cycling across the region are hindered by the community's poor perceptions of road safety, and by the design of local roads.
- The predominant form of transport, in what is mostly a low-density urban environment with wide roads, is private, single-occupant, high-speed motor vehicles. This form of transport contributes to most road trauma across the region, but some safety gains are beginning to be leveraged from activities to manage travel demand, and encouraging the use of public transport.
- Rising trends for crashes over the last decade suggest that new laws are necessary to reduce the risk of crashes for inexperienced young drivers, the increasing number of drivers who have access to alcohol, the increasing number of motorcycle riders, and the many drivers who continue to use excessive speed.

Road crashes currently create road trauma that costs the Auckland region an estimated $1 billion per year in medical costs and lost productivity, and which is a significant cause of death. These costs do not include the considerable economic cost of traffic delays caused by road crashes.

Regional road trauma is largely predictable, and is preventable through a combination of proven and readily available interventions. An estimated $152 million is spent annually in the region to reduce road trauma, through enforcement ($71m), education ($3m), and engineering ($78m). However, there is a significant gap between the estimated social cost of road trauma and Government spending on prevention of road trauma in the region, particularly in safety engineering on local roads.

Safety engineering, legislation and enforcement provide the greatest cost benefits in reducing road trauma. Education is a key tool for supporting engineering and enforcement initiatives by raising road users' awareness of road safety issues and encouraging improved behaviour.

Vision, mission, target and goals

The challenge for this Regional Road Safety Plan has been to assess the best mix of resources to create a safer and more sustainable transport system, which can also provide mobility, access and affordability.

The following vision, mission, target and goals are based on Government targets, regional trends and issues, and available resources.

- *Regional vision:* A safe transport system, in which no law-abiding road users are killed or seriously injured on roads in the Auckland region.
- *Regional mission:* By 2012 the Auckland region, using proven cost effective interventions, leads the country in road safety by achieving a 3% decline in the number of road casualties per 10,000 people and per kilometre travelled, taking the nation closer to the Government Policy Statement goal of a reduction in deaths and serious injuries as a result of road crashes.
- *Regional road safety target:* By 2012 there will be 400 or fewer fatal and serious crashes compared with the annual average of 490 recorded between 2005 and 2007 (or an equivalent 18% decrease)[2].
- *Regional road safety goals for five-year annual averages at 2012:* Compared with the 2003–2007 annual averages for deaths and reported casualties (shown respectively in parentheses) there are:
  - i. Fewer speed-related road fatalities and injuries (37; 734) per year.
  - ii. Fewer alcohol-related road fatalities and injuries (30; 699) per year.
  - iii. A continued decline in the number of pedestrian deaths and injuries (12; 363) per year.
  - iv. Fewer motor-vehicle-related deaths and injuries at intersections (17; 1377) per year.
  - v. Fewer deaths and injuries related to crashes at bends, and with roadside hazards (32; 929: 36; 1045) per year.
  - vi. Fewer fatalities and injuries among motorcyclists (4.7 casualties per million vehicle kilometres travelled) per year.
  - vii. Fewer fatalities and injuries among cyclists (1; 194) per year.

  As well:

  - viii. The percentage of unrestrained motor-vehicle-drivers[3] killed or seriously injured declines from the five-year annual average (2002 to 2006) of 18%; and more than 95% of all motor vehicle occupants (including children) continue using approved restraints.
  - ix. Public transport and travel demand management promotion and safety initiatives contribute to an overall reduction in transport-related deaths and injuries.

Regional road safety strategies

The goals stated above will be achieved through the following seven strategies, which include a combination of planning and engineering, advocacy for legislative change, further enforcement and education.

1. Enhanced safety management, planning and targeting of safety engineering on local roads and rural state highways, including measures to reduce crashes at bends and with roadside hazards.
2. Effective management of speed, lower speeds in urban areas, and other initiatives that support a growing community acceptance of speed limits.
3. Enforcement of well-targeted campaigns towards the prevention of drink driving; integrated driver rehabilitation; visible host responsibility; proactive liquor licensing; and improved drug and alcohol testing.
4. Improved pedestrian safety by integrating this aspect with overall transport planning; through cluster/blackspot studies, and the use of innovative engineering and technology solutions.
5. Improved safety at intersections through safety audits, educational campaigns and technology to deter drivers from running red lights.
6. Initiatives tailored to the needs of at-risk and vulnerable road users.
7. Integrated public transport and travel demand management safety.

These strategies are expanded in Appendix 4, along with key actions proposed over the next three years. The road safety context and background for the Auckland region are outlined in sections 1 to 3.

[2]Refer to section 6.2 for an explanation of this target, along with State highway and local road targets, and targets for each territorial authority. This target will be reviewed when a new national 2020 target is set after the Road Safety to 2010 strategy is reviewed, expected by the end of 2010.

[3]Crash data available regarding restraint use is currently recorded only from drivers, i.e. information as to whether or not a passenger is using a restraint is not available. Therefore, this goal pertains to drivers in relation to crashes, but not to drivers and passengers in terms of survey data from observation of safety-belt and child-restraint use.

Key actions

A number of actions have been identified in each strategy area and responsibilities have been allocated (see Appendix 4) to take the region towards regional goals and targets. Some of the key actions that will provide the greatest cost/benefit in reducing road trauma are outlined below.

> Through the 2009/2012 Regional Land Transport Programme, ARTA and road-controlling authorities will implement a three-year prioritised programme of safety engineering projects on local roads that have both high crash risk and high crash cost density.

> ARTA and RoadSafe Auckland will develop a regional speed management policy by December 2010.

> Road-controlling authorities will foster urban design, planning, and engineering measures to encourage lower speeds in and around town centres, schools, residential areas and places where there are significant numbers of pedestrians, cyclists or passengers.

> RoadSafe Auckland will advise Government that there be increased enforcement of speed limits, including by giving demerit points for speed-camera infringements; the use of fixed speed cameras; and a lowered tolerance when enforcing posted speed limits.

> RoadSafe Auckland will advise Government that there be increased alcohol-related enforcement measures, including lowering to 0.05 the blood-alcohol limit for drivers; a zero blood-alcohol limit for drivers younger than 20 years; raising the minimum age at which a person can purchase alcohol to 20 years; and improved liquor-licensing controls.

> RoadSafe Auckland will advise Government to introduce mandatory drug and alcohol testing of blood samples from drivers involved in fatal and serious road crashes.

> Road-controlling authorities will implement widespread upgrades of pedestrian facilities through use of a road user hierarchy, including a regional pedestrian crash cluster/blackspot programme completed by June 2012.

> With New Zealand Transport Agency assistance, road-controlling authorities will implement crash-reduction studies and safety audits to improve safety at intersections across the region.

> RoadSafe Auckland will advise Government that the minimum driving age should be raised from 15 to 16 years and that the length of the learner licence period be extended from six to 12 months.

> RoadSafe Auckland will advise Government that RoadSense be implemented in schools in high crash-risk areas as a matter of urgency, and that the provision of incentives for more schools to participate in the RoadSense programme be investigated.

> Road-controlling authorities will implement cycle facilities for key cycle routes and destinations, including facilities for younger cyclists and for cycle storage, with assistance from New Zealand Transport Agency and ARTA.

> ARTA will encourage use of safer transport choices through improved access to public transport, and regional travel demand management programmes including workplace and school travel plans, and ride-sharing.

> ARTA will encourage road-controlling authorities and KiwiRail to upgrade railway level crossings to make them safe, particularly crossings at locations where there is a high density of pedestrians.

> ARTA will host a regular regional rail safety forum with stakeholders.

Great South Road Arterial

Regional road safety results framework and monitoring

A regional Road Safety Results Pyramid framework (refer to Appendix 1) has been developed to show the links between the actions and strategies and regional and local outcomes or road safety targets.

The framework includes policy and safety performance indicators for measuring the region's performance, which will be used to monitor and report on annual progress towards outcomes and targets.

Safety interventions for different roading enviroments

The Auckland region's road network is divided into five main road types. Each is allocated a crash-risk profile (the likelihood of exposure to crash injury for road users per vehicle kilometre travelled) and a crash cost density profile (the social cost of crashes per kilometre of road).

The crash cost density per year, based on data for 2002 to 2006, for the Auckland region as a whole, including State highways, is shown in Figure 6 (page 29). The red lines indicate parts of the road network where crash cost density is high.

Roads with a high crash risk do not necessarily produce a great amount of road trauma because traffic may be very light; but they expose people to a greater danger of injury if they do crash e.g. open roads in rural areas.

Roads with a high crash cost density do not necessarily expose people to greater injury, but they do produce a high level of road trauma because the roads carry more traffic e.g. motorways.

Targeting interventions at parts of the road network that have both high crash risk and high crash cost density generally provides the best cost/benefit.

Any specific solutions to address local road safety issues will need to be site or route-specific. However, Table 1 provides an overview of the different safety engineering and enforcement interventions that can be tailored to the five different road environments within the Auckland region, along with a brief description of each road environment.

Road length, traffic volume and social cost are all estimated using 2007 figures for the Auckland region (data sourced from the New Zealand Transport Agency and Ministry of Transport).

Major urban arterial roads stand out as having the highest combined crash risk and crash cost density followed by rural state highways.

Table 1. Safety engineering and enforcement interventions in differing road environments

Motorways				
Road length	**Traffic volume**	**Social cost**	**Low crash risk**	**High crash cost density**
225 lane km	2315 million vkt[4]	$161 million	6.9 cents per vehicle kilometre travelled	$715 per kilometre per year

Key safety issues and engineering interventions

Motorways in the region are built to a very high safety standard and need little upgrading apart from:

Rear-end crash safety measures including improved skid resistance, improved speed management, ramp metering, and improved warning and traffic information systems.

Safety measures for loss of control including sealed shoulders against the median and outside edge, physical median barriers, roadside clear zones, audible edge lines, adequate crossfall and drainage, improved lighting, and crash cushions where lanes diverge.

Key enforcement measures

Highway Patrol, mobile speed enforcement, mobile breath testing, heavy vehicle enforcement and traffic management.

Major urban roads – Arterials				
Road length	**Traffic volume**	**Social cost**	**High crash risk**	**High crash cost density**
636 lane km	1653 million vkt	$378 million	22.8 cents per vehicle kilometre travelled	$594 per kilometre per year

Key safety issues and engineering interventions

Major urban arterial roads carry most of the 'high crash risk' and 'high crash cost density' in the region and therefore need to be given high priority in terms of safety engineering improvements. They also need improved accessibility and land use planning for all road users through integrated corridor plans.

Speed reduction safety measures include using engineering methods to reduce speeds in town centres and areas of high 'place' or residential function of 40km/h, including elements of self-explaining road design and roadside hazard management. Traffic information systems and separation can also be of benefit on high traffic flow routes with lower place function. Urban arterials with speed limits of 70km/h should eliminate road side hazards and create reduced speeds of 50km/h approaching intersections.

Intersection safety measures include controlled intersections, oundabouts of consistent design friendly to cyclists and pedestrians, frequent use of median islands, improved lighting, improved visibility and clarity of markings and signage around intersections.

Pedestrian and cyclist safety measures include providing median refuges and reducing crossing distances where there are many pedestrians, providing traffic signals for pedestrians on four-lane roads, planning and applying appropriate treatments to pedestrian and cycling networks, providing new cycle lanes and improving existing ones. Red light camera technology and separation can also be of benefit at some high traffic flow ntersections.

Key enforcement measures

Strategic Traffic Units, speed enforcement, intersection controls, breath testing, enforcing the use of restraints, traffic management.

[4]Vehicle kilometers travelled

Minor urban roads				
Road length	**Traffic volume**	**Social cost**	**Low risk**	**Low cost density**
3000 lane km	2150 million vkt	$170 million	7.9 cents per vehicle kilometre travelled	$57 per kilometre per year

Key safety issues and engineering interventions

Minor urban roads make up a significant part of the overall network. They are used for most short trips, including by pedestrians and cyclists. Safety issues are addressed primarily through low-cost traffic calming measures, speed reduction, signage and markings, and pedestrian and cyclist infrastructure.

Speed reduction safety measures include engineering lower speeds of 40km/h through traffic calming including curb extensions, pedestrian platforms and speed cushions, and selective self-explaining road improvements.

Intersection safety measures include controlling crossroads and busy T and Y junctions with signs or roundabouts of consistent design friendly to pedestrians and cyclists, and improving lighting to a consistently high standard.

Pedestrian and cyclist safety measures include improving lighting at pedestrian crossings, and reducing width of the roadway at pedestrian crossings.

Safety measures for loss of control include signing and delineating curves with a design speed below 50 km/h, and hazard removal.

Key enforcement measures

Strategic Traffic Units, speed enforcement, breath testing, and enforcing the use of restraints.

State highways				
Road length	**Traffic volume**	**Social cost**	**High risk**	**Medium cost density**
150 lane km	496 million vkt	$66 million	13.3 cents per vehicle kilometre travelled	$440 per kilometre per year

Key safety issues and engineering interventions

State highways make up the smallest proportion of roads in the region by length, but their high speeds and non-separation of opposing lanes can produce very serious crashes.

Head-on and overtaking safety measures include four-laning with median barriers, widening sealed shoulders, roadside clear zones, passing lanes and regular rest areas.

Safety measures for loss of control include treating hazardous horizontal curves, sealed shoulders, hazard removal; reduced slopes, elimination of single-lane and short narrow bridges, and high visibility edge-line and audible edgeline treatments.

Intersection safety measures include controlling all side roads, providing turn-bays where needed, eliminating traffic signals in 100 km/h zones, and improved lighting and signage.

Speed reduction safety measures include gateway treatments in town centres and areas of high 'place' function, and reducing the speed limit to 70 to 80 km/h where the possibility of a head-on collision exists.

Key enforcement measures

Highway Patrol, speed enforcement, breath testing, enforcing the use of restraints, heavy vehicle safety enforcement and traffic management.

Minor open roads				
Road length	**Traffic volume**	**Social cost**	**High risk**	**Low cost density**
3450 lane km	826 million vkt	$170 million	20.6 cents per vehicle kilometre travelled	$49 per kilometre per year

Key safety issues and engineering interventions

Minor open roads make up the greatest road length on the network and, while they produce very little road trauma relative to their length, when crashes do occur they can be very serious. Regular enforcement can often be an effective prevention tool where engineering interventions are cost inefficient.

Loss of control safety measures include edge-line treatment and markers with high visibility, sealed shoulders where traffic volume increases, and advisory speed signs on all curves where speed should be reduced by more than 15 km/h.

Head-on and overtaking safety measures include extending centre-line delineation on all sealed roads, and improvements for greater visibility including use of highly reflective edge-line and centre-line marking.

Intersection safety measures include controlling intersections, and advance warning signs.

Speed reduction safety measures include introducing lower speeds of 70 to 80 km/h where the possibility of a head-on collision exists.

Key enforcement measures

Strategic Traffic Units, speed enforcement, breath testing, enforcing the use of restraints.

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FIGURES, TABLES AND CHARTS

1 INTRODUCTION

The Auckland region has made significant progress in reducing road trauma – death or injury resulting from road traffic crashes – since 2000, with a 21% decrease in numbers of fatalities and an 12% decrease in serious injuries. This was achieved during a period of significant population growth and increasing car ownership and vehicle kilometres travelled. However, minor injuries have increased by 35% since 2000 and more recent trends show a slowing of road safety gains in areas such as speed- and alcohol-related crashes.

While mobility is crucial for the economic, social and cultural well being of our region, we are currently paying too high a price for the transport system in terms of road safety. That price is clearly unsustainable. Road crashes place a heavy burden on the regional economy, individuals, and families, with an annual estimated social cost of $1 billion, most of which is from crashes on local roads. Improvements in road safety are needed to reduce this overall cost, as well as to enhance the economic development and productivity of the region.

The Auckland region continues to face a number of unique road safety challenges. It has a rapidly growing and mobile population, an increasingly multicultural society, and a unique geography, in which harbours and volcanic cones constrain transport corridors and create challenges for road safety and transport in general. Aucklanders often travel relatively long distances across the region for work and other activities. This increases the individual's risk of being involved in a crash. It also increases the need for a more consistent road environment across the region. The region's many cultures and significant new migrant populations also mean that road safety interventions need to be culturally responsive.

Future road safety gains in the region will depend upon strengthened institutional collaboration and decision-making, the introduction of preventative alcohol-related and speed-related legislation, increased speed enforcement, and increased investment in safety engineering on arterial roads.

The Auckland Regional Transport Authority (ARTA) and RoadSafe Auckland will work to address all these challenges through the implementation of this plan, using proven and cost effective strategies.

1.1 A systems approach to land transport safety

Central, regional and local Government, road police, other organisations and community groups have complementary roles in addressing road trauma across the region.

> Road-controlling authorities, funders and planners need to take reasonable steps to plan, design and build an increasingly safe and sustainable transport system. That will be achieved by improving the integration of land use and transport to enhance safe access for all transport modes, and by accommodating human characteristics so that the network is more 'forgiving' if an error or misjudgement is made by road users. Managing speed is a central component of this approach.

> Vehicle manufacturers have a responsibility to build safer vehicles, with the vulnerability of the human body (both occupants of the vehicle and pedestrians) as the limiting design factor.

> Police have a responsibility to enforce the road rules and remind motorists of their obligations and exposure to crash risk.

> Courts and Corrections have a responsibility to ensure that traffic offenders are dealt with swiftly and that penalties provide an effective deterrent to re-offending.

> Individuals have a responsibility to drive within the laws created for the roading network's safe operation. Individuals, communities and organisations have a responsibility to support a safe driving culture.

> Emergency and health services have a responsibility to provide opportunities for robust recovery and rehabilitation for those who make mistakes on the road network.

International and national road safety advice recommends such a 'safe systems' approach to improving road safety, with a focus on the road environment, vehicles, appropriate speed limits, and road user interventions, rather than focusing solely on direct approaches aimed at changing the behaviour of road users (see Figure 1).

Figure 1. The safer transport system (Source: Road Safety Partnership Program Newton J., 2008)

Safer road users, using safe vehicles, travelling at safe speeds, on safe roads, will reduce the impact and severity of injury to the human body from violent crash forces. Such a road system allows for human error without leading to death or serious injury and the responsibility for reducing risk is shared by users and system providers.

State Highway 1

This approach uses appropriate combinations of legislation, engineering, enforcement and education to bring about the long term elimination of death and serious injury through system wide interventions that address human limitations on the road network.

Interventions that will improve road safety using this model include safer access to the road environment, engineering of safer roads and roadsides, encouraging safer modes of transport and vehicle standards, and creating safer road user behaviour, influenced to varying degrees by the environment, enforcement, their vehicle; and individual knowledge, attitudes, and skills.

ARTA and contributing member organisations of RoadSafe Auckland have declared a renewed focus on improving planning and engineering interventions to create a 'safer transport system' for Aucklanders, while continuing to improve vehicle standards, and influence road user behaviour through enforcement, legislation, and education. The model for creating this safer Auckland transport system is outlined in more detail on page i.

1.2 Road injury prevention and control – a new understanding

A paradigm shift in road safety was also advocated in the *World Report on Road Traffic Injury Prevention* (World Health Organisation, 2004), which supports the development of a safer system as follows:

1. Road crash injury is largely predictable and preventable; it is a problem made by humans, amenable to rational analysis and to countermeasures.
2. Road safety is a multi-sector issue and a public health issue – all sectors need to be fully engaged in responsibility, activity and advocacy for road crash injury prevention.
3. Common driving errors and common cycling or pedestrian behaviour should not lead to death and serious injury – the traffic system should help all users to cope with increasingly demanding conditions.
4. The vulnerability of the human body should be a limiting design parameter for the traffic system and speed management is central.
5. Road crash injury is a social equity issue – equal protection for all road users should be aimed for, since non-motor-vehicle users bear a disproportionate share of road injury and risk.
6. Technology transfer needs to fit local conditions and local knowledge needs to inform the implementation of local solutions.

1.3 Land transport planning and road safety planning

Land transport and road safety planning occurs within a range of national and regional legislation or regulation, policies, and strategies. Again, there are multiple organisations involved. The following subsections briefly outline how these policies, and the organisations

Mock crash on Matakana Road

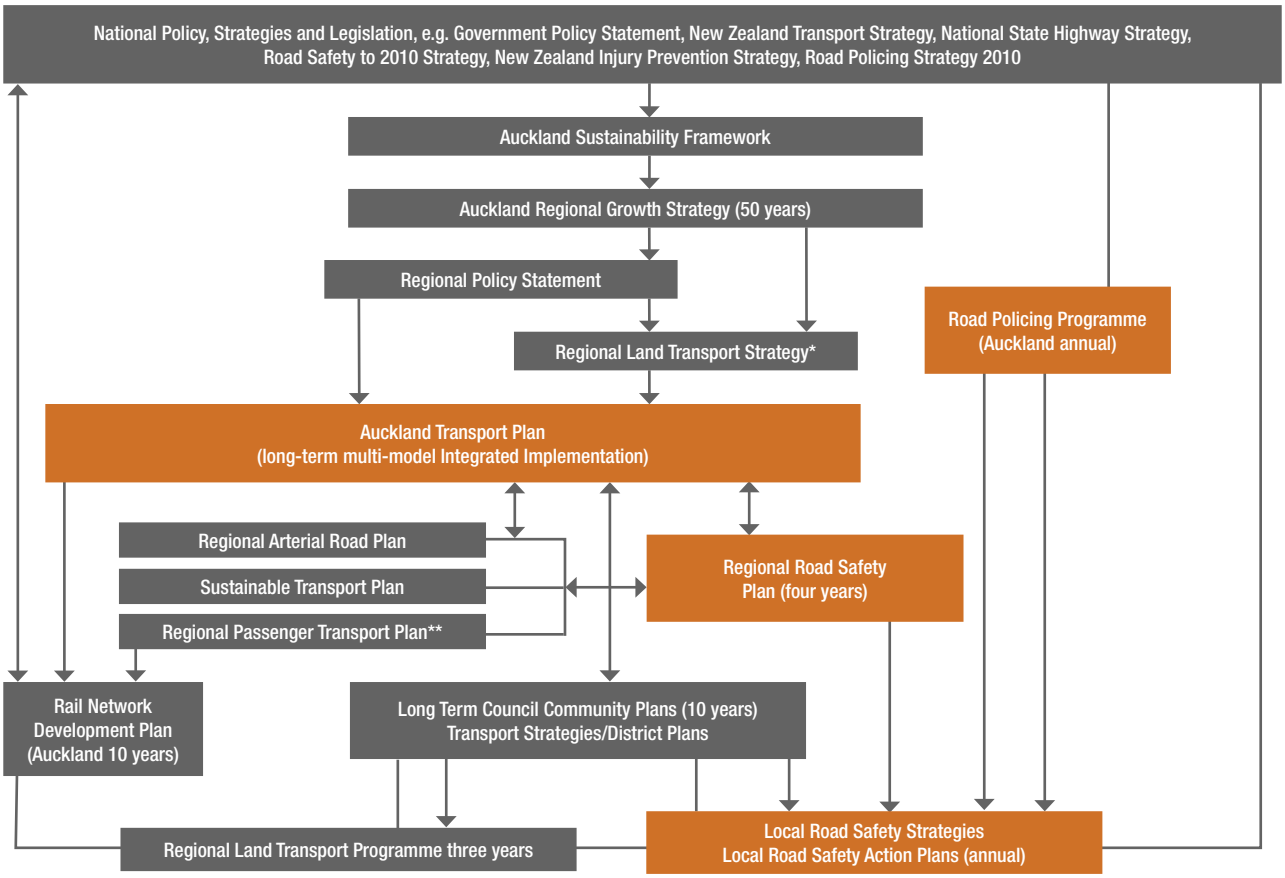

Figure 2. Relationships of transport policy and strategy to road safety planning

that implement them, are organised for the Auckland region. The Auckland Regional Road Safety Plan 2009–2012 outlines broad goals and strategies for these many organisations to work towards.

Figure 2 above outlines the relationship of policies, strategies and organisations with the Auckland Regional Road Safety Plan 2009–2012. Key strategy and policy documents are briefly discussed.

1.3.1 National picture

The updated NZ Transport Strategy (NZTS) and the Government Policy Statement (GPS) have identified a national road safety target of no more than 200 deaths and 1500 serious injuries a year by 2040.

Road Safety to 2010 (Ministry of Transport, 2003) provides the direction for road safety in New Zealand and describes the results the Government wants to achieve by 2010. In summary, it sets out the Government's balanced approach to road safety using initiatives built around the three Es – Engineering, Education and Enforcement – and the priority areas that will be a focus for the Government's road safety activity up to 2010.

Road Safety to 2010 is accepted as global best practice and has influenced many strategies around the world since its release in 2003. It is an important component in achieving the New Zealand Transport Strategy goal of an affordable, integrated, safe, responsive and sustainable transport system. A 2007 review of Road Safety to 2010 assessed its impact as having contributed to a 30% reduction in national road fatalities. However, a number of its requirements are yet to be implemented.

The Road Safety to 2010 strategy is due for review by the end of 2009 to create new 2020 national road safety targets, and that review may influence the implementation of this plan. Any revised targets within a new national road safety strategy will be incorporated in subsequent reviews of the Auckland Regional Road Safety Plan.

The Ministry of Transport provides overall policy advice to the Government on transport-related issues including road safety.

Currently, three main organisations are responsible for implementing a range of road transport programmes, including safety programmes. They are the New Zealand Police, New Zealand Transport Agency and territorial authorities. Each has its own work programme and related performance measures and targets. The New Zealand Police activities and targets are published annually in the Road Policing Programme. The Auckland Regional Road Safety Plan 2009–2012 attempts to align with these as best as possible.

Other organisations, such as the Ministry of Health and the Accident Compensation Corporation, have supportive roles with regard to road safety, as members of the National Road Safety Committee, and align their national strategies to road safety through documents such as the New Zealand Injury Prevention Strategy.

1.3.2 Regional and local picture

As a coordinating group, RoadSafe Auckland has a long history of providing road safety coordination across the Auckland region. It first launched an Auckland Regional Road Safety Plan in 1994. The Auckland Regional Transport Authority (ARTA) was established in 2004 to be the central coordinating agency for transport in the Auckland region.

ARTA is responsible for integrating all the land transport modes used to move people and goods around Auckland in a manner which contributes to an integrated, safe, responsive and sustainable transport system for the Auckland region. ARTA convenes RoadSafe Auckland as a collaborative road safety working group and coordinates transport safety initiatives through the Regional Road Safety Coordinator and Auckland Regional Road Safety Plan 2009-12.

Vehicle messaging sign on Harbour Bridge approach

Future local governance changes

The Government has released its 'Making Auckland Greater' decision on creating an Auckland-wide unitary authority in 2010, which will have responsibility for all local Government transport decisions, including road safety. The creation of the Auckland Council may have an influence on parts of this plan. However, the plan is designed to have continued use as a strategic and implementation tool under any new Auckland local governance structure to 2012.

Regional Land Transport Strategy and Auckland Transport Plan

Previous regional road safety plans were developed by RoadSafe Auckland under the guidance of the Auckland Regional Council and successive Auckland Regional Land Transport Strategies.

The current Auckland Regional Land Transport Strategy outlines a road safety target for 2016. This strategy is in the process of being updated to 2041.

Recent changes to the transport environment within the Auckland region mean that the Auckland Regional Road Safety Plan now sits under the Auckland Transport Plan (Auckland Regional Transport Authority, July 2009) and is adopted by ARTA as part of the overall implementation planning for the Auckland Regional Land Transport Strategy (Auckland Regional Council, 2005).

The Auckland Regional Road Safety Plan 2009–2012 is the fourth such plan; and, for the first time, it will directly influence funding of regional and local projects, including safety-engineering projects through the Auckland Regional Land Transport Programme under the Auckland Transport Plan.

The Regional Land Transport Programme provides a mechanism for the allocation of funding for road safety initiatives across the region for education (community programmes, advertising and local projects) and engineering (pedestrian and cycling infrastructure projects, and funding to address priority safety problems).

The Auckland Regional Road Safety Plan 2009–2012 outlines how the region proposes to achieve the Auckland Transport Plan's desired outcomes[5] of "an established road safety culture", "a safe and secure environment for vulnerable road users", "passenger transport that is safe to ride", and "significantly reduced crash deaths and injuries". It also outlines the region's contribution to national road safety goals and targets.

Long Term Council Community Plans

Long Term Council Community Plans (LTCCPs) are put together by local authorities in consultation with their communities. They identify overall community issues, and are then used to prioritise council activities and funding. The Auckland Regional Transport Programme is envisaged as guiding the preparation of LTCCPs and can also influence regional and local road safety planning. Improved road safety is usually included as a desired outcome in LTCCPs.

Local Road Safety Strategies and Action Plans

Each of the seven Auckland region local authorities develop Road Safety Strategies that give an overview of the key road safety issues in their area and then use a Road Safety Action Plan (RSAP) to record agreed local road safety risks, objectives and targets; actions; and monitoring and reviewing processes. RSAPs are the result of collaboration by key road safety partners (e.g. New Zealand Transport Agency, the local authority, New Zealand Police, Accident Compensation Corporation, community representation) and provide an important link between national, regional and local road safety outcomes.

Planning is driven by the evidence base (e.g. crash data, survey data, enforcement statistics, crash reduction study results, local enforcement intelligence), regional strategies and district plans, and input from communities, including LTCCPs. RSAPs are focused on outcomes and they ensure that resources are targeted to risk, i.e. they encourage a proactive approach to reducing crash risk by directing resources to emerging trends as well as to known high-risk areas.

The RSAP process identifies crash 'blackspots' and crash routes on the local roading network. It also identifies high-risk stretches of the State Highway through a detailed analysis of crash trends and addresses these as separate State Highway Network Safety Coordination projects.

The RSAP multi-agency approach used for achieving crash reduction has been internationally acknowledged as an innovative and best practice local road safety planning tool (Castle and Kamya-Lukoda, 2006).

[5] Refer page 46 of the Auckland Transport Plan (www.arta.co.nz/plans-and-policies/).

1.3.3 Role of RoadSafe Auckland

RoadSafe Auckland is a regional road safety group convened by ARTA, made up of representatives from the Auckland Regional Council, ARTA, Auckland's seven territorial authorities, New Zealand Transport Agency, New Zealand Police, Accident Compensation Corporation, Auckland Regional Public Health Service, Safekids, and the Ministry of Health.

The RoadSafe Auckland group was established in 1991 by the Auckland Regional Council to provide improved multi-agency coordination of road safety activity within the region. It has overseen the development and implementation of a range of road safety activities from this time, primarily guided by a succession of regional plans that have outlined priority areas, strategies and performance measures.

The role of RoadSafe Auckland is primarily one of coordination and information sharing, to improve collaboration between road safety agencies in the region. RoadSafe Auckland also oversees the coordination of a number of regional programmes and projects through ARTA.

RoadSafe Auckland has achieved the following for the region:

Coordination, funding, advocacy

> Provided a coordinated approach to enforcement, engineering and education activities since 1991.

> Provided regional communication networks including Road Ahead Newsletter and RoadSafe Auckland website since 2000.

> Made annual recommendations on Police Traffic Enforcement funding for the region, resulting in increased enforcement.

> Processed community-funded transport activity applications.

> Advocated nationally for greater safety with regard to speed and alcohol offending, and for improved pedestrian, and intersection safety.

> Provided technical advice on road safety for successive Auckland Regional Land Transport Strategies and the New Zealand Transport Strategy.

> Provided national leadership on safety and sustainability, young drivers, and repeat drink drivers' policy and programme development.

Infrastructure

> Initiated the red light camera trial with Auckland City in the Auckland CBD.

> Developed funding mechanisms for school travel plan infrastructure.

Community projects

> Supported and funded Walking School Buses since 2001.

> Directly funded 62 community road safety projects in the region.

> Funded the first Maori and Pacific road safety forums.

> Funded and developed the first Repeat Drink Driver Rehabilitation programme.

Social marketing

> Delivered annual regional road safety advertising projects since 1999 using motorway billboards and other social marketing tools.

Planning

> Maintained and monitored a Regional Road Safety Plan since 1994 that has assisted in an overall reduction in the road toll in the Auckland region.

1.4 Road safety management system

With multiple organisations involved in bringing about reduced road trauma on the roading network, the safer systems approach (refer to section 1.1) also places a significant emphasis on developing accountable institutional management through a shared responsibility for road safety goals.

The 'road safety management system' developed by Bliss and Breen in 2008 advocates the development of accountable 'Institutional Management Functions' that produce best practice 'Interventions'; these, in turn, deliver improved road trauma reduction 'Results'. This 'results' focus is accepted as international best practice and is demonstrated in Figure 3 overleaf, where the many key factors influencing final road safety outcomes are displayed in pyramid form. Key influences on road safety in the Auckland region are identified at the bottom of the pyramid. Examples of the existing national 'results' outcomes and outputs are included at the top of the pyramid.

The Regional Road Safety Plan has adopted this approach to demonstrate how the regional strategies and actions in the plan will deliver the desired regional outcomes (refer to Appendix 1: Road Safety Results for the Auckland Region).

1.5 Road safety and sustainable transport

The Auckland Regional Road Safety Plan 2009–2012 continues to focus on key road safety strategies to reduce vehicle crashes, and places emphasis on creating safe, liveable streets that encourage walking for short journeys.

A specific emphasis on cycle safety and motorcycle safety is also included in response to the importance of cycling as a sustainable transport mode and the recent increase in motorcycling, including use of motor scooters. Travel Demand Management (TDM) strategies can also provide significant safety gains and these are outlined along with the safety gains from public transport.

1.5.1 Walking and cycling

As outlined in the previous Auckland Regional Road Safety Plan (Auckland Regional Council, RoadSafe Auckland, 2005), a systems approach is essential to integrating road safety and sustainable transport.

Walking school bus

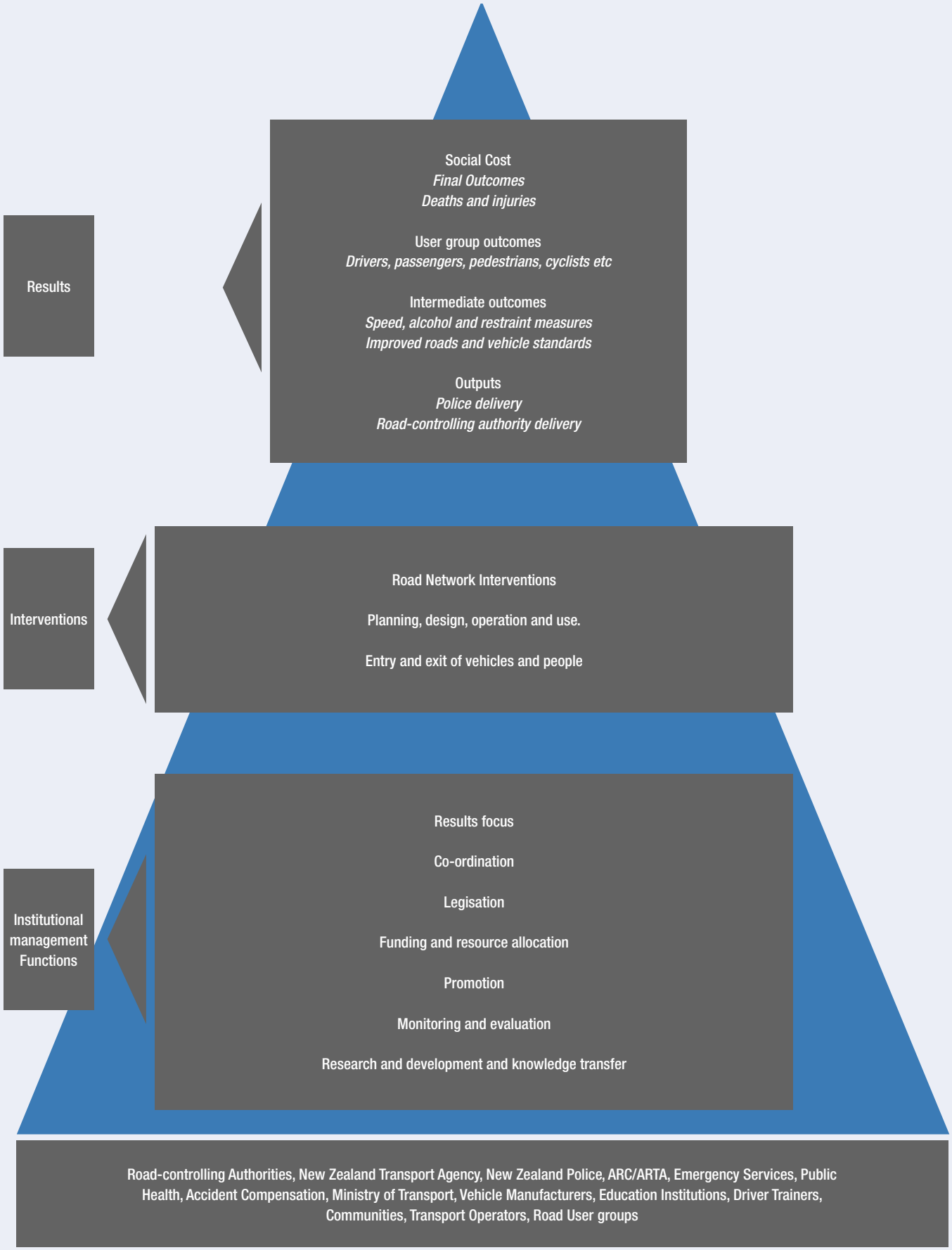

Figure 3. Road safety management system pyramid (Adapted from Bliss and Breen, 2008)

Western Motorway Cycleway

The NZTS has released national targets related to an increase in walking and cycling as a more sustainable form of transport. The public's poor perception of the safety of walking and cycling is a significant barrier to the increased use of these means of transport. National travel survey data suggests that the 'cyclist death and injury rate per 100 million kilometres ridden' is 2.5 times greater in Auckland, when compared to rates for the whole of New Zealand (MOT, 2009).

Speed management (see sections 4.2 and 4.4) is critical to achieving both the region's road safety and sustainable transport goals (Ministry of Transport: Pedestrian and Cyclist Road Safety Framework, 2006). A number of initiatives to encourage lower speed near schools have been implemented recently.

Managing speed consistently across the region and engineering for lower speeds in town centres will encourage more walking and cycling, and reduce the incidence of death and injury among pedestrians and cyclists.

Further safety benefits can be gained through urban design for improved accessibility and amenity, and infrastructure improvements for pedestrians and cyclists.

Cycle skills training is key to developing confident and capable riders, particularly among younger riders in urban settings.

The overall aim in this region is to achieve a 'safety in numbers' effect. Cities with higher rates of walking, cycling and public transport use have reduced road trauma, and having more pedestrians and cyclists in a particular local area is associated with a lower crash rate for pedestrians and cyclists.

The promotion of active modes will also assist broader health goals aimed at addressing chronic diseases such as heart disease, some cancers, obesity and diabetes (Auckland Regional Public Health Service, 2006), and can increase economic development in town centres.

Walking and cycling are distinct travel modes and pedestrians and cyclists have diverse needs. Designing pedestrian and cycling networks and facilities requires attention to these diverse and sometimes conflicting needs (Ministry of Transport, 2005).

The Sustainable Transport Plan (Auckland Regional Transport Authority, 2006) supports initiatives such as walking school buses, school and work place travel plans and neighbourhood accessibility plans. Many of these initiatives also have significant safety benefits e.g. travel plans and town centre upgrades often include engineering improvements that incorporate safety engineering aspects, improved access to public transport, and traffic calming.

The goals in the Sustainable Transport Plan are supported by local authority walking and cycling plans.

1.5.2 Road user hierarchy

The concept of a 'road user hierarchy' has been established overseas and promoted by the New Zealand Transport Agency (refer to Pedestrian Planning and Design Guide, Land Transport New Zealand, 2007) for use in the planning and design of new developments and in proposed traffic management schemes. The objective of the hierarchy is to ensure that the needs of the most vulnerable road users are fully considered in all road schemes. It has significant safety benefits.

Road-controlling authorities use a road user hierarchy to manage their roads according to the importance of the roads through traffic function in relation to other needs such as access. Most road's accommodate a range of users and their, often conflicting, requirements require a balance in the amount of service provided for each user group and the allocation of limited space to each.

The road user hierarchy helps to achieve this integrated approach by:

> Bringing non-private motor vehicle users to the heart of the planning process, ensuring the most vulnerable road users are considered early on.

> Identifying the importance of each travel mode when creating policies that affect the various components of the roading hierarchy.

> Identifying more specifically the importance of each travel mode in local situations, based on local understanding and needs. In some cases a road user hierarchy can change at different times of the day e.g. before and after school.

This approach requires an awareness of the effects of the wider transport network along with a good understanding of the interaction of different transport modes and the benefits and costs of different planning decisions or engineering treatments for each road-user group. By identifying the hierarchical importance of road user groups, designs can be developed and assessed in order of importance for each group.

A road user hierarchy consistent with the promotion of walking places pedestrians and the mobility-impaired at the top, followed by cyclists, then public transport, with unaccompanied users of private cars last (Land Transport New Zealand, 2007):

1. **Mobility impaired and wheeled pedestrians.**
2. **Able pedestrians.**
3. **Cyclists/recreational pedestrians.**
4. **Public transport users.**
5. **Commercial/business users (including delivery and emergency vehicles).**
6. **Car-borne commuters and visitors.**

This hierarchy is recommended for local roads with a community focus, such as high-density centres and town centres where pedestrians, the mobility impaired, and cyclists are considered to have priority, the following hierarchy of solutions is considered:

1. Reducing traffic volumes on the adjacent roadway considered first, followed by reducing traffic speed on the adjacent roadway.
2. Reallocating space in the road corridor to pedestrians.
3. Providing direct at-grade crossing treatments.
4. Improving pedestrian routes on existing desire lines.
5. Providing new pedestrian route alignment and grade separation.

The 2004 review of the Road Safety to 2010 strategy emphasised the importance of strong safety engineering interventions (both road and vehicle) in local authority pedestrian and cycling strategies. They should be foremost in the implementation plan to offset the increased exposure to risk brought about by more cycling and walking.

The importance of 30 km/h as the threshold for severe pedestrian injury needs to be widely understood. Pedestrians have a 90% chance of surviving involvement in a crash with a car travelling at 30 km/h or slower, but less than a 50% chance of surviving impacts at 45 km/h or more (see section 4.3)

The benefits of area-wide, traffic-calmed 30 km/h zones in town centres and residential areas should be promoted by way of demonstration projects e.g. Queen Street lower speed zone (Breen, 2004).

1.5.3 Public transport

The promotion of public transport is an important mechanism for improving road safety. If more passengers use buses and trains there will be improved road safety outcomes because these modes are inherently safer than private motor vehicle use. Public transport also has the potential to reduce private vehicle use.


Bus stop at Botany

Reduced private vehicle use has been shown in some high-income countries to reduce road trauma. For each 1% reduction in private vehicle distance travelled, there is a corresponding 1.6% reduction in the number of crashes (World Health Organisation, 2004).

Initiatives to encourage use of public transport in the region include route improvements, integrated ticketing, greater comfort and safety of vehicles and waiting areas, better coordination between the different modes of travel, secure shelters for bicycles, allowing bicycles to be carried on trains and buses, and possible pricing reforms to discourage car use. Giving vehicles with many occupants priority over those with few occupants also reduces the overall distance travelled by private motorised transport.

While public transport is generally safer than other transport modes (World Health Organisation, 2004), a number of safety interventions require ongoing focus. For example, Crime Prevention through Environmental Design (CPTED) measures need to be built into upgrades to the public transport system, including places where people are likely to walk, cycle or otherwise access public transport. Creating safer access to and from public transport (rail and bus) for pedestrians and cyclists will help address both real and perceived barriers to the overall uptake of public transport. Rail safety could be improved at level crossings and by reducing pedestrian trespass on rail corridors.

School bus transport is one of the safest forms of travel for children to and from school; however education, enforcement and engineering initiatives are necessary to reduce the crash risk related to children getting on and off school buses in loading zone areas.

1.5.4 Travel Demand Management

Increasing travel choice and thereby reducing the use of private vehicles is one of the key transport challenges in the Auckland region. Travel Demand Management (TDM) strategies are implemented across the region to address this issue, primarily to reduce congestion and pollution, and for sustainability. Yet, in many situations, safety is an important reason for implementing TDM programmes. TDM can be a cost-effective way to improve traffic safety where reductions in private motor vehicle travel can reduce total crashes and casualties.

Additionally, many TDM objectives are unachievable unless safety issues are addressed first e.g. the objective for increased walking and cycling will not succeed unless these travel modes are first made safer.

There is evidence that, at the margin, many consumers would prefer to drive somewhat less than they do now, if given suitable incentives

and convenient, safe and affordable alternatives (Litman, 2008). When safety benefits are correctly considered, TDM solutions can receive far greater support and public uptake.

TDM programmes currently used in the Auckland region that can improve safety include school travel plans, workplace travel plans, neighbourhood accessibility plans, ride-sharing, journey-planning, High Occupancy Vehicle (HOV) lanes, park and ride, bus and bike lanes, public transport incentives, street lighting, and Crime Prevention through Environmental Design (CPTED).

1.6 Fundamentals of a successful road safety plan

The New Zealand road safety framework is considered world best practice due to its multi-agency approach, allocation of funding for engineering, enforcement and education, work with high-risk groups and communities, relationships between national targets and local action, and evaluation and monitoring processes (Castle and Kamya-Lukoda, 2006). New Zealand needs to make more progress in setting a greater vision, gaining acceptance of controversial road safety proposals, and championing the targets and action plans to achieve them.

The Auckland Regional Road Safety Plan 2009–2012 sets a challenging vision, clear goals, realistic targets, and encourages new design safety features, integrated community programmes and the use of new enforcement technologies. It also specifies actions that are open to regular monitoring.

The major factors for this plan's success or failure will be collaboration among key stakeholders, the implementation of identified initiatives through management responsibilities for which managers will be held accountable, political will, public support, professional knowledge, and a commitment to funding.

Therefore the implementation of a systems approach to road safety relies on a strong foundation of partnership and shared responsibility, as identified in the Road Safety Management Pyramid, on page 16. ARTA, with the input of RoadSafe Auckland member organisations, has identified six interconnected principles that will underpin the success of the Auckland Regional Road Safety Plan 2009-2012. The principles, more fully explained in the following subsections, are:

- Commitment to the Treaty of Waitangi.
- Community involvement and ownership.
- Visible enforcement and legislation.
- Commitment to safety engineering.
- Developing skilled practitioners.
- Collaborative accountability.

1.6.1 Commitment to the Treaty of Waitangi

The Treaty of Waitangi is the founding document of New Zealand and is the basis on which Nga Rangatira o Nga Hapu and the Crown agreed to co-exist. It is the overarching framework of the constitutional foundation of New Zealand. The Treaty establishes the relationship between the Crown and Maori, providing a framework for all organisations and agencies that work with whanau, hapu, iwi and Maori. For road safety initiatives to be effective, due consideration of the principles of the Treaty of Waitangi need to permeate all levels of planning and the implementation of education, enforcement and engineering activities. This is particularly relevant to road trauma, as young Maori in the Auckland region are over-represented in crashes and injuries on our roads.

1.6.2 Community involvement and ownership

Improved road safety can be achieved only by community involvement which fosters ownership of road safety issues and solutions. ARTA, along with member organisations of RoadSafe Auckland, will continue to work with communities to promote a road safety culture including the victims of road trauma.

Caption: RoadSafe Auckland has a long history of innovative social marketing campaigns that use motorway on-ramp and off-ramp billboards, as illustrated by this 2008 'Share the Road' campaign

Social marketing programmes provide a way to engage with communities and encourage the growth of a safety culture, changing in behaviour associated with specific road safety issues.

1.6.3 Visible enforcement of legislation

Enforcement of road rules and related legislation continues to be a key means of improving road safety, especially in relation to drink driving, excessive speed, and failure to give way or stop at intersections. Legislation and enforcement are controlled by central Government, but ARTA, through its work with other members of RoadSafe Auckland, will continue to advocate for improved enforcement in priority areas such as drink driving, speeding, red light running, young/novice driver issues, illegal street racing and hazardous driving on beaches.

1.6.4 Commitment to safety engineering

There is currently good support nationally and in the Auckland region for improvements through road safety engineering, particularly for State Highways and motorways. That safety engineering focus is strengthened in the Auckland Regional Land Transport Programme 2009–2012 by encouraging funding priority for safety engineering projects across the region, particularly on arterial roads where most injury crashes occur. Such projects include speed reduction, improvements at bends, removal of roadside hazards, and walking and cycling projects (refer to section 4.4 on page 50). It is anticipated that this prioritisation will encourage more safety projects to be undertaken by local authorities.

1.6.5 Developing skilled practitioners

While improving road safety is a widely shared aim, but there is an overall shortage of qualified people in the industry. ARTA and other organisations that are members of RoadSafe Auckland will continue to champion the professional development needs of road safety professionals in the region by encouraging best practice training on key road safety issues, and advocating improved national professional development and recognised qualifications.

1.6.6 Collaborative accountability

Many organisations share responsibility for implementing actions that can together significantly improve road safety in the region. The involvement of numerous agencies could potentially lead to a fragmentation of institutional responsibility if their actions were not integrated.

ARTA and RoadSafe Auckland member organisations agree to work collaboratively by resourcing integrated road safety efforts, and by ensuring transparent and public accountability of both individual and collaborative annual performance. Where possible, priorities in the Auckland Regional Road Safety Plan 2009–2012 will be assigned to key agencies. There will be a mechanism for ensuring transparency in delivery, performance and integration.

2 OVERVIEW OF TRENDS AND ISSUES

As in previous plans, ARTA (with input from other member organisations of RoadSafe Auckland) has drawn on a detailed analysis of crash and other road safety data to inform the Auckland Regional Road Safety Plan 2009–2012. A brief overview of the data follows[6].

2.1 Road safety is an important contributor to health and well-being

On average, between one and two people die on roads in the Auckland region each week, and motor-vehicle-related crashes remain a leading cause of death and hospitalisation in the Auckland region.

Transport-related deaths are a significant cause of death across all age groups. Transport-related hospitalisations are the second leading cause of hospitalisations nationally and within the Auckland region, and account for approximately 10% of all hospitalisations in the region.

Fear of being involved in a road accident is a key reason for the recent steep decline in time spent walking and cycling, especially among children and older adults. A reduction in physical activity is associated with reduced well-being and a range of long-term health problems including heart disease, diabetes and mental illness.

2.1.1 Trends in road safety data

Crash data (1995 to 2007) and related road safety data highlight the following key trends:

> Road fatalities in the Auckland region are showing a long-term downward trend, with a significant drop on previous years in 2007. But the overall number of road injuries in the Auckland region has been increasing in absolute terms and as a rate per population and per vehicle kilometres travelled. In 2007 the Auckland region had a higher casualty and travel rate than the Canterbury region but lower rates than Wellington and other regions.

> Speed-related road fatalities (38% of all regional road deaths) peaked in 2004; and casualties show an increasing trend.

> Alcohol-related road fatalities (36% of all regional road deaths) peaked in 2003/2004; and casualties show an increasing trend.

> Crash casualties at intersections show an increasing trend and deaths at intersections (20% of all regional road deaths) peaked in 2003.

> Injury crashes on bends (loss of control/head-on) on local roads peaked in 2006, and on State Highways fluctuate from year to year but appear to be decreasing in number.

> Numbers of injury crashes with roadside hazards have been increasing over time and peaked in 2006.

> Pedestrian injuries show a decreasing trend but pedestrian-related deaths (21% of all regional road deaths) have remained constant over the last few years. Pedestrians aged from five to 14 years make up a third of these casualties.

> Injuries to cyclists show a slightly increasing trend, but the overall number of deaths and injuries is small. (Note: under-reporting of cycle crashes is well-recognised).

> Injuries to motorcyclists (including moped riders) are increasing and the number of registered motorbikes is increasing, but motorcyclist deaths show a decreasing trend.

> Injuries to drivers aged 15 to 24 years are increasing. Drivers in this age group are over-represented in the region in speed- and alcohol-related crashes, as well as in crashes at night.

> Injury and non-injury rear-end motorway crashes show some fluctuation in number from year to year, but overall appear fairly constant over the last few years.

> The use of safety belts and child restraints in the Auckland region is above the national average, but beneath that of the best region.

> People in the Auckland region have one of the worst records for wearing cycle helmets, which may reflect a lack of attention to this safety intervention in the region.

> Attitudes regarding drink driving and speed enforcement in the Auckland region have deteriorated between 2003 and 2007 (Ministry of Transport[7]).

> Average open road and urban road speeds show a slightly decreasing trend. However, 80% of drivers exceed the urban 50 km/h speed limit across the region.

> Both the number and percentage of 'driver deaths with excess alcohol' show an increasing trend.

> Both the number and percentage of speed-related deaths 'too fast for conditions' show an increasing trend.

> Young Maori appear to be over represented in crashes in the region. Further work is needed to determine the extent of this trend and to examine socio-economic status in relation to crash risk (Craig et al, 2008).

Refer to Appendix 2 for more detailed data on final crash outcomes and Appendix 3 for road safety data on intermediate outcomes.

Chart 2 opposite outlines the 12-month rolling total of deaths plus hospitalisations for the Auckland region. The chart clearly shows the gap that began emerging in 2005 between actual figures and the proposed regional outcome set by Road Safety to 2010 (Ministry of Transport, 2003).

[6]More detailed data breakdowns are included in Appendix 2 and Appendix 3.

[7]A comparison between the selected attitudes reported from the 2003 public attitude survey and the latest available survey (i.e. 2007) is outlined in Table 19 on page 73 (source New Zealand Transport Agency/Ministry of Transport – www.transport.govt.nz/public-attitudes-index/).

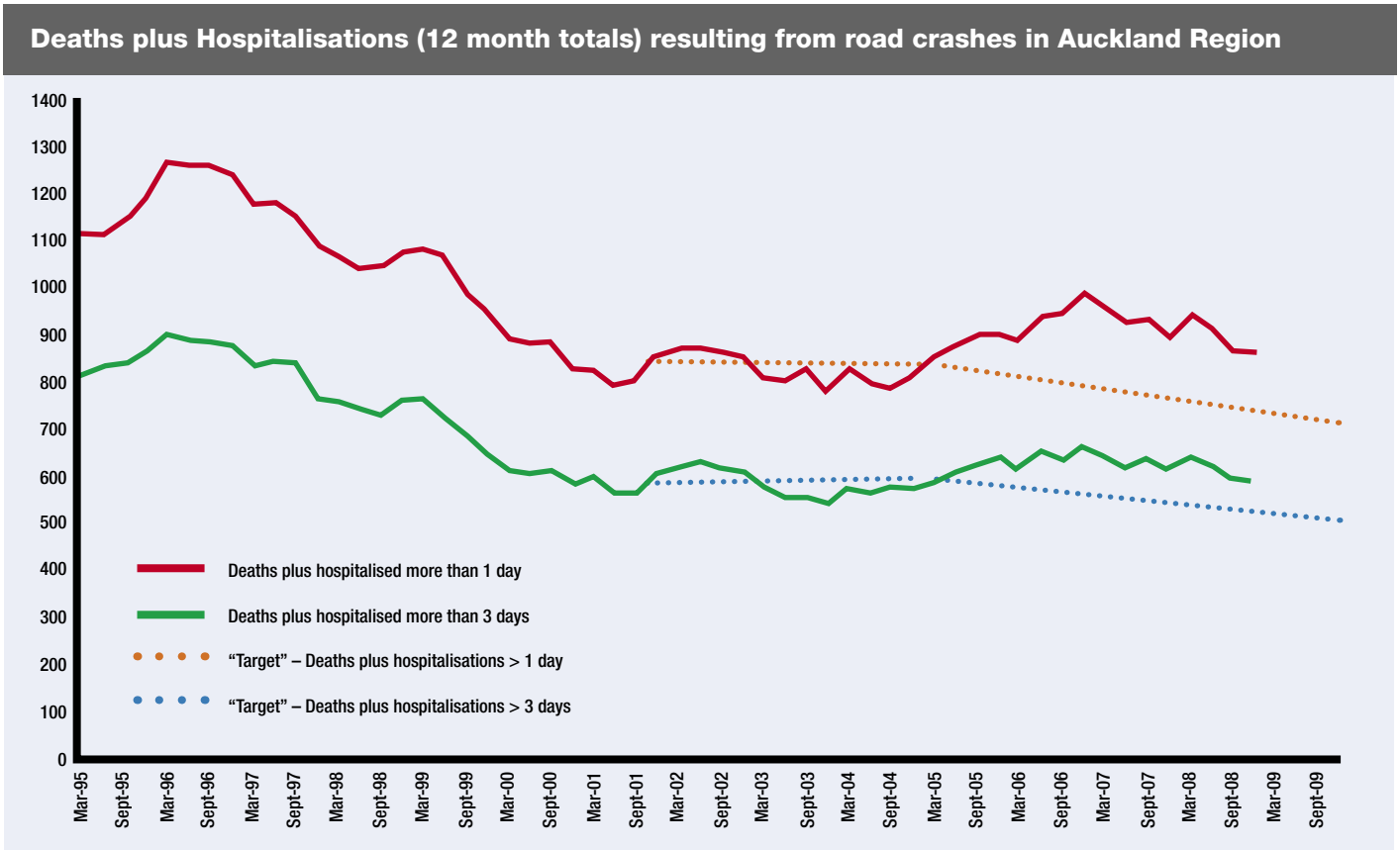

Chart 2. Deaths plus hospitalisations trend in relation to 2010 regional targets (Source: Ministry of Transport, 2009)

2.1.2 Regional comparisons

The measure 'casualties per population' is an accepted international public health measure of exposure to the risk of road crash. In 2007, the Auckland region had 30.9 road casualties per 10,000 people. This is more than the Canterbury region (30.2), but fewer than Wellington (33.7) and Northland (51.8).

The number of casualties per vehicle kilometres travelled (vkt) is another international measure of exposure to travel-related road crash risk. The Auckland region had 36.3 road casualties in 2007 per 100 million vehicle kilometres travelled. This is more than the Canterbury region (33.6), but fewer than Wellington (47.7) and Northland (48.3).

The Auckland Regional Road Safety Plan 2009–2012 has set a goal of achieving a 3% reduction in both the casualties per 10,000 population and casualties per 100 million vkt by 2012, i.e., goals for 2012 of 30 and 35.2 respectively for the region.

Table 2. Casualties per population for the Northland, Auckland, Wellington and Canterbury regions for 2007 (Source: Ministry of Transport, 2008)

Region	Population (000)	Casualties per 10,000 population	Casualties	Deaths	Total casualties including deaths
Northland	153.9	51.8	767	30	797
Auckland	1,393.2	30.9	4,243	61	4,304
Wellington	488.2	33.7	1,624	21	1,645
Canterbury	566.1	30.2	1,660	50	1,710

Table 3. Casualties per 100 million vkt for the Northland, Auckland, Wellington and Canterbury regions for 2007 (Source: Ministry of Transport, 2008)

Region	Vehicle kilometres travelled (100 million)	Casualties per 100 million vehicle kms travelled	Casualties	Deaths	Total casualties including deaths
Northland	16.51	48.3	767	30	797
Auckland	118.53	36.3	4,243	61	4304
Wellington	34.47	47.7	1,624	21	1645
Canterbury	50.83	33.6	1,660	50	1710

International Comparison of Deaths per 100,000 Population (2007)

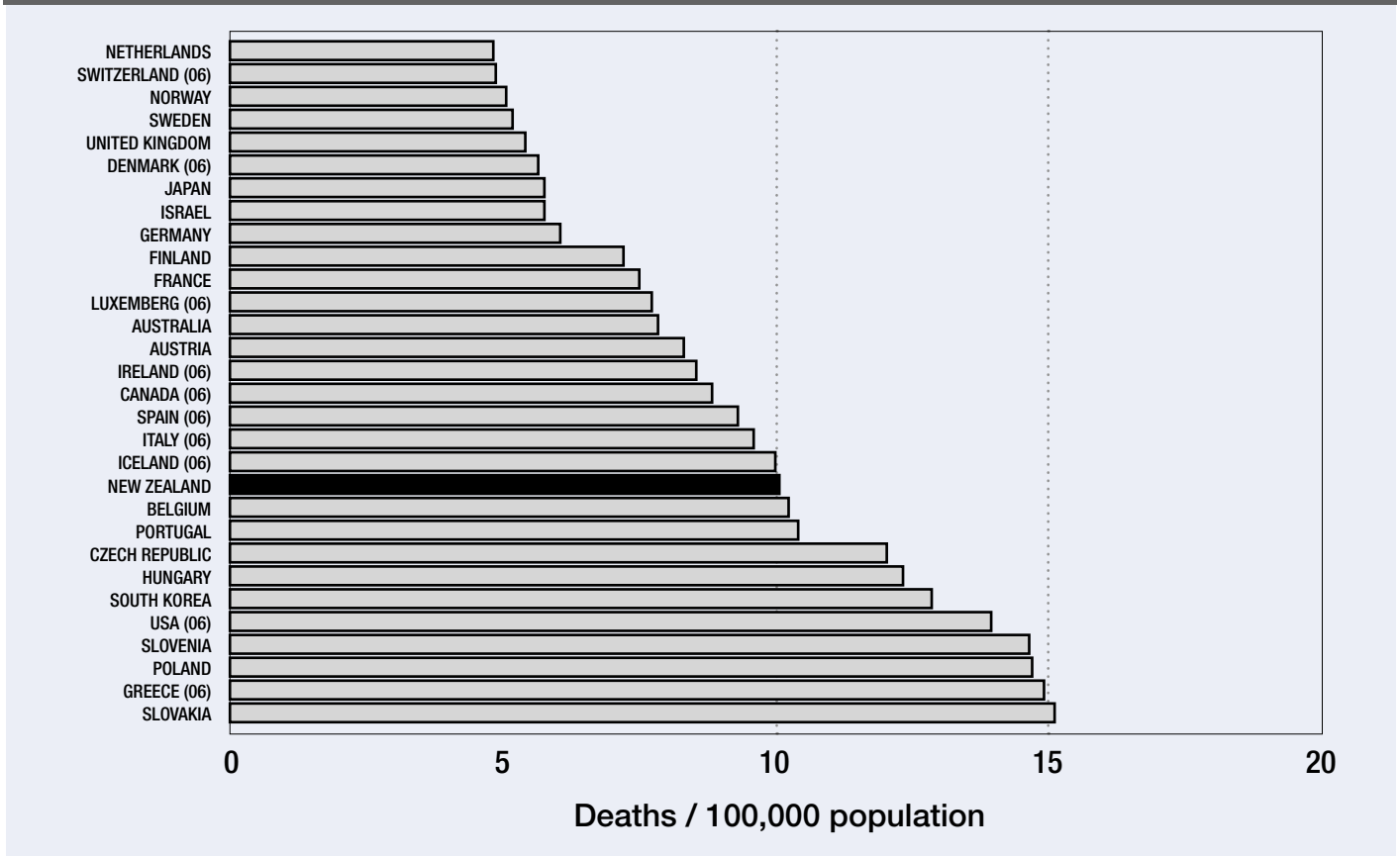

Figure 4. International comparison of deaths per 100,000 population in 2007 (Source: WHO Global Road Safety Status Report 2009)

2.1.3 International comparison

The national goals set in 2003 in the Road Safety to 2010 strategy aimed to achieve safety on the roads comparable to that in the safest countries at that time (Australia, United Kingdom, Netherlands, Norway and Sweden). Figure 4 above provides an international comparison of road deaths per 100,000 population at 2007 among OECD (Organisation for Co-operation for Economic Development) member countries and shows that New Zealand has some way to go to be comparable to the safest countries, including Australia and the United Kingdom.

In 2007, New Zealand dropped two places to be ranked 20th among the 30 OECD member countries for road deaths per 100,000 population.

The number of road deaths for every billion kilometres travelled is a direct international measure of the risk associated with road travel. New Zealand had one of the higher 'deaths per vehicle kilometres travelled' ratings among the thirty OECD member countries in 2007, as well as one of the highest levels of vehicle ownership per capita.

Other international risk indicators measured by the OECD include 'road deaths per 100,000 population' across different age groups.

Among OECD member countries in 2007, New Zealand had the highest recorded 'road deaths per 100,000 population' risk among 15 to 17 year olds, the second highest 'road death per 100,000 population' risk among 0 to 14 year olds, and the fourth highest OECD 'death per 100,000 population' risk among 18 to 20 year olds.

While New Zealand has made significant progress in reducing road deaths by 42% since 1990, progress since 2000 has been significantly slower with only an 8% reduction in road deaths between 2000 and 2007. Figure 5 opposite provides an international comparison of individual OECD member progress in reducing road deaths since 2000, expressed as a percentage reduction in road deaths.

One interpretation from New Zealands current international road safety performance, compared to other OECD countires, is that having liberal personal access to the transport system does not necessarily equate with improved road safety, particularly for younger people. This scenario is a challenge for the Auckland region in particular, as it is one of New Zealand's key productivity centres with a large number of younger road users.

2.2 Identifying key issues and targeting of resources

ARTA and RoadSafe Auckland member organisations work within limited resources. Those resources are best used by identifying key issues and targeting resources to them. This means that, while any road death or injury is unacceptable, greatest effort is applied to areas of greatest risk and where cost-efficiency will be greatest.

2.2.1 Key road safety issues facing the Auckland region

ARTA (with input from RoadSafe Auckland member organisations) has determined key issues by focusing on factors that represent a combination of high actual numbers (e.g. alcohol and speed crash factors; crashes at intersections, on bends and with roadside hazards, and pedestrian deaths) and high-risk issues (e.g. vulnerable road users, and at-risk communities).

The two leading causes of death on Auckland's roads continue to be speed-related and alcohol-related crashes, while significant numbers of people are killed or injured as pedestrians, and at intersections. Bends and roadside objects are contributing factors in a high proportion of crashes resulting in injury and death.

Vulnerable road users are particularly at risk of death and injury. They include pedestrians, motorcyclists, and cyclists. At-risk communities include young drivers aged 15 to 24 years; and Maori and Pacific

International Comparison of Percentage Reduction in Road Deaths since 2000 (2007)

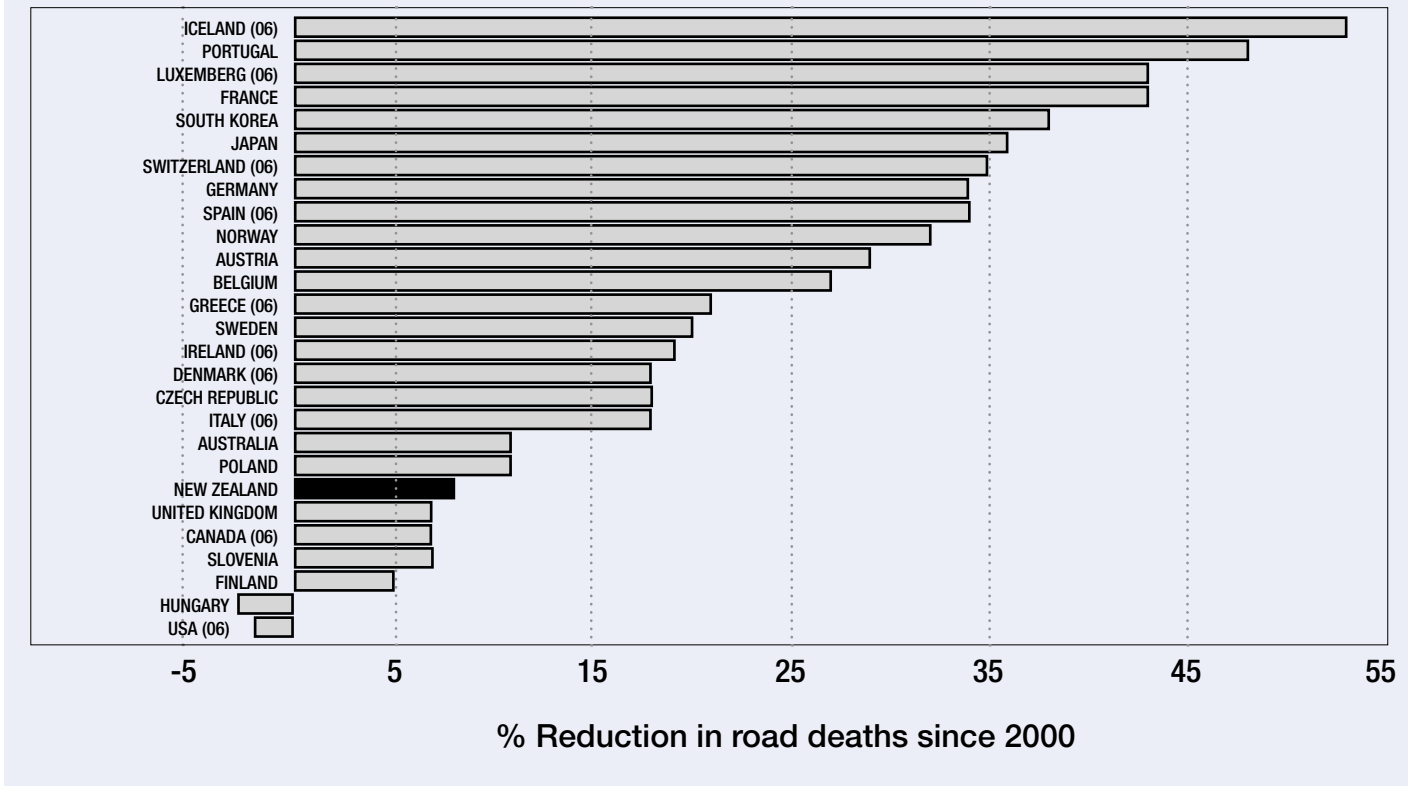

Figure 5. International comparison of percentage reduction in road deaths from 2000 to 2007 (Source: IRTAD 2008)

people, who suffer death or injury because of some road safety issues more often than other Aucklanders. Road crashes contribute to inequalities in health. Assessing the increased risk for certain groups in the population is complex, but risk is often associated with lower socio-economic status.

A review of the 2005 Auckland Regional Road Safety Plan concluded that to achieve better road safety outcomes in the Auckland region, further attention should be paid to key areas of concern, listed below:

> **Improved safety engineering and planning on local roads**

The Auckland region has experienced significant growth and development that places pressures on road infrastructure. Growth and development sometimes work against planned road improvements as land use changes and alters traffic patterns. Such shifting patterns highlight the need for transport engineers and planners to work closely with town planners to anticipate land use changes and the impacts of new developments, to avoid the creation of new hazardous road environments.

> **Speeding or driving too fast for the conditions**

Research indicates that slowing down can significantly reduce the number and severity of road casualties, and improved management of speeding can be achieved by engineering, enforcement and community initiatives.

> **Drink driving**

Drink driving is a significant factor in crashes and fatalities and can be addressed by targeted and universal programmes such as host responsibility, programmes aimed at young drivers and repeat drink drivers, improved legislation and consistent enforcement of alcohol laws.

> **Pedestrian safety**

Pedestrians continue to be killed and injured in the region. Improvements to town centres, improved speed management and provision of more facilities for all pedestrians, including children, will enhance safety. Urban planning and design, and community education also contribute.

> **Intersection injury crashes**

Crashes at intersections that result in injury remain a significant issue for the region and require an increased focus on engineering and 'crash cluster/blackspot' programmes, increased enforcement, including the use of improved technology (e.g. cameras at red lights) and ongoing community education.

> **Crashes on bends and with roadside hazards**

Safety engineering for specific issues and hazards, including bends and roadside hazards, has significant potential to improve road safety. There needs to be a stronger focus on this area across the region.

> **The use of child restraints and safety belts**

Data concerning use of restraints and safety belts indicate that continued effort is required to maintain and increase their use. Means include continued enforcement, local community promotions, and measures to ensure restraints are installed appropriately.

> **Cyclist safety**

Cycling is being actively promoted and the number of cyclists is increasing. They require improved cycle facilities, speed management of motor vehicles, cycle skills training, and safety promotions.

Texting and driving distraction

> **Motorcyclist safety**

As motorcyclist numbers are increasing the number of crashes involving them is also increasing. Safety measures include a range of rider training and safety promotions. The high social cost of motorcycle crashes indicates that from a safety perspective it is a highly subsidised form of transport. Legislative changes to improve safety and the visibility of riders are needed.

> **Young drivers**

Drivers aged 15 to 24 years are over-represented in the region in speed- and alcohol-related crashes, as well as in crashes at night. Many young-driver-related crashes have occurred while drivers have been subject to Restricted License conditions prohibiting the carriage of passengers, alcohol use and driving at night. Drivers in the 15- to 19-year old age group are six to seven times more likely to crash (per 100 million kilometres driven) than drivers in the 45 to 49-year-old age group (Ministry of Transport, 2008).

2.2.2 Emerging issues

ARTA and RoadSafe Auckland has attempted to assess emerging road safety issues and acknowledges that new road safety issues requiring attention will arise from time to time.

The Auckland Regional Road Safety Plan 2009–2012 suggests that more attention needs to be given to cyclist and motorcyclist safety in the Auckland region because of an increased number of cyclists and motorcyclists, and more crashes.

Illegal street racing (or 'boy-racers') has been a road safety concern in recent years, and is occasionally reported in the media. This issue is embedded in a broader youth and speed culture. It involves a relatively small number of people who cause harm to property and create a serious nuisance. As it is a road safety issue, ARTA and member organisations of RoadSafe Auckland believe that it is best addressed by enforcement and improved legislation (currently in development nationally). With sufficient police resources, the road safety risks of illegal street racing can be contained.

Similarly, beach driving received some attention in late 2007 with the tragic death of a teenager on a Northland beach, prompting a review of controls on certain beaches within the Auckland region. Again, ARTA and RoadSafe Auckland member organisations believe that appropriate legislation and enforcement measures will assist in containing the issue.

Recently, Safekids and others have highlighted that the use of adult safety belts without the use of booster seats is not effective for children over the age of five. There is mounting evidence that the recommended age or height limit before which children must use booster seats needs to be increased (Safekids, 2008).

Drugged driving has been recently identified as having a significant relationship with fatal driver crashes in New Zealand, particularly for drivers using both alcohol and cannabis together (Vergara, 2006). Current roadside tests for drugged driving could be improved, and the introduction of mandatory drug testing of drivers in fatal and serious crashes would provide good evidence for further policy in this area. Education of the risk related to drugged driving is also required.

Crashes can be caused by driver distraction. The use of a mobile phone while driving can be a distraction. Despite relatively infrequent reports of crashes attributed to mobile phone use, RoadSafe Auckland has argued for a law against the use of mobile phones while driving, as an important measure to reduce crashes caused by this well-researched risk factor. This law is currently being progressed by the Ministry of Transport.

It is expected that in the future many people in the region will be over 65 years of age. Becoming less able to drive, and with possible financial constraints, many senior citizens will give up driving, creating a population group dependent on public transport or walking. This likelihood illustrates the importance of planning for safer and shorter pedestrian routes and safe and convenient public transport.

Child restraint fitting clinic

2.2.3 Factors influencing crash risk, involvement and severity

Crash risk is a function of four key elements: exposure (the amount of movement or travel within the system by different road users for a given population density); the underlying probability of a crash, given a particular exposure; the probability of injury, given a crash; and the outcome of the injury. These elements are summarised in Table 4 opposite. They are sometimes separated into factors relating to the likelihood of crashes occurring (factors 1 and 2) and those related to the likelihood of injury once a crash has occurred (factors 3 and 4).

It is not practically possible to eliminate all crash risk on the road network, but it is possible to reduce exposure to risk of severe injury and to minimise the intensity and consequences of injury. Identified crash risks relating to the Auckland region's most important road safety issues are outlined below, along with best practice interventions:

> Unnecessary travel, choosing less safe travel modes and routes, and unsafe mixes of traffic all lead to increased risk. Land use policy and planning, urban design, and safety engineering should consider these matters in all transport projects through the use of Integrated Transport Assessments. Reducing drivers' annual vehicle mileage can deliver significant safety benefits for the region, as can Travel Demand Management.

> Exposure to risk increases significantly where road networks fail to route heavy traffic around populated areas, or where pedestrians are not separated from motorised traffic due to haphazard land use and transport planning. Land use policy and planning, urban design, and safety engineering should also consider these issues in all transport projects by means of Integrated Transport Assessments.

> Excess and inappropriate speed influences both crash risk and crash consequences and is widespread across the region, contributing to 38% of fatalities. In 2007, 80% of Auckland drivers exceeded the 50km/h urban speed limit. Speed has an exponentially detrimental effect on safety. In collisions at 80 km/h, car occupants have a 20 times higher risk of being killed than in collisions at 30 km/h. Pedestrians have a 90% chance of surviving car crashes at 30 km/h or below, but less than a 50% chance of surviving impacts at 45 km/h or above (see section 4.3) A regional speed management policy is required together with further safety engineering, lower speeds in town centres, and more enforcement interventions.

> There has been an increasing trend since 2001 of impairment by alcohol causing an increase in both injuries from crashes and the risk of crashes across the region. The trend has occurred within a more liberal alcohol-planning environment where there are no new major enforcement interventions. In 2007, 42% of Aucklanders believed the chance of being caught drinking and driving above the legal limit was small. This is a greater percentage than in previous years and also greater than the national average. All non-zero Blood Alcohol Content (BAC) levels carry more risk than zero BAC, and crash risk starts to rise sharply at levels of 0.04 BAC. Legal BAC limits set at 0.08 (New Zealand's current legal BAC limit) give twice the risk of limits set at 0.05 BAC. Advocating a lower BAC (set at 0.05), stricter alcohol licensing, and initiatives to convince the public that drink drivers are likely to be caught are all required to reduce the increasing trend in alcohol-related casualties.

> Young/novice drivers are at increased risk of crash injury. In New Zealand the risk among teenage drivers is higher than for any other age group (see section 4.3). This is primarily related to the late maturation of cognitive abilities, including visual scanning and hazard detection, lack of driving experience, risk-taking and peer pressure in young drivers (National Road Safety Committee, 2007). The danger is particularly heightened by New Zealand's low legal driving age and alcohol-purchasing age, when compared to other OECD countries. Excess or inappropriate speed is also a common contributing factor in crashes involving young/novice drivers. Associated with this group are crashes at night, and alcohol-related crashes, the number of which has increased following the lowering of the legal age at which alcohol can be purchased. Advocacy for a raised driving age, zero BAC level, raised alcohol-purchase age, changes to the restricted driver license system, improved driver education and enforcement of restricted license conditions is required.

> Pedestrians, particularly child pedestrians, and cyclists bear a disproportionate share of road trauma in the region, and are at high risk of crash injury. Safety engineering and planning policies are required to give these road users greater protection (see road user hierarchy section 1.5.2) along with safety education and cycle skills training.

> **The New Zealand Travel Survey indicates that, on average, a motorcyclist has a more than 18 times higher risk of being involved in a fatal or injury crash than does a car driver travelling the same distance (2003-2007 data).**

Table 4.The main risk factors for road traffic injuries (World Health Organisation, 2004)

1. Factors influencing exposure to risk
• Economic factors, including social deprivation • Demographic factors including age groups and population changes • Land use planning practices that influence the length of a trip or choice of travel mode • Mixture of high-speed motorised traffic and vulnerable road users • Insufficient attention to the integration of road function when making decisions about speed limits, road layout and road design
2. Risk factors influencing crash involvement
• Inappropriate or excessive speed • Presence in the body 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 when environmental factors make it hard to detect vehicles and other road users • Poor road-user eyesight
3. Risk factors influencing crash severity
• Human tolerance factors • Inappropriate or excessive speed • Safety belts and child restraints not used, or used improperly • Crash helmets not worn by users of two-wheeled vehicles • Roadside objects not crash protective • Insufficient vehicle crash protection for vehicle occupants and those hit by vehicles • Presence in the body of alcohol and other drugs
4. Risk factors influencing severity of post-crash injuries
• Delay in detecting crash • Presence of fire resulting from collision • Leakage of hazardous materials • Presence in the body of alcohol and other drugs • Difficulty rescuing and extracting people from vehicles involved in a crash • Lack of appropriate pre-hospital care • Lack of appropriate care in hospital emergency rooms

Loss of control crash on motorway, S.H.1.

- Motorcyclists have the greatest crash cost and risk exposure on the road network. In the Auckland region motorcycle ownership has doubled in the last six years and the number of mopeds has increased by 300%, accompanied by an increase in serious and minor injuries. Care should be taken to avoid the adoption of policies that could encourage greater motorcycle use rather than use of other transport modes in the region.
- The non-use or improper use of safety belts and restraints more than doubles the risk of serious and fatal injury, as does the non-use of cycle helmets. Further education and enforcement is required, along with legislative improvements.
- Crash analysis shows that most pedestrian fatalities involve impact with unprotective car fronts. If all cars were designed to provide protection equivalent to that of the best car in the same class, an estimated half of all fatal and disabling injuries would be avoided. Advocacy for improved vehicle standards is required.
- Roadside design and the positioning of roadside objects play key roles in determining crash injury, as well as influencing the behaviour of road users. Safety engineering targeting more frangible roadside objects, as well as removal of dangerous objects, is required.

It is important to note that major variations in risk exist between pedestrians, cyclists, motorcyclists, car occupants and bus and truck passengers. The risks vary greatly according to the traffic mix, but generally riders of motorcycles are at significantly more risk than any of the other modes, followed by pedestrians, cyclists, car occupants, bus and truck occupants, and then people travelling by rail.

Crash reduction and safer crashing

The regional issues already discussed involve two general approaches to reducing crash risk. One is to prevent crashes from occurring, e.g. reducing vehicle volumes, mileage, and speed; designing and building roadways so there will be fewer conflicts between users; increasing traffic law enforcement; reducing numbers of intoxicated and other high-risk drivers; and imposing more rigorous requirements on those with driving privileges. These strategies are intended to promote crash-free road networks.

The other approach involves reducing the amount of damage that occurs in a crash, particularly for vehicle occupants, by building crash protection into roads and in vehicles, and by requiring vehicle occupants to use safety belts, child restraints, motorcycle and bicycle helmets. This approach has been described as ‘safer crashing’.

‘Safer crashing’ rebound effect

The ‘safer crashing’ approach can have a rebound effect. As the use of vehicles with improved technology such as airbags makes individual drivers feel safer, they tend to take somewhat greater risks, such as driving faster, leaving less distance between their vehicle and the next, and talking on a cell phone. Equally, the over-designing of roads with wide clear zones and forward visibility has been shown to actually encourage drivers to speed in some environments. These kinds of behaviour offset some of the expected safety benefits and may increase risk to others, particularly vulnerable road users such as pedestrians, cyclists and motorcyclists. As a result, net safety benefits may be smaller than expected. This is called risk compensation or risk homeostasis (Litman, 2008).

Individual crash risk versus societal crash risk

Road safety interventions from an individual’s perspective may be quite different from what is optimal from society’s perspective. Individuals value solutions that shift crash risk to others, but society does not.

Table 5. TDM safety and health impact summary (Litman, T. 2008)

Travel change	TDM strategies	Safety effects
Traffic speed reductions	Traffic calming, vehicle restrictions	Increases safety by reducing crash frequency and severity, and reducing total vehicle mileage. Can increase non-motorised travel.
Access management	Access management	Depends on details. Reduces per-mile vehicle crash rates, but can increase traffic volumes and speeds. Can support more efficient land use and mode shifts.
Time and route shifts	Flexi-time, congestion pricing	Mixed. Reducing congestion tends to reduce crashes but increases the severity of crashes that do occur.
Shifts to public transport	Public transport improvements, HOV priority, park and ride	Increases safety due to greater safety for public transport passengers and reduced vehicle traffic. Can increase safety and health if public transport travel leads to reductions in total person-miles in vehicles or increases walking.
Shifts to ridesharing	Ridesharing, HOV priority	Modest safety benefits. Increases safety due to reduced vehicle traffic.
Shifts to non-motorised modes	Walking and cycling improvements, traffic calming	Mixed. Increases crash risk to participants, but reduces risk to other road users, reduces total person-kilometres in vehicles, and improves aerobic health.
Vehicle mileage reductions	Various pricing, TDM programs, other TDM strategies	Increases safety by reducing both the risk of causing a crash and of being hit. Each 1.0% reduction in vehicle-kilometres tends to reduce crash costs by about 1.6%.
Distance-based insurance	PAYD (pay as you drive) insurance, distance-based pricing	Large safety benefits. Reduces total traffic. Gives high-risk motorists an extra incentive to reduce mileage.
Improved vehicle availability	Car-sharing, taxi improvements	May increase automobile use by some drivers, but usually reduces overall vehicle traffic.
Vehicle fuel efficiency	Fuel price increases, fuel efficiency standards	Mixed. Shifts to smaller vehicles may increase risk to some occupants, but reduce risk to other road users.
Mobility Substitutes	Tele-working, Delivery Services	Increases safety by reducing vehicle mileage, but there are often rebound effects that offset a portion of benefits.
Land use and transport system changes	Various land use management and planning reforms	Increases safety by reducing personal travel and encouraging shifts to alternative modes. Tends to increase walking and cycling, providing aerobic health.
Improved personal security	Address security concerns, CPTED (crime prevention through engineering design), new urbanism	Directly improves personal security, and can reduce crashes and improve health if this supports shifts to walking, cycling and public transport.
Safety education	Bicycle encouragement, marketing	Can reduce bicycle crash rates. Encourages shifts to cycling.

For example, individuals may compete for safety by shifting from walking to driving, or purchasing ever larger and heavier vehicles, but this is economically inefficient if it does not result in an overall reduction in crash costs, and it is inequitable if it simply shifts risk to more vulnerable or poorer people. It has been observed that many consumers purchase large vehicles because such vehicles feel safer to drive; but they increase risk to the occupants of other vehicles, resulting in little net benefit to society (Wenzel and Ross, 2002).

Reducing crash risk through TDM initiatives

Travel Demand Management (TDM) strategies can significantly reduce crash risks on the Auckland network. ARTA and RoadSafe Auckland members implement a number of TDM strategies, including school travel plans, workplace travel plans, neighbourhood accessibility plans, ride sharing, journey planning, High Occupancy Vehicle (HOV) lanes, park and ride, bus and bike lanes and public transport incentives. The TDM interventions will increase over time and add safety and health benefits to the region in a variety of ways.

Table 5 above summarises the road safety and public health effects of various travel changes resulting from known TDM initiatives. Some of these effects overlap. For example, shifting travel from using private vehicles to using public transport usually results in an overall reduction in personal travel and an increase in walking and cycling, each of which has an effect on safety and on health.

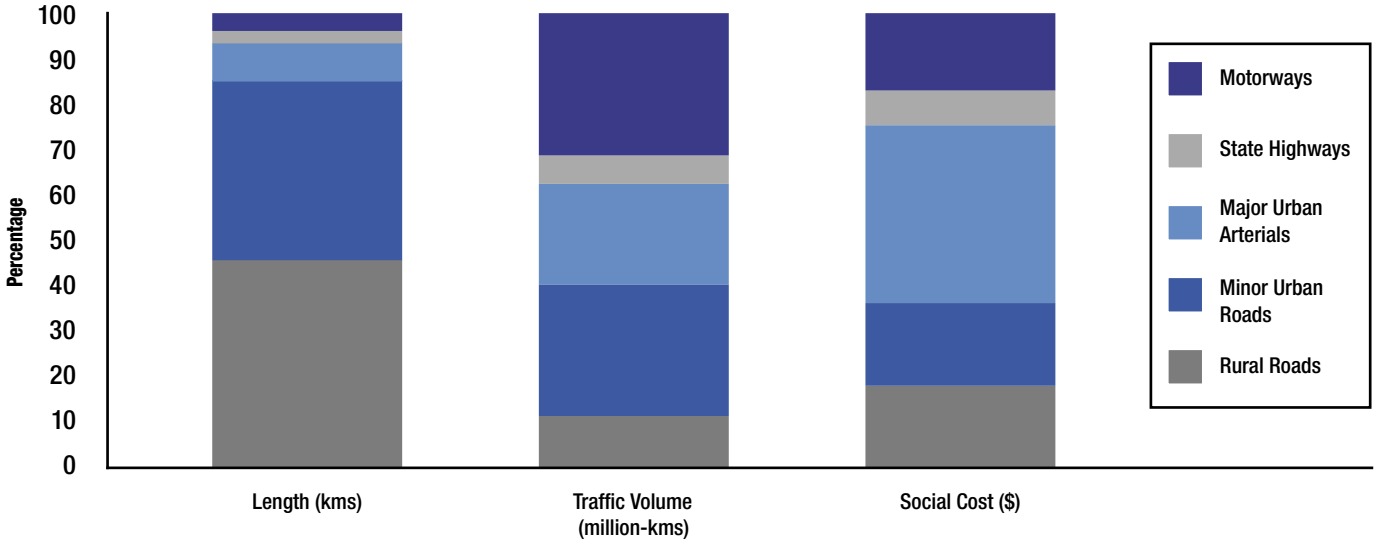

Chart 3. Comparison of network length, traffic volume, and social cost for the Auckland Region 2007 (Ministry of Transport, New Zealand Transport Agency)

TDM strategies that reduce total personal vehicle travel can produce good safety benefits. Each 1% reduction in motor vehicle travel typically reduces total crashes and casualties by 1.6% (World Health Organisation, 2004).

2.2.4 Targeting resources to cost density and crash risk by road

Crashes are never distributed evenly across the regional roading network and instead tend to cluster in certain areas, particularly in relation to traffic volume.

As limited resources are available, it is important to use road safety interventions where they will maximise efficiency or equity, or both. Section 2.2.3 identified the key crash risks in the region by crash type and travel mode. Maximising efficiency or equity can also be done by targeting road safety resources to crash cost density and crash risk by regional road type.

Chart 3 above shows three measures for each road type in the Auckland region: its length, the volume of traffic it carries, and the social cost of the crashes that occur on it. Two further measures of 'crash cost density' and 'crash risk' can be derived from this chart.

Crash risk

Crash risk on the road network is measured by social cost per unit of traffic volume and is generally expressed in cents per vehicle-kilometre travelled. Roads with high crash risk should be targeted for reasons of equity or fairness. It is undesirable to require some road users to be exposed to higher risk than others on parts of the network, especially if the exposure is largely beyond their control. But high crash risk does not mean that a road is economical to treat, as it may carry too little traffic to make engineering treatment cost effective. In the Auckland region, local rural open roads are the best example of high crash risk roads. They are usually roads with higher speed limits and less engineering treatment, and while crashes on them may be more infrequent, when crashes occur they are generally more severe and expensive than on urban roads.

Crash cost density

Crash cost density is defined as the social cost of crashes per unit of road length, and is generally expressed in dollars per kilometre. Roads with a high-cost density should in general be targeted for reasons of efficiency because the benefits are likely to exceed the costs by the greatest margin, making them more economical to treat. For each kilometre treated, we can potentially prevent or mitigate many crashes. In the Auckland region, motorways, State highways and major urban arterials all have high crash cost density.

High-risk and high-cost density can occur together, but do not always do so. A road with a high risk only has a high-cost density if it also carries a lot of traffic. If it carries little traffic, it could be of high risk and still have few crashes. Many minor open roads in rural areas are like this: they are risky, but carry so little traffic that it is hard to justify engineering treatment. Police enforcement is a more efficient alternative for these high-risk roads, combined with lower speed limits.

Busy roads tend to be safer, not because they carry a lot of traffic (if anything, the more traffic, the more scope for collisions), but because they tend to be built to higher standards; with so much traffic it makes economic sense to build them that way. Congestion can lower the impact speed of crashes on these roads. Motorways are the best example.

This raises an apparent dilemma: busy roads most easily justify treatment because they have a high-cost density, but they need it least because they have low risk; conversely, low-volume roads need treatment because they carry high risk, but are least able to justify it because they have a low cost density.

Targeting high-risk/high-cost density roads

The dilemma disappears when we examine roads individually instead of aggregating all roads that have the same traffic flow. Then we see that much of the social cost is incurred on roads that have both higher risk and high-cost density. They may constitute only a small percentage of the network length but they carry a lot of traffic and by targeting them for engineering treatment we can contribute to efficiency and equity at the same time.

In the Auckland region, major urban arterials are the leading high-risk/high-cost density road type, as shown in Table 6 below.

Table 6. Average cost density and risk for Auckland road types (Kiwi RAP, Road Safety to 2010, Ministry of Transport, RARP, 2009)

Auckland region road types	Cost density ($000/km)	Risk (cents/veh-km)
Motorway	High	Low
State highway	High	Medium
Major urban arterials	High	High
Minor urban road	Low	Low
Rural road	Low	High

Great South Road Regional Arterial

2.3 Key crash routes and maps

The maps in Figures 6 to 13 on the following pages show the cost per kilometre of road crashes (i.e. crash cost densities) per year based on data for 2002 to 2006 for the Auckland region as a whole (including State Highways) and for each territorial authority area (local roads only, i.e., not including State Highways).

Cost has been defined as the social cost[8] of crashes. Each reported crash is assigned a cost depending on the severity of the crash. Obviously, fatal crashes are assigned higher values than crashes causing minor injury. A key limitation of the data included in the maps is that the apparent cost per kilometre on short roads may be misleading, e.g. a single fatal crash on a very short road will highlight the road as having a higher crash cost density than longer roads with more crashes. Also, the data is based on cost per kilometre of road, not per kilometre of travel. Therefore more heavily travelled roads are likely to have more crashes and higher crash cost densities than roads with lighter flows, despite not being necessarily more dangerous to the individual road user.

Despite these limitations, the maps indicate roads or routes that have greater or lesser crash issues and assist road safety planning by highlighting areas in need of safety engineering investment over time.

[8]The Ministry of Transport describes 'social cost of road crashes' as a dollar measure of all the damage to society resulting from road crashes. This includes financial (such as medical, legal, loss of output and property damages) and non-financial (loss of life and life quality) costs. The latter figure is derived from surveys that ask New Zealanders how much they would pay to reduce the chances of death, injury and the pain, grief and suffering resulting from crashes

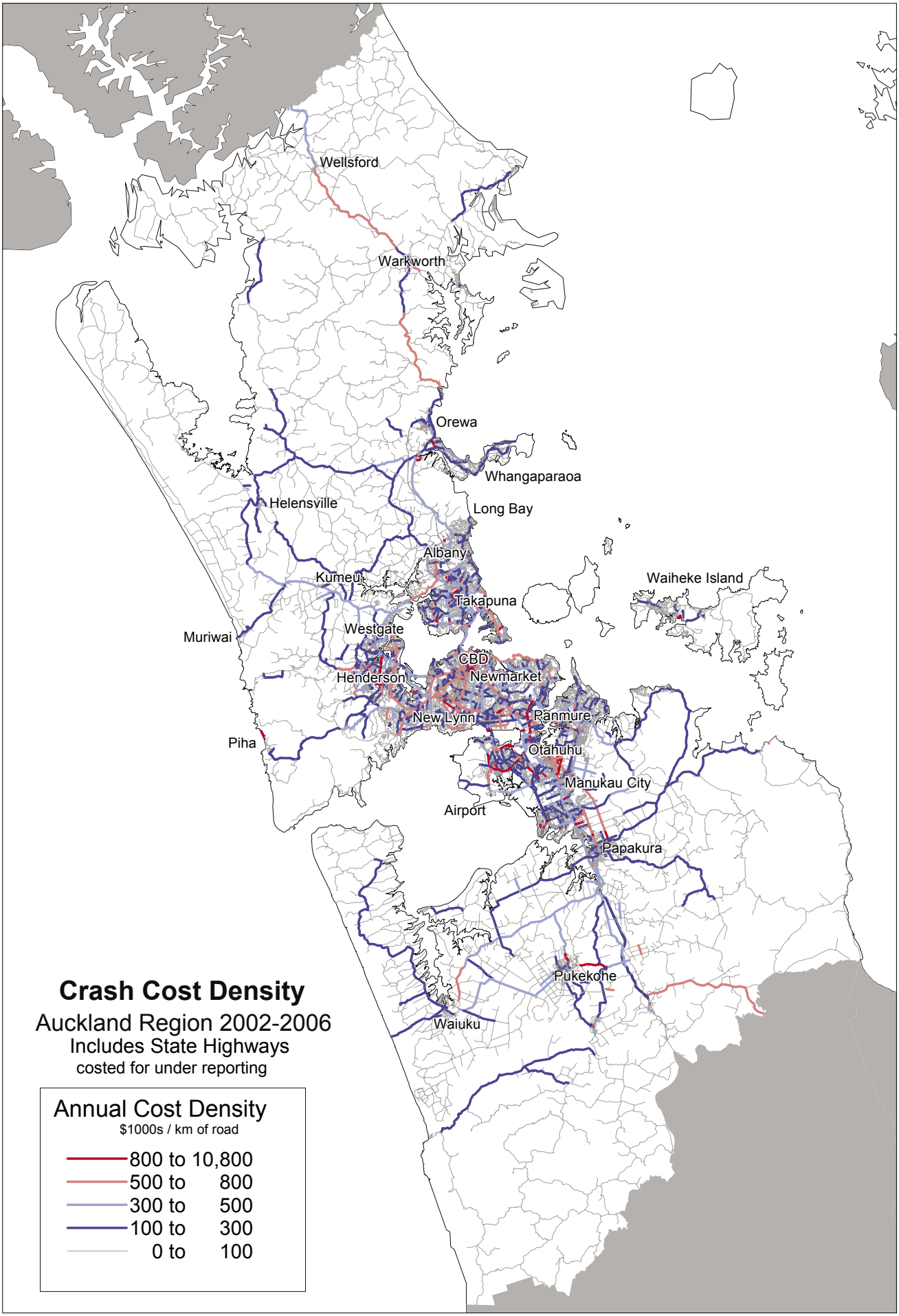

Figure 6. Crash cost density map for the Auckland region including State Highways (Source: Ministry of Transport)

Figure 7. Crash cost density map for Rodney District, local roads only (Source: Ministry of Transport)

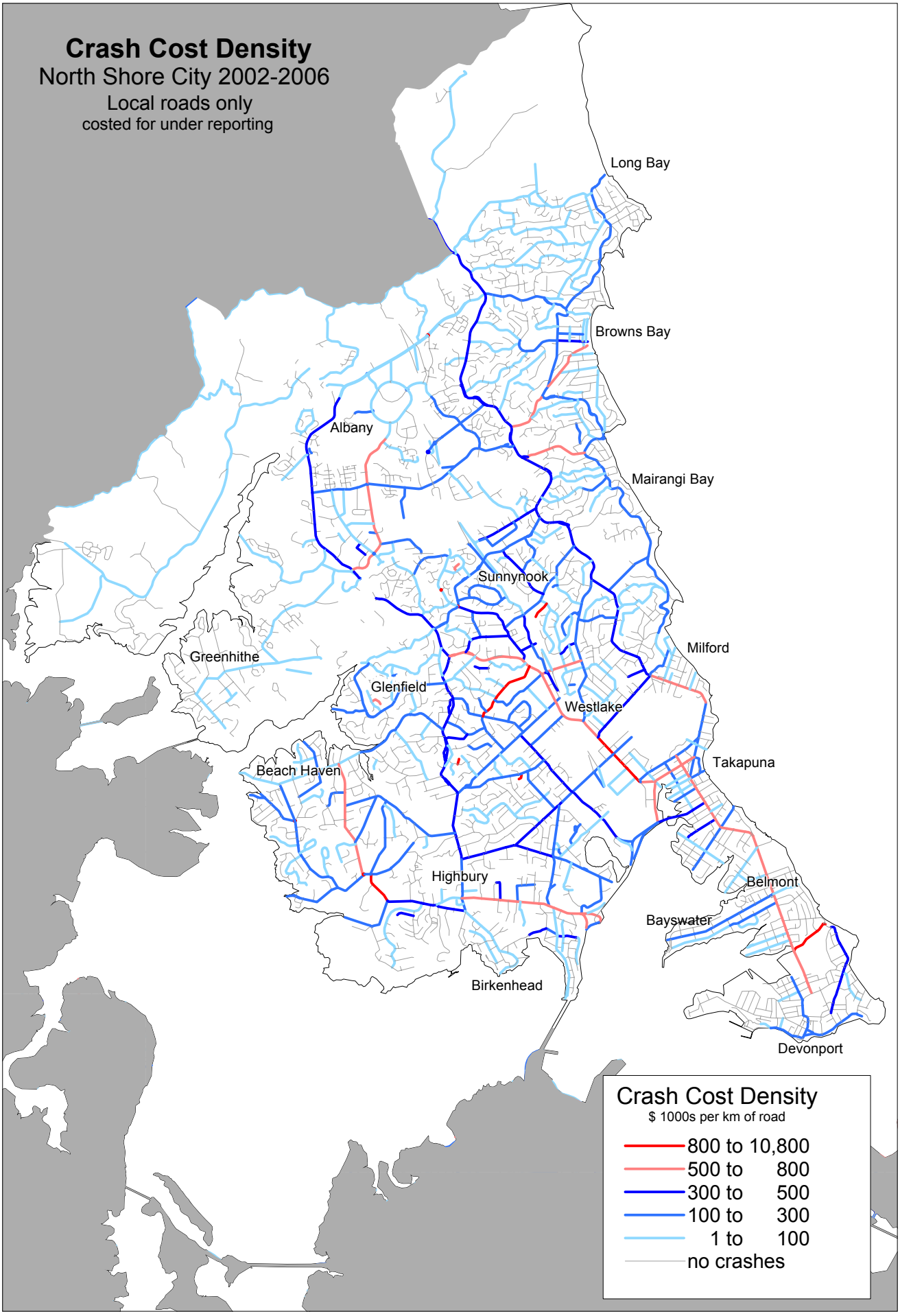

Figure 8. Crash cost density map for North Shore city, local roads only (Source: Ministry of Transport)

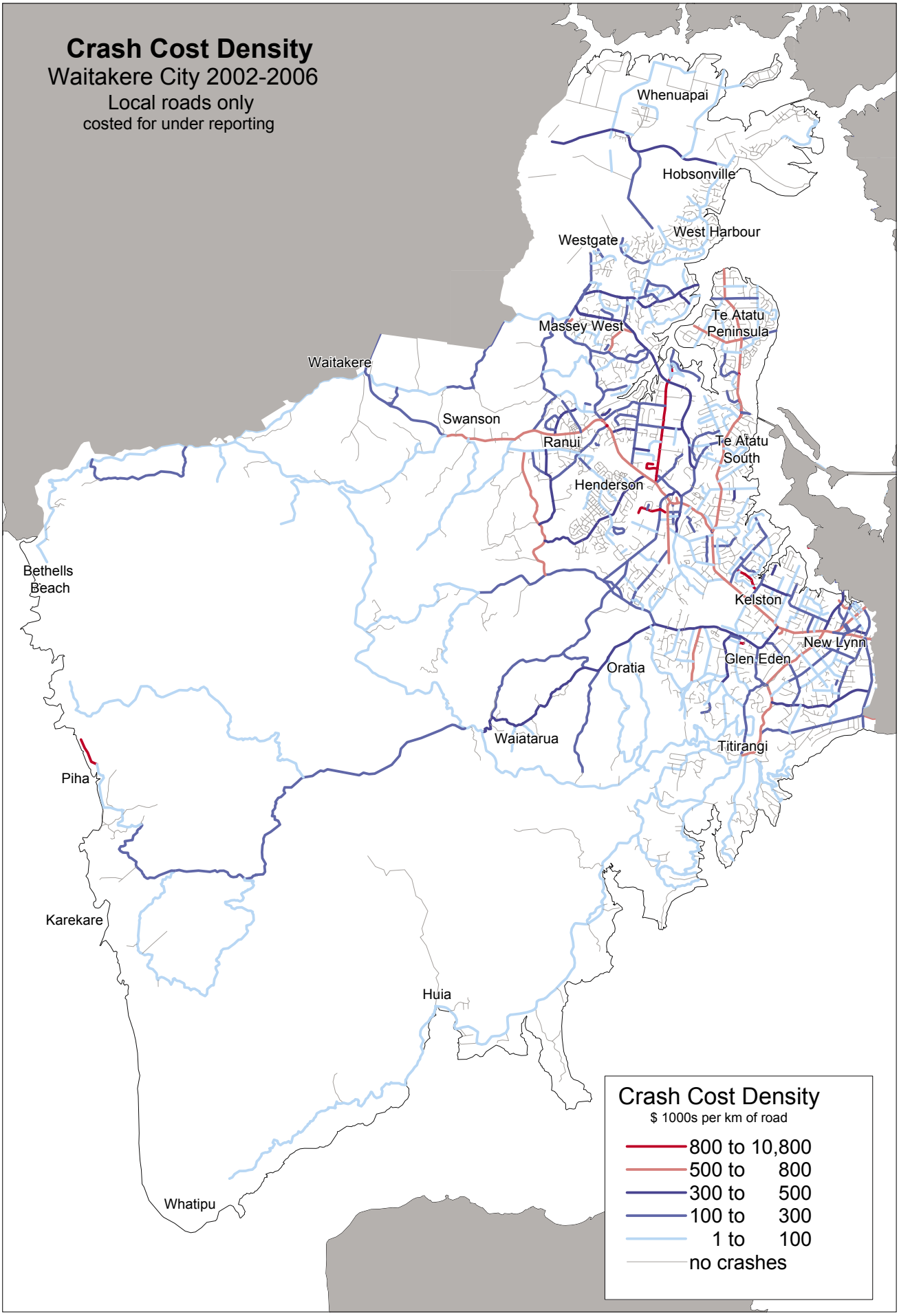

Figure 9. Crash cost density map for Waitakere City, local roads only (Source: Ministry of Transport)

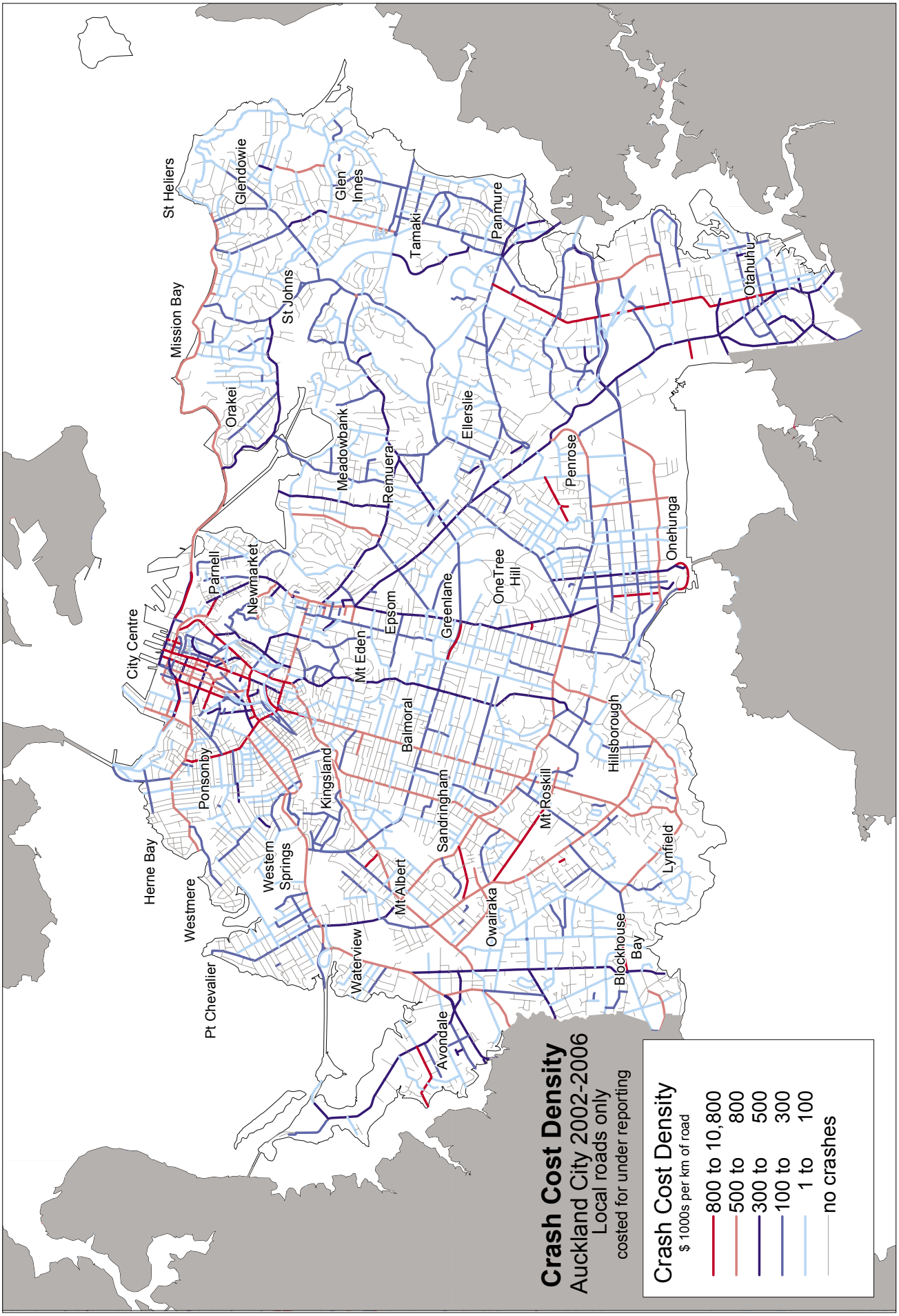

Figure 10. Crash cost density map for Auckland City, local roads only (Source: Ministry of Transport)

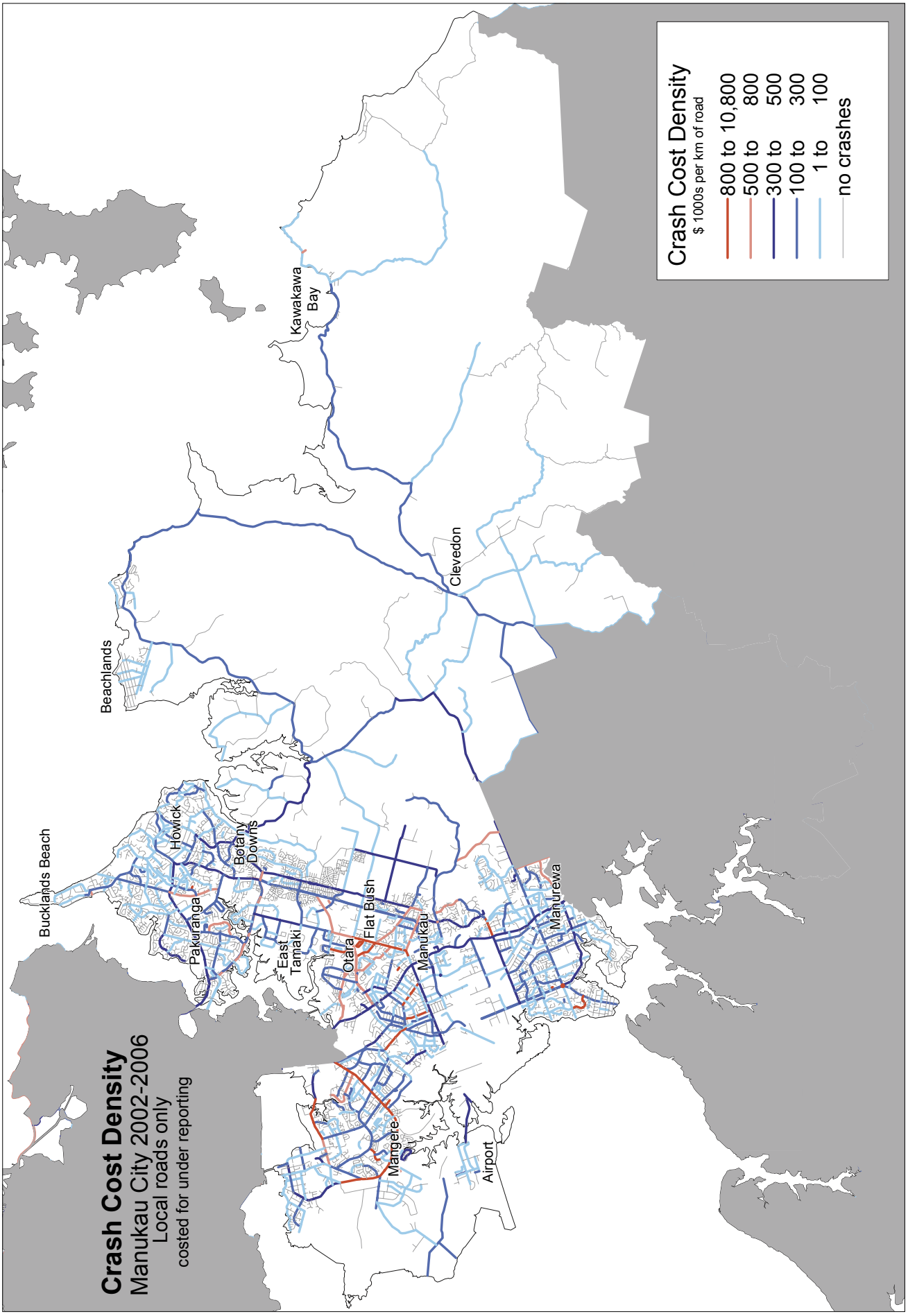

Figure 11. Crash cost density map for Manukau City, local roads only (Source: Ministry of Transport)

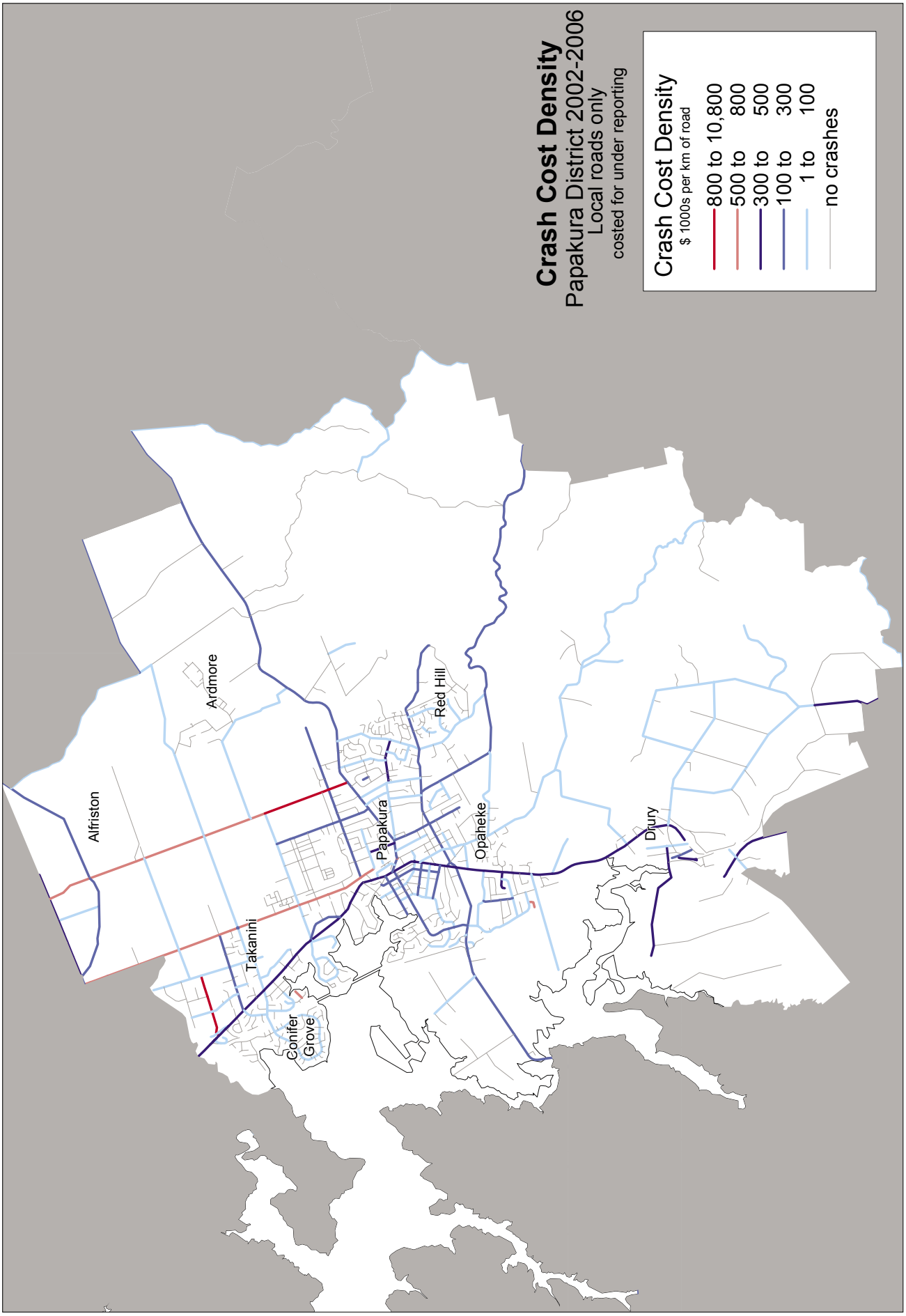

Figure 12. Crash cost density map for Papakura District, local roads only (Source: Ministry of Transport)

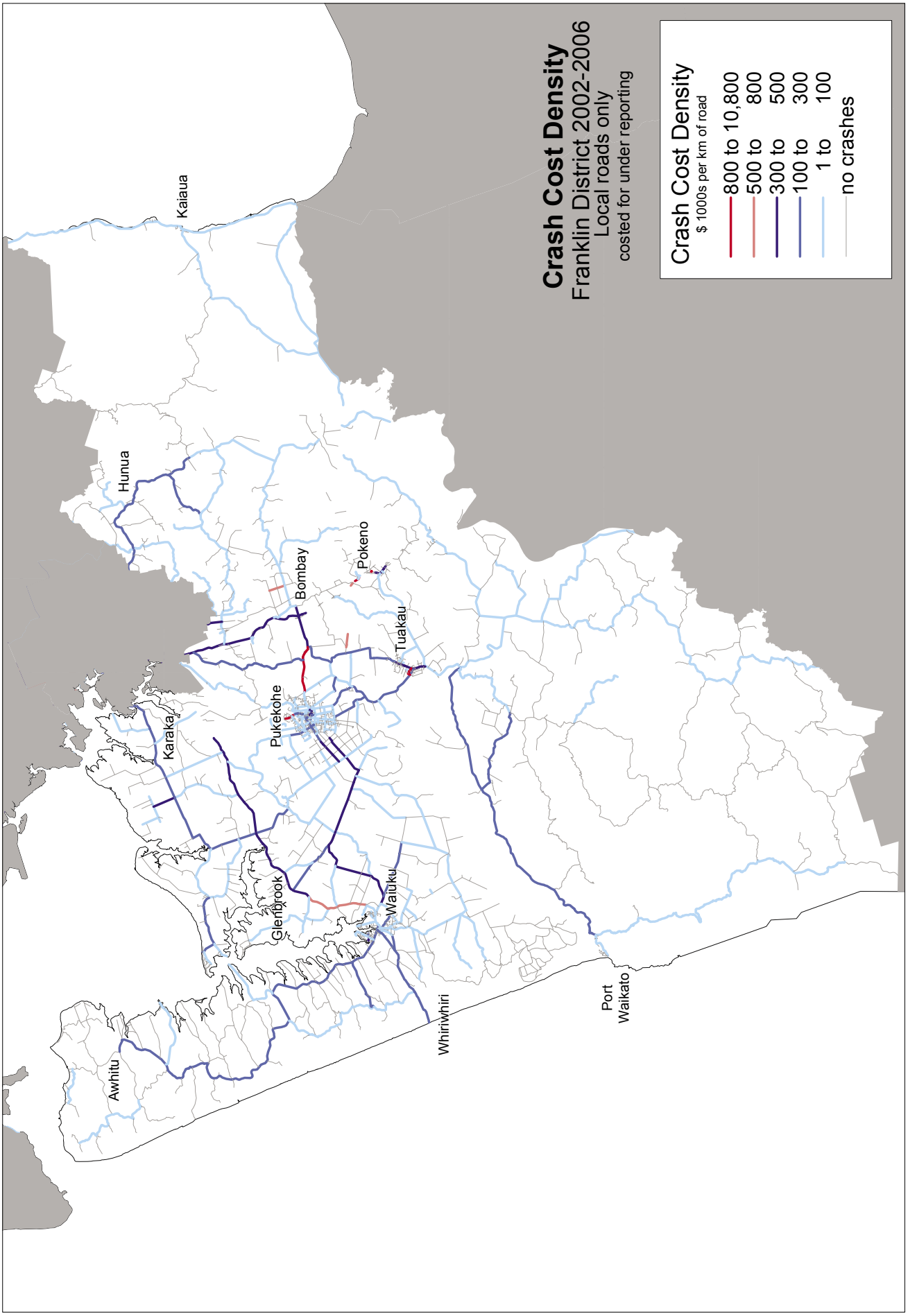

Figure 13. Crash cost density map for Franklin District, local roads only (Source: Ministry of Transport)

2.3.1 Regional State Highway crash routes

The NZ Road Assessment Programme, KiwiRAP, falls under the umbrella of the international Road Assessment Programme (iRAP) and is a partnership between the New Zealand Automobile Association and New Zealand's main transport agencies (Ministry of Transport, New Zealand Transport Agency, Accident Compensation Corporation, New Zealand Police).

KiwiRAP has produced crash risk maps that focus on the State Highway network broken up into road sections, for the purpose of comparing the crash risk between different parts of the network. The different sections are rated in terms of Collective Risk (crash density) and Personal Risk (crash risk).

Collective Risk measures the total number of fatal and serious injury crashes per kilometre of road section. Sections with higher traffic volumes tend to have a higher Collective Risk.

Personal Risk measures the total number of fatal and serious injury crashes per vehicle kilometre travelled on a road section. It shows the likelihood of a driver, on average, being involved in a fatal or serious road crash on a particular stretch of road. Personal Risk is typically higher in more difficult terrain where traffic volumes and road standards are often lower.

Figures 14 and 15 on the following pages show the Collective and Personal Crash Risk for the State Highway network in the Northland and Auckland regions based on crash data from the five-year period 2002 to 2006.

One section of State Highway in the Auckland region that stands out as having both high Collective and high Personal Risk is State Highway 1 from Warkworth to Wellsford.

Other sections of State Highway in the Auckland region and their relative Collective and Personal Risk profiles are outlined in Table 7 opposite, Northland and Auckland region State highways risk mapping results.

Table 7. Northland and Auckland region State Highways risk mapping results (Source: KiwiRAP, 2008)

Link www.kiwirap.org.nz	Length (km)	Serious Injury Crashes 2002 to 2006	Fatal Crashes 2002 to 2006	Collective Risk Annual average fatal and serious injury crashes per km	Collective Risk Band	Personal Risk Annual average fatal and serious injury crashes per 100 million vehicle-km	Personal Risk Band
SH 1 Northern Motorway	35.5	22	3	0.14	Medium-high	0.7	Low
SH 1 from Albany to Orewa and SH 1A	34.5	4	0	0.02	Low	0.4	Low
SH 1 from Auckland to Takanini	50.7	54	14	0.27	High	1.2	Low
SH 1 from Cape Reinga to Kaitaia	109.8	9	7	0.03	Low	7.6	Medium-high
SH 1 from Kaitaia to Ohaeawai	80.1	11	2	0.03	Low	6.4	Medium
SH 1 from Orewa to Warkworth	26	24	10	0.3	High	5.2	Medium
SH 1 from Ruakaka to Wellsford	53.9	41	12	0.21	High	6.3	Medium
SH 1 from Marsden Point (SH 15A) to Whangarei	24.6	19	8	0.22	High	4.9	Low-medium
SH 1 from Takanini to Pokeno*	48.3	17	6	0.1	Medium	1.1	Low
SH 1 from Warkworth to Wellsford	18.7	18	10	0.31	High	7.7	Medium-high
SH 1 from Whangarei to Ohaeawai	70.6	30	16	0.14	Medium-high	5.6	Medium
SH 1A and SH 1 through Orewa	7.4	5	1	0.28	High	4.8	Low-medium
SH 10 from Awanui to SH 1 South (Pakaraka)	103.8	41	9	0.1	Medium	9.8	High
SH 11 from Kawakawa to Puketona (SH 10)	29.6	14	2	0.13	Medium-high	11.8	High
SH 12 from Dargaville to Ohaeawai	147.6	25	8	0.05	Low-medium	11.1	High
SH 12 from Dargaville to SH 1	69.7	11	6	0.06	Low-medium	7.9	Medium-high
SH 14 from Whangarei to Dargaville	49.6	15	3	0.07	Medium	8.8	Medium-high
SH 15A Marsden Point	8.6	0	1	0.02	Low	4.2	Low-medium
SH 16 from Helensville to West Harbour (SH 18)	30.5	21	7	0.22	High	4.6	Low-medium
SH 16 from Parnell to Hobsonville	37.9	35	7	0.23	High	1.6	Low
SH 16 from Wellsford to Helensville	57.7	12	6	0.07	Medium	5.7	Medium
SH 17 Albany to Silverdale	19.7	15	3	0.2	High	5.5	Medium
SH 18 Upper Harbour Highway	16.4	9	1	0.31	High	5.4	Medium
SH 20 and SH 20A and SH 20B	47.1	35	3	0.19	High	2.2	Low
SH 22 from Drury to Pukekohe	13	17	4	0.33	High	6.3	Medium

* These links cross map boundaries, so will appear in more than one regional list

Figure 14. Northland and Auckland region State Highways collective risk mapping (Source: KiwiRAP, 2008)

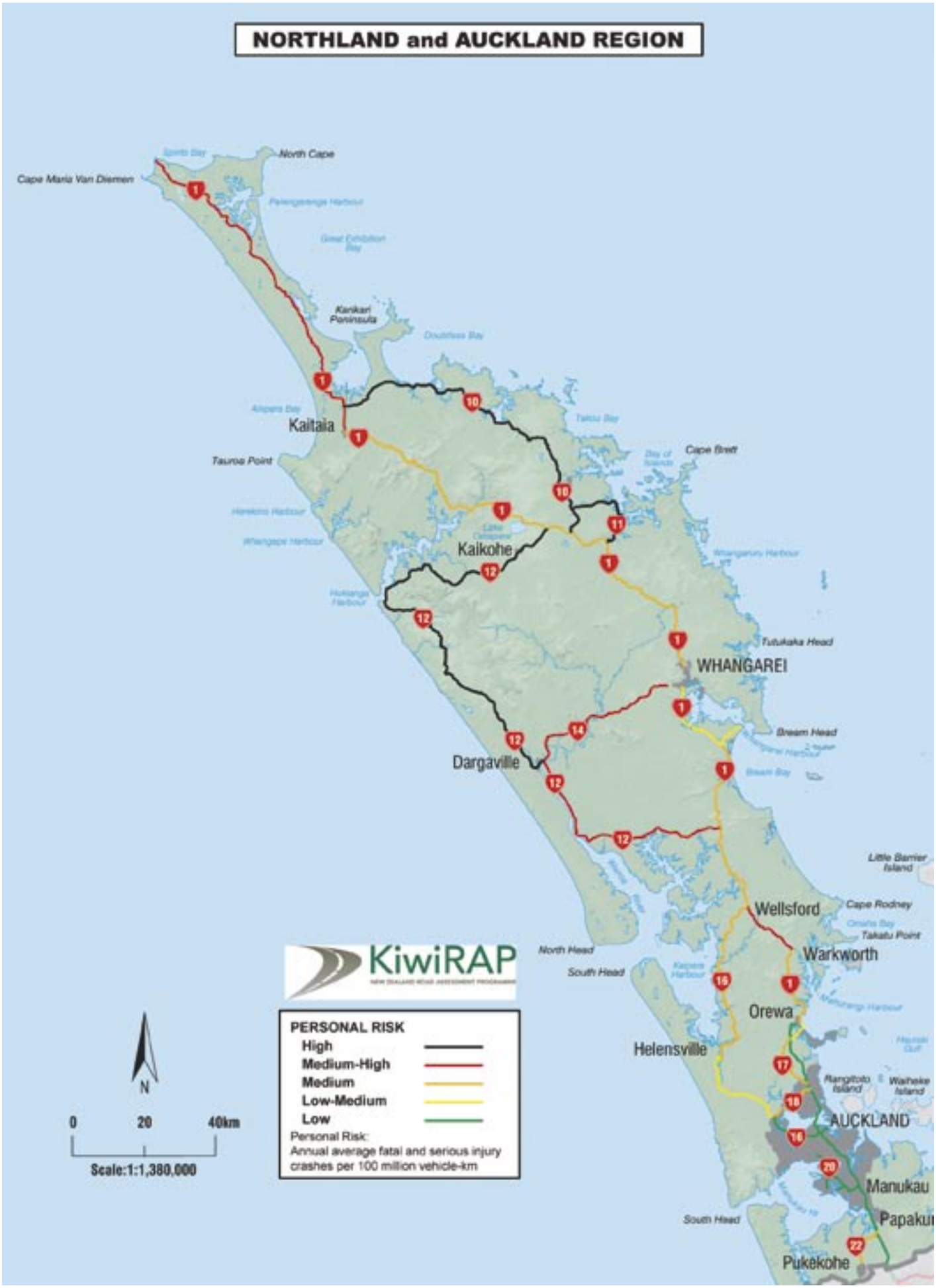

Figure 15. Northland and Auckland region State Highways personal risk mapping (Source: KiwiRAP, 2008)

3 ROAD SAFETY COSTS AND FUNDING

The amount of money spent on road safety is a small proportion of the social cost of road crashes to the region's communities and families, and individual road users.

Work began in 2005 to estimate the increased investment necessary to reach regional 2010 targets for reduction in the number of fatal and serious crashes, primarily through safety engineering improvements on arterial roads. The required amount of investment has not been realised, making it more challenging to achieve the regional 2010 target.

3.1 Social cost of crashes in the Auckland region

'Social cost' is a dollar measure of the damage to society resulting from road crashes. It includes financial costs (such as medical, legal, loss of output and property damages) and non-financial costs (loss of life and life quality). It is one of the greatest costs related to motor vehicle use, outweighing other costs such as those created by congestion or effects on the environment. In 2007 the social cost of crashes in the Auckland region was estimated at $945 million – the highest cost in the country.

The social cost equation does not include the significant economic costs from impaired network efficiency related to delays caused by crashes. It should therefore be viewed as a very conservative estimate.

As outlined in section 2.2.4, most crashes (75%) with a high social cost occur on local roads, particularly arterial roads. Chart 4 opposite shows, in 2008 dollars, the social cost of crashes for the region, and the increase in that cost, from 2001 to 2007.

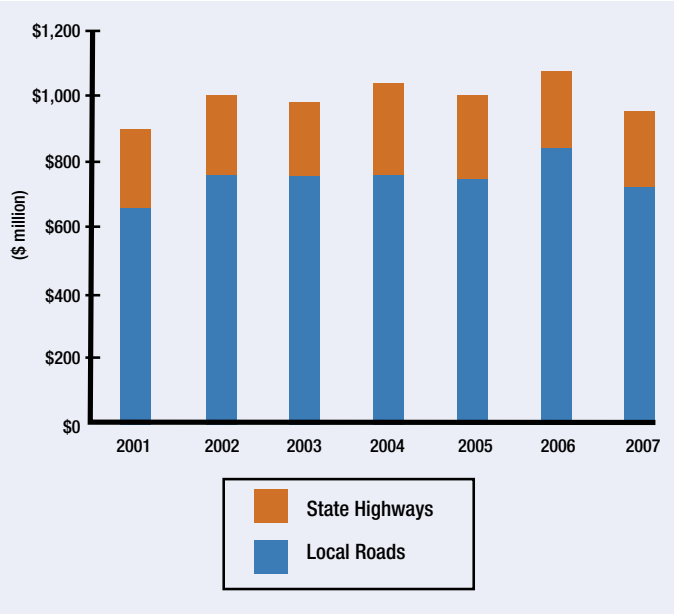

Chart 4. Social cost of crashes for the Auckland region between 2001 and 2007 in $ million (Source: New Zealand Transport Agency, 2008)

3.2 Funding

Road safety activities are predominantly funded by the NZ Transport Agency according to priorities determined by the Auckland Regional Transport Committee in the Regional Land Transport Programme. Auckland is unique in New Zealand in that applications from local authorities are co-ordinated by the Auckland Regional Transport Authority (ARTA).

NZ Transport Agency provides road safety funding under the categories of Community Programmes and Demand Management, Road Policing, Walking and Cycling Facilities and Improvement of Roads. Local authorities contribute a share of their own funding towards these project areas to gain the larger government subsidy as part of the funding application process.

A recent analysis shows that road safety projects account for less than 4% of the overall Regional Land Transport Programme budget in the Auckland region and are underspent in the area of arterial road safety engineering.

Community-Programmes

Road Safety and Sustainability initiatives are funded through the Community Programmes and Demand Management activity class.

In the Auckland region, applications for Community Programmes and Demand Management funding are made to ARTA by local authorities for their own activities and on behalf of community groups. ARTA recommends priorities for funding and the New Zealand Transport Agency makes a final decision on funding to each local authority. ARTA also applies for funding for its own travel planning and regional coordination activities, and on behalf of RoadSafe Auckland for regional road safety projects and advertising.

Community programme and Demand management funding includes the following activities:

> Coordination: funding for human resources such as school and workplace travel planners, and road safety coordinators.

> Community programmes: including neighbourhood accessibility plans, programmes to change travel behaviour, and safety programmes e.g. drink/drive prevention projects, driver licensing education, cycle safety projects, walking school buses, and school and workplace travel plans.

> Community advertising and safety promotions that complement the above activities.

In 2008/09, a total of $10.3 million was allocated to community-funded activities in the Auckland region through the Land Transport Programme. Approximately $3 million was allocated to activities that specifically targeted road safety, which equated to 30% of the regional community programme funding allocation.

The benefits of education, safety promotions and community programmes are generally less direct than engineering and enforcement interventions, but help support, at a community level, overall enforcement and safety engineering funded activities.

While there is no measure of the overall cost/benefit of CFA educational funding in the region as a whole, some specific programmes funded within CFA that are targeted to high-risk behaviours have demonstrated high benefit/cost ratios (BCR).

The community-based Repeat Drink Driver Brief Intervention Programme has reduced re-offending rates of participants in the Auckland region to 14%, compared with national re-offending rates of 54%, a BCR of 20:1.

The Road Policing Programme is the annual programme of road safety education and enforcement activities provided by the New Zealand Transport Agency and the New Zealand Police[9] and makes up 47% of all road safety funding in the Auckland region. The 2008/09 road policing budget for the Auckland region was $71 million. This is the equivalent of 457 full-time equivalent policing staff.

Police activities on State Highways and local roads include:

> Speed enforcement.

> Drinking and/or drugged driver control.

> Restraint device control.

> General visible road safety enforcement.

> Commercial vehicle investigation and road user charges enforcement.

> Crash attendance and investigation.

> Traffic management.

> Prosecutions.

> Community service.

> School road safety education.

These activities are targeted to risk areas through local Road Safety Action Plans and are delivered by traffic police and general duties staff across the three police districts of Waitemata (North Shore City, Rodney District and Waitakere City), Auckland (Auckland City), and Counties Manukau (Manukau City, Papakura District and Franklin District).

Police district performance is measured in terms of fatal and serious crash reduction, other key indicators and attitude change from respondents in the annual Ministry of Transport's Public Attitudes to Road Safety Surveys (refer to Appendix 3: Intermediate outcomes).

Funding police road safety enforcement brings significant benefits, particularly for speed limit, drink driving and safety-belt-use enforcement.

A national 'Evaluation of Road Safety Outcomes to 2005' established that the BCR for fully implemented police enforcement of these areas is 8:1 (Taylor, Duigan, Barry, 2007). The report identifies a national increase in police enforcement expenditure from 2000 to 2005 of around 36% (12.4% when adjusted for cost inflation) that financed a substantial increase in national enforcement activity, with the total number of offence notices issued by New Zealand Police increasing by 36%.

The resulting compliance outcomes, in the areas of speeding, drunk driving incidence and use of restraints (safety belts), improved substantially. National surveys record that by 2005 the proportion of vehicles exceeding 110 km/h (the enforced limit) on the open road fell from around 20% to 5%; and seat belt use increased from 87% to 95% for adult front seat passengers and from 58% to 86% for adult rear seat passengers. During the same time 'road fatalities per billion vehicle kilometres travelled' fell by 30% and 'hospitalisations per billion vehicle kilometres travelled' fell by around 20%.

Regionally, a greater enforcement focus is required to: reduce urban arterial and rural state highway speeds, increase the use of safety (speed and red-light) camera technology, improve road safety education delivery in schools, and introduce new laws to reduce drink driving and speeding in the region.

Increases in compulsory breath testing are also necessary, as research shows that the perception of being caught for drink driving is one of the most consistently effective strategies for reducing drink driving (World Health Organisation, 2004). As noted above, these initiatives would deliver a positive cost/benefit for the region.

ARTA and RoadSafe Auckland have recently recommended a three year regional road policing budget of $243 million for the region ($78.3 million in 2009/10, $81 million in 2010/11, and $83.7 million in 2011/12). This represents 27% of the national road policing budget and is an equivalent increase of 30 FTE's over three years.

Police Checkpoint

[9]As an example, the 2007/08 Police programme is available from the New Zealand Police website (www.police.govt.nz/resources/2007/road-policing-programme/).

Safety engineering improvements on local roads are funded through a process similar to that used for community programme funding. Road-controlling authorities apply through ARTA for a proportional subsidy in the annual Regional Land Transport Programme. The subsidy is used to fund dedicated safety projects, safety benefits from large scale projects of over $250,000, and minor improvements (including those for safety purposes) of $250,000 or less.

The Regional Land Transport Programme, prepared by ARTA in 2008/09, indicated that annual funding for local road safety engineering across the region was $24 million. However, many safety benefits are incorporated into other road projects and therefore not necessarily reflected in this cost.

The BCR for safety engineering interventions is acknowledged internationally as being around 3:1 in best practice safety projects, although it can be as high as 50:1 for site-specific crash-reduction projects such as 'black-spot' treatments that include follow-up monitoring. After a project has been implemented the benefits from safety engineering projects continue to deliver crash savings over time, unlike Police enforcement which needs to be implemented continuously to deliver crash savings.

Safety engineering improvements on State highways are funded from the National Land Transport Fund (NLTF) and implemented by the New Zealand Transport Agency Highways and Network Operations (HNO) group. These projects are different from local road projects in that they are funded entirely by the Government, and prioritised via ARTA through the Regional Land Transport Programme.

The NLTP in 2008/09 indicates that annual funding related to road safety allocated to State Highways in the region was approximately $54 million. This figure includes all large, medium and small engineering projects dedicated to road safety.

The New Zealand Transport Agency Highways and Network Operations effectively spend more than the allocated amount on engineering for safety on State Highways in the region, since many large-scale projects incorporate significant safety benefits; but it is difficult to identify the costs that are directly related to safety. As a result, safety standards on State Highways and motorways road are generally higher than are standards on local roads.

A study by Vulcan (the Vulcan 2003 Report) estimated that planned road construction and re-engineering under New Zealand Transport Agency Highways and Network Operations' projects would reduce national road fatalities, injuries and total associated social cost by 4.2%, 3.5% and 3.3% respectively over the three years 2003 to 2006. The estimate implies annual reduction in fatalities and injuries over the three years of around 1.4% and 1.2% a year. The safety benefits can accrue each year from the date of construction, either indefinitely or until replacement is required.

2005 Regional Land Transport Strategy road safety funding recommendations

The Auckland Regional Land Transport Strategy (Auckland Regional Council, 2005) recommended an additional allocation of 4%, or $512 million, from the Auckland Regional Transport Programme towards specific safety engineering projects on arterial roads. It also recommended additional road safety education as being necessary to achieve the 2010 regional crash reduction targets (refer to Regional Land Transport Strategy Technical Paper 19: Assessing future regional road safety investment, 2005).

This 'funding gap analysis', based on the work of the Technical Advisory Committee safety sub-group and RoadSafe Auckland, recommended an additional road safety education allocation of $5.25 million; and an additional allocation for safety engineering improvements on urban and rural arterial roads of $507.1 million. The projection was for a five-year funding period and equated to an average additional overall spend in these areas of $101 million per year.

DEDICATED ROAD SAFETY FUNDING 2008/09

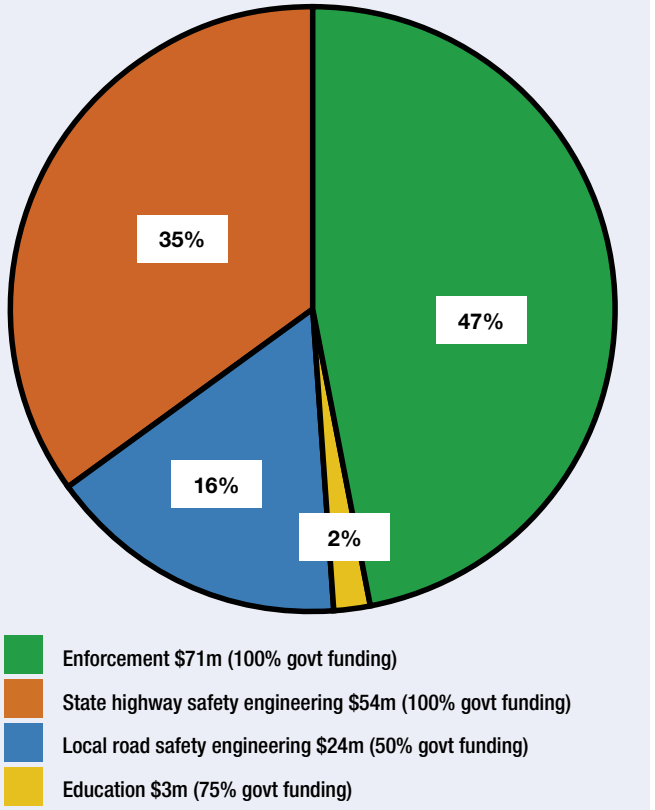

Chart 5. Estimated distribution of overall Auckland region road safety funding for 2008/09 in $ million

Comparing these two 2005 funding recommendations with the actual Regional Land Transport Programme road safety allocations in 2008/09 for both education and local road safety engineering, it appears that the amount allocated in the region varies from the Auckland Regional Land Transport Strategy safety education objective by $800,000 annually; and there is significant under-spending on the safety engineering objective by $72 million annually.

Recent work for the revised Regional Land Transport Strategy 2040 has estimated the amount of safety engineering investment required on local arterial roads to reach the regional 2012 targets as being $659 million over the next five years, or $132 million per annum (Assessing future regional road safety investment, Auckland Regional Council, 2009).

The Auckland Regional Road Safety Plan 2009–2012 seeks to increase the number of road safety engineering projects on urban and rural arterials in future Regional Land Transport Programmes to keep pace with the Auckland Regional Land Transport Strategy recommendations and to deliver the targeted reduction in regional crashes by 2012.

Mechanisms for encouraging local authorities to put forward more safety engineering projects include increasing national funding subsidies for safety engineering, increasing prioritisation for these projects, and improved institutional management and co-ordination of safety engineering projects.

Chart 5 above shows the funding distribution (as a percentage of the total $152 million) in 2008/09 for local safety engineering, enforcement and education funding allocated for the Auckland region.

4 THE THREE Es

The use of the three Es (enforcement, education and engineering) as encapsulated in the systems approach outlined in section 1.1 is fundamental to the Auckland Regional Road Safety Plan 2009–2012.

From a big-picture perspective, factors that influence road safety outcomes in the Auckland region include the physical structure, climate and settlement geography or settlement density of the region; demographics of the population; social deprivation, private disposable income and economic performance; the road network topology, modal split and operational structure; and the norms and values of Auckland society as related to road safety. These factors all have greater or lesser influence on road safety outcomes.

Key interventions for road safety outcomes within the mandate of national organisations in New Zealand include:

> Improved transport and land use policies to reduce exposure to risk of road crash injury e.g. reducing the amount of motor vehicle traffic, encouraging use of safer modes including public transport, and minimising exposure to high-risk situations.

> Planning and design of the road network that takes account of safety, to minimise the risk of crashes and crash injury e.g. classifying the road network according to primary road functions and setting speed limits by their function, incorporating safety features into road design, safety audits and remedial action at high-risk sites.

> Encouraging crash-protective features on vehicles to save lives and reduce injuries for those inside and outside the vehicle.

> Planning a combination of legislation, law enforcement and education that will significantly increase people's compliance with key road safety rules.

> Providing good quality emergency care to save lives and greatly reduce the severity and long-term consequences of road injuries.

At a regional level, ARTA and RoadSafe Auckland have a mandate to deliver on the first, second and fourth of these interventions, i.e. safety engineering and transport policy, legislation and enforcement, and education.

4.1 Enforcement and education

Enforcement (beginning with legislation) and broader public education initiatives (including community development, community action, social marketing and specific road safety education) are well-established and ongoing.

There is little international evidence that education alone contributes to reduced road trauma, although there is evidence that education can change behaviour in some age groups, e.g. changes in the travel behaviour of child pedestrians and cyclists. Thus, many traffic safety experts favour solutions that rely on technology (e.g. improved roads, crashworthy vehicles, airbags) over behavioural solutions (safety belt use, lower speeds, reduced vehicle mileage) on the grounds that it is difficult to change driver behaviour. However, it has been shown that drivers do value safety and respond positively to campaigns to encourage safety belt use and sober driving. Many are also willing to pay a premium for vehicle safety features.

Education is of most benefit when it supports specific legislative, enforcement or engineering interventions. When it does, greater improvements in road safety can result from such behaviour changes as increased use of safety belts than can result from passive crash protection technologies.

Police safety belt checkpoint

There are significant benefits to enforcement, as outlined in section 3. It delivers very good benefit/cost in the short term, can be implemented quickly, and can be used to target emerging risks. The benefits of enforcement increase markedly when it is linked with education and advertising campaigns that highlight crash risk and outline preventive behaviours.

However, as identified in the actions outlined in Appendix 4, enforcement and education in the region could be improved, particularly in relation to speed- and alcohol-related crashes. It is important that existing enforcement and education initiatives be sustained.

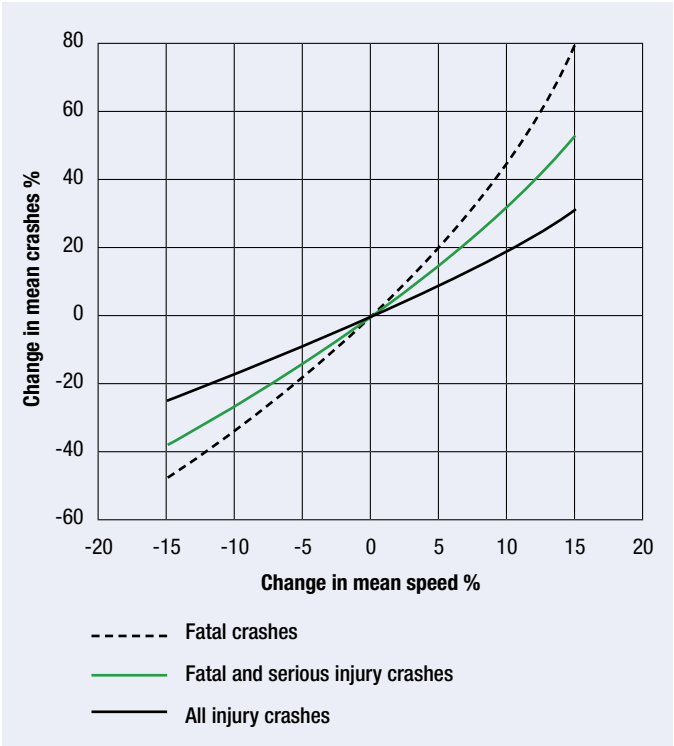

Chart 6. Illustration of the Power model and the relationship between percentage change in speed and percentage change in numbers of crashes

4.2 Enforcement of speed and alcohol driving laws

4.2.1 Excessive or inappropriate speed

'Speed' is defined as either 'excessive speed' (travelling above the speed limit) or 'inappropriate speed' (driving too fast for the conditions but within the limits). It is the major factor contributing to road trauma, by contributing to the seriousness of the results of crashes regardless of their cause. Police enforcement of speed regulations has increased over the years, and the Police have recently enforced a policy allowing a lower tolerance for exceeding the posted speed near schools. That enforcement has produced a positive public response. However, achieving the greatest benefit from speed enforcement requires the regular introduction of new enforcement technology, policing strategies and legislation.

Currently the mean speed on urban roads in the region is 55 km/h; and more than 80% of Aucklanders drive above the posted speed limit of 50 km/h.

Small increases in speed result in major increases in the risk of a crash or injury. Equally small reductions in speed can have significant safety benefits, as demonstrated in Chart 6 above.

The Power model estimates the effects of changes in average speed on the incidence of crashes and their severity. It suggests that a 5% increase in average speed leads to an approximate 10% increase in crashes involving injury, and a 20% increase in those involving fatalities (Nilsson, 2004).

Estimates from research are that a reduction of just 4 km/h in the average speed on rural New Zealand roads would lower the number of deaths by 15% and of injuries by 8% (Frith et al, 2005). The challenge for police in the Auckland region is to bring the mean speed down to 51 km/h by 2012, on urban roads.

Effects of speed on crashes and injury from crashes

Excessive and inappropriate speed is the cause of around one in three of all fatal and serious crashes in the region. Speed affects the risk of a crash occurring: the greater the speed, the less time there is to prevent a collision. At the same time, the greater the speed, the more severe the consequences once a crash has occurred. Various studies (WHO, 2004) have indicated that:

> An average increase in speed of 1 km/h is associated with a 3% higher risk of a crash involving an injury. In severe crashes, the increased risk is even greater, i.e. an average increase of speed of 1 km/h leads to a 5% higher risk of serious or fatal injury.

> A 5% increase in average speed leads to a 10% increase in crashes involving injury and a 20% increase in crashes involving fatalities.

> Travelling at 5 km/h above a road speed limit of 60 km/h results in an increase in the relative risk of being involved in an injury crash that is comparable with having a BAC of 0.05.

> For car occupants in a crash with an impact speed of 80 km/h, the likelihood of death is 20 times what it would have been at an impact speed of 32 km/h.

> Pedestrians have a 90% chance of surviving car crashes at 30 km/h or less, but less than 50% chance of surviving impacts at 45 km/h or more.

> The probability of a pedestrian being killed rises by a factor of 8 as the impact speed of the car increases from 30 km/h to 50 km/h. Consequently, enforced speed zones of 30 km/h are recommended in areas where vulnerable road users are at risk of injury crashes.

The chance of surviving a crash decreases dramatically above certain vehicle impact speeds for the following types of crashes:

> Pedestrian struck by a vehicle – 20 to 30 km/h

> Motorcycle struck by a vehicle – 20 to 30 km/h

> Vehicle striking a pole or tree – 30 to 40 km/h

> Side impact vehicle to vehicle – 50 km/h

> Head-on collision vehicle to vehicle – 70 km/h

Individual driver perceptions of speed

Travelling at higher speeds offers the immediate reward (as a perception, if not in practice) of a shorter journey time. That benefit is reinforced every time a driver undertakes a journey driving above the speed limit without any adverse consequence.

While speeding is involved in a high percentage of serious and fatal crashes, from an individual driver's point of view the chance of having a serious crash as a result of exceeding the speed limit is quite low, so the speed-crash threat is less of a consideration to drivers than the speed-penalty threat from police.

The circumstances of each trip also influence a driver's choice of speed e.g. if the vehicle is owned by an employer, a driver may be tempted to drive at higher speeds; or when a driver is under pressure to keep to a schedule (as with taxi, bus and freight drivers) speeding may be seen as an option. People also tend to rationalise their risk behaviour, as in driving faster on 'safer' roads (refer to 'rebound' effect in section 2.2.3), especially if they see little risk of police enforcement activity. Others get a sense of thrill or achievement from driving fast. Speeding has increased in the last 20 years as more people own cars and more cars are available that have top speeds far greater than the open-road speed limits.

'I'm a better driver' bias

International research suggests that up to 90% of drivers perceive themselves as an above average 'low-risk' driver, despite the crash data indicating otherwise.

Relative risk of fatal crash by blood alcohol level

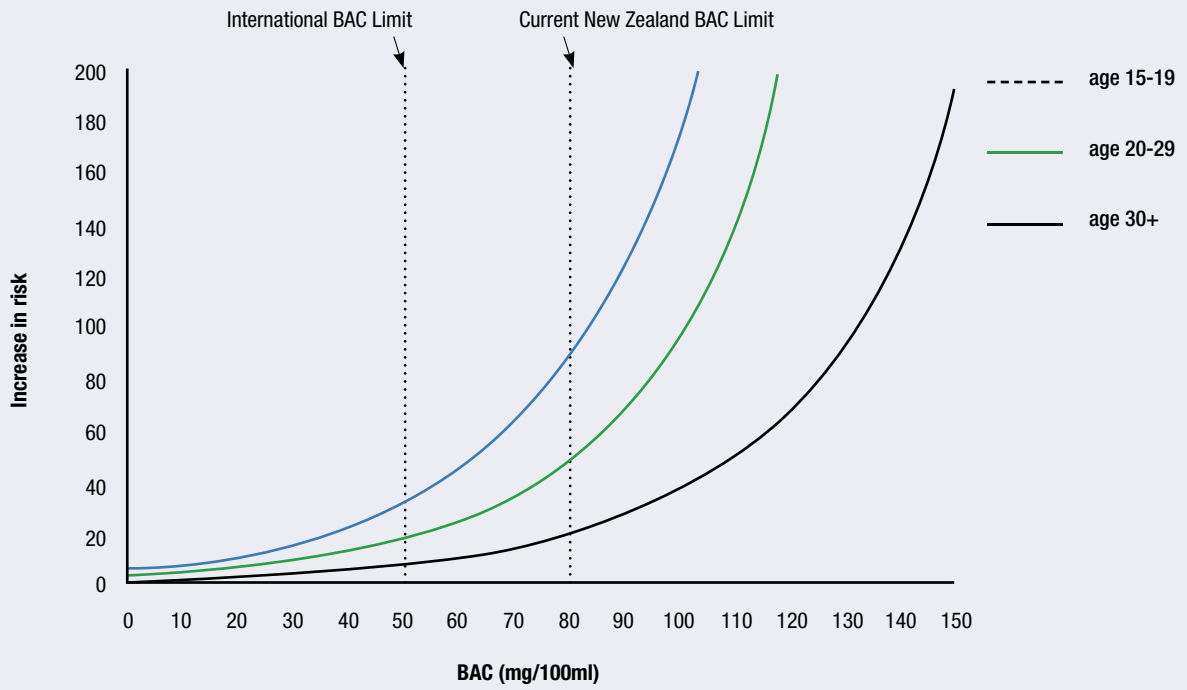

Chart 7.Relative risk of fatal crash by blood alcohol level for drivers (Ministry of Transport 2008)

Most drivers believe they can travel above the limit and not place themselves at high risk of a crash. As a result, many drivers regard speed limits as arbitrary and do not appreciate the greater risk associated with even small increases in speed. National attitude surveys indicate that 74% of Auckland drivers agree with the statement *'Enforcing the speed limit helps to lower the road toll'*, while 30% agree that *'The risk of being caught speeding is small'*. Contrary to these surveyed attitudes, 80% of Auckland drivers actually exceed the urban 50 km/h speed limit (refer to Appendix 3: Intermediate Outcomes).

It is normal for male drivers in particular to hold beliefs about their driving that are contradictory to their actual driving behaviour in terms of speed. The task for enforcement and education is to highlight these contradictions for drivers in a way that brings about behaviour change (see Young male driver optimism bias in section 4.3).

Speed Driver education display

4.2.2 Enforcement of sober driving

Compulsory and mobile breath testing of drivers

Compulsory and mobile breath testing is a key strategy used by police to enforce the drink driving laws and to reduce the number of alcohol-related crashes. It also complements other drink drive prevention initiatives including host responsibility from alcohol providers, repeat drink driver education programmes, and liquor licensing enforcement.

In recent years police have reported a growing number of recidivist drink drivers, younger drink drivers and female drink drivers. Police and local authorities have requested legislation to lower the blood alcohol content limit (BAC) to reverse this trend and its related road trauma. There is also support for raising the minimum age for purchasing alcohol to 20 years.

People are deterred from drink driving by the thought of being caught. A lowered blood alcohol limit, accompanied by an increased number of breath-testing operations, and appropriate sanctions, is required to achieve this deterrent effect.

Effects of alcohol on risk of crashes and on crash injury

Evidence from the last 50 years indicates a direct relationship between a rise in the BAC of a driver and the risk of being involved in a motor vehicle crash. Alcohol slows reaction times, and affects a driver's vision, steering and braking. As driver BAC levels increase, so too does the risk of having a fatal crash.

Chart 7 above illustrates the results of a New Zealand study of drivers involved in fatal crashes. There is a clear increase in risk as BAC levels increase (Keall, Frith and Patterson, 2004). The effect is more pronounced in young drivers. The calculation of risk is made in relation to that of a sober 30+ year old.

Table 8. Relative risk of fatal crash by BAC

Relative risk of fatal crash by blood alcohol level and age group			
BAC	30+ years	20-29 years	15-19 years
0mg	1	3	5.3
30mg	2.9	8.7	15
50mg	5.8	17.5	30.3
80mg	16.5	50.2	86.6

Table 8 above shows that at 80 mg (.08) of alcohol per 100 ml of blood, which is the current New Zealand adult legal BAC limit, a driver aged 30 years or more is about sixteen times as likely to be involved in a fatal crash as the same driver with a zero blood alcohol level.

Other researched effects of alcohol consumption on the risk of crashes and crash injury can be summarised (WHO, 2004) as:

> Drivers and motorcyclists with any BAC greater than zero are at higher risk of a crash than those whose BAC is zero.

> For the general driving population, as the BAC increases from zero, the risk of a crash starts to rise significantly at a BAC of 0.04.

> Teenage drivers have more than five times the risk of a crash than drivers aged 30 and above, at all levels of BAC. Drivers aged 20 to 29 years have three times the risk of drivers aged 30 years and above, at all BAC levels.

> Teenage drivers with a BAC of 0.03 carrying two or more passengers were 34 times more at risk of a crash than drivers aged 30 years or more, with zero BAC, driving with one passenger.

> A BAC limit fixed at 0.08 will result in twice the risk of a crash than exists with the most common limit, in high income countries, of 0.05.

> Alcohol consumption by drivers puts pedestrians and motorcyclists at greater risk.

> Laws which establish lower BACs (between 0 and 0.02) for young/novice drivers can lead to reductions of between 4% and 2% in the number of crashes involving young people.

New Zealand remains one of only four OECD countries with a BAC above 0.05 while international best practice recommends all countries strictly enforce (WHO, 2009):

> **Drink driving laws based on blood alcohol concentration, or the equivalent breath alcohol content limits, of 0.05 BAC or below.**

> **Drink driving laws of 0.02 BAC or below for young/novice drivers.**

Increased access to alcohol in Auckland

In the last decade the Auckland region has experienced a liberalising of access to alcohol among the general population with increased numbers of alcohol outlets, longer operating hours for alcohol sales, and an overall increase in alcohol consumption, including alcohol products directly marketed at younger drinkers.

Liberalised access to alcohol has clearly had an adverse effect on alcohol-related crashes in the region, particularly among younger drivers. Overall alcohol-related crashes have increased by 30% in the region, and by 230% among 15 to 19 year old drivers, since the introduction of a lowered alcohol purchasing age in 2000 (see section 4.3 Safer young and novice drivers).

Police report that up to 50,000 people regularly drive from across the region into the Auckland CBD on a Friday and Saturday night to enjoy the entertainment and alcohol hospitality on offer. Police alcohol enforcement data in the CBD have highlighted increasing trends among drivers over the blood alcohol limit including: greater numbers of drivers over the legal blood alcohol driving limit, more drink drivers being apprehended in the early hours of the morning, higher blood alcohol levels, younger drink drivers, increasing female drink drivers, and recidivist drink drivers.

These trends suggest that current Police enforcement is not working as a deterrent to drink driving in the region and significant changes are needed to reduce alcohol-related crashes including: tighter restrictions on access to alcohol for young drivers by raising the alcohol purchasing age to 20 years, proactive liquor licensing, shorter alcohol sales operating hours, lowering the legal blood alcohol driving limit from 0.08 to 0.05 Blood Alcohol Content (BAC), proactive marketing of low-alcohol products, and improved access to late night public transport choices.

Police compulsory breath testing checkpoint

Drugs and driving

While alcohol is the most widely used drug involved in road trauma in New Zealand, research suggests that the contribution of drugs other than alcohol is under-represented in the police-reported crash system due to the lack of roadside and hospital drug testing procedures for people involved in fatal and serious road crashes (Vergara, 2006).

Cannabis is the most widely used recreational drug, after alcohol, in the driver population of New Zealand, and also the most used drug in combination with alcohol, within the drinking driver population of New Zealand. High use of alcohol and cannabis is evident in the younger male age group of drivers from 15 to 34 years.

The research suggests that the combined use of cannabis and alcohol has a significantly higher incidence within fatally injured drivers in comparison to each substance alone and other drug combinations. This could be due to the synergistic effects of mixing alcohol and cannabis together while driving.

Trials of interventions to reduce the number of people driving while under the influence of drugs, particularly cannabis and alcohol together, are needed including the development of a robust roadside test for screening drinking drivers for recent cannabis use. The requirement of blood samples from all fatal and seriously injured drivers at hospitals for drug testing purposes would also help establish the links between drugs and driving.

Education among target groups around the risks of drugged driving is necessary.

Motorcycle safety billboard campaign

4.3 Educating road users about their crash risk

Local authorities, police, public health officials, the Accident Compensation Corporation, employers, educational institutions and community groups all contribute to road safety education across the region.

Education is a critical component of the overall plan to reduce road trauma despite the relatively small investment made in it, compared to engineering and enforcement.

Areas of education that require further focus include:

> Education about the high crash risk associated with private motor vehicle use and encouragement to reduce crash risk by decreasing miles driven annually in private motor vehicles while increasing the use of public transport.

> Education about the risk related to excessive speed and inappropriate speed for drivers, passengers, pedestrians and cyclists.

> Education about the high-risk effects of fatigue on drivers while they are driving long distances, or driving without adequate rest.

> Culturally appropriate driver licensing and driver education programmes to cater for the growing cultural diversity of drivers within the region and to progress adult learner and restricted drivers on to full licenses.

> Education about the high crash risk for young drivers in the restricted driving phase, and the need to comply with restricted license conditions.

> Establishing improved Safety Culture driving policies in large organisations with vehicle fleets, including heavy vehicle fleets.

> Road safety education programmes for older drivers, including Safe with Age.

> Coordinated promotion of safety belt use including instruction on the correct use of child restraints and booster seats, particularly in areas where they are little used.

> Drink and drugged driving education programmes including host responsibility for servers, SADD (Students Against Driving Drunk), and community-based treatment for first-time drink drivers and recidivist drink drive offenders.

> Cycle/motorcycle safety education and events that promote safe bikes, high visibility of riders and safe riding skills.

> Pedestrian safety education in urban areas, particularly for children, as part of community development projects that involve residents, employees and students in neighbourhood-wide solutions to improve pedestrian safety, e.g. travel plans and slower speed zones in town centres.

Pedestrian safety

The probability that a pedestrian will be killed if hit by a motor vehicle increases dramatically with the speed of the vehicle, as illustrated in Chart 8 below.

Research indicates that while most vulnerable (unprotected) road users survive if hit by a car travelling at 30 km/h, most (80%) hit by a car travelling at 50 km/h are killed (OECD/ECMT, 2006).

People are also more likely to be injured if hit by a vehicle travelling at more than 30 km/h.

Most crashes in the region that involve pedestrians occur during the day on arterial urban roads that have speed limits of 50km/h. A high proportion of pedestrian injuries involve young people up to the age of

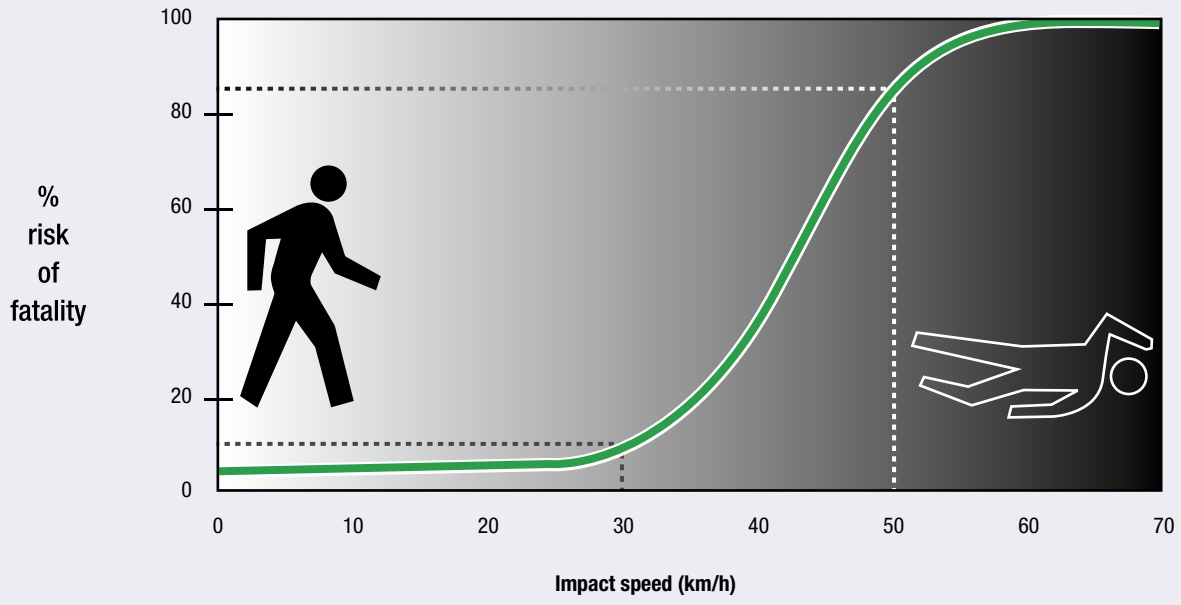

Chart 8. Probability of fatal injury for a pedestrian colliding with a vehicle.

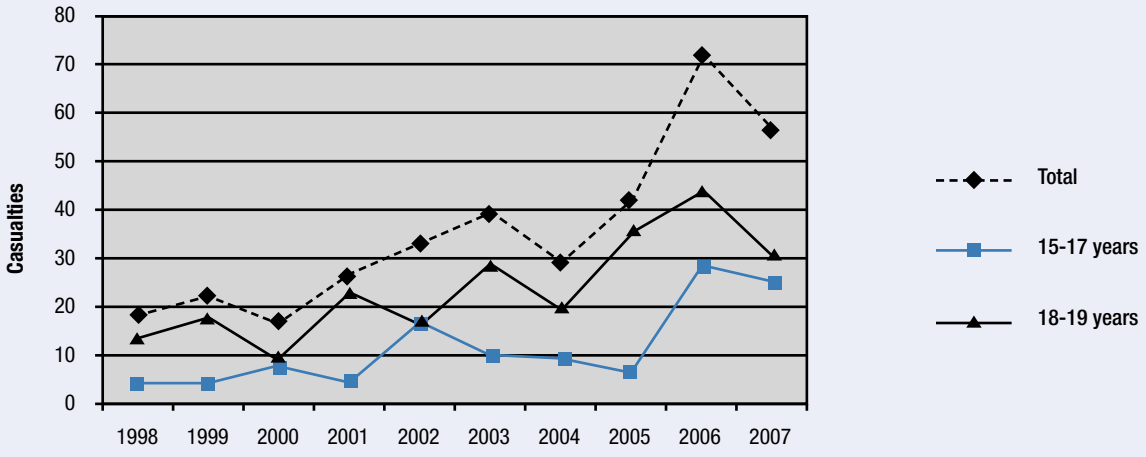

Chart 9. Alcohol-related casualties in Auckland for 15 to 19-year-old drivers 1998 to 2007 (NZTA Crash data 2009).

19 years – making them the most at-risk group. This may be because they also walk more than other age groups. Younger people also lack the cognitive abilities needed to make correct decisions about crossing the complex traffic environments, e.g. young children have difficulty judging the speed and distance of approaching vehicles, are also easily distracted and unable to focus on more than one event at a time.

Both road designers and motorists need to understand that children do not think like 'mini adults' in regard to safety on the roads. The road environment needs to be as safe as possible because children's behaviour is unpredictable.

Local authorities in the Auckland region are encouraged to continue implementing programmes of measures to address issues of safety outside schools and in other places where there are many pedestrians, particularly by using slower speed zones (30 km/h and 40km/h).

Safer young and novice drivers

In the Auckland region male drivers aged 15 to 24 years have a higher risk of a crash per vehicle kilometres travelled than do all other age groups.

This is primarily due to their inexperience as drivers, their late-maturing cognitive and visual scanning skills, their optimism bias, and capacity for risk-taking and peer pressure. Exacerbating these factors are significant social and economic trends including freer access to alcohol, and greater access to motor vehicles over the last decade.

Chart 9 above shows that from 2000 to 2007 alcohol-related casualties for young drivers aged 15 to 19 years increased across the region by 39 casualties, or 230%. This followed the lowering of the age for the legal purchasing of alcohol to 18 years in 2000.

Changes to the delivery of young driver education programmes are needed so that they highlight the increased risk for young drivers and raise their visual scanning, hazard detection and decision-making skills as outlined in the recently released guidelines Safer Young Drivers: A Guide to Best Practice Information (National Road Safety Committee, 2007).

The single most cost-effective intervention for decreasing young driver crash risk is raising the minimum driving age to at least 16 years and extending the learner licence period to 12 months.

Raising the minimum age for purchasing alcohol to 20 years, and the imposition of third-party insurance will also help to reduce crash risk.

Education and incentives to increase the use of public transport by 15 to 24 year-olds also need to be part of any young driver crash reduction programmes.

Young male driver optimism bias

Extensive research by Dr Nikki Harre of Auckland University into young driver attitudes suggests that there is an inherent driver 'optimism' bias among young male drivers i.e. young male drivers believe themselves to be more skilled at driving than they actually are, and therefore take more risks, resulting in higher crash rates.

The research suggests that young male drivers discount many of the severe crash consequences displayed in national road safety advertising, especially if the advertising is related to a failure of driving skill e.g. 'What an idiot for losing control. I wouldn't do that if I was drunk. I really am able to handle a car a lot better than other drivers my age'.

It is also suggested that drivers interpret the same behaviour differently depending on whether it is done by themselves or someone else e.g. young male drivers see themselves as skilled, cautious drivers who sometimes get in a hurry, and like to have fun; however they see their driving peers as having a tendency to show off and take risks, without necessarily being skilled enough to get away with it.

This inbuilt tendency for young male drivers to consider themselves better drivers than their peers or at less risk of a crash, can have negative effects in terms of complacency and risk taking. However, it is possible through education and enforcement to challenge these contradictory beliefs and steer their inherent driver optimism bias towards improved safety outcomes using a strengths based approach.

Young drivers value being able to handle a car, having some battle scars, some risk-taking, being in control, becoming successful people, protecting their friends, protecting children, - fun, friends and status in general.

Young drivers do not necessarily value showing off, being unable to handle a car, letting your friends down, becoming a 'loser', and risking the lives of children.

The main educational implications from Dr Harre's research include:

> Do not rely on examples of driving that could be interpreted as a failure of skill to change young people s attitudes.

> Do not assume that young people automatically identify with a protagonist that is like them.

Table 9. Key strategies to prevent road traffic injuries among children

Strategy	Effective	Promising	Insufficient evidence	Ineffective	Harmful
Introducing (and enforcing) minimum drinking-age laws					
Setting (and enforcing) lower blood alcohol concentration limits for novice drivers and zero tolerance for offenders					
Utilizing appropriate child restraints and seat-belts					
Wearing motorcycle and bicycle helmets					
Forcing a reduction of speed around schools, residential areas, play areas					
Seperating different types of road user					
Introducing (and enforcing) daytime running lights for motorcycles					
Introducing graduated driver licensing systems					
Implementing designated driver programmes					
Increasing the visibility of pedestrians					
Introducing instruction in schools on the dangers of drink-driving					
Conducting school-based driver education					
Putting babies or children on a seat with an airbag					
Licensing novice teenage drivers					

> Challenge wider cultural messages that reinforce the view that being able to handle a car is a key rite of passage to manhood.

> Promote things that are 'cool' and consistent with safe driving e.g. responsible driving is matched with having fun, friends, and status or successful people who are responsible drivers.

> Ignore things that are 'cool' and consistent with unsafe driving rather than highlighting them e.g. talking about cracking down on the boy racer problem could actually encourage boy racers to rise to the enforcement challenge.

> Shift youth driving culture to expand the range of safe driving practices that are 'cool'e.g. promote the message 'real men (and women) take responsibility for others', and use strategies to get young people behaving safely, then encourage a culture to develop around these such as teaching traffic safety to younger children.

Younger road users

Younger road users, particularly child pedestrians, cyclists and vehicle occupants bear a disproportionate share of road trauma in the region, and are at high risk of crash injury. This is due primarily to developmental factors, as children are not small versions of adults, and also because road environments are not designed with child development limitations in mind.

Education is required in the area of pedestrian safety, cycle safety and appropriate use of child occupant restraints in motor vehicles.

A recent World Heath Organisation report on child road traffic injury has identified some of the key interventions that have shown to be effective in preventing road injuries among both young road users and young drivers (WHO, 2008 B.) outlined in Table 9 above.

The interventions include:

> Establishing and enforcing a minimum legal drinking age for alcohol.

> Establishing and enforcing lower blood alcohol concentration levels for novice drivers and zero tolerance for drink driving offenders of all ages.

> Establishing and enforcing graduated licensing systems.

> Encouraging the use of protective equipment in vehicles such as child passenger restraint systems, booster seats and safety belts, and a safer rear seating position for children. Compliance can be enhanced through the introduction of legislation and enforcement, public awareness campaigns, and strategies addressing issues of access and affordability.

> Encouraging the use of helmets for cyclists and cycle skills training. Compliance can be enhanced through legislation requiring use by all ages, public awareness campaigns and making helmets affordable.

> Establishing and enforcing reduced speed limits for vehicles around schools, residential and play areas.

> Establishing infrastructure to separate road users. For example, separate traffic lanes for cyclists and sidewalks for pedestrians.

> Establishing and enforcing daytime running lights to increase visibility of motorcyclists.

While New Zealand has introduced many of the above initiatives, improvements are needed for young road users in the areas of drink driving, driver licensing, child restraints, cycle helmets, cycle skills training, reduced speeds, pedestrian and cycle infrastructure, and motorcycle safety.

It is equally important to avoid resourcing initiatives that have not shown to be effective in reducing road injuries among young road users and which in some cases actually increase injuries. These include:

> Limited evidence to support the implementation of designated driver programmes or instruction for children on the perils of drinking and driving.

> School-based driver education programmes have led to earlier licensing of novice drivers with resultant increases in teenage driver deaths.

> Putting babies or children on the front seat of a vehicle where there is an air bag that will deploy in a crash is strongly discouraged.

Regional Road Safety Plan 2009 - 2012 Strategy	Three Es		
	Safety engineering	Visible enforcement and legislation	Education and community involvement
Enhanced safety management, planning and engineering on local roads, including measures to reduce crashes at bends and with roadside hazards	XXX	XX	XX
Effective speed management, lower speeds in urban areas, and other initiatives that support growing community acceptance of speed limits	XXX	XXX	XXX
Well targeted enforcement of drink-drive laws, effective liquor licensing, integrated driver rehabilitation & penalties, visible host responsibility, and improved drug and alcohol testing	X	XXX	XXX
Improved pedestrian safety	XXX	X	XX
Improved intersection safety	XXX	XX	XX
Initiatives tailored to the needs of at-risk road users	XX	XX	XXX
Integrated passenger transport and travel demand management safety	XX	XX	XX

Figure 16. Auckland Regional Road Safety Plan 2009-2012 strategies in relation to the three Es

4.4 Safety engineering

Safety has become an integral part of all road construction and maintenance in New Zealand, particularly since the introduction of safety audits of projects and the development of regional Safety Management Strategies in the early 1990s. Safety audits are now required for every project submitted to New Zealand Transport Agency for funding. Safety management systems are established in every road-controlling authority in the Auckland region.

The majority of this best practice safety expertise has been developed and resourced at a national level in relation to state highway road building. However, 94% of the regions road network is managed by local roading authorities, and while responsibility for safety on these local roads has been progressively handed over to local authorities as part of the Road Safety to 2010 strategy; resources, funding mechanisms and safety expertise have not translated well into the local roading environment and its high crash risk environments.

More can be done to improve the safety of local roads and the Auckland Regional Road Safety Plan 2009–2012 pushes this emphasis further by reorienting engineering towards a 'safety engineering' approach as distinct from 'traffic engineering'.

While 'driver error' remains the most common cause of crashes, safety engineering is about reducing the possibility of drivers making errors, as well as reducing the physical impact of crashes when drivers do inevitably make mistakes, through the engineering of safer roads and roadsides, and safer speeds (see Figure 1 Safer Transport System in section 1.1).

The following section describes the new safety engineering approach and how this reorientation could occur within the Auckland region. The safety engineering approach is included in more detail than the other two Es (enforcement and education), but enforcement and education are no less important.

Most best practice road safety strategies rely on appropriate combinations of these three Es. Both ARTA and RoadSafe Auckland believe that the engineering component of the three E mix needs addressing on local roads for future road safety gains to be realised, since engineering can deliver robust long-term benefit/costs with good preventative effect.

Figure 16 above summarises the relative combination of the three Es in relation to the proposed strategy areas outlined in section 5.2. The number of Xs indicates the importance of a specific strategy in relation to each of the three Es.

This has been assessed as the best mix for the region as a whole; but each road-controlling authority will need to consider in its local road safety strategies and plans the best local mix for improving the safety of infrastructure, enforcing safe behaviour, and educating road users about their crash risk.

Safety engineering and enforcement are both related to the design and operation of the network, and can therefore be directed to where the risk lies. For instance, if an unsafe stretch of road is uneconomical to re-engineer, using enforcement and education together to lower vehicle speeds can achieve a similar safety outcome if sustained over time.

Construction of Self-explaining residential road

Safety engineering on arterial roads

Safety engineering is important on arterial roads with a higher crash risk. While engineering measures alone cannot eliminate all risks, safety engineering brings substantial benefits. In many town centres conflicts between pedestrians, cyclists, public transport and private motor vehicles can be alleviated through engineering for lower speeds, and by installing pedestrian and cycle facilities to create 'complete streets' or 'shared spaces' where road space is allocated fairly between different road users according to the road user hierarchy (see section 1.5.2). Such strategies create a win/win situation for road users and local communities, and businesses also benefit.

Interactive speed feedback sign on rural bend

In environments where drivers of motor vehicles are the highest-priority users, appropriate engineering measures include interactive warning signs, road marking, rumble strips, lighting, removal of roadside hazards, use of barriers, widened road margins, improved skid resistance, improved road geometry on bends, fine tuning of signalised intersections, improved visibility at non-signalised intersections, and numerous other treatments.

4.4.1 Safety engineering aims within the Regional Road Safety Plan

ARTA and RoadSafe Auckland have established a regional forum to promote the practice of safety engineering, an approach based on creating an appropriate road environment for all road users rather than simply improving the road to meet current standards for geometry, signs and markings that have been established for the efficient use of private vehicles. A safety engineering approach has reduced the number of crashes in similar regional jurisdictions overseas. There are many examples of good practice that could be used in the Auckland region, such as road designs that are forgiving and that allow for human error; and engineering for lower speeds in town centres.

In relation to safety engineering, the Auckland Regional Road Safety Plan 2009–2012 seeks to:

> Establish regional agreement on priorities for funding.

> Encourage a more proactive risk assessment approach, including a revision of the historical benefit-cost approach to funding individual safety projects.

> Ensure that all road users are taken into account, and that safety projects are consistent with wider strategies to improve the road environment for pedestrians, cyclists and people using public transport.

> Reinforce the importance of the basics, such as crash-reduction studies (both 'site-specific' and 'route-specific'), the implementation of their recommendations, inspecting existing roads for safety, and programmes of work to address known issues.

> Re-orientate traffic engineering into a safety engineering approach by providing ongoing professional development and a regional forum for information sharing.

> Greater integration of safety engineering with planning for land use and urban design.

4.4.2 Engineering for vehicle safety

Improvements in engineering design for vehicle safety and crashworthiness have a significant effect on safety outcomes and need to be taken into account. Monash University Accident Research Centre estimated in 2005 that such improvements will contribute to a reduction in fatal and serious injury to occupants of light vehicles in New Zealand by around 30% over the 10 years 2000 to 2010 (Taylor, Duigan, and Barry, 2007). This would be more significant than the effects of either enforcement or engineering interventions for the same period. However, this was a very coarse national assessment and the mandate for further changes to the vehicle fleet remains at a national level.

It is estimated there were 792,971 light vehicles in the Auckland region in 2006, an average of 578 light vehicles per 1000 Aucklanders, one of the higher rates of ownership in the OECD. Almost half the vehicles in the fleet are used imports and their average age is more than ten years – relatively old compared with other OECD countries.

Road safety gains could be enhanced by encouraging drivers to upgrade to vehicles that give better protection against impact, and by improving access to safer modes such as public transport.

Improved vehicle crashworthiness has had a 'rebound' effect. As individual drivers feel safer through using vehicles that have improved crash technology and engineering, they tend to take greater risks, such as driving faster, leaving less distance between their vehicle and the next, and using a cell phone. These behaviours offset some expected safety benefits and may increase risk to others, particularly vulnerable road users such as pedestrians, cyclists and motorcyclists (Litman, 2008). As a result, net safety benefits may be less than expected, depending on the overall make up of the vehicle fleet.

4.4.3 Current safety engineering funding

One of the major issues for territorial authorities in the Auckland region is the 'local share' required for safety engineering projects. That is the money each council must provide in order to obtain the Government subsidy through New Zealand Transport Agency.

Unlike traffic enforcement (100% funded by the Government), road safety education (either 100% or 75% funded by the Government) and New Zealand Transport Agency Highways and Network Operations safety programmes (100% funded by the Government), council engineering projects are subsidised by the Government at 43% to 61% in the Auckland region. This subsidy rate is determined by the Ministry of Transport and is weighted in favour of rural regions , which obtain a higher subsidy rate than metropolitan Auckland. As Government funding is a subsidy, it is approved only if a council allocates money raised towards a project through rates or development contributions.

All councils have annual budgets for safety improvements. The budgets vary from year to year as they compete for funds with other priorities and can be reduced as a means of reducing council rates bills. At the same time, the scope of work undertaken by councils is increasing, as are construction costs, putting increasing pressure on council funding for safety engineering.

The Regional Land Transport Strategy (Auckland Regional Council, 2005) noted that $507 million was required for safety engineering on arterials to address the gap in spending to achieve 2010 road safety targets. This amount of funding is not being realised – and will be achieved only if safety projects become a higher priority for local authorities or if national funding mechanisms and priorities change to suit local roads.

4.4.4 Current safety engineering actions

There is a range of initiatives to identify crash issues and plan safety engineering interventions or treatments. The main processes used currently are outlined below.

Crash reduction studies

Crash reduction studies (CRS) are the basic tool for identifying, and proposing effective solutions to, places and times where crashes occur. Crash reduction studies can look at individual site-specific locations where crashes are occurring, route-specific locations with a number of crashes along a length of road, or a particular type of crash (e.g. crashes occurring at night). Implementation of CRS recommendations is important, as national studies have shown they can reduce crashes causing injury by up to 35% on average, with an average BCR of 28:1 (Land Transport New Zealand, 2004).

Road safety action plans

Road safety action plans (RSAPs) provide a sense of urgency, focus and commitment to mitigate road safety risks (refer to section 1.3.2). The plans are informed by local strategies and data, and annually record agreed local road safety risks, objectives and targets, actions, and monitoring and reviewing processes (Land Transport New Zealand, 2007). Each plan is the result of collaboration by key road safety partners (e.g. New Zealand Transport Agency, local and regional authorities, New Zealand Police, ACC).

RSAPs are the primary mechanism for coordination of education, engineering and enforcement approaches to road safety problems at sub-regional levels. They need to be emphasised and linked to the Auckland Regional Road Safety Plan 2009–2012. Safety engineering projects can be incorporated into RSAPs for implementation and monitoring, and benefit from the added integration with enforcement and education initiatives in the RSAP.

Safety management systems

Safety management systems have been prepared by each road-controlling authority in the Auckland region to document road safety strategies, policies, standards, procedures, staff expertise, management and audit systems. A safety management system ensures that safety is considered in decisions about construction, maintenance and management of the road network and helps to achieve targets and goals identified in local road safety strategies and plans (Land Transport New Zealand, 2003).

Safety inspections

Safety inspections of the existing network are carried out on a regular basis by all road-controlling authorities. They can range from a maintenance inspection ensuring that the maintenance contractor has carried out the work requested, to an inspection that lists all the deficiencies of an existing road against current standards for road marking, signage, lighting etc.

Safety audits

All projects submitted for New Zealand Transport Agency funding are required to have safety audits completed, usually at the following four stages – feasibility, preliminary design, detailed design and post-construction. The client project manager may declare that a particular safety audit is not warranted, for example a small project that does not have a feasibility stage, but this decision must be properly documented with a valid reason. Follow-up of safety audits is equally important.

4.4.5 Future development of an integrated safety engineering approach

Road users travel through various territorial authority areas every day and can encounter a variety of engineering approaches. In the future the region should aim to provide further standardisation in the road environment so drivers and other road users have a consistent road infrastructure, regardless of where they are in the region.

Land use planning

The development of land affects the number of trips people make, the means by which they choose to travel, the length of trips and the route taken. Different land use creates different sets of travel patterns. The main aspects of land use that influence road safety are:

> The position and distribution of ‘start’ and ‘end’ points of road journeys.

> Urban population density and patterns of urban growth.

> The configuration of the transport network.

> The size of residential areas and possible lack of access to various amenities by modes other than the private vehicle.

> Alternatives to private vehicle transport, i.e. public transport.

In the absence of proper land use planning, residential, commercial and industrial activity will evolve in a haphazard pattern, and road traffic will evolve similarly to meet the needs of these various activities. This can produce heavy flows of traffic through residential areas, vehicles capable of high speeds mixing with pedestrians, and heavy, long-distance commercial traffic using routes not designed for such vehicles. Consequently, exposure to traffic injury can be high for car occupants, and even more so for vulnerable road users such as pedestrians, cyclists and motorcyclists.

Traditional land use planning was often done with a view to creating efficient flows of vehicle traffic, resulting in major arterial, high-speed routes that cut off different urban sections to the disadvantage of local residents. In addition, socio-economic changes have lead to a profusion of out-of-town shopping malls that generate increased traffic, create less opportunity for travel by public transport, and increase exposure to crash risk.

Traditionally, traffic impact assessments looked at the distribution of traffic and at car parking requirements. When this form of traffic safety assessment is applied to current land use planning practices such as ‘smart growth’ land use policies (development of high-density, compact buildings with easily accessible services and amenities) it is inadequate, as it fails to consider the surrounding land use, thereby increasing the safety risks of road users.

The integration of land use and transport needs is now a statutory requirement in Auckland[10]. To ensure the region meets its statutory requirement, land use planning must take into account safe access for all transport modes as a priority. The development of clustered mixed-use communities with safe access to walking, cycling and public transport as well as for private vehicles creates a much safer and more integrated transport network.

[10]A requirement under the Local Government Auckland Amendment Act.

Public transport on central auckland regional arterial

A more integrated transport and land use planning approach can reduce exposure to the risk of crashes by shortening the distances between commonly used destinations, reducing the need to travel and lessening people's dependence on private motor vehicles (World Health Organisation, 2004).

Integrated transport assessments and land use

To date, evaluations of the impact of transport projects on safety usually focused on individual projects, with little consideration of their effect on the wider network and adjacent land use. This can result in an increase in the amount of travel using private vehicles, poor urban amenity and reduced safety for other road users.

Traditionally, policies have aimed at producing an efficient network for motor vehicles. However, the NZTS sets out national targets for increased use of public transport and for walking and cycling in urban areas, which will have a significant impact on the efficiency of private motor vehicle transport. The likely effects on the entire transport system of planning decisions to do with transport or land use should be considered early, to avoid unintended adverse consequences for road safety.

To address this ARTA has developed the Integrated Transport Assessment (ITA) Guidelines (ARTA, 2007) to assist in identifying how a development will interact with existing transport networks, where constraints on traffic capacity may occur, where passenger transport services are sufficient, or where extra services are required, and accessibility for walking and cycling.

The ITA provides a process to ensure a full assessment of transport opportunities and constraints is undertaken and that proposed developments accord with regional planning and transport policies. In particular, it seeks to ensure the integration of land use with all modes of transport and to ensure safe access by all modes. This ensures strategies within proposed developments for improving mobility, reducing congestion and improving the environment, are also compatible with positive road safety outcomes.

Safety impact assessment

By undertaking an ITA for either a development proposal or a transport project, risk and safety aspects for all modes of transport should be assessed and options for mitigating the risks identified in line with the goals of the Auckland Regional Road Safety Plan 2009–2012. This component of the ITA is called a Safety impact assessment (SIA).

Transport planners often overlook the cost of crashes and an SIA will give issues of safety a greater priority within integrated transport assessments when transportation policies and projects are being evaluated. For example, if a particular action reduces traffic congestion by 10% but increases traffic crashes and fatalities by 3%, it is probably not worthwhile overall – the reduced congestion is not worth the additional crash costs. A traffic congestion or pollution reduction strategy adds great value to society if it also reduces crash costs.

Urban design

The more accessible an area is to pedestrians and cyclists, the more achievable the road user hierarchy becomes (refer section 1.5.2). Safety benefits can be made through appropriate use of adjacent land and good urban design. Urban design can enhance the transport environment, improving safety and accessibility by incorporating the right urban amenity and transport infrastructure.

Self-explaining roads

Safety engineering in the Auckland region is beginning to see a movement towards 'self-explaining' roads, where psychologists and urban designers work with engineers and planners to design a whole environment that intuitively encourages safer road user behaviour, improves amenity and supports land uses.

These environments have roads designed in such a way that drivers automatically understand what is required of them, including speed choice. They also include innovative technology solutions, such as interactive feedback signs that advise motorists of their actual speed in relation to the environment.

Professional development will encourage the sharing of this 'self explaining road' expertise in the Auckland region among safety engineers as well as regional land use planners and urban designers.

4.4.6 Regional safety engineering forum and priority issues

A regional forum is an important mechanism for strengthening a safety engineering approach and providing professional development for engineers across the region. The forum is chaired by ARTA and operates as a sub-group of RoadSafe Auckland.

The regional safety engineering forum has identified five regional road safety issues that are a priority and that can be addressed by safety engineering projects. They are:

> Speed management.

> Bends and roadside hazards.

> Intersections.

> Pedestrian safety.

> Cyclist safety.

There are many synergies among the issues e.g. reducing motor-vehicle speeds can deliver safety benefits to drivers, pedestrians and cyclists.

Sub-standard roads

Many of the priority issues listed above relate to parts of the region's existing network that do not meet current design standards and require safety engineering. The key reasons for their sub-standard condition are:

> **Increasing road use** – the previous road standard is no longer appropriate e.g. in rural areas where there has been extensive residential development, roads now require widening, lighting, footpaths, cycle facilities, drainage and other improvements to accommodate more road users and associated risk of crashes.

> **Changes in roads over time** – road use changes or develops over time. There may be a lag in road engineering e.g. more pedestrians and cyclists with few improvements in facilities can create hazards.

> **Funding constraints** – every organisation prioritises funding. At the end of each year projects that have not been funded may remain, resulting in some road safety issues not being resolved in a timely manner.

> **Changing design standards** – especially for road marking and signage –can leave large areas of the network in need of updating to new standards.

> **Rural roads** – many carry small volumes of traffic and remain uneconomic to treat with safety engineering, despite remaining a high crash risk. Police enforcement can be an alternative short-term measure.

Examples of safety engineering measures for the region

There is a mix of safety engineering measures that can be implemented to upgrade roads to current safety standards and to benefit all road users.

New purpose-built roads are designed for safety, so spending on engineering for safety needs to be targeted principally at the existing network, on which most vehicle kilometres are travelled and where the greatest crash risk lies.

Major new roads will predominantly serve the needs of motorised transport, while almost all risk to pedestrians and cyclists will remain on existing local roads.

A distinction has recently being made between Primary and Supportive road safety engineering treatments. Primary treatments are those that directly provide a Safer System outcome (see Figure 1 on page 11) e.g. grade separation or reducing impact forces of crashes to safe levels. Supportive treatments assist in delivering safety improvements but in an indirect manner e.g. hazard warning signs may reduce incidence of a crash, but should a crash occur, would not have an influence on the severity. Both Primary & Supportive treatments are of use, bur more use needs to be made of Primary treatments in future.

Examples of Primary and Secondary safety engineering infrastructure are identified in Table 10 (opposite) in relation to key crash issues (ARRB, 2009).

A recent summary of projects or upgrades with high safety benefits presently being carried out in the region include:

> Development of a regional 'speed management' strategy.

> Increased safety auditing, and implementation of recommendations.

> Monitoring of road-controlling authority safety management systems.

> Implementation of the backlog of existing CRS recommendations.

> Implementation of mass-action treatments including roadside hazard treatment, parking management, and lighting on arterial routes; and pedestrian and cycling facilities in key locations and routes, including separation where feasible.

> Improved upgrading and fine-tuning of signalised intersections for safe operation for all road users, including pedestrians and cyclists.

> Improved engineering design and visibility on non-signalised intersections.

> Engineering curves in both urban and rural locations to make them less hazardous.

> Introduction of lower-speed and traffic-calming design in town centres, areas of high 'place' function and residential areas.

> Engineering road design for appropriate speeds according to a clear road hierarchy.

> Modernising safety treatments on older sections of the motorway network.

> Upgrading of rail interface facilities for all road users.

Management of network speed

Management of speed is central to achieving safety transport gains. It aims to balance safety with efficiency of vehicle speeds on the road network by reducing the incidence of driving too fast for the prevailing conditions, and maximising compliance with speed limits. An appropriate speed is one that considers traffic safety as the main goal in the context of mobility and prevailing conditions such as

Table 10. Primary and Secondary safety engineering treatments for achieving a safer system (ARRB, 2009)

Bends, Roadside Hazards & Loss of Control Crash Prevention	
Primary	**Secondary**
• Ensure no objects are present – clear zone, tree removal, undergrounding of utilities • Prevent vehicle from leaving the road and striking objects – roadside and centre-of-road barriers • Max speed limits to limit severity e.g. 50km/h where roadside objects are present or shield hazards	• Identify High Crash Locations • Risk Assessment – as crash locations are not likely to predict location of all future fatal or serious crashes • Lower interim speed limits • Vehicle activated warning signs at curves • Install crash cushions or remove hazards • Improved education of the public about crash risk • Treatments that assist in reducing loss of control crashes – improved shoulder provision, audio tactile edgelines, delineation, low cost median treatments
Pedestrian Crash Prevention	
Primary	**Secondary**
• Grade separation of pedestrians as well as separate facilities (e.g. footpaths or pedestrian malls) • Implement survivable pedestrian-vehicle conflict speeds of 30km/h through: - traffic calming - raised crossing points - safe and convenient crossing points • Landuse planning for pedestrians including an adequate functional road hierarchy e.g. - bypassing high pedestrian areas so that low speed environments can be avoided - Reducing exposure by positioning commercial premises to reduce the necessity for pedestrian s to cross the road • Off-road drop-off facilities including bus-stops	• Interim speed limits (e.g. 40km/h – a speed that is above what is generally considered survivable, but would deliver a benefit over current 50km/h limits) • Pedestrian signals including 'rest in red' and signal linking, or Barnes Dance • Pedestrian fencing • Provisions of medians or refuge islands • Electronic warning signs or systems • Improved lighting • Improved skid resistance
Cycle and Motorcycle Crashes	
Primary	**Secondary**
• Separation for cyclist from traffic flows • Provision of one-way streets in urban areas allowing motorcycle use • Providing motorcycle-friendly barriers • Lower speed limits in cycle and motorcycle areas e.g. <40km/h	• Motorcyclists: - Improved road surface through maintenance and sealing of side roads - Improved clear zones - Improved curve alignment - Protected right turns (fully controlled) - Fixed speed cameras • Cyclists: - On-road cycle lanes - Lower interim speed limits e.g. 40km/h - Improved road surface
Intersection Crash Prevention	
Primary	**Secondary**
• Grade separation of cross-traffic movements • Speed reduction: - Reduce speed limit to 50km/h or below where there is a possibility of a side-impact crash - Roundabouts designs to generate 50km/h approach speeds - Designing <50km/h approach speeds in locations with pedestrians and cyclists • Platforms at intersections, also in high speed environments • ITS systems that detect high risk situations at intersections • Separation in time through traffic signals combined with vehicle collision avoidance technology • Controlling turns at signalized intersections • Pedestrian and cyclist signalized crossings including adequate pedestrian phase • 'Rest in Red' signal phases at night • Improved network planning	• Restricting use of intersections through route guidance, closure or restricted movement • Use of ITS to provide additional warning to road users e.g. vehicle activated speed limit signs
Head-on Crash Prevention	
Primary	**Secondary**
• Separation of traffic traveling in different directions – installing centre-of-road barriers, or in urban environments through use of one-way systems • ITS (Intelligent Transport System) collision avoidance systems • Reduce speed limit to limit severity – 70km/h where there is a possibility of a head-on collision	• Vehicle design improvements • Shoulder sealing • Increased separation between vehicles traveling in opposite directions - wider medians • Provision of over-taking lanes • Audio-tactile edgelines and centre-lines • Improved skid resistance • Vehicle activated warning signs at curves • Provision of rest areas and other forms of fatigue management • Improved delineation • More consistent road alignment

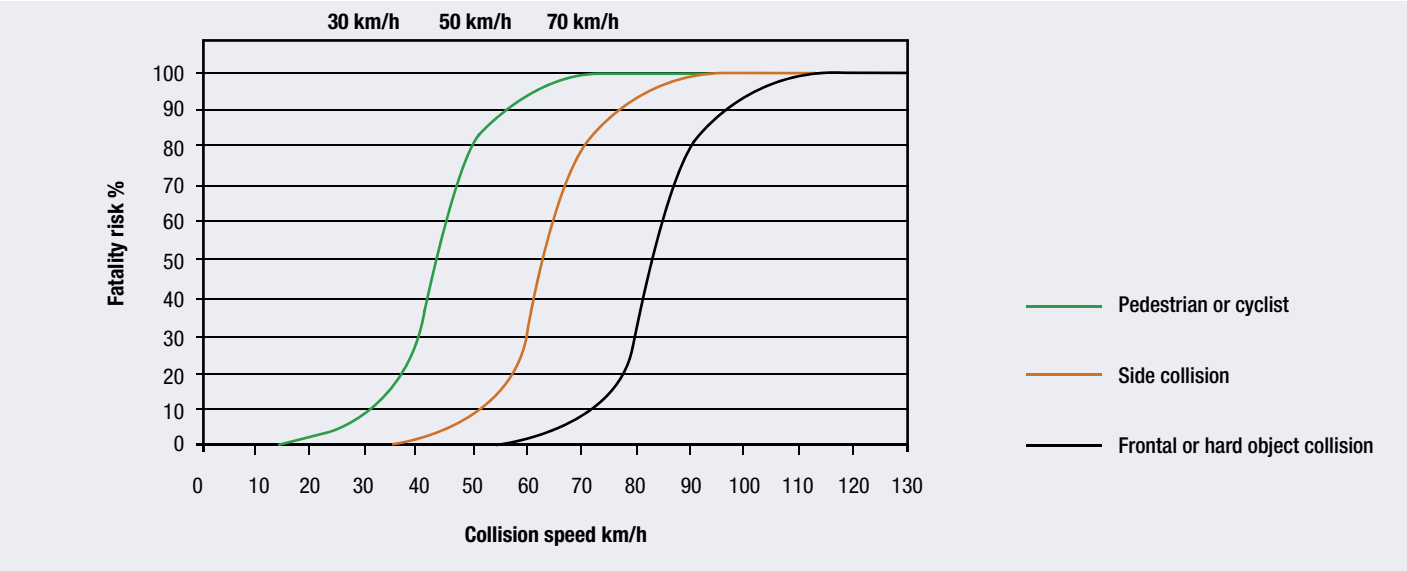

Chart 10. Fatality risk of different crash types in relation to vehicle speed (OECD, ITF 2008).

roadside development, the mix of users along the road, the frequency of access to the road (including intersections), the volume and mix of traffic, environmental concerns and the quality of life for residents living along the road.

Speed management uses a range of measures to achieve appropriate speeds including the setting and reviewing of speed limits; safety engineering measures such as traffic calming, road narrowing, raised platforms, signal optimisation, removal of roadside hazards, improved skid resistance, signage, sealed shoulders, and audible edge lining; public education and regular enforcement.

Internationally, effective speed management has resulted in road environments with:

- **A 30 km/h to 40 km/h speed limit in built-up areas where there is a mix of vulnerable road users and motor vehicle traffic.**
- **A reduction in the likelihood of fatal side-impact crashes at intersections through the introduction of roundabouts with approach speeds of less than 50 km/h.**
- **A reduction in the likelihood of fatal head-on crashes on two-way single carriageway roads by using either median barriers where there are high volumes of traffic, or speed limits below 70 km/h. (WHO, 2008 A.)**

The emphasis on Safer Speeds in urban environments for the prevention of fatal crash types is outlined in Chart 10 above (OECD/ ITF 2008).

The benefits of speed management include a reduction in the number of deaths and injuries resulting from crashes, reduced total vehicle travel, improved walking and cycling conditions, environmental benefits, and increased liveability. In many circumstances speed management can actually improve traffic flow, decrease congestion, reduce vehicle operating costs and decrease trip times (Litman, T. 2008).

40km/h variable speed limit sign outside school

A region-wide speed management strategy is needed that enables further promotion of active modes, increased use of public transport, accessibility, and overall improved safety performance of the transport network.

A speed management strategy must also include a clear functional road hierarchy of both urban and rural roads for speed management purposes. This hierarchy needs to provide a clear distinction between different road classes in terms of their design, appearance and speed limits i.e. provide a self-explaining road for motorists

4.4.8 Safety engineering funding

The New Zealand Transport Agency recognise the need for improved safety engineering throughout the regional roading network. There are four key changes in the New Zealand Transport Agency Planning Programming and Funding Manual (PPFM) to help councils to fund safety engineering for the period July 2009 to June 2012. They include:

> An assessment profile of MM (Medium Strategic Fit, Medium Effectiveness) for generic roading projects costing under $4.5 million where the project provides significant improvements in safety benefits. This includes projects such as replacement of bridges, new roads, road reconstruction, property purchase, pedestrian and cycle facilities, and to passenger transport.

> The funding limit for minor improvements has been raised to $250,000 for individual projects, including safety.

> The subsidy for developing and reviewing local road safety strategies and crash reduction studies has been raised to 75% and the subsidy for development and review of Road Safety Action Plans has been raised to an average of 55% for the region.

> The ability to group projects and activities related to road safety engineering in an application, thereby sharing the benefits of various projects.

NZ Transport Agency have recently provided guidance on rating the 'strategic fit' for the funding of the above projects.

Before these safety engineering projects are submitted to the New Zealand Transport Agency they are assessed and profiled through the ARTA prioritisation system which takes into account the RLTS goal of improved road safety on local roads. The current ARTA profiles for safety engineering projects are identified in Table 11 below in terms of Seriousness and Effectiveness.

Table 11. ARTA Generic Project Profiles for Seriousness and Effectiveness

Generic Project Description	ARTA Profile
Bridge renewals: safety	HM (High Medium)
New roads and bridges: safety	HM (High Medium)
Road reconstruction: rural realignment, safety	HM (High Medium)
Road reconstruction: safety improvements at intersections and along urban routes	HM (High Medium)
Road reconstruction: safety retro-fitting	HM (High Medium)
Road reconstruction: street lighting improvements	HM (High Medium)
Advanced property purchase: safety	HM (High Medium)
Purpose-built walking or cycling facilities	HM (High Medium)
Improvements to existing mixed walking or cycling networks	HM (High Medium)
Passenger transport infrastructure improvements	HH (High High)

Through the ARTA approval process, projects will appropriately target the five priority safety-engineering issues (see page 54) to achieve regional and national safety targets.

Current funding mechanisms allocate a much higher priority to interventions at sites where a crash causing injury has already occurred. ARTA will also explore how to fund proactive safety engineering projects that may not achieve a traditional BCR.

It will be the responsibility of ARTA, with input from the regional safety engineering forum, to monitor how effective the current prioritisation system is and to suggest improvements that can be documented in the three-year Auckland Regional Land Transport Programme.

4.4.9 Regional Arterial Road Plan (RARP)

ARTA's Regional Arterial Road Plan (RARP) identifies safety as an important factor when assessing the relative importance of future improvements on regional arterial roads. Such improvements include safety engineering projects on regional arterials that allocate road space in a way that meets both strategic and local community needs, and gives precedence to the movement of people and freight over the movement of single occupant cars, particularly during peak periods.

Regional arterial roads link districts or urban areas within the region, connect regionally significant facilities, and play a critical role in the movement of people and goods. While the regional arterials make up only 9% of the total road network, they carry 13% of the total traffic volume and incur up to 20% of the social cost of the region's crashes.

The RARP considers the various functions of different regional arterial roads and analyses their ability to perform them. By layering the different functions of a road, and the road's performance, a complete balanced view of the deficiencies of a stretch of road can be found. Safety is analysed by mapping the crash rate of a road against traffic volume (refer to Figure 17 overleaf).

Analysing functions and deficiencies will enable priorities for improvements to be established. Corridor management plans are the main tool. The plans will consider the needs of the road in more detail and the RARP will determine the order in which the plans are carried out. By considering safety as an issue that needs to be addressed through corridor plans and by raising safety as an issue that gains funding priority over other potential road improvements, the interests of safety can be built into all planned road improvements.

Through its analysis of issues, the RARP encourages road-controlling authorities to improve the effectiveness, safety and management of the regional arterial network, in the following ways:

> Making better use of existing road space by giving greater priority to buses (and possibly high occupancy vehicles) and placing appropriate emphasis on moving freight efficiently and safely.

> Supporting land use intensification at identified high density centres.

> Better meeting the needs of pedestrians and cyclists, particularly in areas of high 'place' function where the application of the road user hierarchy is appropriate (refer to section 1.5.2).

> Encouraging the development and implementation of engineering measures to improve road safety.

> Encouraging the use of technology and advanced traffic management systems.

To make these regional arterial improvements possible ARTA will encourage the Ministry of Transport to increase the rate of financial assistance for regional arterials, including engineering projects to increase road safety. The Auckland Regional Road Safety Plan 2009–2012 supports this prioritisation of safety engineering for arterial roads.

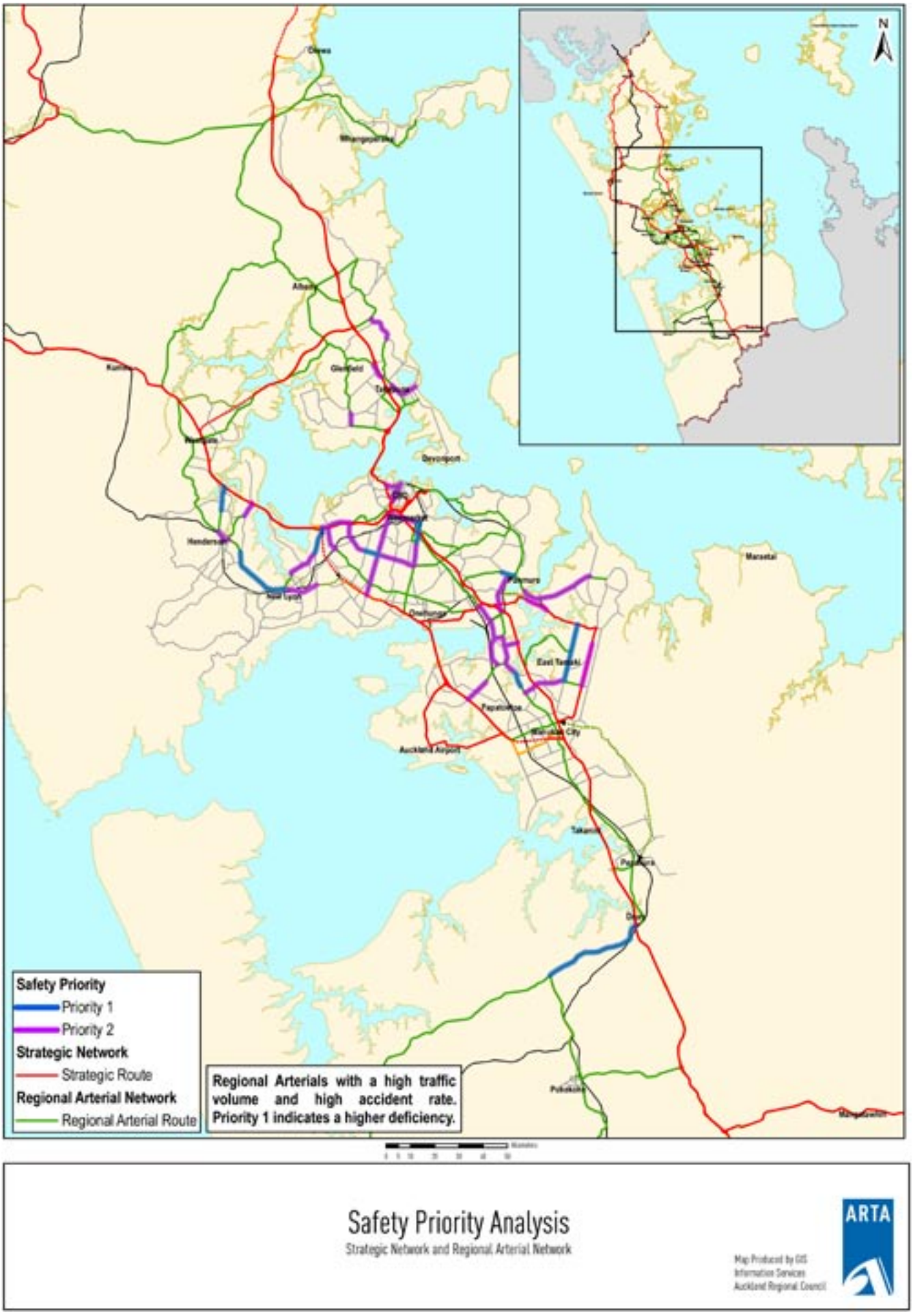

Figure 17. Arterial road safety priority analysis

5 VISION, GOALS, STRATEGIES AND IMPLEMENTATION

The Auckland Regional Road Safety Plan 2009–2012 includes a vision, a mission and a series of interrelated goals and strategies. Each strategy has a series of actions and performance measures. Implementation of the strategies and the actions associated with them will move the region towards accomplishing the goals and overall target.

5.1 Vision, mission and goals

Our vision

A safe transport system, in which no law-abiding road users are killed or seriously injured on roads in the Auckland region.

Our mission

By 2012 the Auckland region leads the country in road safety by achieving a 3% decline in the number road casualties per 10,000 people and per kilometre travelled, taking the country closer to the Government Policy Statement goal of a reduction in deaths and serious injuries as a result of road crashes.

Regional Road Safety Target

By 2012 there will be 400 or fewer fatal and serious crashes compared with the annual average of 490 recorded between 2005 and 2007 (or an equivalent 18% decrease).[11]

Goals for the Auckland region

i. **Speed-related** road fatalities and injuries are fewer than the 2003 to 2007 five-year annual average of 37 deaths and 734 reported casualties.

ii. **Alcohol-related** road fatalities and injuries are fewer than the 2003 to 2007 five-year annual average of 30 deaths and 699 reported casualties.

iii. **Pedestrian** deaths and injuries continue to decline from the 2003 to 2007 five-year annual average of 12 deaths and 363 reported casualties.

iv. Motor-vehicle-related deaths and injuries at **intersections** are fewer than the 2003 to 2007 five-year annual average of 17 deaths and 1377 reported casualties.

v. Deaths and injuries related to **crashes at bends and with roadside hazards** are fewer than the 2003 to 2007 five-year annual average of 32 deaths and 929 reported casualties for 'crashes at bends', and 36 deaths and 1045 reported casualties for 'crashes with roadside hazards'.

vi. **Motorcyclist** fatalities and injuries are fewer than the 2003 to 2007 five-year annual average of 4.7 casualties per million vehicle kilometres travelled.

vii. **Cyclist** fatalities and injuries are fewer than the 2003 to 2007 five-year annual average of 1 death and 194 reported cyclist casualties.

viii. The percentage of **unrestrained motor-vehicle drivers**[12] killed or seriously injured declines, based on the 2002 to 2006 five-year annual average of 18%; and more than 95% of all motor-vehicle occupants (including children) continue to use approved restraints.

ix. **Passenger transport and travel demand management** promotion and safety initiatives contribute to an overall reduction in transport-related deaths and injuries.

5.2 Strategies

Seven strategies of the Auckland Regional Road Safety Plan 2009-2012 relating to the goals for the Auckland region are:

1. Enhanced safety management; planning and targeting of safety engineering on local roads, including measures to reduce crashes at bends and with roadside hazards.
2. Effective management of the speed of motorised vehicles, lower urban speeds, and other initiatives that support a growing community acceptance of speed limits.
3. Well-targeted enforcement of drink drive legislation, integrated driver rehabilitation and visible host responsibility, more effective liquor licensing, and improved drug and alcohol testing of drivers.
4. Improved pedestrian safety by integrating this aspect with overall transport planning, through cluster/blackspot studies, and from the use of innovative engineering and technology solutions
5. Improved intersection safety through safety audits, educational campaigns and technology to deter drivers from running red lights.
6. Initiatives tailored to the needs of at-risk and vulnerable road users.
7. Integrated public transport and travel demand management safety.

5.3 Implementation

Each of the seven strategies is implemented through a set of actions. The strategies relate to the key road safety issues identified for the region (refer to section 2.2.1) and the actions are important cost-effective means of achieving proposed regional goals and targets for road safety.

[11]Refer to section 6.2.1 for an explanation of this target, along with State Highway and local road targets and targets for each territorial authority. This target will be reviewed when a new national target is set after the Road Safety to 2010 strategy has been reviewed, expected by the end of 2010.

[12]Available data on crashes regarding restraint use is currently recorded only from drivers, i.e. information as to whether or not a passenger is using a restraint is not available. Therefore, this goal pertains to drivers in relation to crashes, but not to drivers and passengers in terms of data from observational studies of safety seat and child restraint use.

Underpinning the strategies and actions, ARTA and Roadsafe Auckland believes that there needs to be a focus on:

> Appropriate combinations of education, engineering, enforcement, and encouragement.

> Placing increased attention on resources towards engineering solutions as signalled by the Government's road safety strategy, and supported by:

  - Advertising and safety promotions around key issues.
  - Community projects that develop community ownership of both the problem and the solution.
  - Programmes that support community (especially Maori, Pacific, Asian and new migrant communities) and organisational structures (e.g. schools, businesses, community groups) to establish safety policies and practices.

In consultation with stakeholders, ARTA and other member organisations of RoadSafe Auckland have developed the road safety strategies and actions for 2009 to 2012 in further detail in Appendix 4.

For each strategy in Appendix 4, a series of actions, along with key contributing organisations, has been outlined in relation to implementing the three Es. A lead organisation, responsible for coordinating the actions, is also nominated. Key actions which provide the most benefit in each strategy are highlighted.

Contributing organisations include territorial authorities, the New Zealand Transport Agency, New Zealand Transport Agency Highways and Operations, the Auckland Regional Transport Authority, New Zealand Police, Ministry of Justice, Accident Compensation Corporation, District Health Boards, Alcohol Advisory Council of New Zealand, Ministry of Health, Auckland Regional Public Health Services, and Safekids.

5.4 Impact of actions on targets

Successful implementation of the combined actions derived from the seven strategies will deliver improved results in engineering, enforcement and education across the region in areas where the cost/benefit is most efficient.

The main areas where the actions supporting each strategy will be used are:

> Enforcement of alcohol-related and speed-related legislation through new penalties.

> Improved land use planning and use of safety impact assessments.

> Increased enforcement of urban speed limits and lower speeds.

> Increased investment in safety engineering for the prevention of crashes, particularly on arterial roads, at bends or with roadside hazards, and at intersections.

> Improved infrastructure for pedestrians and cyclists.

> Heightened road user awareness of crash risks and behaviours to prevent them.

> Safer travel to and from passenger transport, and improved travel choices.

Most of the outputs are measurable: e.g. the number of hours spent policing roads to enforce speed and alcohol limits, and the use of restraints; the number of crash reduction study recommendations and safety engineering projects funded and implemented by road-controlling authorities; the performance of the road network; and the number of driver licensing programmes funded and delivered by local authorities and communities.

The delivery of the outputs will be measured where possible and compared against the annual final and intermediate road crash outcomes (refer to Appendices 2 and 3) to gauge progress towards regional road safety targets as outlined in the Road Safety Management for Results model (refer to Appendix 1).

At present there is no analysis of the exact costs and benefits for the overall combination of the individual actions in the Auckland Regional Road Safety Plan 2009–2012. However, international and national experiences, and expert judgement, suggest the combined benefits are likely to be far greater than the costs.

Benefits from road policing

In 1999, the Land Transport Safety Authority estimated that the BCR for the national Safety Administration Programme, which included enforcement and education as a whole, was between 9:1 and 13:1 (refer to Regional Land Transport Strategy Technical Paper 19: Assessing future regional road safety investment, 2005). The more recent 2007 Review of Road Safety to 2010 (Taylor, Duigan, Barry, 2007) concluded that the 36% increase in road policing enforcement outputs from 2000 to 2005 resulted in national compliance outcomes (i.e. those related to speed, drunk driving incidence and use of safety-belts) improving substantially and made a significant contribution to the overall reduction in road trauma nationally. The report established that the BCR for fully implemented police enforcement of these areas, along with national advertising efforts, delivered an 8:1 BCR.

For interventions that target high-risk behaviours, the incremental BCR can be much higher. However, as the amount of enforcement increases, the incremental effect can diminish over time if there are no new policy changes. This implies that the introduction of new enforcement policies, such as lowered blood alcohol driving levels and demerit points for speed camera offences, are critical for improving the overall BCR for the strategies adopted in the Auckland Regional Road Safety Plan 2009–2012.

Increased investment in targeted safety engineering on arterial roads The Auckland Regional Land Transport Strategy (Auckland Regional Council, 2005) estimated that it would cost $507 million to achieve crash reduction targets in the 2010 Auckland Region Road Safety Plan through targeted safety engineering on arterial roads (also refer to Regional Land Transport Strategy Technical Paper 19: Assessing future regional road safety investment, 2005).

The Ministry of Transport estimated in 2005 that engineering work with safety benefits equivalent to an average BCR of 3:1 and an average safety benefit of 100% would produce the same end result as would be achieved by work with an average safety benefit of 75% and average BCR of around 4:1. The estimated reduction in deaths and serious injuries for the region as a result of this investment would be 16 fewer deaths and 184 fewer serious injuries in 2010.

5.4.1 Key regional advocacy issues

RoadSafe Auckland has for many years advocated for national legislative changes to reduce crash risk in the region. The following changes in national policy are critical to achieving the targets in the Auckland Regional Road Safety Plan 2009–2012:

Increased speed enforcement measures, including reduced tolerance for the speed at which speed limits are enforced, and demerit points for drivers caught driving at excessive speed by speed cameras

The cost of enforcing this legislation regionally is not available; but benefits are considered to be significantly greater than costs at the national level. The Ministry of Transport estimated in 2005 that the combined benefits of introducing discrete speed cameras, reducing the tolerance at which speed limits are enforced, and demerit points for speeding offences caught by speed cameras would result in a 5% regional reduction in all deaths and serious injuries; or four fewer

serious injuries and five fewer deaths in 2010 (refer to Regional Land Transport Strategy Technical Paper 19: Assessing future regional road safety investment, 2005).

A reduction of the legal blood alcohol level for driving from 80 milligrams of alcohol per 100 millilitres of blood to 50 milligrams of alcohol per 100 millilitres of blood

The risks of a fatal crash while driving at the current legal limit for blood alcohol are alarmingly high. That is not surprising, considering that the average male would need to consume about six standard drinks without food in 90 minutes to reach the current adult blood alcohol limit of 80mg/100ml. The evidence from other jurisdictions that have lowered the drink/drive limit to 50mg/100ml (0.05 BAC) is that it reduces the number of alcohol-related crashes, including the number of crashes caused by drivers with very high blood alcohol levels.

The cost of enforcing this legislation regionally is not available, but, nationally, benefits are considered to be significantly greater than costs. Breen's 2004 review of the Road Safety to 2010 strategy noted that reducing the blood alcohol level from 80mg/100ml to 50mg/100ml, in line with international good practice, is the only drinking and driving countermeasure not yet implemented that 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 (Breen, 2004).

The Ministry of Transport also estimated in 2005 that this intervention could reduce deaths and injuries related to alcohol in the Auckland region by 3%, or two fewer deaths and 28 fewer serious injuries by 2010 (refer to Regional Land Transport Strategy Technical Paper 19: Assessing future regional road safety investment, 2005).

New Zealand is one of only five OECD countries that continues to maintain it's legal drink driving BAC at 0.08, despite World Health Organisation recommendations of a minimum 0.05 BAC for all countries (WHO, 2009). The remaining 24 OECD countries and another 64 outside of the OECD have already moved to a drink drive BAC of 0.05 or less and seen significant road trauma savings as a result.

Raising the age at which alcohol can be purchased legally to 20 years to reduce young driver alcohol-related crashes

There is evidence of a significant increase in alcohol-related casualties since 2000, when the drinking age was lowered to 18 years. In the Auckland region, the number of casualties related to alcohol for drivers aged between 15 to 19 years has increased by over 230% from 2000 to 2007 (see section 4.3 Educating road users about their crash risk – Safer young and novice drivers).

Nationally, for drivers younger than 18 years involved in fatal crashes, since 1999 there has been a statistically significant increase in the proportion of crashes in which alcohol was cited as a contributing factor. Given that there were no significant changes in the number of non-alcohol related fatal crashes in this group, it is likely that the increase is due to the lowering of the drinking age in 1999 (Alcohol in New Zealand Road Trauma, Land Transport Safety Authority, 2003).

It is clear to RoadSafe Auckland that lowering the drinking age has had a detrimental effect on the safety of drivers aged between 15 to 19 years. RoadSafe believes that significant road safety savings can be made by raising the age at which alcohol can be legally purchased to 20 years.

Introduction of mandatory drug and alcohol testing of drivers involved in fatal and serious crashes

New Zealand research has identified a link between alcohol, cannabis, and driver culpability in fatal crashes (Vergara, 2006). However, drug and alcohol testing of drivers involved in fatal crashes is not carried out on a mandatory basis, which could in turn be under-estimating the size of the link between drugs and fatal crashes. The introduction of mandatory drug and alcohol testing of drivers involved in fatal and serious crashes would provide the basis for future policy and enforcement initiatives around the prevention of drugged driving.

Raising the minimum driving age from 15 years to 16 years

Young novice drivers are over-represented in road crashes in the region. Most of the crashes occur during the restricted phase (not permitted to drive unaccompanied) and relate primarily to inexperience. International best practice recommends a longer period of supervised learner driving as well as an older minimum age, to compensate for the late maturing of the cognitive ability of young drivers, including visual scanning and hazard detection (Breen, 2004).

New Zealand has the highest road death rate per 100,000 population for 15 to 17 year olds in the OECD and RoadSafe advocates raising the minimum driving age from 15 to 16 years and extending the length of the learner licence period from six months to 12 months to address this longstanding international anomaly.

More road safety education in schools

Road safety education should be an important component of the school curriculum, given the large number of children involved in crashes as pedestrians in the urban parts of the region. Young boys are particularly at risk. Road safety education is not delivered in all primary and intermediate schools, so some Auckland children are more at risk than others. RoadSafe advocates road safety education programmes such as RoadSense Ata Haere should be implemented urgently in schools in which students are held to be at high risk of involvement in a crash, and that incentives for schools to participate in such programmes should be investigated.

5.4.2 Convergence of other transport safety benefits

Other safety costs and benefits will arise from related Traffic Demand Management components in the Auckland Transport Plan as well as from increases in the use of public transport. However, the level of potential convergence or 'double counting' of safety costs and benefits from these other components is estimated to be low (refer to Regional Land Transport Strategy Technical Paper 19: Assessing future regional road safety investment, 2005).

While convergence of safety benefits may be low it is still important to ensure that Travel Demand Management, and safety improvements are coordinated so funding is not wasted and so maximum benefits, for more than one objective, are achieved.

6 MONITORING PROGRESS

The targets, goals, key actions and road safety outcomes outlined in this Auckland Regional Road Safety Plan 2009–2012, will be monitored as outlined in the Road Safety Management System results pyramid (refer to Appendix 1). Key performance measures will be used to gauge the plan's progress. Those measures will be reported annually to the Regional Land Transport Committee and the member organisations of RoadSafe Auckland (usually around May) over the life of the plan. A full review of the proposed Auckland Regional Road Safety Plan 2009–2012 will be carried out in 2012, towards the end of the time covered by the plan.

While it is difficult to relate any short-term changes in numbers or severity of crashes resulting in death or serious injury directly to specific actions, there is good evidence to support the view that a balance of education, enforcement and engineering interventions will contribute as a whole to a reduction in crashes resulting in death or serious injury across the region.

6.1 Monitoring overview

The Auckland Regional Road Safety Plan 2009–2012 relies on the continued commitment of member agencies to deliver aspects of the plan. As noted, in or about May each year, ARTA (with input from other member organisations of RoadSafe Auckland, including the New Zealand Transport Agency, Ministry of Transport and Auckland Regional Council) will carry out a review of progress. This review will assist ARTA and individual members of RoadSafe Auckland to assess priorities and actions for the coming year.

All local authorities in the Auckland region have local Road Safety Action Plans and/or strategies. Agencies, such as the police and New Zealand Transport Agency Highways and Operations group are required to prepare annual business plans at a national level. These plans determine much of the regional or local activity by these agencies.

Increasingly, community-based organisations are delivering community road safety programmes and projects. Their work adds a further dimension to road safety efforts within the region. It is important that these organisations collaborate and act in a coordinated manner. The Auckland Regional Road Safety Plan 2009–2012 helps to guide their efforts and to focus resources.

ARTA, with the input of other member organisations of RoadSafe Auckland, has identified the following key road safety performance measures to be reported on annually:

- **Progress towards overall regional and local targets regarding crashes that are fatal or cause serious injury (refer to section 6.2.2).**
- **Crash data (refer to Appendix 2: Final outcomes) in relation to the goals.**
- **Survey data (refer to Appendix 3: Intermediate outcomes) in relation to the goals.**
- **Progress towards key actions.**

Full monitoring measures include crash data reported to the police and compiled by the New Zealand Transport Agency (final outcomes), hospitalisation data provided by the Ministry of Transport (final outcomes), other key data from observational surveys and attitude surveys (intermediate outcomes), and output measures in relation to the key actions.

6.2 Regional and local targets

There are a number of regional targets pertaining to road safety.

'Expected Results by 2016', included in the *Regional Land Transport Strategy* (Auckland Regional Council, 2005) pertaining to road safety included the following:

- Attitudes of Auckland drivers towards drink driving, speeding and general traffic enforcement are expected to improve over time.
- Numbers of crashes, deaths and injuries involving pedestrians and cyclists are expected to decrease.
- User perceptions of the safety of getting to, from and using public transport are expected to improve.
- Numbers of regional road-injury casualties per 10,000 people are expected to decline by 6% (i.e. to fewer than 29.2 casualties per 10,000 people from the 31.0 casualties recorded in 2005).

Targets and performance measures outlined in the Auckland Regional Road Safety Plan 2009–2012 are consistent with the 'Expected Results' noted above.

New Zealand Police and territorial authorities also have a range of targets and performance measures, to which the targets and performance measures given in the Auckland Regional Road Safety Plan 2009–2012 are complementary.

The national Road Safety to 2010 strategy provided a target of no more than '690 deaths plus hospitalisations of more than one day' for the Auckland region in 2010. This was based on a national 2010 target, which has since been superseded by the New Zealand Transport Strategy (NZTS) and the Government Policy Statement (GPS) released in 2008. The NZTS has a new national road safety target of no more than 200 deaths and 1500 serious injuries per annum by 2040. The Auckland region's contribution to this new national target is unstated, but there is potential for a regional target to be established in the new Auckland Regional Land Transport Strategy (RLTS) in 2009.

In the absence of a regional 2020 road safety target for the Auckland region, ARTA (with input from other member organisations of RoadSafe Auckland) has developed a series of interim regional and local targets for 2012 that can be monitored annually to track broad progress at regional and local levels. The regional and local targets for 2012 are based on an estimation of the region's share of the NZTS 2040 targets and will be reviewed when a new regional 2020 target is set by the Road Safety to 2020 strategy, expected in 2010.

Table 12. Regional and local targets by type of road and territorial authority (Source: New Zealand Transport Agency CAS data base, 2008)

	Overall crashes		State highway crashes		Local road crashes	
	Overall 2012 target (fatal plus serious crashes)	Three-year annual average (2005 to 2007) of fatal plus serious crashes	State Highway fatal plus serious crash 2012 target	Three-year annual average (2005 to 2007) of State highway fatal plus serious crashes	Local road fatal plus serious crash 2012 target	Three-year annual average (2005 to 2007) of local road fatal plus serious crashes
Auckland region	**400**	*490*	**80**	*85*	**320**	*405***
NZTA Highways	**80**	*85*			**n/a**	*n/a*
Auckland City	**124**	*146*	**19**	*22*	**105**	*124*
Franklin District	**24**	*30***	**5**	*5**	**19**	*25***
Manukau City	**84**	*107***	**12**	*15***	**72**	*92***
North Shore City	**44**	*58***	**7**	*5**	**37**	*53***
Papakura District	**12**	*20***	**4**	*3**	**8**	*17***
Rodney District	**60**	*69*	**27**	*30*	**33**	*39*
Waitakere City	**52**	*60*	**6**	*5**	**46**	*55*

NOTES:
* Because the numbers are very small, the figures for some targets may already be close to or below the target level, which broadly indicates that the area is already performing well.
**Some areas require a greater than 20% reduction in fatal and serious crashes to achieve the 2012 targets. If the numbers are small (i.e. less than 10), then caution is required in interpreting the figures.

6.2.1 Explanation of regional and local 2012 targets

The above regional and local 2012 road safety targets are based on the current national target of no more than 200 deaths and 1500 serious injuries a year by 2040, and include the relative overall population projections or 'per capita' basis of contribution for the Auckland region.

The Auckland contribution towards the 2040 national target has been estimated using a range of options. A 2012 figure has been estimated based on current trends and required reductions that would need to occur to reach a longer term 2040 target. The estimated 2012 target has been converted into a figure representing the number of crashes resulting in death or serious injury.

In early consultation with local authority road safety personnel, local targets were requested that linked to the overall regional target. ARTA, with input from other member organisations of RoadSafe Auckland, believes that the following targets provide a useful overall regional target and related local targets that can be used to monitor progress in improving road safety in an explicit and straightforward manner.

Crashes have been used instead of casualties, as the overall plan focuses on reducing the number of crashes, which will in turn result in a reduction in the number of casualties. Table 12 above outlines regional and local targets and base data.

6.2.2 Regional and local targets by territorial authority

In summary, the 2012 targets for the Auckland region are:

> Overall, **400** or fewer **crashes resulting in death or serious injury**

> **80** or fewer **crashes resulting in death or serious injury** on **State Highways**

> **320** or fewer **crashes resulting in death or serious injury** on **local roads**.

Overall, the Auckland region requires an 18% reduction from the 2005 to 2007 annual average in crashes resulting in death or serious injury to achieve the 2012 target, mostly on local roads. Reductions in the number of crashes on State Highways are particularly required in Rodney District, Manukau City, and Auckland City. Reductions in the number of crashes on local roads are particularly required in Papakura District, North Shore City, Franklin District and Manukau City. Auckland City also needs to attend to the high numbers of crashes on its local roads.

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APPENDIX 1: ROAD SAFETY RESULTS FOR THE AUCKLAND REGION

The Road Safety Management System pyramid (see section 1.4) in Figure 18 below indicates how the strategies and actions in the Auckland Regional Road Safety Plan 2009–2012 can produce road safety intervention outputs that lead to improved regional intermediate and final outcomes (regional targets). Appendices 2 and 3 outline the annual final and intermediate outcomes for the region in more detail.

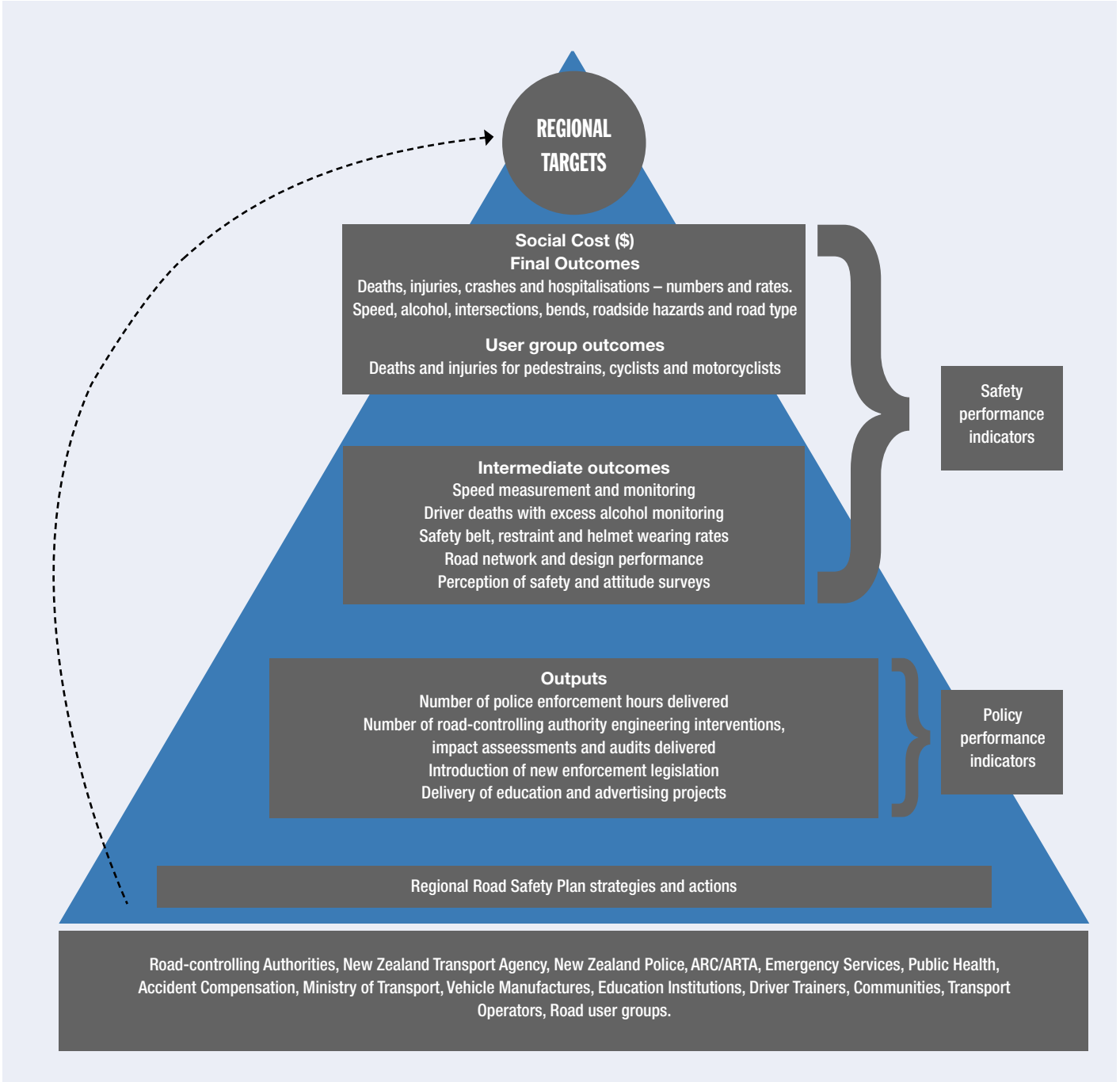

Figure 18. Auckland region road safety management for results (adapted from Bliss. A & Breen J., 2008, Global Road Safety Facility, World Bank)

APPENDIX 2: FINAL OUTCOMES FOR THE AUCKLAND REGION

Table 13 in the following pages outlines regional crash data reported to the Police and compiled by the New Zealand Transport Agency, together with hospitalisation data provided by the Ministry of Transport. This data is collected annually and recorded in terms of actual numbers and rates against other data such as population and vehicle kilometres travelled and will be used to gauge the region's annual progress towards the goals and final outcomes in the Auckland Regional Road Safety Plan 2009–2012.

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Social Cost of crashes (in 2008 dollars)										
Total $ million	$1192	$1218	$1078	$901	$1001	$985	$1040	$999	$1074	$946
Population (000)	1133	1161	1189	1217	1246	1276	1307	1339	1371	1393
$ per population	$1016	$1023	$892	$731	$791	$754	$781	$738	$782	$670
100 million vehicle kllometres travelled (vkt)	NA	NA	NA	100.98	103.4	107.97	110.77	114.01	117.34	118.53
Cents per vkt	NA	NA	NA	8.9c	9.7c	9.1c	9.4c	8.8c	9.2c	8c
Road casualties										
Number of road deaths	105	89	70	74	84	81	93	77	84	61
Serious injuries	527	575	530	560	639	545	576	503	624	483
Sub-total serious and fatal injuries	632	664	600	634	723	626	669	580	708	543
Minor injuries	2893	3032	2597	2803	3111	3561	3482	3595	3786	3760
Total Casualties	3525	3697	3197	3437	3834	4187	4151	4175	4494	4304
Casualties per 10,000 people	31	31.8	26.9	28.2	30.8	32.8	31.8	31.2	32.8	30.9
Casualties per 100 million vkt	NA	NA	NA	34	37.1	38.8	37.5	36.6	38.3	36.3

Table 13. Summary of Auckland region road crash final outcomes between 1998 and 2007 (New Zealand Transport Agency, 2008)

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Road crashes										
Number of fatal crashes	99	85	63	70	77	77	81	69	77	56
Serious crashes	434	475	430	437	545	428	432	411	488	373
Sub-total fatal plus serious crashes	533	560	493	507	622	505	513	480	565	429
Fatal and serious crashes per 100 million vkt	NA	NA	NA	5.02	6.02	4.68	4.63	4.21	4.82	3.62
Deaths plus hospitalisations										
Deaths plus hospitalisations of more than one day	1,077	952	828	846	858	787	818	905	988	896
Deaths plus hospitalisations of more than three days	765	652	588	603	608	547	579	639	663	614
Total deaths plus hospitalisations	1816	1938	2174	2640	2706	2524	2556	2878	3206	2937
Deaths plus hospitalisations per 10,000 people	16	16.7	18.3	21.7	21.4	19.6	19.2	21.5	23.4	21
Deaths plus hospitalisations per 100 million vkt	NA	NA	NA	26.1	26.2	23.4	23.1	25.2	27.3	24.8
Casualties and crashes by contributing crash factors										
Alcohol-related casualties										
Alcohol-related road deaths	32	21	17	16	31	39	39	25	26	22
% Alcohol deaths	30%	24%	24%	22%	37%	48%	42%	32%	31%	36%
Alcohol-related road casualties	692	617	539	525	629	620	660	641	871	701
Speed-related casualties										
Speed-related road deaths	36	29	16	28	33	39	51	37	33	23
% Speed-related deaths	34%	33%	23%	38%	39%	48%	55%	48%	39%	38%
Speed-related road casualties	572	582	568	615	603	718	768	701	810	675
Injury crashes at intersections										
Injury crashes at intersections	945	1069	1020	1036	1268	1391	1323	1314	1462	1396
Intersection deaths	20	14	15	13	16	22	14	17	19	12

Table 13, continued...

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Rear-end crashes										
Rear-end injury crashes	136	172	137	228	217	294	288	304	257	281
Rear-end non-injury crashes	765	918	1046	1239	1315	1222	1193	1240	1196	1236
Total rear-end crashes	901	1090	1183	1467	1532	1516	1481	1544	1453	1517
Crashes at bends										
Local roads										
Fatal crashes	25	21	18	17	28	21	26	19	22	21
All injury crashes	604	656	595	590	669	724	769	739	829	770
State Highways										
Fatal crashes	11	11	11	15	11	10	12	11	14	6
All injury crashes	182	209	177	210	169	146	161	170	183	155
Total injury crashes	786	865	772	800	838	870	930	909	1012	925
Crashes with roadside hazards										
All roads										
Fatal crashes	34	32	32	25	30	42	43	33	37	24
All injury crashes	776	800	752	821	847	932	971	962	1113	1069
Total injury crashes	810	832	784	846	877	974	1014	995	1150	1093
Road user casualties										
Pedestrian deaths and casualties										
Pedestrian deaths	24	24	11	19	14	15	13	8	13	13
% Pedestrian deaths	23%	27%	16%	26%	17%	19%	14%	10%	15%	21%
Pedestrian casualties	337	357	349	408	422	430	379	345	371	290
Cyclist deaths and casualties										
Cyclist deaths	3	1	2	3	3	1	0	1	2	0
Cyclist casualties	135	158	166	154	204	180	179	223	198	192

Table 13, continued...

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Motorcyclist deaths and casualties										
Motorcyclist deaths	15	11	4	5	7	8	8	13	7	4
Motorcyclist casualties	231	220	168	169	190	205	192	252	294	355
Million vehicle kilometres travelled (vkt)					42.91	46	46.33	51.89	59.55	68.53
Casualties per million VKT					4.4	4.5	4.1	4.9	4.9	5.2
Young driver (15 to 24 years) deaths and casualties										
Young driver deaths	19	12	7	8	11	9	17	12	13	6
% young driver deaths	18%	13%	10%	11%	13%	11%	18%	16%	15%	10%
Young driver serious injuries	93	102	87	85	91	84	111	77	104	74
Young driver total casualties	679	701	565	619	671	801	804	801	915	935
Young driver (15 to 19 years) alcohol-related casualties compared to all casualties										
Young drivers 15 to 17 years alcohol-related casualties	4	4	8	4	16	10	9	6	28	25
Young drivers 15 to 17 years total casualties	142	138	106	137	149	153	161	150	190	181
Young drivers 18 to 19 years alcohol-related casualties	14	18	9	23	17	29	20	36	44	31
Young drivers 18 to 19 years total casualties	164	193	129	153	191	215	229	227	233	241
Road deaths by road type										
Motorway deaths	7	14	12	5	7	6	9	1	10	5
State highway deaths (non motorway)	21	16	12	17	5	14	11	19	14	12
Open road deaths (non State highway)	24	15	9	22	22	21	28	24	15	20
Urban road deaths (speed limit of 70 kph or less)	53	44	37	30	50	40	45	33	45	24

Table 13, continued...

APPENDIX 3: INTERMEDIATE OUTCOMES FOR THE AUCKLAND REGION

The following annual survey data is provided by the Ministry of Transport and used in terms of actual numbers and rates to gauge the region's annual progress towards the goals and intermediate outcomes in the Auckland Regional Road Safety Plan 2009–2012.

Restraint use, and drivers killed and injured while not wearing restraints

Use of safety belts and child restraints increased dramatically in the 1990s, but further incremental gains are required, especially in the use of adult rear seat belts and child restraints. The previous regional plan set a goal of more than 95% of all motor vehicle occupants (including children) using seat belts and/or restraints by 2006. That goal came close to being achieved for children and adults in the rear seat, and was achieved for adults in the front seat. The rate was maintained in 2007. Breakdowns and trends are outlined in Table 14 and Chart 11 below (Source: New Zealand Transport Agency/Ministry of Transport – www.transport.govt.nz).

Table 14. Restraint use – Auckland region summary (Source: Ministry of Transport)

% occupant restraint use	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Children under 5 years of age	73	70	75	77	83	82	81	86	92	90
Adult front safety belt use	97	93	94	94	91	95	96	97	97	96
Adult rear safety belt use	62	57	84	84	84	82	90	82	93	92

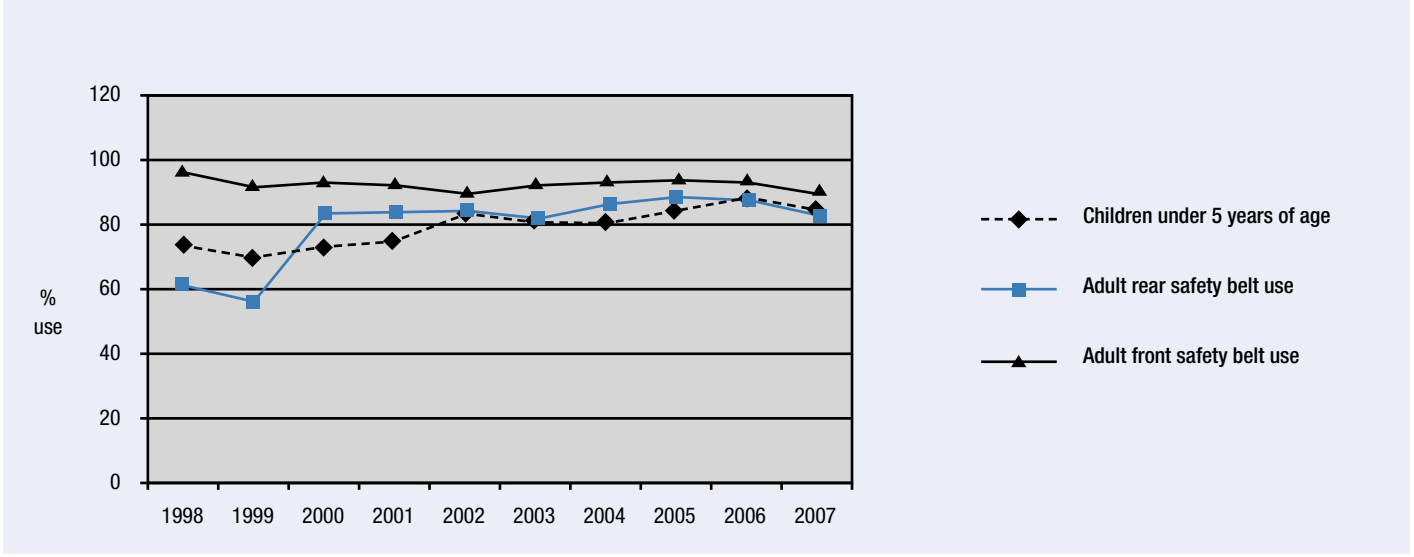

Chart 11. Restraint use between 1998 and 2007 – summary Auckland region (Source: Ministry of Transport)

The use of seat belts by drivers is a protective factor in crashes. Between 2002 and 2006 at least 40 drivers were killed and 100 drivers in the Auckland region were seriously injured when they were not using a seat belt. A breakdown of related figures is outlined in Table 15 below.

Table 15. Seat belt use by drivers by injury severity in the Auckland region between 2002 and 2006 (Source: Ministry of Transport, 2008)

Injury severity	Number of drivers	Number with seat belt use recorded	% with seat belt use recorded	Number recorded as not wearing	% of those with recorded seat belt use who were not wearing seat belt
Fatal	164	134	82%	40	30%
Serious	1,219	646	53%	100	15%
Fatal and serious	1,383	780	56%	140	18%
Minor	10,303	6,891	67%	351	5%
Nil	12,412	7,590	61%	195	3%
Total	24,098	15,261	63%	686	4%

Use of cycle helmets

In February/March 2008 92% of all cyclists wore helmets. That is a slight decrease from figures recorded over the past several years. Nationally, there are fewer differences between age groups than there were previously. More children (93%) of primary and intermediate school age wear helmets than do secondary school students (90%). Adults achieve the same percentage as primary and intermediate school aged children. National, and selected regional, data are outlined in Table 16 below (source: www.transport.govt.nz/cycle-helmets-2006/).

Table 16. Cycle helmet use in the Auckland region compared to New Zealand and best/worst region (Source: Ministry of Transport)

% cyclists wearing helmets	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Auckland region	82	91	86	79	76	85	76	89	89	85
New Zealand	95	93	94	89	89	92	91	94	92	92
Worst region[14] (Waikato) as at 2006	93	91	96	92	93	91	91	88	89	82
Best region (Canterbury) as at 2006	98	97	97	92	89	94	90	98	96	97

Vehicle speed

Management and reduction of speed is one of the central mechanisms for making further road safety gains in the region. Annual survey data from the Ministry of Transport shows how the region is faring in reducing speeds on the transport network. see table 17 below.

The speed survey monitors changes in free speed (that is, speed attained when the vehicle is unimpeded by the presence of other vehicles or by environmental factors such as traffic lights, intersections, hills, corners or road works) of vehicles. By monitoring the speed of unimpeded vehicles the survey measures driver choice of speed. An 85th percentile speed means 15% of the vehicles surveyed were travelling faster than this speed.

Mean speeds in the region have decreased over time on both open and urban roads. However, the mean urban speed, 85th percentile urban speed, and 85th percentile open road speeds are consistently higher than other regions in the country over time. The percentage of cars exceeding the 50 km/h speed limit in urban areas is also significantly high at 80% across the region.

Table 17. Mean speeds and those exceeding the legal limit in the Auckland region (Source: Ministry of Transport)

Auckland region speeds	2002	2003	2004	2005	2006	2007	2008
Mean open road speeds (km/h)	100.5	98.5	97	97	96.5	96.2	95.3
85th percentile open road speeds (km/h)	113	112	110	110	109	109	108
Mean urban speeds (km/h)	56.3	55.9	54.5	54.5	55.4	55.3	55.1
85th percentile urban speeds (km/h)	62	61	59.5	59	60	60	60

Speeds by police district	2003	2004	2005	2006	2007
% of cars exceeding the 100 km/h open road speed limit (Counties/Manukau)	53	61	60	60	57
% of cars exceeding the 50 km/h urban speed limit (Waitemata)	86	76	81	83	81
% of cars exceeding the 50 km/h urban speed limit (Auckland City)	79	74	72	81	78
% of cars exceeding the 50 km/h urban speed limit (Counties/Manukau)	84	81	81	84	84

Driver deaths with excess alcohol

The percentage of drivers killed in crashes who have recorded alcohol levels above the legal limit provides some indication of the overall prevalence of 'excess alcohol driving' across the region and how we are progressing in drink/driving prevention. As demonstrated in Table 18 below, the Auckland region has seen an increase in the proportion of driver 'excess alcohol'-related deaths to 2006. The percentage increased significantly in 2000. Possible explanations include more liberal access to alcohol since 2000.

Table 18. Driver deaths related to excess alcohol use in the Auckland region (Source: Ministry of Transport)

Auckland region	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Driver excess alcohol deaths	7	6	11	10	15	21	21	15	21	10
Driver excess alcohol deaths as a % of all driver deaths	7%	7%	16%	14%	18%	26%	23%	19%	25%	16%

Attitudes to road safety

Auckland drivers have attitudes to road safety comparable to those of drivers in the country as a whole, but areas for improvement are:

> A greater awareness of the risk of being caught drinking and driving.

> Greater acceptance of speed enforcement.

> Less acceptance of driving while slightly intoxicated.

No goals for safety attitudes have been set in the Regional Road Safety Plan, but a comparison between selected attitudes reported from the 2003 public attitude survey and the latest available survey is outlined in Table 19 below (Source: Land Transport New Zealand/Ministry of Transport – www.transport.govt.nz).

Table 19. Selected road safety attitudes in the Auckland region versus all New Zealand in 2006 and 2007 compared with 2003 (Source: Ministry of Transport)

	2003		2006		2007	
Attitude surveyed	NZ	Auckland	NZ	Auckland	NZ	Auckland
Alcohol						
The risk of being caught drinking and driving is small (percentage that agree/strongly agree) – smaller % is better	38%	41%	41% (worse)	43% (worse)	38% (same)	42% (worse)
Have driven while slightly intoxicated in last 12 months (percentage stating yes) – smaller % is better	24%	21%	24% (same)	23% (worse)	23% (improved)	23% (worse)
Speed						
The risk of being caught speeding is small (percentage agree/strongly agree) – smaller % is better	33%	32%	30% (improved)	34% (worse)	29% (improved)	30% (improved)
Enforcing the speed limit helps to lower the road toll (percentage agree/strongly agree) – larger % is better	79%	80%	76% (worse)	81% (improved)	75% (worse)	74% (worse)
General enforcement						
Chance of being stopped for traffic offences other than drink driving or speeding (percentage very likely/fairly likely) – larger % is better	32%	34%	32% (same)	28% (worse)	34% (improved)	35% (improved)

Perceptions about safety

Data on perceptions about the safety of walking and cycling, and of private transport and public transport are regularly compiled by the ARC as part of its monitoring of the Regional Land Transport Strategy.

The ARC notes that this indicator examines transport users' perceptions of safety of the transport system, across different modes. In the 2006 survey, 32% of respondents said they always felt safe when using private transport. (Corresponding percentages for earlier surveys are: 25% in 2004; 19% in 2002; and 20% in 2000.) In the 2006 survey 20% of respondents said they always felt safe when using public transport (compared with 18% in 2004; 15% in 2002; and 16% in 2000). In contrast, only 9% said they always felt safe when walking (compared with 7% in 2004; 5% in 2000; and 6% in 2002). Only 2% of respondents said they always felt safe when cycling, compared with 3% in 2004; and 1% in both 2002 and 2000. Only 1% of respondents said they felt always safe when motorcycling in both 2006 and 2004. Motorcycling was a new category included in the survey from 2004.

Available data for the 2000, 2002, 2004 and 2006 surveys are outlined in Charts 12 to 16.

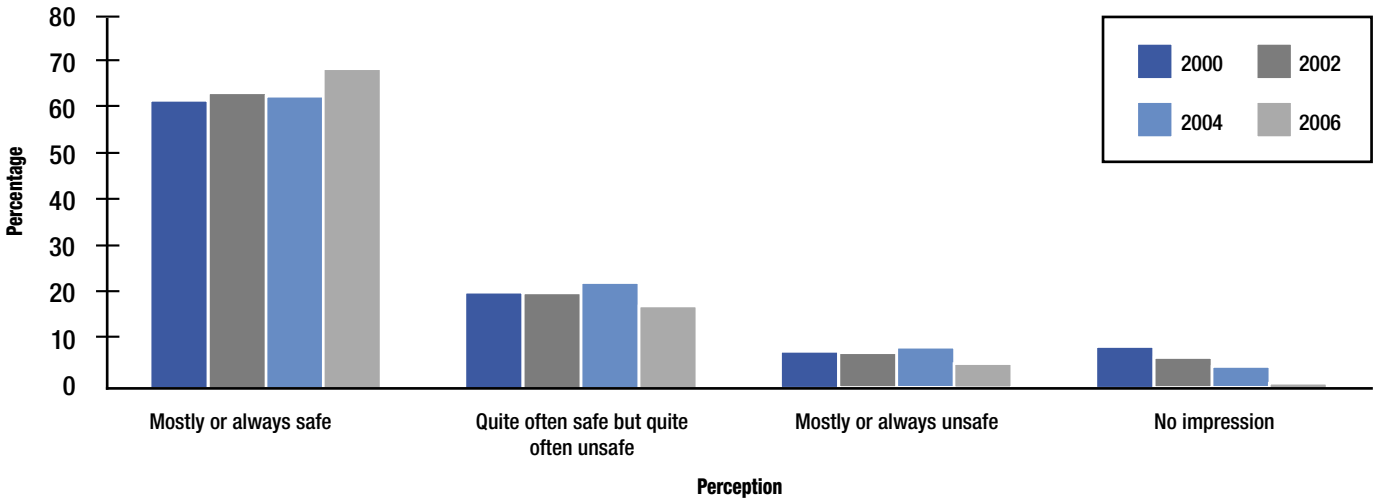

Chart 12. Perceptions of safety in the transport system for public transport
(Source: Community Perceptions of Personal Transport Choices, ARC 2000, 2002, 2004 and 2006)

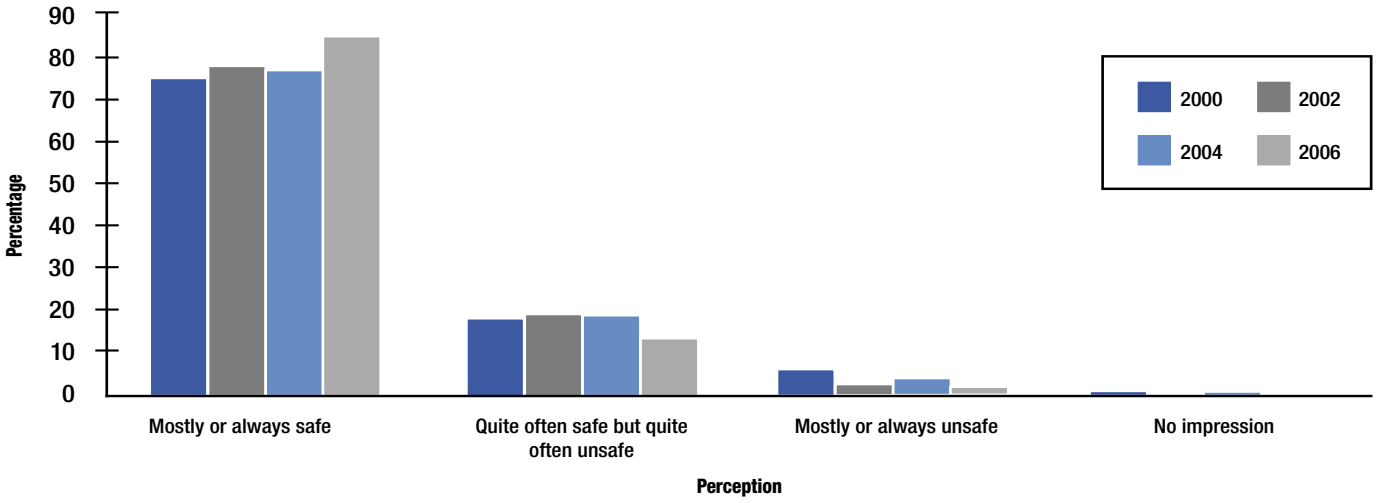

Chart 13. Perceptions of safety in the transport system for private transport
(Source: Community Perceptions of Personal Transport Choices, ARC 2000, 2002, 2004 and 2006)

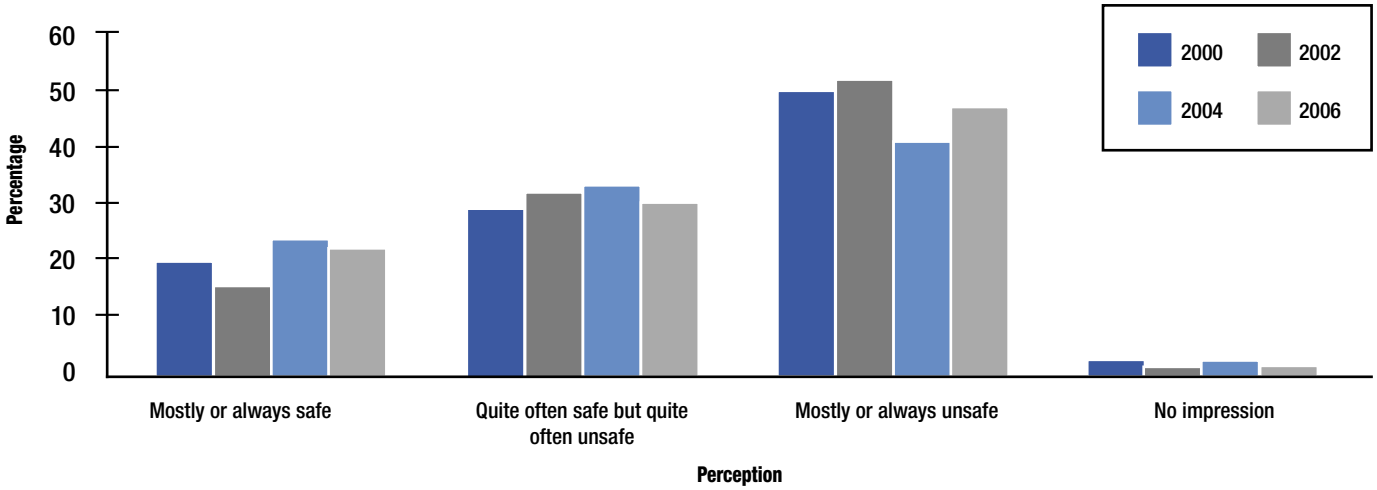

Chart 14. Perceptions of safety in the transport system for cycling source
(Source: Community Perceptions of Personal Transport Choices, ARC 2000, 2002, 2004 and 2006)

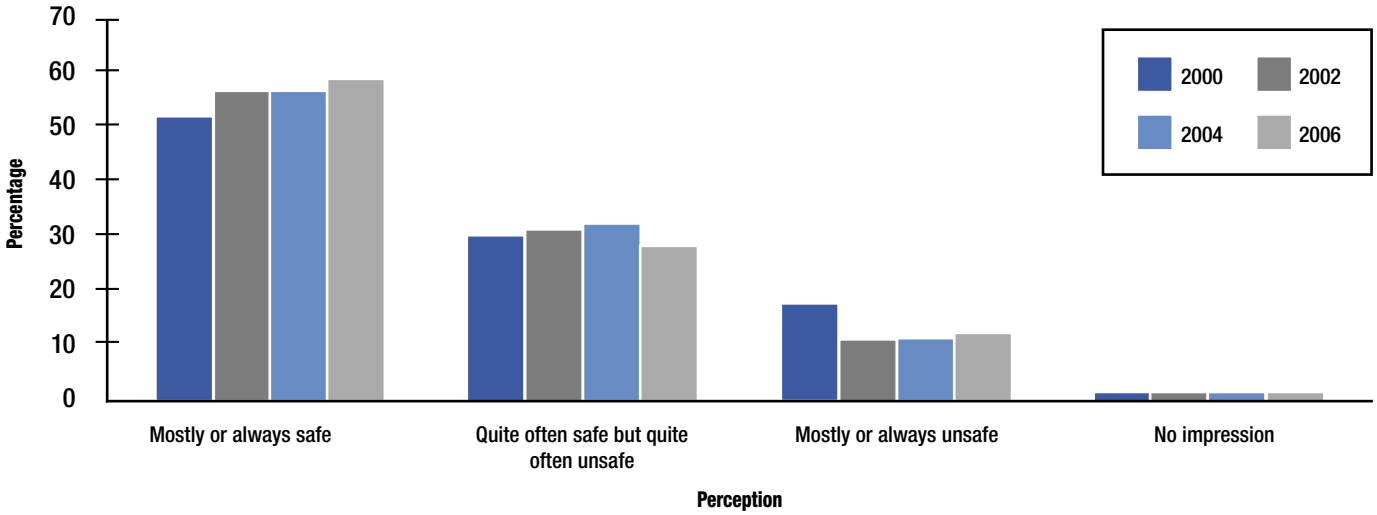

Chart 15. Perceptions of safety in the transport system for walking
(Source: Community Perceptions of Personal Transport Choices, ARC 2000, 2002, 2004 and 2006

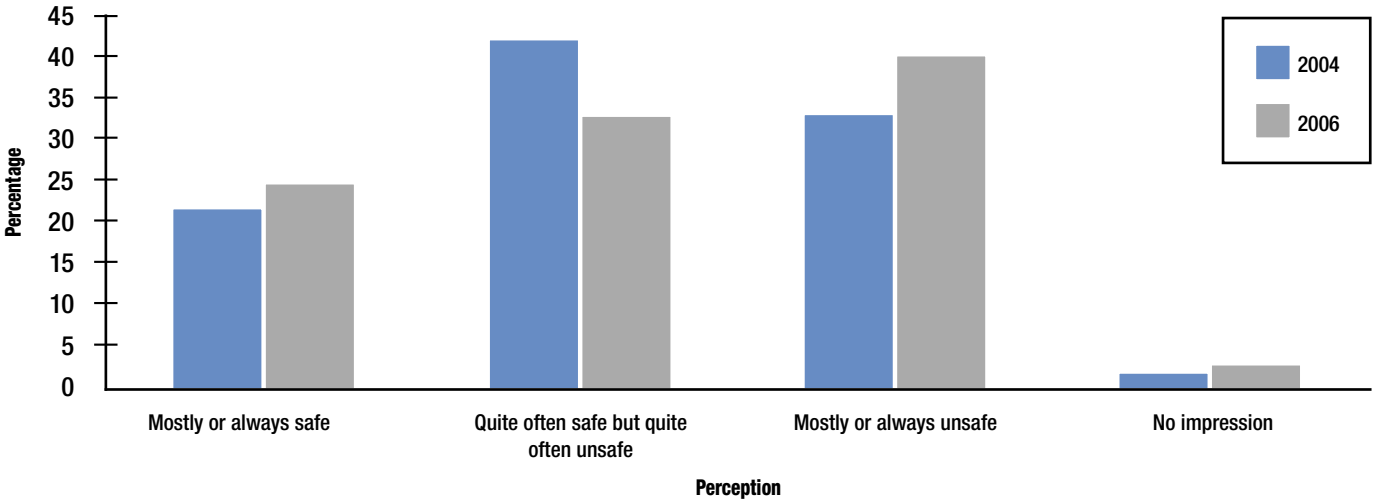

Chart 16. Perceptions of safety in the transport system for motorcycling
(Source: Community Perceptions of Personal Transport Choices, ARC 2004 and 2006)

APPENDIX 4: STRATEGIES AND ACTIONS

Strategies and Actions

In consultation with stakeholders, ARTA and member organisations of RoadSafe Auckland have developed the following strategies and actions for 2009 to 2012 to deliver outputs that taken together over time move the region towards identified goals and road safety targets (refer to section 5).

For each strategy, a series of actions has been outlined in relation to implementing the three Es. Contributing organisations, and a lead organisation responsible for coordinating the actions, are identified. Key actions which provide the greatest cost benefit in each strategy are also highlighted.

The number of X's indicates relative importance of each component of the three Es to achieving benefits in a given strategy.

Explanation of Acronyms

TAs Territorial Authorities

NZTA New Zealand Transport Agency

NZTA Highways New Zealand Transport Agency Highways and Network Operations

ARTA Auckland Regional Transport Authority

NZ Police New Zealand Police

Justice Ministry of Justice

ACC Accident Compensation Corporation

DHBs District Health Boards

ALAC Alcohol Advisory Council of New Zealand

MOH Ministry of Health

CAA Cycle Action Auckland

ARPHS Auckland Regional Public Health Services

OPERATORS KiwiRail and Veolia

North Shore busway on S.H.1

Strategy 1: Enhanced safety management, planning and targeting of safety engineering on local roads

Actions	Responsibility for Implementing the 3 Es			Coordination responsibility
	Safety engineering	Visible enforcement and legislation	Education and community involvement	
Contribution	XXX	XX	XX	
Key action Develop a three-year programme of grouped safety engineering projects based on prioritisation in the Regional Road Safety Plan resulting in identified safety engineering projects on arterials, including bends and roadside hazards, intersections, pedestrians and cycling, increasing to over 4% of the total engineering funding within the Regional Land Transport Programme from 2009/10 to 2011/12	ARTA, TAs and NZTA Highways	TAs, NZTA, NZ Police	TAs and NZTA Highways	ARTA* These projects, if introduced at the rate of $74m a year, provide the greatest safety engineering crash reduction benefit/cost ratio for the region
Establish and support a regional safety engineering forum to facilitate a stronger regional safety engineering approach, particularly on arterials as outlined in the Regional Road Safety Plan. The forum meets at least three times per annum from 2009	TAs and NZTA Highways		TAs and NZTA Highways	ARTA/NZTA
Continuous improvement of safety management systems and safety auditing programmes and development of regional safety engineering 'output' and 'outcome' performance measures by December 2010	TAs and NZTA Highways		TAs and NZTA Highways	TAs, NZTA & ARTA
Continue encouragement of development and implementation of Road Safety Action Plans and Strategies, and carry out a regional review of local Road Safety Action Plans by December 2010	TAs and NZTA Highways	TAs, NZTA, NZ Police	TAs and NZTA, ACC Highways	NZTA/ARTA
Foster appropriate documentation of the integration of safety and sustainable transport within the transport strategies of NZTA Highways and the seven TAs, including Road Safety Strategies, Integrated Transport Assessments, Safety Impact Assessments, and monitor this initiative regularly	ARTA, TAs and NZTA Highways		TAs and NZTA Highways	ARTA

Strategy 2: Effective management of speed, lower speeds in urban areas, and other initiatives that support a growing community acceptance of speed limits

Note: Of all the strategies, speed reduction has the potential to deliver the greatest gains in reducing crashes across the region and therefore is of highest priority.

Actions	Responsibility for Implementing the 3 Es			Coordination responsibility
	Safety engineering	Visible enforcement and legislation	Education and community involvement	
Contribution	XXX	XXX	XXX	
Key action Foster urban design, transport planning, engineering and technology measures to encourage lower speeds around town centres, schools and in places with significant or increasing pedestrian, cyclist or passenger transport use including use of a road user hierarchy	TAs	NZ Police	ACC, CAA Walk Auckland, ARPHS	TAs* These interventions provide the greatest speed-related crash reduction benefit/cost ratio for the region in combination with the key enforcement action below
Key action A regional speed management approach, which all territorial authorities agree to implement, focusing on urban design, transport planning and safety engineering is developed by December 2010	TAs and NZTA Highways	NZ Police		ARTA
Key action Advocate increased speed enforcement, including demerit points for speed camera infringements, lowered speed tolerance and increased use of fixed speed cameras to help bring mean speeds down to 51km/h in urban areas overall by 2012		NZ Police, TAs, NZTA, ACC		ARTA* These interventions provide the greatest speed-related crash reduction benefit/cost ratio for the region in combination with the key engineering action above
Continue to sustain enforcement and community education programmes pertaining to the harms of speeding or not driving to the conditions; and continue local community speed reduction projects in each territorial authority	TAs	NZ Police	TAs, ACC	TAs in partnership with NZ Police

Strategy 3: Well-targeted drink drive enforcement, integrated driver rehabilitation, effective liquor licensing, and visible host responsibility

Actions	Responsibility for Implementing the 3 Es			Coordination responsibility
	Safety engineering	Visible enforcement and legislation	Education and community involvement	
Contribution	X	XXX	XXX	
Key action Advocate increased alcohol-related enforcement measures such as a lowering of the blood alcohol level for drivers to 0.05, and to 0.02 (effectively zero) for young/novice drivers, rasing the mininum alcohol purchasing age to 20 years, along with an overhaul of the chain of evidence required to achieve drink-driving-related convictions, licensing control, and other measures to reinforce a drive sober message.			Alchol Healthwatch, NZ Police, TAs, ACC, NZTA, DHBs, ARPHS, ALAC	ARTA* These interventions provide the greatest alcohol - related crash reduction benefit/cost ratio for the region
Advocate for the justice sector to lead further development of early brief interventions for drink driving offenders, repeat drink-driver programmes, and investigate the establishment of a programme to direct first time offenders and repeat offenders to alcohol treatment programmes, including ensuring appropriate funding and support of alcohol and other drug treatment providers to deliver this treatment by December 2010			TAs, NZTA, DHBs, ARPHS, providers of alcohol and other drugs, Justice	ARTA
Increase efforts to ensure liquor licensing enforcement, host responsibility and broader community education programmes (e.g. SADD and sober drivers) are implemented for drivers, particularly young drivers		NZ Police	TAs, ACC, NZTA, ALAC, MOH, DHBs, ARPHS Alcohol Healthwatch	TAs
Advocate for the introduction of mandatory drug and alcohol testing of drivers involved in fatal and serious crashes				ARTA
Develop public transport initiatives that provide increased transport options and access during large events and late at night as a means for people to avoid the temptation to drink and drive		NZ Police	TAs Taxi Federation	ARTA

Strategy 4: Improved pedestrian safety

Actions	Responsibility for Implementing the 3 Es			Coordination responsibility
	Safety engineering	Visible enforcement and legislation	Education and community involvement	
Improved pedestrian safety	**XXX**	**X**	**XX**	
Key action Greater emphasis on widespread pedestrian facility upgrades across the region occurs through use of a road user hierarchy, including a comprehensive regional pedestrian crash cluster/blackspot programme and the development of innovative engineering and technology solutions to alert drivers to the need to slow down or stop for pedestrians, particularly outside schools and in town centres: > Pedestrian crash cluster/blackspot study, which all territorial authorities agree to implement, is completed by June 2012 > Local community pedestrian safety projects continue in each territorial authority as appropriate	TAs	NZ Police (especially speed)	TAs TAs, NZTA, ARTA, Safekids, NZ Police	These interventions provide the greatest pedestrian-related crash reduction benefit/cost ratio for the region NZTA & TAs*
Ensure Crime Prevention Through Environmental Design (CPTED) measures are built into upgrades to pedestrian facilities	TAs	New Zealand Police	TAs	TAs
Encourage road-controlling authorities to adopt an integrated approach to safety and sustainability within transport strategies	TAs, NZTA		TAs	ARTA

Strategy 5: Improved intersection safety

Actions	Responsibility for Implementing the 3 Es			Coordination responsibility
	Safety engineering	Visible enforcement and legislation	Education and community involvement	
Contribution	**XXX**	**XX**	**XX**	
Key action Implement crash reduction studies and safety audits to improve safety of intersections throughout the region	TAs, NZTA Highways			TAs/NZTA* This intervention provides the greatest intersection-related crash reduction benefit/cost ratio for the region
Establish a two- to three-year regional campaign to raise awareness of intersection safety 2010/11	TAs, NZTA	NZ Police	TAs, NZTA	ARTA
Technology to deter red-light running successfully trialled by 2010 with recommendations for further roll-out actioned	NZTA, ARTA, TAs	NZ Police	TAs	TAs

Strategy 6: Initiatives tailored to the needs of at-risk and vulnerable road users

Actions	Responsibility for Implementing the 3 Es			Coordination responsibility
	Safety engineering	Visible enforcement and legislation	Education and community involvement	
Contribution	XX	XX	XXX	
Key action Advocate raising the minimum driving age from 15 to 16 years and extend the length of the learner licence period from six to 12 months				ARTA* This intervention provides the greatest young driver reduction benefit/cost ratio for the region
Key action Advocate, as a matter of priority, RoadSense being implemented in schools identified as having students at high risk of being involved in crashes and investigate incentives for schools to participate in RoadSense programme			TAs, NZTA, NZ Police, Safekids	ARTA
Key action Develop cycle facilities and facilities for key cycle routes and destinations	TAs, NZTA Highways			TAs, NZTA
Plan and fund at least 20 culturally-responsive community road safety programmes across the region each year			TAs, NZTA, ARTA	TAs
Establish research links between crash risk in relation to ethnicity, age and social inequalities for the Auckland region			ARPHS, ARTA, ARC, NZTA	ARTA
Establish driver licensing programmes to facilitate gaining of full licences by adult graduate learner and restricted license holders			TAs	NZTA
Establish best practice young and novice driver education and training programmes such as 'Practice' that address risks associated with the Restricted Driver's Licence phase			TAs, NZTA, ACC	TAs/NZTA
Support the use of child restraints and safety belt programmes targeted to low-use areas, and advocate for the correct use of booster seats		NZ Police	TAs, NZTA, ACC, Plunket	Safekids
Support region-wide implementation of the Safe With Age programme			NZTA, Age Concern	TAs
Make at least one motorcycle safety programme available across the Auckland region and monitor motorcycle crash trends		NZ Police	TAs, NZTA	ACC
Continue regional 'share the road' promotions (motorists and cyclists)			TAs, CAA, NZTA, AA, ARTA	TAs
All territorial authorities run at least one cycle safety programme, including cycle skills training, each year that links with relevant sustainable transport initiatives			NZTA, ARTA, CAA, New Zealand Police	TAs
Foster a stronger youth voice within road safety and broader transport issues to ensure that initiatives more fully reflect young people's needs			TAs, NZTA, ACC, New Zealand Police	TAs
Foster a disability network voice to ensure transport initiatives reflect the needs of disabled people for safe access and mobility			TAs, NZTA, ACC, New Zealand Police	TAs

Strategy 7: Integrated passenger transport and travel demand management safety

Actions	Responsibility for Implementing the 3 Es			Coordination Responsibility
	Safety engineering	Visible enforcement and legislation	Education and community involvement	
Contribution	XX	XX	XX	
Key action Encourage territorial authorities and KiwiRail to carry out railway level crossing upgrades for safety, particularly upgrades that discourage trespass in the rail corridor	TAs, KiwiRail	NZ Police	TAs	ARTA
Key action ARTA will encourage use of safer transport choices through improved access to public transport, and regional travel demand management programmes including workplace and school travel plans, and ride-sharing	TA's, KiwiRail, Operators	NZ Police	TA's, TA's, KiwiRail, Operators	ARTA
Key action ARTA will encourage passenger rail operators to improve rail safety through a regular forum			Operators, KiwiRail	ARTA
Passenger transport operators continue to work with ARTA to maintain and improve the overall excellent safety record of public transport			ARTA, NZTA, KiwiRail	Operators
Encourage service providers and road-controlling authorities to adopt an integrated approach to safety within their related strategies and policies			TAs, KiwiRail, Operators	ARTA
Ensure Crime Prevention Through Environmental Design (CPTED) measures are built into upgrades to the public transport system including places where people are likely to walk, cycle or otherwise access public transport	NZTA, ARTA, KiwiRail	NZ Police		TAs
Establish regional guidelines on using Crime Prevention Through Environmental Design (CPTED) in relation to passenger transport upgrades by June 2010	TAs, KiwiRail, Operators	NZ Police		ARTA