Safer Journeys

Alcohol impairment project
Lowering Legal Adult Blood Alcohol Concentration (BAC)

Cost Benefit Analysis

November 2013

Preface

This report documents a national cost benefit analysis (CBA) undertaken to inform policy makers of the potential impacts of lowering the legal adult (over 20 years of age) blood alcohol concentration from 80 micrograms of alcohol per 100 millilitres of blood to 50 (or 80 to 50 mg/dL), under an infringement regime.

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Important qualifications

The CBA does <u>not include</u> the following items:

- any potential financial implications around legal aid
- any potential increase in the costs around supervising community work as the number of demerit offences increases
- any potential cost impact on the vehicle impoundment regime following a relatively small potential increase in driving while suspended offences
- any potential increase in revenue to be collected from drink-driving related infringements (as they are transfer payments and therefore are not included in the CBA)
- any licensing related operations surplus or deficit - the NZ Transport Agency recovers cost from licence re-instatements and limited licence applications and they can run a surplus or deficit from these transactions due to discrepancies between actual and forecast transaction volumes. However, cost recoveries are transfer payments and are therefore not included in the CBA.
- any effect of other alcohol consumption related policy changes being considered by other agencies (eg increase in alcohol excise)
- the costs and benefits for other BAC limits - information on the share of the driving population (during high alcohol hours) and detailed crash data by alcohol level is available only for BACs of under 50, 51-80 and over 80 mg/dL. This data gap has limited the policy options to be analysed (eg it is not possible to analysis the effects of lowering the legal limit to 40 mg/dL or 60 mg/dL).

We are grateful to the NZ Police, Ministry of Justice, Department of Corrections, NZ Transport Agency and Health Promotion Agency for providing information and/or cost estimates to complete this analysis. We note that this acknowledgment does not necessarily imply agreement or otherwise with the report's analysis and conclusions by these contributors.

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Disclaimer

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GLOSSARY OF TERMS AND ABBREVIATIONS

BAC	Blood Alcohol Content (or concentration)
BCR	Benefit-cost ratio
CBA	Cost benefit analysis
DWS	Driving while suspended
EEM	Economic Evaluation Manual
GST	Goods and services tax
GVM	Gross vehicle mass
ION	Infringement offence notice
mg/dL	microgram per 100 millilitres
NPV	Net Present Value
NZ Transport Agency	New Zealand Transport Agency
TON	Traffic offence notice
VKT	Vehicle kilometres travelled

1. Executive summary

This document summarises the results of a national CBA of reducing the legal adult (over 20 years of age) BAC from 80 mg/dL to 50 mg/dL. Under the proposed policy, drivers caught with BAC above the proposed legal limit of 50 mg/dL but below 80 mg/dL will be issued with an infringement offence which attracts 50 demerit points[1]. Offenders with a BAC over 80 mg/dL will continue to be prosecuted under the Land Transport Act 1998 (generally known as traffic offences).

The CBA indicates that the policy would produce a net benefit to the economy. The estimated mid-range NPV is $200 million and the estimated mid-range BCR is around 10, based on a 10-year evaluation period. All estimates included in this report are GST and tax exclusive. All present values are evaluated based on an annual real discount rate of 8%.

1.1 Overview

Alcohol[2] is a key contributing factor in road crashes in New Zealand, contributing to over 20% of the annual total social cost of road fatalities and injuries.

For the three years to 2012, the total social cost of road fatalities and injuries[3] caused by at-fault drivers (aged 20 years and over) with some level of BAC was about $446 million (in 2013 $).

One of the objectives of lowering the legal BAC to 50 mg/dL is the potential for the policy to also affect drivers who currently exceed a BAC of 80 mg/dL, especially for those who are marginally over the current legal limit. Because crash risk increases exponentially with BAC, even a small reduction in the level of offending by drinkers exceeding BACs of 80 mg/dL can result in significant road safety benefits.

With a lower legal adult BAC limit, drivers may reduce alcohol consumption, may switch to home-based drinking and therefore reduce the need for travelling or may choose to take an alternate transport arrangement. Their decisions can affect the level of road safety benefits to be achieved, the administrative costs of implementing the policy change and other costs and benefits to consumers.

The CBA aims at identifying and comparing economic and social benefits accruing to the economy as a whole (including externalities), setting aside monetary transfers within the economy.

[1] A driver can have his/her licence suspended for three months if they incur 100 demerit points within a two-year period.

[2] This analysis focuses on crashes where the at-fault drivers had a non-zero BAC and ignores cases where drugs were also present in the driver's blood. This approach avoids overstating the potential safety benefits from the policy change. However, since alcohol can also increase the effects of drugs and crash risk, a reduction in the level of BAC may reduce the risk of alcohol and drug related crashes.

[3] Social cost of road fatalities and injuries is a measure of the total cost that occurs as the result of road injury crashes. It includes loss of life and life quality, loss of economic output, medical costs, legal costs and vehicle damage costs. The value of loss of life and life quality component was established based on a "willingness-to-pay" approach, which is now the preferred approach among most OECD countries (see: http://www.cemt.org/online/conclus/rt117e.pdf). The latest Social Cost of Road Crashes and Injuries update is available from the Ministry's website (http://www.transport.govt.nz/assets/Import/Documents/Social-cost-June-2012-update.pdf).

1.2 Results

Based on a 10-year evaluation period, the estimated net benefit of the lowering the legal adult BAC to 50 mg/dL is $200 million (NPV, in 2013 dollars) with a national BCR of around 10.

Table 1.1: Summary of costs and benefits of lowering the legal adult BAC limit to 50 mg/dL

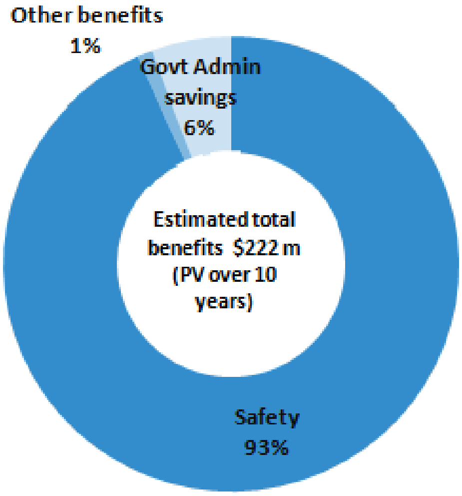
Mid-range estimates	10-year total (in present value, 2013 $)
Benefits	
Road safety	$207.2
Reduction in absenteeism	$1.9
Improvement in health effects	$0.1
Reduction in social cost of crime	$0.3
Administrative cost savings to NZ Police	$7.2
Administrative cost savings to Justice Sector	$5.4
Total benefits in present value	**$222.1**
Costs	
Net increase in transport costs	$1.5
Compliance costs to offenders	$0.7
Changes in consumer surplus	$0.9
Changes in producer surplus	$0.9
Administrative costs to NZ Police	$13.8
Administrative costs to NZ Transport Agency	$0.9
Administrative costs to justice sector	$3.7
Total costs in present value	**$22.5**
Net present value (2014 to 2023) $m	**$199.6**
Benefit:Cost Ratio	**9.9**

Note: Figures may not sum to total due to rounding

Government administrative costs appear in both the benefit and cost components (see Table 1.1). The cost savings refer to the potential reduction in costs to NZ Police and the justice sector resulting from a reduction in drink-driving offences detected at a BAC greater than 80 mg/dL. The cost savings result mainly from a reduced volume of court hearings and the costs associated with home detention and community related sentences. The cost increases refer to the additional cost of handling extra offences (detected at a BAC between 51-80 mg/dL) and other licensing related costs to NZ Police, NZ Transport Agency and the Justice Sector. As the total government administrative cost increase is higher than the total potential savings, there will be a net cost increase of $5.8 million (in present value or PV, 2014 to 2023).

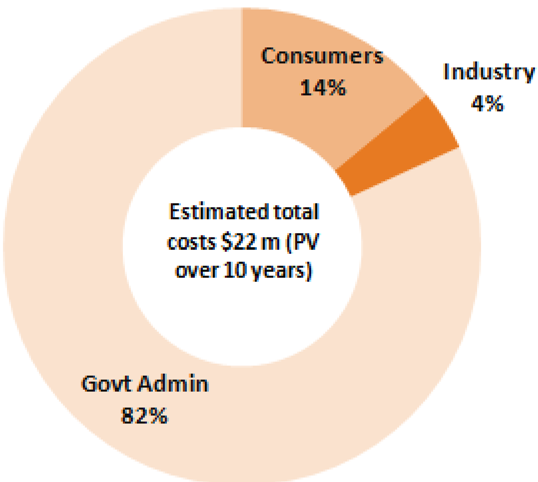
Under the mid-range benefit scenario, total benefits are estimated at $222.1 million (2013$). The largest benefit component of the policy change is road safety, estimated at $207 million (in PV, 2014 to 2023). This represents around 93% of the estimated total benefits. The second largest benefits component is the potential reduction in administrative costs (resulting from a reduction in BAC > 80 mg/dL offences) to NZ Police and Ministry of Justice of $12.6 million (in PV, 2014 to 2023). These potential cost savings would result from a reduction in the number of offences at a BAC greater than 80 mg/dL. The remaining benefits are made up of reduced productivity lost due to absenteeism (ie days off from work), reduced health care costs and reduced social cost of crime (estimated at $2.4 million or 1% of the total).

Figure 1.1: Distribution of benefits



Total costs (under the mid-range benefit scenario) are estimated at $22.5 million (2013$). The largest cost component of the policy change is the administration cost of handling extra offences, estimated at $18.4 million (in PV, 2014 to 2023), most of which is incurred by NZ Police. The second largest cost component is costs and disbenefits incurred to consumers of $3.15 million (in PV, 2014 to 2023), or 14% of the total. This is made up of a net increase in transport costs due to changes in drinking venues or transport arrangement, estimated at $1.5 million (in PV, 2014 to 2023); a loss in consumer and producer surplus resulting from a small reduction in alcohol consumption, estimated at $0.9 million (in PV, 2014 to 2023); and a small increase in compliance cost to offenders detected at a BAC between 51-80 mg/dL. The remaining item of $0.9 million, is incurred by the hospitality industry (loss in producer surplus).

Figure 1.2: Distribution of costs



The policy proposal would contribute to a reduction in an average of 3.4 fatalities and 64 injuries a year (see Table 1.2). These results are based on the 45% of drivers currently in the BAC 51-80 mg/dL range and 9% of drivers currently with a BAC over 80 mg/dL who may alter their drinking or driving behaviours when the full effect kicks in (from year 2).

In the low benefit scenario (with only 15% of drivers with BAC 51-80 mg/dL and 6% of drinkers currently exceeding BAC of 80 mg/dL changing their behaviours from year 2), the estimated safety impacts could be a reduction of around 1.9 fatalities and 33 injuries per year.

In the high benefit scenario (with 75% of drivers with BAC 51-80 mg/dL and 12% of drinkers currently exceed BAC of 80 mg/dL changing their behaviours from year 2), the estimated safety impact in this case could be around 5.2 fatalities and 102 injuries per year.

Table 1.2: Estimated reduction in road fatalities and injuries

Estimated reduction	Low	Mid-range	High
Fatality			
Year 1	1.3	2.4	3.7
Year 2 +	2.0	3.6	5.5
Average pa	**1.9**	**3.4**	**5.2**
Serious and minor injury			
Year 1	24	46	73
Year 2 +	35	68	108
Average pa	**33**	**64**	**102**

Note: The safety benefits for future years are expected to reduce gradually in line with general road trauma improvement trend.

The safety analysis does not include fatalities and injuries caused by drivers with both alcohol and drugs as contributing factors. The rationale for excluding that sub-set of road fatalities and injuries was to avoid overstating the potential benefits of a reduced BAC limit, because the presence of drugs could still cause road crashes. However, if alcohol is considered a stimulant to the use and effect of drugs, some crashes with a combination of alcohol and drugs could be prevented. Allowing for such an effect would result in an extra 5 injuries being prevented under the mid-range benefit assumption.

Furthermore, the analysis also excluded cases where alcohol was suspected but no BAC reading was obtained. In most cases, the drivers were likely to have a BAC exceeding 80 mg/dL. However, if a small percentage of these crashes were caused by drivers with a BAC between 51 and 80 mg/dL, the policy change will also prevent some of these crashes. For example, if 5% of all suspected cases can be attributed to drivers with a BAC between 51 and 80 mg/dL, the policy could save an extra 1.3 fatalities and 27 injuries per year under the mid-range benefit assumption.

This analysis has a lower estimated reduction in the number of alcohol-related road fatalities than reported in the 2010 cabinet paper (between 15 and 30 fatalities a year). Three key reasons for the difference are that:

i) there has been a reduction in alcohol related crashes since 2008 (the latest data used in the 2010 estimate),
ii) there was a lack of information about the proportion of at-fault drivers with a BAC of between 50 and 80 mg/dL, making it infeasible to generate a reliable estimate of the social cost of road fatalities and injuries caused by these drivers, and
iii) this analysis adopts a more conservative approach (eg excluding crashes where the presence of drugs was also cited as a co-factor and where alcohol was suspected but no BAC reading was obtained) to establish the minimum level of road safety benefits to be achieved.

Appendix 2 provides a comparison between the 2010 and current estimates.

1.3 Sensitivity analysis

Monte Carlo simulation[4] was used to estimate the range of net benefits of the policy change (measured in NPV 2013 dollars) and the associated BCR (Table 1.3) considering the probability of occurrence. The broad orders of magnitude of net-benefits for each option are relatively stable. With 90% confidence, the range of NPV is between $151 million and $249 million and the range of BCR is between 6.9 and 13.9 (Table 1.3).

Table 1.3: Confidence intervals of the CBA results

Evaluation period: 2014 to 2023	NPV	BCR
Minimum	$102.6 m	4.4
5th percentile	$150.7 m	6.9
Mean	**$199.5 m**	**10.0**
95th percentile	$249.4 m	13.9
Maximum	$306.8 m	20.1

Note: These figures are the result of Monte Carlo analysis considering the probability of occurrence.

[4] Monte Carlo analysis is a risk modelling technique that uses statistical sampling and probability distributions to simulate the effects of uncertain variables on model outcomes. This simulation was carried out using @Risk programme.

1.4 Conclusion

Our sensitivity analysis found that:

- the NPVs and BCRs are most sensitive to the behavioural changes assumed for drivers currently between BAC 51-80 mg/dL (mid-range assumption of 45% from year 2), but the NPV continues to be positive with a BCR greater than one (at 6.7) under the low benefit scenario of 15%.
- the NPVs and BCRs are also sensitive to the behavioural changes assumed for drivers currently over BAC 80 mg/dL (mid-range assumption of 9% from year 2), but the NPV continues to be positive with a BCR greater than one (at 7.2) under the low benefit scenario of 6%.
- the NPVs and BCRs are also sensitive to the assumed relative transport needs at home-based venues compared to other venues (mid-range assumption of a 50% reduction in transport need), but the NPV continues to be positive with a BCR greater than one (at 8.2) under the low benefit scenario of a 25% reduction.

The analysis has been carried out with a range of conservative assumptions. However, the estimated NPVs and BCRs still make a strong case for lowering the legal adult BAC limit. The analysis demonstrated that even under the least favourable assumptions, the estimated NPV continues to be significantly greater than zero and the estimated BCR continues to be positive. In summary, lowering the legal adult BAC limit from 80 mg/dL to 50 mg/dL (under the proposed infringement regime) is highly likely to result in a net benefit to the nation.

2. Economic evaluation methodology

2.1 Overview

The CBA aims to identify the potential impacts of lowering the legal adult (over 20 years of age) blood alcohol concentration from 80 micrograms of alcohol per 100 millilitres of blood to 50 (or 80 to 50 mg/dL)[5]. The analysis considered economic and social benefits accruing to the economy as a whole (including externalities), setting aside monetary transfers within the economy.

The analysis includes the following benefit and cost components of reduced BAC limits:

Benefits

- a reduction in the number of drink-driving related road fatalities and injuries and the associated social cost
- a reduction in government administrative costs of handling drink-driving offences with BAC > 80 mg/dL
- a potential reduction in health care costs resulting from reduced alcohol consumption by high-level drinkers
- a potential reduction in the social cost of crime resulting from reduced alcohol consumption
- a small potential reduction in the lost productivity due to absenteeism resulting from reduced alcohol consumption

Costs

- a net increase in transport costs incurred by those who decide to take alternate transport options rather than driving
- a small reduction in consumer surplus[6] from a reduction in alcohol consumption
- a reduction in benefits (producer surplus) to hospitality industry from reduced alcohol sales
- an increase in government administrative costs of handling extra infringements (at BAC 51-80 mg/dL) and licensing related transactions.

Figure 2.1 shows the schematic of the CBA. The analysis first categorises drivers who have alcohol prior to driving (referred to as prospective alcohol-impaired drivers for brevity) into three BAC bands – those with a BAC between 50 and 80 mg/dL, those exceeding the current legal BAC limit of 80 mg/dL and those with BAC 50 mg/dL and below.

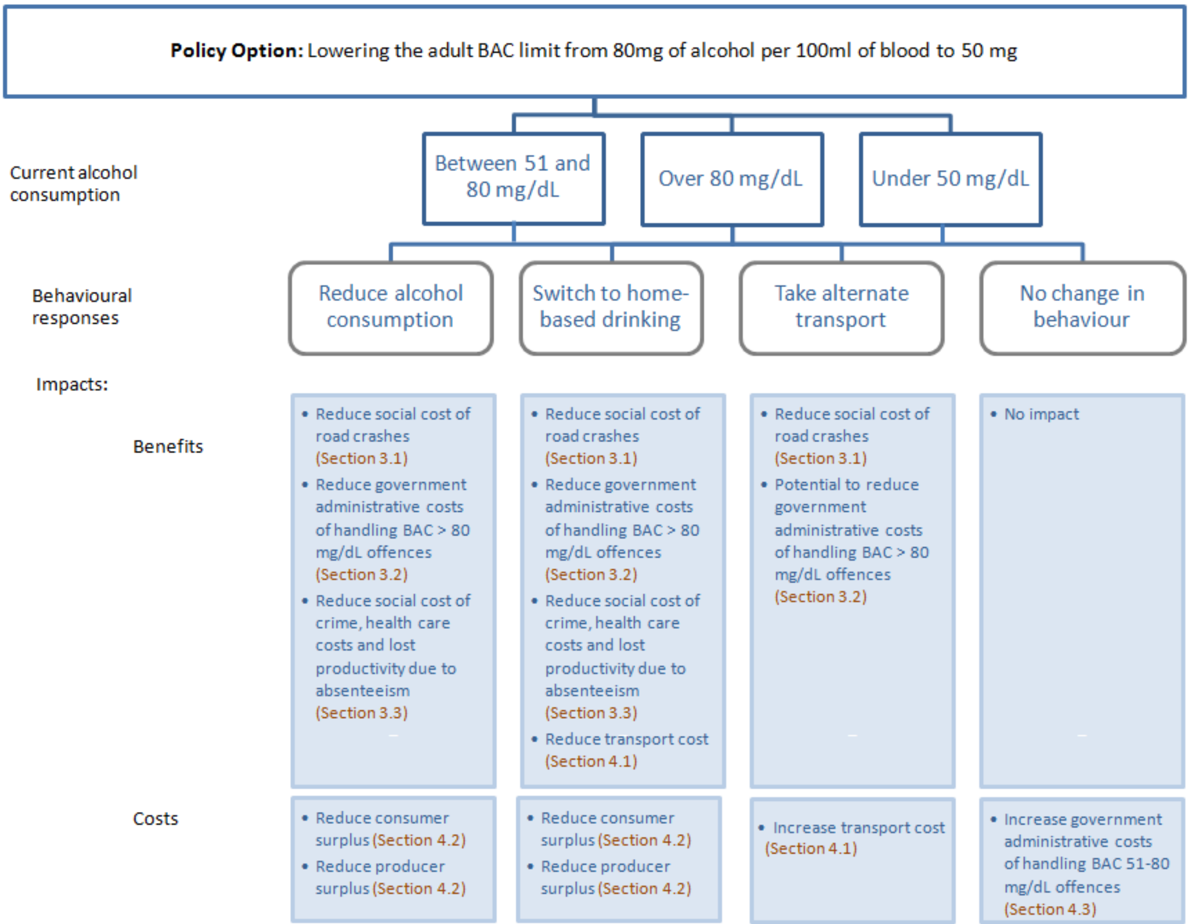
There are four possible behavioural responses by prospective alcohol-impaired drivers, irrespective of the BAC band they belong to. These include: (i) reduce alcohol consumption prior to driving; (ii) switch to home-based drinking thereby reducing the need to travel; (iii) take alternate transport modes; and (iv) no change in behaviours. The decisions of prospective alcohol-impaired drivers can

[5] Alongside a decrease from a legal BAC limit of 80 to 50mg/dL would be an equivalent decrease in the legal breath limit from 400 micrograms (mcg) of alcohol per litre of breath to 250 mcg of alcohol per litre of breath. While this report only refers to impacts associated with a reduction in BAC, results are consistent for the equivalent reduction in breath limits.

[6] Consumer surplus is an economic term that measures consumer satisfaction, utility or pleasure resulting from the consumption of a given good or service. It is the difference between what a consumer would be willing to pay for a good and what they actually pay.

affect the size of the road safety and other benefits, the administrative costs of implementing the policy change and the intangible costs to consumers and hospitality industry. These will be discussed in detail in the next Section.

Figure 2.1: Schematic of the cost benefit analysis



Due to a lack of information around how drivers in each of the BAC bands would behave as a result of the policy change, it is necessary to make estimates either based on expert opinions or findings from related literature. To understand the level of influence the assumed behavioural changes has on the CBA results, sensitivity analysis and Monte Carlo analysis were carried out to gauge how the estimated NPV or BCR varies with changes in key assumptions.

The cost and benefit impacts are discussed in Sections 3 and 4. Unless otherwise indicated, all results tabulated are based on assumptions under the mid-range benefit scenario.

2.2 General assumptions

The general assumptions are listed Table 2.1.

Table 2.1: General assumptions

Parameter	Assumption	Comments
Base year	2014	
Dollar values	2013	All estimates are taxes and GST exclusive
Evaluation period	10 years	
Discount rate	8%	Real (pre-tax) (note)

Note: The NZ Transport Agency recently amended the real discount rate to be used in evaluating transport investment projects from 8% to 6% real (effective from 1 July 2013). However, for the evaluation of policy proposals that seek Cabinet's approval (as is the case for this proposal), NZ Treasury advised that an 8% real rate is more appropriate. Should the analysis adopt a 6% discount rate, the NPV and BCR would be higher than estimated. For this reason, a sensitivity testing of a lower discount rate is not necessary.

2.3 Key assumptions

A key rationale for the proposed reduction in legal adult BAC is to reduce the incidents of alcohol related road crashes and the resulting social cost of road fatalities and injuries. The size of the potential safety benefits is affected by how drivers respond to the policy change. For example, what proportion of drivers currently with a BAC of between 50 mg/dL and 80 mg/dL would alter their drinking or driving behaviours? Would the policy change induce any behavioural changes for drivers currently with a BAC over 80 mg/dL BAC and those with a BAC under 50 mg/dL?

A key principle of the methodology is to avoid making judgement on behavioural changes without sufficient evidence to support the claims. However, because of information gaps, some assumptions are necessary for the analysis. Apart from behavioural changes, another key assumption made relates to the price elasticity of demand for alcohol. This assumption affects the size of the welfare impacts to consumers and the hospitality industry. These are discussed below.

- ***Behavioural responses***: The behavioural response assumptions used in this analysis are based on experience with drivers under 20 years of age. In August 2011, the legal BAC limits for drivers under 20 years of age was lowered from 30 mg/dL to zero. Drivers caught with a BAC of between 0-30 mg/dL will be given an infringement notice and 50 demerit points. Results indicate that one year after the implementation of a zero BAC for young drivers[7], the level of offending at 31-80 mg/dL decreased by 32% and over BAC 80 mg/dL decreased by 28%. Two years after the implementation, these reductions (compared to 2010) increased to 46% and 43% respectively (see Table 2.2).

[7] Zero BAC for young drivers aged under 20 years was introduced in August 2011.

Table 2.2: Drink-driving offences detected for drivers under 20 years of age

Offences (% change from 2010/11)	Under 30 mg/dL	30-80 mg/dL	Over 80 mg/dL
September 2010 to August 2011	Not an offence	2,940	3,352
September 2011 to August 2012	1,177	1,992 (-32%)	2,418 (-28%)
September 2012 to August 2013	878	1,581 (-46%)	1,914 (-43%)

For the purpose of the analysis, it has been assumed that in Year 1 (2014), 30% of adults with a BAC of 51-80 mg/dL will alter their behaviours and that this will increase to 45% from Year 2. To test the impact of this assumption on the CBA results, 15% and 75% were used in the sensitivity analysis.

As discussed earlier, drivers may switch to home-based drinking and therefore reduce the needs for travelling or may choose to take an alternate transport arrangement. Further, a smaller proportion of drivers may reduce alcohol consumption prior to travelling. It has been assumed that twice as many people would switch to home-based drinking and take alternate transport than those who would choose to reduce alcohol consumption.

For adult drivers with a BAC over 80 mg/dL, the potential reduction is likely to be lower than that observed for youth (at 28% in year 1 and 43% in year 2). This is because this group of drivers is made up of a larger proportion of recidivists and higher-end drivers compared to younger drivers (ie those under 20 years of age). For the purpose of the analysis, the assumed minimum reduction is 4-6% and the maximum reduction is 8-12%, with a mid-range of 6-9%. The same level of behavioural assumption has also been used for adult drivers with a BAC of 50 mg/dL and below. This 'spillover' assumption is conservative which means the actual safety benefits may be higher than those estimated in this report. For example, as BAC increases, drivers are less able to correctly judge how much alcohol they have consumed. Further 'spillover' effects may result from drivers at a BAC of 50 mg/dL being less likely to wrongly assume that they are under the legal BAC limit[8].

- ***Price elasticity of alcohol consumption***: This is required for estimating consumer and producer surpluses. Easton (2002)[9] reviewed a range of studies and found price elasticity of alcohol consumption varies between low to heavy drinkers. Other studies, eg Chaloupka et al (2002). Gallet (2007) and Wagenaar et al (2009)[10], reported different price elasticity estimates for different alcohol types. The Law Commission Report (2010)[11] reviewed the literature on price effects on alcohol consumption concluded that the overall price elasticity of demand for alcohol is around -0.51[12]. This is similar to -0.52 reported in Gallet (2007)[13].

[8] Waikato University (2013), "Driver Risk from Blood Alcohol Levels between 50 and 80 mgs/100ml", NZ Transport Agency research report.

[9] Easton, B (2002), "Taxing Harm: Modernising Alcohol Excise Duties", Report to Alcohol Advisory Council.

[10] Chaloupka, F, Grossman, M and Saffer, H (2002), "The Effects of Price on Alcohol Consumption and Alcohol Related Problems", National Institute on Alcohol Abuse and Alcoholism.
Gallet, C.A. (2007)," The demand for alcohol: a meta-analysis of elasticities". The Australian Journal of Agricultural and Resource Economics. 51: 121 – 135.
Wagenaar, Alexander C., et al (2007). "Effects of legal BAC limits on fatal crash involvement: analyses of 28 states from 1976 through 2002", Journal of safety research 38.5: 493-499.

[11] Law Commission Report (2010), "Alcohol in our lives: Curbing the harm", Part 3 (pp.275-280), New Zealand.

[12] This was based on Wagenaar et al (2009).

[13] Cited in ANPHA (2012), "Exploring the Public Interest Case for a Minimum (floor) Price for Alcohol: Pricing Policies".

The Law Commission Report and ANPHA also noted that heavy drinkers are generally less responsive than moderate drinkers to changes in price[14].

As part of this investigation, an attempt was made to estimate the price elasticity of alcohol consumption using New Zealand data. However, due to a lack of sufficient data and limited time to carry out such an analysis, this attempt was abandoned. Based on the above literature results, the mid-range price elasticity has been assumed to be -0.5, with -0.4 and -0.6 as the lower and upper range assumptions[15]. It has been assumed that the price responsiveness reduces by one-third from a lower BAC band to the next. The resulting values are shown in Table 2.3.

Table 2.3: Assumed price elasticity of demand for alcohol by BAC band

BAC band	Low-benefit scenario	Mid-range	High-benefit scenario
BAC under 50 mg/dL	-0.46	-0.57	-0.69
BAC between 51 and 80 mg/dL	-0.34	-0.43	-0.52
BAC over 80 mg/dL	-0.23	-0.29	-0.34
Weighted average	**-0.40**	**-0.50**	**-0.61**

[14] ANPHA (2012) reported (i) ScHARR (2008) has a price elasticity of -0.21 for harmful drinkers, compared to -0.47 for moderate drinkers; (ii) Wagenaar et al (2009) found heavy drinkers to have a mean elasticity of -0.28.

[15] This range is also in line with the results of ScHARR (2008) that the overall own price elasticity of alcohol consumption ranges from -0.36 and -0.62 (Cited in ANPHA 2012).

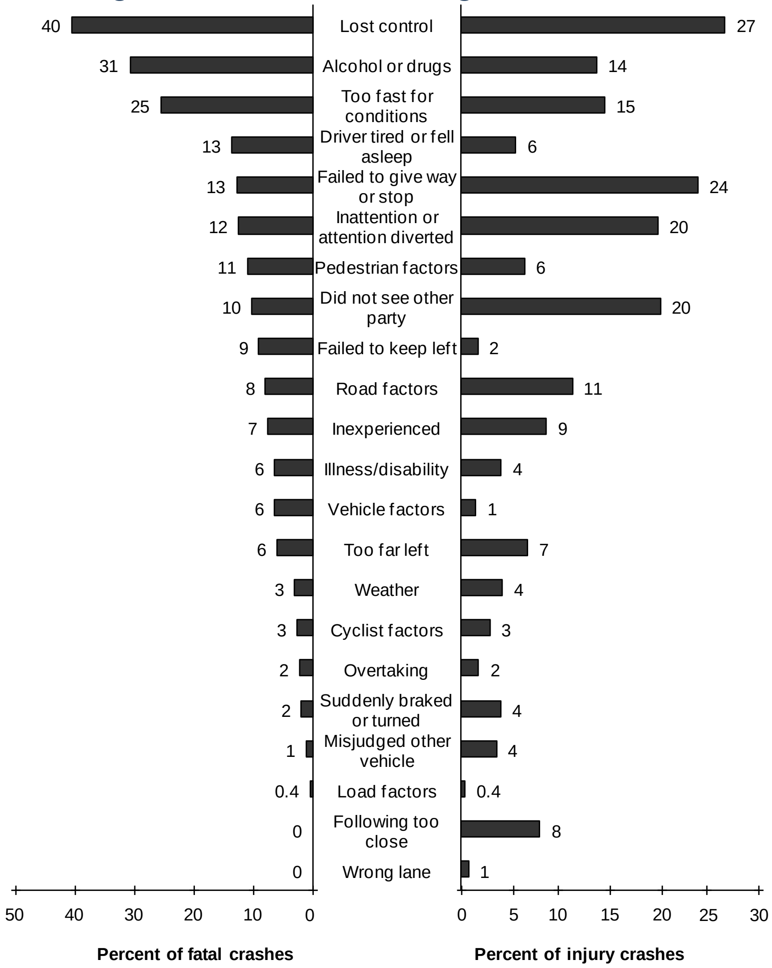
3. Benefits

3.1 Road safety benefits

3.1.1 Alcohol related road fatalities and injuries

The total social cost of motor vehicle fatal and injury crashes in 2012 is estimated at approximately $3.3 billion (in 2013 dollars).

Figure 3.1: Factors contributing to crashes, 2012



As shown in Figure 3.1, alcohol or drugs contributed to 31% of all fatal crashes and 14% of injury crashes in New Zealand in 2012.These crashes accounted for over 20% of the total social cost of road fatalities and injuries. This analysis used social cost of road fatalities and injuries as the key road safety benefit measure. It focused on social cost of road fatalities and injuries resulting from crashes where the at-fault drivers had a positive BAC and ignored cases where drug impairment was also a contributing factor. For the three years to 2012, there was an average of 61 fatalities, 244 serious injuries and 761 minor injuries a year caused by at-fault drivers (aged 20 years and over) with BAC greater than zero (Table 3.1). The total social cost for these road fatalities and injuries was about $446 million (in 2013$)[16].

Alcohol and drugs are sometimes present in a driver's blood and these substances can amplify each other causing serious impairments to the driver's ability to perform even simple tasks. However, to avoid overstating the potential safety benefits from the policy change, crashes where drugs were also cited as a contributing factor were excluded. On the other hand, the analysis also excluded cases where alcohol was suspected but no alcohol reading was available[17]. Because the analysis has excluded cases where the presence of drugs was a co-factor and where alcohol was suspected but no BAC information was available, the safety benefits obtained from this analysis can be considered conservative.

Table 3.1: Alcohol related road fatalities and injuries and the associated social cost caused by at-fault drivers aged 20 years and over

Average of 2010-2012	Blood Alcohol Concentration level of the at-fault drivers			Total	
	< 50 mg/dL	51 - 80 mg/dL	> 80 mg/dL	BAC > zero	BAC >50 mg/dL
Fatality	7	2	52	61	54
Serious injury	10	16	218	244	234
Minor injury	23	59	679	761	738
Total Social Cost in 2013 dollars $m (Exclude cases where drug impairment was also a factor)	**$37**	**$21**	**$389**	**$446**	**$409**
% increase in the total Social Cost if including cases where drug impairment was also a factor	**+15.4%**	**+22.2%**	**+4.6%**	**+6.3%**	**+5.5%**
% increase in the total Social Cost if including cases where drug impairment was also a factor and suspected cases of alcohol impairment (with 5% allocated to BAC between 51-80 mg/dL)	**+15.4%**	**+66.8%**	**+49.7%**	**+11.7%**	**+50.5%**

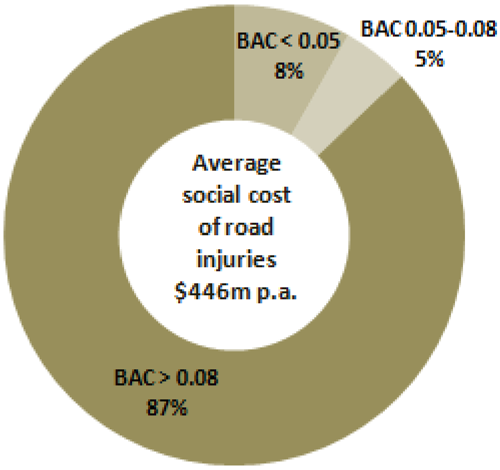
Note: Figures may not sum to total due to rounding

The majority (87% or $389 million) of the annual total social cost of road fatalities and injuries with a positive BAC level was caused by at-fault drivers with a BAC greater than 80 mg/dL (Table 3.1 and Figure 3.2). Drivers with a BAC of 51-80 mg/dL caused around 5% ($21 million) of the social cost of road fatalities and injuries.

[16] The average social cost per reported fatality is $3.798 million, $645,000 per reported serious injury and $65,000 per reported minor injury, in 2012 dollars. These estimates include allowance for incidents not recorded in Police's crash reports considering additional data from Accident Compensation Corporate and NZ Health Information Services. At the time of preparing this report, social cost estimates in 2013 dollars were not available. Therefore, a +2% adjustment has been made to increase the 2012 dollars estimates to 2013 dollars.

[17] For the three years to 2012, there were an average of 17 fatalities, 134 serious injuries and 296 minor serious (at a total social cost of $173.6 million in 2013$) where alcohol was suspected as a contributing factor but no alcohol reading was obtained or recorded. NZ Police advised that one possible reason could be due to late arrival of blood test results after the completion of the traffic crash report. However, whether and how the issue of high level of under-recording can be addressed is outside the scope of this report.

Figure 3.2: Share of total social cost of road fatalities and injuries where the at-fault drivers (aged 20 years and over) had a positive BAC, 2010-2012



This suggests around 8% of the social cost of road fatalities and injuries was caused by at-fault drivers with a BAC under 50 mg/dL. This percentage is higher than that of those in the 51-80 mg/dL range primarily due to factors other than alcohol (such as speed) dominating the results. Drink-driving typically occurs during high alcohol consumption periods (eg evenings, weekends and holiday periods), whereas speeding and other driving violations can occur during other periods as well as the high alcohol consumption periods.

One of the benefits for lowering the legal BAC to 50 mg/dL is the potential for the policy to also affect drivers currently exceeding BAC of 80 mg/dL, especially for those who are marginally over the current legal limit. Because crash risk increases exponentially with BAC, even a small reduction in the level of offending by drivers currently exceeding BAC of 80 mg/dL can result in significant road safety benefits. However, such a "spillover effect" is not limited to BAC over 80 mg/dL. The policy could also influence low-end drinkers in a similar way because individuals usually have limited knowledge about their BAC at any drinking session. Some drivers may opt to drink slightly less to ensure they are well under a BAC of 50 mg/dL (eg to a BAC of 30 mg/dL). Such a behavioural change would also result in a small additional safety benefit.

3.1.2 Literature review of road safety effects of lowering legal BAC limits

Findings from international jurisdictions have generally shown benefits from lowering the drink drive limits (see Table 3.3). A key message from the literature is that lowering the legal BAC limits can achieve road safety gains, irrespective of the level of the BAC limits from which the reduction occurred. For example, Fell and Vaos (2009) found that reducing the BAC from 100 to 80 mg/dL, from 80 to 50 mg/dL, from 50 to 30 mg/dL or 20 mg/dL and a zero tolerance for youth were all effective in reducing the risk of fatal crashes.[18] Mann et al. (2001)[19] found that interventions to reduce BAC limits to 80 mg/dL or 50 mg/dL in parts of Canada, the United States, Australia and Europe were effective

[18] Fell, James C., and Robert B. Voas. "Reducing illegal blood alcohol limits for driving: Effects on traffic safety." *Drugs, Driving and Traffic Safety*. Birkhäuser Basel, 2009. 415-437.

[19] Mann, RE, Macdonald, S, Stoduto, G, Bondy, S, Jonah, B and Shaikh, A (2001), "The effects of introducing or lowering legal per se blood alcohol limits for driving: an international review." *Accident Analysis & Prevention* 33.5: 569-583.

in reducing the number of collisions involving drivers who were alcohol-impaired. In some cases, overall BACs of randomly testing drivers (the general population) was reduced.

Another key message from the literature is that the reduction in the legal BAC limit can result in positive changes in drink-driving behaviour at a higher level of BAC. For example, Shults et al (2001)[20] looked at interventions that lowered the BAC limit in the United States, Australia, Canada, France, New Zealand and the Netherlands. Results showed reduced fatalities involving drivers with BACs above 80 mg/dL, and also reductions in fatalities in drivers who had a BAC level of above 100 mg/dL. As noted earlier, the 2011 implementation of a zero alcohol limit in New Zealand for drivers under 20 years old shows large reductions (over 40%) in the level of offenders for BACs well above 30 mg/dL and 80 mg/dL.

The Centre for Public Health Excellence (2010)[21] reported Swedish and Australian studies with similar results. The Swedish BAC limit was lowered to 20 mg/dL in 1990, and found a reduction in the proportion of drink-driving offenders with BACs above 150 mg/dL. In the Australian Capital Territory after the legal BAC limit was lowered from 80 mg/dL to 50 mg/dL, results showed a 34% decrease in the proportion of driver's randomly breath tested with BACs of between 150 and 190 mg/dL. A 58% decrease was shown in the proportion of drivers above 200 mg/dL BAC.

It is important to note that reductions of legal BAC limits on their own are unlikely to produce significant or long lasting improvements to road safety. Albalate (2008)[22] conducted a review in Europe of lowering BAC limits from 80 to 50 mg/dL, and showed that BAC limits on their own produce modest road safety benefits. Mann et al. (2001) found that changes to drink-driving laws require continued high publicity and education alongside high levels of police enforcement coupled with an effective regime of penalties. In New Zealand, publicity campaigns, education and enforcement are routine road safety promotion activities. The NZ Transport Agency will incorporate a targeted publicity campaign informing drivers of the policy change. There is also a plan to review the penalty regime. Therefore, it is unlikely that the effectiveness of the change in legal BAC limit will be hindered by the lack of such activities.

Further, social norms are also an influencing factor to any change to the legal limit. If public perception of drink-driving is negative, an individual will be less likely to engage in the activity. A 2012 survey of public attitudes to road safety in New Zealand showed that 60% of participants favoured a lower legal BAC limit for driving, up from 40% in 2006. Of the 60% who favoured a lower limit, 41% thought the limit should be lowered to 50mg/dL and 19% wanted the limit lowered to zero. In a more recent television poll[23], 76% of participants favoured a lower legal BAC limit. The increasing support from the public in recent years means individuals are less likely to engage in drink-driving over BAC 50 mg/dL now than in the past.

The various policies implemented in international jurisdictions alongside decreased BAC limits mean that there are certain limitations in applying overseas findings to New Zealand. Vehicle usage, urban

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[20] Shults, R,Elder, R, Sleet, D, Nichols, J, Alao, M, Carande-Kulis, V, Zaza, S, Sosin, D and Thompson, R (2001), "Reviews of evidence regarding interventions to reduce alcohol-impaired driving." *American journal of preventive medicine* 21.4 : 66-88.

[21] Killoran, A, Canning, U, Doyle, N and Sheppard, L (2010), "Review of effectiveness of laws limiting blood alcohol concentration levels to reduce alcohol-related road injuries and fatalities." *Final Report. London: Centre for Public Health Excellence (NICE)*.

[22] Albalate, D (2008), "Lowering blood alcohol content levels to save lives: The European experience." *Journal of Policy Analysis and Management* 27.1 (2008): 20-39.

[23] The poll was conducted by a television programme called "Campbell Live" on 29 October 2013.

planning, acceptance of regulation, access to public transport (particular in the rural areas) and alcohol consumption patterns differ widely across different countries. Table 3.2 presents policy settings for a range of international jurisdictions and their applicability to New Zealand.

Table 3.2: Comparison of drink-driving policy settings by jurisdiction

Jurisdiction	Current BAC limit	Results from drink-driving policy in place/applicability to New Zealand
New Zealand	80 mg/dL for general population (including commercial vehicle drivers) 0 for <20 year old drivers	Moderate enforcement with random testing, alcohol interlocks mandated as a sentencing option, strong public support for lower limits.
United States	80 mg/dL for general population 20 mg/dL for young and novice drivers	Use of alcohol interlocks, no random testing, strong public support for lower limits.
Australia	50 mg/dL for general population 0 for drivers of heavy vehicles over 4.5 tonnes GVM 0 for young and novice drivers.	Close match for New Zealand in terms of culture. BAC limits, enforcement and alcohol related policies (eg control of distribution and marketing of alcohol and alcohol taxation) are stricter than New Zealand.
United Kingdom	80 mg/dL for all drivers	No random testing, overall lenient policies in place. Fatalities low but injuries are high by international standards.
France	50 mg/dL for general population 50 mg/dL or lower for various commercial sectors	Close match for New Zealand in terms of alcohol control, and public attitudes. Differential limits and mandatory interlocks for some sectors have led to positive road safety benefits. Harsher penalties for drink-driving has also had positive effects[24]
Sweden/Norway	20 mg/dL for all drivers, various more stringent limits for commercial sectors	Very stringent policies, supported by public attitudes and behaviour have achieved good safety outcomes.

[24] FIA Foundation (2006), "Road Safety in France: Reflections on three decades of road safety policy". Available at: http://www.fiafoundation.org/publications/Documents/road_safety_in_france.pdf.

Table 3.3: International experience on effects of lowering legal BAC limit

Study	Country/Year	BAC change (note)		Effects	
		From	To	Primary	Secondary
Hingson et al. (1996)	United States (6 states)/1983-1995	0.1	0.08	16% reduction in road fatalities for drivers with BACs≥0.08.	18% reduction in road fatalities for drivers with BACs≥0.15.
Tippetts et al. (2005)	United States (19 states)/1983-2004	0.1	0.08	14.8% decrease alcohol related road fatalities.	
Wagenaar et al. (2007)	United States (28 states)/1983-2004	0.1	0.08	Significant decreases in crashes for drivers with 0.08≤BAC≤0.14 and single vehicle nighttime crashes.	Significant decrease in crashes for drivers with 0.01≤BAC≤0.07 and 0.15≥BAC.
Noordzij (1994)	Netherlands/1974	0.08	0.05	Surveyed drivers with BACs≥0.05 decreased from more than 15% to 2% in the first year of change. Levelled off at 12% for the first 10 years of change.	
Chamberlain and Soloman (2002)	Belgium/1994	0.08	0.05	10% decrease in road fatalities in the first year of change and a further 11% in the second year.	
Mercier-Guyon (1998)	France/1996	0.08	0.05	Alcohol related fatalities decreased from 100 to 64 for a French Province in the first year of change.	
Bartl and Esberger (2000)	Austria/1988	0.08	0.05	9.4% decrease in alcohol-related crashes.	
Ministry of Public Safety (2011)	Canada (British Columbia)/2010	0.08	0.05	40% decrease in alcohol related fatalities in the first year of change.	
Brooks and Zaal (1993)	Australia (Australian Capital Territory)/1991	0.08	0.05	Drivers tested with 0.05≤BAC≤0.08 decreased by approximately 90% in the first year of change.	Drivers tested with 0.15≤BAC≤0.19 and BAC≥0.2 decreased by 34% and 58% in first year of change.
Henstridge et al. (1995)	Australia (New South Wales, Queensland)/1980, 1982	0.08	0.05	8% reduction in fatal crashes, 7% reduction in serious crashes and 11% reduction in single vehicle nighttime crashes in New South Wales. 18% reduction in fatal crashes and 14% reduction in serious crashes in Queensland.	
Kloeden and McLean (1994)	Australia (South Australia)/1991	0.08	0.05	No significant effects on the number of fatally injured drivers who were legally impaired.	Fatally injured drivers with BACs≥0.15 decreased.
Norstrom and Laurell (1997)	Sweden/1990	0.05	0.02	9.7% reduction in fatal crashes, 7.5% reduction in all crashes over the first six years of change.	Drivers with BACs≥0.15 decreased from 57.1% to 47.4% of all impaired driving offenders.
Ministry of Transport (2012)	New Zealand/2010	0.03 (<20)	Zero (<20)	46% reduction in offending drivers under 20 years with 0.03≤BAC≤0.08 in first two years after change.	43% reduction in offending drivers under 20 years with BACs≥0.08 in first two years after change.
Vaos et al. (2003)	United States	0.08	Zero (<21)	24.4% reduction in BACs>0 drivers younger than 21 involved in fatal crashes.	

Note: BAC of 0.1 refers to BAC of 100 mg/dL and so forth.

3.1.3 Previous analyses

There were two evaluations of the potential road safety benefits of lowering the legal adult BAC limits in the last three years. The first is the preliminary analysis conducted by the Ministry of Transport in 2010 (also see Appendix 2). The second is a soon-to-be released Austroads report.

Based on the experience in Australia and France, the Ministry of Transport 2010 analysis estimated that between 15 and 30 fatalities and between 320 and 686 injuries could be prevented if the legal adult BAC limit were lowered from 80 mg/dL to 50 mg/dL. The lower end estimate was based on a 14% average reduction in alcohol related fatalities and injuries observed in Australia during 1980s to 1990s. The upper end estimate was based on a 30% reduction in alcohol related fatalities observed in a French province in the first year of the change implemented in 1996.

More recently, Austroads analysed the same policy change and estimated that a 12.85% reduction in fatalities could be achieved in New Zealand. If these percentages were applied to all casualties caused by adult drivers (over 20 years) in New Zealand, a total of 28 lives could be saved[25]. If these percentages were applied to at-fault drivers (over 20 years) with a positive BAC (and excluding drugs as a co-factor), the estimated reduction in the number of fatalities caused by such drivers is 8 (or 10 if including cases where alcohol was suspected but no BAC reading recorded).

Overseas experience and the above mentioned analyses suggested the expected reductions in road fatalities and injuries from the policy change would potentially be very high. Given these results, the purpose of this current analysis is to develop an alternate approach to estimate the minimum road safety benefits to be achieved following a change in the legal adult BAC limit from 80 mg/dL to 50 mg/dL, considering different behavioural responses drivers may make following the policy change. The new approach used also enables estimation of loss in consumer surplus (a measure of utility from the consumption of goods or services), any potential costs related to changes in transport arrangement and the social cost of health care and crime. These aspects are discussed in Sections 3.3, 4.1 and 4.2.

3.1.4 Estimating the road safety effects

The following equation provides a stylised representation of how the reductions in social cost of road fatalities and injuries were calculated for this analysis.

$$\begin{bmatrix}\text{Estimated}\\ \text{reduction}\\ \text{in Social Cost of}\\ \text{road injuries}\end{bmatrix}_{j,k} = \begin{bmatrix}\text{Annual average}\\ \text{social cost of}\\ \text{road injuries}\end{bmatrix}_{j,k} * \begin{bmatrix}\text{assumed}\\ \text{percentage of}\\ \text{drivers with}\\ \text{behavioural}\\ \text{changes}\end{bmatrix}_{j,k} * \begin{bmatrix}\text{\% reduction in}\\ \text{risk due to}\\ \text{behavioural}\\ \text{changes}\end{bmatrix}_{j,k} \quad (3.1)$$

where j = behavioural response category; k = BAC bands (50 mg/dL and below, between 50 mg/dL and 80 mg/dL and over 80 mg/dL).

Estimates were initially established for different behavioural response categories and alcohol levels. These estimates were then grouped together to form the total safety benefit estimates. All estimates

[25] Austroads report, soon-to-be published.

start from the evaluation base year and adjustments were made to take into account population growth and gradual improvement in road safety over time.

According to the roadside alcohol measurement 2012 survey, approximately 1.37% of surveyed drivers aged 20 and over had a BAC of between 50 mg/dL and 80 mg/dL and 0.8% had a BAC over 80 mg/dL. When estimating the potential safety and other effects, the ratio between those over 80 mg/dL and those between 51 and 80 mg/dL was used to approximate the potential change in offending and other transaction volumes throughout this analysis.

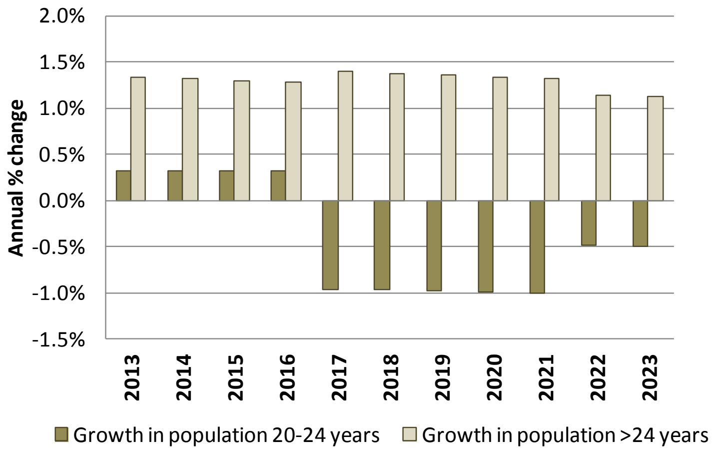
Table 3.4: Distribution of driver population aged 20 years and over, by alcohol band

As of December 2012	BAC > 0		
	50 mg/dL and under	51 mg/dL to 80 mg/dL	Over 80 mg/dL
Proportion of drivers (note)	4.0%	1.37%	0.8%

Source: Ministry of Transport, (2012). Roadside Alcohol Measurement Operation

The driving population typically grows with population over time. To account for this, Statistics New Zealand's population growth projection estimates[26] have been used (see Figure 3.3) for all BAC bands.

Figure 3.3: Projected annual growth in population aged 20 years and over



Data source: Statistics NZ

The four key components required for equation (3.1) are:

- average social cost of alcohol-related road injuries by alcohol band
- assumed percentage of drivers with behavioural changes
- percentage reduction in risk resulting from behavioural changes
- adjustment for gradual improvement in road trauma trend over time.

[26] This analysis used Statistics New Zealand's 50th percentile projections with median mortality, fertility and migration assumption. These projections used resident population estimates as of New Zealand at 30 June 2011 as a base and are derived from results of the 2006 Census. At the time of preparing this CBA, population projections based on Census 2013 are yet to be released.

The first component was covered in Section 3.1.1, the remaining three components are discussed in more detail in the following sections.

3.1.5 Assumptions on drivers with behavioural changes

The proportion of drivers with or without behavioural responses will affect the level of safety benefits to be achieved, as well as the administrative cost of implementing the policy and other tangible and intangible benefits and costs. The assumed behavioural assumptions (refer to discussion in Section 2.3) are tabulated in Table 3.5.

Unless otherwise indicated, all results tabulated in this report are based on assumptions using the mid-range benefit assumptions.

Table 3.5: Behavioural assumptions

Current alcohol band	Behavioural responses	Mid-range		Low		High	
		Year 1	Year 2 onwards	Year 1	Year 2 onwards	Year 1	Year 2 onwards
BAC 51-80 mg/dL	Reduce alcohol use to BAC < 50 mg/dL	6%	9%	2%	3%	10%	15%
	Switch to home-based drinking	12%	18%	4%	6%	20%	30%
	Take alternate transport	12%	18%	4%	6%	20%	30%
	No change in behaviour	70%	55%	90%	85%	50%	25%
BAC over 80 mg/dL	Reduce alcohol use to BAC < 50 mg/dL	0.6%	0.9%	0.4%	0.6%	0.8%	1.2%
	Reduce alcohol use to BAC 50-80 mg/dL	0.6%	0.9%	0.4%	0.6%	0.8%	1.2%
	Switch to home-based drinking	2.4%	3.6%	1.6%	2.4%	3.2%	4.8%
	Take alternate transport	2.4%	3.6%	1.6%	2.4%	3.2%	4.8%
	No change in behaviour	94%	91%	96%	94%	92%	88%
BAC 50 mg/dL and below	Reduce alcohol use to BAC < 30 mg/dL	1.2%	1.8%	0.8%	1.2%	1.6%	2.4%
	Switch to home-based drinking	2.4%	3.6%	1.6%	2.4%	3.2%	4.8%
	Take alternate transport	2.4%	3.6%	1.6%	2.4%	3.2%	4.8%
	No change in behaviour	94%	91%	96%	94%	92%	88%

3.1.6 Percentage reduction in risk resulting from behavioural changes

Many studies[27] show that the risk of being involved in a fatal crash increases exponentially as a driver's BAC increases. Table 3.6 and Figure 3.4 show the relative risk in relation to that of a 30+ years old sober driver by BAC based on Keall et al (2004)[28]. Keall et al (2004) estimated the average proportional increase in risk per interval increase in driver BAC using a log-linear model fitted to data from a case-control study of fatally injured drivers matched with data collected from roadside

[27] For example:
Keall, M, Frith, W and Patterson, T (2004), "The influence of alcohol, age and number of passengers on the night-time risk of driver fatal injury in New Zealand", Accident Analysis and Prevention, Volume 36, pp.49-61.
Borkenstein, R.F., Crowther, R.F., Shumate, R.P., Ziel, W.B., Zylman, R., (1964), "The Role of the Drinking Driver in Traffic Crashes". Department of Police Administration, Indiana University, Indiana, USA.
Zador, P.L., Krawchuk, S.A., Voas, R.B., (2000), "Relative risk of fatal crash involvement by BAC, age and gender", NHTSA Report No. DOT HS 809050, US Department of Transportation, Springfield, VA, USA.
[28] Keall et al (2004), ibid.

breath-testing at randomly selected sites. The study assessed driver risk while controlling for the effects of alcohol, age, influence of carrying a passenger, urbanisation and for driving trips at a time of night and days of the week where the vast majority of travel in New Zealand is associated with socialising. Keall et al (2004) noted that the estimated risk curves are higher than that of other countries for two reasons. First, the New Zealand crash sample was dominated by single-vehicle crashes (64% of the sample), that have been shown to be associated with steeper risk curves than multi-vehicle crashes. Second, the New Zealand road network is relatively unforgiving and may present relatively higher demands on alcohol-impaired drivers than on sober ones, leading to steeper risk curves.

Table 3.6: Relative risk of driver fatal injury by BAC

Relative risk	BAC (mg/dL)			
	Zero	**30**	**50**	**80**
under 20 years	5.3	15.0	30.3	86.6
20-29 years	3.0	8.7	17.5	50.2
30 years and over	**1.0**	2.9	5.8	16.5
Relative risk within each age group:	**1.0**	**2.9**	**5.8**	**16.5**

Source: Keall et al (2004)

Figure 3.4: Relative risk of driver fatal injury by BAC

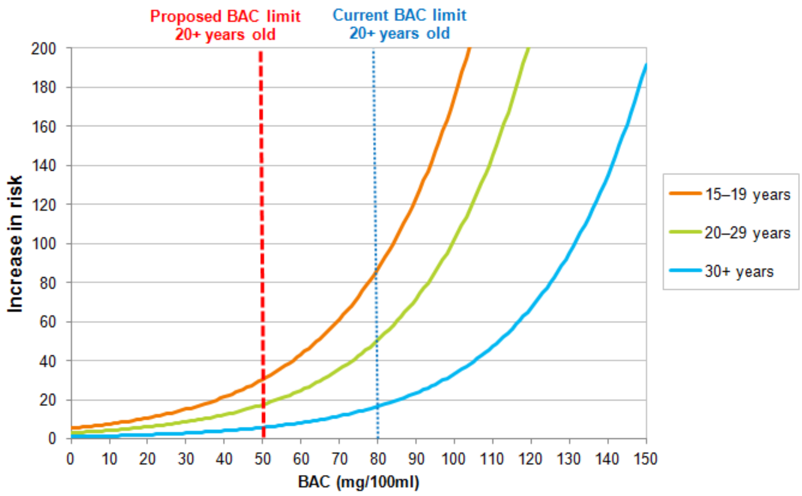


Table 3.6 shows that relative risk within each age group is the same irrespective of age[29]. This characteristic simplifies the estimation procedure as there is no need to identify separate relative risk for drivers over 20 years. However, since the relative risk[30] in Keall et al (2004) only covers driver fatal risk, the overall relative risk for fatal and non-fatal injuries may be lower (eg Blomberg et al 2005[31]). A new Australasian study (by Austroads)[32] that looked at both Australian and New Zealand fatal and serious injury crash data (NB: for the New Zealand's analysis, data for 2007 to 2011 has been used) found the relative risks for serious injury are lower than that for fatal injury at each level

[29] This is also apparent from Figure 3.3 because the risk curves are parallel to each other.

[30] The relative risks of fatal injury by BAC in Keall et al (2004) were derived for all driver fatal injuries and not just fatalities due to at-fault crashes. Arguably the relative risks for the latter group could be higher.

[31] Blomberg, R, Peck, R, Moskowitz, Burns, M and Fiorentino, D (2005), "Crash risk of alcohol involved driving: a case-control study", Dunlap and Associates, USA (http://dunlapandassociatesinc.com/crashriskofalcoholinvolveddriving.pdf).

[32] This study is carried out by Austroads. At the time of preparing this report, the results are yet to be released. Therefore, the relative risk estimates are not reported here.

of BAC[33]. However, when considering the weighted average (by the size of the harm as measured in terms of social cost of road fatalities and injuries), the relative risk for each level of BAC is similar to those of Keall et al (2004) or Keall et al (2013)[34]. Because the Austroads study uses more up-to-date New Zealand data, it is more appropriate to utilise its results. To be conservative, the weighted relative risk estimates derived from the Austroads study have been halved to account for the even lower relative risk for minor injury (since Austroads did not have relative risk estimates for minor injury). However, because the analysis focused on percentage changes in the relative risk between different BAC levels, this adjustment only has small impacts on the results.

This current analysis assessed the benefits of a shift to 50mg/dL by comparing the risk due to the levels of alcohol currently found with that of the expected levels, according to the driver's behavioural response (refer to Table 3.5). The difference represents the baseline crash risk facing a sober driver. The reductions in risk were proxied by changes between BAC bands (Table 3.7).

To illustrate the estimates presented in Table 3.6 using Keall et al (2004), consider the case if a driver with a BAC of between 51-80 mg/dL reduces to 50 mg/dL or below. The minimum of this driver's current BAC range is 50 mg/dL with a relative crash risk of 2.9, the closest match of the target BAC range is 30 mg/dL with a relative crash risk of 1.45. Thus, this driver will reduce his/her risk by 50%, being (5.8-2.9)/5.8. Because the minimum of the current range is used as the comparator, the estimated risk reduction can be considered conservative. Should the analysis use the medium relative risk in each BAC band[35], a driver with a BAC of 120 mg/dL reducing to a BAC of 50 mg/dL would have a 90% risk reduction, as opposed to 65% when the minimum of the current range is used as the comparator.

The last column of Table 3.7 shows the minimum reduction in risk derived from Austroads relative risk estimates (with values halved) used in the analysis.

Table 3.7: Estimated reduction in risk from behavioural change

Current BAC band	Behavioural responses	Proxy by Changes in BAC (mg/dL)	% reduction in risk	
			Keall et al (2004)	Halved of Austroads (note)
BAC 51-80 mg/dL	Reduction in alcohol use	50 to 30	50%	32%
	Removal of travel needs or take alternate transport	50 to 0	83%	64%
BAC over 80 mg/dL	Reduction in alcohol use	80 to 50	65%	68%
		80 to 30	82%	78%
	Removal of travel needs or take alternate transport	80 to 0	94%	88%
BAC 50 mg/dL and below	Reduction in alcohol use	50 to 30	50%	32%
	Removal of travel needs or take alternate transport	30 to 0	66%	47%

Note: This report is yet to be published.

33 Austroads reported that their analysis has been controlled for confounding effects.

34 Keall, M, Clark, B and Rudin-Brown, CM (2013), "A preliminary estimation of motorcyclist fatal injury risk by BAC level relative to car/van drivers", Traffic Injury Prevention, 14:1, 7-12.

35 Common practice typically utilises the distribution of drivers with readings recorded in each of the BAC level to work out the medium level. However, in New Zealand information by BAC is only available for the three alcohol bands considered, which has limited such a detailed analysis. The percentage reduction in relative risk has more impact on those with a BAC over 80 mg/dL (because this group accounts for 87% of the estimated total social cost). If the analysis assumed a 99% risk reduction for the BAC over 80 mg/dL group, the estimated reduction in social cost of road trauma would increase by 14% (or an additional 0.4 fatalities and 8 injuries saved per year) under the mid-range benefit scenario. This is a relatively small increase due to the assumed behavioural change for this BAC group is low (only between 6% and 9%).

3.1.7 Gradual improvement in road trauma trend

Due to a range of road safety interventions in place, the risk of crash involvement has been falling over time. With improving vehicle and roading engineering technologies and other on-going road safety interventions, this downward trend is likely to continue over time, reinforced by the Cooperative Intelligent Transport Systems[36] including crash avoidance technologies. If the Safer Journeys and other related interventions reduce the road trauma level from the current 300 fatalities a year to 240 fatalities a year by 2020, the annual average reduction in fatality risk is about 3.2%. Since many interventions reduce the level of injury severity rather than the risk of crash involvement, the reduction in injury risk is likely to be lower. Assuming the injury risk reduction is half of that for fatalities (at 1.6% a year.); the weighted average risk reduction is 2.1% a year As the level of road trauma falls, it becomes more difficult to achieve similar level of road trauma improvement over a longer term. Thus, for the purpose of this analysis, the risk of road trauma is assumed to decline at a rate of 1% from 2021.

These adjustments are applied to the base estimates obtained from equation (3.1).

3.1.8 Allowance for reduction in non-injury crashes

In addition to a potential reduction in fatal and injury crash involvement, the policy can also reduce the risk of non-injury (ie property damage only) crashes. At the national level, property damage only crashes amount to between 15% and 17% of the annual total social cost of fatal and injury crashes. To be conservative, this analysis assumed alcohol-related non-injury crashes accounts for around 10% of total social cost of fatalities and injuries. In other words, the social cost of non-injury crashes will add 10% to the estimated total social cost of fatal and injury crashes.

3.1.9 Estimated reduction in road fatalities and injuries and associated social cost

Table 3.8 summarises the estimated reduction in road fatalities and injuries. These estimates have accounted for gradual improvement in road safety trend over time and considered different risk level changes between BCA levels and behavioural response assumptions.

Table 3.9 summarises the estimated reduction in social cost of road crashes[37] attributable to a change in the legal adult BAC level. This shows that even under rather conservative assumptions, the potential road safety benefit is significant and amounts to some $200 million over a 10-year period (in PV, 2014-2023).

[36] http://www.transport.govt.nz/assets/Import/Documents/Schematic-of-Cooperative-ITS-Trial.pdf

[37] Final estimates of the social cost of road crashes include allowance for non-reported injuries.

Table 3.8: Estimated reduction in road fatalities and injuries

	Behavioural change scenarios		
Injury severity	Low	Mid-range	High
Fatality	1.9	3.4	5.2
Serious & minor injury	33	64	102

Note: The safety benefits for future years will reduce gradually in line with general road safety improvement trend.

Table 3.9: Estimated reduction in total social cost of road crashes (mid-range estimate)

$ million (2013 prices) / **BAC level**	**Year 1 2014**	**Year 2 2015**	**10-year total in present value**
BAC 51-80 mg/dL	$2.97	$4.41	$29.82
BAC over 80 mg/dL	$16.85	$25.05	$169.14
BAC 50 mg/dL and below	$0.82	$1.21	$8.21
Total	**$20.63**	**$30.68**	**$207.16**
% reduction in social cost of road crashes caused by at-fault drivers with a BAC > zero	**4.6%**	**6.9%**	**6.5% (average pa)**
% reduction in social cost of road crashes caused by at-fault drivers with a BAC > 50 mg/dL	**5.0%**	**7.5%**	**7.0% (average pa)**

Notes:
1. Reduction in year 1 is lower as the model assumes the full effects are felt from year 2.
2. Figures may not sum to total due to rounding.

This analysis has a lower estimated reduction in the number of alcohol-related road fatalities than those reported in the 2010 cabinet paper. Three key reasons for the difference are that:

i) there has been a reduction in alcohol related crashes since 2008 (the latest data used in the 2010 estimate),

ii) there was a lack of information about the proportion of at-fault drivers with a BAC of between 50 and 80 mg/dL, which means that it was not feasible to provide reliable estimates of the social cost of road fatalities and injuries caused by these drivers, and

iii) this analysis adopts a more conservative approach
   a. the analysis only focused on injuries caused by at-fault drivers with a positive BAC
   b. the analysis excluded crashes where drugs was also cited as a co-factor
   c. the analysis excluded crashes where alcohol was suspected but no BAC reading was obtained
   d. the analysis used heavily downward adjusted relative risk estimates for the assessment

Appendix 2 provides a comparison between the 2010 and current estimates.

3.2 Government administrative cost savings

With the assumed behavioural changes for drivers in the BAC > 80 mg/dL category (see Table 3.5), there would be a reduction in the number of detected traffic offence notices (TONs) at BAC > 80 mg/dL. Under the behavioural assumptions listed in Table 3.5, some of these offenders may fall under the new offence category (at BAC 51-80 mg/dL), therefore there could be a small increase in infringement related transactions. The estimated volume changes are summarised in Table 3.10.

Table 3.10: Estimated infringement and other licensing related volumes – BAC > 80 mg/dL group

Transaction	2014	2015
Estimated change in drink-driving TONs (> 80 mg/dL)	-1,360	-2,070
Estimated change in number of drink-driving IONs (51-80 mg/dL)	+140	+210
Estimated change in number of warning letters (= ION offences at @50 pts)	+134	+200
Estimated change in number of suspension notices issued	+6	+ 10
Estimated change in suspension notices served	+4	+6
Estimated change in limited licence application	0	+1
Estimated change in DWS offences	+1	+2
Estimated change in blood tests	-258	-393

With a 9% behavioural change by drinkers currently at BAC over 80 mg/dL, the number of traffic offences could reduce by 2,000 per year (from year 2, under the mid-range benefit scenario). This spillover effect will potentially reduce defended hearing and other costs to Police by $1 million per year (from year 2) and the justice sector by $0.75 million per year (from year 2). The latter estimate includes the cost savings to Corrections from a potential reduction in community and home detention related sentences[38]. Section 4.3 provides more details about the unit costs and other assumptions used to estimate changes in government administrative costs.

3.3 Reduction in social cost of crime, health care cost and absenteeism

To assist estimation of the wider benefits from a reduction in alcohol consumption, it is necessary to estimate the total amount of alcohol beverages consumed by BAC level and the likely reduction in alcohol consumed for different behavioural responses. This section will discuss these two aspects first before discussing the estimated reduction in social cost of crime, health care cost and cost of absenteeism.

[38] It has been assumed that the reduction is likely to come from those with less than two previous drink-driving offences and the average cost savings to Corrections for such conviction is $97 each. This cost savings mainly result from a small reduction in a home detention and community sentences. The administrative cost savings from a reduction in fine related sentences has been excluded as the collection cost savings is likely to be small.

3.3.1 Total amount of alcohol beverages consumed

According to Ministry of Health's 2011/12 health survey[39], around 80% of adults[40] had consumed alcohol in the 12 months to June 2012. Extending this to the general population means around 2.87 million people over 15 years of age would consume alcohol at least occasionally.

Statistics NZ estimated that there were 457 million litres of alcohol available for consumption in 2012. According to Household Travel Survey 2005-09, around 43% of total alcoholic beverages were consumed at venues other than own-home[41]. This means if the opening and closing stocks of alcohol remains relatively stable over time, just under 200 million litres of alcoholic beverages were consumed at venues other than own-home, which would require some forms of transport following the consumption of alcohol[42].

Considering the proportion of drivers with a BAC > 0 by age group (Table 3.2), around 11.8 million litres[43] of alcoholic beverages were consumed by drivers with a BAC > 0. Of this total, 11.6 million litres were consumed by drivers over 20 years of age. This data was disaggregated by age group and BAC level (Table 3.11) using the methodology discussed in Appendix 1.

Table 3.11: Estimated total amount of alcoholic beverages consumed in 2012, in million litres

Million litres / Age group	BAC (mg/dL)			
	Under 50	**50-80**	**Over 80**	**Sub-total**
Under 20 years	0.05	0.10	0.08	0.23
20-24 years	0.67	0.44	0.54	1.65
Over 24 years	4.50	3.10	2.32	9.92
Total all age groups	**5.22**	**3.64**	**2.95**	**11.80**
Over 20 years	**5.17**	**3.54**	**2.86**	**11.57**

3.3.2 Estimated reduction in alcoholic beverages consumed

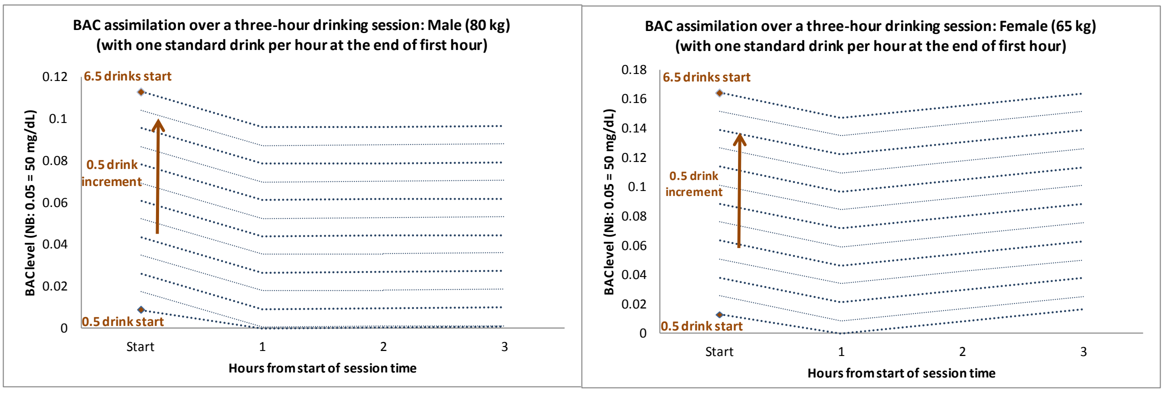
To estimate the reduction in the amount of alcoholic beverages consumed between different BAC bands, it is necessary to know how many standard drinks would be required to reach a certain level of BAC. However, the amount of BAC absorbed into a person's body and how it is absorbed over time varies between individuals depending on their body characteristics. Literature[44] reported gender, body mass, metabolic rate and the amount of water in blood can significantly affect absorption and

[39] Ministry of Health (2013), "Hazardous drinking in 2011/12: Findings from the New Zealand Health Survey", http://www.health.govt.nz/publication/hazardous-drinking-2011-12-findings-new-zealand-health-survey.
[40] This is lower than the 84% estimated for 2006/07 mainly due to a large drop in past-year drinking among youth aged 15-17 years (from 75% in 2006/07 to 59% in 2011/12).
[41] McSaveney, J and Povey, L (2010), "Alcohol and Travel in the New Zealand Household Travel Survey", paper presented at the 29th Australasian Transport Research Forum, Canberra, Australia.
[42] Although not all alcohol users choose to travel after drinking at non-home based venues and some home-based drinkers may travel immediately after the drinking sessions, to minimise the level of complexity it has been assumed the two effects cancel out.
[43] This is less than 3% of the estimated annual total alcohol consumption.
[44] For example, (i) National Highway Traffic Safety Administration, 1994. *Computing a BAC Estimate* Washington: Department of Transportation. (ii) Carey K and Hustad J, 2002. *Are Retrospectively Reconstructed Blood Alcohol Concentrations Accurate? Preliminary Results from a Field Study.* Journal of Studies on Alcohol. 63(6), pp. 762- 766 (iii) Kelly, A and Mozayani, A (2012), "An Overview of Alcohol Testing and Interpretation in the 21st Century", *Journal of Pharmacy Practice* published online 3 January 2012.

assimilation rates. Anecdotal evidence suggests that the amount of food consumed during the drinking sessions and the health status of the individual can also affect the BAC levels.

Figure 3.5 shows the BAC decay rates for a male weight of 80 kg with 46.4 litres of water in body and for a female weight of 65 kg with 31.85 litres of water in body. This shows how the instantaneous BAC at the start of a three-hour drinking session[45] varies over time (with one standard drink per hour at the end of the first hour). Some indicative amount of standard drinks required to reach various BAC levels is provided in Table 3.12. However, it is the relative quantity that is needed for this analysis.

Figure 3.5: Examples of BAC assimilation by gender



Note: BAC calculations based on U.S. National Highway Traffic Safety Authority's BAC formula[46].

Using the relative quantity between BAC bands in Table 3.12, the percentage reduction in the amount of alcohol consumed in order to reduce BAC from over 80 mg/dL to 50 mg/dL and below is estimated at 63% (being (2.7-1)/2.7). The percentage reductions in the amount of alcohol consumed in order to reduce BAC from 51-80 mg/dL to 50 mg/dL and below and from over 80 mg/dL to 51-80 mg/dL were calculated in similar fashion. For drinkers currently below BAC 50 mg/dL, it has been assumed that the reduction in the amount of alcohol consumed is 25% (if they choose to reduce alcohol consumption). The assumed reduction for this group is lower recognising the smaller scope for such changes.

Table 3.12: Relative quantity of standard drinks required to achieve a given BAC level, over a 3-hour drinking session

BAC (mg/dL)	Indicative minimum number of standard drinks required			Relative amount
	Female (65 kg)	Male (80 kg)	Combined	
Under 50	2.5	2.5	2.5	1
50-80	4	6	5	2
Over 80	5.5	8	6.75	2.7

Note: This table is indicative only and should not be used as a guide of the amount of alcoholic beverages permitted under the legal adult BAC limit.

[45] Household Travel Survey 2003-07 shows that the average duration of a drinking sessions is about two hours for adults over 24 years and three hours for young adults between 15 and 24 years.
[46] Source: http://web.archive.org/web/20041020082727/http://www.nhtsa.dot.gov/people/injury/alcohol/bacreport.html

The estimated reduction in alcohol used by BAC band are summarised in Table 3.13. It shows that the reduction in alcohol consumption is low relative to the total. The key reasons are listed below.

- Over half of the alcohol beverages are consumed at own-home and a reduction is not expected from such consumption.
- A large proportion (around 94%) of drivers surveyed at roadsides during high alcohol hours had no alcohol detected. This means even if they do drink occasionally they are unlikely to drive after consumption of alcohol. Therefore, a reduction in the overall alcohol consumption is not expected from this group of drinkers.
- Overall, analysis suggested less than 3% of total alcohol consumption are associated with driving with a BAC of greater than zero.
- Alcohol users will have different strategies to comply with the new limits other than reducing alcohol consumption. Switching to home-based drinking or making alternate transport arrangements are likely to be the key strategies adopted by alcohol users, especially those who place a high value on such consumption.

In fact, the estimated reduction in alcohol consumption could be on the high side because the analysis has not allowed for any switch to lower alcohol content drinks (eg to light beers)[47].

Table 3.13: Estimated reduction in alcoholic beverages consumed as a consequent of lowering the legal adult BAC limit

BAC band	Estimated aggregated reduction in alcoholic beverages consumed			
	Year 1		Year 2	
	In litres	% of total	In litres	% of total
BAC 51-80 mg/dL to < 50 mg/dL	108,700	-0.024%	164,900	-0.036%
BAC over 80 mg/dL to < 50 mg/dL	11,000	-0.002%	16,800	-0.004%
BAC over 80 mg/dL to 51-80 mg/dL	4,600	-0.001%	6,900	-0.002%
BAC 50 mg/dL to < 30 mg/dL (note 1)	15,900	-0.003%	24,100	-0.005%
Total	**140,100**	**-0.031%**	**212,700**	**-0.047%**

Notes:
1. This is based on a 25% reduction in alcohol consumed per drinking session by drinkers in the BAC band under 50 mg/dL.
2. All percentages are calculated based on annual total alcohol available consumption (457 million litres in 2012).
3. Estimates for future years are expected to increase with the growth in population over 15 years of age.
4. Figures may not sum to total due to rounding.

[47] The use of wider alcohol policy options (eg around taxation and alcohol content information provision) could potentially facilitate a switch to lower alcohol content drinks without significantly affecting the value consumers placed on drinking while such a switch could improve the overall road safety risk, all things being equal.

3.3.3 Estimated reduction in social cost of crime

BERL (2009)[48] estimated that the annual total justice sector cost of harmful alcohol use was $792 million[49] in 2005/06 dollars. This covers a range of tangible and intangible costs resulting from alcohol-related offences (such as violence, property damage and disorderly behaviour). The estimate has been adjusted for inflation to 2013 dollars using a 2% annual inflation rate and has been used as the basis for calculating potential change in social cost of crime should total alcohol consumption reduce.

Although not every drinker will commit a crime after drinking, the likelihood of crime involvement is likely to increase with the amount of alcohol consumed. This is because the level of BAC can affect alertness and judgement. It can also result in a decrease in patience and self-control. However, due to factors other than alcohol, reducing alcohol consumption will not eliminate the incidence of crime involvement.

It is difficult to establish the likely reduction in alcohol-related crime following a reduction in alcohol use. To get a sense of the potential scale of such impact, the analysis assumes the reduction is proportionate to the percentage reduction in the overall amount of alcohol consumed. For the purpose of the analysis, it has been assumed that any change in the level of drinking at a BAC below 80 mg/dL is unlikely to result in noticeable impact on crime. Therefore, the analysis assumes crime reduction occurs only to those who would reduce drinking from a BAC over 80 mg/dL. Table 3.14 summarises the estimated result.

Table 3.14: Estimated reduction in social cost of crime

$ million	Year 1 2014	Year 2 2015	10-year total in present value
Estimated reduction in social cost of crime	**$0.03**	**$0.05**	**$0.32**

It is uncertain how accurate BERL's estimates are and critiques have argued their estimates over-stated the true social cost of crime resulting from alcohol use. Recognising it is a relevant factor, the potential reduction in social cost of crime is included in the analysis. However, exclusion of this potential benefit does not have material impact on the overall results.

48 BERL (2009), "Costs of Harmful Alcohol and Other Drug Use", Report to Ministry of Health and Accident Compensation Corporation.

49 BERL's original estimate also included $98m health care costs to victims, which has been deducted to avoid double counting (p.143 of BERL, 2009).

3.3.4 Reduction in health care costs

It is expected that the positive effect on health would be somewhat moderate. This is because most alcohol related health care costs are incurred by heavy drinkers and the policy is not expected to result in significant changes to their drinking behaviour. To avoid overstating the health effects, the analysis also assumes health care cost reduction occurs only to those who would reduce drinking from a BAC over 80 mg/dL.

The base estimate of the total alcohol related health care costs was sourced from BERL (2009), which estimated that the annual total health sector cost of harmful alcohol use was $290 million[50] in 2005/06 dollars. This covers a range of costs including hospital, pharmaceuticals, primary treatment of drinkers, ambulances and treatment for victims of crime. The estimate has been adjusted for inflation to 2013 dollars using a 2% annual inflation rate and has been used as the basis for calculating potential change in health care costs should total alcohol consumption decline.

The resulting estimates of reduction in health care costs are given in Table 3.15.

Table 3.15: Estimated reduction in health care costs

$ million	Year 1 2014	Year 2 2015	10-year total in present value
Estimated reduction in health care costs	**$0.01**	**$0.02**	**$0.12**

Again, it is uncertain how accurate BERL's estimates are, however, exclusion of this potential benefits does not have material impact on the overall results.

[50] BERL (2009), p. 144.

3.3.5 Reduction in cost of alcohol-related absenteeism

Lowering the adult BAC limit could potentially reduce the cost of alcohol-related absenteeism if alcohol users decided to reduce alcohol consumption, albeit only a small proportion of drinkers would do so (see behavioural assumptions listed in Table 3.5).

Equation (3.2) describes how the reductions in cost of absenteeism were calculated.

$$\begin{bmatrix}\text{Estimated}\\\text{reduction}\\\text{in total cost of}\\\text{alcohol related}\\\text{absenteeism}\end{bmatrix}_k = \begin{bmatrix}\text{Number of}\\\text{drivers over}\\\text{20 years}\\\text{of age}\end{bmatrix}_k * \begin{bmatrix}\text{Percentage}\\\text{of drivers}\\\text{in the}\\\text{BAC band}\end{bmatrix}_k * \begin{bmatrix}\text{Assumed}\\\text{percentage}\\\text{of drivers}\\\text{reducing}\\\text{alcohol use}\end{bmatrix}_k * \begin{bmatrix}\text{probability of}\\\text{absenteeism}\\\text{due to alcohol}\\\text{use}\end{bmatrix} * \begin{bmatrix}\text{Estimated}\\\text{number of days}\\\text{off days due to}\\\text{alcohol use}\end{bmatrix} * \begin{bmatrix}\text{Adult}\\\text{medium}\\\text{daily}\\\text{earnings}\end{bmatrix}_k \quad (3.2)$$

where k = BAC bands (50 mg/dL and below, between 50 mg/dL and 80 mg/dL and over 80 mg/dL).

The first three terms of equation (3.2) have been discussed in earlier sections. Results of the New Zealand Alcohol and Drug Use Survey[51] shows that around 6.6% of drinkers aged between 16 and 64 years had days off work (or school) due to alcohol use. The weighted average length of days off work for the surveyed sample is three days. Data from Statistics New Zealand shows the median earnings per day in 2012 was $175.60. This estimate has been used as a proxy for the productivity lost due to absenteeism. Results are shown in Table 3.16.

Table 3.16: Estimated reduction in cost of alcohol-related absenteeism

BAC level \ $ million (2013 prices)	Year 1 2014	10-year total in present value
BAC 51-80 mg/dL	$0.17	$1.9
BAC over 80 mg/dL	$0.02	$0.15
BAC 50 mg/dL and below	$0.05	$0.39
Total	**$0.25**	**$2.44**

These estimates exclude any potential productivity lost resulting from a small increase in licence suspended (to be discussed in Section 4).

These estimates are subject to high level of uncertainties, however, exclusion of this potential benefits does not have material impact on the overall results.

[51] Ministry of Health (2009), "Alcohol use in New Zealand: Key Results of the 2007/08 NZ Alcohol and Drug Use Survey", (see Table 30). http://www.moh.govt.nz/notebook/nbbooks.nsf/0/63710986AF203C1ACC25768100835282/$file/alcohol-use-in-nz-0708-survey.pdf.

4. Costs

As discussed in Section 2, there are four broad categories of costs associated with the policy proposal. These include:

- an increase in transport costs incurred to prospective alcohol-impaired drivers who decide to take alternate transport options
- a reduction in consumer surplus from drinking sessions
- a reduction in benefits (producer surplus) to the hospitality industry from reduced alcohol sales
- an increase in government administrative costs of handling extra infringements and licensing related transactions.

The last cost component can be further broken down into the following items:

- an increase in licensing related operating costs (eg issuing of warning letters, suspension notices and limited licences), to the NZ Transport Agency, resulting from an increase in the number of demerit infringements issued
- an increase in infringement processing and collection costs, to the NZ Police and Ministry of Justice, due to an increase in the number of demerit infringements issued
- an increase in costs to the NZ Police and Ministry of Justice on attendance at additional defended cases in relation to drink-driving offences, limited licence applications, driving while suspended cases and driving in contrary to limited licence provisions
- additional costs of one-off system change, education and promotion to the NZ Transport Agency

When assessing the potential impact of the policy proposal on the number of infringement offences detected, it has been assumed that there is no change in the level of drink-driving related road policing hours. However, it is anticipated that NZ Police will continue with their risk-targeted road policing operation and the use of intelligence-led approach to develop an annual thematic calendar of higher risk events and times, which will also influence the planning of the national road safety advertising programme run by the NZ Transport Agency, to enhance the effectiveness of both.

These costs are discussed in detail in the following sections.

4.1 Changes in transport costs

Equation (4.1) describes how changes in transport cost are estimated.

$$\begin{bmatrix}\text{Estimated}\\ \text{change in}\\ \text{transport}\\ \text{costs}\end{bmatrix}_{j,k} = \begin{bmatrix}\text{Percentage}\\ \text{of drivers with}\\ \text{behavioural}\\ \text{changes}\end{bmatrix}_{j,k} * \begin{bmatrix}\text{Estimated}\\ \text{number of}\\ \text{drivers}\end{bmatrix}_{j,k} * \begin{bmatrix}\text{Assumed}\\ \text{percentage}\\ \text{change}\\ \text{in transprt}\\ \text{needs}\end{bmatrix}_{j} * \begin{bmatrix}\text{Average}\\ \text{annual VKT}\\ \text{per driver}\end{bmatrix}$$
$$* \begin{bmatrix}\text{Percentage}\\ \text{of trips}\\ \text{with BAC}\\ \text{at various}\\ \text{level}\end{bmatrix}_{k} * \begin{bmatrix}\text{Weighted}\\ \text{average cost}\\ \text{per kilometre}\\ \text{by transport}\\ \text{mode}\end{bmatrix}_{k} \quad (4.1)$$

where j = behavioural response category; k = BAC bands (50 mg/dL and below, between 50 mg/dL and 80 mg/dL and over 80 mg/dL); VKT = vehicle kilometres travelled.

For drivers who would choose to take an alternate transport arrangement, there could be an increase in transport costs. Household Travel Survey[52] found that of those who required non-driving motorised travel[53] after drinking sessions, over 80% chose to travel as passengers[54] with the remaining choosing to travel by taxi (see Table 4.1). However, only the cost of taxi trips could be counted as additional costs, which has been assumed to average $2.80 per kilometre[55] (excluding GST).

Table 4.1: Share of motorised mode of transport by BAC level

Motorised mode	BAC 50 mg/dL and below	BAC over 50 mg/dL
Car passengers	88.7%	82.3%
Taxi	11.3%	17.7%

Source: Household Travel Survey (2005-2009)

For drivers who would switch to home-based[56] drinking venues, the analysis assumes transport needs after the drinking sessions will reduce by 50%. In other words, the analysis assumes there is a 50% chance that the concerned driver would be drinking at their own home and therefore would not require transport (or to travel) after drinking. In this scenario, reduction in transport cost associated with driving is based on a vehicle operating cost of $0.27 per kilometre (source: NZ Transport Agency's Economic Evaluation Manual based on average speed 70 km/h at 3% gradient).

To estimate travel cost effects following the policy change, it is necessary to estimate the amount of travel that is currently driven by drivers with a BAC over 50 mg/dL. The Household Travel Survey[57]

[52] McSaveney, J and Povey, L (2010), ibid.
[53] This analysis ignored walking and public transport.
[54] The cost of travelling as a passenger could be lower than as a driver because the vehicle may be used to drop off multiple drinkers. To be conservative, the analysis assumes there is no cost savings for riding as a passenger.
[55] It has been assumed average cost per taxi ride is between $3 and $3.5 per kilometre (including 15% GST).
[56] Home-based venues include venues at both own-home and other home.
[57] McSaveney, J (2009), "Alcohol consumption in the Ongoing New Zealand Household Travel Survey", Paper presented at the Australasian Transport Research Forum 2009.

indicates that approximately 0.12% of the trips made during high alcohol hours[58] were driven by drivers with a BAC between 51-80 mg/dL and 1.83% by drivers with a BAC over 80 mg/dL. Data from the Household Travel Survey estimated that an adult driver over 24 years old travels an average of 10,594 kilometres[59] a year. This means the average total annual kilometres[60] driven with a BAC of between 51-80 mg/dL per driver was 12.7 kilometres and 193.9 kilometres per person for drivers with a BAC over 80 mg/dL.

Combining the above information with data on the driver population and the proportion of drivers with behavioural change assumptions, Table 4.2 summarises the estimated changes in transport costs by BAC band and behavioural responses. The reduction in travel attributable to a change in behaviour to home-based drinking is estimated at $0.22 million in year 1 and $0.32 million in year 2. This reduction in own-vehicle transport costs will be offset by the increase in the demand for transport (taxi), estimated at $0.36 million in year 1 and $0.54 million in year 2. Hence, the net impact will be a small increase in transport costs of around $0.1m to $0.2m a year. In total, transport costs account for around 7% of the estimated total cost of the policy change.

Table 4.2: Estimated changes in transport costs

$ million (2013 prices) / BAC level and behavioural response	Year 1	Year 2	10-year total in present value
Reduction in travel requirement due to switching to home-based drinking venues			
BAC 51-80 mg/dL	-$0.03	-$0.04	-$0.30
BAC over 80 mg/dL	-$0.05	-$0.07	-$0.53
BAC 50 mg/dL and below	-$0.14	-$0.21	-$1.54
Estimated reduction in transport costs	**-$0.22**	**-$0.32**	**-$2.37**
Increase in demand for transport (taxi) due to increase in non-driving transport arrangement			
BAC 51-80 mg/dL	+$0.04	+$0.06	+$0.42
BAC over 80 mg/dL	+$0.07	+$0.10	+$0.74
BAC 50 mg/dL and below	+$0.25	+$0.38	+$2.75
Estimated increase in transport costs	**+$0.36**	**+$0.54**	**+$3.91**
Net impact on transport costs	**+$0.14**	**+$0.21**	**+$1.54**

Note: Figures may not sum to totals due to rounding.

The exclusion of other travel options (eg public transport and walking) means the analysis is likely to overstate the transport cost impact. Furthermore, there could be a net decrease in transport costs through greater use of car-pooling, an aspect that has not been allowed fro in this analysis.

[58] "High alcohol hours" are defined as those between 10pm and 4am daily, plus 4am-6am on Fridays, Saturdays and Sundays and are defined based on motor vehicle crash risk due to alcohol.

[59] Household Travel Survey data shows adult between 15 and 24 years tend to travel less (average 7,900 kilometres per year). Therefore, the use of 10,594 kilometres for all adults over 20 years may overstate the transport cost requirement.

[60] The proportion of trips by drivers with a positive BAC for all times of the day is 0.09% for BAC of 51-80 mg/dL and 0.14% for BAC over 80 mg/dL. Therefore, using the trip proportions for high alcohol hours to estimate the annual distance travelled with BAC over 50 mg/dL is likely to overstate the potential increase in transport costs, which means the estimated BCR would be conservative.

4.2 Loss in consumer and producer surpluses

When an individual reduces the amount of alcohol consumed, all things being equal, the total value (or utility) to this individual from alcohol consumption reduces. In economics, this is measured by consumer surplus. Similarly, producers will incur a loss in producer surplus. It has been assumed that the size of the change in producer surplus is a mirror image[61] of consumer surplus.

In the longer term, the law change may manifest a change in drink-driving culture and result in a shift in the demand for alcohol consumption (for those who would drink then drive). Such a cultural change is also likely to reduce the price sensitivity of alcohol demand[62] (because price would become less of a determinant). However, it is difficult to predict exactly how the new demand curve may look. For some individuals, the value they place on the amount of alcohol they would still be enjoying might in fact increase[63].

It must be stressed that the drink-driving law does not restrict the amount of alcohol consumers may choose to consume. They may consume any level of alcohol provided they do not drive when they are impaired and exceed the legal allowable limits. There are many strategies consumers can take to minimise any utility lost (eg switch to low alcohol drinks or resume drinking after returning home) and similarly that producers can take (eg offer low alcohol drinks or courtesy car services for patrons).

To simplify the assessment, it has been assumed that following the policy change, there will be no overall change in the value to consumers for the amount of alcohol they would still be able to consume before driving. The analysis also assumed that there is no change in utility from alcohol consumption for drivers who would switch drinking venues or take alternate transport[64]. Therefore, the analysis focused on the deadweight loss (the sum of the loss in consumer and producer surpluses) from a reduction in alcohol consumed.

To estimate the deadweight loss from reduced alcohol use, it is necessary to estimate the equivalent price change (note that this is not an actual price change). This can be estimated by using equation (4.2)[65].

$$\Delta \mathrm{P} = \frac{\Delta \mathrm{Q}}{\mathrm{Q}} \times \frac{\mathrm{P}}{\varepsilon} \qquad (4.2)$$

where Δ represents change, P = generalised cost of alcohol use, Q = quantity of alcohol consumed.

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[61] This might not necessarily be the case because the price elasticity of supply can be very different from that of demand. However, given the estimated reduction in alcohol consumption is low, this simplification is unlikely to materially effect the overall conclusion.

[62] This means the slope of the new demand curve will be steeper (therefore, a change in price will have a lower impact on volume compared to previously).

[63] This is the case if the new demand curve is steeper than the original demand curve such that the two demand curves cross over.

[64] Arguably drinkers who would prefer to drive after the consumption of alcohol will have lower utility after the policy change if they change their behaviours. On the other hand, the utility for the wider community will increase when the number of alcohol-impaired drivers falls (eg the utility to sober drivers travelling during high alcohol hours will increase as the number of drink-driver falls as these drivers will feel safer to travel during those periods after the policy change). Therefore, the net effect is likely to be positive (ie there is an overall gain in utility). This analysis essentially assumed the two effects cancel out. However, the analysis did allow for a possible loss in utility due to a reduction in alcohol consumption.

[65] This is based on the standard price elasticity of demand formula, $\varepsilon = \frac{\Delta \mathrm{Q}}{\mathrm{Q}} \times \frac{\mathrm{P}}{\Delta \mathrm{P}}$.

The loss in consumer surplus (or producer surplus) can then be estimated using the rule of half (equation 4.3).

$$\Delta \text{ CS or } \Delta \text{ PS } = {}^{1}/_{2}\, \Delta \text{ P} * \Delta \text{ Q} \qquad (4.3)$$

As discussed in Section 2.3, the assumed price elasticity of alcohol consumption varies with alcohol level with a weighted average of -0.5. Changes in quantity of alcohol consumed were discussed in Section 3.2.1.

To estimate the cost associated with a reduction in the consumption of alcoholic beverages, data on the average price[66] of alcoholic beverages by beverage type, premise and total alcohol available for consumption (in litres) were obtained from Statistics New Zealand. To remove excise duty, excise duty rates were obtained from the New Zealand Customs Service[67].

Analysis shows the weighted average price of alcoholic beverages of all types is $6.70 per litre (at off license venues including home-based venues), excluding GST and excise duty. For the purposes of the analysis, a $7 per litre of alcoholic beverage was used as the mid-range estimate with $5 and $9 used as the low and high scenarios.

Data shows that the 'on licence' mark-up of alcoholic beverages varies considerably with beverage type, the lowest mark-up is for wine and spirit-based drinks (at 130-140%), and the average mark-up for beer is around 210% and 500% for spirit drinks. However, wine and beer are by far the most popular choices of alcoholic beverage (together they account for 85% of total alcoholic beverage consumption in New Zealand). Since many restaurants also allow BYO-wine (which may be subject to a small corkage charge), the average additional cost of drinking at non-home based venues is unlikely to be more than 100% of the base price.

Using a 100% mark-up, the analysis assumed per litre cost of an alcoholic beverage at non-home based venues is $14 per litre (excluding GST and excise duty). In the sensitivity analysis, a mark-up of 50% and 150% were used for the low and high scenarios.

Using equation (4.3), estimates were made by BAC level. Appropriate population growth was then applied for future years. Table 4.3 summarises the estimated reduction in consumer and producer surpluses. Together, they account for 8% of the estimated total cost of the policy change.

Table 4.3: Estimated reduction in consumer and producer surpluses

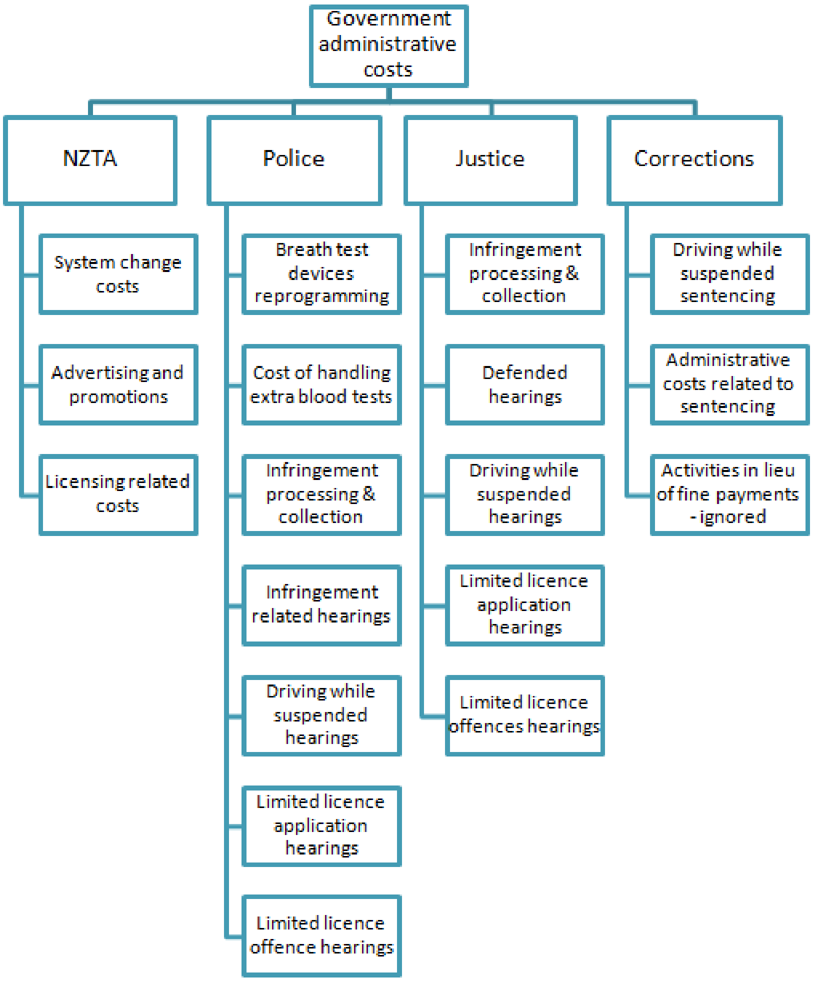
$ million (2013 prices) / BAC level	10-year total (in present value)	
	Consumer surplus	**Producer surplus**
BAC 51-80 mg/dL	$0.90	$0.90
BAC over 80 mg/dL	$0.02	$0.02
BAC 50 mg/dL and below	$0.01	$0.01
Total	**$0.93**	**$0.93**

[66] The price data (unpublished) was for December 2011 quarter. These prices were inflated to 2013 dollars by the CPI-alcoholic beverages obtained from Statistics New Zealand.
[67] http://www.customs.govt.nz/news/resources/thetariffsat1january2010/Documents/Excise%20and%20excise-equivalent%20duties%20table.pdf

4.3 *Changes in government administrative costs*

Figure 4.1 summarises the type of administrative costs to be incurred to various government agencies as a result of the policy proposal.

Figure 4.1: Administrative costs to government



Based on the assumed percentage of drivers by behavioural response category for each BAC band, estimates of potential drink-driving related infringement offences (for BAC 51-80 mg/dL) and reductions in drink-driving related traffic offence (for BAC over 80 mg/dL) were made. These were used to estimate the volumes of warning letters, suspension notices and limited licence applications under the policy options. All of the projected estimates discussed in this section take into account population growth effects.

4.3.1 Estimated number of drink-driving infringement offences

In 2012, a total of 22,454 drink-driving related traffic offences[68] were committed by adults over 20 years of age. If there is no change in behaviour under the policy proposal, the number of infringement offences (BAC 51-80 mg/dL) could be as high as 38,450. This estimate is based on the relative share of drivers in the BAC 51-80 mg/dL and over 80 mg/dL bands[69]. This volume, however, will likely reduce as the policy change should alter the behaviour of many law-abiding citizens. For example, if 30% (year 1 mid-range assumption) of drivers do change their behaviours, the expected infringement volume would reduce to 26,920.

However, drivers with a BAC of 51-80 mg/dL may be more difficult to detect than those over 80 mg/dL because these drivers are less likely to show apparent signs of alcohol impairment, unless they are stopped and breath tested. Therefore, a correction for a lower detection level is needed. Since the level of deterrence is affected by the level of detection, the detection rate adjustment will need to vary with the behavioural response assumptions.

For the purpose of the analysis, a correction factor of 0.7 was used for the mid-range behavioural response scenario, with 50% and 90% as the low and high benefit scenarios respectively. The resulting estimated drink-driving related infringements (at 51-80 mg/dL) are 18,840. Population growth is then applied to estimate future volumes. The final results are 19,100 detected infringements in 2014 and 15,200 in 2015. The volume in 2014 is higher because the analysis assumes full effects occur from Year 2 (or 2015).

4.3.2 Estimated number of licensing related transactions

Under the policy proposal, a driver caught with a BAC of 51-80 mg/dL will be issued with an infringement notice with 50 demerit points. Currently NZ Transport Agency issues warning letters to drivers who have accumulated 50 demerit points. This means in theory, NZ Transport Agency will need to issue a warning letter for each detected drink-driving infringement offence notice (ION) issued (unless a suspension notice[70] needs to be issued instead). Alternatively, a statement could be included in the ION to minimise such cost (there could be cost of printing new forms if this option is chosen). However, under the current legislation, a warning letter must be issued at 50 points, at a cost of $0.69[71] per letter. According to NZ Transport Agency's experience, every 100 warning letters generate 41 inquiries to help desk enquires, at a cost of $8.02 per call.

To estimate the volume of licence suspensions (due to demerits), limited licence applications and the number of offenders caught driving while suspended, the following information and assumptions have been used:

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[68] Over the last two years to 2012/13, Police carried out over 3.5 million breath alcohol screenings a year. This breath test programme resulted in around 26,500 evidential breath alcohol offences (or 0.8%) in 2012.

[69] Being 22,454 * 1.37% / 0.8% (1.37% is the percentage of drivers in the 51-80 mg/dL band and 0.8% is for those over 80 mg/dL) – see Table 3.4.

[70] A suspension notice is issued when a driver accumulates 100 demerit points within a two-year period. In 2011/12, NZ Transport Agency issued 25,694 licence suspension notices and there were 571,176 traffic infringements with demerit points attached (ie 0.045 suspension notices per demerit infringement).

[71] Source: NZ Transport Agency

- NZ Transport Agency currently issues around 0.045 suspension notices per infringement and around 60% are successfully served[72]. The average number of demerit points assigned per ION issued will increase with the new offence category. Because the estimated increase in IONs is low (mid-range estimate of 3.3%) relative to the total number of IONs, the increase in the average number of demerit points per ION is also low. For the purpose of the analysis, the assumed average number of demerit points per ION is 25 points[73], which will increase to 25.64 points (or a 2.6% increase) with the new offence category. This means the time required to accumulate 100 demerit points will be shortened (at 0.046 suspension notice per infringement).
- There are currently 0.283 driving while suspended[74] (DWS) offences per successful licence suspension. This means there could be an increase of between 120 and 150 DWS offences resulting from the policy change.
- Many of the offenders who had their licences suspended could require them for work or commuting purposes. The analysis assumes 8.9% of successfully suspended drivers will apply for a limited licence[75]. Approximately 95 percent of all limited licence applications are granted or granted by consent[76]. The unit cost for Police is $77.50 per application[77], irrespective of whether the application is successful. The unit cost for Ministry of Justice is $33 per application.

The analysis also looked at the changes in the number of infringement defended hearing cases and the number of limited licence offence related prosecutions. These are based on the following assumptions:

- 5% of drivers caught with a BAC of 51-80 mg/dL defend their cases
- 3.5 percent of limited licence holders commit driving offences contrary to licence conditions (in 2011/12 there were 120 such offences and 3,468 limited licences issued)

Table 4.4 summarises the estimated increases in infringement notices, warning letters, suspension notices and other related transaction volumes for the first two years. These volumes are expected to increase slightly over time due to growth in population.

[72] In 2011/12, Police served 7,194 suspension notices and NZ Transport Agency served 8,325. This means of the total 25,694 suspension notices issued, 10,175 were not unsuccessful.

[73] If the average number of demerit points per ION is 20, the increase will be 3.8%. For a baseline average of 30 points, the increase will be around 1.7%. Either of these rates have only a very small impact on the suspension rate.

[74] In 2011/12, 4,395 driving while suspended and 15,519 suspension notices were successfully served.

[75] Over the five years to 2011, there were an average of 1,380 limited licence applications per year, including 1,365 demerits related, 14 driving while suspended related and 2 driving while disqualified related. In 2011/12, there were around 15,520 successful licence suspension notices served (1,380/15,520 = 8.9%).

[76] Of the 1,380 applications, around 1,330 were granted or granted by consent.

[77] This assumes each application take 58 minutes to process at an hourly rate of $80.17 (Source: NZ Police).

Table 4.4: Estimated infringement and other licensing related volumes – BAC 51-80 mg/dL group

Transaction	2014	2015
Estimated increase in the number of drink-driving IONs	19,080	15,170
Estimated additional warning letters issued	18,194	14,470
Estimated increase in the number of defended infringements	954	759
Estimated additional number of suspension notices issued	886	700
Estimated additional suspension notices served (note)	535	423
Estimated additional limited licence applications	48	38
Estimated additional limited licence related offences	2	1
Estimated additional DWS offences	152	120

Note: The analysis assumed all licence holders with suspension notices successfully served will apply for licence reinstatement when the suspension period finishes. However, the actual reinstatement rate is likely to be lower which means the cost estimates may be on the high end.

4.3.3 Estimated increase in blood test volume

In New Zealand, breath testing is used for both screening and evidential purposes. Under the current regime, blood testing can be used as a check on the accuracy of the breath testing. Furthermore, NZ Police can require a blood test if the person refuses to do a breath test. Blood testing can also be requested by the offenders under some circumstances. This analysis assumed this blood testing regime will be expanded to include drivers caught at 51-80 mg/dL. If blood testing were not an option for drivers detected at 51-80 mg/dL, the estimated costs to NZ Police would be lower and the estimated NPV and BCR would be higher.

Table 4.5 shows the historic data on the number of evidential breath alcohol (EBA) traffic offences and the number of blood samples tested over the years from 2006 to 2012. It shows that, on average, there was an average of 0.21 blood tests per EBA offence. Applying this rate to the estimated increase in drink-driving related IONs (at 51-80 mg/dL), the estimated number of additional blood tests required is 4,030 in 2014 and 3,200 in 2015, which increases slightly over time due to growth in population.

Table 4.5: Number of EBA traffic offences and blood tests

	Number of blood samples tested	Total number of EBA (all age group)	Average number of blood tests per EBA
2006	5,683	27,423	0.21
2007	6,465	31,299	0.21
2008	6,925	34,166	0.20
2009	6,939	34,299	0.20
2010	6,499	31,170	0.21
2011	6,680	30,087	0.22
2012	5,599	26,503	0.21

If some of the alcohol-impaired drivers with BAC > 80 mg/dL also exhibit behavioural changes, this volume will reduce slightly as the total number of drink-driving offence reduces (see Table 3.10).

4.3.4 Estimated administrative costs to enforcement agencies

To estimate the cost implications to enforcement agencies, available current average unit cost estimates have been used. Otherwise appropriate assumptions are made. These are summarised in Table 4.6.

Table 4.6: Unit costs and one-off costs assumptions

Agency	Cost item	Note	Unit cost (GST excl)
Police	Breath test device reprogramming (there are a total of around 3,000 devices)	1	$120 (one-off)
	Ticket processing and infringement fees collection (back office administration)		$4 (hand-written) $2 (SMART device or equivalent) (assumed)
	Cost of officer time spent issuing drink-driving ION (assumed average 10 minutes at $111.83/hour)	2	$18.64
	Cost of blood test per sample (21.1% are tested)		$318
	Cost of attending limited licence application hearings	3	$77.5
	Cost per defended hearing	3	$430.4
NZ Transport Agency	One-off cost of education and promotion		$100,000 (one-off)
	Cost of issuing warning letters		$0.69
	Cost of serving suspension notices		$53.51
	Cost of processing limited licence applications		$40.88
	Cost of licence reinstatement cost	4	$66.04
	Cost of help desk enquiries (applies to 41% of additional warning letters issued)		$8.02
Justice	Fine collection and enforcement cost per ION filed	5	$26.09
	Limited licence application hearings – cost per application	6	$33
	Cost per defended hearing	3	$269.10
Corrections	Prison, home detention & community sentence cost		$352 (per DWS case)
	Infringement related activities in lieu of fine		Small and ignored

Notes:

1. This excludes devices that would need to be reprogrammed during the normal course of recalibration.
2. In the Vehicle Licensing Reform project conducted in 2012, it was estimated that on-road enforcement costs $111.83 per hour. This estimate includes officer time, vehicle, equipment and other capital costs.
3. Cost estimates apply to driving while suspended (DWS); limited licence offences; infringements related and BAC over 80 mg/dL cases.
4. The analysis assumed drivers of all licence suspensions successfully served will have their licence re-instated.
5. This is based on 2013 analysis of the Vehicle Licensing Reform project (in relation to Annual Vehicle Licensing) carried out by NZ Institute of Economic Research.
6. Justice estimated that each event of limited licence hearings costs $30. The analysis has assumed one event per successful application and 2 events per unsuccessful application. This means the average cost of Justice hearing per limited licence application is $33.
7. Data source: Department of Corrections, NZ Police, NZ Transport Agency and Ministry of Justice.

Table 4.7 summarises the additional cost to the enforcement agencies for meeting one-off costs of implementing the policy change and for handling increased infringement and licensing related transactions.

Table 4.7: Estimated increase in government administrative costs of handling BAC 51-80 mg/dL related offences

Item	Year 1 $million	Year 2 $million	10-year total (Present value) $million
Police - one-off cost (programming breath test device)	$0.360	n/a	$0.360
Police - on-going cost:			
Infringement processing	$0.419	$0.333	$2.585
Limited licence application hearing	$0.004	$0.003	$0.023
Defended hearing - Infringement related	$0.411	$0.326	$2.536
Defended hearing - limited licensing offences	$0.001	$0.001	$0.004
Defended hearing - DWS	$0.065	$0.052	$0.401
Blood sample testing	$1.282	$1.019	$7.917
Sub-total: Police	**$2.54**	**$1.73**	**$13.83**
NZ Transport Agency - one-off cost (system change and promotion)	$0.100	n/a	$0.100
NZ Transport Agency - on-going cost:			
Handling extra warning letters	$0.013	$0.010	$0.078
Handling extra helpdesk enquiries	$0.060	$0.048	$0.370
Handling extra suspension notice	$0.047	$0.037	$0.291
Handling extra limited licence applications	$0.002	$0.002	$0.012
Licensing related (re-instatements and cancellations)	$0.003	$0.002	$0.019
Sub-total: NZ Transport Agency	**$0.225**	**$0.099**	**$0.870**
justice sector - on-going cost:			
Infringement processing	$0.249	$0.198	$1.537
Limited licence application hearing	$0.002	$0.001	$0.010
Defended hearing - Infringement related	$0.257	$0.204	$1.586
Defended hearing - limited licensing offences	$0.0004	$0.0004	$0.003
Defended hearing - DWS	$0.041	$0.032	$0.251
Corrections related costs	$0.053	$0.042	$0.328
Sub-total: Justice & Corrections	**$0.602**	**$0.478**	**$3.714**
Total Government administrative costs	**$3.37**	**$2.31**	**$18.42**

Note: Figures may not sum to total due to rounding.

This table excludes the spillover effects from alcohol-impaired drivers with BAC greater than 80mg/dL. If drivers with a BAC over 80 mg/dL reduce drink-driving violations (through a range of behavioural changes discussed in Section 3.1.5), there would be additional IONs (at 51-80 mg/dL) and related transactions. As discussed in Section 3.2, with a 9% behavioural change by alcohol-impaired drivers with BAC greater than 80 mg/dL, the number of traffic offences could reduce by 2,000 per year (from year 2 under the mid-range benefit scenario), which could potentially reduce defended hearing costs to Police and Justice by $1 million and $0.75 million per year respectively. The estimated costs for the individual items are very small and therefore are not reported separately in this report.

Table 4.8 summarises the overall impacts on government administrative costs.

Table 4.8: Estimated changes in government administrative costs

Item	Year 1 $million	Year 2 $million	10-year totals (Present value) $million
Estimated increase in administrative costs due to a new offence category (BAC 51-80 mg/dL)			
Police	$2.54	$1.73	$13.83
NZ Transport Agency	$0.23	$0.10	$0.88
justice sector	$0.60	$0.48	$3.71
Sub-Total	**$3.37**	**$2.31**	**$18.42**
Estimated reduction in administrative costs due to a reduction in the number of offenders with BAC > 80 mg/dL (also refer to Section 3.2)			
Police	-$0.66	-$1.01	-$7.21
justice sector	-$0.49	-$0.75	-$5.39
Sub-Total	**-$1.15**	**-$1.76**	**-$12.60**
Net total	**$2.21**	**$0.55**	**$5.82**

4.4 Compliance costs to offenders

Table 4.9 summarises the assumptions used to estimate the compliance costs to offenders (i) regarding the extra time taken to conduct evidential breath test; and (ii) the time taken for fine payments. There could be additional compliance costs to offenders who end up having their licence suspended. However, as shown in Table 4.4 the estimated increase in the number of licence suspensions is relatively small (around 500). Therefore, inclusion of such compliance costs is unlikely to have material impact on the overall results of the policy proposal.

Table 4.9: Assumptions related to compliance costs to offenders

Cost item	Assumed average time taken	Cost per hour	Source
Extra time for evidential breath test	10 minutes	$9.45	NZ Transport Agency's EEM (based on value of leisure time)
Time taken for fine payment	15 minutes	$17.00	Statistics New Zealand (This is based on total weekly earnings divided by total working age population, then by 38 hours.)

The estimated compliance costs (excluding any other compliance costs borne by the offender resulting from licence suspensions) are relatively low, at around $100,000 per year (or $.069 million over a 10-year period, in PV).

4.5 Other impacts not considered

While attempts have been made to include all the relevant and material costs and benefits for the CBA, this analysis has excluded the following items due to a lack of available information at the time of preparing this report. Further, it is considered that these additional elements have a relatively low level of influence on the result. Some of the items also do not affect the national CBA.

These items include:

- any potential financial implications around legal aid
- any potential increase in the costs around supervising community work as the number of demerit offences increases
- any potential cost impact on the vehicle impoundment regime following a relatively small potential increase in driving while suspended offences
- any potential increase in demerit infringement revenue (as they are transfer payments and therefore are not included in the CBA)
- any costs associated with vehicle impoundment when drivers caught driving while suspended (DWS), this could is expected to be low given the small increase in DWS cases
- any licensing related operations surplus or deficit - the NZ Transport Agency recovers cost from licence re-instatements and limited licence applications and they can run a

surplus or deficit from these transactions due to discrepancies between actual and forecast transaction volumes. However, cost recoveries are transfer payments and are therefore not included in the CBA.

- any effect of other alcohol consumption related policy changes being considered by other agencies (eg increase in alcohol excise)
- the costs and benefits for other BAC limits - information on share of the driving population (during high alcohol hours) and detailed crash data by alcohol level is available only for BAC of under 50, 51-80 and over 80 mg/dL. This data gap has limited the policy options to be analysed (eg it is not possible to analysis the effects of lowering the legal limit to 40 mg/dL or 60 mg/dL).

5. Summary of results

Based on a 10-year evaluation period, the estimated net benefit of the lowering the legal adult BAC to 50 mg/dL is $200 million (NPV, in 2013 dollars) with a national BCR of around 10, under the mid-range scenario (see Table 5.1).

Table 5.1: Summary of costs and benefits of lowering the legal adult BAC limit to 50 mg/dL

	10-year total, in Present value $m		
	Low benefit scenario	Mid-range estimates	High benefit scenario
Benefits			
Road safety	$111.3	$207.2	$324.2
Reduction in absenteeism	$0.9	$1.9	$3.0
Improvement in health effects	$0.1	$0.1	$0.2
Reduction in social cost of crime	$0.2	$0.3	$0.4
Administrative cost savings to NZ Police	$4.8	$7.2	$9.6
Administrative cost savings to the justice sector	$3.6	$5.4	$7.2
Total benefits in present value	**$120.9**	**$222.1**	**$344.6**
Costs			
Net increase in transport costs	$1.7	$1.5	$0.5
Compliance costs to offenders	$0.7	$0.7	$0.4
Changes in consumer surplus	$0.3	$0.9	$1.1
Changes in producer surplus	$0.3	$0.9	$1.1
Administrative costs to NZ Police	$14.8	$13.8	$9.0
Administrative costs to NZ Transport Agency	$0.9	$0.9	$0.6
Administrative costs to the justice sector	$4.0	$3.7	$2.4
Total costs in present value	**$22.7**	**$22.5**	**$15.1**
Net present value (2014 to 2023) $m	**$98.1**	**$199.6**	**$329.5**
Benefit:Cost Ratio	**5.3**	**9.9**	**22.9**

Note: Figures may not sum to total due to rounding

Under the mid-range benefit scenario, total benefits are estimated at $222.1 million (2013 dollars). The largest benefit component of the policy change is road safety, estimated at $207 million (in present value or PV, 2014 to 2023). This represents around 93% of the estimated total benefits. The second largest benefits component is the potential reduction in administrative costs (resulting from a reduction in BAC > 80 mg/dL offences) to NZ Police and Ministry of Justice of $12.6 million (in PV, 2014 to 2023). These potential cost savings would result from a reduction in the number of offences caught at a BAC greater than 80 mg/dL. The remaining benefits are made up of reduced productivity lost due to absenteeism (ie days off from work), reduced health care costs and reduced social costs of crime (estimated at $2.4 million or 1% of the total).

Total costs under the mid-range benefit scenario are estimated at $22.5 million (2013 dollars). The largest cost component of the policy change is administration cost of handling extra offences, estimated at $18.4 million (in PV, 2014 to 2023), most of which is incurred by NZ Police. The second largest cost component is costs and disbenefits incurred to consumers of $3.15 million (in PV, 2014 to 2023), or 14% of the total. This is made up of a net increase in transport costs due to changes in drinking venues or transport arrangements, estimated at $1.5 million (in PV, 2014 to 2023); a loss in consumer surplus, resulting from a small reduction in alcohol consumption, estimated at $0.9 million (in PV, 2014 to 2023); and a small increase in compliance cost to offenders detected at a BAC between 51-80 mg/dL. The remainder item, amounts to $0.9 million, is incurred by the hospitality industry (loss in producer surplus).

The benefit estimates associated with crime, health and absenteeism are subject to higher level of uncertainty. However, even if these benefits are excluded, the BCR remains around 10.

6. Sensitivity analysis and Conclusion

6.1 Sensitivity analysis

There is a risk of optimism bias in the assessment of projects resulting from the over-estimation of benefits (or positive outcomes) and the under-estimation of costs (or likelihood) of negative events. To curb this potential optimism bias, sensitivity analyses have been carried out to test the impacts of changing the key assumptions on the final results.

Table 6.1 shows the sensitivity of the net benefit of the policy change (measured in NPV 2013 dollars) and the associated BCR by changing one assumption at a time.

Table 6.1: Sensitivity analysis of key assumptions (changing one at a time)

Under mid-range assumptions NPV = $199.6 m BCR = 9.9	**Mid-range assumption**	**Low benefit scenario**	**High benefit scenario**
1. Behavioural change assumptions (BAC 51-80 mg/dL)	**30% (Year 1) 45% (Year 2+)**	**10% (Year 1) 15% (Year 2+)**	**50% (Year 1) 75% (Year 2+)**
Revised NPV		$171 m	$226 m
Revised BCR		6.7	14.8
2. Behavioural change assumptions (BAC over 80 mg/dL)	**6% (Year 1) 9% (Year 2+)**	**4% (Year 1) 6% (Year 2+)**	**8% (Year 1) 12% (Year 2+)**
Revised NPV		$139 m	$260 m
Revised BCR		7.2	12.5
3. Behavioural change assumptions (BAC under 50 mg/dL)	**6% (Year 1) 9% (Year 2+)**	**4% (Year 1) 6% (Year 2+)**	**8% (Year 1) 12% (Year 2+)**
Revised NPV		$197 m	$202 m
Revised BCR (note)		9.9	9.8
4. Weighted average price elasticity of alcohol consumption	**-0.5**	**-0.4**	**-0.6**
Revised NPV		$199.2 m	$199.9 m
Revised BCR		9.7	10.0
5. Weighted average cost of alcohol per litre at home-based venues	**$7**	**$9**	**$5**
Revised NPV		$199.1 m	$200.2 m
Revised BCR		9.6	10.1
6. Alcoholic drinks price difference between home-based and non-home based venues	**100%**	**150%**	**50%**
Revised NPV		$199.2 m	$200.1 m
Revised BCR		9.7	10.1
7. Relative transport needs at home-based venues compared to other venues	**-50%**	**-25%**	**-75%**
Revised NPV		$171 m	$228 m
Revised BCR		8.2	11.7
8. Potential reduction in alcohol consumption by drivers currently with BAC under 50 mg/dL	**-25%**	**-50%**	**0%**
Revised NPV		$199.5 m	$199.7 m
Revised BCR		9.8	9.9

Note: The estimated BCR for the high benefit scenario is lower than that for the mid-range assumption because in this scenario there would also be a slight increase in the estimated loss in consumer surplus.

Table 6.2 shows the results applying the low and high benefit scenarios.

Table 6.2: Sensitivity analysis of making simultaneous change of assumptions

Under mid-range assumptions **NPV = $199.6 m** **BCR = 9.9**	**Low benefit scenario**	**High benefit scenario**
Revised NPV ($m)	$98	$329
Revised BCR	5.3	22.9

Figure 6.1 and Figure 6.2 show the Tornado plot of changes in the estimated NPV and BCR when the key assumptions are changed one at a time. They indicate that the most influential assumptions are behavioural change assumptions and assumed relative transport needs at home-based venues compared to other venues. The results are less sensitive to the assumption on price elasticity of alcohol consumption, cost of alcoholic beverages, price difference in alcoholic drinks between home-based and non-home based venues.

Our sensitivity analysis found that:

- the NPVs and BCRs are most sensitive to the behavioural changes assumed for drivers currently in the BAC 51-80 mg/dL (mid-range assumption of 45% from year 2), but the NPV continues to be positive with a BCR greater than one (at 6.7) under the low benefit scenario of 15%.
- the NPVs and BCRs are also sensitive to the behavioural changes assumed for drivers currently over BAC 80 mg/dL (mid-range assumption of 9% from year 2), but the NPV continues to be positive with a BCR greater than one (at 7.2) under the low benefit scenario of 6%.
- the NPVs and BCRs are also sensitive to the assumed relative transport needs at home-based venues compared to other venues (mid-range assumption of a 50% reduction in transport need), but the NPV continues to be positive with a BCR greater than one (at 8.2) under the low benefit scenario of a 25% reduction.

Figure 6.1: Tornado plot of NPV sensitivity

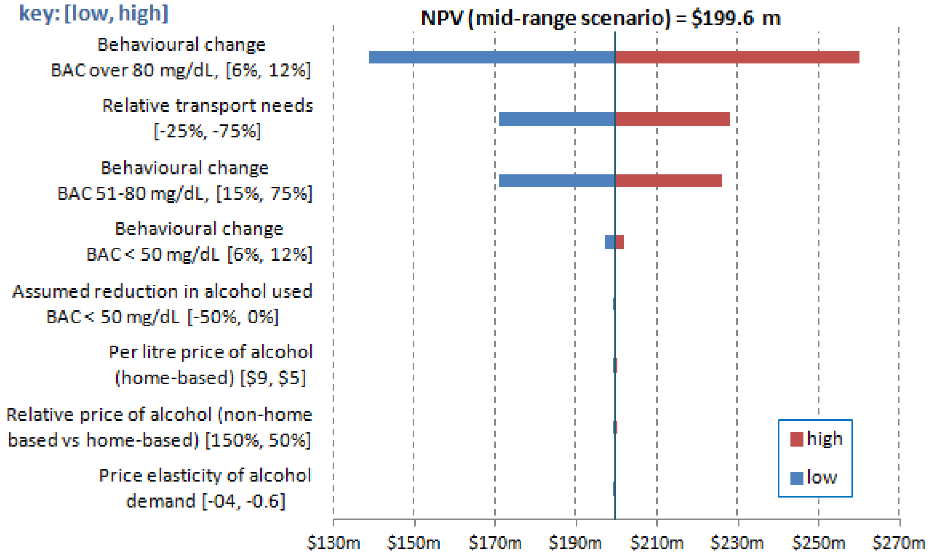
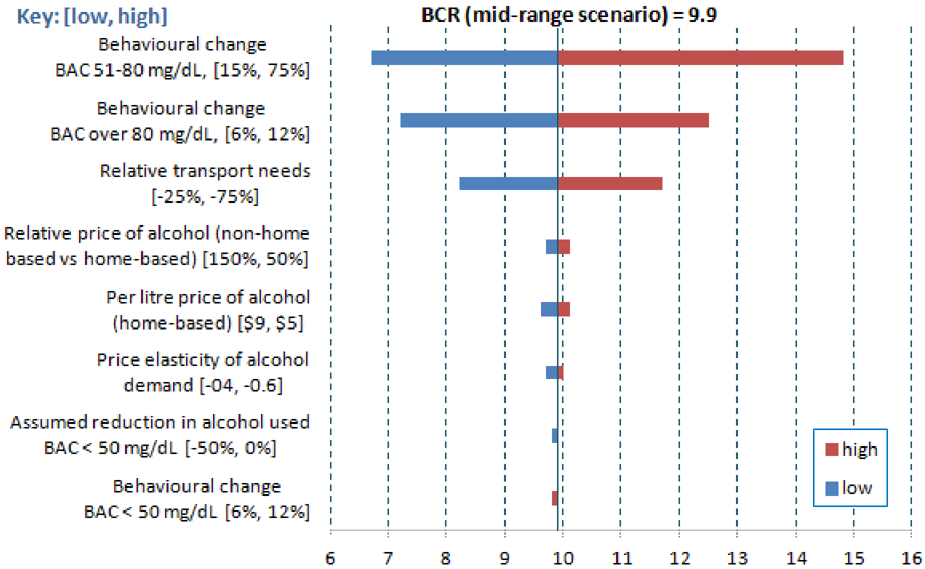


Figure 6.2: Tornado plot of BCR sensitivity



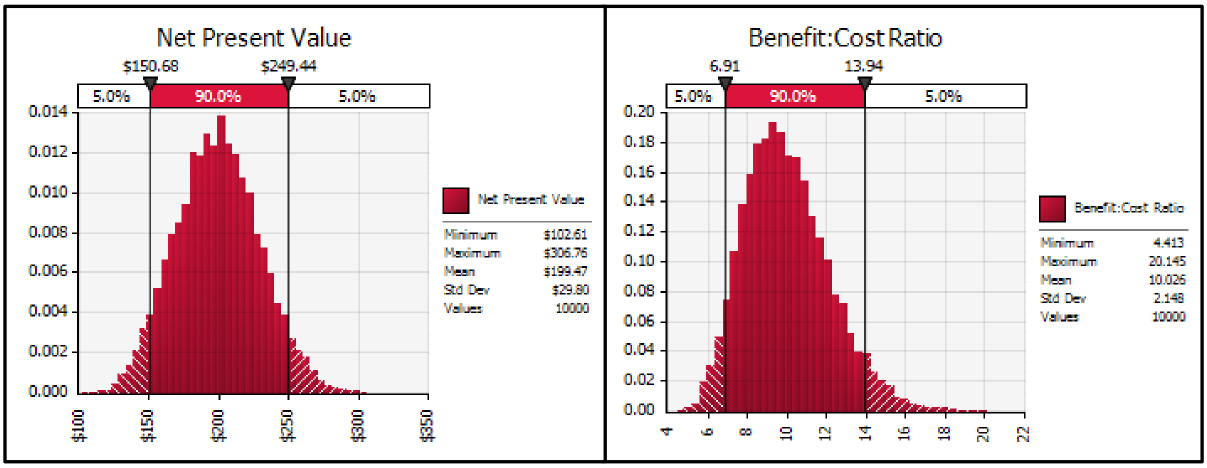
Monte Carlo simulation was used to estimate the net benefit of the policy change (measured in NPV 2013 dollars) and the associated BCR results for varying all the items included in Table 6.1. The broad orders of magnitude of net-benefits for each option are relatively stable. With 90% confidence, the range of NPV is between $151 million and $249 million and the range of BCR is between 6.9 and 13.9 (see Figure 6.3 and Table 6.3).

Table 6.3: Confidence intervals of the conventional CBA results

Evaluation period: 2014 to 2023	NPV	BCR
Minimum	$102.6 m	4.4
5th percentile	$150.7 m	6.9
Mean	**$199.5 m**	**10.0**
95th percentile	$249.4 m	13.9
Maximum	$306.8 m	20.1

Note: These figures are the result of Monte Carlo analysis considering the probability of occurrence.

Figure 6.3: Monte Carlo Simulation of NPV and BCR



6.2 Conclusion

The analysis has been carried out with a range of conservative assumptions. However, the estimated net benefit (measured in NPV, 2013 dollars) and BCR still make a strong case for lowering the legal adult BAC limit (under an infringement regime). The analysis demonstrated that even under the least favourable assumptions, the estimated NPV continues to be significantly greater than zero and the estimated BCR continues to be positive. In summary, lowering the legal adult BAC limit from 80 mg/dL to 50 mg/dL (under the proposed infringement regime) is highly likely to result in a net benefit to the nation.

7. Appendix 1: Estimating alcohol use by age group and alcohol levels

The following method has been developed for estimating the amount of alcohol consumption by those who would drive after a driving session.

$$T = \sum P_{i,j} \times R_{i,j} \times S \qquad (7.1)$$

Where T = Estimated total alcohol consumed associated with driving with a positive BAC is 11.8 m litres
P = Proportion of population who violates drink-driving regulations by age group and alcohol levels
R = relative number of standard drinks per drinking session by age group and alcohol levels
i = alcohol levels (0-50 mg/dL, 51-80 mg/dL , >80 mg/dL) – these are represented by the columns in the matrix
j = age groups (under 20 years, 20-24 years, over 24 years) – these are represented by the rows in the matrix
S = standardised annual alcohol consumption in m litres (a constant comparator for various age group and alcohol level)

$$P_{i,j} = \begin{bmatrix} 0.5\%, 0.5\%, 0.3\% \\ 5.4\%, 1.7\%, 1.6\% \\ 58.7\%, 20.2\%, 11.2\% \end{bmatrix}$$

$$R_{i,j} = \begin{bmatrix} 1.0, 2.0, 2.7 \\ 1.2, 2.4, 3.2 \\ 0.7, 1.4, 2.0 \end{bmatrix}$$

Step 1: Re-arrange (1) and solve for S

$$S = \frac{T}{\sum P_{i,j} \times R_{i,j}} = 10.59$$

Step 2: Estimate alcohol use by age group and alcohol level

For example, the estimated alcohol consumption by age group under 20 with an alcohol level between 0 and 50 mg/dL can be obtained as follow:

$$= P_{i,j} \times R_{i,j} \times \frac{T}{\sum P_{i,j} \times R_{i,j}}$$

= 0.5%*1*10.59

= 0.05 m litres

Results = $\begin{bmatrix} 0.05, 0.10, 0.08 \\ 0.67, 0.44, 0.54 \\ 4.50, 3.1, 2.32 \end{bmatrix}$ which sums to 11.8 m litres.

8. Appendix 2: Comparison of safety benefit estimates with the 2010 results

		2010 analysis	This analysis
Crash and injury data	Time period	2006-2008	2010-2012
	Average annual death and injuries with BAC > zero	110 fatalities 2,287 injuries Social cost of road fatalities and injuries of $793 m (2009 dollars)	61 fatalities 1,005 injuries Social costs of road fatalities and injuries of $446 m (2013 dollars)
	Key differences in the statistics	• include drivers of all ages • include drugs and alcohol (co-factors) • include suspected alcohol but no reading	• include drivers over 20 years only • exclude drugs and alcohol (co-factors) • exclude suspected alcohol but no reading
	Estimation method	• Based on international experience in terms of percentage reduction in alcohol related fatalities and injuries. • Due to a lack of data, separate estimates cannot be made for BAC between 50 and 80 mg/dL.	• Estimates of safety benefits were linked to three key behavioural changes (reduction in alcohol use, switch to home-based drinking and take alternate transport), which were derived considering the results observed for youth (following the introduction of zero BAC in August 2011in New Zealand). • Separate safety benefit estimates are derived for different BAC levels.
Safety benefit estimates	Low and high scenarios	**Low**: 14% (based on experience in Australia) **High**: 30% (based on experience in France) % reduction in all alcohol related injury crashes with BAC > 0	**Low**:3.5% **Mid-range**:6.5% **High**: 10.1% % reduction in at-fault injury crashes where the driver was over 20 years and had a BAC > 0
	Estimated reduction in fatalities and injuries per annum	**Low**: 15 fatalities 320 injuries **High**: 30 fatalities 686 injuries	**Low:** 1.9 fatalities 33 injuries **Mid-range:** 3.4 fatalities 64 injuries **High:** 5.2 fatalities 102 injuries

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