Ministry of Transport
TE MANATŪ WAKA

Enhanced testing regime for drug-impaired driving

Cost-Benefit Analysis

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Preparation of this Report

This report was prepared by the Domain Strategy, Economics and Evaluation team at the Ministry of Transport. The cost-benefit analysis commenced in 2019 with the commissioning of two literature reviews by external organisations: WSP Opus, and the Evidence Based Policing Centre. Technical advice was provided by Crow's Nest Research, while input data were provided by the NZ Police, the Institute of Environmental Science and Research, the Department of Corrections, the Ministry of Justice, and Waka Kotahi NZ Transport Agency. Product information was provided by two device suppliers, Dräger and Pathtech. The assumptions, quantitative model, and written report were reviewed by multiple staff members within the Ministry of Transport, each of the organisations that provided input data, and two independent epidemiologists from Monash University and the University of Otago.

About the Domain Strategy, Economics and Evaluation Team

The Domain Strategy, Economics and Evaluation Team operates within the System Performance & Governance Group of the Ministry of Transport. The team supports the Ministry's policy teams by providing the evidence base at each stage of policy development. The team is responsible for:

- developing the Transport Evidence Base and the Transport Knowledge Hub, which connect people from across the wider transport sector and promote the sharing of transport data, evidence, knowledge, research, information, capabilities, and ideas
- providing economic input on business cases, funding requests, competition issues and specific projects (such as value capture, natural disasters, and the social impacts on environment and health)
- providing the evaluation function for the Ministry, including designing evaluation frameworks, developing performance metrics and indicators, and designing, conducting and procuring evaluations.

The Transport Evidence Base

The Transport Evidence Base Strategy creates an environment to ensure data, information, research and evaluation play a key role in shaping the policy landscape. Good, evidence-based decisions also enhance the delivery of services provided by both the public and private sectors, to support the delivery of transport outcomes and improve wellbeing and liveability in New Zealand.

Executive summary

New Zealand's *Road to Zero* road safety strategy targets a 40% reduction in road deaths and injuries by the year 2030. Under this strategy the Government has committed to enhancing the drug driving testing regime. Under the current regime, the volume of drivers receiving Compulsory Impairment Tests is insufficient to achieve widespread deterrence. In 2018, the number of driver deaths involving drugs on New Zealand roads exceeded the number of driver deaths involving over-the-limit alcohol. It is estimated that road crashes related to drug driving could be contributing up to $800m of social harm in New Zealand annually.

The proposed policy to enhance New Zealand's drug driving testing regime involves the introduction of oral fluid testing devices and the removal of the 'good cause to suspect' testing requirement. These devices would reduce the testing time to 1-8 minutes (versus an average of 52 minutes for the Compulsory Impairment Test), thus allowing Police to significantly increase the number of drivers they screen for drug driving, which should increase deterrence. Four policy option variants are assessed in this cost benefit analysis.

Option 1 involves drivers facing immediate infringements if they fail two consecutive oral fluid tests, with the option to elect an evidential blood analysis by a laboratory if drivers dispute the oral fluid results. Repeat infringers would face criminal penalties, and Police maintain the ability to utilise the Compulsory Impairment Test at their discretion (which is necessary since not all drugs can be detected by current oral fluid testing devices) with some restrictions on when Police can switch between oral fluid tests and the Compulsory Impairment Test.

Option 2 considers a scenario in which there are no infringements, only criminal penalties – assumed to increase the degree of deterrence. Both Option 3 and 4 feature a mixture of infringements and criminal penalties, but Option 3 considers the evidential blood test as a mandatory step before penalties can be issued, decreasing the chance of false-positives, whereas Option 4 considers requiring only a single positive oral fluid test result.

Depending on the option, this regime enhancement is expected to save 65-114 lives, prevent 431-755 death and serious injury crashes, and reduce social harm by $415m-$726m, over a 10-year period (2020 to 2029). The cost of implementing these changes is estimated to be $33m-$150m over that 10-year period, with the majority of costs falling on Police. All four options produce positive benefit cost ratios, ranging from 4.83-12.46. Therefore, despite the degree of uncertainty illustrated by the breadth of estimated impacts, this cost benefit analysis supports the enhancement of New Zealand's drug driving testing regime.

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Glossary of terms and abbreviations

BCR	Benefit Cost Ratio
CAS	Crash Analysis System
CBA	Cost Benefit Analysis
CIT	Compulsory Impairment Test
Corrections	Department of Corrections
DSI	Death and Serious Injury
EEM	Economic Evaluation Manual
ESR	Institute of Environmental Science and Research
MoJ	Ministry of Justice
MoT	Ministry of Transport
NPV	Net Present Value
NZ	New Zealand
OFT	Oral Fluid Test
PV	Present Value
Waka Kotahi	Waka Kotahi NZ Transport Agency

Also see Table 1 for a list of commonly used drugs and their synonyms.

Table 1: List of commonly used drugs - NIDA (2012)

Substance	Also known as	Description
Cannabinoids		
Cannabis	Marijuana, weed, pot, dope, grass	A plant containing the psychoactive compound tetrahydrocannabinol (THC).
Hashish	Hash, hash oil	The separated resin obtained from the cannabis plant.
Synthetic cannabis	Synthetics, synnies, Kronic	Artificial psychoactive substances applied to plant material.
Opioids		
Opiates	Morphine, codeine, thebaine	Compounds naturally found in the opium poppy plant.
Semi-synthetic opioids	Heroin (smack), oxycodone (OxyContin®), hydrocodone (Vicodin®)	Artificial substances based on opiates.
Synthetic opioids	Methadone, fentanyl, tramadol	Artificial substances designed to mimic opiates.
Stimulants		
Cocaine	Coke, crack, blow	An alkaloid derived from the leaves of the coca plant.
Amphetamine	Adderall®, speed	Artificial substance originally used as a decongestant.
Methamphetamine	Meth, P, crystal, ice	Artificial substance originally used to lose weight and/or stay awake.
Benzylpiperazine	BZP	Artificial substance derived from piperazine.
Club drugs		
MDMA	Methylenedioxymethamphetamine, Ecstasy, E	Artificial substance once used to improve psychotherapy.
GHB	Gamma-Hydroxybutyric acid, liquid ecstasy, fantasy	Natural substance often used as a date-rape drug.
Ketamine	K	Artificial substance originally used as an anaesthetic.
Phencyclidine	PCP, angel dust	Artificial substance originally used as an anaesthetic.
Hallucinogens		
LSD	Lysergic acid diethylamide, acid	Artificial substance often applied to “tabs” of paper.
25I-NBOMe	25I, N-bomb, smiles	Artificial substance often applied to “tabs” of paper.
Mescaline	Mesc, peyote	An alkaloid naturally found in the peyote cactus.
Psilocybin	Magic mushrooms	Compound naturally found in a range of mushroom species.
Other		
Benzodiazepines	BZD, Flunitrazepam (roofies), alprazolam (Xanax®), diazepam (Valium®)	Artificial minor tranquilisers.
Inhalants	Solvents, gases, nitrates	Vapours and/or fumes.

1. Introduction

1.1 Policy problem

The current drug driving testing regime in New Zealand (NZ) does not allow for sufficient scale to achieve widespread drug driving deterrence. This cost-benefit analysis (CBA) assesses options to enhance the drug-driver testing regime in NZ as part of efforts to address the recent increase in road trauma, as illustrated in Table 2.

Table 2: NZ annual road crashes - Waka Kotahi CAS

Year	Fatal*	Serious injury	Minor injury	Non-injury
2014	266 (293)	1,737	6,924	20,889
2015	290 (318)	1,833	7,668	22,370
2016	285 (327)	2,129	7,774	27,154
2017	342 (378)	2,410	8,497	28,219
2018	331 (377)	2,128	9,231	26,867

*Fatalities in parentheses.

Table 3 reveals that the number of driver deaths involving drugs has increased to the point where it now exceeds those involving over-the-limit alcohol. However, this observation needs clarification. First, according to the Institute of Environmental Science and Research (ESR), the proportion of deceased drivers who receive drug testing has increased since 2015, which is at least partially responsible for the increase in "involving drugs" deaths over the last five years. Second, while the proportion of deceased drivers who receive drug testing has increased, ESR still does not test all deceased drivers, meaning it is possible that the true number of road deaths involving drugs is higher than the official statistics. Third, the *involvement* of drugs cannot be interpreted as the *cause* of the crash/death, as it is often just one of many potential contributing factors, and may not have contributed to the crash at all.

Table 3: NZ driver deaths involving drugs and/or alcohol - Waka Kotahi CAS*

Year	Involving drugs	Involving alcohol**	
		Above limit (or refused)	Below legal limit
2014	18 (6%)	48 (16%)	41 (14%)
2015	27 (8%)	66 (21%)	56 (18%)
2016	61 (19%)	67 (20%)	69 (21%)
2017	88 (23%)	74 (20%)	75 (20%)
2018	95 (25%)	80 (21%)	43 (11%)

*Involving drugs and involving alcohol are not necessarily mutually exclusive.
**Alcohol legal limit of 0.5 g/L.

If we assume that the proportion of road deaths involving drugs is representative of the proportion of all road crashes involving drugs, it is possible to estimate how many crashes drug driving could have contributed to in 2018. Multiplying these estimates by the average social cost per crash by crash severity, produces a monetary estimate of the annual social cost of road crashed potentially attributable to drug driving, shown in Table 4.

Table 4: Estimated annual social cost of drug driving road crashes in NZ

	Fatal	Serious injury	Minor injury	Non-injury	Total
Reported crashes*	79	511	2,215	6,448	9,253
Social cost per crash**	$5,156,543	$534,403	$30,401	$3,233	N/A
Annual social cost	$430m	$287m	$71m	$22m	$809m

*Based on assuming that 25% of all crashes during 2018 involved drugs.
**See the appendix for details on how these costs were calculated.

The involvement of drugs in fatal crashes may not be, and probably is not, indicative of the involvement of drugs in non-fatal crashes, particularly minor injury and non-injury crashes, in which case the harm from those crash categories may be overestimated. However, since the harm from non-fatal crashes make up just over 10% of the total harm estimated in Table 4, any impact from their overestimation is negligible. Furthermore, based on mapping of data from the Crash Analysis System (CAS) and data from the Accident Compensation Corporation, less than 60% of serious injuries and only around 30% of minor injuries are recorded in CAS. Therefore, even with potential overestimation of non-fatal crashes involving drugs, drug driving could *potentially* contribute to $1b of harm in NZ annually when under-reported crashes are included. However, as mentioned previously, *involving drugs* is not synonymous with *caused by drugs*, and as such this is an overstatement of the real harm of drug driving.

1.2 Policy description

Under the current testing regime, NZ drivers suspected of being impaired can be asked to perform the Compulsory Impairment Test (CIT). The CIT is a behavioural test, commonly known internationally as a Field Sobriety Test, designed to identify impairment, and thus provide good cause to suspect the use of drugs and/or alcohol. In NZ, if a driver fails the CIT they are required to submit a blood sample for laboratory testing. This blood sample is tested for a wide range of illegal substances, with only the presence[1] of a qualifying drug[2] required in order for the driver to face criminal penalties. While there is no intention to eliminate the CIT – Police data confirms that approximately 90% of drivers who fail CITs test positive for drugs when their blood is tested in the lab – there is a desire to supplement them with a faster detection method because each CIT can take upwards of 50 minutes to complete. Due to the lengthy time to administer the test, road Police are presently unable to substantially increase the number of CITs performed, which limits their ability to detect, and therefore deter, drug driving. Police are also frequently unable to require drivers to undergo a CIT because the drivers are injured or in a state of shock or emotional distress following a crash. Police do not record the total number of CITs undertaken, but confirm that 473 CIT blood specimens were submitted for analysis in 2017/18. In comparison, around 1.75 million alcohol breath tests are carried out each year.

The policy being proposed to enhance the drug driving testing regime is twofold: the implementation of oral fluid testing, accompanied by the addition of infringement-level penalties to sit alongside the current criminal penalties. Oral fluid test are used by a number of jurisdictions internationally to screen drivers for the presence of impairing drugs. Since oral fluid devices can screen drivers in much less time than the current CIT, their adoption would support Police to reach the drug driving detection scale necessary to achieve widespread deterrence. On the other hand, the addition of infringements recognises that drug driving is a road safety issue, not a drug-enforcement issue, and acknowledges that penalties should be proportionate to the degree of driver impairment – at least as much as is possible. This CBA considers four options for the implementation of oral fluid testing, differentiated in Table 5.

Table 5: Policy options

Option	# of oral fluid tests	Penalties	Blood tests
1 Mixed	2	Infringements & criminal	Electable
2 Criminal only	2	Criminal only	Electable
3 Mandatory blood	2	Infringements & criminal	Mandatory
4 Single oral fluid test	1	Infringements & criminal	Electable

[1] While this is communicated as a zero-tolerance approach, for accuracy reasons the laboratory only reports presence when concentrations are detected above a very-low, but not technically zero, level.
[2] These are drugs categorised under Schedule 1, 2, and parts of Schedule 3 of the Misuse of Drugs Act 1975, as well as prescription medicines defined in section 2 of the Land Transport Act 1998.

Under all four options, Police retain their discretion to perform a CIT when they have good cause to suspect a driver is under the influence of drugs, be that because:

- a driver has passed the oral fluid test (OFT) but may be impaired by a substance not detectable via the device
- a driver exhibits a severe degree of impairment, or
- because a driver who appears impaired is unable to complete an OFT – for example, due to insufficient saliva.

Drivers who fail two OFTs (or one OFT under Option 4) will receive an immediate infringement notice (except under Option 2 which does not have infringements). Drivers may elect (except under Option 3, where this is mandatory) to have their blood tested by a laboratory if they dispute their drug-positive OFT result(s). The concentration of drugs detected in a driver's blood sample will determine the severity of their penalty in alignment with NZ's current drink-driving regime – whereby there are three possible outcomes: no penalty at very low concentrations, an infringement fine and licence demerit points at impairing concentrations, and a criminal conviction (with possible imprisonment) for severely-impairing concentrations.

1.3 Limitations of this CBA

The period of analysis considered in this CBA is 10 years, covering 2020 to 2029. Fatality data for 2019 was only available up to 21 October 2019 at the time of analysis, so data for the rest of the year was extrapolated based on historic trends.

Due to a lack of information, time and resources, this CBA does not include:

- non-transport related benefits of reduced drug usage in society
- indirect costs associated with drug driving penalties, such as reduced access to employment and/or education
- wider justice pipeline costs associated with increased prosecutions
- wider health sector costs associated with increased drug rehabilitation referrals
- equity concerns related to distributional impacts by region, income, ethnicity, etc.

The following are also outside the scope of this CBA:

- the technology/device that should be used to perform drug screening
- the drugs that should, and should not, be tested for
- the circumstances in which drivers should be tested for drug driving
- the evidence required to establish an offence
- the penalties that would be appropriate.

Furthermore, while this report provides a brief policy description, it does not include all of the policy's details and/or nuances, and therefore should not be exclusively relied upon in order to understand the proposed options and/or the rationale behind them.

2. Methodology & Data

2.1 Benefit estimation

The primary benefit of this policy is a reduction in casualties due to decreased crashes as a result of deterred drug driving. To estimate this benefit we calculate the population attributable risk fraction, an epidemiology concept pioneered in the 1950s (Rockhill, Newman & Weinberg, 1998) and advocated for use in road safety by Elvik (2008). This measures the fraction of all crashes that can be attributed to the increase in relative risk due to the presence of drug driving. We estimate the number of attributable crashes by starting with the following:

1 + (Drug driving prevalence x (Relative risk of crashing while drug driving - 1))

To understand the preceding equation, and how it can be used to estimate the number of drug driving crashes, consider the following *simplified* hypothetical example:

- There are 100 fatal road crashes in a given year.
- 10% of drivers on the road at any one time are drug-drivers.[3]
- The relative risk of crashing while drug driving is 2.5 (i.e. 2.5 times the risk of sober drivers, who we assign a baseline risk of 1).
- 1 + (0.1 x (2.5 – 1)) = 1.15.
- In other words, the presence of drug-drivers raised the population's risk of fatal road crashes from 1 (if every driver was sober) to 1.15.
- (1.15 – 1) ÷ 1.15 = 13%.
- Hence 13 of the 100 fatal crashes could be *attributed* to drug driving.
- If we could eliminate drug driving we would prevent 13 fatal crashes per year.
- However, if we can only deter half of all drug-drivers, we would instead prevent 6.5 fatal crashes per year.
- Each crash prevented can then be multiplied by its respective social cost (dependent on crash severity) to estimate the monetary benefit of deterring drug driving.

This CBA applies the preceding approach separately to seven different drugs and/or drug types[4], each with their own unique combination of prevalence and relative risk. Advantageously, this separation allows policy makers to identify the impacts of particular drugs on NZ's road safety, and thus prioritise which drugs to test for and hence deter.

[3] e.g. 20% of drivers drive under the influence of drugs, and they do so 50% of the time (0.2 x 0.5 = 0.1).

[4] Cannabis, methamphetamine, ecstasy, opiates, sedatives, cocaine, and hallucinogens.

However, the downside to this approach is that it produces slightly incorrect estimates of the number of preventable crashes when there are a combination of drugs being used by NZ's driving population. This is because the formula to calculate the attributable risk of one drug assumes that the baseline population's risk is 1, whereas, in reality, the baseline population's risk is not 1 if there is also another impairing drug present in the population. It is possible to account for this issue and accurately estimate the total crashes preventable for a given combination of tested/deterred drugs. However, even when considering only seven possible drugs to test/deter, this alone equates to 127 unique possible combinations, e.g. Drug A only, Drug B only, Drug C only, Drug A and Drug B, Drug B and Drug C, etc. Therefore, while it is impractical to report the results for all of the possible permutations in this CBA, it is recommended that a recalculation of the crash prevention benefit be performed once/if the preferred combination of drugs to be tested and deterred is determined.

Nevertheless, the preceding paragraphs explain that in order to quantify the number of crashes preventable by deterrence, it is necessary to know four key pieces of information:

- prevalence of drug driving in the general driving population
- relative risk of drug driving
- effectiveness of drug driving deterrence
- expected number of road crashes.

2.2 Prevalence of drug driving in NZ

The prevalence of drug driving is comprised of the number of drivers who drive under the influence of drugs, and the frequency with which they do so. Best practice for determining the prevalence of drug driving is to conduct random drug-testing of the general driving population. As of November 2019, NZ has never conducted such a survey. However, several other developed countries have, and the results of five of these surveys are presented in Table 6.

Table 6: International drug-driver prevalence surveys (random driver testing)

Year	2006	2013/14*	2014	2016/17	2018
Country	Australia	USA	Spain	Norway	Canada
Author(s)	Drummer et al.	Kelley-Baker et al.	Alcañiz et al.	Furuhaugen et al.	Beirness.
Participation	Mandatory	Voluntary	Mandatory	Voluntary	Voluntary
Sample size	13,176	7,881	521	5,034	1,878
Illicit drugs detected	2.4%	11.6% - 15.2%	16.4%	1.7%	8.5%

*Detection rate reported separately for day and night.

Evidence on the extent of drug driving in NZ is poor. Based on interviews with 13,000 adults aged 15 years and over during the New Zealand Drug Survey 2012/2013, 11% reported using cannabis, and of those, 36% reported driving under the influence of cannabis at least once in the past year – suggesting that approximately 4% of adults had driven while under the influence of cannabis (Ministry of Health, 2015).

Starkey and Charlton (2017), from the University of Waikato, on behalf of Waka Kotahi, carried out 2,000 phone surveys and 434 internet surveys to identify the drugs New Zealanders were consuming, and how many people drove within three hours of consuming said drugs – a proxy for being under the influence – the results for recreational drugs are reported in Table 7.

Table 7: Drug driving prevalence in NZ - Starkey & Charlton (2017)

Drug*	Telephone respondents		Internet respondents	
	Used	Within 3 hours of driving	Used	Within 3 hours of driving
Cannabis	6.6%	2.5%	25.6%	14.2%
Sedatives	11.9%	0.2%	12.8%	2.6%
Ecstasy	1.1%	0.1%	6.7%	1.3%
Methamphetamine	0.4%	0.1%	3.7%	2.4%
Hallucinogens	1.3%	0.1%	5.7%	2.1%
Opiates	0.5%	0.2%	1.0%	1.0%
Cocaine	0.4%	0.1%	1.0%	0.5%
Alcohol	83.8%	45.3%	88.9%	N/A

*Note, the survey did not ask about the dosage.

Another source of evidence on the scale of drug driving in NZ comes from the laboratory testing of drivers' blood samples. ESR tests samples from three different cohorts: deceased drivers involved in fatal vehicle crashes, drivers hospitalised following vehicle crashes, and drivers who have failed a CIT. However, for a number of reasons, these samples are not representative of all deceased and hospitalised drivers.

One, not all decreased drivers are tested, and not all are tested for all possible substances. For example, of the 1,000 drivers who died between January 2014 and May 2018, only 845 blood samples were tested by ESR, and only 763 received a full drug presence screening (Poulsen, 2018). Two, the samples from deceased drivers include vehicle crashes not registered in the Crash Analysis System (CAS), such as off-road incidents and autocides (vehicle assisted suicide). Three, samples from hospitalised drivers are only tested for drugs if they do not first test positive for alcohol. Four, drivers are only subjected to a CIT if they pass an alcohol breath test (i.e. if they were negative for alcohol). Therefore, a number of drivers who may drive under the combined influence of alcohol and drugs, are never tested for drugs.

Table 8 reports blood sample results for deceased, hospitalised, and failed-CIT drivers for the last two calendar years. If driving under the influence of drugs does increase the likelihood of crashing, then the prevalence of drugs in deceased and hospitalised drivers would be higher than the prevalence of drugs in the general driving population. Therefore, the prevalence of drugs within the deceased and hospitalised driver samples should be interpreted as inflated upper-bounds of drug prevalence within NZ's driving population.

Table 8: NZ driver blood sample results - ESR*

Drug	2017			2018		
	Deceased	Hospitalised	Failed CIT	Deceased	Hospitalised	Failed CIT
Samples	*191*	*531*	*415*	*197*	*700*	*468*
Any drug**	57%	N/A	89%	50%	N/A	92%
Combination	32%	N/A	33%	35%	N/A	32%
Cannabis	31%	37%	55%	27%	37%	57%
Methamphetamine	12%	25%	42%	11%	28%	42%
Opioids	6.3%	7.3%	8.2%	6.6%	12%	14%
Sedatives	6.3%	9.4%	16%	6.1%	10%	13%
Stimulants	3.7%	1.9%	2.9%	3.0%	3.3%	2.6%
Alcohol	26%	N/A	N/A	28%	N/A	N/A

*Only samples that received full drugs screenings, and excludes crashes not included in CAS.
**Excluding alcohol.

The only evidence of NZ's drug driving prevalence amongst the *general* driving population comes from Starkey and Charlton (2017) as reported in Table 7. In this CBA, we treat the internet respondents' drug driving prevalence as the upper bound, and the telephone response as the lower bound – with the midpoint of the two treated as the most likely prevalence value. The survey did not ask how *often* drivers drove under the influence of drugs, merely whether or not they had done so at least once in the previous 12 months. Therefore, in order to convert the survey results in Table 7 into meaningful prevalence parameters, it is necessary to assume a particular frequency of drug driving. This CBA assumes arbitrary frequency values between 10-30% (i.e. self-reported drug-drivers drive under the influence of drugs 10-30% of the time they drive).

2.3 Risk associated with drug driving

Unlike alcohol, many recreational drugs do not have well-defined relationships between dosage and impairment. However, as Table 9 shows, drug usage can affect a wide range of driving-related brain functions (World Health Organisation, 2016).

Table 9: Impacts of drug use on brain function - WHO (2016)

Drug	Drowsiness	Cognitive function	Motor functions	Mood	Vehicle control	Time perception	Balance
Cannabis	x	x	x	x	x	x	x
Cocaine		x	x	x			
Methamphetamine		x	x	x		x	x
Ecstasy		x		x			x
Hallucinogens		x	x	x		x	x
Opioids	x	x	x	x	x		x
Synthetics	x	x	x	x	x	x	x

A number of behavioural studies, typically involving the use of driving simulators, have found that while cannabis use reduces driver attention and psychomotor skills, drivers often compensated for this by consciously driving slower (Berghaus, Scheer & Schmidt, 1995; Smiley, 1999; Hartman et al., 2015; Starkey & Charlton, 2017). On the other hand, behavioural studies focusing on stimulants have found that while ecstasy improves response times, drivers under the influence of ecstasy also took more risks, resulting in increased crash rates during simulations (Stough et al., 2012; Dastrup, Lees, Bechara, Dawson & Rizzo, 2010). However, several authors note that ecstasy-induced impairment may be a symptom of ecstasy-induced sleep-deprivation, rather than the ecstasy itself (Brookhuis, de Waard & Samyn, 2004). Similarly, Stough et al. (2012) found that ingestion of methamphetamine caused inappropriate use of brakes during driving simulations, although the authors acknowledged that, for ethical reasons, they only administered very small doses of methamphetamine, which may not be representative of typical usage.

Attempts to quantify the risks of driving under the influence of drugs typically fall under two categories: case-control studies and culpability studies. Both methods produce odds-ratios, which can be interpreted as the approximate risk of crashing while under the influence of each drug relative to a control group – those drivers not under the influence of drugs.

Case-control studies compare the prevalence of drugs amongst crash-involved drivers against a sample of the general driving population. A number of case-control studies have been performed throughout Europe and North America, using a range of different case and control groups (Mathijssen & Houwing, 2005; Schulze et al., 2012; Gjerde, Christophersen, Normann & Mørland, 2013; Li, Brady & Chen, 2013; Compton & Berning, 2015; Jamt, Gjerde, Romeo & Bogstrand, 2018). Table 10 reports the results of one of these studies, which are consistent with the results of the other studies, and conveniently categorises different drugs by risk levels relative to blood-alcohol volume.

Table 10: Risk of death and serious injury while driving - Schulze et al. (2012)

Risk level	Relative risk	Drug
No increased risk	1	None
Slightly increased risk	1-3	Alcohol < 0.5 g/L* Cannabis
Medium increased risk	2-10	Alcohol 0.5 - 0.8 g/L Cocaine Benzodiazepines Opioids
Highly increased risk	5-30	Alcohol 0.8 - 1.2 g/L Amphetamines Combination of drugs
Extremely increased risk	20-200	Alcohol > 1.2 g/L Drugs combined with alcohol

*The current NZ blood-alcohol limit for drivers 20 years and over.

Table 10 reveals that driving under the influence of cannabis by itself results in a comparatively minor increase in the relative risk of being in a crash, similar to driving under the current legal blood-alcohol limit. On the other hand, combining drugs, either with other drugs or with alcohol, significantly increases the relative risk of a crash while driving. However, it should be noted that the evidence is unclear regarding whether or not the impairment caused by alcohol is multiplied when combined with drugs, or if the people who combine drugs with alcohol do so when they happen to consume a substantial volume of alcohol. If the latter, high blood-alcohol levels alone could account for the extremely increased risk, regardless of the drugs they are under the influence of at the same time.

Unlike case-control studies, culpability studies compare the prevalence of drugs amongst *culpable* crash-involved drivers versus inculpable drivers. Before considering the results, it is worth noting that these studies may overestimate the relative risks of driving under the influence of drugs. This is because culpability studies consider the risk associated with a *culpable* drug-influenced driver, rather than a drug-driver per se. Based on correction analysis by Rogeberg (2019), this *interpretation bias* results in culpability studies typically exaggerating relative risk by 15% on average. Furthermore, the mere presence of drugs in a driver may increase their risk of death compared to a sober driver who suffered the same bodily injury. It is also worth noting that the classification of drivers as either culpable or inculpable, despite the use of peer-reviewed frameworks, remains inherently subjective.

Unlike the case-control literature, there has been a culpability study based on NZ data. Poulsen, Moar and Pirie (2014) analysed the results of 1,046 blood samples from deceased NZ drivers over a five-year period. Their results, shown in Table 11, reveal an increased relative risk (6.9 times that of the control group) for those who drove with both alcohol and cannabis in their system at the same time. However, they did not find a statistically significant increase in relative risk for those who drove under the influence of cannabis alone, regardless of the concentration of THC in their blood. Because so few of the sampled drivers had used a single drug in isolation (other than cannabis or alcohol) the sample size was insufficient to accurately determine the relative risks of driving under the influence of other drugs, such as opioids, stimulants or sedatives.

Table 11: Odds of culpability for fatally injured drivers in NZ - Poulsen, Moar & Pirie (2014)

Drug	Odds ratio	Drug	Odds ratio
No substance (control)	1	No substance (control)	1
Alcohol only		Alcohol & cannabis combined	
Any amount of alcohol	**13.69***	Any amount of alcohol	**6.90***
0.31 – 0.8 g/L	4.66	0.31 – 0.8 g/L	N/A
0.81 – 2 g/L	**10.25***	0.81 – 2 g/L	**10.76***
> 2 g/L	N/A	> 2 g/L	**6.21***
Cannabis only		Cannabis & alcohol combined	
Any amount of THC	1.31	Any amount of THC	**6.90***
< 2 ng/mL	3.08	< 2ng/mL	**4.35***
2 – 5 ng/mL	0.92	2 – 5 ng/mL	**4.87***
> 5 ng/mL	1.00	> 5 ng/mL	N/A

*Statistically significantly different from no substance (control) based on 95% confidence intervals.

The relative risk of driving under the influence of cannabis reported by Poulsen, Moar and Pirie (2014) – 1 to 3 times that of the no-drug control – albeit statistically insignificant, is inline with the findings of many international culpability studies (Terhune et al., 1992; Longo, Hunter, Lokan, White & White, 2000; Drummer et al., 2004; Laumon, Gadegbeku, Martin & Biecheler, 2005; Bédard, Dubois & Weaver, 2007; Li, Chihuri & Brady, 2017).

Although the NZ culpability study could not identify the risks of driving under the influence of drugs other than cannabis, an Australian study could. The results of that culpability study, by Drummer et al. (2004), are reported in Table 12.

Table 12: Odds of culpability for fatally injured drivers in Australia - Drummer et al. (2004)

Drug	Odds ratio
No substance (control)	1
Any psychoactive drug or combination of drugs**	**1.80***[5]
Psychotropics combined with alcohol (vs alcohol alone)***	**1.70***
Stimulants (all drivers)	2.27
Stimulants (commercial truck drivers only)	**8.83***
Benzodiazepines	1.27
Opiates	1.41
Other psychoactive drugs alone	**3.78***
Miscellaneous drugs****	1.47

*Statistically significantly different from no substance (control) based on 95% confidence intervals.
**Excluding alcohol.
***Alcohol ≥ 0.5 g/L.
****Such as over-the-counter painkillers and asthma medicine.

Table 12 shows that driving under the influence of psychoactive drugs increases the likelihood of being *culpable* when in a fatal crash by 1.8 times. However, driving under the influence of stimulants, benzodiazepines and opiates in isolation did not have a statistically significant impact on relative risk. Driving under the influence of both alcohol and psychotropic drugs at the same time resulted in a statistically significant increase in relative risk compared to driving under the influence of alcohol alone.

The relative risk assumptions used in this CBA are based on Table 10, as case-control studies offer more representative and reliable measures of general drug driving risk than culpability studies. Also, due to insufficient data, this CBA does not model driving under the influence of multiple drugs or alcohol simultaneously. However, this omission is mitigated by assuming

[5] This odds ratio was recently revised down to 1.62 after reanalysis by Rogeberg (2019).

that all drug driving is mutually exclusive (e.g. if 5% of the road population used drug A, and 5% of the road population used drug B, then 10% of the road population would be under the influence of drugs – when in reality, due to combined usage, it could, and probably would, be somewhere between 5-10% in this example).

2.4 Drug driving deterrence

There are two forms of deterrence: general and specific. General deterrence refers to the impact of enforcement on those not directly affected, via mechanisms such as advertising and word-of-mouth. Specific deterrence refers to the impact of enforcement on people directly, via personal experience of detection at checkpoints and/or penalties for failing tests. While both are required for effective deterrence, there is little empirical evidence of their roles on drug driving deterrence. As Woolley and Baldock (2013), and Watson and Mann (2016) noted, evaluation of roadside drug testing has generally been poor, and evidence of the relationship between testing and deterrence of drug driving is lacking.

An attempt to quantify the deterrence impact of drug-driver testing was made by Cameron (2013) based on five years of roadside oral fluid testing in Victoria, Australia between 2005 and 2009. By looking at the number of drivers screened per year compared to the proportion of deceased drivers whose blood tested positive for drugs, shown in Table 13, the author was able to estimate the relationship between the quantity of drug-driver testing and the prevalence of drug driving on the roads by drivers who crashed and were subsequently killed.

Table 13: Victoria, Australia random drug test data - Cameron (2013)

Year	Tests performed	Proportion of deceased drivers with drugs in their blood (%)
2005	13,158	39.9
2006	11,424	39
2007	21,887	34
2008	25,005	32.3
2009	27,883	31.9
2010*	41,642	37
2011*	47,500	38.9

*Not in the original publication (instead from Cameron, 2014).

Based on the data from 2005 to 2009 in Table 13, Cameron (2013) estimated the relationship between the quantity of tests and the prevalence of drugs detected in deceased drivers to be:

$$\% \text{ of deceased drivers positive for drugs} = 455.43 \times \text{number of tests}^{-0.26}$$

The -0.26 exponent implies that the proportion of deceased drivers with drugs in their system decreases when the number of tests performed increases. However, this relationship was determined based on only five data points. The relationship ceases to exist if the analysis includes data from 2010-2011, where the prevalence of drugs in deceased drivers increased despite a far greater number of tests being performed – although this may have been due to a change in tactics, as Victoria's Police began utilising *targeted* testing in 2010 (Cameron, 2014). Targeted testing involves deploying the devices at certain times and/or locations likely to have elevated prevalence of drug driving. One unintended consequence of this is that those who are not targeted may believe they are less likely to be caught.

Other authors have attempted to assess the deterrence effect based on self-reported drug driving behaviour. Bryant, Stevens and Hansen (2009) conducted phone surveys shortly after New South Wales instigated drug-driver testing, and 49% of respondents claimed it had decreased the likelihood that they would drug-drive, although respondents were not asked *how much* it decreased that likelihood. Armstrong, Watling and Davey (2014) surveyed drivers in the Australian Capital Territory, three years after the introduction of drug-driver testing, and found, at least for those who were aware of the drug-driver testing operations, a decreased likelihood to drug-drive. Likewise, Horyniak et al. (2017) conducted annual surveys of drug users between 2007-2013 across all Australian capital cities, and found a statistically significant 9-16 percentage point decrease in recent drug driving, but this was not correlated with personal exposure to roadside testing, suggesting weak specific deterrence.

Further complicating the previous evidence, several authors have acknowledged that, while drug-driver testing must be performed at scale in order to be an effective deterrent, the optimal scale remains unknown (Goldsmid, Coghlan and Patterson, 2015; Davey, Armstrong, Freeman, & Sheldrake, 2017). There are also many factors other than scale that can influence the deterrence effectiveness of drug-driver testing, including:

- quantity and frequency of testing
- type(s) of drugs tested for
- random testing vs good cause to suspect testing
- testing for drug presence vs testing for drug impairment
- substance detection levels
- likelihood of apprehension
- severity of consequences
- swiftness of consequences
- awareness of the law.

Due to lack of evidence, and so as not to overestimate the potential benefits of this policy, this CBA assumes relatively conservative deterrence effectiveness of between 20-33% – i.e. one in five to one in three drug-drivers, or drug driving trips, are deterred by the introduction of oral fluid testing (lower than the 25-55% assumed in a 2009 doctoral thesis by Tay-Teo).

The analysis does not distinguish between the deterrence effectiveness of 1 and 2 OFTs or between electable and mandatory blood testing, as these different operation parameters were judged to affect mainly the chance of having false-positives (see section 2.8) and the likely flow-on operational costs of the regime, rather than the deterrence effect. However, in Option 2, under which all drug-drivers face exclusively criminal penalties, the CBA model assumes a larger deterrence effect in recognition of the increased severity of punishment. The assumed value of this criminal modifier takes a range between 1.5-2, with a value of 1.5 indicating 50% more deterrence, and a value of 2 indicating 100% more deterrence.

2.5 NZ road crashes

Table 2 showed that the reported number of annual crashes on NZ roads has increased since 2014. Before we can forecast crashes for the analysis period (2020-2029) it is necessary to forecast the crashes for the remainder of 2019. As of 21 October 2019 there had been 227 fatal crashes in the incomplete calendar year. Based on data from 2015-2018, fatal crashes as of 21 October 2019 accounted for on average 78.15%[6] of total fatal crashes for the respective calendar year. Based on this assumption, we forecast that the total number of fatal crashes in 2019 will be 290, a decline from the 331 fatal crashes that occurred in 2018. Serious injury, minor injury, and non-injury crashes for 2019, reported in Table 14, were estimated assuming the same decreases year-on-year predicted for fatal crashes.[7]

Table 14: Partially-projected 2019 calendar year crashes

Fatal*	Serious injury	Minor injury	Non-injury
290	1,867	8,100	23,575

*Actual for 1 January – 21 October; Projected for 22 October – 31 December

Three different baseline crash forecasts for the next ten years, 2020-2029, were modelled. The “low” forecast assumes a -3.85% annual change in crashes, which is commensurate with the goal of a 40% reduction in death and serious injury crashes by 2030 outlined in the *Road*

[6] Very consistent between years: a low of 77.19% in 2016 and a high of 78.95% in 2017.
[7] Because there is typically a long lag between when non-fatal crashes occur and when they are finalised in the Crash Analysis System, it is not approrpiate to use the same method used for forecasting fatal crahses.

to Zero road safety strategy. The "medium" forecast assumes the status quo over the next ten years, i.e. a 0% change in annual crashes compared to 2019. The "high" forecast assumes that over the next ten years the number of crashes increase by 5.62% annually, which was the average annual growth rate in fatal crashes over the previous five years, 2014-2018.

As the analysis is on a per crash basis, an additional step is needed to convert all crash reduction estimates into reductions in fatalities and injuries. Fatalities are estimated by multiplying each fatal crash by 1.12, seriously injured are estimated by multiplying each serious injury crash by 1.2, and minor injuries are estimated by multiplying each minor injury crash by 1.32, all based on the average over the 2014-2018 period.[8]

2.6 Cost estimation

This CBA models six cost elements: Police enforcement, blood analysis, corrections costs, Waka Kotahi administrative changes and promotion, innocent driver inconvenience, and justice costs. While this CBA attempts to quantify as many relevant costs as possible, the list of included costs is not exhaustive – two omissions of particular note being the impacts on the justice pipeline and the demand for health and rehabilitation services.

2.7 Police enforcement

Since the proposed policy would be enforced by Police, the majority of costs fall on them. Four main Police costs are considered: initial one-off training, OFT device costs, blood collection kit costs, and the value of Police time. Unless stated otherwise, all assumptions pertaining to operational time requirements and costs have been recommended by Police.

Adding a new infringement option to the OnDuty app is estimated to cost between $300,000 and $600,000. Initial one-off training of Police officers (i.e. those not in Police College) in the use of the OFT device is assumed to be between $300,000 and $400,000 in the first year, after which it would be incorporated into regular recruit training. Each OFT device is assumed to cost between $22.05 and $40.65[9] – more information about these devices is provided in section 2.8. Blood collection kits are assumed to cost between $6.50 and $10.83 per unit.

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[8] Serious injuries and minor injuries can occur in mutliple crash severities, and the approach used here is a simplification which only holds true over a large sample – i.e. 12 or more months of crashes.
[9] Prices quoted in AUD were converted to NZD on 19 August 2019, at an exchange rate of $1.08NZD per AUD.

The value of Police time is assumed to be $118.83[10] per hour, with a lower bound of $89.12 and an upper bound of $148.54. Estimated Police time is heavily dependent on the number of OFTs assumed. This CBA assumes Police will carry out 33,000 to 99,000 OFTs per year from year two onward, based on the 66,000 OFTs performed by Queensland Police in 2017/2018.[11] This is far fewer than the more than 1.5 million alcohol breath tests administered by NZ Police in 2018. Police time is estimated using the assumptions listed in Table 15.

Table 15: Minutes of Police time per event

Per OFT	Stop and discussion with driver	Transport to station	Transport back to car or home	Blood sample collection	Prosecution
1-8	10-15	10-15	15-20	30-50	720-1,440

It is unlikely that Police would use OFTs completely at random. Instead, it is likely that Police will maintain operational flexibility to use targeted methods of deploying OFTs, such as via checkpoints in high-risk areas and/or at high-risk times. To account for this, the CBA incorporates a *targeting* "modifier" ranging from 1-2. A value of 1 on this modifier means the Police are testing completely at random, whereas a value of 2 implies Police are twice as likely to test a drug-driver as they would be if testing the population completely at random. The higher the targeting modifier, the more likely an OFT will return a positive drug finding.

2.8 Oral Fluid Test devices

For this CBA we contacted representatives that promote and sell two of the worlds most common OFT devices, the Securetec DrugWipe® and the Dräger DrugCheck®.[12] There are multiple variants of both devices, with different combinations of drugs and detection thresholds. In general, the lower the detection threshold, the more time each test takes, with the average device taking three minutes. One limitation of these devices is their risk of producing false positive results (i.e. erroneously detecting the presence of drugs).[13]

According to research by Arnston (2013) and Arkell et al. (2019), these OFT devices falsely detect drugs 0-10% of the time. Therefore, to be conservative, in this CBA we assume the

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[10] Note, this is higher than the value of Police time included in Treasury's 2019 CBAX model, $106 per hour, but is used in this CBA in the interest of not underestimating implementation costs.

[11] In year one this assumptions is reduced by 50% to allow for gradual training and ramp-up.

[12] These two suppliers were chosen merely due to ease of information access, and device pervasiveness in other jurisdictions. Their inclusion in this CBA should not be interpretated as a product endorsement or procurement recommendation.

[13] There is also a risk of OFT devices producing false *negative* results. Although this is potentially problematic for deterrence effectiveness, it has no follow-on cost implications that need to be modelled in this CBA.

devices are accurate on 90-99% of occasions, with 95% used as the most-likely value. In order to further reduce the possibility of false positives, this policy also recommends administering two OFTs. However, the calculation regarding the impact of a second OFT on the likelihood of false positive results is not as intuitive as it might seem.

Suppose an OFT device detects a false positive result 10% of the time. Intuitively, one might assume that administering two OFTs would reduce the probability of false positives to 1% (10% of 10%). This is not necessarily true. There are a number of reasons why an OFT might report a false positive: operator error, manufacturing fault, sample contamination, unusual subject biology, out-of-operating-limits climatic conditions, etc. Performing a second OFT does not necessarily eliminate all of these potential false positive causes, and thus the second OFT may not be fully independent of the first OFT. Therefore, rather than the second OFT reducing the probability of false positives from 10% down to 1%, in reality the probability might only drop to, for example, 3%. Because it is impossible to know for sure what causes a false positive, and therefore impossible to know how independent the two OFTs would be, this CBA assumes a range of between 50-100% OFT independence. How this manifests in terms of the probability of false positive results after two OFTs is shown in Table 16.

Table 16: Chance of false positive result after two OFTs

		Chance of false positive per OFT		
		10%	**5%**	**1%**
Second OFT independence	**50%**	5.50%	2.63%	0.51%
	75%	3.25%	1.44%	0.26%
	100%	1.00%	0.25%	0.01%

2.9 Blood analysis

The cost of blood-drug analysis by ESR is currently $668.94[14] per blood sample. However, ESR advised that under the proposed policy the cost of blood specimen analysis could vary between $500 and $2,000, depending on the number of analyses required to determine

[14] www.legislation.govt.nz/regulation/public/2018/0120/latest/whole.html

concentrations. Under Option 3 it is assumed that all drivers who fail two OFTs will be required to have their blood analysed, while for the other three options this CBA assumes that between 10-30% of drivers who fail two OFTs will elect to have their blood collected and analysed. Note, this CBA assumes that ESR would be able to handle the increased volume of samples, and that ESR's blood analysis has a 0% chance of false positive results.

2.10 Corrections costs

Under Option 2, drivers who fail two OFTs face criminal prosecution, even if it is their first offence. For the other options, this CBA assumes 10-30% of drivers who fail two OFTs face criminal prosecution, while the remainder face infringements of $200 and 50 demerit points.[15] Based on data from the Ministry of Justice (MoJ) and the Department of Corrections (Corrections), the average cost of criminal sentences for drug offenders[16] is reported in Table 17. However, while we know the average length drug offenders serve, we have based the service severity on the total corrections population, which may not be indicative of the drug driving corrections population. This CBA assumes an average corrections cost of $10,665 per convicted drug-driver, with lower and upper bounds 20% either side of that: $8,532-$12,798.

Table 17: Corrections cost data - Corrections and MoJ

Service type	Direct cost per day	Population* (8/07/2018)	Ave length (days)	Total cost
Prison sentenced	$172	7,198		
Remanded in custody	$107	3,173		
Imprisonment		10,317	247.3	$390,663,807
Released on conditions	$12	3,461	123.6	$5,344,264
Home detention	$50	1,572	157.8	$12,329,305
Post detention conditions	$6	1,417	193.6	$1,689,793
Intensive supervision	$13	3,644	430.4	$20,874,136
Supervision	$16	7,814	277.7	$35,866,405
Community detention	$12	1,712	120.7	$2,439,389
Community work	$7	13,356	185.5	$18,433,876
			Total	$487,640,976
			Average corrections cost per drug offender	**$10,665**

*The total corrections population (not exclusively drug offenders).

[15] In alignment with NZ's current drink-driving infringements.

[16] Note, this is drug offences in general, not exclusively drug-driving (for which data was unavailable).

Based on all drug driving cases from 2005 to 2014, 42.9% of drivers accused of drug driving received either imprisonment, home detention, or a community sentence[17] while 30% received a monetary fine – this CBA assumes the same rates will prevail under the new regime, with upper and lower bounds 20%[18] either side. Despite the maximum drug driving fine currently set at $4,500, in this CBA the average criminal fine is assumed to be $419-$838, based on the average drug driving fine of $629 during 2018.

2.11 Waka Kotahi changes and promotion

Waka Kotahi advised that one-off system changes to accommodate the new regime would cost approximately $1,050,000, and that a promotion/education campaign to inform the public would cost another $500,000. Waka Kotahi would also be responsible for issuing suspension notices, processing limited licence applications, and reinstating licences. This CBA assumes that all drug-drivers who face criminal penalties will be disqualified from driving, and that all drivers who receive two drug driving infringements, and hence 100 demerit points, will also have their licence suspended. We assume 5-15% of all infringement notices will be to repeat offenders. According to Waka Kotahi, the cost per licence suspension notice is $53.51-$64.21. According to MoJ data[19], 8.7% of drivers who have their licence suspended apply for a limited licence, and on average 87% of them are successful with their application. Each limited licence application currently costs $39.30, and each licence reinstatement, which this CBA assumes all suspended licence holders will apply for when eligible, currently costs $66.40.[20]

2.12 Innocent driver inconvenience

This CBA only monetises the cost of increased travel time for *innocent* drivers. The rationale behind this is that drug driving is illegal, and we do not assign monetary benefits to illegal activity. It is assumed that the majority (67-90%) of OFTs will take place at checkpoints, only involving the OFT time itself, whereas the remainder will include time for the initial stop and discussion, and other steps outlined in Table 15. Based on the Economic Evaluation Manual (EEM), the value of travel time is assumed to be $25.88-$28.01 per hour, assuming a 90:10 to 70:30 split between urban and rural roads.[21]

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[17] Although the proportions of those three is unknown.

[18] Percent, not percentage points – e.g. 24-36% receive a fine, not 10-50%.

[19] For a previous MoT CBA – MoJ is not able to verify the calculation of this figure and advises caution in using the number, however this remains the best estimate available to MoT at the time of completing this CBA.

[20] www.nzta.govt.nz/driver-licences/licensing-fees/licence-fees/#other-fees

[21] In order to be conservative (i.e. overestimate, rather the underestimate, costs) this value of travel time is based on travel for work purposes. Travel for leisure purposes has a lower value of travel time.

2.13 Justice costs

For simplicity, this CBA assumes that all infringements are filed to the courts for MoJ to collect. MoJ previously[22] advised that it costs, on average, $0.29 to enforce collection of every $1.00 of fines. Note, while this CBA monetises and includes that cost of fine collection, it excludes the value of the fines themselves, as they are costs to one party and revenue to another party, hence having no impact on NZ's net-benefits. MoJ also advised that each limited licence application costs it $98, and that each defended licence hearing costs $174-$542 depending on the category/type. Due to time constraints, we were unable to fully quantify the impact this policy would have on the entire Justice pipeline, including the cost of facilitating legal aid and medical defences. These costs would not be insignificant, and thus introduce additional uncertainty in this analysis.

[22] For a previous MoT CBA – MoJ is not able to verify the calculation of this figure and advises caution in using the number, however this remains the best estimate available to MoT at the time of completing this CBA.

3. Results

3.1 Result summary

Table 18 compares the four options based on the medium, or most likely, assumptions, including a discount rate of 6% per annum. All assumptions are listed in the appendix.

Table 18: CBA option results comparison (aggregated over 2020-2029)

	1: Mixed system	2: Criminal only	3: Mandatory blood	4: Single OFT
Benefits ($m - present value)	**$415**	**$726**	**$415**	**$415**
Fatalities prevented	*65*	*114*	*65*	*65*
DSI crashes prevented	*431*	*755*	*431*	*431*
Methamphetamine crash reduction	$175.3	$306.9	$175.3	$175.3
Cannabis crash reduction	$85.2	$149.1	$85.2	$85.2
Sedative crash reduction	$71.6	$125.3	$71.6	$71.6
Ecstasy crash reduction	$36.0	$63.1	$36.0	$36.0
Opiate crash reduction	$30.9	$54.1	$30.9	$30.9
Cocaine crash reduction	$15.5	$27.1	$15.5	$15.5
Costs ($m - present value)	**$34**	**$150**	**$67**	**$33**
Infringements issued	*23,446*	*0*	*19,303*	*24,533*
Criminal prosecutions	*965*	*24,411*	*4,826*	*979*
Police costs*	$26.3	$62.6	$46.3	$25.9
Corrections costs	$3.2	$81.0	$16.0	$3.2
Waka Kotahi costs	$1.8	$3.7	$2.1	$1.8
Innocent driver inconvenience	$1.2	$1.2	$1.2	$1.2
Justice costs	$1.1	$1.6	$1.2	$1.2
Net present value (NPV)	**$381**	**$575**	**$348**	**$381**
Benefit cost ratio (BCR)	**12.36**	**4.83**	**6.21**	**12.46**
*Hallucinogen crash reduction***	*$56.4*	*$98.7*	*$56.4*	*$56.4*
*Infringement revenue***	*$4.7*	*$0*	*$3.9*	*$4.9*

*Includes blood specimen analysis cost.
**Excluded from benefits, costs, NPV, and BCR.

Note that the estimated benefits for options 1, 3 and 4 are identical because the model assumes that the deterrence impact is not influenced by whether one or two OFTs are required, nor whether blood analysis is voluntary or mandatory. However, Option 2, which has harsher penalties than the other options, does increase the modelled deterrence impact. All four options also assume the same number of drivers are tested, 33,000-99,000 per year during year 2-10, and half that amount during year one. However, because Option 4 does not require a second OFT, the overall number of OFTs performed under Option 4 is slightly lower than under the other options.

Note also that “hallucinogens” defined by Starkey and Charlton (2017) included both LSD and psilocybin (magic mushrooms). Although some OFT devices can detect LSD, very few currently detect magic mushrooms. Since we are unsure what proportion of the hallucinogen prevalence relates to magic mushrooms, this CBA takes the conservative approach of excluding hallucinogen crash reduction from the calculation of both net present value (NPV) and the benefit cost ratio (BCR).

Table 18 shows that this policy, depending on the option implemented, could prevent approximately 431-755 DSI crashes and 65-114 fatalities over a ten year period. When monetised, this crash reduction would reduce NZ’s road harm by $415m-$726m. Of note, the crash reduction attributable to methamphetamine-driving deterrence accounts for almost half of the total benefit of this policy, whereas cocaine-driving deterrence makes up less than 5% of the expected benefit.

Table 18 also reveals that the cost of this policy could range from $33m-$150m over the ten year period, with more than 20,000 drivers receiving penalties/sanctions. Of note, relative to Option 1, requiring blood analysis as a mandatory step of the regime almost doubles the total implementation cost, whereas implementing a criminal-only option would result in the most benefit, due to the assumed increase in deterrence, but would significantly increase the costs faced by Police and, in particular, Corrections.

Regardless of option, the modelled results show a BCR well above 1:1, and an NPV in excess of $300m over the 10-year period. Assuming the modelling is accurate, the policy would produce a positive NPV even if methamphetamine was the only substance the OFT detected and hence deterred – although this assumes drug-drivers would not substitute methamphetamine for another, non-tested, substance. The following sections explore the modelled results of each option in more detail.

3.2 Option 1: Mixed

A fully detailed breakdown of all benefits and costs for Option 1 is presented in the appendix.[23] Under Option 1, it is assumed that 652,770 OFTs and 4,896 blood tests would be performed during 2020-2029,[24] resulting in an average annual prevention of 5.8 fatal crashes and 37 serious injury crashes. This would require approximately 9,000 hours of Police time every year, and inconvenience innocent drivers by approximately 6,000 hours every year. Each year analysis of elected blood samples will confirm that approximately 7 drivers were falsely identified by OFT devices as drug-drivers. Hallucinogen crash reduction, which is excluded from the NPV and BCR, would be the fourth largest benefit – ahead of ecstasy, opiate, and cocaine crash reduction – assuming it could be tested for.

3.3 Option 2: Criminal only

Relative to Option 1, the criminal-penalty-only option has three primary implications. One, it increases all crash reduction benefits (under the assumption that criminal penalties would deter more drug-drivers) to the combined value of approximately $300m over ten years. Two, it more than doubles Police enforcement costs, due primarily to a significant increase in time spent on prosecutions, from an average of 1,700 hours per annum under Option 1, to 43,000 hours per annum. Three, it substantially increases costs for Corrections, with the number of drivers receiving imprisonment, home detention or community service rising from approximately 40 per annum under Option 1, to 1,000 per annum. While Option 2 would not raise any infringement revenue, since there are no infringements, it would result in $4.6m[25] in criminal fine revenue.

As a result, Option 2 is more beneficial overall than Option 1, with an NPV of $575m vs $381m, but is less economically/cost efficient, with a lower BCR of 4.83 vs 12.36. The low BCR, lower than any of the other three options, also implies it is a riskier option than the other three as it would take less variation in underlying assumptions to push the BCR below 1:1.

[23] A full breakdown of options 2, 3, and 4 is not provided in the interest of keeping this report concise. However, Option 1 forms the basis from which all other options deviate, and any pertinent differences and/or implications of those other options are discussed in their respective sections.

[24] This is less than half the number of breath-alcohol tests currently perfromed in a single year.

[25] It is purely a coincidence that this number is similar to the amount of infringement revenue foregone.

3.4 Option 3: Mandatory blood

Relative to Option 1, the option to require blood analysis for all offences has three primary implications. One, it increases the number of blood analyses required from approximately 500 per annum under Option 1, to approximately 2,500 per annum. Two, it increases the number of criminal prosecutions from approximately 100 per annum under Option 1, to 500 per annum, which represents drug-drivers who would have only received infringements were they not subjected to blood analysis. Three, it increases the number of drivers who have their innocence confirmed by blood analysis from approximately 7 per annum under Option 1, to approximately 35 per annum, decreasing the number of falsely penalised drivers.

As a result, Option 3 is less economically/cost efficient than Option 1, with a lower BCR of 6.21 vs 12.36. Option 3 is essentially a trade-off between efficiency and accuracy, with the additional accuracy doubling the cost of the policy.

3.5 Option 4: Single oral fluid test

Relative to Option 1, the single-OFT option has three primary implications. One, it increases the number of penalised drivers from approximately 2,450 per annum under Option 1, to 2,550, as false-positive OFT results increase. Two, it reduces Police spending on OFT devices from approximately $2m per annum under Option 1, to $1.5m, however this is partially offset by Police spending more time on criminal prosecutions. Three, the number of innocent drivers who have to rely on blood analysis to confirm their innocence increases from approximately 7 per annum under option 1, to 26 per annum.

As a result, Option 4 is more economically/cost efficient than Option 1, with a higher BCR of 12.46 vs 12.36. However, this marginal improvement in efficiency comes at the cost of more unjustly penalised drivers.

3.6 Sensitivity analysis

In order to assess the degree of uncertainty in this CBA, we performed a Monte Carlo simulation, running 100,000 iterations/permutations of the variable assumptions listed in the appendix, to see how the results would change. In the interest of brevity, this is only reported for Option 1. However, the breadth of results reported in Table 19 is indicative of the uncertainty in the other three options too.

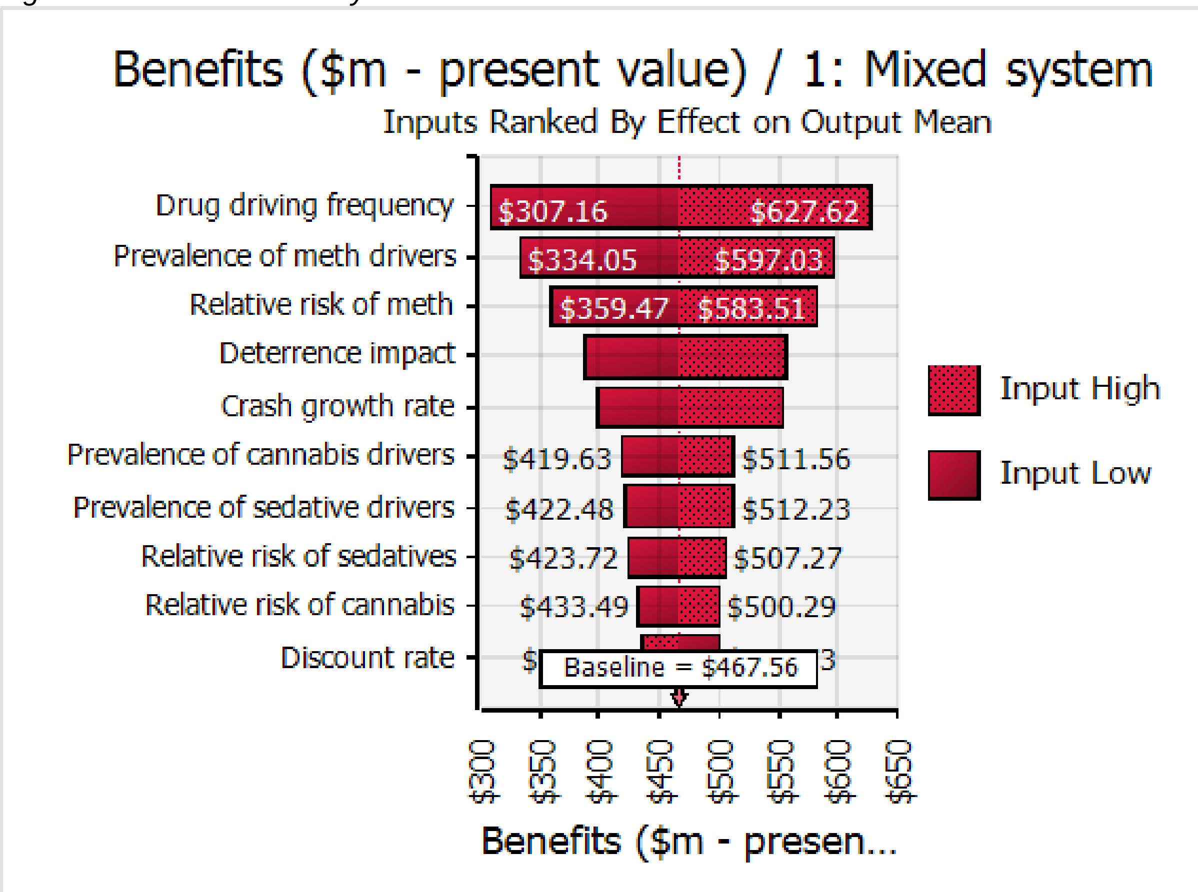
Table 19: Option 1 sensitivity analysis

Benefits ($m - present value)	**$238 - $779**
Fatalities prevented	*37 - 123*
DSI crashes prevented	*248 - 813*
Methamphetamine crash reduction	$57 - $434
Cannabis crash reduction	$38 - $167
Sedative crash reduction	$22 - $159
Ecstasy crash reduction	$11 - $81
Opiate crash reduction	$11 - $66
Cocaine crash reduction	$6 - $33
Costs ($m - present value)	**$22 - $51**
Infringements issued	*11,261 - 39,796*
Criminal prosecutions	*371 - 1,862*
Police cost	$17.5 - $40.0
Corrections costs	$1.2 - $6.3
Waka Kotahi costs	$1.6 - $2.0
Innocent driver inconvenience	$0.7 - $2.1
Justice costs	$0.5 - $1.9
Net present value (NPV)	**$206 - $741**
Benefit cost ratio (BCR)	**6.8 - 24.3**
Hallucinogen crash reduction	*$16.2 - $128.3*
Infringement revenue	*$2.2 - $8.0*

The large range of results in Table 19 illustrates the wide degree of uncertainty underlying this CBA, due to substantial evidential gaps. Under Option 1, the estimated reduction in fatalities could vary anywhere from 37 to 123 over the ten year period. Likewise, the predicted number of DSI crashes prevented could range from 248 to 813. However, despite the wide variability of these results, the NPV remains positive, and large, regardless of the mix of variable assumptions. This is also true of the BCR, which remains substantially above one despite the mix of variable assumptions. Nonetheless, it is important to note that this uncertainty could have significant implications on implementation costs. All of the costs, aside from those faced by Waka Kotahi and innocent drivers, vary considerably, in a relative sense at least, depending on the mix of variable assumptions. Likewise, the number of both infringements and criminal prosecutions vary widely based on the particular mix of variable assumptions.

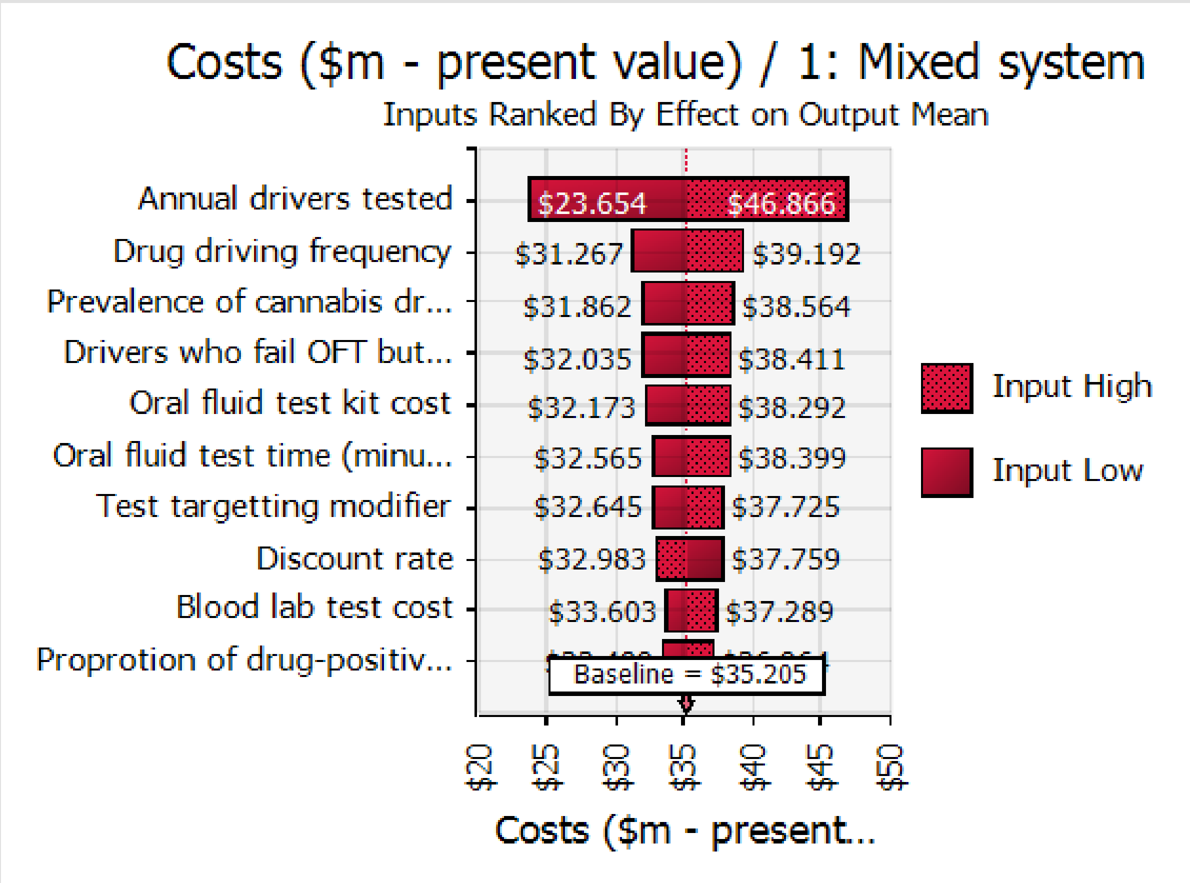
Using Monte Carlo simulation, it is also possible to identify which variable assumptions have the most impact on results, i.e. which assumptions are the most significant contributors to uncertainty. Figure 1 is a tornado plot showing how uncertainty in the variable assumptions contributes to variation in the total benefit estimate – the higher placed the assumption on the vertical axis, the more it contributes to uncertainty. Figure 1 reveals that the three most important elements to the determination of this policy's total benefit are: the frequency of drug driving; the prevalence of drivers with methamphetamine in their system; and the relative risk of driving under the influence of methamphetamine. This is not a surprising result given that evidence for all of these assumptions is lacking, hence the wide range of values for these assumptions in this CBA.

Figure 1: Benefit uncertainty contributors



The tornado plot in Figure 2 shows which variable assumptions have the most significant contribution to variation in the total cost estimate. Figure 2 highlights that the cost of this policy is primarily dependent on the number of drivers tested annually.

Figure 2: Cost uncertainty contributors



4. Conclusion

This CBA modelled the impact of four different options of oral fluid testing to enhance NZ's drug driving testing regime. From an economic/cost efficiency perspective, the estimated results support the introduction of any of the four options, as all were found to produce positive net benefits, each with BCRs above 1:1.

However, sensitivity analysis of the underlying assumptions used in the modelling revealed the possibility of significant variation in the estimated results. This variation highlighted the uncertainty that underlies this analysis, due primarily to several significant evidence gaps. Nevertheless, despite this level of uncertainty, the estimated benefits continue to be much larger than the estimated costs, even at the 90% confidence interval.

Perhaps the most significant evidence gap relates to the deterrence effectiveness of this policy. There is little empirical evidence to determine the deterrence effectiveness of oral fluid testing, and although this CBA has made conservative assumptions regarding this, those assumptions may still be inaccurate. Also, data on the prevalence of drug driving in NZ's driving population is incomplete – while we have a rough idea how many New Zealanders have driven under the influence of drugs, we do not know how regularly they do so. It would be extremely beneficial, both to analysis of this kind and road safety insight in general, if NZ conducted a random roadside testing survey in order to ascertain better evidence on the prevalence of drug driving.

Moreover, due to resource constraints this CBA did not consider the operational capacity of a number of key functions, such as ESR's capacity to analyse an increased number of blood specimens, Police's capacity to train sufficient staff to carryout the volume of oral fluid testing, the justice pipeline's capacity to process an increased number of offenders, or Corrections' capacity to house and/or monitor an increased number of criminals.

Therefore, although this CBA provided evidence to support the implementation of oral fluid testing in NZ, regardless of whether or not this policy, or one like it, is implemented, NZ policymakers would benefit from further research in the drug driving domain.

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Appendix

Table 20: Social cost per road crash - MoT (2018) & Waka Kotahi (2018)

Crash severity	$ May 2015 – EEM	$ June 2018 - MoT	$ July 2019*
Fatal	4,725,000	5,071,600	5,156,543
Serious injury	500,000	525,600	534,403
Minor injury	29,000	29,900	30,401
Non-injury	3,000	N/A	3,233

*Costs adjusted for CPI inflation to Q2-2019 (Stats NZ, 2019).

Table 21: List of variable assumptions

Assumptions	**Low**	**Medium**	**High**
Crash growth rate	-3.85%	0.00%	5.62%
Drug crash proportion	12.50%	25.00%	50.00%
Drug driving frequency	10.00%	20.00%	30.00%
Prevalence of cannabis drivers	2.50%	8.35%	14.20%
Prevalence of meth drivers	0.10%	1.25%	2.40%
Prevalence of hallucinogen drivers	0.10%	1.10%	2.10%
Prevalence of ecstacy drivers	0.10%	0.70%	1.30%
Prevalence of opiate drivers	0.20%	0.60%	1.00%
Prevalence of sedative drivers	0.20%	1.40%	2.60%
Prevalence of cocaine drivers	0.10%	0.30%	0.50%
Relative risk of cannabis	1.5	2	2.5
Relative risk of meth	5	15	30
Relative risk of hallucinogens	2	6	10
Relative risk of esctacy	2	6	10
Relative risk of opiates	2	6	10
Relative risk of sedatives	2	6	10
Relative risk of cocaine	2	6	10
Deterrence impact	20%	25%	33%
Discount rate	4%	6%	8%
One-off police training cost	300,000	350,000	400,000
Annual drivers tested	33,000	66,000	99,000
Proportion of checkpoint tests	67%	75%	90%
Blood collection kit cost	$6.50	$8.66	$10.83
Value of police time (per hour)	$89.12	$118.83	$148.54
Drug driving criminal fine	$419	$629	$838
Fine collection cost (per fine dollar)	22%	29%	36%
Oral fluid test kit cost	22.05	31.35	40.65
Oral fluid test time (minutes)	1	3	8
Initial stop and discussion time (minutes)	10	12.5	15
Test targetting modifier	1	1.5	2
Oral fluid test accuracy	90%	95%	99%
Driver travel time value (per hour)	$25.88	$26.94	$28.01
Transport to station time (minutes)	10	12.5	15
Transport back to car/home time (minutes)	15	17.5	20
Blood collection time (minutes)	30	40	50
Police prosecution time (minutes)	720	1,080	1,440
Defended licence court cost	$174	$304	$542
Criminal only option deterrence multiplier	1.50	1.75	2.00
Criminal sentence Corrections cost	$8,532	$10,665	$12,798
Proportion who would apply for limited licence	7.0%	8.7%	10.4%
Successful with limited licence application	77.0%	87.0%	97.0%
Criminal cases resulting in fines	24.0%	30.0%	36.0%
Criminal cases resulting in imprisonment, home det or com sentences	34.3%	42.9%	51.5%
Drivers who fail OFT but elect evidential blood test	10.0%	20.0%	30.0%
Proprotion of drug-positive blood tests at criminal levels	10.0%	20.0%	30.0%
Repeat infringement offenders	5.0%	10.0%	15.0%
Suspension notice cost to NZTA	$53.51	$58.86	$64.21
Second oral fluid test independence modifier	0.50	0.75	1.00
Blood lab test cost	$500	$900	$2,000
New infringement in OnDuty app	$300,000	$450,000	$600,000

Table 22: Option 1 detailed benefit modelling results

Cannabis-driving reduction benefits	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2020-2029**
Cannabis fatal crash reduction	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	12
Cannabis serious crash reduction	8	8	8	8	8	8	8	8	8	8	77
Cannabis minor crash reduction	33	33	33	33	33	33	33	33	33	33	333
Cannabis non-injury crash reduction	97	97	97	97	97	97	97	97	97	97	968
Cannabis total crash reduction	139	139	139	139	139	139	139	139	139	139	1,389
Cannabis fatality reduction	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	13
Cannabis serious injury reduction	9	9	9	9	9	9	9	9	9	9	92
Cannabis minor injury reduction	44	44	44	44	44	44	44	44	44	44	439
Cannabis total casualty reduction	54	54	54	54	54	54	54	54	54	54	544
Cannabis fatal crash reduction benefit	$6,150,206	$6,150,206	$6,150,206	$6,150,206	$6,150,206	$6,150,206	$6,150,206	$6,150,206	$6,150,206	$6,150,206	$61,502,062
Cannabis serious crash reduction benefit	$4,097,733	$4,097,733	$4,097,733	$4,097,733	$4,097,733	$4,097,733	$4,097,733	$4,097,733	$4,097,733	$4,097,733	$40,977,331
Cannabis minor crash reduction benefit	$1,011,199	$1,011,199	$1,011,199	$1,011,199	$1,011,199	$1,011,199	$1,011,199	$1,011,199	$1,011,199	$1,011,199	$10,111,990
Cannabis non-injury crash reduction benefit	$313,013	$313,013	$313,013	$313,013	$313,013	$313,013	$313,013	$313,013	$313,013	$313,013	$3,130,134
Cannabis total crash reduction benefit	$11,572,152	$11,572,152	$11,572,152	$11,572,152	$11,572,152	$11,572,152	$11,572,152	$11,572,152	$11,572,152	$11,572,152	$115,721,518
Cannabis fatal crash reduction benefit - present value (PV)	$5,802,081	$5,473,662	$5,163,832	$4,871,539	$4,595,792	$4,335,653	$4,090,238	$3,858,715	$3,640,298	$3,434,243	$45,266,053
Cannabis serious crash reduction benefit - present value (PV)	$3,865,786	$3,646,968	$3,440,536	$3,245,788	$3,062,065	$2,888,740	$2,725,227	$2,570,968	$2,425,442	$2,288,153	$30,159,673
Cannabis minor crash reduction benefit - present value (PV)	$953,961	$899,964	$849,022	$800,964	$755,627	$712,855	$672,505	$634,439	$598,527	$564,648	$7,442,513
Cannabis non-injury crash reduction benefit - present value (PV)	$295,296	$278,581	$262,812	$247,936	$233,902	$220,662	$208,172	$196,389	$185,272	$174,785	$2,303,806
Cannabis total crash reduction benefit - present value (PV)	$10,917,124	$10,299,174	$9,716,202	$9,166,228	$8,647,385	$8,157,910	$7,696,142	$7,260,511	$6,849,539	$6,461,829	$85,172,045
Meth-driving reduction benefits	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2020-2029**
Meth fatal crash reduction	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	25
Meth serious crash reduction	16	16	16	16	16	16	16	16	16	16	158
Meth minor crash reduction	68	68	68	68	68	68	68	68	68	68	685
Meth non-injury crash reduction	199	199	199	199	199	199	199	199	199	199	1,993
Meth total crash reduction	286	286	286	286	286	286	286	286	286	286	2,860
Meth fatality reduction	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8	28
Meth serious injury reduction	19	19	19	19	19	19	19	19	19	19	189
Meth minor injury reduction	90	90	90	90	90	90	90	90	90	90	904
Meth total casualty reduction	112	112	112	112	112	112	112	112	112	112	1,121
Meth fatal crash reduction benefit	$12,661,750	$12,661,750	$12,661,750	$12,661,750	$12,661,750	$12,661,750	$12,661,750	$12,661,750	$12,661,750	$12,661,750	$126,617,498
Meth serious crash reduction benefit	$8,436,217	$8,436,217	$8,436,217	$8,436,217	$8,436,217	$8,436,217	$8,436,217	$8,436,217	$8,436,217	$8,436,217	$84,362,166
Meth minor crash reduction benefit	$2,081,808	$2,081,808	$2,081,808	$2,081,808	$2,081,808	$2,081,808	$2,081,808	$2,081,808	$2,081,808	$2,081,808	$20,818,080
Meth non-injury crash reduction benefit	$644,417	$644,417	$644,417	$644,417	$644,417	$644,417	$644,417	$644,417	$644,417	$644,417	$6,444,171
Meth total crash reduction benefit	$23,824,191	$23,824,191	$23,824,191	$23,824,191	$23,824,191	$23,824,191	$23,824,191	$23,824,191	$23,824,191	$23,824,191	$238,241,914
Meth fatal crash reduction benefit - present value (PV)	$11,945,047	$11,268,912	$10,631,049	$10,029,292	$9,461,596	$8,926,034	$8,420,787	$7,944,138	$7,494,470	$7,070,255	$93,191,581
Meth serious crash reduction benefit - present value (PV)	$7,958,695	$7,508,203	$7,083,210	$6,682,274	$6,304,032	$5,947,200	$5,610,566	$5,292,987	$4,993,384	$4,710,739	$62,091,288
Meth minor crash reduction benefit - present value (PV)	$1,963,970	$1,852,802	$1,747,926	$1,648,987	$1,555,648	$1,467,593	$1,384,521	$1,306,152	$1,232,219	$1,162,471	$15,322,288
Meth non-injury crash reduction benefit - present value (PV)	$607,941	$573,529	$541,065	$510,439	$481,546	$454,289	$428,574	$404,315	$381,429	$359,839	$4,742,966
Meth total crash reduction benefit - present value (PV)	$22,475,652	$21,203,446	$20,003,251	$18,870,991	$17,802,822	$16,795,115	$15,844,448	$14,947,592	$14,101,502	$13,303,304	$175,348,123
Hallucinogen-driving reduction benefits	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2020-2029**
Hallucinogen fatal crash reduction	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	8
Hallucinogen serious crash reduction	5	5	5	5	5	5	5	5	5	5	51
Hallucinogen minor crash reduction	22	22	22	22	22	22	22	22	22	22	220
Hallucinogen non-injury crash reduction	64	64	64	64	64	64	64	64	64	64	641
Hallucinogen total crash reduction	92	92	92	92	92	92	92	92	92	92	920
Hallucinogen fatality reduction	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	9
Hallucinogen serious injury reduction	6	6	6	6	6	6	6	6	6	6	61
Hallucinogen minor injury reduction	29	29	29	29	29	29	29	29	29	29	291
Hallucinogen total casualty reduction	36	36	36	36	36	36	36	36	36	36	361
Hallucinogen fatal crash reduction benefit	$4,073,874	$4,073,874	$4,073,874	$4,073,874	$4,073,874	$4,073,874	$4,073,874	$4,073,874	$4,073,874	$4,073,874	$40,738,737
Hallucinogen serious crash reduction benefit	$2,714,323	$2,714,323	$2,714,323	$2,714,323	$2,714,323	$2,714,323	$2,714,323	$2,714,323	$2,714,323	$2,714,323	$27,143,232
Hallucinogen minor crash reduction benefit	$669,814	$669,814	$669,814	$669,814	$669,814	$669,814	$669,814	$669,814	$669,814	$669,814	$6,698,145
Hallucinogen non-injury crash reduction benefit	$207,339	$207,339	$207,339	$207,339	$207,339	$207,339	$207,339	$207,339	$207,339	$207,339	$2,073,389
Hallucinogen total crash reduction benefit	$7,665,350	$7,665,350	$7,665,350	$7,665,350	$7,665,350	$7,665,350	$7,665,350	$7,665,350	$7,665,350	$7,665,350	$76,653,503
Hallucinogen fatal crash reduction benefit - present value (PV)	$3,843,277	$3,625,733	$3,420,503	$3,226,890	$3,044,235	$2,871,920	$2,709,359	$2,555,999	$2,411,320	$2,274,830	$29,984,065
Hallucinogen serious crash reduction benefit - present value (PV)	$2,560,682	$2,415,738	$2,278,998	$2,149,998	$2,028,300	$1,913,491	$1,805,180	$1,703,000	$1,606,604	$1,515,664	$19,977,655
Hallucinogen minor crash reduction benefit - present value (PV)	$631,900	$596,132	$562,389	$530,556	$500,524	$472,193	$445,465	$420,250	$396,462	$374,021	$4,929,893
Hallucinogen non-injury crash reduction benefit - present value (PV)	$195,603	$184,531	$174,086	$164,232	$154,936	$146,166	$137,892	$130,087	$122,724	$115,777	$1,526,033
Hallucinogen total crash reduction benefit - present value (PV)	$7,231,463	$6,822,134	$6,435,976	$6,071,675	$5,727,996	$5,403,769	$5,097,896	$4,809,336	$4,537,109	$4,280,292	$56,417,645

Ecstacy-driving reduction benefits	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2020-2029**
Ecstacy fatal crash reduction	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	5
Ecstacy serious crash reduction	3	3	3	3	3	3	3	3	3	3	32
Ecstacy minor crash reduction	14	14	14	14	14	14	14	14	14	14	141
Ecstacy non-injury crash reduction	41	41	41	41	41	41	41	41	41	41	410
Ecstacy total crash reduction	59	59	59	59	59	59	59	59	59	59	588
Ecstacy fatality reduction	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	6
Ecstacy serious injury reduction	4	4	4	4	4	4	4	4	4	4	39
Ecstacy minor injury reduction	19	19	19	19	19	19	19	19	19	19	186
Ecstacy total casualty reduction	23	23	23	23	23	23	23	23	23	23	230
Ecstacy fatal crash reduction benefit	$2,602,763	$2,602,763	$2,602,763	$2,602,763	$2,602,763	$2,602,763	$2,602,763	$2,602,763	$2,602,763	$2,602,763	$26,027,629
Ecstacy serious crash reduction benefit	$1,734,158	$1,734,158	$1,734,158	$1,734,158	$1,734,158	$1,734,158	$1,734,158	$1,734,158	$1,734,158	$1,734,158	$17,341,577
Ecstacy minor crash reduction benefit	$427,939	$427,939	$427,939	$427,939	$427,939	$427,939	$427,939	$427,939	$427,939	$427,939	$4,279,387
Ecstacy non-injury crash reduction benefit	$132,467	$132,467	$132,467	$132,467	$132,467	$132,467	$132,467	$132,467	$132,467	$132,467	$1,324,671
Ecstacy total crash reduction benefit	$4,897,326	$4,897,326	$4,897,326	$4,897,326	$4,897,326	$4,897,326	$4,897,326	$4,897,326	$4,897,326	$4,897,326	$48,973,263
Ecstacy fatal crash reduction benefit - present value (PV)	$2,455,437	$2,316,450	$2,185,330	$2,061,632	$1,944,936	$1,834,845	$1,730,986	$1,633,006	$1,540,571	$1,453,369	$19,156,561
Ecstacy serious crash reduction benefit - present value (PV)	$1,635,998	$1,543,394	$1,456,032	$1,373,615	$1,295,864	$1,222,513	$1,153,314	$1,088,032	$1,026,445	$968,345	$12,763,552
Ecstacy minor crash reduction benefit - present value (PV)	$403,716	$380,864	$359,306	$338,968	$319,781	$301,680	$284,604	$268,494	$253,296	$238,959	$3,149,666
Ecstacy non-injury crash reduction benefit - present value (PV)	$124,969	$117,895	$111,222	$104,926	$98,987	$93,384	$88,098	$83,111	$78,407	$73,969	$974,969
Ecstacy total crash reduction benefit - present value (PV)	$4,620,119	$4,358,603	$4,111,890	$3,879,141	$3,659,567	$3,452,422	$3,257,002	$3,072,643	$2,898,720	$2,734,641	$36,044,748
Opiates-driving reduction benefits	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2020-2029**
Opiates fatal crash reduction	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	4
Opiates serious crash reduction	3	3	3	3	3	3	3	3	3	3	28
Opiates minor crash reduction	12	12	12	12	12	12	12	12	12	12	121
Opiates non-injury crash reduction	35	35	35	35	35	35	35	35	35	35	352
Opiates total crash reduction	50	50	50	50	50	50	50	50	50	50	504
Opiates fatality reduction	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	5
Opiates serious injury reduction	3	3	3	3	3	3	3	3	3	3	33
Opiates minor injury reduction	16	16	16	16	16	16	16	16	16	16	159
Opiates total casualty reduction	20	20	20	20	20	20	20	20	20	20	198
Opiates fatal crash reduction benefit	$2,233,157	$2,233,157	$2,233,157	$2,233,157	$2,233,157	$2,233,157	$2,233,157	$2,233,157	$2,233,157	$2,233,157	$22,331,572
Opiates serious crash reduction benefit	$1,487,898	$1,487,898	$1,487,898	$1,487,898	$1,487,898	$1,487,898	$1,487,898	$1,487,898	$1,487,898	$1,487,898	$14,878,985
Opiates minor crash reduction benefit	$367,169	$367,169	$367,169	$367,169	$367,169	$367,169	$367,169	$367,169	$367,169	$367,169	$3,671,692
Opiates non-injury crash reduction benefit	$113,656	$113,656	$113,656	$113,656	$113,656	$113,656	$113,656	$113,656	$113,656	$113,656	$1,136,561
Opiates total crash reduction benefit	$4,201,881	$4,201,881	$4,201,881	$4,201,881	$4,201,881	$4,201,881	$4,201,881	$4,201,881	$4,201,881	$4,201,881	$42,018,810
Opiates fatal crash reduction benefit - present value (PV)	$2,106,752	$1,987,502	$1,875,002	$1,768,870	$1,668,745	$1,574,288	$1,485,177	$1,401,110	$1,321,802	$1,246,983	$16,436,232
Opiates serious crash reduction benefit - present value (PV)	$1,403,678	$1,324,224	$1,249,268	$1,178,555	$1,111,844	$1,048,910	$989,537	$933,526	$880,685	$830,835	$10,951,062
Opiates minor crash reduction benefit - present value (PV)	$346,386	$326,779	$308,282	$290,832	$274,370	$258,840	$244,188	$230,367	$217,327	$205,025	$2,702,397
Opiates non-injury crash reduction benefit - present value (PV)	$107,223	$101,153	$95,428	$90,026	$84,930	$80,123	$75,588	$71,309	$67,273	$63,465	$836,519
Opiates total crash reduction benefit - present value (PV)	$3,964,039	$3,739,659	$3,527,980	$3,328,283	$3,139,890	$2,962,160	$2,794,491	$2,636,312	$2,487,087	$2,346,308	$30,926,210
Sedative-driving reduction benefits	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2020-2029**
Sedative fatal crash reduction	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	10
Sediate serious crash reduction	6	6	6	6	6	6	6	6	6	6	64
Sedative minor crash reduction	28	28	28	28	28	28	28	28	28	28	280
Sedative non-injury crash reduction	81	81	81	81	81	81	81	81	81	81	814
Sedative total crash reduction	117	117	117	117	117	117	117	117	117	117	1,168
Sedative fatality reduction	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	11
Sedative serious injury reduction	8	8	8	8	8	8	8	8	8	8	77
Sedative minor injury reduction	37	37	37	37	37	37	37	37	37	37	369
Sedative total casualty reduction	46	46	46	46	46	46	46	46	46	46	458
Sedative fatal crash reduction benefit	$5,169,590	$5,169,590	$5,169,590	$5,169,590	$5,169,590	$5,169,590	$5,169,590	$5,169,590	$5,169,590	$5,169,590	$51,695,901
Sedative serious crash reduction benefit	$3,444,372	$3,444,372	$3,444,372	$3,444,372	$3,444,372	$3,444,372	$3,444,372	$3,444,372	$3,444,372	$3,444,372	$34,443,724
Sedative minor crash reduction benefit	$849,969	$849,969	$849,969	$849,969	$849,969	$849,969	$849,969	$849,969	$849,969	$849,969	$8,499,690
Sedative non-injury crash reduction benefit	$263,105	$263,105	$263,105	$263,105	$263,105	$263,105	$263,105	$263,105	$263,105	$263,105	$2,631,052
Sedative total crash reduction benefit	$9,727,037	$9,727,037	$9,727,037	$9,727,037	$9,727,037	$9,727,037	$9,727,037	$9,727,037	$9,727,037	$9,727,037	$97,270,367
Sedative fatal crash reduction benefit - present value (PV)	$4,876,972	$4,600,917	$4,340,488	$4,094,800	$3,863,018	$3,644,357	$3,438,073	$3,243,465	$3,059,872	$2,886,672	$38,048,633
Sedative serious crash reduction benefit - present value (PV)	$3,249,408	$3,065,479	$2,891,962	$2,728,266	$2,573,835	$2,428,147	$2,290,704	$2,161,042	$2,038,719	$1,923,320	$25,350,881
Sedative minor crash reduction benefit - present value (PV)	$801,858	$756,469	$713,650	$673,255	$635,146	$599,195	$565,278	$533,281	$503,095	$474,618	$6,255,846
Sedative non-injury crash reduction benefit - present value (PV)	$248,212	$234,163	$220,908	$208,404	$196,608	$185,479	$174,980	$165,075	$155,732	$146,917	$1,936,477
Sedative total crash reduction benefit - present value (PV)	$9,176,450	$8,657,028	$8,167,008	$7,704,724	$7,268,608	$6,857,177	$6,469,035	$6,102,863	$5,757,418	$5,431,527	$71,591,837

Cocaine-driving reduction benefits	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2020-2029**
Cocaine fatal crash reduction	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	2
Cocaine serious crash reduction	1	1	1	1	1	1	1	1	1	1	14
Cocaine minor crash reduction	6	6	6	6	6	6	6	6	6	6	61
Cocaine non-injury crash reduction	18	18	18	18	18	18	18	18	18	18	176
Cocaine total crash reduction	25	25	25	25	25	25	25	25	25	25	253
Coaine fatality reduction	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	2
Cocaine serious injury reduction	2	2	2	2	2	2	2	2	2	2	17
Cocaine minor injury reduction	8	8	8	8	8	8	8	8	8	8	80
Cocaine total casualty reduction	10	10	10	10	10	10	10	10	10	10	99
Cocaine fatal crash reduction benefit	$1,119,918	$1,119,918	$1,119,918	$1,119,918	$1,119,918	$1,119,918	$1,119,918	$1,119,918	$1,119,918	$1,119,918	$11,199,183
Cocaine serious crash reduction benefit	$746,174	$746,174	$746,174	$746,174	$746,174	$746,174	$746,174	$746,174	$746,174	$746,174	$7,461,744
Cocaine minor crash reduction benefit	$184,134	$184,134	$184,134	$184,134	$184,134	$184,134	$184,134	$184,134	$184,134	$184,134	$1,841,337
Cocaine non-injury crash reduction benefit	$56,998	$56,998	$56,998	$56,998	$56,998	$56,998	$56,998	$56,998	$56,998	$56,998	$569,980
Cocaine total crash reduction benefit	$2,107,224	$2,107,224	$2,107,224	$2,107,224	$2,107,224	$2,107,224	$2,107,224	$2,107,224	$2,107,224	$2,107,224	$21,072,245
Cocaine fatal crash reduction benefit - present value (PV)	$1,056,527	$996,723	$940,305	$887,080	$836,868	$789,498	$744,810	$702,651	$662,878	$625,357	$8,242,696
Cocaine serious crash reduction benefit - present value (PV)	$703,938	$664,093	$626,502	$591,040	$557,585	$526,024	$496,249	$468,159	$441,659	$416,660	$5,491,909
Cocaine minor crash reduction benefit - present value (PV)	$173,711	$163,878	$154,602	$145,851	$137,595	$129,807	$122,459	$115,528	$108,988	$102,819	$1,355,240
Cocaine non-injury crash reduction benefit - present value (PV)	$53,772	$50,728	$47,857	$45,148	$42,592	$40,181	$37,907	$35,761	$33,737	$31,827	$419,510
Cocaine total crash reduction benefit - present value (PV)	$1,987,948	$1,875,422	$1,769,266	$1,669,119	$1,574,641	$1,485,510	$1,401,425	$1,322,099	$1,247,263	$1,176,663	$15,509,355
Total benefits (excluding hallucinogen benefits)	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2020-2029**
Fatal crash reduction	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	58
Serious crash reduction	37	37	37	37	37	37	37	37	37	37	373
Minor crash reduction	162	162	162	162	162	162	162	162	162	162	1,619
Non-injury crash reduction	471	471	471	471	471	471	471	471	471	471	4,712
Total crash reduction	676	676	676	676	676	676	676	676	676	676	6,763
Fatality reduction	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	65
Serious injury reduction	45	45	45	45	45	45	45	45	45	45	448
Minor injury reduction	214	214	214	214	214	214	214	214	214	214	2,137
Total casualty reduction	265	265	265	265	265	265	265	265	265	265	2,650
Fatal crash reduction benefit	$29,937,385	$29,937,385	$29,937,385	$29,937,385	$29,937,385	$29,937,385	$29,937,385	$29,937,385	$29,937,385	$29,937,385	$299,373,846
Serious crash reduction benefit	$19,946,553	$19,946,553	$19,946,553	$19,946,553	$19,946,553	$19,946,553	$19,946,553	$19,946,553	$19,946,553	$19,946,553	$199,465,527
Minor crash reduction benefit	$4,922,218	$4,922,218	$4,922,218	$4,922,218	$4,922,218	$4,922,218	$4,922,218	$4,922,218	$4,922,218	$4,922,218	$49,222,176
Non-injury crash reduction benefit	$1,523,657	$1,523,657	$1,523,657	$1,523,657	$1,523,657	$1,523,657	$1,523,657	$1,523,657	$1,523,657	$1,523,657	$15,236,568
Total crash reduction benefit	$56,329,812	$56,329,812	$56,329,812	$56,329,812	$56,329,812	$56,329,812	$56,329,812	$56,329,812	$56,329,812	$56,329,812	$563,298,118
Fatal crash reduction benefit - present value (PV)	$28,242,816	$26,644,166	$25,136,005	$23,713,213	$22,370,955	$21,104,675	$19,910,071	$18,783,085	$17,719,892	$16,716,879	$220,341,757
Serious crash reduction benefit - present value (PV)	$18,817,503	$17,752,361	$16,747,510	$15,799,538	$14,905,225	$14,061,533	$13,265,597	$12,514,714	$11,806,334	$11,138,051	$146,808,365
Minor crash reduction benefit - present value (PV)	$4,643,602	$4,380,756	$4,132,789	$3,898,857	$3,678,167	$3,469,969	$3,273,556	$3,088,260	$2,913,453	$2,748,541	$36,227,950
Non-injury crash reduction benefit - present value (PV)	$1,437,412	$1,356,049	$1,279,292	$1,206,879	$1,138,565	$1,074,118	$1,013,319	$955,961	$901,850	$850,802	$11,214,247
Total crash reduction benefit - present value (PV)	$53,141,332	$50,133,332	$47,295,596	$44,618,487	$42,092,912	$39,710,295	$37,462,542	$35,342,021	$33,341,529	$31,454,273	$414,592,318

Table 23: Option 1 detailed cost modelling results

NZTA costs	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2020-2029**
One-off promotion/education cost	$500,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$500,000
One-off system change cost	$1,050,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,050,000
Number of suspension notices issued	174	348	348	348	348	348	348	348	348	348	3,310
Suspension notices cost	$10,253	$20,507	$20,507	$20,507	$20,507	$20,507	$20,507	$20,507	$20,507	$20,507	$194,814
Limited licence applications	15	30	30	30	30	30	30	30	30	30	288
Limited licence success	13	26	26	26	26	26	26	26	26	26	251
Limited licence applications cost	$596	$1,191	$1,191	$1,191	$1,191	$1,191	$1,191	$1,191	$1,191	$1,191	$11,316
Licence reinstatement cost	$10,691	$21,382	$21,382	$21,382	$21,382	$21,382	$21,382	$21,382	$21,382	$21,382	$203,132
Total NZTA cost	$1,571,540	$43,080	$43,080	$43,080	$43,080	$43,080	$43,080	$43,080	$43,080	$43,080	$1,959,263
One-off promotion/education cost - present value (PV)	$471,698	$0	$0	$0	$0	$0	$0	$0	$0	$0	$471,698
One-off system change cost - present value (PV)	$990,566	$0	$0	$0	$0	$0	$0	$0	$0	$0	$990,566
Suspension notices cost - present value (PV)	$9,673	$18,251	$17,218	$16,243	$15,324	$14,456	$13,638	$12,866	$12,138	$11,451	$141,259
Limited licence applications cost - present value (PV)	$562	$1,060	$1,000	$944	$890	$840	$792	$747	$705	$665	$8,205
Licence reinstatement cost - present value (PV)	$10,086	$19,030	$17,953	$16,937	$15,978	$15,074	$14,220	$13,416	$12,656	$11,940	$147,290
Total NZTA cost - present value (PV)	$1,482,585	$38,341	$36,171	$34,124	$32,192	$30,370	$28,651	$27,029	$25,499	$24,056	$1,759,018
Police costs	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2020-2029**
Number of checkpoint tests	24,750	49,500	49,500	49,500	49,500	49,500	49,500	49,500	49,500	49,500	470,250
Number of pulled over tests	8,250	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500	16,500	156,750
Number of oral fluid tests performed	34,356	68,713	68,713	68,713	68,713	68,713	68,713	68,713	68,713	68,713	652,770
Number of positive initial checkpoint tests	1,017	2,034	2,034	2,034	2,034	2,034	2,034	2,034	2,034	2,034	19,327
Number of positive initial pulled-over tests	339	678	678	678	678	678	678	678	678	678	6,442
Number of positive second checkpoint tests	966	1,933	1,933	1,933	1,933	1,933	1,933	1,933	1,933	1,933	18,361
Number of positive second pulled-over tests	322	644	644	644	644	644	644	644	644	644	6,120
Oral fluid test police time (hours)	1,718	3,436	3,436	3,436	3,436	3,436	3,436	3,436	3,436	3,436	32,638
Initial stop and discussion time (hours)	1,719	3,438	3,438	3,438	3,438	3,438	3,438	3,438	3,438	3,438	32,656
Pulled over driver transport to and from station for blood test time (hours)	32	64	64	64	64	64	64	64	64	64	612
Number of blood tests	258	515	515	515	515	515	515	515	515	515	4,896
Blood collection time (hours)	172	344	344	344	344	344	344	344	344	344	3,264
Positive blood tests	254	508	508	508	508	508	508	508	508	508	4,826
Criminal prosecutions	51	102	102	102	102	102	102	102	102	102	965
Prosecution time (hours)	914	1,829	1,829	1,829	1,829	1,829	1,829	1,829	1,829	1,829	17,373
Total police time (hours)	4,555	9,110	9,110	9,110	9,110	9,110	9,110	9,110	9,110	9,110	86,544
One-off app update	$450,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$450,000
One-off training cost	$350,000	$0	$0	$0	$0	$0	$0	$0	$0	$0	$350,000
Oral fluid test device cost	$1,077,070	$2,154,140	$2,154,140	$2,154,140	$2,154,140	$2,154,140	$2,154,140	$2,154,140	$2,154,140	$2,154,140	$20,464,330
Blood collection kit cost	$2,232	$4,463	$4,463	$4,463	$4,463	$4,463	$4,463	$4,463	$4,463	$4,463	$42,401
Total police time cost	$541,265	$1,082,529	$1,082,529	$1,082,529	$1,082,529	$1,082,529	$1,082,529	$1,082,529	$1,082,529	$1,082,529	$10,284,026
Total police costs	$2,420,566	$3,241,132	$3,241,132	$3,241,132	$3,241,132	$3,241,132	$3,241,132	$3,241,132	$3,241,132	$3,241,132	$31,590,758
One-off app update - present value (PV)	$424,528	$0	$0	$0	$0	$0	$0	$0	$0	$0	$424,528
One-off training cost - present value (PV)	$330,189	$0	$0	$0	$0	$0	$0	$0	$0	$0	$330,189
Oral fluid test device cost - present value (PV)	$1,016,104	$1,917,177	$1,808,657	$1,706,281	$1,609,699	$1,518,584	$1,432,626	$1,351,534	$1,275,032	$1,202,861	$14,838,554
Blood collection kit cost - present value (PV)	$2,105	$3,972	$3,747	$3,535	$3,335	$3,146	$2,968	$2,800	$2,642	$2,492	$30,745
Total police time cost - present value (PV)	$510,627	$963,447	$908,912	$857,464	$808,929	$763,140	$719,944	$679,192	$640,747	$604,479	$7,456,881
Total police costs - present value (PV)	$2,283,553	$2,884,596	$2,721,317	$2,567,280	$2,421,963	$2,284,870	$2,155,538	$2,033,527	$1,918,421	$1,809,831	$23,080,897
Justice costs	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2020-2029**
Infringements (transfers - not included in CBA)	1,234	2,468	2,468	2,468	2,468	2,468	2,468	2,468	2,468	2,468	23,446
Criminal fines (transfers - not included in CBA)	15	30	30	30	30	30	30	30	30	30	290
Infringement cost (transfer - not included in CBA)	$246,796	$493,593	$493,593	$493,593	$493,593	$493,593	$493,593	$493,593	$493,593	$493,593	$4,689,132
Criminal fine cost (transfer - not included in CBA)	$9,578	$19,156	$19,156	$19,156	$19,156	$19,156	$19,156	$19,156	$19,156	$19,156	$181,983
Fine collection cost	$74,349	$148,697	$148,697	$148,697	$148,697	$148,697	$148,697	$148,697	$148,697	$148,697	$1,412,623
Limited licence cost	$6,092	$12,185	$12,185	$12,185	$12,185	$12,185	$12,185	$12,185	$12,185	$12,185	$115,755
Total Justice cost	$80,441	$160,882	$160,882	$160,882	$160,882	$160,882	$160,882	$160,882	$160,882	$160,882	$1,528,378
Fine collection cost - present value (PV)	$70,140	$132,340	$124,849	$117,782	$111,115	$104,826	$98,892	$93,294	$88,014	$83,032	$1,024,284
Limited licence cost - present value (PV)	$5,748	$10,844	$10,231	$9,651	$9,105	$8,590	$8,104	$7,645	$7,212	$6,804	$83,933
Total Justice cost - present value (PV)	$75,888	$143,184	$135,080	$127,434	$120,220	$113,415	$106,996	$100,939	$95,226	$89,836	$1,108,217

Blood specimen analysis costs	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2020-2029
Blood specimen analysis cost	$231,927	$463,855	$463,855	$463,855	$463,855	$463,855	$463,855	$463,855	$463,855	$463,855	$4,406,619
Blood specimen analysis cost - present value (PV)	$218,799	$412,829	$389,461	$367,416	$346,619	$326,999	$308,490	$291,028	$274,555	$259,014	$3,195,211
Corrections costs	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2020-2029**
Criminal sentences (imprisonment, home detention, community service)	22	44	44	44	44	44	44	44	44	44	414
Criminal sentence cost	$232,425	$464,851	$464,851	$464,851	$464,851	$464,851	$464,851	$464,851	$464,851	$464,851	$4,416,080
Criminal sentence cost - present value (PV)	$219,269	$413,715	$390,297	$368,205	$347,363	$327,701	$309,152	$291,653	$275,144	$259,570	$3,202,071
Innocent driver costs	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2020-2029**
Number of innocent initial checkpoint drivers	23,733	47,466	47,466	47,466	47,466	47,466	47,466	47,466	47,466	47,466	450,923
Number of innocent initial pulled over drivers	7,911	15,822	15,822	15,822	15,822	15,822	15,822	15,822	15,822	15,822	150,308
Number of innocent second test drivers	68	136	136	136	136	136	136	136	136	136	1,288
Total number of innocent oral fluid tested drivers	31,712	63,423	63,423	63,423	63,423	63,423	63,423	63,423	63,423	63,423	602,519
Number of innocent blood tested drivers	4	7	7	7	7	7	7	7	7	7	70
Innocent initial checkpoint driver time (hours)	1,187	2,373	2,373	2,373	2,373	2,373	2,373	2,373	2,373	2,373	22,546
Innocent initial pulled over driver time (hours)	2,044	4,087	4,087	4,087	4,087	4,087	4,087	4,087	4,087	4,087	38,829
Innocent second test drivers (hours)	3	7	7	7	7	7	7	7	7	7	64
Innocent blood tested driver time (hours)	2	5	5	5	5	5	5	5	5	5	47
Total innocent driver time (hours)	3,236	6,472	6,472	6,472	6,472	6,472	6,472	6,472	6,472	6,472	61,487
Innocent checkpoint driver cost	$31,971	$63,943	$63,943	$63,943	$63,943	$63,943	$63,943	$63,943	$63,943	$63,943	$607,457
Innocent pulled over driver cost	$55,062	$110,124	$110,124	$110,124	$110,124	$110,124	$110,124	$110,124	$110,124	$110,124	$1,046,175
Innocent second test driver cost	$91	$183	$183	$183	$183	$183	$183	$183	$183	$183	$1,736
Innocent blood tested driver cost	$67	$133	$133	$133	$133	$133	$133	$133	$133	$133	$1,264
Total innocent driver cost	$87,191	$174,382	$174,382	$174,382	$174,382	$174,382	$174,382	$174,382	$174,382	$174,382	$1,656,632
Innocent checkpoint driver cost - present value (PV)	$30,162	$56,909	$53,688	$50,649	$47,782	$45,077	$42,526	$40,119	$37,848	$35,705	$440,463
Innocent pulled over driver cost - present value (PV)	$51,945	$98,010	$92,462	$87,228	$82,291	$77,633	$73,239	$69,093	$65,182	$61,493	$758,575
Innocent second test driver cost - present value (PV)	$86	$163	$153	$145	$137	$129	$122	$115	$108	$102	$1,259
Innocent blood tested driver cost - present value (PV)	$63	$118	$112	$105	$99	$94	$89	$83	$79	$74	$917
Total innocent driver cost - present value (PV)	$82,256	$155,200	$146,415	$138,127	$130,309	$122,933	$115,974	$109,410	$103,217	$97,374	$1,201,213
Total costs	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2020-2029**
Police cost	$2,420,566	$3,241,132	$3,241,132	$3,241,132	$3,241,132	$3,241,132	$3,241,132	$3,241,132	$3,241,132	$3,241,132	$31,590,758
NZTA cost	$1,571,540	$43,080	$43,080	$43,080	$43,080	$43,080	$43,080	$43,080	$43,080	$43,080	$1,959,263
Justice cost	$80,441	$160,882	$160,882	$160,882	$160,882	$160,882	$160,882	$160,882	$160,882	$160,882	$1,528,378
Blood specimen analysis costs	$231,927	$463,855	$463,855	$463,855	$463,855	$463,855	$463,855	$463,855	$463,855	$463,855	$4,406,619
Corrections cost	$232,425	$464,851	$464,851	$464,851	$464,851	$464,851	$464,851	$464,851	$464,851	$464,851	$4,416,080
Innocent driver cost	$87,191	$174,382	$174,382	$174,382	$174,382	$174,382	$174,382	$174,382	$174,382	$174,382	$1,656,632
Total drug-driving testing cost	$4,624,091	$4,548,182	$4,548,182	$4,548,182	$4,548,182	$4,548,182	$4,548,182	$4,548,182	$4,548,182	$4,548,182	$45,557,730
Police cost - present value (PV)	$2,283,553	$2,884,596	$2,721,317	$2,567,280	$2,421,963	$2,284,870	$2,155,538	$2,033,527	$1,918,421	$1,809,831	$23,080,897
NZTA cost - present value (PV)	$1,482,585	$38,341	$36,171	$34,124	$32,192	$30,370	$28,651	$27,029	$25,499	$24,056	$1,759,018
Justice - present value (PV)	$75,888	$143,184	$135,080	$127,434	$120,220	$113,415	$106,996	$100,939	$95,226	$89,836	$1,108,217
Blood specimen analysis cost - present value (PV)	$218,799	$412,829	$389,461	$367,416	$346,619	$326,999	$308,490	$291,028	$274,555	$259,014	$3,195,211
Corrections cost - present value (PV)	$219,269	$413,715	$390,297	$368,205	$347,363	$327,701	$309,152	$291,653	$275,144	$259,570	$3,202,071
Innocent driver cost - present value (PV)	$82,256	$155,200	$146,415	$138,127	$130,309	$122,933	$115,974	$109,410	$103,217	$97,374	$1,201,213
Total drug-driving testing cost - present value (PV)	$4,362,350	$4,047,866	$3,818,741	$3,602,586	$3,398,666	$3,206,289	$3,024,801	$2,853,586	$2,692,062	$2,539,681	$33,546,628

Table 24: Option 1 detailed overall modelling results

Net present value (NPV)	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2020-2029
Total benefits - present value (PV)	$53,141,332	$50,133,332	$47,295,596	$44,618,487	$42,092,912	$39,710,295	$37,462,542	$35,342,021	$33,341,529	$31,454,273	$414,592,318
Cumulative benefits - present value (PV)	$53,141,332	$103,274,664	$150,570,260	$195,188,747	$237,281,659	$276,991,954	$314,454,496	$349,796,516	$383,138,045	$414,592,318	N/A
Total costs - present value (PV)	$4,362,350	$4,047,866	$3,818,741	$3,602,586	$3,398,666	$3,206,289	$3,024,801	$2,853,586	$2,692,062	$2,539,681	$33,546,628
Cumulative costs - present value (PV)	$4,362,350	$8,410,216	$12,228,957	$15,831,543	$19,230,210	$22,436,499	$25,461,299	$28,314,885	$31,006,947	$33,546,628	N/A
Total net present value (NPV)	$48,778,982	$46,085,466	$43,476,855	$41,015,901	$38,694,246	$36,504,006	$34,437,741	$32,488,435	$30,649,467	$28,914,592	$381,045,690
Cumulative net present value (NPV)	$48,778,982	$94,864,448	$138,341,303	$179,357,203	$218,051,449	$254,555,455	$288,993,196	$321,481,631	$352,131,098	$381,045,690	N/A
Total benefit cost ratio (BCR)	12.18	12.39	12.39	12.39	12.39	12.39	12.39	12.39	12.39	12.39	12.36
Cumulative benefit cost ratio (BCR)	12.18	12.28	12.31	12.33	12.34	12.35	12.35	12.35	12.36	12.36	N/A