



**Ministry of Transport**  
TE MANATŌ WAKA

# **Initial Evaluation (“Stocktake”) of Road Safety to 2010 Strategy**

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**Contents**

<b>1. Summary .....</b>	<b>3</b>
<b>2. Methodology .....</b>	<b>3</b>
<b>3. Analysis of the Increase in Road Safety Funding Since 2000/01 .....</b>	<b>7</b>
<i>LTSA and Police Road Safety Funding .....</i>	<i>8</i>
<i>Transfund Financed (Including Assisted Local Authority) Expenditure .....</i>	<i>12</i>
<i>Vehicle Fleet Improvements .....</i>	<i>13</i>
<i>The Reduction in Fatality and Hospital Bed-Day Rates .....</i>	<i>13</i>
<b>4. Assessment of Benefits of Individual Outputs.....</b>	<b>16</b>
<i>Road Construction and Re-engineering .....</i>	<i>16</i>
<i>Restraint Control .....</i>	<i>16</i>
<i>Drunk and Drugged Driver Control.....</i>	<i>18</i>
<i>Speed Control and Speed Cameras .....</i>	<i>18</i>
<i>Visible Road Safety Enforcement.....</i>	<i>20</i>
<i>Commercial Vehicle Investigation and RUC Enforcement .....</i>	<i>20</i>
<i>Incident and Emergency Management .....</i>	<i>21</i>
<i>Prosecutions and Sanctions.....</i>	<i>21</i>
<i>LTSA Expenditure .....</i>	<i>21</i>
<b>5. Conclusion.....</b>	<b>22</b>

## INITIAL EVALUATION (“STOCKTAKE”) OF THE GOVERNMENT’S ROAD SAFETY TO 2010 STRATEGY

### 1. Introduction

- 1.1 The Ministry of Transport (MOT) acting on behalf of the National Road Safety Committee is managing the “Initial Evaluation of the Road Safety to 2010 Strategy” for which this report is one input. Other inputs are being provided by an international road safety expert for example. The overall evaluation has been referred to as a “Stocktake” although the Request for Proposals (RFP) notes that the overall evaluation being managed by the MoT “clearly involves more than a straight “stocktake” but this term has been used to differentiate this project from the wider evaluation of the Road Safety to 2010 Strategy that the stocktake is part of”<sup>1</sup>. The objective of the (overall) evaluation is to provide the government with a sound understanding of the costs and benefits of each of the interventions (individually and collectively) implemented in support of achieving the Government’s road safety goals within the context of the New Zealand Transport Strategy (NZTS). The contribution of this report is to provide, within the limitations of the agreed cost, an initial assessment of the costs and benefits of specified road safety expenditures based upon readily accessible measures and existing research results.
- 1.2 This report responds to the RFP which specifies certain key aspects of the project. Firstly, the RFP specifies that “The year under consideration for the stocktake is therefore, 1 July 2003 to 30 June 2004”. The closest available approximation to that year for most outcome data analyses is the 2003 calendar year data and therefore in accordance with the RFP we have focussed on calendar 2003 outcomes<sup>2</sup>. Secondly, the RFP specifies the “The units of analysis for the Police Output Class are as listed on p35 (Table 11). The units of analysis for the LTSA Output Classes are as listed on p15 (Table 6).” The references are to the document “New Zealand Road Safety Programme (Safety (Administration) Programme 2003-2004”. In regard to these outputs, this report is based on an LTSA provided combined version of these two tables.

### 2. Methodology

- 2.1 Evaluation of an intervention such as expenditure on road safety depends upon a comparison with a counterfactual i.e. a view of what would have happened in the absence of the intervention. As it happens the LTSA table shows LTSA and Police road safety funding, after remaining virtually unchanged over the period 1997/98 to 1999/00 (hereafter 1997-99), was increased substantially from 2000/01. This substantial increase after a period of relatively constant

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<sup>1</sup> Request for Proposals para 1

<sup>2</sup> Clearly there is a trade-off between the benefit of smoothing by using data for a number of years versus the value of using the latest data given that there has been a marked step up in enforcement activity through to 2003/04. The RFP decides this trade-off in favour of focussing on the latest data.

funding offers the opportunity of identifying how the increase in funding has translated into changes in outcomes. Essentially the average road safety outcome for the period 1997-99 can serve as a counterfactual with which to compare the 2003/04 outcome (provided relevant changes such as in population, the vehicle fleet and vehicle kilometres travelled are taken into account). Accordingly, the prime focus of this report is to compare recent, usually 2003, outcomes to the average for the period 1997-99. This is in effect an evaluation of the results associated with the increased funding. In principle, consideration can be given to whether the evaluation of the increased funding can be extrapolated to provide some insights into the benefits of the base funding, i.e. the level during 1997-99.

- 2.2 The RFP seeks an assessment of the gross cost and the benefits of each intervention. For many, although not all, of the interventions the gross cost is readily available. In general therefore the key issue is to estimate the benefits of each intervention. This is not straightforward because all of the interventions appear to contribute to the desired outcome namely the reduction of road fatalities, injuries and property damage. The challenge is to separate out the effects of the different interventions. The standard approach to this issue of multiple causes and effects in policy evaluations is to attempt to trace out how the major interventions are believed to contribute to the outcome objectives of reducing road fatalities, injuries and property damage i.e. the “intervention logic” associated with the interventions. The intervention logic is a description of the causal links that focuses on defining measurable “intermediate outcomes” that the intervention is intended to achieve, these being means to the end of achieving the overall outcome sought, in this case reduction in the road toll. While tracing out an intervention logic can often provide insights into the effectiveness of an intervention, a quantitative assessment of the benefits usually requires the availability of additional information.
- 2.3 In undertaking this report we considered three different methodologies for deriving quantitative estimates of the benefits of the different road safety interventions under consideration.
- Firstly, for several interventions, crash reports provide information on changes in the contribution of specific casual factors (e.g. alcohol) to crashes. Changes in the prevalence of these casual factors can in some cases be interpreted to provide an estimate of the effect of the increase in expenditure on the intervention targeted at that casual factor.
  - Secondly, for some intervention logics researchers have estimated a quantitative relationship between the corresponding intermediate outcome, e.g. the mean speed of traffic, and the overall road toll. Not surprisingly much more research on such relationships has been undertaken overseas than in New Zealand and consequently the issue of judging the applicability of the research to New Zealand is involved.
  - Thirdly, regression analysis can be used whereby an equation is estimated which is the best “fit” to explain the outcome results (expressed

quantitatively) as a “weighted” combination of the quantities of the different outputs (or in some applications the intermediate outcomes). The reliability of the estimated weights (coefficients) depends on the number of separate observations i.e. in this case the number of periods for which data on the outcomes are available. In the current case the objective is to provide a stocktake related to the increase in expenditure since 1999/00. Given this time period there are far too few annual observations to undertake a regression analysis. A larger number of observations are available for quarterly data but the one study that has been undertaken using regression analysis noted that limitations regarding quarterly data suggest “we should use quarterly models mainly for comparing the overall effects and not for individual effects, since the error is likely to be greater at that level”<sup>3</sup>. Thus although the results of the study referred to are interesting, regression analysis is of limited relevance to the stocktake until more observations are available (i.e. more years have elapsed since 1999/00.)

- 2.4 Given the limitations applying to the second and third methodologies as discussed above the main methodology of this report is the first approach. We examine developments in the intermediate outputs and developments reported by Police attending crashes in regard to various related casual factors such as speed (“too fast for conditions”). The available data allow a degree of attribution of developments regarding crashes to the various casual factors and thereby to the interventions targeted at those factors. The attribution is incomplete and some uncertainty remains regarding the strength of the causality but the analysis appears to provide useful insights that can inform future decision making regarding expenditure on different interventions.
- 2.5 Various measures of the direct outputs produced are available for the enforcement interventions (e.g. hours logged, tickets issued and breath tests administered) and for advertising expenditure (e.g. viewers and listeners reached and awareness and opinion survey results). Although the measures involved, such as tickets issued and breath tests administered, do not capture all of the effects involved and in particular the deterrent effect of visible patrols this does not undermine the analysis in this case. The reason is that the main contribution of analyses of these measures for the period concerned is to confirm that there was a very marked increase in enforcement activity. The data appears generally consistent with the Police attribution of hours to outputs although it is not possible to verify that attribution and clearly some activities, such as patrolling, cannot in practice be compartmentalised into separate outputs such as speed limit enforcement.
- 2.6 Having confirmed through the measures such as tickets issued that a substantial increase in enforcement activity did indeed occur which is in general terms consistent with the reported attributable hours data the analysis moves on to the issue of identifying the effects of the increased activity in different enforcement areas. With the exception of the “Visible road safety enforcement” output, measures are available indicating some effects of the

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<sup>3</sup> p64 “An evaluation of the Supplementary Road Safety Package July 1995 to June 2000”, LTSA, 2002  
8/06/20062004 Page 5 Taylor Duignan Barry Ltd & Parker  
Duignan Ltd

enforcement on motorist behaviour in such areas as wearing of restraints, speed and breath alcohol levels. These behavioural effects can be viewed as intermediate outcomes of the enforcement interventions.

- 2.7 Some research is available on the links between enforcement and the intermediate outcomes, for example between tickets issued for speeding offences and average speed travelled. For the period of the stocktake, however, it is not really necessary to rely on such research since the increase in enforcement and the effects on behaviour are sufficiently dramatic that the causal links to enforcement seem clear in general terms without needing to depend on regression analysis or other techniques that might otherwise be required.
- 2.8 While the links between the outputs (i.e. enforcement) and the intermediate outcomes (e.g. mean speeds) seem clear for the major enforcement activities (with the exception of “Visible road safety enforcement”) the links between the intermediate outcomes and the overall outcome sought (reduction in fatalities and injuries) are much more difficult to analyse. This is the major focus of the analysis section.
- 2.9 The desired overall outcomes are a reduction in road fatalities and injuries resulting from crashes in which the factors addressed by the interventions feature as a cause (or as a mitigating factor in the case of restraints). In principle the fatalities and injuries can be combined into one measure of social cost by attributing dollar values to fatalities and (different types) of injuries. However, there are issues regarding the comparability of the reported injury data between years in the recent period which suggest that hospital bed-days data is a much better measure of changes in road injuries. (Improved reporting of injuries appears to have increased the number of injuries reported when in fact the incidence of serious injury was falling as discussed further later in this report.) Unfortunately the social cost calculation has been developed for application to reported injury data rather than hospital bed day data which therefore limits the ability to calculate a track of social cost that can be regarded as a reliable basis for analysis. LTSA has advised that it is working on conversion factors to allow social cost to be calculated from hospital bed-days but this work is not yet complete. Consequently the analysis in this present report covers trends in fatalities and in injuries (as measured by hospital bed-days) separately.
- 2.10 Analysis of road safety developments needs to recognise that, absent any change in interventions or characteristics of the vehicle fleet, fatalities and injuries might be expected to reflect the growth in population, traffic volumes (vehicle kilometres travelled) or possibly (for congested roads) registered vehicles. By 2003 the population, vehicle kilometres travelled and registered vehicles were around 5.9%, 6.6% and 14% respectively higher than the 1997-99 average<sup>4</sup>. The measures most relevant to adjust for growth appear to be the rates of fatalities and hospital bed-days per 100,000 of population (“per 100K pop”) and per billion vehicle kilometres travelled (“per BVKT”). The analysis

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<sup>4</sup> For vehicle kilometres travelled the calculation compares 2003 with 1998 (no survey in 1997 or 1999).

is complicated by the marked variability in traffic volume growth between years and the sharp contrast between recent rapid growth in rural traffic and decline in urban traffic. Unfortunately the split between urban and rural traffic volumes is available only since 2000. An estimate for 1998 has been derived by assuming rural traffic volumes grew at the same rate as total traffic volumes between 1998 and 2000. The data are as follows:

Year	VKT (billion)		
	Total	Rural	Urban
1998	36.4	19.0*	n/a
2000	37.2	19.4	17.8
2001	36.1	19.6	16.5
2003	38.8	21.9	16.9

Source: LTSA except \* which is authors' estimate

Given the marked variation in growth rates between urban and rural traffic, several approaches to adjusting for growth have been adopted. Firstly both the urban and the rural outcome data have been expressed as rates per 100K pop. Separately the rural outcomes have been calculated as a rate per BVKT of rural traffic (assuming rural BVKT grew at the same rate as total BVKT between 1998 and 2000 as noted above). The growth rate of rural BVKT on this assumption was 15.4% and therefore similar to the growth rate for registered vehicles of 14.4%. Urban traffic volume has fallen in recent years but is less relevant to urban crashes with factors such as number of registered vehicles and the number of turns and intersections transited being important instead. Accordingly the urban and total outcomes per 10,000 vehicles are also reported to provide insight into the changes in fatality and hospital bed-day rates.

### 3. Analysis of the Increase in Road Safety Funding Since 2000/01

3.1 The Road Safety to 2010 strategy involves a variety of ongoing, expanded and new initiatives. One indication of the implementation to date is the increase in funding of the Land Transport Safety Authority and Police (road safety) outputs amounting to nearly 45% over the four years to 2003/04 as set out below:

	1999/00	2000/01	2001/02	2002/03	2003/04
<b>Police</b>	<b>\$146.6M</b>	<b>\$164.8M</b>	<b>\$180.9M*</b>	<b>\$192.1M</b>	<b>\$202.2M</b>
<b>LTSA</b>	<b>\$22.5M</b>	<b>\$25.6M</b>	<b>\$28.4M</b>	<b>\$42.0M</b>	<b>\$42.2M</b>
<b>Total</b>	<b>\$169.1M</b>	<b>\$190.4M</b>	<b>\$209.3M</b>	<b>\$234.1M</b>	<b>\$244.4M</b>

- After estimates adjustment

In addition to the above Safety Administration Programme (SAP) funding other funding of road safety related expenditure includes:

- Transfund financed expenditure justified by safety objectives
- Local authority expenditure comprising road engineering, and other

activity

- ACC financed expenditure on road safety promotion

The contribution to road safety of Transfund financed road construction and re-engineering (including assisted Local Authority works) is discussed after analysing how the substantial increase in SAP funding since 2000/01 has been utilised.

***LTSA and Police Road Safety Funding***

3.2 Within the overall increase in the SAP funding the allocation to different outputs has changed substantially over the recent period. As a basis for this stocktake the following table provides full details of this allocation including to new outputs such as the Highway Patrol. The data is expressed in dollar terms with the inflation aspect being discussed later.

<b>Output Class/Output</b>	<b>1999/00*</b>	<b>2003/04</b>	<b>\$M Chg</b>	<b>% Chg</b>	<b>03/04 % Total</b>
<b>Strategic Capability and Road Policing</b>					
Strategic Capability and Road Policing Management	\$0.0M	\$3.1M	\$3.1M	n/a	1.3%
District Road Policing Intel	\$0.0M	\$0.7M	\$0.7M	n/a	0.3%
Highway Patrol Groups	\$0.0M	\$26.7M	\$26.7M	n/a	10.9%
Speed Control	\$18.4M	\$24.9M	\$6.6M	36%	10.2%
Traffic Camera Operations	\$16.8M	\$14.3M	-\$2.5M	-15%	5.9%
Drinking or Drugged Driver Control	\$32.6M	\$42.6M	\$10.0M	31%	17.4%
Restraint Device Control	\$4.8M	\$9.1M	\$4.2M	88%	3.7%
Visible Road Safety Enforcement	\$29.5M	\$25.5M	-\$4.0M	-13%	10.4%
Commercial Vehicle Investigation and RUC Enforcement	\$9.0M	\$11.7M	\$2.7M	30%	4.8%
<b>Sub-total</b>	<b>\$111.1M</b>	<b>\$158.6M</b>	<b>\$47.5M</b>	<b>43%</b>	<b>64.9%</b>



## Stocktake of Road Safety to 2010 Strategy

Output Class/Output	1999/00*	2003/04	\$M Chg	% Chg	03/04 % Total
<b>Incident and emergency management</b>					
Crash Attendance and Investigation	\$15.9M	\$18.4M	\$2.5M	16%	7.5%
Traffic Flow Supervision	\$3.6M	\$3.3M	-\$0.3M	-7%	1.4%
Incidents, Emergencies and Disasters	\$1.2M	\$1.3M	\$0.2M	15%	0.5%
Events	\$1.9M	\$1.6M	-\$0.4M	-19%	0.6%
<b>Sub-total</b>	<b>\$22.6M</b>	<b>\$24.6M</b>	<b>\$2.1M</b>	<b>9%</b>	<b>10.1%</b>
<b>Prosecutions and sanctions</b>	<b>\$4.0M</b>	<b>\$10.8M</b>	<b>\$6.8M</b>	<b>170%</b>	<b>4.4%</b>
<b>Community engagement</b>	<b>\$8.9M</b>	<b>\$8.1M</b>	<b>-\$0.8M</b>	<b>-9%</b>	<b>3.3%</b>
<b>NZ Police sub-total</b>	<b>\$146.6M</b>	<b>\$202.2M</b>	<b>\$55.6M</b>	<b>38%</b>	<b>82.7%</b>
<b>LTSA</b>					
Policy Advice	\$3.5M	\$3.2M	-\$0.3M	-8%	1.3%
Safety Information & Promotion	\$15.4M	\$25.8M	\$10.4M	68%	10.6%
Grants Management	\$2.8M	\$8.9M	\$6.1M	220%	3.6%
Safety Audit	\$0.9M	\$2.7M	\$1.8M	212%	1.1%
Licensing	\$0.0M	\$1.1M	\$1.1M	n/a	0.5%
Vehicle Impoundment: Land Transport	\$0.0M	\$0.4M	\$0.4M	n/a	0.2%
<b>LTSA sub-total</b>	<b>\$22.5M</b>	<b>\$42.2M</b>	<b>\$19.7M</b>	<b>87%</b>	<b>17.3%</b>
<b>Grand total</b>	<b>\$169.1M</b>	<b>\$244.4M</b>	<b>\$75.3M</b>	<b>45%</b>	<b>100%</b>

\* Funding in 1997/98 and 1998/99 was very similar to that of 1999/00

The Highway Patrol Group is a new type of output since it is based on the type of road patrolled rather than being based on a specific type of road offence as with most of the other outputs. It is understood that a high proportion of the resources devoted to the Highway Patrol are concerned with speed issues although clearly other interventions such drunk and drugged driver control are also involved.

- 3.3 The effect of inflation is included in the above dollar increases. LTSA have advised that the Police wage round was 4% to 4.5% per annum (p.a.) over the period 2000 to 2004. Based on this and other cost increases Police have assessed that of the \$56M increased funding in the above table only \$38M was a real increase with the remaining amount representing accommodation of inflation in costs (based on movements in policing costs generally). On this basis the overall real increase for the Police outputs would be 23%. The hours reported by Police have increased by more than this 23% factor which could be interpreted as indicating improved productivity in the sense that more hours are allocated to the roads safety outputs. The alternative interpretation is that the cost inflation estimated by Police has not impacted fully on road safety operations possibly because of the mix of staff in this area compared to the Police as a whole or for some other reasons.

## Stocktake of Road Safety to 2010 Strategy

- 3.4 LTSA have advised that TV advertising prices increased by over 10% p.a. over the relevant period implying that over one half of the 68% increase in safety information and promotion expenditure would have been required to offset inflation with the real increase being less than 30%.
- 3.5 LTSA estimate that the overall real increase in LTSA and Police road safety funding over the period concerned is 26.8% in real terms or around \$51.6M at 2003/04 prices.
- 3.6 The above analysis summarises the increase in the direct cost of the interventions listed. The next issue is to assess the benefits. For the first output class, road policing, covering nearly 65% of the total expenditure in the table, hours recorded and tickets issued provide relatively precise quantitative measures of the delivery of the outputs. In the case of “Drinking or Drugged Driver Control” breath tests administered provides a specific measure of the delivery of the enforcement output.
- 3.7 The increase in tickets issued and breath tests administered is detailed in the following table:

<b>Offence Category</b>	<b>1999/00</b>	<b>2002/03</b>	<b>% Chg</b>
Speeding (Under 100 kph)	67,756	190,433	181.1%
Speeding (Over 100 kph)	52,998	159,036	200.1%
Speeding – Other (Trailer etc)	2,804	14,710	424.6%
Drink Drive Offences	28,646	24,744	-13.6%
Seat Belt/helmet	32,373	76,182	135.3%
Dangerous/unsafe etc	85,885	95,757	11.5%
Licence/hours/condition/COF	281,208	408,936	45.4%
Other Transport Offences	8,757	23,197	164.9%
<b>Sub Total “Officer Tickets”</b>	<b>560,427</b>	<b>992,995</b>	<b>77.2%</b>
Speeding - Speed Camera	440,195	488,714	11.0%
<b>Total All Tickets</b>	<b>1,000,622</b>	<b>1,481,709</b>	<b>48.1%</b>
<b>Breath Tests (for Alcohol)</b>	<b>1,783,000</b>	<b>2,197,000</b>	<b>23.2%</b>

The above table indicates that the 43% nominal and around 23% real increase in funding of road policing has been matched by a substantially larger increase in tickets issued, particularly tickets issued by officers which have increased by over 77% in total. The increase has been spread across most offence types with particularly large percentage increases in speeding tickets and seat belt/helmet tickets. These two areas received large increases in funding (taking into account the introduction of the Highway Patrol). In the case of Drink Driving Offences the number of tickets issued has reduced but the increase in

breath tests administered indicates that the reduction is due to less offending rather than less enforcement. Enforcement activity in the form of breath tests administered has increased by 23% which is well above the increase in funding for this activity in real terms.

3.8 Beyond the measure of output delivery, there are a set of measures of intermediate outcomes which can be linked by an “intervention logic” to the outputs on the one hand and to the overall outcomes on the other. The desired overall outcomes are a reduction in fatalities and injuries resulting from crashes in which the factors addressed by the interventions feature as a cause (or as a mitigating factor in the case of restraints). As recorded in the next table the increase in tickets issued has been associated with a marked improvement in compliance. Mean speeds and the percentage exceeding speed limits fell. The increase in breath tests was associated with less drunk driving offences detected. This reduced detection of drunk driving offending appears to reflect a reduction in the percentage of drivers who were over the limit, as discussed later in this report.

3.9 The intermediate outcomes of above enforcement outputs are summarised in the following table which shows substantial improvements in compliance.

<b>Intermediate Outcomes</b>	<b>Avg 97-99</b>	<b>2001</b>	<b>2003</b>	<b>97/99-03 Chg</b>
<b>Survey of Speeds (kph)</b>				
Speed, rural winter mean	101.8	100.2	98	-3.8
Speed, % exceeding 110 km/h	20%	13%	6%	-14%
Speed, rural winter 85 <sup>th</sup> pctile (kph)	113	109	105	-8.0
Speed, rural summer mean (kph)	102.6	101.9	99.9	-2.7
Speed, urban mean (kph)	55.6	54.9	53.7	-1.9
Speed, % exceeding 60 km/h	22%	18%	12%	-10%
Speed, urban 85 <sup>th</sup> pctile (kph)	62	61	60	-2.0
<b>Breath Test Results</b>				
Surveyed % over limit	2.0%	1.2%	<1%*	-50%
<b>Survey of Restraint Use</b>				
Seat belts worn (adult): front	87%	92%	92%	5%
Seat belts worn (adult): rear	58%	70%	81%	23%
Children restrained: 0-14, all	88%	89%	96%	8%

\* Based on interpolation of 2004 results since no survey was undertaken in 2003

These major improvements in compliance have been achieved in a relatively short period. Examination of the longer time series for these compliance areas indicates that while some improvement in compliance was occurring prior to the expanded funding and policing from 2000/01, the improvement accelerated markedly from that time. The data provide compelling evidence that intensified enforcement combined with the LTSA’s advertising and education programmes generated the improved compliance. While it is

relatively easy to measure compliance in the above areas it is more difficult in the case of the Visible Road Safety output where funding has been reduced.

***Transfund Financed (Including Assisted Local Authority) Expenditure***

- 3.10 Transfund assess a construction or re-engineering project's contribution to safety as one component when assessing whether the project's benefit cost ratio is sufficient to justify funding. The safety benefits accrue each year from the date of construction either indefinitely into the future (e.g. widening a cutting) or until replacement is required (e.g. a wire barrier). Transfund discounts future benefits by a standard discount rate which has been the subject of several studies. (Because it is applied to "pre-tax" benefits the discount rate appears high in comparison with commercial rates applied to post-tax cashflows.) An allowance is made for increased future traffic volumes but not for any **real** increase in the social cost of a fatality or injuries over the life of the project. Arguably, the social cost will increase in line with growth in real per capita incomes. However, omission of this growth factor needs to be seen in the context of the willingness to pay approach to social cost which ensures a full value is placed on fatalities and injuries.
- 3.11 Transfund's 2002/03 annual report estimates that National Land Transport Programme projects (including local authority projects) which were to be allocated funding and planned to start in 2002/03, with a total cost of \$596M, had expected benefits of \$2695M. The benefits comprised congestion relief of \$1523M, safety benefits of \$516M and route quality and efficiency benefits of \$656M<sup>5</sup>. The \$516M is the present value of the flow of annual savings in social cost over a number of years - the annual equivalent is discussed below. The 2003/04 data is yet to be published but can be expected to show results of a similar magnitude. Transfund report that "meaningful benefit data are available only for construction projects at this stage".
- 3.12 The recent study "*Assessment of Strategies, Policies and Programmes Affecting Road Safety*" completed in December 2003 by Peter Vulcan and others (the Vulcan 2003 Study) offers an assessment that planned road construction and re-engineering would reduce fatalities, injuries and total associated social cost by 4.2%, 3.5% and 3.3% respectively over the three years to 2005/06. Given their base year social cost of \$3.6B (June 2002 dollars) this would represent an annual social cost reduction of \$118M. The implication is that on average for those three years, road construction and re-engineering expenditure provides savings in social cost of around \$40M per annum. This can be reconciled with the Transfund estimate of a \$516M present benefit from the 2002/03 expenditure if on average the projects concerned yield benefits for more than 10 to 12 years. In general use of the original project analysis appears to be the only way to assess the benefits of Transfund and local authority expenditure apart from the few cases where follow up monitoring is being used such as in relation to "black spot" treatment (see discussion later).

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<sup>5</sup> Transfund Annual Report 2002/03 p 21

- 3.13 The Vulcan 2003 Report estimates imply annual rates of reduction in fatalities and injuries of around 1.4% and 1.2% per annum from Transfund financed projects. However, LTSA has advised that it estimates that road construction and re-engineering over the nine years 2001 to 2010 would reduce fatalities and injuries by 7% or around 0.75% per annum. The LTSA estimate implies that in comparing 2003 with 1997-99, road construction and re-engineering could account for a reduction of around 4% in fatalities whereas the Vulcan 2003 Study estimate would correspond to a reduction of around 7%. In the analysis that follows, the LTSA estimate has been used as the measure of what change in fatality rates is due to Transfund financed projects. The effect of using this lower estimate is that more of the reduction of fatality rates is left to be attributed to the effects of enforcement and education. If the Vulcan estimate was used less of the improvement would be left to be attributed to enforcement.

#### ***Vehicle Fleet Improvements***

- 3.14 In considering the significance of the reductions in the fatalities and hospital per 100K pop or per 10,000 vehicles the starting point is to consider what reduction is attributable to changes in the characteristics of the vehicle fleet. LTSA estimate that improvements in vehicle design would reduce fatal and serious injury to light vehicle occupants by 18% over the 9 years 2001 to 2010. This rate for light vehicle occupants is equivalent to a per annum reduction for all vehicles of around 1.3% per annum. (In absence of better information this is assumed to apply in the same manner to both fatalities and serious injuries.) For 2003 compared to the average of 1997-99 this is a 6.7% reduction.
- 3.15 Based on the LTSA estimates the combined effect of Transfund financed projects and vehicle fleet improvements would have been to reduce fatalities for 2003 by around 10.8% compared to 1997-99 before other factors including growth.

#### ***The Reduction in Fatality and Hospital Bed-Day Rates***

- 3.16 The next step in the analysis is to examine the gains achieved relative to the comparison period in terms of reductions in fatalities, injuries and property damage. In terms of social cost, the major aspects are the loss of lives in fatalities and the loss of the enjoyment of life and of productivity due to injuries. These costs far outweigh the direct cost of hospitalisation and other medical costs and property damage.
- 3.17 An important factor in the analysis is that the hospital bed-days data are a much more reliable measure of the extent of injuries caused by crashes than injuries reported to LTSA. Reported crashes seem to have been considerably affected by a change in Police reporting practice over the relevant period. For example, reported serious injuries increased in sharp contrast to the data for hospital stays over 3 days and the latter seem more reliable. (Hospitals have been seeking to reduce average lengths of stay but this would be expected to focus on medical rather trauma patients). The original injury targets for 2010

were expressed in terms of hospitalisations to avoid issues regarding crash reporting rates. Hospital bed-days are used in the current analysis as a more refined measure than simple hospitalisation numbers.

- 3.18 A very unfortunate consequence of the apparent distortion in reported injury data and consequent need to rely on hospitalisation data is that it becomes more difficult to make full use of data on aspects of reported injury causing crashes such as details of the contribution of alcohol and speed to crashes. As a consequence of the unreliability of data regarding crashes causing injury, the analysis becomes more dependent on data relating to fatal crashes (which do not involve the reporting distortion) but this gives rise to a different concern. The number of fatal crashes is small in absolute terms and thus random fluctuations can significantly affect the analysis and limit the extent to which conclusions can be drawn.
- 3.19 As noted earlier, to make meaningful comparisons between fatality and injury outcomes for 2003 versus 1997-99 an adjustment for growth in population and road traffic volumes is required. The first table below sets out the data adjusted for the growth in population, the second table adjusts the rural fatality data for the growth in vehicle kilometres travelled, while the third table sets out the data adjusted for growth in the number of registered vehicles.

<b>Overall Outcomes (per 100K pop)</b>	<b>Avg 97-99</b>	<b>2001</b>	<b>2003</b>	<b>97/99-03 Chg</b>
Rural fatal crashes	8.31	7.40	7.18	-13.5%
Urban fatal crashes	3.45	2.86	2.92	-15.4%
Rural deaths	9.96	8.88	8.43	-15.4%
Urban deaths	3.66	2.93	3.07	-16.2%
Drivers killed with excess alcohol	1.74	1.43	1.82	4.5%
Fatalities with alcohol involved	3.62	3.06	3.52	-2.8%
Fatalities with "too fast for conditions"	4.20	3.66	4.17	-0.8%
Fatalities avoided if belt worn	1.44	0.91	1.12	-21.8%
Hospitalised, more than 1 day	9.7	8.3	7.5	-23.0%
Hospitalised, more than 3 days	6.5	5.5	5.0	-22.6%
Total hospital bed-days	133.4	107.9	99.4	-25.5%

<b>Overall Outcomes (per BVKT)</b>	<b>Avg 97-98</b>	<b>2001</b>	<b>2003</b>	<b>97/99-03 Chg</b>
Rural fatal crashes	16.6	14.5	13.2	-20.7%
Rural deaths	19.9	17.4	15.4	-22.4%

<b>Overall Outcomes (per 10K vehicles)</b>	<b>Avg 97-99</b>	<b>2001</b>	<b>2003</b>	<b>97/99-03 Chg</b>
Rural fatal crashes	1.29	1.08	1.03	-20.0%
Urban fatal crashes	0.53	0.42	0.42	-21.9%
Rural deaths	1.54	1.38	1.21	-21.7%
Urban deaths	0.57	0.43	0.44	-22.6%
Drivers killed with excess alcohol	0.27	0.21	0.26	-3.3%
Fatalities with alcohol involved	0.47	0.39	0.44	-6.0%
Fatalities with "too fast for conditions"	0.55	0.47	0.50	-8.6%
Fatalities avoided if belt worn	0.22	0.13	0.16	-27.8%
Hospitalised, more than 1 day	15.0	12.1	10.7	-28.7%
Hospitalised, more than 3 days	10.0	8.1	7.1	-28.4%
Total hospital bed-days	206.3	157.8	142.3	-31.0%

- 3.20 The above outcome data indicates for the period analysed a reduction in fatalities per 100K pop of around 14% and a reduction in hospital bed-days per 100K pop of over 25%. The reduction for rural fatalities on a per BVKT basis is over 22%. The reductions on a per 10,000 vehicles basis were over 22% for urban fatalities and over 28% for hospitalisations and hospital bed-days.
- 3.21 The above tables indicate that the reduction in fatality and hospitalisation rates was achieved despite a relatively small improvement in fatality rates involving alcohol. The tables also raise an issue that there was also a relatively small reduction in the rate of fatalities assessed as involving travelling too fast for the conditions. However the recorded improvement in the speed related fatality rate has been constrained by fatalities in which alcohol involvement as the primary cause probably led to speed being a factor.
- 3.22 Around 10.8% percentage points of the reduction in fatality and hospitalisation rates could be attributed to the combined effect of Transfund financed projects and vehicle fleet improvements, on LTSA's estimate.
- 3.23 Although the percentage reductions in fatality and hospitalisation rates attributable to LTSA and Police funding appear to have been less than the 27% percentage real increase in funding, a comparison of the dollar amounts of funding with the social cost savings would show a different picture. The savings in social cost (if it could be calculated using the hospitalisation data) would be much greater in dollar terms than the estimated \$51.6M real increase in funding. This calculation of this net benefit is discussed in the conclusion of this report.
- 3.24 The benefits of individual LTSA and Police road safety outputs are assessed in the next section of this report.

#### **4. Assessment of Benefits of Individual Outputs**

- 4.1 There is no straightforward way to precisely assess what effect the different interventions have had in generating the overall outcome for fatalities and hospitalisations summarised in the above table. A multiple regression analysis could be used to attempt to identify the different effects but there are not enough independent observations to isolate the effects with any certainty. However, it is useful to consider aspects of the way different interventions work because this does enable the effects to be isolated to a certain extent. This opens the way to assigning a range to the benefits which can be attributed to the different interventions or more particularly to the increases in funding implemented since 1999. In the specific circumstances of this stocktake it is useful to start by considering the effects of the road construction and re-engineering programme and then to consider restraint control drunk driver control and by speed control, in that order.

##### ***Road Construction and Re-engineering***

- 4.2 As discussed earlier Transit have estimated the total social cost reductions from projects they finance (in whole or part) that were planned to be started in 2002/03 as \$516M (converted to 2002/03 values). The cost of the projects concerned is estimated as \$596M and the non-safety benefits are estimated congestion relief of \$1523M and route quality and efficiency benefits of \$656M. As also discussed earlier the safety benefits are equivalent to around \$40M per annum. The corresponding reduction in fatality rates for 2003 compared to 1997-99 is estimated as 4% by LTSA or more by others.

##### ***Restraint Control***

- 4.3 Before analysing the effect of other enforcement activities it is useful to clarify the extent to which the observed reduction in fatalities per 100K pop is attributable to greater use of restraints. For 2003/04 funding of restraint control was 88% higher than in 1999/00, with tickets issued being 135% higher. The intermediate outcome was an increase in the use of seat belts by front seat adults from 87% to 92% and substantial increase for rear seat adults from 58% to 81%.
- 4.4 LTSA have advised that the generally used estimate for seat belt risk reduction is that approximately 40% of casualties are saved by seatbelts. On this estimate the 5% percentage point increase in the use of seat belts by front seat adults would be estimated to reduce casualty rates in this group by 2% compared to the 1997-99 base period. The 23% percentage point increase in the use of seat belts by rear seat adults would be estimated to reduce casualty rates in this group by around 9%. The contribution of rear seat adults to crashes is significantly smaller than that of front seat adults and so the expected overall reduction would be a little higher than the 2%.
- 4.5 For 2003, fatalities (per 100K pop) where the Police attending the crash assessed that seat belts were not worn were over 17% less than for 1997-99. This fall reduced the percentage non-use in car, van, truck and bus (CVTB) fatalities to a little over 27%. The high percentage of non-use indicates that



those killed are not typical of vehicle occupants in general in regard to the percentage using restraints. A possible explanation is that the high non-use of belts reflects a high non-use among drivers killed with excess alcohol. If correct, this would indicate non-use among “non-alcohol affected” fatalities could be closer to the survey results.

4.6 Police assess use of belts would have avoided the following fatalities:

Effect if belts worn	2003	Avg 1997-99
Fatalities definitely avoidable	45	54
Fatalities possibly avoidable	29	24
Belts definitely not worn	100	114
Total CVTB fatalities	368	391

Fatalities per 100K pop that were definitely avoidable reduced by nearly 22%.

4.7 If the rates per 100K pop had remained at their 1997-99 values the 2003 results would have been 414 CVTB fatalities, including 120 with belts definitely not worn with 58 of these definitely avoidable by use of belts. Thus if the fatality rate per 100K pop had been affected only by increased use of belts the difference between the predicted 58 and the actual 45 definitely avoidable fatalities could be interpreted as 13 additional cases where belts were worn and fatalities were avoided. This would have reduced CVBT fatalities to 401. The actual further reduction of fatalities by 33 to 368 can be interpreted as due to factors other than increased use of belts. If the 13 saving in fatalities attributed above to increased belt wearing is adjusted for the 33 reduction in fatalities caused by other factors the result is that the saving attributable to increased belt wearing falls to 12. Thus the analysis can be interpreted as suggesting that increased belt wearing avoided 12 fatalities and other factors avoided 34 fatalities (one of which would otherwise have been avoided by increased belt wearing).

4.8 The above analysis is of course only as good as the data on which it is based and given the small absolute numbers of fatalities the results would be considerably affected by statistical fluctuations. Thus if the analysis was undertaken for a different period the detailed conclusions could be markedly different. The key driver of the conclusion is the assessment by attending Police that a significant number of fatalities were avoidable by use of belts but with this number reducing as compliance increases.

4.9 The conclusion from the above analysis is that around 2.2 percentage points of the reduction in fatalities between 1997-99 and 2003 is attributable to increased use of seat belts. This is in line with the estimate derived earlier from the analysis based on 40% of casualties being saved by use of seat belts. No New Zealand data is available to identify the extent of savings in hospitalisation bed-days from increased use of seat belts but the analysis regarding fatalities suggests substantial savings over the period 1997-99 to 2003.

### ***Drunk and Drugged Driver Control***

- 4.10 The next issue to consider is developments regarding alcohol as a factor in crashes. Funding of drunk driver control increased by 31% since 1997-99. The 23% increase in breath tests over the same period has been associated with significantly improved intermediate outcomes namely a substantial reduction in the percentage of drivers over the breath limit in annual breath test surveys and a nearly 14% reduction in drunk driving offences detected by the 23% higher number of breath tests.
- 4.11 The fatalities outcome for 2003 includes a sharp increase in drivers killed with excess alcohol, to 73 compared to 59 for 2002 and the 66 average for 1997-99 corresponding to rates per 100K pop of 1.82, 1.50 and 1.74 respectively. Fatalities assessed by attending Police as “alcohol involved” per 100K pop also recorded a major jump being 3.52 for 2003 compared to 2.77 for 2002 and 3.62 average for 1997-99. Thus the overall fatalities with alcohol involved per 100K pop for 2002 and 2003 were 23% and 2.8% respectively less than the average for 1997-99.
- 4.12 The major fluctuation in overall outcome between 2002 and 2003 may turn out to be a statistical fluctuation but the more fundamental point is the intrinsic difficulty of reducing the road toll from excess alcohol. The issue is that the 1 to 1.5% percent of drivers who are over the breath limit (from surveys) are responsible for between 20% to 30% of fatal crashes and 12% to 15% of injury crashes. Drivers killed with excess alcohol are generally well over the limit rather than close to it and would be charged with an offence if breath tested. Surveys indicate that during the main drinking times 1% of drivers are over the breath limit of 400 mgpl<sup>6</sup> of with 2.2% registering as over 250 mgpl and 4.2% as over 150 mgpl.
- 4.13 The sharp difference in outcome between 2002 and 2003 is an obstacle to drawing conclusions regarding the benefit of the increased funding of drunk driver control. From an analytical perspective however the sharp fluctuation does provide some insight into the extent to which changes in the fatalities outcomes are attributable to the interaction between alcohol and other factors in particular speed as considered next.

### ***Speed Control and Speed Cameras***

- 4.14 Funding of speed control was \$6.6M or 36% higher in 2003/04 than in 1997-99. In addition, expenditure on speed control was boosted by speed related activities of the Highway Patrol (with overall funding of \$26.7M) introduced in this period. Speeding tickets issued by Police officers nearly tripled and speed camera tickets also increased (despite a reduction in funding of the later of around \$2.5M).
- 4.15 Speed survey results indicate a reduction in mean speeds of 2.7 kph (summer) to 3.8 kph (winter) for rural roads and of 1.9 kph for urban roads for 2003 (compared to the average for 1997-99). This has been achieved by a dramatic

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<sup>6</sup> Micrograms of alcohol per litre of breath

reduction in the percentage of drivers exceeding 110 kph (the current tolerance before a ticket is issued) from 20% to 6%. As the percentage travelling at or below 110kph increased, the average speed of this category remained virtually unchanged.

- 4.16 While total fatal crashes per 100K pop have reduced by around 15.6% those for which attending Police assessed “too fast for conditions” was a contributing factor in 2003 were only 1 percent lower than the average for 1997-99 and such crashes represent 35% of the total. However the 2002 crashes per 100K pop data are very different with those assessed as “too fast for the conditions” being 22% less than in 1997-99. A possible explanation is that the jump in alcohol related crashes between 2002 and 2003 directly increased the number of speed related crashes reported. Between 2002 and 2003 the total number of fatal crashes increased by 40, while crashes reported as alcohol related increased by 29 and those where “too fast for conditions” contributed increased by 32. The substantial increase in both drivers killed with excess alcohol and fatal crashes with alcohol suspected would be expected to cause an increase in crashes assessed as “too fast for conditions” given the propensity for drivers incapacitated by alcohol to both drive too fast and to mismanage braking when needed to avoid a crash.
- 4.17 Even where speed is not the cause of a potential crash, the speed at which a vehicle is travelling when a potential crash situation develops affects both the prospects of avoiding the potential crash and the severity of the outcome if a crash does occur. Therefore a range of studies have argued and tested the hypothesis that the mean speed of traffic is closely related to the frequency of crashes. According to a widely used rule of thumb a 1 kph change in mean speeds at around 100 kph is predicted to be associated with a 3% reduction in fatal crashes and some studies would argue that this understates the effect of speed<sup>7</sup>. The studies in which the relationship between mean speed and crash frequency has been derived have typically related to the effects of changes in speed limits. One challenge to such conclusions has been an argument that dispersion of speeds is a factor separate from mean speed in determining crash frequency. As it happens the reduction in mean speeds achieved since 1999 have also involved a compression of the speed distribution which in principle suggests that this particular reduction in mean speed should have if anything a stronger effect on crashes than the rule of thumb.
- 4.18 Based the rule of thumb reported above the 2.7 kph (summer) to 3.8 kph (winter) reduction in rural mean speeds would be predicted to result in a reduction in fatal crashes of 8% to 11%<sup>8</sup>. The effect of the 1.9 kph reduction in mean urban speeds would be smaller. The actual recorded reduction in rural and urban fatal crashes was 14% and 165 respectively on a per 100K pop basis (and over 20% for rural fatal crashes on a per BVKT basis).
- 4.19 The rule of thumb is usually expressed as a relationship between the mean speed of all vehicles and all fatal (or all) crashes on the road or network for

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<sup>7</sup> Nilsson developed a general relationship where by the number of fatal crashes varies as the 4<sup>th</sup> power of speed. For a 1 kph variation around 100kph this relationship suggests a 4% change in fatal crashes.

<sup>8</sup> Nilsson’s formula would suggest a 10% to 14% reduction for rural crashes.

which mean speed is measured. In the present case the reduction in mean speed has been achieved by reducing the percentage travelling above 110kph with an unchanged mean speed for the (increasing percentage) travelling at or below 110kph. This does not invalidate the rule of thumb – indeed the compression of the distribution of speeds may enhance the effect. Rather than invalidate the rule of thumb, the implication is that the reduction in crashes is expected to come from a sharper reduction for the group where speed is reducing. The complication of the contribution of alcohol related accidents makes it difficult to analyse the improvement fully however.

- 4.20 Police assess that in 29% and 25% of rural and urban fatal crashes and 50% and 41% of rural and urban injury crashes all vehicles involved were complying with the speed limit. As noted earlier the mean speed of vehicles travelling within the current 110kph tolerance has remained virtually unchanged since 1997. This group has increased as the percentage travelling at higher speeds has been reduced from around 20% in 1997 to 6% in 2003. Speed limit enforcement has little or no effect on the speed of vehicles travelling within the tolerance speed or therefore on the number of crashes in this group, which based on the 2003 survey now includes 94% of vehicles in the rural roads. The potential gain from increased enforcement of the rural speed limit would appear to be constrained by the fact that only 6% are travelling above the tolerance limit. Reduction of the tolerance (or speed limits) would of course change this conclusion. If the tolerance is not changed and so potential further gains were thereby constrained one issue would be whether the current compliance could be maintained with less expenditure on enforcement.

#### ***Visible Road Safety Enforcement***

- 4.21 Funding of “Visible Road Safety Enforcement” which includes detection of a wide variety of offences has been reduced over the period to 2003/04 albeit that offence notices issued for dangerous and unsafe driving have increased somewhat. In contrast to areas such as drunk driving and speed control it is difficult to assess intermediate outcomes in this area. The extent of crashes caused by failure to give way has attracted attention and a switch of resources to this area is underway. It is unclear whether the effects of this will be easily measured. Clearly, with 50% of rural injury crashes involving vehicles all complying with the speed limit and 94 percent of surveyed vehicles travelling within the tolerance on rural roads, Visible Road Safety Enforcement might be important in reducing crashes in this large group. The issue regarding Visible Road Safety Enforcement is that measurement of the output being delivered and particularly of the results is more difficult to assess than for areas such as speed control where surveys demonstrate changes in actual driven speeds.

#### ***Commercial Vehicle Investigation and RUC Enforcement***

- 4.22 Funding of commercial vehicle investigation and road user charge enforcement has increased by 30%. Truck crashes have been on a rising trend accounting for 17 or more percent of total fatalities. This reflects in part the increase in trucks usage of roads as well as the high lethality of such crashes.

It is difficult to assess the effect of the increased funding particularly since enforcement of speed and other aspects is included in other outputs.

### ***Incident and Emergency Management***

- 4.23 Funding of “Incident and Emergency Management” is a substantial cost, being almost equal to funding of Visible Road Safety Enforcement”. The largest item in this output is crash attendance and investigation costing \$18.4M in 2003/04. The part of this expenditure that is discretionary is the reporting of crashes in detail and particularly the time spent on reporting of non-injury crashes. LTSA argue that this data is highly valuable in identifying black spots and assessing the effectiveness of interventions particularly as regards black spots. The cost of investigation is significant relative to funding of enforcement. A related issue is the variations in reporting practice that have distorted the time series of injury crashes. This change has been induced by a drive for more complete reporting. These issues may warrant a review of the framework for reporting.

### ***Prosecutions and Sanctions***

- 4.24 Funding for prosecutions and sanctions for 2003 at \$10.8M was 170% higher than for 1999/00 reflecting the 77.2% increase in tickets issued by officers over the same period. This area of expenditure is “demand” driven. If the significant increases in compliance achieved in the speed and restraint areas are maintained and embedded the level of expenditure on prosecutions may reduce somewhat but much of the expenditure relates to more serious cases of offending and as such the reductions may be limited.

### ***LTSA Expenditure***

- 4.25 The largest items of LTSA funding are Safety Information and Promotion, which was \$25.8M for 2003/04, an increase of 68% from 1999/00, and Grants Management, which was \$8.9M for 2003/04, an increase of 220% from 1999/00. LTSA analyse the public response to their advertising (and other information) campaigns in considerable depth and use this analysis in shaping overall strategy. Thus LTSA employs market research to analyse public attitudes as a means to identify how interventions are working out in practice and how they and the supporting advertising campaigns could be more effective. Such surveys provide information on the effectiveness of advertising in improving acceptance as well as views regarding the likelihood of detection of infringements. The research also provides early warning that public acceptance of the causal relationship between crashes and causes such as alcohol is changing. LTSA note that the surveys indicate that acceptance of the causal relationships and expectations of detection of infringements erode in the absence of advertising. These results do support the contention that advertising directly affects the success of educational activities and of enforcement. The increase in enforcement activities over recent years has been accompanied, appropriately, by a focus on advertising directed as raising awareness of compliance. In combination with the actual increased enforcement, the advertising appears to have been successful in substantially

raising expectations that infringement will be detected. The focus on increasing awareness of enforcement in the recent period may have been at the expense of acceptance but LTSA is moving to address this.

- 4.26 The evidence that public awareness of enforcement and acceptance of causal relationships erodes if not supported by advertising is clear. However there is no easy way to assess how awareness and acceptance translates into intermediate outcomes such as reduced travel speeds and the overall outcome of crashes, fatalities and injuries. The market research data in principle provides information relevant to this assessment but would require extensive analysis to extract results.

## 5. Conclusion

- 5.1 LTSA and Police road safety funding increased by around 27% or \$51.6M in real terms between 1997-99 and 2003/04. Over the same period there was a reduction, per 100K pop, of over 14% in fatality rates and over 22% in hospitalisation rates. On a per 10,000 vehicle basis the reductions are over 20% and over 28% respectively. On a BVKT basis rural fatalities have fallen by over 20%.
- 5.2 Adjusted for the LTSA estimate of the combined effect of Transfund financed projects and vehicle fleet improvements (10.8%), the reduction in fatality and hospitalisation rates attributable to the increased LTSA and Police funding and other factors would be over 10% and around 16% respectively.
- 5.3 There are complications in an attempt to put a dollar value on the above reductions in the fatality and hospitalisation rates. In particular, the expected saving does not show up in the reported social cost, with the \$3.18B reported for 2003 (at 2001 prices) being only a little less than the \$3.2B average reported for 1997-99<sup>9</sup>. This is because reported social cost is based on reported injuries which as noted earlier appear to have been affected by increased reporting by attending Police of injuries compared to earlier periods. A conversion factor is being derived to allow social cost to be calculated from hospitalisation data but is not yet available. Based on the reported injuries approach, the social cost might be viewed as having fallen by 5.9% or around \$190M adjusted for population growth or by around 14.4% or \$460M adjusted for registered vehicle growth but on the LTSA estimates Transfund financed projects and vehicle fleet improvement would account for \$320M of savings leaving little to be attributed to the increased funding.
- 5.4 An alternative approach, in the absence of a social cost estimate based on hospitalisation data, is to focus on the reduction in the fatality rate and hospitalisation rates of more than 10% after allowing for Transit financed projects and vehicle fleet improvements. For the 2003 social cost estimate, 10% would be around \$320M.
- 5.5 In comparing the increased funding of \$51.6M with the above \$320M a caveat should be noted. The \$3.18B is around 2.3% of GDP and it is not at all clear

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<sup>9</sup> Road Safety Progress June 2004 quarter, LTSA.

that the results of the survey should be interpreted as indicating a willingness to divert such a large proportion of GDP to the objective of reducing road crashes. The \$51.6M dollar value of increased funding on the other hand is an amount that has actually been diverted from other uses.

- 5.6 Intermediate outcomes relating to the major Police road safety outputs of speed control, drunk driving control and restraint control show significant improvements. However the detail of the improvements in intermediate outcomes suggests important issues for consideration particularly when the reported causes of crashes are taken into account. In particular, since 1999 there has been a substantial reduction, to 0.7%, in surveyed drivers whose breath tests are over the alcohol limit but a high number of drivers are killed with excess alcohol and a high 20% to 30% of crashes are assessed as involving alcohol. In 2003 a jump in drivers killed with excess alcohol slowed progress in reducing fatalities per 100K pop.
- 5.7 Given that offence notices for driving over the limit amount to only 1.1% of breath tests, the current approach faces a difficult task in trying to remove the small minority of drunk drivers from the road (and to prevent them resuming driving after conviction) although random testing has changed general behaviour regarding drink driving. The 31% increase in nominal expenditure on enforcement (plus advertising expenditure) in this area since 1999 has been accompanied by a reduction in the percentage of drivers over the limit.
- 5.8 The 36% (or greater when Highway Patrol is taken into account) increase in speed control funding has funded a major increase in tickets issued for speeding. This has been highly successful in reducing from 20% to 6% vehicles travelling at speeds above the tolerance level of 110kph in surveys of the open road speed. Disappointingly, 2003 showed almost the same rate per 100K pop as 1997-99 of fatal crashes assessed as involving “too fast for conditions” speeds. However this appears to be attributable to the jump in alcohol related crashes, which often involve excessive speeds. On this analysis, the 2003 outcome can be reconciled with the widely used international rule of thumb that a 1 kph change in mean speeds at around 100 kph is predicted to be associated with a 3% reduction in fatal crashes. This would imply that the 2.7kph and 3.8 kph reductions in winter and summer surveyed open road mean speeds will have been responsible for a reduction in rural fatal crashes of 8% to 11% compared to the overall observed reduction of around 14% per 100K pop and the reduction of .. per BVKT for rural fatal crashes.
- 5.9 With 94% of surveyed drivers travelling at or below the tolerance of 110kph an increase to 100% would according to the rule of thumb reduce fatal crashes by around 1%. Further reduction would seem to require that either the tolerance or speed limits were reduced or some other way found to persuade drivers who are within the tolerance level to reduce their speed. The introduction of provision for wider use of a variety of speed limits would also open up other possibilities.
- 5.10 Restraint control, plus the effect of advertising and education has improved

seat belt usage significantly and this appears to have been reflected in the assessment of fatal crashes. Non-usage is high compared to the surveyed use in general but this reflects both the involvement of alcohol and the expected outcome that a (declining) number of fatalities occur precisely when belts are not worn.

- 5.11 Visible Road Safety Enforcement received 13% less funding in 2003 than in 1999, with however an increase in offence notice issuance being achieved. The effectiveness of activity in this area is more difficult to measure which would need to be taken into account in considering the case for increased funding. Nevertheless it is an area for consideration in looking for ways to reduce fatalities and injuries and LTSA have advised some increase in funding is being considered. An important issue will be to develop measures to assess the results.
- 5.12 Commercial vehicle investigation and Road User Charge enforcement has received 30% additional funding since 1999. The increase in such vehicles and in their involvement in crashes suggests that increased enforcement is warranted but it is difficult to evaluate the results.
- 5.13 The overall conclusion regarding the increased funding for enforcement provided since 1999 is that significant gains have been achieved in the targeted intermediate outcomes of speed, percentage of drunk drivers and restraint usage. Unfortunately, as noted, in 2003 the gains regarding alcohol for surveyed drivers have not been reflected in the outcome for crashes involving alcohol which reflects the difficulty of detecting and deterring drivers over the limit who are a small percentage but are involved in a high number of crashes. Apart from alcohol, gains in compliance do appear to have been reflected in reductions in crashes.
- 5.14 In regard to Incident and Emergency Management funding the key issue is whether reporting of crashes both injury and non-injury could be made less resource intensive and more uniform. Although these issues have been considered previously the amount of funding involved suggests a continuing search for more efficient techniques is warranted.
- 5.15 In regard to LTSA funding, the major area of safety information and promotion is intensively managed based on a market survey research approach. The need for advertising to maintain and increase awareness of enforcement and public acceptance of causal relationships such as those relating to alcohol and speed is clear. The value being obtained from the current approach appears substantial but is not however easy to quantify.