REPORT ON QUEENSLAND TRANSPORT’S ROAD SAFETY STATISTICAL METHODOLOGIES
PARLIAMENTARY TRAVELSAFE COMMITTEE

49TH PARLIAMENT

1ST SESSION

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Mr Terry Sullivan MLA, Member for Chermside

RESEARCH DIRECTOR: Mr Rob Hansen

SENIOR RESEARCH OFFICER: Mr Tim Moroney

EXECUTIVE ASSISTANT: Ms Tamara Reader
This report examines the statistical methodologies used by Queensland Transport to gauge its road safety performance.

It begins with a description of the methodologies and their use by the department to report on road toll trends and the performance of road safety countermeasures and program. This is followed by a discussion of the work by the Travelsafe Committee of the 48th Parliament concerning the methodologies and an independent review recommended by that committee. The report concludes with a discussion of the committee’s dialogue with Queensland Transport over these matters, its findings and recommendations to the Legislative Assembly.

On behalf of the committee I would like to thank the people who helped us with our review.

I commend the report to the House.

Nita Cunningham MLA

Chairman
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<th>Definitions</th>
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</thead>
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<tr>
<td>BCR</td>
<td>Benefit Cost Ratio</td>
</tr>
<tr>
<td>CBA</td>
<td>Cost Benefit Analysis</td>
</tr>
<tr>
<td>DOT</td>
<td>Department of Transport</td>
</tr>
<tr>
<td>DCA</td>
<td>Data Capture and Analysis</td>
</tr>
<tr>
<td>GSP</td>
<td>Gross State Product</td>
</tr>
<tr>
<td>MUARC</td>
<td>Monash University Accident Research Centre</td>
</tr>
<tr>
<td>QT</td>
<td>Queensland Transport</td>
</tr>
<tr>
<td>QGSO</td>
<td>Queensland Government Statistician’s Office</td>
</tr>
<tr>
<td>UQ</td>
<td>University of Queensland</td>
</tr>
<tr>
<td>RRW</td>
<td>Random Road Watch program</td>
</tr>
</tbody>
</table>
SUMMARY OF RECOMMENDATIONS

RECOMMENDATION 1 ........................................................................................................................................... 26
That Queensland Transport establish a statistical steering committee to provide ongoing
expert advice to the Director-General on the department’s statistical methodologies and
analyses.

RECOMMENDATION 2 ........................................................................................................................................... 27
That Queensland Transport obtain independent external evaluations of all the department’s
major road safety countermeasures.

RECOMMENDATION 3 ........................................................................................................................................... 27
That Queensland Transport devise a timetable for the independent evaluation of the
department’s major road safety countermeasures and report the timetable to Parliament.

RECOMMENDATION 4 ........................................................................................................................................... 27
That Queensland Transport obtain an independent evaluation of the Safest Schools
Program and a further independent evaluation of the Random Road Watch program as a
priority. The evaluation of Random Road Watch should analyse the effectiveness of the
program for accident-types and include geographical aspects of where the enforcement
activities for the program occurred and where reductions in crashes were achieved.

RECOMMENDATION 5 ........................................................................................................................................... 29
That Queensland Transport seek amendment of section 44T(1) of the Traffic Act 1949 to
include ‘evaluations of road safety countermeasures’ as a further purpose for surplus
penalty revenue from camera-detected traffic offences.

RECOMMENDATION 6 ........................................................................................................................................... 30
That Queensland Transport only publish data on the effects of population and economic
growth on the Queensland road toll that is supported by independent statistical proof.

RECOMMENDATION 7 ........................................................................................................................................... 30
That Queensland Transport only publish data on crashes and/or injuries prevented by the
department’s road safety countermeasures and benefit cost ratios for individual
countermeasures from the department’s Control Chart Evaluations that is supported by
independent, external evaluations of the countermeasures to substantiate the claims.
PART 1 ~ INTRODUCTION

THE TRAVELSAFE COMMITTEE

1. The Travelsafe Committee of the 49th Parliament was appointed by a resolution of the Legislative Assembly on 30 July 1998 to inquire into and report on all aspects of road safety and public transport in Queensland.

2. In particular the committee monitors, investigates and reports on:-

   (a) issues affecting road safety including the causes of road crashes and measures aimed at reducing deaths, injuries and economic costs to the community;

   (b) the safety of passenger transport services, and measures aimed at reducing the incidence of related deaths and injuries; and

   (c) measures for the enhancement of public transport in Queensland and reducing dependence on private motor vehicles as the predominant mode of transport.

SCOPE OF THIS REPORT

3. The committee resolved to report on Queensland Transport’s statistical methodologies on 6 August 1998. For its report, the committee considered:

   • Findings of the Travelsafe Committee of the 48th Parliament in its Report No. 18, Queensland’s Road Toll – An Overview, tabled in December 1996;

   • Findings of an independent review by Dr David Andreassen of Data Capture and Analysis of Queensland Transport’s submission to the Travelsafe Committee of the 48th Parliament concerning the road toll. This review was commissioned by the department in May 1998;

   • Advice the department tendered for the committee in 1998 in support of its road safety statistical methodologies;

   • A review by Dr Andreassen in 1999 of advice the committee received from Queensland Transport commissioned by the committee; and

   • Queensland Transport’s response dated 3 December 1999 to Dr Andreassen’s 1998 report from his critique of the department’s submission to the Travelsafe Committee of the 48th Parliament.

4. Dr Andreassen met the committee in Melbourne on 23 February 1999 to discuss his findings about the department’s statistical methodologies.

5. On 26 October 1999, the committee heard evidence from Queensland Transport in a closed hearing at the Parliamentary Annexe. The witnesses at the hearing were:

   • Mr Bruce Wilson, Director-General;

   • Mr Paul Blake, Executive Director, Land Transport and Safety Division; and

   • Dr Mark Leggett, Director-Strategy, Land Transport and Safety Division.

6. The committee subsequently resolved to publish the transcript of the hearing. The transcript is included in a volume of supporting information tabled with this report.
RESPONSIBILITY OF MINISTERS

7. This Report makes recommendations for the Government to implement.

“PART 5 - MINISTERIAL RESPONSES TO REPORTS’ of the Parliamentary Committees Act 1995 requires the responsible Minister or Ministers to respond to recommendations contained in the committee’s Reports.

Subsections 2 to 6 of section (24) of the Act state:-

(2) The Minister who is responsible for the issue the subject of the report must provide the Legislative Assembly with a response.

(3) The response must set out-

(a) any recommendations to be adopted, and the way and time within which they will be carried out; and

(b) any recommendations not to be adopted and the reasons for not adopting them.

(4) The Minister must table the response within 3 months after the report is tabled.

(5) If a Minister cannot comply with subsection (4), the Minister must-

(a) within 3 months after the report is tabled, table an interim response and the Minister’s reasons for not complying within 3 months; and

(b) within 6 months after the report is tabled, table the response.

(6) If the Legislative Assembly is not sitting, the Minister must give the response (or interim response and reasons) to the Clerk of the Parliament for tabling on the next sitting day.
Queensland Transport’s Road Safety Role

1. Queensland Transport, through its Land Transport and Safety Division\(^1\), is the lead state agency responsible for road safety planning and analysis. As lead agency, Queensland Transport coordinates the implementation of road safety countermeasures across the government. According to the department (Queensland Transport, 1999b), these countermeasures are designed to reduce the risk of crashes or the severity of injuries and include:

- Child restraints
- Driver Reviver
- 40 km/h school zones
- School Safe
- Blackspot program
- Red light cameras
- Bicycle helmets
- Audible edge marking
- Speed cameras
- Random Road Watch program

2. A summary of the department’s road safety countermeasures and estimates of operating costs is at Appendix (A). In 1999-2000, the estimated total cost to government of the Road Use Management program that encompasses road safety is $192.8 million (Queensland Treasury, 1999; 1-19).

Road Safety Statistical Analyses in Queensland

3. Much of the research, planning and policy development in road safety is based on analyses of statistics. Queensland Transport uses crash statistics from its Road Crash Information System, population statistics and Consumer Sentiment Surveys\(^2\) to examine the road toll and the impact of its countermeasures. The department’s Land Transport and Safety Division analyses these statistics using methodologies that are unique. The department uses their methodologies to:

- examine trends in risk factors influencing Queensland’s road toll compared to other states using regression analysis of deaths per capita against population growth and Gross State Product (GSP) growth per capita;
- examine trends in the Queensland road toll at a regional level using a regression analysis of percentage changes in deaths and the percentage average annual population growth;
- predict road crash rates per year in Queensland using regression analyses of the ratio of road toll to the National and Queensland consumer sentiment indexes (Queensland Transport describes this as the Consumer Sentiment Model);
- examine the effects of the department’s key road safety countermeasures on crash frequency, crash severity and the social costs of crashes in Queensland by using linear regression analysis of subject/comparison trends in crash frequency by severity for each countermeasure before and after implementation (the method is

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\(^1\) Notes from a briefing for the Parliamentary Travelsafe Committee by Queensland Transport, 28 August 1998.

\(^2\) Consumer Sentiment Survey indexes are surrogate measures of economic activity. The Melbourne Institute of Applied Economic and Social Research, University of Melbourne, compiles the indexes for Australian jurisdictions.
described by Queensland Transport as Control Chart Evaluations of Individual Countermeasures3);

- estimate costs and benefits of individual countermeasures based on the results of the Control Chart evaluations; and
- estimate aggregate costs and benefits for its road safety program by adding the effects of individual countermeasures.

4. The methodologies used by Queensland Transport are unique in that they are not used by other road safety agencies for formal analysis. The committee notes that the Land Transport and Safety Authority of New Zealand has used or proposed to use control chart evaluations informally but the method and application are different4.

QUEENSLAND TRANSPORT’S USE OF ITS ROAD SAFETY STATISTICAL METHODOLOGIES

5. Since 1991, Queensland Transport has used figures it derived using its own statistical methodologies to comment on the state’s road toll, the performance of individual road safety countermeasures the department runs or supports and the aggregate performance of its road safety program. The department has used these figures to inform parliamentary committees, key stakeholders and the public about its performance.

Submission to the Travelsafe Committee of the 48th Parliament

6. Queensland Transport outlined its statistical methodologies in its December 1995 submission to an inquiry by the Travelsafe Committee of the 48th Parliament into Queensland’s road toll. Based on its analyses using the methodologies, Queensland Transport submitted that:

- In the 1990s (up to 1995) Queensland’s road toll record was worse than other states;
- Queensland’s poor road toll record was the result of external factors (high economic and population growth) that served to increase the road crash risk; and
- Queensland’s road safety initiatives had been successful and resulted in a lower road toll than could otherwise be expected given Queensland’s ‘high risk’ factors (Travelsafe,1996:pp27).

7. At the time of the inquiry, Queensland’s road fatality rate was 13.9 fatalities per 100,000 population, the highest of the four larger Australian states, and appeared to be worsening. For some time, Queensland Transport had claimed that Queensland’s higher road toll compared to other states was largely due to its relatively high economic and population growth compared to other states. The department had published similar claims in 1993 in its report on the 1992 road toll (Queensland Transport,1993b), the department stated that:

Statistical analysis shows that over 75 percent of the difference between state road toll trends is explained (by) the economic factor in conjunction with population considerations.

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3 Correspondence to the Chairman dated 23 February 1999 from Mr Paul Blake, Executive Director, Land Transport and Safety Division, Queensland Transport.

4 Correspondence dated 1 March 2000 from Mr Bill Frith of the Land Transport and Safety Authority of New Zealand to the committee.
Reporting Queensland’s road toll and road safety performance

Interpreting the state’s road toll


9. The department claims that there is a relationship between the six-monthly fatality rate per-capita and GSP growth, and that this is confirmed by an independent report by the Queensland Government Statistician’s Office for the department called ‘Analysis of Road Fatalities and External Factors by Australian State’ (Leggett; Transcript page 10).

10. The figure below is from Queensland Transport’s 1998-99 Road Safety Action Plan. The figure plots Queensland’s per capita fatality rate and GSP growth by year for the period 1986 to 1999. The department has presented similar figures in its annual reports, annual road traffic crash reports, monthly road toll status reports and briefing papers provided to Travelsafe Committee members.

\[\text{Figure (1): Six-monthly Queensland fatality rate and the economy.}\]


Reporting the performance of individual countermeasures

11. Performance figures compiled by the department using its Control Chart Evaluation methodology are central to the department’s performance reporting for its road safety program. The department has used these figures to report the performance of individual measures such as speed cameras, the Road Watch program and bicycle helmets (Transcript page 11). Table (1) below is from the department’s 1998 report titled Road Traffic Crashes in Queensland 1997 (Queensland Transport 1998). This report is an

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\(^5\) Correspondence dated 3 December 1999 from Mr Bruce Wilson, Director-General of Queensland Transport to the Chairman.
report on Queensland Transport’s Road Safety Statistical Methodologies Part 2
dition of an annual series published by the department about Queensland’s road toll. It includes statistics and commentaries by the department on the performance of its road safety measures, expressed as average annual savings in crashes/injuries prevented and average annual benefits and costs. The department derived these figures using its Control Chart Evaluations methodology.

12. The department has used this information to brief key stakeholders at the department’s annual road safety summits convened to devise the state’s annual road safety directions (Transcript page 11). Participants at these summits included representatives of stakeholder groups such as the Bicycle Institute of Queensland, Brisbane City Council, Bus & Coach Association, the Royal Automobile Club of Queensland, the driver training industry, the Queensland Council of Parents & Citizens Associations, the Motor Accident Insurance Commission, Office of the Minister for Transport, Office of Cabinet and the Queensland Police Service (QT submission December 1995).

13. The department also used figures derived using the Control Chart methodology in the tables of outcomes for road safety countermeasures in its 1997-98 and 1998-99 road safety strategies (Transcript pages 10-11).

14. With the department’s Control Chart methodology, the crash/trauma reductions (eg numbers of fatal crashes or fatalities prevented) due to a countermeasure are derived from a simple comparison of trends before its implementation, the expected trend without the countermeasure (devised using a straight-line extrapolation of the previous trend line) and the trend observed after implementation.

15. The department calculates a benefit cost ratio (BCR) for the countermeasure from this analysis by multiplying its estimates of saved crashes by its average crash costs to give social cost savings. For each countermeasure, the department then divided these social cost savings estimate by its estimate of implementation costs to give a BCR. Queensland Transport describes their method of calculating BCRs as “… an approximate first-year opportunity cost benefit analysis” (Transcript page 12).
### Table (1): Crashes & Injuries Prevented

<table>
<thead>
<tr>
<th>Date introduced</th>
<th>Fatal</th>
<th>Hospitalised</th>
<th>All severities</th>
<th>Social cost savings ($M)</th>
<th>Cost of program ($M)</th>
<th>BCR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Personal Protection Programs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seat belts</td>
<td>1972</td>
<td>458</td>
<td>-1179</td>
<td>-134</td>
<td>249</td>
<td>10</td>
</tr>
<tr>
<td>Bicycle helmets</td>
<td>1993</td>
<td>9</td>
<td>113</td>
<td>391</td>
<td>28</td>
<td>4</td>
</tr>
<tr>
<td>Child restraints</td>
<td>1991</td>
<td>3</td>
<td>-2</td>
<td>12</td>
<td>2.2</td>
<td>0.67</td>
</tr>
<tr>
<td><strong>Engineering Programs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Schoolsafe Program</td>
<td>1992</td>
<td>3</td>
<td>1</td>
<td>13</td>
<td>2.3</td>
<td>2</td>
</tr>
<tr>
<td>School 40km/h zones</td>
<td>1992</td>
<td>2</td>
<td>14</td>
<td>26</td>
<td>3.7</td>
<td>0.19</td>
</tr>
<tr>
<td>Blackspot Program</td>
<td>1992</td>
<td>8</td>
<td>22</td>
<td>167</td>
<td>11.1</td>
<td>2.6</td>
</tr>
<tr>
<td>Audio-tactile edgelining</td>
<td>1993</td>
<td>7</td>
<td>6</td>
<td>39</td>
<td>4.8</td>
<td>0.1</td>
</tr>
<tr>
<td>Driver Reviver</td>
<td>1991</td>
<td>2</td>
<td>1</td>
<td>22</td>
<td>0.8</td>
<td>0.25</td>
</tr>
<tr>
<td><strong>Enforcement Programs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Random Breath Testing</td>
<td>1988</td>
<td>199</td>
<td>NA</td>
<td>199</td>
<td>16.14</td>
<td>1.86</td>
</tr>
<tr>
<td>Red light cameras</td>
<td>1990</td>
<td>4</td>
<td>11</td>
<td>84</td>
<td>5.57</td>
<td>0.56</td>
</tr>
<tr>
<td>Random Road Watch</td>
<td>1992</td>
<td>97</td>
<td>346</td>
<td>1409</td>
<td>168</td>
<td>1.89</td>
</tr>
<tr>
<td>Heavy Vehicle Road Damage/Accident Reduction Program</td>
<td>1992</td>
<td>1</td>
<td>5</td>
<td>10</td>
<td>1.52</td>
<td>0.4</td>
</tr>
<tr>
<td>Speed Cameras</td>
<td>1997</td>
<td>32</td>
<td>408</td>
<td>1025</td>
<td>68</td>
<td>NYA</td>
</tr>
</tbody>
</table>

* Negative numbers indicate an increase

** For analysis purposes this figure includes fatal, hospitalised and medical treatment crashes

* NYA = Not yet available

Reporting the performance of the road safety program

16. Figures Queensland Transport derived using its statistical methodologies also appear in budget papers for the Transport and Main Roads Portfolio (Transcript page 11-12) and in the department’s annual reports.

1997-98 Budget Papers

17. Page (1-23) of the Ministerial Program Statement for the Minister for Transport and Main Roads provides a table of key outputs for Queensland Transport’s Land Transport and Safety Division. These outputs include fatal crash savings and benefit/cost ratios of road safety programs. The following figures were provided against these outputs:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(goods and services)</td>
<td>Est</td>
<td>Est</td>
<td>Est</td>
</tr>
<tr>
<td></td>
<td>measures/units</td>
<td>Actual</td>
<td>measures/units</td>
</tr>
<tr>
<td>Fatal crash savings</td>
<td>170 crashes</td>
<td>170 or better</td>
<td>200</td>
</tr>
<tr>
<td>Benefit cost ratio of road</td>
<td>30:1</td>
<td>25:1</td>
<td>30:1</td>
</tr>
<tr>
<td>safety programs</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


18. The statistics provided in the table imply that Queensland Transport is responsible for significant fatal crash savings, and that its programs represent excellent value for money. The ministerial program statement however does not give a source for the figures quoted or explain how they were arrived at. In evidence before the committee, the department confirmed that the figures used in this table were derived using its Control Chart methodology (Transcript page 12).

1998-99 Budget Papers

Table (3): Key Performance/Activity Information – Road Safety

<table>
<thead>
<tr>
<th>Performance/Activity indicator</th>
<th>Notes</th>
<th>1997-98 Est measures/units</th>
<th>1997-98 Actual measures/units</th>
<th>1998-99 Est measures/units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated lives saved in the year indicated by major road safety programs introduced since 1991</td>
<td>*</td>
<td>200</td>
<td>200</td>
<td>230</td>
</tr>
<tr>
<td>Road safety programs: benefit cost ratio</td>
<td></td>
<td>30:1</td>
<td>30:1</td>
<td>30:1</td>
</tr>
</tbody>
</table>


Note* Variations on expected based on pre 1988 road safety trends.

20. The ministerial portfolio statement does not state where the figures were taken from or how they were calculated.

1999-2000 Budget Papers

21. The output statement on page 1-19 of the Ministerial Portfolio Statement for the Minister for Transport and Minister for Main Roads includes a quality measure for the Road Use Management program. The measure is “Aggregate percentage crash reductions from actions in the Queensland Road Safety Action Plan”, and the table in the budget papers is reproduced below.

Table (4): Aggregate Percentage crash reductions from actions in the Queensland Road Safety Action Plan

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>45%</td>
<td>45%</td>
<td>45%</td>
</tr>
</tbody>
</table>


22. In evidence before the committee, the department confirmed that it derived the aggregate percentage crash reductions used in the budget paper by summing the results of its Control Chart evaluations of individual countermeasures (Transcript page 11). This practice is discussed later in the report.

Annual reports of the department

23. Queensland Transport included similar impressive performance claims for its road safety program in its 1993/94 and 1994/95 annual reports. The claims in the reports were also derived using the department unique statistical methodologies.

24. In its 1993/94 annual report (Queensland Transport, 1994; 21), the department states that the 1993 road toll “…represents a toll reduction in real terms of 12 percent based on
known relationships with economic trends. This reduction represents a saving of approximately 55 lives.” The report also states that “Research shows that the Random Road Watch program contributed to saving the lives of approximately 36 people, and the bicycle helmet program saved a further nine lives”.

25. In its 1994/95 annual report (Queensland Transport, 1995:23-4) the department states:

Research shows that the expected road toll in a given year can be reliably modelled by a combination of projected trends tempered by short-term changes in community activity.

In the absence of road safety management measures, a 1994 road toll of 560 would have been expected.

Four hundred and twenty-two people died on Queensland roads during 1994. While this represented an increase of 26 fatalities (or seven percent) compared with the 1993 road toll, it is 138 fatalities fewer than expected.

Separate evaluation studies showed that about 90 percent of the crash reduction (about 120 lives) was due to road safety initiatives of the Queensland Road Safety Strategy, which was introduced in 1993.

Major programs contributing to the decrease included “Random Road Watch” (85 lives), “Random Breath Testing” (23 lives), red light cameras (4 lives) and bicycle helmets (8 lives).

The average benefit/cost ratio of these programs was more than 20:1.
Queensland Transport’s road safety statistical analyses were considered by the Travelsafe Committee of the 48th Parliament during its inquiry into Queensland’s road toll. At the time, Queensland’s rate of road fatalities per capita was 13.9 fatalities per 100,000 population, the highest of the four largest Australian states, and appeared to be worsening.

26. The department’s submission to the inquiry drew heavily on statistical analyses by its Land Transport and Safety Division using its own unique methodologies. In the submission (Exhibit No. 3) the department purported to show that:

- Queensland’s poor road toll record was the result of external factors (high economic and population growth) that increase the road crash risk; and
- Queensland’s road safety initiatives have been successful and have resulted in a lower road toll than could otherwise have been expected given the state’s high risk factors.

27. To argue these points, the department used a method it called “Interstate Modelling” to rank Australian states according to their road safety performance adjusted for risk factors. While Queensland’s fatality rate per capita for road deaths was the highest of the larger states, the department’s analysis ranked Queensland “equal second with New South Wales in road safety performance after Victoria”.

28. Queensland Transport also sought to demonstrate the impact of its road safety program on the state’s road toll. Chapter 6 of the submission discussed the department’s road safety countermeasures and their performance. These countermeasures included: seat belts; child restraints; Driver Reviver; School Safe; 40km/hr zones; blackspot funding; red light cameras; Random Road Watch; bicycle helmets; and audible edge-lining.

29. The department also claimed that its countermeasures saved approximately 391 fatal crashes between 1991 and 1995, with 100 fatal crashes in 1994 saved by the Random Road Watch program (Exhibit No.3).

THE COMMITTEE’S CONCERNS

30. The committee noted a number of concerns with the department’s submission and its statistical analyses. The report (Travelsafe Committee,1996) from the inquiry states:

The Committee had some difficulties assessing the validity of the methods and conclusions in the submission, in part because it contains a series of minor errors and omissions. These include figures and tables that are incorrectly or insufficiently labelled, confusion in the use of terms, reference to data and other information that is not presented, and conclusions that are not based on the evidence presented in the submission (Travelsafe Committee, 1996:27).

31. The committee also noted problems in how the department calculated road safety risk factors for each jurisdiction in the submission.

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A fatal crash is a crash resulting in at least one fatality.
32. The department used a regression analysis on:

\[
\text{Deaths per population} \quad \text{Vs} \quad \text{GSP per population growth and population growth}
\]

33. The committee concluded that the use of the population variable on both sides of the regression is likely to generate a ‘spurious correlation’, a false relationship that disguises any relationship that might exist between the basic variables, in this instance deaths, population and GSP.

34. The department used a model it called the Consumer Sentiment Model to predict expected road crash rates per year for the state. It based this model on the link between the state road toll and the National Consumer Sentiment Survey\(^7\), a measure of consumer attitudes on the direction of the national economy. The committee noted that the use of national consumer sentiment figures to calculate road toll projections on a state basis was “logically problematic”. It ignores the important differences between state economies and consumer sentiment indices. The committee also cited a study by Petit et al (1992) that concludes there is no statistically significant association between consumer sentiment and fatal road crashes, nationally or for Queensland.

35. The committee also noted the extraordinary BCRs calculated by the department for its countermeasures, and discrepancies between BCRs given in the conclusions and in the main body of its submission. Table (5) presents information on the BCRs and approximate numbers of fatal crashes prevented for eight countermeasures from the department’s submission to the Travelsafe Committee of the 48\(^{th}\) Legislative Assembly. As shown in the table, these figures varied by up to a factor of six for the same countermeasure.

36. The committee questioned the department’s Director of Strategy in the Land Transport and Safety Division, Dr Mark Leggett, about the analyses and methodologies used by the department. Dr Leggett is the architect of the methodologies that are the subject of this report (Transcript page 8).

37. In evidence, Dr Leggett told the committee the analyses had been “audited and supported” by the Monash University Accident Research Centre (MUARC), and that they were convinced by them\(^8\). However, when approached by the committee, MUARC stated that it did not audit or prepare an evaluation of the approach used by Leggett.

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\(^7\) The Westpac-Melbourne Institute Survey of Consumer Sentiment index is the average of five responses on consumers’ evaluations of their household financial situation over the past year, the coming year and the next five years, anticipations of economic conditions over the coming year and the next five years and a view on buying conditions for major household items. A sample of consumers are surveyed quarterly on their perceptions of changes to the level of unemployment over the coming year, buying conditions for cars and dwellings, the wisest place for savings and news about economic conditions.

\(^8\) Hearing transcript page 186, 26 June 1996 Brisbane.
Table (5): Comparative benefit cost ratios and fatal crash outcomes for eight road safety countermeasures, Queensland.

<table>
<thead>
<tr>
<th>Countermeasure</th>
<th>Approximate number of fatal crashes prevented</th>
<th>Approximate BCR (from conclusions)/BCR (by calculation from data in text)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Random Road Watch</td>
<td>259</td>
<td>33:1/84.6:1</td>
</tr>
<tr>
<td>Bicycle helmets</td>
<td>31</td>
<td>6:1/-</td>
</tr>
<tr>
<td>Driver reviver</td>
<td>20</td>
<td>9:1/7.3:1</td>
</tr>
<tr>
<td>Red light cameras</td>
<td>19</td>
<td>4:1/24.5:1</td>
</tr>
<tr>
<td>Child restraints</td>
<td>13</td>
<td>2.1/2.2:1</td>
</tr>
<tr>
<td>Audible edge-lining</td>
<td>10</td>
<td>70:1/-</td>
</tr>
<tr>
<td>40 km/hr zones</td>
<td>5</td>
<td>15:1/17.12:1</td>
</tr>
<tr>
<td>School Safe</td>
<td>-1</td>
<td>-0.5:1/-1.52:1</td>
</tr>
</tbody>
</table>

Source: Based on information presented in Queensland Transport’s submission to the Travelsafe Committee of the 48th Legislative Assembly on Queensland’s road toll (Exhibit No. 3) and information presented in Travelsafe Committee (1996).

THE COMMITTEE’S RECOMMENDATION TO THE 48TH LEGISLATIVE ASSEMBLY

38. In view of the concerns discussed above, the committee recommended:

   That Queensland Transport, in consultation with the Travelsafe Committee, engage an independent consultant with expertise in road safety and statistical analysis to evaluate the methodologies contained in the Queensland Transport submission and the application of these methodologies (Travelsafe Committee, 1996)

39. The government accepted the committee’s recommendation in May 19979.

INDEPENDENT CRITIQUE BY DATA CAPTURE AND ANALYSIS

40. In May 1998, Queensland Transport, in consultation with the Travelsafe Committee of the 48th Parliament, engaged Dr David Andreassen, principal of Data Capture and Analysis (DCA) in Melbourne, to undertake the review.

41. The committee had provided Queensland Transport with a short-list of three consultants competent to review the department’s statistical methodologies. The Federal Office of Road Safety prepared the short list for the committee10.

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9 See response by the Hon Vaughan Johnson MLA Minister for Transport and Main Roads, tabled in the Legislative Assembly, 1 May 1997.
10 The Federal Office of Road Safety is now part of the Australian Transport Safety Bureau (ATSB).
Dr David Andreassen’s Credentials

42. Dr Andreassen is highly qualified to critique the department’s road safety statistical methodologies. He holds a degree in science, masters’ degrees in engineering and engineering science and a Ph.D. He is expert in accident data systems, traffic engineering and safety investigations, accident data interpretation and analysis, statistical analysis and cost benefit analysis.

43. Dr Andreassen’s road safety experience since 1958 includes posts as Principal Research Scientist with the Australian Road Research Board Traffic Safety Expert with the United Nations and Chief Traffic Scientist with the Road Safety and Traffic Authority of Victoria.

44. He has written over 120 works on road safety and statistics. His paper on quantifying road accident costs (1992), is the most widely used source of accident cost data in Australia.11

45. Dr Andreassen consults to road safety agencies around Australia. His past clients include: the Federal Office of Road Safety; the Roads and Traffic Authority (NSW); Vicroads; Main Roads WA; the NRMA-ACT Road Safety Trust; Austroads; and the Office of Road Safety, Department of Transport, SA.

Critique terms of reference

46. Queensland Transport and Dr Andreassen devised terms of reference for a critique of the department’s submission. They agreed his critique would examine the following aspects:

- the procedures used, including the choice of variables;
- the methodology;
- the consistency of use of terminology;
- the statistical testing where the detail is given;
- the interpretation of results;
- the veracity of claims and statements and whether they are supported by the analysis in the submission and/or any cited work; and
- whether sufficient detail and explanation have been presented for a reader to readily follow the arguments and propositions developed.

Critique findings

47. Dr Andreassen’s completed his critique in July 1998. He provided his report to the Executive Director of Queensland Transport’s Land Transport and Safety Division, Mr Paul Blake. The department subsequently provided a copy of the report, An evaluation of the submission from the Department of Transport to Travelsafe on Queensland’s Road Toll, to the Travelsafe Committee of the 48th Parliament. An extract from the summary to the critique report is at Appendix (B).

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48. Dr Andreassen’s critique report confirmed the committee’s concerns about the department’s submission and the statistical methodologies presented in it. According to Dr Andreassen, the department’s submission to the road toll inquiry “suffers from an inadequate understanding of the need to associate cause and effect in relation to individual countermeasures and their outcomes, a lack of knowledge of how to apply cost benefit analysis and the failure to do rigorous analysis”. His report cites a plethora of errors in the submission and methodological problems with the department’s statistical analysis. These include:

- numerous anomalies and errors;
- inconsistencies in the use of the terms ‘road toll’ and ‘risk’;
- omissions of key tables and figures;
- significant discrepancies between what is stated in the text and what is presented graphically;
- the use of a methodology different to what was stated;
- statistical techniques appear to have been misapplied and/or misunderstood in the evaluation;
- evaluation of countermeasures in terms of numbers of crashes by crash severity irrespective of whether the countermeasures affected the degree of injury or crash numbers;
- the use of poor comparison groups for evaluations;
- the use of straight line equations with poor statistical fit between non-linear variables to predict injury/crash trends; and
- Extrapolation of trends beyond the range of data used.

49. The critique report also provided guidance on how to address the problems it identified. The report states:

- The effects of individual countermeasures should be examined using accident types (eg by types such as head-on and rear-end) and using the correct procedures for cost benefit analysis.
- Black Spot Evaluations need to be done at an individual site level. This is principally to monitor that the expected changes took place and that no adverse side effects resulted from the treatment and, if any did, to implement further corrective treatments.
- This evaluation concludes that, due to faulty analytical procedures, the submission has not established the effect of these parameters (population and economic growth) on Queensland’s road toll, nor the individual effects of 12 countermeasures.
- It is important that correct evaluations be undertaken, as soon as possible, of the countermeasures.
- The results, including proper cost benefit analysis, should then be used to shape the expenditures in future programs.
- A proper evaluation of the ‘School Safe’ countermeasure is particularly important since, according to the submission, this intervention resulted in an increase in crashes.

50. In regard to claims the department made about trends in Queensland’s road toll, Dr Andreassen’s critique report states:

The drops in road crashes and deaths in Queensland since 1989/90 are in common with other States in Australia and might relate to factors applying over the whole country, although to varying degrees, rather than to specific projects in Queensland.
51. Shortly after the Travelsafe Committee of the 49th Parliament was established, it resolved to continue the work of the previous committee on the department’s statistical analyses and to report on the Critique by Data Capture and Analysis (DCA) and the department’s response. The committee’s work on this matter include correspondence with the department, a further review of documents by Dr David Andreassen on its behalf and a hearing with Queensland Transport staff on 26 October 1999.

52. The Chairman first informed the Director General of Queensland Transport about the committee’s interest in Dr Andreassen’s critique in a letter of 6 August 1998. The letter sought:

- a written response from the department to Dr Andreassen’s critique;
- copies of other reports that have examined the department’s statistical methodologies contained in its 1995 submission; and
- advice on whether the department still used the methodologies.

QUEENSLAND TRANSPORT’S RESPONSE TO THE CRITIQUE

53. The department’s reply to the Chairman\(^\text{12}\) did not provide a written response to the critique, as requested, or clarify whether the department still uses the statistical methodologies in question. Instead, the department advised:

\[\ldots\text{it is our intention to work through DCA’s suggestions and continue to improve our systems where it is appropriate;}\]

\[\ldots\text{Queensland Transport uses a wide range of systems to help manage road safety in Queensland. The systems we have in place assist with road safety planning, policy development and informing the Queensland community about road safety issues;}\]

\[\text{and}\]

We have taken on board Travelsafe’s suggestions and intend to make greater use of independent evaluations in the future.

\(^{12}\) Correspondence from Mr Bruce Wilson, Director-General, Queensland Transport to the Chairman, 21 September 1998.
54. The letter also provided copies of four other documents commissioned by the department concerning its monitoring systems:

- *Analysis of Road Fatalities and External Factors by Australian State* prepared by the Queensland Government Statistician’s Office (QGSO);
- *Review and assessment of the control chart method of analysis of Traffic Data* prepared by Professor J A Eccleston & Dr MJ Faddy of Uni Quest Limited;
- *Evaluation of Queensland Random Road Watch Program* prepared by Stuart Newstead and Max Cameron of Monash University Accident Research Centre (MUARC); and
- a copy of advice prepared by the University of Queensland (UQ) concerning the addition of results of separate control chart evaluations to provide an aggregate of the performance of individual programs.

**FURTHER REVIEW COMMISSIONED BY THE COMMITTEE**

55. In April 1999, the committee engaged Dr Andreassen to examine the four documents provided to the committee by the department in support of its statistical methods. The committee asked Dr Andreassen to provide:

- advice on whether the documents provide evidence to support the department’s methodologies contained in its submission to the Travelsafe inquiry into Queensland’s road toll;
- comments on the relevance of these documents to concerns raised in his critique; and
- advice of any matters requiring clarification by the documents’ authors.

56. Dr Andreassen reported his findings to the committee in May 1999. His report states that the documents tendered by Queensland Transport do not support the department’s methodologies. An extract from Dr Andreassen’s report is at Appendix (C).

**Review Findings**

57. The following sections describe the four documents Dr Andreassen reviewed and summarise his comments. Two of the documents, *Review and assessment of the control chart method of analysis of Traffic Data* (Uniquest Limited) and *Advice concerning the addition of results of separate control chart evaluations* (UQ) are discussed together.

**Analysis of Road Fatalities and External Factors by Australian State – (QGSO)**

58. This document provides advice to Queensland Transport on the external risk factors, population growth and growth in GSP.

59. Dr Andreassen’s found:

- this document pre-dates the critique;
- the authors of this report have not reviewed the department’s submission;
- the method used by the authors and the method used by the department are different; and
- this document concludes that growth in road fatalities per capita is inversely proportional to growth in GSP per capita. (The department’s methodology concludes that these growths are ostensibly proportional.)
Review and assessment of the control chart method of analysis of Traffic Data (Uniquest Limited); and advice concerning the addition of results of separate control chart evaluations (UQ).

60. These documents compare three statistical models, examine the department’s control chart evaluation methodology and advise the department whether the results of individual control chart evaluations can be validly summed.

61. The report concerning the addition of control chart evaluations has four propositions:

1. When there is a clear chronological ordering of countermeasures the effects can be added;
2. When the countermeasures have independent effects, the effects probably could be added;
3. When two countermeasures are aimed at the same ‘behaviour’, it will likely be impossible to separate the individual effects; and
4. If two countermeasures applicable to the same behaviour are used at the same ‘location’, then the simple addition of the separate effects is not likely to occur.

62. The report cites, as an example, adding the effects of two countermeasures, seat belt wearing (a measure to reduce the severity of injuries) and random breath testing (a measure normally associated with reducing certain out-of-control crashes).

63. Dr Andreassen’s found that:

- The advice covering the addition of evaluation results pre-dates the critique;
- The first model used for the comparison report appears different to the method used by the department;
- The report gives qualified support for the Control Chart method, assuming the normality of the ratio of the two variables used;
- The report suggests that the use of Chi-squared would be invalid and that a t-statistic would be more appropriate (the department’s submission used the Chi-square regardless);
- The author of the advice doesn’t appear to appreciate the difference between treatments that affect “crash frequency” and those that affect the “severity of injuries” when a crash occurs; and
- Queensland Transport appears to have added the evaluation results for countermeasures with overlapping effects, contrary to this advice.

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15 The Chi-Squared Test of Association allows the comparison of two attributes in a sample of data to determine if there is any relationship between them.
16 The t-statistic is a measure of statistical significance i.e. how far away the sample mean is from the value specified in the null hypothesis.
Evaluation of Queensland Random Road Watch Program (MUARC).

64. This report dated July 1998 is from MUARC’s evaluation of the crash effects of the department’s Random Road Watch (RRW) program. In the report’s introduction, MUARC states that it was commissioned by Queensland Transport to carry out an independent evaluation of the program.

65. Dr Andreassen’s found that:
   - It appears that the MUARC report did not use the method used by Queensland Transport;
   - There are significant differences in effects of RRW across different regions and between rural and urban regions;
   - The combining of significant and non-significant results in different regions, overstates the reductions due to RRW; and
   - MUARC uses crash costs supplied by Queensland Transport that do not differentiate between urban and rural crashes, and contain errors.

66. Andreassen also notes that the MUARC report discusses problems with Queensland Transport’s Control Chart methodology, and that MUARC used a different method:

   Some assumptions made by the control chart method are questionable and remain to be precisely assessed.

   And

   A more complex and rigorous statistical analysis method was developed for use in this evaluation (MUARC, 1998; p5).

67. Dr Andreassen also comments on MUARC’s analysis of the effectiveness of the RRW program in terms of crash severity (i.e. in terms of reductions in numbers of fatal, hospitalisation and other injury crashes). He states:

   In my opinion, this is probably why there are some anomalous results. With an analysis by accident-type, some consideration of cause and effect would be possible. A decrease in fatal crashes means what? It is too gross a yardstick to be useful (Andreassen 1999; p13).

68. Andreassen’s other comments relate to how the RRW program is supposed to work. In its submission, Queensland Transport states that the program contributes to “prudent driving” and that this prudence should be reflected in lower crash rates. However, what prudence means in a road safety context is not explained. Andreassen states:

   Does RRW affect crash occurrence or injury severity? An understanding of the effects of RRW could lead to a refinement of where and how it is used (Andreassen 1999; p13).

   and

   I regard the RRW program as a significant initiative and it deserves a more detailed analysis than it has received so far. The analysis should include accident-types and some geographical aspects of where the enforcement was and where reductions in crashes were achieved (Andreassen 1999; p15).

69. The committee wrote to the department on 22 December 1998 again requesting a response to Andreassen’s critique report. The department’s reply on 23 February 1999 did not
provide a written response to the critique report, though, conceded that the department was no longer using the Interstate Modelling methodology. It states:

...(The interstate modelling) work was used in the context of the 1995 submission and has not been used in that form since. For your information, in its Monthly Status Report, Queensland Transport now uses Queensland Gross State Product rather than National Consumer Sentiment to help identify road safety risk factors.

We continue to use the control chart evaluation method to help determine whether our initiatives are providing positive results or not. We do not however use these methods exclusively and a wide range of other approaches such as community surveys and road safety audits inform the decisions made.

The charts are generally used for internal analysis but are sometimes presented publicly to illustrate a particular road safety issue.

We consider that the continual use of the method is appropriate given the advice from the head of Department of Mathematics at the University of Queensland, Professor John Eccleston, and input from the Monash University Accident Research Centre’s evaluation of the Random Road Watch program.

70. The reply also linked the department’s use of its simplistic methodologies with the perceived information needs of the department’s stakeholders. The letter states:

Queensland Transport uses a range of methods to tackle the road safety risk in this state. Above all else, our approach is to form partnerships across the community and in this regard communication is a key factor.

For this reason, in determining our evaluation approaches we always tend towards simplicity rather than complexity so that we can communicate our message to the wider community. We believe that we have the right balance between rigorous evaluation and effective communication in our current methodology however we continue to seek improvement.

71. In the absence of a written response from the department to Andreassen’s critique report, the committee’s Research Director met with Queensland Transport’s Dr Mark Leggett on 29 March 1999. They discussed the problems identified by Dr Andreassen, the department’s continuing use of the statistical methodologies in question and a timetable for external evaluations of its road safety countermeasures.

72. After the meeting, the committee wrote to the department seeking confirmation of advice provided by Dr Leggett and again sought a written response to Dr Andreassen’s critique report. Mr Paul Blake, Executive Director of the department’s Land Transport and Safety Division replied on 10 May 1999. In the letter, he advised that the department had agreed to undertake external evaluations of two of its programs, and would not commit resources to compile the written response the committee had requested since August 1998. The letter states:

We have commenced a program of having our major road safety programs independently evaluated, in general order of program size, by more sophisticated methods. Of our largest programs, Random Road Watch and Speed Cameras, the first of these evaluations have been completed by Monash University Accident Research Centre and the second evaluation has commenced. Further programs, for reasons of cost, will not be evaluated in the immediate future. We do not have a timetable for such evaluations.

...We use the control chart methods to evaluate programs as an input to our annual Road Traffic Crashes in Queensland report.

You requested we provide a detailed response to Dr Andreassen’s critique. We have not prepared one nor do we intend to allocate resources to such a task.

18 Letter dated 10 May 1999 from Mr Blake to the Chairman.
73. Mr Blake also reiterated the department’s linkage of statistical methodologies with the information needs of its stakeholders. His letter states:

As stated previously, we need to keep our evaluation system simple and have no desire to adopt highly complex approaches which are difficult for the community to understand.

74. Mr Blake’s letter was accompanied by comments provided by Professor Ross Homel of the School of Criminology at Griffith University (Exhibit 13). In the letter, Professor Homel states that Dr Leggett asked him to provide the comments. Professor Homel’s comments are critical of Dr Andreassen’s critique of the department’s submission, though, identify no specific errors or omissions. The committee invited Professor Homel to provide it with specific comments about Andreassen’s critique and Queensland Transport’s use of its statistical methodologies. Professor Homel did not provide specific comments.

QUEENSLAND TRANSPORT’S WRITTEN RESPONSE TO THE CRITIQUE REPORT

75. Queensland Transport finally provided the committee with its written response to Andreassen’s critique report on 3 December 1999. The department provided the response following the appearance of departmental officers at the committee’s hearing on 26 October 1999.

76. Queensland Transport subsequently advised the committee that it has stopped using its statistical methodologies to examine trends in risk factors affecting the states road toll relative to other state tolls. The Government Statistician using a methodology of his choice will now undertake this work19. The department also advised that it has modified its method to predict annual road crash rates using regression analysis of the ratio of road toll and consumer sentiment indices (the department’s Consumer Sentiment Model) and sought further expert advice on its other methodologies. The committee welcomes the department’s efforts to improve its statistical methodologies. The table below summarises the department’s advice on the status of its statistical methodologies based on its written response and previous correspondence with the committee.

77. The department disagrees with other findings of Andreassen’s critique.

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19 Correspondence dated 3 December 1999 from the Director-General to the Chairman.
Table (6): The status of Queensland Transport’s statistical methodologies

<table>
<thead>
<tr>
<th>Statistical method used by Queensland Transport</th>
<th>Summary of the Queensland Transport December 1999 response to comments in Dr Andreassen’s critique report</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method to examine trends in risk factors influencing Queensland’s road toll compared to other states using regression analysis of deaths per capita against population growth and Gross State Product (GSP) growth per capita.</td>
<td>Given the concerns raised, the method has not been used further. As noted above, the Government Statistician, using methods of its choice, will in future be used to address questions of inter-state risk comparisons.</td>
</tr>
<tr>
<td>Method to examine trends in the Queensland road toll at a regional level using a regression analysis of percentage changes in deaths and the percentage average annual population growth.</td>
<td>The department disputes Dr Andreassen’s findings and provided the committee with a letter from the Government Statistician supporting its position.</td>
</tr>
<tr>
<td>Methods to predict road crash rates per year in Queensland using regression analyses of the ratio of road toll to the National and Queensland consumer sentiment indexes.</td>
<td>The method used in the 1995 submission to the Travelsafe Committee of the 48th Parliament is no longer used.</td>
</tr>
<tr>
<td>Method to examine the effects of the department’s key road safety countermeasures on crash frequency, crash severity and the social costs of crashes in Queensland by using linear regression analysis of subject/comparison trends in crash frequency by severity for each countermeasure before and after implementation (The method is described by Queensland Transport as “Control Chart Evaluations of Individual Countermeasures”20).</td>
<td>The department disputes Dr Andreassen’s criticisms of this methodology and advises that MUARC is assessing the relative performance of the control chart evaluation methodology.</td>
</tr>
<tr>
<td>Method to estimate aggregate costs and benefits of individual countermeasures based on the results of the Control Chart evaluations.</td>
<td>The department acknowledges Dr Andreassen’s comment about the discount rates however states that the suggested changes would alter the results only very slightly.</td>
</tr>
<tr>
<td>Method to estimate aggregate costs and benefits for all countermeasures by adding their individual effects.</td>
<td>The department suggests it has advice supporting its aggregation of control chart evaluation results and that further research on this topic would be beneficial if resources can be made available.</td>
</tr>
</tbody>
</table>

20 Correspondence to the Chairman dated 23 February 1999 from Mr Paul Blake, Executive Director, Land Transport and Safety Division, Queensland Transport.
PART 5 - DISCUSSION

78. The problems with Queensland Transport’s road safety statistical methodologies identified by the Travelsafe Committee of the 48th Parliament were significant. They cast doubt on the ability of the department’s Land Transport and Safety Division to analyse and publish statistics that are readily justifiable. These statistical analyses formed an integral part of a submission by the department to the committee’s inquiry. The problems that the committee identified with the analyses were compounded by claims by the department that the analyses had been audited and supported by MUARC, a leading university research centre. These claims proved to be inaccurate.

79. The committee’s work led it to recommend an independent review of the statistical methodologies contained in the department’s submission. Dr Andreassen’s critique found extensive problems with the road safety statistical analyses by the department’s Land Transport and Safety Division.

80. The concerns about the department’s use of road safety statistics have implications beyond the department’s submission to the Travelsafe Committee of the 48th Parliament. They affect how the department monitors and reports the performance of its individual road safety countermeasures and the road safety program.

81. The department’s reliance on internal evaluations of its road safety countermeasures using its Control Chart Evaluation methodology raises additional concerns.

THE CASE FOR INDEPENDENT EXPERT STATISTICAL ADVICE

82. Dr Andreassen’s critique is the only external review of the department’s statistical methods and its use of information it derives from them. Other consultants engaged by the department appear to have examined specific aspects of the department’s statistical work, but not the work in its entirety and in context. The department provided the committee with consultants’ reports in support of its statistical methodologies. The department has cited advice from some of these narrow studies to argue against findings of Andreassen’s Critique, though concedes that their authors had never seen the submission that he reviewed. A review of four of these documents by Dr Andreassen on the committee’s behalf found that they do not support the department’s statistical methodologies. In some cases it appears the department has acted contrary to its own expert advice. As noted by Dr Andreassen, the problems with the department’s statistical analyses may not be the methodologies per se but how they are used.

83. Despite the weight of Andreassen’s findings, the department has not sought to discuss them with him since he completed his report. The department has also been reluctant to discuss the critique with the committee, taking 15 months to provide it with a written response to the findings.
84. The committee suggests there is a risk that the department’s approach to expert statistical advice may not identify systemic shortcomings in its approaches. To address this, the committee concludes the department should establish a statistical reference group. The group’s function should be to provide expert advice to the Director-General on the department’s statistical methodologies and analyses. This reference group should include representatives from the Office of the Government Statistician.

**RECOMMENDATION 1**

*That Queensland Transport establish a statistical steering committee to provide ongoing expert advice to the Director-General on the department’s statistical methodologies and analyses.*

- **Responsibility: Minister for Transport**

**THE VALUE OF EVALUATION**

85. As noted by the previous committee\(^{21}\), performance measurement and evaluation are important to ascertain whether programs are having the desired effect, whether reforms are required and, if so, what form they should take. Performance measurement and evaluation are also important because they will ultimately have a major impact on the distribution of resources\(^{22}\).

86. Council *et al* (1980)\(^{23}\), a widely recognised road safety research manual prepared for the United States Department of Transportation, discusses the value of effectiveness evaluations in road safety (known as highway safety in the US). It offers the following rationales for doing proper evaluations:

- First, because only limited financial resources are available for highway safety programs, it is tritely but truthfully a matter of life and death that these monies be directed towards the programs that have the most direct impact in reducing highway death and injury.
- Second, the success of a program is not “self-evident,” even to individuals with an inordinate amount of common sense.
- Third, we need evaluation because in real life we rarely see a simple cause and effect relationship operating in a vacuum. Usually, many factors that can influence accidents are operating simultaneously – changes in traffic volume, population size, etc. Furthermore, countermeasure programs themselves are in effect concurrently and can augment or obscure each other’s effects. In such a situation, only a formal evaluation that rigorously follows prescribed rules can provide information about the effectiveness of the particular program under examination.
- To sum up, highway safety programs are too important – too many lives depend on their outcome - to allow guesswork to guide program decisions. Because of the complicated mix of factors influencing the setting in which any highway safety program operates, it is imperative that formal evaluation procedures be used to measure actual program results. Nothing could be more “ivory tower” (than) to by-pass evaluation on the grounds of theory, hope, or optimism.

87. The committee agrees.

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THE CASE FOR INDEPENDENT EVALUATIONS

88. There are also strong arguments for having evaluations conducted independently and externally.

89. Factual information on which evaluations are based is often put together by people who have a stake in the outcome of the evaluation, and this may undermine its objectivity. Negative findings may have adverse impacts on the careers of program managers and their staff and on the institutions in which they work. Because of this, there is substantial doubt as to whether evaluations conducted internally will be sufficiently rigorous or critical. This point is widely recognised in the international literature.

RECOMMENDATION 2

That Queensland Transport obtain independent external evaluations of all the department’s major road safety countermeasures.

- Responsibility: Minister for Transport

RECOMMENDATION 3

That Queensland Transport devise a timetable for the independent evaluation of the department’s major road safety countermeasures and report the timetable to Parliament.

- Responsibility: Minister for Transport

RECOMMENDATION 4

That Queensland Transport obtain an independent evaluation of the Safest Schools Program and a further independent evaluation of Random Road Watch program as a priority. The evaluation of Random Road Watch should analyse the effectiveness of the program for accident-types and include geographical aspects of where the enforcement activities for the program occurred and where reductions in crashes were achieved.

- Responsibility: Minister for Transport

ISSUES ABOUT INDEPENDENCE

90. One of the documents the department provided the committee in support of its statistical methodologies, a report by MUARC from its “independent” evaluation of the department’s Random Road Watch program, has since been revised and published by the university. The revised report lists Queensland Transport’s Dr Mark Leggett, the architect of the Random Road Watch program, as co-author.

91. Dr Leggett also prepared the department’s brief to engage consultants for the review, and was a primary contact used by MUARC for information required for the review. The committee suggests that Dr Leggett’s multiple roles as architect of the Random Road Watch program, organiser of the consultancy for the program’s review, primary contact

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person for the consultants’ information requests for the review and co-authorship of the published evaluation report threaten the independence of the review by MUARC.

92. There are well-established parameters for independence in evaluations. Notably, on the subject of evaluator–client relations, a different MUARC report notes:

Communication during the evaluation is also important, although the temptation on the part of the client to suggest strategies which direct the study towards a particular conclusion should be avoided. For this reason it is necessary to keep a distance between the evaluator and the client.26

93. The committee suggests that Dr Leggett’s role in the evaluation may not have afforded adequate “distance between the evaluator and the client” and may, therefore, compromise the independence of the MUARC review.

THE COST OF EVALUATION

94. Council et al (1980) suggests than the cost of a sound evaluation which optimises the use of available data and circumstances may be less than the cost of poor evaluation. Similarly, the Roads and Traffic Authority of New South Wales states in its Research guidelines for the development and evaluation of road safety campaigns27:

Poorly conducted research is far worse than no research at all (to paraphrase Oscar Wilde’s views on art). Once research is reported, there is no way of controlling people’s access to it. People who are unfamiliar with research will often assume that it must be alright; they will refer just to the conclusions of the study and not even look at the method. If the method is flawed, the research is useless and dangerous.

95. The committee agrees. Poor evaluations of road safety countermeasures are worse than no evaluations at all. There is always the risk that other agencies may adopt ineffective programs that appear strong in poorly designed and executed evaluations.

96. Despite stating it intends to make greater use of independent evaluations in the future28, Queensland Transport has refrained from committing itself to external evaluations of all but its two largest road safety countermeasures: the Random Road Watch and Speed Camera programs29.

97. In advice to the committee, the department cites the cost of external evaluation as the reason for not going further. According to the department, the evaluation of the Random Road Watch program by MUARC in 1998 cost $44,00030. On this basis, external evaluations of all the thirteen countermeasures listed in table (1) above could cost $572,000 or 0.3 percent of the cost of the Government’s Road Use Management Program for 1999/2000.

28  Letter dated 21 September 1998 from Mr Bruce Wilson, Director-General of Queensland Transport to the Chairman.
29  Letter dated 10 May 1999 from Mr Paul Blake, Executive Director, Land Transport and Safety Division, Queensland Transport to the committee.
30  Ibid.
98. The department receives no special allocation for external evaluations (Transcript page 21). In a funding sense, external evaluation projects within the Land Transport and Safety Division compete against projects to introduce new road safety countermeasures for funding. In these circumstances, it is not difficult to appreciate why the department might fund new road safety initiatives rather than external evaluations of existing programs. As noted above, departmental officers involved with programs may have a further vested interest in discouraging external evaluations.

99. The committee suggests that these conflicting priorities should be avoided by funding evaluations and road safety countermeasures separately. In addition to the department’s allocation from consolidated revenue and the proceeds from the sale of personalised vehicle number plates, the committee notes that the Traffic Act 1949 provides that Queensland Transport’s Road Safety Program receives funds from surplus revenue collected from motorists for camera-detected traffic offences. S.44T(1) of the Traffic Act 1949 states:

44T.(1) All money collected for penalties imposed for camera detected offences in excess of the administrative costs of collection must be used for the following purposes:

- road safety education and awareness programs;
- road accident rehabilitation programs;
- road funding to improve the safety of the sections of State-controlled roads where accidents most frequently happen.

100. The committee recommends that S.44T(1) be amended to include ‘evaluations of road safety countermeasures’ as a further purpose for the surplus penalty revenue. With the funding issue resolved, the committee recommends that the department devises a timetable for the independent evaluation of all of its major road safety countermeasures.

**RECOMMENDATION 5**

That Queensland Transport seek amendment of section 44T(1) of the Traffic Act 1949 to include ‘evaluations of road safety countermeasures’ as a further purpose for surplus penalty revenue from camera-detected traffic offences.

- **Responsibility: Minister for Transport**

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31 See Part 5: The Case for Independent Evaluations.
KEEPING STAKEHOLDERS INFORMED

101. In advice to the committee, Queensland Transport suggests its use of its internal Control Chart methodology for evaluations is linked to its desire to meet the simplistic information needs of stakeholders. The department told the committee32:

…in determining our evaluation approaches we always tend towards simplicity rather than complexity so that we can communicate our message to the wider community. We believe that we have the right balance between rigorous evaluation and effective communication in our current methodology however we continue to seek improvement.

102. On this subject, Dr Andreassen comments in his review for the committee33:

Evaluation and communication are not connected in the way that appears to be suggested. No matter how complex the analysis is, it is the job of the analyst to translate the findings into terms that can be understood and communicated. The letter sounds more like groundwork comments to avoid undertaking proper analysis at the required levels of disaggregation.

103. The committee agrees. It is imperative that statistical analyses are based on sound methodologies and that they are correctly applied. The department has a separate responsibility for the clarity of language it uses in information it provides stakeholders and the general public that in no way diminishes its obligations for the integrity of its statistical analyses and the information it derives from them.

RECOMMENDATION 6

That Queensland Transport only publish data on the effects of population and economic growth on the Queensland road toll that is supported by independent statistical proof.

• Responsibility: Minister for Transport

RECOMMENDATION 7

That Queensland Transport only publish data on crashes and/or injuries prevented by the department’s road safety countermeasures and benefit cost ratios for individual countermeasures from the department’s Control Chart Evaluations that is supported by independent, external evaluations of the countermeasures to substantiate the claims.

• Responsibility: Minister for Transport

32  Letter from Mr Paul Blake, Executive Director, Land Transport and Safety Division, Queensland Transport, dated 23 February 1999.
33  Report to the Travelsafe Committee, April 1999, Data Capture and Analysis, D.C. Andreassen, April 1999.
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<td><em>The Debate about the Road Toll in Queensland</em> comments by professor Ross Homel, School of Criminology and Criminal Justice, Griffith university April 26, 1999</td>
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The following sections provide a brief outline of the department’s major road safety countermeasures. The approximate costs of each countermeasure are from table (1) Further outcomes of key road safety initiatives on page 3 of this report. Queensland Transport published this table in 1998\textsuperscript{34}.

**Child restraints**

The Traffic Regulations 1962 were amended on July 1991 to enforce the use of approved child restraints by young children. Prior to that date, the regulations made no distinction between older children and infants (defined as a person whose body weight is less that nine kilograms). Child restraints are designed to reduce the severity of injuries sustained by child vehicle occupants in crashes.

From table (1), Queensland Transport estimates the average annual cost of the program is $0.67 million.

**Driver reviver**

Driver reviver is a community-based initiative introduced in December 1990 to reduce driver fatigue-related crashes. Its objective is to increase community awareness of the need for improved long distance driving habits. It consists of a public education campaign and a network of refreshment booths located at sites on the road network where the potential for fatigue-related crashes is high. Volunteers serve motorists free refreshments at these booths during peak holiday travelling periods such as the start and end of school holidays, public holiday long weekends, Easter, Christmas and the New Year.

From table (1), Queensland Transport estimates the average annual cost of the program is $0.25 million.

**40 km/hr school zones**

40 km/hr speed zones were introduced around schools commencing in the 1991/92 financial year. Reduced speeds apply at certain times, typically 7.30-9.00am and 2.30-4.00pm on school days. School zones are not used on multi-lane arterial roads and heavily trafficked areas nor around day care centres or pre-schools detached from primary schools.

School 40 km/hr zones are part of the School Safe program and funded by the Queensland Government on a dollar-for-dollar basis with local authorities. From table (1), Queensland Transport estimates the average annual cost of the program is $0.19 million.

**Blackspot program**

The Blackstop program is a federally funded initiative that operated from 1990/91 for the three years. It provided funds for treatments of black spots (high accident locations) in the Australian road network. The program applied only to non-federal roads. Red light cameras

From table (1), Queensland Transport estimates the average annual cost of the program is $2.6 million.

**Random breath testing (RBT)**

Random breath testing was introduced into Queensland in December 1988 to replace the Reduced Impaired Driving (RID) program, a random stopping program that had been used since August 1986. RBT is an enforcement tool designed to achieve a general deterrence to drink driving. Under RBT police are empowered to stop and breath test any driver without having reason to suspect that the driver has been drinking.

From table (1), Queensland Transport estimates the average annual cost of the program is $1.86 million.

**Bicycle helmets**

In January 1992, the Queensland Government introduced legislation making wearing bicycle helmets compulsory for all cyclists. In January 1993, a penalty was introduced for juvenile cyclists who fail to wear helmets. Helmets are designed to reduce the severity of head injuries to cyclists in crashes.

From table (1), Queensland Transport estimates the average annual cost of the program is $4 million.

**Audible line marking**

Audible line marking was applied to a section of the Bruce Highway from Gin Gin to north of Marlborough in June 1993 as part of the federally funded Blackspot program. The purpose of the treatment is to reduce the risk of fatigue-related crashes. Vehicle tyres emit an audible noise when driven over the lines. Theoretically, this provides a warning to fatigued drivers that their vehicles have straddled the driving lane. Since 1993, audible line marking treatment has been applied to other highways.

From table (1), Queensland Transport estimates the average annual cost of the program is $0.1 million.

**School Safe Program**

School Safe is a dollar-for-dollar subsidy scheme introduced in 1992 to assist local authorities with the funding of works to improve road safety around schools. Measures to improve safety may include: the provision of School Zones; bus and passenger set-down areas and parking for parents waiting to collect children; crossing facilities and parking for parents waiting to collect children; crossing facilities; pedestrian refuges; kerb extensions; bicycle facilities; and other traffic management devices.

From table (1), Queensland Transport estimates the average annual cost of the program is $2 million. This is made up of up to a $1 million in local authority costs and $1 million in subsidies.

**Red light cameras**
The red light camera program was introduced in December 1990 to reduce crashes at signalised intersections. The program’s objective is to discourage red light ‘runners’ by increasing enforcement. Queensland Transport issues camera-detected-offence notices to the owners of vehicles photographed committing a red light offence.

From table (1), Queensland Transport estimates the average annual cost of the program is $0.56 million.

**Seat belts**

From 1 January 1969, state legislation required that passenger vehicles in Queensland be fitted with front seat belts, and with rear seat belts from 1 January 1971. The non-wearing of seat belts, where fitted, was made an offence in 1972.

From table (1), Queensland Transport estimates the average annual cost of the program is $10 million.

**Speed cameras**

The Queensland Government introduced speed cameras in 1996 to reduce speed-related crashes. Like the red light camera program, Queensland Transport issues the owners of vehicles, photographed while committing a speeding offence, with camera-detected-offence notices.

**Random Road Watch (RRW) program**

RRW involves the random deployment of stationary, marked, police vehicles on the road network to undertake general enforcement duties. Queensland Transport devises the deployment sites and times.

From table (1), Queensland Transport estimates the average annual cost of the program is $1.89 million.

**Heavy Vehicle Damage/Accident Reduction Program**

Like the RRW program, this program involves the random deployment of stationary heavy-vehicle inspection vehicles on the road network to undertake enforcement. The aims of the program are to reduce crashes and road damage caused by overloaded heavy vehicles.

From table (1), Queensland Transport estimates the average annual cost of the program is $0.4 million.
APPENDIX B —

EXTRACT FROM AN EVALUATION OF THE SUBMISSION FROM THE DEPARTMENT OF TRANSPORT TO TRAVELSAFE ON QUEENSLAND’S ROAD TOLL BY DR DAVID ANDREASSEN, DATA CAPTURE AND ANALYSIS.

Method

Chapter 1 of the Submission describes a method that was to be used and which would have been satisfactory. However a different method was used throughout the Submission without any mention of the change. For the countermeasures, their success was measured in terms of the number of crashes by crash severity irrespective of whether the particular countermeasure affected the degree of injury or crash numbers. Often, the subject group was not the most appropriate one that could be used for the particular countermeasure. The method used relied on predicting future values based on past data. The models/equations used were all linear (straight line) and frequently had no ‘fit’ to the past data as measured by statistical tests and, as a consequence, had no predictive power. The critique gives some examples of models which better fit the data.

The method uses a ratio as the variable to be estimated and a straight line equation based on previous years values to predict the future values of that ratio. The use of a ratio places a constraint on the relationship that can exist between the two variables that form the ratio. It has to be a linear (straight line) relationship. Frequently the analyses gave “correlation coefficients” that were not significantly different from zero. That is, there was NO relationship. Because of this, the rest of the analysis in these cases was pointless.

Generally speaking, trends should not be extrapolated outside the range of the data that is used in deriving the equation. Extreme caution should be exercised in extending a fitted equation to make long range predictions away from the range of x-values used in deriving the equation. This causes the “confidence interval”, a measure of accuracy, to become so wide that predictions can be extremely unreliable. An even greater danger can exist. If the relationship between the variables should change drastically (at a distant value of x), the data provide no information with which to detect the change. The diagram below demonstrates this with an example. The x-values in the range 5 to 10 are used in deriving the regression which gives a linear relationship. If that line is then extrapolated out to an x-value of 20, the predicted y-value at that point and those predicted y-values from x = 10 to x = 20 will be progressively in error if the true relationship between y and x is curved as shown in the diagram below.
No new techniques have been applied to the evaluation. Rather it appears that existing techniques have merely been misapplied and/or misunderstood. References are quoted (although these are not detailed in a reference list) which are purported to use the same method employed in the Submission. After tracking down some of these references, it was found that the applications described in the references and the Submission differed markedly.

The choice of subject groups and comparison groups have not all been the most direct or appropriate measures for the countermeasure being considered. Furthermore, the sample and comparison groups were not plotted separately to examine their relative trends. It is pointless to use comparison groups if this is not done. As quoted from one of the references and stated in the last paragraph of page 29 of the Submission, “if groups can be found that appear comparable under very close scrutiny, the design becomes a very strong one”. Of course, the converse also applies - the less comparable the groups are, the weaker the design.

Despite the subject and comparison groups stated in the text, it appears that crash frequency by crash severity (ie the number each of 1-fatal, 2-admitted to hospital, 3-medical treatment, 4minor injury, 5-damage only crashes) was used for both the subject and control groups for all analyses. This further weakens the design. Crash severity is a measure of limited information content as it is based on the most serious degree of injury sustained by any one of the persons involved. The system used to assign crash severity does not differentiate between, for example, a car crash where one person is killed and a bus crash where 10 persons are killed and 20 injured. Both would be categorised as fatal crashes.

Some countermeasures such as the wearing of seat belts affect the degree of injury sustained by all occupants but don’t prevent crashes. Therefore the distribution of the degree of injury for all occupants should be used in the analysis of effects.

There are some differences between what was stated in the text as the subject and comparison groups and what appeared on the graphs in the appendix for each countermeasure. In some cases the differences were significant, yet this was not referred to or discussed in the Submission. For example the number of persons killed and the number of fatal crashes are two different parameters. The number of drivers injured and the number of casualty crashes are also different. Changes in the numbers of crashes are different to changes in costs.
Cost Benefit Analysis (CBA)

The Submission suffers from an inadequate understanding of the need to associate cause and effect in relation to individual countermeasures and their outcomes; a lack of knowledge of how to apply cost benefit analysis; and the failure to do rigorous analysis. The effect of various individual countermeasures should be examined using ‘accident-types’ (eg by types such as head-on and rear-end) and using the correct procedures for cost benefit analysis. That would provide a better starting point than the analysis presented in the Submission.

Black Spot evaluation needs to be done at an individual site level. This is principally to monitor that the expected changes took place and that no adverse side effects resulted from the treatment and, if any did, to implement further corrective treatments. At a broad program level evaluation, one would group sites by treatment type and perhaps by ‘before’ frequency categories of accident-types that would be affected by the treatment.

Suggested Action

It should be made clear that the critique does not say that population and economic growths do or do not affect deaths. Nor does it say that the countermeasures implemented in Queensland have or have not had beneficial effects on crashes. This evaluation concludes that due to faulty analytical procedures, the Submission has not established the effect of these parameters on Queensland’s road toll, nor the individual effects of 12 countermeasures.

It is important that correct evaluations be undertaken, as soon as possible, of the countermeasures, described in the Submission, to ascertain their effects, whether positive or negative, on crashes or injury as appropriate. The results, including proper cost benefit analysis, should then be used to shape the expenditures in future programs. A proper evaluation of the ‘School Safe’ countermeasure is particularly important since, according to the Submission, this intervention resulted in an increase in crashes.
In the letter to DoT\textsuperscript{35} that accompanied my Critique, I made the following brief comment about the method used in the DOT Submission:

The Submission gives a procedure/design that was going to be followed which would have been satisfactory but a different one was actually used. This different method was used without any mention of the change. This same method was used throughout. For the countermeasures, the number of crashes by crash severity was used as the measure of success irrespective of whether the particular countermeasure affected the degree of injury or if it affected crash number. Quite often the subject group was not the most appropriate one that could be used for the particular countermeasure. The method used relied on predicting future values based on past data. The models/equations used were all linear ones and frequently had no ‘fit’ to the past data and as a consequence had no predictive power. I have given some examples of models with better fits to the data.

In my opinion, there is nothing in the set of documents DoT sent to the Travelsafe Committee in September 1998 and referred to again in the letter of February 1999 that supports the methods as applied by the DoT in its submission of December 1995. A distinction should be made between a broad reference to a method and what was actually done in the DoT Submission. The documents contain statements regarding their method and the DoT method as follows -

Document 1 - “using different methods ..........”

Document 2- Brief 3 - “On balance, the GLIM analyses of the total crash numbers would appear to be the most reliable .....”

Document 3 - “a more complex and rigorous statistical analysis was developed for use in this evaluation”

The letter from DoT in February 1999 divided DoT methods into two categories that were termed ‘interstate models’ and ‘individual countermeasure evaluations’. The letter states that the first is no longer used in that form since the Submission. [But it might be used in some other form] Document 1 relates to the ‘interstate models’.

The second method, it states, is still used and considered appropriate given the advice from Uni Quest [Document 2] and MUARC [Document 3 and para 3, page 5]. I can only think that they have not read these documents closely nor understood the nuances in them. The actual methods differ and in any case if DoT are still applying their method incorrectly they have not taken any notice of the points in my Critique. These errors included: mixing crash reduction with injury severity; the inappropriate choice of yardsticks for each measure; and the use of control groups that were not really comparable with the subject groups.

\textsuperscript{35} DOT refers to the Queensland Department of Transport
The matters for clarification I have listed need to be pursued, particularly those for Uni Quest whose Brief 3 report deals with what they call the ‘regression of ratio’ model [Control Chart], although it, in any case, differs from what DoT used, and other models. The authors of that document, while no doubt skilled in the use of statistical models, seem unaware of the difference between crash reduction countermeasures and those that affect injury severity. This is probably a function of what interaction they had with DoT and the yardstick they were asked to consider. If the fundamental difference is not understood by the staff in DoT who are responsible for safety evaluations, there seems to be a strong case to have all evaluations done externally.

There is a comment in the February DoT letter about their evaluation approaches and that they tend towards simplicity rather than complexity so that they can communicate their message to the wider community. This is referred to as a balance between rigorous evaluation and effective communication [I wonder where the complexity of the MUARC work lies in their view?].

Evaluation and communication are not connected in the way that appears to be suggested. No matter how complex the analysis is, it is the job of the analyst to translate the findings into terms that can be understood and communicated. The letter sounds more like ground work comments to avoid undertaking proper analysis at the required levels of disaggregation.
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Reports are available from the Committee Secretariat:

**Address:** Parliament House, George Street, BRISBANE QLD 4000


**Email:** tsafe@parliament.qld.gov.au

**Telephone:** (07) 3406 7908

**Fax:** (07) 3406 7262