Fire Research Report

# PEER REVIEW
# Costs and Benefits of Regulating Fire Safety Performance of Upholstered Furniture in New Zealand

**BERL**

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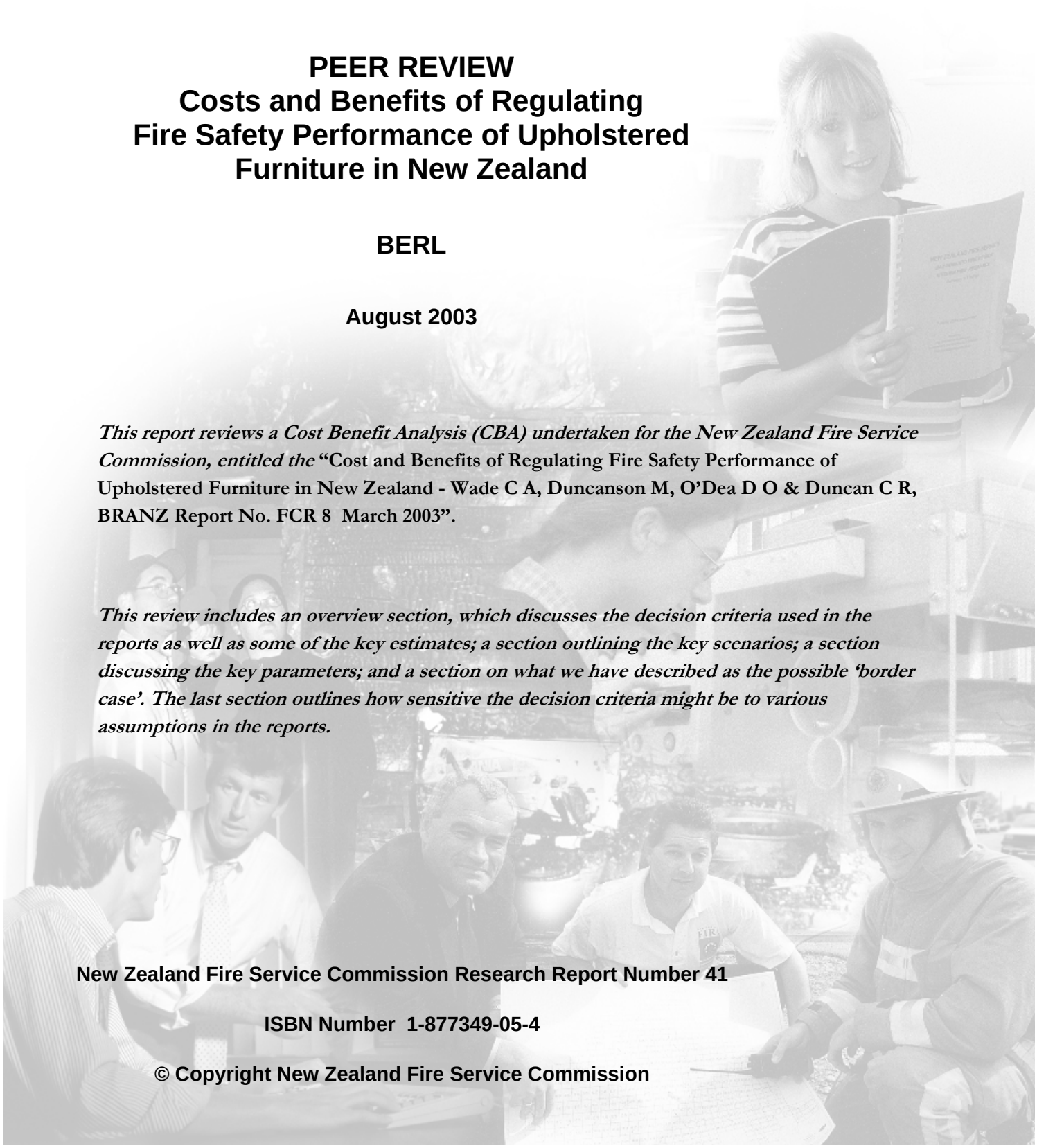

*This report reviews a Cost Benefit Analysis (CBA) undertaken for the New Zealand Fire Service Commission, entitled the* **"Cost and Benefits of Regulating Fire Safety Performance of Upholstered Furniture in New Zealand - Wade C A, Duncanson M, O'Dea D O & Duncan C R, BRANZ Report No. FCR 8 March 2003".**

***This review includes an overview section, which discusses the decision criteria used in the reports as well as some of the key estimates; a section outlining the key scenarios; a section discussing the key parameters; and a section on what we have described as the possible 'border case'. The last section outlines how sensitive the decision criteria might be to various assumptions in the reports.***

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# PEER REVIEW

## *COSTS AND BENEFITS OF REGULATING FIRE SAFTETY PERFROMANCE OF UPHOLSTERED FURNITURE IN NEW ZEALAND*

BERL #4248

Prepared by

**Mark Goodchild**
**Kel Sanderson**

August 2003

# PEER REVIEW

## *COSTS AND BENEFITS OF REGULATING FIRE SAFTEY PERFORMANCE OF UPHOLSTERED FURNITURE IN NEW ZEALAND*

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# 1 INTRODUCTION

This report reviews a Cost Benefit Analysis (CBA) undertaken for the New Zealand Fire Service Commission, entitled the *"Cost and Benefits of Regulating Fire Safety Performance of Upholstered Furniture in New Zealand"*[1]. This CBA draws on material from an earlier report entitled the *"Cost-Effective Fire Safety Measures for Residential Buildings in New Zealand"*[2].

Both of these reports follow a very similar methodology and decision criteria, which are discussed in this review. However, more emphasis is placed on the first report, as this is the primary document to be reviewed.

This review includes an overview section, which discusses the decision criteria used in the reports as well as some of the key estimates; a section outlining the key scenarios; a section discussing the key parameters; and a section on what we have described as the possible 'border case'. The last section outlines how sensitive the decision criteria might be to various assumptions in the reports.

[1] Wade C A, Duncanson M, O'Dea D O & Duncan C R. Costs and Benefits of Regulating Fire Safety Performance of Upholstered Furniture in New Zealand. BRANZ Report No. FCR 8. March 2003.

[2] Wade C A & Duncan C R. Cost-Effective Fire Safety Measures for residential Buildings in New Zealand. Study Report No. 93. 2000.

# 2 AN OVERVIEW

Cost Benefit Analysis (CBA) is a standard procedure used in the evaluation of proposals such as the ones discussed in the reports being reviewed. CBA is also a common form of evaluation for infrastructure investments such as in the area of roading.

The CBA procedure estimates the Net Present Value (ie discounted) of the future stream of monetised benefits and costs associated with the proposal. If monetary values cannot be assigned to all benefits and costs, then CBA may lead to a biased or distorted results, and thus another form of analysis may be more appropriate.

Under CBA, the evaluation of a proposal is typically undertaken by estimating the ratio of total benefits to total costs in NPV terms (ie the BC ratio). Thus, if total benefits are greater than total costs - the BC ratio is greater than 1:1 - and therefore, the proposal can conceptually be regarded as meeting the decision criteria.

However, in practice, a BC ratio of greater than 1:1 is often taken as the 'hurdle rate' for deciding to undertake the proposal. For example, roading projects in New Zealand have had a hurdle rate that requires a BC ratio of at least 3:1.

Note that applying discount rates to arrive at the Net Present Value of costs and benefits takes into account the opportunity costs of funds being allocated to the project across different periods of time. Thus, a decision criterion that requires a BC ratio in excess of 1:1 is reflecting a higher 'hurdle rate', possibly related to budget constraints.

The number of deaths and injuries 'averted' is often a critical benefit of many proposals in the area of public transport, health and safety. However, unless a monetary value can be attached to these deaths and injuries, a full CBA cannot be performed and therefore, other forms of analysis such as cost effectiveness are undertaken.

The monetary value that people are Willing To Pay to avoid the risk of death in certain circumstances can be measured using contingent valuation methods, which can then be summarised as the Value of Statistical Life (or VoSL). In short, this is an average value, which can be attached to the number of deaths averted because of the intervention thus, generating a monetary estimate of this benefit.

The New Zealand Land Transport Safety Authority (LTSA) has undertaken estimates of peoples Willingness To Pay to avoid the risk of road fatalities, and has arrived at several estimates of the VoSL. These estimates range from about $2.6 million through to about $4 million, based upon different Willingness To Pay valuation methods.

The VoSL enables the number of deaths and injuries averted because of the intervention in the transport sector to be monetised, and therefore CBA procedures and evaluations to be undertaken for these proposed interventions.

There is an on-going debate about the extent to which the VoSL derived from peoples Willingness To Pay estimates in the transport sector can be applied to other risks. In this respect, the literature indicates that people are Willing To Pay more to avoid the risk of multi-fatality or 'dread' incidents. The authors of the two reports reviewed have noted that decision makers may want to account for this factor, which presumably means that a VoSL in the order of greater than $2.6-$4 million might be appropriate.

In reviewing the reports, it appears that the authors have gathered or generated all of the necessary sets of information required to estimate total benefits and total costs in Net Present Value terms. That is, to perform a full CBA with different decision criterions or hurdle rates (ie BC ratio's of 1:1 or more). However, as they have discussed, there is a considerable amount of latitude in relation to the value of deaths averted.

Thus, the authors have chosen to complete an alternative form of analysis, described as 'Cost per Life Saved'. In this situation, the net costs of the project (excluding deaths but including injuries) are estimated and then divided by the number of deaths averted. The resulting Cost per Life Saved is then compared against a benchmark VoSL value. Thus, the decision criteria states, that if the Cost per Life Saved is equal to or lower than the VOSL, then the decision criteria is met. A Cost per Life Saved that is equal to a single point estimate of the VoSL (ie $2.6Mn) would be comparable to a BC ratio of 1:1.

As discussed, estimates of the VoSL in transport ranges from between $2.6 million and $4 million with the upper limit open to decision-makers interpretation regarding 'dread' incidents. Thus, a strict decision criterion would require the Cost per Life Saved to be $2.6Mn while a more flexible approach would be to require the Cost per Life Saved to be below about $4.0Mn.

Thus, the appropriate value of the VoSL represents one of the critical parameters in the overall assessment. The authors have correctly identified this as a critical parameter and have left this open to the decision-makers' interpretation.

# 3 THE KEY SCENARIOS

This section outlines the two key scenarios, as we understand them, and discusses how these scenarios are used to derive the benefits from the proposed interventions.

The report compares the proposed introduction of mandatory standards for upholstered furniture against the current situation, which entails voluntary standards for upholstered furniture and the voluntary installation of smoke alarms. That is, assuming no change in smoke alarm usage. The authors note that the current situation should include increasing smoke alarm usage, and reduced fire hazard from declines in the prevalence of smoking, however, to our knowledge these factors have not been explicitly incorporated into the assessment. Nonetheless, the current situation discussed above represents a relevant 'base case' against which to assess the benefits of introducing mandatory standards.

However, a second, alternative scenario is also developed comparing the introduction of mandatory standards for upholstered furniture and the mandatory installation of smoke alarms, against the current situation discussed above. Note that this alternative scenario increases smoke alarm usage to 100% in new and existing buildings.

In the alternative scenario, the affect of mandatory standards for upholstered furniture is second-order, with mandatory installation of smoke alarms being attributed with having the primary impact upon the incidence of fires and fatalities.

The implications of this alternative scenario are difficult to untangle, but the intention appears to be to highlight that mandatory smoke alarms would probably be introduced first. This is presumably based on cost effectiveness, although this does not appear to be assessed in the report, except in Table 86 on Page 86, which compares of the Cost per Lives Saved estimates for upholstered furniture standards as derived from the authors to previous estimates of mandatory installations of smoke alarms and sprinkler systems.

The impact of the two key scenarios discussed above are compared against the 'current situation' as summarised in Table 7.1 on Page 63 of the report. For example, with the introduction of mandatory standards for upholstered furniture and with voluntary smoke alarm usage, it is estimated that 7 deaths per annum will be averted when intervention is fully implemented.

This compares to 9 deaths averted when mandatory installation of smoke alarms are introduced but mandatory standards for upholstered furniture are not introduced. If both standards are introduced, it is estimated that the total number of deaths averted would increase to 13 per annum but that standards for upholstered furniture would account for only 4 of these. Thus, the potential gain from introducing mandatory standards for upholstered furniture is reduced (from 7 too 4 deaths per annum) because the mandatory installation of smoke alarms takes the first 'bite' in reducing the overall number of fires and fatalities.

# 4 KEY PARAMETERS

Rather than working through each piece of detail in the report, this review examines a number of the critical assumptions and estimates used to derive the net costs.

### 4.1.1 Costs to consumers

The authors' estimates of the total costs to consumers from increased furniture costs is poorly presented in the report, which makes an assessment of these calculations difficult to do. However, these estimated costs are clearly an important contributing factor to the overall results. Appendix C on page 98 of the report does indicate that the total annual cost for 1.2Mn households are estimated to be $48Mn per annum on a 15-year furniture purchasing cycle.

The discussion concerning the central estimate and boundary assumptions in relation to household costs are, however, made in terms of costs per household. Specifically, the authors generate a central estimate of $30 per household per year, with the lower and upper bounds set at $20 and $40 for sensitivity analysis.

Although one cannot realistically fault the authors for calculating and then 'passing on' the increased costs of mandatory upholstered furniture standards, the authors themselves note this is a matter of some possible debate. For example, on Page 98 of the Appendix the authors note that "economic theory would suggest, however, that some of any cost increase would be pushed back on to manufacturers and retailers, rather than all passed on to consumers". In short, depending on the market conditions that prevail, it is possible that $20 per household may not be a realistic lower bound.

Nonetheless, the Figure on Page 82 shows that the authors' lower bound estimate of $20 per household per year has a significant impact on the estimated Cost per Life Saved. For example, using the 5% discount rate, the Cost per Life Saved falls from $9.8Mn to what appears to be just over $6.0Mn. However, the authors note that the estimate remains above the $4Mn hurdle rate as implied the upper bound of the VoSL.

In aggregate terms, however, the additional cost of $20 per household per annum would presumably translate to about $32Mn per annum at maximum effectiveness, compared to $48Mn in the central estimate. Similarly, if only half of the authors' central estimate of costs were passed-on to the consumer (ie $15 per household per annum), the total cost per annum would presumably fall to about $24Mn per annum.

Overall, we presume that the cost per household per year has been applied only to those people purchasing furniture as in the furniture replacement model. However, it is not stated that this is the case. In general, this area of the report could be made more explicit to the reader through the use of tables outlining the total NPV of all costs and benefits considered in the research.

### 4.1.2 Proportion of fires and fatalities involving upholstered furniture

The authors have adopted two assumptions as their central estimates in relation to the incidence of fires and fatality rates involving upholstered furniture, and have stated that these assumptions are conservative or lower bound estimates. However, the authors note upfront that more detailed data is required to be able to develop less uncertain estimates of these relationships. And although we do not have the technical knowledge to assess these authors' assumptions in this respect, it is evident that less conservative estimates have a significant impact upon the results of the report.

The authors' central estimates are that 5% of residential fires and 34% of fire fatalities involve upholstered furniture and mattresses. These assumptions are changed so that 8% of residential fires and 47% of fatalities involve upholstered furniture and mattresses.

Relaxing these assumptions has a significant impact upon the benefits derived from the introduction of the mandatory standards for example, with the number of deaths averted per annum rising from 7 to 9 people. Similarly, the estimated Cost per Life Saved falls from $9.8Mn to $7.0Mn holding all other central estimates and assumptions constant.

### 4.1.3 Discounting

The authors have applied discount rates as is appropriate when costs and benefits of the intervention occur over time. They have also applied different discount rate levels to the data in recognition that there is no single 'standard' or agreed discount rate and to assess the sensitivity of the data to different assumptions.

Table 8.1 on Page 79 shows the impact of different discount rates upon the calculations. Taking the authors central estimate of a 6% rate of furniture replacement, it is evident that the Cost per Life Saved falls as the discount rate assumption is reduced or relaxed. For example, the net Cost per Life Saved declines from $12Mn with a discount rate of 10% to $8Mn with a discount rate of zero. This is consistent with a larger proportion of total households being protected by mandatory standards over the course of time and thus, a larger number of fires, injuries, etc being averted, and the benefits being mainly accrued in the future.

The choice of an appropriate discount rate is a matter of debate in New Zealand as well as overseas. However, in the context of health research, the concept of the social rate of time preference is often used with this concept indicating that discount rates of 3% and 5% are appropriate rates for sensitivity analysis[3].

[3] Wright J. Draft paper entitled "Discounting in Cost-Utility Analysis: why is it done and what rate should the Health Funding Authority Use?" unpublished, 1998.

The authors of the report under review have used a discount rate of 5% as their central estimate and have included a discount rate of 3% in the sensitivity analysis summarised in Table 8.1. The difference due to applying these two discount rates is relatively small, representing a reduction in the calculated Cost per Life Saved of about 0.8Mn, or from $9.8Mn too about $9.0Mn.

# 5 A BORDER CASE

The authors have conducted sensitivity tests as is appropriate when the parameters for the model are uncertain and subject to wide variations. However, each sensitivity test is considered in relative isolation.

In this section, we consider a possible 'border case', where a number of the parameters are considered in combination. The purpose is not to revisit the reports conclusions, but to assess how sensitive these conclusions are. Given that we do not have access to all of the information or to the modelling process used, this section will discuss the results and sensitivities in general.

On the cost side of the model, the increased cost to households of furniture replacement is clearly the major factor. The appendix indicates that these costs are expected to rise to about $48Mn per annum based on the central estimate of $30 per household per annum. The sensitivity tests conducted by the authors indicate that lowering this estimate to $20 per household per annum has a significant impact. For example, the calculated Cost per Life Saved is reduced from $9.8Mn to just over $6.0Mn.

And in aggregate terms, the total annual cost to households would presumably fall from $48Mn to about $32Mn.

On the benefits side, assumptions regarding the involvement of upholstered furniture in residential fires and fatalities are clearly the key drivers. Changing the central estimates for these parameters has a significant impact on the benefits, for example, with the number of deaths averted increasing from 7 to 9 people per annum. It is evident that the alternative assumptions have a significant impact on the reports calculated Cost per Life Saved, which changes from $9.8Mn to $7.0Mn holding other assumptions constant.

A combination of different assumptions regarding the cost of furniture replacement and fire and fatality rates would presumably have a significant impact on the calculated Cost per Life Saved. This could include bringing the Cost per Life Saved down to within the $2.6-$4Mn range required, as discussed in the report.

From a broader perspective, and as the authors have emphasised, it is also apparent that mandatory installation of smoke alarms would continue to have significant advantages over mandatory standards for upholstered furniture.

# 6 CONCLUSIONS

From the authors conclusions and the border case discussed above, it is evident that the case for introducing mandatory upholstered furniture standards is - at best - on the cusp in terms of benefits versus costs. On the other hand, the mandatory smoke alarms option appears to have a significant advantage in terms of yielding a much lower Cost per Life Saved. Thus, the smoke alarm option appears favourable as a proposal in its own right, and compared against the upholstered furniture standards option.

Another way of looking at this is that, if both options were introduced, the benefits from the introduction of upholstered furniture standards would come at a high marginal cost. For example, the authors have estimated that the two proposals together would save an additional 4 lives per annum (ie 13 lives saved compared to 9 lives saved in the smoke alarm only option) but that this benefit would come at a high additional cost, especially to households.

The cost to households of furniture replacement is a significant factor in the analysis of upholstered furniture standards. However, there is also a degree of uncertainty as to the magnitude of these costs, including the possibility that very little of the production costs would be passed on to consumers. By comparison, there appears to be less uncertainty with respect to the costs to households from the mandatory installation of smoke alarms option. Indeed, when the cost of householders' time was removed from the model in the sensitivity analysis, it is evident that the Cost per Live Saved was reduced by a dramatic amount.

There is also a degree of uncertainty relating to the physical benefits (reduced fire rates, etc) of introducing the options. In this respect, we do not have much to add other than to note that both reports have undertaken what appear to be reasonable sensitivity tests given the information available. We would also support the authors' recommendation that it would be beneficial to have more detailed data available in routinely collected datasets such as the FIRS database, but at the same time recognise the costs associated with expanding datasets to account for all possible interests.

From a reader's perspective, the main problem with the two reports is the apparent lack of summary information, which would enable the reader to identify the separate costs and benefits assessed, as well as the magnitude of these costs and benefits in relation to the decision criteria. At the present time, the reader must rely on the sensitivity analyses to gain a feel for these magnitudes.

This problem is compounded by the form of evaluation procedure, which shows a single figure (Cost per Life Saved) without offering a 'feel' for the costs and benefits involved. However, this is also a problem with respect to Benefit-Cost ratios. We believe that it would be extremely useful from a readers and decision-makers perspective if reports of this nature include a single table, which itemises the Net Present Value of the costs and benefits assessed.

The value of injuries, fatalities, and property losses that can be averted due to a certain intervention are clearly important considerations in many of the reports completed for the NZFSC.

In this respect, the Value of Statistical Life (VoSL) concept plays a central role in terms of either valuing fatalities for Cost-Benefit Assessments, or in the decision criteria as in the Cost per Life Saved criteria. Unfortunately, we cannot provide a definitive answer with respect to the use of the LTSA's VoSL but note that the authors of the two reports have used this measure appropriately, and have also recognised the measure as a critical factor in their assessments.

However, the VoSL appears almost by default to be becoming a standard tool in reports of this nature including those undertaken for the NZFSC. An interesting feature of this approach is that the VoSL is also used to place a value on serious and minor injuries, not just fatalities. This is achieved by a scale factor, for example, which broadly states that a 'serious' injury is valued at about 10% of the VoSL for a 'fatal' injury. This scale is regardless of the nature of the injury or the medical, rehabilitation and support costs.

Given that the value of injuries, fatalities and property losses are all critical components of reports for the NZFSC, we would suggest that it maybe appropriate for the NZFSC to establish some protocols in this respect. This would certainly assist in comparing reports on different proposed interventions, and may also allow researchers to focus their time and resources more on estimating the 'physical benefits' of these interventions.

In addition to the injury information contained within the FIRS database, it may also be appropriate to establish a set of information with respect to valuing these factors. As one example, it may be possible to establish an accepted benchmark value for injuries by the various severities recorded in the FIRS database. Similarly, a commonly accepted figure for property damage across different property groups in the FIRS could be established to guide researchers in their assessments.

BERL has recently been involved in a Whole of Government review relating to 'injury cost' information that is available in different Ministry administrative databases, such as the NZHIS and ACC. Although a full 'cost of injury' database will not be available for some time, if at all, we have learnt that there is an increasing amount of cooperation between government agencies in terms of linking injuries by different causes to costs of medical care and rehabilitation. This sort of inter-departmental cooperation could be of assistance in establishing baseline information on the value of costs associated with fire-related injuries and severity.