The Use of Accident Costs in Benefit-Cost

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Abstract:

This paper examines a number of papers produced in Australia to ascertain the degree of knowledge exemplified of both benefit-cost procedures and the use of road accident costs

Benefit-cost analysis is a procedure that one would hope to see used more frequently to justify the expenditure of public monies in all transport projects. If benefit-cost analyses are to be carried out on projects that affect road safety the analyses must be sensitive to the variables that will significantly change the accident costs. The papers examined appear to show a lack of awareness by the writers of what is entailed. Authors seldom state all of the variables in their analysis i.e. capital cost, annual costs, project 'life', discount rate and annual benefits. There were examples of inappropriate assumptions, procedures or tests that could materially affect the results and conclusions of individual reports.

Few of the papers used accident costs that were relevant to the particular analyses.

The 'State-of-the-art' displayed by the practitioners in Australia leads to the need for an improvement in knowledge of the application of both benefit-cost analysis and the use of accident costs.

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1. INTRODUCTION

The cost of road accidents reported to the Police throughout Australia exceeded 7.6 billion dollars in 1991. Currently there is a low in accident numbers and the cost to the community in earlier years, in 1991 dollars, was considerably greater. The cost of accidents not reported to the police and the items related to accidents that have not been quantified, lift the costs to the community even higher.

In times of economic recession it is important that expenditure on accident countermeasures be directed to give the greatest savings. Thence the process of evaluating countermeasures must be based on a sound understanding of what particular countermeasures are going to affect which of the myriad of different accident events. There is no universal panacea that affects all the different accident events to the same extent in the same way that there is no single medicine that cures all diseases.

2. COST BENEFIT ANALYSIS

Cost benefit analysis is a process to aid the decision making about whether a project should be done or to retrospectively assess the value of a project. Basically the initial costs and the costs of continuing operation throughout the 'life' of the project/treatment are compared with the estimates of the benefits (and losses) due to the operation of the project over the same life span. It is not necessary that there is a benefit or a cost in each and every year during the life of the project.

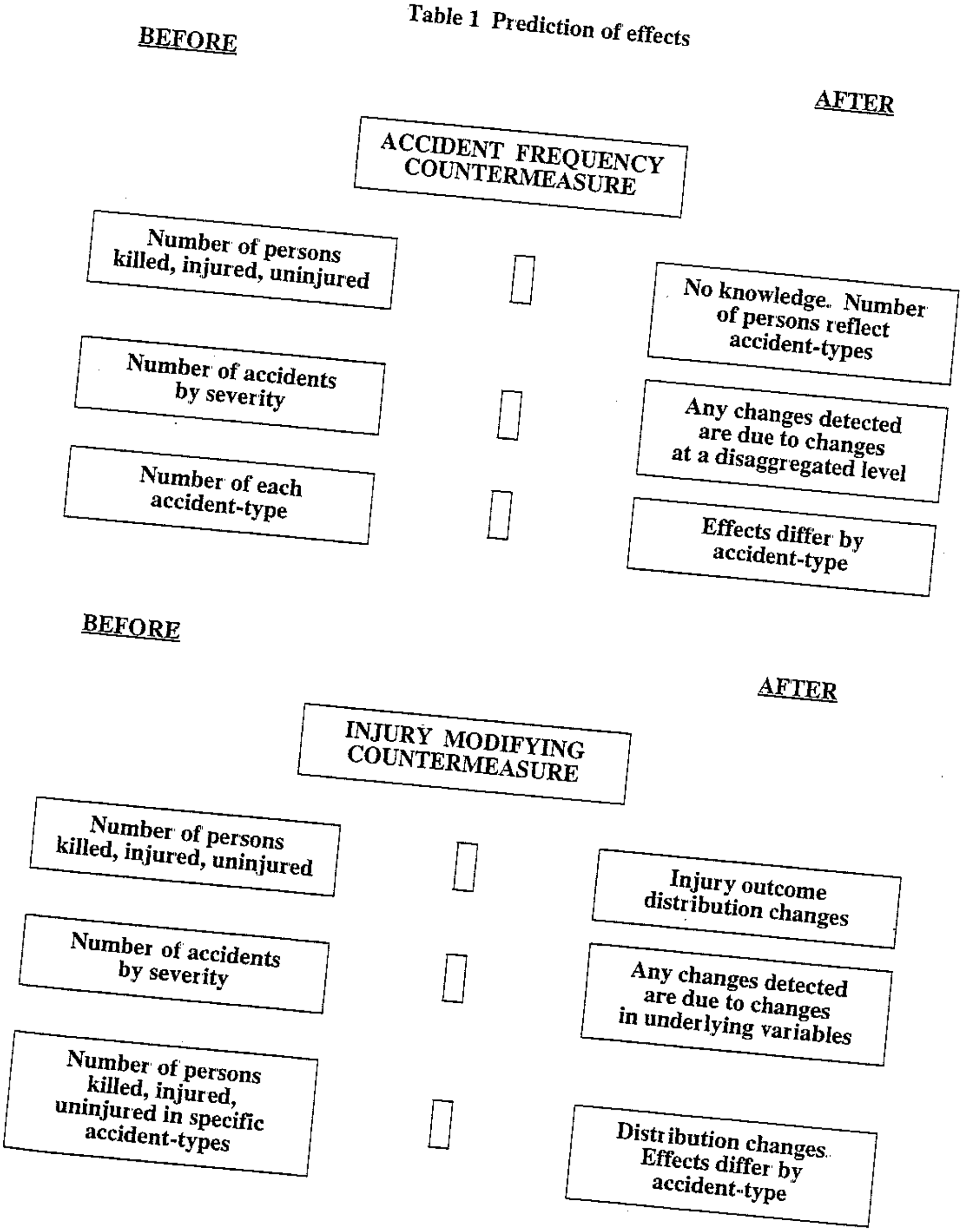
The technique recommended in the Handbook of cost-benefit analysis (Dept Finance, 1991) is the discounted-cash-flow technique also known as the present worth/value method. All cash flows are converted to a common base known as 'present value' and the net present value (P.V. benefit - P.V. costs) of projects can be compared as well as the ratio of P.V. benefits to P.V. costs. The analysis requires a discount rate and a project life. When the analysis is reported these two items should be clearly stated for without them a reader does not know what the author has done. The variation of either or both of these items will affect the result.

Further, the analysis should relate to those variables that change significantly after the project is implemented. This aspect is frequently ignored!

Application to traffic accidents

Projects/treatments vary in their effect on specific accident-types (Andreassen 1986a). That is, all accident-types are not reduced by the same amount and some may increase. Accident-types vary in their average cost per accident [e.g. a head-on accident has more person-casualties and vehicle damage than a parking manoeuvre accident].

Table 1 Prediction of effects



Treatments applied to road accidents affect either the frequency of the accidents OR they affect the distribution of injury severity within accidents.

If the worth of installing a treatment is being considered a prediction (albeit an estimate) of the effects is necessary. In Table 1, some possible measurement parameters are listed in the left hand column. In the right hand column are comments about the effects.

The approach suggested by NAASRA (1989) was that of 'accident-severity'. That is, the number each of fatal accidents, injury accidents and damage accidents before and after the treatment. The costs relating to accident severity are those for an 'average' fatal accident, an 'average' injury accident, etc. The effects, however, tend to be given in terms of the overall reduction in accidents (Andreassen 1986a) and not reduction by accident severity.

The counting of the number of persons involved and the injury levels sustained has not been advocated in the literature for accident frequency reduction treatments and the use of it recently (Sliogeris 1992) to examine the benefits of providing an arterial link road in Melbourne was unusual to say the least

A little diversion into accident severity might be appropriate for the reader. Accidents are rare events, statistically speaking. Fatal accidents are particularly rare events. At any given location the number of fatal accidents (and the number of persons killed) in a given year will be poorly correlated with the number of fatal accidents at the same location in any subsequent year The number of fatal accidents recorded at a particular location over a short period will seriously over-or under-estimate the underlying mean number of fatal accidents that might be expected annually at that location. The same comment could be applied to 'serious injury' accidents

Any error in estimating the mean frequency of fatal accidents is accentuated by the high costs associated with one. This is even more so if a willingness-to-pay figure is adopted for a death and not for other injury levels. This has been the case in the UK and New Zealand.

Of course lengthening the time period to improve the accuracy of the estimate introduces other problems relating to changes in traffic and the environment which could influence the number of accidents occurring.

Disaggregating the number of accidents occurring into accident-types overcomes two problems. The first is that the average casualty class distribution for each accident-type group is statistically stable overtime (Andreassen 1986b) and thus only the frequencies of particular accident-types are of concern. The second is that the effects can be given in terms of the changes in particular accident-types not just the change in the total number of accidents.

Thus for cost-benefit analysis, the costs associated with the statistically significant changes in the frequency of specific accident-types or the change in the distribution of casualty classes within accident-types (depending on the type of treatment employed) has to be weighed against the costs of the treatment.

Table 2 Costs and CBA

Reference	Accident Type	Costs relevant relevant to analysis	Discount rate quoted	Project life quoted	Capital costs	Maintenance costs
1 Thompson (1970)	•	•	√	√	√	√
2 Fisher (1977)	•	•	•	•	•	√
3 Hailey et al (1981)	Not in analysis	•	•	√	•	•
4 Scott (1982)	•	•	√	√	√	√
5 O'Brien and Richardson (1985)	•	•	◆◆	◆◆	√	•
6 Camkin & Webster (1988)	•	•	•	•	•	•
7 Smith et al (1988)	√	•	•	•	•	√
8 Portans (1988)	•	•	•	•	•	√
9 NAASRA (1988)	•	•	•	•		annualised cost
10 Corben (1989)	•	•	√	√	√	√
11 NAASRA (1989)	•	•	√	√	√	√
12 Trayford (1989)	not in analysis	•	•	√	√	√
13 Youngman & de Forest (1989)	•	•	•	•	•	√
14 Corben et al (1990)	•	•	√	√	√	√
15 Croft (1990)	√	√	√	√	√	√
16 Kumar (1990)	•	•	•	3 yr?	√	•
17 Torpey et al (1991)	•	•	•	√	•	•
18 Carter & Wadhwa (1991)	•	•	•	•	√	√
19 Ogden (1992)	not in analysis	•	√	√	√	•
20 Griffith (1992)	√	•	•	•	partly	•
21 South (1992)	√	urban cost only	•	•	√	•

Legend

√ = used
• = not addressed
◆◆ = used 1st year rate of return
not in analysis = author discussed accident-types but did not use the change of same in the CBA

3. THE SURVEY

Some 21 reports were surveyed ranging over time from 1970 to 1992. The results are summarised in Table 2 The Table analyses the reports with regard to six aspects viz, the recognition of accident-types; the use of the 'per accident' or 'per person' costs as appropriate and whether the correct version; the clear quoting of a discount rate; a project life; capital costs; and operating/maintenance costs

A few authors addressed the changes in accident-types but did not use them in their CBA About two thirds did NOT quote a discount rate while about half did NOT quote a project life One author got it all correct (this must be nearly significant, i.e. about 1 in 20!)

All in all the impression is that there is a lack of knowledge of what is involved in performing a cost benefit assessment let alone the use of accident cost data relevant to the intended analysis.

4. THE BLACKSPOT PROGRAM

Of course the published papers may not represent the expertise lurking within Government Departments. The Blackspot Program (FORS 1990) called for the treatment of sites noted for a high incidence of crashes involving death and serious injury and having a BCR of at least 2. FORS did not specify what method should be used to calculate the BCR but recent inquiries made to the State Authorities involved indicated that they all should be using the present value method.

The individual States were permitted to use their own choice of technique for identifying blackspots Solutions/treatments were to be selected from a list in a Schedule which would be accepted without further justification Treatments that were not on the Schedule required separate justification

The application form to be used for each site was to state the crash history for the past three years (where crash was defined as involving a death or serious injury at the site). Applications were also to estimate the 'death/injury/crash reduction' per year and the 'estimated community savings' per year. No costs were given in the FORS document for the States to use Nor was any discount rate specified Recent enquiries to the States have resulted in an interesting variety of costs that were used

Some used the costs for fatal, injury, and damage accidents given by NAASRA (1989). Some were based on the costs in Steadman and Bryan (1988). The Steadman and Bryan unit costs were costs per person but the users took them as costs per accident. One State quoted an urban and a rural average casualty accident cost, the derivation of which was not given. One used averages intended for models such as NIMPAC. One used the NAASRA costs by accident severity and produced weighted costs by accident category. The underlying costs that were used, as best can be ascertained, are summarised in Table 3.

Two States, Qld and NSW, have moved to the use of costs by accident-type from the ARRB study (Andreassen 1991, Andreassen 1992).

(a)

Table 3 Underlying costs (x $1,000)

Accident Severity	Qld	ACT	WA	NT	NSW (4)	Tas
Fatal	560	616	561	555	720	650
Injury	22	24 2	17.9	40	27.5	= (1)
Damages	2.5	2 75	3.4	1 15	9 4, 18.4	9

(b)

	Vic	SA
Average urban casualty accidents	57	82 (2)
Average rural casualty accidents	90	93 (2)
damage accidents	-	2.5 (3)

Notes

1 - Values were given for three levels of injury
2 - These values in (NAASRA 1989) are the 'weighted cost per predicted accident' and are intended for use in models such as NIMPAC
3 - This is the NAASRA cost per damage accident.
4 - NSW produced average accident costs of urban $20,500, rural $38,000

Given the variety of costs, particularly for the injury and damage accidents, the evaluation of a single project would not get the same answer from all States.

The use of these costs by accident severity for project selection and ranking, is fraught with the difficulty discussed earlier about the occurrence of fatal and serious injury accidents

Accident costs for particular locations based only on the count by accident severity and the reduction in costs. It is the costs associated with the net changes in accident-types that gives the potential for reduction.

5. CONCLUSIONS

The costs to the community from road accidents are high and the selection of treatments to reduce the accident problem should be based on the greatest savings to the community for the dollars invested in the treatments. Cost benefit analysis is an appropriate technique to assist decision making in the identification and selection of treatment.

A survey of published papers by local authors indicates a lack of knowledge of how to use CBA. There is little evidence that authors selected variables that changed significantly with the implementation of treatments.

The choice of accident severity leads to over and under estimation of the potential for accident cost reduction of particular treatments. Costs for the net changes in accident-type costs should be used.

The accident costs used by each State should be based on the same underlying costing system.

To compare projects from different States by BCR and/or Present Worth a common discount rate must be used. Project life varies according to the type of treatment but the same period must be used for any comparison.

Only accident-types that change significantly for a particular treatment should be used in the CBA.

The current ill-targetted procedures for the identification and ranking of locations for treatments need to be replaced by one that is more optimal.

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