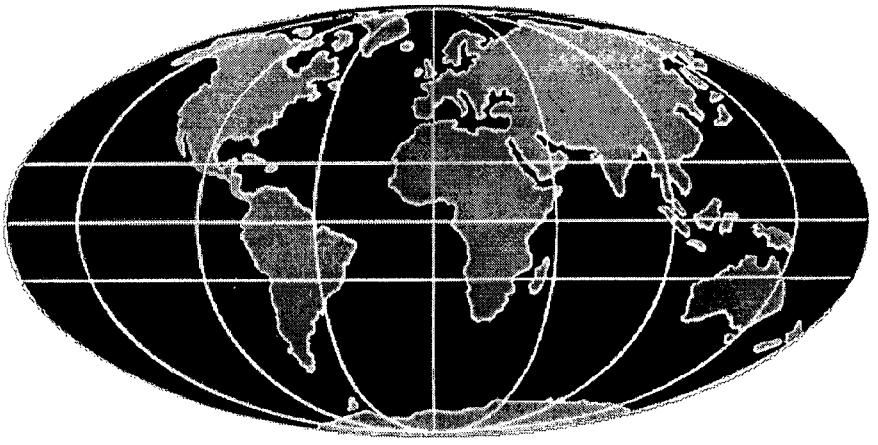
TRANSPORT RESEARCH LABORATORY

TITLE: Accident Costs in Indonesia: A Review

by: A Downing



Overseas Centre
Transport Research Laboratory
Crowthorne
Berkshire RG45 6AU
United Kingdom

PA3303/97

PA33303/97 DOWNING, A (1997).**Accident Costs in Indonesia: A Review.** *ICORS'97, India, 24 - 27 July 1997.*

Republic of Indonesia
Ministry of Public Works
Agency for Research and Development
Institute of Road Engineering

Road Research Development Project

Published Paper PA 4

ACCIDENT COSTS IN INDONESIA: A REVIEW

by

Andrew Downing

Paper presented at the International Conference on Road Safety,
24-27 July 1997, Andhra University, Visakhapatnam, India.

Transport Research Laboratory,
United Kingdom.

in association with

PT Yodya Karya,
Indonesia.

ACCIDENT COSTS IN INDONESIA: A REVIEW

List of Contents

ACCIDENT COSTS IN INDONESIA: A REVIEW

by
Mr A J Downing
Transport Research Laboratory, United Kingdom

ABSTRACT
Indonesia has a serious road accident problem with over 10,000 deaths reported annually. These accidents not only cause considerable pain and suffering but they also lead to direct economic costs and a large waste of the countries scarce resources. The Government and the public are showing increasing concern and Indonesia has taken a series of actions to reduce the number and severity of road accidents. However, in order to plan the management of the countries resources effectively in road safety and ensure that road safety attracts a reasonable share of funding, it is essential that Indonesia develops an acceptable approach to costing road accidents. International costing methods have been adapted for Indonesia and this paper reviews these approaches and makes some estimates for National Costs.

1. INTRODUCTION

The objective of this paper is to:

1) provide a concise review of accident costing methods developed in Indonesia including any key background information
2) show how these can be used to estimate the national cost of road accidents
3) highlight any problems and possible solutions with accident costing in Indonesia.

The key documents used in this review are as follows:

1). Transport Research Laboratory (TRL), 1993. Accident Cost Study.
2). Jacobs, G D, 1993. The Inclusion of Benefits from Reduced Accident Rates in Highway Cost Benefit Analysis. In: Proceedings of Conference on Asian Road Safety, 1993, Kuala Lumpur.
3). Swe Road, 1995. Highway Capacity Manual: Traffic Safety and Environmental Impacts.
4). Swe Road, 1995. Highway Capacity Manual: Accident Costs.
5). Transport Research Laboratory, 1995. Costing Road Accidents in Developing Countries. Overseas Road Note 10.
6). Dorsch Consult, 1996. Economic Evaluation and Determination of Priorities for Road Traffic Safety Enhancement Policies and Projects.

This paper highlights the need for accident costing and then summaries the two most appropriate methodologies with reference to developments in Indonesia. It goes on to estimate the national cost of road accidents and indicates the problems and possible solutions for future costing exercises.

2. THE NEED FOR ACCIDENT COSTING

All countries with well developed road transport systems experience the serious, negative side effect of road accidents. However, most developed countries have managed to bring about large accident and casualty reductions in recent years. For example, in the United Kingdom (UK) deaths were 35 per cent lower in 1995 than the yearly average for 1981 to 1985 in spite of an increase in traffic of 46 per cent. Developing countries with fewer resources and greater growth rates for traffic and population have not been able to achieve the same improvements. Thus in Indonesia road deaths have remained fairly constant between 10,000 and 11,000 deaths per year.

Two of the main reasons for the slow take up of road safety initiatives are:

1). The government's and the public's lack of awareness of the magnitude of the problem.
2). A lack of knowledge about the likely cost effectiveness of various measures.

Clearly costing road accidents can help the government and the public appreciate the real scale of the

problem and enable decision makers to prioritise the allocation of resources more effectively. Thus the major benefits of costing road accidents are as follows.

1). Accident rates only show part of the problem ie the tip of the iceberg of the real damage, pain and suffering caused. Costing approaches, in effect, allow for all the negative consequences to be valued and comparisons made with other national problems.

2). Putting a value on road accidents and casualties enables benefits of accident or casualty savings to be estimated. This ensures that road safety is ranked equitably in terms of investment in its improvement at the national resource planning level. For example, it can be demonstrated that national road safety plans can achieve accident savings of 5 per cent with Benefit:Cost ratios of 10:1. The possible economic benefits are therefore considerable and economic arguments can be used to make a powerful case for road safety improvements.

3). Including values for the safety effects of road improvement schemes in their economic appraisal ensures safety is considered in the decision making process and safer designs are chosen. Without accident cost information, schemes will be biased towards increased speed and capacity for motor vehicles and vulnerable road users will be disregarded.

4). Cost benefit analysis of alternative road safety improvement schemes enables the expenditure on road safety to be optimised, ie with limited resources the selection of improvements is optimised.

3. ROAD ACCIDENT COSTING METHODS

Six alternative methods are detailed in the Overseas Road Note 10 by TRL (1995) but only two of these are recommended if the national objective is to maximise national output or pursue social welfare objectives eg minimise casualty rates. These two methods (extracts quoted from Road Note 10) are:

1). **The "gross output" (or human capital) approach.** In this method, the cost of a traffic accident involving a fatality can be divided into two main categories. Firstly there are the costs that are due to a loss or diversion of current resources and secondly there are the costs that are due to a loss of future output. Included in the former will be the cost of vehicle damage, medical treatment and police/administration costs and usually there is little disagreement as to what should be included here. Determining loss of future output of the person(s) killed however is less clear cut. Usually average wage rates are used (gross of tax) to determine lost output both for the year in which death occurred and then for future years. Costs in future years that the casualty might have lived have to be discounted back to give present day values. This is not done separately for every individual killed (or injured) in a road accident: estimates are based on average (ie national) output or earnings data together with appropriately estimate damage, medical and police costs. In some variants of this approach, a significant sum is added to reflect the "pain, grief and suffering" of the accident victim and to those who care for him or her.

2). **The "value of risk change" or "willingness to pay" approach.** This approach is based on the fundamental premise that decisions made in the public sector concerning the allocation of scarce resources should reflect the preferences and wishes of those individual citizens who will be affected by the decisions (Jones-Lee 1976, 1989). Accordingly, the value of a given improvement in road safety (ie a reduction in risk) is defined in terms of the aggregate amount that people are prepared to pay for it. Conversely the cost of a reduction in safety is defined in terms of the amount people would require in compensation for the increased risk. More specifically, the value of a particular safety improvement is defined as the sum of all the amounts that people (affected by the improvement) would be willing to pay for the (usually very small) reductions in risk provided by the safety improvement. Thus the value of prevention of one accident involving one fatality is defined as the total amount that all affected individuals would pay for the very small risk-reduction, both for themselves and for those they care about.

Estimation of willingness-to-pay costs and values is far from straight forward. Various methods have been used and include an approach where estimates are obtained by observing situations

where people actually do trade off wealth or income for physical risk. Another approach uses a complex questionnaire where samples of individuals are asked more or less directly how much money they would be willing to forfeit in order to obtain a small reduction in their own or other people's risk. For example, a detailed questionnaire might indicate that drivers were prepared to pay, on average UKL 5 for a risk reduction of one chance in 500,000 that they would be killed on a particularly journey. Then the 'value of an average life' in this instance would be UKL 5 x 500,000 ie UKL 2.5 million".

The first approach, Gross Output, is well suited to the objective of maximising the wealth of the country but is not so appropriate for cost benefit analysis.

The second method, Willingness to pay, meets social welfare objectives and is ideal for cost benefit analysis. This method is used in a number of developed countries including the UK, USA, New Zealand and Sweden. However this method is difficult to use and the reliability of the estimates has been questioned. The method involves asking road users to estimate how much they would pay for safety devices which reduce their risk of injury in road accidents. In the UK the study excluded children and non-motorists and assumed they valued safety at the same amounts. These assumptions have been criticised and they are perhaps even less applicable to developing countries where larger proportions of the casualties are children and non-motorists.

Because of these difficulties with the "willingness to pay" approach, the Gross Output method was recommended by TRL for use in developing countries (see Road Note 10). It was also recommended that the method was augmented by the addition of an allowance for pain, grief and suffering in order to 'capture some of the human considerations of the "willingness to pay" approach.

In the UK, this Gross Output method with an addition for pain, grief and suffering was used until 1988 when "willingness to pay" was introduced for fatal accidents and this increased the cost of these accidents by about 260 per cent. Later, in 1993 the method was unified across all injury accidents. It is now generally recognised that the "willingness to pay" based costs will substantially exceed their "gross output" counterparts but that the latter could at least be treated as the lowest reasonable estimate of accident costs.

4. ACCIDENT COSTING IN INDONESIA

The first systematic survey of road accident costs in Indonesia was carried out jointly by TRL, the Institute of Road Engineering (IRE) and the Institute of Technology Bandung (ITB) in 1992 and 1993 as part of the Technical Assistance and Research Training Project, Second Phase (TARP II). These accident costs were reviewed under the Highway Capacity Manual (HCM) project in 1995 and examined again in the Traffic Safety and Vehicle Weights and Dimensions Project (TSVW&DP) in 1996. This section of the paper compares the methodologies proposed in the relevant reports issued by these Projects ie

1). Accident Cost Study. TRL/IRE (1993). TARP II.
2). Highway Capacity Manual. SweRoad/Bina Marga (1995). HCM.
3). Economic Evaluation and Determination of Priorities for Road Traffic Safety Enhancement Policies and Projects. Dorsch Consult/DGLC (1996). TSVW&DP.

4.1 Overall Approach

All 3 studies recommend the Gross Output method for Indonesia at this time. A comparison of the key features of each study is shown in Table 4.1 below. The TARP II and HCM studies give estimated cost figures based largely on the original TARP II estimates made for Bandung and both give multipliers for converting the Gross Output values to Gross Output plus Pain, Grief and Suffering and to Willingness to Pay (see 4.3). The TSVW&DP report focuses on describing a software programme which can provide cost estimates based on Gross Output with a facility for including multipliers to add elements for Pain, Grief and Suffering.

The TARP II study provides estimates for average costs per accident by severity for Bandung and Indonesia (1991 prices) using the Gross Output method, the HCM study report gives average costs per severity of casualty (not accidents) for all three costing approaches. The TSVW&DP report gives some examples of accident costs using its software but warns that these should not be used as estimates of actual costs.

Table 4.1 Overall Costing Approach in the three Indonesian studies

TARP II (1993)	HCM (1995)	TSVW&DP (1996)
1. Describes three approaches as follows. 1). Gross Output 2). Gross Output plus an amount for "pain, grief and suffering" using UK multipliers. 3). Estimated "willingness to pay" based on scaled up Gross Output figures using UK multiplier. 2. Identifies "willingness to pay" as ideal approach for cost benefit analysis but not feasible yet for Indonesia. 3. Accident cost figures provided for Bandung and Indonesia using method 1).	1. Describes three approaches as follows. 1). Gross Output 2). Gross Output plus an amount for "pain, grief and suffering" using UK multipliers. 3). Estimated "willingness to pay" based on scaled up Gross Output figures using Swedish multiplier. 2. Recommends "Gross Output" if objective is to maximise GDP. The other two approaches are recommended if the objective is to maximise economic welfare. 3. Casualty cost figures provided for Indonesia using all 3 methods.	1. Offers software using 1). Gross Output 2). Gross Output plus an amount for "pain, grief and suffering". Any multipliers can be used. 2. Recommends "Gross Output" approach based on GDP but advises preferred criterion for evaluating investments in road improvements is Net Domestic Product ie resources consumed by each saved fatality should be taken into account. 3. Hypothetical case studies only.

4.2 The Gross Output Method

There are four key elements of cost in the Gross Output method as follows.

1). Value of lost production
2). Medical costs
3). Damage/repair costs
4). Administration, police and legal costs

Although the actual cost calculation approaches to each of these elements were based on TRL's Road Note 10 (1995) there were some differences between the three studies. A comparison of the methods used is shown in Table 4.2. The HCM study used the same estimates as made in TARP II except that a correction was made for the value of lost production for fatalities to allow for the non-productive years of children. This had the effect of reducing the value of lost production for a fatality from Rp. 33 million to Rp. 26 million ie by just over 20 per cent.

The TSVW&DP software allowed for more flexibility in the calculation and for more details to be entered. The main differences are shown in Table 4.2. Some of the key changes are:

1). Any average retirement age can be entered.
2). Medical costs are split into daily costs and per patient costs.
3). Repair costs are estimated per vehicle type with a facility for including costs of the vehicle being off the road for repair.
4). Police and administration costs are based on police time costs rather than a percentage of the other resource costs.

Table 4.2 A comparison of Costing Elements in the Gross Output Method in the 3 Indonesian studies

TARP II (1993)	HCM (1995)	TSVW&DP (1996)
a). Value of lost production 1). Gross Domestic Product excluding the mining sector per capita of the working population (15 to 55 year old). 2). For Fatalities average years lost = average retirement age (55) - average age of fatality (27). 3). For Present Values of fatalities saved an income growth rate of 4.6 per cent was used and a discount rate of 10 per cent. 4). For non-fatal accidents, days lost were based on hospital days only ie Serious injury = 31 days Slight injury = 2 days	1). Same as TARP II. 2). Average years lost weighted to exclude non productive years of victims under working age ie overall value reduced. 3). Same as TARP II 4). Same as TARP II	Software allows for the following to be entered. 1). Gross Domestic Produced excluding the mining sector per capita (all population*)s by Province. 2). Same as TARP II. Any average retirement age can be entered. 3). Any values can be input for growth and discount. 4). Off work days are entered separately from hospital days ie usually more. * can change population to working age group.
b). Medical costs 1). Average daily hospital rate (from large hospital)*. 2). Average outpatient rate. 3). Element added for ambulance & administration. 4). Assumed 50% of slight casualties go to hospital for outpatient treatment. 5). No. of days in hospital estimated from survey Fatal = 4 days Serious = 31 days in hospital + 4 visits as out patient. * Likely to underestimate real costs as state subsidises running cost of hospital.	Same as TARP II.	Software allows for the following to be entered. 1). Daily medical costs - Accommodation & administration - Drugs 2). Per patient costs - Tests/surgery - Ambulance - Outpatient visits NB. As with TARP II estimates, it may be difficult to get true costs.
c). Damage/repair costs 1). Average insurance policy payment obtained from PT Asuransi Jasa Indonesia. 2). Used the following ratios from the UK to calculate repair costs per severity of accident i) Fatal accident = 1.8 ii) Severe accident = 1.4 iii) Slight accident = 1.0 iv) Damage only acc. = 0.54 v) Average injury acc. = 1.11 3). The insurance payment in 1) was equated with v) the average injury accident.	1). Same as TARP II. 2). Same as TARP II. 3). Same as TARP II.	The software allows for the following to be entered. 1). The average repair costs per vehicle per accident severity. 2). The average number of vehicles involved/damaged per year per accident severity. 3). Vehicle off road costs based on days for repairing and daily depreciation cost of vehicle. NB. Surveys of garages have shown variations of up to 4 times the cost for the same repair.

Table 4.2 (Cont'd)

TARP II (1993)	HCM (1995)	TSVW&DP (1996)
d). Administration, police and legal costs 1). Costs estimated as percentages of total of all other costs. 2). Percentages were based on UK figures ie Fatal accident x 0.2% Serious accident x 4 % Slight accident x 14% Damage only accident x 10% NB. These percentage allow for all administration, police and legal costs involved.	Same percentages used but final amounts different because of different figure for value of lost production.	Software allows for the following to be entered. 1). Number of police man days per accident severity. 2). Labour cost per day. 3). Overheads as a percentage of 1) and 2).

4.3 Other Approaches

Both the TARP II study and the HCM report give multipliers for estimating the "Gross Output plus Pain, Grief and Suffering" and "Willingness to Pay" values. Both studies use the same values for the former ie the UK figures used in 1980's. However the TARP II study describes the UK increases for "Willingness to Pay" ie a multiplier of 2.6 whereas HCM based its "Willingness to Pay" estimates on Swedish experience. In section 6 of this paper which presents actual cost estimates, the TARP II multipliers were modified for non-fatal casualty costs to match the increases found in 1992 when the UK adopted a "Willingness to Pay" approach for all severities of accidents/casualty. The comparison between the studies is shown in Table 4.3. The TSVW&DP allows for any multipliers to be used for estimating the Pain, Grief and Suffering element but there is no facility for estimating "Willingness to Pay" values.

Table 4.3 Multipliers for alternative methods in the three studies

TARP II (1993)	HCM (1995)	TSVW&DP (1996)
a). Gross Output plus "pain, grief and suffering" 1). Recommends the following increases to the resource costs: Fatal accident +38 per cent Serious injury acc. +100% Slight injury accident +8 % 2). Percentage based on 1986 UK figures. 3). No figures were actually given in the study.	1). Same percentage as TARP II. 2). Same as TARP II. 3). Figures given in report.	1). Software allows for non resource costs to be entered as a percentage of the resource costs. Any values can be chosen.
b). "Willingness to Pay" 1). Identifies UK multiplier as 2.6 times the value for the Gross Output materials costs plus pain, grief and suffering. No figure was presented in the report. In Tables 6.1 and 6.2, the latest UK cost revisions made in 1992 have been used for non fatal accidents ie Serious injury acc. cost x 3.25 Slight injury acc.cost x 3.7 2). The above multipliers apply to the accident cost plus pain, grief & suffering.	1). Calculates an equivalent value using multipliers based on Swedish experience. 2). The multipliers for casualties were as follow: Fatality x 2.93 Severe injury x 5.46 Slight injury x 1.97 3). The multiplier for damage only accidents was 1.11. 4). The above multipliers apply to the basic gross output cost only.	1). The software does not make any provision for "willingness to pay" calculations.

4.4 Casualties per accident

When calculating the resources costs, the value of lost production and medical costs are estimated per casualty whereas repair costs and administration and police costs are estimated per accident. Clearly it is necessary to express these costs uniformally per accident and per casualty.

In Road Note 10, it is recommended that an average conversion factor is used for all severities of accident or casualty. In the TARP II study the Bandung data indicated that there were about 1.25 casualties per injury accident and this figure was used to estimate the accident costs of lost production and medical treatment. It was recommended that a higher value of 1.45 should be used for Indonesia as a whole to allow for the more serious accidents on interurban roads and this was the figure used in the HCM study to convert repair costs per accident to costs per casualty (see Table 4.4). The TSVW&DP software calculates the number of fatalities and casualties per severity of accident and allows for conversions to be made based on actual data.

Table 4.4 The conversion ratio for accident costs to casualty costs proposed by the three Indonesian studies.

TARP II (1993)	HCM (1995)	TSVW&P (1996)
1). A figure of 1.25 casualties per injury accident was used for converting casualty costs to accident costs for Bandung. 2). A figure of 1.45 casualties per injury accident was used for Indonesia in general. This was based on the Cyprus figure in Road Note 10.	1). The second TARP II figure was used ie 1.45.	The software allows for the entry of: 1). The fatalities and casualties per year for each severity of injury accident. These can be based on National or Provincial figures or other data. Conversions are based on actual numbers of casualties per severity of accident.

The conversion factor of 1.45 regardless of severity needs further investigation. The 1995 Indonesian Police road accident statistics indicate 42,453 casualties (including fatalities) for 16,510 accidents ie 2.57 casualties per accident (including a few damage only). Thus 1.45 could be too low. However the TSVW&DP also reviewed reported accident data for five Provinces in 1994 and the Project reported 4,532 casualties for 3170 accidents ie a rate of 1.43 casualties per accident. The estimated numbers of casualties per accident severity are shown in Table 4.5 below.

Table 4.5 Number of casualties per injury accident

Accident severity	Number of casualties per injury accident		
	Fatal	Seriously injured	Slightly injured
Fatal	1.63	0.24	0.09
Serious	0	1.24	0.09
Slight	0	0	1.09

These estimates would indicate that multiplying casualty cost elements by 1.45 for all three severities of accident will underestimate the cost of a fatal accident whereas the costs of serious and slight accidents will be overestimated.

One problem with obtaining a reliable estimate of the number of casualties per accident is the high levels of under reporting of accidents especially the less serious ones and the variability of reporting levels in different parts of the country. Thus the lower number of casualties per accident in the 5 provinces compared with the Nation as a whole could be due to a higher than average proportion of urban roads (less serious accidents) or to a higher level of reporting of less serious accidents which have fewer casualties in the smaller data set. The problem of under reporting is dealt with further in section 5 below.

4.5 Issues in the costing methodology

In order to cost accidents it is evident that a number of assumptions have to be made. Some of these assumptions are questionable and they need to be investigate further by carrying out more detailed analysis or surveys. Some of those at issue are as follows.

1). The use of GDP per capita working population. How close is this to real average incomes? What assumptions have been made about women working ? How can the 'black economy' be taken into account.
2). The retirement age of 55. This seems low and may result in an underestimation of the value of lost output.
3). The medical costs based on figures given by a state hospital. How much subsidy is provided to state hospitals and were their overhead costs excluded ?
4). Police costs were based on UK multipliers. In Indonesia there are a large number of police involved in accident investigation and a high proportion of cases (over 75 per cent) go to court. Therefore the costs may be proportionately higher.

5. ESTIMATING THE TRUE ACCIDENT/CASUALTY PROBLEM

Table 5.1 shows the ratio of different casualty severity totals to the total number of deaths for Indonesia and other countries. According to the police reported accidents in Indonesia there are about twice as many non fatal casualties as deaths whereas in the UK even in 1937 the ratio was 34:1. Although the pattern of accidents may be different in Indonesia especially with more motorbike accidents this huge difference is likely to be due largely to a massive under reporting of the non-fatal accidents by the public.

Also, in Indonesia, the police statistics for fatalities are rarely updated if victims die after being transported from the accident scene, whereas developed countries usually correct all reports up to 30 days after the accident. It is generally accepted that the number of victims dying after being moved from the scene is between 50 to 100 per cent of those who died at the spot. In Indonesia this is supported by the insurance statistics and in 1995 there were 15,080 claims for people killed in road accidents compared with only 10,990 deaths reported by the police (see Table 5.2). Therefore the Police statistics clearly under estimate the number of people killed in road accidents.

In order to estimate the true magnitude of the accident problem in Indonesia it is proposed that the number of fatalities is corrected for the victims who die within 30 days of the accident and serious and slight casualties are estimated by multiplying this corrected figure for road accident deaths. Three estimates have been given in Table 5.1 varying from 25:1 for injuries to deaths using a TSVW&DP figure based on very early UK statistics to 52:1 from the HCM study.

In Table 5.2 these two ratios and the 1937 UK ratios have been used to estimate the 'true' numbers of casualties in Indonesia for 1995. It can be seen that even with the lowest multiplier (TSVW&DP) the estimated total casualties is 428,609 compared with only 32,804 reported to the police ie 92 per cent of the casualties are missing.

Clearly these estimates must be treated cautiously and research is needed to compare hospital records with police records to develop realistic estimates based on factual information.

Table 5.1 Casualty ratios from different sources

Sources	Casualty ratio				
	Fatal (1)	Serious (2)	Slight (3)	All injuries (2)+(3)	Damage only
Indonesia 1995 Police	1	0.9	1.1	2	-
Indonesia 1995 Insurance	1	-	-	2	-
UK 1937 [1]	1	8	26	34	-
UK 1981-1985 [2]	1	13	43	56	-
UK 1995 [2]	1	13	72	85	-
Sweden 1985-1990 Interurban	1	14	33	47	167
Sweden Urban	1	26	130	156	1400
Indonesia - All roads. HCM 1995 (estimate)	1	13	39	52	59
Indonesia - Bandung. HCM 1995 (estimate)	1	20	116	136	559
Indonesia - 1995. TS&VWDP (estimate)	1	-	-	25	-

[1] = from Department of Transport (UK), 1977
[2] = from Department of Transport (UK), 1996

Table 5.2 Road Accident Casualties in Indonesia

Sources	Number of casualties				
	Fatal (1)	Serious (2)	Slight (3)	All injuries (1)+(2)+(3)	Damage only
1). Police, 1995	10,990	9,952	11,862	32,804	-
2). Insurance, 1995	15,080	29,680		44,760	-
3). TSVW&DP, 1995	16,485	103,031	309,093	428,609	-
4). UK, 1937	16,485	131,880	428,610	576,975	-
5). HCM - All roads, 1995	16,485	214,305	642,915	873,705	889,720

Also there is a need to encourage and facilitate better accident reporting by the public. Making third party insurance compulsory in Indonesia could lead to better levels of reporting if drivers involved in accidents actually make insurance claims. However large increases in reporting will also require far more police resources for accident investigation.

6. ESTIMATES OF ROAD ACCIDENT AND CASUALTY COSTS IN INDONESIA

6.1 Average costs per casualty/accident type in 1991

The estimated average costs for different severities of casualty and accident are shown in Tables 6.1 and 6.2. Estimates are given for 1991 prices using the three different valuation approaches and variations according to the methods used by the TARP II study and the HCM study. The main difference between the two studies is that the valuation of a fatality is about twenty per cent lower for the HCM Gross Output estimate and over thirty per cent lower for the Willingness to Pay estimate compared with the TARP II figures. Each table gives a choice of six figures but it is recommended that the minimum estimate for Indonesia should be the HCM Gross Output plus Pain, Grief and Suffering figures highlighted in bold print.

Table 6.1 Accident costs by severity type for Indonesia

Method	Accident Severity	TARP II: 1991 prices (Rp. 1,000.-)		HCM: 1991 prices (Rp.1,000.-)	
1. Gross Output	1). Fatal	38,849		31,583	
	2). Serious	1,924		1,924	
	3). Slight	662		662	
	4). Damage only	308		300	
2. Gross Output plus Pain, Grief and Suffering	1). Fatal	53,612	[1.1) x 1.38]	**43,585**	[1.1) x 1.38]
	2). Serious	3,848	[1.2) x 2]	**3,848**	[1.2) x 2]
	3). Slight	715	[1.3) x 1.08]	**715**	[1.3) x 1.08]
	4). Damage only	308		**300**	
3. Willingness to Pay	1). Fatal	139,391	[2.1) x 2.6]	92,538	[1.1) x 2.93]
	2). Serious	12,506	[2.2) x 3.25]*	10,505	[1.2) x 5.46]
	3). Slight	2,646	[2.3) x 3.7]*	1,304	1.3) x 1.97]
	4). Damage only	308		333	[1.3) x 1.11]

* = based on UK 1992 revision from Hopkin and O'Reilly, 1993

These figures can be used as an estimate for current and future accident costs in Indonesia by increasing the costs according to national indicators of price increases. However this paper has highlighted some issues and limitations and it is recommended that the survey of costs is repeated in order to provide a wider basis for national and regional costs. Also the key agencies involved should reach a consensus on which method to use for the short and medium term future. Ideally a simple system should be established for revising the figures every year. Also estimates should be provided for rural and urban accidents and casualties separately (HCM provides some estimates) and for an average injury accident.

Table 6.2 Casualty costs for Indonesia by severity type

Method	Accident Severity	TARP II: 1991 prices (Rp. 1,000.-)		HCM: 1991 prices (Rp. 1,000.-)	
1. Gross Output	1). Fatal	26,792		21,800	
	2). Serious	1,327		1,300	
	3). Slight	456		460	
2. Gross Output plus Pain, Grief and Suffering	1). Fatal	36,973	[1.1) x 1.38]	**30,100**	[1.1) x 1.38]
	2). Serious	2,654	[1.2) x 2]	**2,600**	[1.2) x 2]
	3). Slight	492	[1.3) x 1.08]	**500**	[1.3) x 1.08]
3. Willingness to Pay	1). Fatal	96,130	[2.1) x 2.6]	63,800	[1.1) x 2.93]
	2). Serious	8,626	[2.2) x 3.25]*	7,100	[1.2) x 5.46]
	3). Slight	1,820	[2.3) x 3.7]*	910	[1.3) x 1.11]

* = based on UK 1992 revision from Hopkin and O'Reilly, 1993

6.2 Estimated total road accident costs in 1995

Table 6.3 shows estimates (not made in the original studies) for total road accident costs in Indonesia. Clearly these figures need to be treated with caution because of the difficulty in estimating the true number of casualties and accidents in Indonesia as well as the costing difficulties.

The costs have been calculated for three different estimates of the number of casualties in 1995 ie the TSVW&DP proposed ratio of casualties to deaths of 25:1 and the higher ratios from UK, 1937 statistics and the HCM ratios based on Swedish experience. Figures are given for three costing methodologies using the HCM 1995 casualty costs rather than the higher TARP II figures. The 1991 costs have been increased by 40 per cent to bring them in line with 1995 prices. Again, assuming a National objective of maximising welfare, values should be adopted with an element for pain, grief and suffering. Therefore, depending on the true magnitude of the road accident problem, **the minimum estimated cost for road accidents in 1995 ranges from 691 to 958 million US dollars**. Adopting a "Willingness to Pay" approach is likely to double these costs.

Table 6.3 Estimated total road accident costs in Indonesia: 1995

Method of estimating true number of casualties		Road Accident Costs: 1995 (Rp millions and US$ millions)		
		Accident Cost Method (HCM, 1995 unit costs)		
		Gross Output	Gross Output + Pain, Grief & Suffering	Willingness to Pay
TSVW&DP:	Rp.	1,263,377	**1,659,644**	3,305,140
	US$	526	**691**	1,377
UK, 1937:	Rp.	1,392,851	**1,848,431**	3,744,164
	US$	580	**770**	1,560
HCM-All roads:	Rp.	1,680,877	**2,298,471**	4,836,493
	US$	700	**958**	2,015

6.3 Comparison of Indonesian and UK costs

The estimated average costs per accident for Indonesia and the UK are shown in US dollars for 1991. The UK figures vary from 12 to 68 times higher than the Indonesian figures.

Table 6.4 A comparison of UK and Indonesia Accident Costs

Accident Severity	Road Accident Costs, 1991		
	Indonesia (1)	UK (2)	(2) : (1)
	HCM: "Gross Output plus Pain, Grief and Suffering" (US Dollars)	Mixed "Willingness to Pay" and "Gross Output + Pain, Grief & Suffering" (US Dollars)	Ratio of UK costs to Indonesia costs
Fatal	18,160	1,243,364	68:1
Serious	1,603	43,195	27:1
Slight	298	4,091	14:1
Damage only	125	1,565	12.5:1

For 1992 (Hopkin and O'Reilly, 1993) the UK human costs were revised for serious and slight accidents and this had the effect of increasing the values by more than three times those in Table 6.4.

However, even using the old UK costing methods for the non-fatal injury accidents, it is evident that the UK costs are much higher per accident than for the same severity in Indonesia. This is not unexpected given lower wages and GDP per capita in Indonesia but it is important that costs of countermeasures are similarly reduced in Indonesia if the same economic returns are to be achieved.

7. CONCLUSIONS

This paper has:

1). Reviewed accident cost studies in Indonesia and proposed a minimum average figure for casualties and accidents.
2). Demonstrated the problems of the under reporting of accidents, proposed methods for estimating the true magnitude of the problem and estimated the national cost of road accidents.
3). Highlighted a number of issues in costing road accidents in Indonesia.
4). Recommended that the cost estimates which were based on Bandung data should be reviewed on a National basis and a system developed for updating these figures using simple procedures on an

annual basis. Also consensus should be reached on which costing approach to use.

5). Indicated that Indonesian accidents are valued significantly less than in the UK and, although this is to be expected, similarly reduced costs for road safety improvements are needed if they are to achieve equivalent economic returns.

8. ACKNOWLEDGEMENTS

The author is grateful to the Institute of Road Engineering for the help given by its staff and the resources provided. Also the assistance with documents and comments provided by the Highway Capacity Manual and the Traffic Safety Vehicle Weights and Dimensions project teams are much appreciated. The draft report was quality reviewed by Dr B Hills of the Overseas Centre, TRL.

9. REFERENCES

Department of Transport (UK), 1978. Road Accidents Great Britain 1977. HMSO: London.

Department of Transport (UK), 1996. Road Accidents Great Britain 1995. HMSO: London.

Dorsch Consult/Directorate General Land Transport, 1996. Economic Evaluation and Determination of Priorities for Road Traffic Safety Enhancement Policies and Projects. Working Paper No. 25, Directorate General Land Transport, Jakarta.

Jacobs, G D, 1993. The Inclusion of Benefits from Reduced Accident Rates in Highway Cost Benefit Analysis. Proceedings of Conference on Asian Road Safety, 1993: Kuala Lumpur, Malaysia.

Jones-Lee, M W, 1976. The Value of Life: An Economic Analysis. London, Martin Robertson, UK.

Jones-Lee, M W, 1989. The Economics of Safety and Physical Risk. Oxford, Basil Blackwell, UK.

Hopkin, M and D O'Reilly, 1993. Revaluation of cost of road accident casualties: 1992 revision. TRL RR 378, Transport Research Laboratory: Crowthorne, UK.

Swe Road/Bina Marga, 1995. Highway Capacity Manual: Traffic Safety and Environmental Impacts. Work Package Report A: 2.1, Directorate General Bina Marga, Jakarta, Indonesia.

Swe Road/Bina Marga, 1995. Highway Capacity Manual: Accident Costs. Work Package Report A: 2.2, Directorate General Bina Marga, Jakarta, Indonesia.

Transport Research Laboratory/Institute of Road Engineering, 1993. Accident Cost Study. Technical Assistance and Research Training Project, Second Phase (TARP II) Project Report, Pusat Litbang Jalan, Bandung.

Transport Research Laboratory, 1995. Costing Road Accidents in Developing Countries. Overseas Road Note 10, Transport Research Laboratory: Crowthorne, UK.