THE CASUALTY COST OF SLIGHT MOTORCYCLE INJURY IN SURABAYA, INDONESIA

Hera Widyastuti* and Corinne Mulley**

ABSTRACT

Motorcycles have become a popular mode of transport in many developing countries. Unfortunately, they also form a large proportion of vehicles involved in traffic accidents. This paper takes the region of Surabaya, Indonesia, as a case study, where the number of motorcycles has grown at an annual average rate of 6.25 per cent over the past nine years. Casualties have increased correspondingly. However, there is less awareness of the social and economic impacts on motorcycle accident casualties. A study was undertaken to find the casualty cost of slight motorcycle injury in Surabaya. This paper presents the findings of the study. It was found that the cost of a motorcycle slight casualty using the generally suggested gross output method of evaluation was almost five times lower than casualties' own perceived cost estimation.

Keywords: Value of safety, motorcycle, casualties.

BACKGROUND

Motorcycles are one of the most commonly used transport modes in Surabaya, Indonesia. Dimitriou and Banjo (1990) found that the number of motorcycles has increased to very high levels in many developing countries in cities such as Jakarta and Kuala Lumpur. The number of motorcycles in Surabaya has also increased dramatically in the last few decades. Between 1992 and 2001 the average growth rate of motorcycles in Surabaya was about 6.25 per cent per year.

Many researchers, for example, Mannering and Grodsky (1995) have considered that motorcycling is generally a relatively risky activity. Reeder et al.

* *PhD student in Transportation-Civil Engineering and Geosciences at the University of Newcastle; e-mail: hera.widyastuti@ncl.a.uk*

** *University of Newcastle, Newcastle upon Tyne, United Kingdom*

(1994) found that motorcycles were involved in a large proportion of accident deaths and serious injuries on public roads. Dimitriou and Banjo (1990) also found that motorcyclists were especially accident-prone.

Most motorcycle accidents result in some degree of casualty to the motorcyclist owing to the rider's vulnerable position on the vehicle. The consequence of a road traffic casualty can be analysed in terms of various costs comprising both direct and indirect costs. The latter cost is the most difficult to estimate owing to the lack of data and difficulties involved in measuring pain, grief and suffering and their valuation in terms of monetary costs. Further, most Indonesians believe that an accident casualty is a form of "destiny" or "Act of God".

Various methods have been suggested to analyse accident costs. The decision to select any particular method clearly depends on the objective of the research. Hills and Jones-Lee (1981) noted that the gross output method was relevant when considering the wealth of a country. In their opinion, an alternative "willingness to pay" method was more appropriate when considering social welfare objectives. Jacobs et al. (2000) reported that among the 20 countries they studied, only 5, developed countries all, were using the willingness to pay approach. The other countries including Indonesia, used the gross output (or human capital) approach.

No matter what accident costing method is used, there are two types of casualty costs of a road traffic accident: direct and indirect. Direct costs are those that have to be borne directly to cover any expenses as a consequence of the accident. These include medical costs, cost for vehicle repairs and administrative costs. Indirect costs are those which are incurred indirectly as a consequence of an accident, such as loss of productivity and loss of quality of life. The loss of quality of life is also sometimes referred to as costs for pain, grief and suffering following an accident.

There are three classes of injury: slight, serious and fatal. This paper looks at how the impact of the costs of a slight motorcycle injury casualty can be measured, which is the most common type of accident for motorcyclists. This is not to suggest, however, that the total costs of other types of accidents, namely fatal and serious motorcycle accident injuries, are not significant. As relatively much less work on the costs of slight injury has appeared in the literature, the present effort is limited to this aspect only. The paper reports the findings of a survey of casualty cost of slight motorcycle injuries in Surabaya, Indonesia.

I. LITERATURE REVIEW

Accident cost components

The result of a motorcycle accident will usually be a casualty, which can be classified as a slight injury, serious injury or fatality. An accident with no casualties can be classified as "damage only". The casualty and accident costing methodologies have been developed by researchers in this field over more than five decades. Some of the studies are briefly described below.

In 1938, Professor H.J. Jones published estimates of the cost of accidents in the United Kingdom (Dawson, 1967). He suggested that the total cost of an accident was made up of three components: compensation for personal injury, repair for damage to property and administrative costs. The personal injury costs were valued at the rates of compensation awards handed down by the courts. The sample used by Jones was taken from army vehicle accident records and no explanation was given as to why this source was used.

In the same year, the government actuary published the cost of accidents, subdivided into four cost components (Dawson, 1967). These were the present value of loss of output or reduction in earnings, hospital and doctors costs, repair for vehicle and property, and miscellaneous costs such as legal and administrative expenses. This estimation of costs was quite different from Jones's estimation. In this valuation, the cost of personal injury was calculated from the loss of output and medical costs. The measurement of the loss of output was made using average earnings, differentiated by male and female categories. Another dissimilarity was in valuing the damage to property which had an element of personal injury costs, as damage to property costs were higher for accidents that involved injury to a person than if there were damage to property but no injury to a person. In addition, this study considered administrative expenses and legal costs separately, whereas Jones had no category for legal costs.

Reynolds (1956), as mentioned in Dawson (1967), updated the government actuary's work, using a more detailed approach to evaluate loss of output. The three main differences in evaluation of loss of output were:

(a) Gross national product was used to make a valuation of the actual loss of output of an individual who sustained the injury rather than using average earnings;

(b) Housewive services were taken into account in the valuation process by using the average female wage rate;

(c) For fatalities, the net loss of output was used to calculate the value of the expected whole life.

Dawson (1967) carried out an empirical study of the cost of road accidents in the United Kingdom using secondary data. The cost components that were considered followed the methods suggested in the government actuary report and Reynolds (1956). The components included were value of the loss of output, cost of medical treatment, cost of damage to vehicles and other property, and administrative and other costs. Further, subjective additions were made to these four cost components but the method underlying this addition was not explained. The subjective cost was intended to relate to every casualty and was to cover items such as suffering and bereavement.

The Traffic Engineering Division of the Institute of Road Engineering Bandung, Indonesia carried out the first study concerning the costs of road accidents in the country (1990). In this study, the accident cost components included were vehicle repair costs, lost output costs, cost of hospital treatment, police and administrative costs and the costs of pain, grief and suffering. The valuation of costs covering pain, grief and suffering followed the suggestions made by the Transport Research Laboratory in the United Kingdom.

The Department of Transport, United Kingdom in its Highway Economic Note No. 1 of 1994, divides the costs per casualty in three components: loss of output, medical and ambulance, and human cost. This is in contrast with the cost per accident which has six components, namely loss of output, medical and ambulance cost, human cost, police cost, insurance and property damage.

The Transport Research Laboratory (TRL) (1995) and Ghee et al. (1997) agree that the costs associated with road crashes in developing countries are a sum of value of the loss of output, cost of medical treatment, cost of damage to vehicles and other property, administrative and other costs, and a subjective cost to cover the pain, grief and suffering elements. Mohan (2002) believes that the elements of pain, grief and suffering should be factored in the quality of life cost and be included in accident costing. Silcock (2003) is also concerned about the subjective cost associated with the “human cost” arising from casualties. However, the costs he identified as being associated with human costs seem to be the same as those identified by TRL (1995) under a different name.

The Bureau of Transport and Regional Economics of Australia identified road accident costs in the country as the sum of human costs, vehicle costs and general costs (2003). The human costs included medical/ambulance/

rehabilitation costs, long-term care, labour in the workplace and in the household, quality of life, legal, correctional services, workplace disruption, and funeral and coroner costs. The vehicle costs comprised the cost of repairs, costs associated with the vehicle being unavailable for use while under repair and towing costs. General costs consisted of travel delays, insurance administration, police, non-vehicle property damage and the costs of the fire and emergency services.

From the discussions above, it could be concluded that every casualty would lead to extra expenses to be met either directly or indirectly. The direct costs that a casualty has to cover can be defined as the money required to pay for the damage to vehicles, medical treatment, and administration and any other expenses caused by the accident. These costs fall into two broad groups: medical costs and non-medical costs. The indirect costs are the loss of earnings due to non-productivity of the casualty and the costs that reflect pain, grief and suffering owing to physical, mental and behavioural problems from an injury.

II. ACCIDENT COST METHODOLOGY

There are various methods to calculate accident cost, which are net output, gross output, life insurance, cost awards, implicit public sector, cost of restitution, cost of value of life and willingness to pay. Hills and Jones-Lee (1981) mention that the decision to choose the appropriate accident cost methodology must be related to the objective of the study. However, the Traffic Engineering Division, Institute of Road Engineering Bandung, Indonesia, stresses that the choice of method much depends on the availability and quality of appropriate data. Silcock and TRL (2003) point out that in the last 20 years only the loss of output (human capital) and value of risk change approach (willingness to pay) have been used frequently.

The Department of Transport, United Kingdom announced that the new valuation for fatal casualties would be £500,000 based on the willingness to pay method (McMahon, 1988). On the other hand, Silcock and TRL (2003) suggest that, even though willingness to pay is the most appropriate method to show the measurable cost for an accident casualty, there are some weaknesses with regard to the complexity of typical questionnaires used in such a valuation process. Further, questionnaires are more appropriate for adults. TRL (1995) and Ghee et al. (1997), conclude that the gross output method should be supplemented with some human elements. This should reflect the pain, grief and suffering of those involved in road traffic accidents. Taking these into account, and as recommended in the previous works by the Transport and

Road Research Laboratory, in the United Kingdom, Indonesia adopted the gross output, or human capital approach, for accident cost evaluation.

III. OVERVIEW OF CASE STUDY LOCATION

The case study location is Surabaya, which is the second largest city in Indonesia and the capital of East Java province. The current population of Surabaya is 2,325,619 and the area is 32,636.6 ha. Like other places in Indonesia, the motorcycle is the most common mode of transport in Surabaya, especially for the young and middle-income people chiefly because of its cheap price and wide accessibility.

Motorcycle volume

The number of motorcycles in Surabaya has increased almost every year since 1992, with the exception of the economic crisis years 1997-98 and 1998-99, when the motorcycle volume fell by 0.48 per cent and 2.75 per cent, respectively. Nevertheless, the annual average motorcycle growth during the nine years between 1992 and 2000 was 6.25 per cent. Table 1 shows the population of Surabaya and the number of cars and motorcycles registered in the province. It can be seen that the ratio of motorcycles to people since 1995 has averaged 1:4; this means that there is one motorcycle for every four people. By comparison, the ratio of private cars to people is 1:16 (Widyastuti and Bird, 2004).

Motorcycle accidents in Surabaya

Motorcycling is a mode of private transport that plays an important role in transporting people in many developing countries. However, as the number of motor vehicles increases, the potential danger of road traffic accidents also increases. Surabaya is no exception to this. Table 2 shows the number of vehicles involved in road traffic accidents in Surabaya. It clearly shows that in each year but one, motorcycles form the largest proportion of vehicles involved in traffic accidents. In 1999, the proportion of motorcycles involved in accidents was slightly lower than that of cars. The figures in the table also show the effects of the economic downturn that started in the middle of 1997 and continued for the next few years. At that time, with fewer journeys and fewer vehicles on the road, there was a drop in the number of motorcycle accidents. It may also be due to the fact that as employment prospects diminished, people realized the financial impact of accidents. This grim realization motivated them to drive far more carefully.

Table 1. Population, car and motorcycle volume in Surabaya, 1992-2000

Year	Population	Population growth (per cent)	Car volume	Car volume growth (per cent)	Car ratio vs population	Motorcycle volume	Motorcycle volume growth (per cent)	Motorcycle ratio vs population
1992	2 259 965		115 018		1:20	421 796		1:5
1993	2 286 413	1.17	122 145	6.20	1:19	456 596	8.25	1:5
1994	2 306 474	0.88	134 328	9.97	1:17	491 117	7.56	1:5
1995	2 339 335	1.42	145 088	8.01	1:16	539 753	9.90	1:4
1996	2 344 520	0.22	154 872	6.74	1:15	602 942	11.71	1:4
1997	2 356 486	0.51	168 568	8.84	1:14	670 394	11.19	1:4
1998	2 373 282	0.71	168 282	-0.17	1:14	667 205	-0.48	1:4
1999	2 405 946	1.38	152 922	-9.13	1:16	648 879	-2.75	1:4
2000	2 444 976	1.62	150 589	-1.53	1:16	684 790	5.53	1:4

Source: *Surabaya in Figures, 2001.*

Table 2. Number of vehicles involved in Surabaya traffic accidents, 1992-2001

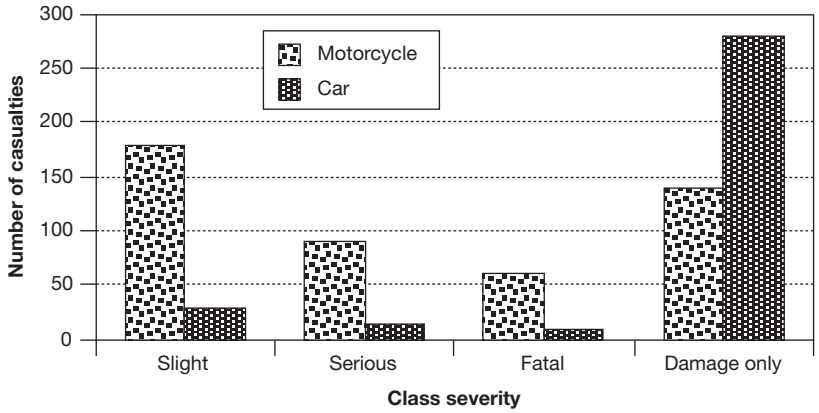
Year	Number of vehicles involved in Surabaya traffic accidents				
	Bus	HGV	Car	Motorcycle	Becak
1992	15	167	248	441	47
1993	12	125	183	357	22
1994	10	103	118	228	16
1995	18	103	149	227	10
1996	26	131	158	218	21
1997	15	135	140	259	20
1998	11	75	107	178	15
1999	3	73	143	126	10
2000	20	161	262	329	18
2001	27	214	322	402	17

Source: *Surabaya in Figures, 2001.*

Note: HGV = heavy goods vehicle.

Motorcycle accident severity

Despite the driving skill required to control the stability of and ensure safety when riding a motorcycle, obtaining a motorcycle driving licence in Indonesia is easier than obtaining one for a car. Further, as generally no body protection is available for the rider, motorcyclists can be seen as relatively vulnerable road users. Figure 1 clearly shows that the number of motorcycle casualties is greater than that for cars. It also shows the higher severity of motorcycle casualties compared with cars. However, the biggest difference between motorcycle and car severity is in the fatal category, which is 15 times higher for motorcycles. It can be concluded that the most likely impact of a motorcycle accident will be some degree of casualty, whereas a damage-only accident is more likely for cars.



Source: Police accident record.

Figure 1. Accident severity difference between motorcycles and cars in Surabaya, 2001

Motorcycle accident casualty by age

The 319 motorcycle casualties recorded in Surabaya in 2001 comprised 58 fatalities, 87 serious injuries and 174 slight injuries. The age distribution of casualties is presented in table 3. Of the total, 41 per cent were in the 20-29 age group. This figure may reflect the fact motorcycle users tend to be at the younger end of the age group in employment.

Table 3. Motorcycle casualties by age group

Injury class / Age group	Slight	Serious	Fatal
0 - 9	5	1	1
10 - 19	29	14	10
20 - 29	70	41	21
30 - 39	37	13	14
40 - 49	19	8	8
50 - 59	10	7	3
60 - 69	3	3	0
≥70	1	0	1

Method of data collection

The method used for obtaining the data was interviewing of motorcycle casualties, as opposed to casualties' secondary data that had been used by previous researchers. This study concentrated on slight injuries only, because the slight injury was the mostly likely outcome of a motorcycle accident and not much work had been done on this type accidents.

About 50 motorcycle slight casualties were interviewed. The interviews were carried out during July and August 2004 in the home of casualties. Surveyed casualties were predominantly male (86 per cent of total respondents). Of the total casualties, 56 per cent fell into the age range (20-29). This was not out of line with police accident records which record all accidents.

The survey made it clear to all interviewees that the questionnaire used was related to the motorcycle casualty cost incurred as a result of an accident. Those who participated in this study were asked a range of questions. First, the respondents were asked personal data such as: age, education, status and income. Then, they were questioned on their accident data in terms of the direct costs incurred and the time for which production was lost as a result of the accident based on the gross output method. Lastly, the respondents were asked about their opinion of total cost prediction incurred including lost productivity and quality of life as well as motorcycle safety and related issues.

IV. FINDINGS OF THE COST SURVEY

Gross output method

As already mentioned, the gross output method for calculating accident cost in developing countries was used to analyse the casualty cost. The casualty cost was broken down into two components, direct and indirect costs. Indirect costs have been divided into two components, loss of productivity and loss of quality of life. Loss of productivity cost is the cost of loss of time being productive as a result of the accident, such as time spent in hospital and care at home. Loss of quality of life is the cost covering pain, grief and suffering as a result of the accident that reduced the quality of life.

Direct cost

The Direct costs in this study encompass eight items: cost at scene, medical treatment, hospital cost, outpatient cost, physiotherapy cost, administration cost, vehicle reparation cost and other costs.

(a) *Cost at scene*

Cost at scene is the cost incurred at the scene either for first aid or transportation from the scene to the hospital. Results show that only 12 or 24 per cent of respondents had to pay cost at scene with an average cost of Rp 8,333.33 (US$ 1 ≈ Rp 9,150). In many cases, casualties had been brought to the hospital by someone near the accident scene rather than by ambulance.

(b) *Medical treatment*

The motorcycle is a cheap mode of transport, most motorcyclists have had an accident, especially one involving a slight injury. When the motorcyclist is involved in an accident, some financial burden is incurred, comprising the direct and indirect costs of treatment. However, most of the slight casualties who had scratches, twisted legs or hands preferred to be cared for at home instead of having medical treatment; 67 per cent of slight injury casualties had a preference for recovering from their severity at home instead of obtaining formal medical treatment either in hospital or as outpatient. Purchasing pain killer medicine, disinfectant liquid and traditional massages are a part of their solution. Even though they did not require medical treatment cost, in fact they spent money in the recovering process.

(c) *Hospital cost*

As all the motorcyclists had a slight injury, it meant the casualties had not stayed in hospital for medical treatment and therefore the hospital cost would not be significant for them. Most of the respondents (72 per cent) had no hospital cost at all. Only 9 respondents had to pay hospital cost with an average cost of Rp 184,444 paid by themselves.

(d) *Outpatient cost*

Of the respondents, 20 per cent obtained medical treatment as outpatients with a minimum cost of Rp 10,000 and the maximum cost was Rp 750,000 and an average cost of Rp 191,000.

(e) *Physiotherapy cost*

Only one of the respondents required physiotherapy for a twisted ankle. Rp 20,000 was paid for the physiotherapy cost.

(f) *Administration cost*

Administration cost is the cost incurred for payments made to police and insurance company. From the data, only one person paid such an administration cost and the cost incurred was Rp 25,000.

(g) *Vehicle reparation cost*

Vehicle reparation cost is normally the highest of all direct costs incurred by motorcycle slight casualties, even though 20 per cent of them had incurred no such expenses. The minimum vehicle reparation cost was Rp 15,000, while the maximum was Rp 800,000 with an average of Rp 165,875.

(h) *Other costs*

Other costs in this study cover any direct expenses related to the accident, which were not included in the items above, such as payment to third parties. Only one of the respondents had to pay other costs to a third party which amounted to Rp 75,000.

Total direct cost

The total direct cost is the sum of all direct costs discussed above. Table 4 shows that most of the respondents had to pay less than Rp 100,000,

Table 4. Total direct cost

Range (Rp)	Number of respondents	Range (Rp)	Number of respondents
No cost incurred	8	500 000 - 599 000	2
<100 000	17	600 000 - 699 000	2
100 000 - 199 000	10	700 000 - 799 000	0
200 000 - 299 000	4	800 000 - 899 000	2
300 000 - 399 000	3	900 000 - 999 000	0
400 000 - 499 000	1	>1 000 000	1

while the second largest group paid between Rp 100,000 and 199,000. The average total direct cost for all respondents was Rp 208,500.

Loss of productivity

Loss of productivity is an indirect cost incurred regarding the loss of casualties' productive working time as a result of an accident. In this study, the loss of productivity had been valued using the loss of casualties' working time multiplied by their income or wages. In the case of casualties who had no paying jobs such as housewives and children, average wages derived from secondary sources were used. These wages were based on a previous study by Sari and Sutomo (2004), where 36 per cent of the respondents lost production time, at an average cost of Rp 106,552.

Total casualty cost based on the gross output method

Other than the direct and indirect costs described above, the other elements which should be taken into account are pain, suffering and inconvenience experienced by the casualties and their relatives. The pain, grief and suffering comprising loss of quality of life have to be taken into account in gross output Method. TRL (1995) and Silcock and TRL (2003) recommend adding 8 per cent of total direct cost and loss of productivity cost to cover loss of quality of life. Based on this recommendation, the total slight casualty cost was calculated and the results are shown in table 5. According to this suggestion, as can be seen from the table, the largest number of casualties had an estimated burden of less than Rp 100,000 with an average cost of Rp 266,607 for all respondents.

Table 5. Total casualty cost, including human cost, using gross output method

Range (x Rp 1,000)	Casualty cost using gross output method + 8 per cent for human cost
No cost incurred	7
<100	14
100 - 199	11
200 - 299	5
300 - 399	2
400 - 499	4
500 - 599	1
600 - 699	1
700 - 799	2
800 - 899	1
900 - 999	0
1 000 - 1 249	0
1 250 - 1 499	1
1 500 - 1 749	0
1 750 - 1 999	0
2 000 - 2 499	1

The average monthly income of the casualties of this study was Rp 682,600. This implies that the average cost of motorcycle slight injury was about one third of the casualties' monthly income.

However, when the casualties were asked about their prediction of slight casualty cost, many of them predicted costs more than that based on the gross output method. The average of slight casualty cost prediction was Rp 1,311,500 for all respondents. A summary of average costs for all items by the gross output method and casualties' own cost prediction are provided in table 6. Figure 2 shows a comparative distribution of the total average cost of motorcycle slight injury casualty by both methods.

Table 6. Casualty cost of motorcycle slight injury

Cost component	Average cost
Cost at scene	2 000.00
Hospital cost	33 200.00
Outpatient cost	38 200.00
Physiotherapy cost	400.00
Administration cost	500.00
Vehicle reparation cost	132 700.00
Other cost	1 500.00
Total direct cost	**208 500.00**
Loss of productivity cost	38 359.04
Total direct + loss of productivity costs	246 859.04
Pain, grief and suffering (8 per cent of total)	19 748.72
Casualty cost by gross output method	**266 607.76**
Casualty cost by casualties' prediction	1 311 500.00

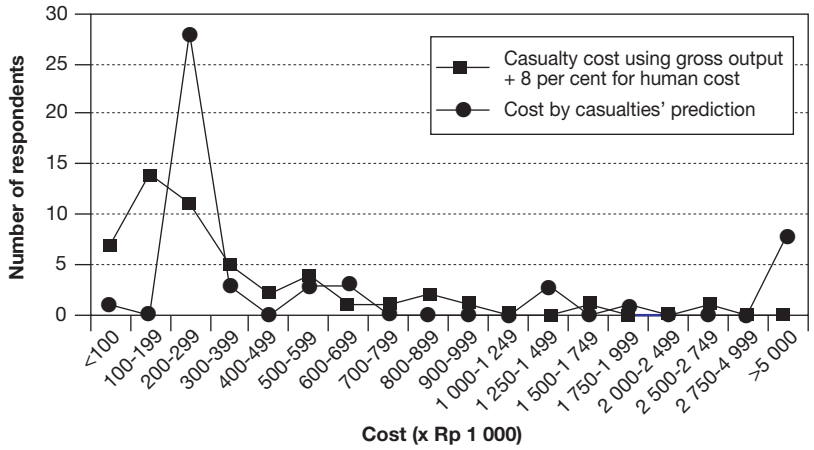


Figure 2. Comparison of serious casualty cost between gross output method and casualties' prediction

DISCUSSION AND CONCLUSION

The assessment of values of road traffic accidents in developed countries has been carried out for more than three decades. However, such efforts in developing countries are of more recent origin. In Indonesia, the gross output method is used for valuing the cost of accidents. In evaluating the costs of pain, grief and suffering of accident casualties, these studies followed the suggestions made by previous researchers. A fixed percentage of direct and loss of productivity costs was added to the total to make an allowance for these cost elements. This has been practiced largely because of a lack of data and the complexity of putting a monetary value on indirect costs such as pain, grief and suffering.

In this study, all motorcyclists had experienced slight injury. The average direct and total costs for such casualties using the gross output method were 208,500 and 266,607 rupiahs, respectively. The total cost represented about a third of the monthly income of the casualties. The total cost included an allowance for pain, grief and suffering as suggested by previous researchers (i.e. 8 per cent of total direct and loss of productivity cost). This study also made an attempt to predict the cost by the casualties themselves. The predicted average slight injury cost by the casualties was found to be Rp 1,311,500 which was about 5 times the total casualty cost using the gross output method.

Previous studies revealed that cost estimates by casualties in a willingness to pay method were usually higher than that of by the gross output method. However, some studies also mention that the willingness to pay method might be difficult to follow in a developing country because of the complexity of a typical questionnaire used for this purpose. Most willingness to pay questionnaires ask about people's willingness to pay for the reduction in casualty rather than the cost incurred by the casualty. This could be difficult to answer in the context of a developing country. To address this problem, the casualties in the present study were asked about their predicted total costs incurred. The results however show that the pain, grief and suffering elements account far greater than 8 per cent of the direct costs as suggested by many of the previous researchers.

The wide difference between the cost estimates by using the two methods suggests that further works need to be undertaken in the future to develop a more appropriate costing methodology. The main area of contention appears to be the evaluation of pain, grief and suffering or the human cost element of accidents. Findings of the present study suggest that probably

a modification needs to be considered in using either method. A combination of the methods might be more appropriate.

With further growth in the number of motorcycles and related accidents, the casualty cost is also expected to increase significantly in the future, no matter what approach is used in accident costing. This would imply significant loss of productivity and quality of life to society at large. To redress the situation, new policies and best practices from other countries may be considered for early implementation in order to enhance the road safety of motorcyclists in Indonesia.

REFERENCES

Bureau of Transport and Regional Economics, 2003. "Road crash costs in Australia", Report 102, Department of Transport and Regional Services, Australian Government, available at <http://www.btre.gov.au/docs/reports/r102/r102.aspx (27/01/2005)>.

Dawson, R.F.F., 1967. *Cost of Road Accident in Great Britain* (Crowthorne, Road Research Laboratory).

Dimitriou, H.T. and G.A. Banjo, eds., 1990. *Transport Planning for Third World Cities* (London, Routledge).

Ghee, C., D. Silcock, A. Astrop and F. Jacobs, 1997. *Socio-economic aspects of road accidents in developing countries* (Crowthorne, Transport Research Laboratory).

Hills, P.J. and M.W. Jones-Lee, 1981. "The Costs of Traffic Accidents and the Valuation of Accident Prevention in Less-Developed Countries – Methods of Valuation in Relation of Traffic Safety Objectives", University of Newcastle upon Tyne, Newcastle.

Institute of Road Engineering Bandung, 1990. "Cost of Road Accident", Bandung, Indonesia.

Jacobs, G., A. Aeron-Thomas, et al. (2000). Estimating Global Road Fatalities, TRL Report 445 (Crowthorne, Transport Research Laboratory).

Mannering, F.L. and L.L. Grodsky, 1995. "Statistical Analysis of Motorcyclists Perceived Accident Risk", *Accident Analysis and Prevention*, vol. 27(1), pp. 21-31.

McMahon, K., 1988. "Cost of Accidents", in Road Accidents-Great Britain, Department of Transport, U.K.

Mohan D., 2002. "Social cost of road traffic crashes in India", in First Safe Community Conference on Cost of Injury, Viborg, Denmark, pp. 33-38.

Reeder, A.I., D.J. Chalmers, S.W. Marshall and J.D. Langley, 1997. "Psychological and social predictors of motorcycle use by young adult males in New Zealand", *Social Science & Medicine*, vol. 45(9), pp. 1357-1376.

Reynolds, D.J., 1956. "The cost of road accident", Road Research Laboratory, London.

Sari, T.L.I. and H. Sutomo, 2004. "Road Accident Cost in Indonesia", Proceedings of the 7th FSTPT, 11 September, Universitas Parahyangan Bandung, Indonesia.

Silcock R. and TRL, 2003. "Guidelines for Estimating the Cost of Road Crashes in Developing Countries", Final report, Project R7780, Department for International Development, U.K.

Surabaya Statistics Office, 2001. *Surabaya in Figures, 2001*.

Transport Research Laboratory, 1995. "Costing Road Accident in Developing Countries", Overseas Development Administration, London, pp. 17.

Widyastuti, H. and R.N. Bird, 2004. "Assessing the social cost of motorcycle casualties in developing countries", Proceedings of the 36th Annual Conference of the Universities Transport Study Group, 5-7 January, Newcastle.