TRAFFIC ACCIDENT COST ANALYSIS

by

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ABSTRACT

Sri Lanka has approximately 100,000 kilometers of road network including 11,147 kilometers of national roads under the Road Development Authority while the rest is under Provincial Councils and Local Authorities. In the year 1996, total investment expenditure in construction and rehabilitation of national roads was Rs. 3,330 million. Each year, a large number of traffic accidents occur causing loss of life, injuries and loss of property. This paper presents an accident analysis carried out for the year 1996, and evaluated the accident cost for the year 2000 by taking the inflation in to consideration.

It is shown that the cost of traffic accidents in Sri Lanka account for about 1% of the GDP. This is for Rs. 5142 million for the year 1996 and 8,136 million on year 1999 or nearly double the total investment in highway infrastructure by the Ministry of Highways. In the view of the high cost of accidents, it is suggested to allocate a separate sum for accident preventive measures for every year to improve the accident black spots and overall safety measures like educating the road user, law enforcement and providing facilities for road users such as good walkways, cycle paths and quality carriageways.

On the basis of accident cost evaluated for each type, it is also shown that the equivalent accident number for a fatal accident is 15, grievous accident is 8, non-grievous accident is 1.2 and a damage only accident is 1. These values can be used to determine the total Equivalent Accident Numbers at all accident-prone locations along any stretch of road. Such total values can be used to determine the accident black spots.

1.0 INTRODUCTION

In the year 1996, there was a total of 46529 traffic accidents in Sri Lanka out of which 1484 were fatal, 2254 were grievous, 11257 were non grievous and 31534 were vehicle-vehicle (damage only) accidents. Major proportion of accident victims was pedestrians and cyclists who also constitute the majority of the road users. Number of pedestrian and cyclist victims were 8547 for the year 1996.

According to Fernando and Fernando (1994), 50% of the road accident casualties from 1980 to 1990 were pe-

destrians, 8.4% cyclists and 5% riders. Out of the total, the expenditure on maintenance and improvements of highway infrastructure, only 3-4 % of funds were allocated to maintain and improve pedestrian and cyclists facilities and more than 95% of the expenditure was for the benefit of motorists.

Accident costs are one of the most useful measures of determining the importance of accident prevention efforts. However, the costs of accidents are quite difficult to determine, because of the variety of factors whose monetary values are difficult to measure. There are also many differences of opinion in the treatment of indirect costs of accidents. As a result, accident costs have not been used extensively in highway planning and traffic control, where detail and precise measurements are required. The high loss of lives and property from highway traffic accidents is an indication of the need for accurate and uniform determination of road accident costs.

The aim of this research is to evaluate the cost of different types of road accidents in Sri Lanka. This can be used to evaluate the total accident cost and also to determine a suitable extra investment for accident preventive measures.

Another use of accident cost is the evaluation of equivalent accident numbers (EAN) for each type of accident. Once the EAN values are known the total annual EAN score for any given accident prone location can be evaluated. These can be used to determine the priority locations to implement accident preventive measures.

2. 0METHODOLOGY

The following methodology was adopted:

1. The accident records for year 1996 were analyzed to determine the number of accidents for each type and the involvement of pedestrians in road accidents.

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- 2. The accident cost for each type was evaluated by considering the loss of income, medical cost, police and legal cost and vehicle damage component.
- 3. The data in item 2 was used to determine the total accident cost.
- 4. The data in item 2 was also used to determine the equivalent accident number (EAN)

To evaluate the annual road accident cost, year 1996 was considered for the entire study. For the detail analysis, net output approach as reported in Lay, (1986) was used.

For the determination of certain costs where exact values are not available, the data presented by the professionals involved is used to arrive at reasonable cost figures.

3.0 COST OF A FATAL ACCIDENT

When a fatal accident occurs, the victims will be hospitalized. Once the patient dies, there will be a loss of future output since his or her service is no longer available for the country. There will be police inquiries and that will be followed by a court cases. Once the patient dies, there will be pain and grief for the relatives. If the vehicles are damaged, those will be repaired or written off. Then, there will be a vehicle damage cost. Therefore, the cost of a fatal accident should include the following components:

- 1. Medical or hospital cost of fatal accident victims
- 2. Loss of net future output to the society
- 3. Police and legal cost
- 4. Cost reflecting pain and grief
- 5. Vehicle damage component involved with the fatal accident

The total number of fatal accidents in year 1996 was 1484.

3.1 Hospital Cost

When an accident victim is hospitalized, there will be a cost that has to be borne by the government, when the number of accident victims are increasing, this may lead to further expenditure on infrastructure such as more accident wards or more facilities in the existing accident wards. Therefore, the total hospital cost has to be estimated with a reasonable accuracy.

Data required to evaluate the hospital cost such as age, number of days in the hospital and severity of accident victims were obtained from the Accident services, General Hospital, Colombo and the Police Department.

The following assumptions were made in the evaluation procedure:

- a. The average cost per accident victim and that of a normal patient is the same.
- b. Above assumption is true for both in-patients and out patients.

Considering all the fatal victims in year 1996, the following age group analysis can be obtained (Ratnayake et. al., 1999).

		Table	1			
Age	group	analysis	of	fatal	victims.	

Age group	Percentage of patients
0-10 years	5 %
10-20 years	10%
20-30 years	25%
30-40 years	21%
40-50 years	15%
50-60 years	11%
60-70 years	6.5%
70+ years	5%

In order to determine the number of days that a fatal accident victim stays at the hospital, a sample of data collected for December 1996 from Accident ward, General Hospital, Colombo was analyzed.

From the accident ward data and values reported by Fernando & Fernando (1994)

- 50% of the patients die within 2 days (they stay in a hospital, 0 to 2 days)
- 20% of the patients die within 4 days (they stay in a hospital, 2 to 4 days)
- 30% of the patients die within 30 days (they stay in a hospital, 4 to 30 days)

3.1.1 HOSPITAL COST FOR AN IN-PATIENT

The following data is available for the calculation of hospital cost for an in-patient.

Total health expenditure in year 1996 = Rs 11,913 million (Central Bank Report, 1997)

Total number of in-patients in year 1996 = 3,339,000 Total number of outpatients in year 1996 = 35,348,000

Average expenditure per out- patient

Cost of treating an outpatient is a variable based on various factors like severity of illness, age of patient etc. Therefore, the following approximate average values are used in the evaluation after inquiring from Government medical officers.

Number of minutes spent by a doctor and a nurse for an outpatient = 15 min.

Overall average payment to a doctor (government) = Rs. 25,000

A doctor is working 6 hours per day and 25 days per month.

1 doctor hour would cost = 25000/(25x6) = Rs 166

Therefore the doctor's cost per out-patient = Rs. $(166/60) \times 15$ =Rs. 40/=

Cost of a nurse for an out-patient assuming Rs. 8000 payment for a nurse working 8 hours per day = 8000/(25x8x4) = Rs.10

Cost of medicine for an outpatient is approximately taken as Rs. 20/= based on the information provided by government doctors.

Cost of overheads is assumed as 30% (This includes electricity, telephone, vehicle expenditure, depreciation of medical equipment etc.)

Therefore average expenditure per out- patient = $(40+10+20) \times 1.3 = \text{Rs} \cdot 90/=$

It is considered that outdoor patients do not need complete hospital services except laboratory facilities etc.

Total expenditure on out- patients

In-patient cost = Total health expenditure - outdoor patients cost = 11,913,000,000 -3,181,320,000

= Rs. 8,731,680,000/=

Average government expenditure on an in-patient

= In-patient cost/ total number of inpatients = 8731680000/333900 = Rs.2615/=

The average stay in the hospital for an accident victim is calculated as 5 days by considering a sample covering the entire cross section of accident victims.

Cost of an in-patient per day = 2615/5 = Rs 525/=

3.1.2 Hospital cost of a fatal victim

Total number of fatal accidents =1484 (source: Police Department)

According to the sample of 150 fatal accident records in year 1996 there were 78 pedestrians involved and 23 cyclists involved (Ratnayake et. al, 1999). Thus, 67%

accidents occurred with pedestrians or cyclists. The other 33% accidents were among vehicles. Total number of fatal accident victims in the sample was 167.

Number of victims per accident = 167/150 = 1.11

Therefore, total number of fatal victims in year 1996 = $1.11 \times 1484 = 1647$

Table 2
The total hospital cost

Percentage	Considered number of patients	Average number of days in hospital	Rate (Rs)	Cost (Rs)
50	1647x 50/100=824	1	525	432,600
20	1647x20/100 =329	3	525	518,175
30	1647x30/100 =494	17	525	4,408,950
Total				5,359,725

Total hospital and medical cost of fatal accident victims = Rs. 5,359,725/=

3.2 LOSS OF FUTURE OUTPUT

When an accident patient dies, his/her service will not be available for the country any more. Therefore, this loss has to be calculated with a reasonable accuracy. For this purpose, certain assumptions are made on the basis of available data.

Assumptions:

- 1. A person will retire at the age of 55 years.
- Considering the average per capita income of Sri Lanka, which is Rs. 41984/=. In year 1996 (Central Bank Report 1997), the average monthly income of a person in 1996 was taken as Rs. 3500/=. The average monthly consumption by one person in year 1996 was taken as Rs. 1000/= (based on four persons per family and one person would need 3500/ 4 =Rs. 875). Thus the net monthly income of a person is Rs 2500/= in 1996.

A person employed in a job of permanent nature, the salaries increase every year due to annual increments. Their salaries are also adjusted from time to time to allow for the inflation prevailing in the country. This means the purchasing power of people changes only marginally although the net salaries drawn may have considerable increases. Therefore, it would be reasonable to calculate the present and future income of a person on the basis of the per capita income reported in Central Bank report 1997. These values can be considered as fixed for the future years in real terms. For example, if the per capita income of a person is US \$ 800 per year in 1999, it is equivalent to Rs. 800 x70 = 56,000/

= . If a person who is of age 30 dies, he losses 25 years of his earnings. Thus, the total loss of future income is Rs. $56,000 \times 25 = \text{Rs } 1,400,000 /= \text{in } 1999 \text{ prices.}$

Age group	Mean age	% of victims	Number of victims	Average yrs of future output	Rate(Rs)	Cost (Rs)
0-20	10 *	15	1647x15/100=247	55-20=35	2500x12	259,350,000
20-30	25	25	1647x25/100=412	55-25=30	2500x12	370,575,000
30-40	35	21	1647x21/100=346	55-35=20	2500x12	207,600,000
40-50	45	15	1647x15/100=247	55-45=10	2500x12	74,100,000
50-60	55	11	1647x11/100=181	55-55=0	2500x12	
60+		11.5	1647x11.5/100 =189	production of the		
Total						911,625,000

Table 3 Loss of Future Output

1. For this age group, it is assumed that they will start earning only at the age of 20.

Total loss of future output = Rs 911,625,000/=.

3.3 POLICE COST

In a fatal accident, there can be a considerable cost associated with police. According to the Police sources, for a fatal accident, it will be necessary for the police personal and an officer to visit the accident site, tow the vehicles to the police station if there are vehicles involved, take photographs, record the detailed statements, attend to the court case arising out of the fatal accident etc. All these costs need to be assessed with a suitable breakdown.

On the day of accident, the following involvement is used for police personal:

Traveling expenses for two vehicles where each vehicle will travel about 10 km. (average distance can be taken as 5 km one way from the Police station) this value is reasonable for urban areas. However, it may underestimate the distance that has to be travelled in rural areas. However, since majority of the accidents occur close to urban centers, this may be reasonable.

Cost of traveling = $2 \times 10 \times 6.25$ =Rs 125/= (current government cost of traveling per 1 km is Rs. 6.25/=)

Number of police personnel involved can be taken as 2 on average and the traffic OIC.

OIC's involvement :	=	one day for the field work and inquiry	
Two PC's :	=	one day each for the fieldwork and	
		inquiry	

3.3.1. Post mortem

For the post mortem traffic OIC' s involvement can be taken as one day and two other policemen will engage one day each.

Post mortem can be held in a hospital where the patient has died which would be a main hospital in the province, in which case police officers may have to travel about 50 km one way from the police station.

3.3.2.Court case

Generally for one police division there is one day per week for court hearings for all accidents occurred in that division. For a fatal case, there could be about one hour at the courts and two hours for the preparatory work.

Therefore total time required is 3 hours of OIC and one other police officer. For a fatal case, it was found on the basis of information provided by Police personal that court hearings are generally held 4 times per year, which is spread over for about 3 years. This means altogether 12 court hearings. A service of one vehicle will be needed for the court visits, which is considered as about 8 km average one way.

The payment for a police personal is taken as Rs. 8000 per month, with 25 working days and 8 hours per day, the cost of each hour is Rs. 40 (Rs 320 per day). The payment for the OIC is assumed to be Rs. 12000 per month with 25 working days and 8 hours per day which cost Rs.60 per hour (Rs 480 per day).

Thus the total cost for the police personnel for accident investigation, post mortem and court case:

(1+1+12x3/8) x480 + (2+2+12x3/8)x320 = 3120 +2720 =Rs.5840/=

Vehicle cost = 125 + (50 x2 x6.25) + (16 x12x6.25) = Rs.1950/=

Total police cost = 5840 + 1950 = Rs. 7790/=

Considering 30% overheads = 7790 x 1.3 = Rs.10127/= Total police cost = 10127 x 1484 = Rs.15,028,468/=

3.4 VEHICLE DAMAGE COMPONENT INCLUDED IN FATAL ACCIDENTS

Considering the sample of 150 fatal accident records in year 1996, the sum of pedestrians and cyclists involved are 78 and 23 respectively. This is 67% of the total. In this type of accident, serious damage to the vehicle is quite remote. Therefore, it is considered that for 67% of fatal accidents, no vehicle damage claim would arise (Rathnayake et. al, 1999).

It is assumed that only vehicle-vehicle accidents would include a vehicle damage cost. Therefore 33% of fatal accidents would need vehicle damage claims. In the 150 samples, 14 records are vehicle - vehicle type and 36 records are single vehicle accidents. This is 9.5% vehicle - vehicle and 24% single vehicle accidents.

Considering the claims paid by the Sri Lanka Insurance corporation for the year 1996, the overall average claim is Rs.30,000/= for a vehicle.

It was reported by Fernando and Fernando (1994) that claims over Rs. 500,000/= were also paid in certain accidents. In the year 1991, for total vehicle claims of 10070 cases; 592 claims were over Rs.50,000/= out of which 398 claims were between Rs. 50,000 to Rs. 100,000, 106 claims were form Rs. 100,000 to Rs. 200,000, 46 claims were from Rs. 200,000 to Rs. 300,000; 20 claims were from Rs. 300,000 to Rs. 400,000; 8 claims from Rs.400,000 to Rs.500,000 and 14 from Rs. 500,000 and above (The maximum claim is assumed as Rs.1,000,000/= by considering the value of a vehicle in Sri Lanka). Then, the average can be calculated as follows:

{(398 x75,000) + (106 x 150,000) + (46 x250,000) + (20 x 350,000) + (8 x 450,000) + (14 x 750,000)} / 592

Therefore the average for claims over Rs. 50,000 is Rs. 132,348/=

This figure is for 1991 prices. In order to convert this figure to 1996 prices, an inflation rate of 10% is used. It should be noted that during this period, the inflation remained as a two-digit number with certain fluctuation. Thus the figure for 1996 is: $132,348 \times (1.1)5 = \text{Rs}$. 213,147

This is an average figure. In order to ensure that the accident costs are not inflated, Rs. 200,000/= was used for the fatal motor vehicle accidents. The following figures are used for grievous and non-grievous accidents involving the motor vehicles. These are used in subsequent calculations.

Grievous accidents where passengers or drivers are injured = Rs. 150,000/=

Non grievous accidents where drivers or passengers are injured =Rs. 75,000/=

Total number of fatal accidents in year 1996 =1484

Out of these 1484 accidents, 33% need vehicle damages out of which 9.5% are vehicle - vehicle accidents that involve two or more vehicles and 24% are single vehicle accidents.

Total number of vehicles need damage claims = $(9.5/100 \times 1484 \times 2) + (24/100 \times 1484 \times 1) = 638$

Total claimed amount = 200,000x 638 = Rs. 127,600,000/

3.5 COST REFLECTING PAIN AND GRIEF

It is very difficult to quantify this in monetary terms, the subjective cost reflecting pain, grief and suffering caused to relatives and friends of the accident victims. In United States an amount equivalent to 65% of the value based on gross out put has been used. In United Kingdom the cost is increased by 50% to reflect pain, grief and suffering. In a study of accident costs in India, the quantifiable costs have been increased by 20% to take account of pain and grief. Therefore it is suggested to increase the quantifiable cost to allow for subjective cost of pain and grief. In this study, 20% of the total quantifiable cost was allocated as the subjective cost of pain and grief (Fernando and Fernando 1994).

3.6 COST OF A FATAL ACCIDENT

Total cost of a fatal accident = Hospital cost + Police cost + Loss of future output + Vehicle damage cost + cost of pain and grief

Total quantifiable cost = 5,359,725 + 15,028,468 + 911,625,000 + 127,600,000 = Rs. 1059,613,193/=

20% of quantifiable cost to allow for pain and grief = Rs. 211,922,639/=

Total cost of fatal accidents in 1996 = Rs.1271,535,832/=

Total cost per fatal accident 1271,535,832 / 1484 = Rs 856,830/=

It is shown with a detailed calculations, that the cost of a fatal accident will be Rs 856,830/= in 1996 terms. This figure can be converted to 1999 and 2000 terms by using a reasonable interest rate such as 10%. It should be noted that in this study, reasonable values have been assumed for figures for which accurate data is not available.

It should also be noted that this cost covers only the fatal victims and the vehicle damage in a fatal accident. However, there are grievous and non-grievous victims in these accidents. Therefore, this total cost should be adjusted appropriately to take account of such victims. For that, only the medical cost and loss of income of such victims will be taken in order to avoid double counting.

3.6.1 Cost of other victims of fatal accidents

Number of grievous victims in the fatal accident sample of 150 accidents=19.

Number of non grievous victims in the fatal accident sample of 150 accidents = 53

Possible number of grievous victims in 1484 fatal accidents = 188

Possible number of non grievous victims in 1484 fatal accidents = 524

Cost of a grievous victim for medical and loss of income based on values presented in Section 4.0 and 5.0 = $(43 \times 525) + (701,951,250 / 2479) = 22575 + 283,159 = Rs.$ 305,734/=

Cost of a non grievous victim medical and loss of income = $943 + 1250 = \text{Rs} \cdot 2193/=$

Overall cost of fatal accidents in year 1996

= 1,271,535,832 +305,734 x 188 + 2,193 x 524 = Rs.1,330,162,956/=

Cost per fatal accident = 1,330,162,956 /1484 =Rs. 896,336/=

Overall cost per fatal accident = Rs 896,336/

4.0 COST OF A GRIEVOUS ACCIDENT

The following components can be considered for a grievous accident.

- 1. Medical or hospital cost of victims
- 2. Loss of future output due to permanently disabled victims
- 3. Police and legal cost

- 4. Loss of earnings due to injuries if recovered after a certain period.
- 5. Vehicle damage component involved with griev ous accidents

Number of grievous accidents = 2254 in year 1996 (Police Department)

In a sample of 150 grievous accidents, there were 64 pedestrian involved accidents and 17 cyclists involved accidents. That is 54% pedestrian and cyclists involved accidents. There were 50 vehicle - vehicle accidents and 17 single vehicle accidents. That is 45% of accidents are vehicle involved (Ratnayake et. al, 1999).

In the sample of 150 accidents; there are 165 grievous victims.

165/150 = 1.1 victims per accident.

Therefore, total number of grievous victims in year 1996 = $2254 \times 1.1 = 2479$

It can be stated by considering a sample of grievous accident victims from General hospital; Colombo for the average number of days in hospital for a grievously injured patient is 43 days.

Hospital charges per day per in-patient = Rs 525 /=

Therefore hospital cost of victims (grievous) =2479 x 43x 525 = Rs 55,963,425/=

4.1 LOSS OF FUTURE OUTPUT

50-60 years

60-70 years

70+ years

Analyzing all the grievous victims in year 1996, the following age group analysis can be obtained.

- - -

Iable 4Age group analysis					
Age group Percentage of pati					
0-10 years	8 %				
10-20 years	13%				
20-30 years	30%				
30-40 years	23%				
40-50 years	12.5%				

6.7%

3.6%

2%

Age group	Mean age	% of victims	Number of victims	Average yrs of future output	Rate(Rs)	Cost (Rs)
0-20	10*	21	2479x21/100=521	55-20=35	2500x12	547,050,000
20-30	25	30	2479x30/100 =744	55-25=30	2500x12	669,600,000
30-40	35	23	2479x23/100=570	55-35=20	2500x12	342,000,000
40-50	45	12.5	2479x12.5/100=310	55-45=10	2500x12	93,000,000
50-60	55	7	2479x7/100=174	55-55=0	2500x12	
60+	-	7	2479x7/100 =174	-	2500x12	
Total						1,651,650,000

Table 5Loss of future output for grievous victims.

* For this age group, it is assumed that they will start earning only at the age of 20.

Loss of future output = Rs 1,651,650,000/=

It is assumed that 90% of grievously injured victims are not permanently disabled and only 10% victims are permanently disabled. It is also assumed that out of grievously injured victims, 40 % will have a partial disability which leads to loss of income by 50% and other 50% victims will recover almost fully after a long hospitalization and treatment. Their loss of income could be taken as 25 %, since their career progress may be hindered to a certain extent.

Therefore total loss of income =1,651,650,000 [0.1 + (0.4 x 0.5) + (0.5 x 0.25)] =Rs 701,951,250/=

4.2 POLICE AND LEGAL COST

Cost of traveling for 2 police vehicles to the accident site (same as for a fatal case)= Rs 125/=

Number of police personnel involved

- = OIC + 2 PCs
- = One day OIC + one day each for PC s) for the field and inquiry
- = (1x480) + (2x320) = Rs 1120/=

Court case

Police personnel involved would be:

3 hours per OIC + 3 hours per one PC

For a grievous case, court hearings are taken as 4 times per year spread over 3 years which means about 12 court hearings. = $(3/8 \times 12 \times 480) + (3/8 \times 12 \times 320) = \text{Rs}$ 3600/=

Service of a one vehicle will be used for court cases = 8 km (average) one-way. = $(8 \times 2 \times 12 \times 6.25)$ = Rs.1200/=

Total police and legal cost = (125 + 1120 + 3600 + 1200)= Rs 6045/=

Total cost with 30% overheads = $6045 \times 1.3 = \text{Rs}.7860/$

Total police and legal cost $= 7860 \times 2254 = \text{Rs}$ 17,716,440/=

4.3 VEHICLE DAMAGE COMPONENT

In grievous accidents also, it is reasonable to assume that no vehicle damage occurs when pedestrians and cyclists are involved. In 54% grievous accidents pedestrians and cyclists were involved. Therefore, the vehicle damage claims would arise only in 45% grievous accidents. Insurance claim for a vehicle subjected to a grievous accident is assumed as Rs.150,000, which is 75% of Rs. 200,000/= allocated for a fatal accident. There are 50 vehicle - vehicle grievous accidents which is 33% and 17 single vehicle accidents which is 11.33% of the total, in the sample considered.

Cost of claims = $[(2 \times 0.33 \times 2254) + (1 \times 0.11 \times 2254)]$ x 150,000= (1488 + 248) x 150,000

Cost of vehicle damage = Rs 260,400,000/=

4.4 COST OF A GRIEVOUS ACCIDENT

Total cost of a grievous accident

= 55,963,425 +701,951,250 +17,716,440 + 260,400,000 = Rs 1036,031,115/=

Allow 5% for pain and grief = 1.05 x 1036,031,115 = Rs 1087,832,671/=

Total cost of a grievous accident = 1087,832,671 / 2254 = Rs 482,623/=

Cost of a grievous accident = Rs 482,623/=

It is shown that the cost of a grievous accident can be Rs 482,623/= in 1996.

It should be noted that this cost covers only the griev-

ous victims and the vehicle damage. However, there are non-grievous victims in these accidents. This cost should be adjusted appropriately to take account of such victims.

4.4.1 Cost of other victims of a grievous accident

Number of non grievous victims in the grievous accident sample of 150 records = 39

Possible number of non grievous victims in 2254 accidents = $39/150 \times 2254 = 586$

Cost of a non grievous victim = Medical cost + Loss of income = Rs. 2193/=

Overall cost of grievous accidents in year 1996 = 1,087,832,671 + (2193 x 586) = Rs. 1089,117,769/=

Cost of a grievous accident = 1089,117,769 / 2254 = Rs. 483,193/=

Overall cost of a grievous accident = Rs 483,193/=

5.0 COST OF NON-GRIEVOUS INJURIES

The cost of a non-grievous accident should include the following:

- 1. Medical treatment cost
- 2. Loss of earnings due to injuries
- 3. Police and legal cost
- 4. Vehicle damage component, if any.

Number of non-grievous accidents reported was 11,257 for the year 1996. It is considered that most of the nongrievous accidents are reported to a police station in Sri Lanka since generally general practitioners do not treat motor accident victims. Those victims are directed to the nearest hospital and they are generally advised to report the accident to the nearest police station. At accident wards there are police posts for this purpose. People are also really concerned about reporting such accidents to the police because they can have legal help only if the accidents are reported. This is especially true when unexpected circumstances arise due to accidents later. It should also be noted that only a minor portion of Sri Lankan population is covered either by social security or insurance schemes and therefore the victims are really concerned about compensation for accidents. With such circumstances, the chances for not reporting a nongrievous accident of significant nature is very remote.

In this report, the emphasis is placed on the accidents, which will be of a burden to the national economy, which are the injuries of significant nature, but not endangering the life. Therefore, unreported accidents are not considered for the study.

5.1 MEDICAL COST

Medical cost of a non-grievous accident victim can be considered as an OPD treatment expenditure. Most of the accident victims will have to take X - rays and hence the initial cost would be higher and can be in the range of Rs 500/=. They will further take treatments for routine dressing of wounds and check ups, therefore the total number of visits for the OPD treatment can be assumed as 3 times in average.

It is considered Rs 500/= initial cost + Rs 90/= each day for OPD treatment cost (for 2 more visits)

According to the 200 non-grievous accident records sample there are 56 vehicle - vehicle accidents that is 28% of the total. There are 66 single vehicle accidents, which is 33% (Ratnayake et. al, 1999).

The sample of 200 records gives 58 pedestrian involved accidents and 20 cyclists involved accidents, which is 29% pedestrian, and 10% cyclists involved accidents.

Total number of victims in the sample = 238

Victims per accident = 238 / 200 = 1.19 = 1.2

The total number of non-grievous victims in year 1996 = 1.2 x 11,257 = 13,508

OPD treatment cost = Rs. 90/=

Medical cost of accident out-patients = $13508 \times (500 + 90 \times 2) = \text{Rs} \cdot 9,185,440 /=$

Some of the non-grievous accident victims can be kept in a hospital under observation for about 2 days (average). It is assumed that 25% of the victims are kept under observation.

Therefore the medical cost of non grievous in-patients = 2 x 525 x 25% x 13,508 =Rs 3,545,850/=

Total non grievous medical cost = 9,185,440 + 3,545,850 = Rs 12,731,290/=

5.2 POLICE COST

Cost of traveling for 1 police vehicle to the accident site $= 10 \times 6.25 = \text{Rs.}62.50/=$

(Average distance to the site from the police station can be taken as 5 km one way).

Number of police personnel involved = 2 PC s

= 1/2 day of 2 PC s for the field and inquiry = $1/2 \times 2 \times 320$ = Rs 320/=

Total police cost for a non grievous case = 62.50 + 320 = Rs.382.50

The cost with 30% overheads = Rs 500/=

Cost for the court case

Court cases can be spread over average of one year including 4 court hearings.

This includes 3 hours service of OIC- traffic and 3 hours service of one PC.

 $= (3/8 \times 4 \times 480) + (3/8 \times 4 \times 320) = \text{Rs.}1200/=$

It is assumed that 25% of reported non-grievous accidents will involve a court case.

The total police cost for the reported cases = Rs 500 x $11257 + 11257 \times 25/100 \times 1200 =$ Rs 9,005,600/=

5.3 LOSS OF FUTURE INCOME

Average loss of earnings of a non-grievous victim is taken as half months income. Therefore the total loss of income = $0.5 \times 2500 \times 13508 = \text{Rs } 16,885,000/=$ (Section 3.2).

5.4 VEHICLE DAMAGE COMPONENT

Most of the non-grievous accidents have occurred with pedestrians, hence will not need any vehicle damage claims from insurance. Only 28% accidents are of vehicle-vehicle type and 33% are single vehicle accidents (Ratnayake et. al, 1999).

For passengers to suffer injuries the vehicle should be substantially damaged. Therefore, the insurance claim is considered as Rs 75,000/= per vehicle which is half the value considered for a grievous accident involving vehicles.

Total number of vehicle-vehicle accidents, $(28/100) \times 11257 = 3152$

Total number of single vehicle accidents (one vehicle involved) = 33%x 11257= 3715

Total vehicle involvement = $(3152 \times 2 + 3715) = 10,019$

Cost of vehicle damages = 75,000 x (3715 + 3152 x 2) = Rs. 751,425,000/=

Therefore, the total cost for non-grievous accidents

= 12,731,290 + 9,005,600 + 16,885,000 +751,425,000 = Rs 790,046,890/=

The cost of a non-grievous accident = 790,046,890 / 11257 = Rs 70183 /=

6.0 COST OF VEHICLE DAMAGE ONLY ACCIDENTS

The cost of the damage only accident should include the following:

1. Cost of reported damages

2. Police and legal cost

When damage only accidents occur, the cost of such accidents are borne by insurance companies or by individuals depending on the type of insurance (full or third party) and also on the amount involved (due to loss of no-claim bonus). Even for a fully insured vehicle, claims below Rs 1000/= will not be paid by the insurance companies. Some vehicle owners with 'no claim bonuses' will not consider insurance payments for damages costing less than Rs 5000/= due to long procedures involved in such claims and also the long term losses arising due to non-availability of no-claim bonus.

For example, for a vehicle of value Rs 500,000/=, the full insurance charge is about Rs 12,500/=, which is calculated at Rs 2500/= for each Rs 100,000/=. For a person having a 35% no-claim bonus, the saving in insurance cost each year will be about Rs 4000/=. Therefore, it is quite unlikely for such a person to claim even Rs 10,000/= from an insurance company. For damage only accidents, it is considered that each damage only accident will be a cost to the national economy whether it is borne by insurance companies or by the individuals. Therefore, a reasonable cost has to be evaluated for such accidents.

With the prevailing costs, if a vehicle is given a complete paint work after a damage only accident, the average costs would be Rs 30,000/=(Fernando & Fernando, 1994) for a car or a light vehicle. Generally, the reporting rate of significant damage only accidents could be quite high since a police entry is essential for insurance claims.

6.1 · VEHICLE DAMAGE COST

Total number of reported damage only accidents = 31,534

In order to determine the cost of damage only accidents, it is necessary to assume a reasonable value for a damage only insurance claim. This can be calculated as the values given in Table 6.

Type of accident	Number of accidents	Vehicles claimed damages
Fatal	1484	638
Grievous	2254	1736
Non grievous	11257	10019
Damage only	31534	31534

Table 6 Number of vehicles claimed damages.

According to the insurance claims paid in 1996, the overall average value is Rs.30,000 for all vehicles except motor cycles for which the average is about Rs. 9000. Since the assumed value for a fatal accident is Rs. 200,000, that for a grievous accident is Rs. 150,000 and non grievous with vehicle damage is Rs. 75,000; the value for the damage only vehicle can be evaluated as follows:

(200,000x638) + (150,000 x 1736) + (75,000 x 10019)+(X x 87505) = (638 +1736 + 10019 + 87505) x 30,000

total vehicles involved except motor cycles = 87505 X = Rs. 21,228/=

The number of vehicles involved in damage only accidents in year 1996 were taken from the police records (Ratnayake et. al, 1999).

Vehicle type	Average insurance payment	No of vehicles involved	Total cost
Car	21,228	25787	547,406,436
Light vehicle	21,228	26888	570,778,464
Lorries	21,228	16083	341,409,924
Buses	21,228	18069	383,568,732
Motor cycles	9229	4821	44,493,009
Land vehicles	21,228	678	14,392,584
Total		92326	1902,049,149

Table 7 Vehicles involved in damage only accidents.

Total cost of vehicles damaged = Rs 1902,049,149/=

6.2 POLICE COST

Cost of traveling for 1 police vehicle to the accident site $= 10 \times 6.25 = 62.50$ Rs.

(average distance to the site from the police station can be taken as 5 km one way)

Number of police personnel involved = 2 PC s

= $1/2 \text{ day } \times 2 \text{ PC s}$ for the field and inquiry = $1/2 \times 2 \times 320 = \text{Rs.}320/=$

Cost for the court case

It is assumed that 50% of the damage only accidents will go to courts.

Court cases can be spread over average of one year including 4 court hearings.

This includes 3 hours service of OIC traffic and 3 hours service of one PC.

 $= (3/8 \times 4 \times 480) + (3/8 \times 4 \times 320) = \text{Rs.1200}$

Total police cost for the damage only accident = 62.50 + $320 + (0.5 \times 1200) = \text{Rs}.985/=$

Police cost of damage only accidents for year $1996 = 985 \times 31,534 = \text{Rs } 31,060,990 / =$

Total damage only accident cost = 31,060,990 + 1902,049,149

Cost of a damage only accident = 1933,110,139 / 31534 = Rs 61,302/=

Cost of a damage only accident = Rs 61,302/=

7.0 TOTAL ACCIDENT COSTS

The cost of four different types of accidents were calculated by considering the cost of each component involved such as medical costs, police costs, cost reflecting pain and grief and vehicle damage component. The total cost of fatal, grievous, non grievous and damage only accidents was calculated as Rs 5142,437,754/= in 1996 prices. The details are given in Table 8.

accident type	fatal	grievous	non grievous	damage only	total cost	% of total cost
medical cost	5,359,725	55,963,425	12,731,290	s - 1 - 12	74,054,440	1.77
police cost	15,028,468	17,716,440	9,005,600	31,060,990	72,811,498	1.82
loss of future output	911,625,000	1651,650,000	16,885,000		2580,160,000	37.91
vehicle damage	127,600,000	260,400,000	751,425,000	1902,049,149	3041,474,149	51.13
cost reflecting pain and grief	211,922,639	51,801,555			263,724,194	6.01
cost of other victims	58,627,124	1,285,098			59,912,222	1.35
Total cost	1330,162,956	1089,117,769	790,046,890	1933,110,139	5142,437,754	100
% of total cost	29.84%	26.52%	18.16%	25.48%	a	
reported accidents	1484	2254	11257	31534	46,529	a:
cost per accident	896,336	483,193	70,183	61,302		

Table 8 Accident cost for the year 1996

The total accident costs are as follows:

Cost of a fatal accident	= Rs 896,336/=	= Rs. 900,000/=
Cost of a grievous accident	= Rs 483,193/=	= Rs. 500,00/=
Cost of a non grievous accident	= Rs 70,183/=	= Rs. 70,000/=
Cost of a damage only accident	= Rs 61,302/=	= Rs. 60,000/=

Using Table 8 the relative costs and the proportions of different cost components can be evaluated.

Total accident cost in year 1996

= (1330,162,624 + 1,089,117,022 +789,982,489+ 1933,097,268) = Rs. 5142,359,403

The gross domestic product of Sri Lanka in 1996 was Rs 695,934,000,000/= or Rs 695.934 billion. The cost of ac-

cidents is 1.03% of the GDP.

The accident cost components for years 1999 and 2000 have also been estimated based on the year 1996 evaluated cost figures. For this 10% inflation rate over the years has been considered. The estimated cost figures are given in Table 9.

8.0 USES OF ACCIDENT COST ANALYSIS

The data obtained from accident cost analysis can be extremely useful in the identification of accident black spots. These can also be used to rank the accident black spots so that the safety at most severe once could be improved initially. The accident costs can be used to calculate equivalent accident numbers (EAN). If the vehicle - vehicle damage only accident is taken as 1.0, the EAN s for other types of accidents can be calculated as given in Table 9.

Class of Accident	Cost 1996 Rs.	Cost 1999 Rs.	Cost 2000 Rs.
Fatal	896,336	1,193,023	1,312,326
Grievous	483,193	643,129	707,443
Non Grievous	70,183	93,413	102,755
Damage only	61,302	81,592	89,752

Table 9Estimated accident costs for years 1999 and 2000 based on 1996 values

	Table 10	
Equivalent	Accident	Numbers

Cost per accident	EAN	EAN
896,336	896,336/61,302	14.6
483,193	483,193/61,302	8
70,183	70,183/61,302	1.14
61,302	61,302/61,302	1

The figures should be considered as only approximate since a number of assumptions were used for the analysis. However, any error in these values could be in the same order of magnitude. Therefore, once used for the calculation of EAN values, the errors would be minimum. When used for the calculation of total accident cost, a certain degree of variation should be anticipated for each year.

9.0 CONCLUSIONS

In 1996, the total investment on the road sector was Rs 3.33 billion. It can be seen that the cost of accidents to the national economy is about twice the investment made on the total road network. This may be an indication that the investment in the road sector is inadequate to maintain a reasonable safety level on Sri Lankan roads. Therefore, a suitable enhancement in the investment, where a component of which can be directly utilized for the accident prevention and safety improvement could be appropriate in the future.

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