COMPARISON OF ACCIDENT RATES BETWEEN VEHICLE TYPES IN SRI LANKA

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ABSTRACT

Accidents have steadily increased with time on Sri Lankan roads. While there are a host of contributory factors, the rapidly increasing vehicle fleet is the primary reason. According to the accident statistics; 92,610 vehicles were involved in the 54,911 road accidents reported in 2002. Of this 2,967 vehicles were involved in 2,024 fatal accidents. The main objective of this paper is to find out the most risky vehicle type that was involved in road accidents in terms of the number of vehicles, faulty rate and fatality rate etc.

Accident data for this study was obtained from the Traffic Police, Sri Lanka. Different kinds of statistics were used for the analysis. These include unadjusted factors such as the number of reported accidents and fatalities. Analysis was also done with respect to the type of vehicle, vehicle kms and population distribution in each province.

It is shown that the light vehicle that is most frequently involved in road accidents. The car, bus and lorry are in the second, third and fourth place, respectively. However, in terms of injury accidents and fatal accidents these rankings change significantly. Here it is the motor cycle that ranks in first place, followed by the bus, lorry and light vehicles in almost equal position. Bicycles were also involved in a high percentage of fatal accidents making up around 12 per cent.

Further analysis revealed that the Police have determined that 49,985 drivers were at fault in the 54,911 road accidents reported in 2002. Out of this, 2,041 drivers were reported at fault for causing fatal accidents. The drivers of light vehicles, lorry drivers, motor cycle riders and bus drivers were associated with causing over 73% of the fatal accidents. Another interesting analysis is that out of the 150 car drivers involved in fatal accidents, 85% were found to be at fault. Likewise, the faulty rates for each vehicle type for the years 2001 and 2002 have been calculated. Even though it was found earlier that the vehicle most involved in fatal accidents was the motor cycle, the faulty rate is much lower when compared to the other larger vehicles mentioned above. The larger vehicles appear to be more at fault than the smaller vehicles. More analysis was done on the distance travelled by these vehicles and the number of vehicles in each category in operation rather than on just the number of vehicles involved in accidents. Accordingly, the ranking of the most dangerous drivers change drastically and then the private bus drivers are in the first place.

In general, light vehicles and cars are mostly invo'ved in road accidents. However, the private buses are by far the most dangerous and lethal vehicles on our roads. Targeted enforcement programs and educational programs are urgently needed to arrest this situation. On the other hand, the motor cycle is found to be the most dangerous vehicle to use. Thus emphasis on the use of safety equipment such as the use of the safety helmet and other general safety measures should be directed at this group of road users.

INTRODUCTION

Road accidents have become a noticeable social problem in Sri Lanka, even though, they may at first seem relatively unimportant, especially when compared to critical problems such as malnutrition, scarcity of financial and economic resources, terrorist problems, unemployment etc. Although it is true that the loss and suffering resulting from road accidents may be small when compared with that caused by poverty and sickness, the problem is much more serious than we imagine.

There is no doubt that accidents have kept on increasing yearly. According to Police records, there are over a 1,000 road accidents per week with five to six people being killed every day. While every life is precious especially to the family and friends, people who get killed or injured deprive the economy and society of their skills and gifts which may have taken years for the society to build. Hence, the loss of such people has a greater impact on the economy than at first appearance. Apart from around 2,000 people who are killed yearly, over 3,000 people are critically injured and another 12,000 suffer minor injuries. Table 1 depicts this sad story with a summary of several thousand lives lost over the last twenty five years and how the number of all types of accidents has grown almost threefold during this period.

All these figures of accidents, fatalities, injuries etc. are based on police reported events. Earlier studies have shown that the unreliability of such reports is high (2). The police reported crashes show considerable underreporting, as well as bias in the reporting with respect to time and area. The reporting rate also varies with crash type and road user category. Therefore, the above figures might be higher than the available statistics. However, most fatal accidents seem to have been reported correct when physically counter checked with police stations. Therefore this research mostly analyses fatal accidents.

However, Sri Lanka is not alone in facing this grim reality of increasing road accidents. Most of the developing countries that are facing rapid increases in motorization and in some cases rapidly growing population as well, have also reported similar situations. A few countries mostly from among the developed countries such as Japan and Sweden (3) are role models having actually reduced the number of road accidents steadily. But in these countries motorization has pretty much reached saturation.

The road accidents as well as the number of casualties arising from these crashes, including fatalities and the number of vehicles involved in these accidents have continued to grow in absolute numbers in Sri Lanka. To understand the possible underlying causes for the increasing trends in road accidents, it is important to study these trends with the relative trends in the growth of population, degree of motorization, changes in the vehicle mix and degree of urbanization.

Year	Fatal	Grievous	Non-Grievous	Damage Only	Total
1977	811	834	6,158	7,494	15,297
1978	817	1,030	6,833	9,607	18,287
1979	854	1,102	7,123	10,816	19,895
1980	1,038	1,410	8,873	12,390	23,711
1981	1,173	1,347	8,947	13,189	24,656
1982	1,180	1,318	8,155	13,349	24,002
1983	1,308	1,301	7,900	13,653	24,162
1984	1,258	1,304	7,503	14,469	24,534
1985	1,223	1,233	7,318	14,410	24,184
1986	1,253	1,471	8,610	20,597	31,931
1987	1,165	1,525	8,568	22,036	33,294
1988	1,365	1,348	7,935	22,380	33,028
1989	1,454	1,287	7,733	21,222	31,696
1990	1,714	1,703	9,462	21,584	34,463
1991	1,255	1,899	9,685	21,305	34,144
1992	1,302	2,112	10,386	23,977	37,777
1993	1,346	2,299	11,687	26,163	41,495
1994	1,414	2,554	11,992	27,855	43,815
1995	1,481	2,588	12,233	31,837	48,139
1996	1,560	2,615	11,510	32,990	48,675
1997	1,705	3,310	10,037	33,481	48,533
1998	1,874	2,393	11,417	35,275	50,959
1999	1,938	2,632	11,612	37,333	53,515
2000	1,983	2,992	11,756	37,508	54,239
2001	1,993	3,390	11,546	35,165	52,094
2002	2,038	3,286	12,725	36,862	54,911

Table 1. Number of Accidents (1977-2002) (1)

In order to understand the relative growth of accidents during the period of study compared to growth in population and vehicle population, Figure 1 has been developed to understand the growth of the different types of accidents set to a base of 100 for the year 1980. As such, the relative growth rates for each of these trends compared to the others can be easily observed. Figure 1 demonstrate that all types of accidents have increased at a rate greater than the increase in population, but lower than the growth in the fleet of vehicles or the estimated vehicle kms operated for that year. Furthermore, the growth rate for fatal accidents is significantly lower than all other types of accidents reported.

This reveals that even though the number of reported accidents has steadily increased, the accident situation in Sri Lanka has improved relative to extraneous factors. As such, the increase in motorization and people switching from relatively safer modes of transport to more risky modes of transport appears to be the most likely causes of the increasing trends in accidents.

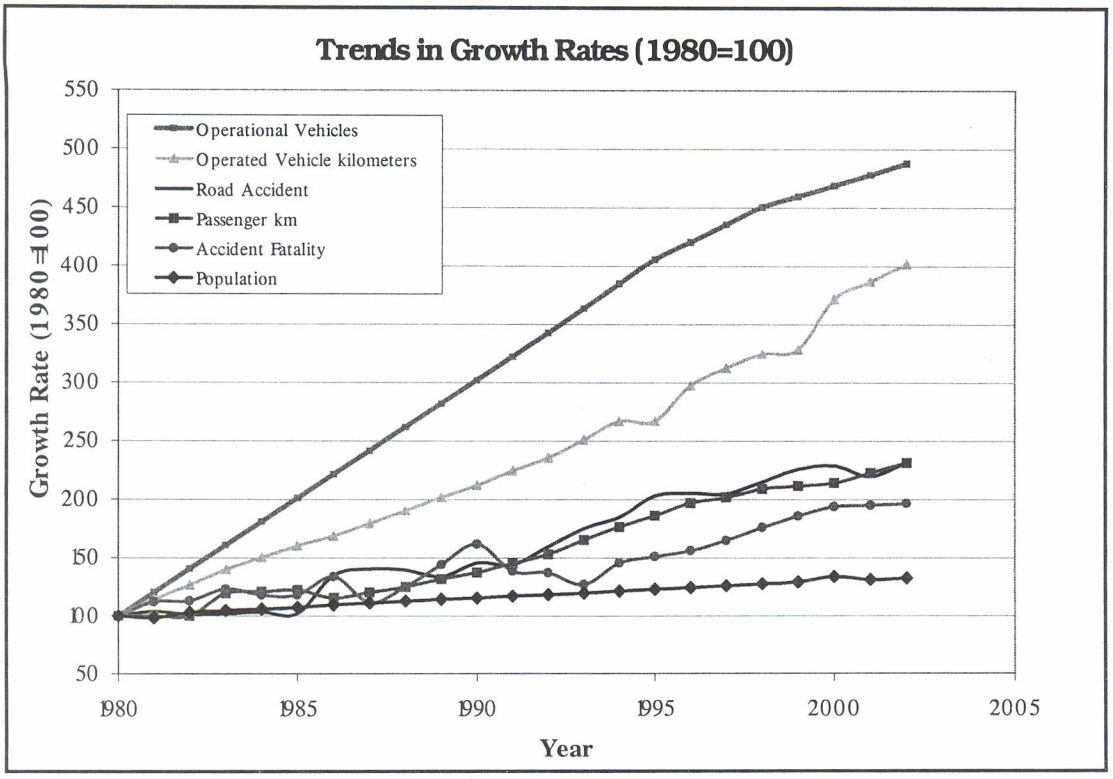

Figure 1. Trends in Growth Rates (1980 = 100)

METHODOLOGY AND OBJECTIVE

For the purpose of this study, data has been obtained from various sources and the following are the three main sources.

- The accident data collected by the Sri Lanka Police
- Operational vehicle data collected by the Motor Traffic Commission and the divisional secretariat's
- Estimated operational vehicle kms and passenger kilometers using *TransPlan* model developed by the Transportation Engineering Division of University of Moratuwa.

The main source of Accident data are Police Records. The police have a statutory duty to investigate road accidents for legal purposes. Police used a standardized form to collect data on accidents. Using this form they collect the accident data from each of the police stations all over the country. The collected data is then sending to Police Headquarters in Colombo. The Traffic Police headquarters maintain the database and prepares reports quarterly and annually. They maintain three different databases namely;

- Master Database
- Casualty Database
- Vehicle Database

The master database consists of variables such as name of the police station, date, time of the accident, the severity of the accident, number of vehicles involved, number of victims (killed, minor injured, seriously injured) road name, location, hit & run, environmental conditions etc.

Casualty database contains the details of the accident such as date, time, vehicle type, degree of injury, and details of the casualty such as age, sex, type of casualty (e.g. pedestrian, passenger etc.) and activity of the casualty at the time of the accident.

Even though there is a large amount of information available on each accident, no analysis were done so far using these information to design, fund and implement road safety projects that would eventually arrest and bring down the heavy accident toll on our roads.

During this project these databases were cleaned of errors using MS Excel and MS Access and also linkages were created between all three databases defined earlier. The analysis of the master database was done using SPSS software. Different statistics were used for the analysis. These include unadjusted factors such as the number of reported accidents and fatalities and cross tabulations. Analysis was also done with respect to the type of vehicle, operational fleet and vehicle kms. The estimated operational fleet as well as the estimated kms operated has been obtained from the *TransPlan* database at the University of Moratuwa.

For the purpose of this study detailed analysis were done using the statistics available in the above mentioned databases for year 2001 and 2002. According to the police records a total of 88,123 vehicles/drivers were involved in 52,094 road accidents reported in 2001 while a total of 92,610 vehicles/drivers were involved in 54,911 road accidents reported in 2002. Of this 2,891 vehicles/drivers were involved in 1,999 fatal accidents and of 2,967 vehicles/drivers were involved in 2,024 fatal accidents in year 2001 and 2002 respectively. The number of vehicles involved in 'Grievous' and Non-grievous" accidents in year 2002 was 5,145 and 19,246 respectively. The balance of 65,252 vehicles has been involved in 'Damage only' accidents.

The main objective of this paper is to find out the most vulnerable and accident prone vehicle types and the relevant drivers that are involved in road accidents in terms of absolute numbers, faulty rates by vehicles types and fatality rate of usage etc.

RESULTS

Involvement by Vehicle Type

Table 2 demonstrates the absolute number of vehicles involved in road accidents by type of accident. The common belief in our country is that the private buses are the most dangerous

vehicle type on the road today. Contrary to this popular belief, it is the light vehicle that is most frequently involved in accidents. The car is in second place, with the bus in third place.

Vehicle Type	Fatal		Injury		Damage Only		Total	
	#	Rank	#	Rank	#	Rank	#	Rank
Motor Cycle	**600**	**1**	**6,104**	**1**	2,815	6	9,519	5
Bus	**498**	**2**	**3,103**	**3**	9,475	4	**13,076**	**3**
Light Vehicle	**485**	**3**	**4,003**	**2**	18,968	1	**23,456**	**1**
Lorry	454	4	2,723	6	10,087	3	13,264	4
Bicycle	364	5	2,798	5	353	8	3,515	7
3 Wheeler	189	6	2,970	4	4,201	5	7,360	6
Car	176	7	2,002	7	17,349	2	**19,527**	**2**
Other Vehicles	116	8	342	9	1,654	7	2,112	8
Land Vehicle	85	9	346	8	350	9	781	9
	2,967		24,391		65,252		92,610	

Table 2. No. of Vehicles involved in Accidents (2002)

However, in terms of injury and fatal accidents these ranking change significantly. This is shown in Table 2. It can be seen that the motor cycle is the most frequently involved vehicle in fatal accidents accounting for 20%. The second highest vehicle type involved in fatal road accidents is the light vehicle accounting for 16%. The lorry accounts for 15% of fatal accidents.

Although it is believed that the private buses are the most frequently involved vehicle type, the contribution to fatal accidents is only 14% and it is in fourth place. According to this analysis it was found that non motorized vehicles such as bicycles are also highly contributed in fatal road accidents. Its contribution was around 12% of fatal accidents.

Other vehicles such as three wheelers, cars, SLCTB buses, land vehicles and other vehicles (such as vehicles of the armed forces, carts and unidentified vehicles etc.) have a much lower involvement as illustrated in Table 2.

Faulty Rate of Drivers by Vehicle Type on Road Crashes

It is revealed that the Police have determined that 49,985 drivers were at fault in the 54,911 road accidents reported in 2002. Out of this, 2,041 drivers were reported at fault for causing 2,038 fatal accidents. As shown in Table 3, drivers of four vehicle categories are associated with causing over 73% of the fatal accidents. These are drivers of light vehicles (mostly vans) – 403 fatal accidents, lorry drivers – 372 fatal accidents, motor cycle riders – 371 fatal accidents and private buses – 343 fatal accidents.

Another interesting analysis is shown in Table 3. This shows that of the 150 car drivers involved in fatal accidents in 2001, 128 were found to be at fault. Therefore, the faulty rate of car drivers involved in fatal accidents was 85% in year 2001. Likewise, the faulty rates for each vehicle type have been calculated for year 2001 and 2002 and shown in Table 3. Accordingly, it was found that armed forces drivers (92%), car drivers (85%), light vehicle drivers (85%), private bus drivers (82%) and lorry drivers (81%) were the most frequently found at fault in fatal accidents in year 2001.

However, when analyzed the 2002 data, this order changes with private bus drivers (84%) having advanced to top spot followed by light vehicle drivers (83%), lorry drivers (82%), car drivers (79%), land vehicle drivers (79%), armed forces vehicle drivers (79%) and SLCTB bus drivers (78%) respectively.

Even though it was found earlier that the vehicle most involved in fatal accidents was the motor cycle, (e.g. 571 in year 2001 and 600 in year 2002), the number of riders at fault for these accidents was 362 and 371 respectively. Hence the faulty rate is much lower when compared to the other larger vehicles mentioned above. Furthermore, earlier it was shown that the buses are in the fourth place when consider the absolute numbers. However, when the faulty rate was calculated it was found that the buses are in top of the list. This can be further illustrated for other larger vehicles such as lorries and light vehicles. That is to say that the larger vehicles appear to be more at fault than the smaller vehicles. This is also confirmed further when considering bicycle riders. As shown in the Table 3, the number of bicycles involved in fatal accidents was very high (e.g. 357) but only 78 bicycle riders were at fault and therefore the faulty rate of bicycle riders is the lowest at 22%. Therefore, it can be concluded that most bicycle accidents have occurred due to the fault of other drivers of the other motorized vehicles and not due to the fault of bicycle riders.

Vehicle Type	2002			2001		
	No of Vehicles involved in Fatal Accidents		Faulty Rate for Fatal Accidents	No of Vehicles involved in Fatal Accidents		Faulty Rate for Fatal Accidents
	Total	Faulty Drivers/ Rider		Total	Faulty Drivers/ Rider	
Bicycle	364	87	24%	357	78	22%
Motor Cycle	600	371	62%	571	362	63%
3 Wheeler	189	126	67%	159	106	67%
Car	176	139	79%	150	128	85%
Light Vehicle	485	403	83%	472	400	85%
Land Vehicle	85	67	79%	59	44	75%
Forces Vehicle	19	15	79%	26	24	92%
Private Bus	415	349	84%	410	338	82%
SLCTB Bus	83	65	78%	91	65	71%
Lorry	454	372	82%	482	391	81%
Other Vehicles	97	47	48%	113	70	62%
	2,967	**2,041**	**69%**	**2,891**	**2,006**	**69%**

Table 3. Faulty Rate for Fatal Accidents by Vehicle Type

Fatality Rate of the Drivers on Road Crashes

So far we consider only the absolute number of road accidents to compare the risks. However, it is not appropriate to make conclusions on these absolute numbers since does not show the actual picture of road safety in a country. .

In regard to measures of risk, we should find a suitable measure of exposure. The following traffic risks measures are used in this study:

- number of vehicles involved in fatal accidents per million registered motor vehicles/year
- number of vehicles involved in fatal accidents per million passenger kilometers/year
- number of vehicles involved in fatal accidents per million vehicle kilometers/year

The ***Traffic Risk*** gives an indication of how dangerous the road traffic (each motor vehicle) is in a country or a region. Therefore, it is more appropriate when examining the vehicle involvement in accidents to consider the distance travelled by these vehicles and the number of vehicles in each category in operation rather than just the number of vehicles involved in accidents, for a given year. For example, even though it was established earlier that there are more car drivers at fault than private bus drivers, it could be argued that there are far more cars than private buses. On the other hand, even if one assumes that there are approximately the same numbers of cars and buses, the fact that a bus on average travels far more than a car over a given year, makes it more exposed to accidents. Hence, the vehicle kms travelled by each vehicle type, passenger kms travelled by each vehicle type and the operational fleet is a better measure of exposure to accidents.

As shown in Figure 2 and Table 4, the fatality rate was calculated for each vehicle type per million vehicle kms, per million passenger kms and per thousand vehicle population. The estimated operational fleet as well as the estimated kms operated has been obtained from the TransPlan database at the University of Moratuwa.

It is shown that when fatalities are adjusted for the operational fleet and vehicle kms driven, the ranking of the most dangerous drivers change drastically. It is headed by the bus driver, followed at quite a distance by lorry drivers and light vehicle drivers. Three wheeler drivers follow in a close fourth place. All other drivers are approximately in equal place.

This analysis clearly positions private bus drivers as being the most lethal drivers on our roads today. It gives a strong reason to change the manner in which the industry is managed especially the extremely competitive nature of the industry and poor standards with respect to drivers, their conduct and the vehicle itself. It also identifies the need for greater enforcement and training and testing of these drivers

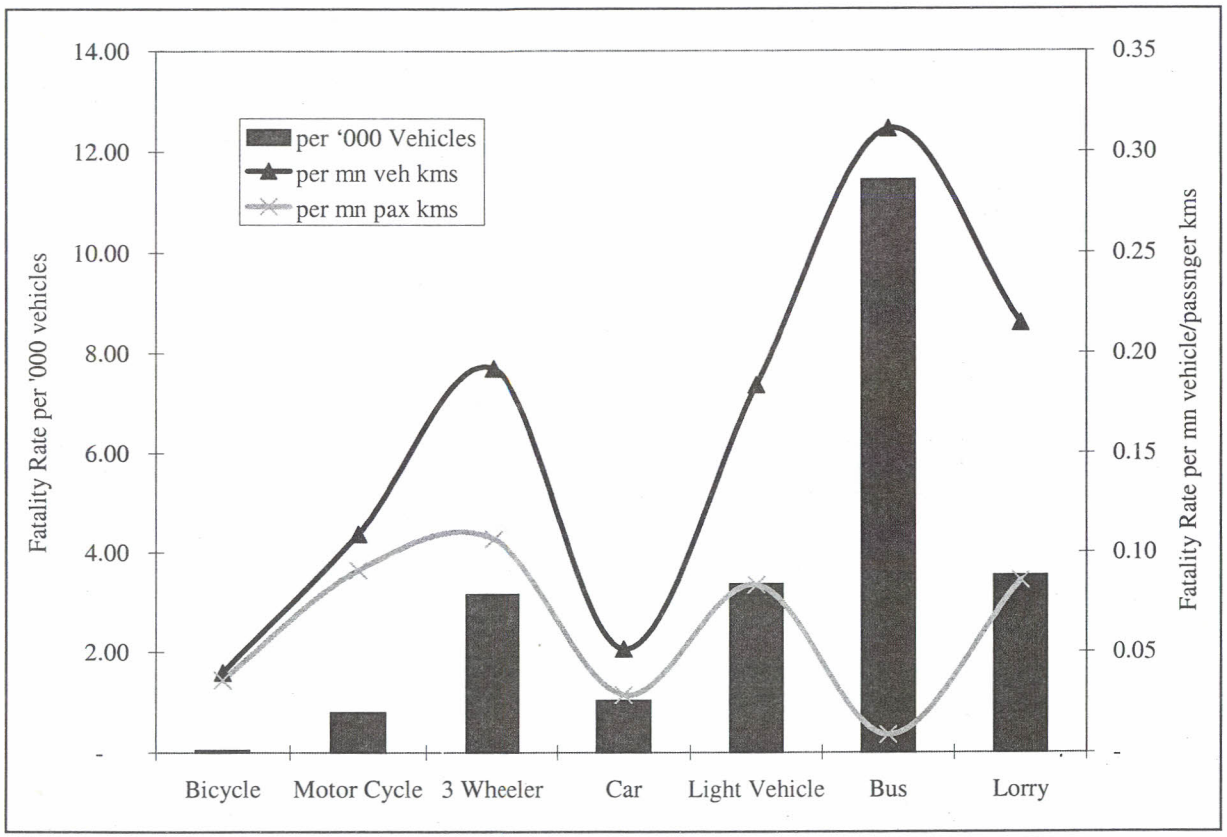

Figure 1. Fatality Rate by Faulty Drivers by Vehicle Type (2002)

Vehicle Type	# of Drivers involved in FA		Pax. Kms (mn) (5)	Vehicle kms (mn)	No. of Vehicles	Fatality Rate		
	All	@ Fault				per mn pax kms	per mn veh. Kms	per '000 vehs
Bicycle	364	87	2,409	2,190	2,000,000	0.04	0.04	0.04
Motor Cycle	600	371	4,073	3,394	464,910	**0.09**	0.11	0.80
3 Wheeler	189	126	1,179	655	39,868	**0.11**	**0.19**	3.16
Car	176	139	4,851	2,695	134,234	0.03	0.05	1.04
Light Vehicle	485	403	4,815	2,188	119,917	0.08	0.18	**3.36**
Bus	498	414	46,90	1,330	36,174	0.01	**0.31**	**11.44**
Lorry	454	372	4,323	1,729	105,276	**0.09**	**0.22**	**3.53**
Other Vehicles[1]	201	129	389	241	59,159	0.33	0.54	2.18
	2,967	2,041	68,93	14,421	2,959,538	0.03	0.14	0.69

Table 4. Fatality Rate by Faulty Drivers by Vehicle Type (4) (2002)

[1] Service vehicles, land vehicles and other private coaches

CONCLUSIONS

Contrary to common belief, light vehicles and cars are among the vehicles that are recorded as being the most involved in road accidents. However, the private buses are by far the most dangerous and most lethal vehicles on our roads in terms of the severity of accidents.

In 2002, private buses were involved in 413 fatal accidents out of which the drivers of those buses were held responsible in 349 instances. These accidents resulted in over 14% of all deaths. Most vulnerable are the pedestrians and cyclists. Thus the bus is the most dangerous vehicle for non-motorized road users. Targeted enforcement programs and educational programs are urgently needed to arrest this situation.

On the other hand, the motor cycle is found to be the most dangerous vehicle to use. There have been 339 fatal accidents involving the riders themselves. Thus emphasis on the use of safety equipment such as the use of the safety helmet and other general safety measures should be directed at this group of road users who are most vulnerable to serious accidents

It is shown that when fatalities are adjusted for the operational fleet and vehicle kms driven, it was found that the bus drivers are the most dangerous drivers. It is followed at quite a distance by lorry drivers and light vehicle drivers. Three wheeler drivers follow in a close fourth place. All other drivers are approximately in equal place.

REFERENCES

1. TRANSPORTATION ENGINEERING DIVISION, University of Moratuwa, '*Historical Transport Database*', unpublished database 2005
2. KUMARAGE AMAL *'Safety in Mobility: The Sri Lankan Record'*, National Transport Day, February 1992, Colombo
3. GORAN TEGNER, An Analysis of Urban Road Traffic Safety in the city of Stockholm – The use of aggregate time-series models with the TRIO programme, Solna, Sweden, 11th International Conference: TRAFFIC SAFETY OF THREE CONTINENTS, 10-11 September 2000, CSIR Conference Centre, Pretoria, South Africa
4. KUMARAGE, WICKREMASINGHE, JAYARATNE, "*Statistical Analysis Road Accidents in Sri Lanka 2001 and 2002*", October 2003.
5. TRANSPORTATION ENGINEERING DIVISION, University of Moratuwa, '*TransPlan* Database', unpublished database, 2005.