GLOBAL
ROAD SAFETY
PARTNERSHIP

Estimating global road fatalities

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INTRODUCTION

Global Road Safety Partnership

The problem of deaths and injury as a result of road accidents is now acknowledged to be a global phenomenon with authorities in virtually all countries concerned about the growth in the number of people killed and seriously injured on their roads. In recent years there have been two major studies of causes of death worldwide, published in the 'Global Burden of Disease' (1996, World Health Organization (WHO), World Bank and Harvard University) and in the 'World Health Report - Making a Difference' (WHO 1999).

These publications show that in 1990 road accidents as a cause of death or disability were in ninth place out of a total of over 100 identified causes. However, by 2020 forecasts suggest that as a cause of death, road accidents will move up to sixth and in terms of years of life lost (YLL) and 'disability-adjusted life years' (DALYs)[1] will be in second and third respectively.

This growing awareness is reflected in the recent establishment of the Global Road Safety Partnership (GRSP) by the World Bank, the International Federation of Red Cross and Red Crescent Societies, bilateral aid agencies and other interested parties under the framework of the World Bank's Business Partners for Development (BPD) Programme. GRSP focuses specifically on developing and transitional countries.

A steering committee for GRSP is now in place with the aim of creating a global information network that aims to produce solid evidence of the

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[1] DALYs express years of life lost to premature death and also years lived with a disability, adjusted for the severity of the disability.

positive impact of partnerships – both the development impact and the business benefits. Two important aspects of GRSP are the involvement of the private sector in funding road safety projects and the promotion of greater awareness of road safety worldwide.

With the setting up of GRSP it was considered important that a comprehensive summary of the global situation was made available. For example, using published statistics from countries throughout the world, TRL (Transport Research Laboratory) has in the past attempted to identify the number of people killed in road accidents globally and also on a regional basis. The last attempt to do this however used 1990 data (Ghee et al 1996).

Since that time, more research has been done on the under-reporting of accidents (including fatals) and a better estimate of the global situation can be obtained. Using different statistics, the World Health Organization (WHO) investigated deaths from many causes in the two studies above. Differences exist in these early estimates provided by TRL and WHO, and the GRSP Steering Committee proposed that a review should be undertaken to resolve these differences and identify the current situation as accurately as possible. It was agreed that the World Bank, the Department for International Development UK (DFID) and TRL would co-fund a study which would be restricted to the analysis of published material.

The study was carried out by TRL with the following objectives, to:

- derive an estimate of road accident fatalities worldwide and on a regional basis for 1999 and to derive forecasts of the likely number of deaths in the years 2010 and 2020;
- provide an estimate of accident costs worldwide (based on accident costs as a percentage of Gross National Product (GNP)); and
- obtain regional analyses of fatality trends, rates and risk (deaths per 10,000 vehicles and per 100,000 population respectively) and casualty trends by age, sex and road user type.

The main sources of data used for this study were the International Road Federation (IRF) and the United Nations annual yearbooks, WHO publications, recent regional and country studies, such as the Asian Development Bank (ADB) funded Road Safety in Asia/Pacific, the Inter American Development Bank financed Latin America Study and the EC PHARE Multi-Country Transport Programme.

Road casualty data also came from TRL publications and individual country studies and national statistics published by the UK, USA and others. A full report has been produced for GRSP and is summarised here.

ESTIMATING GLOBAL road fatalities

Previous reviews of global fatalities undertaken by TRL, the World Bank and others have produced a wide range of estimates and whilst the problem of data reliability and under-reporting has been regularly acknowledged, previous forecasts have used officially published statistics based on police reports. Using these values to obtain a more accurate estimate of the current situation required the following to be taken into account:

1. Updating the fatality figures given for the latest year available (usually 1995/96) to 1999.

2. Estimating for those countries where fatality data was not available.

3. Making adjustment for those countries which do not use the definition of a road death occurring when a person dies within 30 days of an accident. This ranges from 'on the spot' to 'within a year of the accident occurring'. Furthermore, many developing countries state that they use the '30-day' definition and may do so at the local level (for prosecution purposes) but at the same time, official statistics are often based on preliminary information which is not always updated.

4. Adjusting official figures to take into account the under reporting of fatal accidents. Figures derived for both developed and developing countries were based on recent research. Rather than use one figure for under-reporting in developing countries, upper and lower adjustment factors were calculated.

There is no standard approach to regional groupings used by the many different international organisations concerned with road safety. However, to aid interpretation of data, a total of 192 countries were assigned to six major regional groups as follows:

- Africa.
- Asia/Pacific.
- Central and Eastern Europe (CEE).
- Latin/Central America and the Caribbean (LAC).
- Middle East and North Africa (MENA).
- Highly motorized countries (HMC), i.e. North America, Australia, New Zealand, Japan and Western Europe.

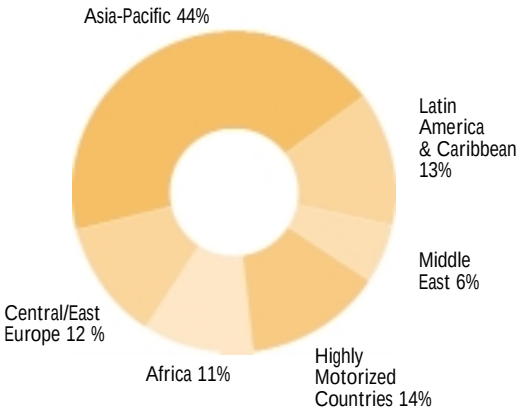
Less motorized countries (LMC) is the collective term used to describe the first five regions where motorization is typically much lower than in the industrialized HMCs.

Current estimates

Based on the factors described above, a realistic estimate of global road deaths is between 750,000 and 880,000 for 1999. The calculations and regional totals are presented in Figure 1 and Table 1.

Figure 1

Estimated road fatality regional distribution (1999)



It should be noted that these estimates are less than those derived by WHO in the studies mentioned. However, WHO estimates were based on forecasts from

Table 1

1999 Estimated road fatalities with under-reporting (UR) adjustments

		30 days fatality		Low UR estimates		Upper UR estimates	
	1999 Estimate	Adjustment Factor	Estimate	Adjustment Factor	Estimate	Adjustment Factor	Estimate
HMC	98,834	ECMT*	105,654	1,02	107,767	1,05	110,937
Africa	58,319	1,15	67,067	1,25	83,834	1,50	100,600
Central/Eastern Europe	63,540	1,15	73,071	1,25	91,339	1,50	109,607
Asia-Pacific	228,405	1,15	262,666	1,25	328,332	1,50	393,999
LAC	64,699	1,15	74,404	1,25	93,005	1,50	111,606
MENA	28,864	1,15	33,194	1,25	41,492	1,50	49,790
Global	**542,661**		**616,056**		**745,769**		**876,539**

**** ECMT** standard adjustment factors applied.*

1990 data which in turn came from a variety of sources. The WHO forecast was that in 1998 there would be 1.17 million deaths worldwide. A lack of detailed information on WHO data sources, forecasting techniques etc. made detailed comparisons difficult.

Results from a number of countries show wide variation between official (i.e. police) statistics and information from other sources. For example, in the Philippines only one out of five medically reported road deaths are included in police statistics (WHO, 1996). In Indonesia, insurance companies report almost 40 per cent more deaths than the police. The Department of Health in Taiwan reported in 1995 some 130 per cent more deaths than the police (Lu, 1999). In Karachi a recent study comparing road casualties reported by the police with ambulance statistics showed only about half of road accident deaths were reported by the police (Razzak, 1998). Under-reporting also appears to be high in China which already has the world's highest reported number of road deaths.

Thus the Beijing Research Institute of Traffic Engineering estimated that the actual number of people killed in road accidents in 1994 was about 111,000, over 40 per cent greater that the 78,000 reported officially by the police (Liren, 1996). Using results from a number of studies indicated that in developed countries under-reporting of fatalities was minimal (between 2-5 per cent), (James 1991, and Simpson, 1997) whilst in developing countries upper and lower adjustment factors were accepted as 25 to 50 per cent increases of those numbers reported by the police (Sayer, 1984).

It can be seen that the burden of global road fatalities is on the LMCs where 86 per cent of the world's road fatalities occur, with almost half of all fatalities in Asia. Figure 1 shows the regional distribution of 750,000 fatalities, the low end of the range suggested for 1999.

Global injuries

Whilst the under-reporting of injuries is known to be even worse than with fatalities, a minimum estimate within a likely range has

been derived. Based on the International Road Traffic and Accident Databases (IRTAD) report and earlier studies that had estimated approximately 50 per cent of road injuries were reported, it was decided that a ratio of 100 injuries for every fatality would apply in the HMCs. For LMCs, a ratio of between 20 to 30 was taken to be a minimum estimate. These values produce annual road accident injury estimates for 1999 of at least:

- 11 million in HMCs;
- 12 to 23 million in LMCs;
- global estimate of between 23 and 34 million road accident injuries per annum.

This range is approximately twice the global road injury estimates currently being suggested. An estimate of the number or per cent of injuries that are disabling was beyond the scope of this review.

Fatality forecasts

Forecasting future deaths worldwide is fraught with difficulties. For example, past trends may be thought to give a reasonable picture of what may happen. However, some countries, such as Japan, experienced rapid deterioration in road safety in the 1960s with an 80 per cent growth in road fatalities but then, with massive investment, reduced deaths by almost 50 per cent over the next decade. However deaths started to increase once again in the early 1980s due in part to a continued increase in vehicle ownership but also because of a slowing down of investment in life-saving activities.

Additionally, trends in many parts of the world are not consistent and there is evidence (see later) that rapid increases of deaths in Africa and Asia/Pacific show signs of slowing down (that said, growth rates in Africa and Asia are still high and of concern). Social and political changes also play a part and ideally would be taken into account in any forecasting. However, changes are difficult to predict. For example, in the CEE region, road accident reporting methodology was changed with the transition to market economies. While the trend in this region over recent years has been one of fewer fatalities, it is possible that with economic development and rapid motorization there is potential for growth in the number of accidents and fatalities.

Forecasting trends should be approached with caution for the reasons outlined above. With these caveats in mind, we suggest that for 2010 the likely range of global road deaths will be between 900,000 and 1.1 million and between 1 million and 1.3 million in 2020.

ECONOMIC COSTS

Apart from the humanitarian aspect of reducing road deaths and injuries in developing countries, a strong case can be made for reducing road accident deaths on economic grounds alone, as they consume massive financial resources that the countries can ill afford to lose. That said, it must of course be borne in mind that in developing and emerging nations, road safety is but one of many problems demanding funding and other resources. Even within the boundaries of the transport and highway sector, hard decisions have to be taken on the resources that a country can devote to road safety. To assist in this decision-making process it is essential that a method be devised to determine the cost of road accidents and the value of preventing them.

The first need for cost figures is at the level of national resource planning to ensure that road safety is ranked equitably in terms of investment in its improvement. Fairly broad estimates are usually sufficient for this purpose, but must be compatible with competing sectors.

A second need for road accident cost figures is to ensure that the best use is made of any investment and that the best (and most appropriate) safety improvements are introduced in terms of the benefits that they will generate in relation to the cost of their implementation. Failure to associate specific costs with road accidents will almost certainly result in the use of widely varying criteria in the choice of measures and the assessment of projects that affect road safety.

As a consequence it is extremely unlikely that the pattern of expenditure on road safety will in any sense be 'optimal' in terms of equity. In particular, if safety benefits are ignored in transport planning then there will inevitably be associated under-investment in road safety.

A study conducted almost a quarter of a century ago (Fouracre and Jacobs, 1977) estimated road accidents to cost on average 1 per cent of a country's gross national product (GNP). This figure has been used by many countries and international aid agencies to estimate (albeit crudely) the scale of costs incurred by road accidents but as countries have developed, a higher range, 1 to 3 per cent, has been suggested by the World Bank and others (but it should be stressed, with limited supporting evidence) for road accident costs.

Expressing accident costs as a percentage of GNP provides an albeit crude but useful approach to costing accidents, particularly on a global or regional basis. That said, there is no real substitute in individual countries to carrying out a detailed appraisal of national accident costs.

Results of accident costing procedures

Information was obtained of 21 studies worldwide which had attempted to cost road accidents. (One in Latin America, seven studies in Asia, four in Africa, one in the Middle East and eight in developed countries). An analysis of these studies showed all developing countries using the 'Human Capital' approach whilst the majority of developed countries used the 'Willingness to Pay' approach. (For a critique on costing road accidents, the reader is referred to TRL Overseas Road Note 10, 1995). Values derived of national accident costs (usually for the year 1995 or 1996) were expressed as a percentage of GNP for the different countries and results ranged from 0.3 per cent in Vietnam and 0.5 per cent in Nepal and Bangladesh to almost 5 per cent in USA, Malawi and Kwa Zulu, Natal. It should be noted that in this analysis the costs determined by the different countries have been used directly and not amended in any way. However, relatively little is known about the accuracy of the costing procedures used in each country. For example, whether or not under-reporting of accidents has been taken into account, how damage-only accidents have been assessed, what sums (if any) have been added to reflect pain, grief and suffering if the Human Capital approach has been used etc. Overall it does appear that in most countries, costs exceed 1 per cent of GNP which may now be considered to be an under-estimate of national accident costs. However, the figures also indicate that costs as a percentage of GNP may be lower in less developed countries and therefore caution should be exercised in moving from 1 per cent of GNP to a much higher level for developing countries.

The following table 2 provides a crude estimate of global and regional costs assuming that the annual cost of road accidents is about 1 per cent in developing countries, 1.5 per cent in transitional countries, and 2 per cent in highly motorized countries.

Table 2 implies that road accident costs may be US$65 billion in developing and transitional countries, and US$453 billion in highly motorized countries, making a crude estimated total of US$518 billion worldwide.

Table 2

Road accident costs by region (US$billion) 1997

	Estimated annual accident costs		
Region	Regional GNP	Percent GNP	Cost
Africa	370	1,0	3,7
Asia	2454	1,0	24,5
Latin America/Caribbean	1890	1,0	18,9
Middle East	495	1,5	7,4
Central & Eastern Europe	659	1,5	9,9
Highly motorized countries	22,665	2,0	453
Total			**518.0**

REGIONAL ANALYSES

The full report provides a detailed summary of the road safety situation in individual regions. However, the differences within the regions are often as wide as those between them. The regional summary was presented in three parts, starting with the current situation and basic safety and motorization indicators for the ten countries with the largest number of road fatalities. A review of the change in the last decade in motorization, fatalities and population followed with sub-regions and information on the largest country presented separately. Lastly, information on the type of road accident casualties, including road user type, age and gender distribution, was presented.

Several indicators were used as no single indicator accurately describes the traffic safety situation in a country. The most common method used in motorized countries is the number of injury accidents per million vehicle kilometres per annum (which clearly relates accidents taking place to a measure of exposure to traffic) but few developing countries have vehicle usage data. Instead, the number of reported fatalities per 10,000 motor vehicles has been used by TRL and others to compare traffic safety records between countries. Yet fatality rates might be considered to be of less importance to a specific country than the actual number of deaths. Fatality risk, the number of reported fatalities per 100,000 population, is the most common indicator used by the health sector to prioritize diseases and other causes of death. In this section therefore both fatality rates and risks are presented.

Results

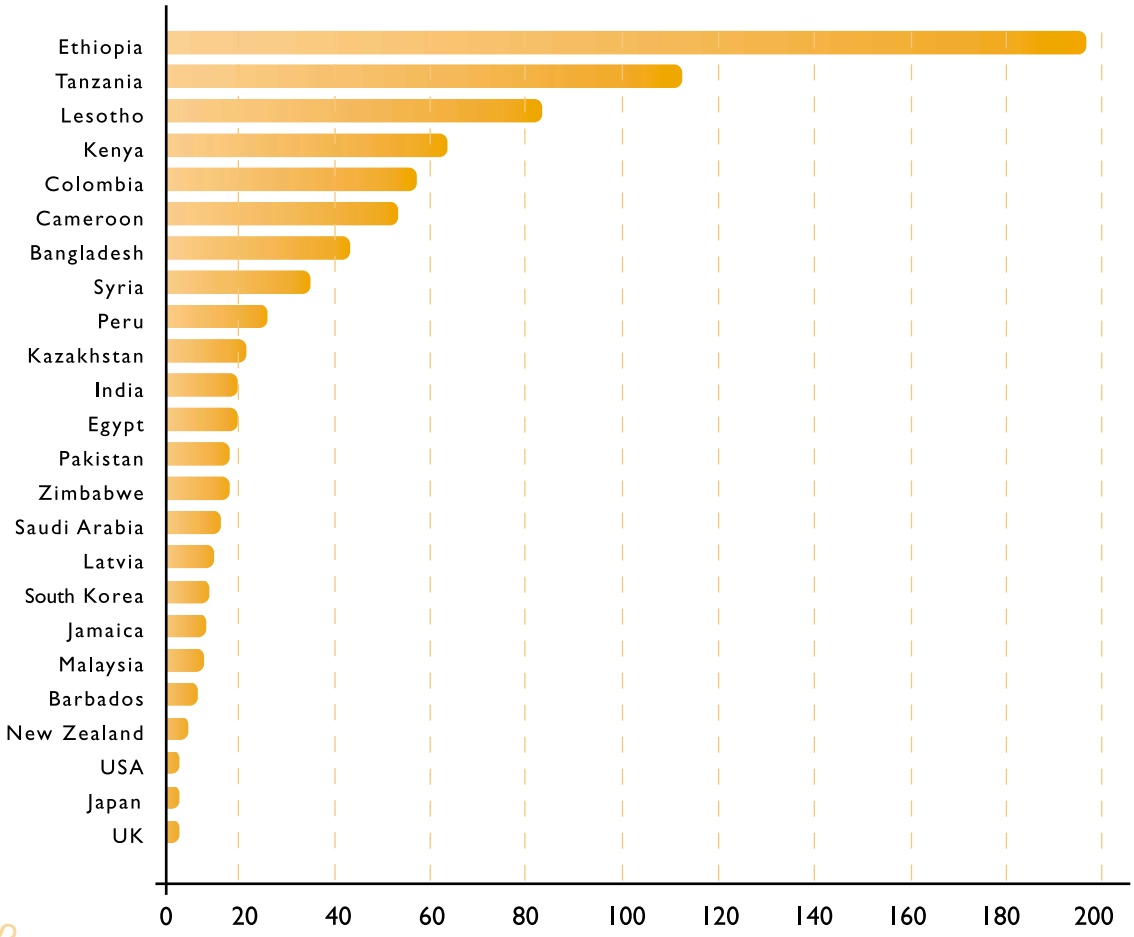
A brief summary of findings is presented below attempting to highlight the road safety situation within the various regions. It shows that fatality rates (i.e. death per 10,000 vehicles) were lowest in developed countries (in the range 1.1 to 5.0) whilst the highest (frequently in excess of 100) were found in Africa particularly Ethiopia, Lesotho and Tanzania (see Figure 2). Fatality risk (i.e. deaths per 100,000 population) was highest in a disparate group of countries including Malaysia, South Korea, Latvia, Saudi Arabia and Colombia, (see Figure 3). In most of these analyses, as might be expected, values in Central and Eastern European countries lay closer to those of Western Europe, than to Africa, Asia or Latin America.

Table 3 shows an interesting comparison of the global distribution of road accident deaths and licensed vehicles by region. Thus highly motorized countries with 60 per cent of global vehicles have only 14 per cent of global deaths. Conversely Asia/Pacific with only 16 per cent of vehicles has about 44 per cent of global deaths. Central and Eastern Europe, Africa and the Middle East show a similar pattern. Latin America/Caribbean is the only region of the developing world where the global distribution of road deaths and vehicles match.

One of the most important differences between developed and developing regions is that over the last ten years or so the number of deaths fell by about 10 per cent

Figure 2

Fatalities/10,000 licensed motor vehicles in selected countries 1996 or latest year available



in Western Europe and North America, whilst in the Africa, Asia/Pacific and Latin America regions road deaths continued to rise. Figures 4a to 4f show trends in road deaths, population and motor vehicles in different regions. In comparing trends in a relatively small group of countries the changes in the major country can dominate and trends in USA, China, South Africa, Poland, Brazil and Saudi Arabia are shown separately. Most noticeably, fatality trends in South Africa and Poland differ from other African and East European countries respectively. Whereas in the other regions trends in the major and other countries tend to show a reasonably similar pattern. Thus over the period 1987-95 deaths in the Asia-Pacific region rose by 39 per cent, in Africa by 26 per cent (excluding South Africa) and in the MENA region by over 36 per cent and in the Latin America/Caribbean region by over 100 per cent (excluding Brazil).

In Central and Eastern Europe there was a marked difference between Poland where deaths increased by 31 per cent and other countries where deaths fell. In Africa and Asia there is now evidence that the rapid increase in road deaths throughout the 1970s and early 1980s is now slowing down but nevertheless the problem still causes concern in these regions.

As might be expected, the majority of people killed in the West are car drivers and passengers but with about 15 to 20 per cent being pedestrians. In Asian countries, a wide variation was

found with, for example, almost 70 per cent of those killed being pedestrians in Hong Kong compared to 50 per cent in South Korea. In China, Malaysia and Thailand, pedestrian deaths were surprisingly low at around 10-15 per cent of the total. Conversely in Singapore, Taiwan (China) and Malaysia over 50 per cent of deaths were motorcyclists. When deaths involving pedestrians, non-motorized vehicles and motorcycles are combined in Asian countries to form the overall category 'Vulnerable Road Users' (VRUs), they represent a significant proportion of all people killed. For example in Hong Kong, Singapore, Malaysia and Taiwan, VRUs form 80-89 per cent of all fatalities and in Fiji and South Korea about 50 per cent (ADB, 1997).

In African countries (Gorell, 1997), pedestrians were again one of the main classes of road users involved in fatal accidents. Pedestrian deaths also featured strongly in Middle Eastern countries (usually over 30 per cent). An analysis of deaths by gender showed wide variation between countries (even within regions). The overall tendency however was for females to be more involved in non-fatal accidents than in fatal. This probably indicates

Figure 3

Fatalities/100,000 population in selected countries 1996 or latest year available

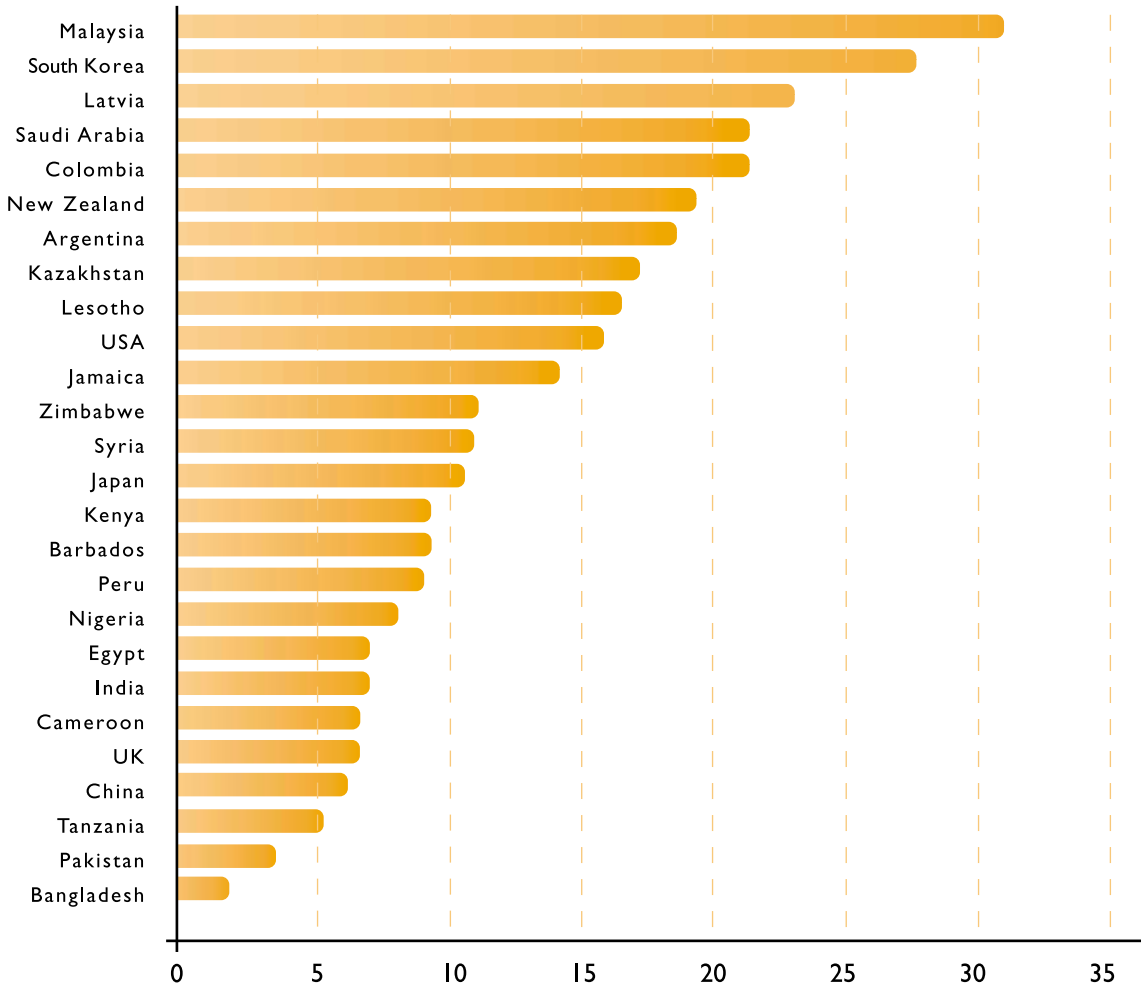


Table 3

Current distribution of global deaths and licensed vehicles

Region	Global percentage of Road fatalities	Vehicles	Population
Highly motorized countries	14	60	15
Asia/Pacific	44	16	55
Central/Eastern Europe	12	6	7
Latin America/Caribbean	13	14	8
Africa	11	2	11
Middle East/North Africa	6	2	4
Total	**100**	**100**	**100**

the fact that females tend to be injured in urban accidents at lower speeds. The overall tendency was for there to be proportionately more females involved in both fatal and non-fatal accidents in the higher income countries.

An analysis of casualties and fatalities by age showed that young people are involved in proportionately more accidents in Africa, Asia and the Middle East than in the West. In general, the data from all regions indicated that road accidents involving the economically active in the age group 25-40 dominate.

Recent trends

Figure 4a

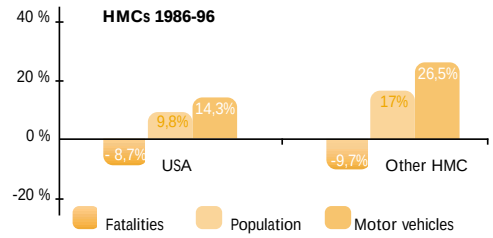


Figure 4b

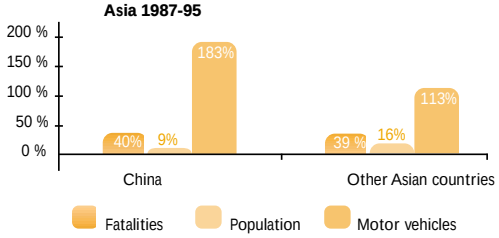


Figure 4c

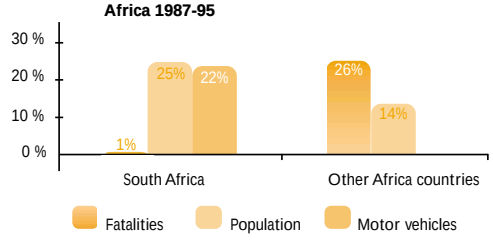


Figure 4d

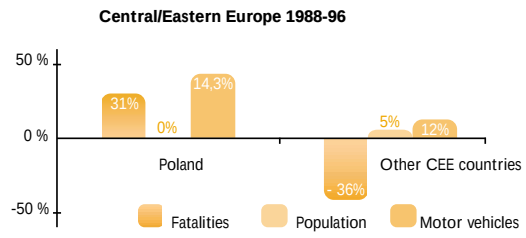


Figure 4e

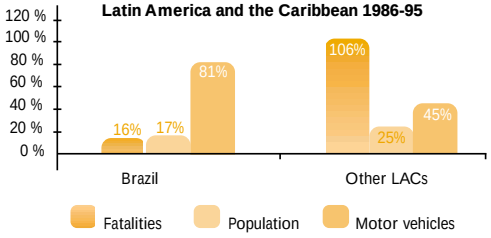
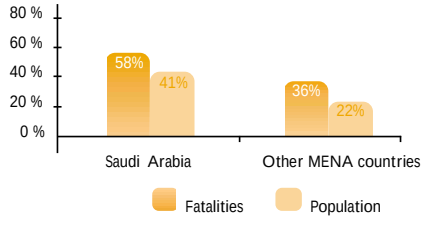


Figure 4f



REGIONAL ANALYSES

SUMMARY

The GRSP was launched in order to 'reduce the number of deaths, injuries and disabilities and associated social costs of road crashes through partnerships which promote collaboration and coordination of road safety activities among GRSP participants'. The World Bank, DFID (UK) and TRL agreed jointly to fund a study in order to assist the GRSP to define the magnitude of the road safety problem, particularly in developing countries.

Global and regional rates and trends

- Using published data as a base, the study estimates that in 1999 between 750,000 and 880,000 people may have died as a result of road accidents and that the majority of these deaths occurred in developing and emerging nations, with approximately half in the Asia-Pacific region.
- Road fatalities are expected to continue to increase with a fatality toll estimated between 900,000 and 1.1 million by 2010 and between 1.1 and 1.3 million by 2020.
- Crude estimates were derived of accident costs. The global cost in 1998 is estimated to be US$520 billion and of this US$65 billion was borne by developing regions.
- Trend data showed that the total number of people killed in road accidents in the developing world continues to increase, whereas in the West there has been a steady decrease since the late 1960s. However, evidence exists that the rate of increase of deaths in the developing world is now slowing, particularly in Africa.
- Results also show that the highest fatality rates (deaths per 10,000 motor vehicles) worldwide occur in Africa, particularly Ethiopia, Uganda and Malawi while fatality risk (deaths per 100,000 population) is highest in a disparate group of countries including Thailand, Malaysia, South Africa and Saudi Arabia.
- It should be emphasized that pedestrians are a particularly high risk group throughout Africa and Asia as well as the Middle East. Car occupant casualties dominate in developed countries and are much more common in the Latin America/Caribbean region.

The way forward

This report identifies weaknesses in the quality of existing data, particularly from developing countries and highlights the following areas that could be examined within the GRSP programme so that a greater understanding of the global road accident situation can be obtained:

- better use of injury information from hospital data which could complement that obtained from police records;
- greater priority should be given by the medical community, led by the WHO, to monitoring road accident victims and include road accidents in national hospital surveillance systems;
- accident databases in many developing countries should be improved through greater use of accident reporting and recording systems such as TRL's accident-package MAAP;
- given the widespread evidence that inadequate use is made of even the limited amount of accident information collected in developing countries, more effective dissemination and research is required into the application of accident data; and
- the economic cost of road accidents is also generally not well understood in developing countries and further research is needed on accident costing and its application.

Conclusion

In conclusion, this study has attempted to identify the magnitude and nature of the road safety problem worldwide but particularly in the developing regions of Africa, Asia and Latin America and the Caribbean. Hopefully, the newly-formed GRSP can assist in the reduction of this global toll of death and injury by the mechanism of partnerships between the public and private sectors which promote collaboration and coordination of road safety activities worldwide.

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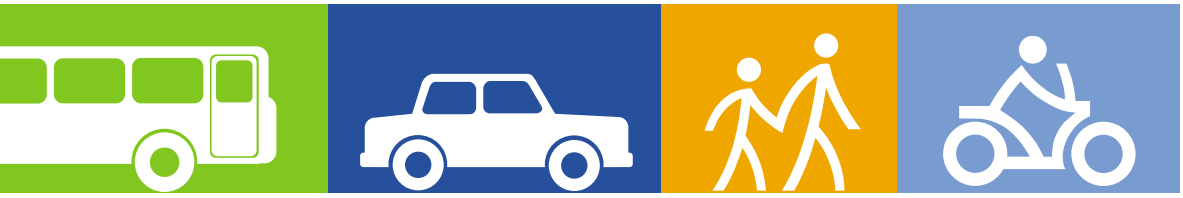
Goff Jacobs has many years experience of road safety research and development, at first in the UK where he did some of the early work on drink/drive legislation, and then working on a wide range of traffic and safety projects in developing countries. For almost twenty years he acted as adviser to the British Overseas Development Administration (now DFID). Goff has been a Visiting Professor at Cranfield University since 1998. Formerly International Programme Director (Traffic and Safety), he now works as an adviser to TRL in international projects.

Amy Aeron-Thomas' background is in public administration and planning, and transportation engineering. Her early interest in road safety began while on an urban transport study in Bangladesh in 1992. She has now worked in over ten countries and helped develop national road safety action plans for Bangladesh, Zambia, Ethiopia, and Vietnam. She is currently completing DFID funded research into the under-reporting of road injuries in developing countries.



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