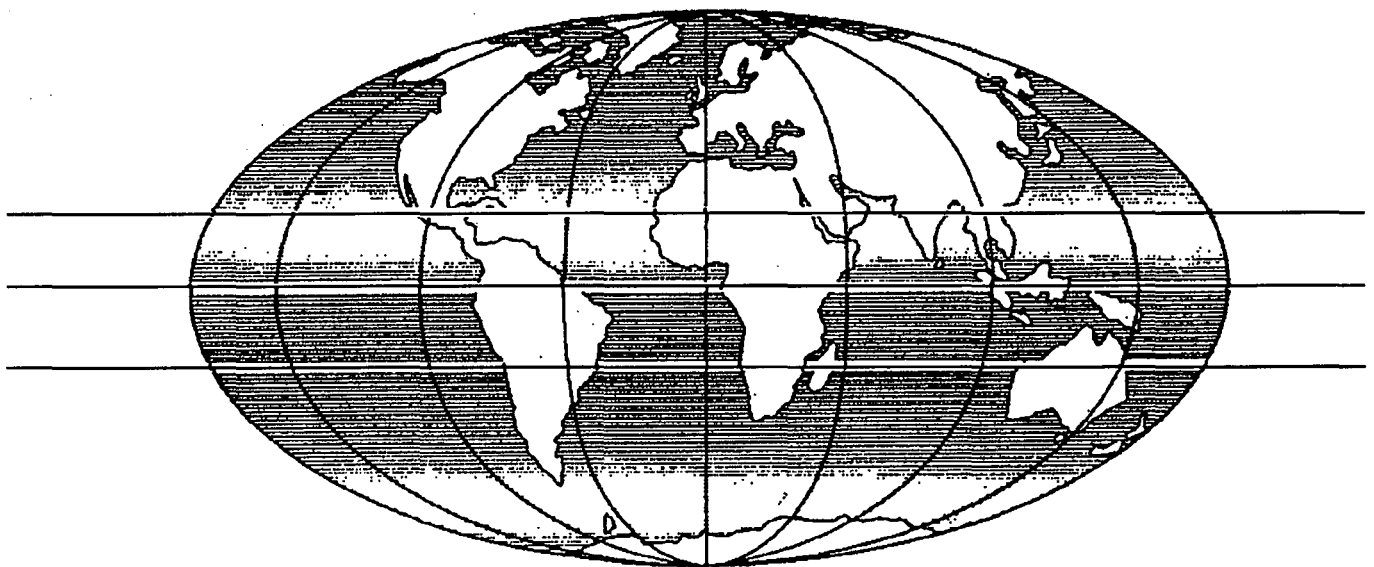




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PEDESTRIAN SAFETY IN DEVELOPING COUNTRIES

by

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1. INTRODUCTION

Road accidents have long been recognised as a major cause of death in industrialised countries and considerable resources have been spent on trying to contain the problem in the face of rapid growths in traffic. Currently, many of these countries place the emphasis on improving the safety of vulnerable groups, particularly pedestrians.

On the other hand, in developing countries concern about road accidents began much more recently and the general seriousness of the problem was first indicated by studies carried out by the Overseas Unit of the Transport and Road Research Laboratory in the 1970's^{1,2,3}. With this late start in road safety and with comparatively few resources, developing countries have, perhaps not surprisingly, lagged behind developed countries in road safety improvements. Delays in taking action have also occurred because reliable information has not been available and because there has been uncertainty about the transferability of developed country solutions to the different conditions found in the Third World. In addition, improvements have tended to be aimed at motorists rather than pedestrians in spite of the evidence of the high involvement rates of pedestrians in accidents⁴.

Since 1972, the Overseas Unit has been working together with developing countries to carry out road safety research with the aim of understanding the road accident problem and finding practical solutions. More recently, the Unit has embarked on a study of pedestrian safety and, although the work is in its infancy particularly with respect to countermeasures, this paper sets out to summarise the information collected on the severity and nature of the pedestrian accident problem and give some directions for improvements in developing countries.

2. PEDESTRIAN ACCIDENTS

2.1 The Magnitude of the Problem

Studies carried out by the Overseas Unit^{1,2,3,5,6,7} have demonstrated that road accidents in the Third World are:

- 1) a major cause of death and injury, for example they account for almost ten per cent of deaths reported in the 5-44 year age group

- 2) a considerable waste of scarce resources with accidents typically costing at least one per cent of countries' GNP per annum
- 3) a serious problem in terms of fatality rates with rates at least an order of magnitude higher than those in industrialised countries.

Because of the lack of relevant exposure data, it is difficult to make valid comparisons between the levels of safety or unsafety of developed and developing countries. Nevertheless, a study of trends in road accident fatalities⁸ showed that between 1970 and 1980, deaths in developing countries more than doubled whereas industrialised countries experienced a slight drop. More recently, between 1980 and 1986, the contrast in trends is still evident (see Fig 1) but there are grounds for optimism as the rate of increase has clearly slowed throughout the Third World; and Asian countries have, on average, shown a slight improvement.

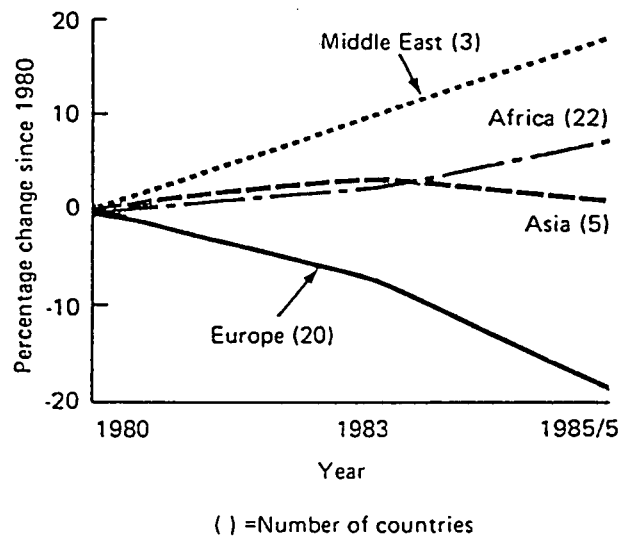


Fig.1 Percentage change in road accident fatalities

Although the trends are somewhat encouraging, there is still considerable cause for concern, particularly for pedestrians as they represent up to 70 per cent of the fatalities in developing countries. Also the pedestrian accident problem would appear to be relatively worse in the Third World as pedestrians in four developing country regions represented more than double the proportion of fatalities found in Europe and the USA (see Fig 2).

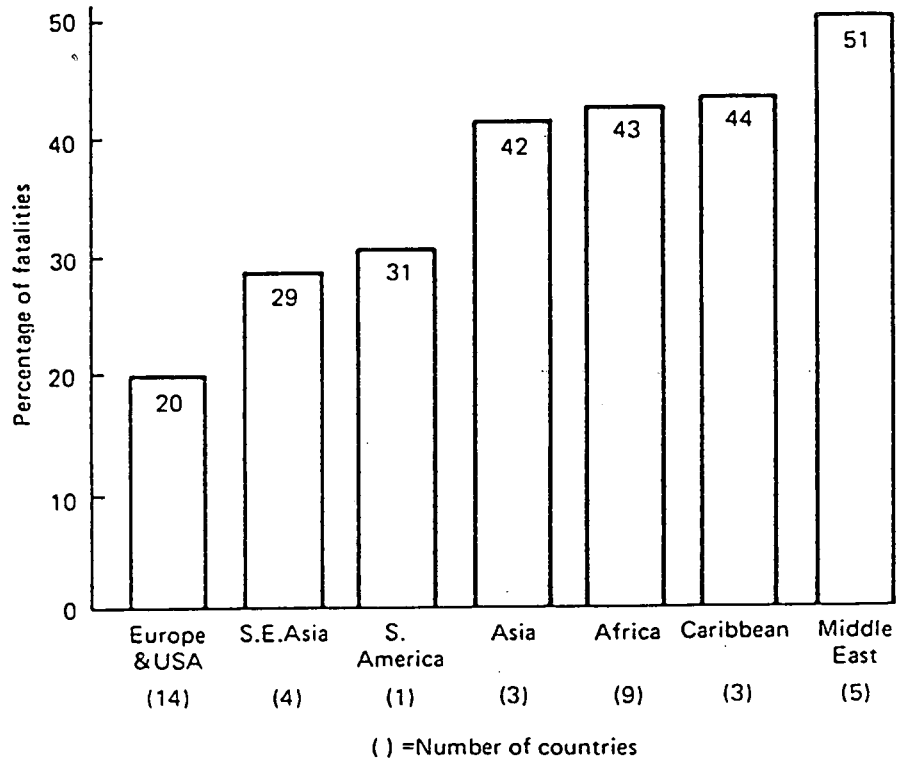


Fig.2 Pedestrian fatalities as a percentage of all road accident fatalities

This high involvement of pedestrians in accidents is in part due to their comparatively large numbers in developing countries and to the high proportion of walking trips made as shown in Table 1. However, there is also some suggestion from a study of urban safety¹⁴ that pedestrians in cities of developing countries are much more at risk at high levels of vehicle flow than they are in developed countries. For example, at 1500 vehicles per hour, the risk rates were 86 and 172 per cent greater in Nairobi and Surabaya respectively, than in urban areas of Great Britain. Therefore it seems that factors other than exposure also contribute to the higher involvement rates of pedestrians in road accidents in developing countries.

TABLE 1

Percentage of trips by different modes

	Motor Vehicle		Walk	Cycle
	Private	Public		
India(3)	14	29	39	18
Malaysia(1)	24	34	32	9
Nigeria(1)	25	45	23	2
Cameroon(2)	29	41	24	1
UK	59	23	18	-
USA	89	2	9	-

() = Number of cities. Sources, see references 9 to 13.

2.2 The Nature of the Problem

Detailed information about the pedestrian accident problem in the Third World is in short supply. However a number of countries have recently improved their databases by adopting the TRRL's Microcomputer Accident Analysis Package (MAAP)¹⁵ and the relevant data from these systems has been incorporated in Table 2 together with data from Delhi. Also, the corresponding UK figures have been included to give some idea of developed country accident patterns.

The seven main characteristics of pedestrian accidents selected for inclusion in the table are by no means exclusive but they highlight some of the key features of developing country pedestrian safety problems and in particular, the last six columns indicate some of the major differences between developed and developing country accidents which will have to be taken into account when planning improvements. The key differences for the developing country sample were as follows.

1. A higher percentage of child fatalities ie excluding Indonesia, the percentage of child fatalities was at least one and a half times higher in the developing countries. This finding does not necessarily mean that children are more at risk in the Third World as the proportion of the population aged under 16 years is approximately double that of developed countries²⁰. Nevertheless, in absolute terms the problem is very serious and child pedestrian accidents clearly needs to be given some priority in improvement programmes.

2. A greater involvement of buses and goods vehicles eg in India the figure was more than three times that of the UK. Although this is not surprising given these vehicles greater share of the traffic, these statistics indicate that some attention needs to be paid to improving vehicle design of buses and goods vehicles in developing countries in order to provide better protection for pedestrians.

TABLE 2
Main characteristics of pedestrian accidents

Country	Percentage of pedestrian fatalities which:							occurred away from junctions
	were male	were crossing the road	were children (under 16)	involved a bus or truck (+ vans and minibuses)	occurred in darkness		occurred in rural areas	
					all roads	unlit roads		
Botswana, 88	67	51	24	27	41	30	63	84
Egypt, 85-86	79	75	26	36	29	10	-	82
India, 79,85 (Delhi)	80* (16)	-	31* (16)	72** (17)	38** (17)	-	80-85 (17)	84 (17)
Indonesia, 89 (Bandung)	72	78	17	40	26	-	-	85
Pakistan, 88 (Karachi)	80	75	27	55	29	15	51 (Sind)(18)	85
Papau New Guinea, 87-88	70	36	39	38	28	16	56	74
Zimbabwe, 88	75	77	25	51	39	24	47	92
UK, 88 (19)	61	79	16	20	43	8	20	46

() - Source, see References. * - 1979, ** - 1985

3. A higher proportion of pedestrians killed on unlit roads ie excluding Egypt, the percentages were two or three times higher in the developing countries. These figures point to problems of inadequate street lighting and poor pedestrian conspicuity.

4. More pedestrian fatalities on rural roads and away from junctions. The rural figures may be overestimates in some cases because of differences in definitions of urban and rural accidents. Nevertheless, the problem of rural accidents is supported by other studies; for example, in Pakistan¹⁸ 27 per cent of the fatal accidents in the Punjab province occurred on one of the National Highways, the N-5. In addition, the extremely high percentage of fatalities occurring away from junctions (up to 92 per cent) may partly be due to the predominance of rural

highway accidents and also to a relative lack of safe pedestrian crossing facilities on busy links in towns and cities in developing countries.

From the Table it is also evident that differences existed between the developing countries in the sample. Thus in Botswana and Papua New Guinea (PNG) there were fewer pedestrians killed crossing the road and conversely more killed walking along the road. This may have been due to higher flows of pedestrians walking along the road and to poorer provision of footpath facilities in those two countries. In addition the proportions of pedestrians killed in darkness varied considerably from country to country and these differences are likely to be related to inter-country variations in pedestrian activity at night. Thus the figure was probably low for PNG because of night-time curfews. Alcohol consumption may also be a factor both for drivers and pedestrians in some countries. For example, in Zimbabwe a hospital survey demonstrated that over 50 per cent of drivers killed and over 70 per cent of pedestrians killed, had alcohol in their blood.

Many of the above characteristics of pedestrian fatalities are indicative of problems with the road infrastructure and this is supported by a World Bank report on road condition²¹ which showed that 36 per cent of paved main roads in Southern Asia and 25 per cent in Sub-Saharan Africa were in poor condition compared with 12 per cent in the USA and 3 per cent in the UK. In general, many of the older highways will have been designed to outdated standards of safety and, in urban areas of developing countries, the considerable competition between road users for road space is often compounded by an inadequate provision of facilities for pedestrians.

TABLE 3

Road user behaviour at pedestrian crossings

City	Percentage of drivers choosing to stop	Percentage of pedestrians using crossing
Bangkok	16	48
Colombo	11	43
Cairo	Under 1	-
Kingston	10	-
Karachi	Under 1	20
Nicosia	17	-
Surabaya	Under 1	-
London	40	
Reading	72	89 (UK mean)

Also, poor road user behaviour will have contributed to the pedestrian accident problem. Thus observations of road users²² indicated that their behaviour in developing countries is often less disciplined than in developed countries. For example, from Table 3 it can be seen that, at uncontrolled pedestrian crossings, fewer than 20 per cent of drivers stopped for pedestrians in the road in Third World cities, whereas 40 to 72 per cent stopped in the UK. Also, not surprisingly, less than half the pedestrians chose to use crossings in the cities where driver behaviour was poor.

Observations of pedestrian behaviour in Pakistan indicated that crossing problems were not the only cause for concern. For example, at twelve sites with footpaths, 26 per cent of the pedestrians walked in the road and of these, 56 per cent walked with their backs to the passing traffic.

The avoidance of footpaths was probably due to their poor condition or their high kerb heights but the high incidence of walking with the back to traffic was almost certainly related to a lack of knowledge. Thus only 58 per cent of pedestrians interviewed said they should face the passing traffic when walking in the road; and in addition, only 7 per cent mentioned wearing bright clothing at night.

Such gaps in knowledge will mostly be due to inadequacies in road safety education. This is illustrated by a study of children's crossing knowledge²⁰ (see Table 4) which demonstrated that children in Jamaica, Pakistan and Thailand received much less advice than children in the UK.

TABLE 4

The people who had talked to children about crossing the road.

Percentage of 8 to 11 year olds in:	People who had talked to children						
	Mother	Father	Teacher	Police man	Police woman	Friend	Other
Jamaica	63	41	34	28	5	19	7
Pakistan	73	78	37	13	4	16	11
Thailand	53	54	48	7	0	1	1
United Kingdom	95	83	83	64	8	27	57

Also, surveys which are currently being conducted in schools indicate that relatively few primary schools in developing countries teach road safety (23 per cent in Karachi and 52 per cent in Zimbabwe), whereas in Europe road safety education was compulsory in primary schools in 11 out of 13 countries as far back

as 1974 and, even where it was not mandatory, road safety was taught by most schools, for example by over 90 per cent in the UK²³.

3. ROAD SAFETY IMPROVEMENTS

Clearly there are some wide differences between developed and developing countries in culture, resources, road and traffic conditions, and in road user behaviour, attitudes and knowledge. Such differences will undoubtedly effect the transferability of solutions from one region of the world to another, and even from one country to another. Therefore it is imperative that improvements are accompanied by evaluation studies.

Some developing countries have begun such monitoring programmes, for example Egypt, Ghana, Pakistan and PNG are studying the effectiveness of low cost engineering improvements jointly with the TRRL. However as yet there is very little information available on the success or failure of these improvement schemes.

Consequently, in the absence of scientific data, developing countries will have to identify those approaches and measures which are likely to be most successful on the basis of an analysis of conditions in their own countries and the effectiveness of the improvements elsewhere. In order to help developing countries with this identification process, an attempt has been made in the remainder of this paper to highlight some of the approaches and measures in the fields of engineering and road safety education which are likely to be transferable and be effective in improving pedestrian safety. The recommendations which follow are based on an Overseas Unit Information Note⁸ and on a number of key references which are indicated in the appropriate places in the text. The advice has been restricted to engineering and education improvements because these areas are seen as the most important for pedestrian safety and because of the time and space constraints of this paper. This focus does not mean that other approaches should be ignored; indeed it is important that countries introduce programmes which integrate a wide range of measures selected on the basis of a proper diagnosis of the accident problem and on an assessment of their likely cost effectiveness.

3.1 Engineering Improvements

In developed countries a variety of road safety strategies and countermeasures have been used at different stages of network development and generally these have led to significant safety benefits. Many of these improvements will have considerable potential for accident injury reduction in developing countries and the key approaches have been summarised in Table 5. More detailed guidelines are given in the Overseas Unit's Guide for Planners and Engineers²⁴ and in other references given in the Table.

Although developing countries should consider all the above approaches it is suggested that, with limited resources, the emphasis should be placed initially on introducing low cost improvement schemes at hazardous locations. Such schemes have proved very effective in industrialised countries; for example, in a survey of UK schemes, overall first year rates of return were estimated to range from 65 to 950 per cent²⁸ and with respect to pedestrian improvements, London achieved first year rates of return of over 300 per cent⁸.

General advice is more difficult to give when it comes to selecting specific countermeasures. However, countries which have relatively low levels of road user discipline are less likely to have success with very low cost measures such as

signs and markings and they will probably need to make more use of self enforcing measures. Also, in areas where pedestrians and vehicles are required to share the road space, improvements should be aimed at reducing traffic speeds and volumes.

TABLE 5

Approaches to improving the road environment for pedestrians

ACCIDENT PREVENTION: Improved planning and design of new roads and developments particularly in urban areas.²⁵

- * Land use should be distributed to minimise vehicle trips and pedestrian vehicle conflicts.
- * Networks should be classified into a hierarchy with the emphasis on speed management.
- * New schemes should be checked for safety ie road safety audit.²⁶

ACCIDENT REDUCTION: Application of cost effective measures on existing roads.

- * Low cost engineering improvements at hazardous locations.^{27,28}
- * Area (urban) wide schemes.^{29,30,31}
- * Traffic calming.³²

From the accident data in Table 2, it would appear that some of the key countermeasures needed for pedestrian safety are:

1. pedestrian segregation
2. improved footpath facilities on urban and rural roads
3. improved crossing facilities especially away from junctions
4. speed controlling devices eg humps and road 'pinches'
5. access controls for residential and shopping streets
6. improved street lighting.

In the case of crossing facilities, alternative designs to standard uncontrolled crossings need to be considered. For example, raised crossings are currently being tested on residential and distributor roads in Pakistan and Ghana³³.

Also, street lighting improvements would appear to have considerable potential given the relatively high proportion of fatalities which occurred at night particularly on unlit streets in the countries in Table 2. Although such improvements are more costly than most of the above measures, a road lighting manual for developing countries³⁴ predicts night-time accident savings of over 30 per cent.

3.2 Road Safety Education

In developed countries a number of approaches to educating children about road safety have been tried both through school systems and through parents. There have been numerous evaluation studies³⁵ and, although it has been difficult to demonstrate accident savings, knowledge and performance tests indicate that road safety education practices have improved.

As with engineering measures, it seems that some general principles will be transferable to developing countries; but specific measures will need considerable adaptation to ensure that they are appropriate for local conditions. Also, on the basis of the evidence of the lack of advice given on road safety in developing countries and the high involvement of children in accidents, there is clearly a need for improvements in road safety education. However, as some countries will have low school attendance figures it is important that education through community programmes is considered as well as through the school system.

With respect to teaching methods, a number of studies³⁶ in Europe have evaluated teaching environments in terms of children's performances on crossing tests. Overall, the results demonstrated the importance of training on real roads; and this need for frequent supervised practice on local roads close to where children live is likely to apply to all countries.

Traffic gardens were usually found to be one of the least helpful environments and their cost effectiveness in developing countries must be even less certain. However, they may be seen as useful for raising public awareness and demonstrating governments' commitments to child safety, and investment in traffic gardens may be justifiable on such grounds.

Also it is recognised that road safety education programmes should be graded and developmental^{36,23} and that teachers need guidelines on what should be taught and how. To meet these requirements, many countries have produced syllabus documents and teacher guides, including a few in the Third World³⁷. However, it is in this area that the transferability of developed country solutions to developing countries is less certain and much more research is needed. Also, studies in Europe^{23,27} and to some extent surveys in Pakistan and Zimbabwe, have indicated that teachers guides and even the making of road safety teaching compulsory, were not on their own sufficient to greatly improve the quantity and quality of road safety education in schools. For example, in the UK a 'core curriculum' document circulated to all schools was used by fewer than 4 per cent and in Zimbabwe, a schools 'road safety kit' was used by only 5 per cent of schools. Clearly other actions including teacher training are necessary to promote and increase the provision of road safety education in all countries.

4. INTEGRATION AND RESEARCH

Although attention in this paper has been focused on engineering and education improvements to deal with the problem of pedestrian unsafety, there is clearly a need for countries to adopt a wide range of appropriate cost effective measures, including vehicle design, driver training, publicity and enforcement. To obtain the maximum effect, these measures will need to be integrated by organisations which are capable of planning and implementing multi-sectoral programmes and procuring the necessary funds.

Also, it is clear from the accident data presented in this paper that most countries need to give some priority to alleviating the pedestrian accident problem in particular. However, pedestrian safety should not be considered in isolation from general road safety. Indeed road safety improvement programmes can only be planned in relation to overall national priorities and policies, particularly those in the health, education, and transport sectors.

In addition, this paper has emphasised the scarcity of road safety research activities in developing countries. In total, it is estimated that there may be 20 man years of research effort per year in developing countries compared with over 500 in developed countries. Given the need for research to find practical

solutions to the accident problem of developing countries, it is clear that this imbalance in effort needs to be addressed.

5. CONCLUSIONS

Although countries of the Third World have scarce resources and in spite of their late start on improving road safety, there are some encouraging signs for the future. For example, surveys of twenty three African countries³⁸ indicated that eight had active national road safety committees, nearly half were implementing a wide range of improvements, and twelve ranked pedestrians in the top priority group.

In the case of research there have also been some promising developments. For instance, at the Second African Road Safety Congress³⁹ (1989), one of the key recommendations was the strengthening of research centres at the national or sub-regional level. Also, the Organisation for Economic Co-operation and Development (OECD) has established a group (DC2) to promote and coordinate developing country road safety research. This group has proposed a multinational collaborative study of pedestrian safety in the Third World.

In conclusion, it is clear that developing countries have accelerated their efforts to improve road safety. It is hoped that these trends will continue and that all countries will, through joint programmes of research and development and by sharing information, maintain an effective and scientific approach to reducing road accidents throughout the world.

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