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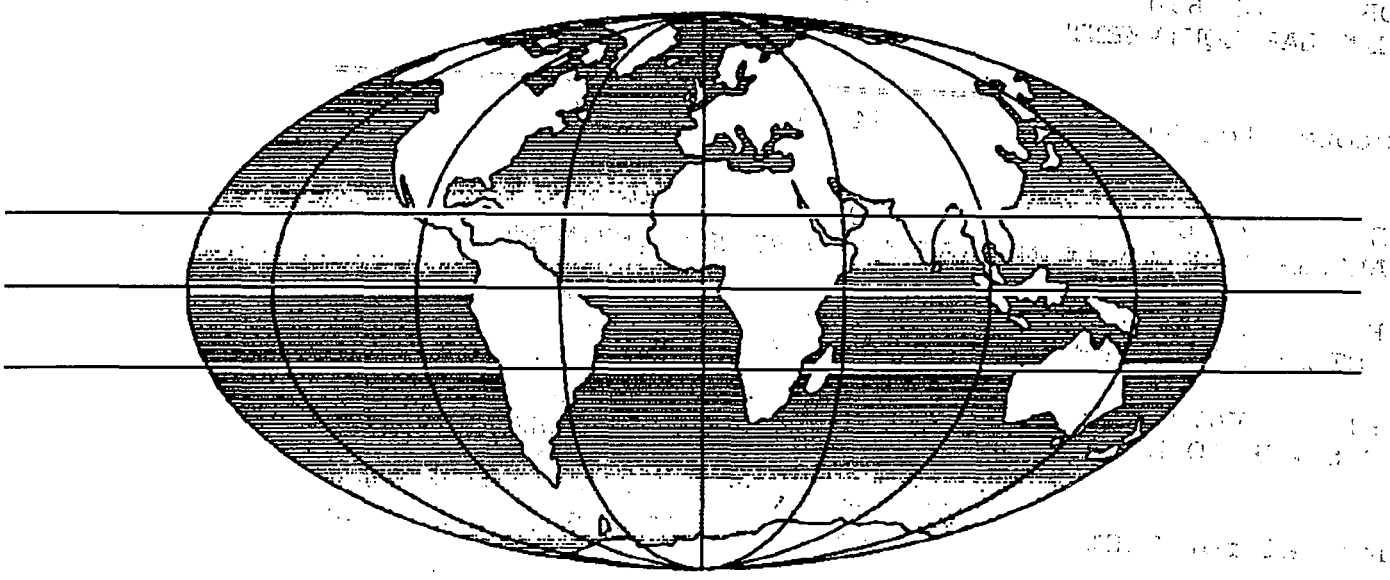

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PEDESTRIAN SAFETY IN THE DEVELOPING WORLD

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ABSTRACT

This paper describes some of the pedestrian safety research carried out jointly by the UK's Transport Research Laboratory (TRL), Karachi's Traffic Engineering Bureau (TEB) and counterpart organisations in Botswana, Papua New Guinea and Zimbabwe.

Pedestrian fatalities in Asia, Africa, the Caribbean and the Middle East typically represent more than 40 per cent of all road deaths. Detailed analysis of national data indicates some key differences between developing and developed country pedestrian accidents. For example, Third World pedestrian casualties are more likely to be children and the accidents frequently occur on rural roads and away from junctions.

In Karachi the TEB has pioneered the use of raised pedestrian crossings in Pakistan, and in Papua New Guinea the Road Authorities have introduced measures such as rural footpaths and improved crossing facilities. The preliminary results of the evaluation of these measures are presented in this paper, together with the findings from surveys of road safety education activities in Pakistan, Zimbabwe and Botswana.

1. INTRODUCTION

In industrialised countries, road accidents have long been recognised as a major cause of death and considerable resources have been spent on alleviating the problem, with more and more emphasis being placed on helping the vulnerable road users, particularly pedestrians.

In developing countries however, concern about road accidents began relatively recently with the seriousness of the problem being highlighted by the Transport Research Laboratory's (TRL) studies in the 1970's (Jacobs and Hutchinson, 1973; Jacobs and Fouracre, 1977; Jacobs and Cutting, 1977). With comparatively few resources, developing countries have generally lagged behind motorised countries in road safety actions. Also, improvements have often focused on motorists rather than pedestrians, in spite of the evidence of high involvement rates of pedestrians in road accidents in Asia, Africa and the Middle East (Downing, 1991; Downing et al, 1991; Jacobs and Sayer, 1983).

However, concern for vulnerable road users is growing in these regions and the TRL, together with the Traffic Engineering Bureau (TEB) in Karachi and Road and Traffic Authorities in other countries, have initiated studies of the pedestrian problem, together with trials of engineering improvements and surveys of road safety education. This paper sets out to summarise the results of these studies and gives some directions for improvements in developing countries.

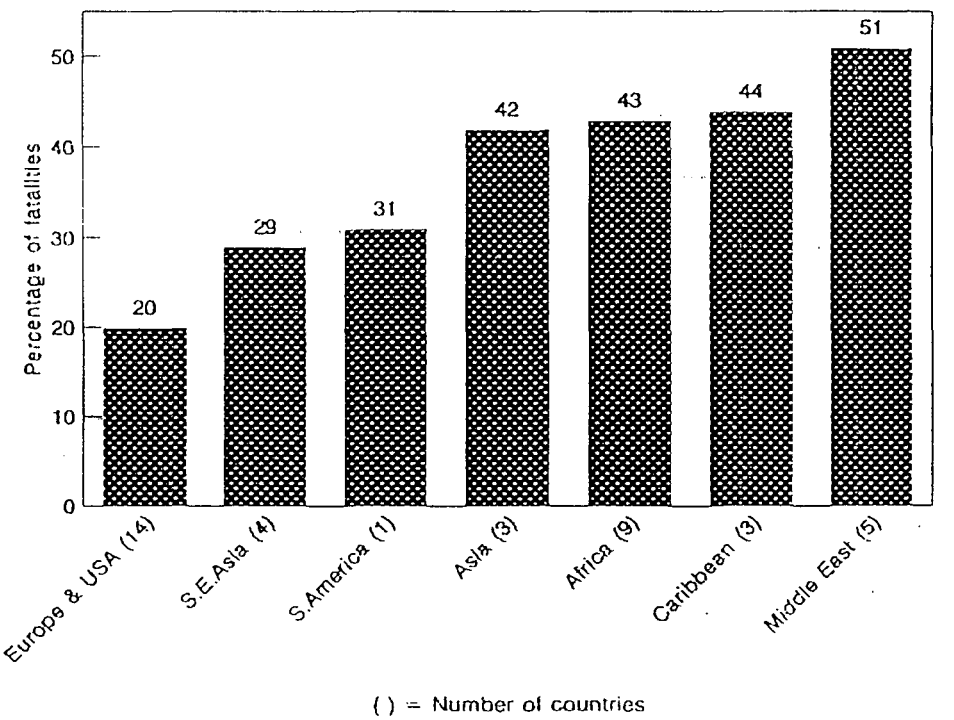


Fig.1 Pedestrian fatalities as a percentage of all road accident fatalities

2. PEDESTRIAN ACCIDENTS

2.1 The Magnitude of the problem

Studies carried out by the Overseas Centre of TRL (Jacobs and Bardsley, 1977; Fouracre and Jacobs, 1976; Jacobs, 1986) 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 per ten thousand vehicles with rates at least an order of magnitude higher than those in industrialised countries.

Current road accidents fatality statistics reveal a deteriorating situation in developing countries compared with industrialised countries. For example between 1978 and 1988 the total road accident deaths for 13 motorised countries decreased by 18 per cent, whereas the total for 16 developing countries increased by thirty two per cent.

Not only is the problem growing more serious in the Third World but also far more of the victims are pedestrians. In Asia, Africa, the Caribbean and the Middle East more than 40 per cent of the road accident deaths were pedestrians compared with only 20 per cent in Europe and the United States of America (see Figure 1). Although this high involvement of pedestrians may be partly due to their comparatively large numbers in developing countries, there is some evidence from a study of urban safety (Jacobs and Sayer, 1977) that pedestrians are more at risk in Third World cities at high levels of vehicle flow than they are in industrialised countries. Therefore, it seems that

Table 1
Main characteristics of pedestrian accidents: national data

Country	Percentage of pedestrian fatalities which:							
	were male	were crossing the road	children under 15	involved a bus or truck (vans and minibuses)	occurred in darkness			
					all roads	unlit roads	in rural areas	away from junctions
Botswana 91	71	69	29	20	31	27	64	74
Egypt 85-86	79	75	24	36	29	10	NA	82
Ghana 89	60	70	42	41	24	17	53	76
India 79, 85 (Delhi)	80*	NA	31*	72**	38**	NA	80-85**	84**
Indonesia 89 (Bandung)	72	78	17	40	26	NA	NA	85
Malaysia 92	68	61	28	18	25	15	51	89
Pakistan 91 (Karachi)	82	81	20	62	28	9	NA	87
Papua New Guinea 90	69	37	32	51	29	21	59	82
Swaziland 90	67	NA	45	50	38	33	59	93
Zimbabwe 90	72	72	22	47	42	30	51	91
UK 91	60	82	15	20	44	9	18	49

* = Bawa, 1980; ** = Dinesh, 1989; NA = Not available

the higher involvement rates of pedestrians are due to other factors in addition to exposure; a lack of road safety education, inadequate pedestrian facilities and insufficient political concern for pedestrians could all be contributory factors.

Pedestrians typically come from the poorest sectors of the community and have the least influence over decision makers. However, there are encouraging signs that the pedestrian problem is being recognised as a priority in developing countries and, in a recent survey of delegates to a road safety course in Sweden, twelve out of sixteen countries ranked pedestrians as the first priority. The exceptions were Indonesia, Malaysia, Taiwan and Thailand. Three of these countries put motorcyclists at the top of their problem list and this reflected the relatively high involvement of motorcyclists in their casualty statistics.

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 database by adopting the TRL's Microcomputer Accident Analysis Package (MAAP), (Hills and Elliott, 1986) and the relevant data from these systems have been incorporated in Table 1, together with data from Delhi. Also, the corresponding UK figures have been included to give some idea of developed country accident patterns.

Table 2
Characteristics of pedestrian accidents: special surveys

Percentage of casualties which were:	Country		
	Botswana	PNG	Zimbabwe
Walking along road with:			
no footpath	NA	NA	40
grass/dirt shoulder			35
paved footpath			4
Walking along road:			
facing traffic	33	24	20
with back to traffic	33	52	48
other	33	24	32
Within:			
400 metres of home	34	62	25
401 metres to 1 km	16	16	21
over 1 km from home	50	22	44
Children and:			
unaccompanied	7	22	39
with other children	79	37	37
with adult	14	40	21
Walking from home to:			
work	NA	NA	8
shops			13
bar/club			1
school			1
Walking to home from:			
work	NA	NA	11
shops			13
bar/club			9
school			2

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.** Excluding Indonesia and Pakistan, 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 countries (Downing and Sayer, 1982). Nevertheless, in absolute terms the problem is very serious and child pedestrian accidents clearly need to be given some priority in improvement programmes.

2. **A greater involvement of buses and goods vehicles.** For example, 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, and to better training of professional drivers.

3. **A higher proportion of pedestrians killed on unlit roads.** In the sub-Saharan African countries and in Papua New Guinea (PNG) the percentages were two or three times higher than in the developed countries. These figures point to problems of inadequate street lighting and poor pedestrian conspicuity.

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	NA
Kingston	10	NA
Karachi	Under 1	20
Nicosia	17	NA
Surabaya	Under 1	NA
London	40	89 (UK mean)
Reading	72	

NA = No data available

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 Pakistan (Downing, 1985) 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 Table 1 it is also evident that differences existed between the developing countries in the sample. Thus in 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 the terrain and roadside vegetation forcing more people to walk in the road. In addition the proportions of pedestrians killed in darkness was higher in Delhi and Swaziland and these differences are likely to be related to inter-country variations in pedestrian activity at night. 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.

To get a better understanding of the problem it is necessary to carry out in-depth surveys of pedestrian accidents and study their behaviour, knowledge, opinions and attitudes. Some results of detailed accident studies carried out jointly by TRL and the Traffic Police in Botswana, PNG and Zimbabwe are shown in Table 2.

The main findings were as follows:

1. Accidents involving pedestrians walking along the road were, not surprisingly, rare for roads with paved footpaths and involved relatively few pedestrians who were facing the traffic.

2. Pedestrian accidents occurred close to home more often in PNG than in the other two countries.

3. In Zimbabwe, more than one third of the child pedestrian casualties were alone at the time of the accident. In other countries the picture was different, with PNG having an alarmingly high proportion of children hurt

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	Policeman	Policewoman	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

when with an adult, and in Botswana the young victims were often with other children when the accident occurred.

4. In Zimbabwe there were sufficient data to analyze journey purpose and the results indicated that for many trips there were more accidents on the way to home than from home.

Some of the above characteristics of pedestrian accidents are indicative of problems with the road infrastructure both in relation to design and maintenance. This is supported by a World Bank report on road condition (Harral and Faiz, 1988), 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.

Also, poor road user behaviour will have contributed to the pedestrian accident problem. Thus observations of road users (Jacobs et al, 1981) 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, fewer 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.

Table 5
Road Safety education in primary schools: country questionnaire

	Percentage of:	
	Developing countries (n = 28)	Developed countries/ provinces (n = 22)
Road Safety in the National Curriculum	77	76
Road Safety mandatory	50	79

Table 6
Percentage of primary schools teaching road safety:
Schools questionnaire

	Percentage of primary schools			
	Botswana	Pakistan	Zimbabwe	UK*
Road safety taught	46	37	52	over 90

* from Downing, 1987

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; 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 knowledge (Downing and Sayer, 1982) (see Table 4) which demonstrated that children in Jamaica, Pakistan and Thailand received much less advice than children in the UK.

More information about countries' and schools' road safety education activity was collected from questionnaires sent to Ministries of Education worldwide and to schools in Botswana, Pakistan and Zimbabwe. From Table 5 it can be seen that there is little difference between developed and developing countries with respect to road safety being included in the National Curriculum (about three quarters of countries included road safety) but far more developed countries had made road safety education mandatory in primary schools (79 compared with 50 per cent). Similarly the percentage of primary schools teaching road safety (see Table 6) was much lower in Botswana, Pakistan and Zimbabwe than in the UK (37 to 52 per cent compared with over 90 per cent). The schools' information is clearly the most valid indicator of road safety education activity and the survey results support the findings in Table 4 that there is much less road safety teaching in Third World Schools than in developed countries.

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 undoubtably affect 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 Indonesia, Malaysia, Pakistan and Papua New Guinea are studying the effectiveness of low cost engineering improvements jointly with the TRL. Also road safety education surveys have been carried out in Botswana, Pakistan and Zimbabwe. The preliminary results from some of these studies, together with some key recommendations for engineering improvements and road safety education, are presented below. The advice has been restricted to engineering and education improvements because these areas are seen as most important for pedestrian safety, and because of the space constraints in this paper. This focus does not mean that other approaches should be ignored. Driver education about pedestrians is also essential and 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 7. More detailed guidelines are given in TRL's "Guide for Planners and Engineers" (TRRL, 1991) and in other references given in the Table.

Table 7
Approaches to improving the road environment for pedestrians

ACCIDENT PREVENTION: Improved planning and design of new roads and developments, particularly in urban areas.[1]

* 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.[2]

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

* Low cost engineering improvements at hazardous locations.[3,4]
* Area (urban) wide schemes.[5,6]
* Traffic calming.[7,8]

1 = The Institute of Highways and Transportation (IHT), 1990;
2 = IHT, 1990; 3 = Department of Transport, 1986;
4 = The Institute for Road Engineering, 1993;
5 = Organisation for Economic Co-operation and Development (OECD), 1979;
6 = OECD, 1990; 7 = Tolley, 1990; 8 = Devon County Council, 1991.

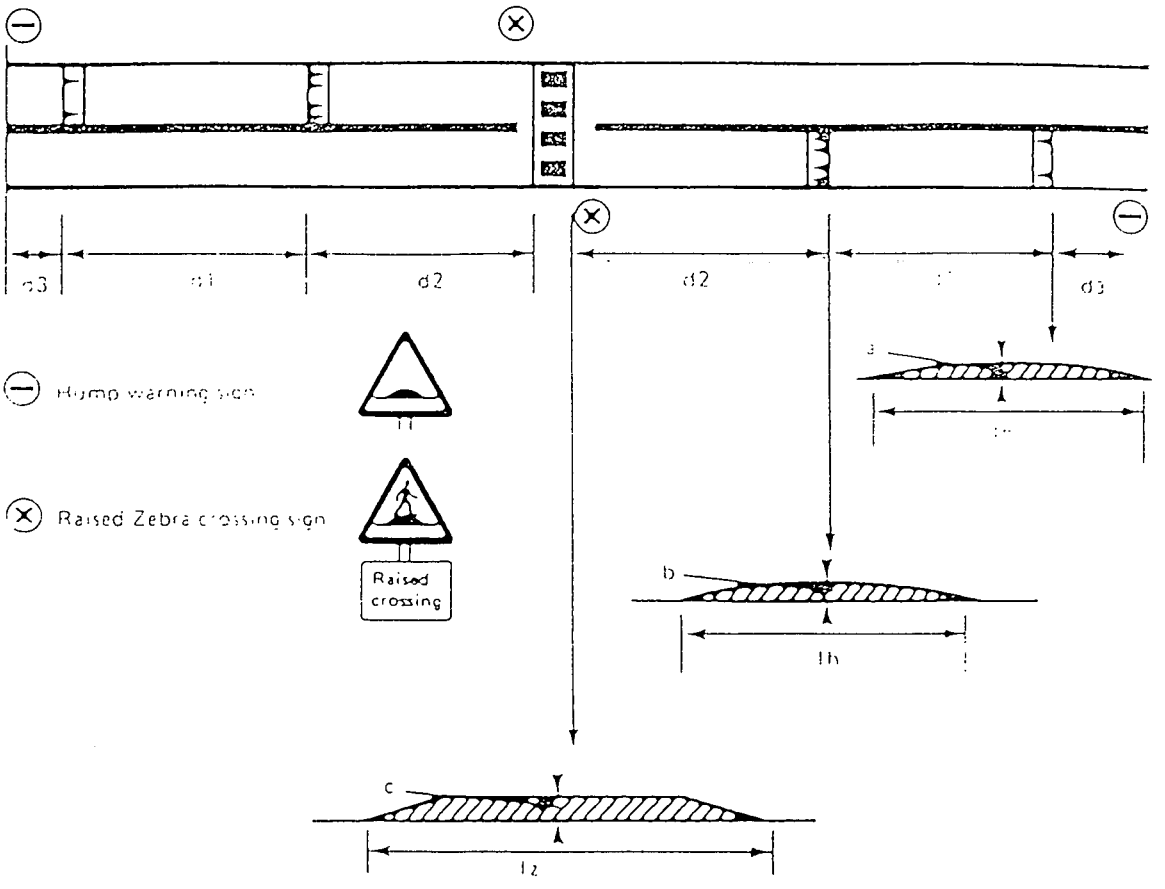
Although developing countries should consider all the above approaches it is suggested that, with limited resources, the emphasis should be placed initially on introducing low cost improvement schemes at hazardous locations. Such schemes have proved very effective in industrialised countries; for example, in a survey of UK schemes, overall first year rates of return were estimated to range from 65 to 950 per cent (Helliar-Symons and Lynam, 1989) and, with respect to pedestrian improvements, London achieved first year rates of return of over 300 per cent (TRRL, 1986).

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 8
Accidents before and after the
introduction of raised pedestrian crossings in Karachi

Site	Accident type	Accidents*					
		BEFORE				AFTER	
		1986	1987	1988	1989	1990	1991
Bunder Rd	Pedestrian All	1 7	1 1	1 2	0 1	1 2	1 2
Korangi 3.5	Pedestrian All	1 5	1 1	1 1	1 3	0 0	0 1
Monghopir Rd	Pedestrian All	1 2	3 3	2 2	2 2	1 1	1 1
Karachi City	Pedestrian All	NA 1706	727	629	659	534	539 1123

* = Accident periods adjusted to whole years before and after construction



a = 40 mm
b = 65 mm
c = 100 mm

lh = 3.7 m
lz = 5 m

d1 = 50 m
d2 = 50 m
d3 = 12 m

Fig.2 Proposed layout for raised Zebra Crossings, Pakistan

The importance of vehicle speed for pedestrian safety was demonstrated by Ashton and Mackay (1979), who found that 30 kph was the critical speed below which most pedestrians survived a collision with a vehicle. Subsequently, many countries have introduced 'traffic calming' and urban safety schemes, where the road designs constrain vehicle speeds, discourage through traffic and provide a healthier and safer environment for the non-motorized road user. Those schemes aimed at keeping vehicle speeds below 30 kph have proved to be particularly effective for pedestrians, with reported accident reductions in Germany, Denmark and Holland, ranging from 15 to 40 per cent (Proctor, 1991).

With these potential benefits in mind, the Traffic Engineering Bureau (TEB) in Karachi and the TRL initiated the introduction and evaluation of raised crossings in Karachi. The standardised layout is shown in Figure 2. Although a number are planned, to date only three have been introduced and the initial effects on accidents, vehicle speeds and use of the crossing are shown in Tables 8, 9 and 10.

The accident data indicate that there was a drop in accidents over the three sites of 27 per cent in excess of the overall drop of reported accidents in Karachi City (Table 9). This is an encouraging result but data from more sites need to be collected to verify these preliminary findings, which are based on a very small sample.

From Table 10 it can be seen that the raised crossings were very effective in bringing down the vehicle approach speeds to below 30 kph, whereas vehicle speeds at standard Zebra crossing sites were generally in excess of 40 kph. However the raised crossings did not seem to improve pedestrian use of the crossing, possibly because pedestrians felt they could cross in a wide area with the slower speeds and because the crossing markings were somewhat faded.

Table 9
The percentage reduction in accidents after
the installation of raised crossings in Karachi

	Accidents per year					
	Pedestrian accidents			All accidents		
	Before	After	Percentage reduction*	Before	After	Percentage reduction*
Three raised crossing sites	3.75	2	47	7.5	3.5	53
Karachi city	671.7	536.5	20	1558.75	1152	26
Net reduction	-	-	27	-	-	27

$$* = \left(\frac{\text{Before - After}}{\text{Before}}\right) \times 100$$

Also driver stopping behaviour at the crossings remained unchanged, with virtually no drivers stopping for pedestrians on the crossing. Therefore, it would seem that these sites could be further improved by greater channelisation of pedestrians using barriers and markings, and with a driver education programme to improve stopping behaviour. The benefits for pedestrians might then be much greater and well worth the extra construction cost, which was about two and a half times that of a standard zebra crossing.

Table 10
Characteristics of different pedestrian crossing
sites in Karachi in the 'After' period

Site	Approach Speeds (kph)	Percentage using crossing facility*
Raised Crossings		
1	25.9	28
2	22.2	3
3	17.8	17
Zebra Crossings		
4	41.2	28
5	41.5	7
6	41.6	4
7	43.5	5
8	39.8	32

* = (number using crossing ÷ number crossing on crossing and 50 metres either side x 100)

The accident data in Table 1 also indicated the need for pedestrian footpaths on rural roads with heavy pedestrian flows, particularly in Papua New Guinea. The Department of Transport (DoT) in PNG have constructed a trial low cost footpath and this is being monitored jointly by the DoT and TRL (Hills et al, 1991). A preliminary analysis of the pedestrian accidents at the footpath site and other sections of the highway is shown in Tables 11 and 12. Again the results are encouraging with accidents involving pedestrians walking along the road dropping by 79 per cent,

Table 11
Goroka-Kitamu Highway, PNG: Accidents before
and after the construction of a footpath along the highway

Site	BEFORE SCHEME			CONSTRUCTION		AFTER SCHEME	
	1985	1986	1987	1988	1989	1990	1991
Experimental site (H58) Pedestrian accidents*	6	1	7	1	4	0	2
Control site (H56, 59, 60) Pedestrian accidents*	4	4	5	1	1	4	8
Goroka-Kitomu Highway All casualties	17	12	36	21	14	23	14

* excludes accidents involving pedestrians crossing the road

whereas the pedestrian accidents per year on the control sections increased by 40 per cent. From Table 11 it can be seen that the accident numbers do fluctuate from year to year and more trial sites and more accident data are needed to corroborate this finding.

Table 12
The percentage reduction in pedestrian accidents after
the construction of the footpath in PNG

	Pedestrian accidents per year		
	Before	After	Percentage reduction*
Footpath site	4.7	1	79
Control	4.3	6	-40

$$* = \left(\frac{\text{Before - After}}{\text{Before}}\right) \times 100$$

Nevertheless, the results from these pilot studies are encouraging and they suggest that raised pedestrian crossings which are properly designed and improved footpath facilities both have considerable potential for reducing pedestrian casualties. Other engineering measures which need to be considered are better access controls for residential and shopping streets, pedestrian segregation, speed reduction devices and improved street lighting. Although the latter is more costly than the other improvements, a road lighting manual for developing countries (The Institution of Lighting Engineers, 1990) predicts night-time accident savings of over 30 per cent. Overall, these approaches need to be integrated and targeted at specific problems under an area wide action programme.

3.2 Road safety education

Road safety education is clearly important in helping children to avoid road accidents when they are young, and also to make them safer as adults when they grow up. 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 studies (OECD, 1986; OECD, 1978) and, although it has been difficult to demonstrate accident savings, knowledge and performance tests indicate that road safety education practices have improved. Some of the key findings have been summarised in Table 13.

Table 13
Key findings from Road Safety Education Research

Key findings
1. Need for community and parental education as well as programmes in schools.
2. Training on real roads is essential.
3. Road safety teaching needs to be structured and continuous.
4. Traffic gardens are generally the least effective teaching environment.
5. Teachers' guidelines and pupil materials are necessary but not sufficient.
6. Teacher training and other actions are required to encourage the take up of road safety education recommendations.

As with engineering measures, it seems that some general principles will be transferable to developing countries; however 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 both through schools and community groups.

To determine how far the principles in Table 13 were being adopted in developing countries, TRL has carried out a global questionnaire survey of road safety education activities, together with detailed surveys of schools in Botswana, Pakistan and Zimbabwe. The results are summarised in Table 14 and the main findings are as follows:

1. Fewer developing countries issued guides for teachers than developed countries (41 per compared with 67 per cent).

2. Even where guides were available they were rarely used by schools in developing countries (2 to 27 per cent).

3. Few countries and schools taught road safety as a separate subject (less than 15 per cent).

4. Very few developing countries provided teacher training in road safety compared with developed countries (14 per cent compared with 53 per cent).

5. Country replies indicated that the pattern of methods used by most schools in developed and developing countries was similar. Classroom teaching was the most common approach (87 to 77 per cent respectively). The playground was used more in developed than developing countries (47 compared with 27 per cent) and few countries reported the use of teaching on the real road (13 and 18 per cent).

6. The school questionnaires indicated that these methods were used less frequently than suggested by the Ministry of Education replies. Also there was considerable variation between countries. For example 36 per cent of schools in Zimbabwe claimed to teach on real roads, compared with only 8 per cent in Botswana and 2 per cent in Pakistan.

7. Developing countries proposed far more priority improvements than developed countries and the ranking of priorities was somewhat different. New pupil materials were most frequently stipulated by developing countries, followed by teachers' guides (79 and 71 per cent respectively). More teacher training was the most common requirement identified by developed countries (45 per cent), whereas a teacher's guide was only requested by 27 per cent. Developing countries also saw a need for more visiting road safety specialists (46 per cent).

Table 14
Road Safety Education: Ministry of Education and Schools Surveys

	Percentage of countries				
	Ministry Questionnaire		Schools Questionnaire		
	Developed countries (n = 15)	Developing countries (n = 22)	Botswana (n = 132)	Pakistan (n = 566)	Zimbabwe (n = 383)
Issued road safety teaching guide	67	41	used guide 27	2	14
Taught safety as a separate course	5	14	4	2	5
Provided road safety teacher training	53	14	DNA	DNA	DNA
Methods used:	by most schools		by schools in the last year (middle primary)		
Classroom	87	77	39	17	74
Playground	47	27	13	3	44
Roadside	13	18	8	2	36
Films/posters	33	23	3	2	7
Police visits	20	32	3	2	7
Traffic gardens	7	9	2	1	3
Suggested high priority/most useful improvements:					
New teachers' guide	27	71	81	38	62
New pupil materials	36	79	77	33	69
New films/posters	41	68	86	47	82
More teacher training	45	57	73	41	63
More visiting Specialists	14 (n = 22)	46 (n = 28)	52	29	57

8. The schools' views of priority improvements needed were similar to those of the Ministry of Education, except that teachers most frequently mentioned the need for films, posters and other teaching aids.

Clearly these surveys have demonstrated a strong perceived need for improving road safety education in developing countries. Teachers require more guides, more teaching aids and more training in road safety education. The methods used have to be appropriate to the general approach used in schools but, almost certainly, it will be a common requirement for more practical instruction to be given in playgrounds and particularly on real roads. The content of teaching should focus on the skills required by the pupils and priority should be given to those topics which the accident analysis has shown to be important. Few countries report teaching road safety as a separate subject in primary schools and, instead, it is recommended that it is introduced regularly as part of other subjects such as social or health education. Also parents have a significant role to play and existing communication channels eg health clinics, health workers, radio programmes before parents take children to school could all be successfully used to inform parents about safe behaviour and how to help their children.

Above all, there is a need to promote and increase the provision of road safety education in all countries and this can best be achieved by introducing the above improvements, by increasing the public's and the decision makers' awareness of the road safety problem and by carrying out successful demonstration projects.

4. CONCLUSIONS

This paper has demonstrated the seriousness of the pedestrian accident situation in the Third World and given some recommendations for effective action in road engineering and road safety education. In the case of engineering improvements, preliminary trials of raised pedestrian crossings in Karachi and rural footpaths in PNG have led to accident savings. The initiation of such trials in developing countries is encouraging but much more data are required for confident recommendations to be made, and also there is a need for more quality control of the design and construction of engineering measures, and for actions to be integrated.

In road safety education, trials of programmes need to be carried out in schools and communities and it is suggested that the research should focus on the value of practical instruction and some key developmental issues. Such research should lead to international guidelines on road safety education and include sample approaches and materials for teachers and pupils.

In conclusion, it is recommended that road safety research and development activities in developing countries are increased, with pedestrian safety being given some priority. Such a programme needs to include a scientific investigation of the pedestrian safety problem and trials of an integrated package of improvements. Because resources are scarce, the research needs to be focused on key issues and lead to recommendations which benefit the widest possible range of countries.

By striking the right balance between targeting research on important problems and solutions, and maintaining a wide view of developing countries needs, it is hoped that joint, international programmes of research and development will help all countries tackle their road accident problems more quickly and more effectively in the future.

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