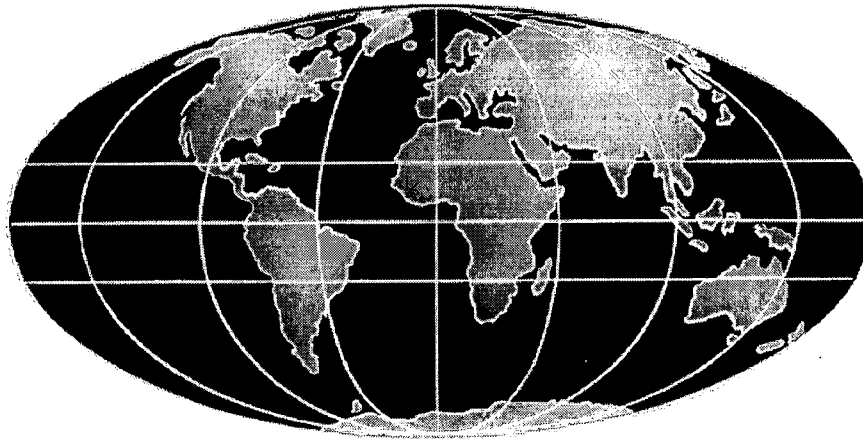


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**A STRATEGY TO DRIVE EFFECTIVE URBAN TRANSPORT SAFETY PROGRAMMES
WITHIN EMERGING ECONOMIES**

Dr G D Jacobs and Angela Astrop

**URBAN TRANSPORT DEVELOPMENT AND FINANCE IN DEVELOPING AND
DEVELOPED COUNTRIES**

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A STRATEGY TO DRIVE EFFECTIVE URBAN TRANSPORT SAFETY PROGRAMMES WITHIN EMERGING ECONOMIES

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1. Background

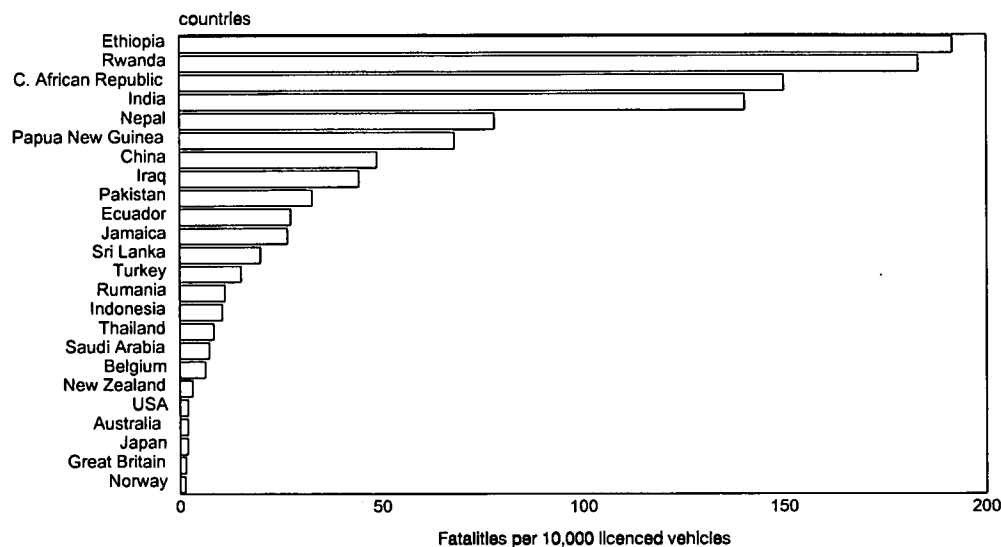
In this century of road death – the world's first road accident fatality occurring in 1896 – the motor vehicle has claimed an estimated 30 million lives. A recent major study on 'The Global Burden of Disease' undertaken by the World Health Organisation, Harvard University and the World Bank showed that in 1990, traffic accidents were assessed to be the world's ninth biggest cause of death. However, assessing the long term impact of accidents and taking full account of the impact of injuries, this study forecast that by the year 2020 road accidents would move up to third place in the total table of major causes of death and disability.

Independent studies by both the World Health Organisation and the Transport Research Laboratory (Ghee et al 1996) have estimated that about 500,000 people lose their lives each year as a result of road accidents and over 15 million suffer injuries. Perhaps surprisingly the majority of these, about 70 per cent, occur in those countries which the World Bank classifies as low or middle income and where vehicle ownership levels are low by Western standards.

Fatality rates for a wide range of countries (1989-1995) have been calculated by TRL (see figure 1) and it has been found that whilst countries of Western Europe and North America are characterised by a death rate of often less than 2, some developing countries, for example Ethiopia and Rwanda have a death rate in excess of 150. These figures are expressed as deaths per 10,000 licenced vehicles (see figure 1).

An earlier study undertaken by TRL of accidents in Third World Cities (Jacobs and Sayer 1984), also showed the wide discrepancy between fatality rates in developed and developing regions. Thus, London, Tokyo and New York had death rates ranging from 1.4 to 2.2 whilst in Dehli, Bombay and Nairobi, rates ranged from 40 to almost 60 fatalities per 10,000 licenced vehicles.

Figure 1: Fatalities per 10,000 licenced vehicles

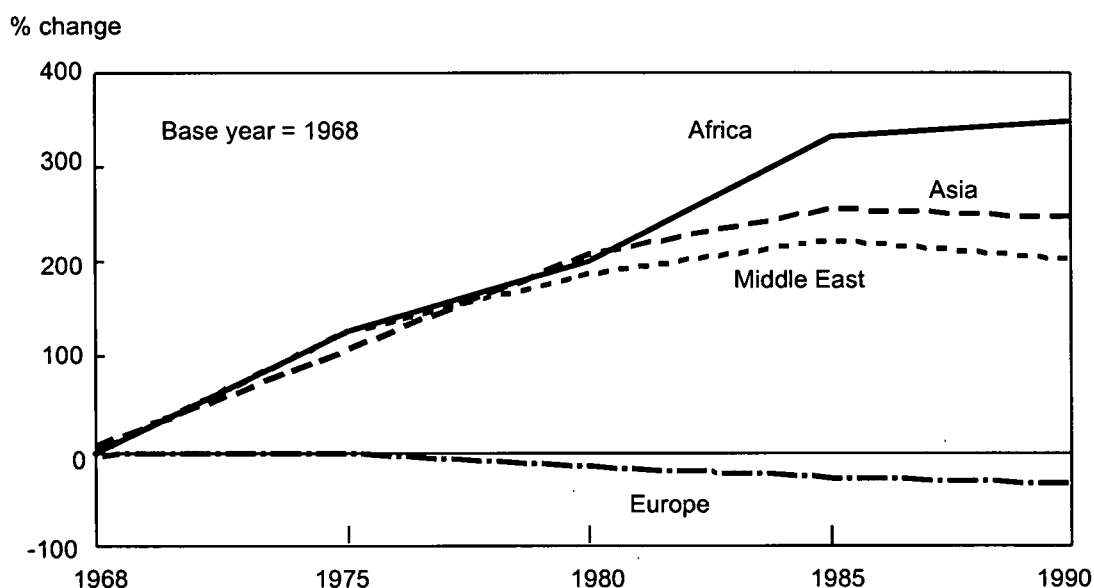


In most developing countries there will be an under-reporting of road accident deaths and an over-estimate of licensed vehicles because as vehicles are scrapped they tend not to be moved from the vehicle register. In a recent study in Bangladesh it was estimated that for the reasons given above, the actual fatality rate maybe at least 50 per cent greater than the officially quoted figure of 60.

In 1984, TRL carried out a study in Colombo, Sri Lanka (Sayer and Hitchcock), comparing 'official' road accident statistics from police records with those held by hospitals. It was found that less than 25 per cent of the hospital records (of fatal and serious accidents) were identified in police data. Matching of accidents involving children was particularly low. Studies such as these suggest that the road safety problem in developing countries (and cities in particular) may be much worse than official statistics suggest.

In a recent study (Jacobs and Baguley 1996), TRL examined the percentage increase or decrease in the actual number of road accident fatalities over the period 1968 to 1990 for four groups of countries. It was found that over this given time period, the number of road accident deaths in 14 Western European and North American countries fell on average by 30 per cent. Conversely in 6 Asian countries and 12 African countries (for which reasonably accurate statistics were available) there were increases of about 200 and 340 per cent respectively (see figure 2). In these countries there is obviously need for much effort and investment in safety measures to reverse this trend - as has been the case in the developed world.

Figure 2: Percentage change in road accident fatalities



Another important factor affecting the number of people killed in road accidents in developing countries is the level of medical facilities available. Thus in Western Europe with good ambulance services, road accident casualties are very quickly taken to hospital to receive immediate attention. Even before reaching hospital trained paramedic services mean that expert assistance can, in many cases, be provided at roadside. Another useful measure of the seriousness of the road accident problem in a country is the Fatality Index (FI), i.e. the percentage of all casualties that are fatally injured. In a study carried out by TRL (Ghee and Astrop et al 1996) the FI was determined for 32 (mainly) developing countries and was found to range from about 4 per cent (Cyprus, Mauritius) to over 20 per cent (Pakistan, Iraq). Factors associated with high FIs were investigated by means of regression analysis and it was found that the level of medical facilities available in these countries (expressed as population per physician and population per hospital bed) were very closely correlated with the FI, the poorer the medical facility as defined above, the higher the FI.

2. Accidents in Urban Areas

In most European countries the majority of reported injury accidents occur on roads in urban areas, the proportion in Great Britain being particularly high, at over 75 per cent of the total. As Stated by Sabey:-

“While the drama of the high speed crash or multiple pile-up attracts widespread publicity and makes the greatest impact on the public, in terms of hard facts, the largest problem associated with road accidents lies in urban areas where traffic speeds are relatively low. Three-quarters of all injury accidents reported in Great Britain occur on roads restricted to

30 or 40 miles per hour. It is vital therefore to examine under what circumstances these accidents occur and how the problem may be alleviated.....”

It is interesting to note that in the UK where three-quarters of all accidents occur in urban areas, a similar proportion of the population also live in urban areas. If this is representative of other countries, then where the percentage of the population living in urban areas is low, then the proportion of accidents taking place in urban areas might also be expected to be low. Population statistics from 20 developing countries showed that in all cases but one, the majority of the population lived in rural areas and for these countries combined, the population distribution was about 30 per cent urban and 70 per cent rural. In these circumstances the majority of accidents in Third World countries might be expected to occur in rural areas; from Table 1 it can be seen that this is not the case.

Table 1: Fatalities and casualties in different countries by Region (1996 or nearest)

Country	Fatalities (percentage)			Injuries (percentage)		
	Urban	Rural	Total	Urban	Rural	Total
Korea	20	80	10402	39	61	337679
Taiwan	30	70	2078	63	37	628
Malaysia	36	64	3651	49	51	29201
Iran	19	81	2957	40	60	47011
Sri Lanka	90	10	1599	90	10	18603
Azerbaijan	32	68	1152	48	52	3225
Turkmenistan	29	71	648	43	57	2736
Barbados	59	41	39	62	38	1659
Honduras	63	37	523	48	52	1843
Bolivia	41	59	220	58	42	2054
Chile	57	43	1890	81	19	45829
Equador	42	58	1271	62	38	5418
Paraguay	79	21	973	78	22	7687
Peru	80	20	1734	27	73	2616
AVERAGE	48	52		56	44	

Table 1 actually shows a wide variation between countries. For example in Sri Lanka, Paraguay and Peru the large majority of fatalities occur in urban areas whilst in Korea and Iran, the majority occur in rural areas. However the (unweighted) average for countries shown is that almost fifty per cent of all fatalities and over fifty per cent of casualties occur in urban areas. Some countries also show a wide variation between fatalities and casualties. Thus in Taiwan, Bolivia and Equador the majority of fatalities are in rural areas whilst the majority of casualties are in urban areas. Despite wide variation, the overall picture that is that in most emerging nations shown, a significant proportion of either fatalities or casualties take place in urban areas. (In European countries where data are more reliable, the

tendency is for the majority of *fatal* accidents to occur on rural roads where vehicle speeds are highest).

Early work by TRL (Jacobs and Sayer 1984) in a number of Third World cities for which data were available showed that pedestrians were by far the main class of casualty whilst in western European cities less than a quarter of persons injured were pedestrians. This highlights two key factors which are, firstly, the lack of facilities for pedestrians to cross busy roads safely in Third World cities and, secondly, poor driver behaviour at traffic signals (and where they exist) pedestrian crossings, making it hazardous for pedestrians to cross the road.

The study also showed that in the UK, the main vehicle involved in accidents is the car or taxi (almost 70 per cent of all accidents) whereas in Third World cities commercial vehicles were involved in 16 to 25 per cent of accidents and public service vehicles is 10 to 25 per cent.

3. INSTITUTIONS AND INFORMATION SYSTEMS

Little can be done to deal with the road safety problem in any country, be it developed or developing, until two key requirements are fulfilled. Firstly the country concerned must have a suitable organizational structure in place in order to carry out the essential stages in a comprehensive safety action plan. Secondly the country concerned must have a systematic process for the collection, storage and analysis of accident records.

3.1 Organizational Requirements

In road safety matters, as in many other sectors, there is a need to strengthen the various institutions responsible for the various aspects of road safety and to increase their capability for multi-sectoral action. The whole process of planning and implementing road safety improvements should be multidisciplinary and dynamic.

The setting of targets is a well established management strategy and, when applied to accident reductions, has proved very effective in a number of developed countries. A national target does need to be disaggregated so that all those with safety responsibilities are given their own specific and realistic targets with adequate funding directly related to those targets. To manage this efficiently, it is also recommended that the authorities produce an annual Road Safety Plan which clearly states the current accident reduction target and how it is to be achieved. These Plans should be published to provide higher authorities and the public with a valuable record of the efforts the authority is making (as well as its effectiveness in subsequent years) in improving the safety of the road network.

Road safety organizations should thus be established on a full-time basis and be capable of:

- 1) diagnosing the road accident problem
- 2) drawing up an integrated plan of action including the setting up of goals and objectives
- 3) coordinating the work of all organizations involved
- 4) procuring funds and resources
- 5) producing design guides
- 6) designing and implementing improvements
- 7) monitoring implementation and evaluating measures
- 8) feeding back information from the evaluations and amending the action plan as necessary.

Typically three phases can be identified in the implementation process of a national (or regional) action plan and these can be defined as:

Phase 1. Raising awareness and defining the problem.

Phase 2. Development of a strategy and the implementation of a prioritized action plan.

Phase 3. The implementation of a 5 year Road Safety Programme.

Different developing countries will be at different stages of road safety development and may have already covered some of these stages. The phases themselves follow one after the other although overlap may occur in some sectors.

At as early a stage as possible a country should set up a National Road Safety Council (or an equivalent coordinating mechanism). A large country may also need to set Regional Safety Councils in order that problems (of major cities for example) can be fully addressed. Representatives of the most important organizations with road safety responsibility should meet periodically to discuss and coordinate activities. Such an organization should have adequate funding and technical support made available to allow decisions to be implemented.

3.2 Road Accident Databases

One of the key activities listed above was the diagnosis of the road accident problem. The most important source of data for this activity is the police road accident report. An early survey of road accident information systems in use in developing countries (Jacobs et al, 1975) indicated that only 15 per cent of the countries had adequate accident report forms and none had computer analysis facilities. Therefore, to help countries improve their accident investigation and research capability, TRL developed its Microcomputer Accident Analysis Package (MAAP), initially in collaboration with the traffic police in Egypt, (Hills and Elliott, 1986) and it is now in use in over 50 countries with 9 countries using it as their full national database. MAAP has been configured to operate in several languages including

Arabic, Chinese, French and Spanish. The software has been gradually developed and improved over the years, and a MAAP Windows version has recently been developed. MAAP is also now used by a number of Police and Local Authorities in the UK.

MAAP is a powerful yet simple system which enables users to:

- 1) obtain good data for diagnosis, planning, evaluation and research purposes
- 2) set up low-cost engineering improvement schemes similar to those which have proved successful in developed countries.

It consists of two key components: a police report booklet or form with a recommended structure, although details can vary considerably; and a set of software programs for data entry and analysis. The relatively low-cost and increased availability of microcomputers means that individual highway authorities can analyse their own data to help identify hazardous locations, the nature of the problems, choose appropriate countermeasures and assess their effectiveness, all with increased efficiency and therefore it is hoped, accuracy.

Modern PC's are now powerful enough to enable MAAP to store many thousands of accident records. In other words, one single PC should be sufficient to cover the storage and analysis requirements of either a small country or also a large city. At very modest cost therefore, all accident information collected for a major Third World city such as Bombay, Bangkok, Colombo, Nairobi etc. can be stored and analysed on a single Personal Computer.

MAAP was originally developed to operate at the 'Local Authority' level, although, as stated, it can handle the analysis of accidents at the national level. As such therefore it is ideally suited for the identification of hazardous locations, what the specific problem appears to be at these sites and how the problem can be solved. The latest (Windows) version of MAAP has developed this capability with the use of enhanced graphics facilities.

4. DISCUSSION

With limited financial resources it is essential that remedial measures are introduced as part of a comprehensive action programme (see section 3). The problem itself, in terms of factors involved, types of accidents taking place, vehicles and class of road user involved and location of dangerous sites can only be identified with a sound data collection and analysis system in place. That said, sufficient research and development has been undertaken by TRL and others to identify where emphasis should be placed in Third World cities.

Studies of road-user behaviour in selected Third World cities have shown that behaviour at traffic signals, pedestrian crossings and at priority junctions is markedly poorer than in cities in Great Britain. Studies have also suggested that the level of knowledge on road safety matters is not high. Whether this poor knowledge and behaviour has an effect on the number of accidents taking place in developing countries is not yet fully established and more research is needed to establish whether such links exist. However, it is possible that remedial measures such as road-user education or publicity, could be even more effective in developing countries where existing standards of knowledge and behaviour are much lower.

Because of their relatively greater numbers in developing countries, children represent a much greater proportion of road accident casualties than they do in developed countries. Thus a comparison of the age distribution of persons killed in developing countries (Ghee and Astrop et al 1996) showed that 20 per cent of those killed in developing countries were aged under 15 whilst the equivalent figure in developed countries was 10 per cent. This points to the values of developing teaching aids for use in Third World countries, similar to those developed for use in schools in Great Britain and other developed countries. TRL is now actively involved in this process and has recently developed materials for use in schools in Ghana and India.

With the generally low standard of road-user behaviour that exists in many Third World countries, which may in turn be due either to a lack of awareness of traffic regulations or to a general "attitude" towards road safety, it is important that adequate traffic law enforcement is provided by the police. Because little research had been carried out in this field it is difficult to assess the potential of police enforcement for accident reduction in developing countries. There is however likely to be considerable potential in these countries, for in many of them the traffic police are not so well trained or equipped as they are in developed countries. Further, in many Third World cities the police are obliged to spend much of their time controlling traffic, with little time available for traffic law enforcement.

Perhaps the two most important measures that can be adapted to protect the road user during the course of an accident are the use of seat belts for vehicle occupants, and crash helmets for motorcyclists. There has been growing evidence from the developed world that the compulsory wearing of seat belts results in a significant reduction in injuries, particularly those of a more severe nature. The benefits of wearing a seat belt in any particular accident situation should be similar in both developed and developing countries. In view of the often poorer medical facilities, the benefits could in fact be greater in Third World cities in the case of the more serious injuries. Regretably, few Third World countries have, as yet, introduced compulsory wearing of seat belts.

Wider social and behavioural differences between developed and developing countries must also be considered when assessing the potential for road accident reduction in Third World cities. Thus in many Asian cities three or more people can frequently be observed riding a motorcycle or scooter. The relative risk of such over-loading has not been investigated but new legislation and/or stronger enforcement of existing laws would be

required if this problem is to be dealt with effectively. Thus in Dehli legislation exists for the compulsory wearing of crash helmets but the law applies only to the driver of the vehicle; consequently passengers rarely wear crash helmets. As it is common in Dehli to find upto five people using a motor cycle or scooter at one time, the law is far less effective than in a similar city in a developed country.

As stated previously, commercial and public service vehicles are involved in proportionately more accidents in Third World cities than is the case in Europe and North America. The way in which these vehicles are used leads to potentially dangerous situations with open lorries often carrying large numbers of workers, and buses carrying people hanging on the outside of the vehicle. Paratransit forms of public transport, cycle rickshaws, shared taxis etc also have a reputation of being dangerous vehicles in which to travel. The accident record of these vehicles could be considerably improved by legislation prohibiting lorries, buses and minibuses from carrying passengers in a dangerous manner. Results from Dehli and Islamabad also suggest that much could be done to improve the safety of passengers in public service vehicles through improved vehicle maintenance and also through improved training of bus drivers.

There has been increasing evidence from the UK and USA that relatively detailed local accident investigation, combined with low-cost engineering remedial measures, can be highly cost-effective. The experience being gained from following this approach in these two countries is of particular relevance to the Third World. In developed countries, a growing emphasis has been placed in recent years on obtaining value for money from money spent on road safety. With limited financial resources, this must also be an important consideration for developing countries, and TRL has, over recent years worked in Malaysia, Indonesia, Papua New Guinea etc demonstrating the effectiveness of low cost engineering measures at hazardous locations.

It is important that safety features, such as those involving geometry, signing and delineation, be introduced at the design stage rather than be added later, almost as an 'afterthought'. For example, it can often be greatly more expensive to widen the main roads at a T-junction after an accident problem has built up than to incorporate it at the construction stage; this is because after construction it is often found that utility services have to be moved for any local widening scheme. Safety Audits, where safety considerations are introduced at the planning stage as well as design and construction stages are now regularly used on roads throughout Europe.

It has become appreciated in developed countries that planning can have a profound effect upon the level of road safety in a city. The layout of roads in residential areas, for example, has been found to have a major impact upon the level of pedestrian accidents in particular. It is now generally acknowledged that the 'grid layout' is not conducive to road safety, particularly because of the large number of cross-roads and the availability of 'rat-runs' through residential streets, used by motorists either as short cuts or to bypass main road congestion. Thus at the planning stage of residential areas in Third World cities, consideration should be given to road safety.

Finally, when introducing road safety remedial measures in Third World cities, it is essential that scarce resources are not wasted and that any measures introduced are carefully appraised and an assessment made of their relative effectiveness.

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