Reprint

Potential for road accident reduction

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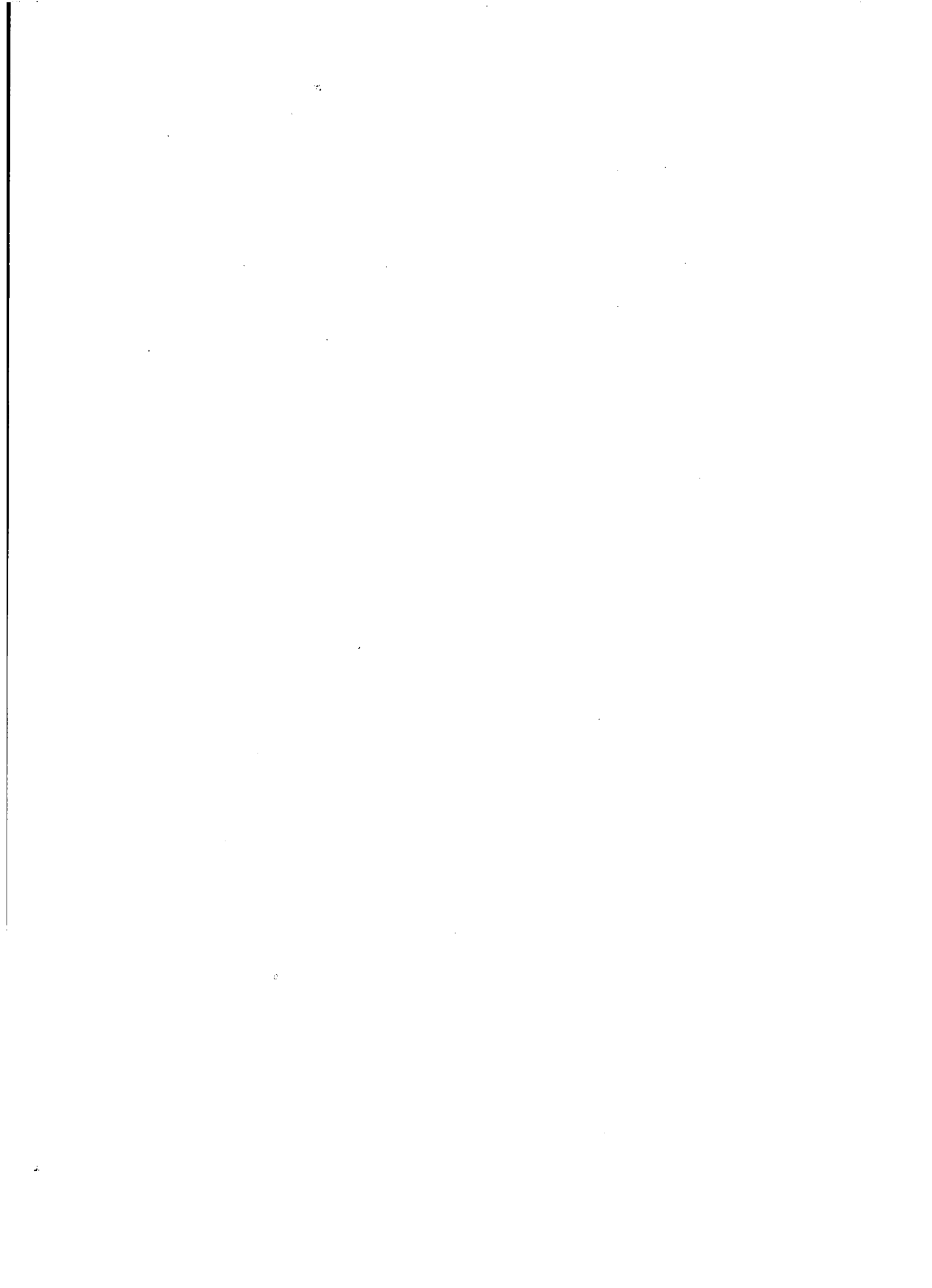
The potential for road accident reduction in developing countries

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ABSTRACT

This paper illustrates the seriousness of the road accident problem in countries of the Third World by examining the cost of these accidents and also by comparing road accident fatalities with other causes of death. The paper then attempts to answer the largely hypothetical question, 'If fatality and injury rates are thought to be too high at present in these countries, to what level could they be realistically reduced?'

Results from the various methods used suggest that existing numbers of deaths and injuries could be reduced by between 30 and 40%, thus saving 40 000 to 50 000 lives in the Third World each year.

A comparison of those countries with particularly high fatality rates with those with particularly low rates showed that factors such as drinking and driving legislation and level of medical facilities available may be playing an important role in reducing fatality rates.

The paper stresses the need for careful monitoring of remedial measures when introduced and an assessment made of their cost-effectiveness. In this way it is hoped that scarce financial resources are not wasted and that a greater understanding is built up of the effectiveness of road safety countermeasures in developing countries.

§1. INTRODUCTION

Research work carried out by the Overseas Unit of the Transport and Road Research Laboratory (TRRL) in recent years has shown that many developing countries already have a serious road accident problem (Jacobs and Bardsley 1977). Fatality rates (per licensed vehicle) are high in comparison with those in developed countries (Jacobs and Hutchinson 1973, Jacobs and Fouracre 1977) and whereas in Europe and North America the situation is generally improving, many developing countries face a worsening situation (Jacobs and Hards 1977). A study of road accident costs (Fouracre and Jacobs 1976) indicated that in those developing countries for which data were available, the overall average cost imputed by those countries to a personal injury accident was no less than that imputed in Great Britain for example. The total cost so calculated of road accidents in developing countries was found to constitute, on average, almost 1% of their gross national product (GNP) per annum—a sum that these countries can ill afford to lose. No clear-cut definition of a 'developing country' exists but if, for sake of argument, a developing country is defined as one with a GNP/capita below $1400 per annum, then 1% of the total GNPs of all these countries combined is approximately £6500 million—a crude estimate of the total annual cost of road accidents in these countries on the basis they use for calculating it. Most of the countries for which data were available in the above study used a 'gross output' approach in costing road accidents with no additional sum added to reflect 'pain, grief and suffering'. This additional sum now represents

over 30% of the assumed cost of a fatal road accident in Great Britain. Further, alternative methods of costing accidents such as 'value of risk change' or 'court award basis' are likely to produce accident cost estimates considerably greater than the 'gross output' method, particularly if no component for 'pain, grief or suffering' is included. The cost of accidents to developing countries is, therefore, likely to be much higher than stated above.

Another way of illustrating the extent of the road accident problem is to compare road accident fatalities with the number of deaths resulting from diseases and other known causes in developing countries. Using statistics published by the World Health Organization and United Nations, data were obtained from 19 Third World countries using the most up-to-date classification of causes of death used by these two organizations. It was found that road accidents accounted for almost 2·5% of all deaths recorded in the 19 countries, making road accidents the tenth most important cause of death.

The analysis was repeated for deaths in the age group 5–64 years thus removing the very young and the elderly, with information being available from 11 countries. In this case, road accidents accounted for over 6% of all deaths reported, a value exceeded by only five other causes. When repeated for the age group 5–44 years, road accidents accounted for almost 10% of the total number of deaths and ranked second only to the 'multiple' cause 'all other accidents, suicide and homicide'.

Although the countries for which data were available may not be representative of the entire Third World, it is clear that road accidents represent a growing social problem, particularly for juveniles, young adults and those in early middle age, and also a growing economic problem for the country as a whole.

§2. THE POTENTIAL FOR REDUCTION IN FATALITY RATES

As stated earlier, road accident fatality rates are high in developing countries and the overall trend over the last ten years has been for them to increase. Fatality rates in countries of Europe and North America have, on the other hand, decreased steadily over the same period. The question can therefore be asked, 'If fatality and injury rates had not increased in developing countries over recent years, what potential reduction in the number of death and injuries might there have been?' The answer to this question pre-supposes that existing fatality and injury rates can be be compared with some previous lower level. In order to make this largely hypothetical but nevertheless interesting comparison, fatality rates in a number of developing countries over the period 1965–78 have been examined and comparisons made with the fatality rates that existed in earlier years in develop countries.

Using data for road fatalities, vehicles and population for the year 1938 from 20 mainly European countries, Smeed (1968) derived a relationship expressed by the formula

$$F/V = 0 \cdot 0003 (V/P)^{-0 \cdot 66}$$

where F = road fatalities, V = number of vehicles, P = population.

Using the same method as Smeed, the author (Jacobs and Hutchinson 1973, Jacobs and Fouracre 1977) carried out analyses of fatality rates in developing countries for a number of different years. The earliest analysis, carried out on over 30 developing countries, was for the year 1965. A relationship, statistically significant at the 1% level, was derived which is shown in fig. 1 (on a logarithmic scale). The

Fig. 1
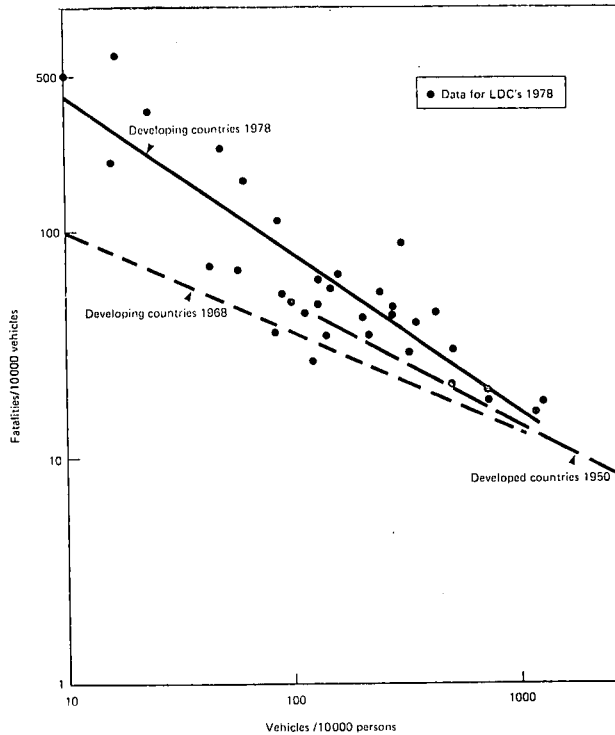
Relationships between fatality rates and levels of vehicle ownership.

equation was of the form

$$F/V = 0.0005(V/P)^{-0.43} \quad \text{where } F, V, P \text{ are as above.}$$

From fig. 1 it can be seen that, as vehicle ownership increases, the fatality rate decreases: that is, the less developed countries (with lower vehicle ownership) were those with the higher fatality rates.

The analysis was now repeated for the year 1978 using data from the 35 developing countries, given in the table (all having a GNP per capita below $1400). The relationship, again statistically significant at the 1% level, was markedly different, see fig. 1, from that found for the year 1965 (differences being statistically significant at the 5% level). It can be seen that over the given time period, the slope of the regression line has increased; in other words for the same level of vehicle ownership, the fatality rate had increased. The equation derived for the year 1978 was:

$$F/V = 0.00033(V/P)^{-0.7}$$

In an earlier analysis by the author (Jacobs and Hards 1977), the same group of countries used by Smeed in his study of data for the year 1938 was taken and the analysis repeated for the years 1950, 1960 and 1970. The relationships derived were very close indeed to those obtained by Smeed. In other words, the relationship between fatality rate and vehicle ownership would appear to be fairly stable in

G. D. Jacobs

Fatality and vehicle ownership rates, Developing Countries 1978.

Country	Fatalities per 10 000 vehicles	Vehicles licenced per 10 000 persons
Angola	508·0	9·7
Botswana	43·2	278·0
Cameroun	18·2	748·2
Chile	21·1	519·0
Congo	56·9	150·7
Colombia	34·5	243·3
Ethiopia	206·1	15·5
Ivory Coast	42·3	209·6
Indonesia	35·9	83·3
Jordan	44·1	427·0
Kenya	65·4	166·3
Korea (S)	29·0	335·8
Liberia	62·0	134·3
Lesotho	111·2	88·6
Mauritius	340·2	22·9
Mexico	18·2	748·2
Malaysia (W)	16·2	1196·0
Malawi	173·5	62·1
Morocco	46·6	278·0
Mali	21·3	127·3
Niger	68·7	57·0
Nigeria	234·8	48·7
Panama	29·7	511·1
Pakistan	53·2	93·3
Peru	611·4	17·0
Sierra Leone	44·2	114·0
Sri Lanka	48·2	131·2
Senegal	34·8	142·5
Swaziland	88·9	310·0
Taiwan	17·7	1295·3
Thailand	26·8	340·0
Togo	56·7	147·3
Tunisia	39·0	364·4
Turkey	53·3	250·4

developed countries whereas in developing countries the fatality rates increased markedly, for similar levels of vehicle ownership over the period 1965–78.

If the equation had remained stable in the group of developing countries with, say, the relationship for 1965 still applying in 1978 then there would have been far fewer deaths in 1978 than was the case. The actual number of vehicles and people for 1978 in each country were therefore substituted into the 1965 equation and the total number of deaths obtained. This analysis showed that by using 1978 data in the 1965 relationship for fatality rates (per licensed vehicle) and vehicle ownership levels, the number of deaths in developing countries would have been 45 000 as opposed to the 75 000 that actually occurred. Thus it can be argued that, if fatality rates had not increased in the Third World between 1965 and 1978, then the number of deaths might have been, say, 60% the actual number occurring in 1978.

A second approach in assessing the potential for reduction in fatality rates might be to take the equation derived for developed countries for the year 1950 (see fig. 1)

when vehicle ownership levels were fairly similar to the majority of Third World countries in 1978 and to substitute 1978 vehicle ownership and population statistics for each of the 37 developing countries into this equation. This analysis suggests that using the 1950 developed country relationship, the number of deaths would have been approximately 55 000, as opposed to the 75 000 that actually occurred.

A third approach is to examine the fatality rates for the 35 developing countries in 1978 and to suggest that the fatality rates experienced by those 25% of countries with their rates the furthest distance below the regression line could be matched by the remaining 75% with the effect that those countries with the highest fatality rates reduce their rates to match those with lowest rates (for an equivalent level of vehicle ownership). For each country in the upper 75th percentile, the fatality rate was reduced (for each appropriate level of vehicle ownership) until it matched a regression line for the lowest quartile. Using this approach the number of deaths might have been reduced from 75 000 to 52 000.

An attempt was made to see if those countries with the highest rates (relative to vehicle ownership) differed in any way from those countries with lowest rates. It was found that of the ten countries with the relatively highest rates, eight were African whilst of those with lowest rates, only three were African. Although numbers are small, a Chi-square test suggests that this is a significant result. Use was also made of a questionnaire sent by TRRL in conjunction with the WHO to over 50 developing countries seeking information on road safety programmes, legislation, etc. The only difference found between the two groups of countries (those with relatively high and relatively low rates) was that only one country with high rates had legislation dealing with drinking and driving whilst five of the nine countries for which information were available with low rates were either Muslim countries with alcohol forbidden or had legislation on drinking and driving. Again, although numbers are small, a Chi-square test suggests that differences are statistically significant.

Earlier work (Jacobs and Hards 1977) on fatality rates in developing countries showed that rates could be correlated to the level of medical facilities available in each country (expressed in terms of population per physician and population per hospital bed). It was found that the median value of population per physician for those countries with relatively high fatality rates was almost four times that of the value for the group of countries with relatively low fatality rates. It is possible, therefore, that certain countries may have particularly high numbers of road accidents leading to death due to the relatively low level of medical facilities available.

Using the above three hypothetical approaches it can be seen that:

(1) If the problem had not worsened between 1965 and 1978 in the Third World with death rates remaining at their 1965 levels for a given level of vehicle ownership, then there would have been 45 000 deaths in the 35 developing countries as opposed to the 75 000 that actually occurred.

(2) If the relationship for developed countries in 1950 applied to the 35 developing countries for 1978 then the number of deaths would have been approximately 55 000.

(3) If those countries with the poorest road accident fatality rates improved to match the 25% with the best record then the number of deaths in 1978 would have been 52 000 as opposed to the 75 000 that actually occurred.

The above approaches are theoretical and no attempt is made to suggest how these lower rates could have been achieved. Nevertheless it is clear that the accident

situation has worsened considerably in those developing countries for which data were available between 1965 and 1978. If strenuous efforts had been made from 1965 onwards to deal with this growing problem there might have been between 30 and 40% fewer deaths in these countries in 1978.

§3. THE POTENTIAL FOR REDUCTION IN INJURY ACCIDENT RATES

A study (Gratton and Keigan 1975) carried out in Great Britain on the under-reporting of road accidents showed that there was a substantial element of under-reporting of casualties to the police consisting mainly of those with slight injuries and mostly among bicyclists. Needless to say, in virtually all developing countries the accident reporting system is much less comprehensive than in Great Britain and non-fatal accidents will be considerably less well reported than in this country. Casualty and accident rates in developing countries therefore have to be treated with some degree of caution.

A study of fatality indices in developing countries (Jacobs and Hutchinson 1973) made by the author, (with the fatality index defined as the proportion of all injury accidents that were fatal), showed that fatality indices ranged from as high as 20% to as low as 4%. Countries showing indices as high as 20% are almost certainly under-reporting non-fatal accidents to a considerable degree. In comparison, the fatality index in Great Britain is of the order of 2%, in the U.S.A., 2·5%, and in Canada, 2·6%. The study carried out by the author showed that the fatality index in 29 developing countries was significantly related to both the population per physician in each country and the population per hospital bed. As the medical facilities available, expressed in terms of the above two parameters, decreased, the fatality rates increased.

If a fatality index of 7·5% is taken as representative of Third World countries then there may have been of the order of 1·0 million injury accidents in the 35 countries in 1978 listed in the table. If the accidents had been reduced by the same hypothetical 30 or 40% as the number of fatalities discussed above then the estimated 1·0 million injury accidents in 1978 would have been reduced to 700 000 or 600 000 respectively.

Earlier research work carried out by the author (Jacobs 1976, Jacobs and Sayer 1977) can be used to compare accident rates in developed and developing countries in specific situations. These relationships can then be compared with those derived above.

3.1. *Accidents in towns*

Relationships were established (Jacobs and Sayer 1977) between the number of personal-injury accidents taking place on busy shopping streets in selected urban areas in developing countries and the vehicle flow on these streets. From fig. 2 it can be seen that accident rates (per kilometre per annum) in cities in developing countries were considerably greater, at similar levels of vehicle flow, than in four towns selected for detailed study in Great Britain. By combining data from all four Third World cities, a composite regression line was obtained which can be compared with the line derived for the towns in Great Britain. This showed that injury accidents per kilometre of road per annum were almost twice as high in Third World cities as in Great Britain. Thus, if the measures introduced in this country over the last 30 years or so were introduced successfully in the developing world, it may be

Fig. 2
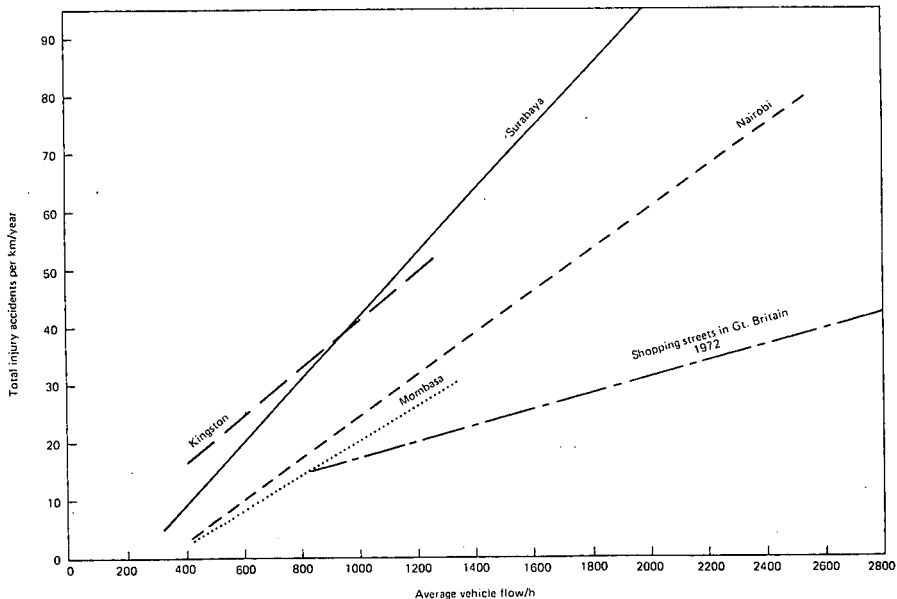
Injury accidents in the central areas of the cities compared with Great Britain.

possible to reduce accident rates by 40 to 50%, thereby matching rates found in towns and cities in this country.

3.2. *Accidents outside towns*

An investigation (Jacobs 1976) was also made by the author which correlated the personal-injury accident rate occurring on rural roads in developing countries with the design characteristics of the road. Data were obtained on main 'A' roads in Jamaica and on the Nairobi–Mombasa road Kenya. Relationships were first established between the accident rates per kilometre of road per annum and vehicle flow as shown in fig. 3. Results from Kenya and Jamaica were compared with a composite line developed by Silyanov (1973) from a number of developed countries and it can be seen from fig. 3 that, for similar levels of vehicle flow, the personal-injury accidents per kilometre of rural road per annum were much greater in Jamaica and Kenya than in developed countries. Thus at a traffic flow level of 100 vehicles per hour the rate is over twice as high in the two developing countries, whilst at a flow of 200 vehicles per hour it is about five times greater.

The study also used multiple regression analysis to establish relationships between the personal-injury accidents per million vehicle-kilometres travelled and geometric design features of the road such as horizontal and vertical curvature, width, roughness and junctions per kilometre. Again it was found that for a given level of geometric design, the injury accident rates were considerably greater in Kenya and Jamaica than in Europe, Australia and the U.S.A. Thus, by introducing design featues commonly found on busy inter-urban roads in the developed world and also by improving other important factors such as road user behaviour, it may be possible to reduce accident rates on rural roads in developing countries by 50%.

Fig. 3
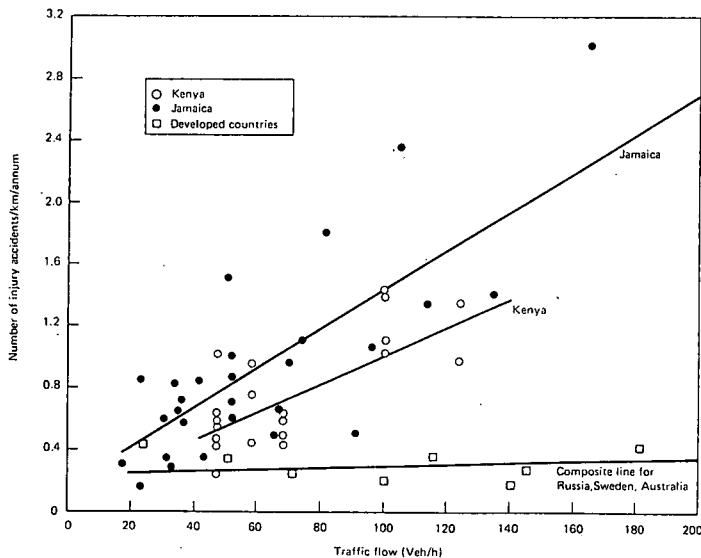
Comparison of accident rates and vehicle flow on rural roads for various countries.

§4. SUMMARY

Work carried out by the Overseas Unit TRRL on accident rates and trends in developing countries has shown that, in comparison with the countries of Western Europe and North America, accident rates are high and have increased markedly over the period 1965–78. In this paper an attempt has been made to show what potential exists for reducing death and injury rates in developing countries. In order to do this a number of assumptions have to be made; but results suggest that, if the accident situation had not worsened in 35 Third World countries between 1965 and 1978, or alternatively if these countries could come some way to matching the accident rates of the developed world as they existed in the 1950s, then between 30 and 40% of the deaths and injuries that occurred in 1978 might not have taken place. This in turn means a saving of between 22 000 and 30 000 lives and a saving of between 300 000 and 400 000 injuries in the 35 countries for which data were available. For all developing countries with a GNP per capita below $1400 it is estimated that in 1978 there were approximately 130 000 deaths from road accidents. A reduction of 30% would mean a saving of about 40 000 to 50 000 lives respectively. Further, since the collection of road accident data is not very thorough in the large majority of developing countries, then the actual number of people killed and injured is likely to be considerably greater than the data available suggests. This in turn means that the potential for injury reduction is likely to be greater than the figures above suggest.

Almost all the countries of the Third World suffer from lack of financial resources and the sums of money available to spend on road safety improvements, road rehabilitation and maintenance, police enforcement, etc. will be severely limited. Consequently it is particularly difficult for these countries to deal effectively with their road safety problems. Under these circumstances it is essential that scarce resources are not wasted and that any measures that are introduced are carefully

appraised and an assessment made of their relative effectiveness. The careful monitoring of remedial measures and an assessment of their cost-effectiveness is one of the goals of an ongoing programme of research within the Overseas Unit of TRRL.

This points to the further and fundamental need for a good accident data collection and analysis system. This should be sufficient to produce essential information for accident investigation purposes but, at the same time, it should not be too sophisticated either for the needs or capabilities of those who operate it or contribute to it.

This again is part of the ongoing programme of research in the Overseas Unit of TRRL. It is also essential that developing countries have the appropriate administrative machinery for dealing with the road safety problem. This could include setting up a National Road Safety Committee, thus ensuring closer liaison between the various Government Departments which may be involved in aspects of road safety. Preferably there should be one Government Department with clear cut overall responsibility in this very important field.

FOREIGN SUMMARIES

Cet article souligne l'importance du problème des accidents de la route dans les pays du tiers-monde, tant en ce qui concerne le poids qu'ils font peser sur l'économie, qu'en relation avec les autres facteurs de mortalité. Il essaie de répondre à une question dont la formulation pose elle-même des questions: 'si l'on considère que les taux d'accidents mortels et de blessures sont trop élevés dans ces pays, jusqu'à quels taux peut-on espérer les abaisser de façon réaliste?'

Des travaux effectués selon différentes méthodes convergent pour estimer que le nombre de décès et de blessures provenant des accidents de la route pourraient être réduits de 30 à 40%, ce qui correspondrait, pour l'ensemble du tiers-monde, à 40 à 50 000 vies sauvées chaque année.

Une comparison entre les pays où l'on trouve les taux d'accidents mortels les plus élevés et les plus bas montre le poids considérable de facteurs tels que l'alcoolisme, les règlements de circulation routière et l'équipement médical et hospitalier.

L'auteur insiste sur l'importance d'un suivi attentif des méthodes utilisées après leur entrée en vigueur et d'une évaluation du rapport entre leur coût et leur efficacité. C'est à ce prix que l'on pourra éviter le gaspillage de ressources financières particulièrement rares et que les programmes de sécurité routière seront mieux acceptés par la population.

Dieses Papier veranschaulicht die Schwere des Problems von Straßenverkehrsunfällen in Ländern der Dritten Welt, indem die Kosten dieser Unfälle untersucht werden. Gleichzeitig werden Unfälle mit Todesfolge anderen Todesursachen gegenübergestellt. Das Papier versucht eine Antwort auf die äußerst hypothetische Frage zu geben: 'Wenn Todes- und Verletztenraten heute als zu hoch eingeschätzt werden, bis zu welchem Niveau können sie unter realistischer Einschätzung abgesenkt werden?'

Die Ergebnisse unterschiedlicher methodischer Ansätze lassen darauf schließen, daß die heutige Zahl von Toten und Verletzten im Straßenverkehr um 30 bis 40% gesenkt, so daß jährlich 40–50 000 Leben gerettet werden können.

Ein Vergleich zwischen Ländern mit hoher und niedriger Todesrate erbrachte, daß Einflußfaktoren wie Gesetze gegen Fahren mit Alkohol sowie der Stand der medizinischen Versorgung (speziell des Rettungswesens) eine bedeutende Rolle bei der Senkung der Todesrate spielen.

Das Papier weist auf die Notwendigkeit hin, alle Abhilfemaßnahmen sorgfältig zu beobachten und ihre Effizienz durch Nutzen—Kosten—Untersuchungen zu untersuchen. Hierdurch können knappe öffentliche Mittel sparsam eingesetzt werden. Gleichzeitig werden so die Zusammenhänge und Wirkungen von Verkehrssicherheitsmaßnahmen in Entwicklungsländern verdeutlicht.

Este artículo ilustra la severidad del problema de accidentes camineros en países del tercer mundo, mediante un exámen del costo de estos accidentes y la comparación de la cantidad de muertes por éste y otros motivos. Se trata, en el fondo, de contestar la pregunta, básicamente hipótetica 'ya que se piensa que actualmente las tasas de accidentes y de mortalidad son muy elevadas en estos países, a que niveles podrían reducirse en forma realista'.

Los resultados de varios métodos que fueron probados sugieren que el número actual de muertos y heridos podría reducirse entre un 30 y un 40 por ciento, salvando de este modo entre 40 000 y 50 000 vidas al año en el tercer mundo.

Una comparación de aquellos países contasas de mortalidad particularmente elevadas y aquellos con tasas particularmente bajas, sugiere que factores tales como la legislación respecto a bebidas alcohólicas y conducción de vehículos, o el nivel de servicios médicos disponibles, pueden estar jugando un papel importante en reducir las tasas de mortalidad.

El artículo enfatiza la necesidad de estudiar cuidadosamente, en un análisis de seguimiento, las medidas correctivas que se introduzcan a fin de determinar su relación costo-efectividad. De esta manera se espera evitar el desperdicio de recursos financieros escasos, y que se logre llegar a un mejor entendimiento de la efectividad de medidas de seguridad caminera en países en desarrollo.

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SILYANOV, V. V., 1973, Comparison of the pattern of accident rates on roads of different countries. *Traffic Engineering and Control*, **14**, 432.

SMEED, R. J., 1968, Variations in pattern of accident rates in different countries and their causes. *Traffic Engineering and Control*, **10**, 364.

WORLD HEALTH ORGANIZATION AND UNITED NATIONS *Annual Statistical and Demographic Year Books*.

EDITORIAL SUGGESTIONS FOR FURTHER READING

EID, A. M., 1980, Road traffic accidents in Qatar. The size of the problem. *Accident Analysis and Prevention*, **12** (3), pp. 287–98.

This study on traffic accidents registered in Qatar during the years 1976, 1977 and 1978 shows the size, evolution and epidemiological characteristics of the

problem. Descriptive and quantitative information is given about motor transport in the country with the purpose of finding the reasons for the high incidence of traffic accidents. In fact, the average of the three years studied shows that some 185 deaths were due to this cause (over 90% of all traumatic deaths registered) in a country which in 1978 had approximately 220 000 inhabitants, 80 000 motor vehicles and 1200 km of paved roads. It is concluded that there were definite cultural, ethical and behavioural attitudes, and also psychological problems in this multiracial community which predisposed to the high incidence of road traffic accidents.

(Author)

HAIGHT, F. A., 1980, Traffic safety in developing countries, *Journal of Safety Research*, **12** (2), pp. 50–8.

Traffic safety in developing countries is strongly dependent on the development of the transportation—and hence the economic—system. Countermeasures should be designed with this dependence in view, should recognize 'natural' trends in safety, and should seek low cost effective solutions to local problems. Since the problems in traffic safety are quite different in developing and developed countries; the lessons to be learned should not be regarded as 'technology transfer'; in fact, many of the 'truths' about traffic safety in highly motorized countries may be untrue in developing countries.

(Author)

HILLS, B. L., and JACOBS, G. D., 1981, The application of road safety counter-measures in developing countries, *Traffic Engineering and Control*, **22** (8/9), pp. 464–8.

Over the past 50 years developed countries have built up considerable experience in road safety theory and practice, including a fairly substantial body of research data. Potentially, this experience should be of value to developing countries in assessing priorities in their own road safety programmes, but a number of problems occur and these are considered in this paper. The nature of the problem in developing countries may be considerably different from that in Europe or North America. Countermeasures that are effective in developed countries may be ineffective in developing countries, and vice versa. Although there has been extensive research into the effectiveness of countermeasures in developed countries, the results of this research may be less definitive than might be desired. Countermeasures that are appropriate in developed countries may, for financial or other reasons, be inappropriate in Third World countries.

(D.B.)

JACOBS, G. D., SAYER, I. D., and DOWNING, A. J., 1981, *Road Accident Data Collection and Analysis in Developing Countries*, TRRL SR 646 (Transport and Road Research Laboratory).

A questionnaire was sent to 42 developing countries to determine what methods are used to collect and analyse road accident data. 34 replies (80 per cent) were received.

It was found that over 60 per cent of the countries replying, used a police booklet or form to report accidents 'on-the-spot'. Few of these however were sufficiently comprehensive or incapable of improvements in design.

Only 15 per cent of these countries used an accident analysis form equivalent to the UK Stats. 19, 'Report of a road accident involving personal injury'. Those that were used were either inadequate or even over-elaborate.

A system for reporting and coding road accidents is suggested for use in developing countries. Ease of completion and simplicity of design were major considerations.

Advice is given on methods of data processing that could be adopted in developing countries.

(Authors)

PRESTON, B., 1981, Road safety: international comparisons, *Transport Reviews*, **1** (1), pp. 75–100.

It is difficult to compare the safety records of different countries because of differences in reporting accidents, population sizes and numbers of vehicles. Smeed's formula for predicting the expected number of road deaths in a country from the size of population and the number of motor vehicles is critically evaluated. The difference between the number of deaths expected from the formula and the actual number of deaths in different countries (which does not seem to depend on the degree of motorization) is recommended for international comparisons.

Some effects of legislation, propaganda, education and enforcement in various countries are reviewed.

The road safety measures used in selected countries, with especially good or bad records, are compared. Countries with fewer road deaths than expected have lower speed limits and stricter laws to prevent driving after drinking than countries where there are more road deaths than expected.

It is suggested that, if a country decides that the existing death rate on the roads is intolerable and is prepared to spend money and introduce and enforce legislation, then the road deaths can be reduced dramatically, as demonstrated by Japan.

(Author)

SILCOCK, D. T., 1982, The procedure adopted in various countries for estimating the cost of traffic accidents or valuing their prevention, *Transport Reviews*, **2** (1), pp. 79–106.

This paper is derived from work conducted as part of a recent study of the methods which can be used to estimate the costs of traffic accidents or to value their prevention, undertaken for the World Bank (Hills and Jones-Lee 1981). As a contribution to that study the author examined the procedures adopted in a number of countries. This paper extends and further reports on that examination.

(Author)