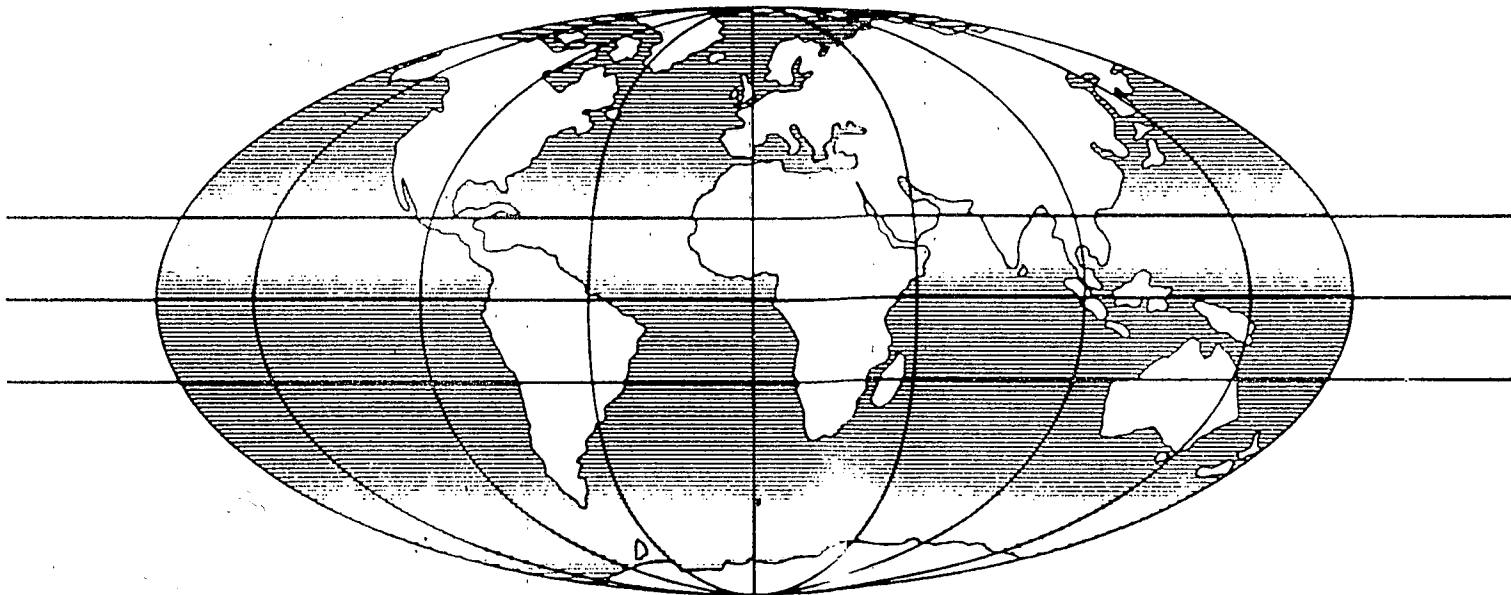


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Road accidents in Pakistan



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ROAD ACCIDENTS IN PAKISTAN AND THE NEED FOR IMPROVEMENTS
IN DRIVER TRAINING AND TRAFFIC LAW ENFORCEMENT

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1. INTRODUCTION

Since 1972 the Overseas Unit of the Transport and Road Research Laboratory (TRRL) has been carrying out studies of road accidents in developing countries (1,2). These have indicated that the fatality rates (fatalities per licenced vehicle) are high in comparison with those of developed countries, and many developing countries are faced with a worsening situation, whereas the situation in Europe and America is generally improving.

More recently, the Unit has developed a road accident reporting and microcomputer analysis package for developing countries(3) (at present in use on a trial basis in 2 countries and to be in use in 2 more countries shortly), and has begun a programme to evaluate low cost road accident countermeasures in developing countries.

Part of the latter programme was started in 1981 in collaboration with the National Transport Research Centre (NTRC) in Pakistan. Road accident data were examined to establish the magnitude and nature of the problem and to determine priority areas for investigation(4). This paper summarises the main findings of those studies which were closely related to the problems of driver behaviour, and gives some insight into the effectiveness of road markings, road signs, driver training and enforcement in Pakistan.

2. THE ROAD ACCIDENT PROBLEM IN PAKISTAN

In 1981 there were 9,647 injury accidents reported to the police in Pakistan of which 3,458 were fatal. About 4,000 people died in these accidents and a further 10,366 were injured (data from the Transport Bulletin(5), excluding accidents from Baluchistan)

One way of assessing the seriousness of the accident problem in one country is to compare the fatality rate of that country with the corresponding values of other countries. Figure 1 shows the number of deaths per 10,000 vehicles for 29 developing countries (data from the International and Road Federations Statistics 1978(6)). It can be seen that the fatality rate for Pakistan was about 105 making it the fourth highest of the countries included and it would appear from these results that the road accident problem is particularly severe in Pakistan.

Deaths per million vehicle kilometres would be a more appropriate statistic but unfortunately accurate traffic censuses are rarely carried out in developing countries. However figures have been calculated for the Punjab Province in Pakistan (1980) and the fatal accident rate per million vehicle kilometres for the Province was found to be 16 times higher than the rate for United Kingdom (0.49 compared to 0.03). As 52 per cent of the fatal accidents and 49 per cent of the registered vehicles were from the Punjab it is not unreasonable to assume that the Province is representative of Pakistan

as a whole with respect to accident rates and the data therefore support the finding with Pakistan has a very serious road accident problem compared with other countries.

Research work(1,2,7) has shown that in a group of countries a statistical relationship can be established between fatality rates (per licenced vehicle) and levels of vehicle ownership (vehicles per head of population). Figure 2 shows the relationship for 25 developing countries (from the IRF statistics(6) 1978). The equation (statistically significant at the 1 per cent level) was of the form:

$$\frac{F}{V} = 0.00078 (V/P)^{-0.44}$$

where F = road fatalities

V = number of vehicles

P = population

It is evident that countries with lower levels of vehicle ownership have higher fatality rates. From Figure 2 it can be seen that the point for Pakistan lies above the regression line, indicating that Pakistan's fatality rate is higher than one would expect from its vehicle ownership levels. Indeed if the point for Pakistan were to lie exactly on the regression line for the same level of vehicle ownership it would correspond to 2932 deaths in 1978 instead of the 3725 given in the IRF statistics.

Another indicator of the seriousness of the road accident situation in a country is the fatality index, usually defined as the proportion of persons killed amongst those both killed and injured. In Pakistan in 1981 the value was 28 per cent; this is extremely high even for a developing country and is far greater than the average value of under 3 per cent for developed countries. It seems probable that, as in a number of developing countries, the less serious accidents are often not reported and as a result the fatality index is artificially high. However, earlier research by the Unit(1) has shown that the fatality indices in a group of countries is correlated with the level of medical facilities available and it is possible that the high index for Pakistan is due in part to inadequacies in the medical and emergency services.

Unfortunately not a great deal of detailed information exists about the pattern of accidents in Pakistan as a whole. However the Traffic Engineering Bureau in Karachi publishes monthly statistics for the city and from a 3 month sample of these (Table 1) it can be seen that pedestrians were by far the largest group of fatalities and casualties in road accidents. Other data from the review carried out(4) at the beginning of the TRRL/NTRC collaborative project indicated that the pedestrian accident problem was widespread throughout Pakistan; for example, in the Punjab 38 per cent of the accidents involved pedestrians.

Table 1 Percentage of fatalities and casualties
by road user class Karachi, May-July 1984

	Pedestrians	Cyclists	Motor Cyclists	Motor Rickshaws	Cars/Taxis	Buses	Goods Vehicles	Other	Total
Fatalities	65	5	17	1	2	3	5	2	100
Casualties	38	5	22	7	7	11	9	1	100

Table 2 Percentage of vehicles involved in reported
road accidents

Province	Vehicle type						Total
	Buses/Minibuses	Trucks	Cars/Jeeps	Motor Cycles	Motor rickshaws	Others	
Punjab 1981	46	19	19	6		10	100
Sind* 1980	30	24	15	10	4	17	100
NWFP* 1980	47	16	14	7	6	10	100

* - only 'main vehicle' involved identified.

Information about vehicle involvement was available for 3 of the 4 Provinces but in two of them only the 'main' vehicle was identified. The most recent data (Table 2) shows that buses and mini-buses were the group most often involved in accidents. Clearly bus accidents are a major problem in Pakistan and although their high frequency is in part related to the relatively high volumes of buses on the roads, data from one of the major urban bus companies indicated that the fatality rate per million kilometres operated was at least an order of magnitude higher than that of urban operators in the UK.

Little information was available nationally on the location of accidents. However data from Sind Province indicated that at least half of the fatal accidents occurred in urban areas as 49 per cent of them occurred in Karachi alone. In addition it would appear that a high proportion of accidents occurred on the major intercity trunk roads as in a large area of the Punjab it was found that 27 per cent of the fatal accidents occurred on the National Highway, N-5.

According to the police identification of causes, road accidents were blamed on road user error in 90 per cent of the cases, on the road condition and the environment in 6 per cent and on vehicle defects in 4 per cent. Caution is needed when interpreting these results as police in general have not been trained as engineers and therefore they may underestimate the contribution of engineering related causes. Nevertheless it seems probable that road user error

has contributed to the majority of road accidents in Pakistan and further research on behaviour was identified in the joint TRRL/NTRC programme.

Although not much detailed information was available on road accidents it was sufficient to estimate the seriousness of the problem and identify priority areas for research. The areas chosen for study were as follows:

1. Police accident reporting methods and under-reporting of accidents.
2. The effectiveness of low cost engineering measures ('Black spot' improvement schemes, road signs and markings) on the National Highway, N5.
3. The design and evaluation of retraining courses for bus drivers.
4. The effectiveness of traffic policing.
5. Factors affecting pedestrian knowledge and behaviour.

In the following sections of this paper some of the main findings of the research of particular relevance to problems of driver behaviour are summarised. These are drawn from area 2 (particularly road signs and markings), and areas 3 and 4.

3. ROAD SIGNS AND MARKINGS

Observations of driver behaviour were made at a number of sites often as part of a monitoring programme to determine the effectiveness of remedial measures. From a summary of the results of this work shown in Table 3 it is clear that a very high proportion of drivers were committing errors at junctions particularly when turning right. Also it would appear that stop signs were frequently disregarded even when traffic on the major road was close to the junction and in addition many drivers were taking risks at bends by crossing over the centre of the road.

The sites where the above observations were made were all in the Rawalpindi-Islamabad area of Pakistan and at the time, road markings were virtually non-existent apart from centre line markings on urban roads. In order to try and reduce some of the driver errors made, experimental markings were introduced at 12 urban junctions and at 7 bends and one hill crest on 2 rural main roads. The markings used were the same as those specified in the Pakistan Highway Code and were similar to those used in the UK.

Table 3 Percentage of drivers making errors and the effect of police presence

Driver error	Percentage ¹ of drivers	Average change in percentage ² when police present
Failed to stop at red signal ³	13 (6)	- 3.8 (5)
Failed to give way when turning left on red signal	12 (6)	+ 4.7 (4)
Failed to stop at stop sign - traffic near	52 (6)	- 2.3 (3)
Failed to stop at stop sign - no traffic near	99 (6)	No data
Cut corner on right turn	48 (3)	- 3.7 (3)
Turned right from wrong lane	42 (3)	- 7.0 (3)
Failed to give way when turning right	36 (5)	+ 1.6 (5)
Drove wrong way down dual carriageway ⁴	51 (4)	- 4.4 (1)
Crossed double white lines	15 (8)	No data

() = number of sites

¹percentage = $\frac{\text{total number of drivers making error at all sites}}{\text{total number of drivers at all sites}} \times 100$

²average change in percentage = $\frac{\text{change in percentage at each site}}{\text{number of sites}}$

(negative change indicates an improvement in behaviour when police present)

³only drivers with the choice of stopping or not stopping were considered. Drivers forced to stop because the leading vehicle stopped were not counted.

⁴only drivers using a route where they had to make the choice between driving the wrong way or driving correctly and making a U-turn were considered. Other drivers on the same stretch of carriageway were not counted.

Driver behaviour was measured before and after the introduction of the markings at the experimental sites and also at the same time at control sites, where no improvements were made. In addition at a selection of sites a random sample of drivers was stopped and interviewed immediately after passing through the site.

In all, 10 measurements of behaviour were made and an analysis of variance revealed that only one of these, that is the proportion of vehicles completely crossing the centre of the road, was consistently

affected by the markings.

It was found that, on average, there was a small improvement from 6.8 per cent to 5.6 per cent in this measure after the markings were introduced compared with a 1.5 per cent deterioration at the control sites.

Overall the introduction of road markings seems to have had very little impact on the high levels of driver error. The lack of improvement may have been due to drivers not seeing the markings or to a lack of understanding of their meaning. On the other hand drivers may have still remained unwilling to change the way they were driving even though they had seen and understood the markings.

In the subsequent interviews, 86 per cent of the drivers claimed that they had seen the markings. However when they were asked to identify those they had just seen from a selection of 9 presented on a chart, many of the drivers experienced some difficulty especially with the stop lines and the centre line markings. From the results shown in Figure 3 it is clear that arrow markings on the carriageway were well remembered by drivers (identified by 65 to 72 per cent) whereas only 22 per cent of the drivers correctly identified the other types of marking*.

In the interviews the drivers were also asked the meaning of 9 road markings and the results are shown in figure 4. It is clear that the knowledge of road markings was generally poor and the best known markings were the lane arrows (59 per cent of the drivers) whereas the meanings of the stop, give way and no overtaking markings were known by only just over a third of the drivers interviewed. Clearly these relatively low levels of knowledge and the inability of many drivers to identify the correct marking suggest that improvements are required in driver education if road markings are to be in any way effective.

The effect of a small selection of road signs was also investigated in conjunction with a study of skidding resistance. At the time of the study it was noticed that when road works were carried out there were often no temporary signs available to warn and control drivers, and workmen had to make do with bricks or rocks placed in the road close to the obstruction. In order to carry out the programme of skidding resistance measurements it was necessary to provide protection for the technicians working in the road and a set of signs and cones was prepared similar to those recommended for road works in the UK. (The 5 basic signs used are shown in Figure 6). The opportunity was taken to assess the impact of the cones and signs by measuring vehicle speeds and overtaking levels before and after they were set up. Also, as in the previous study, a random sample of drivers was interviewed immediately after the road works.

*When calculating the percentage of drivers who correctly identified a marking only drivers who had just passed through a site with the appropriate marking were counted.

From Figure 5 it is clear that speeds dropped significantly for all vehicles at urban and rural sites, except for motorcycles in urban areas. The latter result is perhaps not surprising as motorcycles are small vehicles and therefore least affected by obstructions in the road.

After the signs and cones were installed, the average overtaking level dropped from 16.6 per cent to 10.7 per cent in the 'no overtaking' area designated by the signs and although this reduction is statistically significant there was still a surprisingly high proportion of drivers violating the overtaking ban (as high as 25 per cent at one site).

In the interviews the drivers were asked first to identify the signs they had just seen from a chart of 10 signs and then to tell the interviewer what each sign meant. From the results shown in Figures 6 and 7 it would appear that although most of the drivers may have noticed the signs many could not identify precisely which ones they had just seen nor was the level of knowledge of the meaning of some of the signs very high. Therefore it is perhaps not surprising that overtaking levels were not significantly reduced.

The findings from the interview data in both the last two studies suggest that many drivers do not normally attend to signs and markings or use them for information when driving. Also knowledge of signs and markings was found to be generally quite poor and in particular comparisons between professional drivers (hired to drive a vehicle) and owner drivers showed that the former knew significantly fewer signs than the latter (48 compared to 61 per cent). One would have expected the standards of knowledge of the professional driver to have been at least as high as those of other drivers but the above results suggests that this is not the case in Pakistan; there is probably a need to make the licencing requirements more stringent for professional drivers and also to improve their training.

4. A RETRAINING COURSE FOR BUS DRIVERS

It is clear from data presented earlier that Pakistan has a serious bus accident problem. This finding together with the information that professional drivers know less than others about road signs and markings led to the authorities setting up a retraining course for bus drivers. Initially 9 drivers (including 2 instructors) were trained on a 4 day course and the effectiveness of the training was assessed by giving 1 written test (multiple choice answers), 2 oral tests and a 45 minute driving test before and after the course (details of the driving test and course syllabus can be obtained from the pilot study report(8)). The methods of assessment and marking adopted in the driving test were similar to those used in the UK for testing learner car drivers and faults made were graded as minor, serious or dangerous (any one serious or dangerous fault would lead to failure in the UK test).

Table 4 Serious and dangerous errors committed by bus drivers

	Number of errors		Percentage reduction ¹	
	Pre test	Post test		
Control errors: Brakes, steering or gears used incorrectly	2	2	0	
Procedure errors:				
Junctions	Speed too fast	8	0	100
	Observation inadequate	13	0	100
	Emerged when traffic too close	21	16	24
	Wrong position	27	8	70
Overtaking	Mirror not used	12	4	67
	Too close to other vehicles	13	3	77
	Disobeyed signs or signals	16	1	94
	Other procedure errors	3	4	- 33
Total errors	115	38	67	

$$^1 \text{percentage reduction} = \frac{\text{Pre test} - \text{Post test}}{\text{Pre test}} \times 100$$

All but 2 of the serious and dangerous errors were procedural errors i.e. drivers were not failing because they could not control the vehicle but because they were not following the rules or advice given in the Pakistan Highway Code for carrying out manoeuvres and driving in traffic. In particular they were making mistakes at junctions and when overtaking.

Not only was the standard of driving low but also the level of knowledge was unsatisfactory as all the drivers failed to reach the 95 per cent level required for a pass.

After the course there was a considerable improvement in the drivers' performance on the driving test (67 per cent reduction in errors see Table 4) and this was matched by an overall improvement on the knowledge tests of 13 per cent. However only 1 driver improved sufficiently to pass the driving test and 3 passed the knowledge test. Therefore it was concluded that retraining courses could improve driver behaviour but more than 4 days were needed for most bus drivers.

Subsequent to the pilot study the Government of Pakistan agreed to fund a Federal Government Training School along the same lines as the pilot course except that the course was extended to 5 days and it was agreed that drivers who failed were to come back for another course.

Table 5 The effect of retraining on bus driver behaviour

Driver behaviour	Percentage of drivers correct		Statistical significance (Chi square)
	Trained	Untrained	
Signal before stopping at bus stop	48	37	Trained group better.
Signal for left turn	76	46	
Signal for right turn	90	81	
Emerging after left turn	92	97	Trained group worse
Position before right turn	32	42	
Signal before moving off	26	23	No difference
Stopping position at bus stop	27	37	
Stopping position in layby	32	38	
Emerging after bus stop	86	85	
Position before left turn	71	68	
Position after left turn	71	68	
Position after right turn	54	57	
Emerging after right turn	87	84	

The first objective of the school was to retrain about 550 local bus drivers working for the Punjab Urban Transport Corporation. To assess the effectiveness of the training, observations were made of bus driver behaviour at bus stops and junctions whilst the drivers were carrying out their normal duties and without them being aware of the assessment. From Table 5 it can be seen that out of the 13 items measured, the trained groups* did significantly better on only 3 items and these were all related to signalling. On two of the items the trained group actually made more errors than the untrained group. Apart from signalling, it would appear that the retraining course has enabled drivers to improve their performance under test conditions but when they are driving on their normal routes they revert to their previous habits.

It seems likely therefore that retraining on its own is insufficient to bring about a major change in driver behaviour and possibly an enforcement component is required in addition.

*The small group of trained drivers who failed the course were not included in the analysis.

5. TRAFFIC LAW ENFORCEMENT

To examine the effectiveness of the traffic police the NTRC carried out a study(9) of driver violations at 4 busy intersections both when the police were on duty and when there were no police present. The results indicated that the traffic police on point duty had no impact on driver behaviour as the percentage of observed violations was not reduced by police presence. Similar results were also obtained by a more recent study and these are shown in Table 3. It can be seen that there was no consistent reduction in violations as a result of police presence.

Although the normal method of deploying traffic police on point duty seems to have little influence on driver behaviour, a study carried out by the NTRC(9) indicated that a short specialised training course for the police in which enforcement of moving violations was emphasised did result in considerable improvements in driver behaviour. After training 30 traffic policemen it was demonstrated that there was a large increase in their knowledge of the traffic rules (average test scores increased from 65 per cent to 97 per cent correct) and at sites where they were on duty reductions in violations were reported to be as high as 98 per cent.

A further study by the NTRC(9) in which they assisted with the training and control of the operations of some of the traffic police in the Rawalpindi-Islamabad area also showed promising improvements in the effectiveness of the traffic police and reductions in the percentages of drivers speeding, turning incorrectly and not stopping at stop signs were reported to be as high as 50 per cent at some sites.

Outside the urban areas in Pakistan there were normally only very limited numbers of mobile police with responsibility for traffic. However at the end of 1982 the North West Frontier Province Police introduced regular Highway Patrols on 14 sections of main road. To investigate the effectiveness of these patrols the police were asked to collect road accident data on the patrolled sections of road for 6 months after they were introduced and for the same 6 month period in the preceding year. Accidents elsewhere in the Province during the same periods were used as control data. The analysis of the road accidents by the police indicated that fatal accidents dropped on the patrolled roads by 52 per cent from 232 to 111 whereas fatal accidents elsewhere increased by 11 per cent from 140 to 155. Non fatal accidents showed a similar trend with a decrease of 34 per cent (1331 to 878) on patrolled roads and an increase elsewhere of 8 per cent (719 to 778).

The above accident results along with the earlier evidence of reductions in violations suggested that the Police in Pakistan can be very effective in changing behaviour and reducing road accidents provided that they are given adequate training and that they are deployed appropriately.

6. SUMMARY AND CONCLUSIONS

Pakistan has a serious road accident problem and the fatality rates appear to be higher than those of many other developing countries (4th highest of 29 countries). Although not a great deal of detailed

accident information was available in Pakistan, there was sufficient data to indicate that pedestrian accidents (65 per cent of Karachi's fatalities were pedestrians) and bus accidents (46 per cent of the accidents in the Punjab involved buses) were a cause for concern. Also according to police reports the major contributory factor in accidents was driver error (90 per cent of accidents).

Studies of driver behaviour indicated that many drivers drove incorrectly through junctions particularly when turning right (48 per cent) and also a relatively high proportion of drivers appeared to be taking risks by crossing the centre of the road at bends (15 per cent).

Experimental road markings were introduced to try and improve this behaviour but overall it was found that they had little impact. Results from interviews suggested that the lack of effect was probably due to many drivers not identifying the road markings (22 per cent identified stop lines and no overtaking lines correctly) and to the low levels of knowledge (about a third knew the correct meaning for all but the direction arrow markings).

The opportunity was also taken to measure the impact of road work signs and cones in conjunction with a skidding resistance survey. Although speeds and overtaking levels were reduced when the signs and cones were installed, driver responses to interviews indicated that many were unable to identify individual signs they had just seen (as few as 35 per cent for one sign) and many drivers did not know their meaning (on average the drivers only knew the meaning of 5 out of 10 signs). The results also indicated that the professional drivers knew less than other drivers (48 per cent correct compared to 61 per cent).

The findings of the last 2 studies suggest that the improvement of road signs and markings on their own is unlikely to have the desired effect in Pakistan unless other measures such as improved training and enforcement are also introduced.

To evaluate training improvements, a retraining course was designed for bus drivers and the effects on knowledge and behaviour monitored. The course was found to have improved knowledge and behaviour significantly (by 13 and 67 per cent respectively) under test conditions but observations of drivers on their routes indicated that these improvements were not generally transferred to their everyday driving. Therefore it was concluded that training needed to be backed up with appropriate enforcement if it was to succeed in changing the pattern of driver behaviour.

Studies of traffic law enforcement indicated that the old practice of deploying most of the traffic police on point duty in Pakistan had little effect on drivers moving violations. However the introduction of specialised training for the police, particularly in the methods of enforcing moving violations, was shown to result in a significant change in the pattern of driving behaviour (up to 98 per cent reduction in some violations). Also the setting up of a mobile highway patrol on rural highways brought about an impressive drop in road accidents on the patrolled roads (fatal accidents reduced by 52 per cent).

From the research described in this paper it is possible to suggest some recommendations for road safety in Pakistan and these are outlined below. However they should not be regarded as conclusive as it has not been the aim of this paper to examine all aspects of accident reduction.

From the studies of enforcement it seems probable that the traffic police in Pakistan can do a great deal for road safety particularly if the sort of improvements outlined earlier in this paper continue. In particular it is recommended that the traffic police are given specialised training in traffic law enforcement and in driving. To make the most of this training they should specialise in traffic work for several years. In addition, the enforcement emphasis should be on moving violations particularly those related to road accidents and deployment strategies should be devised such that the limited resources of the traffic police can be used to maximum effect.

There is also clearly a need for improvements in driver training particularly for professional drivers. To raise the standards of instruction and driving it is probable that the way the driving tests are carried out in Pakistan will need to be changed. The results from the training study clearly indicated that the bus drivers had little problem controlling their vehicles but they were often unable to follow the correct procedures for driving in traffic as laid down in the Highway Code. Therefore it is recommended that the emphasis in the driving test should be on assessing a driver's ability to carry out these procedures safely. Driving examiners should be trained to make these assessment by conducting 'on the road' tests on predetermined routes using a simple assessment form.

Studies in other countries would suggest that low cost engineering improvements, particularly 'black spot' improvement schemes, have considerable potential for accident reduction. However, the results from this paper indicate that this potential, particularly when the measure is not self enforcing, may not be fully realised unless backed up by appropriate improvements in training and enforcement.

7. ACKNOWLEDGEMENTS

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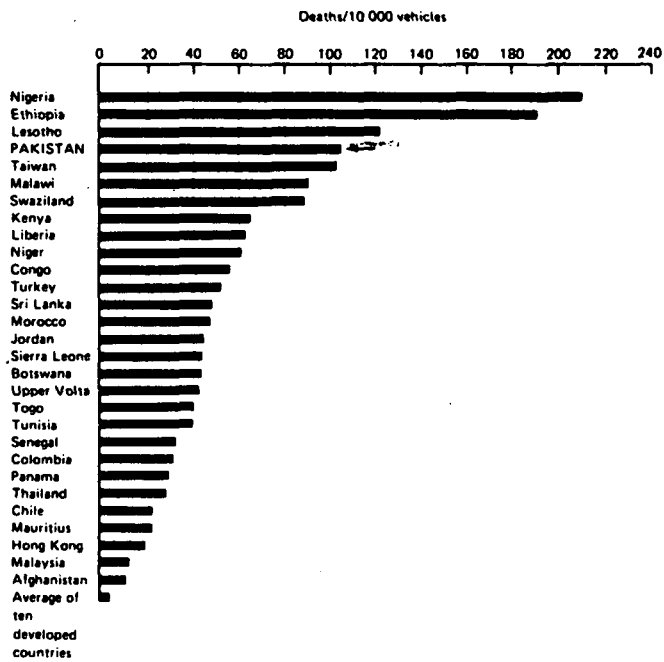


Fig.1 Fatality rates in various developing countries 1978

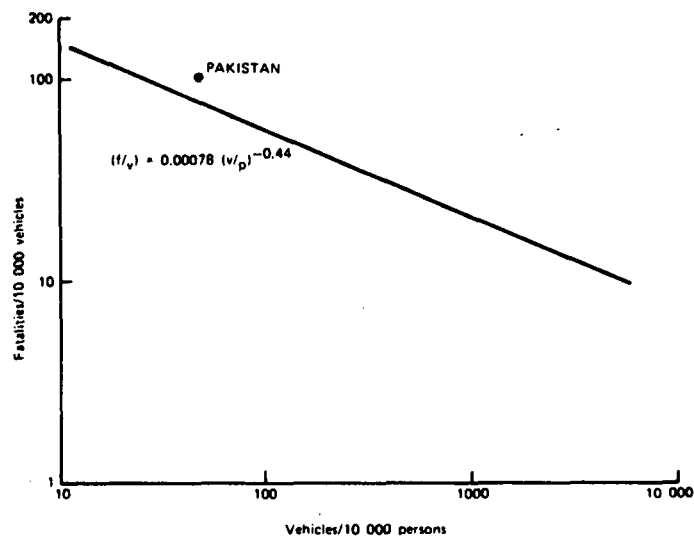


Fig.2 Relationships between fatality rates and vehicle ownership (for developing countries 1978)

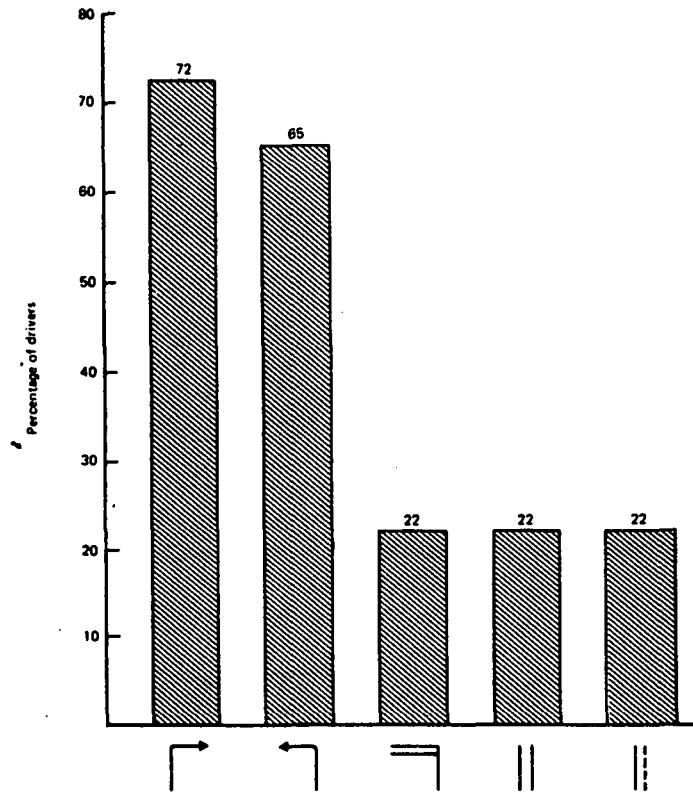


Fig.3 Identification levels for different road markings

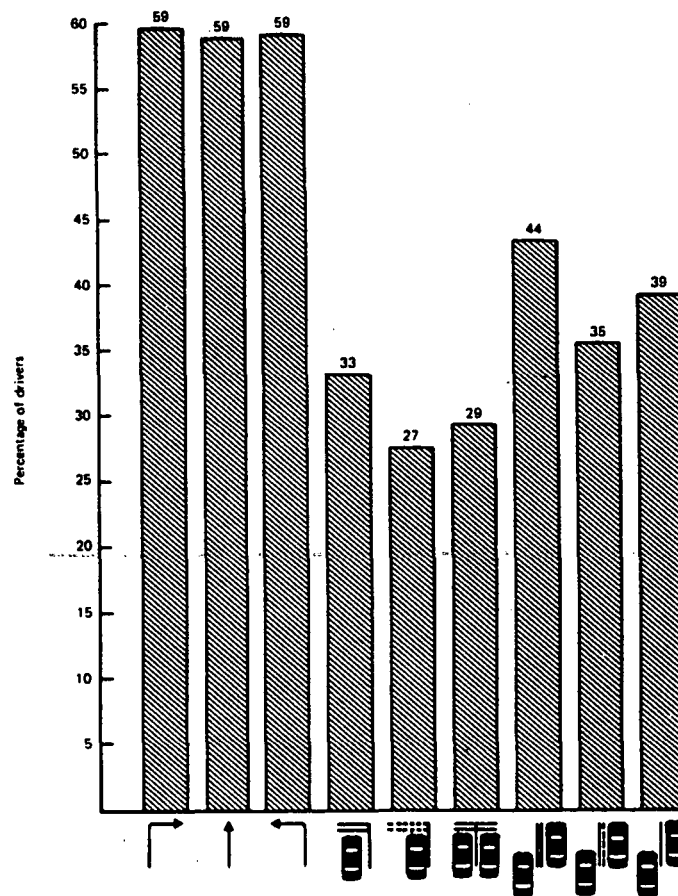
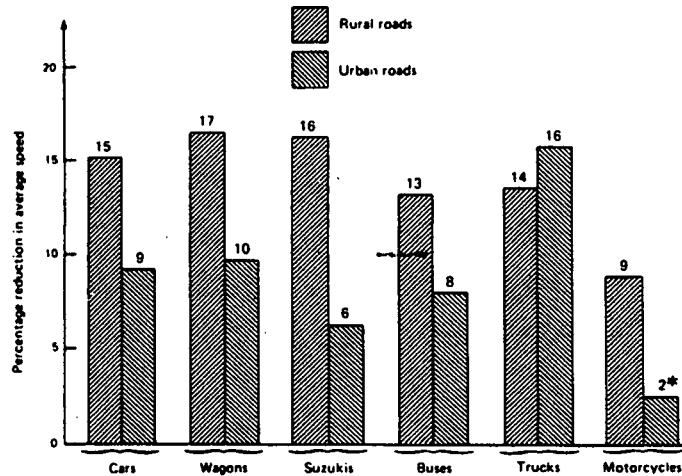


Fig.4 Percentage of drivers who gave the correct meaning for each road marking



*The only reduction which is not statistically significant

Fig. 5 The percentage reduction in average speeds after the introduction of road works and signs

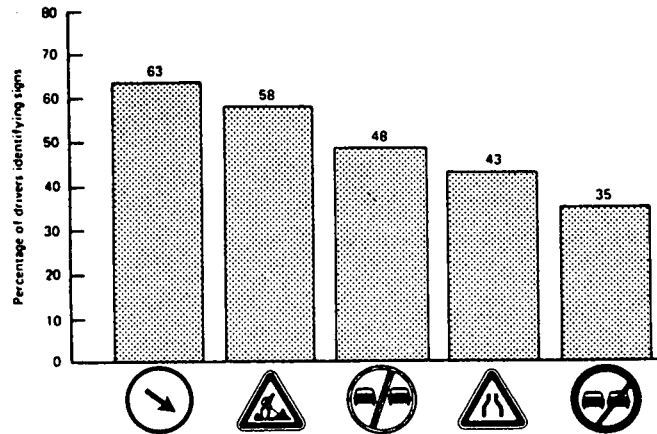


Fig.6 Identification levels for different road work signs

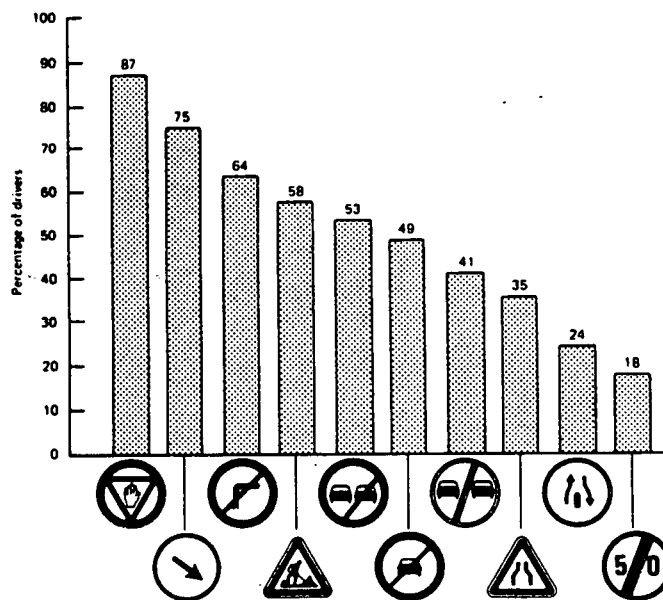


Fig. 7 Percentage of drivers who gave correct meaning of each sign