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EFFECTIVENESS OF BUS DRIVER TRAINING COURSES

NTRC-100

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1. ABSTRACT

Buses are involved in proportionately more road accidents in Pakistan than is the case in Great Britain and their fatal accident rate per million kilometres travelled is an order of magnitude higher. In order to improve the safety of a major bus operator in Pakistan over 500 drivers from Rawalpindi and Islamabad were sent on a five day retraining course. This report examines the effects of the course on the drivers' accidents their driving errors and their knowledge. It is concluded that retraining brought about an improvement in driver behaviour under test conditions (67 per cent fewer serious and dangerous errors) and knowledge (scores increased by 13 per cent) but under normal operating conditions, the driving improvements were considerably reduced and accident rates were unaffected. The relationship between accident rates and variables other than training were also investigated and their implications for countermeasures are discussed.

2. 1. INTRODUCTION

The relatively serious problem of bus accidents in the Indian Subcontinent was initially highlighted in a study of bus safety by Jacobs and Downing (1978). This showed that between 16 to 22 per cent of road accidents in India involved buses compared with only 5 per cent in the United Kingdom.

About three years after this study, the National Transport Research Centre (NTRC), Pakistan began a joint safety research programme in collaboration with the Overseas Unit of the Transport and Road Research Laboratory, UK. During the initial stage of examining the road accident data and determining priority areas for research and improvement, it was established that Pakistan's bus accident problem was at least as serious as that of India. For example studies by Downing (1985), and Swati and Downing (1983) showed that 46 per cent of the road accidents in the Punjab involved buses or mini-buses (an even higher proportion than that found in the Indian cities). Also the fatal accident rate (per million vehicle kilometers operated) of a

large state operator was shown to be at least 10 times higher than that of a similar operator in the UK.

In order to try and improve the safety of bus services in Pakistan a pilot retraining course lasting four days was designed and tested on nine bus drivers from the Punjab Urban Transport Corporation (PUTC). The findings were promising (see Downing, 1985 and Swati and Downing, 1981) in that a comparison of driving and knowledge test results before and after the course showed an average reduction of 67 per cent in serious and dangerous driving errors and an increase in questions answered correctly of 13 per cent. However as only one driver improved sufficiently to pass the driving test (i.e made no serious or dangerous errors) and only three passed the knowledge test (scored at least 95 per cent) it was concluded that more than four days retraining were needed for most drivers.

Subsequent to the pilot course the Government of Pakistan agreed to fund a Federal Government driver training school running a similar course except that it was extended to five days and it was agreed that drivers who failed were to come back for additional training. The first objective of the school was to retrain about 550 local bus drivers working for the PUTC and this study was carried out to measure the effects of this course on the driving behaviour and accidents of the retrained drivers.

The relationships between factors other than training and both road accidents and test performances were also investigated.

3. COURSE AND DRIVING TEST DETAILS

The retraining programme was begun in 1982 with the cooperation of the PUTC. Each course (accommodating up to ten drivers) lasted for five days at the end of which a day was spent giving the drivers practical and theory tests. Between 30 and 40 courses were completed each year and by the end of 1984, 447 of the 578 PUTC drivers (77 per cent) working at the Rawalpindi and Islamabad depots had been trained and 303 (68 per cent) had passed.

Two instructors carried out the teaching and the methods used were classroom instruction, demonstration drivers and practical driving tuition. As with the initial pilot course, the class of ten was

split into two for many of the sessions, one half staying in the classroom while the other half travelled in the training bus. In this way it was possible to keep to a ratio of five trainees to one instructor in the bus (although a small ratio was more desirable the above was the minimum that was practically feasible).

The content of the course was fairly comprehensive and much the same as that of the initial pilot course (for a summary see Appendix 1 and for more details see the study by Swati and Downing, 1981). Particular emphasis was placed on the teaching of driving procedures rather than vehicle control and the main objectives of the course were to ensure that drivers:

- 1) Knew the Pakistan Highway Code
- 2) Knew the stopping distance of their vehicle and that they could use the "2 second rule" to check their following distance.
- 3) Followed the correct procedure for moving off, stopping, overtaking and carrying out manoeuvres at junctions.
- 4) Used the correct "mirror, signal, manoeuvre" (MSM) procedure
- 5) Positioned their vehicles correctly at all times.
- 6) Corrected any bad steering habits
- 7) Used the correct gears for all manoeuvres.

The practical driving test lasted about 30 minutes and was carried out on a fixed route in Islamabad using the assessment form shown in Appendix 2. The methods of assessment and marking were similar to those adopted in the UK learner driver test. Driving faults were classified by type and were marked as minor, serious and dangerous according to the severity of the faults.

Every fault committed by a driver was recorded on the form immediately after it occurred.

There were two theory tests known as Test A and Test B. The first was an oral test of driving rules (100 statements requiring 'true' or 'false' answers), and the second an oral test examining knowledge of a) the principles taught on the course and b) 27 road signs (maximum score 53).

To pass the course the drivers had to complete the practical without making a single serious or dangerous error and score at least 95 per cent

correct on the theory tests overall. Drivers who failed had to repeat the course at a later date and those who failed a second time were recommended to have their public service vehicle licences withdrawn. (In practice the latter recommendation was not very successful as the affected drivers appealed and eventually the appropriate authorities decided in their favour).

4. MONITORING METHODS

To assess the effectiveness of the retraining programme, information on road accidents and driver behaviour was collected for as many as possible of the 578 drivers working at the Islamabad and Rawalpindi depots during the period of the study (1980-84). The data were collected at appropriate times (see below) so that it was possible to make meaningful comparisons between the following groups.

1. Drivers before passing with the same drivers after passing (accident data only).
2. Passed drivers with failed drivers (accident and behaviour data).
3. Passed drivers with untrained drivers (accident and behaviour data).
4. Trained drivers with untrained drivers (accident and behaviour data).

Details of the drivers accidents and the dates they joined (and left in a few cases) the PUTC were obtained from the staff records for the period from 1980 to 1984. Data on driver behaviour were collected by trained observers who recorded bus drivers' errors and vehicle registrations for one day at 6 bus stops and at 13 intersections in the Islamabad/Rawalpindi region. In addition five short routes (up to 3 miles long) were selected on the basis of having sufficient hazards, left and right turns and buses operating on them. Buses were followed for one day on each route by the practical instructor of the school who assessed and recorded specific faults made by the drivers on specially prepared forms (see Appendix 3) along with their vehicle registration. Vehicle faults relating to the rear lights or outside mirrors were also noted. All the behaviour surveys were carried out in March 1983 when about half the local PUTC drivers had been retrained. After they had been completed, the vehicle registrations and the appropriate time of day were checked with the

PUTC records and the drivers identified accordingly.

To determine which variables if any were related to drivers accidents and to their ability to pass the tests, all the trainees were required to complete a questionnaire on joining the course. By this means information was collected on their driving experience, education, age and other biographical data as well as their test results.

5. RESULTS

5.1 Bus Drivers' accidents

According to the PUTC records for 1980-84, 80 of the 577 drivers¹ (13.9 per cent) studied were reported to have had a road accident during the five year period. Of these, 37 (6.4 per cent) were involved in fatal accidents, 21 (3.6 per cent) in injury (non fatal) accidents and 28 (4.9 per cent) in damage only accidents (the total is over 80 because some drivers were involved in more than one category of accident).

The fatal accident rate per driver was extremely high and the rate per year of 2.0 per cent is about 11 times higher than the equivalent figure for London Transport, UK (0.18 per cent) and about the same as that of the Delhi Transport Corporation (DTC), India (1.9 per cent).

On the other hand the overall reported accident rate per PUTC driver per year (5.6 per cent) was considerably lower than that of either London Transport (182.2 per cent) or that of the DTC (12.4 per cent). However it seems probable that the latter result does not indicate fewer accidents on the behalf of PUTC drivers but rather that many damage only accidents were not reported by them (hence an extremely high severity ratio² of 43 per cent). Therefore it is recommended that whenever comparisons are to be

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1. One driver's record not available
 2. Percentage of reported accidents that were fatal.

made between operators only fatal accident data should be used.

The retraining programme began in 1982 and, because only a maximum of 10 could attend each weekly course, the proportion of retrained drivers increased somewhat slowly throughout the period of the study. Nevertheless if the course was effective in reducing accidents, some drop in road accidents should have been evident after 1982. In 1980 and 1981 the fatal accident rate per million kms was 0.80 and 0.77 respectively. Thereafter the figures for 82, 83 and 84 were 0.49, 1.21 and 0.50 respectively. Similarly the fatal accident rate per 100 drivers was 1.6 and 2.0 in 1980 and 1981 compared to 1.3, 3.2 and 1.9 in the following three years; therefore there does not appear to have been any steady drop in rates after the introduction of the retraining course.

To determine the effects of training on accidents it is necessary not only to examine the overall changes in rates over time as above but also to compare the accidents of trained drivers before training and passing with those which occurred afterwards. Also, in case there was a general change in accidents with time which was not related to the training programme, the latter figures also need to be compared with those of untrained drivers over similar periods ie a control group. (It should be noted that in this study only an approximate matching was possible as there was no distinct 'before' and 'after' period for the drivers as a group because they passed and were retrained at different times).

From Table 1 it can be seen that there was no difference between the accident (any reported accident) involvement rate of drivers before and after passing the course ($1a - 1b = 0$). In addition the differences between the involvement rates of 'passed' and 'failed' drivers ($1b - 2b = 2.0$ per cent) and between those of trained drivers before and after training ($3a - 3b = 2.5$ per cent) were very small and not statistically significant³. Indeed these small changes could readily be accounted for by the differences in

3. The term 'statistically significant' is used when the probability of a difference occurring by chance has been determined as 1 in 20 or less by a statistical test. This is the Chi Square test when otherwise stated.

the average number of months driven in the relevant period (see last column of Table 1). A similar analysis of the injury and fatal accidents separately, produced even smaller differences and it is therefore evident that the retraining programme had no beneficial effect on the reported accidents of the PUTC drivers.

TABLE 1
Training and PUTC bus driver accidents (1980-84)

Training type	Accident Period	Percentage of Drivers involved in accidents	Average period served (months)
1. Passed drivers (N=303)	a) Before passing	7.6	26.9
	b) After passing	7.6	19.6
2. Failed Drivers (N=144)	a) Before failing	13.2	31.8
	b) After failing	5.6	17.7
3. All trained drivers (N=447)	a) Before training	9.4	28.5
	b) After training	6.9	19.0
4. Untrained drivers (N=130)	After June 1982	2.3	24.4

The group with the safest record in Table 1 was surprisingly the untrained group (group 4) in the 'after' period⁴. Although these drivers were not significantly safer (statistically) than those in the other groups in the same period (ie 1 b and 3b) further analysis of the relationship between variables and drivers' accidents throughout 1980-84 (see Table 2) indicated that the untrained drivers were safer than the trained ones (particularly those who failed) over the whole five year period. The reasons for this unexpected difference were made clearer by carrying out a multiple regression analysis. The latter indicated that the training relationship with accidents was spurious (ie not causal) and it existed because of a trainee selection

4. The monitoring period of the untrained group (group 4) was limited from June 1982 to the end of 1984 in order to match it with the appropriate 'after' periods of the trained and passed group of driver.

bias, ie the untrained drivers came predominantly from the safer depot (Rawalpindi) and they were generally younger and had not been driving for as long as the trained drivers (ie safer - see below).

Four other variables were also found to be individually related⁵ to accidents (see Table 2). Of these, 'length of service' (during the study period) was not surprising as one would expect drivers with greater exposure to be more at risk.

Age and driving experience are also commonly linked with accident involvement rates but, somewhat unusually in this case, the older (over 45 years) and the more experienced (over 22 years) had more accidents than their counterparts (whereas in the case of car drivers in developed countries the younger and less experienced are usually more at risk). In addition it was found that more of the drivers from the Islamabad depot were involved in accidents than those from Rawalpindi. Differences between depots were similarly found in the study of the DTC in India (Jacobs and Downing, 1982) and, although such variations in accidents are to be expected, more research is required to determine whether they were due to differences in route characteristics (more hazardous routes), average operating speeds, average distances driven per day or to other causes.

The way these variables combined to form sub groups of safer and less safe drivers is shown in figure 1⁶. Of the drivers who had served for at least 26 months in the accident study period, the least safe group was that containing drivers who had more than 22 years experience and worked at the Islamabad depot (32.9 per cent involved in accidents). Conversely the safest group was that with drivers of less than 12 years experience from the Rawalpindi depot (7.1 per cent involved in accidents). Within the former group (and only that group) it would appear that a fourth variable, driver score on the knowledge test (test B) was related to drivers' accidents (58.3 per cent of those who scored less than 94 per cent correct were involved in accidents compared to only 22.2 per cent for

5. A variable was described as related if the difference between the accident rates of the groups formed by the variable were statistically significant.

6. Figure I shows how the accident involvement of groups of drivers changed as the whole group was subdivided into progressively smaller groups by taking first one variable and then another until either the groups became too small to divide further or no additional change in accident involvement could be achieved.

TABLE 2

Variables related to drivers' accidents (1980-84)

Variables*	Best group		Worst group	
	Group name	% of drivers involved in an accident	Group name	% of drivers involved in car accidents
1. Length of service during 1980 (2)	1-25 months	5.4	26-60 months	15.8
2. Depot (2)	Rawalpindi	9.2	Islamabad	18.0
3. Driving experience (3)	Under 12 years	6.9	over 22 years	20.9
4. Age of driver (3)	Under 36 years	9.1	Over 45 years	18.4
5. Training received (3)	Untrained	5.3	Trained failed	

* Only statistically significant relationships have been included in the table (Chi square test).
() = number of groups of drivers formed by the variable.

those who scored 100 per cent). The last finding suggests that it may be possible for a knowledge test to be used to select out the least safe drivers. However more research is required to develop a satisfactory test as, in this case, it did not predict the high risk drivers in the inexperienced or Rawalpindi depot groups.

Experience is shown in figure 1 rather than age because the former variable produced groups with slightly larger differences in accident involvement rates (see Table 2). Nevertheless they are closely related (correlation coefficient $r = 0.8$) and consequently, it is impossible to tell from this study how the two combined to contribute to the high accident rate. For example the drivers may have been less safe because of medical conditions associated with their age eg slower reaction times and poor eyesight and/or because they had adopted driving techniques which were no longer appropriate to the modern traffic conditions. As regards recommendations, one obvious although difficult course of action to take, is to replace the older or more experienced drivers with either the younger or less experienced ones. Using the figures from this study it is estimated that replacing the drivers having more than 22 years experience with those with less than 12 years experience would result in a road accident saving of 35 per cent. Alternatively the older, more experienced drivers could be transferred to safer (and perhaps easier) routes if such could be determined.

5.2. Errors made by bus drivers

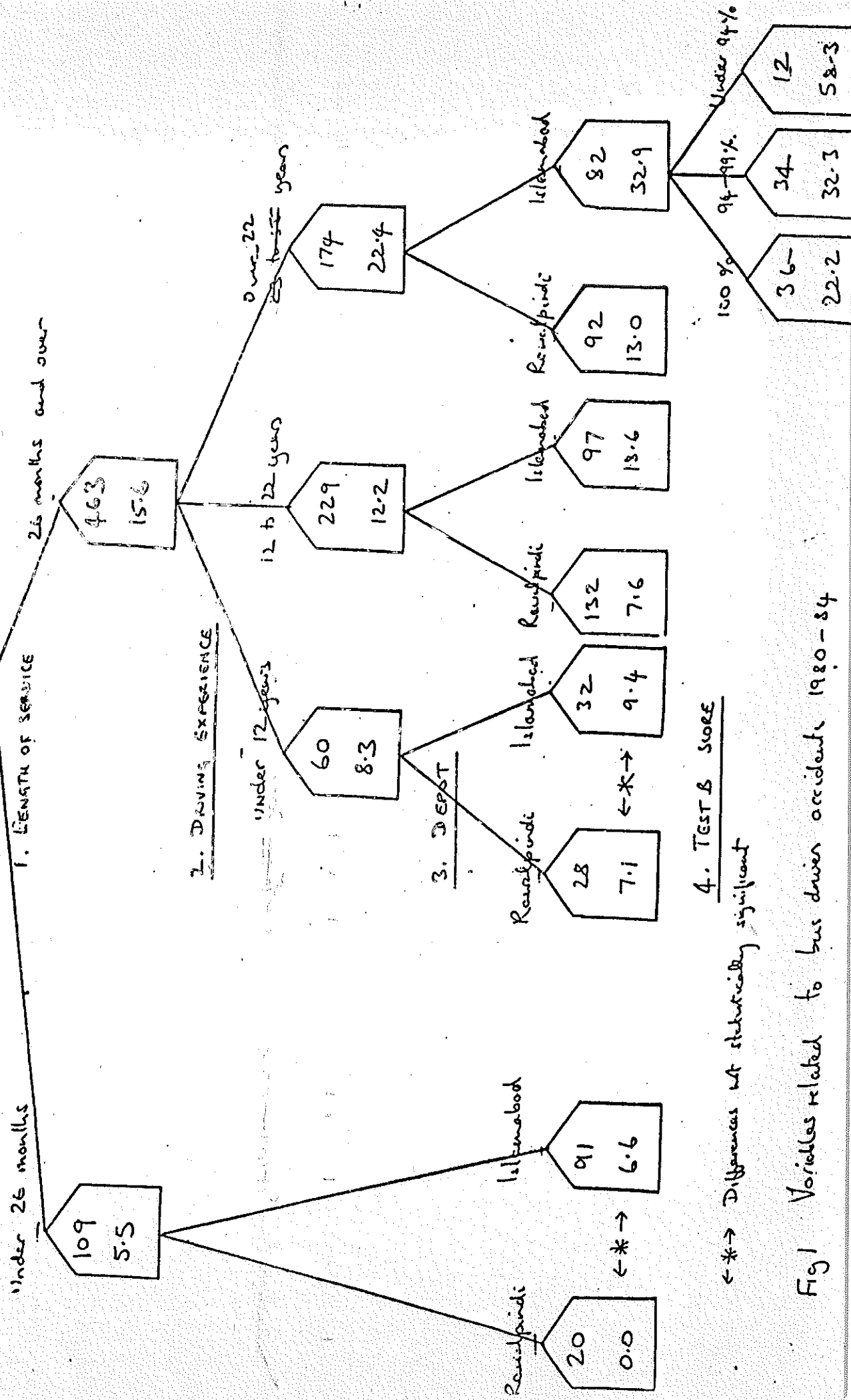
From the stationary observer results shown in Table 3, it can be seen that the levels of driver error at bus stops were extremely high and the most common fault was the driver's failure to signal before moving off (75 per cent failed to do so). At junctions, fewer drivers made errors than at bus stops except in the case of positioning before right turns where, on average 66 per cent of drivers were at fault. The results also indicated that the error levels varied considerably from site to site (up to 88 per cent difference between 2 sites) and although these differences were probably related to variations

⁷ All drivers have been included in these results regardless of whether they had attended the retraining course or not.

ALL DRIVERS

572
13.6

— = number in group
— = % of drivers involved in an accident



4. TEST SCORE

←*→ Differences not statistically significant

Fig 1 Variables related to bus driver accidents 1980-84

in geometric design and traffic characteristics, more research is needed to determine the reasons for them.

In the case of the 'following observer'⁷ ^{Survey} not only was a wider range of behaviour observed but also each driver was watched at a number of stops and junctions consecutively instead of at just one site. Therefore, the opportunity for drivers to commit errors was greater and consequently, as can be seen from Table 4, the error level were

TABLE 3
Driver behaviour at bus stops and junctions

Type of behaviour observed	Percentage of drivers making an error		
	Best site	Worst site	Average of all sites
At bus stops:			
1. Signal omitted or wrong before stopping	29.6	82.1	57.3
2. Signal omitted or wrong before moving off	45.4	95.5	75.3
3. Stopping position wrong	18.5	100.0	65.2
At junctions:			
1. Signal omitted or wrong before left turn	3.8	41.4	31.4
2. Position wrong before left turn	3.2	45.5	30.7
3. Position wrong during left turn	12.4	59.1	26.8
4. Signal omitted or wrong before right turn	0.0	30.4	14.2
5. Position wrong before right turn	11.6	100.0	66.5
6. Position wrong during right turn	1.4	77.3	33.4

⁷ All drivers have been included in these results regardless of whether they had attended the retraining course or not.

even higher than those recorded by the stationary observers (up to 39 per cent higher). The maximum levels of error occurred when drivers were stopping or moving off (over 90 per cent made signalling or position errors) and when overtaking (over 90 per cent failed to signal and overtook when approaching traffic was too near). As with the stationary observations, the levels of error were somewhat lower at junctions than at bus stops but even so they were still relatively high (nearly 50 per cent made signalling errors and 66 per cent positioned their bus incorrectly). However, in contrast to the above high error levels, relatively few drivers disobeyed stop signs and traffic signals (7 per cent) and very few drove too fast for the conditions (2 per cent generally). Nevertheless the results in general indicated that the overall standards of driving were poor, especially in relation to signalling, positioning and overtaking.

Although the retraining course was directed particularly towards improving the above types of procedure error, the findings from the behaviour surveys were disappointing in that a comparison of the error levels of the passed, failed and untrained groups of drivers revealed that the passed group was better than the untrained group for only three of the nine error categories (given in Table 3) in the 'stationary observations' and for none of the twenty categories (given in Table 4) in the 'following observations'. The three affected categories were all related to signalling (see Table 5) and even these benefits would appear to have been very limited as the maximum difference between the passed and untrained groups was only 15 per cent and similar differences were not found in the 'following observer' survey.

From the pilot course results (Downing, 1985) it was clear that the training enabled the drivers to perform better in test situations (67 per cent reduction in serious and dangerous errors). However these latest studies indicated that most drivers reverted to their old habits when they were not being tested (or not aware of being observed) and therefore the training on its own was insufficient to improve everyday driving standards.

TABLE 4

Following driver observations

Driver Error	Percentage of drivers making one or more errors (n=273)
<u>STOPPING</u>	
1. Signals omitted or wrong	96.7
2. Position wrong.	94.5
<u>MOVING OFF</u>	
1. Signals omitted or wrong.	99.3
<u>RIGHT TURN</u>	
1. Signals omitted or wrong.	41.1
2. Position wrong.	64.1
3. Disobeyed sign/signal.	16.8
4. Speed too fast.	4.0
<u>LEFT TURN</u>	
1. Signals omitted or wrong.	49.1
2. Position wrong.	62.6
3. Disobeyed sign/signal.	11.0
4. Speed too fast.	2.6
<u>STRAIGHT AHEAD</u>	
1. Position wrong.	66.0
2. Disobeyed sign/signal.	15.0
3. Speed too fast.	0.7
<u>OVERTAKING</u>	
1. Signals omitted.	99.6
2. Passed too close to vehicle	50.9
3. Cut in on vehicle.	83.2
4. Oncoming traffic too near.	95.2
5. Anticipation poor.	2.2
<u>GENERAL DRIVING</u>	
1. Speed too fast .	2.2

TABLE 5

The effect of retraining on bus driver behaviour

Driver behaviour	Number of sites	Percentage of drivers making an error	
		Passed	Untrained
Signal omitted or incorrect:			
before stopping at a bus stop	6	52.1 (n=288)	63.0 (n=137)
before turning left	5	24.0 (n=150)	39.4 (n=137)
before turning right	8	8.7 (n=252)	20.7 (n=213)
Six other error categories recorded by 'stationary observers	—	No differences between passed and untrained drivers	
Twenty error categories recorded by the 'following' observer	—	No differences between passed and untrained drives	

The following driver also noted the condition of the rear lights and outside mirrors of the buses and it was found that brake lights were in the most need of maintenance as they were faulty in 73 per cent of the buses, followed by indicators (14 per cent) and mirrors (11 per cent). Although the condition of the buses was not studied in any detail the above results suggest that there is considerable room for improvement.

5.3 Bus driver's test performances

Of the 465 trained drivers, 54 per cent passed the course at their first attempt, 15 per cent passed at the second attempt, 27 per cent failed once without retaking it and 4 percent failed twice.

Five characteristics of the drivers ie age, experience, education, depot and month trained (earlier or later course), were found to be individually related to the pass rate (see Table 6). However, as there was some covariance between these variables, a stepwise multiple regression analysis was carried out and this indicated

that just two variables, age and depot, accounted for most of the variance in test performance.

TABLE 6

Variables related to pass rate of the driving test

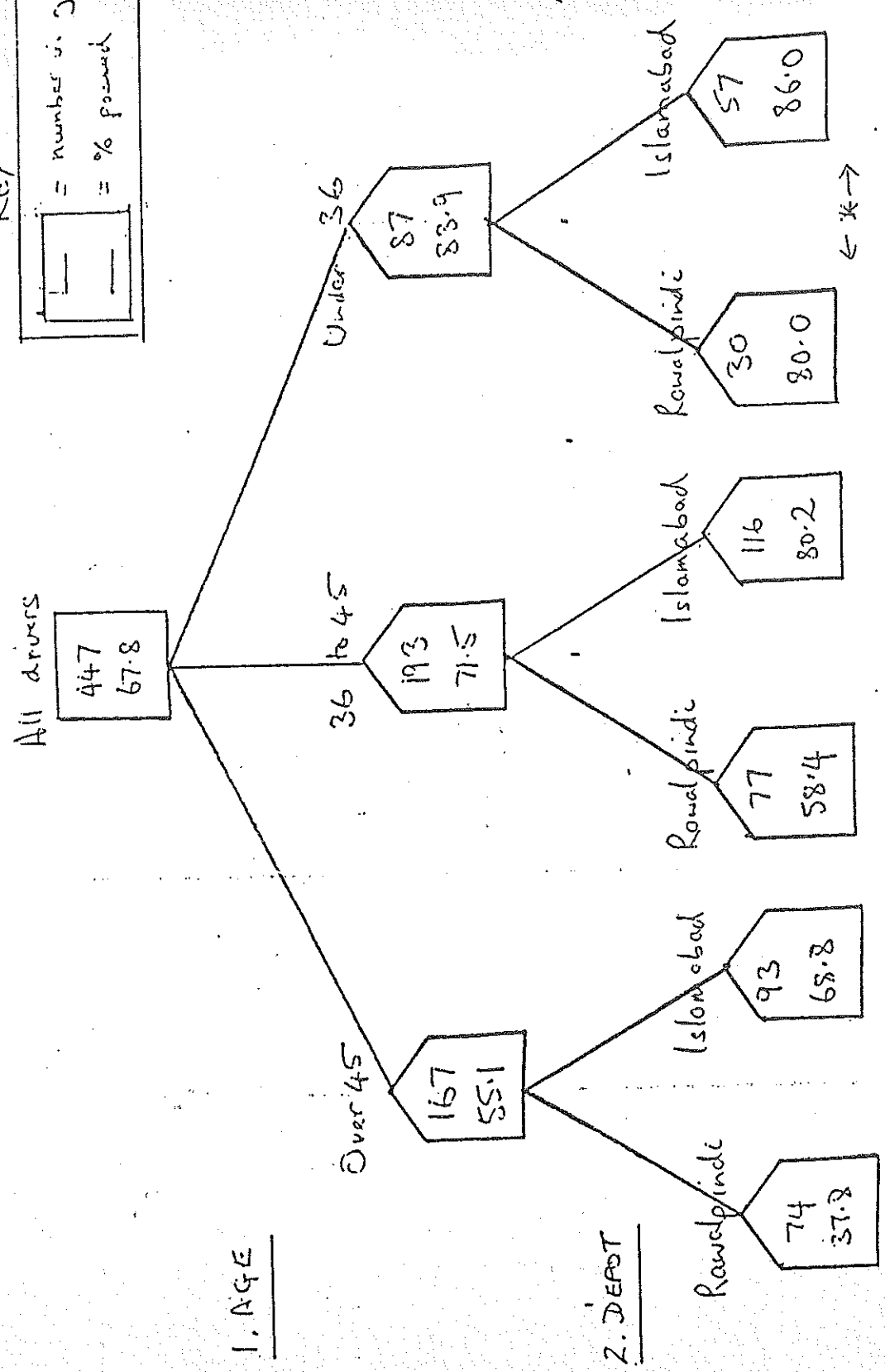
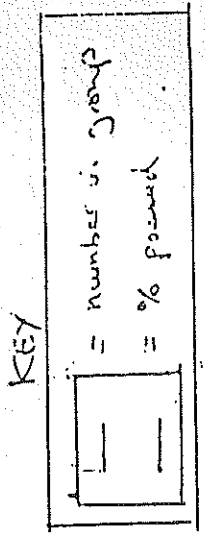
Variables *		Best group		Worst group	
		Group Name	Percentage of drivers passed	Group Name	Percentage of drivers passed
1. Depot	(2)	Islamabad	77.4	Rawalpindi	53.6
2. Education	(2)	Educated	70.1	Uneducated	56.6
3. Driving experience	(3)	Under 12 Years	77.9	Over 22 years	53.8
4. Age	(3)	Under 36 years	83.9	Over 45 years	55.1
5. Month trained	(2)	Before Sept 1983	72.4	After August 1983	56.8

* Only statistically significant relationships have been included in the table, (Chi square test).

() = Number of groups of drivers formed by the variable.

From Fig 2 which shows the pass rates of the groups formed by these two variables it is evident that the youngest drivers (under 36) from the Islamabad depot were far more successful (86 per cent passed) than for example, the oldest drivers (over 45) from the Rawalpindi depot (only 38 per cent passed). Although it is easy to understand why the youngest drivers were best at the tests (being more adaptable and generally finding habits easier to change) it is not so easy to explain why Islamabad drivers did better than those from Rawalpindi. One possibility is that the former's greater familiarity with Islamabad roads helped them pass the practical test which was carried out in Islamabad.

The relationships between driver Characteristics and the two



←*→ difference not statistically significant

FIG 2 Variables related to pass rate of the driving test

knowledge test⁸ scores were also investigated. From Table 7 it can be seen that only two variables, age and education, were related to scores on Test A (100 questions) whereas five variables including age and education were related to scores on Test B (53 questions).

TABLE 7
Variables related to knowledge test scores

Variables *	Best group		Worst group	
	Group name	% scored over 94/100	Group name	% scored over 94/100
TEST A (100 questions)				
1. Age (3)	Under 36	82.8	Over 45	63.4
2. Education (2)	Educated	78.8	Uneducated	53.0
TEST B (27 signs and 26 questions)				
	Group name	% scored over 50/53	Group name	% scored over 50/53
1. Depot (2)	Islamabad	84.6	Rawalpindi	64.6
2. Education (2)	Educated	80.6	Uneducated	54.2
3. Driving Experience (3)	Under 12 years	83.1	Over 22 years	69.3
4. Age (3)	Under 36	83.9	Over 45	67.2
5. Month trained (2)	Before Sept 1983	79.0	After August 1983	69.8

* Only statistically significant relationships have been included in the table, (Chi square test).

() = Number of groups of drivers formed by the variables.

As with the pass rate data, multiple regression analysis was carried out to take into account the covariance between the variables and although there was no change in the case of Test A, only three variables, age, education and depot were found to be related to Test B scores.

From Fig 3 it can be seen that the younger, educated drivers were best at Test A (85 per cent passed) and conversely the older, uneducated drivers were the least successful group (48 per cent passed). The findings for Test B were very similar (see Fig 4) except that even

⁸ Test A required 'true' or 'False' answers to 100 general questions whilst Test B required correct answers to 26 questions on driving principles and 27 on road signs.

after age and education were taken into account, the drivers from Islamabad did better than those from Rawalpindi. Again it is not clear why such a difference should exist between depots.

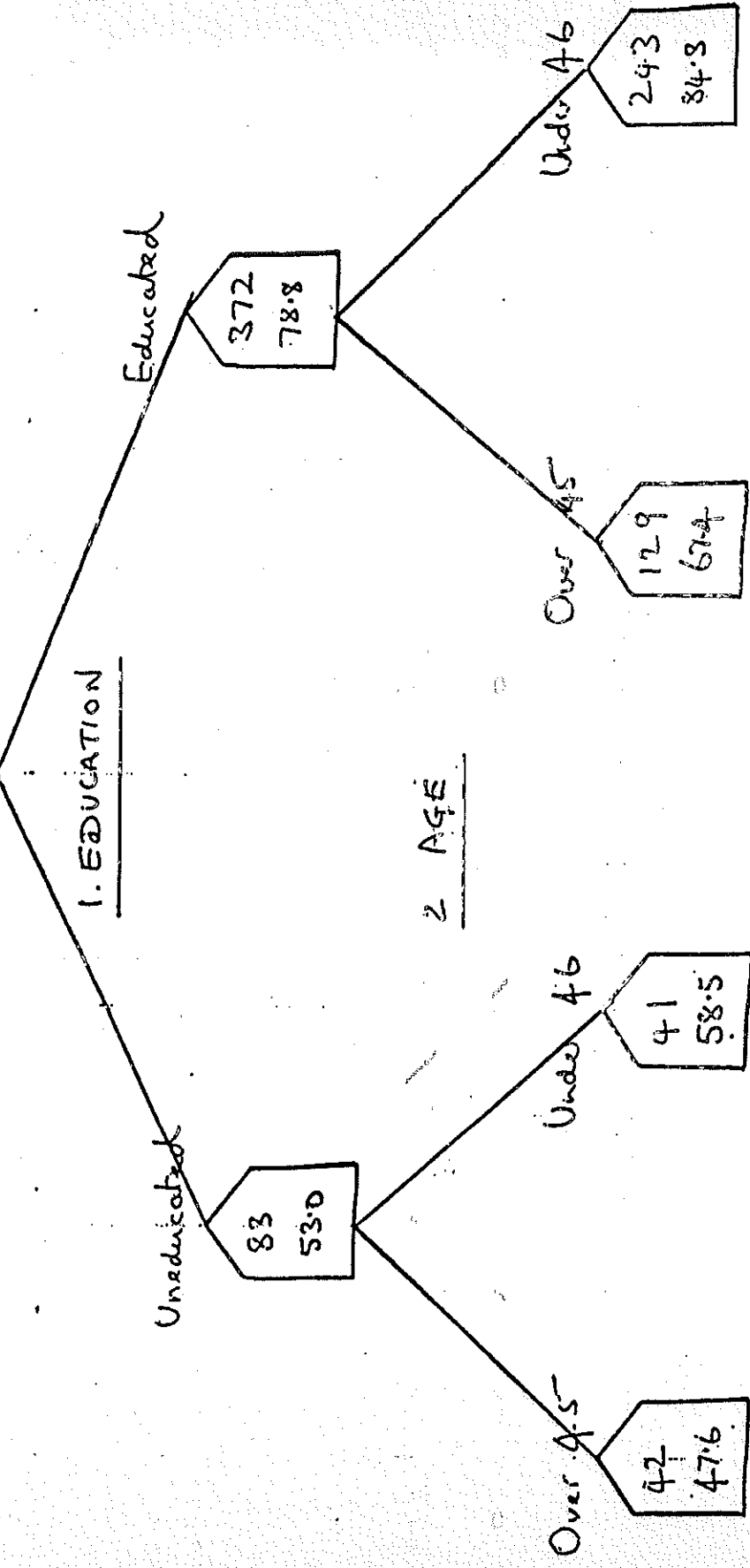
However as regards safety recommendations, the case for replacing the older drivers with younger ones or giving them safer routes, is strengthened by these results as they indicate that the older drivers are considerably more difficult to retrain as well as being more accident prone.

6. CONCLUSIONS

A study of drivers accident records (577) from the PUTC's Islamabad and Rawalpindi depots indicated that they had a relatively serious road accident problem (for example the fatal accident rate per driver between 1980-84 was found to be eleven times higher than that of London Transport in the UK). Also bus driving standards were found to be very poor, particularly at bus stops and when overtaking (nearly 100 per cent of the drivers made errors) and, from the driving test results in the pilot course, it was clear that procedure errors were far more common than control errors (only 2 out of 115 serious and dangerous errors were control errors).

In order to improve their driving (especially their driving procedures) and safety record, 447 drivers from these depots were sent on a five day retraining course between 1982 and 1984. A comparison of the trained and untrained drivers' accidents from 1980 to 1984 indicated that the training did not lead to any significant improvements in accident rates. For example, for the drivers who passed the accident involvement rate was 4.6 per 100 drivers per year after passing compared with 3.4 before and for the drivers who were trained (regardless of whether they passed or failed), the rate was 4.4 after training compared with 4.0 before. Similarly, no difference was found between the involvement rates of drivers who passed (4.6 per cent) and those who failed (3.8 per cent). Also, observations of driver behaviour indicated that the training had very little effect on their driving standards as the 'passed' drivers did better than the untrained drivers (ie made between 11 and 15 per cent fewer errors) on only three categories of fault (all relating to signalling) out of the 29 assessed.

$\frac{\text{—}}{\text{—}}$
 = number in group
 = % scored more than 94%

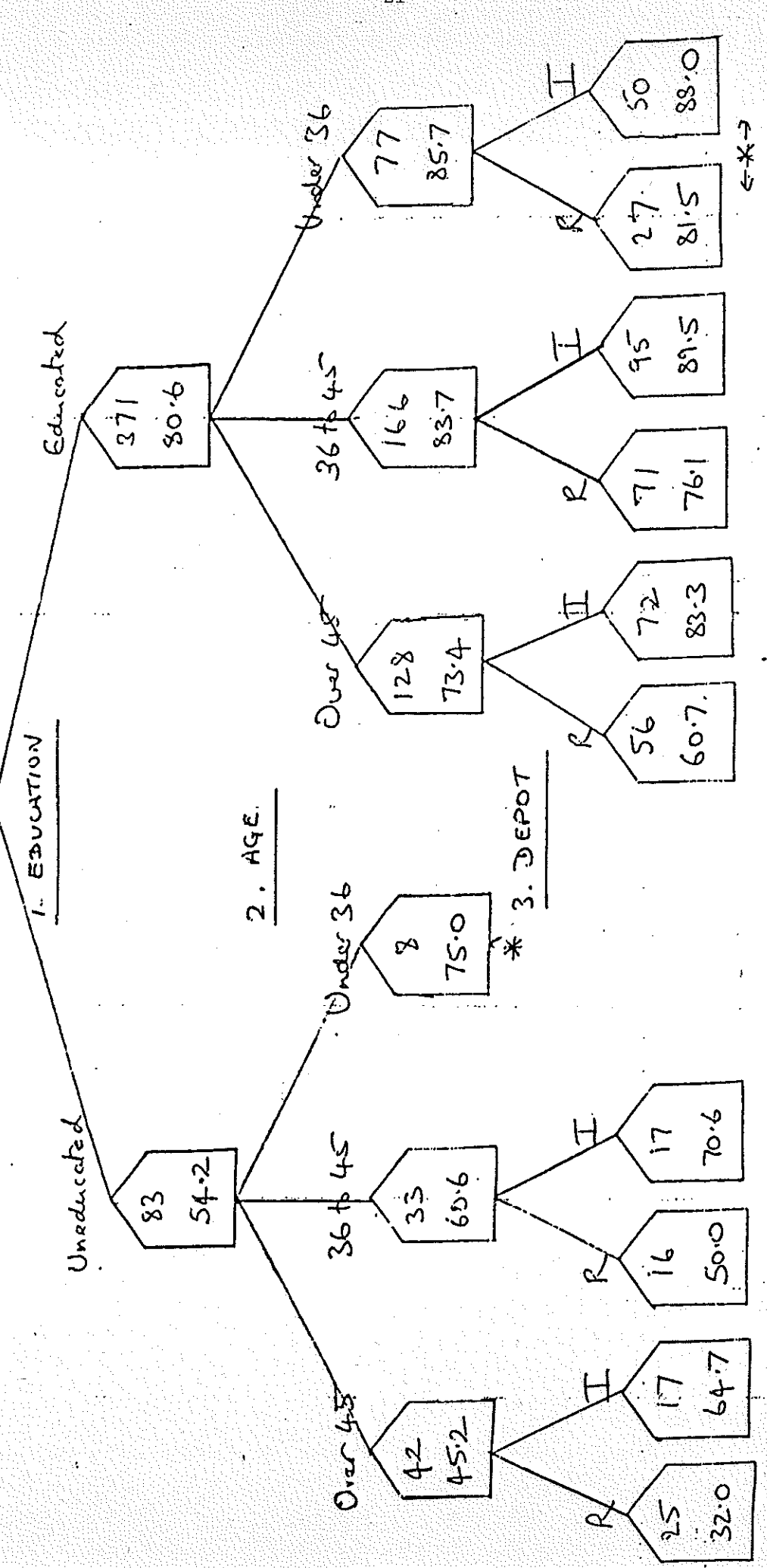


2. AGE

variables : related to driver knowledge = Test A
 Fig 3 Y

All drivers
 454
 75.8

— = number in group
 — = % scored more than 49 out of 53



←*→ = Differences not statistically significant
 * = Differences too small to split variables related to drivers knowledge + Test B

R = Rayalpindi I = Islamabad

Fig 4

However, although the course did not result in either an accident reduction or in major changes in driving standards, evidence from the tests given before and after the pilot course indicated that it did bring about an improvement in the drivers knowledge (scores increased by 13 per cent) and in their behaviour under test conditions (67 per cent fewer serious and dangerous errors). The relatively high first time pass rate of the 5 day retraining courses (54 per cent) supported this finding. Therefore the training did provide the drivers with the knowledge and ability to raise their driving standards but on its own it was not sufficient to change their everyday driving habits. Possibly retraining courses could lead to more substantial benefits if they were backed up with enforcement and incentive schemes.

Further analysis of the accident data indicated that older and more experienced drivers were less safe than their counterparts (eg 18.4 per cent of the over 45 years and 20.7 per cent of those with more than 22 years experience had accidents compared with 9.1 per cent of those under 36 and 6.0 per cent for those with less than 12 years experience) but more research is needed to determine whether these differences were due to either age related factors alone (eg poorer eyesight and slower reactions) or experience (eg driving habits which were no longer appropriate) or to some combination of both.

The older and more experienced drivers were also found to be the least successful at the course tests (overall pass rate differences of 19 per cent between the under 36's and the over 45's and 24 per cent between the drivers with under 12 years and those with over 22 years experience), and it would appear difficult to improve their driving. Instead it may be possible to take the most experienced and oldest drivers off general driving duties and replace them with younger less experienced drivers or transfer them to the safest routes (if such could be determined). If all the drivers with more than 22 years experience were replaced with those with less than 12 years experience it was estimated that the number of accidents would be reduced by 35 per cent.

In addition, although some priority should be given to improving bus safety in Pakistan as such a high proportion of accidents involved buses (46 per cent in the Punjab Province), the problems

of poor driving standards are not restricted to bus drivers. For example a study of driver behaviour (Swati, 1980) indicated that 37 per cent of cars violated stop signs and 28 per cent committed turning violations compared to 33 per cent and 55 per cent respectively for buses. Therefore there is a need to raise the driving standards of all drivers. However, as with the bus drivers in this study, it seems likely that other measures such as more stringent testing (for example using the test system and forms adopted in the course see Appendix 2) and increased enforcement of moving violations, are needed in addition to improvements in training.

Also the study indicated that some improvements in vehicle maintenance were required as it was noted during the behaviour surveys that 73 per cent of the buses had faulty brake lights and 14 per cent had rear indicator faults.

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9. APPENDIX I

Summary of retraining course content (Pakistan)

1. Highway code. Rules and road signs and markings
2. Pre-driving checks.
3. Mirror use and blindspots
4. Starting the engine.
5. Steering.
6. Moving off and stopping.
7. Following distances and stopping distances.
8. Signalling and use of the horn.
9. Junction procedures.
10. Lane discipline.
11. Overtaking.
12. Night driving.
13. Pedestrians.
14. Reading the road.

Candidate's name _____ Age _____ Date of test _____
 Vehicle registration _____ Examiner's name _____
 Description of candidate _____

TEST RESULTS		Door	Seat	Mirror	Handbrake	Gear
Eysight						
H code						
D test						

Checks omitted 1

		Stopping and moving off	Junctions	Overtaking	General
Mirror omitted	2				
Mirror after signal	3				
Inad. observation	4				
Signal omitted	5				
Signal wrong	6				
Pos. before wrong	7				
Pos. during wrong	8				
Shaved ped/veh	9				
Cut in too close	10				
Followed too close	11				
Emerged traffic near	12				
Ovtk. traffic near	13				
Ovtk. at junc/hazard	14				
Disobeyed sign/mark	15				
Failed to stop for pedestrian	16				
Speed+	17				
Speed-	18				
Anticipation poor	19				
Steering wrong	20				
Gear wrong	21				
Clutch wrong	22				
Brake wrong	23				
Accel. wrong	24				
Handbrake omitted	25				

		Reverse	Park	Other	Emergency stop	Examiner took action
Inad. control	26					
Inaccurate	27					
Inad. abs.	28					
Inad. control	29					
Too slow	30					

STATEMENT OF FAILURE OF THE DRIVING TEST

The reasons for failure are summarized below (those leading to failure are underlined>)

OFFICIAL
USE ONLY

1. Inadequate knowledge of Highway Code
 2. Poor eyesight
- PROCEDURE FAULTS
- 2.3 3. Mirror was not used-before signalling/before moving off/before turning at junctions/before changing lanes/before overtaking/before stopping/often enough in general driving
 - 4.28 4. Observation was inadequate-before moving off/at junctions/when overtaking/generally/when reversing/when parking
 - 5 5. Signals were not given before moving off/before turning at a junction/before changing lanes/before overtaking
 - 6 6. Wrong signals were given-before moving off/approaching a junction /before changing lanes/before overtaking
 - 6 7. Drivers or pedestrians were incorrectly signalled to proceed/give way
 - 7.8 8. At junctions-turned from the wrong position/went straight ahead from the wrong lane/straddled lanes/cut the corner
 - 8 9. Drove in the middle of the road--at bends/brow of hill/generally
 - 9 10. Gave insufficient room to-pedestrians/cyclists/animals/motor vehicles when overtaking
 - 10.11 11. Cut in too close after overtaking/followed other vehicles too closely
 12. Emerged at junctions/moved off when approaching traffic was too close
 - 13.14 13. Overtook-when approaching traffic was too near/when traffic was overtaking from behind/on a bend/at a junction/at a pedestrian crossing/at a railway crossing/school bus/on the wrong side of the vehicle being passed
 - 15 14. Disobeyed-stop signs/give way signs/traffic signals/police signals /no overtaking signs/no entry sign/speed limit signs/other signs or markings
 - 16 15. Failed to give way to pedestrians
 - 17 16. Drove too fast up to-junctions/bends/pedestrian crossings/railway crossings/other hazards/for prevailing conditions
 - 18 17. Drove too slowly for traffic conditions
 - 19 18. Failed to anticipate the actions of other road users

CONTROL FAULTS

- | | |
|-------|--|
| 1. | 19. Failed to check the-door/seat/mirror/handbrake/gear before starting the engine |
| 20.25 | 20. Used the steering/gears/clutch/footbrake/accelerater/handbrake incorrectly |
| 26 | 21. Failed to reverse-smoothly/accurately |
| 27 | 22. Failed to park-smoothly/accurately |
| 29.30 | 23. In an emergency stop-lost control/stopped too slowly |

REMARKS

11. APPENDIX 3

Driving errors assessed in observation surveys

Stationary observers	Following observer (5 routes)
<p><u>At bus stops (6)</u></p> <ol style="list-style-type: none"> 1. Signal wrong or omitted before stopping 2. Signal wrong or omitted before moving off. 3. Stopping position wrong <p><u>At intersections (13)</u></p> <p>For left and right turn manouvres.</p> <ol style="list-style-type: none"> 1. Signal omitted or wrong. 2. Position before turning wrong. 3. Position during turn wrong. <p>() = number of sites</p>	<p><u>At bus stops</u></p> <ol style="list-style-type: none"> 1. Signals wrong or omitted before stopping 2. Signals wrong or omitted before moving off. 3. Stopping position wrong <p><u>At intersections</u></p> <p>For left and right turn man-oeuvres and drivers going straight ahead.</p> <ol style="list-style-type: none"> 1. Signal omitted or wrong. 2. Position wrong. 3. Disobeyed sign or signal. 4. Speed too fast. <p><u>Overtaking</u></p> <ol style="list-style-type: none"> 1. Signals omitted or wrong. 2. Passed too close to a vehicle or pedestrian. 3. Cut in on a vehicle. 4. Oncoming traffic was too near. 5. Anticipation poor. <p><u>General Driving</u></p> <ol style="list-style-type: none"> 1. Speed too fast.