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COMPARISON OF ON-ROAD AND OFF-ROAD CYCLE TRAINING FOR CHILDREN

by

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ABSTRACT

The effectiveness of cycle training carried out on public roads was compared with the effectiveness of cycle training carried out on simulated roads in school playgrounds. Five hundred and eighty one children aged eight, nine or ten took part. The children were tested on the roads before training (Pre-Test), immediately after training (Post-Test 1) and again 6 to 8 months later (Post-Test 2). Both types of training resulted in significant improvements in cycling performance being made from Pre-Test to Post-Test 1. Some deterioration was observed in Post-Test 2 but no group of children regressed to the Pre-Test level. The performance of an untrained Control group did not change over a similar 7 month period. The Road Trained group performed significantly better than the Playground Trained group on all three manoeuvres tested (left and right turns out of a side road and a right turn into a side road) in both Post-Test 1 and Post-Test 2. Eight year olds did not benefit from either form of training to the same extent as nine or ten year olds.

1. INTRODUCTION

Cycle training in the United Kingdom has been carried out since 1959 under the auspices of the National Cycling Proficiency Scheme set up in that year by the Royal Society for the Prevention of Accidents (RoSPA). Under this scheme children who are at least nine years old are trained to perform a number of manoeuvres on their bicycles, and are taught the sections of the Highway Code appropriate to the use of a bicycle on the public roads. About 250,000 children are trained every year. The scheme is national, to the extent that a national standard is maintained, but the form of training varies between different local authorities.

One of the major sources of variation between training schemes in different areas is the degree to which they include training on the public roads. Most cycle training takes place entirely on simulated roads laid out in school playgrounds, but in a few places some or all of the training takes place on the public roads.

In 1974 Local Government reorganisation resulted in the amalgamation of the county of Cambridgeshire and the Isle of Ely with the county of Huntingdon and Peterborough. Prior to amalgamation the two counties had used different methods of cycle training. Training in Huntingdon and Peterborough had taken place on simulated roads laid out in school playgrounds, whereas training in Cambridgeshire and the Isle of Ely had been carried out on public roads close to the schools. In order to shape the policy of the new county of Cambridgeshire with regard to cycle training, information was required on the effectiveness of the different forms of training.

Evaluation studies of pedestrian training for young children suggest that training at the roadside or on the roads is more effective than teaching in the classroom or in the playground. The experiment described

in this report was therefore set up jointly by TRRL and the Cambridgeshire Road Safety Section to compare the effectiveness of training courses which included training on public roads with training courses which took place wholly in the playground.

The experiment was also designed to investigate whether eight year old children could learn from the normal training scheme to the same extent as older children. The normal lower limit for cycle training is nine years old and RoSPA recommend that children under this age should receive training under the junior scheme rather than under the National Cycling Proficiency Scheme (NCPS). Few children, however, are trained under the junior scheme. The increasing proportion of younger children in the cycling accident figures (five to nine year olds formed 7 per cent of serious and fatal casualties in 1964 and 13 per cent in 1974) shows that there is a need either to restrict the cycling activities of children under nine years old or to give them training which will make them safe on the roads. It was, therefore, decided to investigate the extent to which the NCPS courses might be able to achieve this latter goal for eight year old children.

2. THE SAMPLE

The 581 children involved in the experiment came from 18 schools throughout the new county of Cambridgeshire. Between 30 and 45 children from each school were involved. In eight of the schools cycle training took place on simulated roads in the playground and in eight it took place on public roads. At all 16 schools there was an initial session in the classroom. At two schools no cycle training was given during the course of the experiment and children at these schools formed a Control group (these children were trained after the end of the experiment).

The schools in the experiment were matched for location so that equal numbers of rural and suburban schools were involved in each type of training. They were also matched on the basis of their previous pass/fail rate in cycle training. Using these data the Road Safety Officers made a subjective judgement on whether the schools had a good or a bad record of cycle training success over the previous few years and equal numbers of 'good' and 'bad' schools were involved in each type of training.

At each school three groups of children were trained and tested. The three groups were of different ages. One group consisted of children aged eight, one of those aged nine and one of those aged ten. The three age groups were kept separate for training and testing. There were between 10 and 15 children in each group.

3. TRAINING

The training was carried out by Road Safety Officers. Two were responsible for road training and two for playground training. The instructors were matched for length of previous experience in the type of cycle training (road or playground) for which they were to be responsible.

3.1 Content of course

The content of the course was the same for all the children. They received four hours of instruction. The first hour took the form of a theoretical session, in the classroom, where the main teaching points in the course were covered and the children were told which parts of the Highway Code they needed to learn. The remaining three hours were used for practical instruction on the road or in the playground. Each course covered the following manoeuvres:

1. Starting off.
2. Left turn out of a side road (ie minor road to major road at a T-junction).
3. Right turn into a side road.
4. Right turn out of a side road.
5. Overtaking a parked vehicle.
6. Stopping.

The courses also included more general points such as:–

1. Correct pedalling (using ball of foot on pedals).
2. Correct braking (using both brakes, back brake first).
3. Knowledge of Highway Code as it relates to cyclists.
4. Knowledge of elementary maintenance (how to identify faults, not necessarily how to correct them).
5. Signalling (where and when signals are necessary).
6. Road positioning.
7. Observation (where and when to look for traffic).

4. TESTING

The children in the Training groups were tested three times as part of the evaluation exercise. The tests took the same form at each stage and consisted of a practical test of cycling performance. The first test (Pre-Test) took place before any training had been given and was intended to give information about the children's basic level of skill as cyclists. The second test (Post-Test 1) took place shortly after training was completed and the final test (Post-Test 2) took place between 6 and 8 months later. The Control group were tested only twice, with an interval of about 7 months between the two tests. The time interval was thus comparable with the time between the Pre-Test and Post-Test 2 for the training groups. The form of the test was the same as for the Training Groups.

At four schools the Pre-Tests were carried out in the playground at the request of the Head Teachers involved. The rest of the Pre-Tests and all the Post-Tests took place on the public roads. The tests were carried out at and near T-junctions close to the schools and at each school the tests were carried out on the same junction on each of the three occasions. In most cases it was possible to train the children on a different junction from that on which they were tested.

In order to make them more conspicuous while testing took place the children wore brightly coloured slipover jerkins with identification numbers on them.

Each child was assessed on one right and one left turn out of a side road (ie from the minor to the major road at a T-junction), a right turn into a side road (ie from the major road to the minor road) and on his or her starting and stopping procedures. In addition, some of the children had to overtake one or more parked vehicles in the course of their tests. Parking was not controlled and about 10 per cent of the children had to deal with the problems of parked vehicles. A diagram of the three turns tested is given in Figure 1.

The children's behaviour on each manoeuvre was observed by experienced driving examiners who recorded (onto cassette tape recorders) a running commentary on the actions performed by each child

during each manoeuvre. Transcriptions of these tapes were later used as a basis on which to classify each child's performance in terms of the number and type of errors made. The examiners worked in pairs to ensure that no action of the child was missed.

In addition to these performance tests the children in the training groups were interviewed about their cycling habits (where they cycled, when and how often) in order to make some assessment of the effect of cycling experience on cycling performance. These interviews took place at the Pre-Test and at Post-Test 2 and were carried out by trained interviewers with wide experience of working with children.

5. RESULTS OF PERFORMANCE TESTS

Four categories were used to classify the performance of the children on each manoeuvre; (1) correct (ie no errors), (2) slight errors, (3) serious errors, (4) very serious errors. Errors took the form of omissions (eg failure to look behind, failing to signal) or wrong actions (eg making the wrong signal, swinging wide on a corner). Examples of how behaviour was classified are given in Appendix 1.

Throughout the text of this report a simplification of these classifications has been used and detailed results (ie those showing all four categories) have been given only in Appendix 2. Statistical tests were performed on the four categories of performance but for ease of representation the categories have been reduced to two in the text. Minor errors – which include the correct and slight error categories, and Major errors – which include the serious and very serious error categories.

5.1 Performance of the Control group

When the performance of the Control group was compared with that of the training groups at the Pre-Test stage using chi squared tests, no significant differences were found between them*. When the Control group was tested 7 months later there was no significant change in its behaviour between the two tests when performance was compared using the Wilcoxon matched pairs test. It is therefore reasonable to assume that changes in the behaviour of the training groups over a similar period of time may be ascribed to the different training they received.

5.2 Performance of the Training groups

Performance classifications for each cycling manoeuvre tested were examined separately.

5.2.1 Starting off. The children's behaviour was recorded each time they started off from the kerb, three times in each test. In order to be safe when starting off the child had to look behind to check that the road was clear before moving off. The Playground Trained children were also taught to make a right turn signal before moving off but the children who were trained on the road were instructed to use their judgement about whether a signal was necessary and many of them did not make a signal if the road was clear when they looked behind.

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* A difference between two sets of scores was defined as being significant if it had a probability of less than 1 in 20 ($p < 0.05$) of occurring by chance.

In the Pre-Test about 90 per cent of the children made Major errors in their starts (ie they started from the kerb without looking behind). In Post-Test 1 only 3 per cent of the children failed to look behind before starting and the percentage only increased slightly to about 10 per cent in Post-Test 2. Table 1 shows these results.

TABLE 1

Percentage of starts showing some types of behaviour

	Look behind and signal		Look behind NO signal		NO look behind and NO signal		Total number of starts	
	Road Trained	Playground Trained	Road Trained	Playground Trained	Road Trained	Playground Trained	Road Trained	Playground Trained
Pre-Test	<1	2	11	5	89	93	723	723
Post-Test 1	75	96	22	2	3	2	684	678
Post-Test 2	64	80	30	7	6	13	672	642

No significant differences were found between the performance of Road Trained and Playground Trained children at any stage of testing.

When the performance of children from the three age groups was examined no significant differences were found between the behaviour of children of different ages at any stage of testing.

5.2.2 Left turn. The percentage of all the children who made Major errors on the left turn was reduced from 87 in the Pre-Test to 27 in Post-Test 1. However, a deterioration in performance was observed over the 6 to 8 month period between Post-Test 1 and Post-Test 2 and the percentage making Major errors rose again to 41 per cent.

When the Wilcoxon Signed Ranks Test was applied significant changes in performance at the $p < 0.05$ level were found between Pre-Test and Post-Test 1 and between Post-Test 1 and Post-Test 2 for all training groups and age groups. The improvement between the Pre-Test and Post-Test 1 was, therefore, statistically significant, as was the deterioration between Post-Test 1 and Post-Test 2. However, the performance in Post-Test 2 was still significantly better than in the Pre-Test for each age group and training group.

5.2.2.1 Differences between Road Trained groups and Playground Trained groups (left turn). Table 9 in Appendix 2 gives the full results for the left turn. The percentage of each age group and training group who made Major errors is shown in Figure 2.

When the Pre-Test results were examined no significant differences were found between the Road Trained groups and the Playground Trained groups. In both groups over 85 per cent of children made Major errors. Examination of the Post Test 1 results showed significant differences between the groups which had received Road Training and those who had received Playground Training. Overall, 36 per cent of the Playground Trained children made Major errors in Post-Test 1 while only 18 per cent of the Road Trained children did so. When chi squared tests were applied to the results for each of the three age groups the Playground Trained children were found to perform significantly worse ($p < 0.01$) than Road Trained children of the same age.

When the Post-Test 2 results were compared using the chi squared test they also showed a significant difference between the Road Trained groups and the Playground Trained groups with the Road Trained groups still having a lower percentage of children who made Major errors. Overall 44 per cent of Playground Trained children made Major errors in Post-Test 2 while 36 per cent of Road Trained children did so.

The groupings of the data used in Figure 2 masks these differences for the nine year olds but examination of the data in Table 9 (Appendix 2) shows that fewer Road Trained children made category 4 (very serious) errors.

5.2.2.2 Differences between age groups (left turn). Figure 3 shows the percentage of children in each age group who made Major errors.

In the Pre-Test the differences between the three age groups was significant, though small, when tested by the chi squared test ($p < 0.05$). Overall, 91 per cent of eight year olds made Major errors, compared with 85 per cent of nine and ten year olds.

In Post-Test 1 the differences between age groups were significant (using chi squared $p < 0.05$ for groups matched for type of training). Since the differences may depend on the type of training received the Road Trained groups and Playground Trained groups were considered separately. Among the children who received road training, more nine year olds made Major errors (30 per cent) than did eight year olds (13 per cent) or ten year olds (12 per cent). Among children trained on the playground the pattern was more like that which was expected with Major errors being made more often by eight year olds (48 per cent) than by nine year olds (30 per cent) or ten year olds (31 per cent).

In Post-Test 2 there were no significant differences between the age groups among the Playground Trained children when the detailed data were examined. However when the children were split into those making Major errors and those making Minor errors, then significantly more eight year olds than nine or ten year olds made Major errors (using chi squared test; $p < 0.05$). Among the Road Trained children more eight year olds made Major errors (49.3 per cent) than did nine year olds (36.6 per cent) or ten year olds (23.5 per cent) and these differences were also statistically significant when the detailed data of Table 9 were examined (chi squared test; $p < 0.05$).

5.2.3 Right turn into a side road. The overall percentage of children who made Major errors on their manoeuvre was reduced from 87 per cent in the Pre-Test to 19 per cent in Post-Test 1. As in the left turn, there was a deterioration during the period between Post-Test 1 and Post-Test 2 but the overall percentage of children making Major errors only rose to 26 per cent.

5.2.3.1 Differences between Road Trained groups and Playground Trained groups (right turn into a side road). Table 10 in Appendix 2 gives the full results for the right turn into a side road. Figure 4 shows the percentage of children in each age group and training group who made Major errors.

Road Trained children were compared with Playground Trained children of the same age using the chi squared test. In the Pre-Test no significant difference was found between the two training groups.

In Post-Test 1 the two types of training appear to have affected different age groups in different ways. For eight and nine year olds the Road Trained children performed significantly better ($p < 0.05$) than the

Playground Trained children but for ten year olds there was no significant difference between the two training groups (it should be noted that the grouping of data used in Figure 4 tends to emphasise differences which may not be so marked when the detailed data of Appendix 2 are considered).

In Post-Test 2 the situation was reversed. The ten year olds who had received Playground Training performed significantly worse (chi squared test: $p < 0.05$) than those who were trained on the road but for the eight and nine year olds there was no significant difference between the performance of the two training groups.

5.2.3.2 Differences between age groups (right turn into a side road). Figure 5 shows the differences between age groups on this manoeuvre.

In the Pre-Test the performance of the children in the Road Training group did not depend on their age. However, in the Playground Training group a lower proportion of ten year olds made Major errors than did eight or nine year olds. When averaged over the two training groups 93 per cent of eight year olds, 90 per cent of nine year olds and 79 per cent of ten year olds made Major errors in the Pre-Test.

In Post-Test 1 there were significant differences between the proportion of children in each of the three age groups which made Major errors. The nine and ten year olds were not significantly different from each other but the eight year olds performed significantly worse than the others, whether they had been trained on the road or in the playground (34 per cent of Road Trained eight year olds, and 49 per cent of Playground Trained eight year olds made Major errors).

In Post-Test 2 the eight year olds who received Road Training still performed significantly worse than the nine or ten year olds (chi squared test; $p < 0.05$). Consideration of the detailed data for Playground Trained children showed no significant difference between age groups but when the proportions of children making Major errors were compared, then significantly more eight year olds fell into this category (chi squared test; $p < 0.05$).

5.2.4 Right turn out of a side road. As for the other two manoeuvres there was an overall improvement in performance for all the groups of children. The percentage of children making Major errors was reduced from 85 in the Pre-Test to 17 in Post-Test 1. There was, however, a deterioration between Post-Test 1 and Post-Test 2 and 26 per cent of the children made Major errors in Post-Test 2.

5.2.4.1 Differences between Road Trained groups and Playground Trained groups (right turn out of a side road). Table 11 in Appendix 2 gives the full results for the right turn out of a side road. Figure 6 shows the percentage of children who made Major errors.

Road Trained children were compared with Playground Trained children of the same age using the chi squared test on the detailed data of Table 3. In the Pre-Test there was no significant difference between the Road Trained group and the Playground Trained group. In Post-Test 1, immediately after training, there were significant differences between the two training groups and the Road Trained children performed significantly better than the Playground Trained children. (The grouping of the data for Figure 5 obscures this difference for the nine year olds but it can be seen from the detailed results in Appendix 2.)

When the results for Post-Test 2 were considered, only the older groups (nine and ten year olds) of Road Trained children performed significantly better than the Playground Trained children of the same age. There was no significant difference between eight year olds who had received Road Training and those who had been trained in the playground.

5.2.4.2 Differences between age groups (right turn out of a side road). Figure 7 shows the percentage of children in each age group and training group who made Major errors. In the Pre-Test the variation of performance with age is clear; 95 per cent of eight year olds, 85 per cent of nine year olds and 76 per cent of ten year olds made Major errors. These differences between age groups were significant when tested by chi squared tests ($p < 0.05$).

In Post-Test 1 the age variation was different for the two training groups. Among the Playground Trained children the eight year olds performed significantly worse ($p < 0.01$) than the nine or ten year olds. Among the Road Trained children more nine year olds than ten year olds made Major errors ($p < 0.05$) but none of the other differences between age groups were significant.

In Post-Test 2 the age variation of the Pre-Test was re-established; ten year olds performed significantly better than nine year olds who performed in turn significantly better than eight year olds ($p < 0.05$).

5.2.5 Stopping. The children's performance was observed each time they stopped at the kerb at the end of a manoeuvre (ie three times in each test). Correct behaviour was defined as looking behind and then making a slowing down signal with the right arm before pulling into the kerb. However, the children were, in general, fairly safe if they pulled close into the kerb without either looking behind or signalling, provided they did not wobble. In the Pre-Test only 1 per cent performed the stopping manoeuvre correctly. This rose to 53 per cent in Post-Test 1 and dropped back to 48 per cent in Post-Test 2.

The most serious error the children made when stopping was to make a U-turn without looking and pull up on the opposite side of the road instead of pulling into the nearside kerb. They did this in spite of instructions to pull in at a marked point because other children were waiting on the other side of the road, having walked their bicycles across. However, this occurred in only about 5 per cent of cases in the Pre-Test, less than 1 per cent in Post-Test 1 and 2 per cent in Post-Test 2. Table 2 shows some of the other behaviour seen in stopping manoeuvres.

TABLE 2

Percentage of stops showing some types of behaviour

	Looks behind and gives slowing down signal		NO look behind and NO signal		Slowing down signal given with left arm		Total number of stops	
	Road Trained	Playground Trained	Road Trained	Playground Trained	Road Trained	Playground Trained	Road Trained	Playground Trained
Pre-Test	2	1	88	94	1	0	718	718
Post-Test 1	65	40	4	29	3	7	683	673
Post-Test 2	49	47	9	24	8	9	677	641

This table does not include every combination of action made when stopping. Rows do not, therefore, add to 100 per cent.

When the chi squared test was applied to the data of Table 2 the Road Trained children were found to be significantly more likely than the Playground Trained children to make a correct stop (ie look behind, signal, pull into nearside kerb) and significantly less likely to just pull into the side of the road without looking or signalling in both Post-Test 1 and Post-Test 2.

It is also interesting to note that the incidence of children using their left arm to give a slowing down signal increased after training. This suggests that some confusion about which arm to use arose from the training.

When the age differences were examined only small differences were found between age groups. There was a tendency for a smaller percentage of the youngest children (the eight year olds) to make totally correct stops in both Post-Test 1 and Post-Test 2 but this did not reach statistical significance.

5.3 Types of errors made by children in the three turning manoeuvres

Table 3 shows the percentage of children making errors of various kinds. The most common type of error made in the Pre-Test was a failure to look for traffic. In the left turn 54 per cent of all the children failed to look right before emerging into the major road and in the right turn out of a side road 44 per cent failed to look both ways before emerging. In Post-Test 1 these errors were still relatively common for Playground Trained children (29 per cent failed to look right on the left turn and 19 per cent failed to look both ways on the right turn out of a side road). However, the Road Trained children made these errors much less frequently in Post-Test 1 (only 8 per cent failed to look right on the left turn and 2 per cent failed to look left and right on the right turn out of a side road).

In the two right turns, another error which was made by a large number of children was that of failing to move to the crown of the road before making the turn. In the Pre-Test this error occurred slightly more often with the right turn out of a side road than with the turn into it (49 per cent of children failed to move to the crown when turning right into a side road and 58 per cent when turning out of the side road). In Post-Test 1 this error occurred more often among the eight year olds who were trained in the playground (30 per cent on the turn into a side road and 25 per cent on the turn out of it as compared with 6 per cent and 1 per cent respectively for the Road Trained eight year olds), while in Post-Test 2 only the turn out of a side road showed a difference between the two training groups. (32 per cent of Playground Trained eight year olds failed to move to the crown when turning out of a side road but only 4 per cent of Road Trained eight year olds made this error.)

6. RESULTS OF INTERVIEWING THE CHILDREN

The purpose of the interview was to determine the extent of the children's cycling experience. They were therefore asked about the length of time they had owned a bicycle, where and how often they cycled, and their frequency of cycling to and from school.

The children in the two training groups were interviewed twice, once at the Pre-Test and once at the Post-Test 2 stage. The children in the Control group were not interviewed. The interviews were carried out by trained interviewers with wide experience of working with children.

TABLE 3

Percentage of total number of children making particular types of errors

			Pre-Test		Post-Test 1		Post-Test 2	
			Road Trained	Playground Trained	Road Trained	Playground Trained	Road Trained	Playground Trained
LEFT TURN								
No look right before emerging		8 year olds	55%	78%	6%	39%	23%	35%
		9 year olds	56%	56%	18%	20%	18%	24%
		10 year olds	39%	42%	1%	27%	6%	34%
No signal		8 year olds	44%	52%	4%	8%	12%	14%
		9 year olds	15%	43%	8%	13%	10%	11%
		10 year olds	41%	40%	1%	7%	15%	6%
No look behind		8 year olds	37%	27%	4%	4%	17%	16%
		9 year olds	56%	34%	1%	4%	12%	12%
		10 year olds	29%	30%	4%	0%	3%	2%
RIGHT TURNS								
No move to crown of road	Turning into side road	8 year olds	54%	64%	6%	30%	33%	27%
		9 year olds	41%	46%	5%	18%	19%	5%
		10 year olds	43%	44%	14%	6%	15%	20%
	Turning out of side road	8 year olds	61%	68%	1%	25%	4%	32%
		9 year olds	60%	53%	4%	4%	9%	8%
		10 year olds	50%	53%	0%	7%	3%	11%
No look behind or signal before moving to crown	Turning into side road	8 year olds	13%	13%	3%	3%	5%	9%
		9 year olds	8%	17%	6%	0%	6%	8%
		10 year olds	19%	9%	3%	3%	1%	3%
	Turning out of side road	8 year olds	21%	17%	3%	8%	8%	10%
		9 year olds	12%	24%	3%	3%	5%	6%
		10 year olds	9%	10%	0%	0%	2%	4%
No look left and right before emerging from side road		8 year olds	51%	73%	2%	31%	9%	26%
		9 year olds	34%	51%	3%	12%	7%	21%
		10 year olds	23%	34%	0%	15%	2%	14%
Cut corner when turning into side road		8 year olds	10%	19%	26%	13%	21%	22%
		9 year olds	37%	24%	7%	13%	11%	28%
		10 year olds	36%	17%	5%	15%	13%	19%

Seventy-nine per cent of the children reported having owned a bicycle for at least 2 years prior to the experiment and most of them (67 per cent) said that they had got their first two-wheeled bicycle by the time they were 6 years old (see Tables 4 and 5).

About 45 per cent of the children who were involved in the experiment cycled to school, at least occasionally, before training and this number did not change significantly after training. Seventy per cent of those (137 children) who said they cycled to school reported doing so nearly every day. Most of the children started cycling to school when they were about 8 or 9 years old (see Table 6).

TABLE 4

Age when child first acquired a two-wheeled bicycle

	4 years	5 years	6 years	7 years	8 years	9 years	10 years	Don't know	Total
Number of children	90	132	94	74	38	9	4	24	465
Percentage of total	19	28	20	16	8	2	<1	5	100

TABLE 5

Number of years child had owned a bicycle

	<1 year	1 year	2 years	3 years	4 years	5 years	6 years	Don't know	Total
Number of children	17	48	66	111	101	56	31	35	465
Percentage of total	<1	10	14	24	22	12	7	7	100

TABLE 6

Age when child first cycled to school

	5 years	6 years	7 years	8 years	9 years	10 years	11 years	Don't know	Total
Number of children	9	19	43	177	51	17	7	0	323
Percentage of total	4	9	19	35	23	8	3	0	100

Prior to training (ie when interviewed in the Pre-Test) 78 per cent (368 children) claimed to cycle mainly on the roads. The rest claimed to cycle mainly on pavements and in parks and gardens. After training, when interviewed in Post-Test 2, 89 per cent (147 children) claimed to ride mostly on the road.

Very few of the children in the sample reported having received any cycle training before taking part in the experiment. Eighty-nine per cent (416 children) claimed to have had no previous cycling lessons. Of the remainder 4 per cent (17 children) said that they had attended an NCPS course without taking a test and 2 per cent (11 children) had failed the test. The remaining children had received lessons from Brownie or Cub leaders, or from parents.

An attempt was made to determine whether the child's degree of cycling experience affected performance in the practical cycling tests. When experience was assessed in terms of the frequency with which the child cycled to school, some effect was found. In the Pre-Test, 9 year olds who cycled to school at least once a week were found to perform significantly better on all the manoeuvres tested than children of the same age who seldom or never cycled to school. Eight and ten year olds only showed this difference for certain manoeuvres (eight year olds for the right turn into a side road, ten year olds for the left turn).

An index of experience was constructed based on several categories:– the length of time the child had owned a bicycle, the length of time he/she had been cycling on the roads and the frequency of cycling to school; but no significant differences were found in the performance of children with high and low values of this index.

This finding suggests that the relationship between age and cycling performance found in the Pre-Test might be a function more of changes in general maturity and the development of psychomotor skills than of cycling experience. It should, however, be noted that the experience data is based on the children's own reports and these may not be very accurate, especially where the children had to recall things which had happened some time before.

7. DISCUSSION OF RESULTS

In all the turning manoeuvres tested and in the starting and stopping, the performance of the children improved significantly between the Pre-Test and Post-Test 1 and although deterioration occurred during the 6 to 8 months between Post-Test 1 and Post-Test 2 their performance at the time of Post-Test 2 was still significantly better than before the training. The training, whether it took place on the road or in the playground, had a positive effect which was statistically significant and was maintained over the experimental period. The Wilcoxon Signed Ranks test was used to test these results.

7.1 Road Training versus Playground Training

As shown in Sections 5.2.1 and 5.2.5 there was little difference between the results of Road Training and Playground Training on starting and stopping. It seems that these manoeuvres can be taught equally effectively in either situation. The overall level of performance of starts and stops was high after training and showed only slight deterioration in Post-Test 2.

In the Pre-Test there were no significant differences between the groups of children who were to receive the two types of training (the Road Training group and the Playground Training group) or between these groups and the Control group. It is, therefore, reasonable to assume that differences between the groups in the Post-Tests can be attributed to the training they received.

It is clear from Table 7 that although there were differences between the two training groups for the manoeuvres tested and between different age groups in them, the Road Trained children usually performed better and in no case performed worse than the Playground Trained children. In Post-Test 1 Road Training was found to be significantly more effective in almost all cases. In Post-Test 2 the results showed a significant advantage for Road Training in six out of the nine comparisons made.

TABLE 7

Comparison of Road and Playground Trained groups

	Pre-Test	Post-Test 1	Post-Test 2
Left turn	No difference	Road Trained significantly better for all age groups.	Road Trained significantly better for all age groups.
Right turn into a side road	No difference	Road Trained 8 and 9 year olds significantly better. No difference for 10 year olds.	Road Trained 10 year olds significantly better. No difference for 8 or 9 year olds.
Right turn out of a side road	No difference	Road Trained significantly better for all age groups.	Road Trained 9 and 10 year olds significantly better. No difference for 8 year olds.

7.2 Differences between age groups

When the starts and stops were examined little or no difference was found between the performance of the three age groups. Training resulted in a high level of performance in Post-Test 1 and Post-Test 2 for all age groups in both starting and stopping.

Table 8 summarises the differences between age groups for the three turning manoeuvres. In most cases eight year olds performed worse than older children on the manoeuvres tested. There was also a tendency for ten year olds to perform better than either eight or nine year olds, though the difference between nine and ten year olds did not always reach statistical significance.

7.3 Differences between manoeuvres

The results all show that the effect of age and type of training varied with the manoeuvres being tested.

For the left turn, probably the simplest of the three turning manoeuvres, the pattern is fairly simple. After training the Road Trained children performed better than the Playground Trained children on this manoeuvre and the eight year olds performed worse than nine or ten year olds. Overall, about 13 per cent of the children made Major errors in Post-Test 1 and 20 per cent in Post-Test 2.

For the right turn into a side road the pattern was more complicated. In Post-Test 1 Road Training resulted in better performance for the younger children but for the ten year olds there was no difference between training groups. However, in Post-Test 2 the effect was reversed, the Playground Trained ten year olds having deteriorated more than the Road Trained ones, with the result that the Road Trained children made less Major errors. As in the left turn, the eight year olds performed worse than nine or ten year olds

in both Post-Test 1 and Post-Test 2. Overall, about 19 per cent of the children made Major errors in Post-Test 1 and 26 per cent in Post-Test 2.

In the right turn out of a side road, Road Trained children usually performed better than Playground Trained children after training. The only exception to this was the eight year old group where the Road Trained group deteriorated to the same level as the Playground Trained group in Post-Test 2. On this manoeuvre also, the eight year olds performed worse than nine or ten year olds in most cases. The exception here was in Post-Test 1 for Road Trained children. Overall, about 17 per cent of the children made Major errors in Post-Test 1 and 26 per cent in Post-Test 2.

TABLE 8

Comparison of performance of different age groups

	Pre-Test	Post-Test 1	Post-Test 2
Left turn	8 year olds significantly worse than 9 or 10 year olds for both types of training.	9 year olds significantly worse than 8 or 10 year olds for Road Training. 8 year olds significantly worse than 9 or 10 year olds for Playground Training.	8 year olds significantly worse than 9 year olds who were significantly worse than 10 year olds for Road Training. 8 year olds significantly worse than 9 or 10 year olds for Playground Training.
Right turn into a side road	No difference	8 year olds significantly worse than 9 or 10 year olds for both types of training.	8 year olds significantly worse than 9 or 10 year olds for both types of training.
Right turn out of a side road	8 year olds significantly worse than 9 year olds who were significantly worse than 10 year olds.	No difference for Road Training. 8 year olds significantly worse than 9 or 10 year olds for Playground Training.	8 year olds significantly worse than 9 year olds who were significantly worse than 10 year olds for both types of training.

8. CONCLUSIONS

1. Training of child cyclists, whether on the road or in the playground, resulted in a large reduction in the number of errors made by children aged between eight and ten years.

2. A significant improvement was still evident six to eight months after training, though this was not as marked as it had been immediately after training.

3. Road Training of the type used in this study generally resulted in performances which were better than those achieved by Playground Training, when the children were tested immediately after training.

4. Road Training of this type also generally resulted in better performances when the children were tested six to eight months after training, though the difference between the two training groups had been reduced.

5. The severity and type of error made by children who received different types of training differed. More Playground Trained children than Road Trained children made Major errors. Errors related to looking for traffic were more likely to be made by Playground Trained children than by Road Trained children.

6. The eight year olds in this study performed worse than the older groups. This could be because the training was not suitable for younger children or because the children of this age are unable to gain as much from training as older children.

7. The child's experience as a cyclist did not seem to be related to his performance, age had a much greater influence.

It is necessary to consider the results of this study in the context of cycle training in general. The gains to be derived from training on the roads have to be balanced against the possible disadvantages associated with it.

Effective and safe training on the road may mean that fewer children can be trained by one instructor; thus questions of cost effectiveness may need to be considered. There may be increased risk during training to the children who are trained in the road and this too must be taken into account.

In some areas, where traffic densities are high, it may be difficult to find suitable training sites close to schools and journey time to a suitable site may reduce the time available for training. Any decision to change to road training would, therefore, need to be based on a careful examination of many factors. In Cambridgeshire the decision was made to move in the direction of road training.

9. ACKNOWLEDGEMENTS

The work described in this report was carried out in the Road User Characteristics Division (Division Head: Mr L Watkins) of the Safety Department of TRRL.

The authors wish to express their thanks to the members of the Cambridgeshire Road Safety Section for their cooperation and assistance in this research. Thanks are also due to Mrs M Pattinson and Mr J Fazakerley for supplying interviewers and observers.

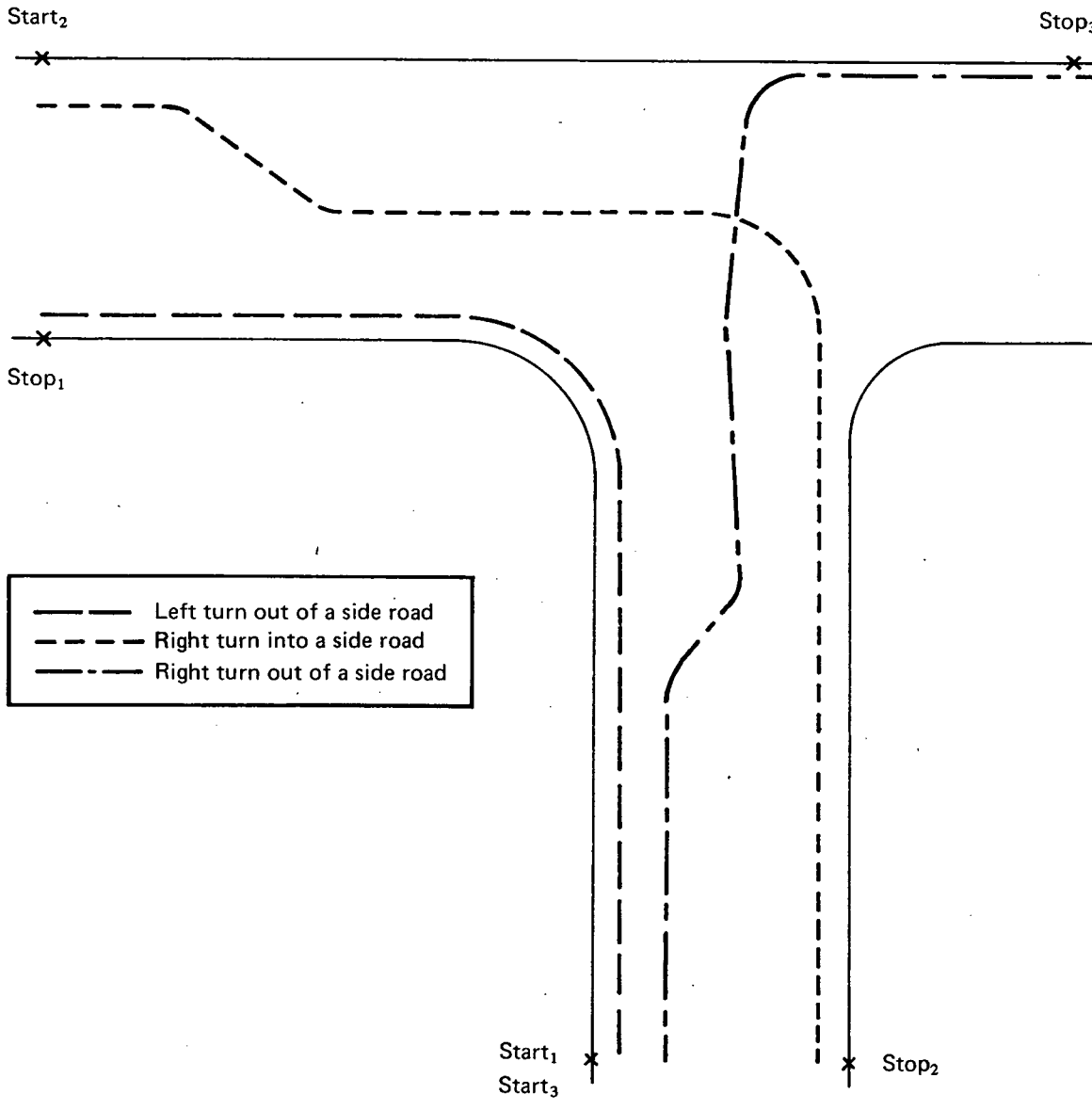

Fig. 1 T-JUNCTION USED FOR PRACTICAL TESTS

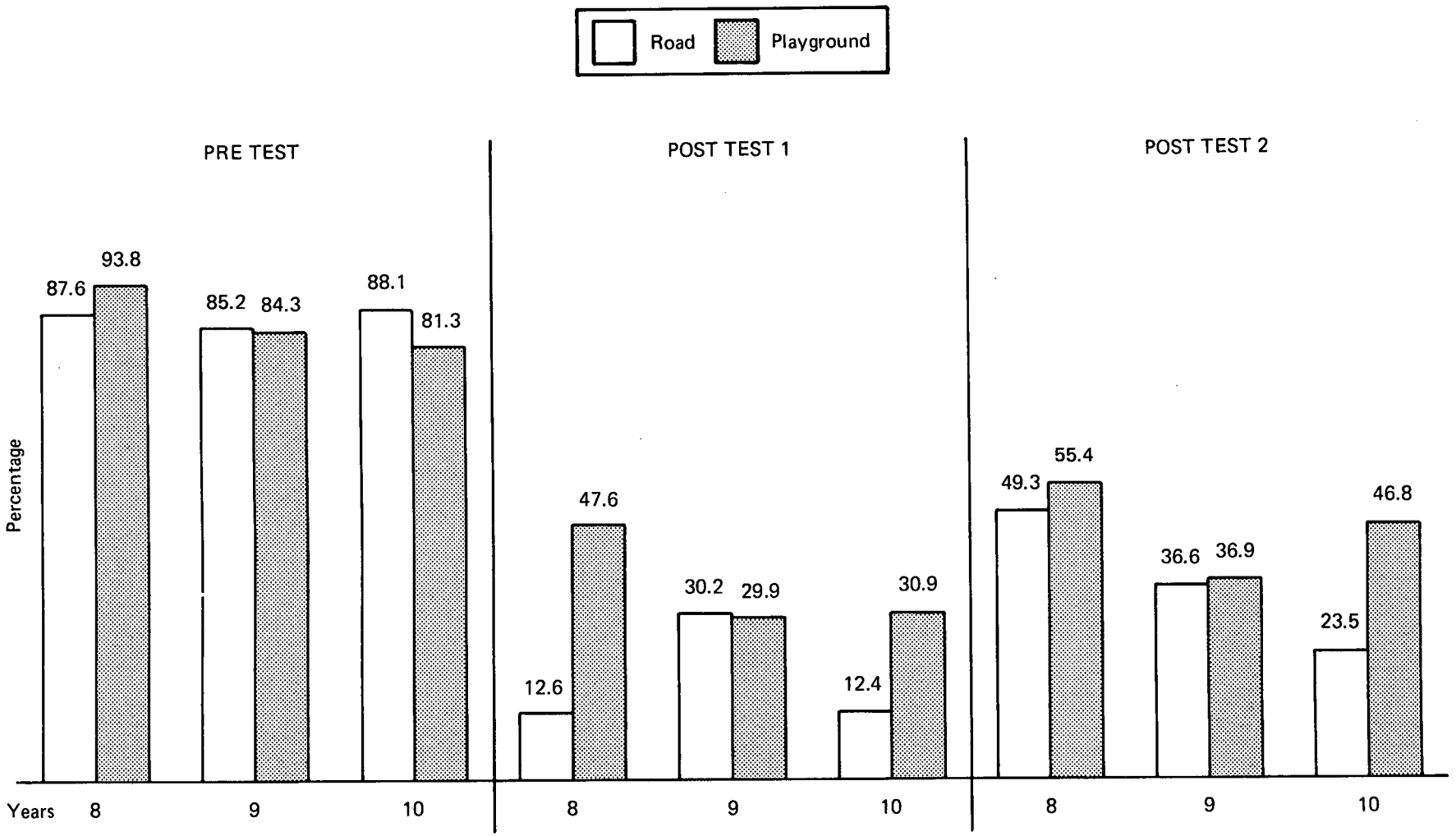

Fig. 2 LEFT TURN: PERCENTAGE OF CHILDREN WHO MADE MAJOR ERRORS IN EACH AGE GROUP

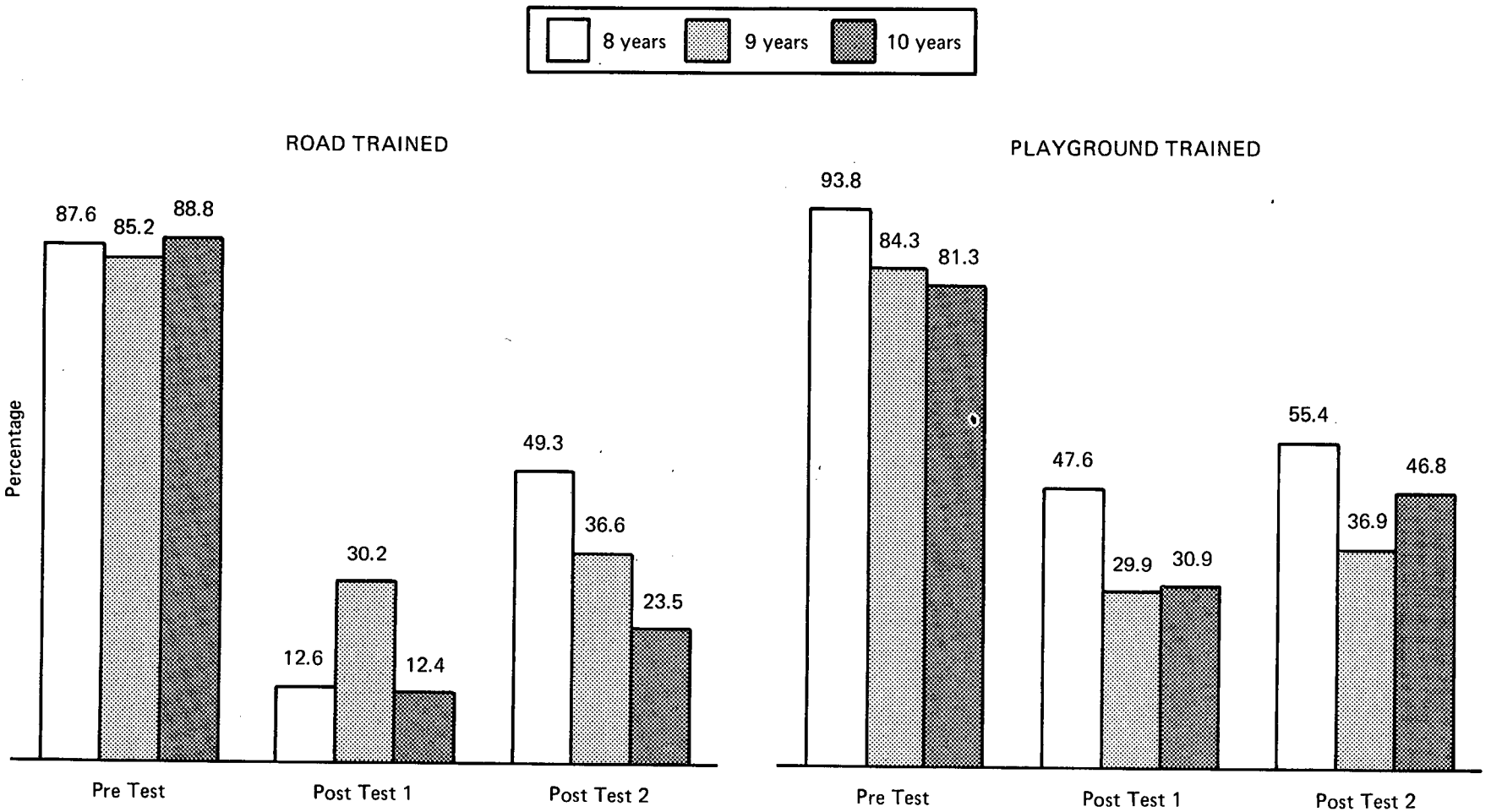

Fig. 3 LEFT TURN: PERCENTAGE OF CHILDREN WHO MADE MAJOR ERRORS IN EACH TRAINING GROUP

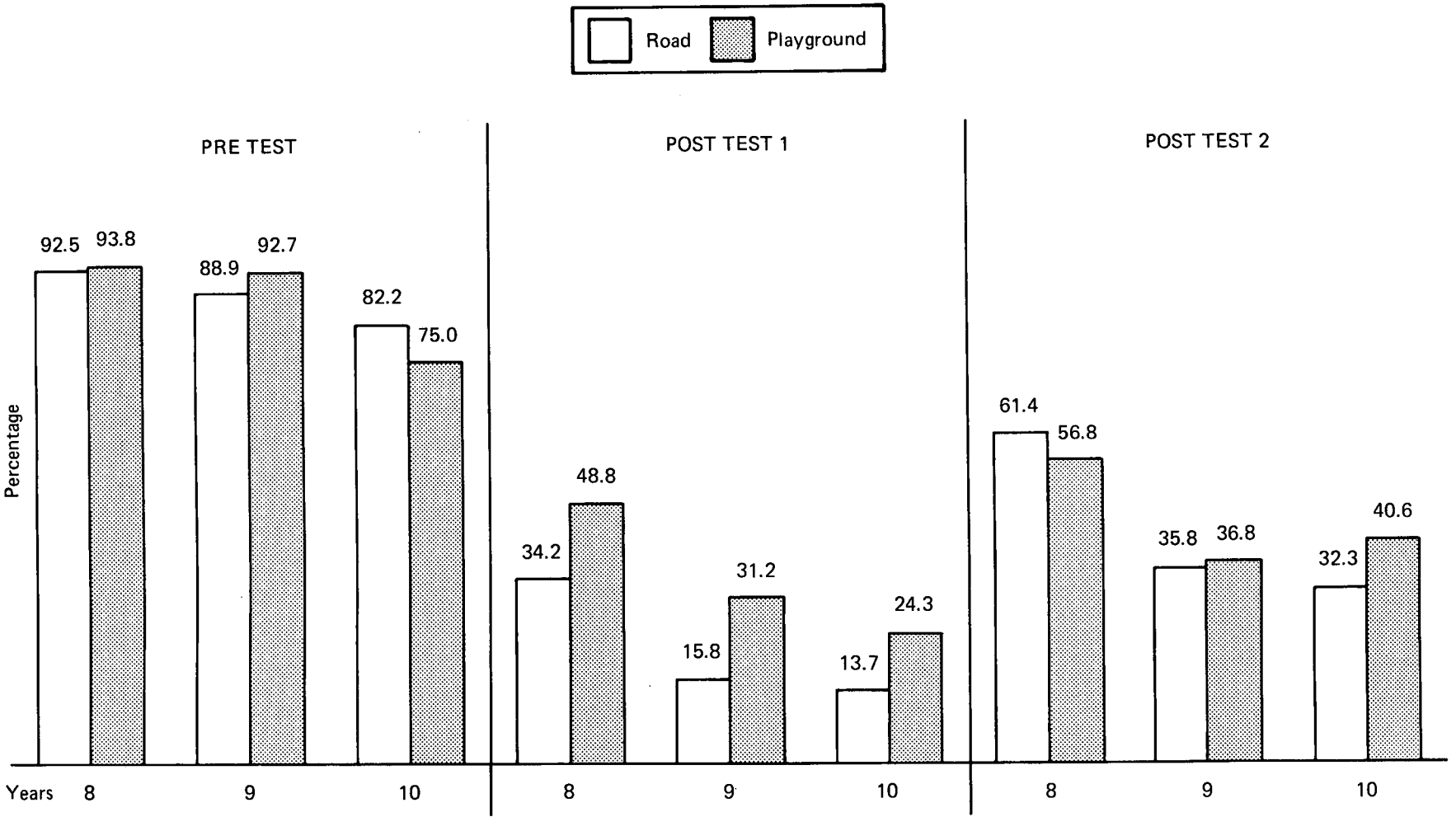

Fig. 4 RIGHT TURN INTO A SIDE ROAD: PERCENTAGE OF CHILDREN WHO MADE MAJOR ERRORS IN EACH AGE GROUP

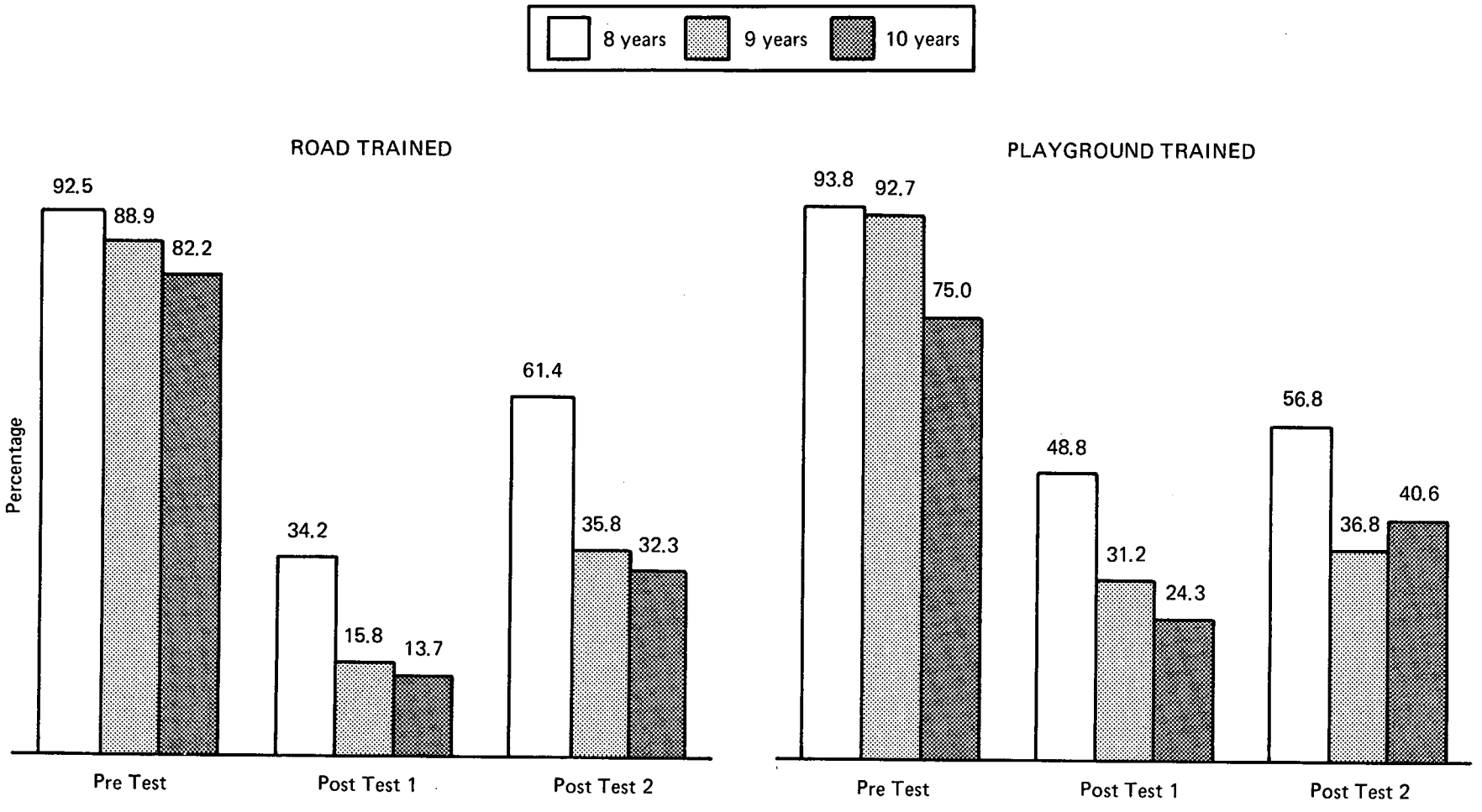

Fig. 5 RIGHT TURN INTO A SIDE ROAD: PERCENTAGE OF CHILDREN WHO MADE MAJOR ERRORS IN EACH TRAINING GROUP

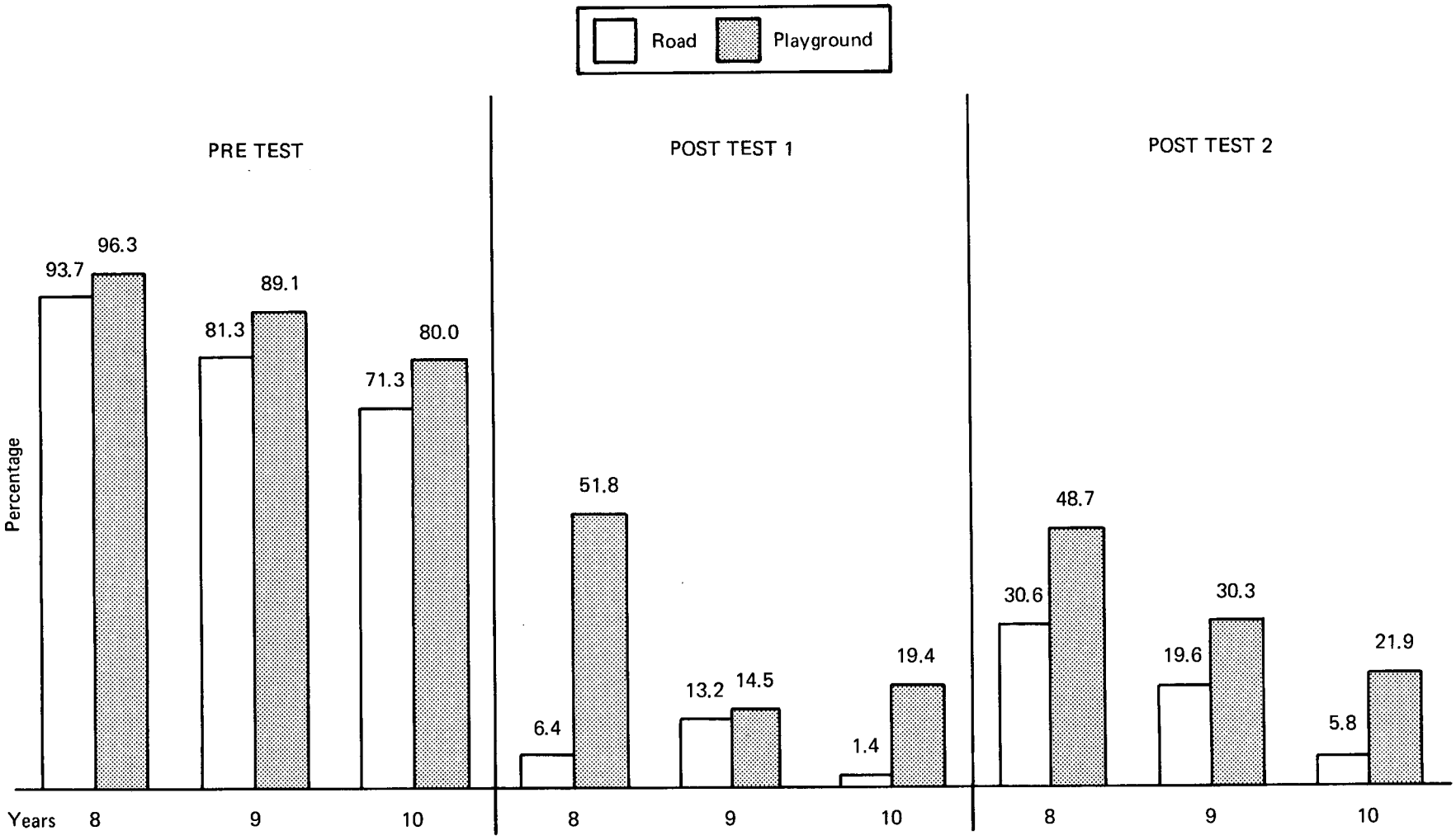

Fig. 6 RIGHT TURN OUT OF A SIDE ROAD: PERCENTAGE OF CHILDREN WHO MADE MAJOR ERRORS IN EACH AGE GROUP

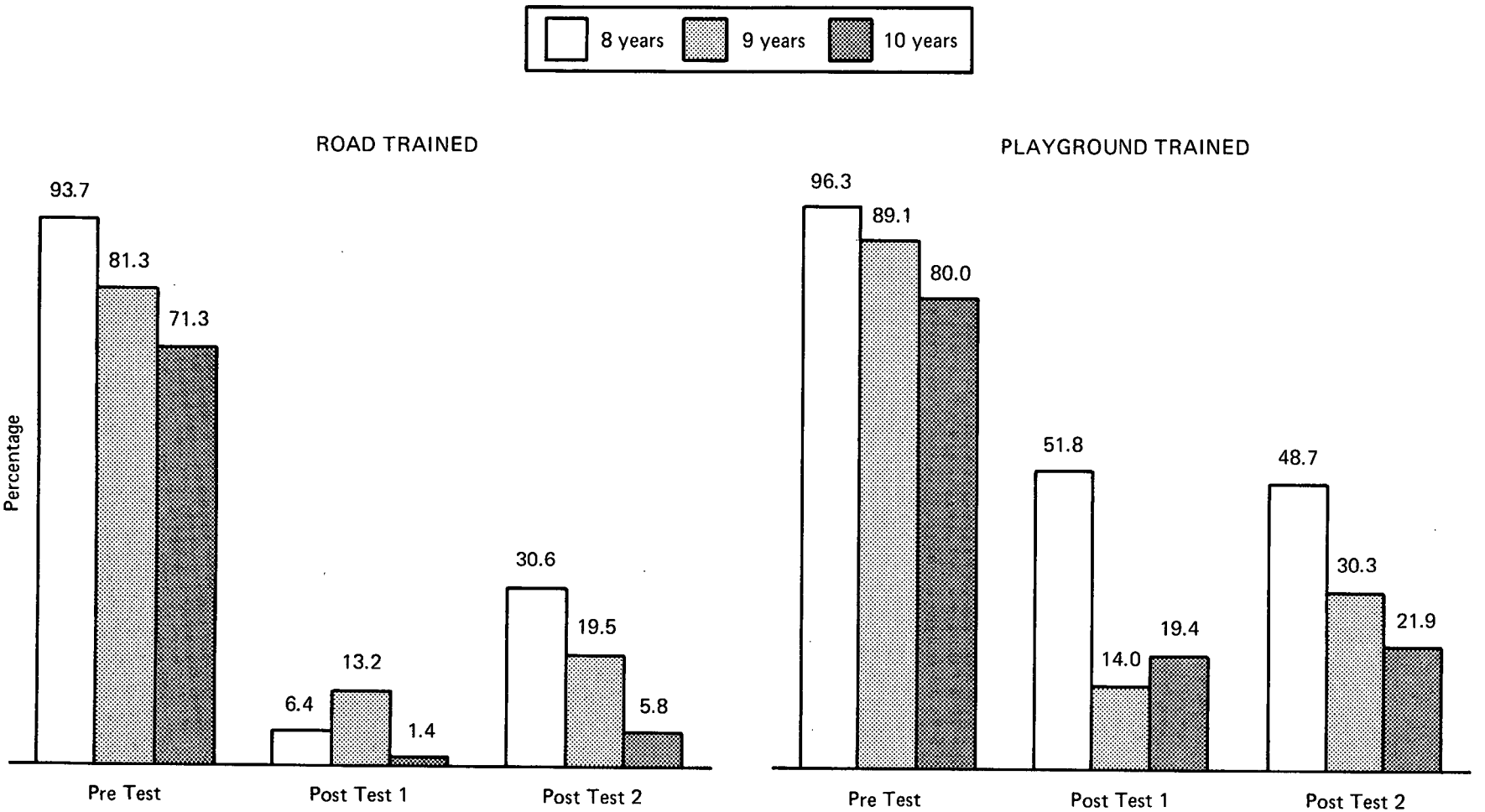

Fig. 7 RIGHT TURN OUT OF A SIDE ROAD: PERCENTAGE OF CHILDREN WHO MADE MAJOR ERRORS IN EACH TRAINING GROUP

10. APPENDIX 1

EXAMPLES OF TYPES OF BEHAVIOUR IN EACH OF THE 4 CATEGORIES

Type of turn / Category	Left turn	Right turn into side road	Right turn out of side road
1	Riding on left. Look behind, signal and slow down at junction. Look right and left before emerging.	Riding on left. Look behind, signal, move to crown. Ride on crown to junction. Corner with both hands on handlebars.	Riding on left. Look behind, signal, move to crown. Ride on crown to junction. Slow or stop, signal, look right and left. Corner with both hands on handlebars.
2	No look behind before turning.	a) Look behind but no signal before move to crown. b) No move to crown but does look behind and signal before turning from left side of road. c) Carried out correct actions but late.	a) As right turn into side road. b) As right turn into side road. c) As right turn into side road. d) No second signal at point of turn.
3	a) Swings wide on cornering. b) Swings wide when making signal or looking behind.	a) Signal but no look behind before moving to crown. b) Signal but no look behind before making turn from left side of road.	a) As right turn into side road. b) As right turn into side road. c) Brief and possibly inadequate looks left and right at junction.
4	a) No look right before emerging.	a) Move to crown with no look behind or signal. b) Move to wrong side of road.	a) As right turn into side road. b) As right turn into side road. c) Fail to look left and right before emerging.

11. APPENDIX 2

DETAILED RESULTS FOR THE THREE TURNING MANOEUVRES

TABLE 9

Left turn

		Pre-Test									Post-Test 1									Post-Test 2								
		Base No.	1		2		3		4		Base No.	1		2		3		4		Base No.	1		2		3		4	
			N	%	N	%	N	%	N	%		N	%	N	%	N	%	N	%		N	%	N	%	N	%	N	%
Road	8 yrs	80	0		10	12.5	25	31.3	45	56.3	79	4	5.1	65	82.3	5	6.3	5	6.3	75	9	12.0	29	38.7	19	25.3	18	24.0
	9 yrs	81	0		12	14.8	23	28.4	46	56.8	76	9	11.8	44	57.9	9	11.8	14	18.4	82	6	7.3	46	56.1	14	17.1	16	19.5
	10 yrs	80	2	2.5	7	8.8	40	50.0	31	38.3	73	12	16.5	52	71.2	8	11.0	1	1.4	68	11	16.2	41	60.3	10	14.7	6	8.8
Playground	8 yrs	80	0		5	6.3	11	13.8	64	80.0	80	10	12.5	32	40.0	7	8.8	31	38.8	74	9	12.2	24	32.4	13	17.6	28	37.8
	9 yrs	83	0		13	15.7	22	26.5	48	57.8	77	23	29.9	31	40.3	8	10.4	15	19.5	76	19	25.0	29	38.2	10	13.2	18	23.7
	10 yrs	80	1	1.3	14	7.6	31	38.8	34	42.5	68	21	30.7	26	38.2	3	4.4	18	26.5	64	14	21.9	20	31.3	7	10.9	23	35.9
Control	8 yrs	21	0		1	4.8	8	38.1	12	57.1										16	0		5	31.3	5	31.3	6	37.5
	9 yrs	22	1	4.5	0		11	50.0	10	45.5					NO TEST					19	0		5	26.3	5	26.3	9	47.4
	10 yrs	24	0		2	8.3	12	50.0	10	41.7										22	1	4.5	11	50.0	4	18.2	6	27.3

TABLE 10

Right turn into a side road

		Pre-Test									Post-Test 1									Post-Test 2								
		Base No.	1		2		3		4		Base No.	1		2		3		4		Base No.	1		2		3		4	
			N	%	N	%	N	%	N	%		N	%	N	%	N	%	N	%		N	%	N	%	N	%	N	%
Road	8 yrs	80	1	1.3	5	6.3	38	47.5	36	45.0	79	34	43.0	18	22.8	21	26.6	6	7.6	75	16	21.3	13	17.3	23	30.7	23	30.7
	9 yrs	81	5	6.2	4	4.9	48	59.3	24	29.6	76	49	64.5	15	19.7	5	6.6	7	9.2	81	40	49.4	12	14.8	19	23.5	10	12.3
	10 yrs	79	7	8.9	7	8.9	43	54.4	22	27.8	73	50	68.5	13	17.8	6	8.2	4	5.5	68	39	57.4	7	10.3	20	29.4	2	2.9
Playground	8 yrs	80	0		5	6.3	21	26.3	54	67.5	82	25	30.5	17	20.7	20	24.4	20	24.4	74	19	25.7	13	17.6	23	31.1	19	25.7
	9 yrs	83	1	1.2	5	6.0	29	34.9	48	57.8	77	28	36.4	25	32.5	17	22.1	7	9.1	76	32	42.1	16	21.1	20	26.3	8	10.5
	10 yrs	80	3	3.8	17	21.3	30	37.5	30	37.5	66	37	56.1	13	19.7	12	18.2	4	6.1	64	23	35.9	15	23.4	19	29.7	7	10.9
Control	8 yrs	21	0		1	4.8	16	76.2	4	19.0										16	0		1	6.3	13	81.3	2	12.5
	9 yrs	22	1	4.5	0		12	54.5	9	40.9					NO TEST					19	2	10.5	2	10.5	13	68.4	2	10.5
	10 yrs	24	1	4.2	3	12.5	14	58.3	6	25.0										22	0		0		18	81.8	4	18.2

TABLE 11

Right turn out of a side road

		Pre-Test									Post-Test 1									Post-Test 2								
		Base No.	1		2		3		4		Base No.	1		2		3		4		Base No.	1		2		3		4	
			N	%	N	%	N	%	N	%		N	%	N	%	N	%	N	%		N	%	N	%	N	%	N	%
Road	8 yrs	79	1	1.3	4	5.1	30	38.0	44	55.7	79	12	15.2	62	78.5	1	1.3	4	5.1	75	18	24.0	34	45.3	10	13.3	13	17.3
	9 yrs	80	1	1.3	14	17.5	32	40.0	33	41.3	76	11	14.5	55	72.4	5	6.6	5	6.6	82	25	30.5	41	50.0	6	7.3	10	12.2
	10 yrs	80	5	6.3	18	22.5	33	41.3	24	30.0	73	16	21.9	56	76.7	1	1.4	0		68	23	33.8	41	60.3	2	2.9	2	2.9
Playground	8 yrs	80	0		3	3.8	16	20.0	61	76.3	81	16	19.8	23	28.4	12	14.8	30	37.0	74	15	20.3	23	31.1	13	17.6	23	31.1
	9 yrs	83	1	1.2	8	9.6	28	33.7	46	55.4	76	20	26.3	45	59.2	1	1.3	10	13.2	76	29	38.2	24	31.6	4	5.3	19	25.0
	10 yrs	80	5	6.3	11	13.8	32	40.0	32	40.0	67	23	34.3	31	46.3	3	4.5	10	14.9	64	21	32.8	29	45.3	4	6.3	10	15.6
Control	8 yrs	21	0		0		11	52.4	10	47.6										16	0		2	12.5	9	56.3	5	31.3
	9 yrs	22	0		3	13.6	15	68.2	4	18.2				NO TEST						19	2	10.5	4	21.1	9	47.4	4	21.1
	10 yrs	24	1	4.2	1	4.2	14	58.3	8	33.3										22	1	4.5	4	18.2	7	31.8	10	45.5

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