Cycle helmet wearing in 2002

Prepared for Road Safety Division, Department for Transport

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Executive Summary

A study was undertaken by TRL in the autumn of 1994 investigating the cycle helmet wearing rate in Great Britain on major built-up roads. This study was then repeated in 1996 and 1999. In 1994, 27,000 cyclists were observed at 79 busy sites around Great Britain. Of these cyclists, 16% were wearing helmets. In 1996 this wearing rate had increased by a small, but statistically significant amount, to 17.6%. The cycle helmet-wearing rate was then observed to increase by about a quarter in the 1999 survey to 21.8%. This was due to an increase in the number of adults wearing cycle helmets, with no significant increase amongst children. In 1999, an additional survey was carried out on minor built-up roads and 8.2% of cyclists were observed wearing helmets. This report reviews the nationwide observation surveys of cyclists conducted in 2002.

A review of research and literature on the efficacy of cycle helmets was carried out for DfT by Towner *et al.* (Department for Transport, 2002). The review notes that cycle helmets have been found to be effective in reducing the incidence and severity of head, brain and upper facial injuries, and that they are particularly effective in reducing injuries amongst children. It further finds that cycle helmet education campaigns increase the use of helmets, and that this effect is most significant amongst younger children and girls. This finding coincides with the results of this survey, which found that girls' wearing rates had increased, whereas boys' wearing rates had not.

Survey on major built-up roads

In 2002 the survey was repeated to assess changes in cycle helmet wearing rates since 1999. The survey was kept as close as possible to the previous surveys and Local Authorities conducted the surveys on TRL's behalf. 27,164 cyclists were observed in total. The results showed that the wearing rate was 25.1%, which was a significant increase of 3.3% from the rate of 1999. As with the previous survey, this was due to an increase in the number of adults wearing helmets; the wearing rate amongst child cyclists had not significantly increased.

Helmet wearing levels varied according to the age of the cyclists (child or adult), the sex of the cyclists (male or female), the type of bicycle ridden and time (peak or off-peak). Cyclists observed in London and on a recreational route had a higher rate of helmet wearing than at other sites. To examine the cyclists' helmet wearing patterns more fully, the interaction between helmet wearing, age and sex, type of bike, time of day, weather and ethnicity was analysed. This revealed that there was an effect of time, bicycle type and ethnicity on wearing rates in London. Outside London time, sex, age, bicycle type and ethnicity had an effect, also type of bike on recreational routes.

Survey on minor built-up roads

The purpose of conducting the survey on minor built-up roads, as in 1999, was to increase the sample of child cyclists and to be more representative of the type of cycling that children do. The overall cycle helmet wearing rate observed in the 2002 survey on minor built-up roads was 9.5%, a statistically significant increase of 1.3% from the previous survey.

The factors observed to increase wearing rates significantly included cycling during peak weekday hours, when dark, on the road, when riding a racing bike, when the cyclist was of white ethnic origin, and when additional safety aids were being used. Whilst the cycle helmet wearing rate for children was significantly higher at 9.7% than for adults (age 16+) at 7.4% in 1999, this trend was reversed in this year's survey, with only 6.5% of children and 10.9% of adults observed wearing a helmet. This is a reduction of over 3% amongst children and an increase by the same amount amongst adults.

The cycle helmet wearing rate has increased in both surveys since 1999. This is largely due to an increase in the number of adults wearing cycle helmets rather than the number of children. Although the cycle helmet wearing rate has increased with each survey, the findings suggest that action needs to be taken to encourage cycle helmet wearing amongst all cyclists, especially children.

1 Introduction

A survey was undertaken by TRL in the autumn of 1994 (Taylor and Halliday, 1996) to observe the cycle helmet wearing rate in Great Britain on major built-up roads. This was repeated in 1996 and 1999.

In 1994, twenty-seven thousand cyclists were observed at 79 sites all over Great Britain. 16.0% of cyclists were wearing cycle helmets. When this survey was repeated two years later, the wearing rate had increased by a small – but statistically significant amount – to 17.6%. The survey was again repeated in 1999, and this revealed that the cycle helmet-wearing rate had increased to 21.8%. The increase was greatest amongst adult cyclists.

When TRL were asked to repeat the survey for a third time in 1999, it was decided to make the sample more representative of the national cycling population. This involved increasing the number of child cyclists in the sample, as this group was under-represented in the two previous surveys. Child cyclists tend to use minor rather than major roads, so the representation of children was improved by conducting a parallel survey on minor built up roads. The original two surveys were not intended to produce a nationally representative wearing rate, but rather to measure trends over time.

The survey on minor built-up roads, which attempted to improve the representativeness of the sample by observing cyclists on minor built-up roads, found that the proportion of cyclists wearing a cycle helmet was 8.2%, significantly less than the 21.8% in the survey on major built-up roads. This confirmed that the original survey on major built-up roads was not representative of the cyclists in Great Britain. Both adults and children were less likely to wear cycle helmets on the relatively quiet roads covered by the survey on minor built-up roads than on the busier roads covered by the survey on major built-up roads.

In Autumn 2002, the two surveys were again conducted in order to ascertain cycle helmet wearing rates on major and minor built-up roads, to report changes in wearing rates over time and to investigate national and regional differences by age group, sex and other factors. For the first time, the survey attempted to record the ethnicity of the cyclists.

This report describes the surveys performed and presents the results of analysing the survey data.

2 Methodology

2.1 Major built-up roads survey

The survey design was kept as close to the design of the 1994, 1996 and 1999 surveys as possible, using the sites shown in Figure 1. The relevant local authorities (listed in Appendix A) were asked to conduct the surveys on TRL's behalf. A few site changes were made by some local authorities due to changes in the road layout and cycle flow since the 1999 survey. In these cases, the surveys were undertaken as near to the original sites as possible or at new sites where the cycle flow was similar to that of 1999.

The local authorities were asked to conduct the surveys at the same times and on the same day of the same week of the year as they had in 1999. They were sent a supply of data collection forms (see Appendix B) and instructions and examples of how to complete them. The majority of the surveys were carried out on the same days as in previous years.

The survey teams were asked to collect the following data for each passing cyclist:

- whether wearing a helmet;
- sex;
- type of bicycle ridden (racing/touring, mountain/BMX, traditional town or 'other');
- age (child, (under 16) or adult, (16 or over));
- if more than one cyclist riding together, number in the group;
- ethnic origin (black, white, Asian (Indian subcontinent e.g. Pakistan, Bangladesh) or South East Asian (e.g. China, Thailand, Malaysia));
- whether cyclist carrying a passenger and if so, whether the passenger was wearing a cycle helmet.

It was decided to collect information regarding the ethnicity of each passing cyclist, which had not been done in earlier surveys. As this was an observational survey, only very basic categories could be used, but it was felt that this might give an indication of differences in cycle helmet wearing rates between ethnic groups. It was suggested, following the 1999 survey on minor built-up roads, that wearing rates varied greatly and were influenced by many external factors, some measurable or observable, others not. It was thought that including additional factors could help identify target groups. As the ethnicity of the cyclists was not noted in the previous surveys, changes in cycle helmet wearing cannot be related to ethnicity.

2.2 Minor built-up roads survey

This survey was first carried out in 1999 on minor built-up roads. The main aim was to boost the sample of child cyclists and to be more representative of the types of cycling that children do. The main considerations were to observe a large sample of children in an economical way, ensuring a geographical spread, across all socio-economic groups. The same compact areas (1km squares) were used as those in 1999. Previous studies had shown that socio-economic status of the area affects helmet wearing rates. The DfT's Index of Local Deprivation was used as a measure of area wealth. Child casualty rates derived from STATS 19 accident data were used as a proxy for cycling levels. Districts were ranked by child casualty levels and by Deprivation Index. Districts were sampled from those with high cycling activity (i.e. casualties), ensuring a good mix of wealth and geographical areas. Within each area a route was mapped out, covering as many roads within the square as possible.

Each of the selected routes was surveyed on one weekday and one weekend day by driving around the prescribed route for a 6 hour period (either from 7am to 1pm,

Key

1 Aberdeen
2 Glasgow (8)
3 Edinburgh
4 Newcastle
5 Darlington
6 Stockton (2)
7 Barrow
8 York (2)
9 Beverley
10 Hull
11 Scunthorpe
12 Grimsby
13 Doncaster (2)
14 Liverpool (2)
15 Warrington (2)
16 Manchester (2)
17 Stockport (2)
18 Crewe
19 Stafford
20 Derby
21 Nottingham (2)
22 Newark
23 Boston (2)
24 Wolverhampton
25 Loughborough
26 Leicester
27 Coventry
28 Warwick
29 Rugby
30 Northampton
31 Peterborough (2)
32 Cambridge (4)
33 Bedford (4)
34 Norwich
35 Lowestoft
36 Ipswich
37 Colchester
38 Chelmsford (2)
39 London (3)
40 Reading
41 Oxford (3)
42 Ridgeway – Oxford
43 Swindon
44 Cheltenham
45 Gloucester
46 Cardiff
47 Bristol
48 Bristol-Bath Cycle Route (2)
49 Bournemouth
50 Portsmouth

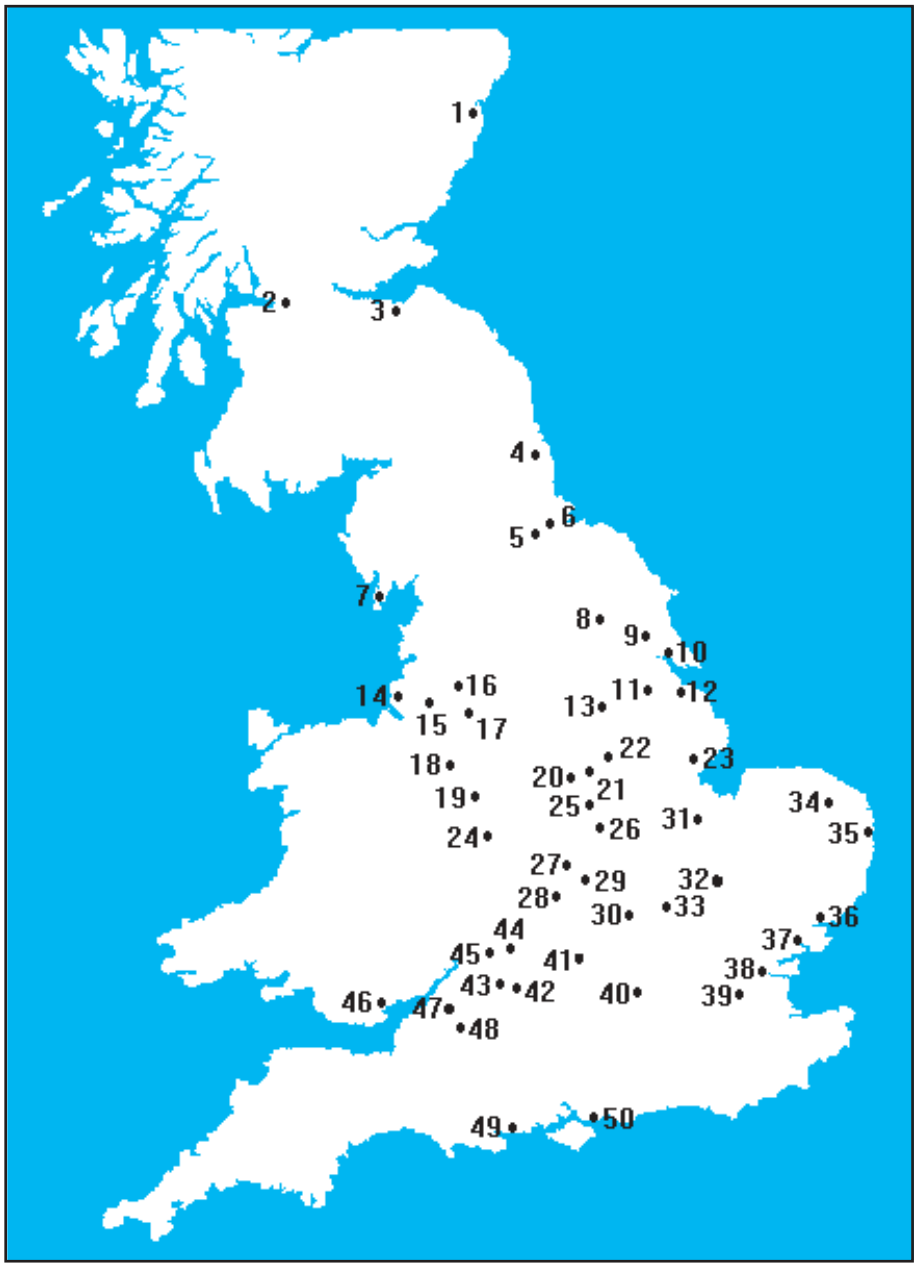

Figure 1 Repeat cycle helmet observation survey sites

or 1pm to 7pm) recording the following details for each cyclist observed:

- type of area (residential, shops, school or other);
- sex of cyclist;
- age group (infant 0-6, junior 7-10, secondary 11-16 or adult);
- ethnic origin (black, white, Asian (Indian subcontinent e.g. Pakistan, Bangladesh or South East Asian e.g. China, Thailand, Malaysia));
- helmet (on head, carrying but not worn on head, no);
- riding position (road, pavement, other);
- type of bike (racer, mountain traditional town, other);
- school uniform (yes or no);
- passenger (yes - helmet worn, yes - no helmet worn, no);
- paper round (yes or no);
- additional safety aids e.g. front/rear lights; fluorescent clothing; stabilisers; reflectors (yes or no).

A column was also provided where the observers could record any additional comments.

2.3 Statistical significance of results

Throughout the following sections, there are tables showing differences between groups of cyclists e.g. children versus adults. Significant differences between groups are indicated as follows:

NS	Not significant at the 5% level
p<0.05	Significance of at least 5%
p<0.01	Significance of at least 1%
p<0.001	Significance of at least 0.1%

In the main body of text, significance levels are quoted as a *p* level i.e. a p value of 0.05 or less means that the result is significant to at least the 5% level. In some cases data are missing, so sample sizes are given where appropriate.

3 Results of the major built-up roads survey

In the 2002 survey, 26,174 cyclists were observed at the sites previously surveyed. Of these cyclists 25.1% were wearing helmets. The large sample size means that one can be 99% certain that this figure is within 0.7% of the helmet wearing rate of the population who cycle on busy urban roads on weekdays.

The wearing rate has increased by 3.3% (a statistically significant amount) on the wearing rate observed in the 1999 survey. As shown in Table 1 however, the rise is due to increased numbers of adult cyclists wearing helmets. There has been no statistically significant change in child wearing rates in this sample.

Appendix C shows a breakdown of wearing rates and cyclist counts by local authority area.

3.1 Factors affecting helmet wearing in 2002 – Simple effects

3.1.1 Age and sex of cyclist

The 2002 adult cycle helmet wearing rate of 25.7% was significantly greater than the 15.3% observed amongst children[1]. The proportion of adults wearing helmets has significantly increased from 22.2% in 1999 to 25.7%[2]. The proportion of children cyclists has increased by 0.3% but this was not significant.

There was a significant difference between the wearing rates of males and females[3] (see Table 2), but there was no such difference in 1999. There was found to be a significant difference between female (24.4%) and male

Table 2 Wearing rates by age group and sex

	Children		*Adult*	
	Wearing rate	*Sample size*	*Wearing rate*	*Sample size*
2002 survey				
Males	12.3%	1183	25.2%	17738
Females	24.4%	385	27.0%	6868
1999 survey				
Males	12.7%	1,122	22.2%	17,794
Females	20.9%	426	22.2%	6,794
1996 survey				
Males	13.3%	1,326	16.7%	17,545
Females	17.6%	415	17.5%	7,328
1994 survey				
Males	16.0%	1,036	15.5%	18,624
Females	21.9%	389	17.0%	7,368

Table 1 Changes in wearing rates between 1994, 1996, 1999 and 2002

	Wearing rates								
Category of cyclist	*2002*	*Sample size*	*1999*	*Sample size*	*1996*	*Sample size*	*1994*	*Sample size*	*Significance of 1999/2002 difference*
All cyclists	25.1%	26,174	21.8%	26,230	17.6%	27,783	16%	27,417	p<0.001
Males	24.4%	18,921	21.7%	18,975	17.4%	19,793	15.5%	19,660	p<0.001
Females	26.9%	5,302	22.1%	7,243	18.3%	7,973	17.2%	7,757	p<0.001
Missing	–	–	16.7%	12	16.7%	6	–	–	–
Children	15.3%	1,568	15.0%	1,549	14.4%	1,741	17.6%	1,425	NS
Adults	25.7%	24,606	22.2%	24,599	17.0%	24,879	15.9%	25,992	p<0.001
Missing	–	–	42.7%	82	37.2%	1,152	–	–	–

(12.3%) child wearing rates[4]. The difference between male and female adult wearing rates was also significant. More female adults were observed wearing helmets (27.0%) than male adults (25.2%)[5].

The wearing rate of males increased from 21.7% in 1999 to 24.4% in 2002, and females increased from 22.1% to 26.9%; both increases were significant[6].

3.1.2 Type of bicycle

The type of bicycle being ridden by the cyclist was recorded. They were classified as mountain bike, traditional town bike, racing/touring bike and 'others'. In 2002 the most common types of bikes were the mountain bike (over 50% of the bikes observed) and traditional bike (over 30%).

Helmet wearing varied significantly according to the type of bike ridden[7] (see Table 3). 38.0% of cyclists riding racing bikes wore a helmet compared with 25.4% on other bikes, 24.8% on mountain bikes and 21.9% traditional town bikers.

Table 3 Wearing rate by type of bike

Type of bicycle	*% Riding bike (N=26,174)*	*Wearing rate*
Mountain bike	55.9%	24.8%
Traditional town	32.5%	21.9%
Racing	9.0%	38.0%
Other	2.6%	25.4%
Total	100%	25.1%

When adult and child cyclists were analysed separately, helmet wearing varied according to the type of bike ridden (Table 4). This was significant for adult cyclists only[8]. 38.6% of adult cyclists riding racing bikes were wearing cycle helmets. 26.7% were riding on other bikes, 25.9% were riding a mountain bike/BMX and 21.8% on traditional town bikes. For child cyclists, the wearing rate also varied according to the type of bike ridden but this was not significant

Table 4 Wearing rate by bike type and age

	Adults		*Children*	
	Riding bike	*Wearing rate*	*Riding bike*	*Wearing rate*
Mountain bike	54.2%	25.9%	82.3%	13.3%
Traditional town	33.9%	21.8%	10.0%	27.4%
Racing	9.5%	38.6%	1.5%	33.3%
Other	2.4%	26.7%	6.2%	17.5%
Total	100%	25.7%	100%	15.3%

3.1.3 Time

The survey teams monitored cyclists continuously, grouping observations into quarter hour periods. Morning surveys began at 0700hrs and continued until 1259hrs. Afternoon surveys commenced at 1300hrs and finished at 1859hrs. 25322 cyclists were observed on weekdays. 60.8% were observed during peak time and 39.2% observed during off-peak times[9] (see Figure 2).

16.8% of those observed off-peak were wearing helmets whereas 29.6% of those observed during peak time were wearing helmets. This difference was found to be significant[10]. During peak time 73.4% of the cyclists were males and 94.2% were adults.

Figure 3 shows the wearing rate by time of day for children and adults. The adult wearing rates are hourly averages. e.g. the rate shown at 0700 is the average wearing rate between 0700 and 0759. There are far fewer observations of children, so averages over periods of three hours are shown. e.g. the rate shown at 0800 is the average between 0700 and 0959.

Overall, 13.3% of children were observed wearing cycle helmets during peak times compared with 18.0% in off-peak times. The wearing rate for children was at its highest during the off-peak period, between noon and 3pm.

Table 5 shows how the peak and off-peak wearing rates have varied over the years. Whereas the number of cyclists observed in peak and off-peak periods has remained fairly constant since 1994, the wearing rate has increased, both in peak and off-peak periods. The wearing rate in peak time remains higher than in off-peak times. Cyclists may believe they are more at risk in peak time due to the greater volume of traffic and therefore are more likely to wear a helmet.

Table 5 Wearing rate by year (cyclists of all ages)

Year	*Peak*	*Off peak*
1994	19.4%	11.3%
1996	20.9%	13.2%
1999	26.0%	15.0%
2002	29.6%	16.8%

Only two sites were observed at the weekend and these sites were on recreational routes. A total of 852 cyclists were observed on these sites and these were excluded from the peak/off-peak analysis.

3.1.4 Weather

The weather was recorded for 62.5% of the cyclists observed in 2002. A wearing rate of 28.2% was found in rain, 25.6% in dry weather and 24.5% when the weather was mixed. These differences were not found to be statistically significant.

A significant weather effect was found in 1996 and 1999 with more cyclists wearing helmets in wet weather but the effect was not significant in the 1994 and 2002 surveys.

3.1.5 London

The mean wearing rate at the London sites was 53.9% in the 2002 survey, significantly higher than at sites outside London (21.8%)[11]. Cyclists in London were more likely to be wearing cycle helmets than cyclists elsewhere in Great Britain. The wearing rate in London has increased since 1999 by 10.4%.

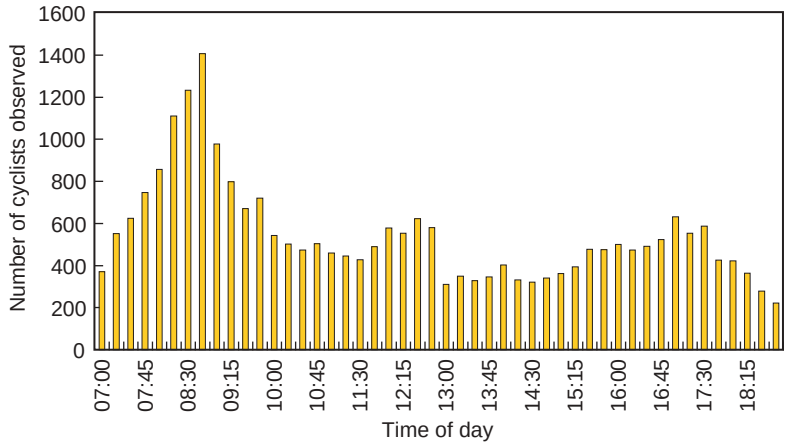

Figure 2 Number of cyclists by time of day

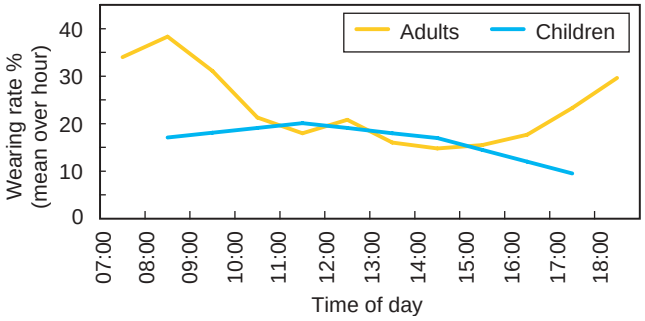

Figure 3 Wearing rates by time of day

One factor contributing to this difference is the characteristics of cyclists observed in London (as found in the 1999 survey). Only 2.0% of the cyclists observed (2671 in total) were children compared with 6.6% in the rest of Great Britain. 77.1% of the sample were males compared to 71.7% elsewhere.

3.1.6 Recreational routes

A total of 852 cyclists were observed on a Sunday afternoon on the Ridgeway cycle track in Oxfordshire and on the Bath to Bristol cycle route. More cyclists wore helmets on these routes (39.7%) than at other sites (24.6%). This difference was found to be significant[12]. The characteristics of the cyclists at recreational sites differed from that of other locations (see Table 6). More females and children were observed at these sites and more of the cyclists were riding in groups. It was found that there was a significant difference between the wearing rate for children observed on recreational routes (55.7%) and at other sites in Great Britain (9.3%)[13].

No weekday recreational route data are available, so this effect cannot be distinguished from any weekday effect.

3.1.7 Ethnicity

In 2002, the ethnicity of the cyclist was recorded to test whether ethnicity might influence helmet wearing rate[14]. Significant differences were found[15]. White cyclists were more likely to be wearing a cycle helmet (26.1%) and cyclists of an Indian-subcontinent origin were least likely to be wearing a helmet (9.2%). Table 7 compares the wearing rate of cyclists by ethnic groups.

Table 6 Wearing rate by site

	Recreational routes	*Other sites*
Wearing helmets	39.7%	24.6%
Children	23.6%	5.7%
Females	38.7%	27.3%
Riding in a group	66.5%	2.9%
Total observed	852	25322

Table 7 Wearing rate by ethnicity

Ethnicity	*Wearing rate*	*Sample size*
Black	18.6%	435
White	26.1%	24,274
Indian Subcontinent	9.2%	465
South East Asian	11.9%	901
Other	19.2%	99
Total	25.1%	26,174

When child and adults were analysed separately, wearing rates varied with ethnicity but this was significant for adult cyclists only[16]. White adult cyclists were more likely to be wearing helmets (26.7%). The sample sizes for child cyclists are low so it is difficult to draw conclusions. Table 8 compares wearing rate by ethnicity and age.

Table 8 Wearing rate by ethnicity and age

	Adults		*Child*	
Ethnicity	*Wearing rate*	*Sample size*	*Wearing rate*	*Sample size*
Black	18.6%	408	18.5%	27
White	26.7%	22,786	18.7%	1488
Indian subcontinent	9.7%	431	2.9%	34
South East Asian	12.0%	888	0%	13
Other	20.4%	93	0%	6
Total	25.7%	24,606	15.3%	1568

3.1.8 Local cycling levels

As shown in Figure 4, there is evidence to suggest that wearing rates are highest where there are low levels of cycling, as measured by the 2001 census cycling to work data (Office for National Statistics, 2002). As was found in 1999, the notable exceptions are Cambridge and Oxford, which have both high levels of cycling and high wearing rates.

The 1996 survey found that, when analysed by area, an increase in helmet wearing was associated with a fall in the number of cyclists observed. This effect was not found in the 2002 survey.

3.2 Interactive effects

The simple analysis of the previous section indicates statistically significant effects of age, type of bike, sex, time of day, ethnicity, weather, recreational route and location (London or not London) on cycle helmet wearing. The analysis has not explored whether these effects are the consequence of a single variable acting on its own, or whether the effects actually arise as a result of interaction between variables.

In order to examine this, a statistical technique called logistic regression was used. This estimates the parameters of an equation to predict the level of a bivariate variable (in this case wearing or not wearing a helmet) from the values of a set of independent variables (age, sex etc). The results can be used to investigate interrelationships between independent variables.

The significant interaction terms revealed by this analysis represent the inter-relationships between the independent variables.

The analysis looked at three separate, but not mutually exclusive, sub-samples from the whole data-set. These were for London sites, for non-London sites and for recreational sites. The factors that were considered were age (adult or child), gender (male or female), type of bicycle (racing, mountain/BMX, traditional or other), time of use (off-peak, peak or weekend) and weather conditions (dry, wet or mixed) and ethnicity.

A generalised linear model (GLIM) was used to identify which of these factors and which interactions between these factors were statistically significant. The model varied depending on which set of data was being analysed. This was in part due to different sample sizes (London had 2,671 records, non-London 23,503 records and there were only 852 records for the weekend): the bigger the sample the more complex the potential model.

3.2.1 London

The GLIM analysis for the London data showed that there was a significant effect (χ^2=75.9 on 1 degree of freedom, p<0.001), associated with the time when riding (off-peak or peak, there were no weekend data for London). This is illustrated in Table 9, which shows the proportion who are wearing helmets by type of cycle and when riding.

It is clear from Table 9 that a higher proportion of riders in peak time wear helmets regardless of the type of bike,

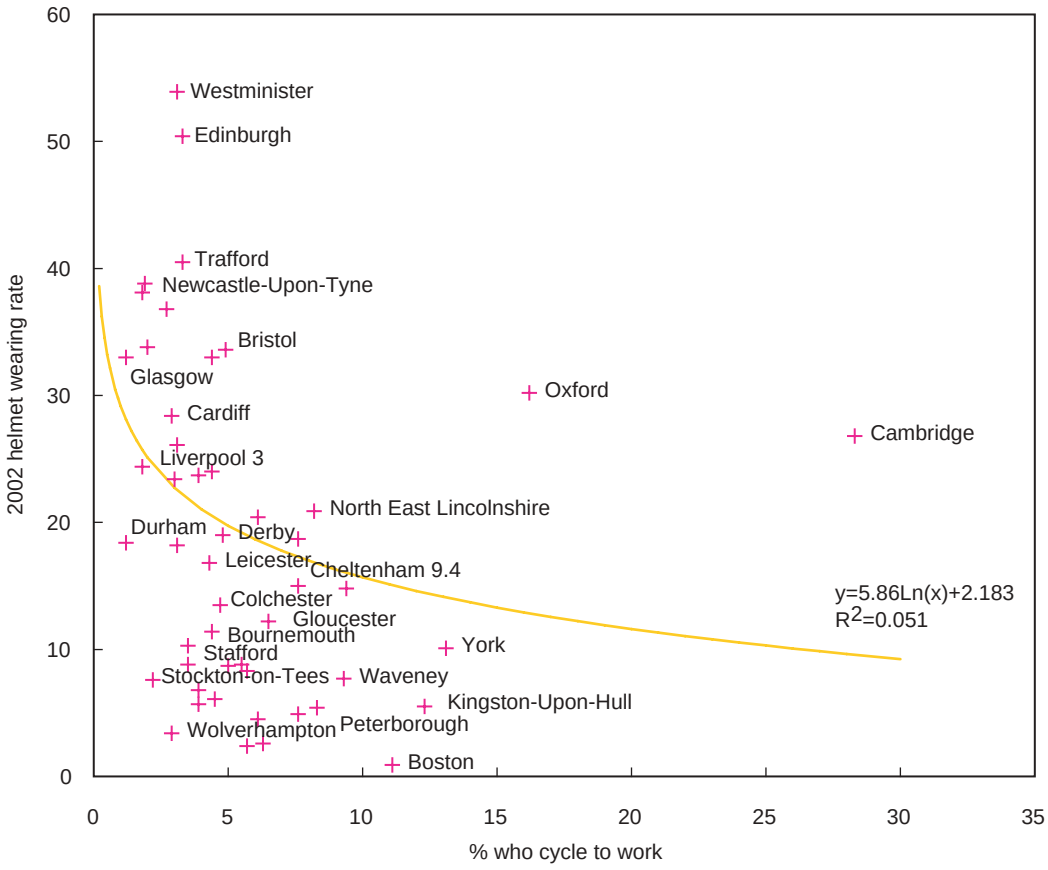

Figure 4 Relationship between helmet wearing and local levels of cycling

Table 9 Proportion wearing helmets by type of bike and when riding – London

	Off peak		*Peak*		*Total*	
Type of bike	*Wearing rate*	*Sample size*	*Wearing rate*	*Sample size*	*Wearing rate*	*Sample size*
Racing bike	45.9%	85	61.4%	249	57.5%	334
Mountain bike/BMX	37.9%	409	61.3%	1,397	56.0%	1,806
Traditional town	39.7%	151	48.6%	282	45.5%	433
Other	39.1%	23	41.3%	75	40.8%	98
Total	39.4%	668	58.8%	2,003	53.9%	2,671

and there is a difference in the proportion wearing helmets by the type of bike being ridden (χ^2=18.7 on 3 df, p<0.001). However, there is an even larger increase in wearing rates for those riding mountain/BMX bikes in peak time, the interaction term was just statistically significant at the 95% level (χ^2=8.64 on 3 df, p<0.05).

Adding the ethnicity factor to the analysis found that it was significant (χ^2=77.5 on 4 df, p<0.001), but that the interaction term between peak time and type of bike was not. Table 10 includes ethnicity and shows that the proportion wearing cycle helmets is always greater during peak periods regardless of ethnic group. Most of the sample is white with relatively low numbers in the other ethnic groups, however there is some evidence that white people tend to be more likely to be wearing cycle helmets.

3.2.2 Outside London

The non-London data consisted of 23,503 records and hence provided a much larger set of data for analysis. The GLIM model analysis showed that the following factors (entered into the model in the order given), were all statistically significant:

- bike type, (χ^2=487.7 on 2 df, p<0.001);
- peak/off-peak, (χ^2=210.5 on 2 df, p<0.001);
- interaction of bike with peak/off-peak, (χ^2=49.4 on 6 df, p<0.001);

Table 10 Proportion wearing helmets by ethnicity, type of bike and when riding – London

Ethnicity	*Off peak time*		*Peak time*		*Group total*	
Type of bike	*Wearing rate*	*Sample size*	*Wearing rate*	*Sample size*	*Wearing rate*	*Sample size*
Black						
Racing bike	33.3%	6	75.0%	8	57.1%	14
Mountain bike/BMX	18.2%	33	40.0%	65	32.7%	98
Traditional town	25.0%	4	42.9%	7	36.4%	11
Other	–	–	33.3%	3	33.3%	3
Total	20.9%	43	43.4%	83	35.7%	126
White						
Racing bike	49.3%	75	61.5%	239	58.6%	314
Mountain bike/BMX	41.5%	349	63.0%	1299	58.5%	1648
Traditional town	42.1%	140	52.8%	250	49.0%	390
Other	45.0%	20	42.9%	70	43.3%	90
Total	42.8%	584	60.7%	1858	56.4%	2442
Indian subcont-inent						
Racing bike	0.0%	1	0.0%	2	0.0%	3
Mountain bike/BMX	22.2%	9	33.3%	21	30.0%	30
Traditional town	0.0%	2	9.5%	21	8.7%	23
Other	0.0%	1	0.0%	2	0.0%	3
Total	15.4%	13	19.6%	46	18.6%	59
South East Asian						
Racing bike	0.0%	3	–	–	0.0%	3
Mountain bike/BMX	6.3%	16	27.3%	11	14.8%	27
Traditional town	0.0%	5	0.0%	4	0.0%	9
Other	0.0%	2	–	–	0.0%	2
Total	3.8%	26	20.0%	15	9.8%	41
Other						
Mountain bike/BMX	50.0%	2	100%	1	66.7%	3
Total	50.0%	2	100%	1	66.7%	3

- interaction of sex by bike type and peak/off-peak, (χ^2=139.6 on 12 df, p<0.001);
- interaction of sex by age and peak/off-peak, (χ^2=106.4 on 6 df, p<0.001).

Table 11 shows the proportion of those wearing helmets by the above significant factors. There did not seem to be any significant effects due to different weather conditions.

It is clear from Table 11 that the proportion of helmet wearing is higher in peak periods than in off-peak and even higher at the weekends, particularly for children riding mountain/BMX bikes. The proportion of children wearing helmets is significantly lower than that for adults, except at weekends where it tends to be higher. Most children were riding mountain/BMX type bikes and the proportion wearing helmets at peak and off-peak times is low.

Ethnicity was introduced into the analysis and was found to be significant. There was an interaction effect of ethnicity with when riding (χ^2=125.4 on 12 df, p<0.001), with sex (χ^2=35.5 on 5 df, p<0.001) and with type of bike (χ^2=29.0 on 12 df, p<0.001). The interactions between when riding, age and sex (χ^2=180.8 on 8 df, p<0.001) and type of bike, age and sex (χ^2=41.9 on 9 df, p<0.001) were still statistically significant.

There were only nine observations of non-white riders over the weekend, and so these have not been included in the Table 12. This table shows the proportion of cycle helmet wearing by all the above factors.

In order to interpret the interactions of ethnicity with when riding, sex and type of bike, Table 12 has been compacted. Tables 13, 14 and 15 show ethnicity with peak/off-peak riding, sex and type of bike respectively.

The interaction of ethnicity and peak/off-peak riding may be, in part, due to there being very few non-white riders in the survey for weekend riding. A higher proportion wear helmets during peak time regardless of ethnicity.

The interaction of ethnicity with sex is probably due to a much higher proportion of Indian subcontinent female riders wearing helmets than Indian subcontinent males, whereas for South East Asians and Others this is reversed (albeit the males have a slightly higher rate of helmet wearing than the females).

The interaction of ethnicity with type of bike is a reflection of Black and Indian subcontinent riders less likely to be wearing cycle helmets when riding Mountain/BMX and traditional bikes than the other ethnic groups, relative to the proportion of helmets worn when using racing bikes. There is also a different trend for South East Asians when wearing helmets, compared to other groups.

3.2.3 Recreational routes

The survey recorded 852 cyclists on recreational routes. These were at weekends and mainly by white ethnicity riders (as seen in Table 13). Analysis of just these records found a statistically significant effect for the type of bike factor (χ^2=36.6 on 3 df, p<0.001). Table 16 shows the proportion wearing helmets for just these records.

The wearing of helmets on traditional bikes is significantly lower than for other types of bike, although overall the wearing rate is much better than for peak or off-peak riding not on weekdays. This suggests that cyclists when using their bikes for weekend riding are more safety conscious than when using them for commuting or going to school during weekdays.

3.3 Trends in cycle helmet wearing since 1994

Cycle helmet wearing has changed since 1994. The helmet-wearing rate of adult males increased steadily between 1994 and 2002 by 9.7%. Similarly, the wearing rate of adult females has increased steadily over the same period by 10%.

Table 11 Proportion wearing helmets by significant factors – non-London

Age		*Off peak*		*Peak*		*Weekend*	
Sex	*Type of bike*	*Wearing rate*	*Sample size*	*Wearing rate*	*Sample size*	*Wearing rate*	*Sample size*
Adult							
Male	Racing bike	23.2%	607	43.1%	1,021	41.9%	62
	Mountain bike/BMX	14.0%	3,510	23.1%	5,261	37.5%	224
	Traditional town	14.9%	1,946	24.0%	2,601	26.2%	107
	Other	18.9%	148	23.3%	189	100.0%	15
Female	Racing bike	26.3%	118	36.0%	178	50.0%	12
	Mountain bike/BMX	18.2%	969	30.5%	1,428	31.3%	150
	Traditional town	15.7%	1,442	25.0%	1,740	24.7%	81
	Other	9.7%	62	30.6%	85	–	0
Child							
Male	Racing bike	0.0%	4	46.2%	13	0.0%	2
	Mountain bike/BMX	3.1%	320	8.4%	574	53.3%	92
	Traditional town	10.3%	29	22.5%	40	55%	20
	Other	0.0%	15	14.8%	61	–	0
Female	Racing bike	–	0	33.3%	3	–	0
	Mountain bike/BMX	4.1%	74	13.5%	156	62.5%	64
	Traditional town	0.0%	10	17.9%	28	52.2%	23
	Other	57.1%	7	33.3%	12	–	0

Table 12 Proportion wearing helmets by significant factors, including ethnicity – non-London

Ethnicity			*Off peak time*		*Peak time*	
Age	*Sex*	*Type of bike*	*Wearing rate*	*Sample size*	*Wearing rate*	*Sample size*
Black						
Adult	Male	Racing bike	0.0%	5	50.0%	10
		Mountain bike/BMX	5.3%	95	13.8%	80
		Traditional town	0.0%	25	7.4%	27
		Other	50.0%	2	100%	3
	Female	Mountain bike/BMX	0.0%	6	6.7%	15
		Traditional town	14.3%	7	37.5%	8
		Other	0.0%	1	–	–
Child	Male	Mountain bike/BMX	9.1%	11	12.5%	8
		Traditional town	0.0%	2	0.0%	1
	Female	Mountain bike/BMX	–	–	0.0%	1
White						
Adult	Male	Racing bike	23.8%	576	44.0%	986
		Mountain bike/BMX	14.7%	3136	24.0%	4854
		Traditional town	15.6%	1813	24.7%	2446
		Other	17.6%	136	22.2%	176
	Female	Mountain bike/BMX	19.0%	858	31.9%	1318
		Traditional town	15.9%	1341	25.4%	1669
		Other	9.1%	55	33.8%	77
		Racing bike	27.1%	107	37.9%	169
Child	Male	Mountain bike/BMX	3.0%	296	8.8%	536
		Traditional town	11.5%	26	23.1%	39
		Racing bike	0.0%	4	46.2%	13
		Other	0.0%	14	15.0%	60
	Female	Mountain bike/BMX	4.1%	73	13.2%	151
		Racing bike	–	–	33.3%	3
		Traditional town	0.0%	10	17.9%	28
		Other	57.1%	7	33.3%	12
Indian subcontinent						
Adult	Male	Racing bike	12.5%	8	0.0%	9
		Mountain bike/BMX	5.3%	114	10.8%	120
		Traditional town	0.0%	39	6.3%	32
		Other	0.0%	4	0.0%	3
	Female	Mountain bike/BMX	8.3%	12	11.1%	9
		Traditional town	50.0%	10	0.0%	5
		Other	–	–	0.0%	2
		Racing bike	100%	2	0.0%	2
Child	Male	Mountain bike/BMX	0.0%	9	0.0%	21
		Other	0.0%	1	0.0%	1
	Female	Mountain bike/BMX	–	–	50.0%	2
South East Asian						
Adult	Male	Racing bike	6.7%	15	7.1%	14
		Mountain bike/BMX	12.3%	146	13.1%	183
		Traditional town	7.8%	64	16.7%	84
		Other	33.3%	3	28.6%	7
	Female	Mountain bike/BMX	12.4%	89	13.3%	83
		Traditional town	9.0%	78	12.7%	55
		Other	16.7%	6	0.0%	5
		Racing bike	0.0%	7	0.0%	7
Child	Male	Mountain bike/BMX	0.0%	3	0.0%	6
	Female	Mountain bike/BMX	0.0%	1	0.0%	1
Other						
Adult	Male	Racing bike	66.7%	3	0.0%	2
		Mountain bike/BMX	10.5%	19	12.5%	24
		Traditional town	20.0%	5	33.3%	12
		Other	66.7%	3	–	–
	Female	Mountain bike/BMX	25.0%	4	33.3%	3
		Traditional town	0.0%	6	33.3%	3
		Other	–		0.0%	1
		Racing bike	0.0%	2	–	–
Child	Male	Mountain bike/BMX	0.0%	1	0.0%	3
		Traditional town	0.0%	1	–	–
	Female	Mountain bike/BMX	–	–	0.0%	1

Table 13 Proportion wearing helmets by ethnicity and when riding – non-London

	Off peak time		*Peak time*		*Weekend*		*Total*	
Ethnicity	*Wearing rate*	*Sample size*	*Wearing rate*	*Sample size*	*Wearing rate*	*Sample size*	*Wearing rate*	*Sample size*
Black	5.2%	154	17.0%	153	100%	2	11.7%	309
White	15.8%	8452	26.1%	12537	39.9%	843	22.7%	21832
Indian subcontinent	7.5%	199	8.3%	206	0.0%	1	7.9%	406
South East Asian	10.7%	412	13.3%	445	0.0%	3	12.0%	860
Other	18.2%	44	18.4%	49	0.0%	3	17.7%	96
Total	15.2%	9261	25.3%	13390	39.7%	852	21.8%	23503

Table 14 Proportion wearing helmets by ethnicity and sex – non-London

	Male		*Female*		*Total*	
Ethnicity	*Wearing rate*	*Sample size*	*Wearing rate*	*Sample size*	*Wearing rate*	*Sample size*
Black	11.4%	272	13.2%	38	11.7%	309
White	22.0%	15629	24.3%	6203	22.7%	21832
Indian subcontinent	6.1%	362	22.7%	44	7.9%	406
South East Asian	12.6%	525	11.0%	335	12.0%	860
Other	18.9%	74	13.6%	22	17.7%	96
Total	21.2%	16861	23.5%	6642	21.8%	23503

Table 15 Proportion wearing helmets by ethnicity and type of bike – non-London

	Racing bike		*Mountain bike/BMX*		*Traditional town*		*Other*		*Total*	
Ethnicity	*Wearing rate*	*Sample size*	*Wearing rate*	*Sample size*	*Wearing rate*	*Sample size*	*Wearing rate*	*Sample size*	*Wearing rate*	*Sample size*
Black	33.3%	15	9.2%	217	9.9%	71	66.7%	6	11.7%	309
White	36.3%	1934	21.3%	11746	21.2%	7600	22.8%	552	22.7%	21832
Indian subcontinent	14.3%	21	7.6%	288	8.1%	86	0.0%	11	7.9%	406
South East Asian	4.7%	43	12.5%	514	11.7%	282	19.0%	21	12.0%	860
Other	28.6%	7	12.3%	57	21.4%	28	50.0%	4	17.7%	96
Total	35.4%	2020	20.4%	12822	20.6%	8067	22.9%	594	21.8%	23503

Table 16 Proportion wearing helmets by bike type – recreational

Recreational	*Wearing rate*	*Sample size*
Racing bike	42.1%	76
Mountain bike/BMX	41.5%	530
Traditional town	30.7%	231
Other	100%	15
Total	39.7%	852

Whilst the helmet-wearing rate has increased over the years for adult cyclists, the wearing rate of both male and female children fell between 1994 and 1996. By 1999 the wearing rate for girls had almost recovered to the level observed in 1994. By 2002, the wearing rate had increased by 3.5% since 1999 and was greater than the 1994 level. The wearing rate for boy cyclists has decreased with every survey between 1994 and 2002. In 2002, the wearing rate had decreased by 0.4% since 1999 and by 3.7% since 1994.

4 Results of the minor built-up roads survey

A total of 4,897 cyclists were observed in the 2002 survey, of whom 9.5% were wearing a cycle helmet[17]. This was a statistically significant increase of 1.3% from the 1999 survey, when the wearing rate was 8.2%[18].

Although there was an increase for both male and female cyclists in their cycle helmet wearing rate, as in 1999 there does not appear to be a gender effect (i.e. there was a similar increase for both males and females). The wearing rate was greatest during the weekday peak hours[19], as in 1999. Table 17 shows the wearing rate during the different times of the week.

Table 17 Sample sizes and wearing rates by day and time of day

Category	*Wearing rate*	*Sample size (N=4897)*	*Significance (χ^2)*
Weekday peak	14.2%	1,488	p<0.001
Weekday off-peak	10.0%	1,095	
Weekend	6.2%	2,314	

As in the 1999 survey, cyclists were found to be more likely to wear a helmet if they were riding on the road (11%) rather than the pavement (5.6%)[20]. Whereas in 1999 a slightly higher proportion of cyclists wore a helmet in wet weather, the current survey found that the wearing rate was slightly lower when raining than when dry (although the difference was not significant). However, the wearing rate varied significantly with light level, with a greater tendency for cyclists to wear helmets in darkness. Table 18 shows the wearing rate by light condition.

Table 18 Sample sizes and wearing rates by light condition

Category	*Wearing rate*	*Sample size (N= 4892)*	*Significance (χ^2)*
Getting light	12.9%	232	p<0.001
Light	8.9%	4,280	
Getting dark	10.6%	255	
Dark	18.4%	125	

Type of bicycle was also noted, with those riding on racing bikes being more likely to wear a helmet than those riding on mountain bikes/BMXs and traditional town bikes (see Table 19).

Table 19 Sample sizes and wearing rates by type of bike

Category	*Wearing rate*	*Sample size (N=4887)*	*Significance (χ^2)*
Racing bike	22.9%	354	p<0.001
Mountain bike/BMX	8.9%	3,021	
Traditional town bike	7.0%	1,357	
Other	11.6%	155	

In addition to the variables observed in the previous surveys, ethnicity of cyclists was also noted. Cyclists of white ethnic origin were statistically more likely to wear a helmet than those of black, Indian-Asian or South East Asian origin (see Table 20). When adults and children were analysed separately, only amongst adults was the difference statistically significant.

Table 20 Sample sizes and wearing rates split by ethnic origin

Category	*Wearing rate*	*Sample size (N=4828)*	*Significance (χ^2)*
Black	4.6%	195	p<0.001
White	9.0%	4,359	
Indian-Asian	2.8%	181	
South East Asian	1.1%	93	

The presence of additional safety aids such as fluorescent jackets, front/rear lights and reflectors, correlated with the wearing rate, the rate being 7.8% on cycles without additional safety aids and 12.8% with safety aids[21]. There were 84 cases where the cyclist was observed with a passenger, in 54 of these where neither passenger nor cyclist wore a helmet, in 15 cases where only the passenger wore a helmet, and in 15 cases where both passenger and cyclist wore a helmet.

Some cyclists were observed carrying their cycle helmet but not wearing it (i.e. it was hanging from the handlebars of their bicycle). There were only 19 of these cyclists, however, so they were analysed with the non-wearers. Of these 19 people, all were white, eleven were adults, five of secondary age (11-16) and three juniors (age 7-10)[22], and all were observed when it was light and dry. It is also worth noting that one cyclist was observed wearing a helmet but the strap was not done up. Thus, it appears that this type of behaviour is uncommon.

4.1 Differences between childrens' and adults' cycling

The purpose of conducting the survey on minor built-up roads, as in 1999, was to increase the sample of child cyclists and to be more representative of the type of cycling that children do. Although the overall cycle helmet wearing rate observed in the current survey was significantly higher than that observed in 1999, the rate for children aged under seven was significantly[23] lower than in 1999, with only one in ten wearing a helmet in 2002 compared to one in five in 1999. The wearing rate for 7-10 year olds and 11-16 year olds also decreased from the 1999 survey to the 2002 survey, significantly[24] in the case of the 11-16 year old category. Only the wearing rate for cyclists over 16 actually

increased from the 1999 survey; the rate was 10.9% and exceeded the rates for the other age groups[25].

Whilst the cycle helmet wearing rate was significantly[26] higher for children than for adults in 1999, this trend was reversed in 2002[27]. It is noticeable that the wearing rate amongst children has decreased by over 3% from 1999 to 2002, whilst the wearing rate amongst adults has increased by approximately the same amount. Table 21 gives summaries of sample sizes and wearing rates by age group in the 1999 and 2002 surveys.

Table 21 Comparison of wearing rates by age group for 1999 and 2002

Age group	*Wearing rate 1999*	*Wearing rate 2002*	*Significance of differences (χ^2)*
0-6 Infant	22.5% (n= 53)	10.1% (n= 139)	p<0.05
7-10 Junior	9.2% (n= 174)	6.3% (n= 431)	NS
11-16 Secondary	8.8% (n= 725)	6.2% (n= 1,003)	p<0.05
16+ Adult	7.4% (n= 2,354)	10.9% (n= 3,231)	p<0.001
Significance of differences (χ^2)	P<0.01	P<0.001	

Other differences between child and adult cyclists are summarised in Table 22, from which it can clearly be seen that the distributions of each observation vary significantly between children and adults.

The previous trend noted from the 1999 survey for a decline in cycling amongst females during their teenage years was also replicated in the current survey. The proportion of girls in the 11-16 year old sample (19%) was smaller than the proportion of females in the other age groups (39.7% of children under 6, 23.8% of children aged 7-10, and 26.6% of adults).

Adults were significantly more likely to wear a helmet when riding on the road than on the pavement (12.1% compared with 5.2%)[28], which is in line with the findings from 1999. Child cyclists were also more likely to wear a helmet when riding on the road, although the difference was not found to be significant (6.6% compared with 5.9%). As was found in 1999, neither adults nor children were more likely to ride on the pavement during peak hours.

Wearing rate by time varied between children and adults, with children more likely to wear a helmet during weekday off-peak hours whilst the adult wearing rate[29] was highest during weekday peak hours (replicating the findings from the 1999 survey). Table 23 presents wearing rate for children and adult cyclists.

4.2 Childrens' cycling

The number of child cyclists peaked in the morning and afternoon, presumably associated with travel to and from school (see Figure 5). However, as mentioned previously, the wearing rate for children was greatest during weekday off-peak hours.

The wearing rate is significantly higher amongst children in identifiable school uniform than those not in uniform for both the 1999 and 2002 surveys. Table 24 summarises the sample sizes and wearing rates split by school uniform.

Table 22 Distribution of child and adult cyclists, 2002

Variable/ Category	*Children (N=1573)*	*Adults (N=3231)*	*Significance of difference between children and adults (c^2)*
Overall wearing rate	6.5%	10.9%	p<0.001
Sex			p<0.001
Male	78.0%	73.4%	
Female	22.0%	26.6%	
Additional safety aids	19.9%	39.8%	p<0.001
Type of area			p<0.001
Residential	74.8%	64.8%	
Shops	20.2%	27.6%	
School	1.7%	1.2%	
Other	2.0%	5.2%	
Day/time			p<0.001
Weekday peak	29.9%	31.0%	
Weekday off- peak	16.5%	25.4%	
Weekend	53.5%	43.6%	
Light/dark			p<0.001
Light	88.3%	87.0%	
Getting light	1.7%	6.3%	
Dark	3.0%	2.3%	
Getting dark	7.0%	4.4%	
Passenger			p<0.001
With helmet	0.4%	1.1%	
Without helmet	3.3%	0.7%	
Riding position			p<0.001
Road	36.2%	74.5%	
Pavement	61.7%	21.9%	
Other	0.8%	2.9%	
Type of bike			p<0.001
Racing bike	2.7%	9.4%	
Mountain bike/BMX	79.3%	53.2%	
Traditional town	13.8%	34.8%	
Other	4.2%	2.7%	
Weather			NS
Dry	92.7%	94.1%	
Raining	4.9%	2.8%	
Mixed	2.4%	3.1%	

Table 23 Wearing rates by day/time and adult/child cyclist

	Children		*Adults*	
	Wearing rate	*Sample size*	*Wearing rate*	*Sample size*
Weekday peak	7.6%	471	17.1%	1,001
Weekday off-peak	8.5%	260	10.4%	820
Weekend	5.3%	842	6.8%	1,410

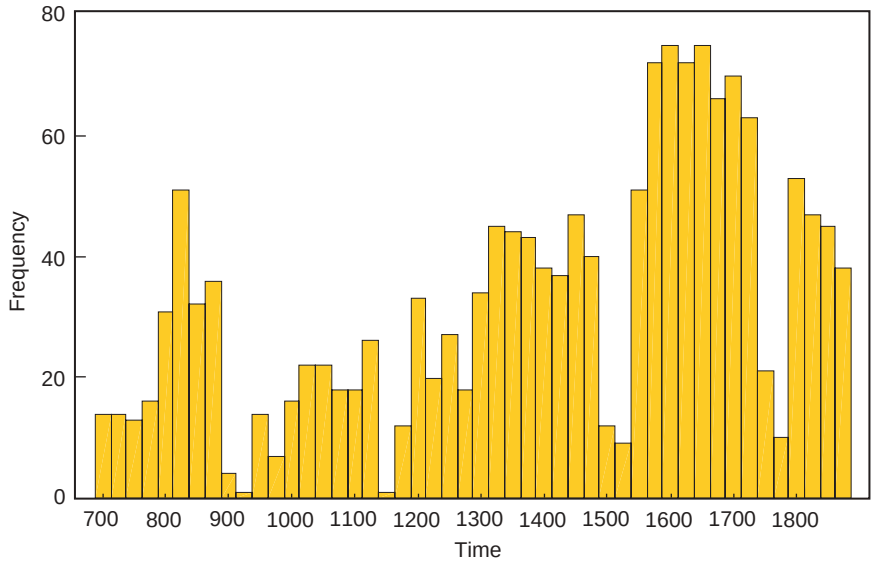

Figure 5 Child cyclists observed during 2002 survey by time of day

Table 24 Wearing rates amongst children, by wearing of school uniform

Year / *Category*	*Wearing rate*	*Sample size*	*Significance (χ^2)*
1999			
Children in uniform	18.2%	88	p<0.01
Children not in uniform	8.9%	866	
2002			
Children in uniform	8.0%	88	p<0.001
Children not in uniform	6.3%	1,481	

Although the wearing rate for children on a paper round (90 cases observed) was higher at 11.8% than for all children (6.3%), the difference was not statistically significant. No significant difference was found between the type of bike ridden by children and the wearing rate, being 7% for racing bikes, 6.3% for mountain bikes/BMX, 6.5% for traditional town bikes, and 10.6% for other types of bike, with four in five riding mountain bikes. Although the wearing rate amongst children was only 2.7% when raining compared to 7.1% when dry, the difference was not statistically significant.

4.3 Cycle helmet wearing by district

Table 25 shows how wearing rates varied by district. There was no clear relationship between wearing rate and the level of deprivation index number. However, it can be seen that the highest rate was recorded in Gloucester, which may be as a result of Safer City initiatives.

4.4 Other observations

Forty-eight cases were observed where the cyclist was not actually on their bicycle, but walking alongside pushing it, for example. Observers were instructed to record data for every cyclist that they saw, however it could be made clearer in future surveys whether to include these people or not.

Table 25 Cycle helmet wearing rate (and total number observed) by district name

		Adults		*Children*	
District name	*Level of deprivation*	*Wearing rate*	*Sample size*	*Wearing rate*	*Sample size*
Coventry	1	13.7%	95	1.7%	60
Crewe & Nantwich	4	8.5%	177	1.1%	92
Doncaster	1	25%	12	25%	24
Eastleigh	5	11%	155	10%	110
Fareham	5	14.5%	159	4.3%	184
Gloucester	2	44.4%	126	65.3%	49
Ipswich	2	18.1%	160	0%	20
Kingston-upon-Hull	1	13.9%	144	20.7%	29
Kingston-upon-Thames	4	2.8%	251	1.9%	154
Lincoln	1	2.8%	107	0%	108
Liverpool	1	9.5%	338	0%	76
Milton Keynes	4	13.4%	134	3.9%	103
Peterborough	2	3.1%	226	1.1%	87
Portsmouth & Gosport	2	8.3%	314	1.5%	66
Slough	2	9%	133	3.8%	52
Taunton Deane	4	11.8%	364	14.4%	132
Wigan	2	6.5%	46	1.5%	68
Wirrall	1	7.9%	63	2.1%	96
Wolverhampton	1	6.5%	93	3.1%	32
Worthing	4	10.4%	134	12.9%	31

In total 69 postmen were observed, and it could be worth considering for future surveys noting differences in their wearing rate compared to the general wearing rate amongst adults. Observations of dangerous behaviour were also added to the data recording sheets. This included a passenger standing on the back wheels of the bike (six cases), shopping on handlebars causing the bike to sway (five cases), drunkenness or extreme ‘weaving’ (two cases), and even one case where the cyclist was speaking on a mobile phone whilst riding their bike.

5 Conclusions

A review of research and literature on the efficacy of cycle helmets has been carried out for DfT (Towner *et al.*, 2002). The review notes that cycle helmets have been found to be effective in reducing the incidence and severity of head, brain and upper facial injuries, and that they are particularly effective in reducing injuries amongst children. It further finds that cycle helmet education campaigns increase the use of helmets, and that they are most effective amongst younger children and girls. This finding coincides with the results of this survey, which found that girls' wearing rates had increased, whereas boys' wearing rates had not. The greatest decline in boys wearing rate was in the 11-16 age group.

The analyses of the two surveys have been carried out independently, and the results cannot be combined to give overall rates. However, they show that wearing rates on major built up roads are significantly higher for both adults (25.7%) and children (15.3%) than those on the minor built up roads (10.9% and 6.5% for adults and children respectively). In both types of road the adults' wearing rate had increased since the 1999 survey, whereas there was no significant increase (major roads) or a decrease (minor roads) in the children's wearing rate.

Major built-up roads

The 2002 surveys on major built-up roads showed that helmet wearing had increased by 3.3% on 1999 figures. The wearing rate was greater for adults (25.7%) than children (15.3%). The increase in wearing rate since 1999 was greatest among adults, with both male and female adult wearing rates increasing. Among children, the girls' wearing rate had increased but the boys' wearing rate reduced slightly. Overall, there was no significant increase in children's wearing rate since 1999.

Since the first survey in 1994, the overall cycle helmet wearing rate has increased in each survey. Between 1994 and 1996 the proportion of children wearing helmets fell. In 2002 the wearing rate for girls recovered and was above the 1994 level but the rate for boys wearing remains about the 1996 level.

As in the 1999 survey on major built-up roads, helmet wearing rates varied according to the type of bike ridden: those on racing bikes were more likely to be wearing a cycle helmet (38%) than on any other bike. This difference was only significant amongst adults. No significant weather effect on cycle helmet wearing was found, unlike in 1994 and 1999.

Cycle flows were greatest in the morning and peak hours and adult helmet wearing rates also peaked at these times, so helmet wearing rates are high when the levels of traffic are high. In the peak time, 29.6% of cyclists were observed wearing a helmet whereas only 16.8% of cyclists were observed wearing helmets during off-peak times.

Cyclists in London were more likely to be wearing cycle helmets (53.9%) than cyclists outside of London (21.8%). Only 2% of cyclists observed in London were children, which may partly explain this high wearing rate. The perceived risk of cycling in and around London may also contribute to this high wearing rate.

Recreational routes were observed in the 2002 survey and the rate of cycle helmet wearing was greater (39.7%) at these sites than any other. The cyclists were observed on a Sunday, however, so this effect is indistinguishable from any weekend effects.

The 2002 survey recorded the ethnicity of the cyclist for the first time and it was found to have an effect on the wearing rate. Cycle helmet wearing was greatest amongst white cyclists (26.1%) and lowest amongst Indian-Asian cyclists (9.2%). This effect was only identified amongst adult cyclists, as there were too few child cyclists from ethnic minorities for any significant differences to be apparent.

To examine cyclists' helmet wearing patterns more fully, the interaction between helmet wearing and age and sex of cyclist, type of bike, time of day, weather and ethnicity was analysed. Time, ethnicity and bicycle type had significant effects on wearing rates in London. For the non-London data, the following factors significantly affected wearing rates: bike type, when riding, interaction of bike type and time when riding, interaction of sex by bike type and when riding and interaction of sex by age and when riding. When ethnicity was introduced to the analysis there was found to be a significant interaction effect of ethnicity and when riding, sex and type of bike. Of those cyclists observed on recreational routes, the wearing rate varied significantly with bike type, being highest for 'other' types of bikes.

Minor built-up roads

The purpose of conducting the survey on minor built-up roads, as in 1999, was to increase the sample of child cyclists and to be more representative of cycling patterns. The overall cycle helmet wearing rate in the 2002 survey on minor built-up roads was 9.5%, a significant increase of 1.3% from the previous survey in 1999.

The factors associate with higher wearing rates significantly included cycling during peak weekday hours, when dark, when riding on the road, when riding a racing bike, when the cyclist was of white ethnic origin, and when additional safety aids were being used. Whilst the cycle helmet wearing rate for children was significantly higher at 9.7% than for adults (age 16+) at 7.4% in 1999, this trend was reversed in the 2002 survey, with only 6.5% of children wearing a helmet compared with 10.9% of adults. This is a reduction of over 3% amongst children and an increase by the same amount amongst adults. The wearing rate for infants (0-6 years) at 10.1% is still greater than for juniors (7-10 years) at 6.3% and secondary (11-16 years) at 6.2%, as in 1999. The wearing rate for children (age 0-16) was significantly higher amongst those in identifiable school uniforms, replicating the findings from 1999.

6 References

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7 Acknowledgements

The work described in this report was carried out in the Safety Department of TRL Limited.

Notes

[1] Chi-square (df=1) = 85.350, p<0.001.

[2] Chi-square (df=1) = 85.060, p<0.001.

[3] Chi-square (df=1) = 16.953, p<0.001.

[4] Chi-square (df=1) = 32.666, p<0.001.

[5] Chi-square (df=1) = 8.381, p<0.01.

[6] For male data, Chi-square (df=1) = 39.036, p<0.001. For female data, Chi-square (df=1) = 44.776, p<0.001.

[7] Chi-square (df=3) = 273.174, p<0.001.

[8] Chi-square (df=3) = 270.121, p<0.001.

[9] Peak hours were defined as 0700-0959 hours and 1600-1859 hours.

[10] Chi-square (df=1) = 533.609, p<0.001.

[11] Chi-square (df=1) = 1311.401, p<0.001.

[12] Chi-square (df=1) = 405.384, p<0.001.

[13] Chi-square(df=1) = 290.501, p<0.001.

[14] Asian cyclists were identified as either Indian (including Pakistani and Bangladeshi) or South East Asian (e.g. China, Thailand, Malaysia).

[15] Chi-square (df=4) = 169.163, p<0.001.

[16] Chi-square (df=4) = 168.536, p<0.001.

[17] 5,137 cyclists were observed altogether but 240 were excluded from the analyses as it was not recorded whether they were wearing a helmet: the valid total was 4,897.

[18] Chi-square (df=1) = 3.88, p<0.05.

[19] Weekday peak hours are defined as 0700 to 0959 and 1600 to 1859 hours.

[20] Chi-square (df=1) = 37.99, p<0.001. Total number cyclists riding on the road = 3,014, total number of cyclists riding on the pavement = 1,674.

[21] Chi-square (df=1) = 31.84, p<0.001. Sample size of those with additional safety aids = 1632, sample size of those without additional safety aids = 3262.

[22] 0.3% of the adult sample, 0.5% of the secondary sample, and 0.7% of the junior sample were observed with a helmet but not wearing one.

[23] Chi-square (df=1) =5.18, p<0.05 for the age group 0-6 (infant).

[24] Chi-square (df=1) = 4.36, p<0.05 (11-16 year olds).

[25] The difference between the wearing rate in 1999 and 2002 for children (age 0-16) and adults (age 16+) was statistically significant at p<0.001 (df=1, x^2= 11.49).

[26] Chi-square (df=1) = 4.87, p<0.05.

[27] Chi-square (df=1) = 23.31, p<0.001.

[28] Chi-square (df=1) = 27.66, p<0.001 with 4.8% missing data.

[29] Chi-square (df=2) = 63.97, p<0.001 for adult wearing rate by day/ time, the difference for child cyclists was not statistically significant.

Appendix A: Participating local authorities

Local authority	*Site number(s)*	*Former name (if different from 1999)*
Aberdeen City	49	
Bath & NE Somerset	41 - 42	
Bedfordshire	4 – 7	
Berkshire	64	
Bournemouth	15	
Bristol	43	
Cambridgeshire	67a/b, 68-71	
Cardiff	32	
Cheshire	38a – 38c	
City of Coventry	33	
City of Edinburgh	51	
City of Liverpool	55 – 56	
City of York	65 – 66	
Cumbria	40	
Derby City	1	
Doncaster Metropolitan	47 – 48	
Durham	54	Darlington Borough
East Riding of York	18	
Essex	2, 3a/b	
Glasgow	24 – 31	
Gloucestershire	72 – 73	
Greater Manchester Transportation Unit	11 – 14	
Kingston Upon Hull	19	
Leicester City	22	
Leicester Council	23	Leicestershire
Lincolnshire	16 – 17	
Newcastle Upon Tyne	46	
Norfolk	37	
North East Lincolnshire	21	
North Lincolnshire	20	
Northampton	50	
Nottinghamshire County	8	
Nottinghamshire City	9 – 10	
Oxfordshire	57 – 60	
Portsmouth	63	
Staffordshire	44	
Stockton-on-Tees	74 – 75	
Suffolk	61 – 62	
Swindon	39	
Warrington	38b/c	
Warwickshire	52 – 53	
Westminster	34 – 36	
Wolverhampton	45	

2002 CYCLIST SURVEY - MAJOR BUILT-UP ROADS

DATA COLLECTION FORM

Sheet start time _____

Enclose groups in brackets {	Sex ✓		Ethnic origin ✓					Helmet ✓		Type of bicycle ✓				Age ✓		Passenger ✓			Group ages ✓	
	M	F	Black	White	Asian		Other	Yes	No	Racer	Mountain / BMX	Trad. town	Other	Adult	Child	Yes Wearing helmet	Yes NOT wearing helmet	No	mixed	similar
					Indian subcontinent (e.g. Pakistan Bangladesh)	South East Asia (e.g. China, Thailand, Malaysia)														
1																				
2																				
3																				
4																				
5																				
6																				
7																				
8																				
9																				
10																				
11																				
12																				
13																				
14																				
15																				
16																				
17																				
18																				
19																				
20																				
21																				
22																				

P.T.O.

2002 CYCLIST SURVEY - MAJOR BUILT-UP ROADS

DATA COLLECTION FORM (cont'd/.....)

Enclose groups in brackets {	Sex ✓		Ethnic origin ✓					Helmet ✓		Type of bicycle ✓				Age ✓		Passenger ✓			Group ages ✓	
	M	F	Black	White	Asian		Other	Yes	No	Racer	Mountain / BMX	Trad. town	Other	Adult	Child	Yes Wearing helmet	Yes NOT wearing helmet	No	mixed	similar
					Indian subcontinent (e.g. Pakistan Bangladesh)	South East Asia (e.g. China, Thailand, Malaysia)														
23																				
24																				
25																				
26																				
27																				
28																				
29																				
30																				

Weather during 15 minute period *(Circle one)*

dry	1
wet	2
mixed	3

PLEASE USE A NEW SHEET FOR EVERY 15 MINUTE PERIOD

Job no.183D
Interviewer no._____

2002 Cyclist survey (supplementary) - Minor built-up roads

Header sheet

SURVEY DETAILS

Observer's name _____

Driver's name _____

Date ____/____/____

Day of week Mon / Tues / Wed / Thurs / Fri / Sat / Sun

Survey start time _____ am / pm mileometer reading _____

Survey end time _____ am / pm mileometer reading _____

SITE DETAILS

Area (CIRCLE CODE)				
	Coventry	01	Liverpool	11
	Crewe & Natwich	02	Milton Keynes	12
	Doncaster	03	Peterborough	13
	Eastleigh	04	Portsmouth	14
	Fareham	05	Slough	15
	Gloucester	06	Taunton	16
	Ipswich	07	Wigan	17
	Kingston (Surrey)	08	Wirral	18
	Kingston-upon-Hull	09	Wolverhampton	19
	Lincoln	10	Worthing	20

Type of route (if mixed, choose option that describes largest part of the route).
Tick one

☐$_1$ City / town centre

☐$_2$ Urban location (out of centre)

☐$_3$ Suburban

☐$_4$ Rural

Start point (only fill in if you use have to use a different starting point from that given in the route instructions)

_____

2002 CYCLIST SURVEY (EXTENDED) – DATA COLLECTION FORM

Job no.183D
Interviewer No._____

PLEASE USE A NEW SHEET FOR EVERY 15 MINUTE PERIOD

At sheet start time _____ AM / PM *(write in)* it was GETTING LIGHT/ LIGHT/ GETTING DARK / DARK *(circle one only)*

Weather during 15 minute period: DRY / RAINING / MIXED *(circle one only)*

CODING CATEGORY			CYCLIST (ENCLOSE GROUPS IN BRACKETS)														
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
AREA (tick one)	Residential																
	Shops																
	School																
	Other																
SEX (tick)	Male																
	Female																
AGE GROUP (tick one)	0-6 years (infant)																
	7-10 years (junior)																
	11-16 years (secondary)																
	Adult																
ETHNIC ORIGIN (tick one)	Black																
	White																
	Asian	Indian subcontinent (e.g. Pakistan, Bangladesh)															
		South East Asian (e.g. China, Thailand, Malaysia)															
	Other																
HELMET (tick one)	On head																
	On bike (e.g. visible but not worn)																
	No																
RIDING POSITION (tick one)	Road																
	Pavement / grass verge at side of road																
	Cycle Path																
	Other																
TYPE OF BIKE (tick one)	Racing bike (dropped handlebars)																
	Mountain bike / BMX (thick tyres, straight handlebars)																
	Traditional town (straight handlebars, mudguards, thin tyres – e.g. shoppers)																
	Other (e.g. tandems, small-wheel adult bikes, folding bikes & 'hybrids')																
SCHOOL UNIFORM (tick if yes)																	
PASSENGER (tick one)	YES	Helmet worn															
		NO helmet worn															
	NO																
PAPER ROUND (tick if yes)																	
ADDITIONAL SAFETY AIDS (e.g. front/rear lights; fluorescent clothing; stabilizers; reflectors) (tick if yes)																	

P.T.O.

ADDITIONAL COMMENTS ON OBSERVED CYCLISTS

Job no.183D
Interviewer No. _____

Please record any additional comments in the table below, next to the corresponding cyclist number.

CYCLIST NO.	ADDITIONAL COMMENTS (e.g. other behaviours; 2 children on one bike)
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	

Appendix C: Changes in wearing rates by local authority

Local authority	2002		1999		1996		1994	
	Wearing rate %	Count	Wearing rate %	Count	Wearing rate %	Count	Wearing rate %	Count
Aberdeen City	38.1%	155	22.1%	104	21.0%	176	25.7%	136
Bath & NE Somerset	36.8%	807	33.6%	298	24.0%	537	24.9%	554
Bedfordshire	8.7%	676	6.4%	565	5.9%	706	5.6%	587
Berkshire	33.0%	209	20.5%	449	23.4%	380	18.9%	428
Bournemouth	11.4%	498	9.1%	594	7.9%	762	6.9%	725
Bristol	33.6%	696	29.8%	514	19.5%	159	18.0%	194
Cambridgeshire	24.4%	5,708	24.0%	6,122	20.1%	5,684	19.2%	5,238
Cardiff	28.4%	222	22.2%	243	53.8%	156	18.3%	323
Cheshire	4.9%	304	9.4%	212	4.2%	285	6.4%	171
City of Coventry	23.4%	124	19.8%	162	16.3%	160	18.7%	203
City of Edinburgh	50.4%	421	46.5%	654	42.5%	320	35.9%	412
City of Liverpool	24.4%	124	21.2%	189	11.2%	152	10.5%	153
City of York	10.1%	1021	12.6%	937	7.6%	955	5.2%	904
Cumbria	2.6%	309	4.2%	404	5.9%	340	5.2%	539
Derby City	19.0%	343						
Doncaster Metropolitan	26.1%	119	13.9%	158	19.2%	130	13.6%	125
Durham	18.4%	38						
East Riding of York	8.3%	96	6.9%	102	6.7%	149	9.1%	88
Essex	8.8%	455	8.6%	521	7.0%	628	6.5%	589
Glasgow	33.0%	1,743	34.2%	1,318	38.8%	1,232	21.4%	1,584
Gloucestershire	13.5%	430	14.2%	549	7.3%	578	7.2%	748
Greater Manchester Transportation Unit	32.3%	287	30.9%	265	22.3%	287	21.1%	356
Kingston Upon Hull	5.5%	640	2.0%	507	2.9%	787	2.2%	734
Leicester City	16.8%	982	17.5%	794	15.7%	1,042	12.2%	951
Leicester Council	6.1%	261						
Lincolnshire	0.9%	331	0.9%	338	2.7%	298	0.0%	373
Newcastle Upon Tyne	38.8%	227	33.7%	205	31.8%	198	24.2%	211
Norfolk	14.8%	169	21.5%	261	10.6%	908	15.0%	381
North East Lincolnshire	20.9%	239	5.7%	331	5.8%	345	9.7%	299
North Lincolnshire	4.5%	333	3.9%	382	6.2%	421	3.1%	295
Northampton	18.2%	121	20.8%	154	8.8%	102	22.6%	53
Nottinghamshire County	2.4%	373	5.2%	516	0.6%	650	0.9%	585
Nottinghamshire City	23.7%	877	21.7%	757	14.5%	888	14.9%	803
Oxfordshire	31.3%	2,396	27.7%	2,834	23.5%	3,155	21.2%	3,180
Portsmouth	18.7%	584	15.9%	334	17.2%	274	16.2%	328
Staffordshire	8.8%	105	10.1%	99	10.1%	138	6.1%	214
Stockton-on-Tees	7.6%	66	8.1%	86	8.5%	71	6.7%	90
Suffolk	12.9%	505	13.1%	191	8.0%	576	10.4%	712
Swindon	8.8%	216	11.2%	205	6.5%	275	4.2%	331
Warrington	10.3%	39	14.6%	89	4.4%	91	10.8%	102
Warwickshire	8.5%	165	11.0%	327	11.9%	328	19.5%	128
Westminster	53.9%	2,671	43.5%	2,177	39.2%	1,975	38.1%	1,986
Wolverhampton	3.4%	89	8.9%	135	11.9%	135	7.0%	171
Total	25.1%	27,164	21.8%	26,230	17.6%	27,772	16.0%	27,417

N.B These figures are not intended to represent overall wearing rates within each local authority as they are based only on a small number of sites.

Abstract

This report describes a nation-wide observation survey of cyclist helmet wearing that was conducted in 2002 by TRL. Previous cycle helmet surveys had been undertaken in 1994, 1996 and 1999 on major built-up roads. In 1994, 16% of cyclists were wearing helmets. The wearing rate increased by a small but statistically significant amount in 1996, to 17.6% and increased further to 21.8% in 1999. This was due to an increase in the number of adults wearing cycle helmets, with no significant increase amongst children. In 1999, additional observations were carried out on minor built-up roads, where 8.2% of cyclists were wearing helmets.

The analyses of the 2002 observations on major and minor built-up roads were carried out independently, and the results cannot be combined to give overall rates. However, they show that wearing rates on major built up roads were significantly higher for adults (25.7%) and children (15.3%) than those on the minor built up roads (10.9% for adults and 6.5% for children). The wearing rate among adults had increased on both types of road since 1999, whereas there was no significant change in the wearing rate amongst children.

Related publications

TRL487 *Cycle helmet wearing in 1999* by K Bryan-Brown and N Christie. 2001 (price £20, code A)

TRL286 *Cycle helmet wearing in 1996* by K Bryan-Brown and S Taylor. 1997 (price £25, code E)

TRL156 *Cycle helmet wearing in Great Britain* by S B Taylor and M E Halliday. 1996 (price £25, code E)

TRL154 *Attitudes to cycle helmets - a qualitative study* by M E Halliday, C White, H Finch and K Ward. 1996 (price £35, code H)

CT83.2 Safety helmets (cycle and motorcycle) update (1998-2001*). Current Topics in Transport: selected abstracts from TRL Library's database*. (price £25)

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