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CRANFIELD INSTITUTE
OF TECHNOLOGY

DAVID M. BOTTOMLEY

&

DR. ANDREW GUPPY

Observed & Reported Driving
Behaviour at a Junction: The
Influence of Engineering
Countermeasures.

Summary Report

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College of Aeronautics

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ABSTRACT

In response to the predominance of small engineering schemes at a local level, this study was designed to evaluate a technique of identifying road locations amenable to remedial measures. Through liaison with Bedfordshire County Council a recently-modified roundabout was selected as the site to be studied. Video recordings of 1307 vehicles passing through the roundabout over a period of two days was compared on a wide variety of variables with a similar recording taken some time prior to the modifications by the council.

The results suggested that the modifications had been successful in reducing the problem of 'straight-lining' behaviour, but at the same time appear to have brought about an increase in the prevalence of poor signalling on leaving the roundabout and failure to 'Give Way'-type behaviours. However, several methodological problems were noted and these have certain implications for the conclusions. The major problem concerned the compatibility of the pre- and post -modifications video recordings as very little information about the time and date of former recording was available. It was concluded that any differences that were found could have been due to the video recordings having been taken at different times.

A questionnaire was distributed to users of the roundabout to supplement the observational data. The behaviours of roundabout users that were highlighted by these subjects as being potentially dangerous were in fairly good agreement with the findings from the observation study. Once again, several methodological problems of the questionnaire study were discussed. The major problem concerned the sampling strategy used as car drivers were over-represented in this sample and no responses from heavy goods drivers were obtained.

It was concluded that the technique of comparing observational data with more subjective accounts of road-user behaviours did provide a reasonable guide to the previous accident history of a site, although its' ability to predict future accidents could only be determined after analysing the characteristics of these accidents. Therefore, further research utilising a longitudinal design on a wider range of sites was suggested.

CONTENTS

	<i>PAGE</i>
ABSTRACT.....	1
CONTENTS.....	11
INTRODUCTION.....	1
METHOD:	
A - The Observation Study.....	3
B - The Questionnaire Study.....	4
RESULTS.....	6
DISCUSSION.....	10
CONCLUSIONS.....	13
REFERENCES.....	14
APPENDIX A: THE QUESTIONNAIRE.....	15

INTRODUCTION

One of the more promising approaches to the area of road safety and accident prevention is placing emphasis on alterations to the road environment. There has recently been a call for an increase in the amount of small, low-cost engineering schemes at a local level, and many local authorities in Britain are currently in the process of putting such schemes into operation. However, these type of engineering schemes are not such a new development and there are a number of researchers who have studied the effects of these schemes in the past. For example, Sumner and Shippey (1977) looked at the effects of using rumble areas (patches of coarse material laid on the road surface which causes an intermittent vibration and rumbling noise inside the vehicle) to reduce drivers' approach speeds at intersections. The results showed that approach speeds and the number of conflicts at the intersections studied were reduced, but not by a significant amount.

Some researchers (eg. Huddart and Dean, 1981) have suggested that by identifying undesirable driver behaviours and accident patterns at a particular site, the number of accidents occurring at that site may be reduced. The underlying theory hypothesizes that changes would be made to the road layout to present the driver with fewer opportunities to make the kinds of errors that lead to the type of accidents predominating at that site. This type of approach concentrates on the interaction between the road user and environmental variables, and in any task as complicated as driving it can be argued that to look at any single factor in isolation may be an oversimplification.

One extensively-used method of studying the accident potential of a road location is known as the traffic conflicts technique (TCT) developed by Perkins & Harris (1968). The technique utilises the concepts of 'near' accidents (when some form of corrective procedure, such as harsh braking, is needed by at least one driver to avoid a collision) and 'far' accidents (in which a driver places him/herself in a potentially dangerous situation for which no emergency action is necessary). The original theory suggested that the number of conflicts occurring at a particular location reflected the number of actual accidents at that site. Subsequent research has shown that the issue is somewhat more complex than this, but some researchers (eg. Williams, 1981) suggest that the technique may be useful in the assessment of the effectiveness of remedial measures made to hazardous locations.

One of the major drawbacks with using this form of assessment technique is that, whilst it can provide an accurate reflection of what drivers are actually doing on the road, it can offer no information on motivational factors behind any undesirable driving practices. Knapper and Cropley (1980) suggest that the opinions, beliefs, values and attitudes, and hence the motivational factors, of drivers can be investigated by administering a questionnaire to the road users in question.

The primary aim of this project is to develop a method for the identification of existing hazardous road locations and for the assessment of the effectiveness of remedial measures made to previously identified hazards. This would obviously require an evaluation of current driving habits at that site and these can be most reliably assessed by utilising an observational technique. In addition, by administering a questionnaire to users of that location, the information gained can be used to supplement the purely objective assessment of driving practices provided by the video recordings. A questionnaire can also be used to assess public opinion of the site and also to gather suggestions on how it could be improved.

For the purposes of the current study, it was decided to obtain video recordings of a site hazard with a known accident record both prior to and immediately after some remedial measures had been implemented. The assessment technique can then be used to determine whether the behaviour of drivers has changed as a result of the design modifications, and thus to predict the effectiveness of those changes in terms of accident reduction.

METHOD

A: The Observation Study

Subjects

The subjects included in the observation study were the drivers of all vehicles which entered the roundabout via the entrance that was being filmed on each of the twenty sessions (four sessions in each of the five time periods) in the post-modifications video. In addition, all the vehicles which passed through the roundabout in the pre-modifications video were also included.

Apparatus

The video camera used in the observation study was a JVC JX7E, the video recorder being a JVC HR 265 OEK, working off rechargeable batteries.

Design

Because of the limited amount of time that was available in which to complete the project, traffic behaviour before and after road layout modifications could not be filmed, and therefore a site for which such footage already existed had to be found. Bedfordshire County Council were in possession of a video recording of a recently-modified roundabout with a poor accident record, and this complied with all criteria set for the selection of the site. The modifications themselves consisted mainly of the reduction of the four entrance roads from three lanes to two.

The categories by which the video recordings were to be analysed were partly derived from previous research (eg. Clube, 1979). However, it was felt that each site is liable to present its' own unique set of driving practices and so a pilot video of the roundabout was taken, from which the remaining variables were derived. The potential problem of experimenter subjectivity on some variables was overcome by the implementation of reliability tests. As a result of these tests, the experimenter achieved satisfactory levels of agreement both with himself and with a second rater on all but one variable. However, when its' definition was slightly altered, acceptable reliability coefficients were also recorded for this variable.

In order that a representative sample of traffic travelling through the roundabout was obtained, it was decided that the video recordings must be taken at various periods of time throughout the day. The filming was timed to coincide with the morning and evening 'rush-hour' periods, the lunch-time period, and two additional 'off-peak' periods in mid-morning and mid-afternoon.

Time restraints meant that filming had to be completed in a very short space of time and therefore it was not possible to adopt the more preferable approach of filming on all days of the week. Additionally, the days on which recording took place had to be carefully selected to achieve as representative sample as possible, traffic flow on some days (particularly at the weekend) tending to be somewhat irregular. The days selected were Tuesday and Wednesday.

Procedure

Prior to arriving at the site it was ensured that the battery powering the video recorder was fully charged and that all of the equipment was in working order. The experimenter arrived at the site in good time to set up the equipment and ensure that filming could begin at the correct time. The tripod containing the video camera and the video recorder were set up by the side of the relevant road section at the predetermined distance from the 'Give Way' line (markers had been left to ensure that exactly the same location was chosen every time). The recorder was left on the 'pause' setting so that the video recorder could be started and stopped using a more convenient button on the video camera.

Each ten minute session began with the experimenter holding a piece of card (containing details of the time period and entrance road featured in that particular filming session) in front of the camera. At the exact time of the start of that session the pause button was released and, a few seconds later, the cue card removed. At the end of the ten minute period the pause button was pressed once again to end the filming of that session. The experimenter then transferred the equipment to the next entrance road and, after exactly five minutes, began the same procedure again. This was done for all four entrances (filmed in their predetermined random order). The experimenter then left the site to re-charge the battery, returning to implement the same procedure for each of the remaining sessions until all five time periods had been filmed.

B: The Questionnaire Study

Subjects

200 questionnaires were distributed to users of the '101' roundabout of which 77 were returned in a useable form.

Apparatus

The questionnaire designed for this study, complete with its' introductory letter and 'freepost' envelope, were the only items used in this part of the study.

Design

It was decided that a questionnaire would be most useful as a supplement to the video data if the subjects were asked to comment on the perceived prevalence of certain types of undesirable driving practices. A self-completion-type questionnaire was thought to be the most applicable to this study because of the time constraints.

The questionnaire was divided into four sections as follows:

- 1) General driver information questions;
- 2) Attitudinal items about various types of junctions and the accident potential of each type;
- 3) Specific questions about the '101' roundabout;
- 4) Items about undesirable driving practices at roundabouts.

It was decided to utilise a postal survey technique because they usually provide a relatively high return rate and take less time to administer. In addition, subjects are able to answer the questions in their own time and are therefore more likely to participate in the study.

Procedure

Distribution of the questionnaires involved approaching every customer at a garage (situated a short distance from the roundabout) after they had left the office in which they paid. The experimenter provided a brief introduction to the questionnaire by explaining that it was part of a study on driver behaviour at roundabouts, and then asked them if they would be willing to take a questionnaire home to complete in their own time. If the customer accepted a questionnaire they were also handed a 'freepost' envelope in which they were asked to return the questionnaire and finally thanked for their participation.

Forty questionnaires were distributed to customers of the '101' garage during each of the time periods that the video recordings were taken. The days of the week on which the questionnaires were given out were also the same as those on which the videos had been taken.

RESULTSGeneral Road-User Details

The video recording provided by Bedfordshire County Council (referred to as the 'Bedford' video) contained 433 vehicles for which data could be obtained. The video recorded for the purpose of the present study (referred to as the 'Post' video) included a total of 1307 vehicles. The distribution of vehicles types in these videos is summarised in Table 1 (below), the figures in brackets denoting the percentage of the total number of vehicles recorded on each video for each vehicle type.

NB. The classification 'Slow Vehicles' refers to farm vehicles and road sweepers.

Table 1 : Distribution of Vehicle-Types For Both Videos

Video:	Cycle	Moped	Motor Cycle	Car	Vehicle Type				Other	Total
					Light Goods	Heavy Goods	Bus/ Coach	Slow Vehicles		
Bedford	3 (0,7)	0 (0,0)	0 (0,0)	322 (74,4)	44 (10,2)	53 (12,2)	1 (0,2)	5 (1,2)	3 (0,7)	433 (100)
Post	13 (1,0)	4 (0,3)	15 (1,1)	1073 (82,1)	85 (6,5)	83 (6,4)	8 (0,6)	15 (1,1)	11 (0,8)	1307 (100)
Total	16 (0,9)	4 (0,2)	15 (0,9)	1395 (80,2)	129 (7,4)	136 (7,8)	9 (0,5)	20 (1,1)	14 (0,8)	1740 (100)

Traffic Conflicts

Table 2 (below) details the number and type of traffic conflicts recorded in both videos.

Table 2 : Distribution of Traffic Conflicts

VIDEO	No Conflict	Far Accident	TCT		Total
			Near Accident- Slight	Near Accident- Severe	
Bedford	419 (96,8%)	5 (1,2%)	8 (1,8%)	1 (0,2%)	433
Post	1232 (94,3%)	41 (3,1%)	34 (2,6%)	0 (0,0%)	1307
Total	1651 (94,9%)	46 (2,6%)	42 (2,4%)	1 (0,1%)	1740

A Pearson's Chi-Squared test of association was carried out on the above data, combining the two near accident categories to ensure there were no expected frequency cells with values of less than 5. The calculated value of Chi-Squared was 5.41 (2 d.f.), a value of 5.99 is required for significance at the 5% level and so the result is not significant.

Despite the modifications to the roundabout, it can be seen from the figures that there were proportionally slightly more conflicts after the modifications than before. The video recordings show that prior to the modifications, approximately 1 vehicle in 31 was involved in some form of conflict, whilst the equivalent post-modifications ratio was 17.4:1. From these videos, it is quite clear that conflicts occur more frequently at the roundabout since the alterations have been made. Overall, there appear to be roughly equal numbers of near (involving 2.4% of vehicles) and far (2.6%) accidents. It should also be noted that the only example of a near accident requiring severe evasive action occurred on the Bedford video.

One of the most striking findings from the conflict analyses concerned the predominance of heavy goods vehicles that were seen to be involved in both near and far accidents. Whilst around 8% of the vehicles included in the sample were HGVs, 13% of far accidents and 14% of near accidents involved one of these vehicles.

Concerning the types of manoeuvres that resulted in traffic conflicts, almost 90% of near accidents were a consequence of one of two types of manoeuvre: pulling out into the path of another vehicle and adoption of an excessive approach speed. This would appear to indicate that most conflicts occur as vehicles enter the roundabout, and indeed when conflicts were broken down by place of occurrence, over 75% of vehicles which needed to take some evasive action did so in this region.

Undesirable Driving Practices

Probably the most relevant comparisons that can be made in a study of this nature concerns the occurrence of undesirable driving practices in the post-modifications video in comparison with the same behaviours before the modifications were made. Tables 3a to 3d (over) show the contingency tables for all behaviours that showed a significant difference in pre/post comparisons.

Table 3:

a) <i>Approach Speed</i>			
Video:	Acceptable Approach Speed	Excessive Approach Speed	Total
Bedford	426 (98.4%)	7 (1.6%)	433
Post	1244 (95.2%)	63 (4.8%)	1307
Total	1670 (96.0%)	70 (4.0%)	1740

b) <i>Following-On Behaviour</i>			
Video:	Following On	No Following On	Total
Bedford	10 (2.3%)	423 (97.7%)	433
Post	73 (5.6%)	1234 (94.4%)	1307
Total	83 (4.7%)	1657 (95.2%)	1740

c) <i>Tracking</i>			
Video:	Correct Tracking	Incorrect Tracking	Total
Bedford	223 (52.0%)	206 (48.0%)	429
Post	1074 (82.5%)	228 (17.5%)	1302
Total	1297 (74.9%)	434 (25.1%)	1731

d) <i>Use Of Indicators On Exit</i>			
Video:	Correct Indication	Incorrect Indication	Total
Bedford	32 (30.5%)	71 (69.5%)	103
Post	111 (13.2%)	732 (86.8%)	843
Total	143 (15.1%)	803 (84.9%)	946

Chi-Square tests of significance performed on the data in all four of these tables were significant at the 5% level. However, only lane tracking behaviour was shown to have improved in the Post video. In other words, the incidence of each of the undesirable behaviours relating to 'excessive approach speed', 'following-on', and 'incorrect exit signals' was more prevalent in the Post video. Driving practices for which no difference between the two videos was demonstrated were: correctly 'giving way'; 'edging-out'; and correct use of indicators on the approach to the roundabout.

The remainder of the results section will focus upon analyses from the questionnaire study. One of the most relevant features of the questionnaire study concerned the respondents' perceptions of the undesirable driving practices as highlighted by the videos. Subjects were asked to indicate the frequency with which they observed each type of behaviour on the roundabout as well as being asked to list the three such practices that they thought occurred most frequently. The former category of questions revealed that drivers' perceptions of the most frequent types of undesirable practices tied in reasonably well with the information provided by the analysis of the video data. The three undesirable driving practices that emerged from the open-ended questions were: 'excessive approach speed'; 'straight-lining'; and 'incorrect use of indicators' (this quoted by over 60% of respondents).

At this point it may be worth a brief look at the respondents' perceptions of the safety of the roundabout as a result of the remedial measures. Of the 66 subjects who had noticed the modifications, 35 (53%) thought that the roundabout was safer as a result of them, whilst 27 (40.9%) thought that they had made no difference. The remaining 4 subjects (6.1%) could not make a decision. When asked to state reasons for their answers, 33% of subjects who thought that the roundabout's safety had not been improved were concerned about its' small size, by far the most popular reason.

The other major item on the questionnaire was the one which asked subjects to suggest ways in which the roundabout could be improved. Table 4 (over) list the 12 most popular suggestions (ie. ones suggested by more than 1 respondent).

Table 4 : Suggested Modifications to the Roundabout

Number	Description	Frequency
1	Yellow speed-reduction lines on entry	8
2	Speed-reduction ramps on approach roads	5
3	Increased roundabout size	5
4	Entrances widened to 3 lanes	3
5	Pedestrian barriers lowered or removed	3
6	Improvement of pedestrian facilities	3
7	Use of 'reduce speed' signs on approach	2
8	Larger centre island	2
9	Convert roundabout to 'flyover'	2
10	Current signs placed further away	2
11	Improved visibility at South entrance	2
12	Use of 'Stop' sign on North entrance	2

The table shows that many of the more popular suggestions involve attempts to reduce drivers' approach speeds. The other general theme appears to revolve around increasing the size of the roundabout or its' approach roads, accounting for 19.6% of all suggestions. Several of the categories are concerned with an improvement in signposting facilities, whilst improved visibility also appears to be a fairly dominant concern.

DISCUSSION

The primary aim of this section of the report should be to establish the effectiveness of the technique of using questionnaire data to supplement that obtained by the observational method in the identification of hazardous road locations.

The Observation Study

The traffic conflicts technique was incorporated into the study because it was hypothesized that the incidence of such conflicts would be linked to the accidents that have happened at the roundabout. Upon analysis of the manoeuvres resulting in traffic conflicts, it was found that around 60% of all near accidents were due to incorrect observation of the 'Give Way' ruling. The accident data for the '101' roundabout for the period 1984 to 1987 (April) reveals that, of the accidents for which a causal manoeuvre could be established, almost 80% were a direct result of this type of behaviour.

On the surface, this appears to be a reasonable approximation, but it should be noted that little additional information about the actual accidents was available and the categorisation of 'failure to give way' is somewhat vague as it stands. Indeed, it is not clear whether these drivers did not 'Give Way' because they were travelling too quickly and could not stop in time or because they simply did not consider the traffic conditions on the roundabout sufficiently well. Additionally, Williams (1981) discovered that the underlying causes of traffic conflicts and actual accidents may not be identical, making such comparisons inappropriate.

The one type of undesirable driving practice that the modifications to the roundabout appear to have been designed specifically to eliminate is 'straight-lining' (the tendency for drivers to traverse the roundabout by taking as direct a route as possible across it without regard for the lanes). By narrowing the approach roads from three lanes to two, the roundabout is now more difficult to 'straight-line' as the absence of the nearside lane now means that drivers no longer have a direct line across and must therefore deviate to at least some extent. The significant reduction in the amount of this type of driving indicates that the modifications have achieved their goal in reducing 'straight-lining'. However, the post-modifications videos show an increase in other undesirable behaviours such as 'piggybacking' (where one vehicle enters the roundabout directly behind another vehicle without the driver of the former vehicle appearing to make any checks of their own) and failure to give a (correct) signal when leaving the roundabout.

It is difficult to determine why the modifications appear to have brought about an increase in these two behaviours. The questionnaire technique could provide useful information on drivers motives for indulging in these behaviours. Unfortunately, the one used in this study did not cover such issues and it is suggested that this style of question be the focal point of any subsequent questionnaires used in research of this nature.

The next section of the discussion will focus on ideas generated from the questionnaire study.

The Questionnaire Study

Despite the finding from the observation study that the incidence of 'straight-lining' activity has been reduced since the alterations to the roundabout, respondents to the questionnaire still identified this activity as a major dangerous driving activity. Also highlighted by these questions were the practices of incorrect indication, use of excessive approach speeds, and failure to observe the correct 'Give Way' procedure.

Comparing the Observation and Questionnaire Data

All of these behaviours were prevalent in the video recordings and the latter three appeared to be more dominant in the Post video. This seems to suggest that drivers' perceptions of undesirable driving practices at this roundabout are reasonably accurate and therefore the technique of supplementing video data with that derived from a questionnaire is a valid one. However, when looked at in these terms it could be argued that this supplementation is a fairly pointless exercise, and the incidence of undesirable driving practices could be studied using either method without missing much information. It should be pointed out that the technique would need to be applied to a wider range of locations before any firm conclusions could be reached.

When asked to suggest alterations to the roundabout the primary concern of respondents appeared to focus on the reduction of drivers' approach speeds and several alternative methods of doing this were given. The two most common suggestions involved the addition of yellow bar lines or ramps to the approach roads. Studies by Maycock and Hall (1984) and Sumner and Baguley (1979) (respectively) concluded that each method could be used to reduce accidents resulting from excessive approach speeds.

The fact that more HGVs than expected appear to be involved in traffic conflicts suggests that these vehicles have particular problems at this site. The '101' roundabout is fairly small, with only two relatively narrow lanes, and it perhaps not surprising that large vehicles such as HGVs sometimes appear to have problems negotiating it. Indeed, many of the respondents to the questionnaire suggested that the roundabout was too small and thought that increasing its' size would make it generally safer to drive through.

Several methodological problems with the study were found to exist and they will be discussed briefly here. The most important of these concerns the assessment of the remedial measures made to the roundabout. Such an assessment is dependent on the compatibility of the 'before' and 'after' video recordings, and the lack of information about the Bedford video has implications for any conclusions. It could be argued that any differences between the two recordings that have been noted may not necessarily be a function of the modifications to the roundabout and may be a function of daily fluctuations in road user characteristics. It is clear that any future research of this nature should ensure that the two samples are compatible.

One of the key issues concerning the questionnaire study is the extent to which the obtained sample reflects the roundabout-user population. The fact that the vast majority (89.6%) of respondents were car drivers and none drove HGVs suggests that the sampling strategy was not particularly effective. It is not clear why this was the case but it is suggested that subsequent studies should adopt a quota sampling strategy in which the number of questionnaires distributed to drivers of each type of vehicle is in proportion to the number of each vehicle seen passing through the roundabout.

It is also suggested that any further research should address the issue of the nature of traffic conflicts more comprehensively and aim to determine whether or not the underlying causes of near accidents and accidents are identical. In addition, it would be preferable to study a number of sites for a longer period of time to ensure that any modifications in drivers' behaviours are of a more permanent nature.

CONCLUSIONS

It may be concluded that the technique of supplementing observational data with that derived from a questionnaire survey of users of the observed site can provide much useful information about road user behaviour at that site. The type of near accidents that were observed provided a reasonably good estimate of the type of accidents that had occurred at the site prior to the modifications. However, it should be pointed out that, as drivers' behaviour at the roundabout appears to have altered since the modifications, the accidents occurring there in the future may be of a different nature and so any predictions of these future accidents may not be strictly accurate.

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APPENDIX A:

The Questionnaire

SECTION 1

1) Which town or village do you live in ?

2) How old were you on your last birthday ?
..... yrs

3) Your Sex ?
Female [] Male []

4) How long have you had your full driving licence ?
(in years)
.....

5) On how many days do you drive in the average week ?
.....

6) Estimate your total weekly mileage

7) Estimate your total yearly mileage

8) How long have you been driving on a regular basis ?
(Give answer to nearest year)
.....

9) What type of vehicle do you usually drive ?

- Car []
- Motorcycle []
- Light goods/Van []
- Heavy goods []
- Bus/Coach []
- Other (please specify) []

10a) Do you drive another type of vehicle regularly ?

YES [] NO [] (if NO go to Q11)

10b) What other type of vehicle do you regularly drive ?

- Car []
- Motorcycle []
- Light goods/Van []
- Heavy goods []
- Bus/Coach []
- Other (please specify) []

11) Does your work involve any driving (other than for getting to and from work) ?

YES [] NO []

SECTION 2

In this section you are presented with a series of statements about firstly junctions and then accidents. Please mark in the appropriate box the extent to which you agree with each statement.

12)

a) I find it easy to drive through FULL-SIZE ROUNDABOUTS

Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
[]	[]	[]	[]	[]

b) I find it easy to drive through 'T' or STAGGERED JUNCTIONS

Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
[]	[]	[]	[]	[]

c) I find it easy to drive through CROSSROADS

Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
[]	[]	[]	[]	[]

d) I find it easy to drive through 'Y'-JUNCTIONS

Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
[]	[]	[]	[]	[]

e) I find it easy to drive through MINI-ROUNDABOUTS

Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
[]	[]	[]	[]	[]

<PTO>

Yet again, please indicate in the appropriate box the extent to which you agree with each statement.

13)

a) A large proportion of road accidents occur at CROSSROADS

Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
[]	[]	[]	[]	[]

b) A large proportion of road accidents occur at 'T' or STAGGERED JUNCTIONS

Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
[]	[]	[]	[]	[]

c) A large proportion of road accidents occur at ROUNDABOUTS

Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
[]	[]	[]	[]	[]

d) A large proportion of road accidents occur on STRAIGHT ROAD SECTIONS

Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
[]	[]	[]	[]	[]

e) A large proportion of road accidents occur at 'Y'-JUNCTIONS

Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
[]	[]	[]	[]	[]

14) Which type of vehicle do you think is responsible for most accidents or near-misses on roundabouts ?

- Car []
- Motorcycle []
- Light goods/Van []
- Heavy goods []
- Bus/Coach []
- Other (please specify) []

SECTION 3

15) Are you familiar with the '101' roundabout at the junction of the Ampthill By-pass (A507), Ampthill Road (A5120) and Flitwick Road (L100) ?

YES [] NO [] If 'NO', go to SECTION 4 on page 5.

16) How regularly do you use this roundabout in the average week ?

- 10 or more times per week []
- Between 5 & 10 times per week []
- Between 2 & 5 times per week []
- About once a week []
- Less than once a week []

17) Please indicate in the boxes below the direction you usually enter the roundabout from. If you enter the roundabout from two different directions on roughly the same number of occasions, please tick the two boxes that correspond to these directions.

- Enter by NORTH road from Ampthill []
- Enter by EAST road from Shefford []
- Enter by SOUTH road from Flitwick []
- Enter by WEST road from Ampthill By-Pass []

18) Please indicate in the boxes below the exit you usually leave the roundabout by. If you leave the roundabout by two different exits on roughly the same number of occasions, please tick the two boxes that correspond to these exits.

- Exit by NORTH road towards Ampthill []
- Exit by EAST road towards Shefford []
- Exit by SOUTH road towards Flitwick []
- Exit by WEST road towards Ampthill By-Pass []

19) Are you aware of any modifications that have been made to the roundabout in the last few months ?

YES [] NO [] If 'NO', go to Question 21.

If 'YES', what were they ?
.....
.....

<PTO>

20) Do you think that these modifications have improved the safety of the roundabout in question ?

YES [] NO [] If 'NO', why not ?

.....
.....

21) Can you suggest any further modifications or additions to the location to improve the safety of the roundabout ?

.....
.....
.....

SECTION 4

In this section you are asked to provide information on how often you see each type of behaviour described at full-size roundabouts, with particular reference to the '101' roundabout previously mentioned.

22) HOW OFTEN DO YOU SEE : (tick one box only)

a) Drivers approaching the roundabout too quickly causing them to brake harshly or over-run the 'Give Way' line ?

Always Frequently Sometimes Rarely Never
[] [] [] [] []

b) Drivers about to enter the roundabout over-estimate the gap in the traffic on the roundabout and cause another vehicle to swerve or brake harshly to avoid a collision ?

Always Frequently Sometimes Rarely Never
[] [] [] [] []

c) Drivers entering the roundabout directly behind another vehicle from the same entrance without appearing to make any of their own checks at the 'Give Way' line ?

Always Frequently Sometimes Rarely Never
[] [] [] [] []

22) (cont) : HOW OFTEN DO YOU SEE..

d) Drivers giving incorrect signals for the exit they leave the roundabout by ?

Always	Frequently	Sometimes	Rarely	Never
[]	[]	[]	[]	[]

e) Drivers not giving a left signal as they leave the roundabout ?

Always	Frequently	Sometimes	Rarely	Never
[]	[]	[]	[]	[]

f) Drivers selecting the wrong lane for the exit they leave the roundabout by ?

Always	Frequently	Sometimes	Rarely	Never
[]	[]	[]	[]	[]

g) Drivers travelling too quickly around the roundabout ?

Always	Frequently	Sometimes	Rarely	Never
[]	[]	[]	[]	[]

h) Drivers travelling too slowly around the roundabout ?

Always	Frequently	Sometimes	Rarely	Never
[]	[]	[]	[]	[]

i) Drivers who leave by the exit directly opposite the one they entered by 'straight-lining' (ie. travelling across the roundabout in as straight a line as possible without sticking to a single lane on the roundabout) ?

Always	Frequently	Sometimes	Rarely	Never
[]	[]	[]	[]	[]

j) Drivers leaving the roundabout from the inside lane (ie. the one nearest the central island) cutting across vehicles in other lanes ?

Always	Frequently	Sometimes	Rarely	Never
[]	[]	[]	[]	[]

<PTO>

23) In your opinion, what are the THREE most dangerous driving practises you have seen at roundabouts ? Please place your three choices in order of severity in the spaces below.

1st

.....

2nd

.....

3rd

.....

24) Are there any other comments you would like to make about anything concerning this roundabout or this questionnaire ?

.....

.....

.....

THIS IS THE END OF THE QUESTIONNAIRE,
THANK YOU FOR YOUR COOPERATION.