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# ROUTE CHOICE IN CONGESTED URBAN NETWORKS

Project Report

Volume One - Text
(appendices are in Volume Two)

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## Acknowledgement

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CHAPTER 1

# 1. INTRODUCTION

## 1.1 General

1.1.1 The main objective of the project was to study the factors affecting choice of route by drivers in a congested sector of the city of Leeds (see Figure 1.1) and to study the effects over time on any choice of route following the introduction of two complementary traffic management schemes.

1.1.2 Data was collected on regularly undertaken trips through this sector by means of:

i) A series of travel logs completed by a panel of city centre employees;
ii) A stop line questionnaire survey;
iii) A series of follow up interviews with selected members of the panel used in (i).

Further detailed background information on overall traffic movements in the area of study was provided by West Yorkshire Metroplitan County Council (WYMCC) from their regular monitoring of the effects of the two traffic management schemes.

1.1.3 The information collected will be important in improving the traffic engineer's ability to predict the effect of traffic management measures, reduce the use of environmentaly sensitive "rat-runs" and to provide an improved input to transport planning and system performance models.

## 1.2 Background

1.2.1 Faced with a change in travel costs a change in route is probably the most readily available alternative for the car driver. The route selected can influence not only the individual's travel time, delay and comfort but the environment and safety of others and the performnce of the road system as a whole.

1.2.2 All of these issues have been the focus of traffic management action. Recommendations have been made for improved signposting and route guidance (1, 2); electronic in-vehicle route guidance equipment is being developed to advise drivers of optimum routes as traffic conditions change (3); environmental management measures have been designed to reduce "rat-running" traffic (4); signal settings have been designed to influence route choice (5) and proposals have been made for route control which would achieve system-optimal rather than user-optimal routeing (6). Several analytical tools are now available for the design of traffic management schemes (7, 8) all of which rely on recent developments in traffic assignment modelling (9).

1.2.3 However, little is known about the basis on which

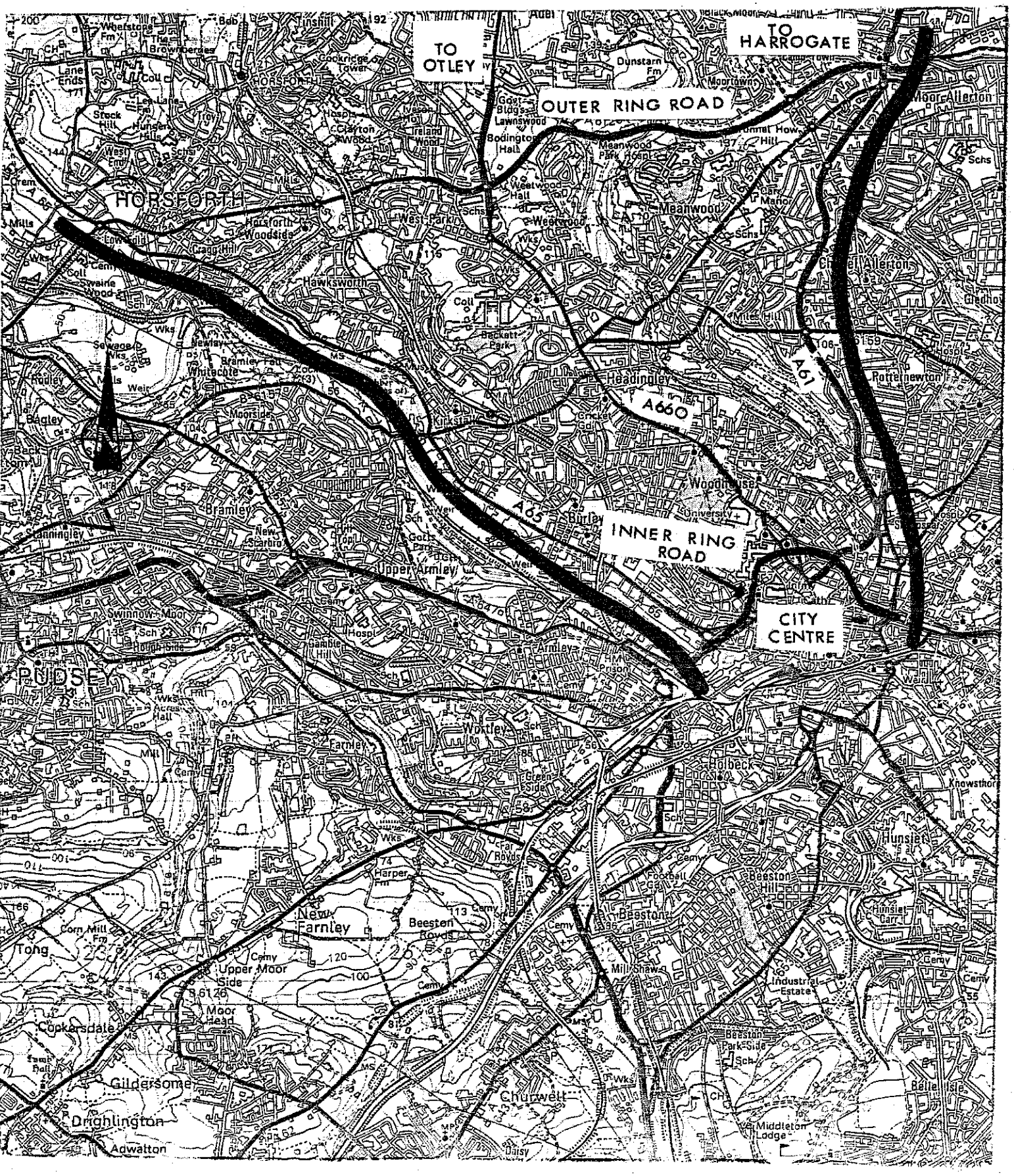


**FIGURE I.1** **BOUNDARY OF ROUTE CHOICE STUDY AREA**

drivers select routes in congested urban networks. Studies of inter-urban and rural travel suggest that time is the main determinant (10) but that distance, signposts and scenery may also influence choice (2, 11). In urban areas, and particularly for regular commuting journeys the latter two are unlikely to apply, travel time will be unpredictable (12) and perceptions of stress and other environmental factors, awareness of alternative routes and uncertainty as to traffic conditions to be experienced may all influence choice. Assignment models for congested networks tend to ignore these effects making the assumption that all routes are minimum cost ones, with a single definition of cost common to all drivers.

1.2.4 A clearer understanding of the basis of route choice will be of importance in improving the design of traffic management measures and the formulation of anlaytical tools used for design and assessment. This will ideally require awareness of the variability in and between individuals' route choices, of changes made at the origin and en-route, of changes made in the light of trffic management measures, of the factors which drivers take into account in making these changes and of those factors which best explain their choices.

1.2.5 Whilst some of these issues can be studied by observing different drivers travelling between the same points over time, there is considerable benefit in studying their responses to major changes. One of the major barriers to such studies has been the difficulty of collecting detailed data on conditions on alternative routes, however the two major traffic management schemes proposed for the area of study were expected to affect drivers' perceptions of the relative merits of different routes between the centre of Leeds and the northern suburbs.

1.2.6 These schemes were:

i) Improvements to a major traffic intersection at Sheepscar;
ii) The introduction, in three phases as shown in Table 1.1, of an outbound, evening peak (1600-1830 hours) bus lane on the A660 Otley Road between Cookridge Street and Hyde Park.

These schemes, and the main routes within the area of study are shown in Figure 1.2.

1.2.7 The specific aim of the A660 bus lane was to aleviate congestion occuring during the evening peak in Headingley and to facilitate the passage of buses outbound from the city centre. This was to be achieved partly through the bus lane and partly by restricting the entry of minor road traffic to the most congested sections of the route. Furthermore traffic signal settings were to be adjusted such that traffic was "throttled back" at selected junctions, thus allowing buses to bypass queues using the bus lanes.

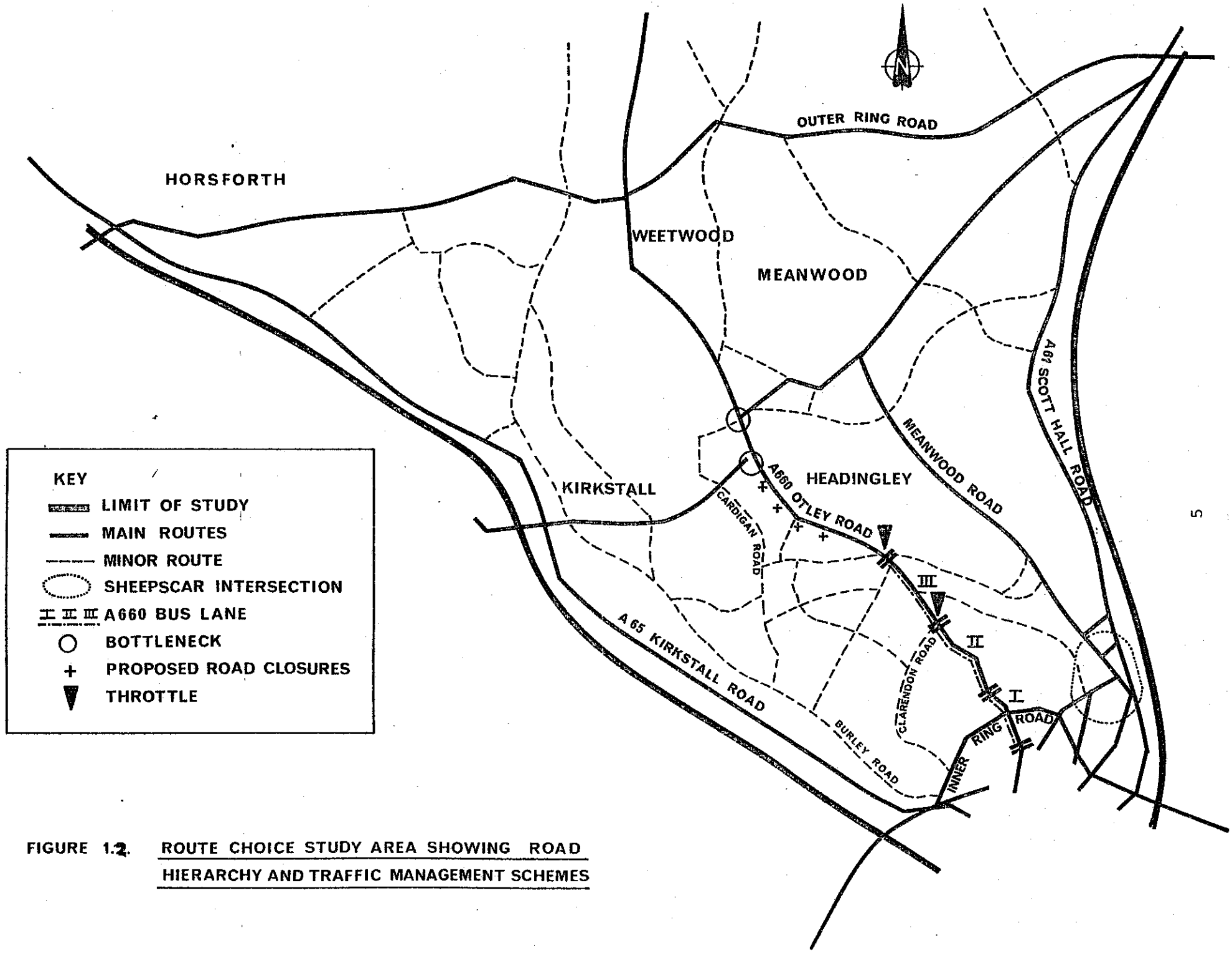


FIGURE 1.2. ROUTE CHOICE STUDY AREA SHOWING ROAD HIERARCHY AND TRAFFIC MANAGEMENT SCHEMES

1.2.8 One expected effect of this scheme was that there would be a partia transfer of traffic away from the A660 onto alternative routes which might include Burley Road, Cardigan Lane, Meanwood Road or Scott Hall Road. It was accepted by the highway authority that any transfer of traffic to these routes would in the first instance make them relatively more congested and secondly cause drivers already using these routes to transfer to others further afield.

1.2.9 The improvements at Sheepscar - carriageway widening and re-alignment with linked signals - were expected to reduce delays for drivers using Meanwood Road, Scott Hall Road and Chapeltown Road/Harrogate Road.

1.2.10 It was anticipated that the two schemes would be complementary and that traffic would move away from the A660 towards the A61 and, as the scheme was to be introduced in stages as shown in the table below, there was an opportunity for data to be collected in a before and several stable after situations for comparison.

| Traffic Management Scheme Phasing | Date |
|---|---|
| Sheepscar Completed | July 1983 |
| A660 Bus Lane Phase I (Cookridge Street to Blackman Lane) | 12/9/83 |
| A660 Bus Lane Phase II (Blackman Lane to Clarendon Road) | 5/12/83 |
| A660 Bus Lane Phase III (Clarendon Road to Hyde Park) | 12/3/84 |

Table 1.1 Phasing of Traffic Management Schemes

1.2.11 Although there have been several previous studies of route choice, most survey techniques are designed for travel to unfamiliar destinations in an inter-urban context (13) and of the urban methods one, based on vehicle following, is not practical in the corridor in question (14) and the other, based on maps and questionnaires was not designed for repeat surveys (15). Two survey methodologies, described fully in Chapter 2, were therefore developed in order to collect the data required to meet the aims discussed above.

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CHAPTER 2

# 2. DATA COLLECTION

## 2.1 Introduction

2.1.1 The intention within this project was to obtain information on the following:

i) changes in network flows and travel times;

ii) variability of routes chosen by individual drivers;

iii) the range of routes chosen by different drivers travelling to the same destination from a common starting point;

iv) route change as the result of changes in network capacities following the traffic management schemes;

v) the factors which drivers take into account when making route choice decisions.

2.1.2 In order to study these, a combination of traffic counts, journey time surveys, travel logs, questionnaires and interviews were planned. The traffic counts and journey surveys were carried out by WYMCC and are described, together with their results, in Chapter 3. There now follows descriptions of our own surveys.

## 2.2 The Panel Surveys

2.2.1 Introduction: The panel survey was designed primarily to monitor the effects on route choice and perceived traffic conditions of the traffic management measures described above. It was also designed to yield information on the determinants of route choice and day-on-day variability in route choice. The panel was recruited from among those employees of firms in central Leeds whose home location was such that they might be expected to use the A660 corridor for their journey home from work. The journey from work was selected in preference to the journey to work because the traffic management measures were most likely to affect the outbound evening traffic. Particular emphasis was paid, in the design of the questionnaires, to disguise the project's interest in route choice; this was done in order to minimise experimental bias. The respondents were asked to keep journey logs for three periods of six days - with the first period being before introduction of Sheepscar and the bus lane and subsequent periods being after phases I and II of the bus lane. The whole operation was preceded by a pilot exercise. We attempted to achieve a high response rate to our various surveys by offering the inducement of cash prizes. After each survey £50 was awarded to the respondent whose completed questionnaire was drawn at random from the pile of returned questionnaires. In the final survey a second prize of £25 was

also offered to boost any flagging interest. We were also careful to maintain good public relations by thanking all respondents for their help.

Details of each of the surveys now follow:

2.2.2 The pilot survey: In order to check for problems within the questionnaires a small pilot survey was carried out on 14th April 1983, asking members of the University staff to complete and return the forms. Only one major problem came to light and this was the absence of an explicit question on the time of arrival at home. This error was rectified

2.2.3 Recruitment of the panel: Respondents were approached through the personnel departments of their firms. The firms were chosen according to their size and location, large firms being chosen to minimise administrative effort. The location was chosen so that the A660 would be a possible choice of route for drivers travelling home to the north of Leeds after work. A letter was sent to the personnel officers, requesting permission to approach the firm's employees and cooperation in gathering together responses (see Appendix 1a).

Following a telephone call to confirm their assistance, invitational letters were distributed within each of the firms involved. These asked for volunteers who drove home through northern Leeds to participate in the surveys (see Appendix 1b).

From the returns, respondents were divided up into three groups according to the estimated frequency of use of the A660 for trips home from work. The categories were as follows:

i) those that use a great part of the A660 everyday.
ii) likely but less frequent users of the A660.
iii) unlikely users of the A660.

Of the 1875 invitational letters distributed on 13th April 1983, 131 responses were received of which:

51 fell in Category 1 (42%)
32 fell in Category 2 (26%)
39 fell in Category 3 (32%)

2.2.4 The initial survey (April/May 1983): Each of the 131 respondents was given a questionnaire pack which contained two types of questionnaire. The first asked questions of a general nature regarding home and work locations, flexibility of travel times and travel habits, knowledge of the network and frequency of travel along main routes in the study area. The second set of questionnaires asked for details of the respondent's journey home from work on the first three days of the week beginning 23rd April and a further three days covered from the 4th to the 6th May 1983.

The survey days were selected to be typical working days. Thus

none of them was a bank holiday and all were within normal University and school term time. This survey was timed to be finished before the major junction improvements at Sheepscar came into effect on May 8th 1983.

The date stamped daily questionnaires aimed to uncover variability in route choice and journey times to provide a base for comparison with the situation after the implementation of the traffic management schemes. In addition, the questionnaires were designed to identify reported travel times for different routes in order that the choice of the 'fastest' route could be examined.

In all, the survey pack comprised an introductory note, an initial questionnaire, six date stamped daily questionnaires, a completed sample questionnaire, and a Freepost envelope in which to return the completed forms. (An example of the contents of the survey pack is included in Appendix 2.)

Each of the questionnaires was numbered in such a way that respondents could readily be identified. Respondents in the first two categories were allocated numbers in the range 101-192, and those in the third category, 601-640.

Respondents in the third category were asked an additional question about the reason for their choice of routes. Respondents in categories one and two were not asked this question to avoid prompting them to think specifically about 'route choice'.

By the 18th May 1983, 104 responses had been received.

| | | |
|---|---|---|
| 77.4% | (41) | from category 1 |
| 82.1% | (32) | from category 2 |
| 79.5% | (31) | from category 3 |

In order to increase this response, the remaining 27 respondents were chased up by telephone. An additional 8 questionnaires were returned, thus making the total response 112. The survey results are discussed in chapters 4 and 5.

2.2.5 The second survey (November 1983): Following an initial telephone call to the Personnel Officers of the firms being used in the Panel survey, each firm's internal mail system was used to distribute an invitation to each person who had indicated a willingness to participate prior to the April/May survey.

129 panel members were invited to participate. This number was made up of 110 who had participated in the April/May survey and 19 others who had indicated an interest in participating. 27 people indicated that they would be unable to respond to this survey. In addition, one person had to be deleted due to a confusion over respondents' names. Therefore, 101 persons made up the panel for this survey.

The questionnaire packs were essentially the same as those used in the April/May survey except that it was now possible to omit some of the background questions. Thus none of the respondents were asked about the reasons for their choice of routes or about their prior knowledge of the network. The completion instructions were slightly modified to ask respondents to record times to the nearest second in order to avoid the rounding to the nearest five minutes which had been evident in the replies to the April/May survey. The packs were distributed for completion on 2-9 November 1983.

Of the questionnaire packs distributed, 61 were returned. To boost the response, follow-up telephone calls were made to the 38 persons who had failed to return their questionnaire packs. (It was not possible to contact the other two respondents by 'phone.) Of these:

6 said they had returned their packs
8 had done the survey but forgotten to post the packs
14 had forgotten to do the survey and were asked to do extra days
1 had not received a pack
1 was off sick during the survey period
2 had changed travel arrangements
1 had been unable to participate due to business away from Leeds
2 gave no reasons for not participating
3 were unobtainable but messages were left.

This resulted in a further 13 packs being received. The final response of 74 (77.2%) was achieved on 18th December 1983. Of these:

42 were in Category 1 (56%)
19 were in Category 2 (26%)
13 were in Category 3 (18%)

2.2.6 The third survey (Feburary 1984): As with the two previous surveys, potential respondents were contacted through an invitation. To keep the participation rates high, three types of invitation were sent out: Type A, B & C, of which; Type A was sent to members of the panel who had taken part in the November survey only, or had taken part in both of the previous surveys, and to those who had agreed to participate but had failed to do so. In all, 86 persons received this type A invitational letter; Type B was sent to those who had participated in the April/May survey but had declined to take part in the November survey. In all, 30 members of the panel were sent this type B letter; Type C was sent to members of the original panel who had yet to participate in any way. 9 persons received this type C letter. This meant that 125 persons were approached in the February 1984 survey. The remaining 6 members of the original full panel of 131 persons were deleted because they had either moved house, left work or now used public transport exclusively.

Following the delivery of the invitations on 10th January 1984, reply slips were received back from 34 members of the panel indicating that they would be unable to participate in the survey. 91 members of the panel were sent questionnaire packs. The total number of respondents left in each group who had received invitations of type A, B and C respectively was as follows:

TYPE A 73 participants left in the survey
TYPE B 18 " " " " "
TYPE C 0 " " " " "

TOTAL 91 participants in the February 1984 survey.

The questionnaire packs were exactly the same as those used in the November survey except that, since bad weather was rife, the instructions were extended to include the request that, if journeys were cancelled due to the weather, the forms for those days should be returned marked to that effect. The packs were distributed for completion on 1-8 February 1984.

By 29th February some 58 of the 91 packs sent out had been returned (63.7%). This left a further 33 still outstanding. The follow-up stage was carried out using a reminder note and was delivered to their respective offices on 16th March 1984.

This resulted in a further 5 packs being returned, thus giving a final total response of 63 returns representing a 69.2% response. Of these:

42 were in Category 1 (66%)
17 were in Category 2 (26%)
4 were in Category 3 ( 8%)

2.2.7 Summary of responses to the panel survey: The table below compares the response rates to the three surveys.

| Survey | No. of questionnaires Distributed | Returned | % Sample | No. (%) Returns in Category 1 | 2 | 3 |
|---|---|---|---|---|---|---|
| April/May '83 | 131 | 112 | 85.5 | 45 (40) | 36 (32) | 31 (28) |
| November '83 | 101 | 74 | 77.2 | 42 (56) | 19 (26) | 13 (18) |
| February '84 | 91 | 63 | 69.2 | 42 (66) | 17 (26) | 4 ( 8) |

Note:

Category 1 Those assumed to use a great part of the A660 regularly
Category 2 Likely bus less frequent users of the A660
Category 3 Unlikely users of the A660

Table 2.1 Comparison of response rates to the three panel surveys

## 2.3 Stop Line Surveys

2.3.1 Introduction: In order to complement the data available and to obtain a wider range of responses, a further survey of driver's route choice in northern Leeds was proposed following the introduction of the third phase of the A660 bus lane (see figure 1.1).

A decision was taken not to carry out a repeat survey of the panel previously used because of falling response rates between the first three years, the short time period in which to mobilise a fourth Panel survey and the demands that would be exerted on the participant's goodwill. Furthermore, the fourth survey was designed to investigate more than the effects of the completion of the third phase of the bus lane. It aimed to test whether the panel was representative, because initial analysis of the results had shown that panel respondents were less likely to use rat-runs than other surveys suggested. In addition, the survey was designed to cover a considerably larger sample and asked about both journey to and from work. Two alternative approaches were tested using the stopline methodology. The two approaches were piloted in November 1984.

The main aim of these pilot surveys was to test whether sufficient data could be collected from drivers during the red phase of selected traffic signals. Two survey techniques were employed based on methods used by the GLC in 1977 and 1982 (1, 2).

The first two surveys involved interviewing drivers as they were stopped during the red phse of the traffic lights. In both of these surveys a controller was used to count the flow of traffic across the stopline and to clear the interviewers from the road before the lights changed to green. This survey technique was employed at two locations; Sheepscar and Blenheim Walk (see figure 2.1).

The third survey was employed at the Inner Ring Road/Burley Road junction. This involved handing the driver a questionnaire pack to be filled in at his/her convenience and returned in the FREEPOST envelope.

2.3.2 The experimental stopline interviews: A brief interview form was designed to provide base information about people's route choice during the morning peak (see Appendix 3). On the first pilot run of the survey, the following problems were encountered.

a) the length of the red time (average 35 seconds) was insufficient to enable one full interview to be completed.

b) the design of the questionnaire was such that most of the important questions were not being reached. However, while the principal cause of this was the limited 'red' time, particular problems were encountered where the respondent

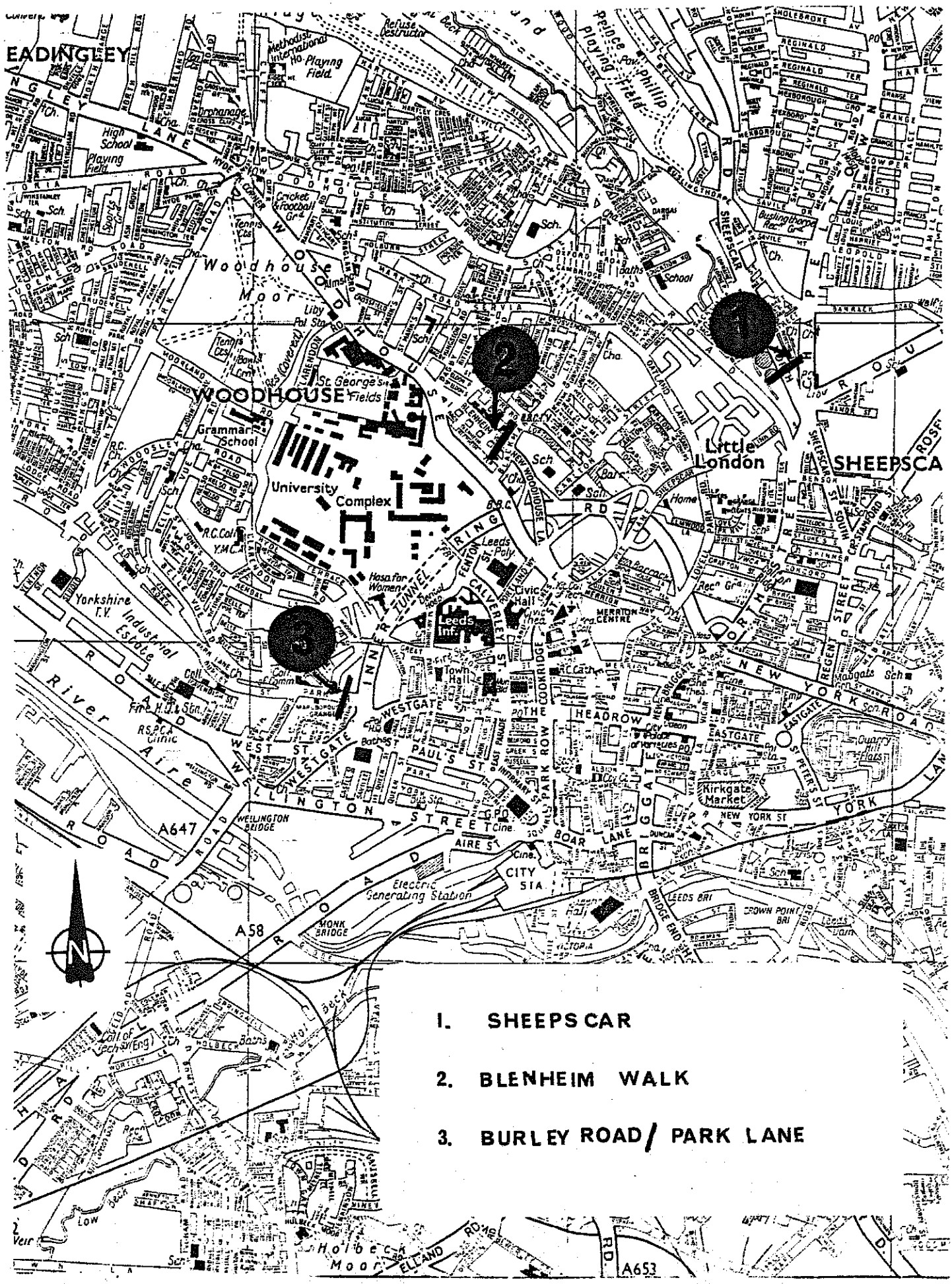


**FIGURE 2.1 STOPLINE SURVEY – LOCATION OF PILOT SURVEY SITES**

either hesitated over replying, refused to reply, or answered in an indistinct manner thus forcing the interviewer to repeat the question.

c) the Sheepscar junction has integrated (UTC controlled) traffic signals. There was a problem of the drivers anticipating the red phase and thus tending to drift or cruise up to the junction stopline. This meant that something in the order of 10-15 seconds of 'red time' was lost thus further restricting the interviewers survey completion time.

d) The signal settings were such that traffic from Sackville Street usually went straight through the lights and thus went unsurveyed. A brief investigation of the Sackville Street junction with the A61 confirmed that a similar survey could not have been effectively implemented at this site.

e) The pelican crossing, between Sackville Street and the Sheepscar junctions caused additional problems. The pelican lights were phased with the lights at the survey site. Thus, traffic which had been held at the pelican crossing was able to catch the 'green' phase of the surveyed junction and thus passed straight across the stopline site. The pelican lights were activated at least 7 times throughout the survey period.

f) The variation in the red time and the volume of traffic meant that the controller could not accurately record the traffic flow by lane and safely allow the interviewers maximum time on the carriageway. There was a serious problem of safety.

Failure to complete any of the stopline questionnaires in the first survey (see Appendix 3a) and to collect sufficient useful information resulted in a change in the design of the questionnaire for the second pilot survey. The second survey was altered such that the questions were asked in order of importance (Appendix 3). This format, applied at the Blenheim Walk survey site, was also found to be unsuitable as again it was impossible to collect sufficient information during the red time available.

The overall conclusions of using the Stopline Interview technique were that it was neither safe nor practical.

2.3.3 The experimental stopline questionnaires: Failure of the Stopline interview technique to produce any useful information relating to driver's route choice resulted in the application of the Stopline Questionnaire Survey technique.

This was implemented at a third survey site. Questionnaires with a FREEPOST envelope attached were handed to potential respondents during the red phase of the traffic lights at Burley Road/Park Lane.

(35%) - 7 of the short version and 7 of the long version. All of the returned forms contained full information.

2.3.4 Conclusions from the experimental stopline surveys: The general conclusions of the various methods tested were as follows:

a) Interviewing at stoplines was both unsafe and failed to provide the additional data desired.

b) The handing out of questionnaires at the stoplines was possible and useful information could be gathered using this method.

c) A higher response rate per driver approached was achieved using the short introduction when distributing the questionnaire packs.

d) It was important to obtain information relating to both journeys to and from work since these were often different.

e) The handing out of the additional maps did not have any significant effect on the survey response rate

2.3.5 The main stopline questionnaire survey: It was decided to proceed with the distribution of pre-paid questionnaires at four junctions in Northern Leeds (see figure 2.2) during the first week in December, 1984. The four junctions were selected because they formed a cordon across our A660 corridor and because each site was a signalised junction under the control of UTC and therefore the red time was known and allowed the interviewers sufficient time to safely distribute a minimum of one questionnaire pack per light phase. Furthermore these sites were chosen such that the minimum number of junctions could be surveyed to cover the maximum amount of traffic.

It was intended that each junction should be surveyed for one day during the period of highest morning peak hour flow. This was determined using West Yorkshire MCC peak hour flows in northern Leeds. This revealed that the most suitable time for surveying vehicles would be between 0800 and 0900.

The pilot surveys had indicated that a response rate of between 25-30% could be expected. Therefore, in order to obtain a large enough data base (about 100 returns) approximately 450 survey packs should be distributed between the 4 selected junctions. This was considered a large enough sample size to provide a useful and significant source of data and exceed the sample covered in the panel surveys.

Each survey pack consisted of:

a) An introductory letter with a map on the reverse side on which respondents were required record every route they had ever used to and from work.

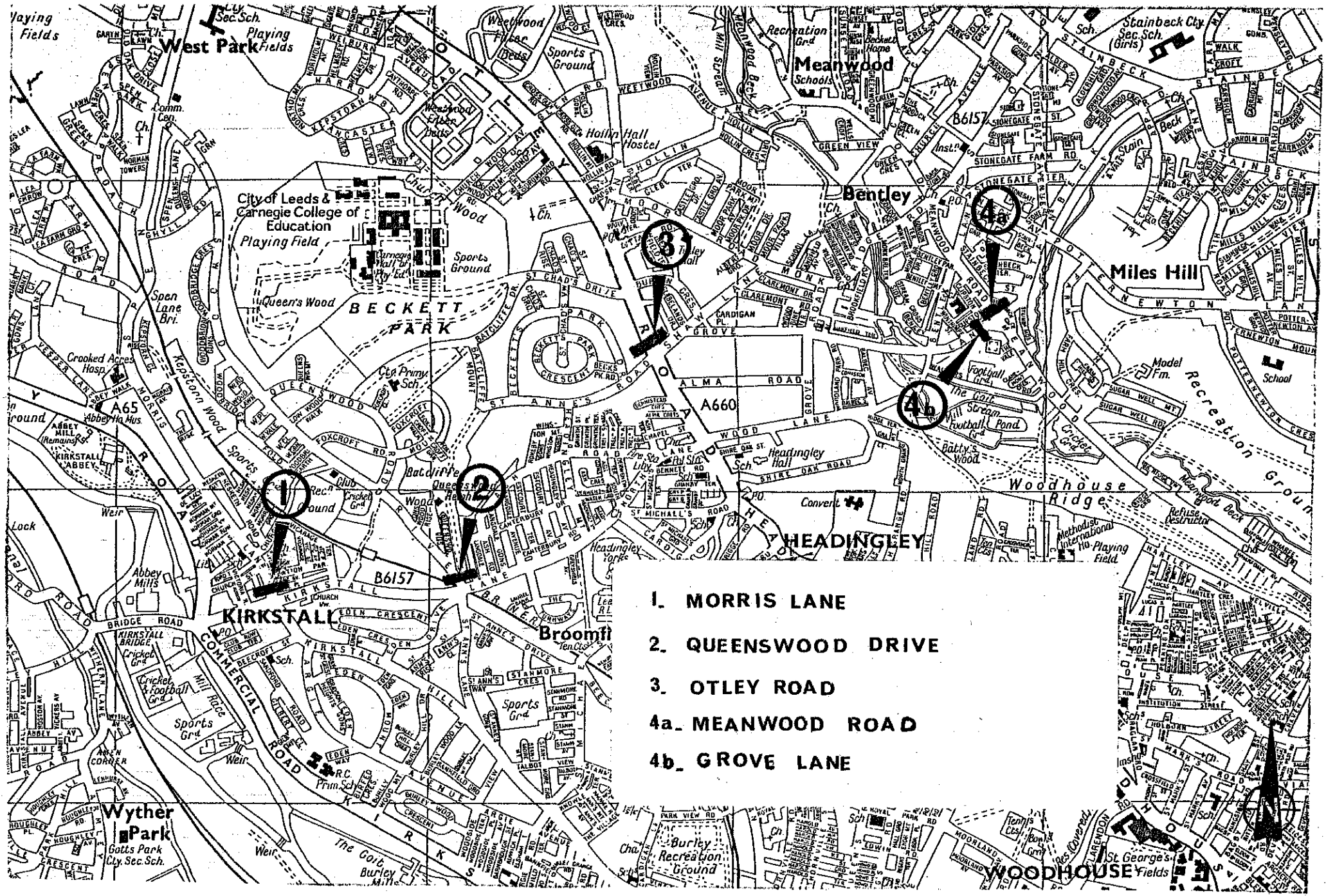


FIGURE 2.2 LOCATION OF STOP LINE SURVEY SITES

b) A questionnaire relating to the journey to work.

c) A questionnaire relating to the journey from work.

An example of the survey pack is included in Appendix 6.

The questionnaire packs were distributed as follows:

| | | | | |
|---|---|---|---|---|
| Meanwood Road | / | Grove Lane | 150 packs | 3/12/84 |
| Otley Road | / | Shaw Lane | 150 packs | 4/12/84 |
| Queenswood Driver | / | Kirkstall Lane | 75 packs | 5/12/84 |
| Morris Lane | / | Kirkstall Lane | 75 packs | 6/12/84 |

All surveys started at 0800 and continued until all the forms had been distributed. This took on average just over 30 minutes. A record of total traffic flow was kept during each of the survey day for control purposes. During the four survey days the weather was fine and frost free. No roadworks, accidents or traffic signal failures were reported which could have influenced traffic flows. Detailed descriptions of the actual surveys are given in Appendix 7.

The overall sample rate obtained during the survey is given in the table below (see Table 2.2).

Table 2.2 Sample rates obtained during surveys

| Junction | No. of forms distributed | No. of vehicles approached | Total flow in survey | % sample | Survey date |
|---|---|---|---|---|---|
| Meanwood Rd/ Grove Ln | 150 | 162 | 884 | 18.3 | 3/12/84 |
| Otley Rd/ Shaw Ln | 150 | 160 | 592 | 27.0% | 4/12/84 |
| Queenswood Drive | 75 | 81 | 287 | 28.2% | 5/12/84 |
| Morris Lane | 75 | 85 | 199 | 42.7% | 6/12/84 |
| T O T A L | 450 | 488 | 1962 | 24.9% | - |

Table 2.3 Response rates

| Junction | No. of forms distributed | No. of forms returned | Response rate | Sample rate |
|---|---|---|---|---|
| Meanwood Rd/ Grove Ln | 150 | 66 | 44% | 7.5% |
| Otley Rd/ Shaw Ln | 150 | 81 | 54% | 13.7% |
| Queenswood Drive | 75 | 39 | 52% | 13.6% |
| Morris Lane | 75 | 30 | 40% | 15.1% |
| T O T A L | 450 | 215 | 48% | 11.0% |

Of the 215 questionnaires returned, 60 (28%) did not contain the map recording every route that had ever been used to and from work. It may be that this was because it was printed on the reverse side of the introductory letter and respondents, on opening their packs, may have gone straight to the questionnaires without reading the explanation relevant to the completion of the additional route map. Alternatively failure to complete this map may be put down to respondents feeling that they were being asked to repeat themselves in their identification of routes that they use for journeys into and out of work.

## 2.4 In-depth Interviews

2.4.1 In order to investigate some issues that arose from initial analysis of the panel survey data, and in order to verify our interpretation of responses recorded in that questionnaire, a limited number of in-depth interviews were carried out among members of the panel. Interviewees were approached during January 1985 via their work telephone numbers (which they had earlierprovided for just such an eventuality).

2.4.2 The interviews were intended to explore in depth certain aspects of journey making such as attitude to journey time, and therefore by inference congestion, knowledge of the highway network and attitudes to short-cuts and finally to confirm the main reasons for variation in route.

2.4.3 Appendix 8 shows the rough guidelines used by interviewers in order to cover these topics.

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CHAPTER 3

# 3. OVERALL TRAFFIC FLOW CHANGES IN THE A660 CORRIDOR

## 3.1 Introduction

3.1.1 In order to assess the impact of the traffic measures introduced in the A660 corridor, in particular the outbound evening peak bus lane, West Yorkshire Metropolitan County Council conducted a series of traffic surveys between 1982 and 1984:

i) Automatic traffic counts at two cordons;
ii) Turning movement surveys at selected junctions; and
iii) A journey time survey.

3.1.2 Surveys i) and ii) were carried out in the "before" situation and after each of phases I and II of the bus lane were implemented. Automatic traffic counts are also available for the period after the introduction of phase III of the bus lane but the journey time survey was carried out only twice - before and after the first phase of the bus lane was introduced.

3.1.3 The results of these surveys enable an overall view of traffic flows within the area of study to be produced and any general changes in the use of routes to be determined.

## 3.2 Traffic Flow Changes

3.2.1 Figure 3.1 shows the location of the two cordons used in the analysis of traffic flows. Data was obtained using automatic traffic counters for a period of at least 15 days and the data analysed below is for an average weekday during that period. Traffic flows in Leeds are monitored regularly by West Yorkshire Metropolitan County Council and it can be shown that on weekdays, with the exception of the evening peak hours on Fridays, there is little variation in daily traffic flows across a cordon round central Leeds (see Figure 3.2) (1). It is assumed that this result is true also of our corridor.

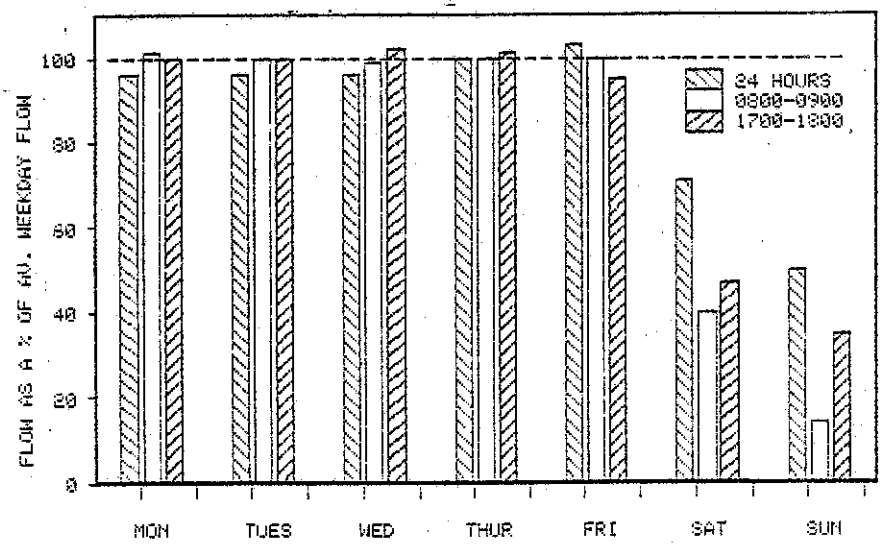



Figure 3.2 Leeds Central Cordon - Daily Variation in Traffic Flow

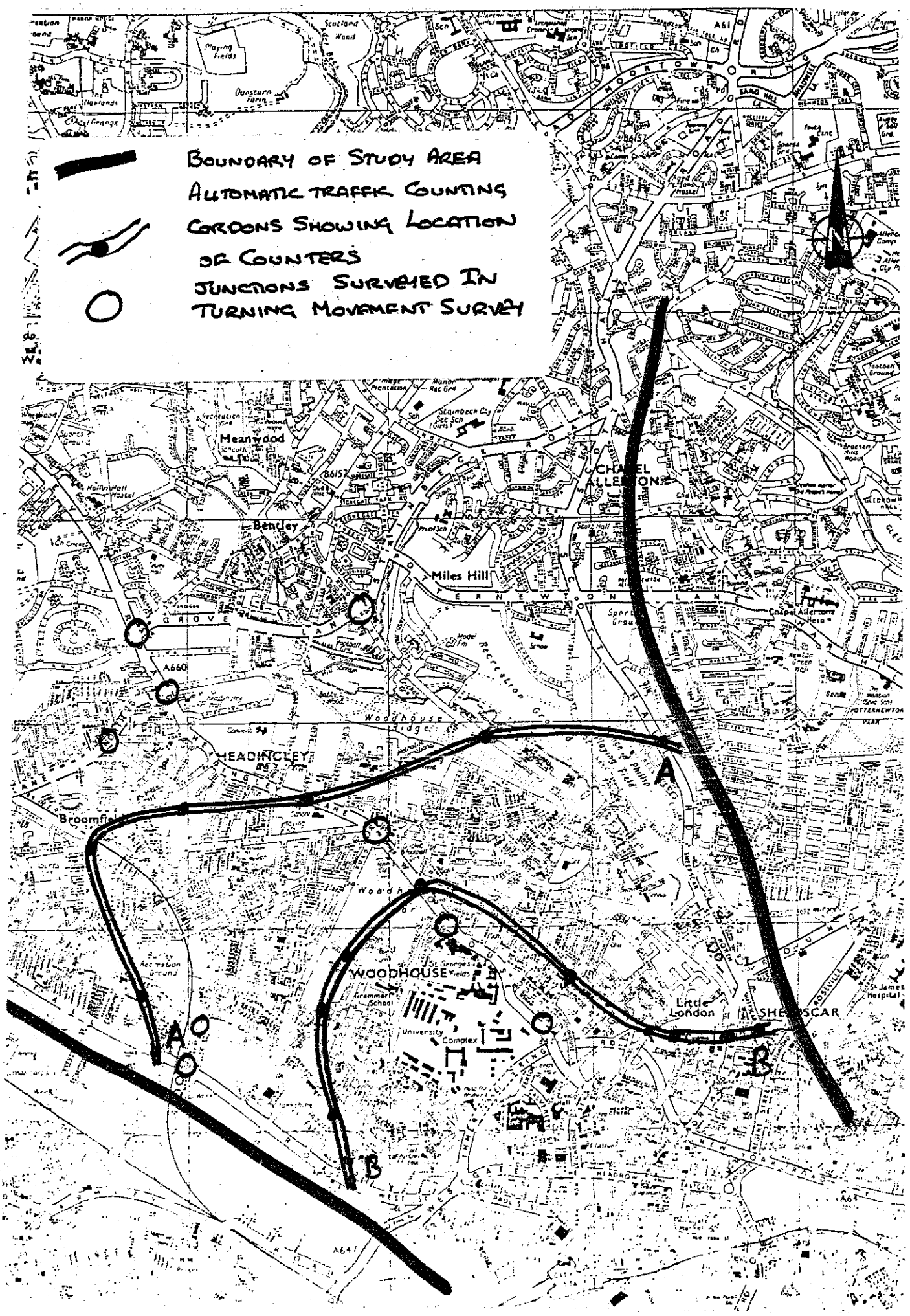



**FIGURE 3.1 COLLECTION OF TRAFFIC DATA**

3.2.2 Table 3.1 shows the change in total traffic flow across the two cordons between 1982 and 1984 for the morning peak hour, the evening peak hour and 24 hours on an average weekday.

| Time Period | Cordon A (Outer Cordon) | | | Cordon B (Inner Cordon) | | |
|---|---|---|---|---|---|---|
| | 1982 | 1983 | 1984 | 1982 | 1983 | 1984 |
| AM Peak Hour Veh (0800-0900) | 10,340 | 11,100 | 10,620 | 14,660 | 14,640 | 15,060 |
| 1982 = 100 | 100 | 105 | 104 | 100 | 100 | 103 |
| PM Peak Hour Veh (1200-1800) | 10,120 | 10,700 | 10,840 | 13,640 | 13,670 | 14,260 |
| 1982 = 100 | 100 | 106 | 107 | 100 | 100 | 105 |
| 24 Hours Veh | 108,030 | 109,270 | 111,500 | 138,600 | 140,150 | 145,990 |
| 1982 = 100 | 100 | 101 | 104 | 100 | 101 | 105 |

Table 3.1 Changes in Traffic Flow in the A660 Corridor, 1982-1984

Note: The data in this and subsequent tables in this chapter has been obtained from surveys conducted at various times of the year. However the figures have been factored using locally devised seasonal variations (1) to represent an average weekday flow (equivalent to October). The data therefore relates to the phasing of the traffic management schemes in the following manner:

1982 Data — Before Sheepscar and A660 bus lane (May/June 1982).

1983 Data — After Sheepscar completed and after phase I of A660 bus lane (October/November 1983).

1984 Data — After phase II and III of A660 bus lane (May/June 1984).

3.2.3 The table shows that over 24 hours traffic flow changes across the two cordons have been about the same, but in the peak hours greater increases have been recorded at the outer cordon, particularly in 1982-83.

3.2.4 When compared to growth across the whole Leeds Central cordon, which is monitored regularly by the County Council, the increases in the A660 corridor are about average, with the exception of the morning peak hour where a lower growth has been recorded. For the total cordon traffic flow changes since 1982 are: Morning peak hour + 7%, evening peak hour + 5% and 24 hours + 5% (2).

3.2.5 Tables 3.2 and 3.3 show the changes in flow for individual roads on the two cordons and show a wide range of traffic flow changes both between roads on each cordon and between the same road on both cordons. For example traffic flows

| | AM Peak Hour (0800 - 0900) | | | PM Peak Hour (1700 - 1800) | | | 24 Hours | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1982 | 1983 | 1984 | 1982 | 1983 | 1984 | 1982 | 1983 | 1984 |
| Kirkstall Rd. Veh. | 3270 | 3250 | 3280 | 2980 | 2850 | 3100 | 28700 | 29150 | 30870 |
| 1982 = 100 | 100 | 99 | 100 | 100 | 95 | 104 | 100 | 101 | 107 |
| Burley Rd. Veh. | 1240 | 1390 | 1430 | 1190 | 1480 | 1480 | 12240 | 13350 | 14780 |
| 1982 = 100 | 100 | 112 | 115 | 100 | 124 | 124 | 100 | 109 | 120 |
| Woodsley Rd. Veh. | 300 | 250 | 300 | 250 | 170 | 160 | 2180 | 1350 | 1410 |
| 1982 = 100 | 100 | 83 | 100 | 100 | 68 | 64 | 100 | 61 | 64 |
| Moorland Rd. Veh. | 220 | 460 | 490 | 380 | 360 | 320 | 2960 | 3350 | 3390 |
| 1982 = 100 | 100 | 209 | 222 | 100 | 94 | 84 | 100 | 113 | 114 |
| Woodhouse Ln. Veh. | 2490 | 2270 | 2190 | 2060 | 2180 | 1970 | 23580 | 23370 | 22770 |
| 1982 = 100 | 100 | 91 | 87 | 100 | 105 | 95 | 100 | 99 | 96 |
| Blackman Ln. Veh. | 240 | 190 | 210 | 150 | 160 | 170 | 1580 | 1370 | 1420 |
| 1982 = 100 | 100 | 79 | 87 | 100 | 106 | 113 | 100 | 87 | 89 |
| Lovell Park Rd. Veh. | 1090 | 830 | 790 | 460 | 600 | 520 | 6660 | 5830 | 5630 |
| 1982 = 100 | 100 | 76 | 72 | 100 | 130 | 113 | 100 | 87 | 84 |
| Claypit Ln. Veh. | 3830 | 3660 | 3760 | 3050 | 3240 | 3600 | 31640 | 33090 | 36050 |
| 1982 = 100 | 100 | 95 | 98 | 100 | 106 | 118 | 100 | 103 | 113 |
| North St. Veh. | 840 | 1160 | 970 | 2490 | 2010 | 2100 | 17780 | 18000 | 16500 |
| 1982 = 100 | 100 | 138 | 115 | 100 | 80 | 84 | 100 | 101 | 92 |
| Sheepscar St. Veh. (South) | 1140 | 1180 | 1640 | 630 | 620 | 840 | 11280 | 11290 | 13170 |
| 1982 = 100 | 100 | 103 | 143 | 100 | 98 | 113 | 100 | 100 | 116 |

Table 3.2 Two Way Traffic Flow Changes on Individual Roads, Inner Cordon, 1982-1984

on the A660 have fallen between 1982 and 1984 at the inner cordon for all time periods whereas at the outer cordon peak hour flows show an increase.

| | AM Peak Hour (0800 - 0900) | | | PM Peak Hour (1700 - 1800) | | | 24 Hours | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1982 | 1983 | 1984 | 1982 | 1983 | 1984 | 1982 | 1983 | 1984 |
| Kirkstall Rd. Veh. | 2820 | 2850 | 2710 | 2490 | 2790 | 2550 | 27620 | 28920 | 30300 |
| 1982 = 100 | 100 | 101 | 96 | 100 | 112 | 102 | 100 | 104 | 109 |
| Burley Rd. Veh. | 1210 | 1070 | 950 | 1320 | 1340 | 1390 | 12570 | 12080 | 12530 |
| 1982 = 100 | 100 | 88 | 78 | 100 | 101 | 105 | 100 | 96 | 99 |
| Cardigan Rd. Veh. | 1600 | 1310 | 1210 | 1600 | 1360 | 1370 | 13330 | 12340 | 11520 |
| 1982 = 100 | 100 | 81 | 75 | 100 | 85 | 86 | 100 | 92 | 86 |
| Headingley Ln. Veh. | 1870 | 1930 | 2050 | 1870 | 1880 | 1890 | 24510 | 24070 | 22900 |
| 1982 = 100 | 100 | 103 | 109 | 100 | 100 | 101 | 100 | 98 | 93 |
| Meanwood Rd. Veh. | 1240 | 1850 | 1810 | 1240 | 1500 | 1450 | 13270 | 14970 | 14900 |
| 1982 = 100 | 100 | 149 | 145 | 100 | 120 | 116 | 100 | 112 | 112 |
| Scott Hall Rd. Veh. | 1600 | 2090 | 1890 | 1600 | 1830 | 2190 | 16730 | 16890 | 19350 |
| 1982 = 100 | 100 | 130 | 118 | 100 | 114 | 136 | 100 | 100 | 114 |

Table 3.3 Two Way Traffic Flow Changes on Individual Roads, Outer Cordon, 1982-1984

3.2.6 Both the inner and outer cordons show an increased use of the Sheepscar intersection (via Claypit Lane, North Street and Sheepscar South Street), Meanwood Road and Scott Hall Road.

3.2.7 The inner cordon shows a greatly increased use of Burley Road whereas at the outer cordon flows have decreased in both the morning peak and over 24 hours with only a small increase in evening peak flows being recorded. It is, however, relevant to note that traffic counters used on the outer cordon were almost exclusively activated using pneumatic tube detectors which can be inaccurate in slow moving traffic or where queues are likely to form, whereas data at the inner cordon was collected almost entirely using inductive loop detectors which are much more accurate in congested conditions. It must be stressed that all the automatic traffic count data was checked for accuracy and consistency on site.

3.2.8 As the traffic management measures introduced into this sector of the Leeds highway network were specifically designed to influence traffic in the evening peak the following analysis concentrates on outbound evening peak hour flows in detail and these are summarised in Tables 3.3 and 3.4. Again, the increase in overall traffic flow has been greatest at the outer cordon

| | Outbound Traffic Flow, PM Peak Hour (1700-1800) | | | | | |
|---|---|---|---|---|---|---|
| | 1982 | | 1983 | | 1984 | |
| | Veh. | 1982 = 100 | Veh. | 1982 = 100 | Veh. | 1982 = 100 |
| Kirkstall Rd. | 1810 | 100 | 1710 | 94 | 1800 | 99 |
| Burley Rd. | 870 | 100 | 1040 | 119 | 1000 | 114 |
| Woodsley Rd. | 130 | 100 | 130 | 100 | 150 | 115 |
| Moorland Rd. | 190 | 100 | 210 | 110 | 200 | 105 |
| Woodhouse Ln. | 1430 | 100 | 1530 | 106 | 1400 | 97 |
| Blackman Ln. | 80 | 100 | 94 | 117 | 100 | 125 |
| Lovell Park Rd. | 450 | 100 | 350 | 77 | 220 | 48 |
| Claypit Ln. | 2050 | 100 | 2210 | 107 | 2590 | 126 |
| North St. | 2090 | 100 | 2010 | 96 | 2100 | 100 |
| Sheepscar St. | 50 | 100 | 32 | 64 | 40 | 80 |

Table 3.3 Changes in Outbound Evening Peak Hour Traffic Flows - Inner Cordon, 1982-1984

| | Outbound Traffic Flow, PM Peak Hour (1700-1800) | | | | | |
|---|---|---|---|---|---|---|
| | 1982 | | 1983 | | 1984 | |
| | Veh. | 1982 = 100 | Veh. | 1982 = 100 | Veh. | 1982 = 100 |
| Kirkstall Rd. | 1690 | 100 | 1890 | 111 | 1630 | 96 |
| Burley Rd. | 1000 | 100 | 980 | 98 | 1050 | 105 |
| Cardigan Rd. | 1000 | 100 | 1100 | 101 | 1130 | 102 |
| Headingley Ln. | 1250 | 100 | 1260 | 100 | 1280 | 102 |
| Meanwood Rd. | 1000 | 100 | 1370 | 137 | 1200 | 120 |
| Scott Hall Rd. | 1260 | 100 | 1420 | 112 | 1880 | 149 |

Table 3.4 Changes in Outbound Evening Peak Hour Traffic Flows - Outer Cordon, 1982-1984

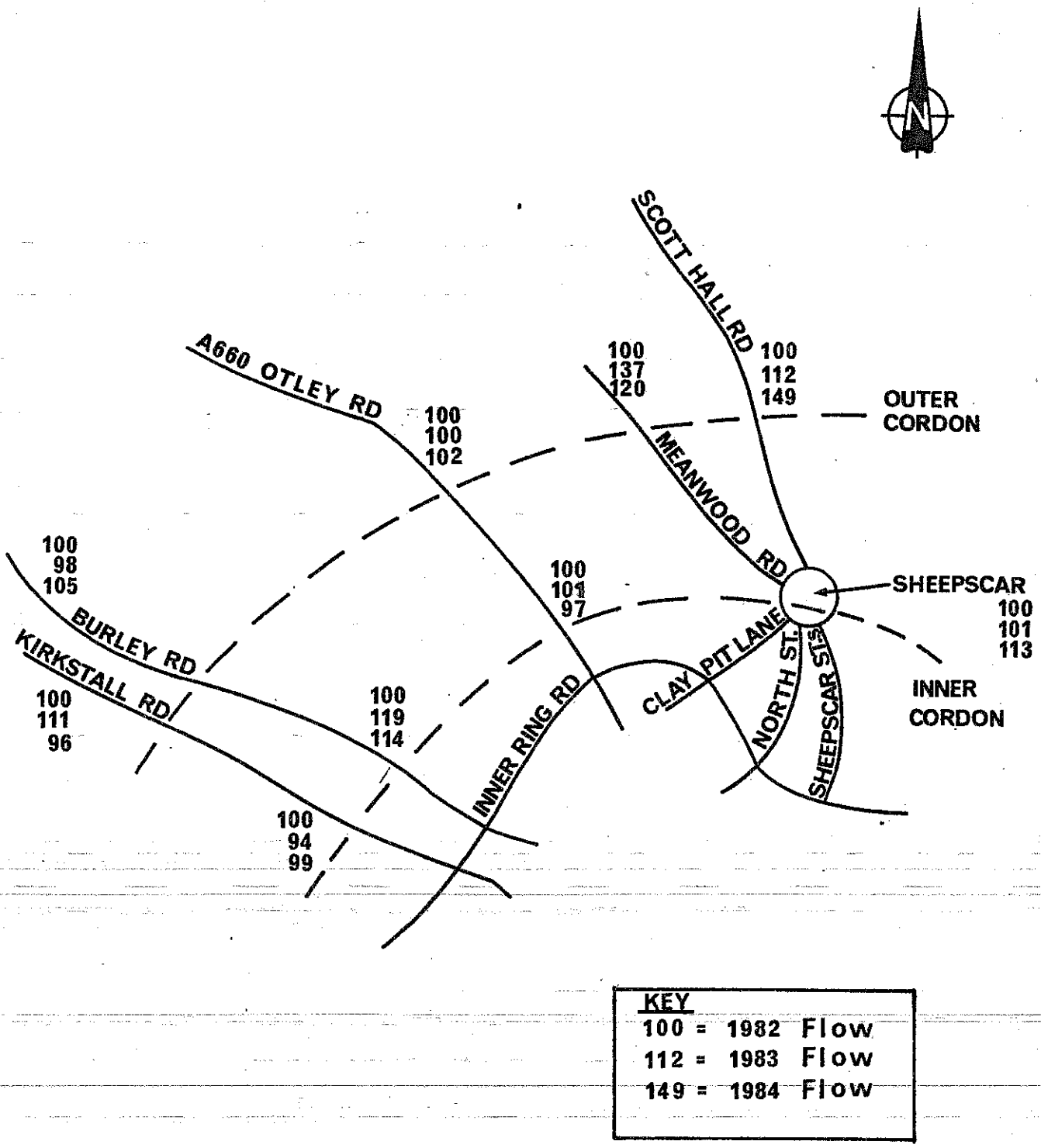



FIGURE 3.3. CHANGES IN TRAFFIC FLOWS ON MAJOR ROADS AT THE INNER AND OUTER CORDONS, 1982-1984 (EVENING PEAK HOUR - OUTBOUND FLOWS ONLY)

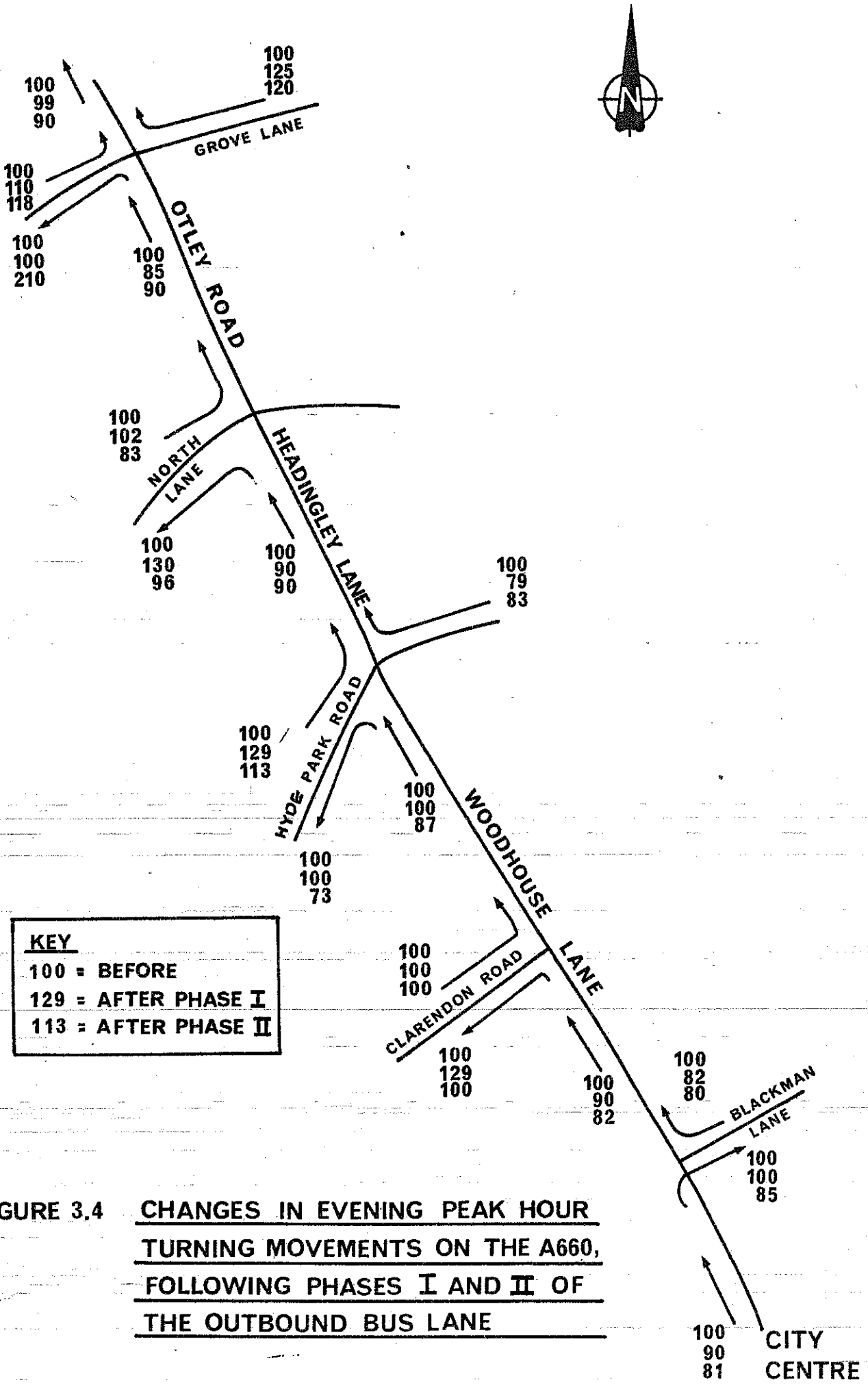



FIGURE 3.4 CHANGES IN EVENING PEAK HOUR TURNING MOVEMENTS ON THE A660, FOLLOWING PHASES I AND II OF THE OUTBOUND BUS LANE

## 3.4 The A660 Journey Time Survey

3.4.1 Journey times along the A660 were measured before the introduction of phase I of the bus lane and again some weeks after. About 50 journeys from the city centre to the Outer Ring Road were timed during the evening peak period (between 1600 and 1800 hours) in each case.

3.4.2 Analysis of the results has shown that taking the 95 percentile journey times for all vehicles have improved by 3.22 minutes. However much of this improvement relates to buses - from Blackman Lane to Shaw Lane the average bus journey time has improved by 2 minutes 18 seconds yet the average vehicle journey time has improved by only 27 seconds.

## 3.5 Summary

3.5.1 Overall traffic flows in the study area have increased at both the inner and outer cordons for all time periods considered (AM Peak Hour, PM Peak Hour, 24 Hours).

3.5.2 There has been some redistribution of traffic within the study area, particularly within the evening peak, with the A660 showing decreases in flow at the inner cordon and traffic volumes at Sheepscar, Meanwood Road and Scott Hall Road increasing. Similarly a decrease on Kirkstall Road has been mirrored by an increase on Burley Road.

3.5.3 Evidence from the turning movement survey reinforces the idea of redistribution of traffic away from the A660 following the introduction of the bus lane.

3.5.4 This survey also indicates that traffic may have also been a redistribution in time as reflected by the reduction in peak hour flows compared to the two-and-a-half hour peak period flows. This redistribution in time is also apparent outside the A660 corridor; WYMCC analysis of traffic flows in Leeds suggests that the evening peak is spreading both in terms of length of time for which flows are within 90% of peak flows and in terms of the actual time of the peak hour (2).

## References


1. "Monthly Traffic Variations in West Yorkshire". Monitoring Report M11, West Yorkshire Metropolitan County Council, March 1984.

2. "Traffic Flow Changes Across the Leeds Central Cordon, 1979-1984". Monitoring Report M27, West Yorkshire Metropolitan County Council, 1985 (unpublished until July 1985).

CHAPTER 4

# 4. THE RESULTS OF THE PANEL SURVEY

## 4.1 i) The Panel

4.1.1 The data provided by the initial questionnaire (see Appendix 2, Section 2.2) distributed to respondents enables a general picture of the panel to be built up.

4.1.2 At the time of the first survey 80% of respondents had been driving home through the study area for more than a year and over 90% drove home more than 3 times per week (see Tables 4.1 and 4.2). This would suggest that the panel respondents would have had a fairly detailed understanding of the road network and driving conditions within the study area and this was confirmed by the maps completed as part of this initial questionnaire which showed that the majority of respondents had, over the months and years, used a variety of routes for their journey home. This will be discussed further in section iii).

| | % Total Respondents in | | |
|---|---|---|---|
| | Survey 1 | Survey 2 | Survey 3 |
| Less than 6 months | 14.3 | 1.4 | 3.2 |
| 6 - 12 months | 5.7 | 2.8 | 0 |
| Over 1 year | 80.0 | 95.8 | 96.8 |

Table 4.1 Length of Time Panel Members Driving Home from Central Leeds

| Frequency of Driving Home | % Total Respondents In | | |
|---|---|---|---|
| | Survey 1 | Survey 2 | Survey 3 |
| Once a week | 5.7 | 0 | 0 |
| 1-2 per week | 2.9 | 8.3 | 11.1 |
| 3-4 per week | 17.1 | 15.3 | 15.9 |
| 5 + per week | 74.3 | 76.4 | 73.0 |

Table 4.2 Variation in the Frequency with which Respondents Regularly Drove Home from Work

4.1.3 Despite the fact that most respondents (63%) were employed in the Planning, Finance and Administrative departments of public sector authorities only 12% of the total panel members were women.

ii) Journey Start Time

4.1.4 Table 4.3 shows that most of the respondents to the surveys were able to vary the time at which they finished work, although the proportion fell gradually over the period of the three surveys, with the majority of the panel having this freedom monitored through clocking out.

| | Can you vary the time at which you finish work? | | | If Yes, do you have to clock out? | | |
|---|---|---|---|---|---|---|
| | Survey 1 | Survey 2 | Survey 3 | Survey 1 | Survey 2 | Survey 3 |
| Yes | 68.4 | 65.3 | 64.5 | 92.4 | 93.0 | 95.1 |
| No | 31.6 | 35.7 | 35.5 | 7.6 | 7.0 | 4.9 |

Table 4.3 Proportion of Panel Members Able to Vary Their Working Hours

4.1.5 For those workers unable to vary their times of departure Table 4.4 summarises the time at which they were supposed to finish work.

| | % of Workers Finishing at | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1630 | 1645 | 1700 | 1715 | 1730 | 1745 | 1800 |
| Survey 1 | 9.1 | 36.4 | 18.2 | 18.2 | 9.0 | 0 | 9.1 |
| Survey 2 | 0 | 40.0 | 0 | 60.0 | 0 | 0 | 0 |
| Survey 3 | 0 | 40.0 | 20.0 | 40.0 | 0 | 0 | 0 |

Table 4.4 Times at which Respondents on "Fixed Hours" Finished Work

4.1.6 An analysis of the departure times of workers who could choose their own finishing times shows a permitted range of departure times between 1600 and 1830 hours. Figures 4.1 and 4.2 indicate that the median earliest departure time has remained fairly constant at around 1630 during the three surveys and that over 80% of respondents usually left before 1700. Similarly the median latest departure time is around 1720 for all three surveys and around 95% of respondents had usually left by 1800 at the latest.

iii) Drivers Knowledge of the Highway Network

4.1.7 One factor which may influence a drivers choice of route through an area is how well he knows the highways system. In order to better understand this factor panel respondents were asked, at the time of the first survey, to complete a map showing how many roads they had ever used on their journey home.

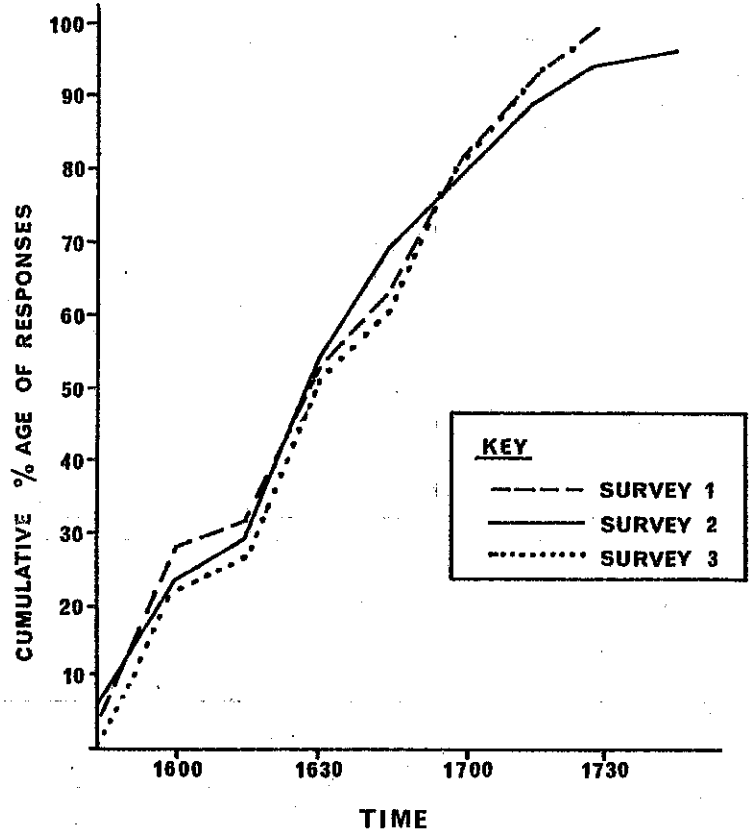



FIGURE 4.1. DISTRIBUTION OF EARLIEST FINISH TIMES

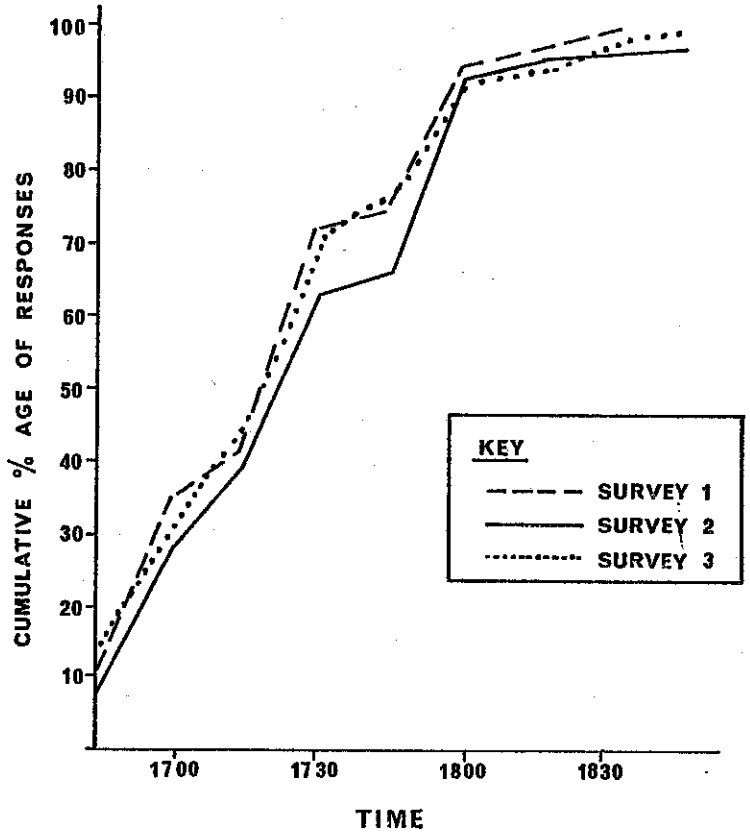



FIGURE 4.2. DISTRIBUTION OF LATEST FINISH TIMES

4.1.8 These maps show a wide variation from those respondents who had only ever used one road to those who had tried many roads during their history of driving between their current home and work place. Figure 4.3 shows the routes used by a random selection of one in 10 responses. Half of this sample had only ever used one road whereas one respondent had used virtually every available road in his journey between Horsforth and central Leeds. The maps also illustrate a significant use of residential roads ("rat runs") in the Headingley area, possibly to avoid congestion along the A660.

iv) Analysis Techniques

The analysis in the remainder of this section will be described at two levels:

i) A description of the results of each of the three surveys.

ii) A comparison of the results of the three surveys based on those respondents who replied to all three.

4.1.9 In order to facilitate the analysis of the routes described by respondents as part of their response to the daily questionnaires a series of cordons was developed as illustrated in Figure 4.4. These cordons were numbered and the radial routes were allocated a code letter.

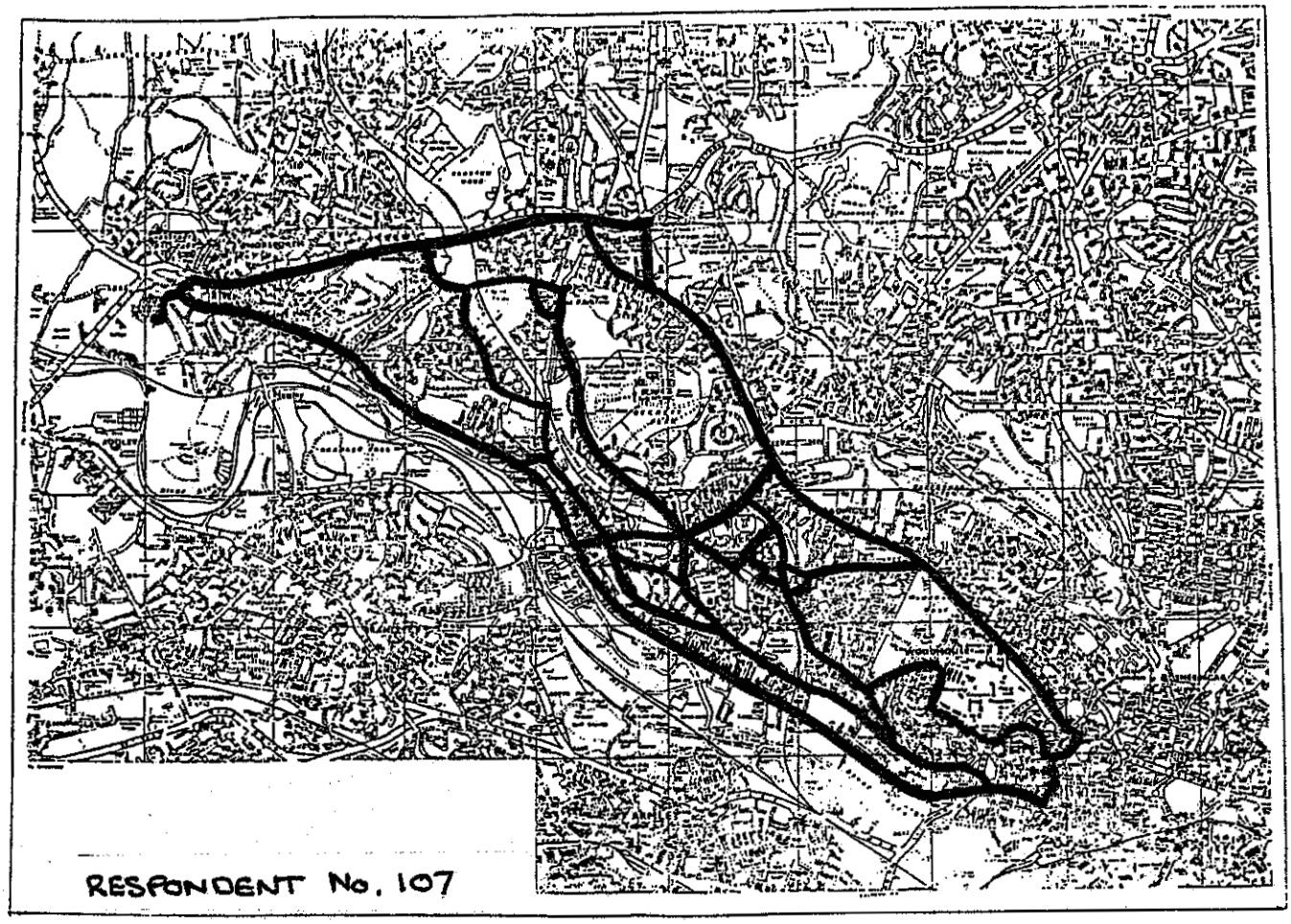
4.1.10 Six cordons were used crossing the study area from the Inner Ring Road to just north of the Outer Ring Road. To enable the use of each route, and any variation in an individuals journey to be determined, each road crossing a cordon was allocated a code based on the cordon number and radial letter (e.g. B3 implied crossing cordon 3 on radial B).

4.2 The Results of the Three Panel Surveys

i) Survey 1 (April/May 1983)

4.2.1 This survey was undertaken before any of the traffic management measures, described in Chapter 1, were introduced, and Figure 4.5 shows the proportion of journeys using each of the major routes through the six cordons and indicates that the A660 Otley Road was the most popular route.

4.2.2 Table 4.5 shows how members of the panel varied their choice of route during the six day survey period.



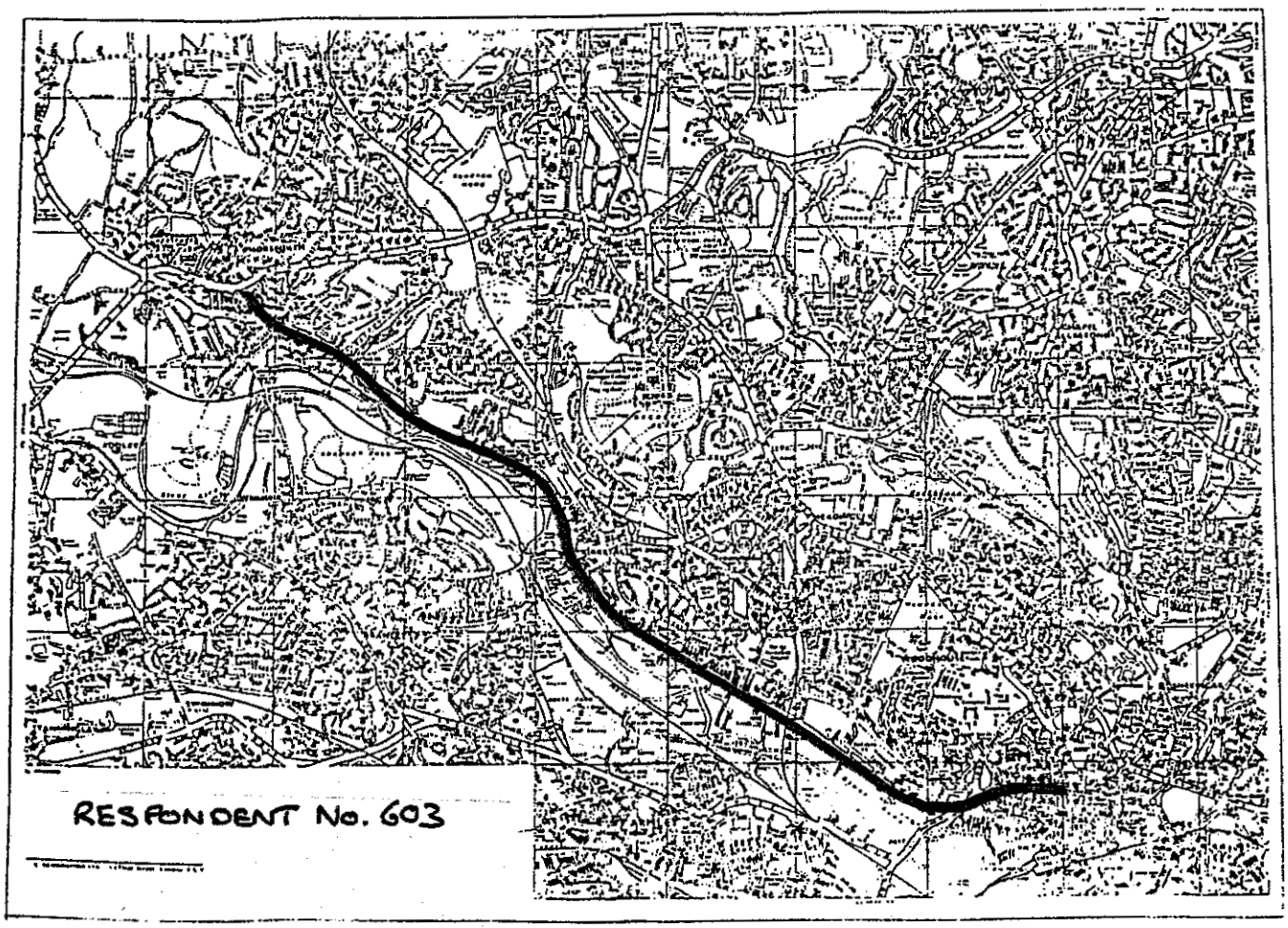
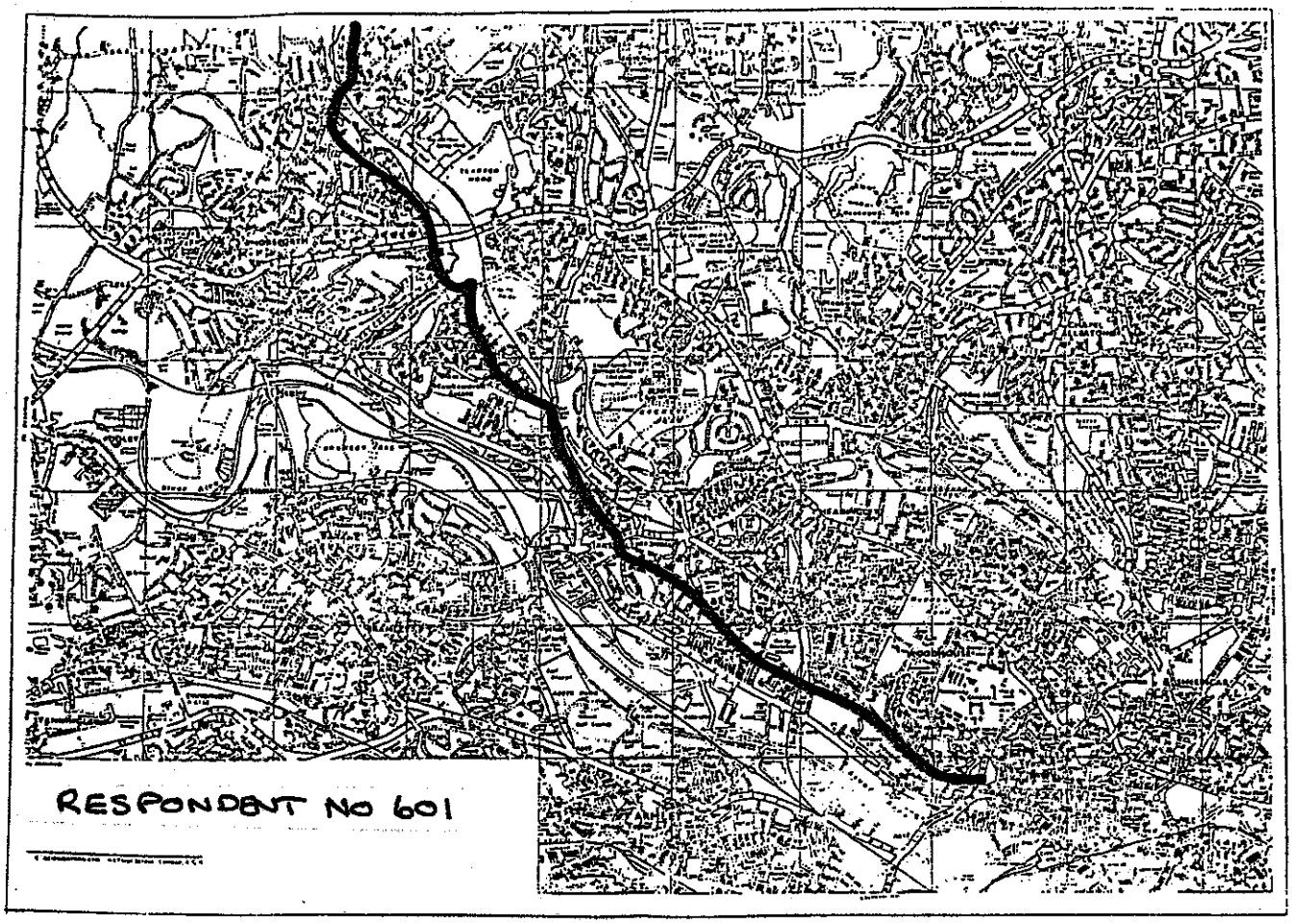




**FIGURE 4.3 ROUTES USED BY A RANDOM SELECTION OF RESPONDENTS**



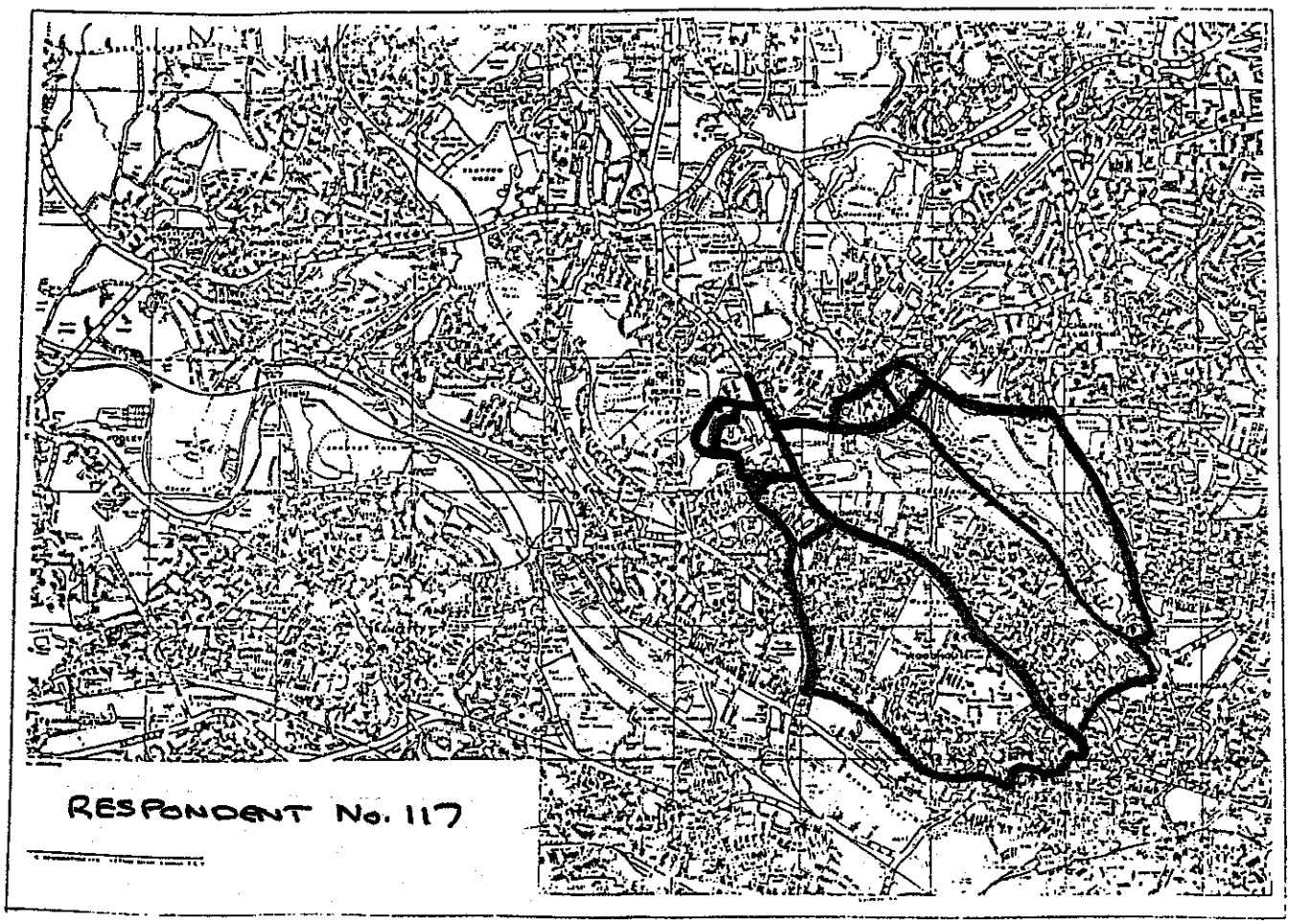
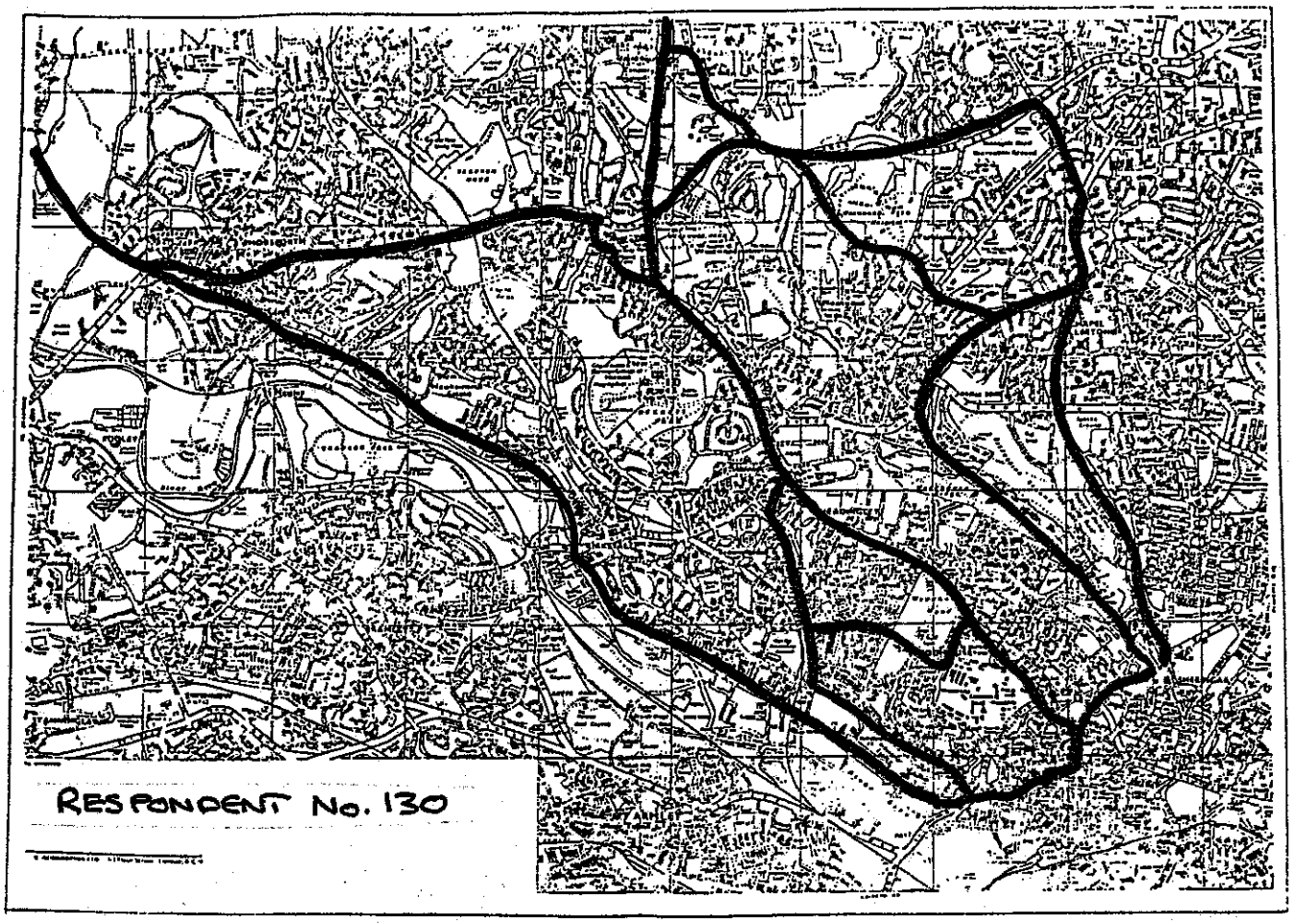




FIGURE 4.3 (CONT.)



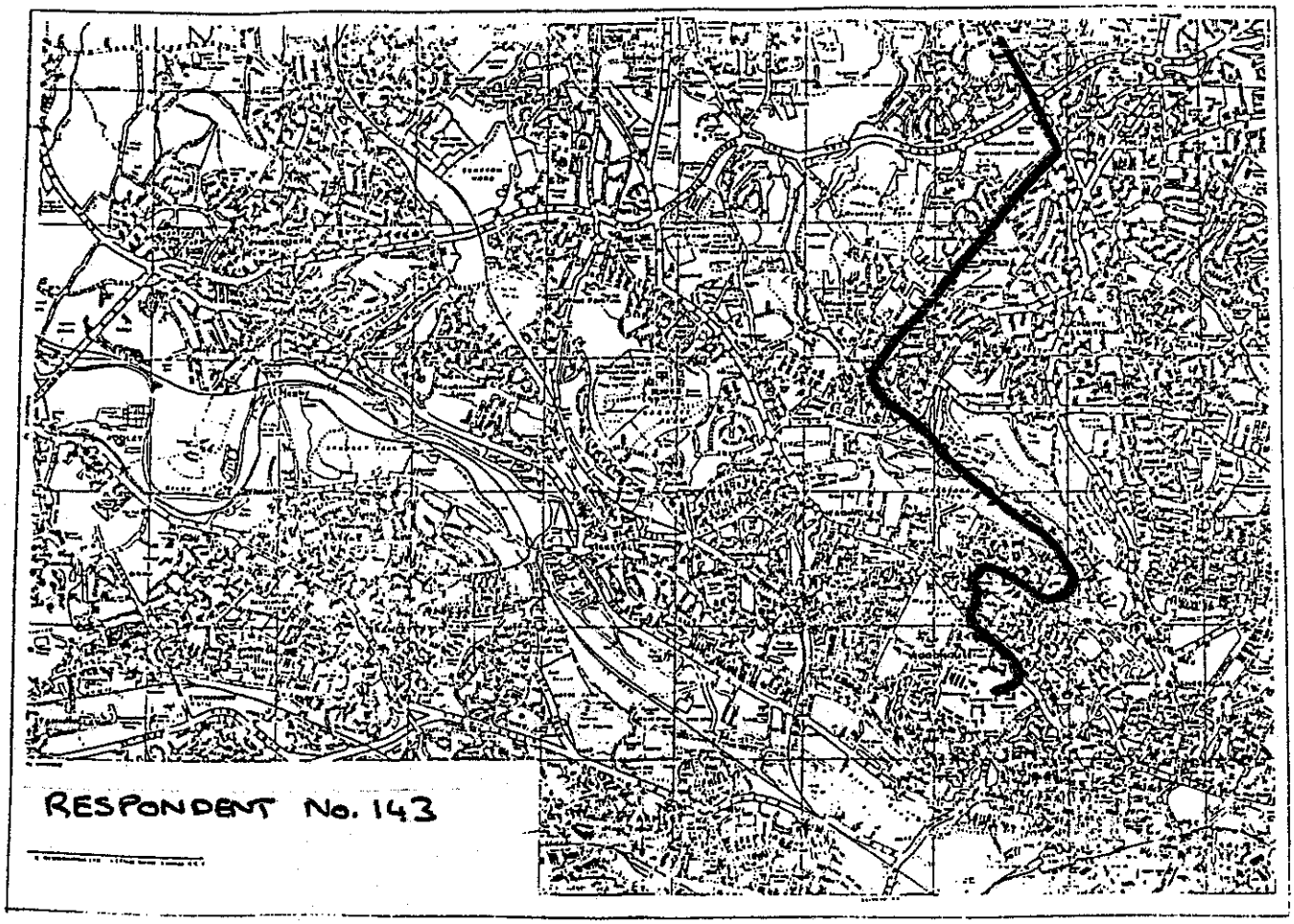
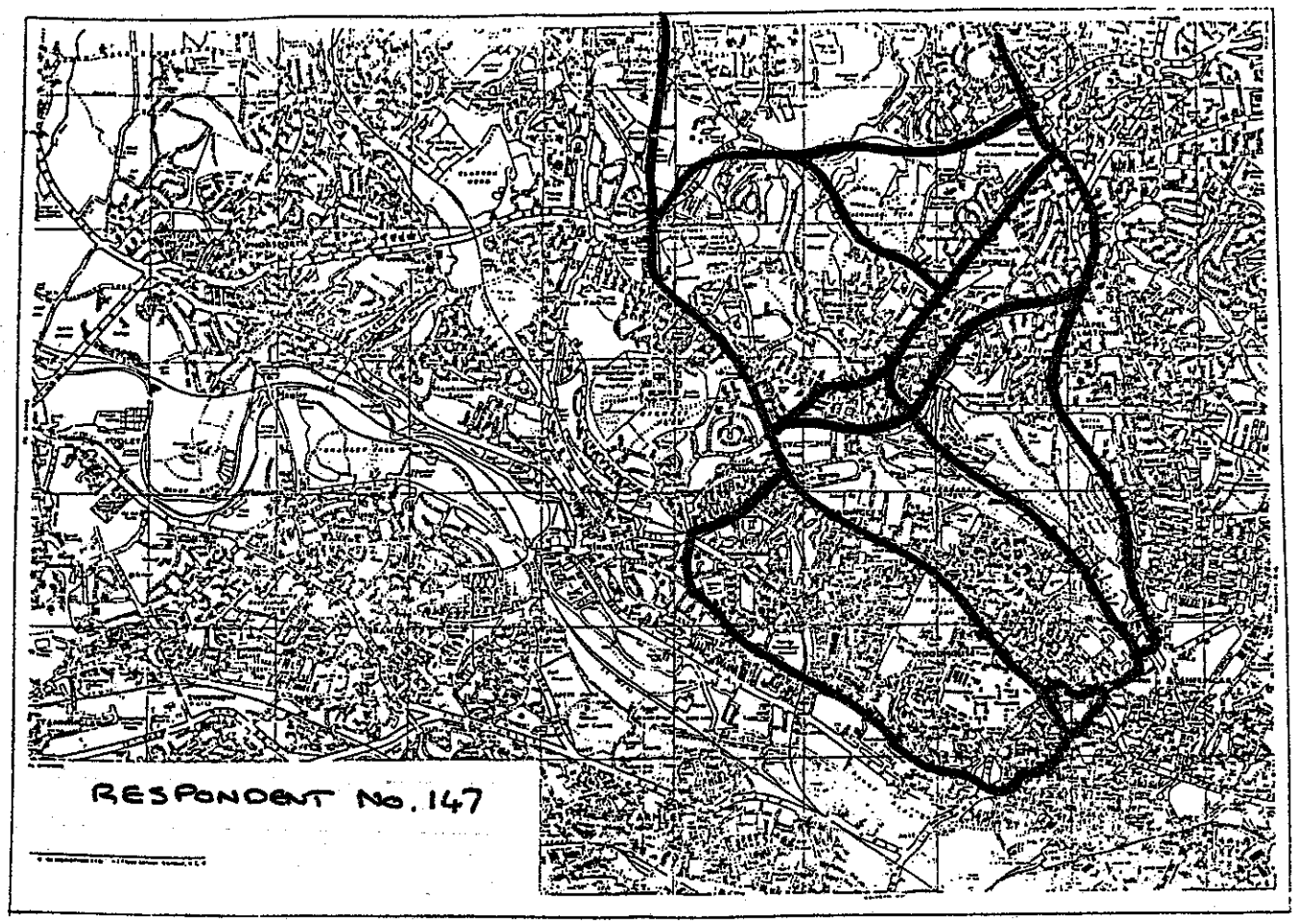




FIGURE 4.3 (CONT.)



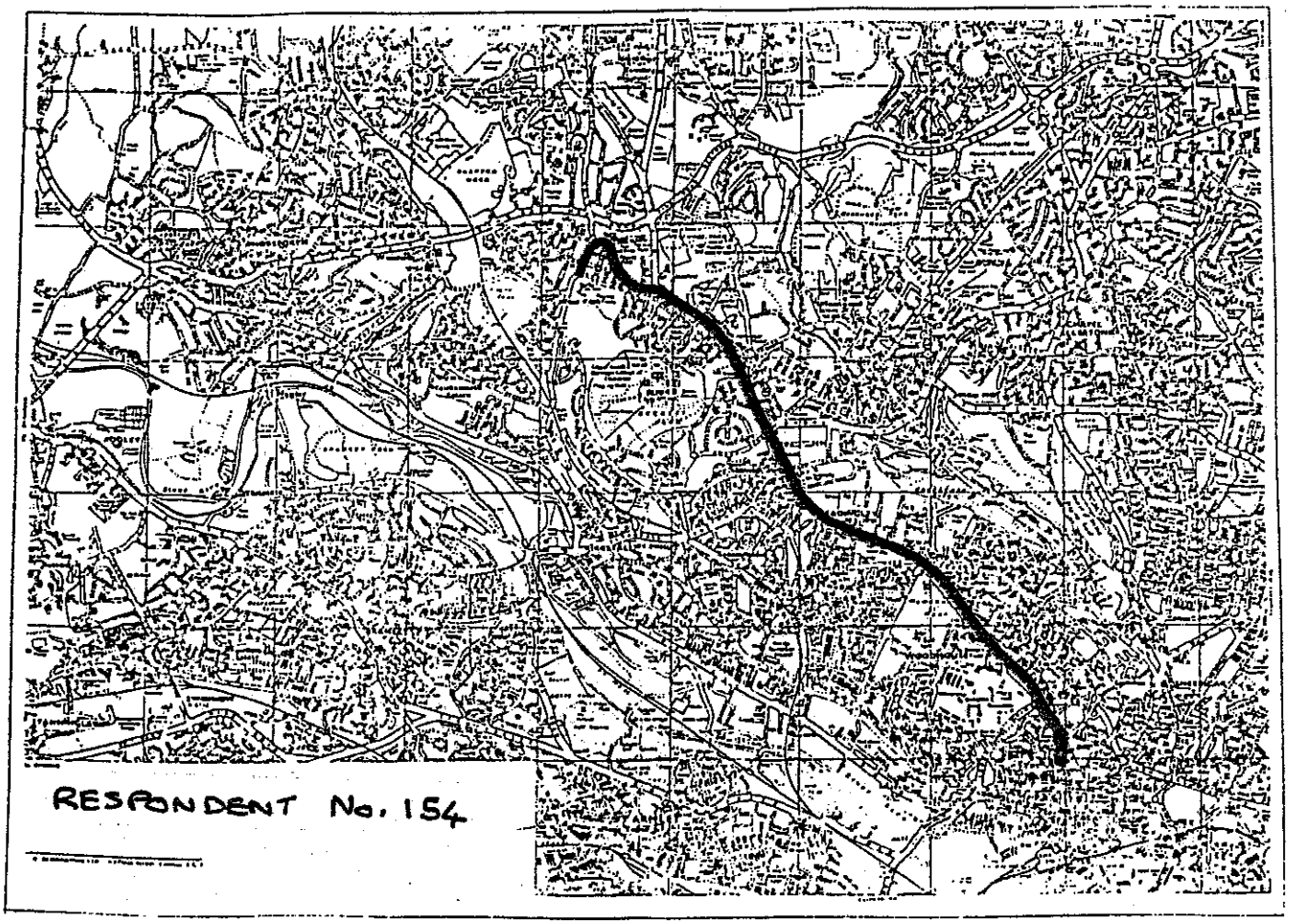
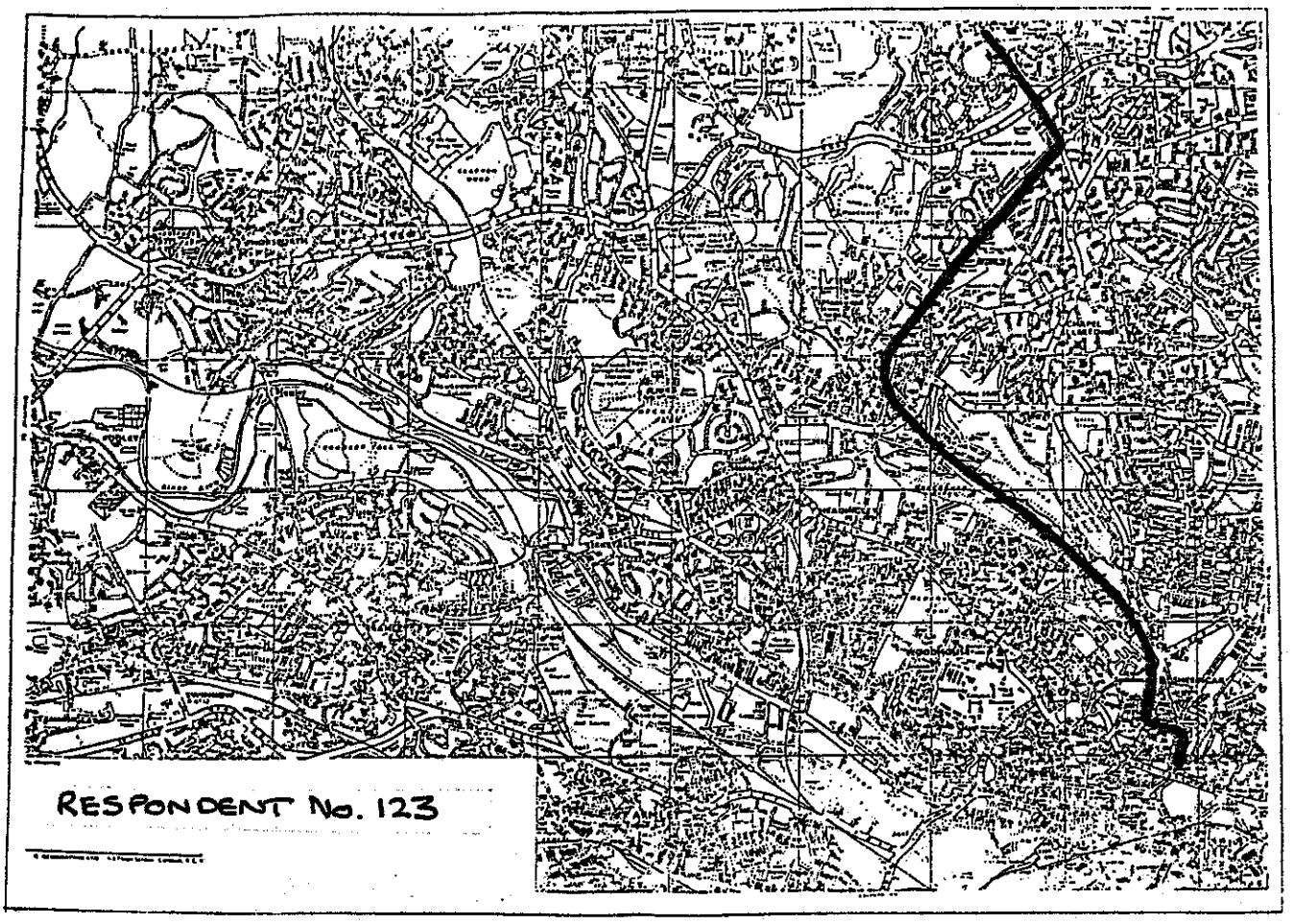




FIGURE 4.3 (CONT)



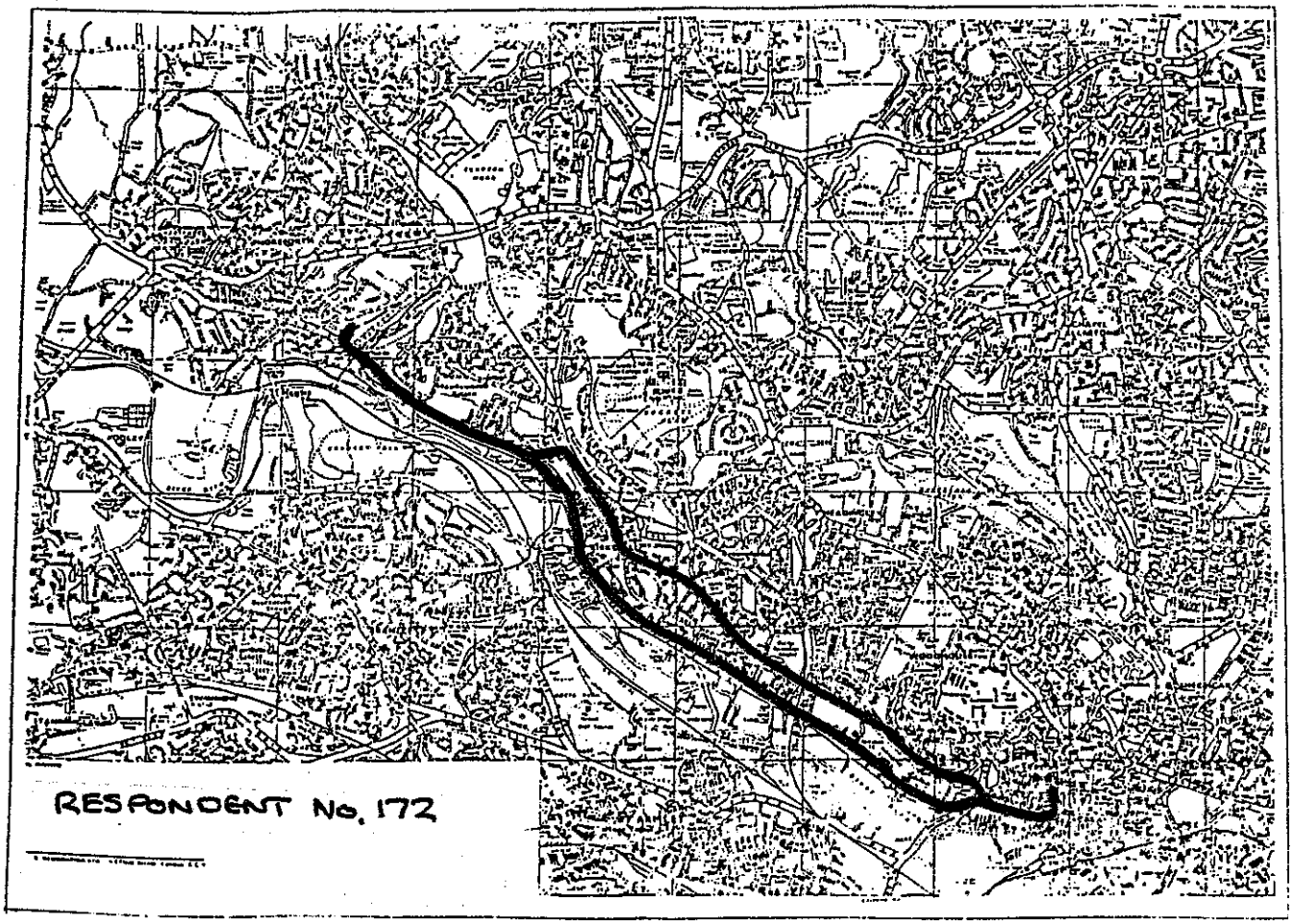




FIGURE 4.3 (CONT.)

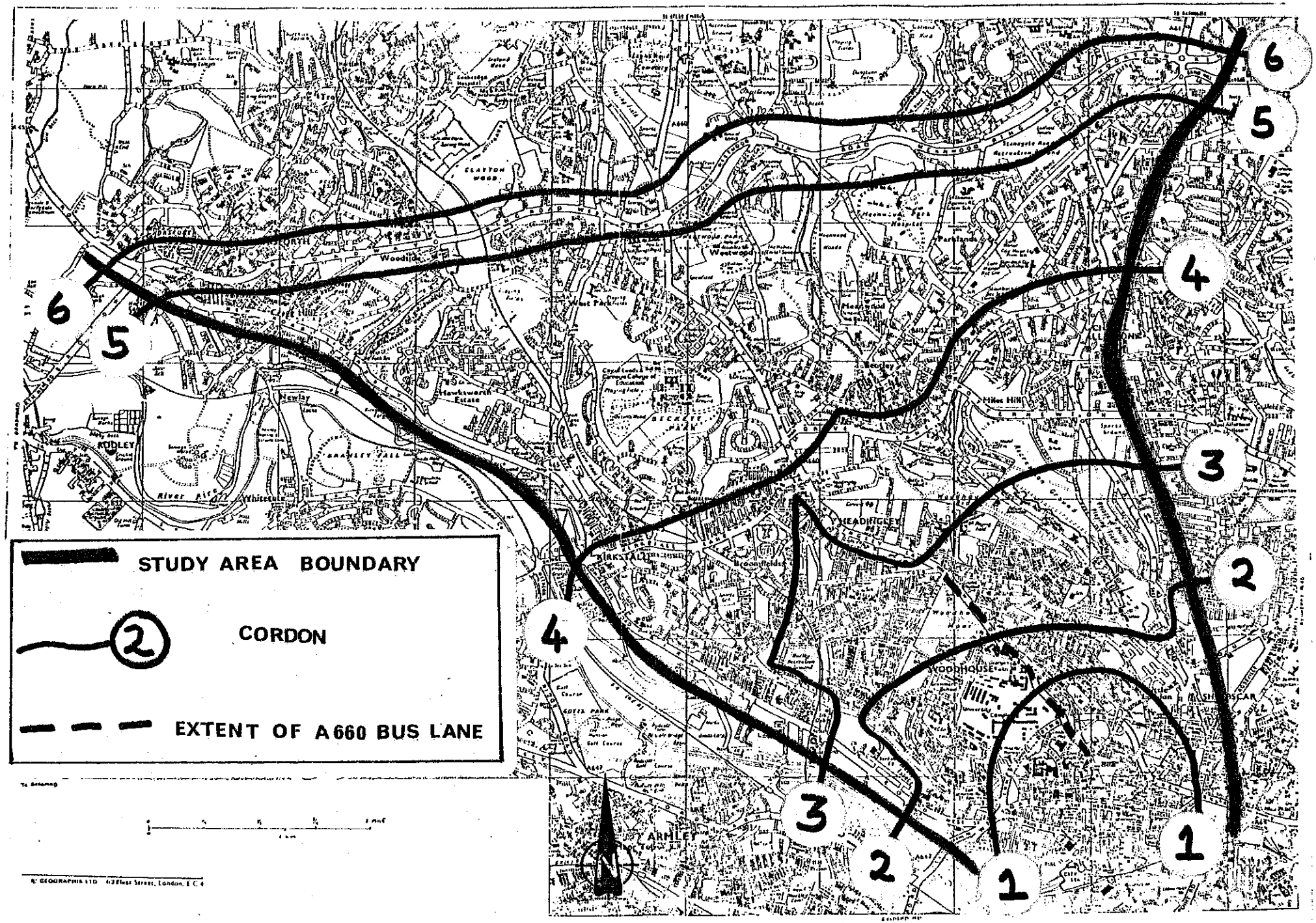



FIGURE 4.4 CORDONS USED IN ANALYSIS OF DAILY QUESTIONNAIRES

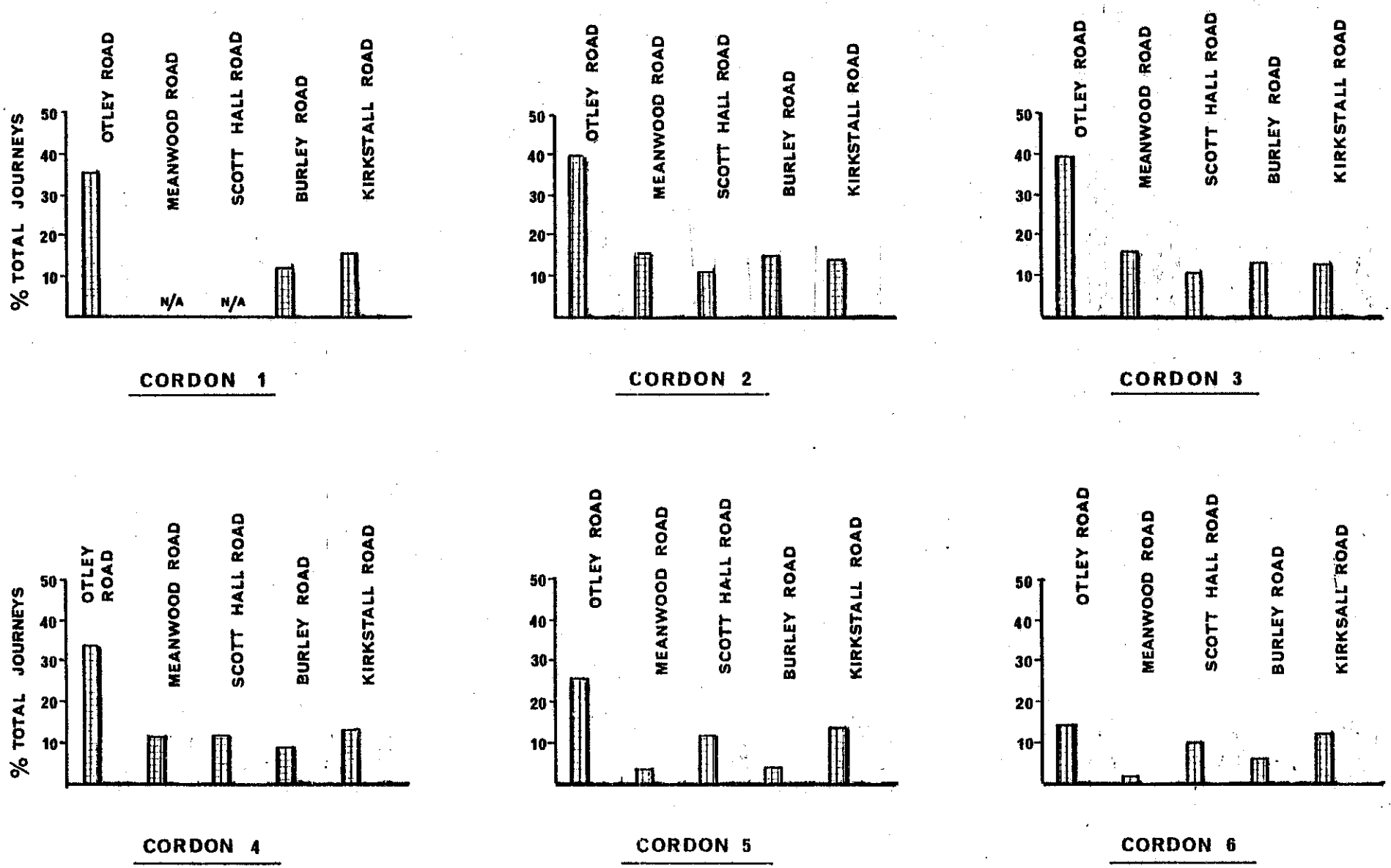



FIGURE 4.5 PROPORTION OF TOTAL JOURNEYS CROSSING EACH CORDON ON THE MAJOR ROADS.

| Proportion of respondents who used the same route on | |
|---|---|
| All six days | 53.0 |
| At least 5 days | 76.0 |
| At least 4 days | 89.5 |
| At least 3 days | 98.0 |
| At least 2 days | 99.0 |

Table 4.5 Frequency of Use of Same Route

The table shows that the great majority of respondents were fairly settled in their choice of route, using exactly the same route for at least 4 of the six days surveyed.

4.2.3 Table 4.6 is drawn from a detailed analysis of the maps produced by respondents. It shows that less than 10% of the panel members used more than 3 distinct routes during the six day period*. However, about one-fifth of respondents made minor variations in route, particularly in crossing either of the outer two cordons (i.e. at the outer ring road or beyond) or at cordon 1 (i.e. the Inner Ring Road).

| No. of Distinct Routes Use | % total respondents |
|---|---|
| 1 | 53.0 |
| 2 | 39.7 |
| 3 or more | 7.3 |
| Minor variations made by respondents using 1 route | 9.4 |

Table 4.6 Number of Routes Used by Panel Members

4.2.4 Many reasons were given for changes in route from that usually taken (see Table 4.7) with the affects of congestion (including "perceived easiest route") and variations in work departure time being most important. Furthermore Table 4.8 shows that the majority of respondents chose their route before leaving their parking place and of those who did vary their route most made their choice before reaching the Inner Ring Road (cordon 1).

---

* A "distinct" route involves crossing two or more cordons at a different point. A "minor" route variation involves crossing only one cordon at a different point.

| Reason for Planned Deviation from Usual Route | % Respondents |
|---|---|
| Personal business/lifts | 17.4 |
| Perceived easiest route | 26.1 |
| Congestion on original route | 15.5 |
| Early/late start | 21.7 |
| Road works | 4.3 |
| Other | 4.3 |

Table 4.7 Main Reasons Given for Planned Change of Route

| Route Planned Before Leaving Parking Place | | If no, cordon following Route Change (% of respondents) | | | | | |
|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 |
| Yes | 97.1 | | | | | | |
| No | 2.9 | 50.7 | 20.0 | 6.6 | 6.7 | 16.0 | 0 |

Table 4.8 Route as Planned Before Leaving Parking Place

4.2.5 Despite traffic congestion being given as one of the main reasons for a change in route the majority of panel respondents found traffic conditions over the whole survey period either the same or better than expected. Daily variations suggest that traffic conditions were worse than expected on Tuesday and better than expected on Wednesday and Friday (see Table 4.9).

| Perceived Traffic Condition | | Daily | | | | |
|---|---|---|---|---|---|---|
| | Overall | Mon. | Tues. | Wed. | Thur. | Fri. |
| Much worse than expected | 1.0 | 0 | 3.1 | 0 | 3.7 | 0 |
| Worse than expected | 12.2 | 8.3 | 28.1 | 6.3 | 14.8 | 11.1 |
| Same as expected | 59.9 | 63.9 | 46.9 | 56.3 | 66.7 | 55.6 |
| Better than expected | 23.0 | 19.4 | 15.6 | 34.4 | 14.8 | 27.8 |
| Much better than expected | 4.6 | 8.3 | 6.3 | 3.1 | 0 | 5.6 |

Table 4.9 Perceived Traffic Conditions - Survey 1

ii) Survey 2 (November/December 1983)

4.2.6 This phase of the overall survey programme was undertaken after the first phase of the A660 bus lane was introduced (between Cookridge Street and Blackman Lane and after the Sheepscar intersection improvements were completed. Figure 4.6 shows the proportion of journeys using each of the major

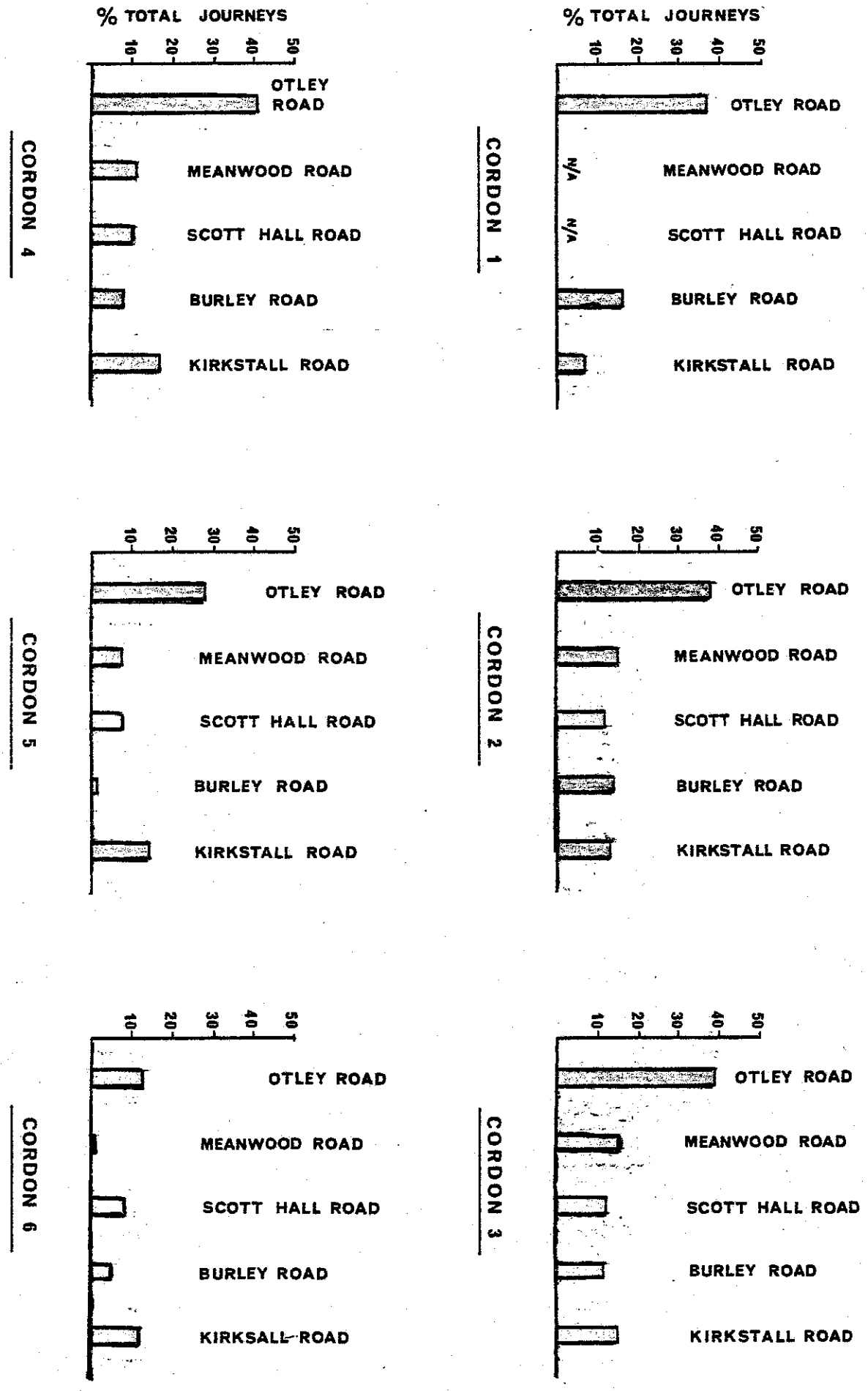



FIGURE 4.6. PROPORTION OF TOTAL JOURNEYS CROSSING EACH CORDON ON THE MAJOR ROADS.

routes through the six cordons and again indicates that the A660 Otley Road was the most frequently used route.

4.2.7 Table 4.10 shows how members of the panel varied their choice of route during the six day survey period.

| Proportion of respondents who used the same route on | |
|---|---|
| All six days | 53.0 |
| At least 5 days | 68.2 |
| At least 4 days | 69.7 |
| At least 3 days | 86.4 |
| At least 2 days | 97.0 |

Table 4.10 Frequency of Use of Same Route, Second Survey

4.2.8 Although over 50% of respondents used the same route on all six days, there was greater variation in use of route at the time of this survey and Table 4.11 shows that over 10% of respondents used 3 or more distinct routes at the time of this survey, with a similarly large proportion making minor changes to their route.

| Number of District Routes Used | % Total Respondents |
|---|---|
| 1 | 53.3 |
| 2 | 34.9 |
| 3 or more | 12.1 |
| Minor variations made by respondents using 1 route | 12.4 |

Table 4.11 Number of Routes Used by Panel Members

4.2.9 A detailed analysis of reasons given for change of route indicates that most changes were made in response to congestion on the original routes or the effects of the bus lane (Table 4.12) and Table 4.13 indicates that the majority of respondents chose their route before leaving their parking place and again the majority of respondents made any changes by the time of reaching the second cordon.

| Reason for Planned Deviation from Usual Route | % of Respondents |
|---|---|
| Personal business/lifts | 12.3 |
| Perceived easiest route | 10.0 |
| Congestion on original route | 55.0 |
| Effects of bus lane | 20.0 |
| Other | 2.7 |

Table 4.12 Main Reasons Given for Planned Change of Route

| Route Planned Before Leaving Parking Place | | If no, cordon following Route Change (% of 'no's) | | | | | |
|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 |
| Yes | 95.6 | | | | | | |
| No | 4.4 | 60.0 | 33.3 | 0 | 6.7 | 0 | 0 |

Table 4.13 Route as Planned Before Leaving Parking Place

4.2.10 The importance of congestion at the time of the second survey is also reflected in respondents perception of traffic conditions (Table 4.14) which shows that over 15% of respondents considered conditions to be worse than expected, with all days except Friday being considered poor. However the vast majority of panel members considered traffic conditions to be the same as expected.

| Perceived Traffic Conditions | Daily | | | | | |
|---|---|---|---|---|---|---|
| | Overall | Mon. | Tues. | Wed. | Thur. | Fri. |
| Much worse than expected | 2.7 | 0 | 7.7 | 3.2 | 0 | 0 |
| Worse than expected | 12.6 | 19.4 | 7.7 | 11.7 | 20.0 | 6.5 |
| Same as expected | 69.9 | 71.0 | 69.2 | 69.0 | 70.0 | 74.2 |
| Better than expected | 13.2 | 9.7 | 11.5 | 14.5 | 6.7 | 19.4 |
| Much better than expected | 1.6 | 0 | 3.9 | 1.6 | 3.3 | 0 |

Table 4.14 Perceived Traffic Conditions - Survey 2

iii) Survey 3 (February 1984)

4.2.11 This survey of panel members' route choice was undertaken after the introduction of the second phase of the A660 bus lane was introduced between Blackman Lane and Clarendon Road. Figure 4.7 shows the proportion of journeys using each of the major routes through the six cordons and Table 4.15 shows how members of the panel varied their choice of route during the six day survey period.

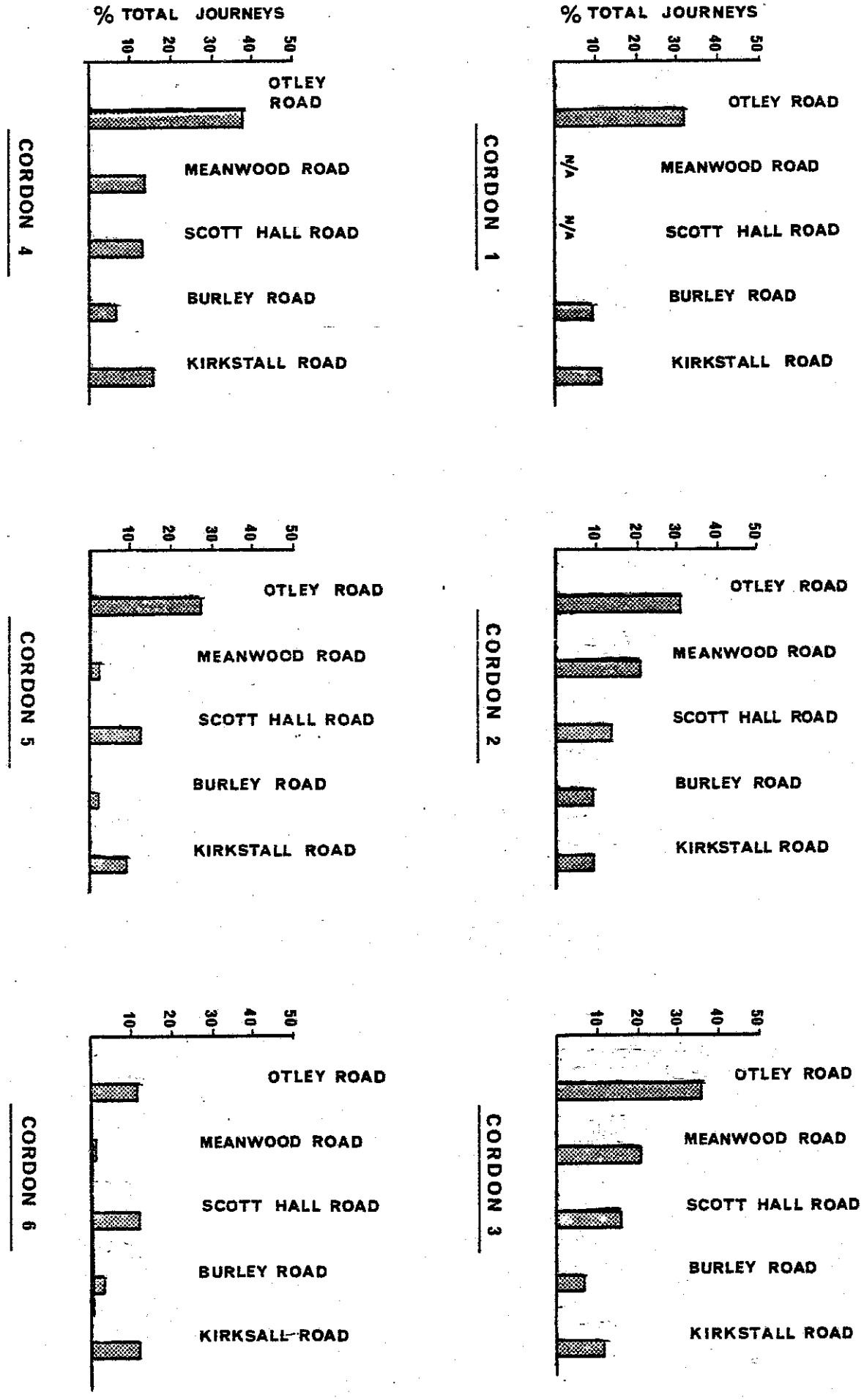



FIGURE 4.7. PROPORTION OF TOTAL JOURNEYS CROSSING EACH CORDON ON THE MAJOR ROADS.

| Proportion of respondents who used the same route on | |
|---|---|
| All six days | 62.0 |
| At least 5 days | 71.9 |
| At least 4 days | 96.5 |
| At least 3 days | 98.4 |
| At least 2 days | 100.0 |

Table 4.15 Frequency of Use of Same Route

4.2.12 The table shows that respondents in this survey were more stable in their choice of route than in either of the previous surveys and that nearly all respondents (96.5%) claimed to use the same route on at least 4 out of the 6 days. Table 4.16 also indicates this stability in that over 90% of respondents used two or less distinct routes during the six days. Similarly only a small proportion of respondents recorded making minor changes to their route. The possibility of bias in these responses is considered in Chapter 7.

| Number of District Routes Used | % Total Respondents |
|---|---|
| 1 | 62.0 |
| 2 | 30.1 |
| 3 or more | 7.9 |
| Minor variations made | 6.7 |

Table 4.16 Number of Routes Used by Panel Members

4.2.13 Nearly all the changes in route which occured at the time of this survey were as a direct result of congestion, the effects of the bus lane or related issues (see Table 4.17). Table 4.18 indicates that the majority of respondents chose their route before leaving their parking place and again the majority of changes were made before reaching the Inner Ring Road (Cordon 1).

| Reason for Planned Deviation from Usual Route | % Respondents |
|---|---|
| Personal business/lifts | 11.7 |
| Perceived easiest route | 35.3 |
| Congestion on original route | 11.8 |
| Effects of bus lane | 23.5 |
| Long traffic queues day before | 11.3 |
| Early/late start | 4.4 |
| Other | 2.0 |

Table 4.17 Main Reasons Given for Planned Chnge of Route

| Route Planned Before Leaving Parking Place | | If no, cordon following Route Change (% of 'no's) | | | | | |
|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 |
| Yes | 96.2 | 80.0 | 13.3 | 0 | 6.7 | 0 | 0 |
| No | 3.8 | | | | | | |

Table 4.18 Route as Planned Before Leaving Parking Place

4.2.14 Despite congestion being quoted as the main reason for any route change the majority of respondents indicated that traffic conditions were usually the same as or better than expected with only Monday and Tuesday showing problems (Table 4.19).

| Perceived Traffic Conditions | Daily | | | | | |
|---|---|---|---|---|---|---|
| | Overall | Mon. | Tues. | Wed. | Thur. | Fri. |
| Much worse than expected | 2.2 | 3.0 | 10.3 | 0 | 0 | 0 |
| Worse than expected | 10.3 | 15.2 | 13.8 | 6.5 | 12.1 | 12.9 |
| Same as expected | 69.0 | 60.6 | 69.0 | 74.2 | 72.7 | 67.7 |
| Better than expected | 16.8 | 21.2 | 6.9 | 16.1 | 12.1 | 16.1 |
| Much better than expected | 1.6 | 0 | 0 | 3.2 | 3.0 | 3.2 |

Table 4.19 Perceived Traffic Conditions - Survey 3

## 4.3 Panel Members Who Replied to All Three Surveys

4.3.1 A total of 38 respondents out of the initial sample of 131 (29%) replied to all three surveys. This section of the analysis is based on their replies only.

### i) Route Choice Between Surveys

4.3.2 Table 4.20 shows the most frequently used routes in each of the three surveys.

| Route | Proportion of Total Journeys Using Named Routes | | |
|---|---|---|---|
| | Survey 1 | Survey 2 | Survey 3 |
| Otley Rd. | 35.2 | 31.7 | 31.9 |
| Meanwood Rd. | 11.2 | 10.5 | 11.7 |
| Scott Hall Rd. | 8.1 | 8.9 | 8.2 |
| Burley Rd. | 6.0 | 8.2 | 5.7 |
| Kirkstall Rd. | 15.5 | 15.1 | 14.9 |

Table 4.20 Total Journeys On Most Frequently Used Routes

4.3.3 The table shows that a higher proportion of respondents in this group initially used Otley Road and Kirkstall Road when compared to the total data. The table again shows a decline in the use of Otley Road.

4.3.4 There has been little change in the use of Meanwood Road and Scott Hall Road; following an increase on the use of Burley Road at the time of the second survey usage had again decreased by February 1984.

4.3.5 A detailed analysis of the number of plotted journeys crossing each cordon again revealed a drop in the number of trips made along Otley Road. This, however, has not been matched by a similar increase on any other road. A possible explanation for this is an increase in "rat-running" around the Otley Road corridor, particularly before cordon 3 which marks the limit of the bus lane. The number of journeys crossing each cordon by specific routes is illustrated in Figure 4.8.

ii) Route Stability

4.3.6 Table 4.21 shows how often respondents in this category varied their choice of route during each of the three surveys.

| Proportion of Respondents Who Used the Same Route on | Survey 1 | Survey 2 | Survey 3 |
|---|---|---|---|
| All six days | 54.7 | 55.2 | 65.7 |
| At least 5 days | 83.9 | 81.9 | 88.3 |
| At least 4 days | 92.1 | 89.4 | 95.4 |
| At least 3 days | 97.8 | 98.5 | 99.3 |
| At least 2 days | 99.0 | 100.0 | 100.0 |

Table 4.21 Frequency of Use of Same Route - Respondents to All Three Surveys

4.3.7 The table shows that the majority of respondents used the same route on at least 5 days of the six surveyed. Again the second survey shows a greater degree of unstability than the other two, but the table shows that those respondents who replied to all three surveys were more settled in their choice of route than panel members in general.

iii) General Factors Influencing Route Choice

4.3.8 Several reasons were given for changes in route from that usually taken (Table 4.22). The most important were traffic congestion on the usual route (particularly important at the time of the second survey), variation on the time of leaving work and the effect of the bus lane.

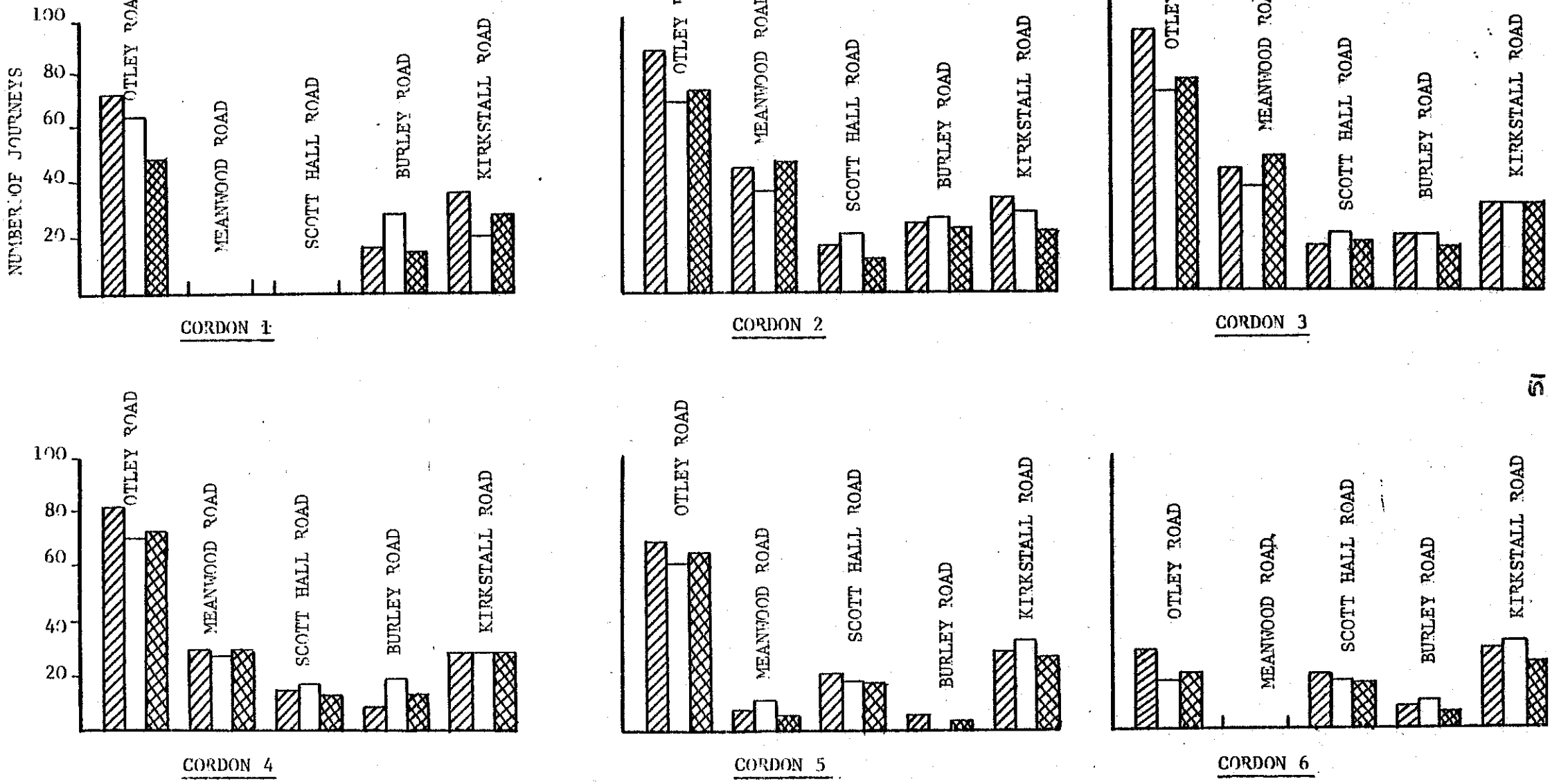



FIGURE 4.8 NUMBER OF JOURNEYS CROSSING EACH CORDON ON MAJOR ROUTES

| Reason for Planned Deviation from Usual Route | % of Respondents Quoting Main Reason As: Survey 1 | Survey 2 | Survey 3 |
|---|---|---|---|
| Lifts | 20.0 | 10.0 | 5.0 |
| Assumed easiest route | 10.0 | 0 | 29.0 |
| Previous traffic congestion on usual route | 10.0 | 60.0 | 14.0 |
| Effects of bus lane | 0 | 20.0 | 10.0 |
| Late or early departure from work | 30.0 | 0 | 14.0 |
| Social/Personal business | 7.4 | 6.3 | 17.3 |
| Other | 2.6 | 3.7 | 10.7 |

Table 4.22 Stated Reasons for Planned Change in Route

4.3.9 Table 4.23 shows that the majority of the respondents in this sub-group chose their route before leaving their parking place, and that (with the exception of the first survey) if any unplanned change was made it usually occurred before Cordon 2.

| Survey | Route Planned Before Leaving Parking Place: Yes | No | If NO Cordon Following Route Change (% No's): 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|---|
| 1 | 95.9 | 4.1 | 44.3 | 22.2 | 0 | 0 | 33.5 | 0 |
| 2 | 94.6 | 5.4 | 40.0 | 50.0 | 0 | 10.0 | 0 | 0 |
| 3 | 96.7 | 3.3 | 66.7 | 16.7 | 16.6 | 0 | 0 | 0 |

Table 4.23 Percentage of Person Trips for Which Route as Planned Before Leaving Car Park

## 4.4 Results of the In-Depth Interviews

4.4.1 A total of 4 in-depth interviews were completed in January and February 1984 - Fruther interviews were planned but resource constraints and a high level of unwillingness of panel members to respond (15 were contacted in order to obtain the four respondents) precluded further work in this area.

4.4.2 The interviews did show that the route used most frequently was chosen after investigating many alternatives and that journmey time was a major factor in choosing the final route. Those who had been driving regularly along the same route were able to predict journey time accurately and claimed to arrive at work within $\pm$ 5 minutes each day.

4.4.3 All respondents chose routes specifically to avoid

congestion with the main aim being to keep moving - time spent stationary in queues was regarded as wasted time.

4.4.4 In general respondents regarded short cuts unfavourably - not, in general, for environmental reasons but because of the difficulty in re-joining the main traffic stream.

4.5 Results of Panel Survey Compared to Other Survey Results

4.5.1 It is possible to compare two aspects of the panel survey results with data collected in other surveys, i.e.:

i) The overall change in the use of the main routes can be compared with the automatic traffic count analysis described in Chapter 3; and

ii) The stability of use of routes by the panel can be compared with the results of a registration number matching survey carried out in 983 by the Institute for Transport Studies (1).

4.5.2 The decrease in the use of the A660 by members of the panel at Cordon 2 is about the same as that indicated by the analysis of an automatic traffic count at that location although the increase in the use of Meanwood Road and Scott Hall Road is much less than that indicated by the automatic traffic counts. (This is not unexpected since the new Sheepscar intersection will have attracted trips from other radials as well as from the A660.)

4.5.3 When comparing the survey with the matched registration plate survey the panel would appear to be more stable, both in its choice of route and in journey start time than the population as a whole.

4.6 Summary

4.6.1 The analysis of panelist's reported daily journey start times indicates that there hs been little variation in this factor over the period of the three surveys, although the automatic traffic counts do indicate that there has been some flattening of the peak.

4.6.2 The route choice surveys show a decrease in the use of Otley Road and an increase in the use of Meanwood Road/Scott Hall Road, i.e. away from the road affected by the bus lane towards the improved junction of Sheepscar.

4.6.3 Respondents' choice of route hs stabilised following a period of uncertainty at the time of the second survey, i.e. following the introduction of the A660 bus lane.

4.6.4 Some rat-running around the Otley Road corridor to avoid the bus lane is indicated by the time of the second and third survey.

4.6.5 The results of the panel survey suggest, that when compared to other survey results, those respondents who replied to all three surveys were more stable in their choice of route and journy times than average.

References

1. Bonsall, P., C. Jones and F. Montgomery. Deriving the constancy of traffic flow composition from vehicle registration data. TEC 1984.

CHAPTER 5

# 5. INFLUENCES ON ROUTE CHOICE

## 5.1 Introduction

5.1.1 The analysis in this section is based on those panel members who answered all three surveys.

5.1.2 The main aim of this chapter is to determine the factors which respondents considered important in their choice or route and also to investigate the differences in route choice between respondents with similar origins and destinations.

## 5.2 Factors Influencing Route Choice

5.2.1 In order to determine the factors which caused drivers to a) choose a particular route or b) vary their route after starting out, respondents were sked to list the factors influencing their choice of route on that particular day and, if the chosen route was not that normally used, to state why that particular route was used.

5.2.2 Table 4.22 gives the main reasons for pre-planned changes in route and show that factors consistent through the three surveys were personal business or giving lifts and the avoidance of traffic congestion on the usual route. The introduction of the A660 bus lane also affected many peoples' choice of route. An analysis of the reasons given for changes in route en route revealed that across all three surveys over 90% of such changes were due to congestion on the original route. The only other factor of importance occurred when drivers got into the wrong traffic lane at junctions (4.7%, 2.3% and 6.1% of responses respectively in the three surveys) (Table 5.1).

5.2.3 In the following sections the influences of each of these stated reasons for variation in route choice will be discussed together with an analysis of the effect of congestion.

| Reason for Changes En Route | % Respondents Who Changed Route Survey 1 | Survey 2 | Survey 3 |
|---|---|---|---|
| Avoid congestion | 92.7 | 80.3 | 77.6 |
| Avoid bus lane | - | 15.7 | 14.3 |
| Wrong lane at junction | 4.7 | 2.3 | 6.1 |
| Personal business | 2.3 | 1.6 | 1.6 |
| Lifts | 0.3 | 0.1 | 0.4 |

Table 5.1 Stated Reasons for Change of Route After Departure

a) Route Variability and Giving Lifts

5.2.4 Table 5.2 shows that the frequency with which panel respondents claimed to give lifts has fluctuated throughout the three surveys with a noticeable drop in the proportion of respondents very regularly giving lifts (i.e. more than three times per week), particularly at the time of the second survey which took place in November 1983 following the introduction of the first phase of the bus lane. Since we see no reason to assume that this is a seasonal effect, it does seem to reflect a real decline in regular lift giving.

| Occasions of Giving Lifts | Survey 1 | Survey 2 | Survey 3 |
|---|---|---|---|
| Rarely | 34.2 | 43.1 | 34.9 |
| At least 1 per month | 65.8 | 56.9 | 65.1 |
| At least 1 per week | 54.0 | 45.8 | 53.9 |
| At least 3 per week | 39.5 | 27.7 | 31.7 |
| At least 5 per week | 25.0 | 18.0 | 19.0 |

Table 5.2 Frequency of Giving Lifts

5.2.8 A detailed analysis of inividual responses has shown that where lifts were given once per week or more, there was often only a minor* change in route involved. However when lifts were given less frequently there was more likely to be a major* change in route, although in the majority of cases giving lifts involved no change in route from that normally used - see Table 5.3. In nearly all cases the change in route caused by giving lifts was a planned change (over 94% in all surveys) i.e. the route used was chosen before leaving the parking place.

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* Minor route variation - crossing only 1 cordon at a different point on lift giving days.

Major route variation - crossing 2 or more cordons at different points on lift giving days.

| Survey | Of those giving lifts (one or more per week) % of trips involving | | | Of those giving lifts (less than one a week) % trips involving | | |
|---|---|---|---|---|---|---|
| | No Route Change | Minor Route Variation | Major Route Variation | No Route Change | Minor Route Variation | Major Route Variation |
| 1 (Apr./May '83) | 75 | 20 | 5 | 55 | 27 | 18 |
| 2 (Nov./Dec. 83) | 82 | 15 | 3 | 62 | 30 | 8 |
| 3 (Feb. '84) | 90 | 8 | 2 | 58 | 23 | 19 |

Note

Some further small variations in route were made towards the end of some journeys and were not identified by the cordon system of analysis.

Table 5.3 Planned Route Changes as a Result of Giving Lifts

b) Route Variability and Personal Business

5.2.6 Table 5.4 shows that about half our respondents stopped more than once a week on their journey home from work. Although the figure was somewhat higher in the second survey there is no obvious reason for this (a seasonality effect would tend to operate in the opposite direction).

| | % of Responses | | |
|---|---|---|---|
| | Survey 1 (Apr/May 83) | Survey 2 (Nov/Dec 83) | Survey 3 (Feb 84) |
| Rarely | 25.7 | 29.2 | 31.7 |
| At least 1 per month | 74.3 | 70.8 | 68.3 |
| At least 1 per week | 51.4 | 61.1 | 50.8 |
| At least 3 per week | 2.9 | 16.6 | 11.1 |
| At least 5 per week | 0 | 8.3 | 6.3 |

Table 5.4 Frequency of Stopping Off On Way Home

5.2.7 Although respondents were asked to mark on their daily route map any stops made between the origin and destination of the journey they were not specifically asked to give the reasons for these stops. However the reasons were often apparent from the answers to the question "Did anything other than traffic conditions affect your journey today?", and the most frequent stated reasons for stopping were:

| | |
|---|---|
| For petrol | 32% |
| Shopping | 27.6% |
| Visiting friends/relatives | 8.3% |
| Doctors/dentists visit | 7.5% |
| Social/recreational reasons | 3.2% |

5.2.8 Only in a very few instances did stopping for petrol or shopping involve a major change in route (less than 1% in each case) although in the case of shopping trips the change was usually related to a once-a-week visit to a large supermarket (usually Sainsburys in North Leeds). However the remaining reasons were often associated with a change in pre-planned route from that usually taken asillustrated in Table 5.5.

| Reason | Survey | % of drivers making each trip of route change who quoted each reason for change: Of those stopping for stated reason % making No Change | Minor Route Change | Major Route Change |
|---|---|---|---|---|
| Petrol | 1 | 99.2 | 0.7 | 0.1 |
| | 2 | 99.6 | 0.3 | 0.1 |
| | 3 | 99.3 | 0.6 | 0.1 |
| Shopping | 1 | 93.0 | 5.7 | 1.3 |
| | 2 | 95.1 | 3.2 | 1.7 |
| | 3 | 89.5 | 8.4 | 2.1 |
| Visiting Relatives | 1 | 39.8 | 23.1 | 37.1 |
| | 2 | 37.7 | 17.3 | 45.0 |
| | 3 | 31.1 | 27.9 | 41.0 |
| Doctor/ Dentist | 1 | 30.0 | 47.2 | 22.8 |
| | 2 | 30.4 | 53.1 | 16.5 |
| | 3 | 40.9 | 39.0 | 20.1 |
| Social Reasons | 1 | 50.9 | 32.0 | 17.1 |
| | 2 | 45.9 | 25.8 | 28.3 |
| | 3 | 49.1 | 22.7 | 28.2 |

Table 5.5 Planned Route Changes Caused by Stopping on Journey Home

5.2.9 Only in 5 instances during the three surveys was a need to stop associated with an unplanned change of route, and in all cases this was occasioned by an urgent need for petrol. Interestingly 3 of the cases (one on each survey) were attributable to 1 respondent.

c) Route Choice and Parking Place

5.2.10 The general analysis of the panel interviews suggested that where an en route decision to change route occurred, the final decision on choice of route was made by the time of reaching Cordon 1 (The Inner Ring Road) (see Table 4.23). Respondents were asked to record their reasons for any en route decision to change route and the most popular was congestion on the original route.

5.2.11 Earlier analysis has indicated that changes in parking location had little effect on preplanned route choice but it should be noted that people not parking in their usual place were more likely than others to modify their route after setting off. Tables 5.5 and 5.6 indicate that the majority of respondents parked in their usual parking places during each of the three survey periods and that when a parking place other than the usual one was used the most frequent reason for this was that the respondent was not at the usual place of work.

| Usual Parking Place | % of Respondents in Survey | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| Yes | 92.9 | 91.3 | 91.8 |
| No | 7.1 | 8.7 | 8.2 |

Table 5.5 Parking Location by Survey

| Stated Reasons for Not Being in Usual Place | % of Respondents Quoting the Reason in Survey | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| Usual place full | 7.1 | 12.5 | 18.8 |
| Not at usual place of work | 21.4 | 25.0 | 43.8 |
| Needed car during day | 14.3 | 18.8 | 12.5 |
| Nearer to work | 14.3 | 25.0 | 6.3 |
| Car used by other people in day | 14.3 | 6.3 | 0 |
| Cheaper parking | 0 | 0 | 12.5 |
| Other | 28.6 | 12.5 | 6.3 |

Table 5.6 Stated Reasons for Variation in Parking Place

5.2.12 Detailed analysis of the responses shows that in most cases a change in parking place was responsible for a minor change in route at the start of the journey, i.e. a different crossing point on Cordon 1 (the Inner Ring Road) as shown in Table 5.7.

| Survey | Usual Parking Place | | Of those NOT in usual place % crossing Cordon 1 at a different point than usual |
|---|---|---|---|
| | Yes | No | |
| 1 | 92.9 | 7.1 | 63.4 |
| 2 | 91.3 | 8.7 | 52.1 |
| 3 | 91.8 | 8.2 | 71.3 |

Table 5.7 Change in Crossing Point of Inner Ring Road Related to Parking Place

5.2.13 This minor change in route was particularly noticeable for those leaving Leeds via Sheepscar and the Meanwood Road/Scott Hall Road corridor as there are three distinct entry points to the Sheepscar intersection, namely North Street, Lovell Park Road and Clay Pit Lane.

5.2.14 Table 5.8 shows that being in a non-usual parking place was rarely associated with a major change in route.

| Survey | Usual Parking Place | | Of those NOT in usual place % crossing Cordon 1 at a different point than usual |
|---|---|---|---|
| | Yes | No | |
| 1 | 92.9 | 7.1 | 3.4 |
| 2 | 91.3 | 8.7 | 2.8 |
| 3 | 91.8 | 8.2 | 2.1 |

Table 5.8 Major Change in Route Related to Parking Place

d) Route Choice and Time of Leaving Work

5.2.15 Table 4.22 showed that, during the period of the first and third surveys a late or early departure from work was quoted as a main reason for a planned change in route by 30.0% and 14.0% respectively of respondents to all three surveys.

5.2.16 An analysis of the individual responses in this sample of panel members shows that there has been little variation in the time of starting a homeward journey either between surveys or on individual days. Over 85% finished work within $\pm$ 10 minutes of the mean time in each of the three surveys with the exception of Fridays. On Fridays over 35% of respondents finished work more than 25 minutes earlier than other weekdays.

5.2.17 The main reasons given for varying working finish times were, for each of the three surveys:

| | | |
|---|---|---|
| i) | Social or personal business arrangements | 43%<br>52%<br>47% |
| ii) | Work commitments | 38%<br>28%<br>35% |
| iii) | Giving lifts | 15%<br>10%<br>6% |

(NB: Respondents were not asked specific questions as to why they varied the time at which they left work except in answer to the question "Did anything other than traffic conditions affect your journey home today?" and "If so, what?" with left "work early/late due to ..." being prompted as a response.)

5.2.18 At the time of the second survey several respondents mentioned leaving work early or late in relation to traffic congestion. They were all regular users of the A660 and left work at a different time the day following a journey when traffic congestion was recorded as 'much worse than expected'. However there was no indication of a route change to avoid the congested parts of the journey.

5.2.19 Changes in departure time were not usually associated with any change in route. The exceptions to this are when the journey home occurred outside the normal range of finishing times when the chosen route was, when different from normal, stated to be the quickest at that time of day.

e) Perceived Traffic Conditions and Their Effect on Route Choice

5.2.20 Although the majority of respondents to the survey considered that traffic conditions were the same as, or better than, expected, the avoidance of congestion was the main reason given for changes in routes, either planned or unplanned.

5.2.21 In terms of a planned change in route this usully involved a major change from the previous day's route, particularly when avoiding congestion on the A660 as a result of the introduction of the bus lane (surveys 2 and 3) (27% of all route changes in survey 2, 16% in survey 3). At the time of the second survey many panel members, particularly those who were regular users of the A660 appeared to be experimenting with alternative routes in order to avoid the effects of the bus lane. One respondent however, who recorded congestion as far worse than expected and who also made specific adverse comments about the bus lane tried a route via Sheepscar once, returned to the A660 and recorded an improved journey time whilst still stating congestion as being worse than expected.

5.2.22 The second and third surveys also showed a marked

increase in the incidence of admitted rat-running around the A660 corridor, again the main reason given for these minor changes in route was the avoidance of congestion.

5.2.23 Table 5.9 shows how respondents who regularly used the A660 between the two ring roads perceived traffic conditions on that road.

| Survey | % of respondents who travelled regularly along the A660 perceived traffic conditions | | | | |
|---|---|---|---|---|---|
| | much worse | worse | same | better | much better |
| | than expected | | | | |
| 1 | 0.7 | 9.3 | 75.2 | 1.4 | 0.8 |
| 2 | 3.7 | 15.5 | 70.5 | 9.2 | 1.1 |
| 3 | 0.9 | 10.2 | 82.1 | 6.3 | 0.5 |

Table 5.9 Perceived Traffic Conditions on Otley Road

## 5.3 Analysis of Individual Responses

5.3.1 Figure 5.1 illustrates the routes used by a randomly selected sample of 9 panel members (23.6% of those who responded to all three surveys) and shows:

i) The number of routes used by respondents at the time of the first survey.

ii) Daily route variation during the second survey.

iii) The routes used on each of the three surveys.

5.3.2 The figure again confirms that the main reason stated for any change in route, particularly between surveys is the avoidance of congestion, particularly that seen as resulting from the introduction of the bus lane on the A660. Several respondents stated that the time of travel was particularly important as to whether they used Otley Road or not preferring to use the more drect route outside peak hours.

5.3.3 The figure also illustrates that some respondents increased their knowledge of the network during the course of the three surveys suggesting that the instability introduced as a result of the traffic management schemes caused drivers to look for alternative routes.

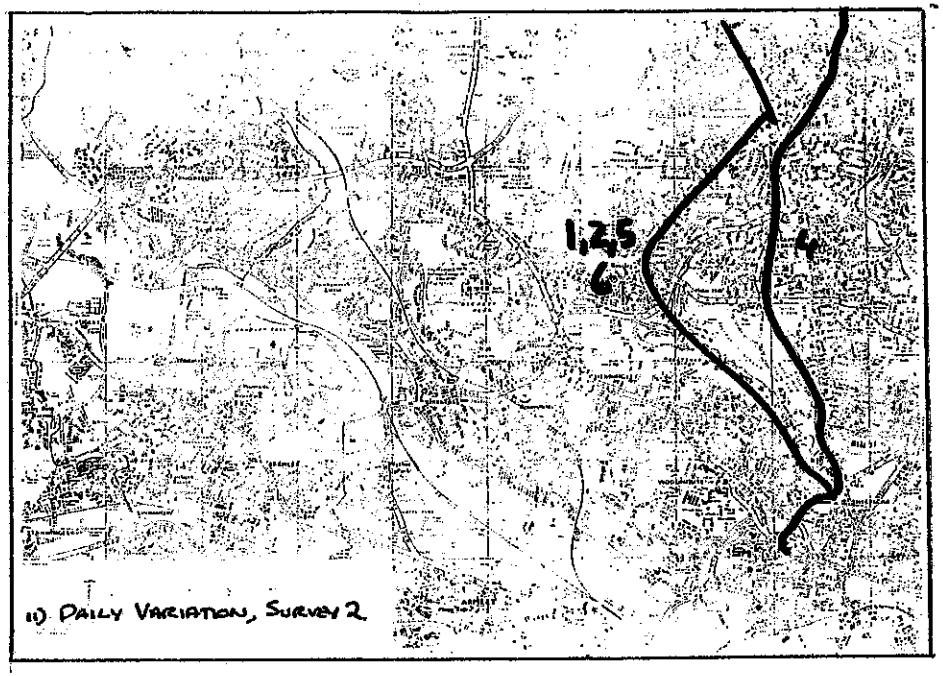
## 5.4 Route Choice and Traffic Management Schemes

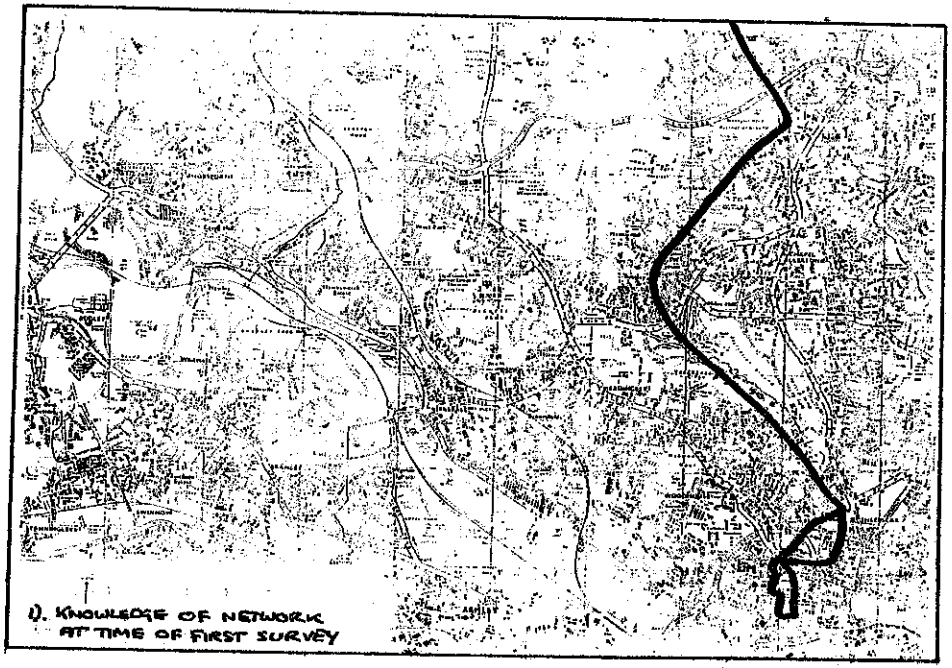
5.4.1 The two traffic management schemes introduced into the study area during the period of the three panel surveys (the outbound A660 bus lane and the improvements to the Sheepscar

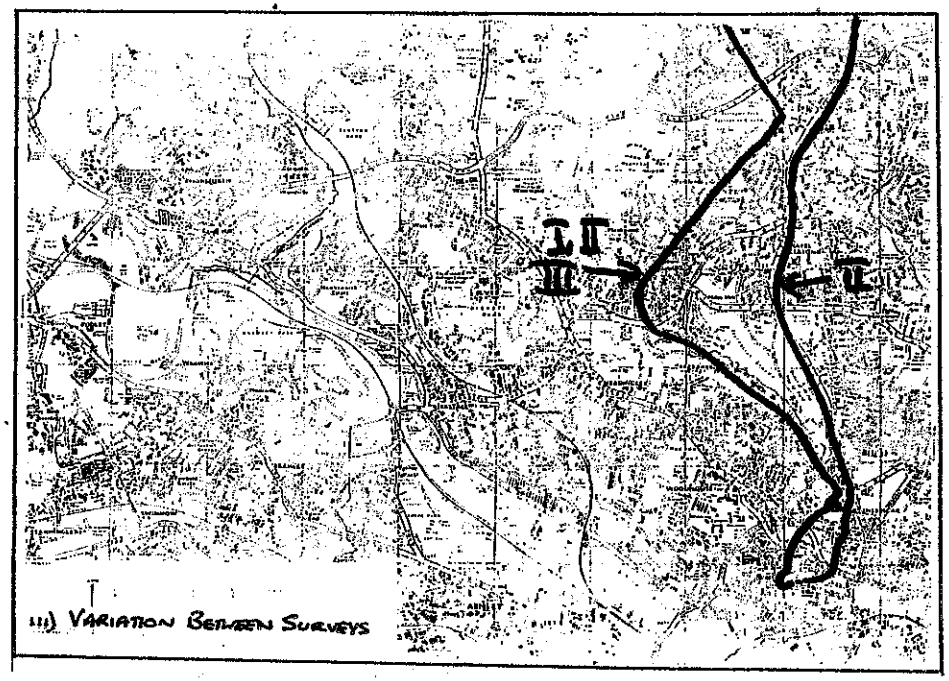
**FIGURE 5.1 ROUTE CHOICE FOR A SAMPLE OF PANEL MEMBERS**

RESPONDENT No. 103

NOTES : DAILY VARIATION – ONE DAY DID NOT TRAVEL
– GAVE LIFT ON DAY 4.

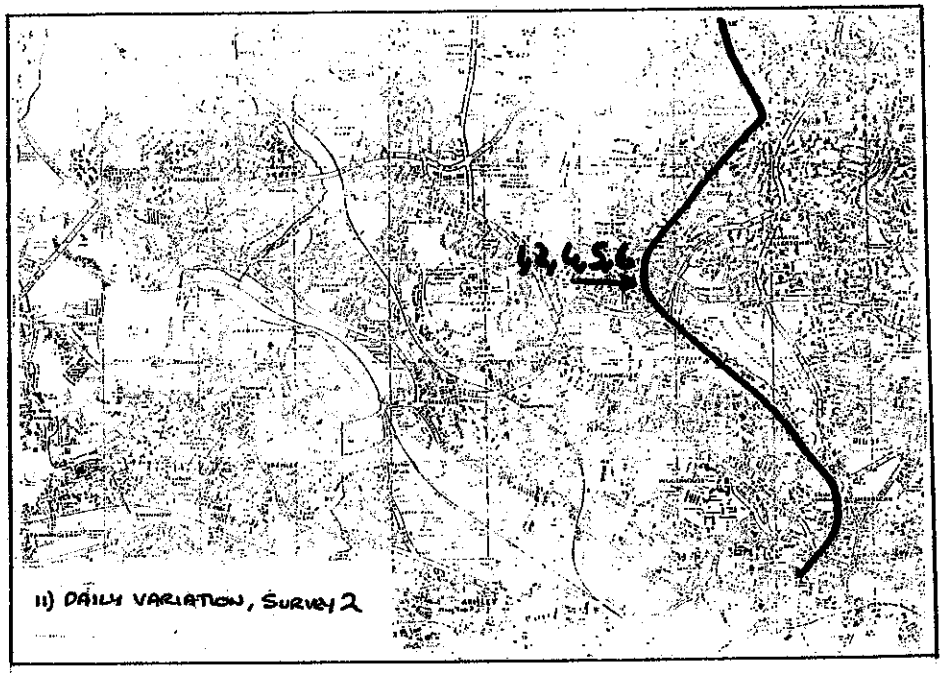


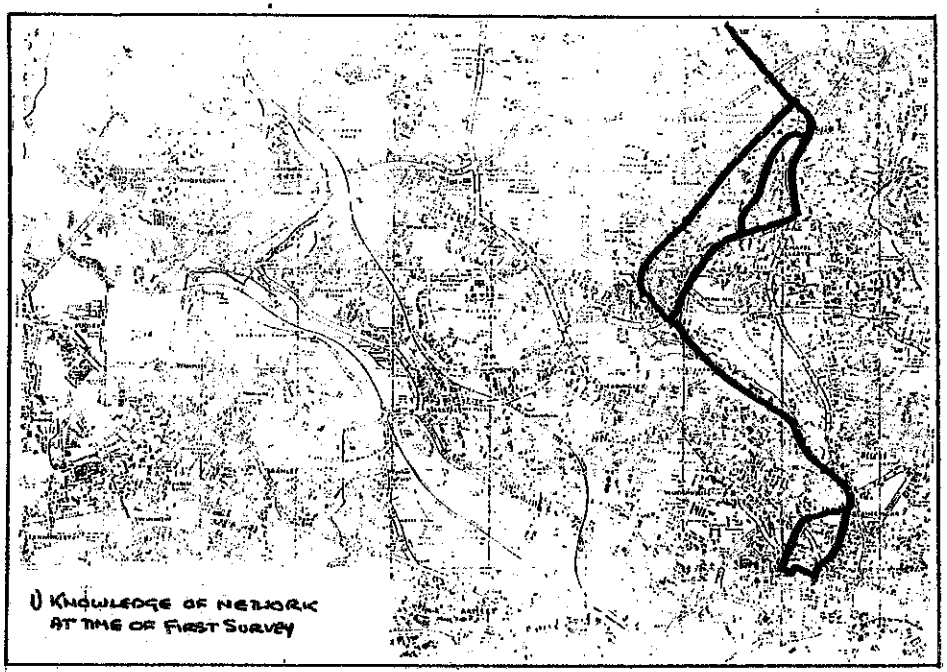



RESPONDENT No. 112

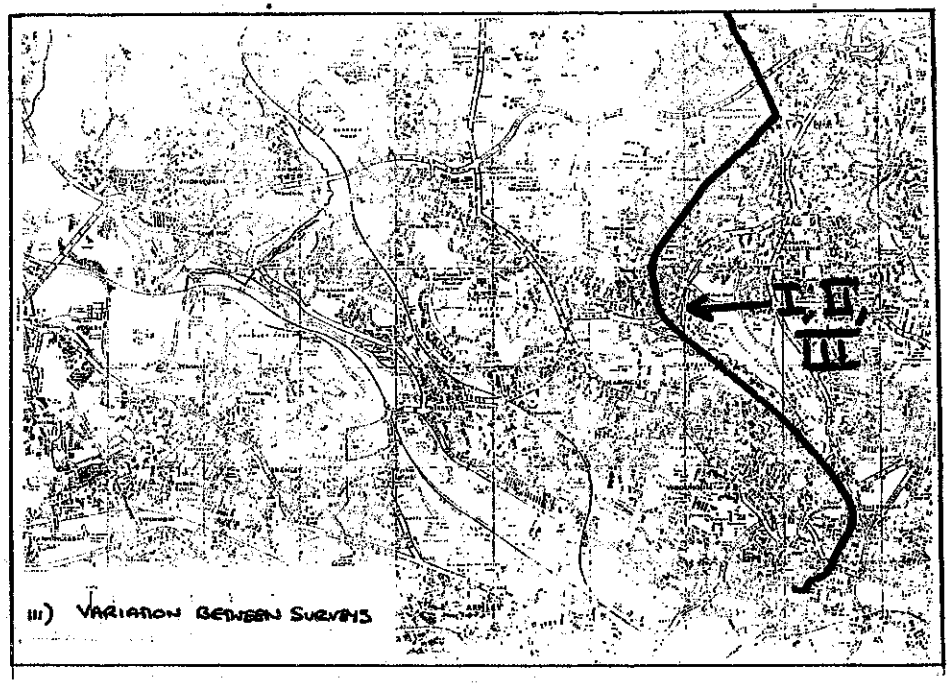
NOTES : SURVEY 2, ONE DAY MISSING DUE TO OUT-OF-TOWN BUSINESS.




ii) DAILY VARIATION, SURVEY 2



i) KNOWLEDGE OF NETWORK AT TIME OF FIRST SURVEY

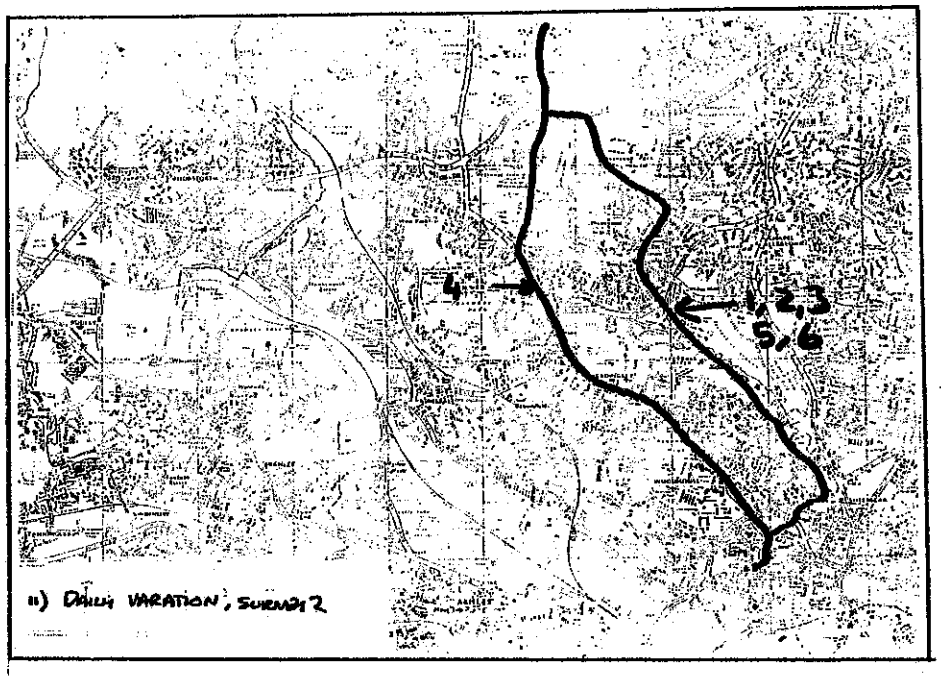


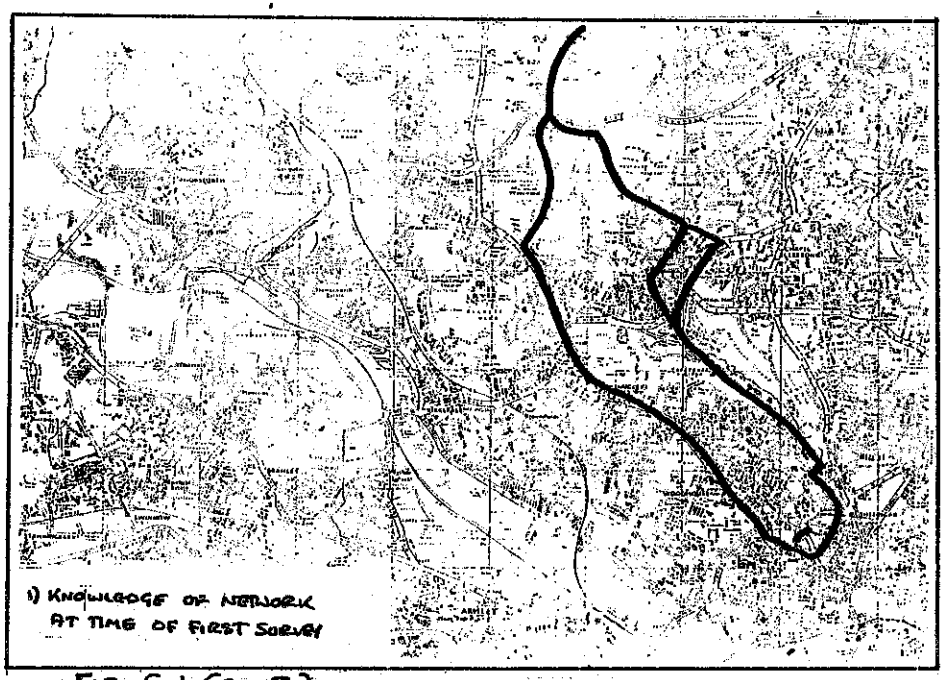

iii) VARIATION BETWEEN SURVEYS

FIG. 5.1 (CONT)

69

RESPONDENT No. 119



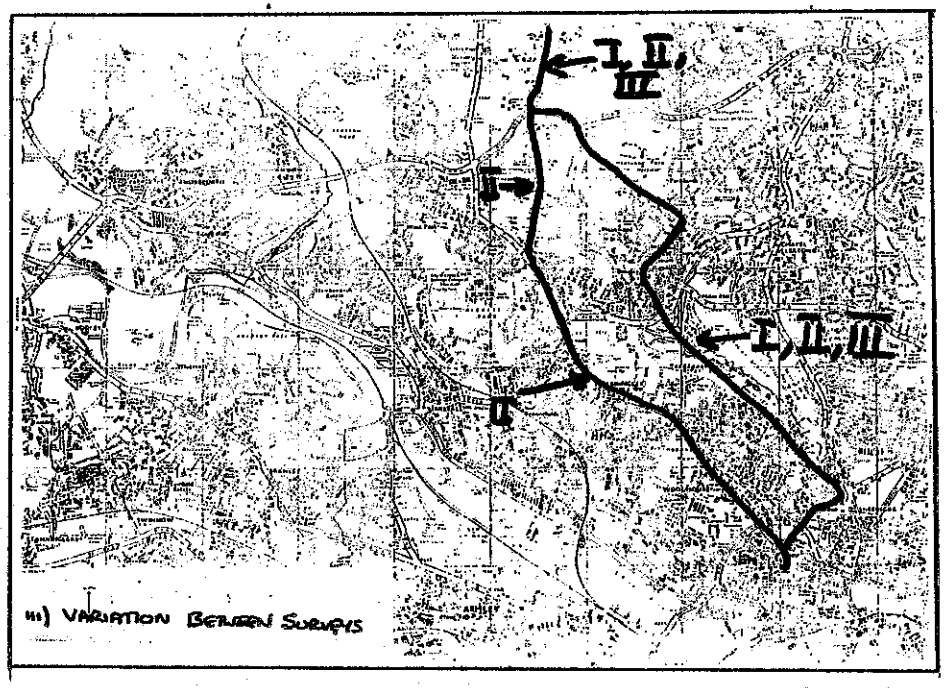
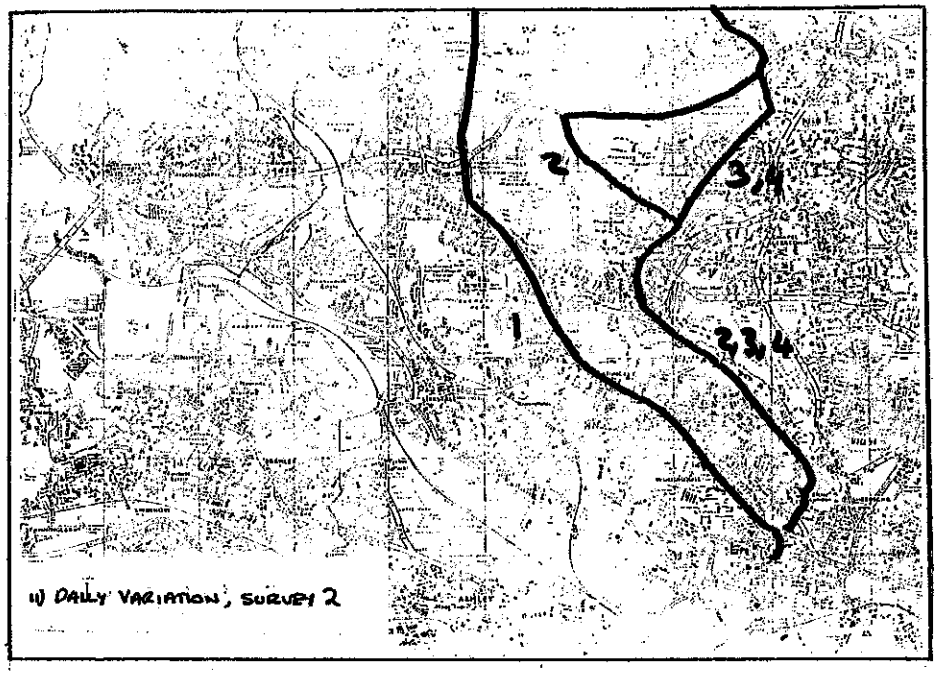



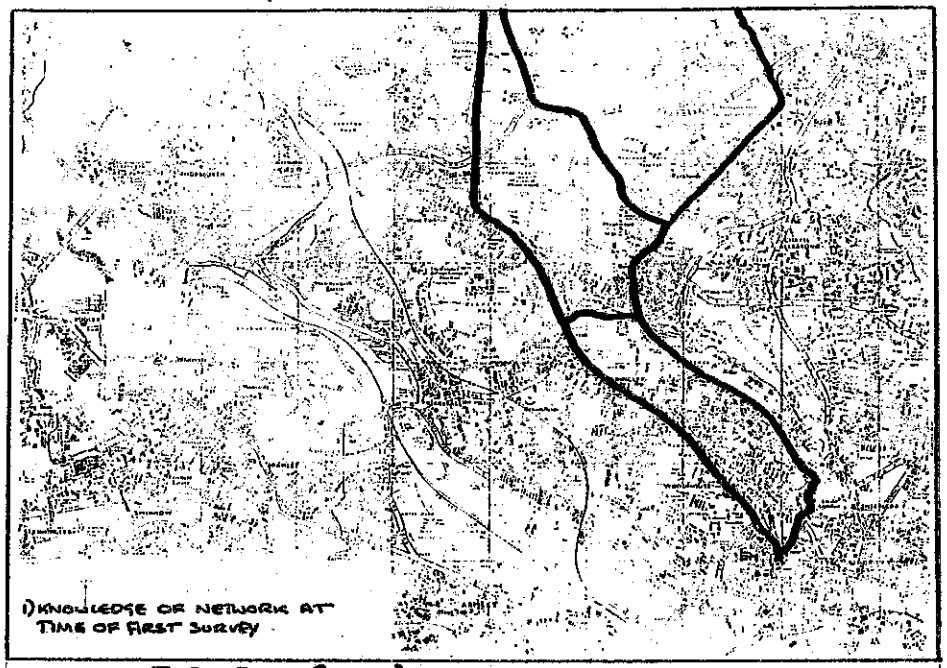

FIG. S.1 (CONT.)

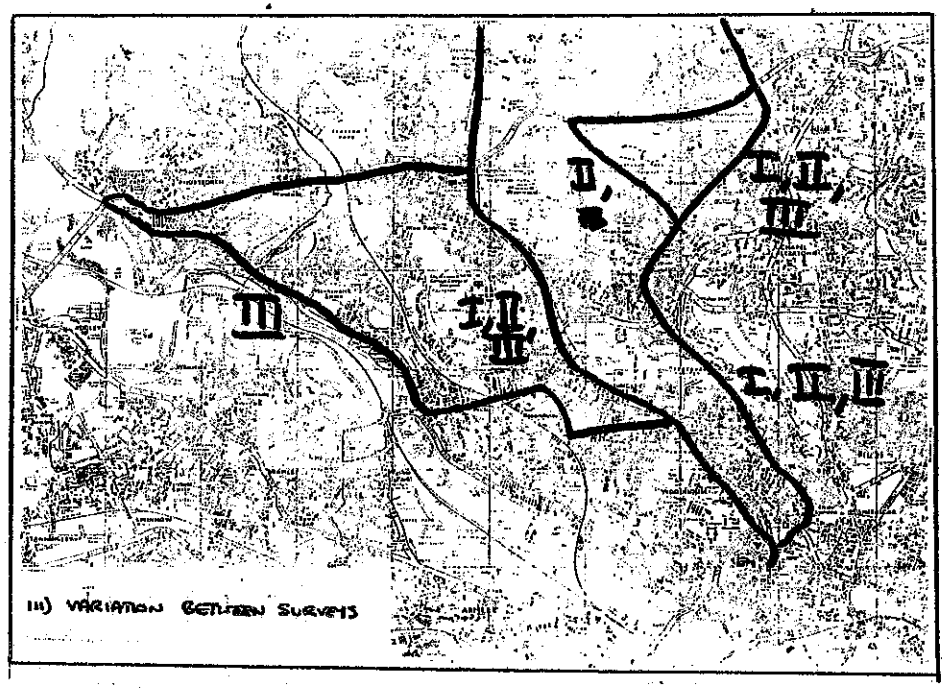
RESPONDENT No.126.

NOTES : RUNS TO WORK 1-2 TIMES PER WEEK (MORE IN SUMMER)
SURVEY 1. USED A660 4 OUT OF 6 DAYS
TRIED OTHER ROUTES DUE TO CONGESTION
SURVEY 2 – RAN TWICE
– A660 USED ONLY OUTSIDE PEAKS
SURVEY 3 – MAJOR DIVERSION DUE TO MEETING



ii) DAILY VARIATION, SURVEY 2


i) KNOWLEDGE OF NETWORK AT TIME OF FIRST SURVEY

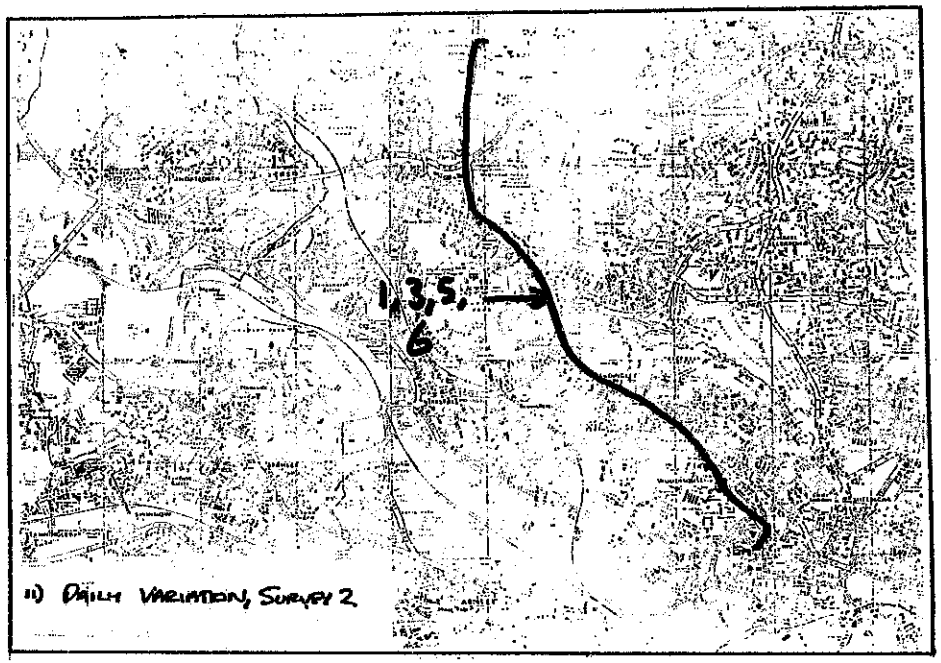


iii) VARIATION BETWEEN SURVEYS

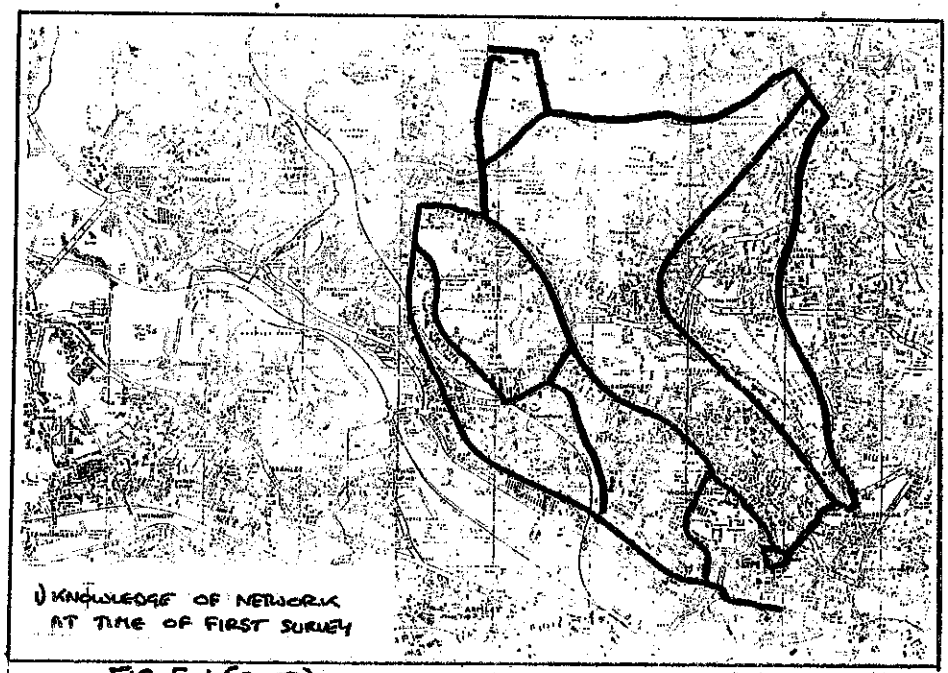
FIG. 5.1 (CONT.)

RESPONDENT No. 130

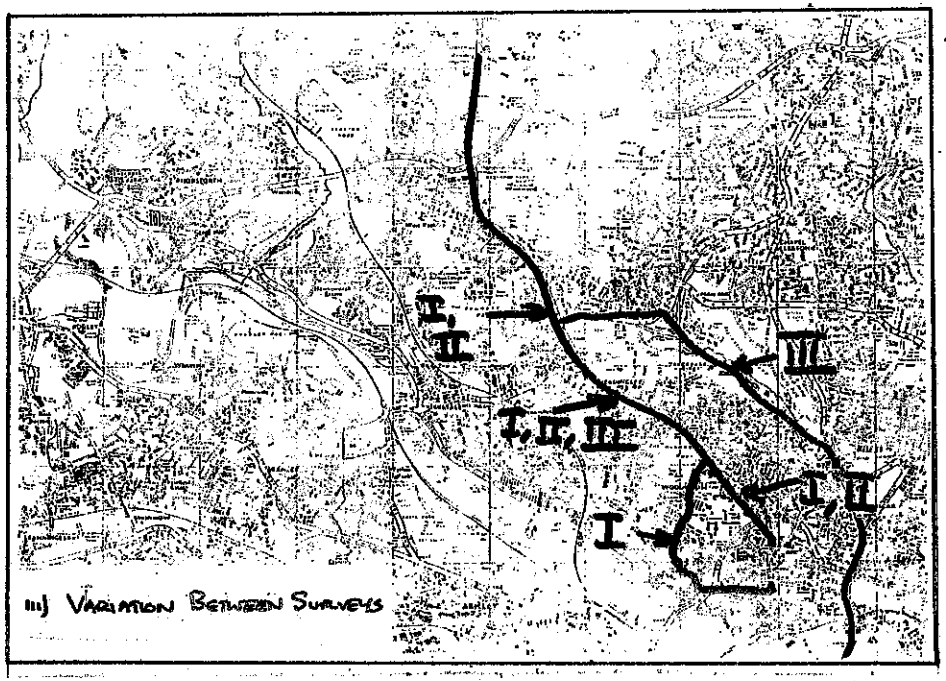
NOTES : VARIATION IN SURVEY 3 DUE TO WORK TRIP




ii) DAILY VARIATION, SURVEY 2



i) KNOWLEDGE OF NETWORK AT TIME OF FIRST SURVEY

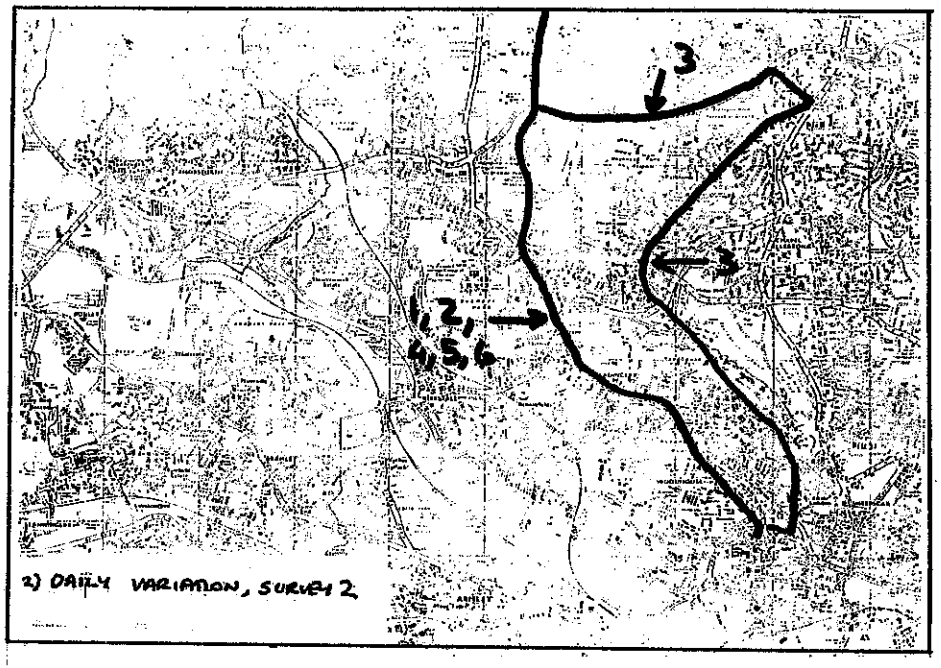


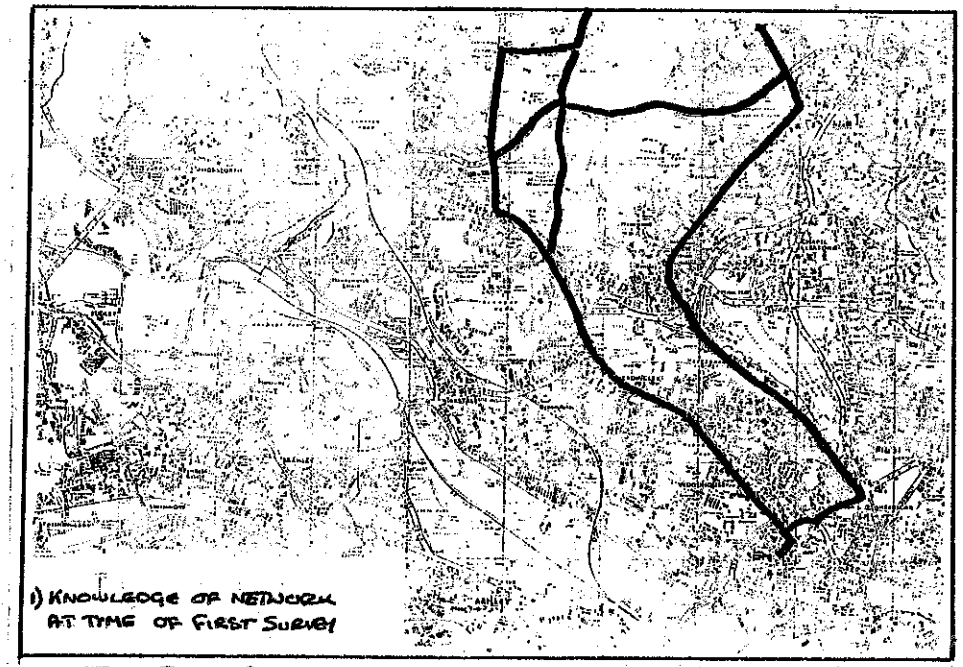

iii) VARIATION BETWEEN SURVEYS

FIG. 5.1 (CONT)

RESPONDENT No. 147

NOTES : VARIATION SURVEY I DUE TO GINNG LIFTS
VARIATION SURVEY III DUE TO SHOPPING TRIP.



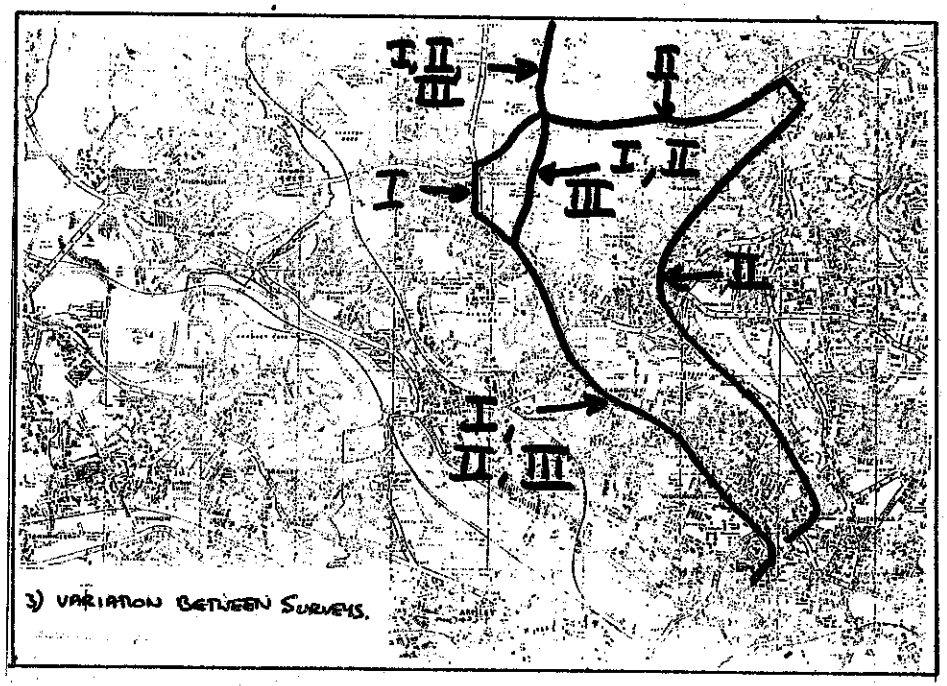
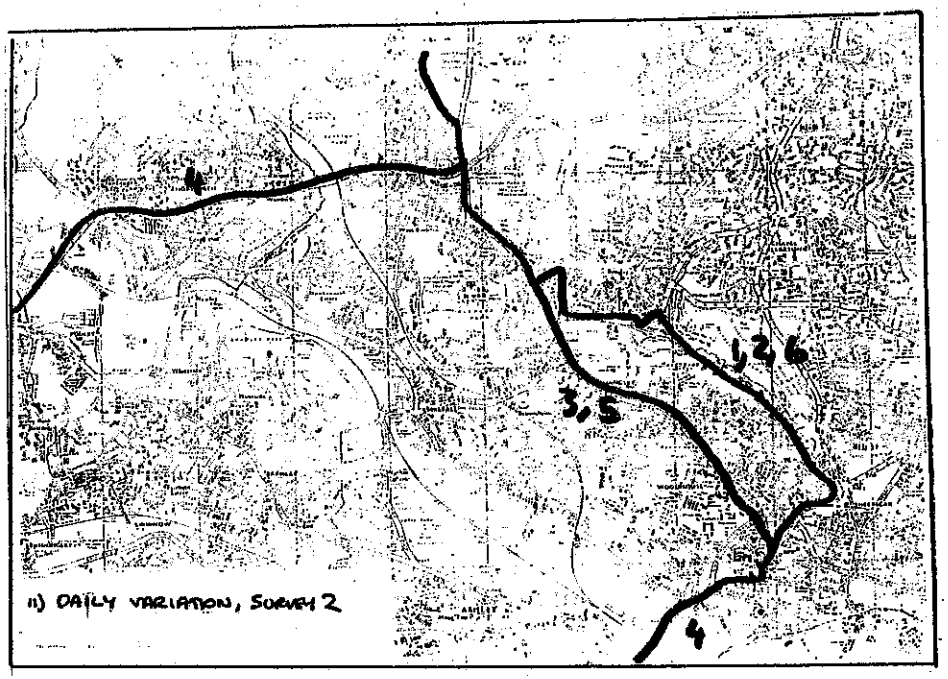



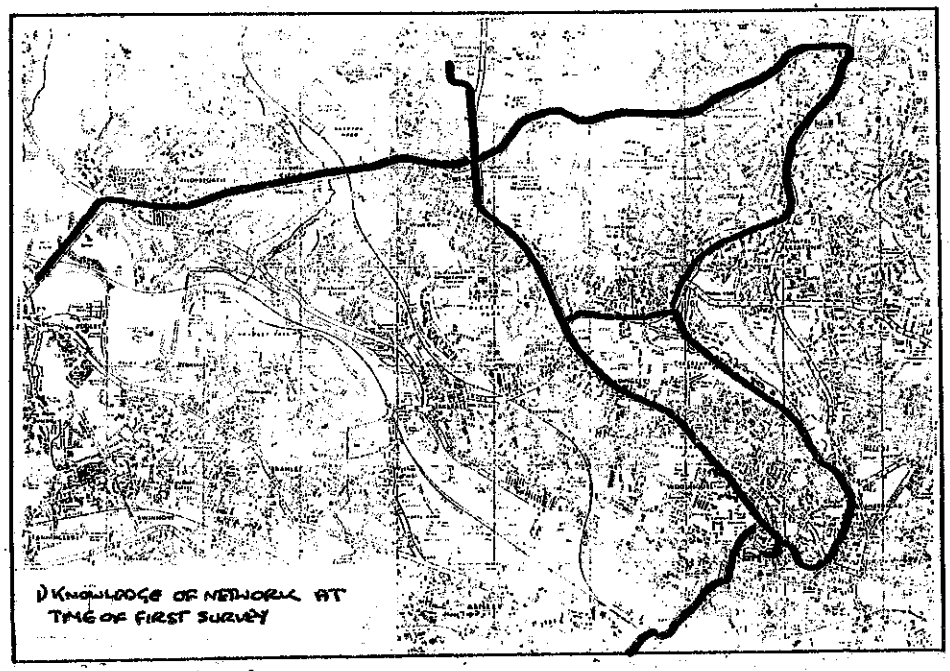

FIG. 5.1. (CONT)

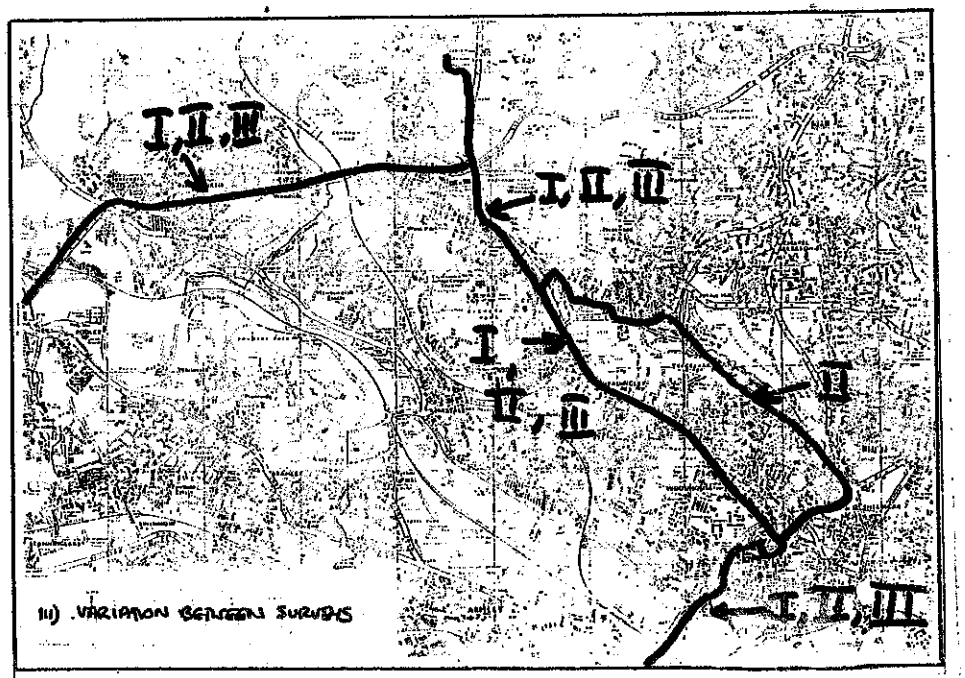
RESPONDENT No. 149

NOTES : MAJOR VARIATION DUE TO EVENING CLASS
A660 ONLY USED OUTSIDE PEAK PERIODS
DUE TO CONGESTION AND BUS LANES
SURVEY 3, ALL JOURNEYS START AFTER 1800 HOURS.



ii) DAILY VARIATION, SURVEY 2


i) KNOWLEDGE OF NETWORK AT TIME OF FIRST SURVEY

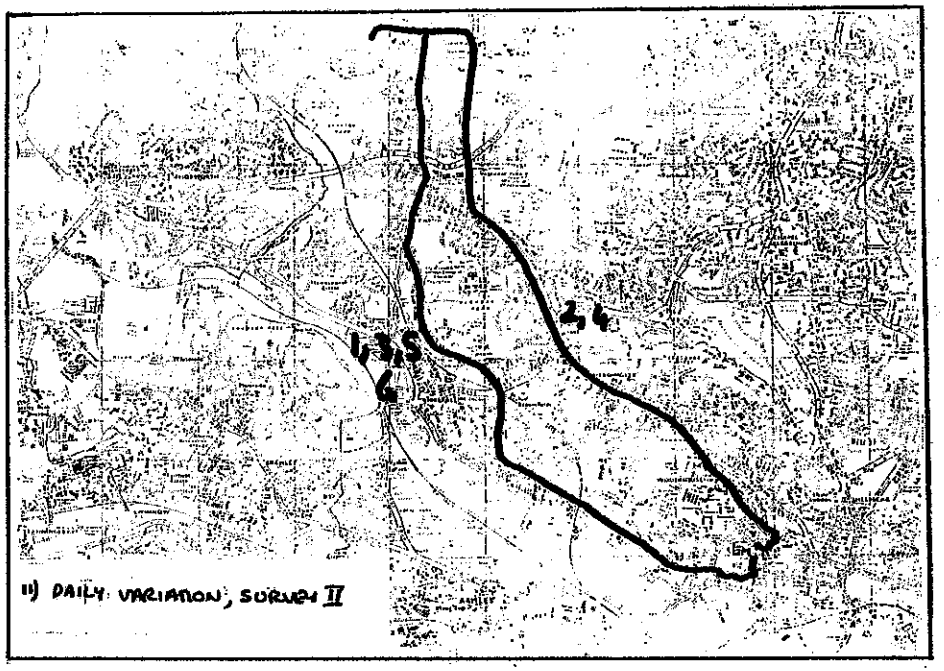


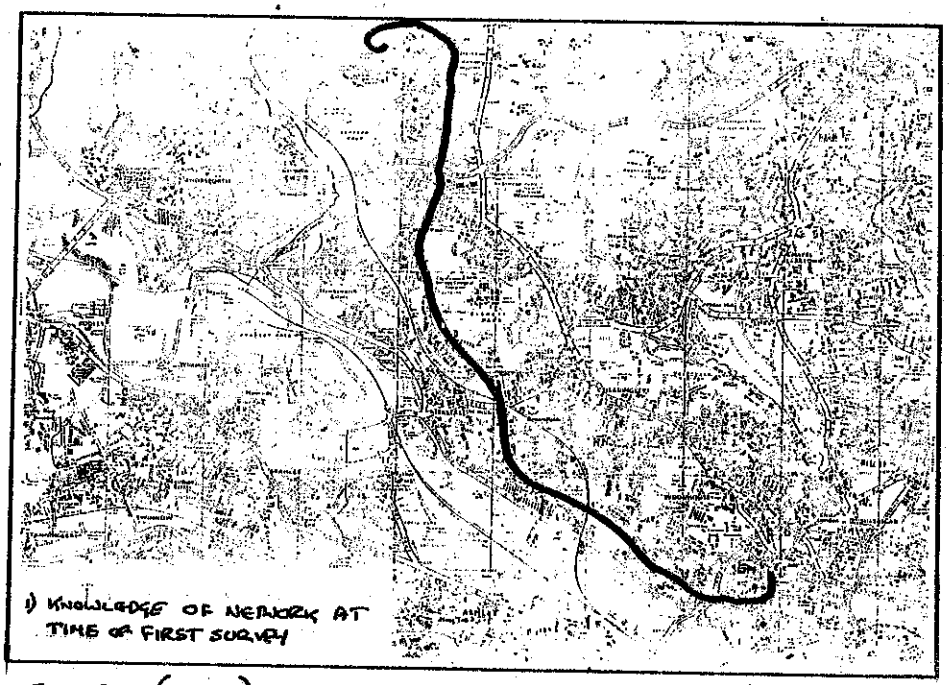
iii) VARIATION BETWEEN SURVEYS

FIG. 5.1 (CONT)

RESPONDENT NO. 159

NOTES : A660 ONLY USED OUTSIDE PEAK PERIODS.



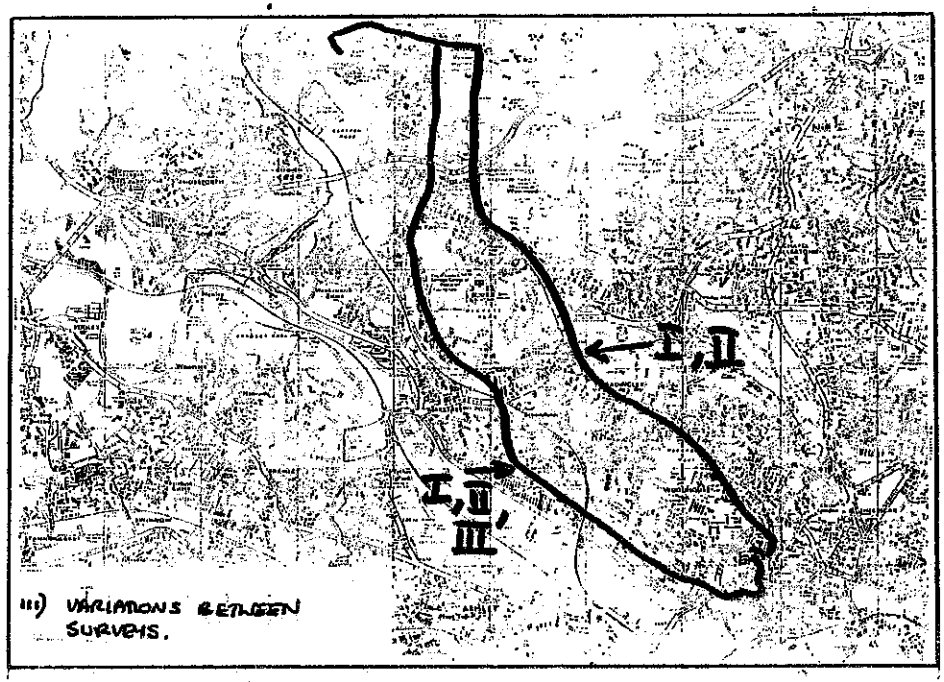
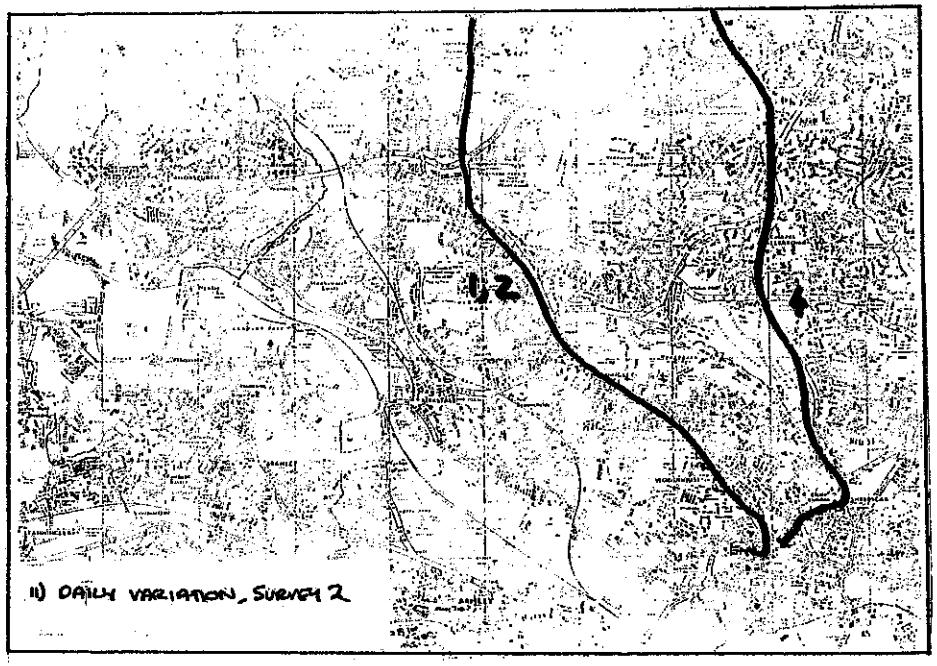
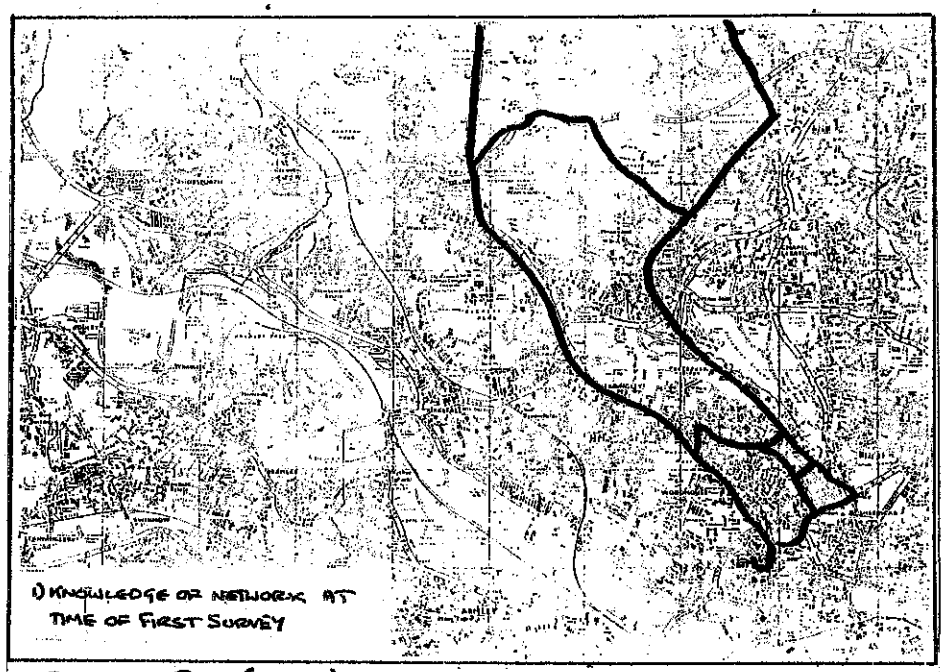




FIG. 5.1. (CONT)

RESPONDENT No. 640

NOTES: IN CAR SHARING SCHEME DURING SURVEYS 2 AND 3
MAJOR CHANGE SURVEY 1 DUE TO WORK.



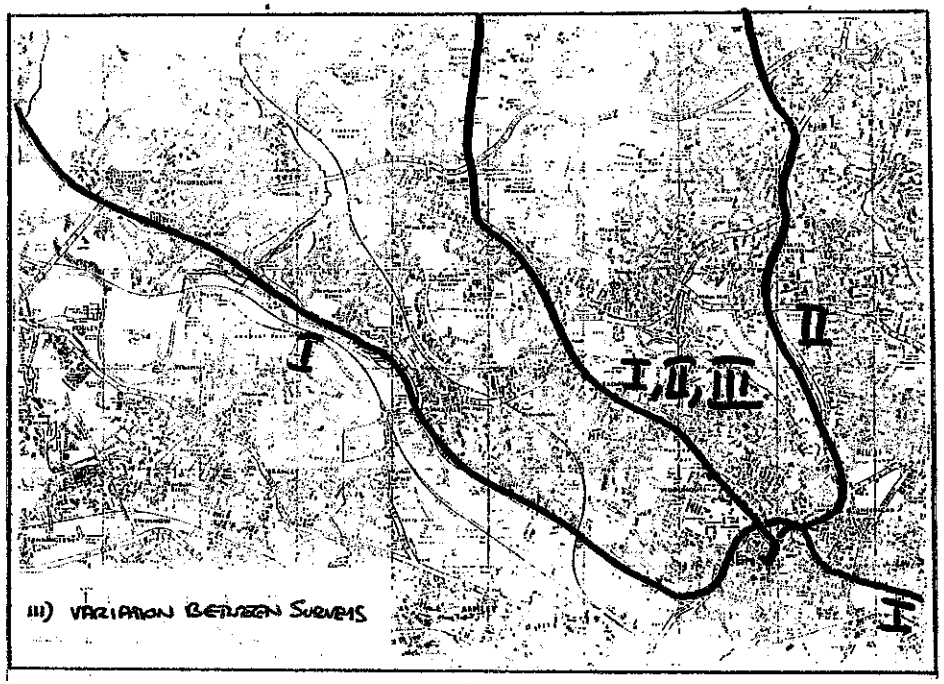




FIGURE. 5.1 (CONT.)

Intersection) have had a noticeable effect on route choice, particularly over time.

5.4.2 Of regular users of Otley Road at the time of the first survey (i.e. those who travelled between the inner and outer ring roads on at least 4 times during the survey period) less than 30% were still using the A660 regularly by the time of the third survey.

5.4.3 The period between the first and second surveys (before any changes took place and after the introduction of the first stage of the bus lane) seems to have been the period of most instability with many panel members trying alternative routes away from the A660. Particularly important is transfer to the Meanwood Road corridor via the improved Sheepscar intersection (63% of these regular users who changed route) and then back to the A660 along Grove Lane or continuing via Parkside or Stonegate to the outer ring road. A further 32% transferred, for some of their journeys, to Burley Road. The remainder used minor roads around the University/Headingley area to rejoin the A660 along Clarendon Road, Hyde Park Road or North Lane.

5.4.4 Figure 5.2 shows how regular users of the A660 varied their route choice between surveys. In nearly all cases (83%) any move away from the A660 was said to be as a result of increased congestion on the original route or specifically to avoid the effects of the bus lane.

| Survey 1 | Survey 2 | Survey 3 |
|---|---|---|
| | Meanwood Road (7) | Meanwood Road (34) |
| A660 (100) | A660 (25) | A660 (29) |
| | Burley Road (30) | Burley Road (27) |
| | Others (8) | Others (10) |

Figure 5.2 Variation in Use of A660 Otley Road

CHAPTER 6

# 6. RESULTS OF THE STOP LINE SURVEY

## 6.1 Introduction

6.1.1 The stop line survey, which was conducted in early December 1984 had three main aims:

i) to provide information on travel within the study area following the completion of the A660 bus lane;
ii) to enable comparisons between the journey to work and the journey home to be made;
iii) to test whether the panel used in the previous three surveys was a representative sample of drivers as a whole. This was prompted by the analysis described in Chapters 4 and 5 which indicated that the panel members were less likely to use rat-runs, and were more regular in their use of a chosen route than other surveys had suggested.

6.1.2 The survey was carried out at the junctions identified in Figure 2.3 according to the techniques described in section 2.3.5. The overall response rate to the survey was 48% which was equivalent to an 11% sample of total traffic during the survey period. Table 6.1 shows the distribution of returns during the survey periods.

| Date of Completion | % Returns | |
|---|---|---|
| | To Work | From Work |
| 3/12/84 (Mon) | 30.5 | 30.0 |
| 4/12/84 (Tues) | 33.3 | 33.8 |
| 5/12/84 (Wed) | 18.3 | 19.0 |
| 6/12/84 (Thurs) | 16.0 | 15.2 |
| 10/12/84 (Fri) | 1.9 | 2.0 |

Table 6.1 Daily Distribution of Questionnaire Responses By Day of Completion

## 6.2 General Information

6.2.1 Table 6.2 shows for how long the respondents to the survey had been commuting through the study area.

| Time Travelling | Stop Line % Respondents |
|---|---|
| Under 6 months | 14.4 |
| 6 months to 1 year | 7.7 |
| Over 1 year | 77.9 |

Table 6.2 Respondents Experience of Travelling Through Study Area

6.2.2 The table shows a much higher percentage of "new" users of the highway network than was apparent from the panel survey (see Table 4.1), indicating that the responses to the stop line survey covered a wider cross-section of drivers than did the panel and that the stop line survey was more likely to include drivers who were not as familiar with the highway network.

6.2.3 Table 6.3, however, indicates that stop line respondents were more likely to claim to drive every day than panel members. The two surveys showed little difference in the frequency of giving lifts (Table 6.4) or in the number of times journeys were broken (Table 6.5), although Tables 6.4 and 6.5 show that respondents were more likely to give lifts on the journey to work and to stop off on the way home.

| Frequency of Driving | % Responses To Work | % Responses From Work |
|---|---|---|
| Very rarely | 0.9 | 0.9 |
| At least once per month | 99.1 | 99.1 |
| At least once per week | 98.6 | 98.7 |
| At least 2 times per week | 98.1 | 98.1 |
| At least 5 times per week | 90.2 | 90.8 |

Table 6.3 Claimed Frequency of Driving To and From Work

| Frequency of Taking Passengers | % Responses To Work | % Responses From Work |
|---|---|---|
| Very rarely | 51.6 | 55.0 |
| At least once per month | 48.4 | 44.9 |
| At least once per week | 45.1 | 37.8 |
| At least 2 times per week | 40.0 | 26.0 |
| At least 5 times per week | 21.9 | 10.4 |

Table 6.4 Claimed Frequency of Taking Passengers

| Frequency of Stopping Off in Journey | % Respondents To Work | % Respondents From Work |
|---|---|---|
| Very rarely | 52.3 | 29.5 |
| At least once per month | 47.6 | 70.5 |
| At least once per week | 37.8 | 60.5 |
| At least 2 times per week | 15.8 | 21.9 |
| At least 5 times per week | 6.5 | 4.3 |

Table 6.5 Claimed Frequency of Stopping on Journey

6.2.4 Table 6.6 shows that although the majority of respondents chose their route before starting a journey to work or to home they were more likely subsequently to change route on the journey to work. When considering the journey from work the proportion who chose their route before starting was lower than that indicated by the panel survey.

| Route Chosen Before Starting Journey | % Total Responses To Work | % Total Responses To Home |
|---|---|---|
| Yes | 83.3 | 90.1 |
| No | 16.7 | 9.9 |

Table 6.6 Route as Planned Before Starting Journey

6.2.5 Table 6.7 shows how respondents saw traffic conditions during the period of the survey and indicates that over three quarters found conditions to be the same as normally expected. However there was a tendency for conditions on the journey to work to be regarded as worse than expected and for conditions on the journey home seen to be better than expected. There was a much higher degree of satisfaction with traffic conditions from respondents to the stop line survey than the panel members.

| Expected Traffic Conditions | % Responses To Work | % Responses From Work |
|---|---|---|
| Much worse | 2.8 | 0.9 |
| Worse | 13.5 | 6.1 |
| Same | 74.4 | 82.1 |
| Better | 9.3 | 9.9 |
| Much better | 0 | 0.9 |

Table 6.7 Perceived Traffic Conditions

## 6.3 Journey Times and Regularity

6.3.1 The majority of responses covered journeys to work

between 0751 and 0820 hours and arrive at work between 0831 and 0850 with the majority of journeys taking between 16 and 35 minutes (Figure 6.1).

6.3.1 For the homeward journey the peak time of leaving work is between 1651 to 1700 although the remainder of departure times are more evenly distributed than the journey to work. Journey times here are quicker than those to work and the time of arriving home is much less peaked than that for arrival at work (Figure 6.2).

6.3.3 Analysis of the panel survey data indcated that members were much more regular in the time they left work than other survey results would suggest. Consequently respondents to the stop line survey were specifically asked how often they arrived at and left work within 5 minutes of that day's time. The results are summarised in Table 6.8 which shows that under half the respondents left or arrived at work within 5 minutes of the same time on 5 or more days a week. Furthermore, respondents were less regular in the time at which they left work.

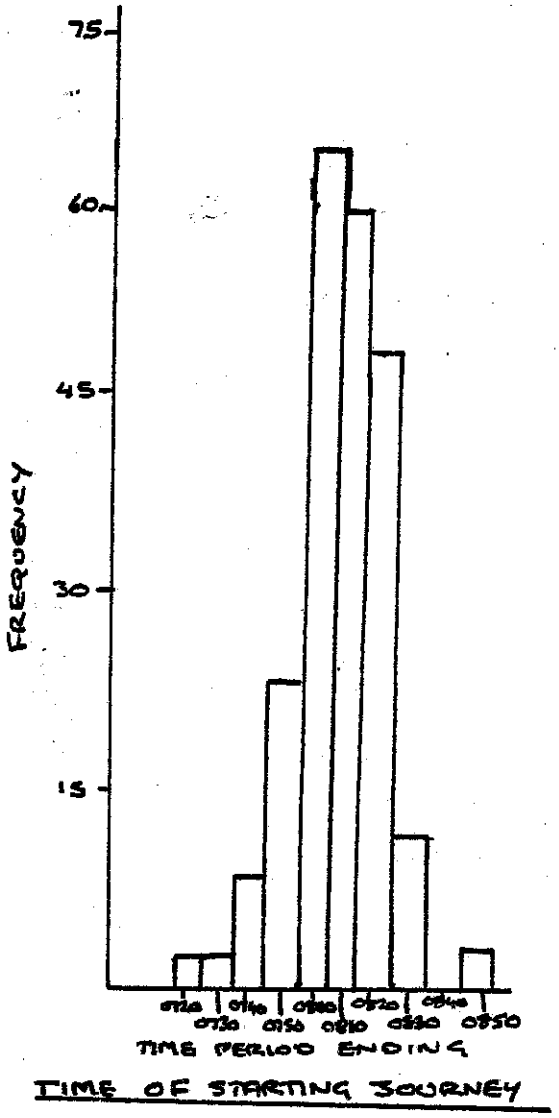
| Arrive/Depart within 5 minutes of Today's time | % Total Responses To Work | From Work |
|---|---|---|
| Very rarely | 2.8 | 10.9 |
| At least once per month | 97.1 | 89.0 |
| At least once per week | 94.3 | 86.2 |
| At least 2 times per week | 88.6 | 78.7 |
| At least 5 times per week | 38.4 | 22.7 |

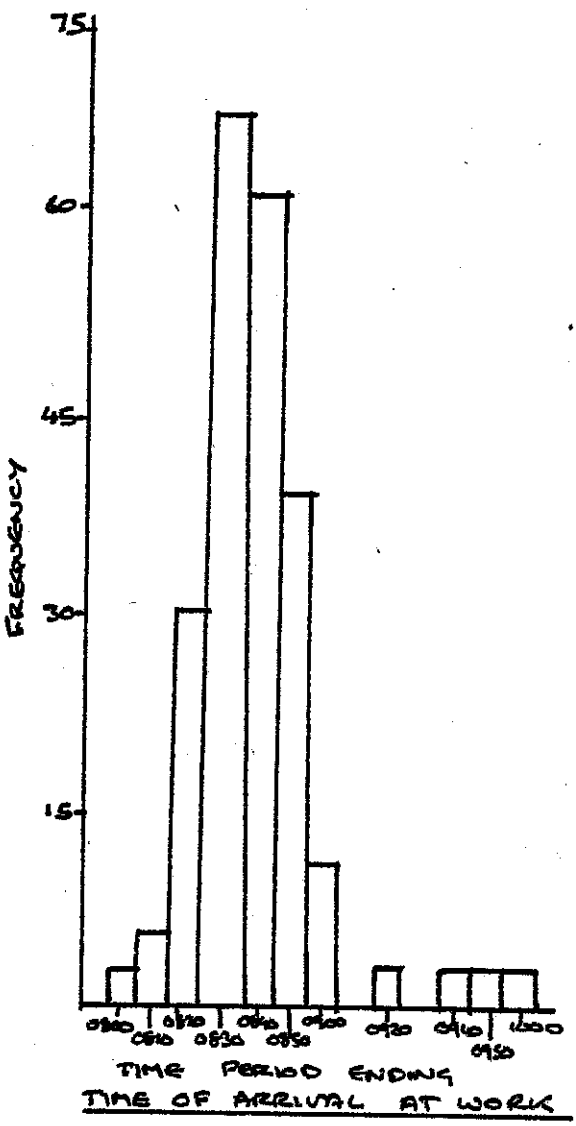
Table 6.8 Regularity of Arriving At and Leaving Work

## 6.4 The Journey to Work

6.4.1 Figure 6.3 illustrates how respondents to the stop line survey crossed the six cordons within the study area or their journey to work.

6.4.2 Table 6.9 shows that over half of respondents were using the route which they considered to be the easiest or quickest route between their home and work with a further 19% claiming that the route was the one they usually used. The relationship between respondents perception of which is the quickest route and the quickest route producing an assignment model will be explored in Chapter 8.



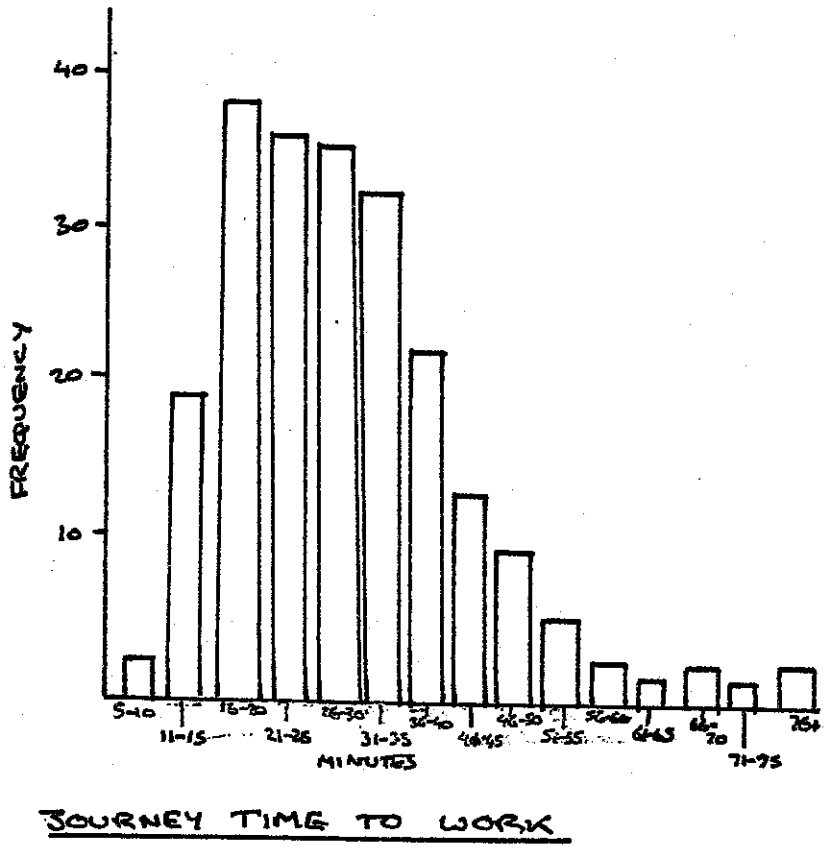
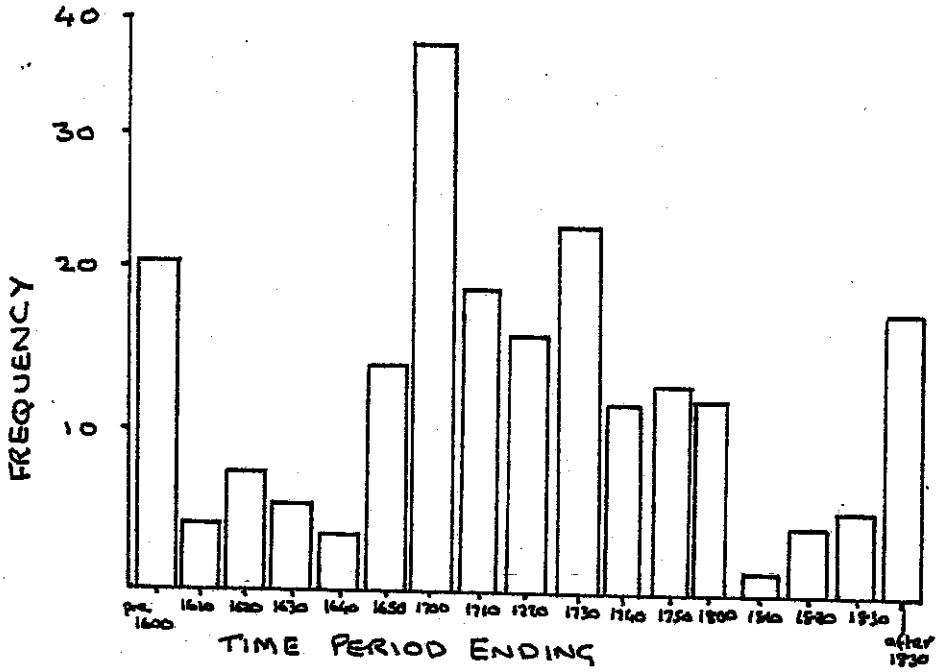
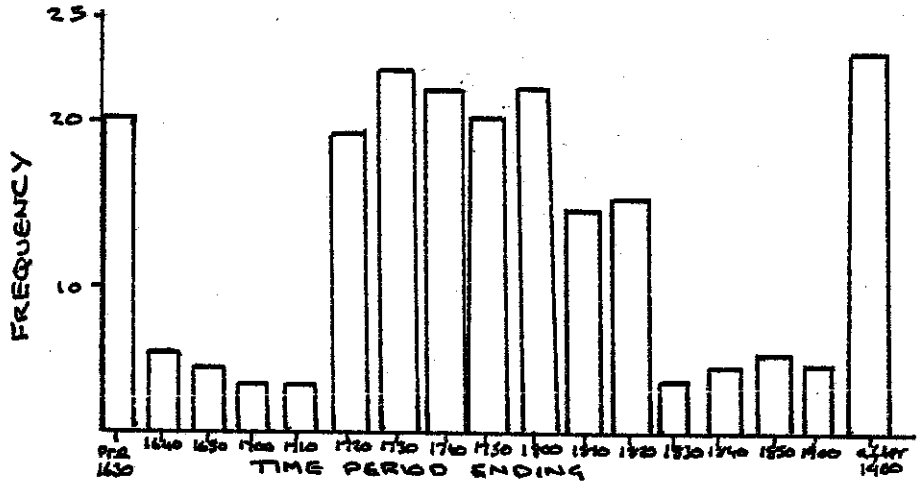



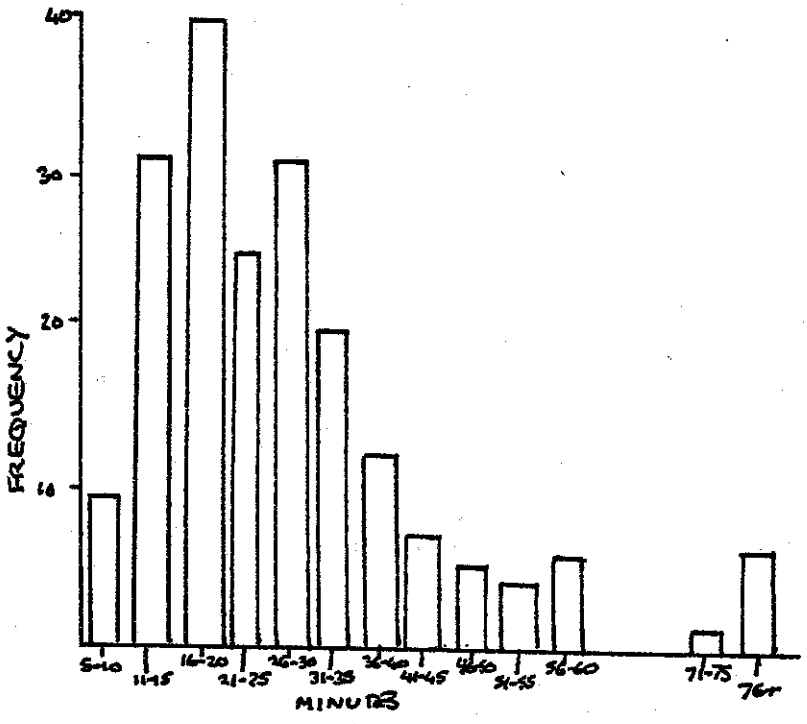

**FIGURE 6.1 STOP LINE SURVEY — JOURNEY TO WORK**




TIME OF LEAVING WORK




TIME OF ARRIVING HOME




JOURNEY TIME

**FIGURE 6.2 STOP LINE SURVEY - JOURNEY FROM WORK**

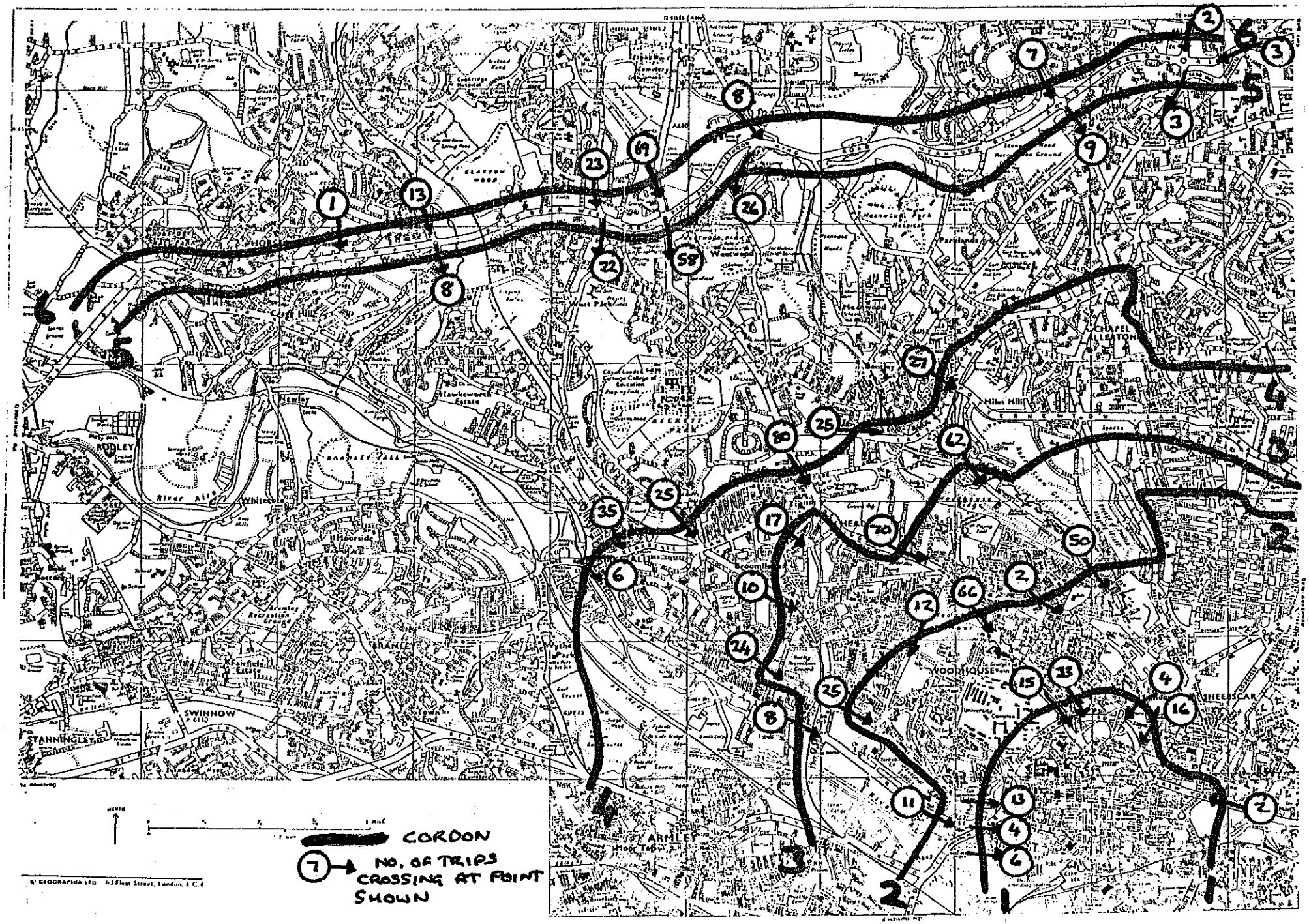



**FIGURE 6.3 STOP LINE SURVEY (JOURNEY TO WORK) DISTRIBUTION OF TRIPS ACROSS CORDONS**

| Main Reason for Choice | % Responses |
|---|---|
| Easiest/Quickest | 57.3 |
| Usual route | 19.4 |
| Special circumstances | 0.5 |
| Avoid congestion | 9.0 |
| Avoid bus lane | 2.8 |
| Roadworks | 0.9 |
| Other | 10.0 |

Table 6.9 Stated Main Reasons for Choice of Route to Work

6.4.3 Table 6.6 has previously shown that over 80% of respondents claimed to have chosen the route they travelled on before leaving home. Of those who did change route en route most (60%) had made their final decision before reaching cordon 5 as shown in Table 6.10 and the main reason given for any change was avoiding traffic congestion as shown in Table 6.11. In fact all the reasons given for a route change relate in some way to traffic congestion (see also para. 6.4.5).

| Cordon by Which Final Choice of Route Made | Cumulative % of Respondents Who Decided Route After Leaving Home |
|---|---|
| 6 | 8 |
| 5 | 60 |
| 4 | 88 |
| 3 | 100 |

Table 6.10 Cordon by Which Final Choice of Route Made (Inbound)

| Reason Stated | % Respondents Who Changed Route |
|---|---|
| Traffic Congestion | 45.2 |
| Easiest Route | 25.8 |
| Bus Lane | 3.2 |
| Long Traffic Queues | 25.8 |

Table 6.11 Stated Reasons for Change of Route (Inbound)

6.4.4 Table 6.12 shows that 54% of the survey respondents said that they used exactly the same route 5 or more times a week, yet 64% of survey respondents said that they varied their route as shown in Table 6.13 which also gives the main reasons for variation in route. Again the avoidance of congestion is the main reason.

| Stated Frequency | % Responses |
|---|---|
| Very rarely | 4.2 |
| At least once per month | 95.9 |
| At least once per week | 93.6 |
| At least 2 times per week | 90.3 |
| At least 5 times per week | 54.0 |

Table 6.12 Frequency of Use of Same Route for Journey to Work

| Route Ever Varied | % Responses | If Yes, Reasons Stated (% Yes) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Personal Business | Lifts | Social, Recreational | Avoid Congestion | Different Car Park | Avoid Bus Lane | Other |
| Yes | 64.7 | 2.9 | 7.9 | 2.2 | 46.0 | 0.7 | 25.1 | 15.2 |
| No | 35.3 | | | | | | | |

Table 6.13 Frequency and Stated Reasons for Variation in Journey to Work

6.4.5 As shown in Table 6.7 over 80% of respondents considered traffic conditions on the journey to work to be the same as or better than expected and very few respondents (less than 20%) considered any factors other than traffic conditions having an influence on their journey - see Table 6.14.

| Factors Other Than Congestion Affecting Journey | | If "Yes" stated reasons (% YES) | | | | |
|---|---|---|---|---|---|---|
| | | Left Home Early | Late | Roadworks | Shopping | Other |
| YES | 17.8 | 36.1 | 11.1 | 11.1 | 13.9 | 27.8 |
| NO | 82.2 | | | | | |

Table 6.14 Factors Other Than Traffic Congestion Influencing Journey

6.4.6 At the end of their journey to work over 94% of respondents parked in their usual parking place. For those not in their usual parking place three quarters were working elsewhere in the city centre on that day.

## 6.5 The Journey Home From Work

6.5.1 In addition to presenting the results of the stop line survey in this section some general comparisons will be made between these results and those of the panel survey reported in Chapters 4 and 5.

6.5.2 Figure 6.4 illustrates how respondents crossed the six cordons within the study area on their journey home and when compared with Figure 6.3 shows a much greater incidence of the use of minor roads on the homeward journey particularly at cordons 2, 3 and 4. We note that, when compared with the panel survey, the stop line survey sample shows a greater use of the A660. Figure 6.4 shows that the least used section of the A660 after crossing the inner ring road is in Headingley itself (i.e. at cordon 3) and respondents to this survey would appear to be trying to avoid congestion in this area rather than the outbound bus lane (between cordons 1 and 2).

6.5.3 Table 6.15 shows that almost half the respondents were using the route which they considered to be the easiest or quickest between their work place and home, a lower proportion than identified in the journey to work. A further 23% stated that it was their usual route.

| Reasons for Choice of Route | % Responses |
|---|---|
| Easiest/Quickest | 44.4 |
| Usual | 23.7 |
| Avoid Congestion | 12.6 |
| Avoid Bus Lane | 1.4 |
| Other | 17.9 |

Table 6.15 Stated Reasons for Choice of Route Home

6.5.4 Table 6.6 has previously indicated that just over 90% of respondents claimed to have chosen their route before leaving their parking place - a smaller proportion than in the panel survey (see Table 4.10). Of those who did change their route after setting off, most (70%) had made the change by the time they reached cordon 2 (Table 6.16) and the main reason given for change was avoiding traffic congestion (Table 6.17). Giving lifts and personal business purposes were also important stated reasons for any unplanned change of route.

| Cordon by Which Final Choice of Route Made | Cumulative % of Respondents Who Decided on Route After Leaving Parking Place |
|---|---|
| 1 | 40% |
| 2 | 70% |
| 4 | 90% |
| 5 | 100% |

Table 6.16 Cordon by Which Final Choice of Route Was Made

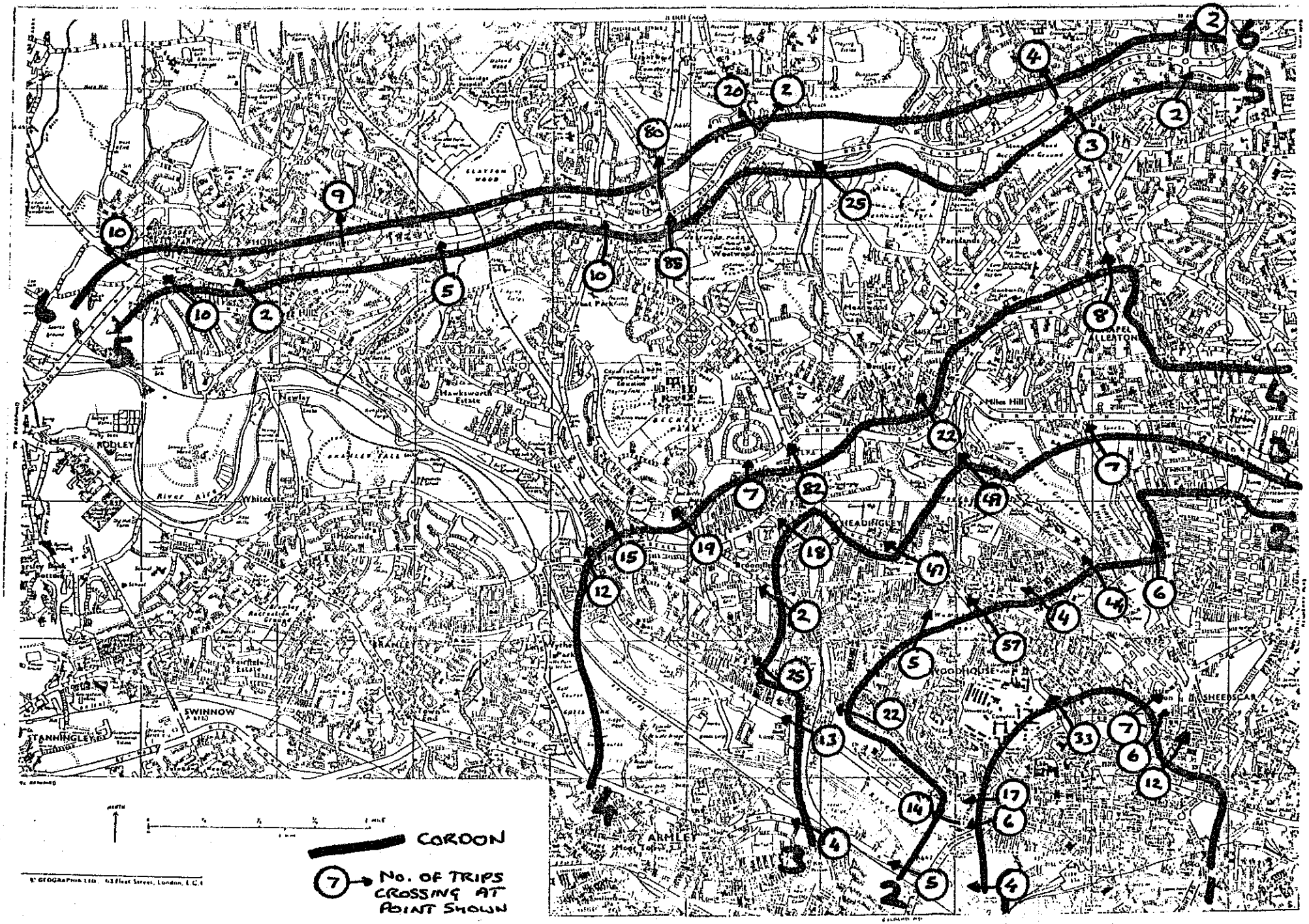



FIGURE 6.4 STOP LINE SURVEY (JOURNEY FROM WORK) DISTRIBUTION OF TRIPS ACROSS CORDONS

| Reasons Stated For Change of Route | % Respondents Who Changed Route |
|---|---|
| Easiest/Quickest | 22.2 |
| Giving Lifts | 16.7 |
| Personal Business | 11.1 |
| Avoiding Bus Lane | 5.6 |
| Avoiding Congestion | 33.3 |
| Long Traffic Queues | 11.1 |

Table 6.17 Stated Reasons for En Route Change of Route

6.5.5 Table 6.18 shows that only 37% of respondents said they used the same route home every day of the week, much less than for the journey to work and a significant reduction on the regularity claimed by the panel survey (see Table 4.5). The main reason given (Table 6.19) for varying a route was the avoidance of congestion although personal business reasons were also important.

| Stated Frequency | % Responses |
|---|---|
| Very Rarely | 6.1 |
| At least once per month | 93.9 |
| At least once per week | 93.4 |
| At least 2 time per week | 85.4 |
| At least 5 times per week | 36.6 |

Table 6.18 Frequency of Use of Same Route Home

| Route Ever Varied | % Responses | If YES, Reasons Stated (% Yes) Personal Business | Lifts | Social/ Recreation | Avoid Congestion | Easiest Route | Avoid Bus Lane | Other |
|---|---|---|---|---|---|---|---|---|
| Yes | 66.0 | 14.4 | 9.4 | 7.9 | 29.5 | 15.5 | 15.2 | 8.1 |
| No | 34.0 | | | | | | | |

Table 6.19 Frequency of, and Stated Reasons for, Variation in Journey Time

6.5.6 As shown in Table 6.7 over 90% of respondents considered traffic conditions on the journey to work to be the same as or better than expected and only 15% of respondents considered anything other than traffic conditions affected their journey. The main factors other than traffic conditions were leaving work early or late, shopping and personal business.

## 6.6 A Comparison Between the Journey To and From Work

6.6.1 The analysis in previous sections has highlighted several differences between the journey to and from work. Firstly respondents were less regular in their use of a particular route but were less likely to vary a route after starting their journey on the way home. Respondents were also more likely to stop on the journey home than on the way to work. However the main aim of this section is to determine whether or not respondents actually used different routes on the journey to and from work.

6.6.2 Table 6.20 shows the variation in routes used by individual survey site and for the total survey and shows that overall more people used a different route home than used an exact reverse of their journey to work (excluding changes caused by one way roads within the city centre).

| Survey Location (morning journey) | % Total Responses: Exactly the same route used over the whole journey | Different Route | Major Change * | Minor Change * | Missing Data |
|---|---|---|---|---|---|
| Otley Road | 49.3 | 43.2 | 18.5 | 24.7 | 7.5 |
| Morris Lane | 33.3 | 63.3 | 50.0 | 13.3 | 3.4 |
| Queenswood Drive | 17.9 | 64.2 | 46.3 | 17.9 | 17.9 |
| Grove Ln/Meanwood Rd | 50.0 | 37.9 | 13.6 | 24.3 | 12.1 |
| T O T A L | 41.6 | 48.1 | 26.3 | 21.8 | 10.3 |

* Major change : crossing 2 or more cordons at a different point than normal.

Minor change : crossing less than 2 cordons at a different point than normal.

Table 6.20 Differences in Routes Used To and From Work

6.6.3 The table shows that the most obvious changes in route occurred through the two "minor" survey sites - on Morris Lane and Queenswood Drive - which are in effect major "rat runs" through the survey area. Of the major routes, those using Otley road were more likely to use a different route on the way home, although this often involved only a minor change in route in order (we surmise) to avoid the bus lane or congestion in Headingley.

6.6.4 The extent of the variation in route is also illustrated in Figure 6.5 which illustrates the routes used to and from work by a sample of respondents.

## 6.7 Summary

6.7.1 The results of the stop line survey have shown that respondents were much more regular, both in terms of the timing of their journeys and the frequency of use of route, on the journey to work than from work. Respondents were also more likely to break their journey on the way home than to work.

6.7.2 The survey results showed that the majority of respondents who completed both halfs of the survey used a different route on the way home than that used to work.

6.7.3 The stop line survey confirmed that the members of the panel survey were more settled both in their choice of route and the frequency with which they used the same route than a wider sample obtained from the stop line survey. Furthermore panel members admitted to less use rat runs than did respondents to the stop line survey.

CHAPTER 7

## 7. CRITICAL ASSESSMENT OF THE SURVEY TECHNIQUES

7.1.1 Two distinct survey techniques were used to collect the data analysed in the previous chapters. These were the panel survey and the stop line survey. Both relied on respondents completing detailed questionnaires relating to journeys they had just made, and returning the completed forms via freepost.

7.1.2 One of the main reasons why the survey technique was changed for the final data collection exercise was due to suspicions, confirmed in the main by later analysis, that the panel was not representative of drivers as a whole. Panel respondents were, in general, more regular in their choice of routes, had been driving for longer and were less likely to use rat-runs than the population as a whole.

7.1.3 Although the stop-line technique provided a more representative sample of drivers one of the main objectives of the panel survey was to provide a comparative sample over a lengthy time span. It seems likely that it is the requirement to take part in a repeated study that biases the sample and so it is doubtful whether use of a sample derived from the electoral register or even from following up the stop line survey sample, would result in a much better selection of respondents.

7.1.4 A further difficulty experienced with the panel survey was the falling response rate in the second and third surveys compared with the initial survey, despite increased cash prizes being offered. Two possible explanations can be put forward: firstly the overall time span of the survey was too long (April 1983 - February 1984) and respondents had lost interest and secondly the final survey (in February '84) was carried out too soon after the second survey (in December 1983) thus overtrying the patience and goodwill of those willing to participate.

7.1.5 Further evidence of this strain of good will is evidenced by the difficulties experienced in the later part of the project in trying to arrange follow up personal interviews with people who had responded to all three panel surveys. Only two interviews were possible after approaching 15 of the 38 respondents eligible. The main reasons given for not participating were either lack of time or lack of interest in further survey work.

7.1.6 Even amongst those respondents who answered the final panel surveys evidence of a lack of interest is shown in the answers to questions. Many of the responses gave the impression of regularity not evidenced in a registration plate survey conducted for a different purpose and also the later stop line survey.

7.1.7 Although the stop line survey gave a better cross section of the population as a whole, a better sample could

possibly have been achieved by surveying at more stop lines and issuing more forms, both problems of resources.

7.1.8 Both surveys rely on the accuracy, and honesty, of respondents in answering the questionnaire and, more importantly in completing the map showing the chosen route. In this context we note that both surveys have shown a lesser degree of rat running than evidenced in a survey of registration plate matching in the same area.

CHAPTER 8

# 8. A COMPARISON OF DRIVERS ACTUAL CHOICE OF ROUTE WITH THAT PREDICTED BY AN ASSESSMENT MODEL

## 8.1 Introduction

8.1.1 One of the aims of the project was to compare the routes used by drivers with those predicted by current assignment models with a secondary aim of providing information for use in further research into the development of models of route choice. These would perhaps incorporate the different elements of generalised cost used in the determination of route choice including the weighting to be given to time spent in queues, to incorporate the effects of uncertainty with respect to delay and to reproduce the dynamic process by which changes in queues influence route choice during the actual journey.

8.1.2 In order to achieve this it was initially proposed to set up several assignment models operating at different levels of network definition (e.g. the TRADVV and SATURN suites (1, 2) and compare the routes predicted by these models with those observed.

8.1.3 However several difficulties were experienced during the course of the project. Firstly problems were encountered in coding a suitable network for use with the SATURN model and secondly the results of the panel survey indicated a bias towards regularity and use of major routes. Consequently substantial resources were put into developing and collecting stop line survey data at the expense of developing a SATURN network. Time resources eventually prevented any more than comparing the inbound routes recorded by respondents to the stop line survey with those predicted by a standard equilibrium assignment model.

8.1.4 A network was therefore developed for the study area based on a SATURN buffer network* used within the Institute for Transport Studies with updated information provided by WYMCC on capacities and link speeds, particularly in the light of relevant traffic management schemes introduced (i.e. the A660 bus lane, the A65 Kirkstall Road bus lane - which came into operation following the final panel survey but before the stop line survey in late 1984, and the improvements made to the Sheepscar intersection). The network is illustrated in Figure 8.1.

8.1.5 Analysis of the results of the inbound journeys recorded by the stop line survey showed that the most frequently given reason for the choice of route was that it was the quickest between the respondents origin and destination (see Table 7). Therefore the observed routes were compared with those produced by minimum time trees for the specified origins and destinations (4).

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* NB: The SATURN buffer network is link based not junction based like the full SATURN network.

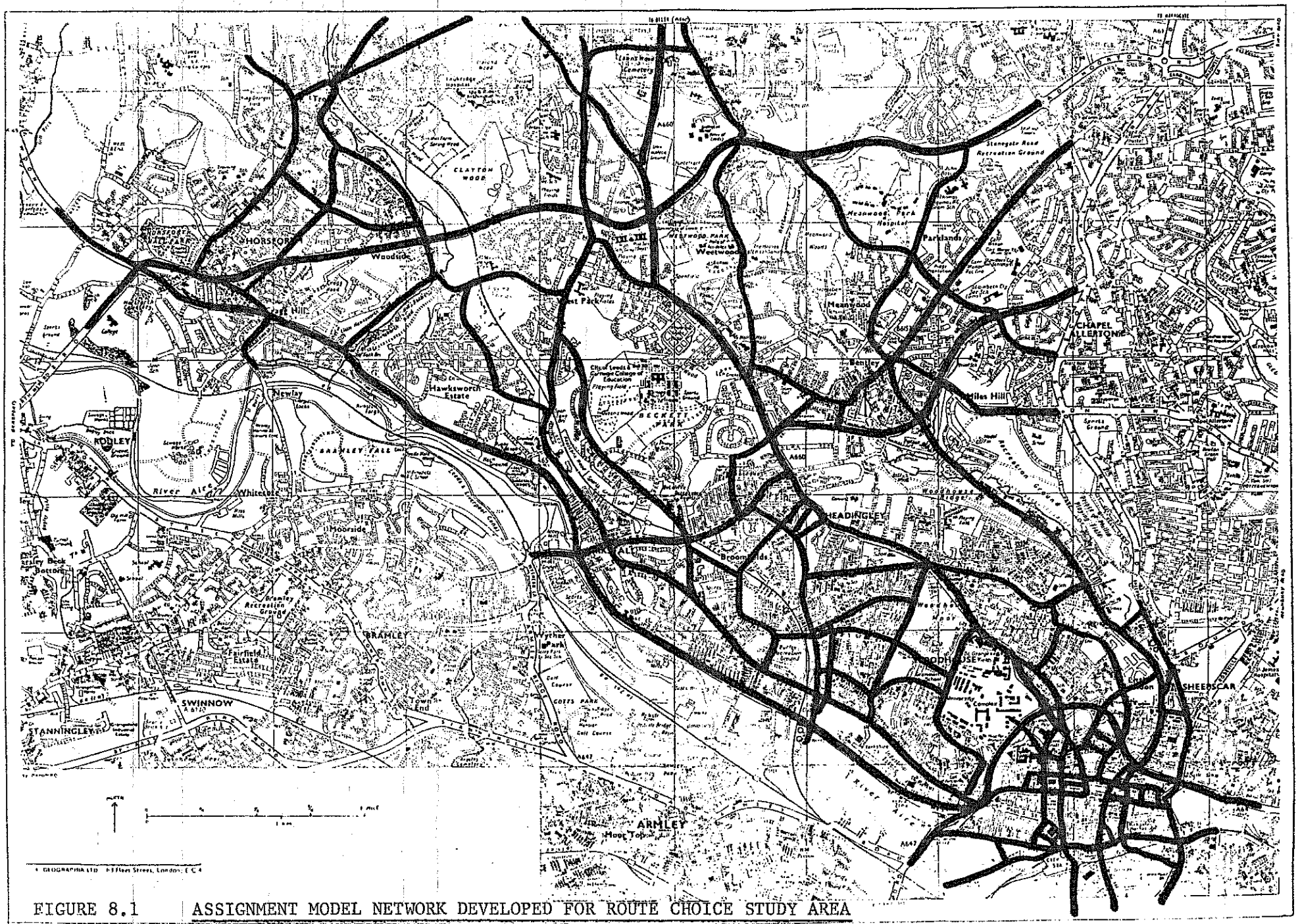



FIGURE 8.1 ASSIGNMENT MODEL NETWORK DEVELOPED FOR ROUTE CHOICE STUDY AREA

8.1.6 Comparisons between observed and predicted routes have been made at two levels:

1) Total number of journeys through each of the stop line sites.

2) For randomly selected individual responses.

## 8.2 Overall Comparison of Predicted and Observed Routes

8.2.1 In order to compare the overall ability of the model to represent the routes chosen by respondents to the stop line survey minimum time trees were initially plotted from all identifiable journey origins to each stop line survey site and secondly from each survey site to all identifiable journey destinations. The results observed to the Meanwood Road site are described below. Other results are illustrated in Appendix 9.

8.2.2 Figures 8.2 illustrates the differences between predicted and observed routes to the Meanwood Road/Grove Lane survey site and shows that the model would seem to have over assigned traffic to the section of the A660 between the outer ring road and Shaw Lane and between the outer ring road and Parkside at the expense of Weetwood Lane and the outer ring road between the A660 and Weetwood Lane. Respondents using these routes are travelling in general from North West to South East and may use Weetwood Lane in preference to the main road to avoid congestion caused by an inbound morning peak hour bus lane on this stretch of the A660 and also delay at the A660/Shaw Lane traffic signals. Several roads were used by respondents which were not included in the network, the most important of which is Glenn Road, between the A660 and Weetwood Lane which was used by nearly 10% of the total respondents at this site.

8.2.3 Trips from the Morris Lane survey site have been quite accurately represented by the model with the exception of the use of minor roads (many of them not runs) some of which were not coded into the model network. A further discrepancy is the use of Kirkstall Lane and the A660 through Headingley by two respondents. This route was not indicated in the minimum time trees (Figure 8.3).

8.2.4 In summary, therefore, the assignment model used to compare actual and predicted routes to and from the stop lines has represented the overall picture at each stop line survey sites in the majority of cases, particularly for journeys from the stop line sites to the cty centre for which the number of available routes is limited. Although some discrepancies may be due to the fact that the comparison has been made based on minimum time trees produced from one specific iteration of the model (another iteration may have included them) many differences are due to rat running taking place in certain parts of the study area and thus not being adequately represented in the model network.

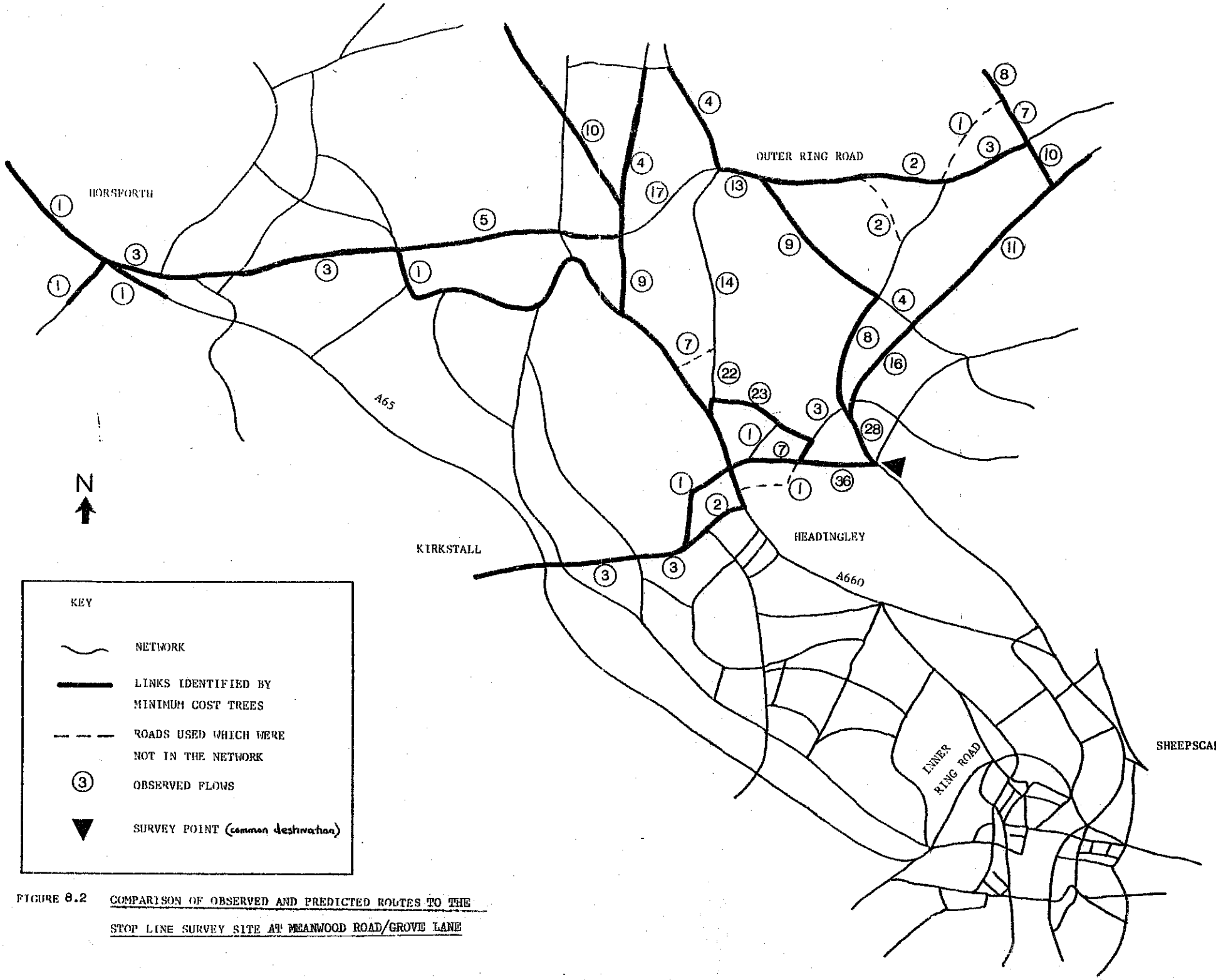



FIGURE 8.2 COMPARISON OF OBSERVED AND PREDICTED ROUTES TO THE STOP LINE SURVEY SITE AT MEANWOOD ROAD/GROVE LANE

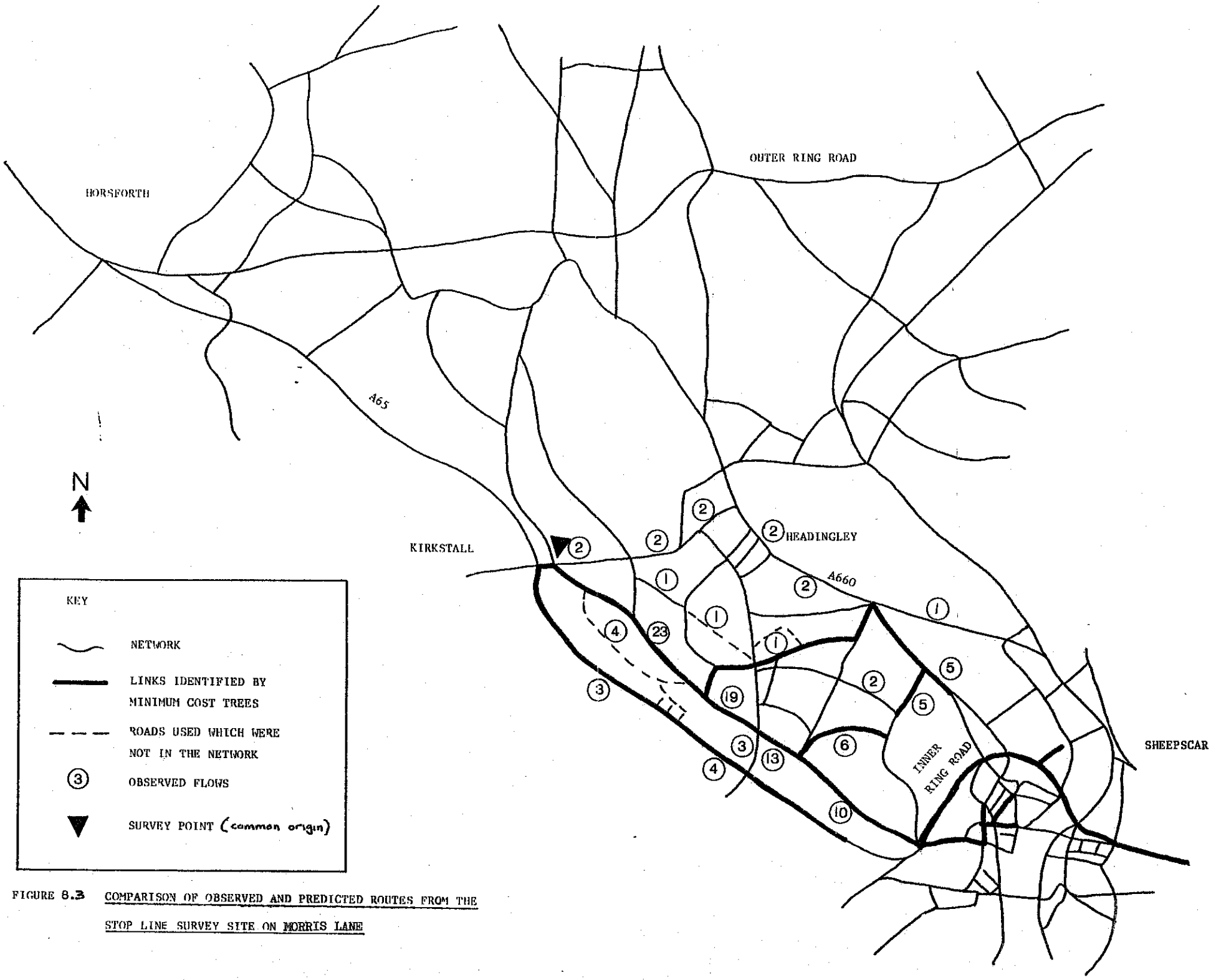



FIGURE 8.3 COMPARISON OF OBSERVED AND PREDICTED ROUTES FROM THE STOP LINE SURVEY SITE ON MORRIS LANE

## 8.3 A Comparison Between Observed and Predicted Routes for a Sample of Individual Responses

8.3.1 In order to assess how accurately the model represented individual trips from a specified origin to a specified destination, without imposing the intermediate constraint of passing through the stop line survey sites, a random sample of 38 responses were selected (roughly 1 in 5 replies to each individual survey site) and minimum cost trees were produced for each origin destination pair identified from the respondents' maps of their journey to work. (Note that respondents with an intermediate destination were excluded from the sample.)

8.3.2 Table 8.1 gives the reasons behind the respondents' choice of route, where the route was chosen, how often the identical route was used and reasons given for variation from this route. The table shows that exactly 50% of respondents gave as their main reason for choosing that route that it was the quickest and a further 26% stated that the route they chose avoided congestion, possibly implying that this was the quickest route available. The majority of respondents claimed to have chosen their route before leaving home and to use it each day. Where variation did occur from the choice of route it was apparently mainly in order to avoid congestion.

8.3.3 Figure 8.4 shows a comparison of the observed and predicted routes for the journeys identified in the sample of respondents listed in Table 8.1. Only 11 out of the 38 cases (29%) of the two routes coincided exactly and even amongst those 19 respondents claiming to be seeking the quickest route only 7 (37%) coincided exactly with that identified as a minimum cost route by the model. In many cases, e.g. responses 67 and 71, the differences were marked.

8.3.4 In only 1 instance did routes chosen "to avoid congestion" coincide with minimum cost routes. In many cases this was due to the model allocating routes along the A660 (e.g. responses 37, 52, 85 and 87) whereas respondents in general avoided using this road, particularly in Headingley and where the road is affected by the inbound morning peak hour bus lane.

8.3.5 Several explanations can be put forward as to why the model inadequately represents observed trips:

1) Incomplete networks - the results of the stop line survey indicated some frequently used rat runs which were not included in the original network.

2) Wrongly coded networks - this may be particularly relevant in the case of Weetwood Lane which is the source of many discrepancies.

3) The absence of junction representation in a complex urban network may have influenced the results.

| Response Number | Reason for Choice of Route: Exact Match | Quickest | Safest | Usual | Avoiding Congestion | Shortest | Avoid Bus Lane | Most Convenient | Comparison | Choice of Route Made: Before Leaving Home | En Route | Regularity (times per week): 5 | 5 | Reasons for Variation in Route: Avoid Congestion | Giving Lifts | Personal Business | Other Work Place | Change from Normal Route |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | | * | | | | | | | | * | | * | | | | | | |
| 6 | | * | | | | | | | | | * | | * | * | | | | |
| 22 | * | | | | | * | | | | * | | * | | | | | | |
| 37 | | | | | * | | | | | * | | * | | | | | | |
| 52 | | | | | * | | | | | * | | | * | * | | | | |
| 57 | | | | | * | | | | | * | | * | | | | | | |
| 59 | * | * | | | | | | | | * | | | * | | * | | | |
| 67 | | * | | | | | | | | * | | * | | | | | | |
| 71 | | * | | | | | | | | * | | * | | | | | | |
| 85 | | | | | * | | | | | * | | * | | | | | | |
| 87 | | | | | * | | | | | * | | * | | | | | | |
| 122 | | * | | | | | | | | * | | * | | | | | | |
| 133 | | * | | | | | | | | * | | * | | | | | | |
| 138 | * | * | | | | | | | | | * | | * | * | | | | |
| 165 | * | * | | | | | | | | * | | | * | * | | | | |
| 166 | * | * | | | | | | | | * | | * | | | | | | |
| 192 | | | | * | | | | | | * | | * | | | | | | |
| 198 | * | | | | * | * | | | | * | | | * | * | | | | |
| 209 | | * | | | | * | | | | * | | | * | | | * | | |
| 228 | | * | | | | | | | | * | | * | | | | | | |
| 236 | * | | | * | | | | | | * | | * | | | | | | |
| 249 | | * | | | | | | | | * | | * | | | | | | |
| 258 | | | | | * | | | | | | * | | * | * | | | | |
| 263 | * | * | | | | * | | | | | | | * | | | * | | |
| 290 | | | | * | | | | | | | * | | * | * | | | | |
| 297 | | | | * | | | | | | * | | | * | * | | | | |
| 300 | | | * | | | | | | | * | | * | | | | | | |
| 308 | | * | | | | | | | | | * | | * | * | | | | |
| 329 | | | | | | | | | * | | * | | | | | | | * |
| 346 | | * | | | | | | | | * | | * | | | | | | |
| 349 | | | | | * | * | | | | * | | * | | | | | | |
| 380 | * | * | | | | | | | | * | | | * | | | | * | |
| 387 | | | | | * | | * | | | | * | | * | * | | | | |
| 390 | | | | | * | | | | | * | | * | | | | | | |
| 410 | | * | | | | | | | | | * | | * | * | | | | |
| 421 | * | * | | | | | | | | * | | * | | | | | | |
| 433 | * | | | | | | | * | | * | | * | | | | | | |

Table 8.1 Reasons for and Regularity of Choice of Route for a Sample of Stop Line Respondents

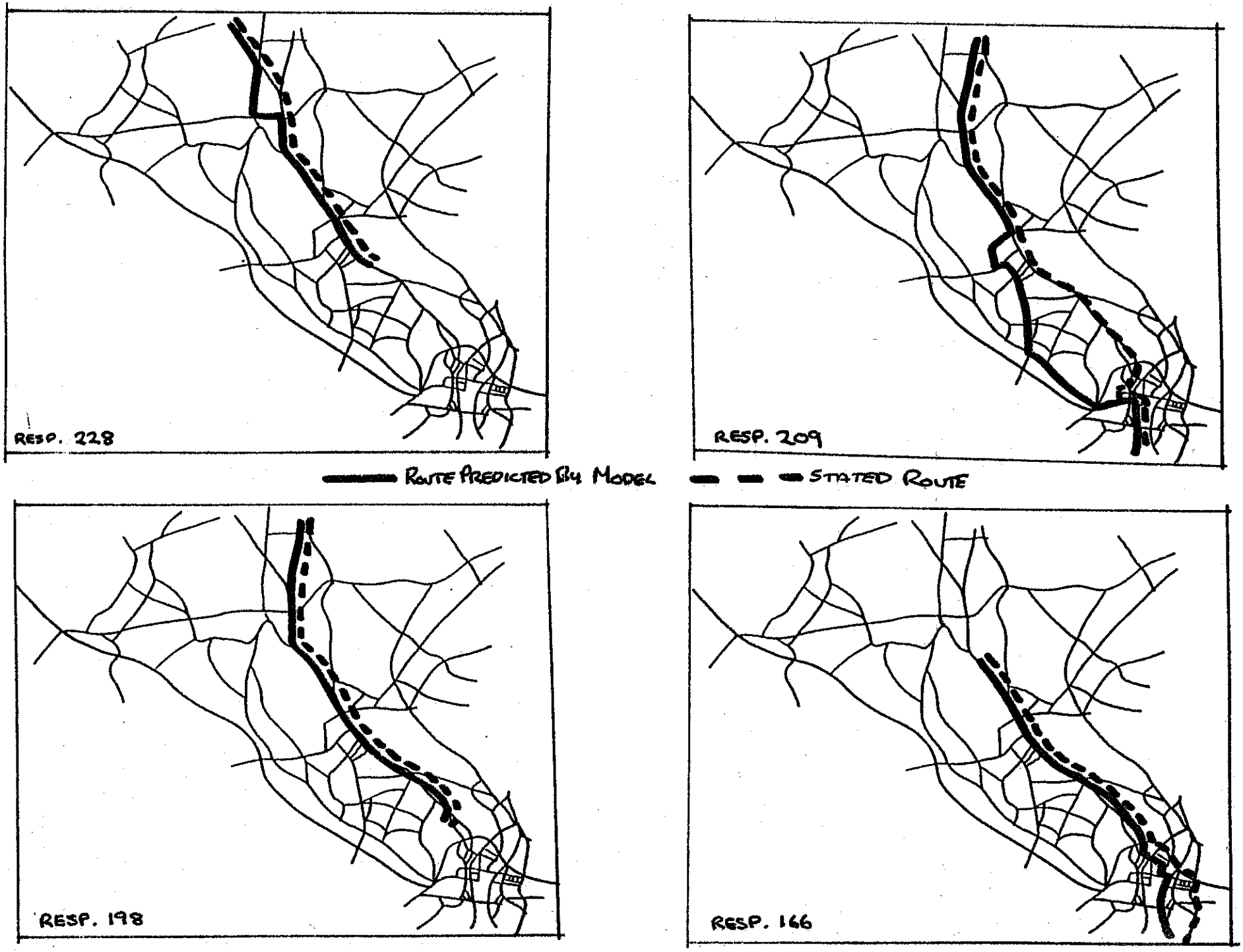
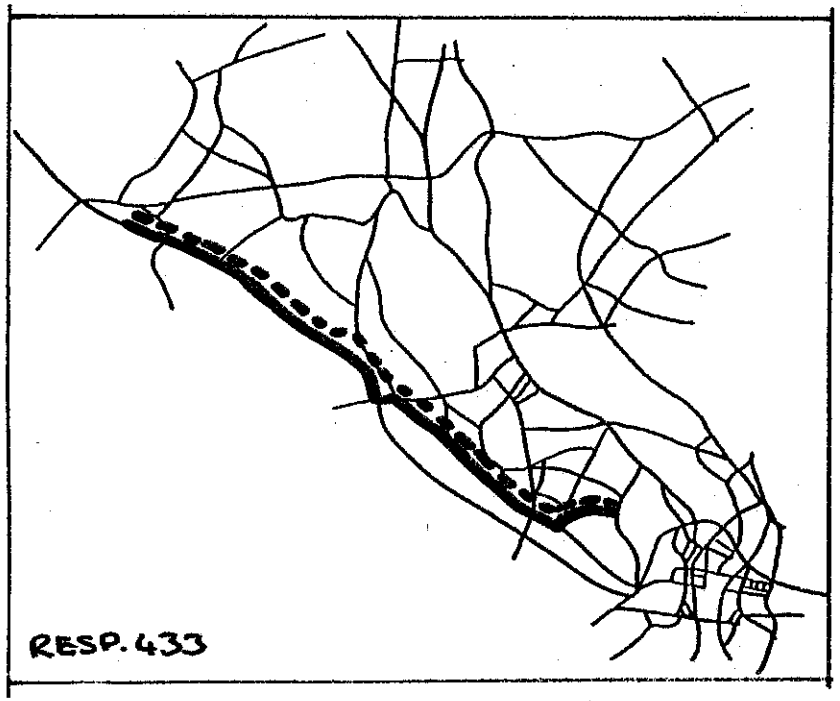
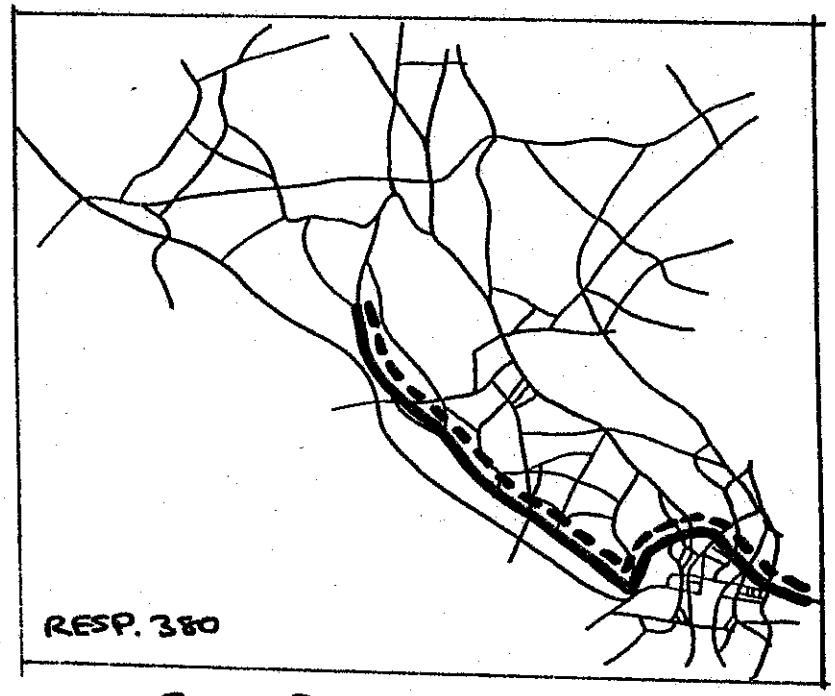
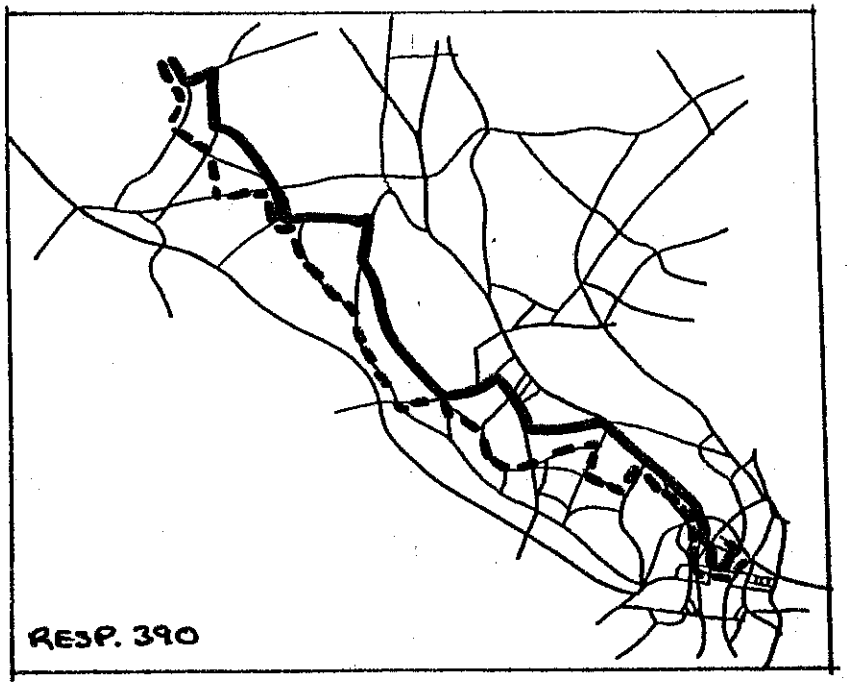


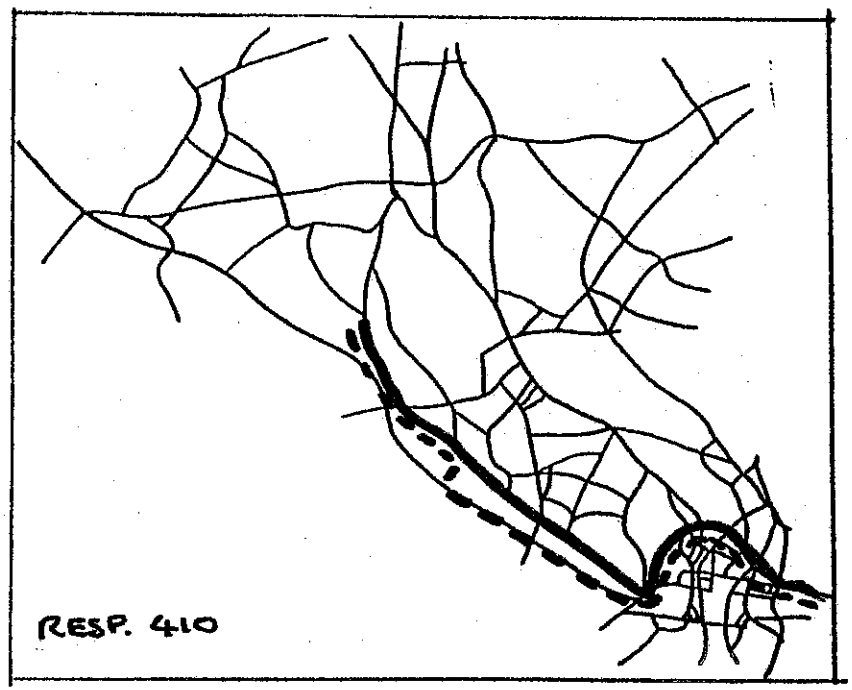

**FIGURE 8.4 COMPARISON OF A SAMPLE OF OBSERVED AND PREDICTED ROUTES**

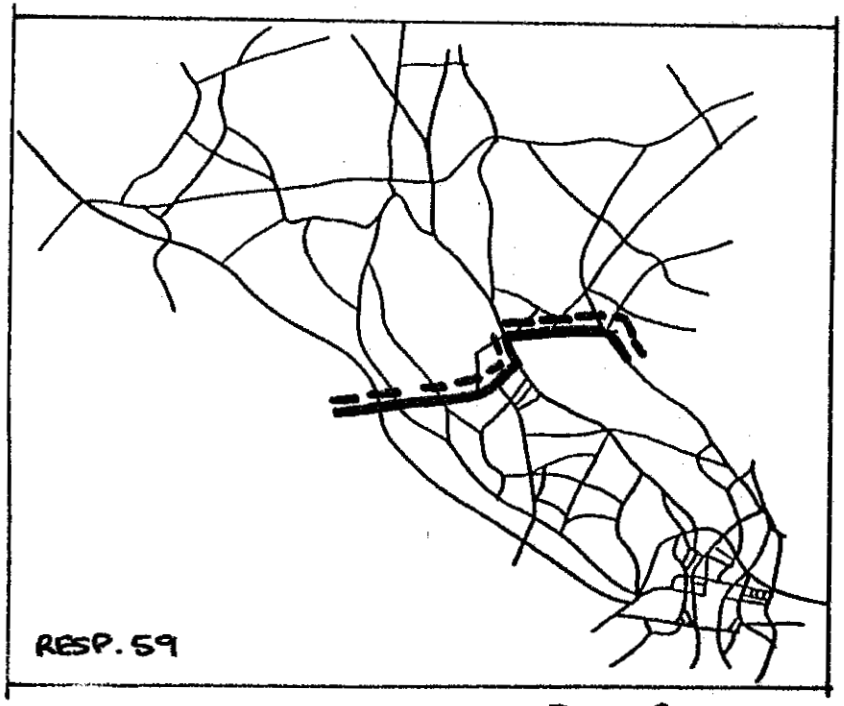


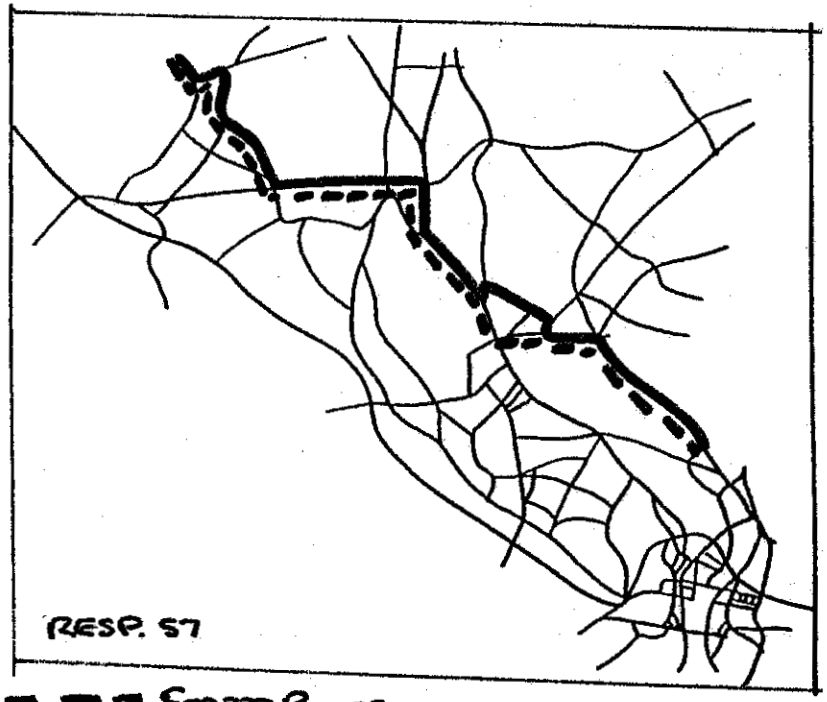




ROUTE PREDICTED BY MODEL — — — STATED ROUTE



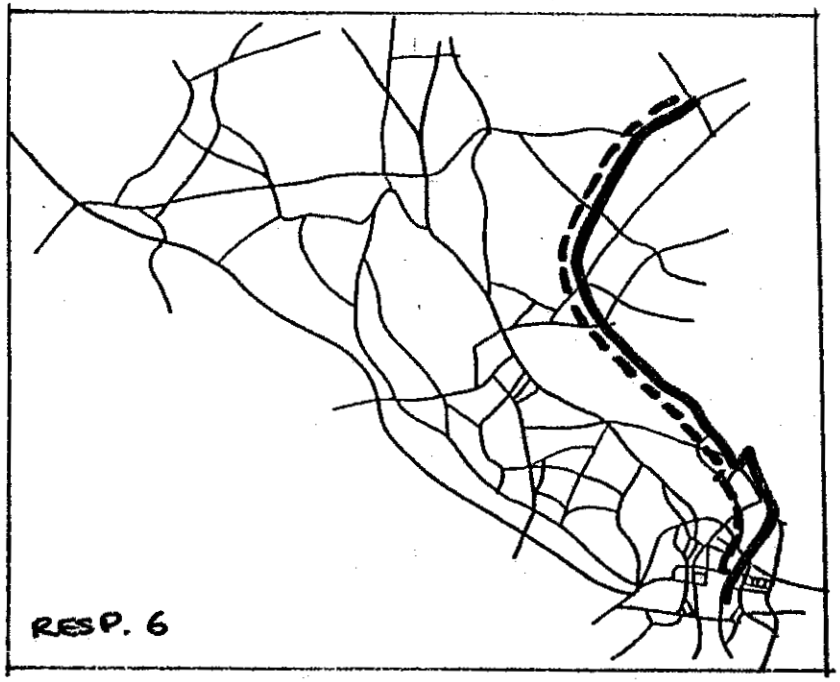



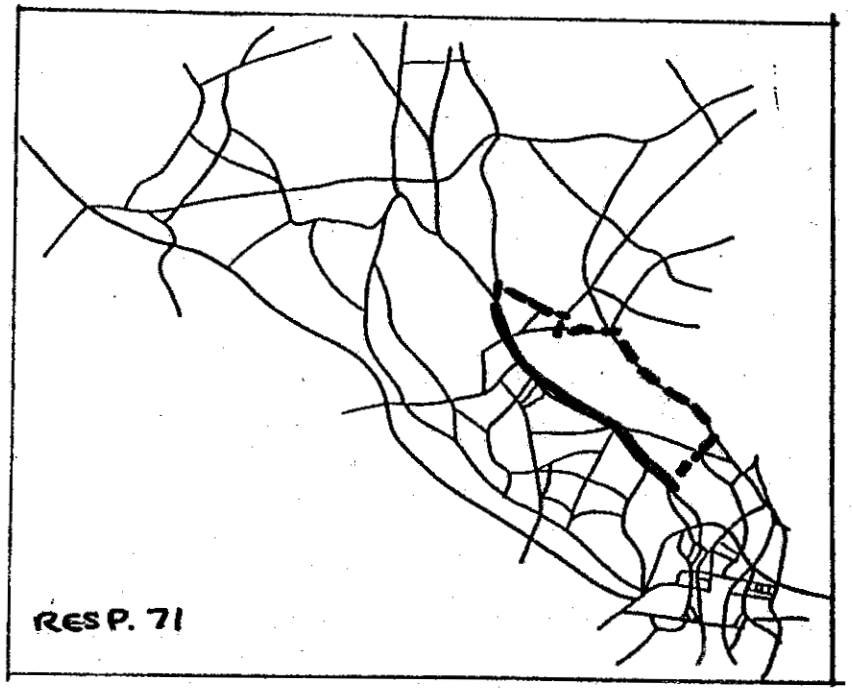


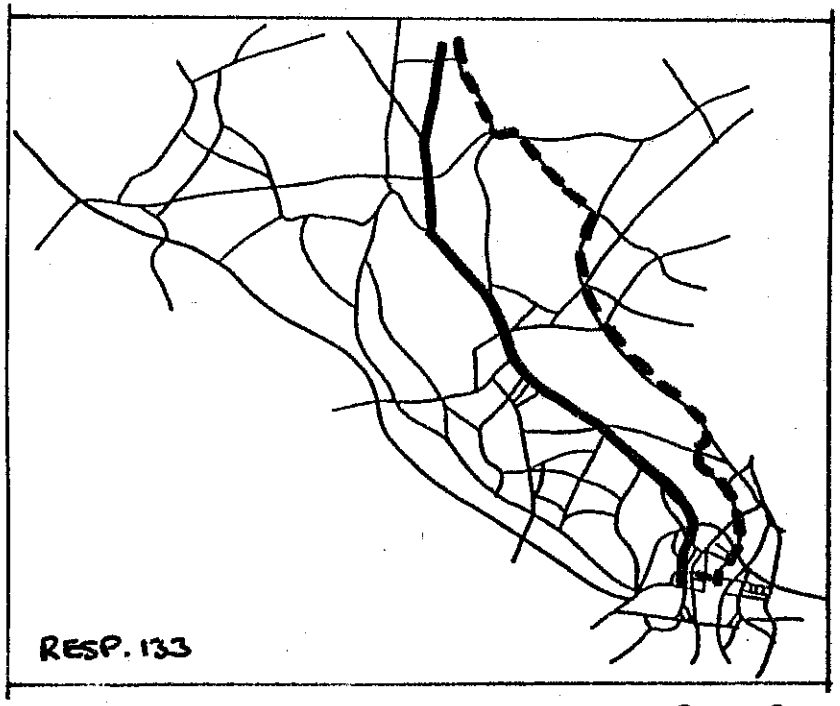



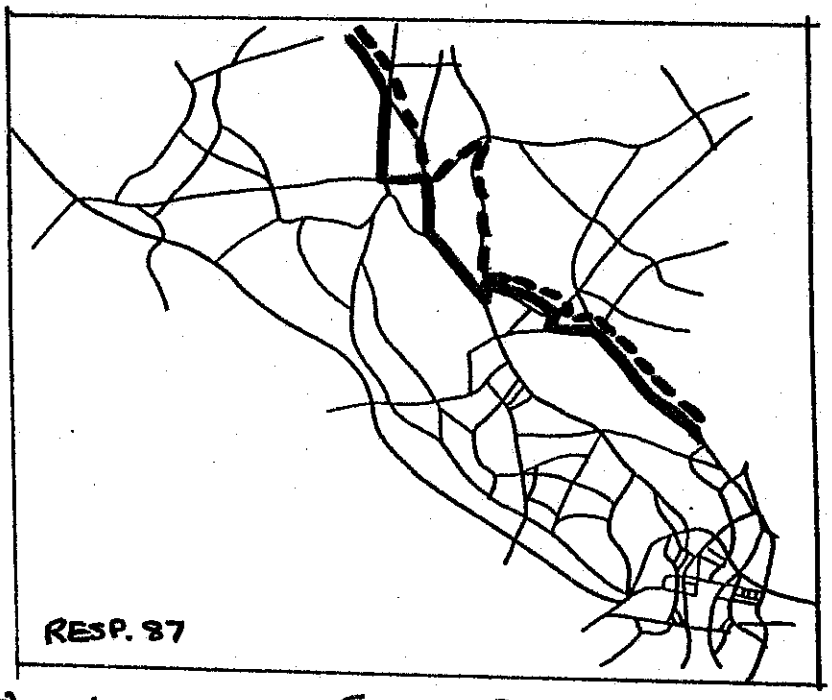

ROUTE PREDICTED BY MODEL

STATED ROUTE



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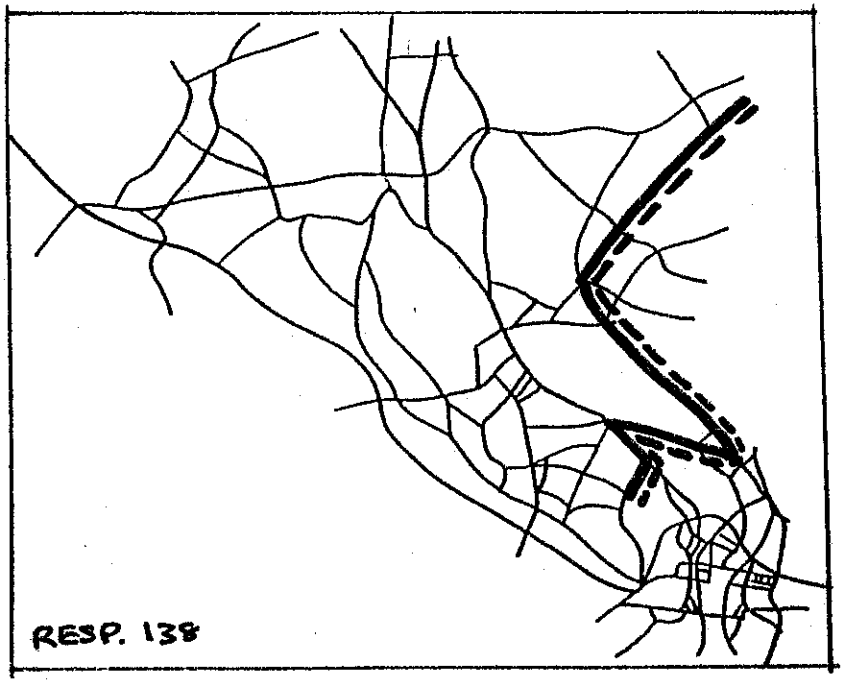


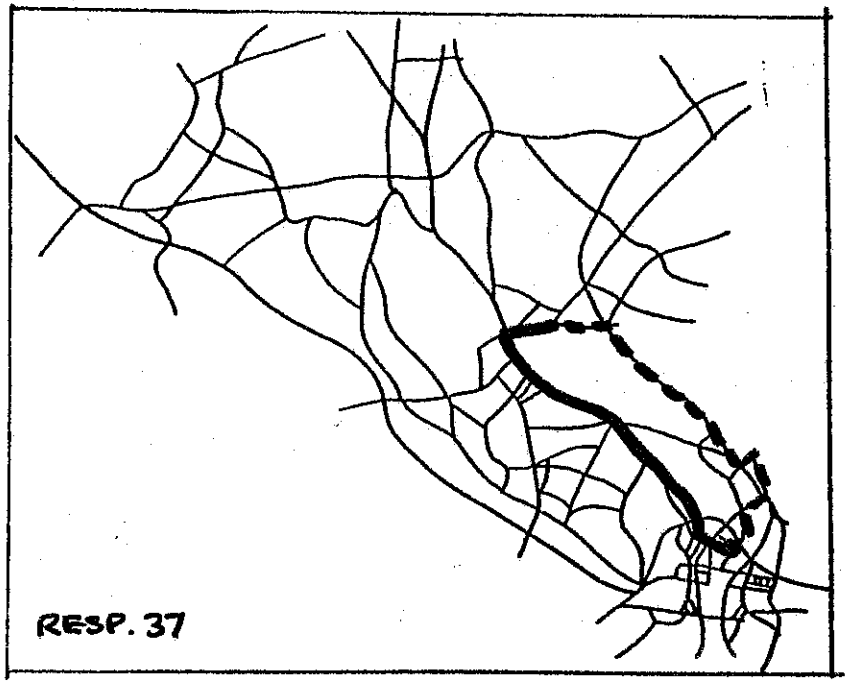

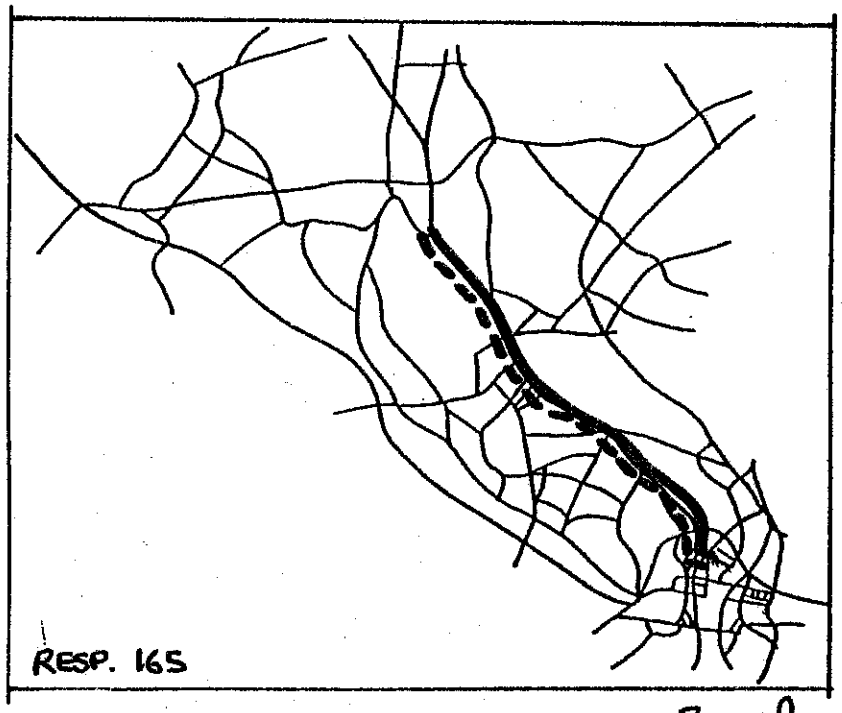


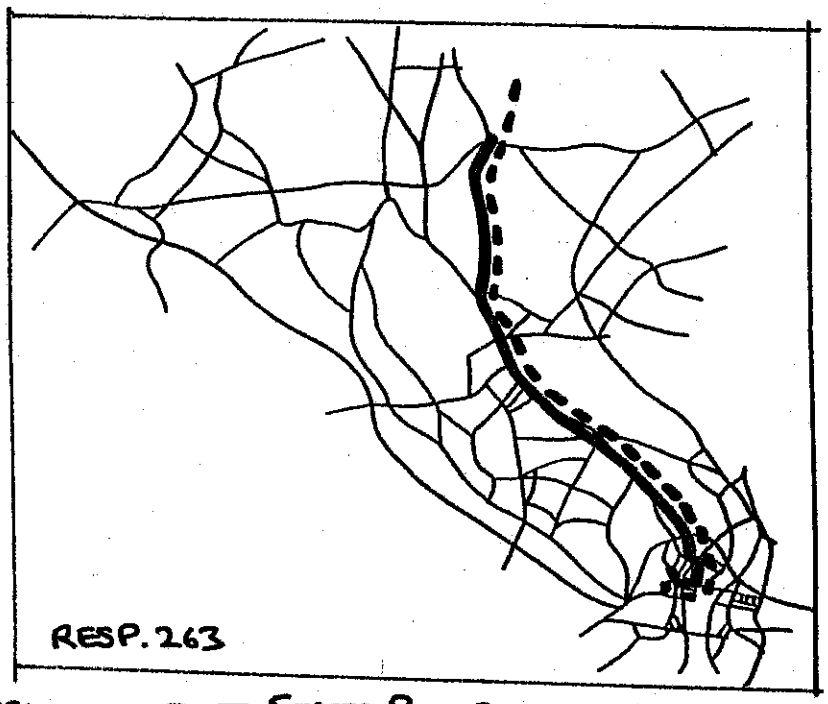


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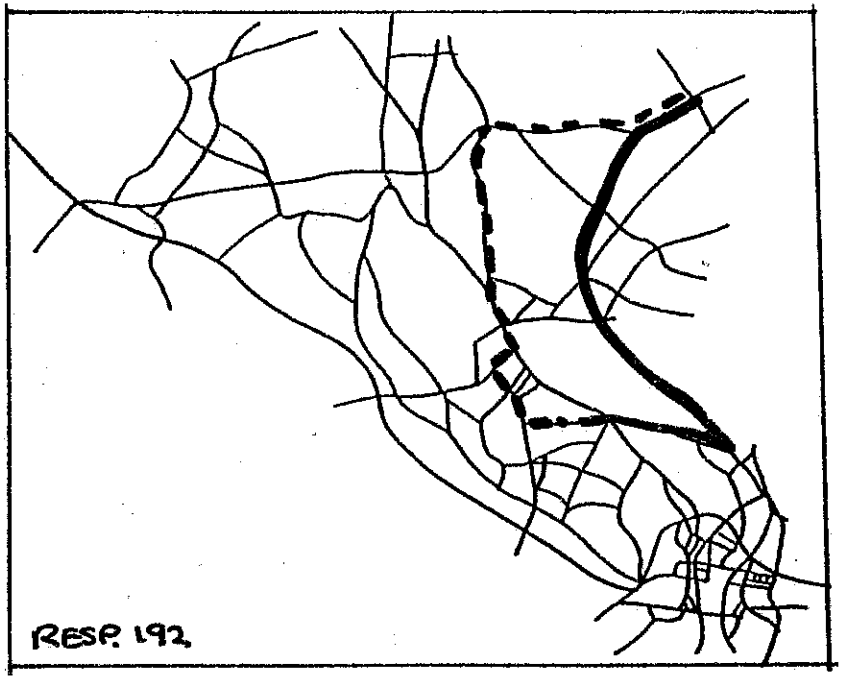


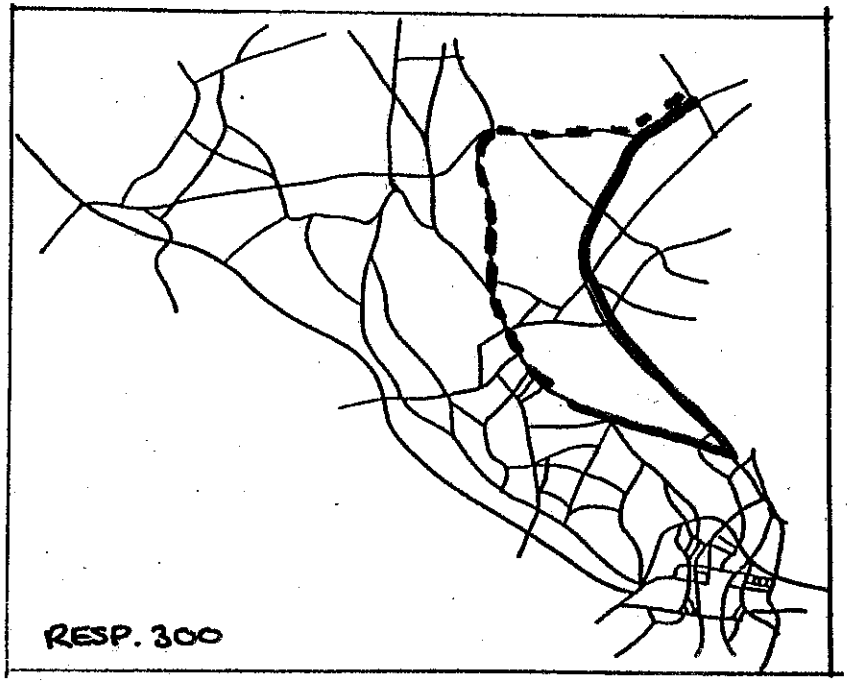


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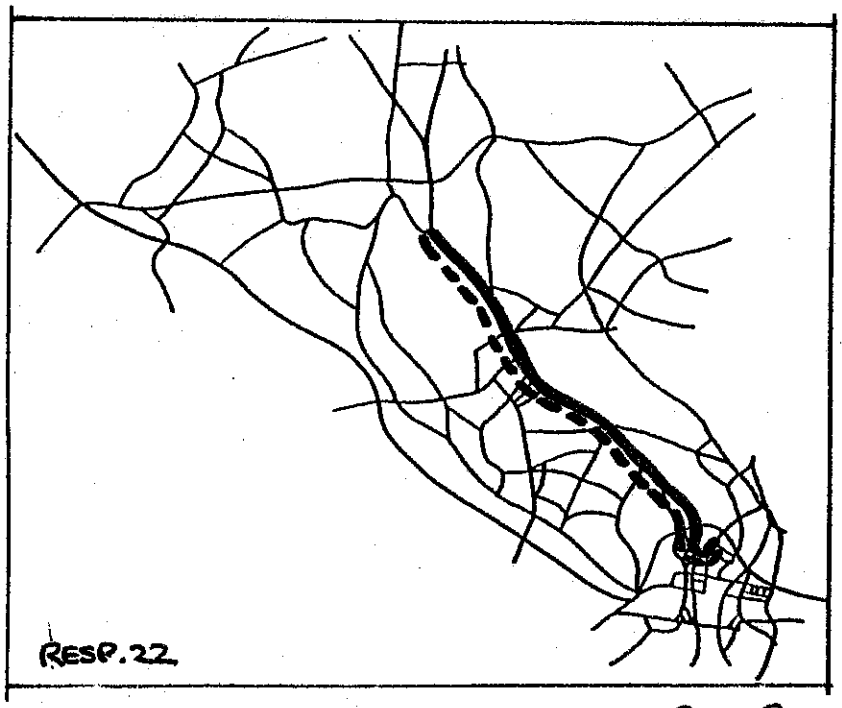


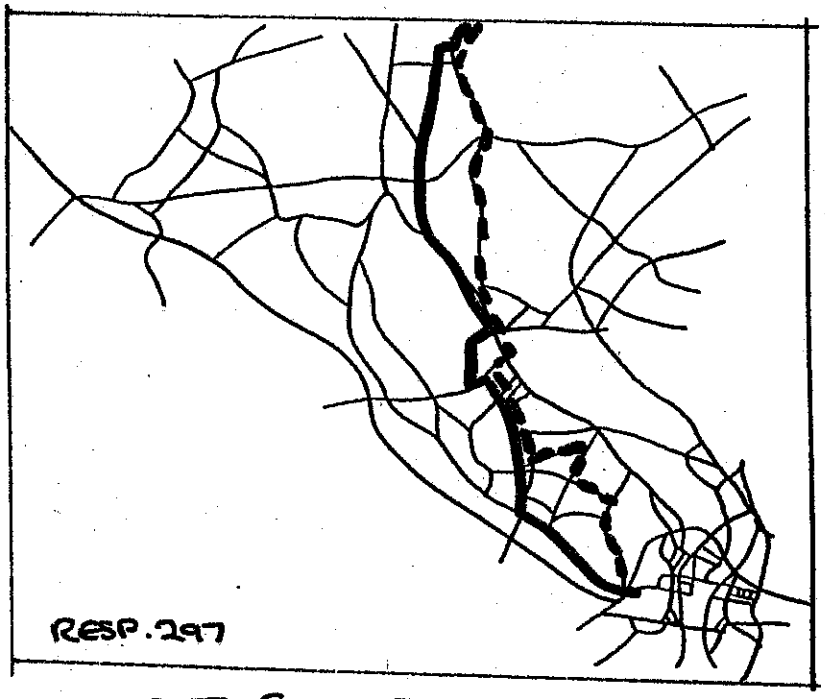


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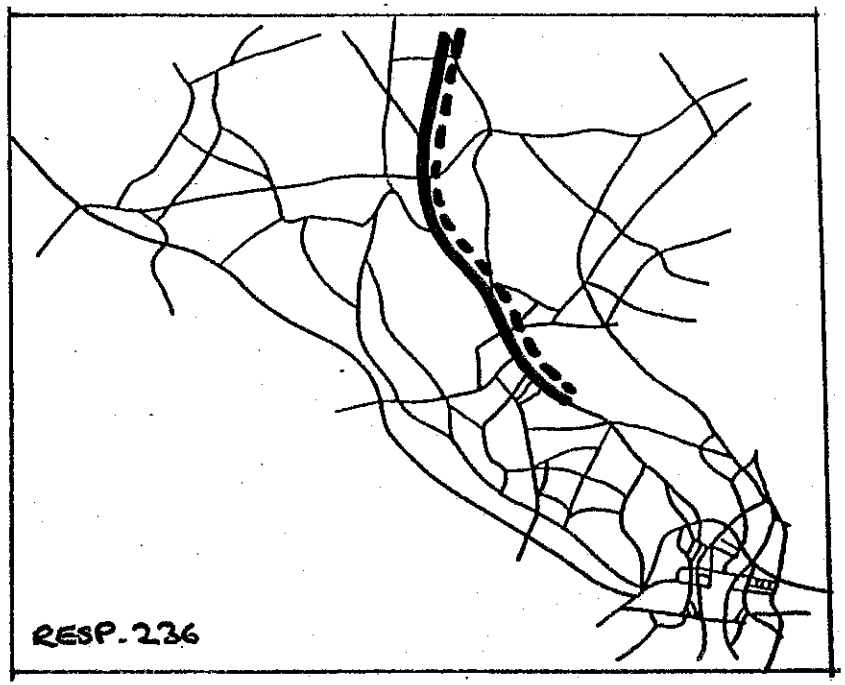


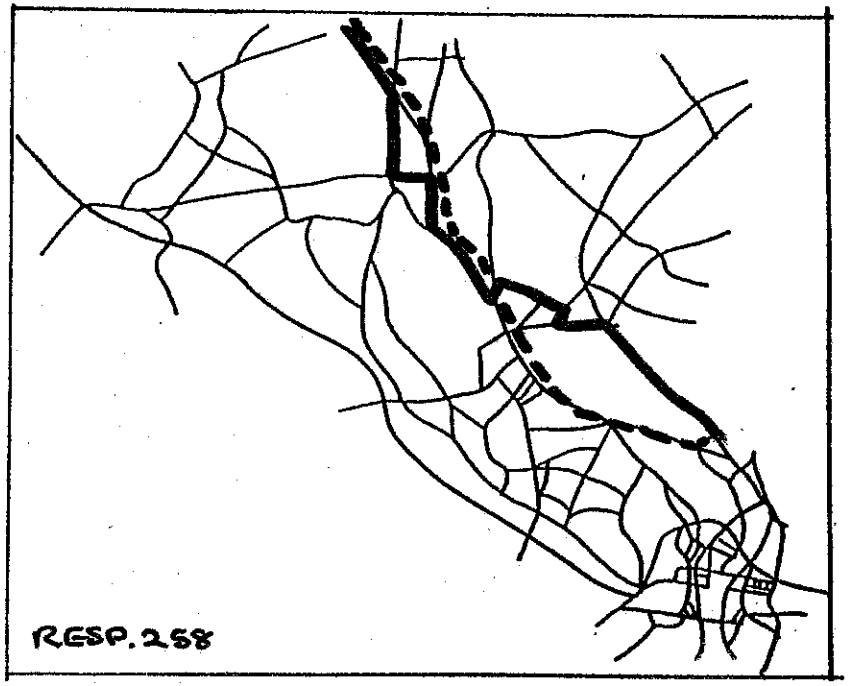

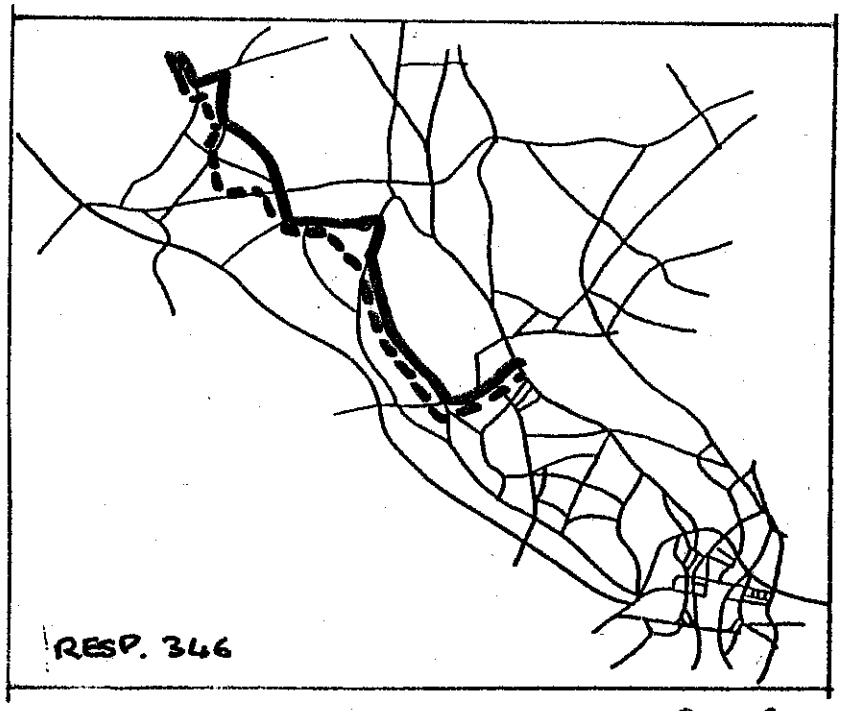


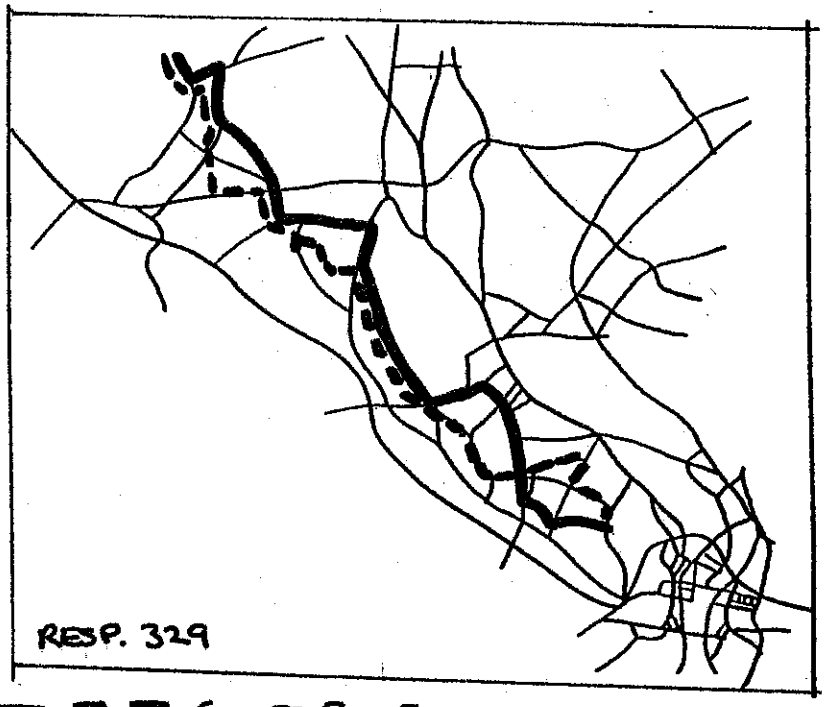


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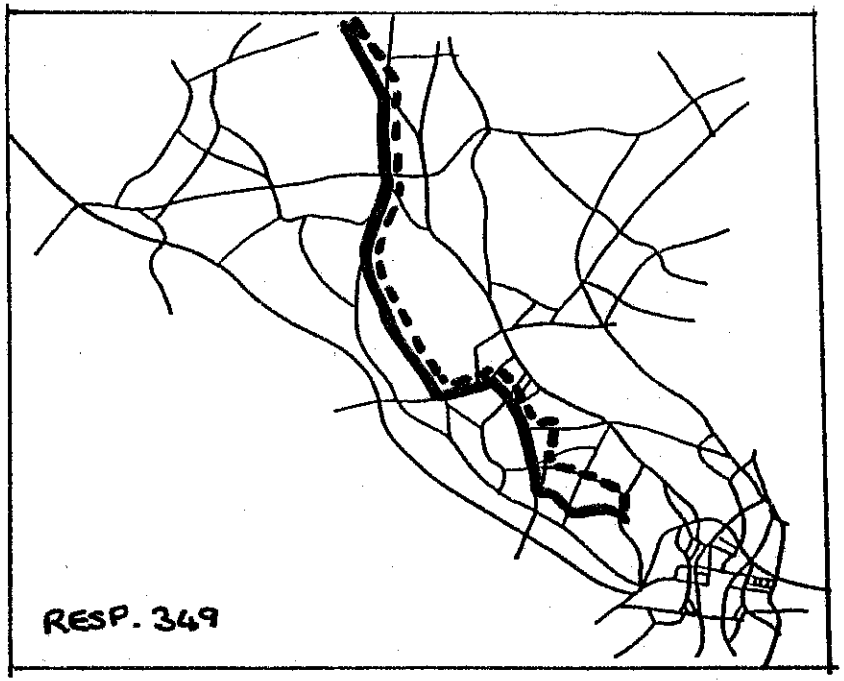


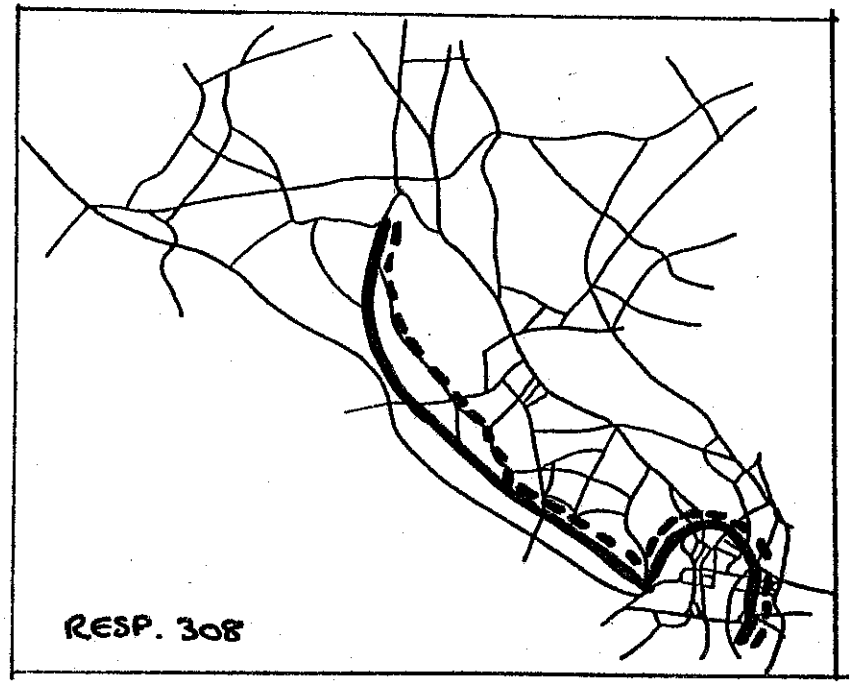


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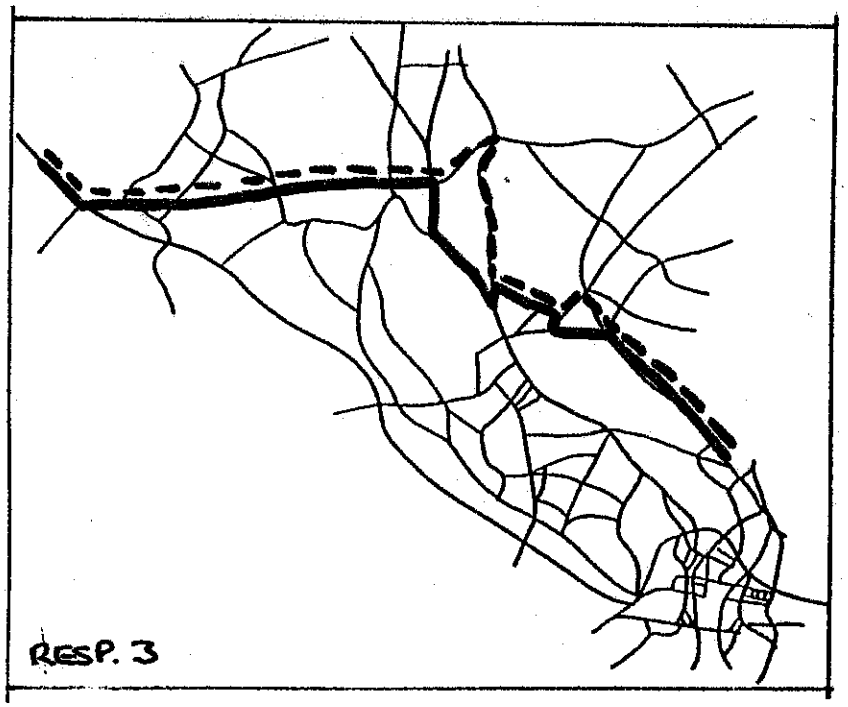
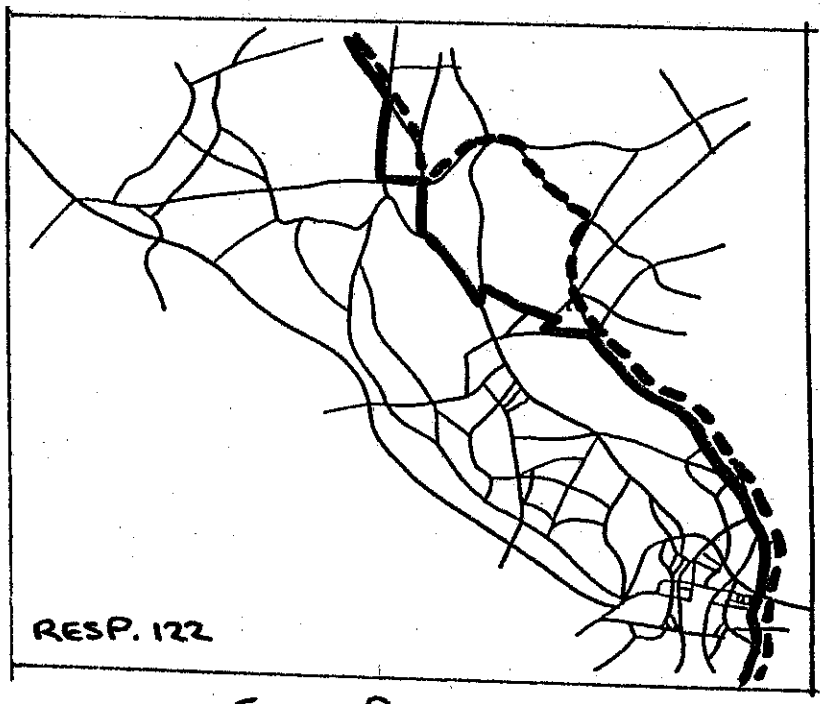
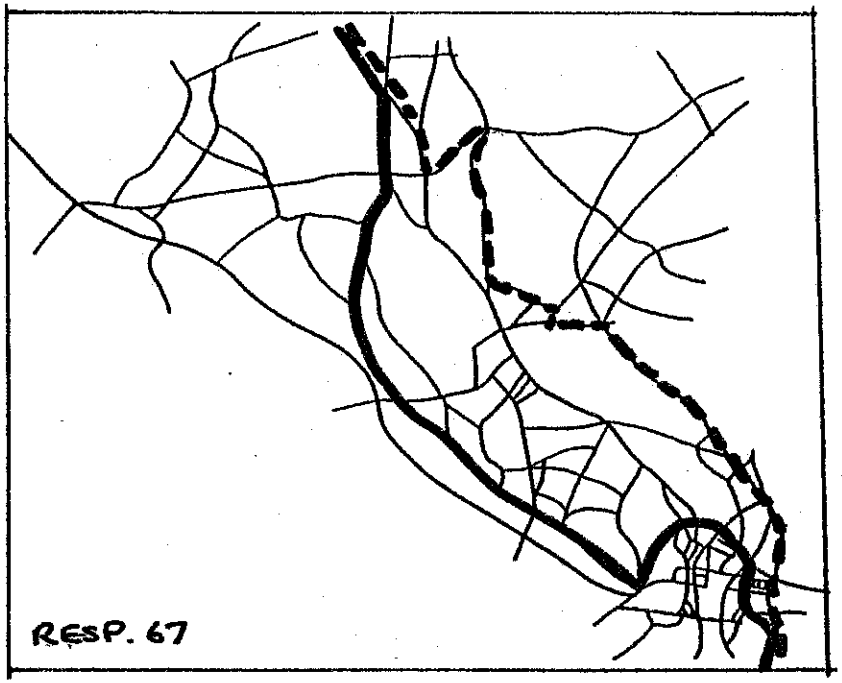
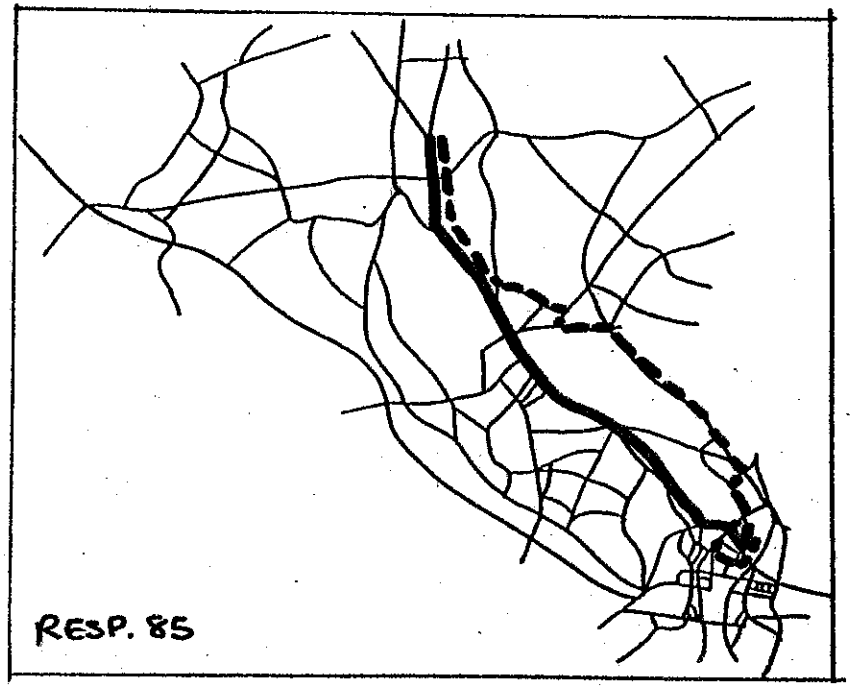


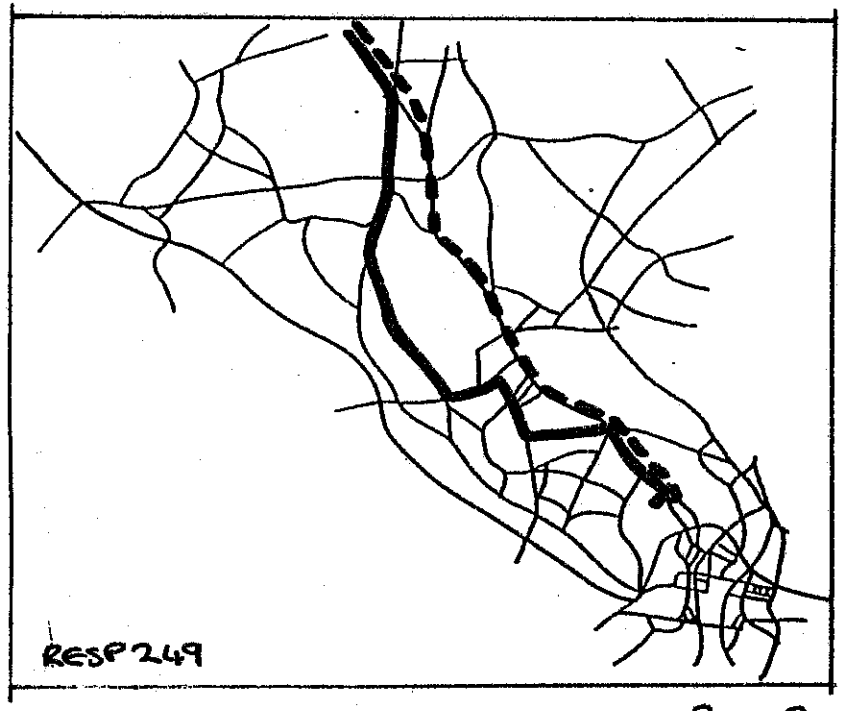



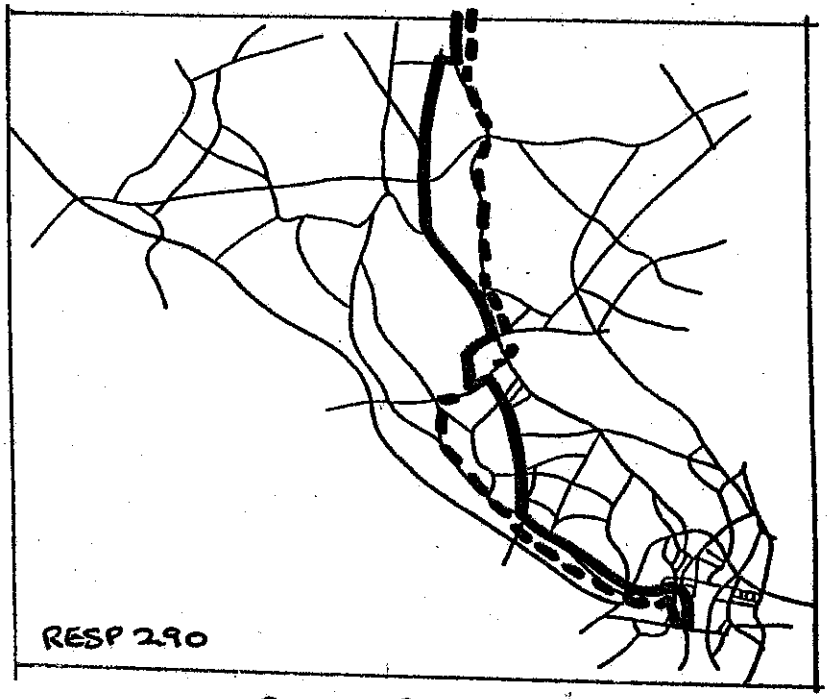

ROUTE PREDICTED BY MODEL

STATED ROUTE

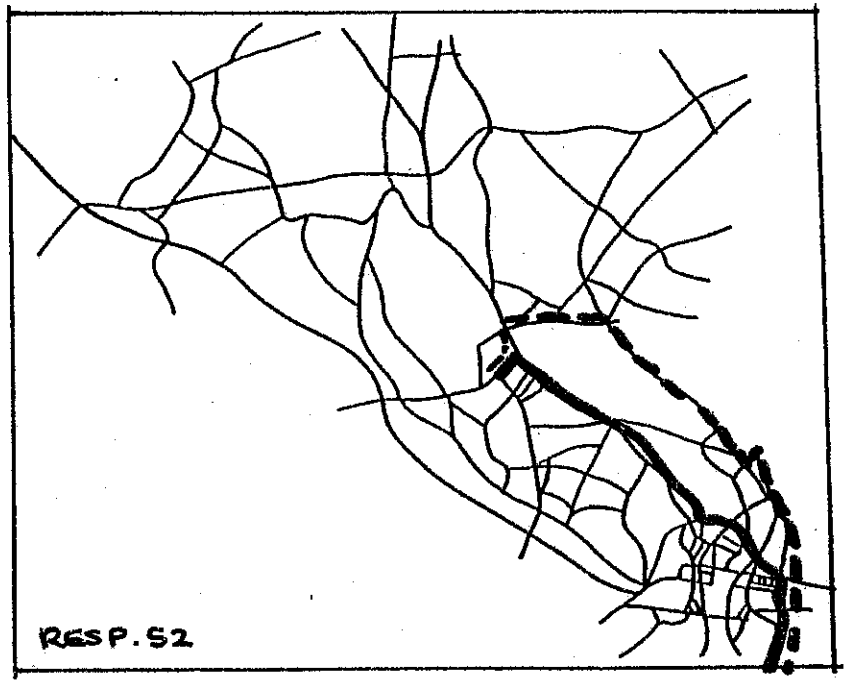


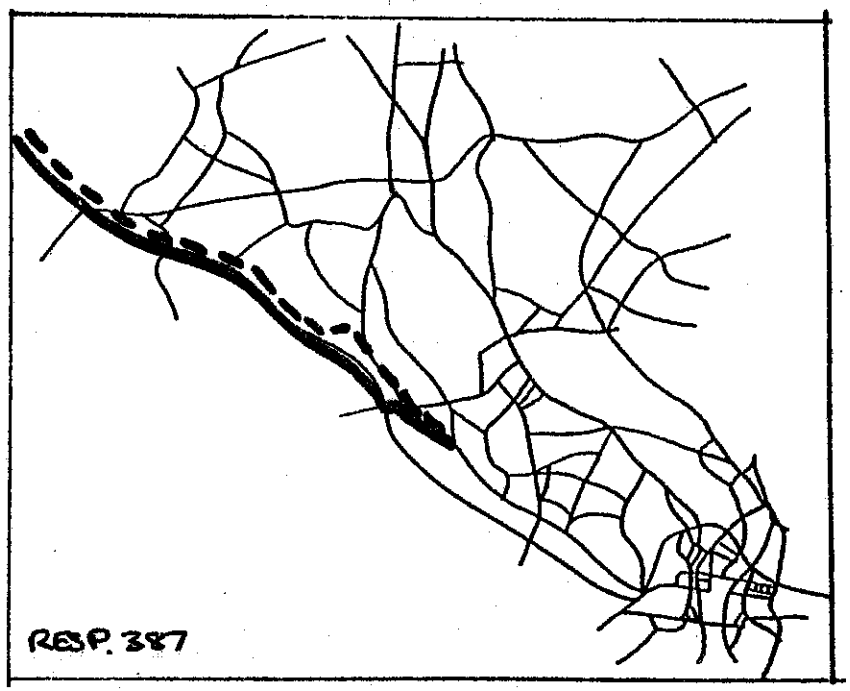






ROUTE PREDICTED BY MODEL — — — STATED ROUTE

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4) The use of a standard generalised time almost certainly oversimplifies the situation.

5) The comparisons are based on a single iteration of the model and it may be that in previous or subsequent iterations a better match between predicted and observed routes occurred.

## 8.4 Summary

8.4.1 The analysis of predicted and observed routes indicates that, when the model is artificially constrained through the survey sites a good match between the two sets of routes is obtained. However the model was less successful in predicting individual journeys particularly when the route was chosen 'to avoid congestion'.

CHAPTER 9

# 9. SUMMARY AND SUGGESTIONS FOR FURTHER RESEARCH

## 9.1 Summary

9.1.1 In order to determine both theroutes used by drivers in the chosen sector of Leeds and the response to two major traffic management schemes in the area, data was collected on the choice of route at four times over a period of 18 months using two main techniques - a panel survey and a stop line survey - involving pre paid questionnaires. Table 2.1 shows that the sample route in the panel survey fell from 85.5% at the time of the first survey to 69.2% in the third (despite an increase in the cash prize draw). A response rate of 48% was achieved with the stop line survey (Table 2.3). The data obtained from these surveys was supplemented by traffic survey data supplied by WYMCC. This included automatic traffic counts on two screenlines, junction timing movement surveys and journey time surveys.

9.1.2 The surveys were conducted in a period of overall traffic growth between 1982 and 1984 (AM Peak hour + 4%, PM Peak hour + 7%, 16 hours + 4%) although there has been a redistribution of traffic within the study area, particularly during the evening peak. Flows on the A660 have decreased and traffic volumes through the Sheepscar interchange have increased significantly (+ 13%). The results of the panel survey reinforce the theory of a redistribution of traffic away from the A660 following the introduction of the peak-hour bus lane.

9.1.3 The main reasons given by respondents to both the panel and stop line surveys for their choice of route were to minimise journey time and to avoid congestion. Table 4.21 shows that over 80% of those members who responded to all three panel surveys used the same route on at least 5 days out of the 6 surveyed and where changes of route occurred they were usually planned before leaving work.

9.1.4 When changes were made en-route the main reason quoted in over 90% of cases was to avoid congestion. The main reasons stated for planned changes in route from that normally used were giving lifts, personal business and time of leaving work (see Table 4.22). However, again the main reason quoted for route change was the avoidance of congestion, with particular reference being made to the bus lane on the A660. The importance of congestion, and more interestingly the desire to keep moving on a journey especially to work, was reinforced during the in-depth interviews.

9.1.5 The results of the panel survey showed that there has been a significant response to the introduction of the two traffic management schemes in this sector. Of regular users of the A660 at the time of the first survey less than 30% were still doing so, by the time of the third, with a period of instability being apparent during the second survey (see Figure 5.2).

Particularly important is transfer to the Meanwood Road via the improved Sheepscar intersection, either for the whole of the journey or returning to the A660 after the end of the bus lane.

9.1.6 The stop line survey enabled a comparison of the journey to and from work to be made and showed that in general more respondents used a different route home than an exact reverse of the journey to work (Table 6.20). The survey also showed that respondents were less regular in their use of a specific route home, were less likely to vary their route after starting out for home, but were more likely to stop off.

9.1.7 An analysis of the observed routes with those predicted by an assignment model showed that if the model was artificially constrained through the survey sites a reasonable match was obtained, but when comparing individual trips less than 29% of observed routes compared exactly with those predicted. This was particularly noticeable where respondents claimed to choose a route to avoid congestion.

9.2 Suggestions for Further Research

i) Investigations into survey techniques to determine the reasons for the decline in response rates to repeated surveys and methods of maintaining the motivation of panel members.

ii) Investigations into the value of time incorporated into assignment models particularly related to the problems of congestion and the importance attached to keeping moving.

iii) An investigation of the performance of more advanced assignment models with regard to comparisons with observed trips.

iv) Detailed investigations of drivers attitudes to congestion and at that level it becomes such a problem that a change of route is considered.

v) Investigations into the extent to which drivers will reduce their journey time even if it involes a much longer journey than the most direct between the origin and destination.

Appendices are in Volume Two.

WP209
RH/plh
05 07 85

Working Paper 209
June 1985

# ROUTE CHOICE IN CONGESTED URBAN NETWORKS

Project Report

Volume Two - Appendices

R. Heywood

## APPENDIX 1

1a) LETTER OF APPROACH TO THE PERSONNEL OFFICERS.

1b) INVITATIONAL LETTER AS DISTRIBUTED TO EMPLOYEES.

ITS

INSTITUTE FOR TRANSPORT STUDIES
THE UNIVERSITY OF LEEDS
LEEDS LS2 9JT
Tel: (0532) 431751 ext 7215
Telex: 557939

Director and Professor of Transport Economics: K. M. Gwilliam
Professor of Transport Engineering: A. D. May

ADM/bgh

30th March 1983

&A1& &a2& &a3&,
&A4&,
&A5&,
&A6&,
&A7&
&A8&

Dear &A1& &A3&,

The Institute for Transport Studies is currently investigating congestion occurring during the evening rush-hour in North-West Leeds. In order to complement our own observations, we would like to conduct a survey of some of your firm's employees who usually drive home through that part of Leeds. They would be asked to complete a questionnaire in their own time.

A draft of a letter is attached which inviting participation in the survey. We should be grateful if you would agree to the distribution of copies of this letter to members of your staff. We would like to distribute these invitations shortly after the Easter break and are planning to start the survey towards the end of April.

We can provide you with further details of the survey on request. We shall in any case contact you shortly to discuss details of the arrangements. Thank you in advance for your cooperation.

Yours faithfully,

A.D. May.
Professor of Traffic Engineering

This matter is being dealt with by Mr Heydecker, telephone Leeds 431751, ext. 7215

APPENDIX 1a) Letter of approach to personnel officers.

ITS

# INSTITUTE FOR TRANSPORT STUDIES

THE UNIVERSITY OF LEEDS
LEEDS LS2 9JT

Tel: (0532) 431751 ext 7215
Telex: 557939

Director and Professor of Transport Economics: K. M. Gwilliam
Professor of Transport Engineering: A. D. May

Dear Sir/Madam,

The Institute for Transport Studies is currently investigating congestion in North-West Leeds in the afternoons and evenings. We are consequently studying traffic conditions in some detail. However, we recognise the importance of drivers' own experiences.

We are looking for drivers whose usual route from work to home includes any part of

Kirkstall Road (A65),
Burley Road,
Woodhouse Lane / Headingley Lane / Otley Road (A660),
Meanwood Road,
Scott Hall Road (A61),
or any of the roads in between these.

Drivers will be asked to record timings along their routes home each day for about 6 days and to answer a brief questionnaire. While we cannot offer payment to those who complete the survey, they will all be included in a draw for a £50 cash prize.

If you drive through the area described above and are willing to take part in this survey, please complete the form below and return it to the your firm's personnel office by 12 noon on Friday 15th April. If you require any further details, please contact Mr Heydecker at the Institute for Transport Studies.

Yours faithfully,

A.D. May
Professor of Transport Engineering.

---

I am interested in taking part in the congestion survey.

Name: _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

Home address:
Street _ _ _ _ _ _ _ _ _ _ _ _
District _ _ _ _ _ _ _ _ _ _ _ _
Post-Code _ _ _ _ _ _

Firm _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
Building _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
Department _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
Work telephone number _ _ _ _ _

I drive home from work

1 [_]
2 [_]
3 [_] times each week.
4 [_]
5 [_]

APPENDIX 1b) Invitational letter as distributed to employees

## APPENDIX 2

THE POWER SURVEY

2.1 INSTRUCTIONS

2.2 INITIAL QUESTIONNAIRE

2.3 DAILY QUESTIONNAIRE

2.4 EXAMPLE OF DAILY QUESTIONNAIRE

2.5 MAP OF CORDON POINTS

INSTRUCTIONS

- Please find enclosed: 1 yellow questionnaire with a map attached, 6 date-stamped white questionnaires and a "freepost" envelope.

- Please complete the yellow questionnaire now (remember that all information you give will be treated in complete confidence).

- Please read these instructions and look at the example of a completed white questionnaire.

- Please complete the appropriate white questionnaire on each of:
  Monday to Wednesday - (25th-27th April)
  and Wednesday to Friday - ( 4th- 6th May)

  On each of these days

  1. Put the questionnaire in the car with a pen handy and in a position where you can use it on your journey.

  2. On your journey, note the precise time at which you:
     - get into the car
     - reach the inner ring road
     - reach the outer ring road
     - stop for anyone (including yourself) to get into or out of the car
     - start again after someone has got into or out of the car
     - arrive home.

  3. As soon as you arrive home, before getting out of the car, fill in the questionnaire for the day.

- When you have completed all 6 white questionnaires (i.e. on Friday, 6th May), please return them to us, together with the yellow questionnaire, in the "freepost" envelope provided.

- When we receive your completed questionnaires, we will enter you for our £50 cash prize draw.

- If on any of the survey days you do not drive home, please mark that day's white questionnaire accordingly and return it to us anyway.

- Thank you!

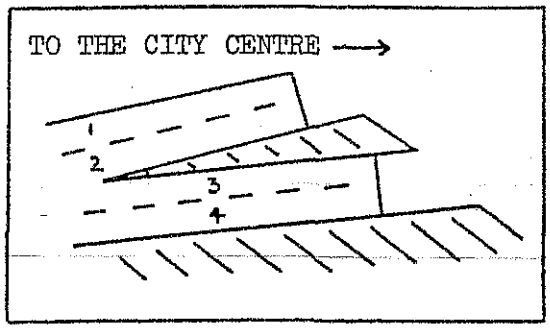
# APPENDIX 3

## STOP LINE SURVEY - PILOT INTERVIEWS

3.1 INTERVIEW FORM USED AT SHEEPSCAR

3.2 INTERVIEW FORM USED AT BLENHEIM WALK

| |
|---|
| LANE |
| DATE |
| TIME |
| SITE |
| ENUM |
| NO. |




We are doing a study of traffic congestion. Can we ask you a few questions about your journey into Leeds today?
(Your answers will be treated as confidential)

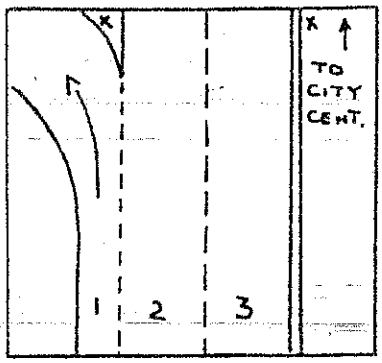
1. FROM WHAT ADDRESS DID YOU START YOUR JOURNEY?
   .....
2. WHAT TIME DID YOU START YOUR JOURNEY? .....
3. HAVE YOU STOPPED FOR YOURSELF OR ANY OTHER PASSENGERS SINCE THEN? .....
   IF SO: WHERE? .....
4. WHERE WILL YOU PARK YOUR CAR? ...../.....
5. HAVE YOU TO STOP THERE BEFORE THEN? .....
   IF SO: WHERE? .....
6. HAVE YOU COME ALONG: KING LANE.....
   PARKSIDE ROAD.....
   MEANWOOD ROAD.....
   WEETWOOD LANE.....
7. HOW OFTEN DO YOU COME INTO LEEDS BY THIS ROUTE?
   1) EVERY WEEKDAY..... 3) 2-3 TIMES A WEEK.....
   2) 3-4 TIMES A WEEK..... 4) LESS THAN TWICE A WEEK.....

ITS Stop Line Survey. October 1984 -- Pilot.

APPENDIX 3a.

INTERVIEW FORM USED AT SHEEPSCAR.

| | |
|---|---|
| LANE | |
| DATE | |
| SITE | |
| ENUM | |
| NO. | |




We are doing a study of traffic congestion. Can we ask you a few questions about your journey into Leeds today?

(Your answers will treated as confidential)

1) FROM WHAT ADDRESS DID YOU START YOUR JOURNEY?

.....

2) HAVE YOU STOPPED FOR YOURSELF OR ANY OTHER PASSENGERS SINCE THEN? .....

IF SO: WHERE? .....

3) HAVE YOU TO STOP ANYWHERE BEFORE THEN? .....

IF SO: WHERE? .....

4) HAVE YOU COME ALONG: OTLEY ROAD .....

BUTCHER HILL .....

VICTORIA ROAD .....

MEANWOOD ROAD .....

WEETWOOD LANE .....

NONE OF THESE .....

6) WHAT TIME DID YOU START YOUR JOURNEY? .....

7) DO YOU USUALLY USE THIS ROUTE? .....

8) HOW OFTEN DO YOU COME INTO LEEDS BY THIS ROUTE?

1) EVERY WEEKDAY .....
2) 3-4 TIMES A WEEK .....
3) 2-3 TIMES A WEEK .....
4) LESS THAN TWICE A WEEK ....

ITS Stop Line Survey. October 1984 -- Pilot

INTERVIEW FORM USED AT BLENHEIM WALK.

APPENDIX 3b.

## APPENDIX 4

STOP LINE SURVEY - PILOT QUESTIONNAIRE

4a. LETTER ACCOMPANYING QUESTIONNAIRE DISTRIBUTED AT BURLEY ROAD

4b. TRAVEL QUESTIONNAIRE

4c. INTRODUCTIONS TESTED.

APPENDIX 4a) LETTER ACCOMPANYING QUESTIONNAIRE DISTRIBUTED AT BURLEY ROAD.


# INSTITUTE FOR TRANSPORT STUDIES

THE UNIVERSITY OF LEEDS
LEEDS LS2 9JT

Tel: (0532) 431751 ext 7215
Telex: 557939

Director and Professor of Transport Economics: K. M. Gwilliam
Professor of Transport Engineering: A. D. May


1st November 1984

PWB/plh

Dear Sir/Madam,

The Institute for Transport Studies is currently investigating afternoon and evening congestion in North West Leeds. We are studying traffic conditions in some detail, but we do recognise the value of individual drivers' own experiences and therefore seek your help.

We would be very grateful if you would complete the attached questionnaire. It is important that we have detailed information about journeys actually made and would like you to fill in details for your next journey home from work.

Please note that we ask for the precise time at which you start and finish your journey; clearly this cannot be provided unless you make a record of it at the time.

After completing the form please return it to us in the freepost envelope provided.

All information will be treated in the strictest confidence and cannot, in any event, be traced back to individuals. Thank you for your help.

Yours faithfully,

Peter Bonsall

Peter Bonsall
Lecturer in Local Transport Planning

P.S. If you have any queries do not hesitate to contact me or my colleague Ray Heywood on 431751 ext. 7215.

1) HELLO THIS IS A TRAFFIC SURVEY.

2) ARE YOU GOING TO WORK?

3) WILL YOU BE TRAVELLING BACK FROM CENTRAL LEEDS AFTER 4PM THIS EVENING?

4) a) Could you please fill in this questionnaire tonight and return it to us in the FREEPOST envelope?

b) We are doing a study of congestion in Leeds and would appreciate your help in filling in this questionnaire this evening. It asks about the precise route you take and how long it takes you. You'll need to record the precise time you get into the car.

1,2,3,4a = short interview.

1,2,3,4b = long interview.

APPENDIX 4c)

INTRODUCTIONS TESTED.

## APPENDIX 5

STOP LINE SURVEY

5a. INTRODUCTORY LETTER - SHORT QUESTIONNAIRE

5b. INTRODUCTORY LETTER - LONG QUESTIONNAIRE

5c. JOURNEY TO WORK QUESTIONNAIRE

5d. JOURNEY HOME FROM WORK QUESTIONNAIRE

ITS

INSTITUTE FOR TRANSPORT STUDIES
THE UNIVERSITY OF LEEDS
LEEDS LS2 9JT
Tel: (0532) 431751 ext 7215
Telex: 557939

Director and Professor of Transport Economics: K. M. Gwilliam
Professor of Transport Engineering: A. D. May

15th November 1984

Dear Sir/Madam,

The Institute for Transport Studies is currently investigating congestion in North West Leeds. We are studying traffic conditions in some detail, but we do recognise the value of individual driver's own experiences and therefore seek your help.

We would be very grateful if you would complete the attached questionnaires. We would like you to record details about today's journey to work on the yellow form and details about today's journey from work on the green form.

After completing the forms please return them to us in the FREEPOST envelope provided. (NO STAMP REQUIRED)

All information will be treated in the strictest confidence and cannot, in any event, be traced back to individuals. Thank you for your help.

Yours faithfully,

P W Bonsall.

Peter Bonsall
Lecturer in Local Transport Planning

P.S. If you have any queries do not hesitate to contact me or my colleague Ray Heywood on 431751 ext. 7215.

APPENDIX 5a)

INTRODUCTORY LETTER - SHORT QUESTIONNAIRE.

ITS

INSTITUTE FOR TRANSPORT STUDIES
THE UNIVERSITY OF LEEDS
LEEDS LS2 9JT
Tel: (0532) 431751 ext 7215
Telex: 557939

Director and Professor of Transport Economics: K. M. Gwilliam
Professor of Transport Engineering: A. D. May

15th November 1984

Dear Sir/Madam,

The Institute for Transport Studies is currently investigating congestion in North West Leeds. We are studying traffic conditions in some detail, but we do recognise the value of individual driver's own experiences and therefore seek your help.

We would be very grateful if you would complete the attached questionnaires. We would like you to record details about today's journey to work on the yellow form and details about today's journey from work on the green form.

We would also like you to draw lines on the map overleaf along all of the roads you have ever used for journeys between your present home and work, (however you travelled.) } NB =

After completing the forms please return them to us in the FREEPOST envelope provided. (NO STAMP REQUIRED)

All information will be treated in the strictest confidence and cannot, in any event, be traced back to individuals. Thank you for your help.

Yours faithfully,

P W Bonsall.

Peter Bonsall
Lecturer in Local Transport Planning

P.S. If you have any queries do not hesitate to contact me or my colleague Ray Heywood on 431751 ext. 7215.

APPENDIX 5b)

INTRODUCTORY LETTER LONG QUESTIONNAIRE

ITS

# INSTITUTE FOR TRANSPORT STUDIES

THE UNIVERSITY OF LEEDS
LEEDS LS2 9JT

Tel: (0532) 431751 ext 7215
Telex: 557939

Director and Professor of Transport Economics: K. M. Gwilliam
Professor of Transport Engineering: A. D. May

December 1984

Dear Sir/Madam

The Institute for Transport Studies is currently investigating congestion in North West Leeds. We are studying traffic conditions in some detail, but we do recognise the value of individual drivers' own experiences and therefore seek your help.

We would be very grateful if you would complete the attached questionnaires. We would like you to record details about today's journey to work on the yellow form and details about today's journey from work on the green form.

We would also like you to draw lines on the map overleaf along all of the roads you have ever used for journeys between your present home and work, (however you travelled).

After completing the forms please return them to us in the FREEPOST envelope provided. (NO STAMP REQUIRED).

All information will be treated in the strictest confidence and cannot, in any event, be traced back to individuals. Thank you for your help.

Yours faithfully

Peter Bonsall.

Peter Bonsall
Lecturer in Local Transport Planning

PS If you have any queries do not hesitate to contact me or my colleague Ray Heywood on 431751 ext. 7215.

## TODAY'S JOURNEY TO WORK

1. Today's Date .....

2. From what address did you start your journey today?
   If for reasons of privacy you would rather not give this in full, please give enough detail for us to locate it on a map. eg:"Weetwood Lane by the junction with Glen Road."
   .....
   .....

3. At what time did you get into the car? .....

4. Please mark on the map overleaf, the precise route you used today for your journey to work.

   Mark with a cross any points where you stopped for any passengers to get into or out of the car.

   Mark with a circle any points where you (the driver) got into or out of the car.

5. When did you decide on the precise route you would take this morning?
   a) before leaving home.....
   b) after setting off .....(if so: where and why?).....
   .....
   .....
   .....

6. How often do you use this precise route for journeys to work?

| very rarely | about once per month | about once per week | 2-4 times per week | 5 or more times per week |
|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ |

   If you don't always use this route, please explain why not?
   .....
   .....

7. Why did you choose to travel along this particular route today?
   .....
   .....

8. Where did you park the car? (ie;address of car park)
   .....

9. Is this your usual parking place? YES ☐ NO ☐

   If NO : Why did you park here today? .....
   .....

   Where do you normally park? .....
   .....

10. At what time did you arrive at work today? .....

11. How often do you arrive within 5 minutes of this time?

| very rarely | about once per month | about once per week | 2-4 times per week | 5 or more times per week |
|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ |

12. How would you describe the traffic conditions you experienced on your journey to work today?

- Much worse than expected ☐
- Worse than expected ☐
- About the same as expected ☐
- Better than expected ☐
- Much better than expected ☐

13. Did anything other than traffic conditions affect your journey to work today? YES ☐ NO ☐

If YES: please give details (eg; left home 30 minutes late because the meter reader called) .....
.....

14. How often do you drive to work?

| very rarely | about once per month | about once per week | 2-4 times per week | 5 or more times per week |
|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ |

15. How often do you stop off somewhere on your journey to work? (eg: for petrol, a paper etc...)

| very rarely | about once per month | about once per week | 2-4 times per week | 5 or more times per week |
|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ |

16. How often do you take passengers on any part of your journey to work?

| very rarely | about once per month | about once per week | 2-4 times per week | 5 or more times per week |
|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ |

## TODAYS JOURNEY HOME FROM WORK

1. Today's Date.....

2. At what time did you leave work?.....

3. How often do you leave work within 5 minutes of this time?

| very rarely | about once per month | about once per week | 2-4 times per week | 5 or more times per week |
|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ |

4. At what time did you get into the car? .....

5. Where was it parked? (eg:address of car park)
.....
.....

6. Please mark on the map overleaf, the precise route you used today for your journey home from work.

Mark with a cross any points where you stopped for any passengers to get into or out of the car.

Mark with a circle any points where you (the driver) got into or out of the car.

7. When did you decide on the precise route you would take this evening?
a) before leaving the car park.....
b) after setting off .....(if so: where and why?).....
.....
.....
.....

8. How often do you use this precise route for journeys home from work?

| very rarely | about once per month | about once per week | 2-4 times per week | 5 or more times per week |
|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ |

If you don't always use this route, please explain why not?
.....
.....

9. Why did you choose to travel along this particular route this evening?.....
.....

10. Where did you finish your journey? (address)
If for reasons of privacy you would rather not give this in full, please give enough detail for us to locate it on a map. eg:"Weetwood Lane by the junction with Glen Road".....
.....
.....

11. At what time did you arrive there?.....

12. How would you describe the traffic conditions you experienced on your journey home from work today?

Much worse than expected ☐
Worse than expected ☐
About the same as expected ☐
Better than expected ☐
Much better than expected ☐

13. Did anything other than traffic conditions affect your journey home from work today? YES ☐
NO ☐

If YES: please give details (eg;left work 30 minutes early because had to pick the children up from school).....
.....
.....

14. How often do you stop off somewhere on your way home from work? (eg; at a petrol station, at friends, at the pub.....)

| very rarely | about once per month | about once per week | 2-4 times per week | 5 or more times per week |
|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ |

15. How often do you take passengers on any part of your way home from work?

| very rarely | about once per month | about once per week | 2-4 times per week | 5 or more times per week |
|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ |

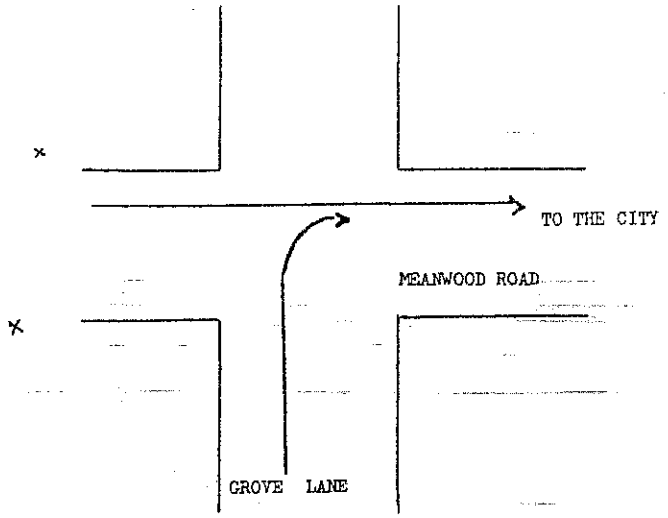
16. How long have you been driving between Central Leeds and your present home area?

under 6 months ☐ 6 months to 1 year ☐ over 1 year ☐

THANK YOU FOR YOUR HELP

JUNCTION : Meanwood Road / Grove Lane
DATE : 3/12/84
START TIME : 0800
FINISH TIME : 0840

Junction Layout.




1) Right turn filter controlled
2)Traffic on Meanwood Road drifted up to the stop line in the early part of the survey.
3) School crossing patrol at X
4) Long queues at Grove Lane after 0810.

Survey Details

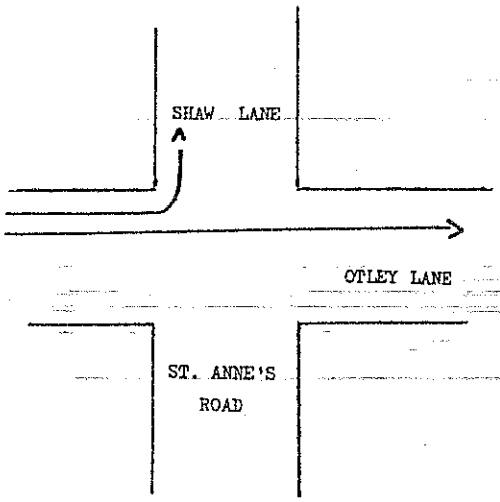
150 forms distributed, 85 to right turners from Grove lane, 65 to Meanwood Road traffic. 10 outright refusals.

| TRAFFIC FLOWS | Meanwood Road | Grove Lane to Meanwood Road |
|---|---|---|
| 0800-0815 | 168 | 50 |
| 0815-0830 | 334 | 85 |
| 0830-0840 | 190 | 57 |
| Total | 692 | 192 |

| Sample Rates : | | |
|---|---|---|
| | Meanwood Road | 10.4% |
| | Grove Lane | 45.0% |
| | Overall | 18.3% |

JUNCTION : Otley Road / Shaw Lane
DATE : 4/12/84
START TIME : 0800
FINISH TIME : 0833

Junction Layout




Survey Details.

150 forms distributed, 5 outright refusals, 5 non work journeys.

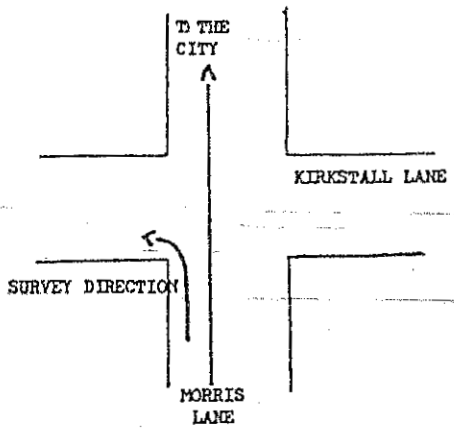
TRAFFIC FLOWS

| | |
|---|---|
| 0800-0815 | 233 |
| 0815-0830 | 272 |
| 0830-0833 | 87 |
| TOTAL | 592 |

Sample Rate 27%

JUNCTION : Morris Lane / Kirkstall Lane
DATE : 6/12/84
START TIME : 0810
FINISH TIME : 0834

Junction Layout




1) Traffic flows dropped markedly after 0825

Survey Details

75 forms were given out, 4 outright refusals and 6 non work journeys

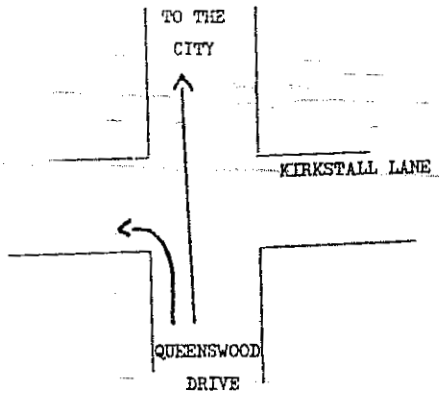
TRAFFIC FLOWS

| | | |
|---|---|---|
| 0810-0815 | 33 plus | (13 right turns) |
| 0815-0830 | 150 plus | (40 right turns) |
| 0830-0834 | 16 plus | ( 5 right turns) |
| Total | 199 | (58 right turns) |

Sample Rate 42.7%

JUNCTION : Queenswood Drive / Kirkstall Lane
DATE : 5/12/84
START TIME : 0815
FINISH TIME : 0832

Junction Layout




Survey Details

75 forms were given out, 0 refusals, 6 non work journeys

TRAFFIC FLOWS

| | |
|---|---|
| 0815-0830 | 235 |
| 0830-0832 | 52 |
| TOTAL | 287 |

Sample Rate 28.2%

# APPENDIX 8

## GUIDEINES USED IN IN-DEPTH INTERVIEWS

## AREAS TO BE COVERED

### A. ATTITUDE TO JOURNEY TIME

How long does your journey take on a good/bad day?

- What causes the variation
- How accurately can you predict journey time
- How important is lateness/prompt arrival at work
- What is more important - arrival/departure time or journey time.

Do you pick the quickest or shortest route.

### B. NETWORK KNOWLEDGE

- What do you look for in a good route?
- How confident are you that your route is best - why?
- Do you think there may be any short cuts, e.g. through backstreets/residential areas?
- What is your attitude to short cuts - are they worth-while?
- Have you tried all sensible alternative to your chosen route. If not, why not. What made you choose the ones you have tried?

### C. VARIATIONS IN ROUTE

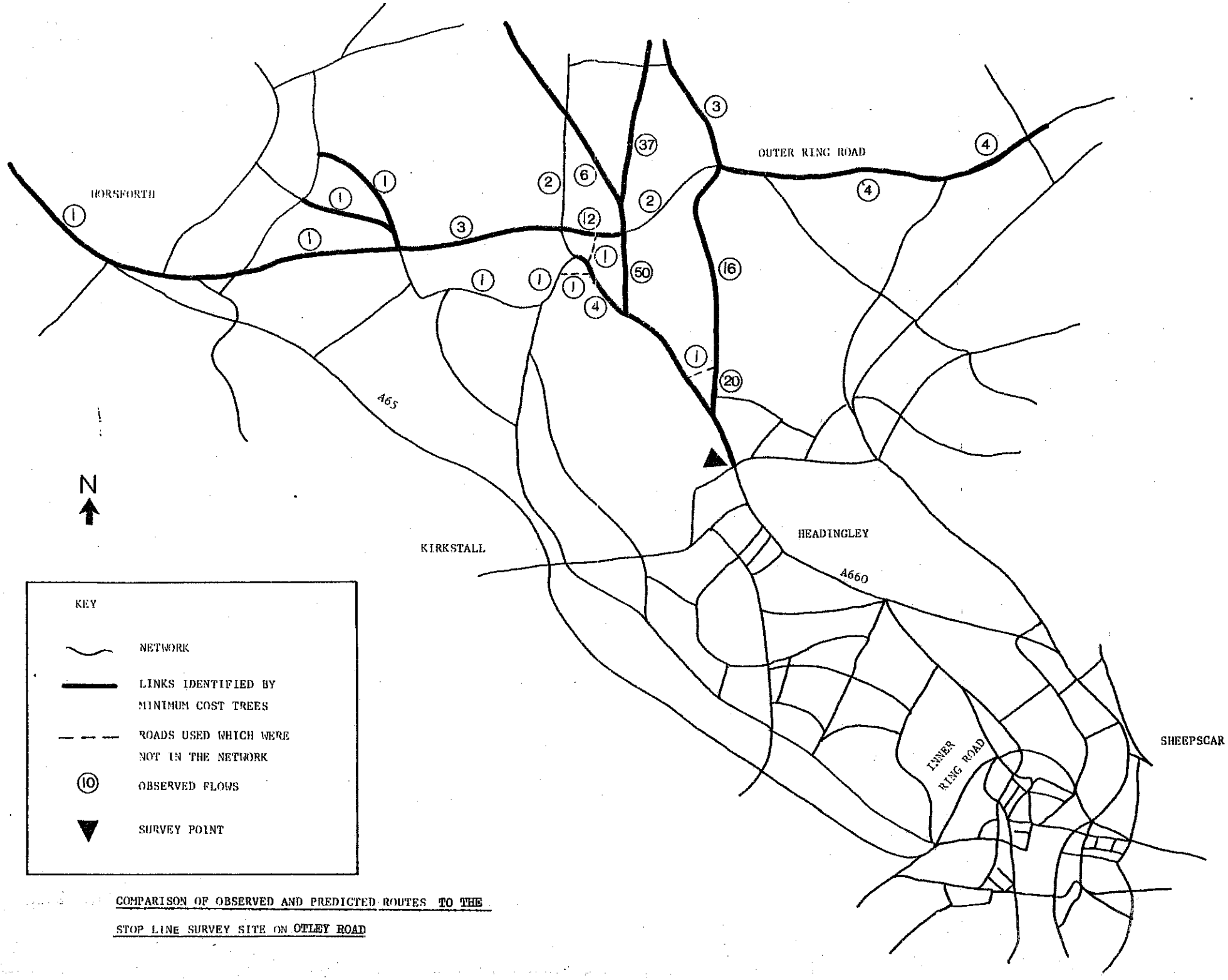
- How often do you know precisely which route you will take before you set off?
- What would cause you to vary this route, once chosen?
- Why do you vary routes on a day to day basis?
- Do you tend to choose different routes at different times of the day/week/year?

### D. ROUTE TIMING

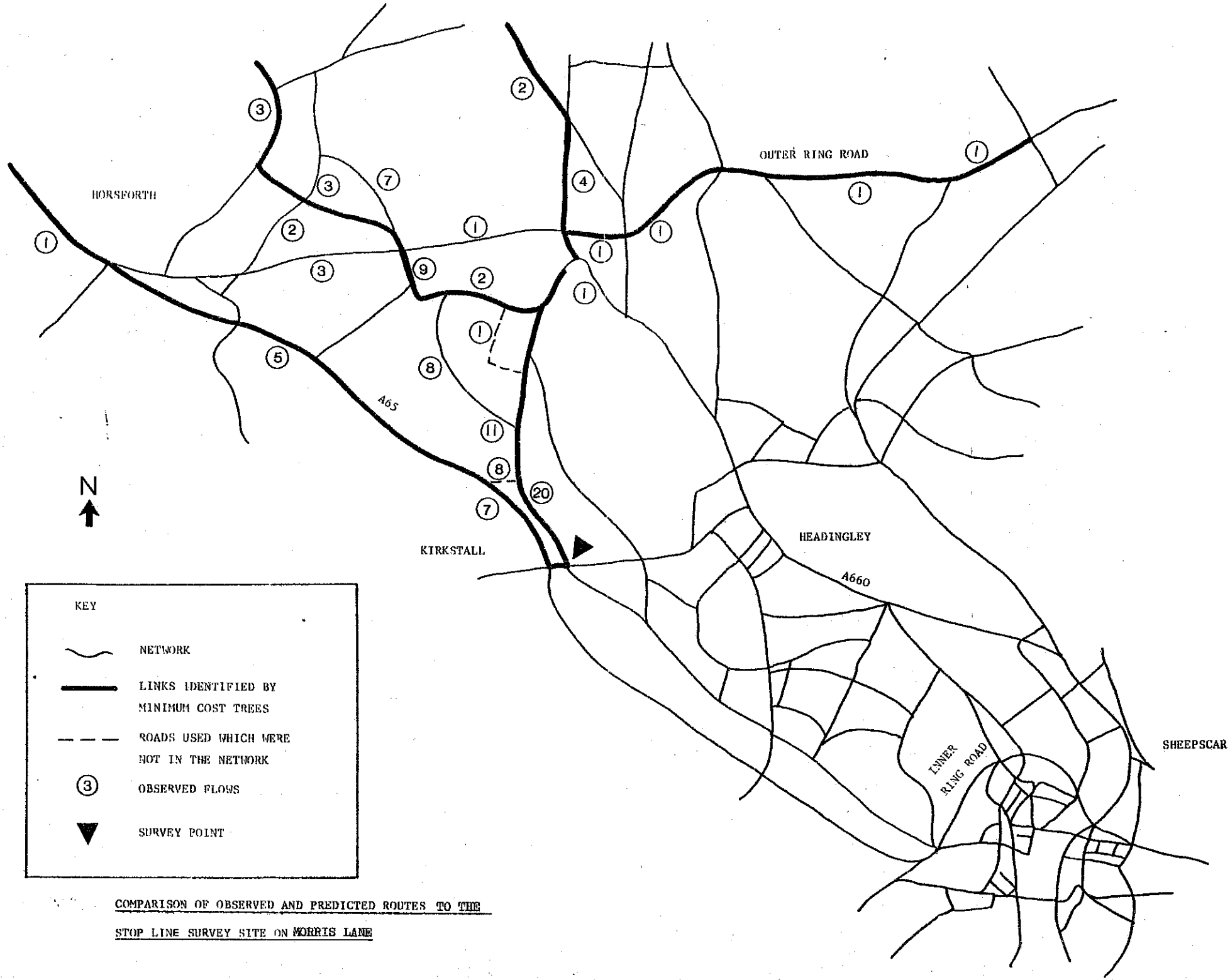
Do you try to avoid the busiest times of the peak. If NO could you?

# APPENDIX 9

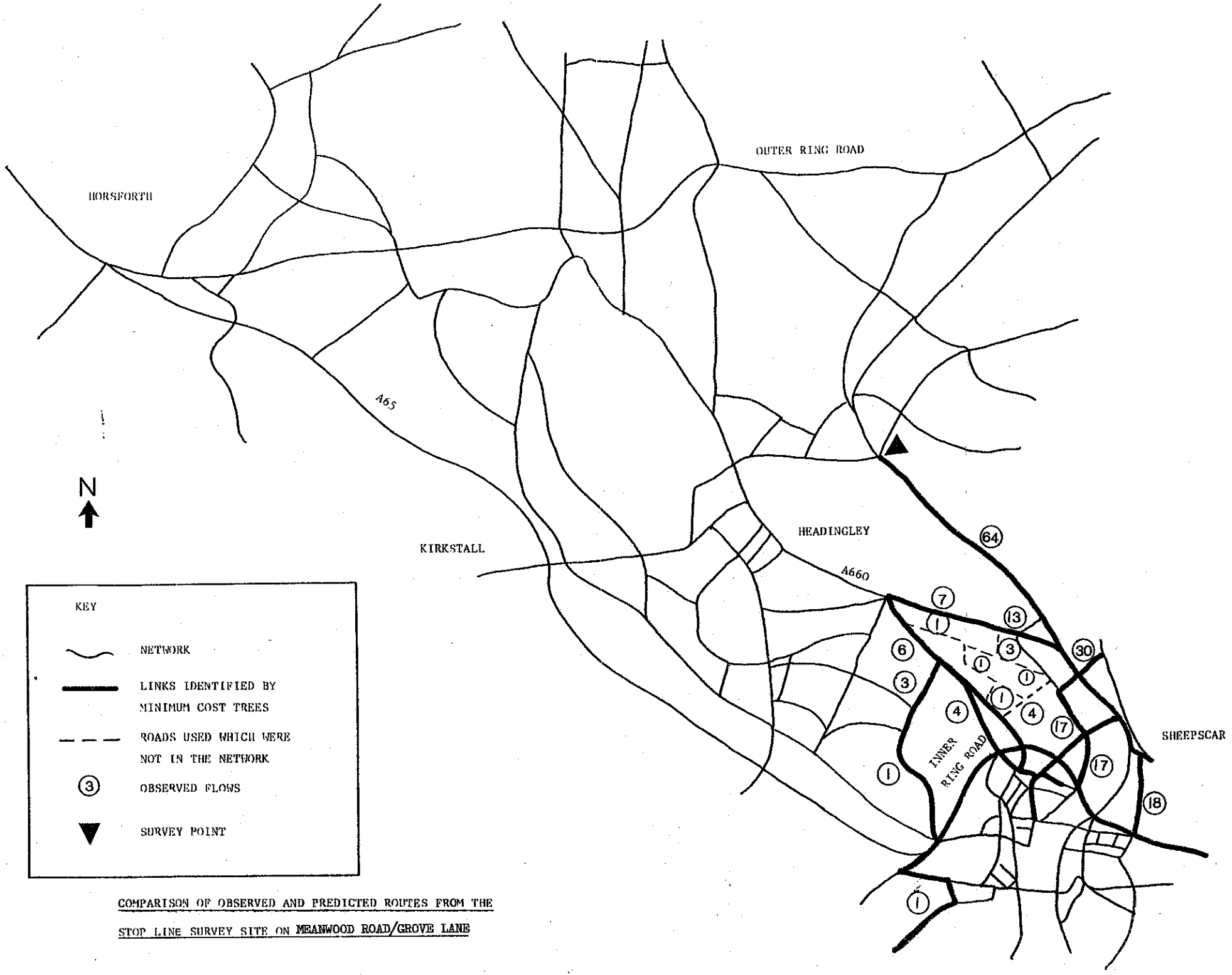
## A COMPARISON OF OBSERVED AND PREDICTED ROUTES TO AND FROM THE STOP LINE SURVEY SITES



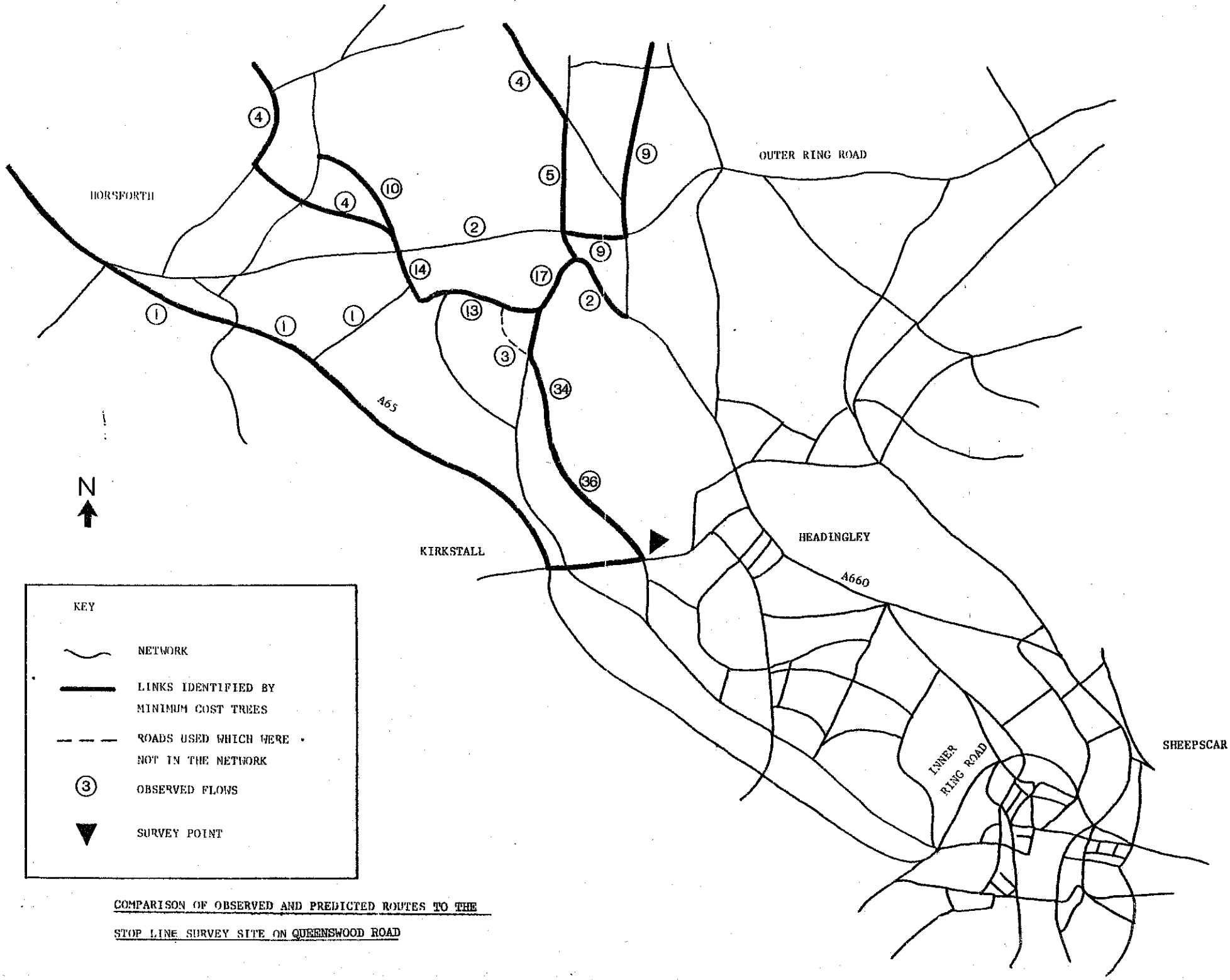

COMPARISON OF OBSERVED AND PREDICTED ROUTES TO THE STOP LINE SURVEY SITE ON OTLEY ROAD



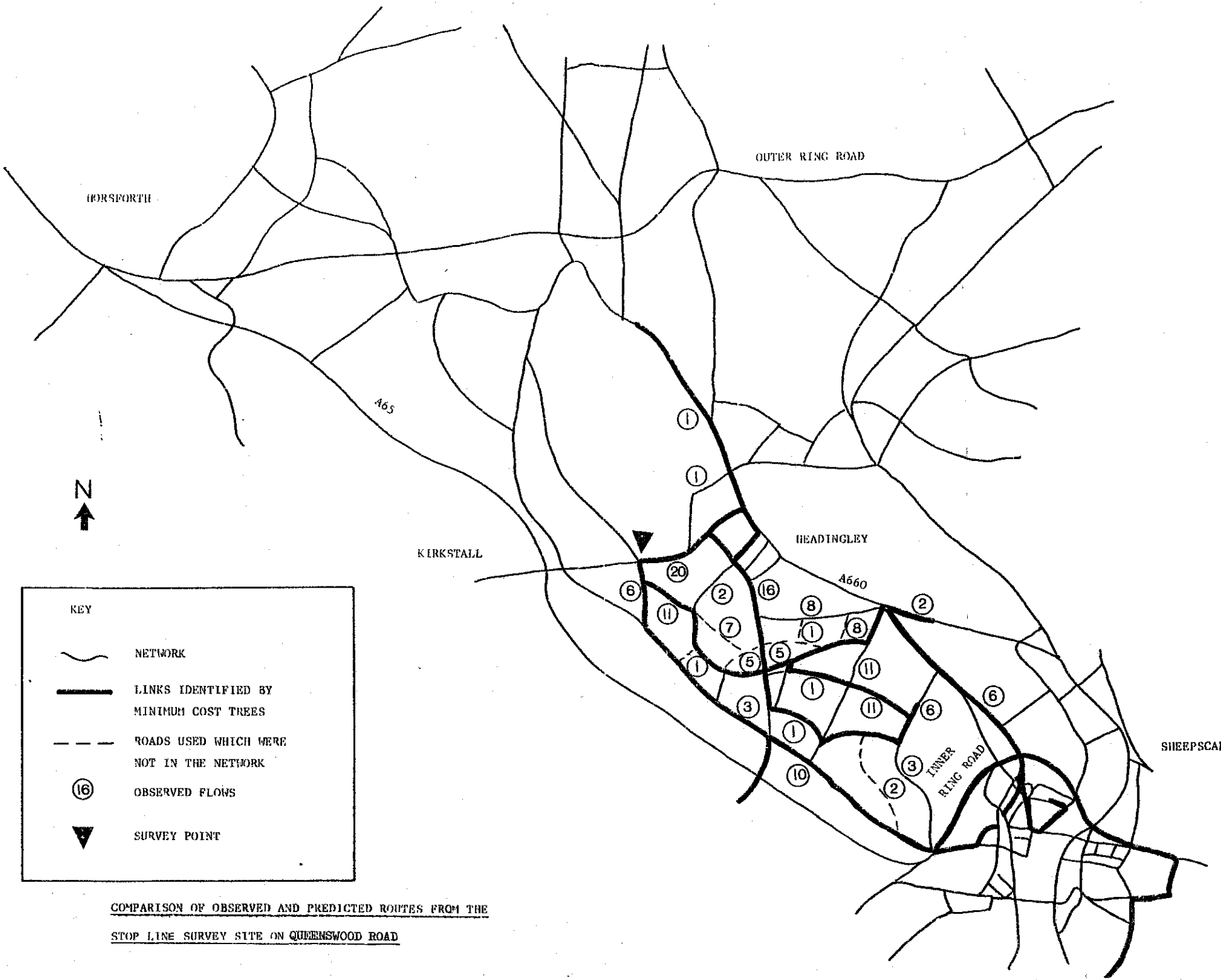

COMPARISON OF OBSERVED AND PREDICTED ROUTES TO THE STOP LINE SURVEY SITE ON MORRIS LANE



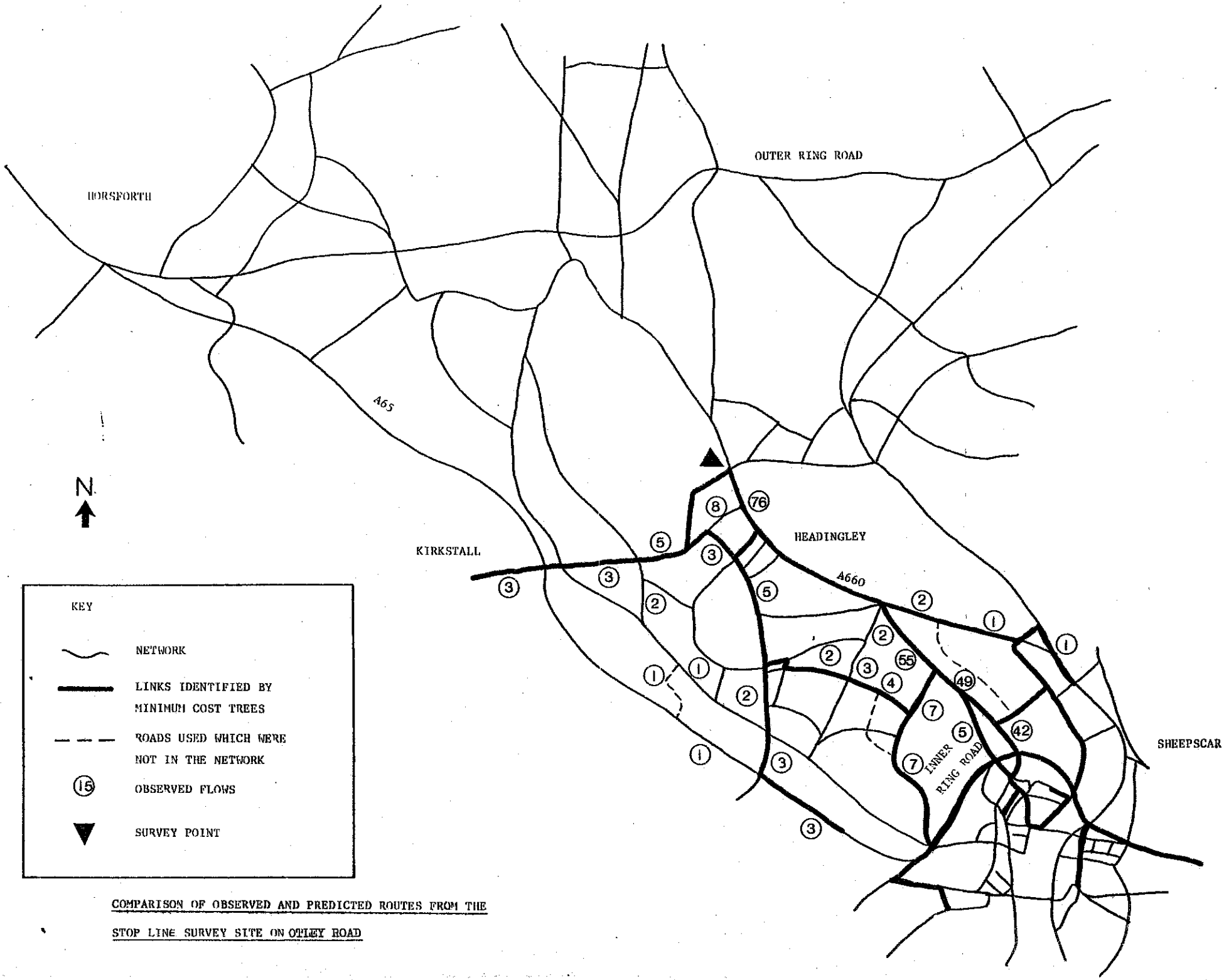

COMPARISON OF OBSERVED AND PREDICTED ROUTES FROM THE STOP LINE SURVEY SITE ON MEANWOOD ROAD/GROVE LANE




COMPARISON OF OBSERVED AND PREDICTED ROUTES TO THE STOP LINE SURVEY SITE ON QUEENSWOOD ROAD




COMPARISON OF OBSERVED AND PREDICTED ROUTES FROM THE STOP LINE SURVEY SITE ON QUEENSWOOD ROAD




COMPARISON OF OBSERVED AND PREDICTED ROUTES FROM THE STOP LINE SURVEY SITE ON OTLEY ROAD

# INITIAL QUESTIONNAIRE
(Confidential)

For Office Use Only

Name _____

Home address: Street _____
District _____
Post-Code _____

1 ☐☐☐☐☐☐☐☐
8 ☐☐
10 ☐☐☐☐
14 ☐☐☐☐☐☐
20 ☐☐

Employer _____
Work Location _____
Work Phone number _____
Occupation _____

Can you choose when you finish work in the evenings? . . Yes ☐ No ☐ 22 ☐

If No: - When do you finish? . . . . . _____ 23 ☐☐☐☐

If Yes:- What is the earliest time you can finish? . . _____ 27 ☐☐☐☐
What is the latest time you can finish? . . _____ 31 ☐☐☐☐
What is your usual range of finishing times?
from _____ to _____ 35 ☐☐☐☐☐☐☐☐

Do you have to clock out? . . . . . Yes ☐ No ☐ 43 ☐

How long have you been driving between Central Leeds and your present home area?

under 6 months ☐ 6 months to 1 year ☐ over 1 year ☐ 44 ☐

How often do you drive home from work?

| rarely or never | about once per month | about once per week | 1-2 times per week | 3-4 times per week | 5 or more times per week |
|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

45 ☐

How often do you stop off somewhere on your way home from work?

| rarely or never | about once per month | about once per week | 1-2 times per week | 3-4 times per week | 5 or more times per week |
|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

46 ☐

How often do you take passengers on any part of your way home from work?

| rarely or never | about once per month | about once per week | 1-2 times per week | 3-4 times per week | 5 or more times per week |
|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

47 ☐

6) How often do you drive along each of the following sections of road on your way home from work? (See the attached map.)

(A) Scott Hall Road (just before roundabout with Potternewton Lane)

| rarely or never | about once per month | about once per week | 1-2 times per week | 3-4 times per week | 5 or more times per week | |
|---|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | 48 ☐ |

(B) Meanwood Road (past the Yorkshire Switchgear works)

| rarely or never | about once per month | about once per week | 1-2 times per week | 3-4 times per week | 5 or more times per week | |
|---|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | 49 ☐ |

(C) Headingley Lane (Past the Original Oak pub)

| rarely or never | about once per month | about once per week | 1-2 times per week | 3-4 times per week | 5 or more times per week | |
|---|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | 50 ☐ |

(D) Woodhouse Lane (over Woodhouse Moor)

| rarely or never | about once per month | about once per week | 1-2 times per week | 3-4 times per week | 5 or more times per week | |
|---|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | 51 ☐ |

(E) Cardigan Road (at the North Lane junction)

| rarely or never | about once per month | about once per week | 1-2 times per week | 3-4 times per week | 5 or more times per week | |
|---|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | 52 ☐ |

(F) Burley Road (past Burley Post Office)

| rarely or never | about once per month | about once per week | 1-2 times per week | 3-4 times per week | 5 or more times per week | |
|---|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | 53 ☐ |

(G) Kirkstall Road (under the viaduct)

| rarely or never | about once per month | about once per week | 1-2 times per week | 3-4 times per week | 5 or more times per week | |
|---|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | 54 ☐ |

7) On the attached map, please draw a line along every road which you can remember using for your journey home from work (however you travelled).

55 ☐☐☐

59 ☐4☐

DAILY QUESTIONNAIRE
(confidential)

Today's date . . . . 25/4/83

Times: Note the precise time when you

1) Get into the car . . . . . 1706
2) Reach the inner ring road . . . . 1711
3) Reach the outer ring road . . . . 1726
4) Stop for someone to get into or out of the car
1719
5) Start after someone has got into or out of the car
1724
6) Reach home . . . . . 1731

Parking

o Where was your car parked while you were at work today?

NCP SOVEREIGN STREET

Is this your usual parking place? . . . . Yes ☐ No ☑

If not: - Why did you park there today?

USUAL PLACE FULL

Where do you usually park?

UNDER CITY STATION

Special Circumstances

o Did anything other than traffic conditions affect your journey home today? Yes ☑ No ☐

If so: please give details (e.g. left work 30 minutes early because of a dentist's appointment).

LEFT WORK 15 MINS LATE BECAUSE OF MEETING, STOPPED FOR PETROL

Only

1 ☐☐☐☐
5 ☐☐☐☐
9 ☐☐☐☐
13 ☐☐☐☐
17 ☐☐☐☐
☐☐☐☐
☐☐☐☐
☐☐☐☐
33 ☐☐☐☐
☐☐☐☐
☐☐☐☐
☐☐☐☐
49 ☐☐☐
53 ☐☐☐☐
57 ☐
58 ☐☐☐☐
63 ☐☐☐☐
67 ☐
68 ☐

Route

o Mark the route you used today for your journey from work to home on the map overleaf.

o Mark with a cross any points where you stopped for someone to get into or out of the car.

o Mark with a cross the points where you reached the inner and outer ring roads.

o Did you plan to travel this way before you left your parking place? . . . . . Yes ☐ No ☑

If not: - Where did you decide to travel the way you did?

TOP OF EAST PARADE

Why did you travel the way you did?

I COULD SEE A TRAFFIC JAM IN CALVERLY STREET

o How often do you use this route for your journey home from work?

| rarely or never before | about once per month | about once per week | 1-2 times per week | 3-4 times per week | 5 or more times per week |
|---|---|---|---|---|---|
| ☐ | ☐ | ☑ | ☐ | ☐ | ☐ |

If you don't always use this route, why not?

THE ROUTE VIA CALVERLY STREET AND WOODHOUSE LANE IS QUICKER

If you don't often use this route, why did you use it today? JAM IN CALVERLY STREET

Traffic conditions

o How would you describe the traffic conditions you experienced on your journey home today?

Much worse than expected . . . . ☐
Worse than expected . . . . . ☑
About the same as expected . . . . ☐
Better than expected . . . . . ☐
Much better than expected . . . . ☐

73 ☐
74 ☐☐☐
78 ☐☐☐
82 ☐
83 ☐☐☐
87 ☐☐
91 ☐
92 ☐☐☐
97 ☐☐☐