

**Parking & Public Transport
The Effect on Mode Choice**

**Additional Surveys at
B1 Developments with
Constrained Parking**



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APPENDICES

DISCLAIMER: This document does not necessarily represent the current views of the TRICS Consortium. This research report was commissioned by the TRICS Consortium, and while all data contained within it was correct at the time of the report's production, it should be noted that policies and methods change over time. Therefore the contents of this report should be used with regard to the time when the report was originally written.

1. Introduction

Background

- 1.1 This report was commissioned, by the TRICS consortium of county councils, to extend a study originally undertaken as part of the South East Regional Planning Conference (SERPLAN) research into parking policy in the south-east. The original study was completed in April 1993 and involved a joint collaborative arrangement between SERPLAN and TRICS to undertake and analyse surveys of parking demand and modal choice at a range of office developments located throughout the SERPLAN area.
- 1.2 In total 59 separate sites were included in the original study, with each of the SERPLAN County Councils being asked to undertake surveys at four sites within their area. Questionnaires were handed out to some 23,000 employees and responses were obtained from some 14,000, a response rate of some 62 percent. One of the objectives of the study was to examine the relationship between modal split and the contributing factors of public transport provision and parking restraint.
- 1.3 The study found that, although 50% of the sites were selected as being in town centres, parking restraint was virtually non-existent. In fact only 15% of the sites had less car parking than the demand for space. Accordingly additional surveys were commissioned at sites where greater levels of parking restraint, both on-site and on-street were known to exist. Of particular interest were sites in areas where strict parking controls had been enforced over a number of years.

Study Objectives and Scope of Work

- 1.4 The objective of the study was to investigate the effectiveness of parking restraint policies, as a means of effecting modal choice for the travel to work. The study was undertaken in the following manner;
 - Identification of suitable sites in consultation with the relevant local authorities
 - Distribution and collection of journey to work questionnaire to all employees and management questionnaire to obtain particular site details
 - Input and analysis of data using the SPSS spreadsheet package

Contents of this Report

- 1.5 Details of the site locations and survey response are given in Chapter 2 of this report. The survey results and analysis are presented in Chapter 3 and the influence of accessibility to public transport is discussed in Chapter 4. Chapter 5 includes a brief summary and conclusions.

2. Site Details

Site Locations

2.1 Initially the seven County Councils involved in the study were asked to identify appropriate sites with constrained parking both on-site and on-street (i.e. no free parking spaces within a 10 minute walk). Most had considerable difficulty in finding appropriate sites; this in itself is a telling conclusion. The only suitable examples outside London were found to be sites in Brighton, Maidstone and Reading. These sites were surveyed along with additional sites in Richmond, Bromley, Hammersmith and Oxford. All the sites chosen were located in town centres within close proximity of major bus and rail interchanges.

Survey Response

2.2 In total 14 office sites were surveyed. See Appendix A for the survey form. These included sites in Richmond (3 sites), Reading (2), Brighton (3), Maidstone (3), Oxford and Bromley. The sites consisted of a variety of different companies but were generally occupied by 'service and financial' businesses. Table 2.1 summarises the number of employees at each site. The response rate was very good with an average of almost 90 percent.

Table 2.1 Site Details

Site	Employees	Present on Day	Forms Received	Response Rate
Prudential, Reading	698	612	358	58
Foster Wheeler Energy, Reading	1441	1273	843	66
International Factors, Brighton	347	286	261	91
Sun Alliance, Brighton	96	81	81	100
Eagle Star, Brighton	n/a	n/a	180	n/a
Star House, Maidstone	75	45	44	98
Colman House, Maidstone	177	112	112	100
Cornwallis House, Maidstone	81	46	46	100
Macclesfield House, Oxford	179	163	135	83
Bank of America, Bromley	654	574	499	87
Stoy Hayward, Richmond	38	20	20	100
Credit Agricole, Richmond	75	57	47	82
Coca Cola, Hammersmith	n/a	n/a	n/a	n/a
Mills & Boon, Richmond	56	43	31	72
TOTAL	4022	3142	2762	87.48

3. Survey Results and Analysis

Employment Density

- 3.1 The original study had concluded that employment densities (ie the gross floor area, sq m, per employee) within buildings were, on average, much higher in town centre areas than areas outside the town centre. Average employment densities were found to be of the order of 16 to 20 sq m GFA per person in town centre areas compared with 26 sq m GFA outside the town centre.
- 3.2 The results of this study found there to be considerable variation in employment densities, between the different sites, ranging from 7 sq m GFA per person to 27 sq m per person (see Appendix B1). The 34 sq m GFA per person at the Credit Agricole site in Richmond is misleading as a large part of the office was vacant at the time of the survey. The mean employment density for all sites was about 19 sq m GFA per person and compares well with the average employment densities of town centre sites in the original study.

Arrival and Departure Patterns

- 3.3 Average arrival and departure patterns are illustrated in Figure 3.1 and are compared to the results from the previous study. Generally arrival patterns are similar to the original study with about 50 percent of employees arriving between 08:15 and 09:00 hours. Departure patterns are considerably more peaked with, on average, over 35 percent of staff leaving in one quarter hour period between 17:00 and 17:15 hours.

Journey Time

- 3.4 The average travel time for all employees for their journey to work, at the additional sites, was 38 minutes. In contrast to the previous study, the surveys indicated that the average journey time by private transport (38 minutes) was only slightly less than the average travel time by public transport (43 minutes) where previously there had been a large disparity (26 minutes by car and 43 minutes by public transport). A summary of mean journey times, by modal choice and site location, for both this study and the previous study are compared in Table 3.1. The journey times by public transport to the sites with 'constrained' parking correspond with public transport journey times to the town centre sites in the previous study. However mean journey times, by private transport, to sites with constrained parking are some 11 to 12 minutes longer than those to other town centre sites. In part this seems to reflect the longer travel time for London sites.

Table 3.1 Mean Journey Time by Modal Choice and Site Location (minutes)

Location	Private	Public	Others	All Modes
Constrained Sites	38	43	18	38
<u>Previous Study</u>				
Town Centre Core	26	43	20	27
Town Centre	27	45	20	28
Edge of Town	28	60	17	29
Out of Town	24	46	14	25

3.5 Figure 3.2 plots trip length patterns again comparing the sites with constrained parking with the results from the previous study. In general, average journey times are significantly longer at the constrained sites with almost 20 percent of employees travelling in excess of 50 minutes.

Parking Provision

3.6 The intention of the study team was to select sites where free parking was constrained both on-site and on-street. The average car parking provision that existed at the offices included in the study was approximately 137 sq m gross floor area per space or 0.20 car parking spaces per employee. There was a considerable range between sites from 45 sq GFA to 243 sq m GFA per space, and from 0 to 0.50 car parking spaces per employee. Full details on a site-by-site basis are included in Appendix A1. The average parking provisions are compared with those for the different locations included in the previous study in Table 3.2. The figures illustrate the more constrained nature of parking of the sites selected for this study.

Table 3.2 Average Parking Provision Standard

Location	Car Park Spaces per Employee	GFA per Car Park Space (sqm)
Constrained Sites	0.20	137
<u>Previous Study</u>		
Town Centre Core	0.32	69
Town Centre	0.53	49
Edge of Town	0.83	36
Out of Town	0.72	27

Modal Split

- 3.7 The modal split for the journey to work at the constrained sites, consisted on average, of 51 percent by private transport (defined as car driver, car passenger, taxi and motor cycle), 36 percent by public transport (defined as bus, train and company coach) and 13 percent by 'other' modes (defined as walking and cycling). In terms of motorised modes only, the average modal split was 58 percent private, and 42 percent public. These average modal split results are illustrated in Figure 3.3 and are compared to the results from the previous study. When the modal split of the sites with constrained parking is compared with the town centre 'core' sites, from the previous study, it is clear that those travelling by private transport has reduced largely due to a shift to public transport and not other modes.
- 3.8 As was the case with the previous study, there was considerable variation in modal splits between sites. Generally the sites with the lowest percentage of workers travelling by private transport are located in the locations with the most heavily controlled parking policies and largest public transport networks (eg. Richmond, Oxford, Hammersmith). However the modal split information by site (see Appendix A2) suggests that modal split may vary significantly even between office sites in the same town and in similar locations. For example in Richmond, 32 percent of staff at one site travelled to work by private transport compared to 65 percent travelling by private transport at another adjacent site. The possible reasons for these differences are examined in the following paragraphs.

Parking Provision and Public Transport

- 3.9 The previous study which compared a variety of different office locations, found that a major influence on modal choice was the access to public transport and the size of the public transport network relative to the catchment area of the private motor car.
- 3.10 This study examined sites with more constrained levels of parking. As one would expect the sites with the lowest modal splits were those in Richmond, Hammersmith and Oxford which all have strict parking controls and excellent accessibility to public transport. However there is a danger in drawing too many assumptions from completely different towns and office sites with different characteristics, parking controls and highway networks.
- 3.11 In order to investigate the influence of parking provision there is some merit in comparing the parking provisions of different sites with practically identical on-street parking controls and public/private transport catchment areas. Accordingly the 'constrained' sites were considered by location in order to investigate how much variations in modal split could be explained by differences in parking provision and how much could be explained by other obvious differences between sites.

Case Studies

Brighton Sites

- 3.12 Parking provision and modal split are compared for the three new Brighton Sites and the British Telecom Site from the previous study (Table 3.3). All

four sites are financial / service offices located in Brighton town centre within close proximity of each other. All have good access to major bus and rail interchanges. Table 3.3 compares the percentage of employees travelling by private transport with on-site parking provision and the percentage of drivers who parked in a free space or in the employee car park.

- 3.13 The percentage of those travelling by private modes appears to correlate well with on-site parking provision. For a number of years, Brighton town centre has been subject to strict on-street parking controls, through a parking voucher scheme. However despite the fact that all four sites are of a similar business type and are in almost identical locations there is a wide range in modal splits between the sites. The results indicate that a major factor could be the differing levels of on-site parking provision. It would also appear that once controls on parking reach a certain level it is difficult to further decrease private modal split by a significant level. For example some 28 percent of employees driving to the Eagle Star site, the most constrained in terms of on-site parking provision, are prepared to pay for a parking space rather than switching to other modes of transport.

Table 3.3 Comparison of Brighton Sites

Site	Spaces per Employee	Percent Parking in Employee Car Park	Percent Drivers Parking Free	Modal Split: Private (All Modes)
British Telecom ⁽¹⁾	0.64	79	100	73
International Factors	0.17	42	90	49
Sun Alliance	0.17	35	91	49
Eagle Star	0.08	6	72	43

Note: (1) British Telecom: Town Centre Site from original Study

Reading Sites

- 3.14 Table 3.4 compares three sites in Reading which include the out of town Shire Hall site from the previous study. Like the Brighton sites, the results emphasise the importance of on-site parking provision, with regard to modal split.

Table 3.4 Comparison of Reading Sites

Site	Spaces per Employee	Percent Parking in Employee Car Park	Percent Drivers Parking Free	Modal Split: Private (All Modes)
Shire Hall ⁽¹⁾	n/a	99	100	91
Foster Wheeler Energy	0.35	35	79	53
Prudential	0.11	37	74	45

Note: (1) *Shire Hall: Out of Town Site from original Study*

Richmond Sites

- 3.15 The results for the Richmond sites are inconclusive despite the fact that all three sites are located within close proximity of each other, and have similar access to public transport facilities. This could be explained by the nature of businesses occupying each site. For example Stoy Hayward has a high private transport modal split, despite strict on-street and off-street controls, possibly explained by the high managerial / professional numbers of staff (31 out of 37) and the availability of charged off-street spaces elsewhere in Richmond. Some 57 percent of those driving were willing to pay for a space rather than change to another mode of transport. At the Mills and Boon site, despite there being 0.50 spaces per employee, the percent of employees travelling by private transport was only 32 percent. This could be a reflection of the high secretarial / clerical content of the staff (21 out of 56) which could indicate lower car ownership levels. At Credit Agricole a significant number of staff were prepared to pay £1400 per annum for an off-street charged parking space rather than leave their car at home.

Table 3.4 Comparison of Richmond Sites

Site	Spaces per Employee	Percent Parking in Employee Car Park	Percent Drivers Parking Free	Modal Split: Private (All Modes)
Stoy Hayward	0.00	14	43	65
Credit Agricole	0.23	57	51	47
Mills and Boon	0.50	92	100	32

Maidstone Sites

- 3.16 A comparison of parking provision, parking behaviour and modal split for the Maidstone sites shows no correlation with regard to on-site parking provision and modal split (Table 3.5). All the sites are located in Maidstone town centre with good access to public transport interchanges. However a number of off-street long-term parking spaces are available in Maidstone at a reasonable cost and may well have influenced the results.

Table 3.5 Comparison of Maidstone Sites

Site	Spaces per Employee	Percent Parking in Employee Car Park	Percent Drivers Parking Free	Modal Split: Private (All Modes)
Colman House	0.41	70	94	72
Star House	0.09	17	61	71
Cornwallis House	0.49	32	77	60

Remaining Sites

- 3.17 Of the remaining sites in the study, Macclesfield House at Oxford and the Coca Cola offices at Hammersmith had the second and third lowest modal split by private transport of all the fourteen sites (see Table 3.6). This is hardly surprising as both have excellent accessibility to large public transport networks combined with strict parking controls both on-street and off-street. Oxford has operated a 'park and ride' policy for several years and 36 percent of employees used 'park and ride' on the day of the survey. Meanwhile Hammersmith is served by the underground network (District, Piccadilly and Hammersmith & City Lines) and has excellent bus communications. Nevertheless at both sites there were still 35 percent of employees who arrived using private transport as their main mode of travel, with a significant proportion still able to find free parking. Evidence from the sites at Brighton and Reading suggests that stricter control of off-street parking could lead to reductions in those travelling by private transport. However it is likely that a significant number will still use private transport even if stricter controls were implemented.

Table 3.6 Comparison of Remaining Sites

Site	Spaces per Employee	Percent Parking in Employee Car Park	Percent Drivers Parking Free	Modal Split: Private (All Modes)
Bank of America, Bromley	0.07	11	63	56
Coca Cola, Hammersmith	n/a	82	92	35
Macclesfield House, Oxford	0.14	31	97	35

Reasons for not Using Public Transport

- 3.18 Even at sites where parking is constrained and there is good accessibility to public transport it would appear that a significant number of employees are reluctant to leave their car at home and travel by public transport. Figure 3.4 summarises the main reasons given for not using public transport. Almost half (44 percent) of the 1459 people who responded stated that the car was more flexible, while a third (33 percent) claimed that public transport was either not convenient or too expensive. Other responses included that public transport was too unreliable (27 percent), too slow (25 percent) or too infrequent (23 percent) while some claimed that there was no suitable service (24 percent). Just under a quarter (24 percent) stated that they preferred the comfort of the car while 12 percent needed the car during the day.
- 3.19 The results are similar to those of a study recently carried out by the AA of some 1400 of its members. Furthermore the AA study found that more than half (59 percent) of those questioned would consider leaving their cars at home if bus and train services were improved.

4. Catchment Areas

Public Transport Accessibility

- 4.1 As was the case for the previous study, public transport accessibility was defined as the relative catchment area population that could be reached within a set travel time (45 minutes) by public transport compared with the size of the area that could be reached in the same time by private transport.
- 4.2 The following rules were applied;
- Private transport
- travel times were based on typical peak period travel conditions.
 - isochrones and population data were estimated using the Mapbase computer package.
- Public transport
- all bus services within 10 minutes walk or train services within 15 minutes walk were included.
 - all bus services with a service of 2 or less buses per hour were excluded
 - five minute wait time assumed
 - five minutes assumed for each interchange
 - timetabled travel times assumed
 - a maximum of 10 minutes walk from bus or 15 minutes walk from train was assumed at the home end.
- 4.3 Catchment area populations were calculated from 1991 census data based on sub-division at district level. The catchment area populations were derived as part of a quick desk-based study and should be considered as rough estimates only.
- 4.4 Accordingly public transport accessibility was defined as;

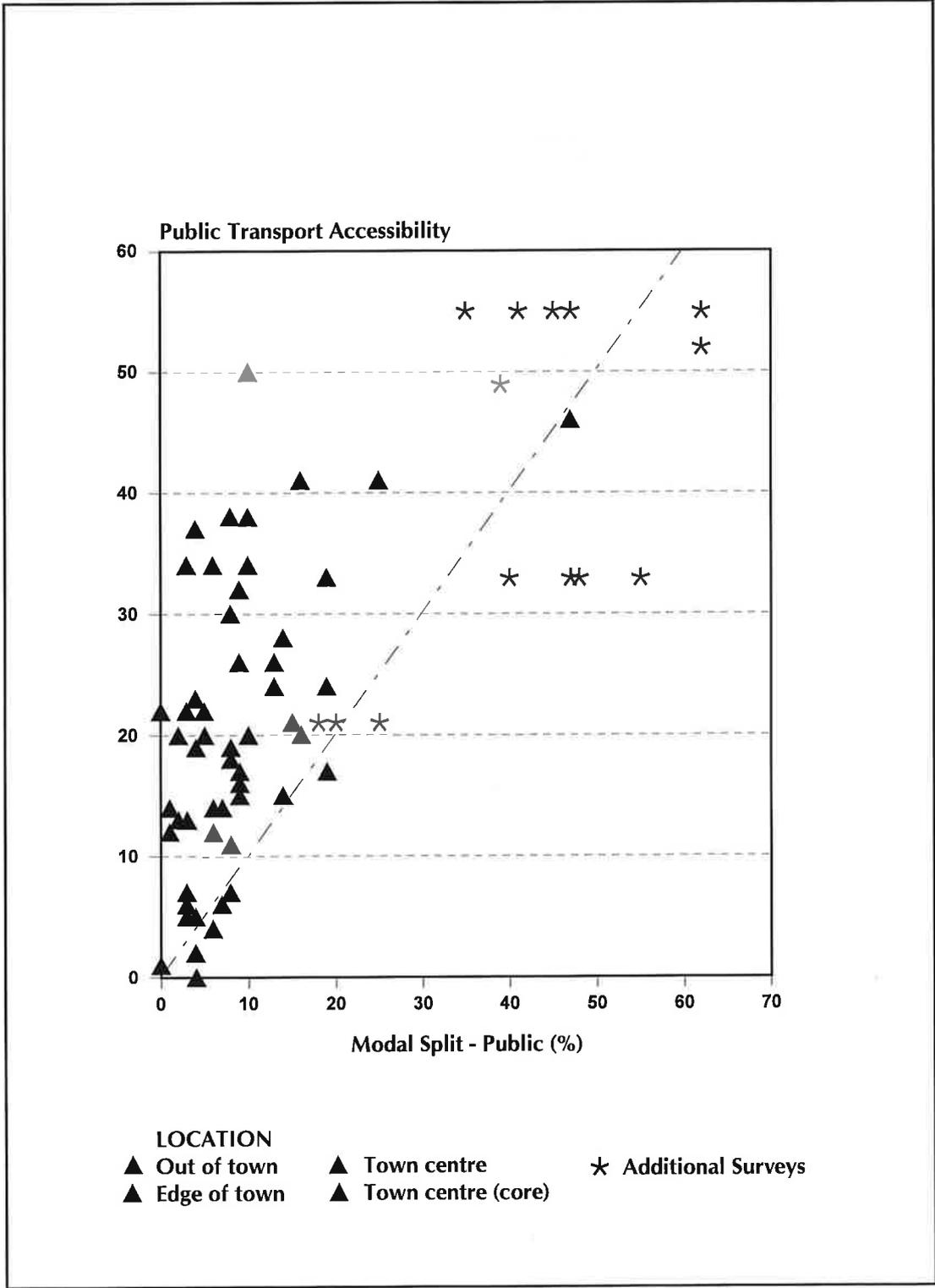
$$\text{Public Transport Accessibility} = \frac{P_{\text{PUB45}}}{P_{\text{PUB45}} + P_{\text{PRIV45}}}$$

Where: P_{PUB45} is the population within 45 minutes travel time by public transport
 P_{PRIV45} is the population within 45 minutes travel time by private transport

- 4.5 The catchment areas of a number of the different sites in the study are compared for private and public transport. These are shown for Brighton (Figure 4.1), Reading (Figure 4.2), Oxford (Figure 4.3), Richmond (Figure 4.4) and Hammersmith (Figure 4.5). It is clear that the public transport catchment areas for the London sites are generally equal to or greater than the private transport catchment areas. This is in contrast to the sites at Oxford and Brighton where the ratio of private transport population catchments compared to public transport population catchments is 67:33.
- 4.6 The site at Oxford, despite a public transport accessibility index of only 33 percent, has comparatively high public transport usage. This is most probably

explained by the 'park and ride' policy of the local authority, whereby free parking spaces are provided on the outskirts of the city and the journey is completed into the centre using public transport.

- 4.7 Figure 4.6 brings together the modal split / public transport accessibility ratios for both the original and subsequent survey data. It will be seen that although there is a wide spread in the data there is a clear correlation between accessibility ratio and modal split. From the discussion of the individual sites in Section 3, the spread of data can, in part, be put down to differing levels of parking restraint.



**PUBLIC TRANSPORT ACCESSIBILITY BY MODAL SPLIT
MOTORISED MODES - PUBLIC**

Figure 4.6

5. Summary and Conclusions

Summary

5.1 The analysis of data can be summarised as follows;

- Initially it proved difficult to find suitable survey sites as it was difficult to find sites within self-standing towns where car parking restraints were actually effective.
- Questionnaires were distributed at fourteen office sites, identified as being constrained with regard to access to free on-site and on-street parking spaces. Almost 3,000 questionnaires were returned representing a response rate of almost 90 percent.
- Employment density varied considerably on a site-by-site basis, but had an average for all sites of 19 sq m GFA per person.
- Average journey times by private (38 minutes) and public transport (43 minutes) were generally of the same order, which contrasted with the results of the previous study where average journey times by private transport were considerably shorter. The average journey times of those travelling by other modes (ie. walking or cycling) was 18 minutes.
- Journey times were generally longer at the constrained sites, compared to the original study, with some 20 percent of employees having journey times in excess of 50 minutes. This could well be attributable to the 'London effect'.
- All sites were constrained with regard to on-site parking provision, with an average of 0.20 parking spaces per employee.
- The average modal split (for all modes) was 51 percent - private, 36 percent - public with 13 percent using other modes. There was considerable variation between sites with a minimum of 32 percent travelling by private transport (in Richmond) and a maximum of 72 percent (in Maidstone). When motorised modes only were considered, the average modal split was 58 percent private (ranging from 38 percent to 82 percent) and 42 percent public (ranging from 18 percent to 62 percent). This modal split was more orientated towards public transport than any of the previous surveys.

Conclusions

5.2 The study of additional sites has illustrated that although parking restraint can be a powerful tool in restraining private car usage, in isolation it is unlikely to lead to substantial shifts in modal split. Even strict parking controls have the limitations as a number of cars are required during the day for legitimate business purposes. These is an indication that parking restraint is only effective up to a point. Beyond this drivers would be prepared to pay large sums for parking.

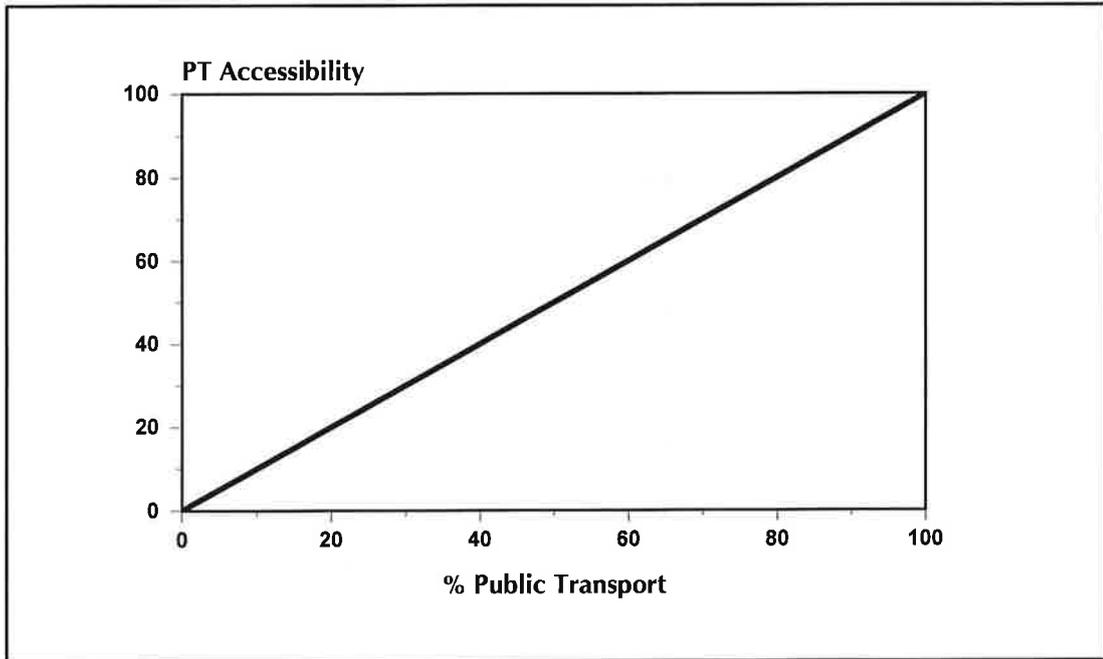
- 5.3 The role of mechanisms such as 'park and ride', have proved successful in increasing public transport usage in Oxford, which has a relatively high level of public transport usage, given that it has a public transport accessibility index of only 33 percent. The role of such mechanisms may have considerable value, although appropriate complementary measures are essential if such schemes are to achieve their aims. These would include measures such as bus priorities and tight parking controls on both the price and availability of parking in the controlled area.

Discussion

- 5.4 The results support a theoretical approach which is outlined in the following paragraphs. This study defined accessibility in a particular way based on a 45 minute catchment area. It is not clear that 45 minutes is the right figure; for instance 30 minutes, which is more akin to average travel times, may be more appropriate. It might also be appropriate to define catchment areas based on 30 minutes for private transport and 45 minutes for public transport (representative of the average travel times by each mode). This study has neither the resources or the data to determine the best was to define accessibility and hence the values used in the diagrams may not be the best ones and this may explain some of the variation.
- 5.5 If one was to consider public transport accessibility and modal choice (with no parking restraint) the relationship should look like Figure 5.1.
- 5.6 In reality most of the points are off-set to the left. This reflects one of two points, either the inaccuracy of the definition of accessibility or more likely the 'discomfort' factor for using public transport. The term 'discomfort' is used to include issues such as lack of flexibility, uncertainty, security, waiting, etc. Hence, for instance, despite a public transport accessibility rate of 50% only say 30% use public transport as the discount factor accounts for the other 20% (see Figure 5.2).
- 5.7 The addition of parking restraint should provide an "off-set" to the right of this graph as illustrated in Figure 5.3. For instance, with a public transport accessibility of 30% the theory would suggest that modal split would be 30% by public transport. If parking restraint is applied the modal split may increase to 50%.
- 5.8 Clearly then in order to reduce the dominance of car travel one needs to:
- improve public transport accessibility;
 - reduce the 'discomfort' factor; and
 - reduce parking provision.

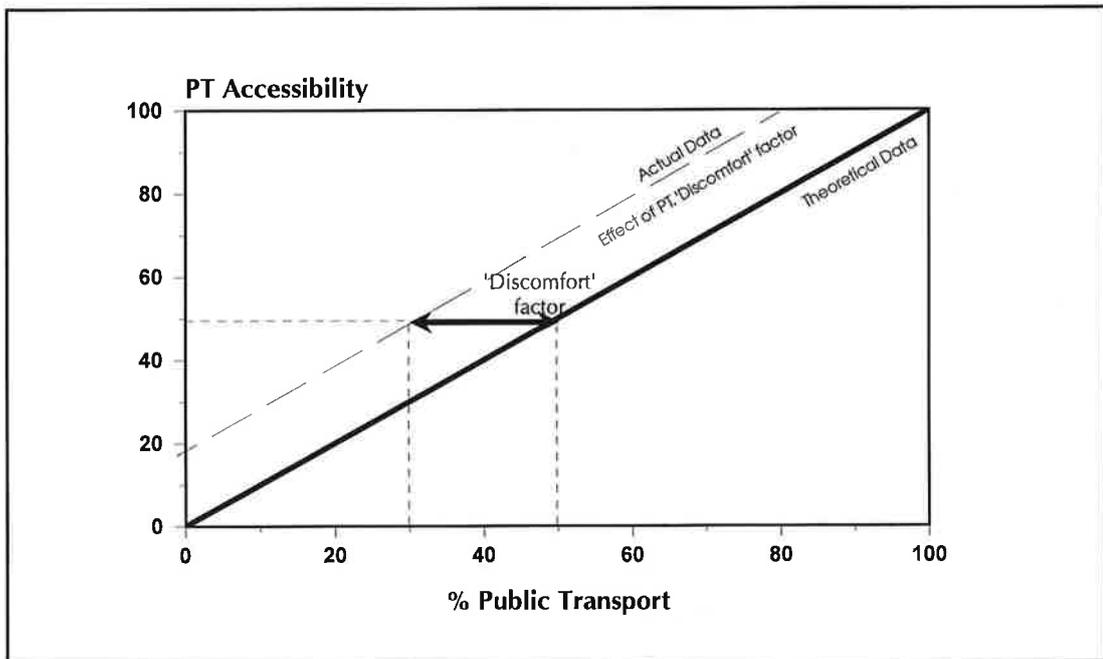
Reducing the 'discomfort' factor requires major improvements to the level of service of public transport operations. Previous discussions have indicated that it is likely to be much more practical to make a significant change in the parking component of the equation than the public transport accessibility element.

- 5.9 The debate could be turned round the other way, to determine what infrastructure should be provided if one was to seek say a 50% modal split for a particular development or town centre. The first aim would be to seek



MODAL SPLIT

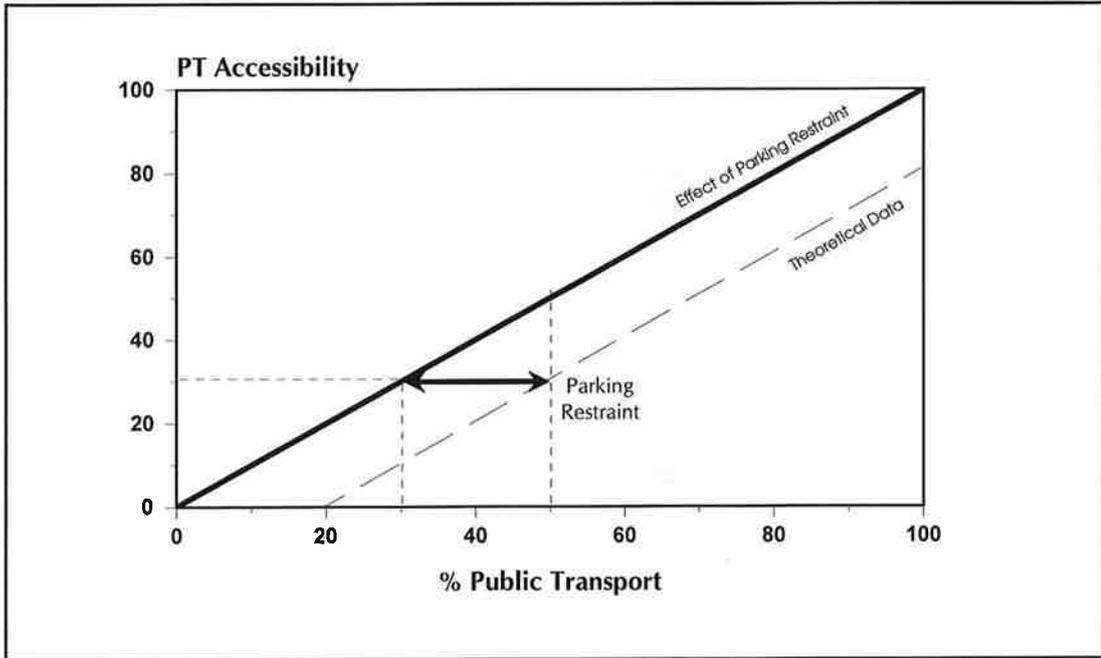
Figure 5.1



MODAL SPLIT

EFFECT OF PUBLIC TRANSPORT 'DISCOMFORT'

Figure 5.2



**MODAL SPLIT
EFFECT OF PARKING RESTRAINT**

Figure 5.3

to provide a public transport accessibility rate of 50%. i.e. an equal catchment area for both public and private transport. (That would require a public transport provision similar to say Richmond, Hammersmith or Harrow). Even if this could be achieved it is likely that the required level of modal split would not materialise due to the in-built 'discomfort' factor inherent in most public transport systems. This factor could probably be reduced by improving the system, using fixed track or tram systems improving reliability, etc. If public transport infrastructure cannot be provided to this level the 'shortfall' could be made up by parking restraint. To be effective this should be equally applied to all users.

- 5.10 There must, however, be a limit to the amount that modal shifts can be induced. If too much restraint is applied it is likely that the urban balance will give way. For instance, too much parking restraint without public transport provision will probably lead to vacant properties and businesses moving to less restricted areas. There needs to be a balance that cannot be pushed too far from an equilibrium level.

Appendices

Appendix A

1. WHERE DO YOU LIVE?

TOWN _____

POSTCODE _____

2. WHAT TIME DID YOU ARRIVE AT WORK TODAY? (please tick)

<input type="checkbox"/>									
BEFORE	07.30	07.45	08.00	08.15	08.30	08.45	09.00	09.15	AFTER
07.30	07.45	08.00	08.15	08.30	08.45	09.00	09.15	09.30	09.30

3. WHAT TIME DO YOU EXPECT TO LEAVE WORK TODAY?

<input type="checkbox"/>									
BEFORE	16.00	16.15	16.30	16.45	17.00	17.15	17.30	17.45	AFTER
16.00	16.15	16.30	16.45	17.00	17.15	17.30	17.45	18.00	18.00

4. HOW DID YOU TRAVEL TO WORK TODAY?

(a) Please tick main mode of travel only.

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	} <input type="checkbox"/> PARK & RIDE
CAR DRIVER	CAR PASSENGER	TAXI	WALK	BUS	TRAIN	MOTOR CYCLE	CYCLE	COMPANY COACH	
<p>(b) If your journey to work also involved any other modes of travel, please specify.</p>									
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
CAR DRIVER	CAR PASSENGER	TAXI	WALK (if over 5 mins)	BUS	TRAIN	MOTOR CYCLE	CYCLE	COMPANY COACH	

5. HOW LONG DID YOUR JOURNEY TAKE? _____ minutes (door to door)

6. DO YOU BELONG TO A CAR SHARING POOL OR GET A LIFT FROM A COLLEAGUE ON A REGULAR BASIS? YES NO

IF YOU DROVE A CAR TODAY, PLEASE ANSWER THE FOLLOWING QUESTIONS YES NO

7. Did you pay for your parking space? YES NO

If yes what was the equivalent daily charge? _____

8. WHERE DID YOU PARK?

- SPACE PROVIDED AT YOUR PLACE OF EMPLOYMENT
- FREE OFF STREET CAR PARK
- CHARGED OFF-STREET CAR PARK
- ON THE STREET
- PARK AND RIDE CAR PARK
- ELSEWHERE (please explain)

<input type="checkbox"/>

9. If you did not park at your place of employment, approximately how far away did you park (in walking time) _____ minutes

10. WHY DID YOU CHOOSE NOT TO USE PUBLIC TRANSPORT? (please tick)

<input type="checkbox"/>								
CAR NEEDED DURING DAY	TOO EXPENSIVE	TOO INFREQUENT	TOO UNRELIABLE	TOO SLOW	NOT CONVENIENT	NO SUITABLE SERVICE	CAR MORE FLEXIBLE	PREFER COMFORT OF CAR

ADD COMMENTS _____

SURVEY OF COMMUTING PATTERNS IN SERPLAN REGION

COMPANY QUESTIONNAIRE

Please note that this company questionnaire will provide valuable information for the purposes of survey analysis. Accordingly please feel free to add any additional information you feel may be relevant.

Location _____

Date of Interview _____ Survey Date _____

1. Nature of Business _____

2. How many people in the following occupational groups do you employ at these premises?

Job Category	Full Time (over 30 hrs pw)	Part Time
Managers, Professionals, Technicians and Support Staff		
Clerical, Secretarial and Sales Staff		
Craft and Skilled Service Workers Operatives and Unskilled Workers		
TOTAL		

2a. Please give details of part-time working hours and shift systems operated.

3. APPROXIMATELY, how many employees are/were at work on the survey day?
(Note: It is important that as accurate an estimate as possible is given) _____

3a. Of those absent, how many were: Sick _____
On Holiday _____
Out on Business _____

4. What is the gross floor area of your premises? _____ sq.ft./sq.m*
(*delete as appropriate)

5. Are the premises fully occupied? YES _____

NO _____

Please explain
below

6. Is there a staff restaurant located in the building? YES _____

NO _____

7. Are there any staff leisure facilities on the site? YES _____

NO _____

7a. Please describe these facilities.

8. Do you provide parking facilities on this site? YES _____

NO _____

9. How many car spaces do you provide for:-

	General	Disabled	Total
Employees			
Visitors/Customers			
TOTAL			

10. Do you make a charge for any of these spaces? YES _____
NO _____

10a. If yes how much? _____

11. Do you operate some form of Flexitime policy? YES _____
NO _____

11a. If yes, please explain.

12. Do you provide a special bus service for employees? YES _____
NO _____

12a. If yes, please explain.

13. Were there any exceptional circumstances applying on the day of the survey? YES _____
NO _____

13a. Please describe these circumstances.

Name of Respondent _____

Telephone No. _____

Thank you for your help

Appendix B

APPENDIX B1 SITE DETAILS

Office Site	Town	GFA (sqm)	No. of Employees	Car Park Spaces	GFA per Employee (sqm)	Car Park Spaces per Employee	GFA per Car Park Space
Mills & Boon	Richmond		56	28		0.50	
Macclesfield House	Oxford	3670	179	25	20.50	0.14	146.80
Coca Cola	Hammersmith	7420	200	60	37.1 *	0.30	123.67
Eagle Star	Brighton	3345		16			209.06
Prudential	Reading	7154	698	75	10.25	0.11	95.39
Credit Agricole	Richmond	2573	75	17	34.31 *	0.23	151.35
Sun Alliance	Brighton	2638	96	16	27.48	0.17	164.88
International Factors	Brighton	5760	347	60	16.60	0.17	96.00
Foster Wheeler Energy	Reading	27685	1441	510	19.21	0.35	54.28
Bank of America	Bromley	10963	654	45	16.76	0.07	243.62
Cornwallis House	Maidstone	1468	81	40	18.35	0.49	99.07
Stoy Hayward	Richmond	267	38	0	7.03	0.00	
Star House	Maidstone	1394	75	7	18.59	0.09	199.14
Colman House	Maidstone	3252	177	72	18.37	0.41	45.17

* Not fully occupied.

APPENDIX B2

MODAL SPLIT AND POPULATION CATCHMENT SITE INFORMATION

Office Site	Town	Average Modal Split (%) (All Modes)			Average Modal Split (%) (Motorised Modes)		Population Catchment Size within 45 Minutes		
		Private	Public	Others	Private	Public	Private	Public	Ratio
Mills & Boon	Richmond	32	52	16	38	62	1,738,500	2,120,700	45:55
Macclesfield House	Oxford	35	43	22	45	55	708,200	347,500	67:33
Coca Cola	Hammersmith	35	56	9	38	62	2,593,100	2,767,300	48:52
Eagle Star	Brighton	43	39	18	52	48	633,700	308,293	67:33
Prudential	Reading	45	40	15	53	47	1,239,200	1,503,800	45:55
Credit Agricole	Richmond	47	28	15	55	45	1,738,500	2,120,700	45:55
Sun Alliance	Brighton	49	44	6	53	47	633,700	308,293	67:33
International Factors	Brighton	49	32	20	60	40	633,700	308,293	67:33
Foster Wheeler Energy	Reading	53	37	11	59	41	1,239,200	1,503,800	45:55
Bank of America	Bromley	56	36	9	61	39	1,840,100	1,771,700	51:49
Cornwallis House	Maidstone	60	20	20	75	25	784,300	210,000	79:21
Stoy Hayward	Richmond	65	35	0	65	35	1,738,500	2,120,700	45:55
Star House	Maidstone	71	18	11	80	20	784,300	210,000	79:21
Colman House	Maidstone	72	16	12	82	18	784,300	210,000	79:21

TRICS

Trip Rate Information Computer System

Parking & Public Transport The Effect on Mode Choice

Additional Surveys at B1 Developments with Constrained Parking

JMP
Consultants Ltd

Consulting Civil, Structural and Transportation Engineers

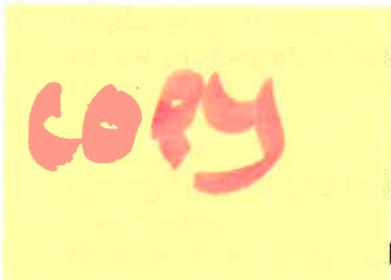
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APPENDICES

1. Introduction

Background

- 1.1 This report was commissioned, by the TRICS consortium of county councils, to extend a study originally undertaken as part of the South East Regional Planning Conference (SERPLAN) research into parking policy in the south-east. The original study was completed in April 1993 and involved a joint collaborative arrangement between SERPLAN and TRICS to undertake and analyse surveys of parking demand and modal choice at a range of office developments located throughout the SERPLAN area.
- 1.2 In total 59 separate sites were included in the original study, with each of the SERPLAN County Councils being asked to undertake surveys at four sites within their area. Questionnaires were handed out to some 23,000 employees and responses were obtained from some 14,000, a response rate of some 62 percent. One of the objectives of the study was to examine the relationship between modal split and the contributing factors of public transport provision and parking restraint.
- 1.3 The study found that, although 50% of the sites were selected as being in town centres, parking restraint was virtually non-existent. In fact only 15% of the sites had less car parking than the demand for space. Accordingly additional surveys were commissioned at sites where greater levels of parking restraint, both on-site and on-street were known to exist. Of particular interest were sites in areas where strict parking controls had been enforced over a number of years.

Study Objectives and Scope of Work

- 1.4 The objective of the study was to investigate the effectiveness of parking restraint policies, as a means of effecting modal choice for the travel to work. The study was undertaken in the following manner;
 - Identification of suitable sites in consultation with the relevant local authorities
 - Distribution and collection of journey to work questionnaire to all employees and management questionnaire to obtain particular site details
 - Input and analysis of data using the SPSS spreadsheet package

Contents of this Report

- 1.5 Details of the site locations and survey response are given in Chapter 2 of this report. The survey results and analysis are presented in Chapter 3 and the influence of accessibility to public transport is discussed in Chapter 4. Chapter 5 includes a brief summary and conclusions.

2. Site Details

Site Locations

2.1 Initially the seven County Councils involved in the study were asked to identify appropriate sites with constrained parking both on-site and on-street (i.e. no free parking spaces within a 10 minute walk). Most had considerable difficulty in finding appropriate sites; this in itself is a telling conclusion. The only suitable examples outside London were found to be sites in Brighton, Maidstone and Reading. These sites were surveyed along with additional sites in Richmond, Bromley, Hammersmith and Oxford. All the sites chosen were located in town centres within close proximity of major bus and rail interchanges.

Survey Response

2.2 In total 14 office sites were surveyed. See Appendix A for the survey form. These included sites in Richmond (3 sites), Reading (2), Brighton (3), Maidstone (3), Oxford and Bromley. The sites consisted of a variety of different companies but were generally occupied by 'service and financial' businesses. Table 2.1 summarises the number of employees at each site. The response rate was very good with an average of almost 90 percent.

Table 2.1 Site Details

Site	Employees	Present on Day	Forms Received	Response Rate
Prudential, Reading	698	612	358	58
Foster Wheeler Energy, Reading	1441	1273	843	66
International Factors, Brighton	347	286	261	91
Sun Alliance, Brighton	96	81	81	100
Eagle Star, Brighton	n/a	n/a	180	n/a
Star House, Maidstone	75	45	44	98
Colman House, Maidstone	177	112	112	100
Cornwallis House, Maidstone	81	46	46	100
Macclesfield House, Oxford	179	163	135	83
Bank of America, Bromley	654	574	499	87
Stoy Hayward, Richmond	38	20	20	100
Credit Agricole, Richmond	75	57	47	82
Coca Cola, Hammersmith	n/a	n/a	n/a	n/a
Mills & Boon, Richmond	56	43	31	72
TOTAL	4022	3142	2762	87.48

3. Survey Results and Analysis

Employment Density

- 3.1 The original study had concluded that employment densities (ie the gross floor area, sq m, per employee) within buildings were, on average, much higher in town centre areas than areas outside the town centre. Average employment densities were found to be of the order of 16 to 20 sq m GFA per person in town centre areas compared with 26 sq m GFA outside the town centre.
- 3.2 The results of this study found there to be considerable variation in employment densities, between the different sites, ranging from 7 sq m GFA per person to 27 sq m per person (see Appendix B1). The 34 sq m GFA per person at the Credit Agricole site in Richmond is misleading as a large part of the office was vacant at the time of the survey. The mean employment density for all sites was about 19 sq m GFA per person and compares well with the average employment densities of town centre sites in the original study.

Arrival and Departure Patterns

- 3.3 Average arrival and departure patterns are illustrated in Figure 3.1 and are compared to the results from the previous study. Generally arrival patterns are similar to the original study with about 50 percent of employees arriving between 08:15 and 09:00 hours. Departure patterns are considerably more peaked with, on average, over 35 percent of staff leaving in one quarter hour period between 17:00 and 17:15 hours.

Journey Time

- 3.4 The average travel time for all employees for their journey to work, at the additional sites, was 38 minutes. In contrast to the previous study, the surveys indicated that the average journey time by private transport (38 minutes) was only slightly less than the average travel time by public transport (43 minutes) where previously there had been a large disparity (26 minutes by car and 43 minutes by public transport). A summary of mean journey times, by modal choice and site location, for both this study and the previous study are compared in Table 3.1. The journey times by public transport to the sites with 'constrained' parking correspond with public transport journey times to the town centre sites in the previous study. However mean journey times, by private transport, to sites with constrained parking are some 11 to 12 minutes longer than those to other town centre sites. In part this seems to reflect the longer travel time for London sites.

Table 3.1 Mean Journey Time by Modal Choice and Site Location (minutes)

Location	Private	Public	Others	All Modes
Constrained Sites	38	43	18	38
<u>Previous Study</u>				
Town Centre Core	26	43	20	27
Town Centre	27	45	20	28
Edge of Town	28	60	17	29
Out of Town	24	46	14	25

3.5 Figure 3.2 plots trip length patterns again comparing the sites with constrained parking with the results from the previous study. In general, average journey times are significantly longer at the constrained sites with almost 20 percent of employees travelling in excess of 50 minutes.

Parking Provision

3.6 The intention of the study team was to select sites where free parking was constrained both on-site and on-street. The average car parking provision that existed at the offices included in the study was approximately 137 sq m gross floor area per space or 0.20 car parking spaces per employee. There was a considerable range between sites from 45 sq GFA to 243 sq m GFA per space, and from 0 to 0.50 car parking spaces per employee. Full details on a site-by-site basis are included in Appendix A1. The average parking provisions are compared with those for the different locations included in the previous study in Table 3.2. The figures illustrate the more constrained nature of parking of the sites selected for this study.

Table 3.2 Average Parking Provision Standard

Location	Car Park Spaces per Employee	GFA per Car Park Space (sqm)
Constrained Sites	0.20	137
<u>Previous Study</u>		
Town Centre Core	0.32	69
Town Centre	0.53	49
Edge of Town	0.83	36
Out of Town	0.72	27

Modal Split

- 3.7 The modal split for the journey to work at the constrained sites, consisted on average, of 51 percent by private transport (defined as car driver, car passenger, taxi and motor cycle), 36 percent by public transport (defined as bus, train and company coach) and 13 percent by 'other' modes (defined as walking and cycling). In terms of motorised modes only, the average modal split was 58 percent private, and 42 percent public. These average modal split results are illustrated in Figure 3.3 and are compared to the results from the previous study. When the modal split of the sites with constrained parking is compared with the town centre 'core' sites, from the previous study, it is clear that those travelling by private transport has reduced largely due to a shift to public transport and not other modes.
- 3.8 As was the case with the previous study, there was considerable variation in modal splits between sites. Generally the sites with the lowest percentage of workers travelling by private transport are located in the locations with the most heavily controlled parking policies and largest public transport networks (eg. Richmond, Oxford, Hammersmith). However the modal split information by site (see Appendix A2) suggests that modal split may vary significantly even between office sites in the same town and in similar locations. For example in Richmond, 32 percent of staff at one site travelled to work by private transport compared to 65 percent travelling by private transport at another adjacent site. The possible reasons for these differences are examined in the following paragraphs.

Parking Provision and Public Transport

- 3.9 The previous study which compared a variety of different office locations, found that a major influence on modal choice was the access to public transport and the size of the public transport network relative to the catchment area of the private motor car.
- 3.10 This study examined sites with more constrained levels of parking. As one would expect the sites with the lowest modal splits were those in Richmond, Hammersmith and Oxford which all have strict parking controls and excellent accessibility to public transport. However there is a danger in drawing too many assumptions from completely different towns and office sites with different characteristics, parking controls and highway networks.
- 3.11 In order to investigate the influence of parking provision there is some merit in comparing the parking provisions of different sites with practically identical on-street parking controls and public/private transport catchment areas. Accordingly the 'constrained' sites were considered by location in order to investigate how much variations in modal split could be explained by differences in parking provision and how much could be explained by other obvious differences between sites.

Case Studies

Brighton Sites

- 3.12 Parking provision and modal split are compared for the three new Brighton Sites and the British Telecom Site from the previous study (Table 3.3). All

four sites are financial / service offices located in Brighton town centre within close proximity of each other. All have good access to major bus and rail interchanges. Table 3.3 compares the percentage of employees travelling by private transport with on-site parking provision and the percentage of drivers who parked in a free space or in the employee car park.

- 3.13 The percentage of those travelling by private modes appears to correlate well with on-site parking provision. For a number of years, Brighton town centre has been subject to strict on-street parking controls, through a parking voucher scheme. However despite the fact that all four sites are of a similar business type and are in almost identical locations there is a wide range in modal splits between the sites. The results indicate that a major factor could be the differing levels of on-site parking provision. It would also appear that once controls on parking reach a certain level it is difficult to further decrease private modal split by a significant level. For example some 28 percent of employees driving to the Eagle Star site, the most constrained in terms of on-site parking provision, are prepared to pay for a parking space rather than switching to other modes of transport.

Table 3.3 Comparison of Brighton Sites

Site	Spaces per Employee	Percent Parking in Employee Car Park	Percent Drivers Parking Free	Modal Split: Private (All Modes)
British Telecom ⁽¹⁾	0.64	79	100	73
International Factors	0.17	42	90	49
Sun Alliance	0.17	35	91	49
Eagle Star	0.08	6	72	43

Note: (1) British Telecom: Town Centre Site from original Study

Reading Sites

- 3.14 Table 3.4 compares three sites in Reading which include the out of town Shire Hall site from the previous study. Like the Brighton sites, the results emphasise the importance of on-site parking provision, with regard to modal split.

Table 3.4 Comparison of Reading Sites

Site	Spaces per Employee	Percent Parking in Employee Car Park	Percent Drivers Parking Free	Modal Split: Private (All Modes)
Shire Hall ⁽¹⁾	n/a	99	100	91
Foster Wheeler Energy	0.35	35	79	53
Prudential	0.11	37	74	45

Note: (1) *Shire Hall: Out of Town Site from original Study*

Richmond Sites

- 3.15 The results for the Richmond sites are inconclusive despite the fact that all three sites are located within close proximity of each other, and have similar access to public transport facilities. This could be explained by the nature of businesses occupying each site. For example Stoy Hayward has a high private transport modal split, despite strict on-street and off-street controls, possibly explained by the high managerial / professional numbers of staff (31 out of 37) and the availability of charged off-street spaces elsewhere in Richmond. Some 57 percent of those driving were willing to pay for a space rather than change to another mode of transport. At the Mills and Boon site, despite there being 0.50 spaces per employee, the percent of employees travelling by private transport was only 32 percent. This could be a reflection of the high secretarial / clerical content of the staff (21 out of 56) which could indicate lower car ownership levels. At Credit Agricole a significant number of staff were prepared to pay £1400 per annum for an off-street charged parking space rather than leave their car at home.

Table 3.4 Comparison of Richmond Sites

Site	Spaces per Employee	Percent Parking in Employee Car Park	Percent Drivers Parking Free	Modal Split: Private (All Modes)
Stoy Hayward	0.00	14	43	65
Credit Agricole	0.23	57	51	47
Mills and Boon	0.50	92	100	32

Maidstone Sites

- 3.16 A comparison of parking provision, parking behaviour and modal split for the Maidstone sites shows no correlation with regard to on-site parking provision and modal split (Table 3.5). All the sites are located in Maidstone town centre with good access to public transport interchanges. However a number of off-street long-term parking spaces are available in Maidstone at a reasonable cost and may well have influenced the results.

Table 3.5 Comparison of Maidstone Sites

Site	Spaces per Employee	Percent Parking in Employee Car Park	Percent Drivers Parking Free	Modal Split: Private (All Modes)
Colman House	0.41	70	94	72
Star House	0.09	17	61	71
Cornwallis House	0.49	32	77	60

Remaining Sites

- 3.17 Of the remaining sites in the study, Macclesfield House at Oxford and the Coca Cola offices at Hammersmith had the second and third lowest modal split by private transport of all the fourteen sites (see Table 3.6). This is hardly surprising as both have excellent accessibility to large public transport networks combined with strict parking controls both on-street and off-street. Oxford has operated a 'park and ride' policy for several years and 36 percent of employees used 'park and ride' on the day of the survey. Meanwhile Hammersmith is served by the underground network (District, Piccadilly and Hammersmith & City Lines) and has excellent bus communications. Nevertheless at both sites there were still 35 percent of employees who arrived using private transport as their main mode of travel, with a significant proportion still able to find free parking. Evidence from the sites at Brighton and Reading suggests that stricter control of off-street parking could lead to reductions in those travelling by private transport. However it is likely that a significant number will still use private transport even if stricter controls were implemented.

Table 3.6 Comparison of Remaining Sites

Site	Spaces per Employee	Percent Parking in Employee Car Park	Percent Drivers Parking Free	Modal Split: Private (All Modes)
Bank of America, Bromley	0.07	11	63	56
Coca Cola, Hammersmith	n/a	82	92	35
Macclesfield House, Oxford	0.14	31	97	35

Reasons for not Using Public Transport

- 3.18 Even at sites where parking is constrained and there is good accessibility to public transport it would appear that a significant number of employees are reluctant to leave their car at home and travel by public transport. Figure 3.4 summarises the main reasons given for not using public transport. Almost half (44 percent) of the 1459 people who responded stated that the car was more flexible, while a third (33 percent) claimed that public transport was either not convenient or too expensive. Other responses included that public transport was too unreliable (27 percent), too slow (25 percent) or too infrequent (23 percent) while some claimed that there was no suitable service (24 percent). Just under a quarter (24 percent) stated that they preferred the comfort of the car while 12 percent needed the car during the day.
- 3.19 The results are similar to those of a study recently carried out by the AA of some 1400 of its members. Furthermore the AA study found that more than half (59 percent) of those questioned would consider leaving their cars at home if bus and train services were improved.

4. Catchment Areas

Public Transport Accessibility

4.1 As was the case for the previous study, public transport accessibility was defined as the relative catchment area population that could be reached within a set travel time (45 minutes) by public transport compared with the size of the area that could be reached in the same time by private transport.

4.2 The following rules were applied;

Private transport

- travel times were based on typical peak period travel conditions.
- isochrones and population data were estimated using the Mapbase computer package.

Public transport

- all bus services within 10 minutes walk or train services within 15 minutes walk were included.
- all bus services with a service of 2 or less buses per hour were excluded
- five minute wait time assumed
- five minutes assumed for each interchange
- timetabled travel times assumed
- a maximum of 10 minutes walk from bus or 15 minutes walk from train was assumed at the home end.

4.3 Catchment area populations were calculated from 1991 census data based on sub-division at district level. The catchment area populations were derived as part of a quick desk-based study and should be considered as rough estimates only.

4.4 Accordingly public transport accessibility was defined as;

$$\text{Public Transport Accessibility} = \frac{P_{\text{PUB45}}}{P_{\text{PUB45}} + P_{\text{PRIV45}}}$$

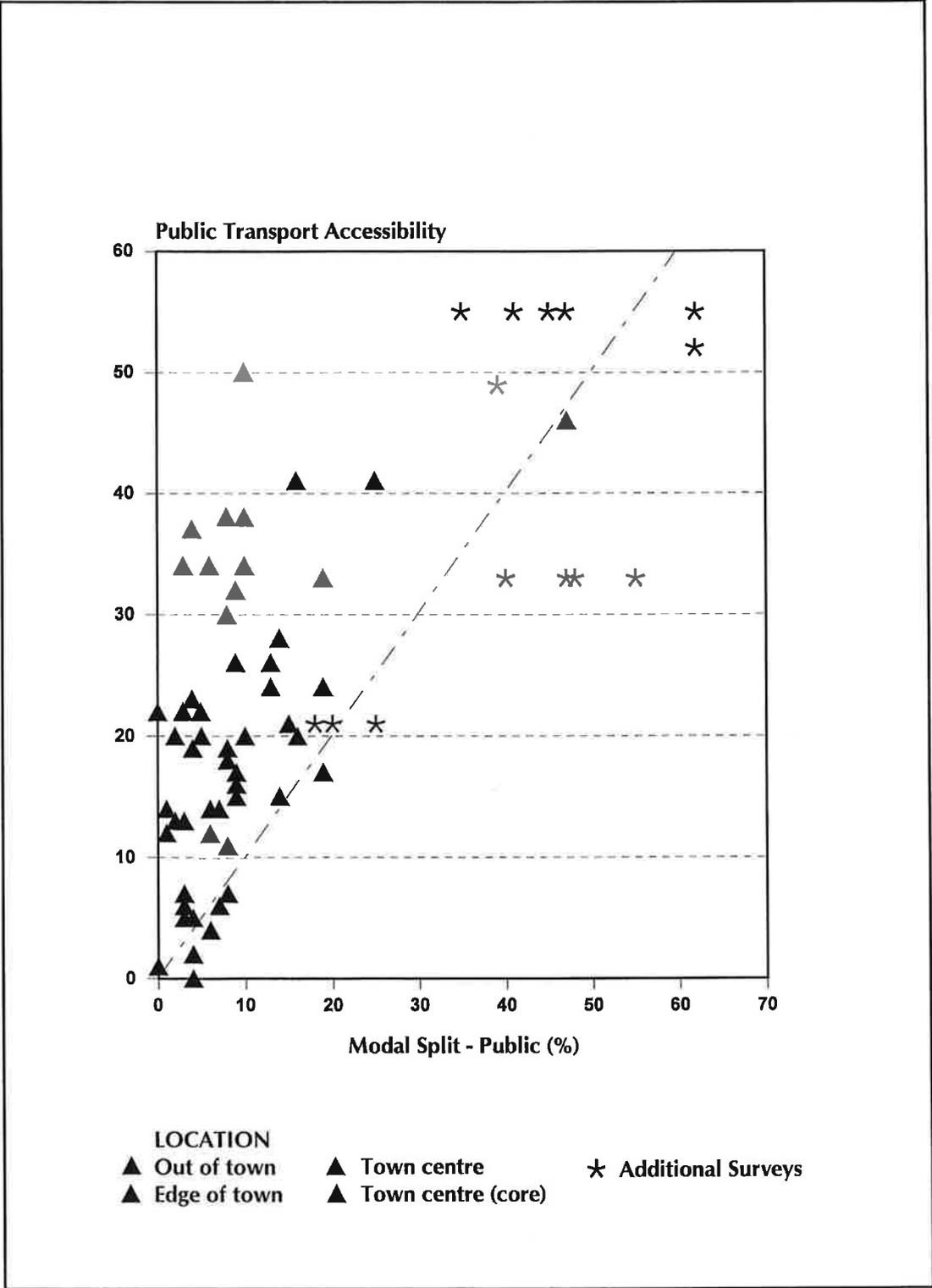
Where: P_{PUB45} is the population within 45 minutes travel time by public transport
 P_{PRIV45} is the population within 45 minutes travel time by private transport

4.5 The catchment areas of a number of the different sites in the study are compared for private and public transport. These are shown for Brighton (Figure 4.1), Reading (Figure 4.2), Oxford (Figure 4.3), Richmond (Figure 4.4) and Hammersmith (Figure 4.5). It is clear that the public transport catchment areas for the London sites are generally equal to or greater than the private transport catchment areas. This is in contrast to the sites at Oxford and Brighton where the ratio of private transport population catchments compared to public transport population catchments is 67:33.

4.6 The site at Oxford, despite a public transport accessibility index of only 33 percent, has comparatively high public transport usage. This is most probably

explained by the 'park and ride' policy of the local authority, whereby free parking spaces are provided on the outskirts of the city and the journey is completed into the centre using public transport.

- 4.7 Figure 4.6 brings together the modal split / public transport accessibility ratios for both the original and subsequent survey data. It will be seen that although there is a wide spread in the data there is a clear correlation between accessibility ratio and modal split. From the discussion of the individual sites in Section 3, the spread of data can, in part, be put down to differing levels of parking restraint.



**PUBLIC TRANSPORT ACCESSIBILITY BY MODAL SPLIT
MOTORISED MODES - PUBLIC**

Figure 4.6

5. Summary and Conclusions

Summary

5.1 The analysis of data can be summarised as follows;

- Initially it proved difficult to find suitable survey sites as it was difficult to find sites within self-standing towns where car parking restraints were actually effective.
- Questionnaires were distributed at fourteen office sites, identified as being constrained with regard to access to free on-site and on-street parking spaces. Almost 3,000 questionnaires were returned representing a response rate of almost 90 percent.
- Employment density varied considerably on a site-by-site basis, but had an average for all sites of 19 sq m GFA per person.
- Average journey times by private (38 minutes) and public transport (43 minutes) were generally of the same order, which contrasted with the results of the previous study where average journey times by private transport were considerably shorter. The average journey times of those travelling by other modes (ie. walking or cycling) was 18 minutes.
- Journey times were generally longer at the constrained sites, compared to the original study, with some 20 percent of employees having journey times in excess of 50 minutes. This could well be attributable to the 'London effect'.
- All sites were constrained with regard to on-site parking provision, with an average of 0.20 parking spaces per employee.
- The average modal split (for all modes) was 51 percent - private, 36 percent - public with 13 percent using other modes. There was considerable variation between sites with a minimum of 32 percent travelling by private transport (in Richmond) and a maximum of 72 percent (in Maidstone). When motorised modes only were considered, the average modal split was 58 percent private (ranging from 38 percent to 82 percent) and 42 percent public (ranging from 18 percent to 62 percent). This modal split was more orientated towards public transport than any of the previous surveys.

Conclusions

5.2 The study of additional sites has illustrated that although parking restraint can be a powerful tool in restraining private car usage, in isolation it is unlikely to lead to substantial shifts in modal split. Even strict parking controls have the limitations as a number of cars are required during the day for legitimate business purposes. These are an indication that parking restraint is only effective up to a point. Beyond this drivers would be prepared to pay large sums for parking.

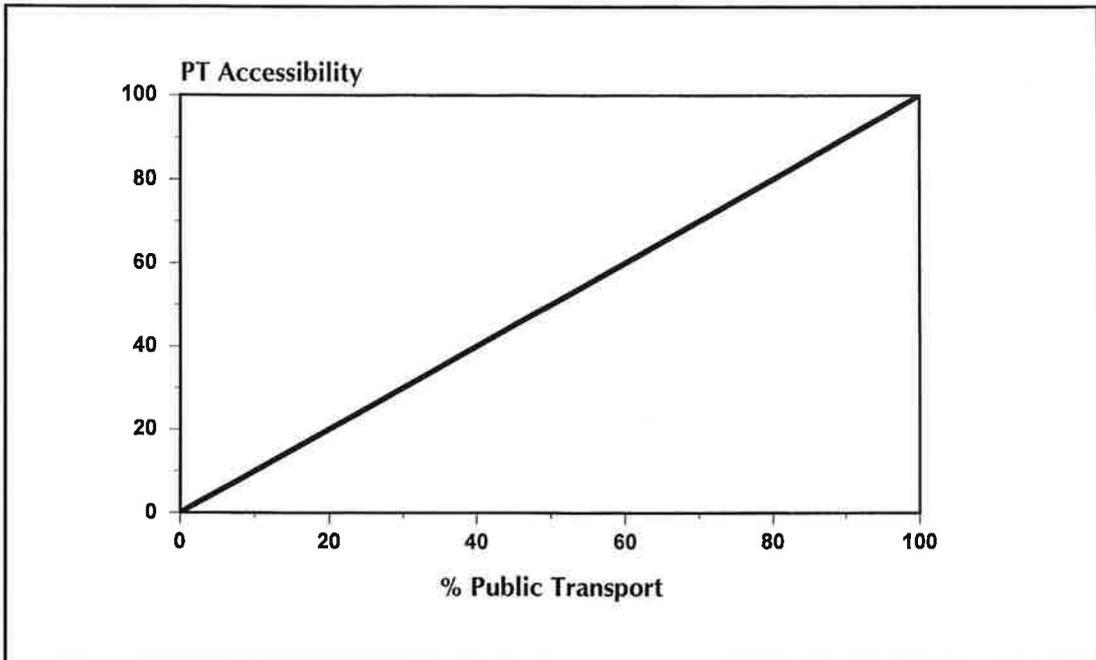
- 5.3 The role of mechanisms such as 'park and ride', have proved successful in increasing public transport usage in Oxford, which has a relatively high level of public transport usage, given that it has a public transport accessibility index of only 33 percent. The role of such mechanisms may have considerable value, although appropriate complementary measures are essential if such schemes are to achieve their aims. These would include measures such as bus priorities and tight parking controls on both the price and availability of parking in the controlled area.

Discussion

- 5.4 The results support a theoretical approach which is outlined in the following paragraphs. This study defined accessibility in a particular way based on a 45 minute catchment area. It is not clear that 45 minutes is the right figure; for instance 30 minutes, which is more akin to average travel times, may be more appropriate. It might also be appropriate to define catchment areas based on 30 minutes for private transport and 45 minutes for public transport (representative of the average travel times by each mode). This study has neither the resources or the data to determine the best was to define accessibility and hence the values used in the diagrams may not be the best ones and this may explain some of the variation.
- 5.5 If one was to consider public transport accessibility and modal choice (with no parking restraint) the relationship should look like Figure 5.1.
- 5.6 In reality most of the points are off-set to the left. This reflects one of two points, either the inaccuracy of the definition of accessibility or more likely the 'discomfort' factor for using public transport. The term 'discomfort' is used to include issues such as lack of flexibility, uncertainty, security, waiting, etc. Hence, for instance, despite a public transport accessibility rate of 50% only say 30% use public transport as the discount factor accounts for the other 20% (see Figure 5.2).
- 5.7 The addition of parking restraint should provide an "off-set" to the right of this graph as illustrated in Figure 5.3. For instance, with a public transport accessibility of 30% the theory would suggest that modal split would be 30% by public transport. If parking restraint is applied the modal split may increase to 50%.
- 5.8 Clearly then in order to reduce the dominance of car travel one needs to:
- improve public transport accessibility;
 - reduce the 'discomfort' factor; and
 - reduce parking provision.

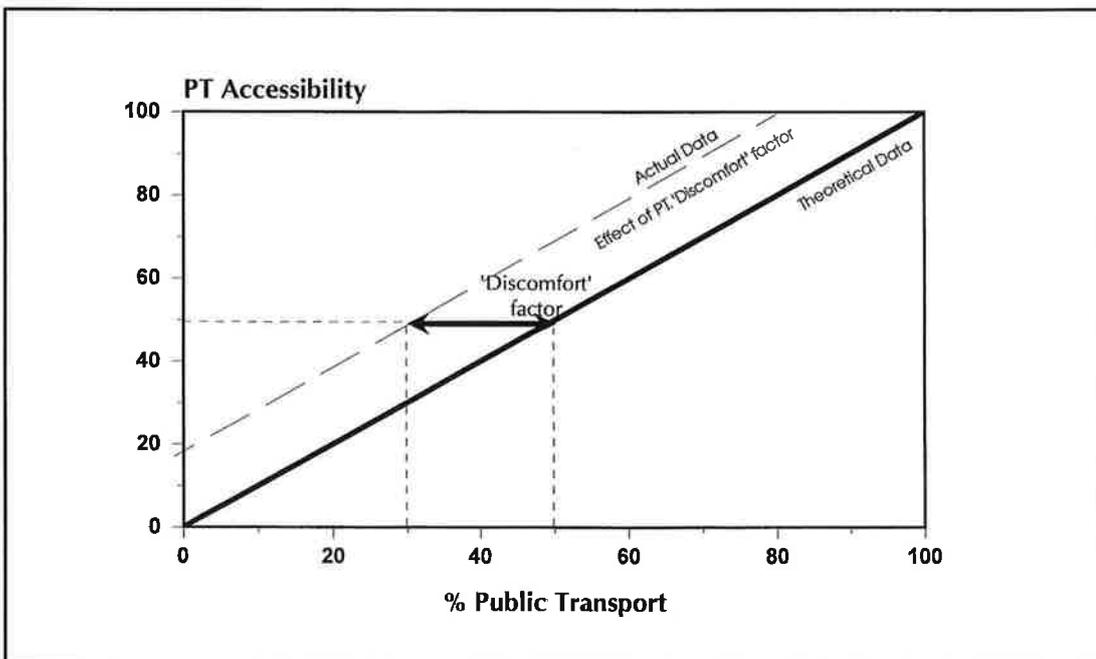
Reducing the 'discomfort' factor requires major improvements to the level of service of public transport operations. Previous discussions have indicated that it is likely to be much more practical to make a significant change in the parking component of the equation than the public transport accessibility element.

- 5.9 The debate could be turned round the other way, to determine what infrastructure should be provided if one was to seek say a 50% modal split for a particular development or town centre. The first aim would be to seek



MODAL SPLIT

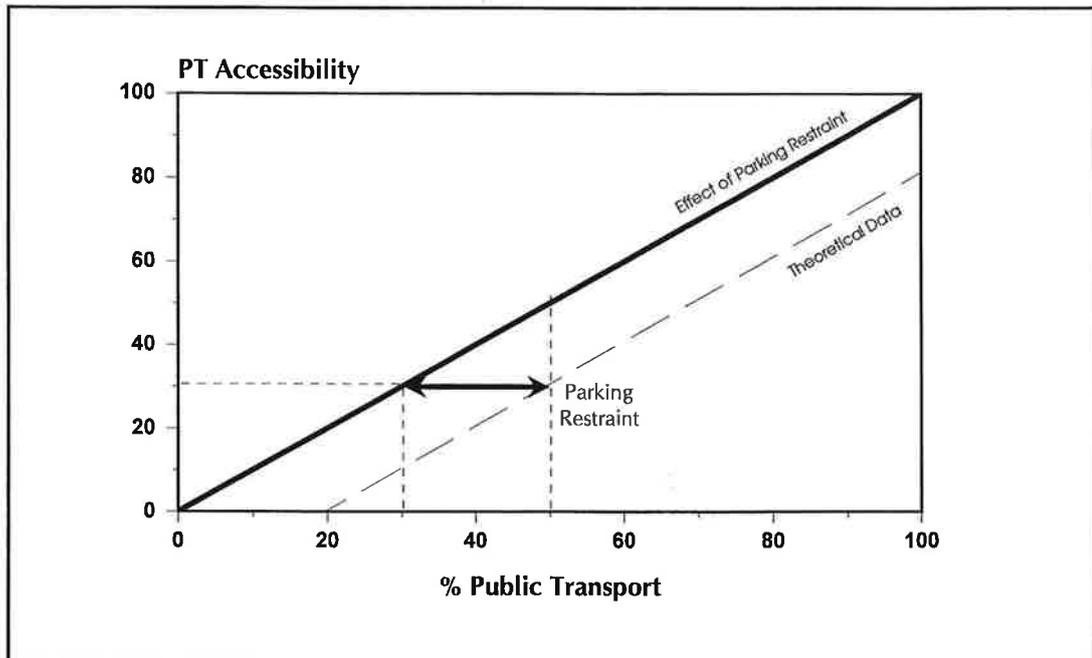
Figure 5.1



MODAL SPLIT

EFFECT OF PUBLIC TRANSPORT 'DISCOMFORT'

Figure 5.2



**MODAL SPLIT
EFFECT OF PARKING RESTRAINT**

Figure 5.3

to provide a public transport accessibility rate of 50%. i.e. an equal catchment area for both public and private transport. (That would require a public transport provision similar to say Richmond, Hammersmith or Harrow). Even if this could be achieved it is likely that the required level of modal split would not materialise due to the in-built 'discomfort' factor inherent in most public transport systems. This factor could probably be reduced by improving the system, using fixed track or tram systems improving reliability, etc. If public transport infrastructure cannot be provided to this level the 'shortfall' could be made up by parking restraint. To be effective this should be equally applied to all users.

- 5.10 There must, however, be a limit to the amount that modal shifts can be induced. If too much restraint is applied it is likely that the urban balance will give way. For instance, too much parking restraint without public transport provision will probably lead to vacant properties and businesses moving to less restricted areas. There needs to be a balance that cannot be pushed too far from an equilibrium level.

Appendices

Appendix A

1. WHERE DO YOU LIVE?

TOWN _____ POSTCODE _____

2. WHAT TIME DID YOU ARRIVE AT WORK TODAY? (please tick)

<input type="checkbox"/>									
BEFORE	07.30	07.45	08.00	08.15	08.30	08.45	09.00	09.15	AFTER
07.30	07.45	08.00	08.15	08.30	08.45	09.00	09.15	09.30	09.30

3. WHAT TIME DO YOU EXPECT TO LEAVE WORK TODAY?

<input type="checkbox"/>									
BEFORE	16.00	16.15	16.30	16.45	17.00	17.15	17.30	17.45	AFTER
16.00	16.15	16.30	16.45	17.00	17.15	17.30	17.45	18.00	18.00

4. HOW DID YOU TRAVEL TO WORK TODAY?

(a) Please tick main mode of travel only.

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	} <input type="checkbox"/> PARK & RIDE
CAR DRIVER	CAR PASSENGER	TAXI	WALK	BUS	TRAIN	MOTOR CYCLE	CYCLE	COMPANY COACH	
<p>(b) If your journey to work also involved any other modes of travel, please specify.</p>									
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
CAR DRIVER	CAR PASSENGER	TAXI	WALK (if over 5 mins)	BUS	TRAIN	MOTOR CYCLE	CYCLE	COMPANY COACH	

5. HOW LONG DID YOUR JOURNEY TAKE? _____ minutes (door to door)

6. DO YOU BELONG TO A CAR SHARING POOL OR GET A LIFT FROM A COLLEAGUE ON A REGULAR BASIS? YES NO

IF YOU DROVE A CAR TODAY, PLEASE ANSWER THE FOLLOWING QUESTIONS YES NO

7. Did you pay for your parking space? YES NO
If yes what was the equivalent daily charge? _____

8. WHERE DID YOU PARK? SPACE PROVIDED AT YOUR PLACE OF EMPLOYMENT
FREE OFF STREET CAR PARK
CHARGED OFF-STREET CAR PARK
ON THE STREET
PARK AND RIDE CAR PARK
ELSEWHERE (please explain) _____

9. If you did not park at your place of employment, approximately how far away did you park (in walking time) _____ minutes

10. WHY DID YOU CHOOSE NOT TO USE PUBLIC TRANSPORT? (please tick)
 CAR NEEDED DURING DAY TOO EXPENSIVE TOO INFREQUENT TOO UNRELIABLE TOO SLOW NOT CONVENIENT NO SUITABLE SERVICE CAR MORE FLEXIBLE PREFER COMFORT OF CAR

ADD COMMENTS _____

SURVEY OF COMMUTING PATTERNS IN SERPLAN REGION
COMPANY QUESTIONNAIRE

Please note that this company questionnaire will provide valuable information for the purposes of survey analysis. Accordingly please feel free to add any additional information you feel may be relevant.

Location _____

Date of Interview _____ Survey Date _____

1. Nature of Business _____

2. How many people in the following occupational groups do you employ at these premises?

Job Category	Full Time (over 30 hrs pw)	Part Time
Managers, Professionals, Technicians and Support Staff		
Clerical, Secretarial and Sales Staff		
Craft and Skilled Service Workers Operatives and Unskilled Workers		
TOTAL		

2a. Please give details of part-time working hours and shift systems operated.

3. APPROXIMATELY, how many employees are/were at work on the survey day?
 (Note: It is important that as accurate an estimate as possible is given) _____

3a. Of those absent, how many were: Sick _____
 On Holiday _____
 Out on Business _____

4. What is the gross floor area of your premises? _____ sq.ft/sq.m*
(*delete as appropriate)

5. Are the premises fully occupied? YES _____

NO _____ Please explain below

6. Is there a staff restaurant located in the building? YES _____

NO _____

7. Are there any staff leisure facilities on the site? YES _____

NO _____

7a. Please describe these facilities.

8. Do you provide parking facilities on this site? YES _____

NO _____

9. How many car spaces do you provide for:-

	General	Disabled	Total
Employees			
Visitors/Customers			
TOTAL			

10. Do you make a charge for any of these spaces? YES _____
NO _____

10a. If yes how much? _____

11. Do you operate some form of Flexitime policy? YES _____
NO _____

11a. If yes, please explain.

12. Do you provide a special bus service for employees? YES _____
NO _____

12a. If yes, please explain.

13. Were there any exceptional circumstances applying on the day of the survey? YES _____
NO _____

13a. Please describe these circumstances.

Name of Respondent _____

Telephone No. _____

Thank you for your help

Appendix B

APPENDIX B1 SITE DETAILS

Office Site	Town	GFA (sqm)	No. of Employees	Car Park Spaces	GFA per Employee (sqm)	Car Park Spaces per Employee	GFA per Car Park Space
Mills & Boon	Richmond		56	28		0.50	
Macclesfield House	Oxford	3670	179	25	20.50	0.14	146.80
Coca Cola	Hammersmith	7420	200	60	37.1 *	0.30	123.67
Eagle Star	Brighton	3345		16			209.06
Prudential	Reading	7154	698	75	10.25	0.11	95.39
Credit Agricole	Richmond	2573	75	17	34.31 *	0.23	151.35
Sun Alliance	Brighton	2638	96	16	27.48	0.17	164.88
International Factors	Brighton	5760	347	60	16.60	0.17	96.00
Foster Wheeler Energy	Reading	27685	1441	510	19.21	0.35	54.28
Bank of America	Bromley	10963	654	45	16.76	0.07	243.62
Cornwallis House	Maidstone	1468	81	40	18.35	0.49	99.07
Stoy Hayward	Richmond	267	38	0	7.03	0.00	
Star House	Maidstone	1394	75	7	18.59	0.09	199.14
Colman House	Maidstone	3252	177	72	18.37	0.41	45.17

* Not fully occupied.

APPENDIX B2

MODAL SPLIT AND POPULATION CATCHMENT SITE INFORMATION

Office Site	Town	Average Modal Split (%) (All Modes)			Average Modal Split (%) (Motorised Modes)		Population Catchment Size within 45 Minutes		
		Private	Public	Others	Private	Public	Private	Public	Ratio
Mills & Boon	Richmond	32	52	16	38	62	1,738,500	2,120,700	45:55
Macclesfield House	Oxford	35	43	22	45	55	708,200	347,500	67:33
Coca Cola	Hammersmith	35	56	9	38	62	2,593,100	2,767,300	48:52
Eagle Star	Brighton	43	39	18	52	48	633,700	308,293	67:33
Prudential	Reading	45	40	15	53	47	1,239,200	1,503,800	45:55
Credit Agricole	Richmond	47	28	15	55	45	1,738,500	2,120,700	45:55
Sun Alliance	Brighton	49	44	6	53	47	633,700	308,293	67:33
International Factors	Brighton	49	32	20	60	40	633,700	308,293	67:33
Foster Wheeler Energy	Reading	53	37	11	59	41	1,239,200	1,503,800	45:55
Bank of America	Bromley	56	36	9	61	39	1,840,100	1,771,700	51:49
Cornwallis House	Maidstone	60	20	20	75	25	784,300	210,000	79:21
Stoy Hayward	Richmond	65	35	0	65	35	1,738,500	2,120,700	45:55
Star House	Maidstone	71	18	11	80	20	784,300	210,000	79:21
Colman House	Maidstone	72	16	12	82	18	784,300	210,000	79:21

APPENDIX B3 AVERAGE JOURNEY TIMES AND PARKING CHARACTERISTICS

Office Site	Town	Average Journey Time (minutes)			Parking Locations (percent)			
		Private	Public	Others	All Modes	Free Spaces	On-Street	Employee Car Park
Mills & Boon	Richmond	43	51	13	42	100	8	92
Macclesfield House	Oxford	30	38	35	35	97	2	31
Coca Cola	Hammersmith	50	48	24	47	92	5	82
Eagle Star	Brighton	34	37	19	32	72	44	6
Prudential	Reading	42	47	16	40	74	21	37
Credit Agricole	Richmond	45	58	13	45	51	13	57
Sun Alliance	Brighton	37	33	14	34	91	45	35
International Factors	Brighton	26	36	16	28	90	32	42
Foster Wheeler Energy	Reading	33	44	20	36	79	7	35
Bank of America	Bromley	38	49	19	40	63	52	11
Cornwallis House	Maidstone	41	32	19	35	77	4	32
Stoy Hayward	Richmond	43	47	0	45	43	29	14
Star House	Maidstone	30	38	18	30	61	13	17
Colman House	Maidstone	41	47	19	40	94	10	70

**Parking & Public Transport
The Effect on Mode Choice**

**Additional Surveys at
B1 Developments with
Constrained Parking**

**Parking & Public Transport
The Effect on Mode Choice**

**Additional Surveys at
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**Parking & Public Transport
The Effect on Mode Choice**

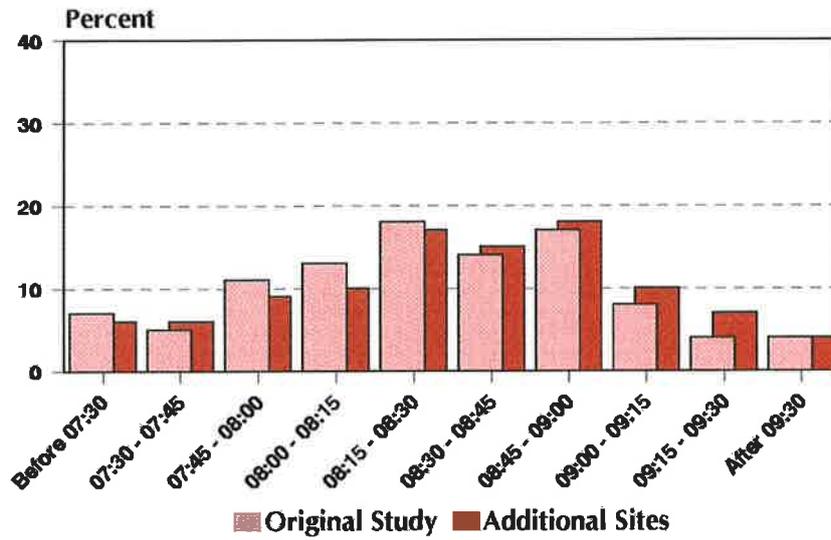
**Additional Surveys at
B1 Developments with
Constrained Parking**

APPENDIX B3

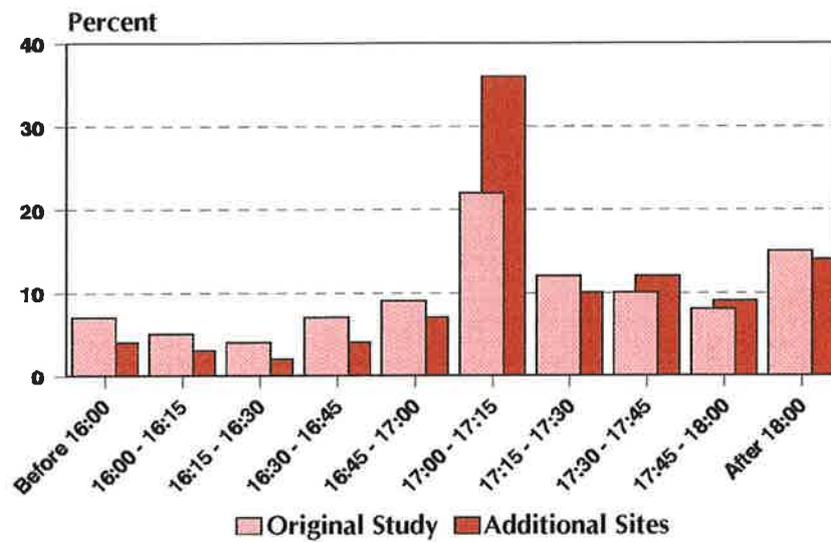
AVERAGE JOURNEY TIMES AND PARKING CHARACTERISTICS

Office Site	Town	Average Journey Time (minutes)				Parking Locations (percent)		
		Private	Public	Others	All Modes	Free Spaces	On-Street	Employee Car Park
Mills & Boon	Richmond	43	51	13	42	100	8	92
Macclesfield House	Oxford	30	38	35	35	97	2	31
Coca Cola	Hammersmith	50	48	24	47	92	5	82
Eagle Star	Brighton	34	37	19	32	72	44	6
Prudential	Reading	42	47	16	40	74	21	37
Credit Agricole	Richmond	45	58	13	45	51	13	57
Sun Alliance	Brighton	37	33	14	34	91	45	35
International Factors	Brighton	26	36	16	28	90	32	42
Foster Wheeler Energy	Reading	33	44	20	36	79	7	35
Bank of America	Bromley	38	49	19	40	63	52	11
Cornwallis House	Maidstone	41	32	19	35	77	4	32
Stoy Hayward	Richmond	43	47	0	45	43	29	14
Star House	Maidstone	30	38	18	30	61	13	17
Colman House	Maidstone	41	47	19	40	94	10	70

AVERAGE ARRIVAL TIMES (PERCENT)



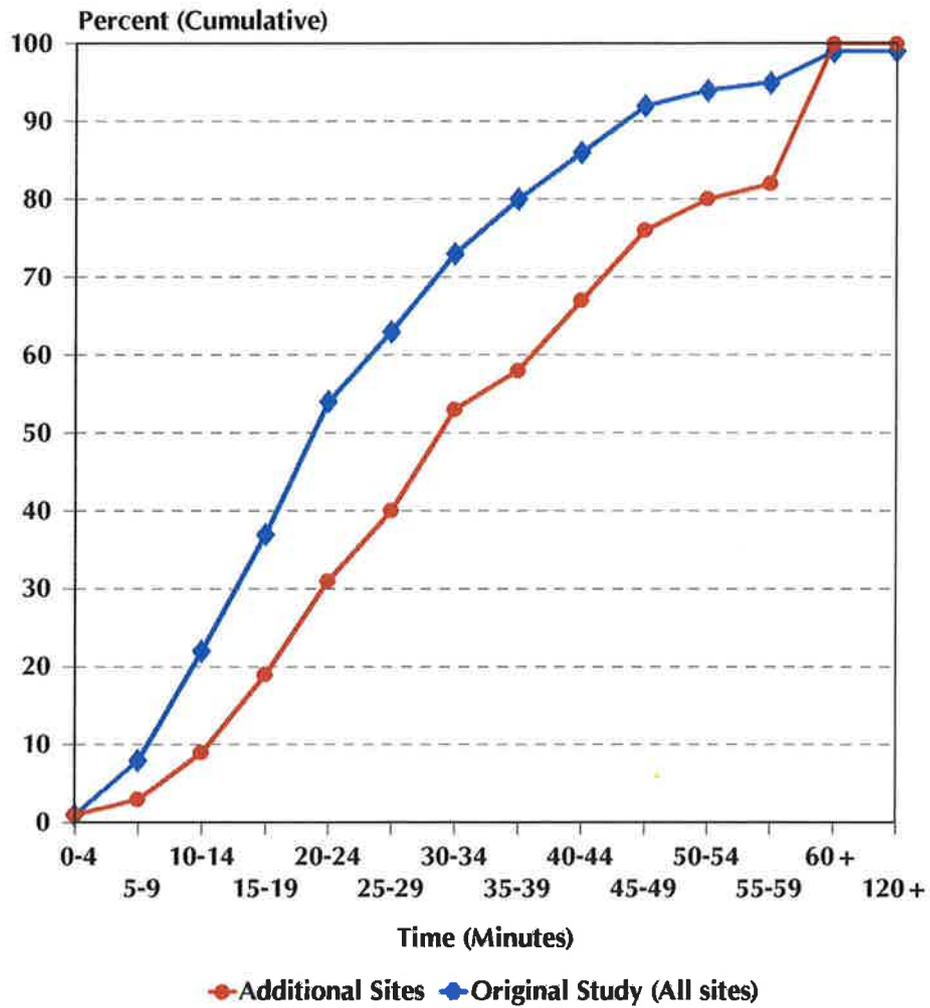
AVERAGE DEPARTURE TIMES (PERCENT)



ARRIVAL AND DEPARTURE PATTERNS

Figure 3.1

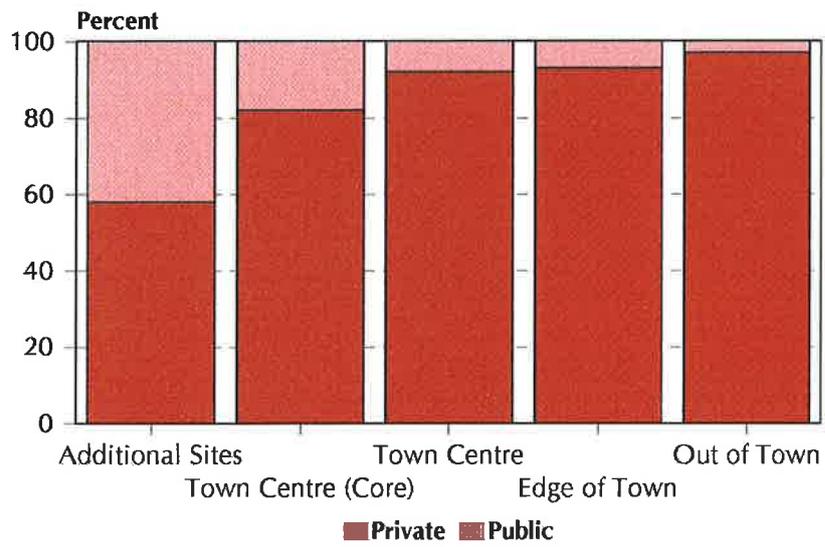
AVERAGE JOURNEY TIME BY LOCATION



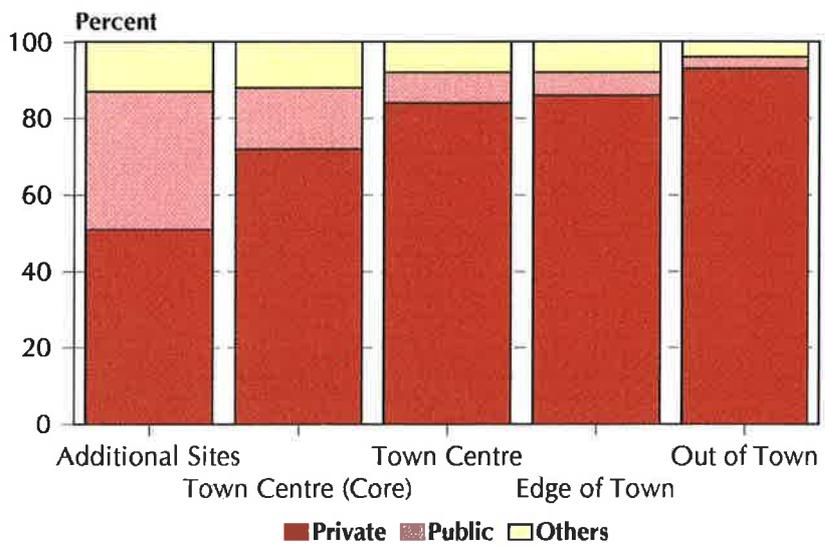
A COMPARISON OF AVERAGE JOURNEY TIMES

Figure 3.2

AVERAGE MODAL SPLIT BY MOTORISED MODES

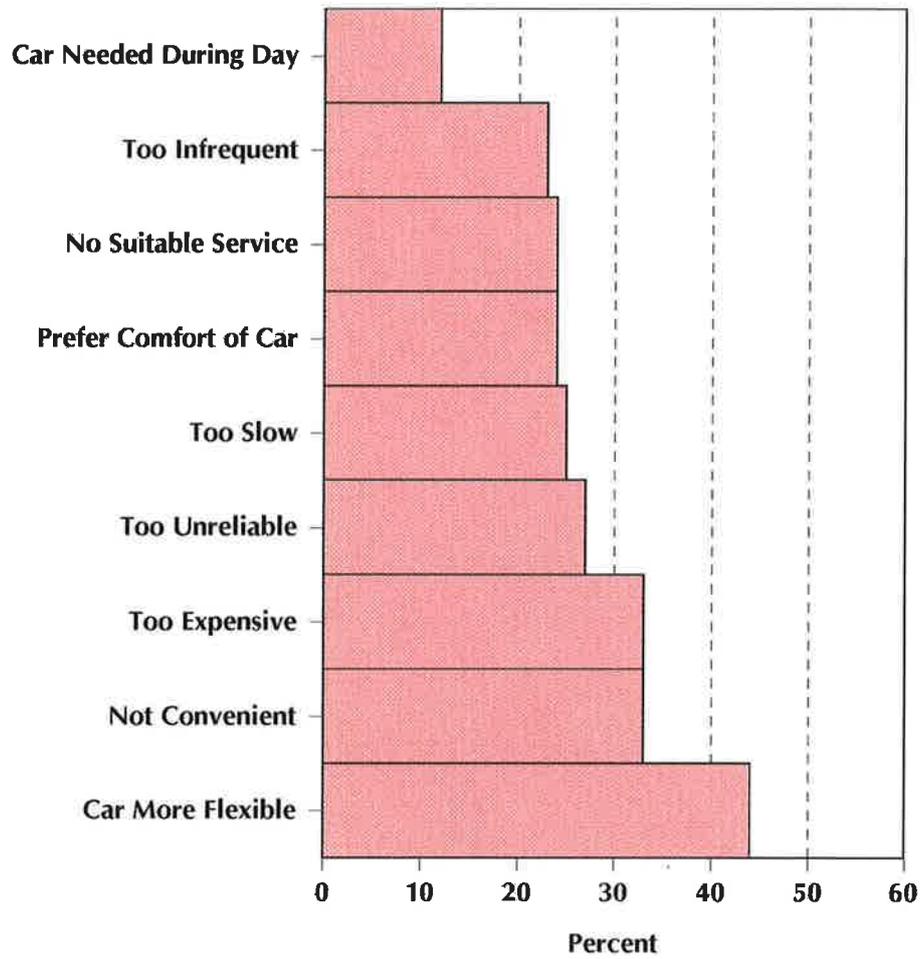


AVERAGE MODAL SPLIT - ALL MODES



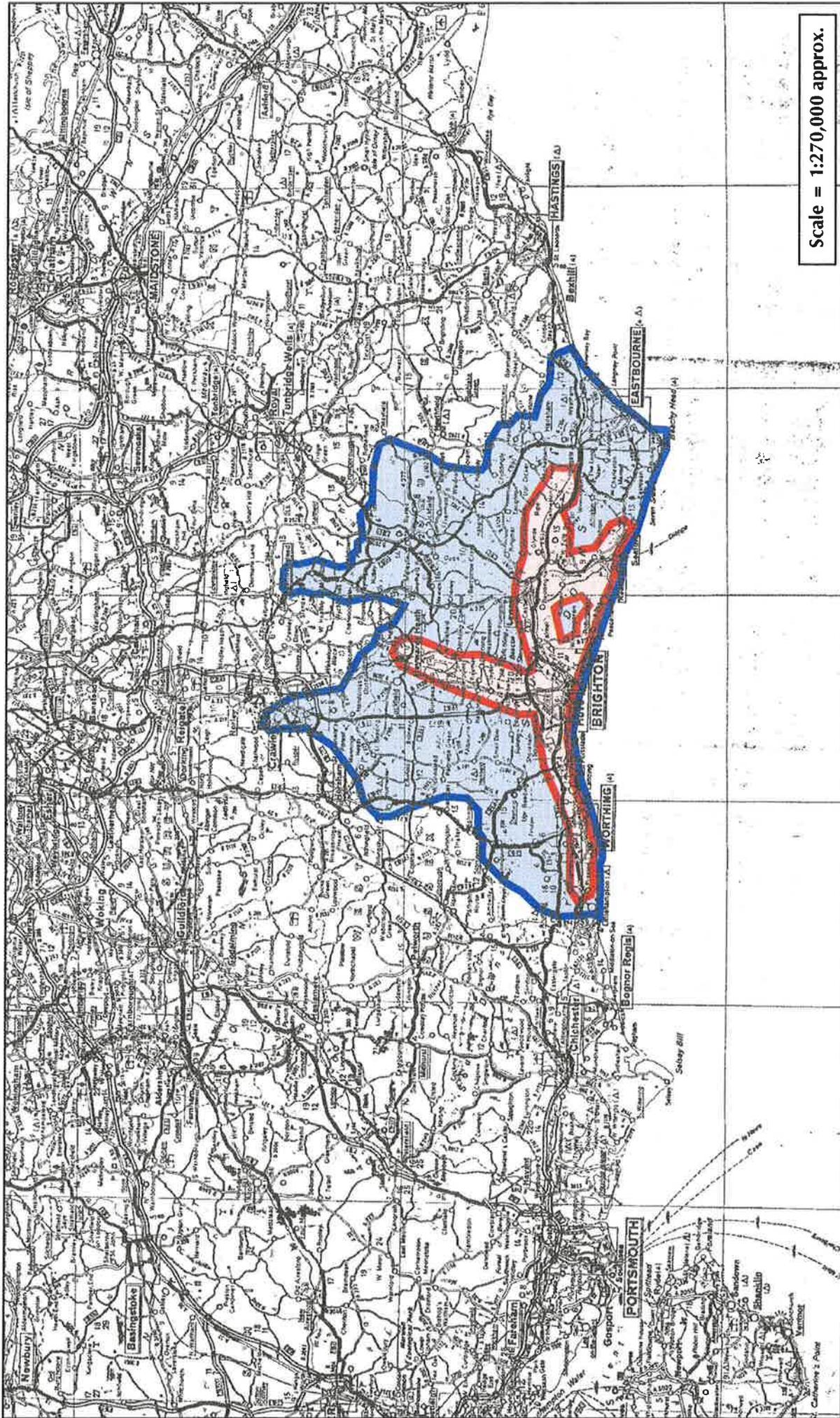
MODAL SPLIT

Figure 3.3



REASONS FOR NOT USING PUBLIC TRANSPORT

Figure 3.4

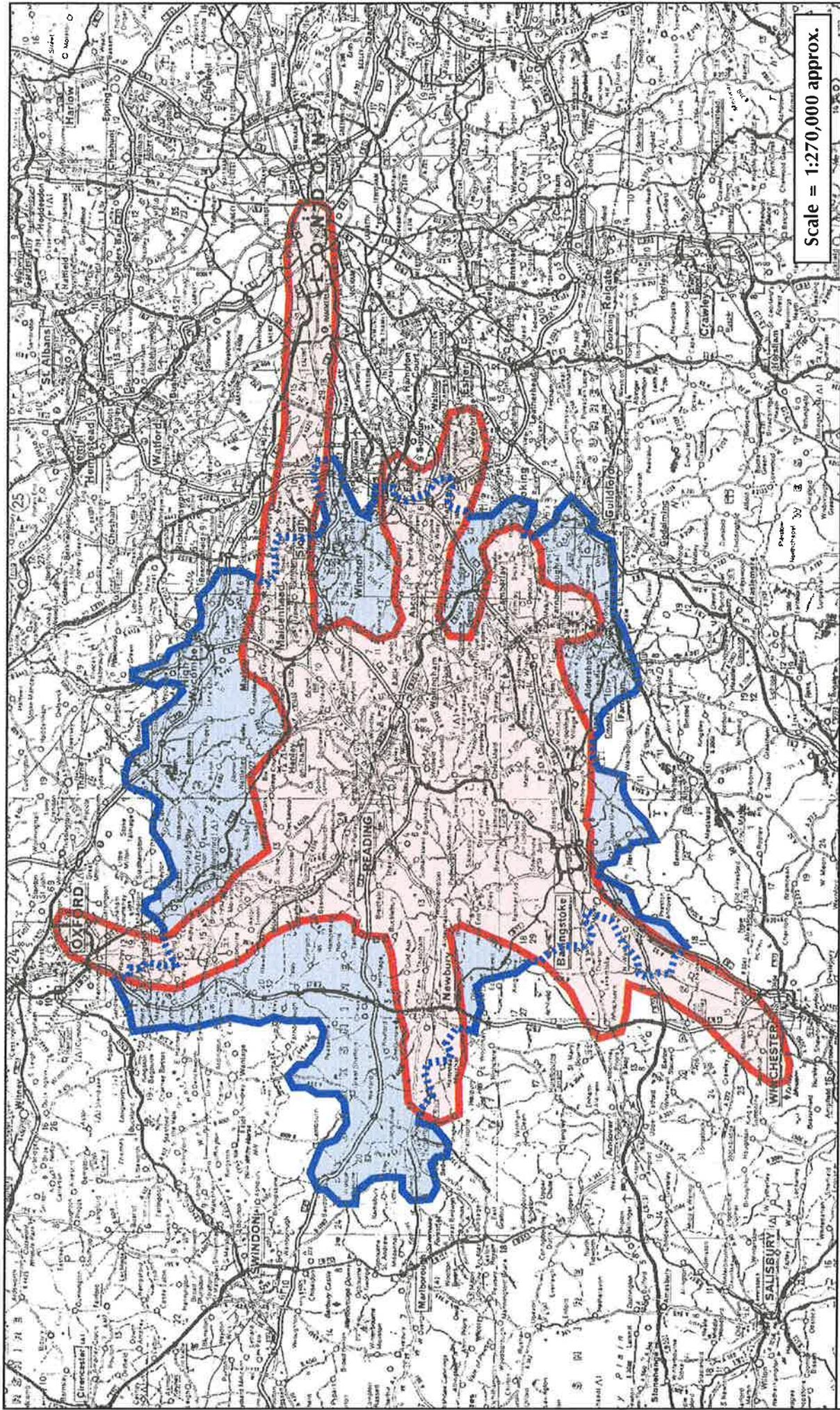


Scale = 1:270,000 approx.

MODAL SPLIT - PRIVATE: (MOTORISED MODES)	EAGLE STAR	SUN ALLIANCE	INTERNATIONAL FACTORS	POPULATION CATCHMENTS	RATIO
	= 52%	= 53%		PRIVATE = 633 700	(% PRIVATE : % PUBLIC)
				PUBLIC = 308 293	67 : 33

TRAVEL TIME ISOCHRONES (45 minutes) BRIGHTON SITES

Figure 4.1

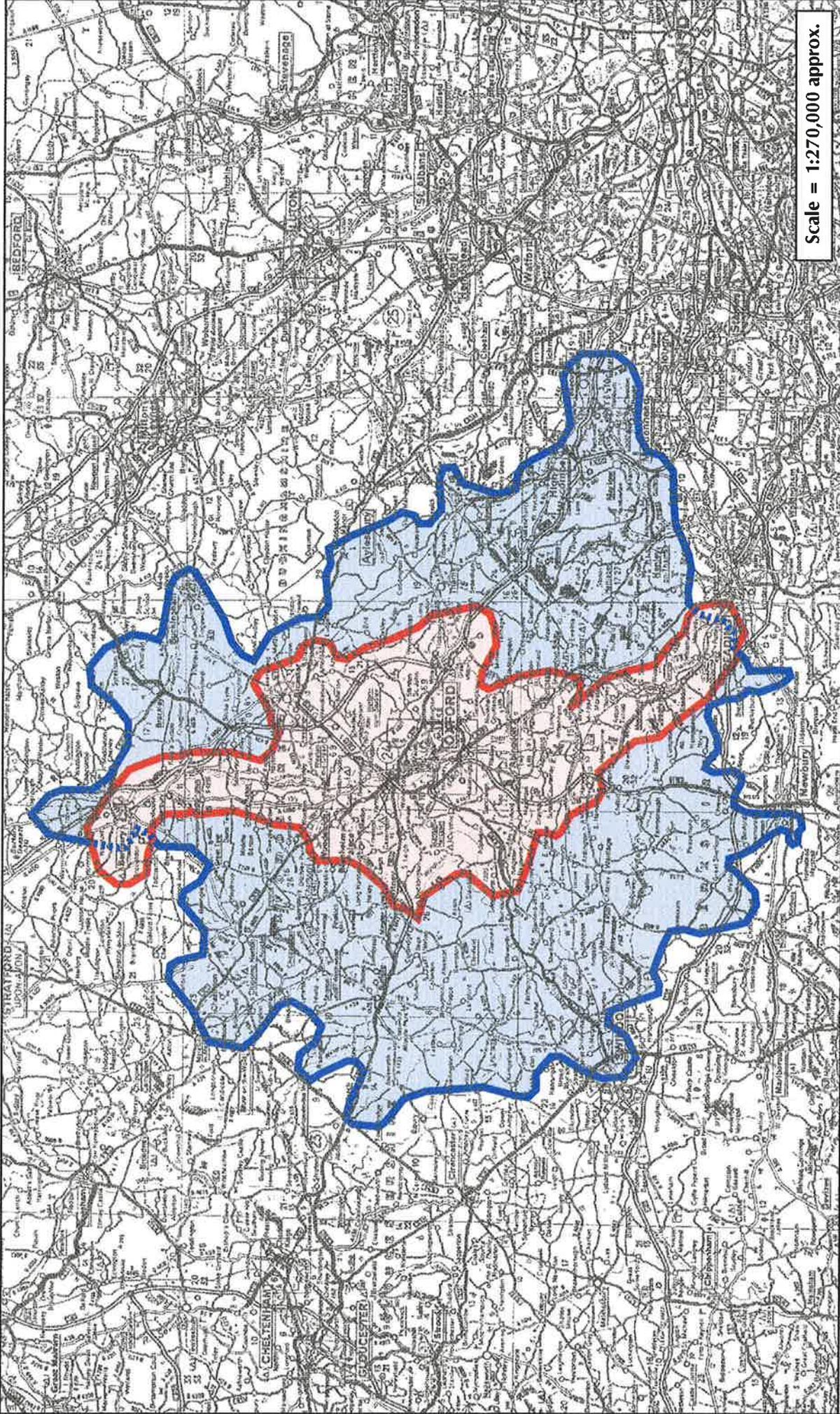


Scale = 1:270,000 approx.

MODAL SPLIT - PRIVATE: (MOTORISED MODES) **PRUDENTIAL** **FOSTER WHEELER ENERGY = 53%**
POPULATION CATCHMENTS **RATIO**
PRIVATE = 1 239 200 **(% PRIVATE : % PUBLIC)**
PUBLIC = 1 503 800 **45 : 55**

TRAVEL TIME ISOCHRONES (45 minutes) READING SITES

Figure 4.2

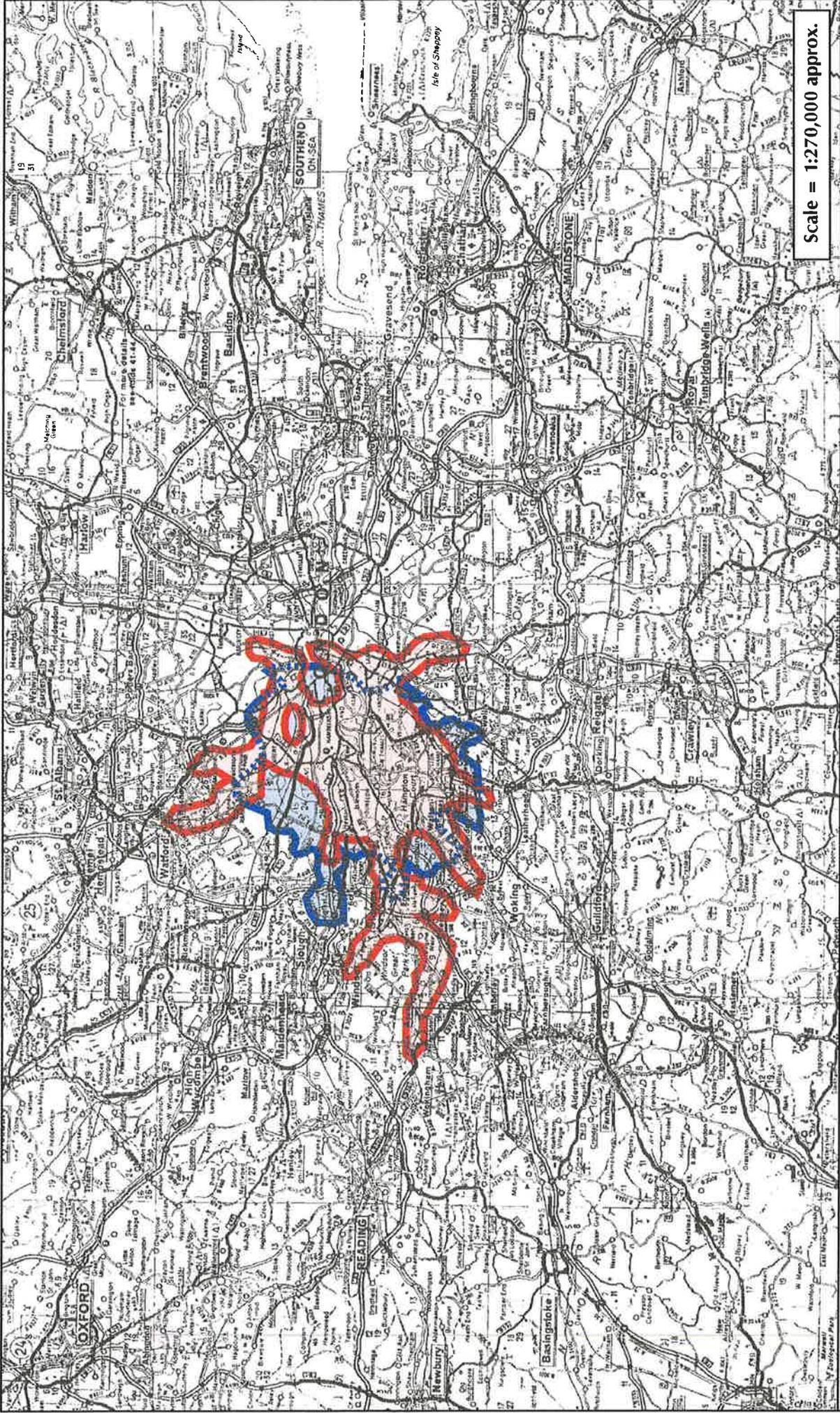


Scale = 1:270,000 approx.

MODAL SPLIT - PRIVATE (MOTORISED MODES) **MACCLESFIELD HOUSE = 45%** **POPULATION CATCHMENTS** **RATIO**
 PRIVATE = 708 200 (% PRIVATE : % PUBLIC)
 PUBLIC = 347 500 67 : 33

TRAVEL TIME ISOCHRONES (45 minutes) OXFORD

Figure 4.3



Scale = 1:270,000 approx.

MODAL SPLIT - PRIVATE:
(MOTORISED MODES)

MILLS AND BOON = 38%
CREDIT AGRICOLE = 55%
STOY HAYWARD = 65%

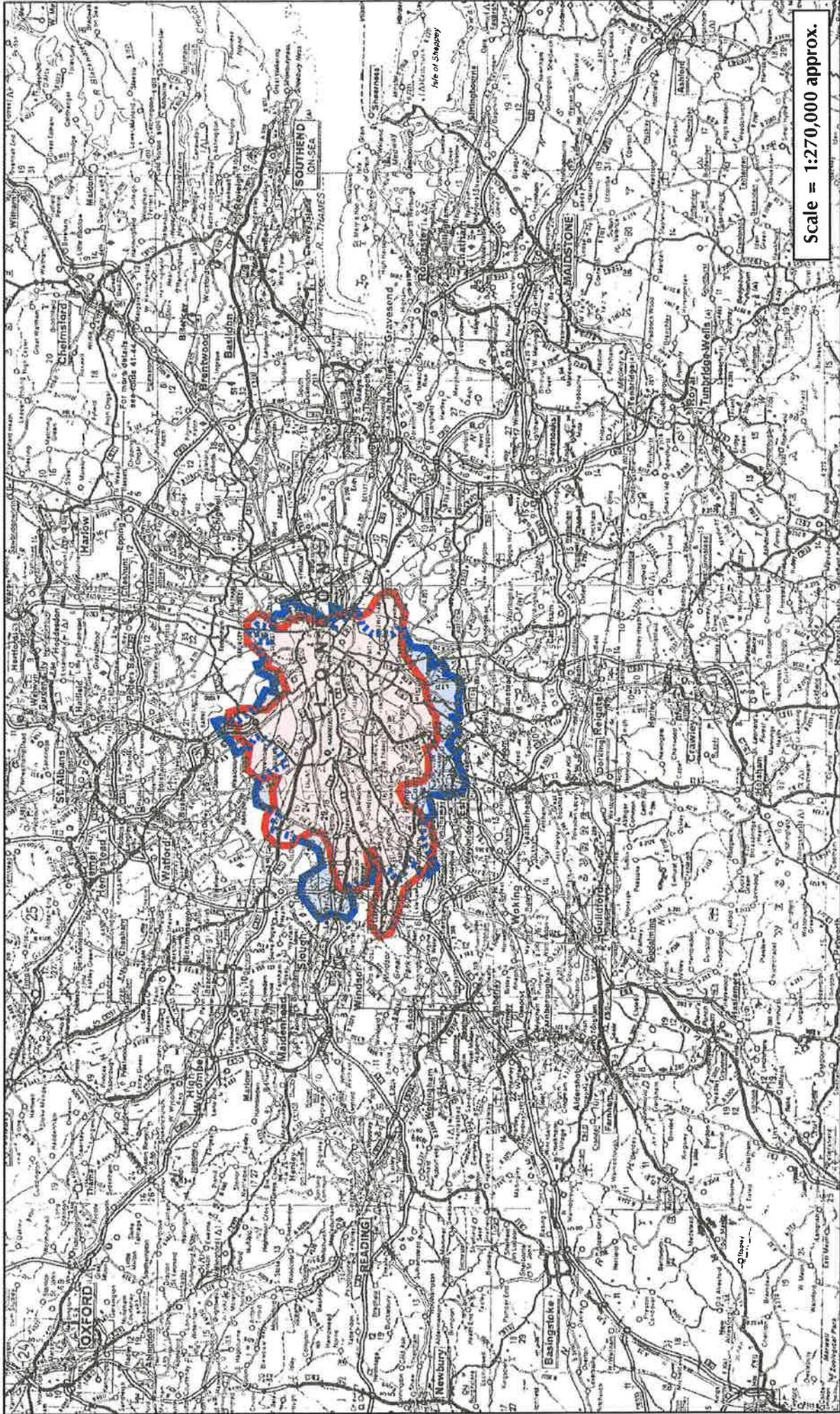
POPULATION CATCHMENTS

PRIVATE = 1 738 500
PUBLIC = 2 120 700

RATIO
(% PRIVATE : % PUBLIC)
45 : 55

TRAVEL TIME ISOCHRONES (45 minutes) RICHMOND SITES

Figure 4.4



Scale = 1:270,000 approx.

MODAL SPLIT - PRIVATE:
(MOTORISED MODES)

COCA COLA = 38%

POPULATION CATCHMENTS

PRIVATE = 2 593 100

PUBLIC = 2 767 300

RATIO
(% PRIVATE : % PUBLIC)
48 : 52

TRAVEL TIME ISOCHRONES (45 minutes) HAMMERSMITH

Figure 4.5